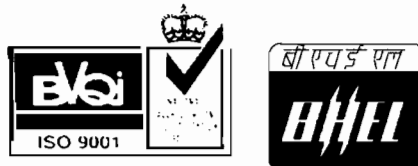


**2 X 660 MW - NTPC MOUDA STPP STAGE II .  
1 x 500 MW – NTPC VINDHYACHAL STPP, STAGE- V .**

**TECHNICAL SPECIFICATION  
FOR CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS).**


**Specification No. : PE-TS- 387/388-165-N001 (REV. 0)**

**VOLUME -IIB**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
PPEI BLDG., SEC-16A, PLOT NO. 25  
NOIDA – 201301 (UP)**



|   |   |  |                         |
|---|---|--|-------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS).<br/>PREAMBLE</b> | <b>SPEC. NO. PE-TS- 387/388-165-N001</b> |                         |
|   |   | <b>VOLUME : II B</b>                     |                         |
|   |   | <b>REV. NO. 0</b>                        | <b>DATE :04.02.2013</b> |
|   |   | <b>SHEET 1</b>                           | <b>OF 2</b>             |

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

#### 1.1 **Volume -I CONDITIONS OF CONTRACT**

This consists of four parts as below :

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

#### 1.2 **Volume - II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

##### 1.2.1 **Volume - II B :**

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides "Project Information"

Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.


Section - D : This section comprises of standard technical specifications of equipments complete with data sheet A, B & C.

Data sheet-A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).




|   |   |  |                         |
|---|---|--|-------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS).<br/>PREAMBLE</b> | <b>SPEC. NO. PE-TS- 387/388-165-N001</b> |                         |
|   |   | <b>VOLUME : II B</b>                     |                         |
|   |   | <b>REV. NO. 0</b>                        | <b>DATE :04.02.2013</b> |
|   |   | <b>SHEET 2</b>                           | <b>OF 2</b>             |

**1.2.2 Volume - III TECHNICAL SCHEDULES**

- 1.0 This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No.PES-100-901 in Volume-III.
- 2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.




|   |  |   |                          |
|---|--|---|--------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS).</b> | <b>SPEC. NO. PE-TS-387/388-165-N001</b> |                          |
|   |  | <b>VOLUME : II B</b>                    |                          |
|   |  | <b>SECTION : A</b>                      |                          |
|   |  | <b>REV. NO. 0</b>                       | <b>DATE : 04.02.2013</b> |
|   |  | <b>SHEET 1</b>                          | <b>of 1</b>              |

### INDEX


| SECTION | TITLE  |
|---------|--|
| A       | SCOPE OF ENQUIRY   |
| B       | PROJECT INFORMATION  |
| C       | SPECIFIC REQUIREMENTS  |
| C1      | SPECIFIC TECHNICAL REQUIREMENTS FOR CONDENSER ONLOAD TUBE CLEANING SYSTEMS .   |
| C2      | SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)   |
| C3      | SPECIFIC TECHNICAL REQUIREMENTS (C&I)  |
| D       | STANDARD TECH. SPECIFICATIONS  |
| D1      | CONDENSER ON LOAD TUBE CLEANING SYSTEMS <ul style="list-style-type: none"> <li>◆ STANDARD TECHNICAL SPEC.NO. PE-TS-999-165-N001</li> <li>◆ DATA SHEET-A</li> <li>◆ DATA SHEET-C</li> <li>◆ QUALITY PLAN</li> </ul> |
| D2      | ELECTRICAL SYSTEMS   |
| D3      | CONTROL & INSTRUMENTATION SYSTEMS  |



|   |  |   |                          |
|---|--|---|--------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS).</b> | <b>SPEC. NO. PE-TS-387/388-165-N001</b> |                          |
|   |  | <b>VOLUME : II B</b>                    |                          |
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|   |  | <b>SHEET 1</b>                          | <b>of 1</b>              |

## SECTION - A SCOPE OF ENQUIRY



|   |  |   |                          |
|---|--|---|--------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS).</b> | <b>SPEC. NO. PE-TS-387/388-165-N001</b> |                          |
|   |  | <b>VOLUME : IIB</b>                     |                          |
|   |  | <b>SECTION : A</b>                      |                          |
|   |  | <b>REV. NO. 0</b>                       | <b>DATE : 04.02.2013</b> |
|   |  | <b>SHEET 1 of 2</b>                     |                          |

## 1.00.0 SCOPE

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works properly packed for delivery of the items as follows:

### 1.01.0 Condenser On Load Tube Cleaning Systems :

Condenser On Load Tube Cleaning Systems (COLTCS) complete with all accessories as per the requirements specified in different sections of this specification **for** :

- **2 X 660 MW - NTPC MOUDA STPP STAGE II .**
- **1 x 500 MW – NTPC VINDHYACHAL STPP, STAGE- V .**

The bidder's scope also includes installation checks, commissioning, trial runs & PG Testing at site of COLTCS.

### 1.01.0 The bids shall be evaluated as per NIT.

Equipments shall be ordered separately for each project.

In the event of more than one order being placed on the same bidder, the drawings/ documents etc. shall be submitted separately for each project during detailed engg. stage for approval.

## 2.00.00 GENERAL TECHNICAL INSTRUCTIONS:

2.01.00 It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standard of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

2.02.00 The omission of specific reference to any component/ accessory necessary for the proper performance of the equipments shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of the equipments at quoted prices.

2.03.00 In case of any deviation from this Technical specification (Vol. IIB) and General Technical Conditions (Vol. IIC), the same shall be indicated in the schedule of deviations enclosed in Volume-III, Part-A. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

2.04.00 BHEL's/ Customer's representatives shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

2.05.00 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/ Customer

2.06.00 Un-priced copy of price bid shall be furnished alongwith the technical bid.





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**

**VOLUME : II B**

**SECTION : B**

**REV. NO. 0**


**DATE : 04.02.2013**

**SHEET 1 of 1**


## **SECTION – B**

### **PROJECT INFORMATION**



| CLAUSE NO.  | PROJECT SYNOPSIS   |   |                  |  |
|---|--|---|------------------|---|
| 1.00.00   | <b>BACKGROUND</b><br><br>Mouda STPP Stage-I comprising of two units of 500 MW each is presently under implementation. Now in view the huge power generation capacity requirement and future capacity addition plans, it is proposed to enhanced capacity of Mouda STPP. The present proposal is to install additional two units of 660 MW in Stage-II this making the ultimate capacity of the project to 2320 MW.   |   |                  |   |
| 1.01.00   | <b>Location and Approach</b><br><br>The plant site is located in Mouda Tehsil, district Nagpur of Maharashtra Stage, having latitude and longitude of 20° 10'50" N and 79° 23'52" E respectively. The site is bounded by villages Kumbhari on North, Lapka & Mouda on South, Koradi on East & Rahli on West and is at a distance of about 4 Kms. From Mouda town and approachable from NH-6. Nearest railway station is Chacker 8 Kms away from site on Nagpur – Kolkata Broad Gauge (BG) section of South Eastern Railway (main line).<br><br>Vicinity Plan is enclosed as <b>Exhibit-I</b> .<br><br>For further information apart from given in this sub-section and Bidders are also advised to visit the project site and collect data regarding local site conditions.  |   |                  |   |
| 1.02.00   | <b>Airport</b><br><br>The nearest commercial airport is at Nagpur located at a distance of approximately 42 Kms form the project site.   |   |                  |   |
|   | <b>Land</b><br><br>For Stage-I of Mouda project, about 1580 acres of land required for the project is acquired/under acquisition.<br><br>About 125 acres of additional land for plant and 50 acres for Township required. The same has been identified contiguous to existing plant and township areas. The township is to be located in North West of the plant area and on Mouda – Ramtek road, 6 kms away from Mouda town. No major problem anticipated in acquisition as per site visit and discussions with State Govt. officials.<br><br>About 550 acres of land is required for ash disposal. Alternatives suggested by Mouda site visited on 09.07.09 and the land near Kirnapur & Kpra villages have been finalized. In principle land availability for Mouda Stage-II has been obtained from Office of the Collector, Nagpur vide letter ref. No. Desk-17/Resettlement/T-1/w.s. 323/09 dated 27.08.09. |   |                  |   |
| MOUDA SUPER THERMAL POWER PROJECT<br>STAGE-II (2X660 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | TECHNICAL SPECIFICATION<br>SECTION-VI<br>PART-A | PROJECT SYNOPSIS | PAGE<br>1 OF 9  |



| CLAUSE NO.  | PROJECT SYNOPSIS   |   |  |
|---|---|---|--|
| 1.03.00   | <p><b>Water</b></p> <p>Make up water requirement for Stage-II of this project would be about <b>4800 m<sup>3</sup>/hr.</b> Water requirement for the project will be met from pondage created on river Wain Ganga/ Kanhan by construction of dam near Gosikhurd by Govt. of Maharashtra. Make-up water shall be drawn from above mentioned source and shall be pumped to the raw water reservoir located about 24 Kms from intake well.</p> <p>Maharashtra Government has approved the reservation of 100 MCM water including the evaporation losses for NTPC in Goshikhurd Project for the ultimate stage of the project (Stage-I 2x500 MW) + Stage-II (2x660 MW). Ministry of Industries, Energy and Labour Department, Government of Maharashtra vide letter dated 10.12.2002 has given in principle consent for making available the required water for the Mouda project.</p>  |   |  |
| 1.04.00   | <p><b>Railway Siding</b></p> <p>Employer intends to construct the railway siding to project site from the nearest existing railway line. However, the same may not be available to the bidder for his use to transport equipment and material.</p> <p>Bidder may visit the site and acquaint themselves with the facilities available.</p>  |   |  |
| 1.05.00   | <p><b>Metrological Data</b> Metrological Data from the nearest observatory is placed at <b>Annexure- 1.</b></p>   |   |  |
| 1.06.00   | <p><b>Plant Water Scheme</b></p> <p>The Plant water scheme is described below.</p>  |   |  |
| 1.06.01   | <p><b>Condenser Cooling (CW) Water System</b></p> <p>It is proposed to provide recirculating type CW system with induced draft type cooling towers. For the recirculating type CW system it is proposed to supply clarified water as make up. Raw water from the make-up water pump house shall be pumped to a Water Pretreatment Plant (PT - CW system). The treated clarified water shall be led to the cold water channel of CW system. CW system shall be operated at a C.O.C of about 4 . Chemical treatment programme (using acid dosing and scale cum corrosion inhibitors dosing) may be employed in addition to blow down of CW water to control the CW system chemistry in case CW system is required to be operated beyond 4COC. The expected circulating water analysis is given in this sub-section. CW blow down shall be drawn from the discharge of CW pumps and the same shall be led to a Service water Tank. For carrying circulating water from CW pump house to TG-area and from TG area to cooling tower, steel lined concrete encased duct would be provided. For interconnecting CW duct with</p> |   |  |
| MOUDA SUPER THERMAL POWER PROJECT<br>STAGE-II (2X660 MW)<br>STEAM TURBINE GENERATOR PACKAGE |   | TECHNICAL SPECIFICATION<br>SECTION-VI<br>PART-A | PROJECT SYNOPSIS<br><br>PAGE<br>2 OF 9 |












| CLAUSE NO.  | PROJECT SYNOPSIS  |   |                   |  |
|---|---|---|-------------------|---|
|   | COOLING WATER ANALYSIS  |   |                   |   |
|   | Sl. No.   | Constituent                                     | as                | mg per litre  |
|   | 1.  | Calcium   | CaCO <sub>3</sub> | 407   |
|   | 2.  | Magnesium                                       | CaCO <sub>3</sub> | 250   |
|   | 3.  | Sodium & Potassium                              | CaCO <sub>3</sub> | 175   |
|   | 4.  | Cations   | CaCO <sub>3</sub> | 832   |
|   | 5.  | Bicarbonates                                    | CaCO <sub>3</sub> | 516   |
|   | 6.  | Chloride  | CaCO <sub>3</sub> | 162   |
|   | 7.  | Sulphate  | CaCO <sub>3</sub> | 154   |
|   | 8.  | Anions  | CaCO <sub>3</sub> | 832   |
|   | 9.  | Silica  | SiO <sub>2</sub>  | 50  |
|   | 10.   | Iron  | Fe                | <0.8  |
|   | 11.   | pH Value  | -                 | 8.4   |
|   | 12.   | TSS   | mg/l              | <25   |
|   | <b>Note :</b> The C.W system is expected to operate at about 3.0 Cycles of Concentration. |   |                   |   |
| MOUDA SUPER THERMAL POWER PROJECT<br>STAGE-II (2X660 MW)<br>STEAM TURBINE GENERATOR PACKAGE |   | TECHNICAL SPECIFICATION<br>SECTION-VI<br>PART-A |                   | PROJECT SYNOPSIS<br><br>PAGE<br>5 OF 9  |



|   |  |                  |                |
|---|--|------------------|----------------|
| CLAUSE NO.  | <div>PROJECT SYNOPSIS</div> <div> </div> <div>Exhibit No. 1</div> |                  |                |
|   |  |                  |                |
| MOUDA SUPER THERMAL POWER PROJECT<br>STAGE-II (2X660 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATION<br>SECTION-VI<br>PART-A  | PROJECT SYNOPSIS | PAGE<br>7 OF 9 |




## Annexure-I

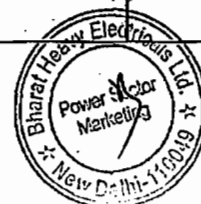
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| CLAUSE NO.  | PROJECT INFORMATION   |   |  |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
|---|---|---|---|---------|----------------|--------|---------|----------|----------------------------|-----|----------|----------------------------|-----|----------|----------------------------|-----|----------|--------------------------------|-----|----------|-------------------------------|-----|-----|------------------------|-----|---|
| 1.00.00   | <b>BACKGROUND</b><br><p>Vindhyachal Super Thermal Power Project was conceived as a pit head coal based super thermal power plant of 2260 MW (6x210 MW + 2X500 MW) for which land was acquired during stage-I of the project. the capacity of the project was increased to 4260 MW by adding two units of 500 Mw each under Stage-III and two units of 500 MW each under Stage-IV of the project. Further, the capacity of the project was increased to 4760 MW by adding one unit of 500 MW under Stage-V. Stage-I, II &amp; III of the project comprising of six units of 210 Mw + two units of 500 MW + two units of 500 MW are under commercial operation. Two units of 500 Mw under stage-IV and one unit of 500 MW under stage V of the project is under implementation. The capacity after implementation of Stage-V of the project shall be 4760 MW.</p>   |   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| 2.00.00   | <b>CAPACITY</b><br><table border="1"> <thead> <tr> <th>Stage</th> <th>Capacity</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>I</td> <td>6X210 MW</td> <td>Under Commercial Operation</td> </tr> <tr> <td>II</td> <td>6X500 MW</td> <td>Under Commercial Operation</td> </tr> <tr> <td>III</td> <td>2X500 MW</td> <td>Under Commercial Operation</td> </tr> <tr> <td>IV</td> <td>2X500 MW</td> <td>Presently under implementation</td> </tr> <tr> <td>V</td> <td>1x500 MW</td> <td>Presently under implmentation</td> </tr> </tbody> </table>   |   |   | Stage   | Capacity       | Status | I       | 6X210 MW | Under Commercial Operation | II  | 6X500 MW | Under Commercial Operation | III | 2X500 MW | Under Commercial Operation | IV  | 2X500 MW | Presently under implementation | V   | 1x500 MW | Presently under implmentation |     |     |                        |     |   |
| Stage   | Capacity  | Status  |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| I   | 6X210 MW  | Under Commercial Operation  |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| II  | 6X500 MW  | Under Commercial Operation  |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| III   | 2X500 MW  | Under Commercial Operation  |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| IV  | 2X500 MW  | Presently under implementation  |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| V   | 1x500 MW  | Presently under implmentation   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| 3.00.00   | <b>LOCATION AND APPROACH:</b><br><p>The plant is located in Sidhi district of Madhya Pradesh, having a latitude and longitude of 24° 6' N and 82° 40' E respectively.</p> <p>Major rail and road distances from the project site are as under:</p> <table border="1"> <thead> <tr> <th rowspan="2">Between</th> <th colspan="2">Distance (Kms)</th> </tr> <tr> <th>By Road</th> <th>By Rail</th> </tr> </thead> <tbody> <tr> <td>Vindhyachal – Lucknow</td> <td>435</td> <td>475</td> </tr> <tr> <td>Vindhyachal – New Delhi</td> <td>850</td> <td>925</td> </tr> <tr> <td>Vindhachal- Sidhi</td> <td>095</td> <td>-</td> </tr> <tr> <td>Vindhyachal- Bhopal</td> <td>610</td> <td>590</td> </tr> <tr> <td>Vindhyachal- Mirzapur</td> <td>175</td> <td>175</td> </tr> <tr> <td>Vindhyachal – Varanasi</td> <td>220</td> <td>-</td> </tr> </tbody> </table> <p>The Vicinity Plan of the project is enclosed as Annexure A-I.</p> |   |   | Between | Distance (Kms) |        | By Road | By Rail  | Vindhyachal – Lucknow      | 435 | 475      | Vindhyachal – New Delhi    | 850 | 925      | Vindhachal- Sidhi          | 095 | -        | Vindhyachal- Bhopal            | 610 | 590      | Vindhyachal- Mirzapur         | 175 | 175 | Vindhyachal – Varanasi | 220 | - |
| Between   | Distance (Kms)  |   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
|   | By Road   | By Rail   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| Vindhyachal – Lucknow   | 435   | 475   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| Vindhyachal – New Delhi   | 850   | 925   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| Vindhachal- Sidhi   | 095   | -   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| Vindhyachal- Bhopal   | 610   | 590   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| Vindhyachal- Mirzapur   | 175   | 175   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| Vindhyachal – Varanasi  | 220   | -   |   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |
| <b>VINDHYACHAL SUPER THERMAL POWER PROJECT</b><br><b>STAGE-V (1X500 MW)</b><br><b>STEAM TURBINE GENERATOR PACKAGE</b> |   | <b>TECHNICAL SPECIFICATIONS</b><br><b>SECTION-VI</b><br><b>PART-A</b> | <b>PROJECT INFORMATION</b><br><b>PAGE 1 OF 13</b>                                   |         |                |        |         |          |                            |     |          |                            |     |          |                            |     |          |                                |     |          |                               |     |     |                        |     |   |

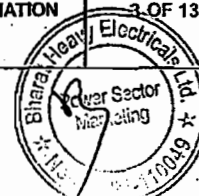





| CLAUSE NO.   | PROJECT INFORMATION  |  |                                     |
|--|--|---|-------------------------------------|
| 4.00.00  | <b>LAND REQUIREMENT</b><br><br>A total area of 5378 acres of land was acquired for the project during implementation of Stage-I. The plant facilities and township for this project would be accommodated in the land acquired during Stage-I of the project. However, for ash dyke, approximately 260 acres of land is proposed to be acquired.   |   |                                     |
| 5.00.00  | <b>COAL AVAILABILITY AND LINKAGE</b><br><br>Coal requirement for Vindhyachal STPP, Stage-I, II & III is presently being met from Northern Coal Fields (NCL). The daily coal requirement for one 500 MW Unit shall be about 2.87 MTPA at 90% PLF. For FR purposes, coal from NCL has been considered.   |   |                                     |
| 6.00.00  | <b>COAL TRANSPORTATION</b><br><br>Coal requirement for Stage-V shall be met from Stage-IV itself. Accordingly Stage-IV CHP capacity has been selected as 2000 MTPH. Coal input to Stage-IV & Stage-V may be from BOBR or BOX N wagons.   |   |                                     |
| 7.00.00  | <b>RAILWAY SIDING</b><br><br>For bringing the equipment and material to the power house through rail, a permanent railway siding has already been constructed during Stage-I, II & III. This siding is proposed to be extended upto Stage-V of the project to provide rail access to unloading bays and transformer yard.  |   |                                     |
| 8.00.00  | <b>COOLING WATER REQUIREMENT, SOURCE, COMMITMENT AND SYSTEM</b><br><br>The source of raw water for the project is hot water Discharge channel of CW System of Singrauli STPP as that of in existing Stage-I, II, III & IV of Vindhyachal STPP.<br><br>Raw water is proposed to be used for meeting the complete water requirement of the project. Normal Make up water requirement for this project would be about 1800 M <sup>3</sup> /hr with ash water re-circulation system and 2800 m <sup>3</sup> /hr with once thru system.<br><br>The total commitment for the project is 180 Cusecs and the same has been duly concurred by CWC. The make-up water requirement of Stage-V will be about 20 Cusecs which shall be met from surplus water available within existing commitment. |   |                                     |
| VINDHYACHAL-SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A                                    | PROJECT INFORMATION<br>PAGE 2 OF 13 |



| CLAUSE NO.   | PROJECT INFORMATION  | एनटीपीसी<br>NTPC  |  |                        |                 |
|--|--|---|--|------------------------|-----------------|
| 9.00.00  | <b>METREOLOGICAL DATA</b><br><br>Important Metreological Data from nearest observatory at Sidhi is placed at Annexure B-I.   |   |  |                        |                 |
| 11.00.00   | <b>PLANT WATER SCHEME</b><br><br>The Plant water scheme is described below.  |   |  |                        |                 |
| 11.01.00   | <b>Condenser Cooling (CW) Water System</b><br><br>It is proposed to provide recirculating type CW system with induced draft type cooling towers, Raw water for Stage - V of this project shall be pumped from the hot water (CW system) discharge channel of Singrauli Project of NTPC to Water pretreatment Plant. The treated clarified water shall be pumped to the Stage - V circulating Water (CW) system as make up to the system. It is proposed to operate the CW system at a C.O.C. of about 4 and chemical treatment programme (using acid dosing and scale cum corrosion inhibitors dosing) shall be employed in addition to blow down of CW water to control the CW system water chemistry. The expected circulating water analysis is given in Annexure C-I of the Sub-section. |   |  |                        |                 |
| 11.02.00   | <b>Equipment Cooling Water (ECW) System (Unit Auxiliaries)</b><br><br>The plant auxiliaries of Steam Generator shall be cooled by Demineralised water (DM) in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from CW system in a closed secondary circuit. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.  |   |  |                        |                 |
| 11.03.00   | <b>Ash Water System</b><br><br>(a) It is proposed to operate ash water system in a closed circuit. The ash water from the ash dyke shall be recirculated. During re-circulation mode, the make up to the ash water system (to compensate for the ash water blow down and evaporation loss in ash dyke) shall be supplied from CW blow down.<br><br>(b) During initial operating stage of the project, when decanted ash water is not available from the dyke, the ash water system shall be operated in once through mode. The make-up water to ash water system shall be pumped from the raw water (from the discharge channel of Singrauli station) source and CW blow down water.   |   |  |                        |                 |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | <table border="1"> <tr> <td>           TECHNICAL SPECIFICATIONS<br/>           SECTION-VI<br/>           PART-A         </td><td>           PROJECT<br/>           INFORMATION         </td><td>           PAGE<br/>           3 OF 13         </td></tr> </table> | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A | PROJECT<br>INFORMATION | PAGE<br>3 OF 13 |
| TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A   | PROJECT<br>INFORMATION   | PAGE<br>3 OF 13   |  |                        |                 |



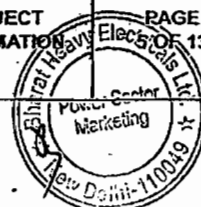


| CLAUSE NO.   | PROJECT INFORMATION   |  |                                     |
|--|---|---|-------------------------------------|
| 11.04.00   | <p>(c) Considering total ash handling plant water requirement of 1100 Cu.M/hr. for slurry formation during re-circulation mode operation, it is expected that about 970 M<sup>3</sup>/hr of decanted ash water shall return to the ash handling system after accounting for evaporation loss.</p> <p>(d) The quality of raw water is given at Annexure B-III.</p> <p><b>Other Miscellaneous Water Systems</b></p> <p>(a) CW system blow down water shall be used for the dust suppression system of coal handling plant, ash slurry pumps sealing, make-up to ash handling plant, make-up to fire water storage tanks and cooling water requirement of hydrogen generation plant. The service (wash water) water collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use. The excess service water shall be led to central monitoring basin for disposal.</p> <p>(b) Separate water Pre-treatment plants are proposed for Circulating water (PT-CW) system and Demineralisation Plant (PT-CW) plant.</p> <p>(c) It is proposed to provided a DM plant for this stage of the project. From the proposed DM plant DM water shall be pumped to meet the Steam Cycle make-up water requirement, makeup the hydrogen generation plant and makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water shall be provided from Demineralising plant. In addition, separate set of boiler fill pumps shall be provided to fill the boiler from these DM water storage tanks, DM water required for regeneration of condensate polishing plant and resin transfer operation shall also be provided by these tanks.</p> <p>(d) The quality of filtered (potable) water and DM water is given in Annexure -B-III of this sub-section.</p> |   |                                     |
| 12.00.00   | <p><b>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></p> <p>All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given in Sub-Section-D-1, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.</p>  |   |                                     |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |   | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A                                    | PROJECT INFORMATION<br>PAGE 4 OF 13 |





| CLAUSE NO.   | PROJECT INFORMATION   | एन टी पी सी<br>NTPC    |                 |
|--|---|------------------------|-----------------|
| 13.00.00   | <p><b>CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</b></p> <p>All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Sub-Section-D-1, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.</p> |                        |                 |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A  | PROJECT<br>INFORMATION | PAGE<br>5 OF 13 |





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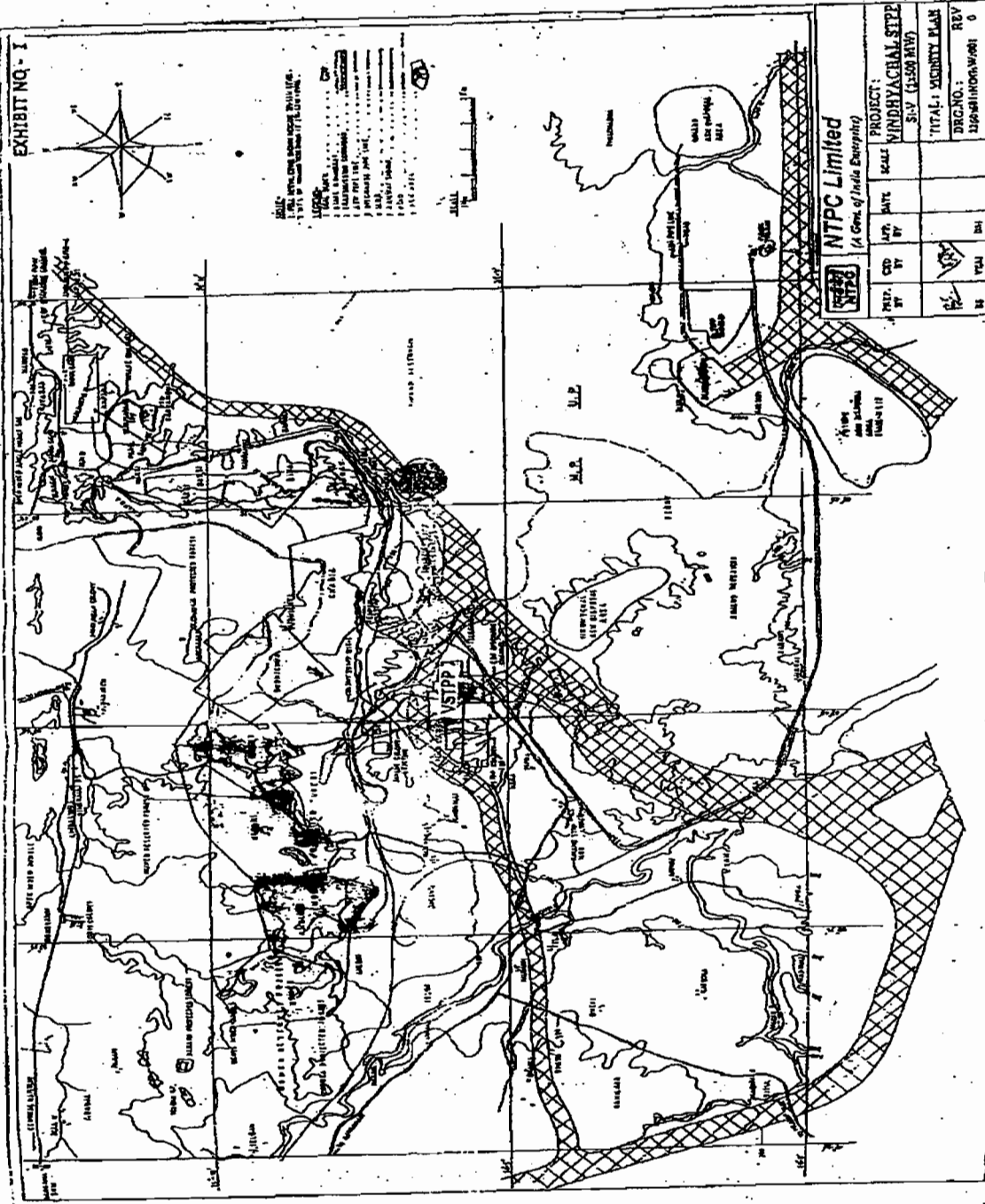
PROJECT INFORMATION



VICINITY PLAN

ANNEXURE A-I

EXHIBIT NO. - I



| NTPC Limited                    |                        |                        |                        |
|---------------------------------|------------------------|------------------------|------------------------|
| (A) Govt. of India (Enterprise) |                        |                        |                        |
| PROJECT                         | SCALE                  | DATE                   | REV                    |
| VINDHYACHAL STP                 | 1:50,000               | 11/11/2000             | 0                      |
| TOTAL: VINDHYACHAL STP          | TOTAL: VINDHYACHAL STP | TOTAL: VINDHYACHAL STP | TOTAL: VINDHYACHAL STP |
| DRG. NO.:                       | REV                    | DATE                   | REV                    |
| 11/11/2000                      | 0                      | 11/11/2000             | 0                      |

VINDHYACHAL SUPER THERMAL POWER PROJECT  
STAGE-V (1x500 MW)  
STEAM TURBINE GENERATOR PACKAGE

TECHNICAL SPECIFICATIONS  
SECTION-VI  
PART-A

PROJECT  
INFORMATION

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6 OF 13



## METROLOGICAL DATA

**ANNEXURE B-1**  
**PAGE 1 OF 2**

## ANNEXURE - I

जलवायवी सारणी  
CLIMATOLOGICAL TABLE

1938 से 1980 तक के मैडन्यै पर आधारित  
BASED ON OBSERVATIONS FROM 1938 TO 1980

गुजराती भास प्रबन्ध से ऊपर  
HEIGHT ABOVE M. S. L. 272 METRES मीटर

अक्षांश देशांतर  
LAT 24°25' N LONG 81°52' E

STATION, Sidhi

CHAL S  
S  
AM TUN

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VINDHYACHAL SUPER THERMAL POWER PROJECT  
STAGE-V (1X500 MW)  
STEAM TURBINE GENERATOR PACKAGE

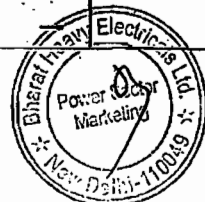
# TECHNICAL SPECIFICATIONS

## SECTION-VI

### PART-A

## PROJECT INFORMATION

**PAGE  
7 OF 13**






## METROLOGICAL DATA

## ANNEXURE B-I

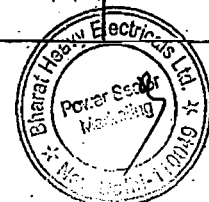
**PAGE 2 OF 2**

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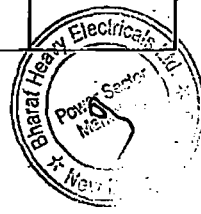
| CLAUSE NO.   | PROJECT INFORMATION   |                        |                 |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
|--|---|------------------------|-----------------|--|-------------|----|--------------|----|---------|-------------------|-------|----|-----------|-------------------|------|----|--------------------|-------------------|------|----|-------------|-------------------|-------|----|----------|-------------------|------|----|----------|-------------------|------|----|-----------|-------------------|---|----|--------|------------------|------|----|------|----|-----|-----|----------|---|---------|-----|-----------|-----|----|
|  | <div style="text-align: right;">  </div> <div style="text-align: right;">           ANNEXURE C-I<br/>PAGE 1 OF 5         </div> <div style="text-align: center;"> <b>COOLING WATER ANALYSIS</b> </div> <table border="1"> <thead> <tr> <th></th><th>Constituent</th><th>as</th><th>mg per litre</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Calcium</td><td>CaCO<sub>3</sub></td><td>148.0</td></tr> <tr> <td>2.</td><td>Magnesium</td><td>CaCO<sub>3</sub></td><td>37.5</td></tr> <tr> <td>3.</td><td>Sodium &amp; Potassium</td><td>CaCO<sub>3</sub></td><td>47.5</td></tr> <tr> <td>4.</td><td>Bicarbonate</td><td>CaCO<sub>3</sub></td><td>104.5</td></tr> <tr> <td>5.</td><td>Chloride</td><td>CaCO<sub>3</sub></td><td>47.5</td></tr> <tr> <td>6.</td><td>Sulphate</td><td>CaCO<sub>3</sub></td><td>81.0</td></tr> <tr> <td>7.</td><td>Carbonate</td><td>CaCO<sub>3</sub></td><td>0</td></tr> <tr> <td>8.</td><td>Silica</td><td>SiO<sub>2</sub></td><td>25.0</td></tr> <tr> <td>9.</td><td>Iron</td><td>Fe</td><td>.75</td></tr> <tr> <td>10.</td><td>pH Value</td><td>-</td><td>7.6-7.9</td></tr> <tr> <td>11.</td><td>Turbidity</td><td>NTU</td><td>50</td></tr> </tbody> </table> <p><b>Note:</b> The C.W system is expected to operate at about 4.0 Cycles of concentration.</p> |                        |                 |  | Constituent | as | mg per litre | 1. | Calcium | CaCO <sub>3</sub> | 148.0 | 2. | Magnesium | CaCO <sub>3</sub> | 37.5 | 3. | Sodium & Potassium | CaCO <sub>3</sub> | 47.5 | 4. | Bicarbonate | CaCO <sub>3</sub> | 104.5 | 5. | Chloride | CaCO <sub>3</sub> | 47.5 | 6. | Sulphate | CaCO <sub>3</sub> | 81.0 | 7. | Carbonate | CaCO <sub>3</sub> | 0 | 8. | Silica | SiO <sub>2</sub> | 25.0 | 9. | Iron | Fe | .75 | 10. | pH Value | - | 7.6-7.9 | 11. | Turbidity | NTU | 50 |
|  | Constituent   | as                     | mg per litre    |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 1.   | Calcium   | CaCO <sub>3</sub>      | 148.0           |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 2.   | Magnesium   | CaCO <sub>3</sub>      | 37.5            |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 3.   | Sodium & Potassium  | CaCO <sub>3</sub>      | 47.5            |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 4.   | Bicarbonate   | CaCO <sub>3</sub>      | 104.5           |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 5.   | Chloride  | CaCO <sub>3</sub>      | 47.5            |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 6.   | Sulphate  | CaCO <sub>3</sub>      | 81.0            |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 7.   | Carbonate   | CaCO <sub>3</sub>      | 0               |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 8.   | Silica  | SiO <sub>2</sub>       | 25.0            |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 9.   | Iron  | Fe                     | .75             |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 10.  | pH Value  | -                      | 7.6-7.9         |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| 11.  | Turbidity   | NTU                    | 50              |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A  | PROJECT<br>INFORMATION | PAGE<br>9 OF 13 |  |             |    |              |    |         |                   |       |    |           |                   |      |    |                    |                   |      |    |             |                   |       |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |    |

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| CLAUSE NO.   | PROJECT INFORMATION   |                        |                  |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
|--|---|------------------------|------------------|--|-------------|----|--------------|----|---------|-------------------|------|----|-----------|-------------------|------|----|--------------------|-------------------|------|----|-------------|-------------------|------|----|----------|-------------------|------|----|----------|-------------------|------|----|-----------|-------------------|---|----|--------|------------------|------|----|------|----|-----|-----|----------|---|---------|-----|-----------|-----|-----------|-----|------------------|--|----|
|  | <div style="text-align: right;">  </div> <div style="text-align: right;">           ANNEXURE C-I<br/>PAGE 2 OF 5         </div> <div style="text-align: center;"> <b>RAW WATER ANALYSIS</b> </div> <table border="1"> <thead> <tr> <th></th><th>Constituent</th><th>as</th><th>mg per litre</th></tr> </thead> <tbody> <tr><td>1.</td><td>Calcium</td><td>CaCO<sub>3</sub></td><td>34.0</td></tr> <tr><td>2.</td><td>Magnesium</td><td>CaCO<sub>3</sub></td><td>15.0</td></tr> <tr><td>3.</td><td>Sodium &amp; Potassium</td><td>CaCO<sub>3</sub></td><td>19.0</td></tr> <tr><td>4.</td><td>Bicarbonate</td><td>CaCO<sub>3</sub></td><td>46.0</td></tr> <tr><td>5.</td><td>Chloride</td><td>CaCO<sub>3</sub></td><td>12.0</td></tr> <tr><td>6.</td><td>Sulphate</td><td>CaCO<sub>3</sub></td><td>10.0</td></tr> <tr><td>7.</td><td>Corbonate</td><td>CaCO<sub>3</sub></td><td>0</td></tr> <tr><td>8.</td><td>Silica</td><td>SiO<sub>2</sub></td><td>10.0</td></tr> <tr><td>9.</td><td>Iron</td><td>Fe</td><td>2.0</td></tr> <tr><td>10.</td><td>pH Value</td><td>-</td><td>7.6-8.2</td></tr> <tr><td>11.</td><td>Turbidity</td><td>NTU</td><td>upto 1000</td></tr> <tr><td>12.</td><td>Temperature (°C)</td><td></td><td>43</td></tr> </tbody> </table> <p><b>Note:</b> Raw water from hot water channel of Singrauli STPP.</p> |                        |                  |  | Constituent | as | mg per litre | 1. | Calcium | CaCO <sub>3</sub> | 34.0 | 2. | Magnesium | CaCO <sub>3</sub> | 15.0 | 3. | Sodium & Potassium | CaCO <sub>3</sub> | 19.0 | 4. | Bicarbonate | CaCO <sub>3</sub> | 46.0 | 5. | Chloride | CaCO <sub>3</sub> | 12.0 | 6. | Sulphate | CaCO <sub>3</sub> | 10.0 | 7. | Corbonate | CaCO <sub>3</sub> | 0 | 8. | Silica | SiO <sub>2</sub> | 10.0 | 9. | Iron | Fe | 2.0 | 10. | pH Value | - | 7.6-8.2 | 11. | Turbidity | NTU | upto 1000 | 12. | Temperature (°C) |  | 43 |
|  | Constituent   | as                     | mg per litre     |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 1.   | Calcium   | CaCO <sub>3</sub>      | 34.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 2.   | Magnesium   | CaCO <sub>3</sub>      | 15.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 3.   | Sodium & Potassium  | CaCO <sub>3</sub>      | 19.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 4.   | Bicarbonate   | CaCO <sub>3</sub>      | 46.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 5.   | Chloride  | CaCO <sub>3</sub>      | 12.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 6.   | Sulphate  | CaCO <sub>3</sub>      | 10.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 7.   | Corbonate   | CaCO <sub>3</sub>      | 0                |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 8.   | Silica  | SiO <sub>2</sub>       | 10.0             |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 9.   | Iron  | Fe                     | 2.0              |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 10.  | pH Value  | -                      | 7.6-8.2          |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 11.  | Turbidity   | NTU                    | upto 1000        |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| 12.  | Temperature (°C)  |                        | 43               |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A  | PROJECT<br>INFORMATION | PAGE<br>10 OF 13 |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |     |     |          |   |         |     |           |     |           |     |                  |  |    |

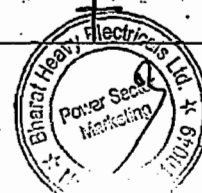





| CLAUSE NO.   | PROJECT INFORMATION   |                        |  |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
|--|---|------------------------|--|--|-------------|----|--------------|----|---------|-------------------|------|----|-----------|-------------------|------|----|--------------------|-------------------|------|----|-------------|-------------------|------|----|----------|-------------------|------|----|----------|-------------------|------|----|-----------|-------------------|---|----|--------|------------------|------|----|------|----|------|-----|----------|---|---------|-----|-----------|-----|----|-----|------------------|--|----|
|  | <div style="text-align: right;">  </div> <div style="text-align: right;">           ANNEXURE C-I<br/>PAGE 3 OF 5         </div> <div style="text-align: center;"> <b>CLARIFIED WATER ANALYSIS</b> </div> <table border="1"> <thead> <tr> <th></th><th>Constituent</th><th>as</th><th>mg per litre</th></tr> </thead> <tbody> <tr><td>1.</td><td>Calcium</td><td>CaCO<sub>3</sub></td><td>59.2</td></tr> <tr><td>2.</td><td>Magnesium</td><td>CaCO<sub>3</sub></td><td>15.0</td></tr> <tr><td>3.</td><td>Sodium &amp; Potassium</td><td>CaCO<sub>3</sub></td><td>19.0</td></tr> <tr><td>4.</td><td>Bicarbonate</td><td>CaCO<sub>3</sub></td><td>41.7</td></tr> <tr><td>5.</td><td>Chloride</td><td>CaCO<sub>3</sub></td><td>19.0</td></tr> <tr><td>6.</td><td>Sulphate</td><td>CaCO<sub>3</sub></td><td>32.5</td></tr> <tr><td>7.</td><td>Corbonate</td><td>CaCO<sub>3</sub></td><td>0</td></tr> <tr><td>8.</td><td>Silica</td><td>SiO<sub>2</sub></td><td>10.0</td></tr> <tr><td>9.</td><td>Iron</td><td>Fe</td><td>.030</td></tr> <tr><td>10.</td><td>pH Value</td><td>-</td><td>7.6-8.2</td></tr> <tr><td>11.</td><td>Turbidity</td><td>NTU</td><td>10</td></tr> <tr><td>12.</td><td>Temperature (°C)</td><td></td><td>43</td></tr> </tbody> </table> <p><b>Note:</b> At the outlet of clarifier of PT Plant</p> |                        |  |  | Constituent | as | mg per litre | 1. | Calcium | CaCO <sub>3</sub> | 59.2 | 2. | Magnesium | CaCO <sub>3</sub> | 15.0 | 3. | Sodium & Potassium | CaCO <sub>3</sub> | 19.0 | 4. | Bicarbonate | CaCO <sub>3</sub> | 41.7 | 5. | Chloride | CaCO <sub>3</sub> | 19.0 | 6. | Sulphate | CaCO <sub>3</sub> | 32.5 | 7. | Corbonate | CaCO <sub>3</sub> | 0 | 8. | Silica | SiO <sub>2</sub> | 10.0 | 9. | Iron | Fe | .030 | 10. | pH Value | - | 7.6-8.2 | 11. | Turbidity | NTU | 10 | 12. | Temperature (°C) |  | 43 |
|  | Constituent   | as                     | mg per litre   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 1.   | Calcium   | CaCO <sub>3</sub>      | 59.2   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 2.   | Magnesium   | CaCO <sub>3</sub>      | 15.0   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 3.   | Sodium & Potassium  | CaCO <sub>3</sub>      | 19.0   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 4.   | Bicarbonate   | CaCO <sub>3</sub>      | 41.7   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 5.   | Chloride  | CaCO <sub>3</sub>      | 19.0   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 6.   | Sulphate  | CaCO <sub>3</sub>      | 32.5   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 7.   | Corbonate   | CaCO <sub>3</sub>      | 0  |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 8.   | Silica  | SiO <sub>2</sub>       | 10.0   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 9.   | Iron  | Fe                     | .030   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 10.  | pH Value  | -                      | 7.6-8.2  |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 11.  | Turbidity   | NTU                    | 10   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| 12.  | Temperature (°C)  |                        | 43   |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-A  | PROJECT<br>INFORMATION | <div style="text-align: center;">  </div> |  |             |    |              |    |         |                   |      |    |           |                   |      |    |                    |                   |      |    |             |                   |      |    |          |                   |      |    |          |                   |      |    |           |                   |   |    |        |                  |      |    |      |    |      |     |          |   |         |     |           |     |    |     |                  |  |    |



| CLAUSE NO.  | PROJECT INFORMATION  |   |  |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
|---|--|---|---|-----------------|-------|----|---------------|--------------------------------|----|------------|-------|----|----------------|-------|----|----------|--------------|----|--------------|---|--|
|   | <p style="text-align: right;">ANNEXURE C-I<br/>PAGE 5 OF 5</p> <p style="text-align: center;"><b>ANALYSIS OF DM WATER TO BE USED<br/>FOR<br/>MAKE-UP WATER TO CONDENSER</b></p> <table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Characteristics</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Silica (Max.)</td> <td>- 0.02 ppm as SiO<sub>2</sub></td> </tr> <tr> <td>2.</td> <td>Iron as Fe</td> <td>- Nil</td> </tr> <tr> <td>3.</td> <td>Total hardness</td> <td>- Nil</td> </tr> <tr> <td>4.</td> <td>pH value</td> <td>- 6.8 to 7.2</td> </tr> <tr> <td>5.</td> <td>Conductivity</td> <td>- Not more than 0.1 excluding the effects of free CO<sub>2</sub></td> </tr> </tbody> </table> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE : FOR PASSIVATED DM WATER pH IS 8.5 - 9.5</p> </div> |   | Sl. No.   | Characteristics | Value | 1. | Silica (Max.) | - 0.02 ppm as SiO <sub>2</sub> | 2. | Iron as Fe | - Nil | 3. | Total hardness | - Nil | 4. | pH value | - 6.8 to 7.2 | 5. | Conductivity | - Not more than 0.1 excluding the effects of free CO <sub>2</sub> |  |
| Sl. No.   | Characteristics  | Value   |   |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
| 1.  | Silica (Max.)  | - 0.02 ppm as SiO <sub>2</sub>                                    |   |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
| 2.  | Iron as Fe   | - Nil   |   |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
| 3.  | Total hardness   | - Nil   |   |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
| 4.  | pH value   | - 6.8 to 7.2  |   |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
| 5.  | Conductivity   | - Not more than 0.1 excluding the effects of free CO <sub>2</sub> |   |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
| <b>VINDHYACHAL SUPER THERMAL POWER PROJECT<br/>STAGE-V (1X500 MW)<br/>STEAM TURBINE GENERATOR PACKAGE</b> |  | <b>TECHNICAL SPECIFICATIONS<br/>SECTION-VI<br/>PART-A</b>         | <b>PROJECT<br/>INFORMATION</b>  |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |
|   |  |   | <b>PAGE<br/>13 OF 13</b>  |                 |       |    |               |                                |    |            |       |    |                |       |    |          |              |    |              |   |  |





|   |   |                                   |                   |
|---|---|-----------------------------------|-------------------|
|  | TITLE : TECHNICAL SPECIFICATION<br>FOR<br>CONDENSER ON LOAD TUBE CLEANING<br>SYSTEMS (COLTCS) | SPEC. NO. PE-TS- 387/388-165-N001 |                   |
|   |   | VOLUME : II B                     |                   |
|   |   | SECTION : C                       |                   |
|   |   | REV. NO. 0                        | DATE : 04.02.2013 |
|   |   | SHEET 1                           | of 1              |

## SECTION – C

### SPECIFIC REQUIREMENTS

- SECTION C1 : CONDENSER ONLOAD TUBE CLEANING
- SECTION C2 : ELECTRICAL SYSTEMS
- SECTION C3 : C&I SYSTEMS





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**

**VOLUME : IIB**

**SECTION : D**

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**SECTION C1**

**CONDENSER ONLOAD TUBE CLEANING SYSTEMS**

**(MECHANICAL DETAILS)**





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

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## 1.0 GENERAL

The Condenser On load Tube Cleaning Systems (COLTCS) complete with all accessories shall conform to the standard technical specifications (Section-D) and Data Sheet-A enclosed herewith. In addition the requirements of this section C shall also be complied with. However, wherever the details given in Section-D and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly in the event of contradictions between Section-C & Section-D/ Data Sheet-A, Section-C shall prevail.

Section C consists of 3 parts viz. Sec. C1, C2 and C3 for Mechanical, Electrical and C&I respectively, the requirements of all 3 sections shall be complied with.

## 2.0 DESCRIPTION OF EQUIPMENTS :

### 2.1 Condenser on load tube cleaning systems (COLTCS) :

The condenser on load tube cleaning system (COLTCS) is intended to prevent formation of various forms of fouling and scaling in the condenser tubes. The cooling water system is of closed circuit type with cooling towers or open circuit type as specified. The water analysis is indicated in project information in section B.

## 3.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR COLTCS.

3.1 The scope of supply for COLTCS covered under this specification is as under.

The size, MOC's and other particulars of the equipments for various projects are detailed in Data Sheet A annexed with Section – D of the specification.

| SL.NO. | PROJECT  | COLTCS  |
|--------|--|---|
| 1.     | 2 X 660 MW NTPC MOUDA STPP STAGE II – (STG PKG).   | 2 SETS PER UNIT<br>viz. TOTAL 4 SETS FOR BOTH UNIT. |
| 2.     | 1 x 500 MW – VINDHYACHAL STPP, STAGE- V (STG PKG). | 2 SETS PER UNIT<br>viz. TOTAL 2 SETS.               |





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### 3.2 SCOPE OF SUPPLY IN THE BIDDER'S SCOPE FOR COLTCS:

3.2.1 Each set of COLTCS for each projects shall comprise of following :

- a) One No. Ball Separator at Condenser CW outlet pipe.
- b) One No. Ball recirculation pump with drive motor.
- c) One No. Ball collector.
- d) One No. Manual ball sorter (Bucket type sorter with sieves to manually sort out the undersized balls by shaking the sieved bucket manually) for each set of COLTCS.
- e) Differential pressure measuring system for ball separator. DP measuring system shall comprise of 2 nos. DPT +1 no. DPG for each COLTCS. Instrument shall be with *Remote seal* arrangement. Stubs for DPT and DPG shall be independent.
- f) Ball monitoring system comprising of an independent balls recirculation monitor and an independent balls oversize monitor. If bidder is not manufacturing Ball over size monitor then they can offer other alternatives like automatic ball sorter etc.
- g) Length of Ball separator, Scope of Counter Flange, Nuts and bolts shall be as per Annexure- I of section C1.  
Thickness of body flange and counter flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.
- h) Complete Pipe work, including interconnection piping, flanges/counter flanges for valves & pipes, bends, fittings, distributors, nozzles and support installation materials shall be in Bidder's scope. Bidder shall finalize the pipework to suit the layout at contract stage in such a way that no site welding is required for his pipework otherwise the same shall be carried out by bidder at site.
- i) The Electrical and C&I item / accessory as specified in succeeding clause/ respective sections herein.
- j) Power and Control cables between starter Panel (Switch Gear) and various drives in bidder's scope of supply for all projects.
- k) Starter Panel (Switch Gear Panel) shall be as follows:
  - a) 2 Sets of COLTCS shall have one Common Starter Panel (Switch Gear Panel) for DCS based control system.





**TITLE : TECHNICAL SPECIFICATION  
FOR  
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SYSTEMS (COLTCS)**

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**SHEET 3 OF 10**

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1 Working + 1 Standby feeder).

- l) Control cables between field instruments and control panel.
- m) All the field instruments stipulated in this specification shall be in Bidder's scope.
- n) Commissioning balls and other commissioning spares on "As required basis".
- o) Set of mandatory spares as indicated in Data Sheet A.
- p) Supporting arrangement complete with foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps and other accessories etc for complete equipment supplied under this package.
- q) Finish paints for touch up painting of equipment after erection at site, in sealed containers.
- r) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- s) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.
- t) Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make COLTCS a complete package shall also be in bidder's scope.

**4.0 SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE :**

The bidder's scope also includes following services at site, for scope under this specification for COLTCS for respective projects

- a) Installation checks (Erection in BHEL's scope).
- b) Commissioning of equipment.
- c) Trial run for requisite period
- d) Performance Testing.





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The trial run of equipment shall be generally conducted immediately after commissioning while PG testing shall be conducted at a later date. These activities for different units shall be timed separately.

The no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

In the event of order number of visits as follows shall be made as a minimum with charges included in the bidder's base price itself.

- **For drawings/documents approval**

In the event of order all drawings / documents in soft as well as hard copy shall be submitted within 2 weeks of LOI for approval.

Further on receipt of Customer comments, if required bidder's engineer shall visit BHEL/ Customer alongwith soft copy to resolve all issues and incorporate comments in the soft copy for across the table finalisation and Category-I approval.

- **Site Visits :**

- i. No. of site visits for combined activities of erection checks and commissioning for COLTCS as applicable shall be one per unit - for both sets of equipments of one unit. Time duration for erection and commissioning shall be "on as required basis" with equipments run for trial operation thereafter for requisite period to demonstrate satisfactory operation.

However the no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

- ii. Bidder shall demonstrate guarantees including balls recovery, life of balls, pressure drops, etc. at site during subsequent visit for COLTCS of each unit.
- iii. For trouble shooting on "as required basis".





**TITLE : TECHNICAL SPECIFICATION  
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**5.0 EXCLUSIONS :**

The following are excluded from the bidder's scope .


- 5.1 Civil foundation works required for installation
- 5.2 Erection of Equipment at site.

**6.0 DESIGN CONSTRUCTION :**

In addition to the requirements of Section-D the following shall also be complied with for packages/ projects under scope of this specification:

- 6.1 For COLTCS - Layout Piping Arrangement Drg. are enclosed in the specifications and same is enclosed at Annexure-III.
- 6.2 Thickness of body flange and counter flange of COLTCS shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.
- 6.3 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.
- 6.4 Housing/ body of COLTCS shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of force and moments as enclosed in the specification. However in no case thickness of housing/ body shall be less than connecting pipe thickness as specified in Data Sheet-A of COLTCS.
- 6.5 Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type) shall be kept by the bidder in the equipment.
- 6.6 Any flow straightner for streamlining the CW flow in balls collecting strainer if required shall be supplied by the bidder along with mounting arrangement and the fixing details.
- 6.7 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.2 m/ sec. in other pipe work. All valves upto 150 NB shall be ball valves. For higher sizes, gate/ globe/ B.F. valves shall be provided. All instrument valves shall be needle valves.



|   |   |   |                          |
|---|---|---|--------------------------|
| 16<br> | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS)</b> | <b>SPEC. NO: PE-TS-387/388-165-N001</b> |                          |
|   |   | <b>VOLUME : II B</b>                    |                          |
|   |   | <b>SECTION:C1</b>                       |                          |
|   |   | <b>REV. NO. 0</b>                       | <b>DATE : 04.02.2013</b> |
|   |   | <b>SHEET 6 OF 10</b>                    |                          |

## 7.0 Performance Guarantee and Testing :

The Tube Cleaning Systems shall be guaranteed to meet the performance requirements specified in Section-D and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Consultant/Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

## 8.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.

### 8.1 Condenser On Load Tube Cleaning Systems.

#### 8.1.1 Performance Parameters to be guaranteed by bidders for COLTCS of all projects shall be as under :

- i) Pressure drop in ball separator in clean condition viz. after back washing.
- ii) Percentage recovery of balls (min. 90% recovery)
- iii) Life of Sponge Rubber Ball (Min. 3 weeks).


Any deviation to above balls life and percentage recovery will not be accepted.

Bidder to indicate the life of sponge rubber ball and nos. of balls lost during 1000 hours of plant operation and pressure Drop in Ball separator in clean condition in the Guarantee schedule and shall demonstrate same at site.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchasers approval.

In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.



|    |   |   |   |                          |
|----|---|---|---|--------------------------|
| 16 |  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS)</b> | <b>SPEC. NO: PE-TS-387/388-165-N001</b> |                          |
|    |   |   | <b>VOLUME : II B</b>                    |                          |
|    |   |   | <b>SECTION: C1</b>                      |                          |
|    |   |   | <b>REV. NO. 0</b>                       | <b>DATE : 04.02.2013</b> |
|    |   |   | <b>SHEET 7 OF 10</b>                    |                          |

8.1.2 Bidder to note that bids shall be evaluated on account of pressure drop across ball collecting strainer (in clean condition) and liquidated damages on account of not meeting the same during PG test shall be in accordance with following:

**A) Bid Evaluation Criteria & Liquidated Damages:**

The bids received shall be evaluated for Pressure drop across balls collecting strainers:

- The permissible limit of pressure drop across balls collecting strainers in clean condition shall be 0.15 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A for respective projects per **0.05 MWC** pressure drop across each balls collecting strainer.
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across balls collecting strainer shall be (with technical loadings) 0.2 MWC.  
The bids will be technically rejected for pressure drops quoted higher than above maximum limit.
- The guaranteed pressure drops shall be demonstrated at site by bidder and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

**9.0 SPARES :**

**9.1 Recommended Spares :**

The supply of spare parts as necessary recommended by the manufacture for three (3) years of reliable operation and maintenance of COLTCS of respective projects shall be supplied. List of such spares along with the unit price shall not be included in base price but indicated separately in the schedule of prices for recommended spares enclosed in Vol. -III.

**9.2 Mandatory Spares**

Mandatory Spares shall be as per Data Sheet-A or annexure enclosed with data sheet of the respective packages applicable for specific projects, prices for same shall be included by bidder in the equipment base price itself.

**10.0 Quality Plan**

Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3<sup>rd</sup> party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. Witness for all the test identified under agency "C" & "N" in Quality plan shall be by third party.





**TITLE : TECHNICAL SPECIFICATION  
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SYSTEMS (COLTCS)**

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**VOLUME : II B**

**SECTION:C1**

**REV. NO. 0**

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**SHEET 8 OF 10**

If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

**11.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE :**

- a. Delivery of Equipment for each project shall be as per NIT.
- b. The drawings to be submitted by bidder in event of award of contract for COLTCS for each project shall be as follows:
  - Technical Data Sheets, P&ID, Installation Plan , for COLTCS.
  - GA drawings, Details of BR Skid and C& I Document( Part-I & II) of COLTCS as applicable.
  - Quality Plan.
  - O & M Manual.
- c. Drawings submission schedule shall be as per NIT/as advised by Project Group.:

**12.0** The makes of various bought out items shall be subjected to purchaser's approval in the event of order.

**13.0** It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" any thing else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.***

**14.0** The following documents shall be furnished by the bidder with his offer :

- Compliance certificate duly signed and stamped (Enclosed at Schedules).
- Guarantee schedule duly signed and stamped (Enclosed at Schedules).
- GA drawings of following with empty/ filled-ups.
  - Balls Collecting Strainers (as applicable).
  - Balls recirculating Skids.
  - Debris Flushing pumps (if applicable)
  - Other equipments considered necessary for Layout/ Civil.





**TITLE : TECHNICAL SPECIFICATION  
FOR  
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SYSTEMS (COLTCS)**

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**VOLUME : II B**

**SECTION:C1**

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**SHEET 9 OF 10**

- Electrical Load Data (Enclosed at Vol. III of Specification)
- Schedule of Deviation (Enclosed at Schedules).

The bidder to note that load requirement furnished and finalised during tender stage shall only be provided by BHEL and any changes or additional requirement of Electrical load by bidder during contract stage shall be provided by BHEL with cost repercussions to the bidder.

**NOTE:** Apart from above, no other drawing/ document/ data sheet etc. shall be submitted along with the offer. If any drawing/ document etc. is submitted with the offer, same shall be considered as for 'Reference' purpose only and shall not be reviewed/ commented upon and any deviation, exclusion to scope, etc. taken in documents but not highlighted in the deviation schedule shall not be taken cognizance of.





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO: PE-TS-387/388-165-N001**

**VOLUME : II B**

**SECTION:C1**

**REV. NO. 0**

**DATE : 04.02.2013**

**SHEET 10 OF 10**

**ANNEXURE- I**

**COLTCS**

| SL.NO. | Projects   | Size (NB) | Length of Ball Separator (Including Counter Flange) | Scope of Counter Flange | Scope of nuts and bolts. |
|--------|--|-----------|---|-------------------------|--------------------------|
| 1      | 2 X 660 MW NTPC MOUDA STPP STAGE II – (STG PKG).   | 2300 NB   | 4200 mm   | In Purchaser's Scope.   | In Bidder's Scope        |
| 2      | 1 x 500 MW – VINDHYACHAL STPP, STAGE- V (STG PKG). | 2200 NB   | 3010mm  | In Bidder's Scope.      | In Bidder's Scope        |

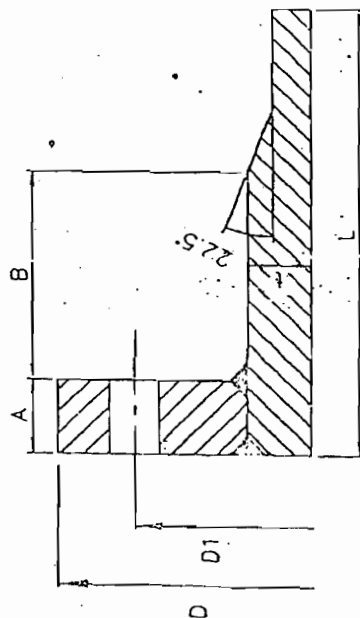


FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING NO. PE-DG-999-141-M017

# ANNEXURE-II



## NOTES:-

Flange thicknesses listed are for Design pressure=5Kg/cm<sup>2</sup>(g) and Flange dimensions as given in the table. Final thickness of the flange is to be checked for actual OD/Bolting PCD/Neck dimensions.

| PIPE SIZE | PIPE THK. | FLANGE OD 'D' | Bolt PCD 'D1' | WELD NECK FLANGE  |                            | SLIP-ON FLANGE THICKNESS |
|-----------|-----------|---------------|---------------|-------------------|----------------------------|--------------------------|
|           |           |               |               | FLANGE THICK. 'A' | NECK Length 'D' Length 'L' |                          |
| 1200      | 10-12     | 1465          | 1380          | 40                | 24 70 200                  | 90                       |
| 1400      | 14        | 1675          | 1590          | 50                | 24 70 200                  | 100                      |
| 1600      | 14        | 1915          | 1920          | 60                | 32 80 220                  | 110                      |
| 1800      | 14-16     | 2115          | 2020          | 70                | 32 90 250                  | 120                      |
| 2200      | 18        | 2550          | 2420          | 90                | 36 100 300                 | 140                      |
| 2300      | 20        | 90            | 38            | 110               | 325                        | 150                      |
| 2500      | 20        | 90            | 38            | 110               | 325                        | 150                      |
| 2700      | 20        | 90            | 38            | 110               | 325                        | 150                      |

DRAWING FOR BALL SEPARATOR COUNTER FLANGE

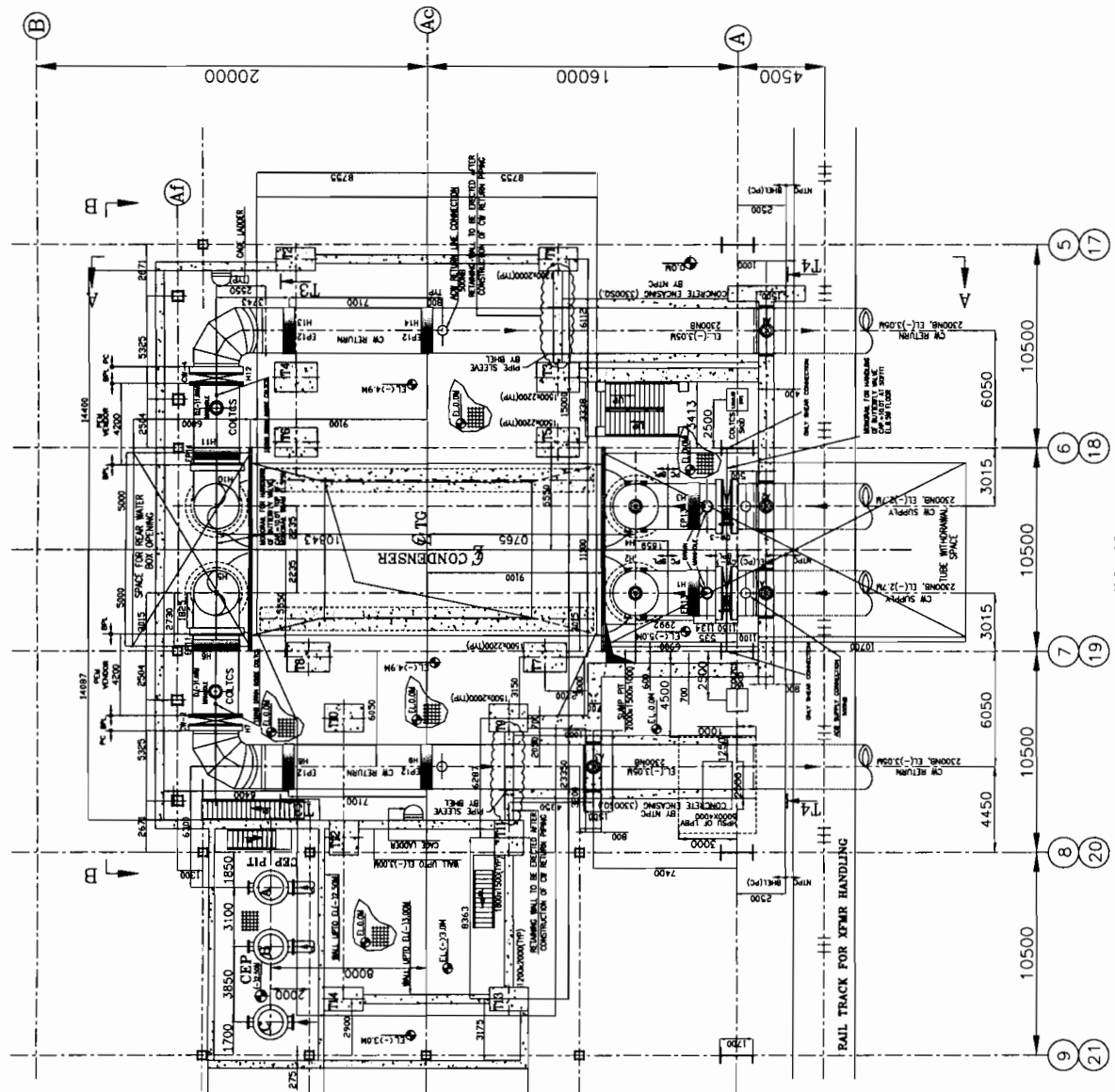
|  |      |      |     |      |              |     |
|--|------|------|-----|------|--------------|-----|
| REV.   | DATE | ALTU | CHD | APPD | JOB NO.      | 999 |
|  |      |      |     |      | STATUS       |     |
|  |      |      |     |      | DISTRIBUTION |     |
| <div style="display: flex; justify-content: space-between;"> <div> <p>SHARAT HEAVY ELECTRICALS LTD<br/>POWER GROUP<br/>PROJECTS ENGINEERING MANAGEMENT<br/>PPEI, NOIDA</p> </div> <div> <p>DRIVING NO.<br/>PE-DG-999-141-M017</p> </div> <div> <p>SHEET NO.<br/>SHEET 01 OF 01</p> </div> </div> |      |      |     |      |              |     |

COUNTER FLANGE DETAILS

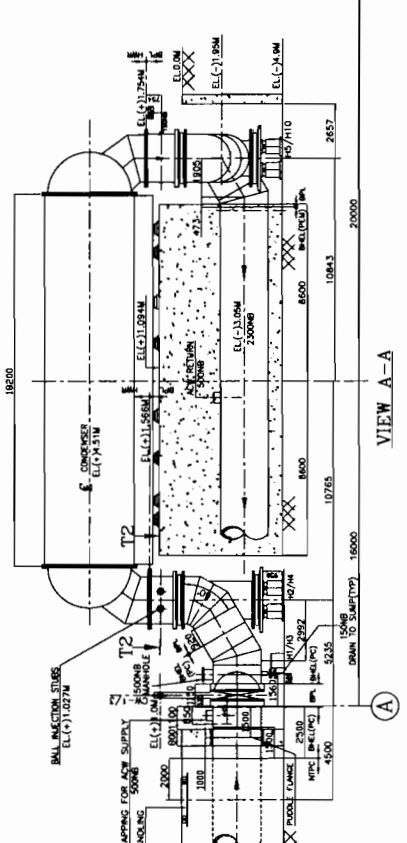




# ANNEXURE-III



PLAN



VIEW A-A

## REFERENCE DRAWINGS:

- 1. EQUIPMENT PLAN AT 0.0M
- 2. TG HALL CROSS SECTION
- 3. P&ID - COOLING WATER AND AUX COOLING WATER SYSTEM
- 4. PG TEST INSTRUMENTATION SCHEME
- 5. CONDENSER ASSEMBLY
- 6. G.A. DRAWING OF R.E. JOINT AT CONDENSER INLET/OUTLET
- 7. ARRGT. OF 2300NB B.F. VALVE
- 8. ARRGT. OF 2300NB BALL SEPARATOR
- 9. PUDDLE FLANGE ASSEMBLY

## VALVE DETAILS:-

| SL. NO. | VALVE TAG No.              | SIZE (NB) | TYPE | END TYPE | LENGTH (MM) | SUPPLIED BY |
|---------|----------------------------|-----------|------|----------|-------------|-------------|
| 1.      | CV1 TO CH                  | 150       | BFV  | FLD.     | 150         | INCL. BOMC  |
| 2.      | CV1 TO CH (FOR DRAIN LINE) | 150       | BFV  | FLD.     | 127         | PEM         |

441

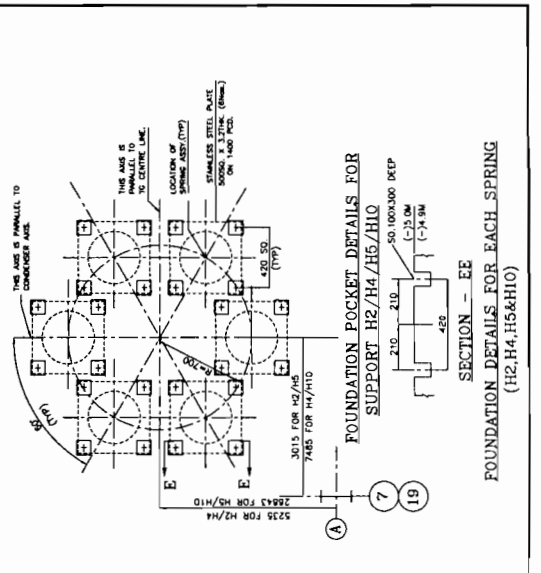
## LOAD DETAILS:-

| SL. NO. | VALVE TAG No.              | SIZE (NB) | TYPE | END TYPE | LENGTH (MM) | SUPPLIED BY |
|---------|----------------------------|-----------|------|----------|-------------|-------------|
| 1.      | CV1 TO CH                  | 150       | BFV  | FLD.     | 150         | INCL. BOMC  |
| 2.      | CV1 TO CH (FOR DRAIN LINE) | 150       | BFV  | FLD.     | 127         | PEM         |

NOTES:-  
1. THE WEIGHT OF VALVES AND FITTINGS ARE TO BE TAKEN FROM R.E. JOINT UPTO ANCHOR.  
2. THE EFFECT OF FLANGE PRESSURE (INTERNAL ANCHOR) INCLUDING PRESSURE WEIGHT, FLANGE WEIGHT, AND WEIGHT OF FITTINGS ARE TO BE TAKEN INTO ACCOUNT WHILE CALCULATING THE TOTAL LOAD ON ANCHOR.  
3. THE TOTAL LOAD ON ANCHOR SHALL BE SUPPORTED BY IT'S ANCHORING. FLANGE LOADS TO BE CONSIDERED SEPARATELY.

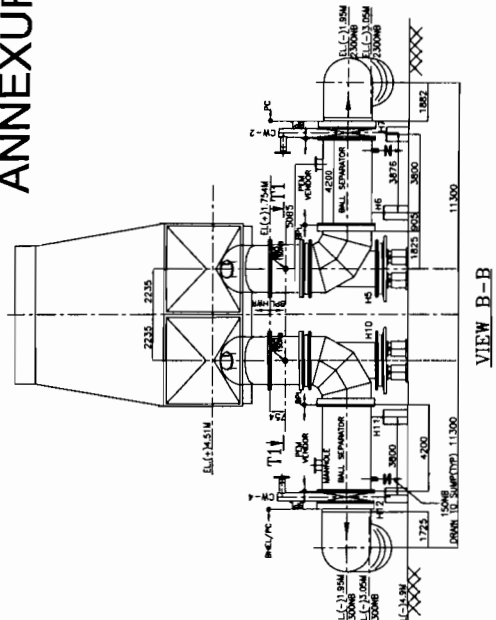
## BOM OF LOOSELY SUPPLIED DRAINS, VENTS & IMPULSE PIPES (UP TO ROOT VALVES)

- 1. 150NB PIPE = 60M
- 2. 150NB ELBOW = 12Nos.
- 3. 150NB EQUAL TEE = 2Nos.
- 4. 150NB PIPE = 50M
- 5. 150NB COUPLING = 10Nos.

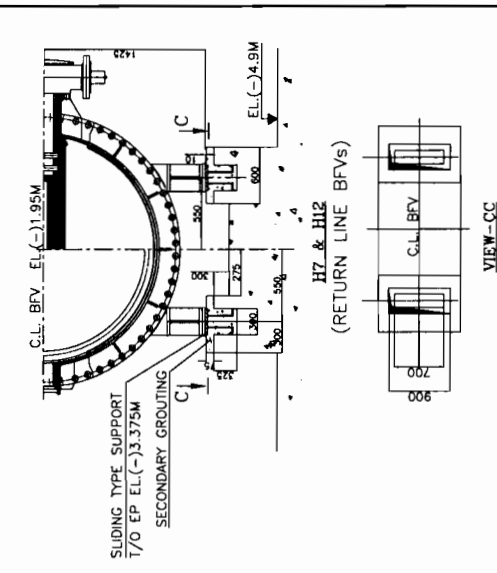


FOUNDATION POCKET DETAILS FOR SUPPORT H2/H4/H5/H10

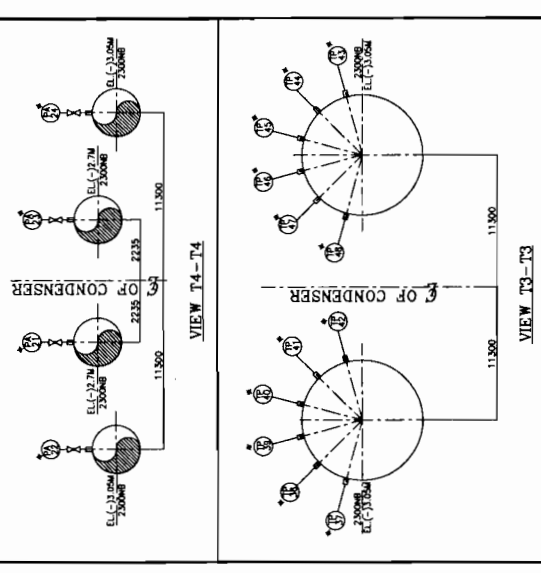
SECTION - EE  
(H2, H4, H5 & H10)



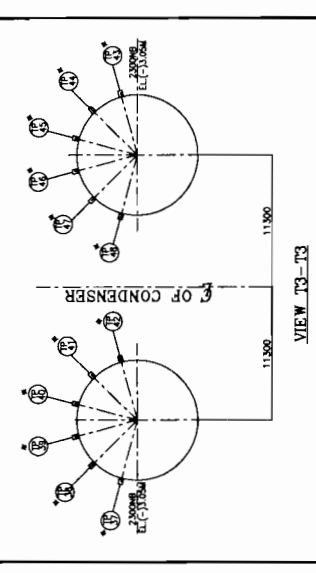
VIEW B-B



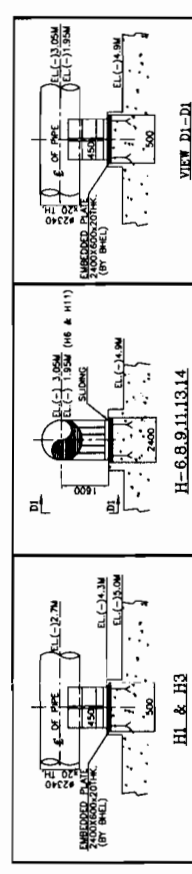
VIEW CC



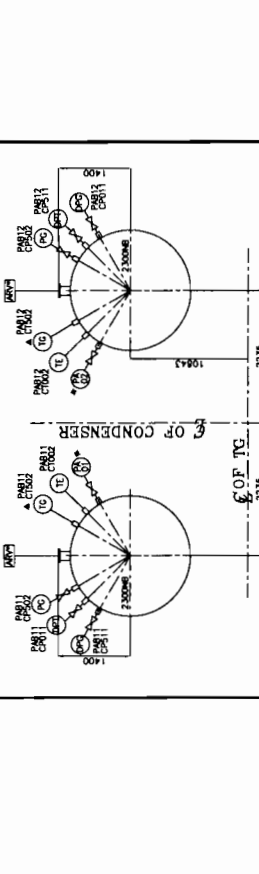
VIEW T4-T4



VIEW T3-T3

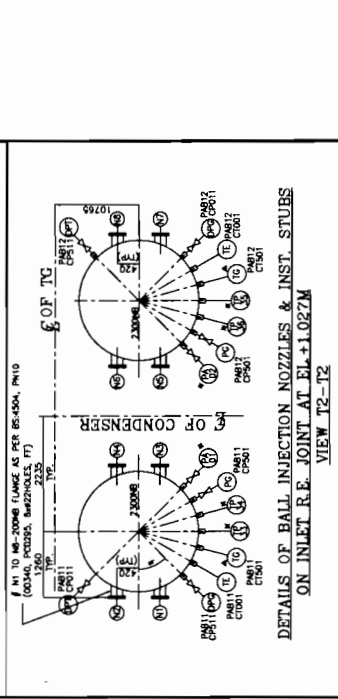


H1 & H3



H-6.8.9.11.13.14

VIEW D1-D1  
(RETURN LINE RE JOINT AT EL.+1.00M)



VIEW D1-D1

VIEW T2-T2  
ON INLET RE JOINT AT EL.+1.027M

VIEW T2-T2

## NOTES:-

- 1. ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METRES UNLESS STATED OTHERWISE.
- 2. ALL ELEVATIONS ARE MARKED W.T.L. T.G. HALL FINISHED FLOOR LEVEL AS +0.0M.
- 3. DESIGN PARAMETERS:  
PRESSURE : 5 kg /sq.cm (g) & 0.1 kg /sq.cm (e)  
HYD. TEST PRESSURE : 7.5 kg /sq.cm, TEMPERATURE : 80°C
- 4. PIPING UPTO 150NB SHALL BE CARBON STEEL ERW IS12139(H). PIPING ABOVE 150NB SHALL BE CARBON STEEL ERW IS12139(H). 2300NB - 2340 OD x 20 THK. 150NB - 166.5 OD x 5.4THK. ALL BEINGS ARE OF MITRE TYPE WITH RADIUS = 1725MM (0.75D) FOR 2300NB. 6) INSTRUMENTS MARKED WITH \* ARE FOR PERFORMANCE GUARANTEE TEST. 7) MATING FLANGES FOR B.F.Vs & BALL COLLECTING STRAINERS ARE WITH NECK PIPES AND SHALL BE SUPPLIED WITH RESPECTIVE EQUIPMENT. 8) BALLS SHALL BE SUPPLIED WITH RESPECTIVE EQUIPMENT. 9) INSTRUMENTS MARKED WITH \* WILL BE SUPPLIED ALONG WITH EQUIPMENTS.

NTPC DRAWING No. 9575-110-PE-PVM-F-1914

|                                   |  |
|-----------------------------------|--|
| NTPC LTD.                         |  |
| MOUDA SUPER THERMAL POWER PROJECT |  |
| STAGE-III (2 X 660 MW)            |  |
| POWER SECTOR                      |  |
| PROJECT ENGINEERING MANAGEMENT    |  |
| NTPC LTD.                         |  |
| CW PIPING LAYOUT INSIDE TG HALL   |  |

|      |      |    |       |       |
|------|------|----|-------|-------|
| REV. | DATE | BY | CHKD. | APPD. |
| 1    |      |    |       |       |
| 2    |      |    |       |       |

|     |      |      |    |       |       |
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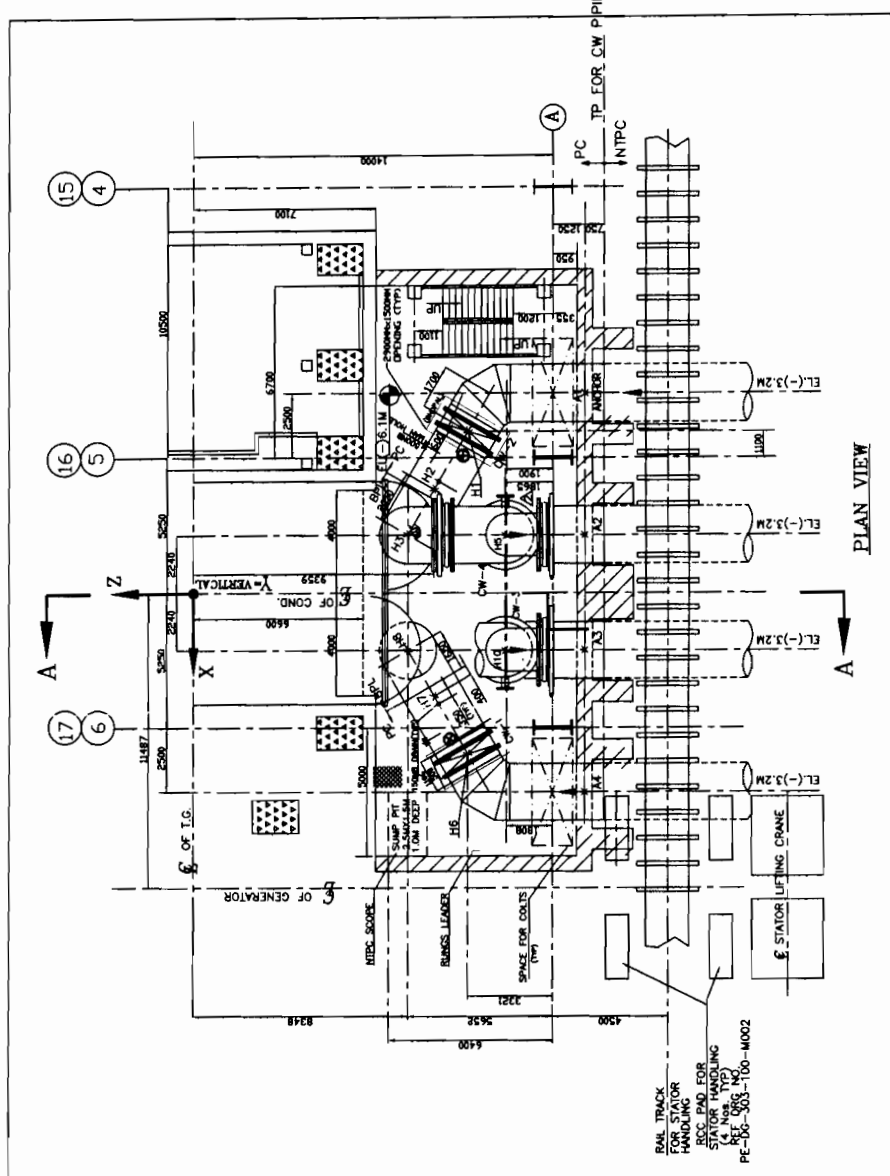
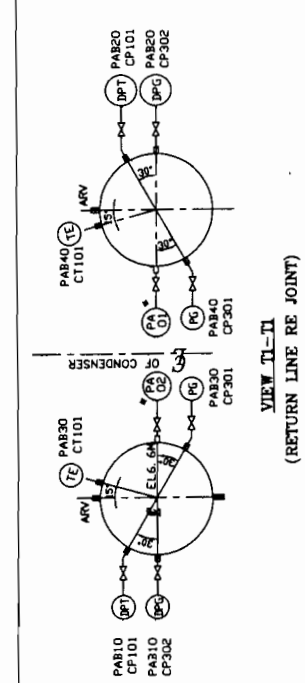
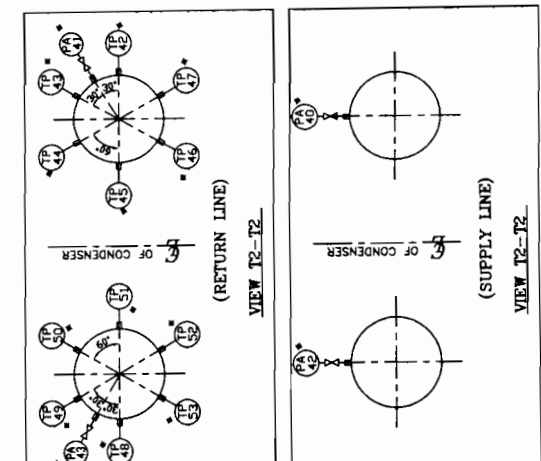
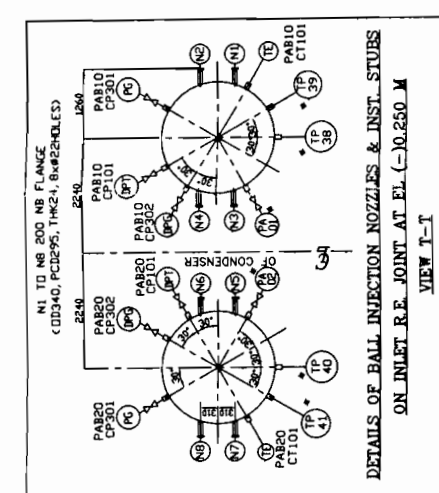
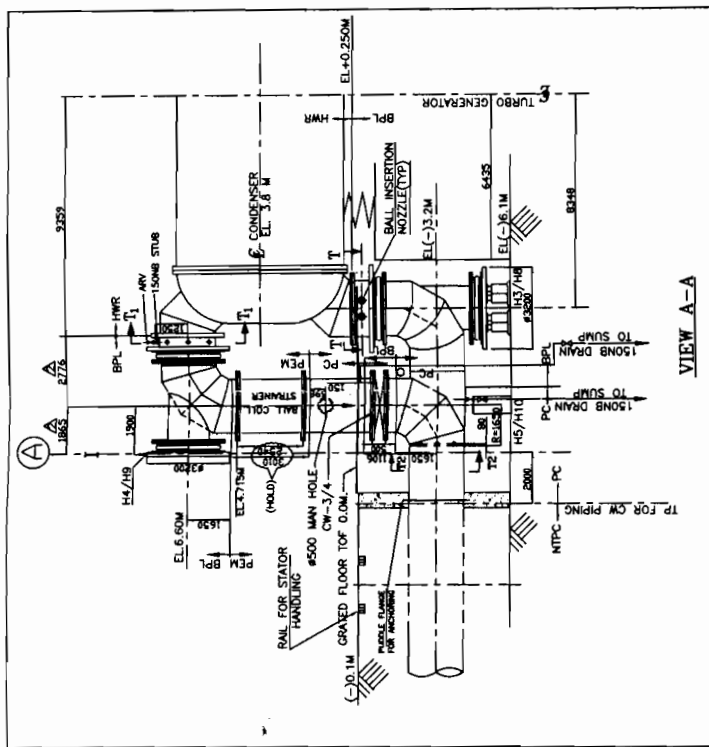
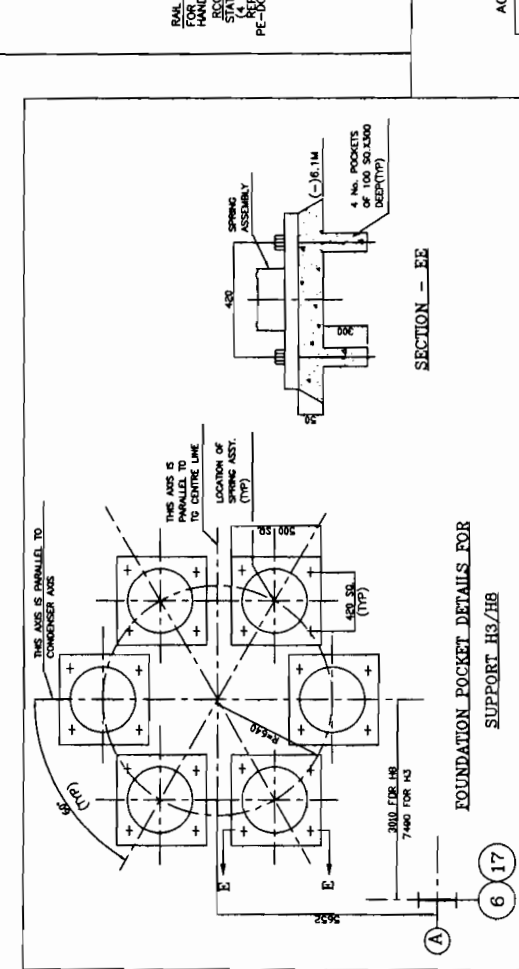
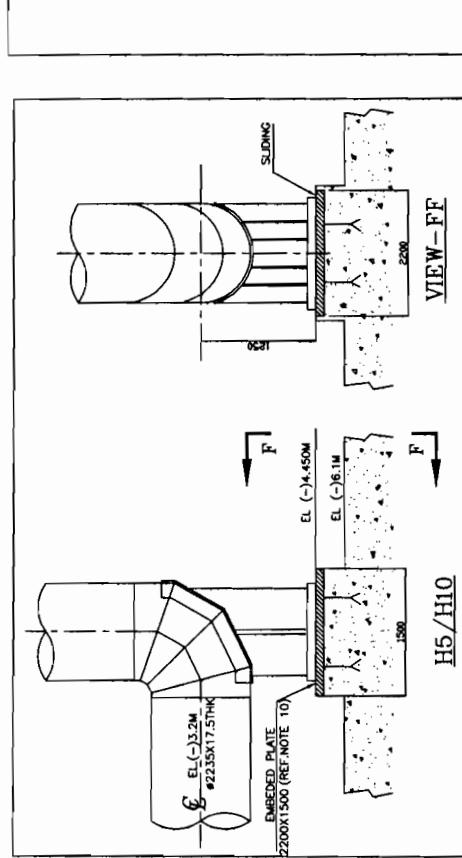
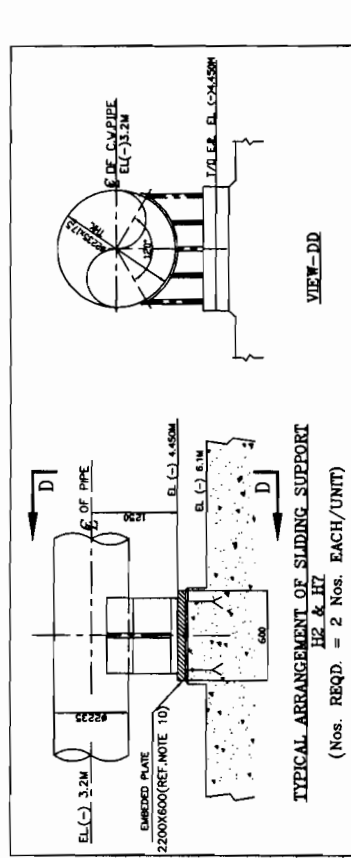
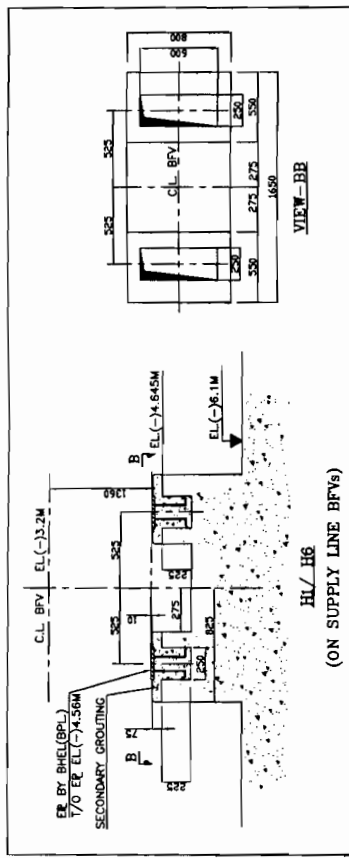
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| NO. | REV. | DATE | BY | CHKD. | APPD. |
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| 2   |      |      |    |       |       |



## ANNEXURE-III



**TABLE-C**  
**BOM OF DRAIN PIPES**

| LOAD POINT | VERTICAL LOAD (TONS)<br>$F_y$ | HORIZONTAL FRICTION FORCE (TONS) |       |
|------------|-------------------------------|----------------------------------|-------|
|            |                               | $F_x$                            | $F_z$ |
| H1         | (-325.81)                     | 4.11                             | 4.95  |
| H2         | (-325.81)                     | (-33.31)                         | 6.3   |
| H6         | (-322.53)                     | 6.71                             | 0.81  |
| H7         | (-320.77)                     | (-35.8)                          | 2.29  |
| H3 & H8    | (-19.3)                       | BOTTOM SP. SUPPORT               |       |
| H4 & H9    | (-311.11)                     | TIE-ROD SUPPORT                  |       |
| H5         | (-371.97)                     | 0.17                             | 14.75 |
| H10        | (-371.97)                     | 0.66                             | 14.75 |

**TABLE-8**

**ACTUAL FORCES & MOMENTS AT ANCHORS**

| TAG No. | FORCES (T)     |                |                | MOMENTS (tm)   |                |                |
|---------|----------------|----------------|----------------|----------------|----------------|----------------|
|         | F <sub>x</sub> | F <sub>y</sub> | F <sub>z</sub> | M <sub>x</sub> | M <sub>y</sub> | M <sub>z</sub> |
| A1      | (-11.64)       | (-12.72)       | (-19.94)       | (+13.64)       | (-122.98)      | (-14.28)       |
| A2      | (+10.17)       | (-10.51)       | (-17.67)       | (+17.0)        | (-30.62)       | (+30.38)       |
| A3      | (+30.62)       | (-10.58)       | (-17.67)       | (+17.0)        | (-32.34)       | (+1.44)        |
| A4      | (+14.11)       | (-12.16)       | (-13.33)       | (+13.34)       | (+33.10)       | (+32.38)       |

REF. DRGS. :-

- |   |   |
|---|---|
| 1) COOLING WATER SYSTEM # & NO. (PDA)                           | DRC. NO. PE-DC-303-103-4178             |
| 2) PG TEST INSTRUMENTATION SCHEME (PEM)                         | DRC. NO. PE-DC-303-100-4171             |
| 3) CONDENSER ASSY. C.A. (NWD)                                   | DRC. NO. PE-DC-10-70044-4172 (3 SHEETS) |
| 4) ARIOT. OF #2200 B.F. VALVE (CW-1 & 2) (89-3)                 | -                                       |
| 5) ARIOT. OF #2200 B.F. VALVE (CW-3 & 4) (89-3)                 | -                                       |
| 6) C.A. OF R.E. JOINT (BWL)                                     | BP-DC-289-133-0001                      |
| 7) PG TEST INST. STUD DETAIL TEMP.                              | DRC. NO. TS-PE-TS-200                   |
| 8) PG TEST INST. STUD DETAIL PRESSURE                           | DRC. NO. TS-PE-SP-200                   |
| 9) PUDDLE FLANGE ASSY. (PC)                                     | -                                       |
| 10) PUDDLE FLANGE LOCATION (PC)                                 | -                                       |
| 11) C.A. & RCD DETAILS OF C.W. PRT (NTPC)                       | 9561-315-PDC-C119                       |
| 12) LAYOUT & SECTIONAL DETAILS OF CW DUCTS IN TRANSFORMER YARD. | 9561-315A-PDC-C266                      |

NOTE:—

- 1) ALL ELEVATIONS MARKED ARE w.r.t. T.G.HALL FINISHED FLOOR ELEVATION OF +0.00 WHICH CORRESPONDES TO RL (+271.54).
- 2) DESIGN PARAMETERS :  
PRESSURE : 5 kg /sq.cm (g) & VACUUM OF 0.1 kg/sq.cm. (a)  
TEMPERATURE : 80°C  
HYD. TEST PRESSURE : 7.5kg/sq.cm.
- 3) PIPE SPECIFICATION :  
22.5 mm  $\pm$  17.5 THK. ; R & W FROM CS AS PER IS : 2042 GRADE-B CONFORMING TO IS 3589.
- 4) PAINTING OF PIPEWORK SHALL BE AS PER PAINTING SCHEDULE.
- 5) ALL BONDS ARE OF WIRE TYPE WITH RADIUS = 1850 mm
- 6) ALL PIPE END FLANGES ARE WITH NECK PIECE.
- 7) ON PIPES & BUTTERFLY VALVES OPENING ARE INDICATED IN 0.0 W FLOOR PLAN.
- 8) INSTRUMENTS STUDS WILL BE REVIEWED AFTER FINALISATION OF SCHEMES.
- 9) DRAIN & VENT COUPL. ON OW PIPES ARE TO BE PROVIDED WITH WIRE MESH TO PREVENT THE ESCAPE OF TUBE CLEANING BALLS FROM THE SYSTEM.  
ALL PRESSURE STUDS SHALL BE 15MM JOHANN VALVES 150MB, & VENT VALVES 150MB.
- 10) SUPPLY OF EMBEDDED PLATES SHALL BE BY BHEL (AS PER APPLICABLE SCOPE OF CONTRACT).
- 11) PROXIMAL SIZE FOR H2/H7 AND H5/H10 SHALL BE DECIDED BY WTPC ACCORDING TO LOAD.
- 12) TERMINAL POINT INDICATED THUS  $\uparrow$  BHEL  $\uparrow$  WTPC  
+ PERFORMANCE TEST INDICATOR

HOLD:-

1. CO

TABLE-C

| SL. No. | PIPE SIZE<br>OD(mm) x THK(mm) | MATERIAL<br>SPECIFICATION | PIPE LENGTH<br>(METERS) | FITTINGS | REMARKS |
|---------|-------------------------------|---------------------------|-------------------------|----------|---------|
|         |                               |                           |                         |          |         |

|   |              | ELBOW             | FLG.   |
|---|--------------|-------------------|--|
| 1 | ø168.5 x 5.4 | SA 106 Gr.B<br>80 | 90° 1.50<br>AS PER AISI B113<br>20 MON<br>1150FT Blows |

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

NTPC DRG. No. 9561-110-PEM-PVM-F-040

APPLICABLE FOR VINDHYACHAL STPP STAGE- V- 1X500 MW  
STEAM TURBINE GENERATOR PACKAGE

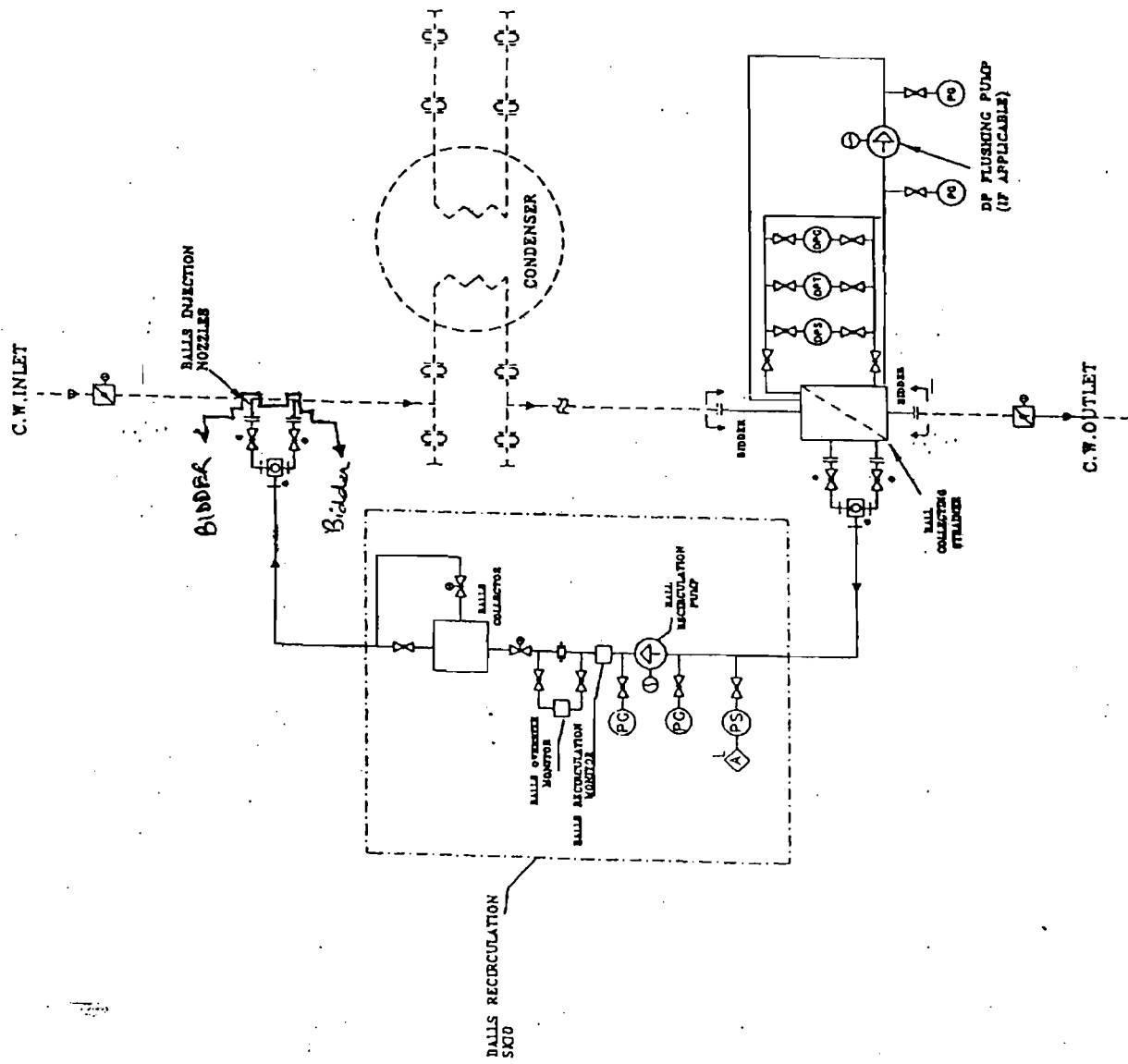
| DEPT CODE | NAME                           | UNIT | MO | DOY |
|-----------|--------------------------------|------|----|-----|
|           | BHARAT HEAVY ELECTRICALS LTD   |      |    |     |
|           | POWER SECTOR                   |      |    |     |
|           | PROJECT ENGINEERING MANAGEMENT |      |    |     |
|           | NW DELHI                       |      |    |     |

| DATE | TITLE   | DRAWN BY | CHECKED BY |
|------|---|----------|------------|
|      | TITLE LAYOUT OF C W PIPING LOCAL TO CONDENSER |          |            |

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|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
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| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 |
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- NOTE:-  
1. SCHEMATIC SHOWN IS TYPICAL FOR ONE HALF OF CONDENSER. SHALL BE IDENTICAL FOR THE CONDENSER SECOND HALF.
2. BIDDER'S SCOPE OF SUPPLY INCLUDES :  
a) BALL RECIRCULATING SKID COMPLETE WITH BALLS COLLECTOR, BOM, BRM, VALVES, INSTRUMENTS ETC.  
b) COUNTERFLANGES FOR BALL SEPARATORS.  
c) INJECTION NOZZLES WITH FLANGES/COUNTER FLANGES.  
d) ALL VALVES IN COTCS (\*) INCLUDING THEIR COUNTERFLANGES, NUTS, BOLTS, GASKETS.  
e) COUNTERFLANGES WITH NUTS, BOLTS & GASKETS FOR ALL TERMINAL POINTS.  
f) SIGHT FLOW INDICATORS (\*) OR ANY OTHER SPECIAL FITTING/EQUIPMENT COMING ON COTCS PIPEWORK.
3. SCOPE OF SUPPLY

PURCHASER'S  
BIDDER'S

TYPICAL FLOW DIAGRAM FOR  
ON LOAD TUBE CLEANING SYSTEM





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**

**VOLUME : IIB**

**SECTION : C**

**REV. NO. 0**

**DATE : 04.02.2013**

**SHEET 1 of 1**

**SECTION C2**

**CONDENSER ONLOAD TUBE CLEANING SYSTEMS**

**ELECTRICAL DETAILS**



## ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL/NTPC AND VENDOR

## PACKAGE : COLTCS

## PROJECT : 2X660 MW MOUDA STPP, STAGE- II &amp; 1X500MW NTPC VINHYACHAL STPP STAGE-V.

| S.NO | DETAILS   | SCOPE SUPPLY                      | SCOPE E&C                           | REMARKS   |
|------|---|-----------------------------------|-------------------------------------|---|
| 1    | 415V MCC  | BHEL/NTPC                         | BHEL/NTPC                           | 1. 415 V AC/240 V AC supply shall be provided by BHEL/NTPC based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor.<br>2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL/NTPC in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage. |
| 2    | Local Push Button Station (for motors)  | Vendor                            | Vendor                              | Located near the motor.   |
| 3    | Power cables, control cables and screened control cables for<br>a) both end equipment in BHEL/NTPC's scope<br>b) both end equipment in vendor's scope<br>c) one end equipment in vendor's scope | BHEL/NTPC<br>Vendor<br>BHEL /NTPC | BHEL/NTPC<br>BHEL/NTPC<br>BHEL/NTPC | 1. Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL/NTPC). Finalisation of cable sizes shall be done by BHEL/NTPC. Vendor shall provide lugs & glands accordingly.<br>2. Laying of cables by BHEL/NTPC.<br>3. Termination at BHEL/NTPC equipment terminals by BHEL/NTPC.<br>4. Termination at Vendor equipment terminals by Vendor.  |
| 4    | Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.   | Vendor                            | Vendor                              |   |
| 5    | Cable trays, accessories & cable trays supporting system  | BHEL/NTPC                         | BHEL/NTPC                           |   |
| 6    | Cable glands and lugs for equipments supplied by Vendor   | Vendor                            | Vendor                              | 1. Double compression Ni-Cr plated brass cable glands<br>2. Solder less crimping type heavy duty tinned copper lugs for power cables<br>3. Solder less crimping type heavy duty copper lugs for control cables.   |
| 7    | Conduit and conduit accessories for cabling between equipments supplied by vendor   | Vendor                            | Vendor                              | Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to   |



## ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL/NTPC AND VENDOR

## PACKAGE : COLTCS

| S.NO | DETAILS  | SCOPE SUPPLY               | SCOPE E&C   | REMARKS   |
|------|--|----------------------------|-------------|---|
| 8    | Lighting   | BHEL/NTPC                  | BHEL/NTPC   | customer/ BHEL/NTPC approval at contract stage.   |
| 9    | Equipment grounding & lightning protection   | BHEL/NTPC                  | BHEL/NTPC   |   |
| 10   | Below grade grounding  | BHEL/NTPC                  | BHEL/NTPC   |   |
| 11   | LT Motors with base plate and foundation hardware  | Vendor                     | Vendor      | Makes shall be subject to customer/ BHEL/NTPC approval at contract stage.   |
| 12   | Mandatory spares   | Vendor                     | -           | Vendor to quote as per specification.   |
| 13   | Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.   | Vendor                     | -           | As per specification  |
| 14   | Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system). | Vendor                     | Vendor      |   |
| 15   | a) Input cable schedules (C & I)<br>b) Cable interconnection details for above<br>c) Cable block diagram   | Vendor<br>Vendor<br>Vendor | -<br>-<br>- | Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL/NTPC cable schedule format.   |
| 16   | Equipment layout drawings  | Vendor                     | -           | For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL/NTPC approval. |
| 17   | Electrical Equipment GA drawing  | Vendor                     | -           | For necessary interface review.   |

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/NTPC/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/NTPC/customer after award of contract without any commercial implication.
3. For skid mounted system, 2 nos. (1W+1S) supply of 415 V, 3 phase AC shall be provided by BHEL/NTPC. Complete electrical distribution for the skid including changeover between feeder/starters/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope.





TITLE

**LV MOTORS****DATA SHEET-A****2x660 MW MOUDA STPP**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. DATE


SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor: Below 200KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V  $\pm$  10%
  - b) Rated frequency (with variation) : 50 Hz +3 to -5%
  - c) Combined voltage & freq. variation : 10% (sum of absolute values)
  - d) System fault level at rated voltage : 45 kA RMS for 1 sec
  - e) Short time rating for terminal boxes
    - o 110 kW and above (Breaker : 45 KA for 0.20 sec. controlled)
    - o Below 110 kW (Contactor : 45 KA protected by fuse controlled)
  - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting : 85% of rated voltage  
(As percentage of rated voltage)
- 7.0 Power cables data : Shall be given during Detailed engg
- 8.0 Earth Conductor Size & Material : Shall be given during Detailed engg
- 9.0 Space heater supply : 240 V, 1 $\phi$ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following  
(Without any further tolerance) : As per clause no. 7.16 of technical spec sec-VI part-B (page 5 of 8)
- 12.0 Additional tests : As per QP
- 12.1 Flame-proof motor
- a) Enclosure suitable (As per IS:2148) : As per requirement
  - b) Classification of Hazardous area : As per requirement  
(As per IS: 5572 part-I)
- 12.0 Makes : As per customer approved vendors



| <b>SPECIFIC ELECTRICAL REQUIREMENT FOR COLTCS</b><br><b>PROJECT-- 1x500 MW- VINDHYACHAL STPP,STAGE-V</b> |   |          |  |
|--|---|----------|--|
| SL.NO.   | PARAMETERS  | UNIT     | VINDHYACHAL STAGE-V  |
|  | <b>MOTOR</b>  |          |  |
| 1  | DESIGN AMBIENT TEMP                                     | DEG. C   | 50   |
| 2  | VOLTAGE SUPPLY AND VARIATION                            | VOLT     | 415V, $\pm 10\%$   |
| 3  | FREQUENCY WITH VARIATION                                | Hz       | 50, $+3\%$ & $- 5\%$                                       |
| 4  | COMBINED VOLTAGE & FREQUENCY VARIATION                  |          | 10%  |
| 5  | MAX ACCEPTABLE RATING OF MOTOR AT 415 V                 | KW       | Below 200 KW   |
| 6  | SYSTEM FAULT LEVEL AND ITS DURATION                     | KA       | 45 KA, 1 Sec   |
| 7  | SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION |          | 50 KA, 0.2 sec   |
| 8  | CLASS OF INSULATION & TEMP RISE LIMITED TO              |          | Class-F and temp rise limited to Class-B                   |
| 9  | MIN. STARTING VOLTAGE                                   |          | 1) 80% for below 110 KW<br>2) 85% from 110 KW to 200 KW    |
| 10   | MOTOR RATING FOR SINGLE PHASE SUPPLY                    |          | 0.2 kW & Below   |
| 11   | MAXIMUM LOCKED ROTOR CURRENT                            | % OF FLC | 600% $\pm$ IS tolerance                                    |
| 12   | ACCEPTABLE NOISE LEVEL                                  | DB       | 85dB at 1.5m   |
| 13   | TYPE OF STARTER PROVIDED IN MCC                         |          | DOL  |
| 14   | DOP OF ENCLOSURE  |          | IP- 55   |
| 15   | SPACE HEATER REQUIREMENT                                | <30kW    | 30KW & ABOVE   |
| 16   | PAINT SHADE   |          | RAL 5012 (Blue)  |
| 17   | SPECIAL REQUIREMENT                                     |          | TYPE TEST REPORTS MORE THAN 5 YEARS OLD ARE NOT ACCEPTABLE |



|   |   |                             |
|---|---|-----------------------------|
|  | <b>ELECTRICAL EQUIPMENT SPECIFICATION<br/>FOR COLTCS</b><br><br><b>1X500MW NTPC VINDHYACHAL STPP STAGE-V<br/>(ELECTRICAL PORTION)</b> | SPECIFICATION NO.<br>PE-TS- |
|   |   | VOLUME NO. : II-B           |
|   |   | SECTION : C                 |
|   |   | REV NO. : 00 DATE : 9.1.12  |
|   |   | SHEET : 1 OF 1              |

**1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :**

- a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for COLTCS.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
- i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

**2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**  
Refer "Electrical Scope between BHEL and Vendor".

**3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

**3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:**

- a) A copy of this sheet "Electrical equipment Specification for "COLTCS" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
- b) List of Erection and Commissioning spares.
- c) List of Erection & Maintenance tools & tackles.
- d) Electrical load requirement

**3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.**

**4.0 List of enclosures :**

- a) Specification AC/DC Motors
- b) Data sheet of AC/DC Motors.
- c) Quality Plan.
- d) Load data format.





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**  
**VOLUME : IIB**  
**SECTION : C**  
**REV. NO. 0** **DATE : 04.02.2013**  
**SHEET 1 of 1**

**SECTION C3**  
**CONDENSER ONLOAD TUBE CLEANING SYSTEMS**  
**C&I DETAILS**



**SPECIFIC C&I TECHNICAL REQUIREMENT FOR COLTCS**

| <b>Sl.No.</b> |  | <b>2X660MW MOUDA</b> | <b>1X500 MW vindhyachal</b> |
|---------------|--|----------------------|-----------------------------|
| 1.00          | <b>SYSTEM</b>  | COLTCS               | COLTCS                      |
| 2.00          | <b>COMMON / PER UNIT</b>   | PER UNIT             | PER UNIT                    |
| 3.00          | <b>CONTROL SYSTEM</b>  | DCS (TG C&I)         | DCS (TG C&I)                |
| 3.10          | <b>PROCESSOR CONFIGURATION FOR PLC SYSTEM</b>  | NA                   | NA                          |
| 4.00          | <b>LOCATION OF CONTROL SYSTEM</b>  | CCR                  | CCR                         |
| 4.10          | <b>CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)</b>                                       | BHEL                 | BHEL                        |
| 5.00          | <b>HARDWIRED INTERFACE WITH DCS (Y/N)</b>  | NA                   | NA                          |
| 5.10          | <b>PURPOSE OF HARDWIRED INTERFACE WITH DCS</b>   |                      |                             |
| 5.11          | <b>a) COMMAND FROM DCS (Y/N)</b>   | NA                   | NA                          |
| 5.12          | <b>b) STATUS FEEDBACK TO DCS (Y/N)</b>   | NA                   | NA                          |
| 5.13          | <b>c) GROUP FAULT ALARM TO DCS (Y/N)</b>   | NA                   | NA                          |
| 6.00          | <b>SOFTLINK TO DCS (Y/N)</b>   | NA                   | NA                          |
| 6.10          | <b>PURPOSE OF SOFTLINK TO DCS</b>  |                      |                             |
| 6.11          | <b>a) COMMAND INTERFACE WITH DCS (Y/N)</b>   | NA                   | NA                          |
| 6.12          | <b>b) STATUS MONITORING IN DCS (Y/N)</b>   | NA                   | NA                          |
| 7.00          | <b>PROTECTION CLASS FOR PLC / RIO PANEL</b>  | NA                   | NA                          |
| 8.00          | <b>CONTROL FROM PB's ON LCP/OWS ON LCP</b>   | NA                   | NA                          |
| 9.00          | <b>ANNUNCIATION ON LCP (Y/N) – IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS</b>         | NA                   | NA                          |
| 9.10          | <b>MIMIC ON LCP (Y/N)</b>  | NA                   | NA                          |
| 10.00         | <b>CONTROL FROM DCS IN CCR (Y/N)</b>   | Y                    | Y                           |
| 11.00         | <b>TYPE OF SOFTLINK (TP/OFC)</b>   | NA                   | NA                          |
| 11.10         | <b>COMMUNICATION CABLE SCOPE (BIDDER/ PEM/ EDN/ CUSTOMER)</b>                              | NA                   | NA                          |
| 11.20         | <b>REDUNDANT CABLE (Y/N)</b>   | NA                   | NA                          |
| 11.30         | <b>PROTOCOL</b>  | NA                   | NA                          |
| 12.00         | <b>RIO / RPU (Y/N)</b>   | NA                   | NA                          |
| 13.00         | <b>## NO. OF OWS / LAPTOP</b>  | NA                   | NA                          |
| 13.10         | <b>SIZE OF OWS/ CRT OR LCD</b>   | NA                   | NA                          |
| 14.00         | <b>NO. OF PRINTER</b>  | NA                   | NA                          |
| 14.10         | <b>PRINTER SIZE AND TYPE</b>   | NA                   | NA                          |
| 15.00         | <b>\$\$ POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)</b> | 24V DC               | 24V DC                      |



|       |   |                             |                             |
|-------|---|-----------------------------|-----------------------------|
| 15.10 | <b>&amp;&amp; POWER SUPPLY AVAILABLE FOR PLC PANEL (3PHASE, 415 V AC/ 1PHASE, 110 V UPS/ 1PHASE, 230 V UPS)</b> | NA                          | NA                          |
| 15.20 | <b>REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY</b>                                      | NA                          | NA                          |
| 15.30 | <b>UPS BATTERY CONFIGURATION (1X100% / 2X100%)</b>  | NA                          | NA                          |
| 15.40 | <b>BATTERY TYPE (LEAD ACID/ Ni-Cd)</b>  | NA                          | NA                          |
| 15.50 | <b>BATTERY BACK-UP TIME (in minutes)</b>  | NA                          | NA                          |
| 16.00 | <b>ACTUATOR WITH INTEGRAL STARTER (Y/N)</b>   | Y                           | Y                           |
| 17.00 | <b>PG/ DPG/ PS/ DPS/ PT/ DPT per Balls Collecting Strainer</b>  | DPT = 2 nos.<br>DPG = 1 no. | DPT = 2 nos.<br>DPG = 1 no. |
| 19.00 | <b>REMARKS</b>  |                             |                             |
| 20.00 | <b>PROJECT SPECIFIC INFO</b>  |                             |                             |

**NOTES:**

- 1. \$\$ THIS IS APPLICABLE FOR DCS CONTROLLED SYSTEMS ONLY.**
- 2. IN CASE OF DCS CONTROLLED SYSTEMS, BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING**
- 3. FOR THE PROJECTS IN WHICH CONTROL ARE ENVISAGED WITH DCS CONTROL SYSTEM FOR COLTCS- 2 SETS OF COLTCS/ SHALL HAVE ONE COMMON STARTER PANEL (SWITCH GEAR PANEL).**
- 4. INSTRUMENT RACK AND JUNCTION BOXES SHALL BE IN BIDDER'S SCOPE OF SUPPLY.**
- 5. BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.**
- 6. ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.**

**LEGEND:**

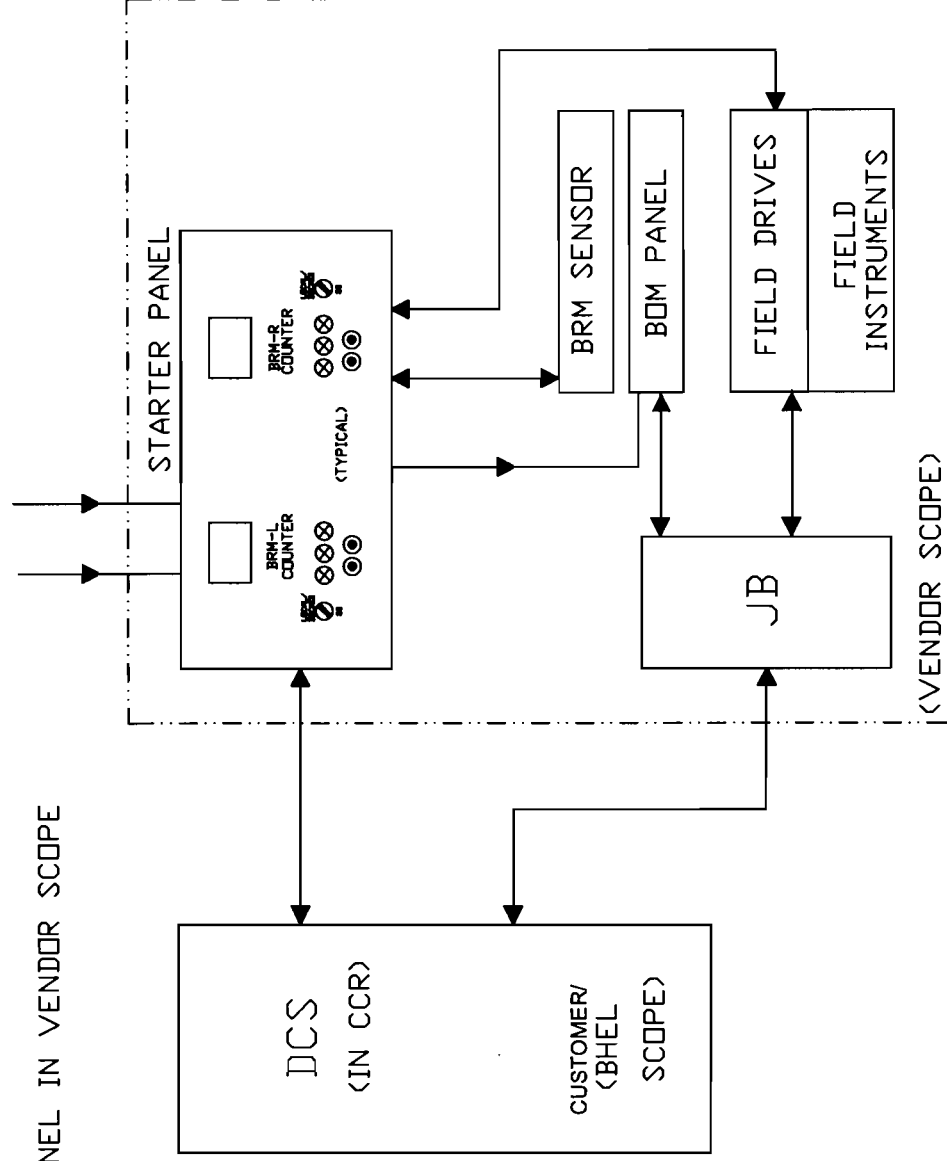
DCS- DISTRIBUTED CONTROL SYSTEM  
 PLC- PROGRAMMABLE LOGIC CONTROLLER  
 RPU - REMOTE PROCESSING UNIT



# STANDARD BLOCK BLOCK DIAGRAM FOR COLTCS PACKAGE WITH DCS CONTROL

415V AC, 3P, 4WIRE  
REDUNDANT FEEDER (BY CUSTOMER/BHEL)

CONFIGURATION A:  
WITH STARTER PANEL IN VENDOR SCOPE



PE-DG-999-145-I274A(a)





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**

**VOLUME : IIB**

**SECTION : D**

**REV. NO. 0**

**DATE : 04.02.2013**

**SHEET 1 of 1**

## **SECTION – D**


### **STANDARD TECHNICAL SPECIFICATION**

**SECTION D1 : CONDENSER ONLOAD TUBE CLEANING  
SYSTEM**

**SECTION D2 : ELECTRICAL SYSTEMS**


**SECTION D3 : C&I SYSTEM**



|   |   |  |                          |
|---|---|--|--------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS)</b> | <b>SPEC. NO. PE-TS- 387/388-165-N001</b> |                          |
|   |   | <b>VOLUME : IIB</b>                      |                          |
|   |   | <b>SECTION : D</b>                       |                          |
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|   |   | <b>SHEET 1 of 1</b>                      |                          |

**SECTION D1**  
  
**STANDARD TECHNICAL SPECIFICATION  
FOR  
CONDENSER ONLOAD TUBE CLEANING SYSTEMS**



|   |  |   |                        |
|---|--|---|------------------------|
|  | <b>TITLE :</b><br><b>STANDARD TECHNICAL SPECIFICATION</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b> | <b>SPECIFICATION NO. PE-TS-999-165-N001</b> |                        |
|   |  | <b>VOLUME : II B</b>                        |                        |
|   |  | <b>SECTION : D</b>                          |                        |
|   |  | <b>REV. NO. 00</b>                          | <b>DATE : 27.09.07</b> |
| <b>SHEET 1 OF 14</b>  |  |   |                        |

**1.00.00      GENERAL**

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of condenser on-load tube cleaning system (sponge rubber balls type) complete with all accessories as specified hereinafter. Each half of the condenser shall be provided with an independent tube cleaning system.

**2.00.00      CODES AND STANDARDS**

**2.01.00**      The design, materials, manufacture, inspection and testing of the condenser on-load tube cleaning system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

**2.01.01**      IS/BS/DIN/US Standards regarding pressure vessels, pumps, piping, flanges and others as necessary.

**2.01.02**      IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

**2.01.03**      IS/BS/DIN/AWWA Standards for valves and the testing.

**2.02.00**      In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

**3.00.00      DESIGN AND CONSTRUCTION**

**3.01.00**      General Requirements


**3.01.01**      Unless otherwise necessary, manufacturer's standard and proven models of the tube cleaning system shall be supplied.

**3.01.02**      The tube cleaning system shall be capable of safe, continuous and trouble-free operation for removal of fouling and scaling materials from condenser tubes. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.


**3.01.03**      Suitable Corrosion allowance shall be provided whenever necessary. Adequate provision for future installation of cathodic protection shall be provided.

**3.01.04**      The tube cleaning system shall consist of ball separator at condenser outlet, recirculating pump, ball collector, differential pressure measuring system for ball separator, ball monitoring system, cleaning balls, piping valves, distributors, injection nozzles, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the tube cleaning system shall be as described in section C and / or as per the scheme enclosed.




|   |  |   |                        |
|---|--|---|------------------------|
|  | <b>TITLE :</b><br><b>STANDARD TECHNICAL SPECIFICATION</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b>   | <b>SPECIFICATION NO. PE-TS-999-165-N001</b> |                        |
|   |  | <b>VOLUME : II B</b>                        |                        |
|   |  | <b>SECTION : D</b>                          |                        |
|   |  | <b>REV. NO. 00</b>                          | <b>DATE : 27.09.07</b> |
|   |  | <b>SHEET 2</b>                              | <b>OF 14</b>           |
| <b>3.02.00</b>  | <b><u>Performance Requirements.</u></b>  |   |                        |
| <b>3.02.01</b>  | The tube cleaning system with all accessories shall be designed and guaranteed to meet the following requirements :  |   |                        |
|   | The tube cleaning system shall perform satisfactorily under the flow and pressure drop conditions ( in the condenser) specified in Data Sheet - A and shall be capable of removing the various forms of fouling and scaling from condenser tubes.  |   |                        |
| <b>3.02.02</b>  | The ball separator at the condenser outlet, shall be designed such that the pressure drop across the ball separator under clean conditions shall not be more than that specified in Data Sheet - A. The performance of the ball separator shall be continuous with minimum number of backwashing operations. |   |                        |
| <b>3.02.03</b>  | The power consumption by ball recirculation pump during various operations shall be minimum possible.  |   |                        |
|   | The quantity of cleaning balls worn out and / or lost, shall be minimum possible.  |   |                        |
| <b>3.03.00</b>  | <b><u>Operational Requirements.</u></b>  |   |                        |
|   | The tube cleaning system and other accessories shall be designed for the following operation modes :   |   |                        |
| <b>3.03.01</b>  | Complete automatic start-up of tube cleaning system initiated by pressing the push button (manual command).  |   |                        |
| <b>3.03.02</b>  | Complete automatic shut-down of tube cleaning system with ball collection, effected by the following :   |   |                        |
|   | <ul style="list-style-type: none"> <li>◆ Push button (manual command).</li> <li>◆ Adjustable timer (after a defined cleaning period).</li> <li>◆ Ball monitoring system (when the number of oversized balls falls below a set value).</li> </ul>   |   |                        |
| <b>3.03.02</b>  | Complete automatic backwashing of ball separator with ball collection, effected by the following :   |   |                        |
|   | <ul style="list-style-type: none"> <li>◆ Differential pressure measuring system at a pre-determined differential across the ball separating strainer/ screen.</li> <li>◆ Adjustable timer</li> <li>◆ Push button</li> </ul>  |   |                        |
| <b>3.03.04</b>  | Complete automatic emergency backwashing of ball separator with alarm indication, effected by differential pressure measuring system.  |   |                        |
| <b>3.03.05</b>  | Manual operation for start-up, shut-down with ball collection backwashing of ball separator, flushing of differential pressure measuring system etc., in case of failure of control system.  |   |                        |



|   |  |   |                        |
|---|--|---|------------------------|
|  | <b>TITLE :</b><br><b>STANDARD TECHNICAL SPECIFICATION</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b>   | <b>SPECIFICATION NO. PE-TS-999-165-N001</b> |                        |
|   |  | <b>VOLUME : II B</b>                        |                        |
|   |  | <b>SECTION : D</b>                          |                        |
|   |  | <b>REV. NO. 00</b>                          | <b>DATE : 27.09.07</b> |
|   |  | <b>SHEET 3</b>                              | <b>OF 14</b>           |
| <b>3..04.00</b>   | <b><u>Ball Separator</u></b>   |   |                        |
| <b>3.04.01</b>  | Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A |   |                        |
| <b>3.04.02</b>  | The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.  |   |                        |
| <b>3.04.03</b>  | If specified in Data Sheet -A, ball separator body shall be Epoxy lined.   |   |                        |
| <b>3.04.04</b>  | The ball separating screen / strainer shall be designed for the maximum differential pressure across the separator and shall be securely mounted in the body. Screen / strainer shaft shall be sized adequately considering the overloading of screens / strainer due to debris accumulation.  |   |                        |
| <b>3.04.05</b>  | The ball separating strainers / screens shall have electric actuators for swivelling to allow for their backwashing. Also suitable handwheels shall be provided to enable manual swivelling of strainers / screens.  |   |                        |
| <b>3.05.00</b>  | <b><u>Ball Recirculating Pump</u></b>  |   |                        |
| <b>3.05.01</b>  | The ball recirculating pump shall be horizontal centrifugal type. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.  |   |                        |
| <b>3.05.02</b>  | The impeller shall be non-clog type and shall be contoured suitably to avoid damage to the cleaning balls. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.  |   |                        |
| <b>3.05.03</b>  | Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller.  |   |                        |
| <b>3.05.04</b>  | Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands.   |   |                        |
| <b>3.05.05</b>  | Shaft size selected shall take into Consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.   |   |                        |



|   |  |                                      |                 |
|---|--|--------------------------------------|-----------------|
|  | TITLE :<br>STANDARD TECHNICAL SPECIFICATION<br>CONDENSER ON - LOAD TUBE CLEANING<br>SYSTEM ( Sponge Rubber Ball Type ) | SPECIFICATION NO. PE-TS-999-165-N001 |                 |
|   |  | VOLUME : II B                        |                 |
|   |  | SECTION : D                          |                 |
|   |  | REV. NO. 00                          | DATE : 27.09.07 |
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3.05.06

Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly

3.05.07

Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.

3.05.08

Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account the cooling/lubricating/sealing water requirement.

3.05.09

All rotating components shall be statically and dynamically balanced.

3.05.10

The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.

3.05.11

The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range of 40% of rated flow to 120 -130 % of rated flow.

3.05.12

The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.

3.05.13

The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.

3.05.14

The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.

3.05.15

The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :

a)

Maximum power input to the pump over the entire range for maximum flow to shut-off condition.

b)

125% of power input to the pump at duty point corresponding to 103% of the rated speed.


3.06.00

**Ball Collector**


3.06.01

The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher.




|   |   |  |
|---|---|--|
|  | <b>TITLE :</b><br><b>STANDARD TECHNICAL SPECIFICATION</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b>  | <b>SPECIFICATION NO. PE-TS-999-165-N001</b><br><b>VOLUME : II B</b><br><b>SECTION : D</b><br><b>REV. NO. 00</b> <b>DATE : 27.09.07</b><br><b>SHEET 5 OF 14</b> |
|   | <p>The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.</p> <p>3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.</p> <p>3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.</p> <p>3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.</p> <p>3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.</p> <p>3.06.06 If specified in Data Sheet -A, ball collector body shall be lined with suitable resilient material.</p> <p>3.06.07 The differential pressure measuring system shall be provided with D.P. transmitter ,DPS &amp; DPGof remote seal arrangement.</p> <p>3.07.00 <b><u>Differential Pressure Measuring System</u></b></p> <p>3.07.01 The ball separator shall be provided with a measuring system for differential pressure across the ball separating strainer/screen, to check debris accumulation and to initiate ball catching and backwashing operations. This shall consist of a differential pressure switch/transmitter for automatic backwashing operation, a differential pressure guage for manual observation with adequate number of tappings with isolating valves.</p> <p>3.07.02 The contacts for differential pressure switch/transmitter and for differential pressure guage shall be independent, so that in the event of failure of one, the other is available.</p> <p>3.07.03 The differential pressure measuring system shall be with remote seal arrangement .</p> <p>3.08.00 <b><u>Ball Monitoring System</u></b></p> <p>3.08.01 Ball monitoring system shall be provided for continuously monitoring the quantity and size of the cleaning balls in circulation. The monitoring system shall perform the following functions :</p> <ol style="list-style-type: none"> <li>Continuously counting the oversize balls in circulation and giving an alarm calling for investigation of ball losses, when the number of oversize circulating balls falls below a set valve.</li> <li>Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling-for replacement of balls when the number of oversized balls falls below a set valve.</li> <li>Bidder's if not manufacturing ball oversized monitor, can supply automatic ball sorter in lieu of same for automatic sorting of the undersized balls.</li> </ol> |  |




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| 3.08.02<br><br>3.08.03<br><br><br><br><br><br><br><br><br>3.08.04<br><br>3.09.00<br><br>3.09.01<br><br><br>3.09.02<br><br>3.09.03<br><br><br>3.09.04<br><br>3.10.00<br><br>3.10.01<br><br><br>3.10.02<br><br>3.10.03 | The monitoring system shall be of proven and reliable design and shall be complete with necessary transducers, amplifiers, transmission lines, power cables and electronic processor etc.<br>The electronic processor of the ball monitoring system shall be housed in the control panel and shall consist the following : -<br>a) Indicators for<br>♦ required basic ball charge.<br>♦ recirculating ball quantity.<br>♦ oversized ball quantity.<br>b) Time counters for<br>♦ total cleaning system operating hours.<br>♦ cleaning system operating hours with sufficient number of oversized balls.<br>c) Recorder for ball consumption.<br>The ball monitoring system shall have provisions for self-testing and self-calibration.<br><b><u>Cleaning Balls</u></b><br>The sponge rubber cleaning balls shall be slightly oversized to the internal diameter of condenser tubes and should be able to remove all fouling and scaling deposits in the condenser tubes.<br>The specific gravity of the cleaning balls shall be such that good distribution of balls across the tube sheet and cleaning of all tubes are ensured.<br>The composition of the cleaning balls shall be based on natural rubber and shall be suitable for temperature upto 100°C. Hardness of the cleaning balls shall be compatible to tube material and corrosion/fouling behaviour. If cleaning balls consist of abrasive coated balls, the abrasive material shall also be compatible for use with the tube material.<br>Calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc., shall be furnished during contract stage.<br><b><u>Piping, Valves, Distributors and Injection Nozzles.</u></b><br>Interconnecting piping, valves, injection nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.<br>Interconnecting piping shall be sized and routed optimally. Velocity in the pipe work shall be less than 1.5 m/s for pump suction and less than 2.2 m/s in other pipe work.<br>Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Valves provided in ball transport piping shall be ball type. Gland packing of all valve shall be of superior quality to avoid leakage. All valves upto 150 Nb shall be ball valves. For higher sizes , |   |                        |




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|   | gate / globe / B.F. valves shall be provided. All instrument valves shall be needle valves.   |                                      |                 |
| 3.10.04   | Adequate number of ball injection nozzles shall be provided for proper distribution of cleaning balls in condenser inlet. Ball injection nozzles shall be flanged type and shall have two sets of flanges, one for connecting to ball transport pipe and other for connecting to the stub on condenser inlet pipe for ease of removal during repairs or checking.   |                                      |                 |
| 3.10.05   | Distributors ( if applicable) with sight glass shall be provided wherever ball transport piping branching out or joining together for proper guidance of cleaning balls.  |                                      |                 |
| 3.10.6  | Type of valves shall be ball valves, no diaphragm type valve shall be used.   |                                      |                 |
| 3.11.00   | <b><u>Actuators</u></b>   |                                      |                 |
| 3.11.00   | Tube cleaning system shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuator shall be provided with auxiliary handwheel for manual operation in the event of control system failure.   |                                      |                 |
| 3.12.00   | <b><u>Electric Motors</u></b>   |                                      |                 |
|   | The drive motors for recirculating pump and differential pressure measuring system flushing pump shall conform to the requirements of the enclosed specification.   |                                      |                 |
| 3.13.00   | <b><u>Instrumentation and Control System.</u></b>   |                                      |                 |
| 3.13.01   | Complete instrumentation and control system for automatic operation of tube cleaning system, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel (As applicable ) and interconnecting control and power cabling between the control panel and various equipments in the tube cleaning system. |                                      |                 |
| 3.13.02   | The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential pressure indicator, timer, function selection switches, ball monitoring system processor, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.                                   |                                      |                 |
| 3.13.03   | Pressure gauges shall be provided at recirculating pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.   |                                      |                 |
| 3.14.00   | <b><u>Other Accessories.</u></b>  |                                      |                 |
| 3.14.01   | Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for ball separator inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in  |                                      |                 |




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| <p>Data Sheet-A / Section -C.</p>   |   |   |                        |
| 3.14.02   | Ball recirculating pump, ball collector with interconnecting piping and valves, shall be mounted on a frame. For fixing the frame, necessary foundation plates, bolts, nuts etc. shall be provided.   |   |                        |
| 3.14.03   | Suitable lifting arrangement shall be provided for various equipments of the tube cleaning system, for handling during erection and maintenance.  |   |                        |
| 3.15.00   | <b><u>Materials of Construction</u></b>   |   |                        |
| <p>Materials of various equipments in the tube cleaning system shall be corrosion resistant and consistent with the fluid handled. However, material specification for various components shall be equal to or superior to those specified in Data Sheet-A.</p> |   |   |                        |
| 4.00.00   | <b><u>PAINTING</u></b>  |   |                        |
| 4.01.00   | <p>The surface preparation of the various equipments / components of the tube cleaning system shall be done as per the standard mentioned in Data Sheet - A and shall include the following :</p>   |   |                        |
| <p>a) Removal of oil, grease, dirt and swarf etc.<br/> b) Removal of rust and scale etc.<br/> c) Sand blasting / shot blasting.</p>   |   |   |                        |
| 4.02.00   | <p>All internal surfaces of the various equipments / components of the tube cleaning system, which are subjected to immersion or water spray and which are not made of stainless steel or other corrosion resistant materials after surface preparation, shall be coated with epoxy paint of approved make and quality over a coat of zinc chromite primer, unless otherwise specified in Data Sheet - A.</p> |   |                        |
| 4.03.00   | <p>The external surfaces of the various equipments / components of the tube cleaning system after surface preparation, shall be coated with synthetic enamel paint of approved make and quality over two coats of red oxide primer, unless otherwise specified in Data Sheet -A.</p>  |   |                        |
| 5.00.00   | <b><u>SHOP INSPECTION AND TESTS</u></b>   |   |                        |
| 5.01.01   | <b><u>General</u></b>   |   |                        |
| 5.01.01   | <p>Manufacturer shall conduct all tests and stage inspections as per the approved</p>   |   |                        |




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|   |  | <p>quality plan to ensure that the various equipments and other accessories of the tube cleaning system shall conform to the requirements of this specification and of the applicable codes / standards.</p> <p>5.01.02 All materials used for manufacture /fabrication of the various equipments of the tube cleaning system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.</p> <p>5.01.03 All shop tests shall be conducted as per approved quality plan and test certificates / reports for the same shall be furnished to BHEL for approval.</p> <p>5.01.04 Qualification of welding procedures and welders shall be as per ASME B&amp;PV code, Section - IX / applicable codes.</p> <p>5.2.00 <b><u>Ball Separator</u></b></p> <p>5.02.01 Chemical analysis, mechanical tests shall be carried out on materials used for body, strainer / screen, strainer / screen shaft and other appurtenances as per the applicable material specification standards.</p> <p>5.02.02 All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.</p> <p>5.02.03 Strainer / screen shaft shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per ASME B&amp;PV code, Section VIII, Division 1.</p> <p>5.03.00 <b><u>Ball Recirculating Pump</u></b></p> <p>5.03.01 Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.</p> <p>5.03.02 The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&amp;PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL.</p> <p>5.03.03 Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.</p> <p>5.03.04 Wear rings shall be subjected to penetrant test as per ASTM-E165.</p> <p>5.03.05 Pump impellers and rotor assembly shall be statically and dynamically balanced as</p> |                        |



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|   | per ISO-1940   |   |                        |
| 5.04.00   | <u><b>Ball Collector</b></u>   |   |                        |
| 5.04.01   | Chemical analysis, mechanical tests shall be carried out on materials used for body and other appurtenances / accessories as per the applicable material specification standards.  |   |                        |
| 5.04.02   | All but welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects. |   |                        |
| 5.05.00   | <u><b>Piping, Valves, Distributors, and Injection Nozzles.</b></u>   |   |                        |
| 5.05.01   | Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.  |   |                        |
| 5.05.02   | All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.                             |   |                        |
| 5.05.03   | Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.                       |   |                        |
| 5.05.04   | All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.  |   |                        |
| 5.06.00   | <u><b>Rubber Lining (as applicable)</b></u>  |   |                        |
|   | Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.   |   |                        |
| 5.07.00   | <u><b>Flanges</b></u>  |   |                        |
| 5.07.01   | Chemical and mechanical test certificates shall be furnished for flange materials.   |   |                        |
| 5.07.02   | In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, Section VIII, Division 1.   |   |                        |
| 5.07.03   | In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.  |   |                        |
| 5.07.04   | If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.   |   |                        |
| 5.07.05   | Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.  |   |                        |



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5.08.00

**Dimensional Checks.**

Dimensional checks for various equipments/components of the tube cleaning system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

5.09.00

**Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components of the tube cleaning system at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

5.10.00

**Leakage Test**

Leakage test shall be conducted at the design pressure on all assemblies of the tube cleaning system to demonstrate that the assemblies are leak tight and no water seepage shall take place at various nozzles and valve connections.

5.11.00

**Performance Test on Recirculating Pump**

Performance test on recirculating pump with drive motor shall be conducted as per BS-599 / ASME PTC 8.0. Performance curves i.e., discharge flow Vs head, discharge flow Vs power consumption and discharge flow Vs efficiency shall be plotted and acceptance norms shall be as per BS-599 / ASME PTC 8.0. Vibration and noise shall be measure and acceptance norms shall be as per Hydraulic Institute (USA) standard.

5.12.00

**Functional Tests**

Various assemblies / equipments / components of the tube cleaning system shall be subjected to functional tests and the following shall be checked.

5.12.01

Smooth and free operation of all movable parts.

5.12.02

Interlock and sequential operation.

5.12.03

Satisfactory operations of ball monitoring system.

5.12.04


Satisfactory operations of actuators torque switches, limit switches etc.

6.00.00

**TESTING AT SITE**

After completion of installation at site, the tube cleaning system will be tested to check that the tube cleaning system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.



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**7.0.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.**

The Tube Cleaning Systems shall be guaranteed to meet the performance requirements specified in Section-D , Data Sheet A and Guarantee schedule and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

**7.01.00 Performance Parameters to be guaranteed by bidders shall be as under :**

- Pressure drop in ball separator in clean condition viz. after back washing.
- Percentage recovery of balls (min. 95% recovery)
- Life of Sponge Rubber Ball (Min. 4 weeks)

**7.02.00 Bidder to note that bids shall be evaluated on account of pressure drop across ball collecting strainer (in clean condition) and liquidated damages on account of not meeting the same during PG test shall be in accordance with following :**

**A) Bid Evaluation Criteria & Liquidated Damages:**

The bids received shall be evaluated for Pressure drop across balls collecting strainers :

- The permissible limit of pressure drop across balls collecting strainers in clean condition shall be 0.15 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ indicated in Data Sheet A .
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across balls collecting strainer shall be (with technical loadings) 0.2 MWC.


The bids will be technically rejected for pressure drops quoted higher than above maximum limit.

- The guaranteed pressure drops shall be demonstrated at site by bidder and if found higher shall be subject to LD @ twice the bid evaluation factor as above.


**7.03.00 Other Guaranteed Parameters to be demonstrated at site**

- Life of sponge rubber balls shall be minimum 4 weeks.
- Percentage recovery of balls shall be minimum 95%.



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|   | <p>Any deviation to above balls life and percentage recovery will not be accepted.</p> <p>Bidder to indicate the life of sponge rubber ball and nos. of balls lost during 1000 hours of plant operation in the Guarantee schedule and shall demonstrate same at site.</p> <p>In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchasers approval.</p> <p>In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.</p> <p><b>8.00.00      <u>QUALITY ASSURANCE &amp; QUALITY PLAN</u></b></p> <p><b>8.01.00</b>      The tube cleaning system and other accessories to be supplied, shall have assured quality and workmanship.</p> <p><b>8.02.00</b>      Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the tube cleaning system being offered.</p> <p><b>9.00.00      <u>NAME PLATE AND TAG NUMBERS</u></b></p> <p><b>9.01.00</b>      Ball separator, recirculating pump, ball collector shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-</p> <p>         a)      Design and maximum flow rates.</p> <p>         b)      Design and test pressures.</p> <p>         c)      Design temperature.</p> <p>         d)      Empty and operating weights.</p> <p><b>9.02.00</b>      Each valve in the tube cleaning system shall be provided with a name plate indicating the following :-</p> <p>         a)      Service.</p> <p>         b)      Design and test pressures.</p> <p>         c)      Maximum flow and flow direction.</p> <p>         d)      Size.</p> <p>         e)      Tag Number.</p> <p>         Tag Numbers will be indicated on the drawings submitted for approval during contractstage.</p> <p><b>9.03.00</b>      Each motor shall be provided with a name plate indicating the following details :</p> <p>         a)      Supply conditions.</p> <p>         b)      KW Rating.</p> <p>         c)      Make.</p> |  |



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| 10.00.00 | <b><u>DRAWING, DATA &amp; INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.</u></b><br><br><p>The drawings, data and other documents as required in Data Sheet-C shall be furnished after the award of contract.</p> |
|----------|---|

6043. 2-21. 2-26 PM







| Manufacturer's Name & Address |  |  |  |  |  |  |  |  |  | STANDARD QUALITY PLAN |  |  |  |  | BHEL Doc No.:    |  |  |  |  |
|-------------------------------|--|--|--|--|--|--|--|--|--|-----------------------|--|--|--|--|------------------|--|--|--|--|
| P.O. No.                      |  |  |  |  |  |  |  |  |  | Item : Ball Separator |  |  |  |  | Vendor O.P. NO.: |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | PACKAGE : COLTCS      |  |  |  |  | PROJECT:         |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | Date :                |  |  |  |  | CUSTOMER:        |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | Page 02 of 15         |  |  |  |  | PURCHASER:       |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | Acceptance            |  |  |  |  | CONSULTANT:      |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | Documents             |  |  |  |  | Format of Record |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 7                     |  |  |  |  | M C O            |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 8                     |  |  |  |  | D                |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 9                     |  |  |  |  | 10               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 11                    |  |  |  |  | 11               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 12                    |  |  |  |  | 12               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 13                    |  |  |  |  | 13               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 14                    |  |  |  |  | 14               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 15                    |  |  |  |  | 15               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 16                    |  |  |  |  | 16               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 17                    |  |  |  |  | 17               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 18                    |  |  |  |  | 18               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 19                    |  |  |  |  | 19               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 20                    |  |  |  |  | 20               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 21                    |  |  |  |  | 21               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 22                    |  |  |  |  | 22               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 23                    |  |  |  |  | 23               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 24                    |  |  |  |  | 24               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 25                    |  |  |  |  | 25               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 26                    |  |  |  |  | 26               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 27                    |  |  |  |  | 27               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 28                    |  |  |  |  | 28               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 29                    |  |  |  |  | 29               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 30                    |  |  |  |  | 30               |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 31                    |  |  |  |  | 31               |  |  |  |  |
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| P.O. No.                      |  |  |  |  |  |  |  |  |  | 166                   |  |  |  |  | 166              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 167                   |  |  |  |  | 167              |  |  |  |  |
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| P.O. No.                      |  |  |  |  |  |  |  |  |  | 170                   |  |  |  |  | 170              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 171                   |  |  |  |  | 171              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 172                   |  |  |  |  | 172              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 173                   |  |  |  |  | 173              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 174                   |  |  |  |  | 174              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 175                   |  |  |  |  | 175              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 176                   |  |  |  |  | 176              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 177                   |  |  |  |  | 177              |  |  |  |  |
| P.O. No.                      |  |  |  |  |  |  |  |  |  | 178                   |  |  |  |  | 178              |  |  |  |  |
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| P.O. No.                      |  |  |  |  |  |  |  |  |  | 322                   |  |  |  |  | 322              |  |  |  |  |



| Manufacturer's Name & Address  |   | STANDARD QUALITY PLAN                                 |          |                                     |                              | BHEL Doc No.: PE-QP-999-165-N008 |                              |
|--|---|---|----------|-------------------------------------|------------------------------|----------------------------------|------------------------------|
| P.O. No.   |   | Item : Ball Separator                                 |          | Vendor Q.P. NO:                     |                              | PROJECT:                         |                              |
| P.O. No.   |   | PACKAGE : COLTCS                                      |          | CUSTOMER:                           |                              | PURCHASER:                       |                              |
| P.O. No.   |   | Date :  |          | CONSULTANT:                         |                              | REMARKS                          |                              |
| P.O. No.   |   | Page 03 of 15   |          | Format of Record                    |                              | Agency                           |                              |
| P.O. No.   |   | Reference Documents                                   |          | Date                                |                              | M C O                            |                              |
| P.O. No.   |   | Quantum of Check                                      |          | Acceptance Norms                    |                              | D                                |                              |
| P.O. No.   |   | Type of Check   |          | ASME Sec.VIII Div.1                 |                              | 10                               |                              |
| P.O. No.   |   | Class   |          | ASME Sec.VIII Div.1                 |                              | 11                               |                              |
| P.O. No.   |   | Characteristics Checked                               |          | ASME Sec.VIII Div.1                 |                              | 11                               |                              |
| 1  | 2 | 3   | 4        | 5                                   | 6                            | 7                                | 8                            |
|  |   | Surface defects on machined area                      | Critical | Penetrant test                      | 100%                         | ASME Sec.VIII Div.1              | Inspection report            |
|  |   | Sub-surface defects                                   | Critical | Ultrasonic test                     | 100%                         | ASME SA745                       | Inspection report            |
| [e]  |   | Chemical properties & Physical properties             | Major    | Chemical Analysis & Mechanical test | One sample / heat            | Approved sheet                   | Inspection report / Lab test |
|  |   | Corrosion Resistance                                  | Major    | IGC                                 | One/Heat                     | ASTM A 923                       | Inspection report / Lab test |
|  |   | Surface Defects                                       | Minor    | Visual                              | 100%                         | Approved sheet                   | Inspection report / Lab test |
| [f]  |   | Ball Extraction Nozzle Pipe [Duplex Stainless Steel]  | Major    | Chemical Analysis & Mechanical test | One sample / cast/heat/batch | Approved sheet                   | Inspection report / Lab test |
|  |   | Surface Defects                                       | Minor    | Visual                              | 100%                         | Approved sheet                   | Inspection report / Lab test |
|  |   | Leak Tightness  | Major    | Hydrostatic Test                    | 100%                         | Approved sheet                   | Inspection report / Lab test |
| 1.2.0  |   | Inprocess Quality Control                             |          | Scrutiny                            | 100%                         | ASME Sec.IX                      | Inspection report / Lab test |
| 1.2.1  |   | Welding procedure specification                       | Critical | Physical test                       | 100%                         | ASME Sec.IX                      | Inspection report / Lab test |
| 1.2.2  |   | Welding procedure qualification                       | Critical | Radiography                         | 100%                         | ASME Sec.IX                      | Inspection report / Lab test |
| 1.2.3  |   | Welder performance qualification                      | Major    | Template, visual                    | 100%                         | ASME Sec.VIII Div.1              | Inspection report / Lab test |
| 1.2.4  |   | Flare-up of butt weld                                 | Major    | Template, visual                    | 100%                         | ASME Sec.VIII Div.1              | Inspection report / Lab test |
| 1.2.5  |   | Flare-up of shell flange and nozzle assembly to shell | Major    | Template, visual                    | 100%                         | ASME Sec.VIII Div.1              | Inspection report / Lab test |
| <b>LEGEND</b><br>* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.<br>** M.Manufacturer / Manufacturer's Sub-contractor<br>C: Contractor<br>Indicate : "P" - Perform, "W" - Witness and "V" - Verification |   |   |          |                                     |                              |                                  |                              |
| Manufacturer / Sub-Contractor Signature  |   |   |          | Reviewed By                         |                              |                                  |                              |
| Name & Sign. Of Approving authority & Seal   |   |   |          |                                     |                              |                                  |                              |



| Manufacturer's Name & Address  |   |   | STANDARD QUALITY PLAN |   |  | BHEL Doc No.: PE-QP-999-165-N008                 |  |                                 |    |
|--|---|---|-----------------------|---|--|--|--|---------------------------------|----|
| P.O. No.   |   |   | Vendor Q.P. NO:       |   |  | PROJECT:   |  |                                 |    |
| Item : Ball Separator  |   |   | PACKAGE : COLTCS      |   |  | CUSTOMER:  |  |                                 |    |
| Date :   |   |   | Date :                |   |  | PURCHASER:                                       |  |                                 |    |
| Page 04 of 15  |   |   | Page 04 of 15         |   |  | CONSULTANT:                                      |  |                                 |    |
| Format of Record   |   |   | Format of Record      |   |  | Remarks  |  |                                 |    |
| M  |   |   | M                     |   |  | O  |  |                                 |    |
| D*   |   |   | D*                    |   |  | 11   |  |                                 |    |
| 1  | 2   | 3   | 4                     | 5   | 6  | 7  | 8  | 9                               | 10 |
| 1.2.6  | Weld quality for Pressure Parts                   |   |                       |   |  |  |  |                                 |    |
|  | (a) Root run                                      | Surface defects                                 | Major                 | Penetrant test / Visual   | 100%                                     | ASME Sec.VIII Div.1 Appendix 8                   | ASME Sec.VIII Div.1 Appendix 8                   | Operation Process Sheet         | P  |
| 1.2.7  | (a) Completed butt welds                          | 1 Surface defects                               | Major                 | Penetrant test  | 100%                                     | ASME Sec.VIII Div.1 Appendix 8                   | ASME Sec.VIII Div.1 Appendix 8                   | Inspection report               | P  |
|  |   | 2 Sub-surface defects                           | Critical              | Radiography test  | 10% of total weld length & 100% T Joints | ASME Sec.VIII Div.1 Appendix 4, Div.2 Appendix 8 | ASME Sec.VIII Div.1 Appendix 4, Div.2 Appendix 8 | Radiographs & Inspection report | P  |
|  | (b) Completed fillet welds                        | Surface defects                                 | Major                 | Penetrant test  | 100%                                     | ASME Sec.VIII Div.1 Appendix 8                   | ASME Sec.VIII Div.1 Appendix 8                   | Inspection report               | P  |
| 1.2.8  | Fabricated Shell (Prior to sand blasting)         | 1 Dimensions, Orientation                       | Major                 | Measurement by visual   | 100%                                     | ASME Sec.VIII Div.1 Appendix 8                   | ASME Sec.VIII Div.1 Appendix 8                   | Inspection report               | P  |
|  |   | 2 Hydro test                                    | Critical              | Hydrostatic Pr. @ 1.5 times design (positive) Duration 30 minutes | 100%                                     | ASME Sec.VIII Div.1 Appendix 8                   | ASME Sec.VIII Div.1 Appendix 8                   | Inspection report               | P  |
| 1.2.9  | Pickling and Passivation                          | Protection Layer                                | Major                 | Visual  | 100%                                     | IS : 10117                                       | IS : 10117                                       | Log Book                        | P  |
| 1.2.10   | Final tests (completed equipments) After assembly | 1 Dimensions, orientation, workmanship & finish | Major                 | Measurement by visual   | 100%                                     | G.A.drawing                                      | G.A.drawing                                      | Inspection report               | P  |
|  |   | 2 Leak tightness for assembly                   | Critical              | Leak Tightness @ design pr. (positive) Duration 30 minutes        | 100%                                     | ASME Sec.VIII Div.1 Appendix 8                   | ASME Sec.VIII Div.1 Appendix 8                   | Inspection report               | P  |
|  |   | 3 Dry function test for Ball Separator          | Critical              | Operational test  | 100%                                     | Approved procedure                               | Approved procedure                               | Inspection report               | P  |
| <p><b>LEGEND</b></p> <p>* Records identified with "STAR" shall be essentially included by contractor in QA documentation.</p> <p>** M- Manufacturer / Manufacturer's Sub-contractor</p> <p>C- Contractor</p> <p>O- Owner</p> <p>Indicate : "P" - Perform, "W" - Witness and "V" - Verification</p> |   |   |                       |   |  |  |  |                                 |    |
| <p>Manufacturer / Sub-Contractor Signature</p>   |   |   |                       |   |  |  |  |                                 |    |
| <p>Reviewed By</p>   |   |   |                       |   |  |  |  |                                 |    |
| <p>Name &amp; Sign. Of approving authority &amp; Seal</p>  |   |   |                       |   |  |  |  |                                 |    |



| Manufacturer's Name & Address  |   | STANDARD QUALITY PLAN  |       |                               |             | BHEL Doc No.: PE-QP-999-165-N008           |                          |
|--|---|--|-------|-------------------------------|-------------|--|--------------------------|
| P.O. No.   |   | Vendor Q.P. NO.  |       | PROJECT:                      |             | CUSTOMER:                                  |                          |
| Item : Ball Separator  |   | PACKAGE : COLTCS   |       | PURCHASER:                    |             | CONSULTANT:                                |                          |
| Date :   |   | Page 05 of 15  |       | Format of Record              |             | Remarks                                    |                          |
| Class  |   | Reference Documents  |       | M                             |             | C  |                          |
| Checked  |   | Quantum of Check   |       | D                             |             | 10   |                          |
| 3  |   | 4  |       | 7                             |             | 11   |                          |
| 1.3.0  | Rubber Lining for ball Separator Shell, V-Piece & skid IC Pipe. |  |       |                               |             |  |                          |
| 1.3.1  | Rubber formulation  | Tensile elongation and hardness                                      | Major | Physical test                 | One per lot | Manufacturer's procedure                   | BS 6374:Equivalent       |
|  |   | Polymer identification   | Major | Flame test                    | One per lot | For Semi Ebonite                           | For Semi Ebonite         |
|  |   |  |       |                               |             | Inspection report                          | Inspection report        |
|  |   | % Change in weight after 24 hrs immersion in sea water at 70 degrees | Major | Immersion (bleeding test)     | One per lot | ASTM D 471                                 | +/- 1%                   |
| 1.3.2  | Surface preparation of items to be lined                        | Free from rust, scale, dust and grease                               | Major | Visual                        | 100%        | SA 2.5                                     | SA 2.5                   |
| 1.3.3  | Vulcanising   | Temperature, Pressure and time                                       | Major | Process monitoring            | 100%        | Manufacturer's procedure                   | Manufacturer's procedure |
| 1.3.4  | Vulcanised rubber lined items                                   | a) Chip test   | Major | Chip test                     | One per lot | Approved drawing and BS 6374:Equivalent    | BS 6374:Equivalent       |
|  |   | b) Adhesion, Visual defects, thickness and hardness                  | Major | Measurement/visual inspection | 100%        | Approved drawing and BS 6374:Equivalent    | BS 6374:Equivalent       |
|  |   | c) Spark test for Pin holes at 5 kv/mm                               | Major | Spark test for Pin holes      | 100%        | Approved drawing and BS 6374:Equivalent    | BS 6374:Equivalent       |
| <b>LEGEND</b><br>* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.<br>** M: Manufacturer / Manufacturer's Sub-contractor<br>C: Contractor<br>O: Owner<br>Indicate: "P" - Perform, "W" - Witness and "V" - Verification |   |  |       |                               |             |  |                          |
| Manufacturer / Sub-Contractor Signature  |   | Contractor Signature   |       | Reviewed By                   |             | Name & Sign. Of approving authority & Seal |                          |

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| Manufacturer's Name & Address   |  | STANDARD QUALITY PLAN |  |  |  | BHEL Doc No.: PE-QP-999-165-N008 |  |
|---|--|-----------------------|--|--|--|----------------------------------|--|
| P.O. No.  |  | Vendor Q.P. NO.:      |  |  |  | PROJECT:                         |  |
| Item : Ball Recirculation Skid & PACKAGE : COLTCS   |  | Date :                |  |  |  | CUSTOMER:                        |  |
| Ball Vessel   |  | Page 07 of 15         |  |  |  | PURCHASER:                       |  |
| Class   |  | Reference Documents   |  |  |  | CONSULTANT:                      |  |
| Type of Check   |  | Quantum of Check      |  |  |  | Format of Record                 |  |
| Checked   |  | 3                     |  |  |  | 9                                |  |
| 3   |  | 4                     |  |  |  | M C O                            |  |
| 2   |  | 5                     |  |  |  | 10                               |  |
| 1   |  | 6                     |  |  |  | 11                               |  |
| 2.0.0 Complete Skid   |  | 7                     |  |  |  |                                  |  |
| Characteristics   |  | 8                     |  |  |  |                                  |  |
| Major   |  | 9                     |  |  |  |                                  |  |
| Completeness, Correctness, Orientation, Dimensions  |  | 10                    |  |  |  |                                  |  |
| Recirculating Skid with ball vessel and ball oversize monitor                                     |  | 11                    |  |  |  |                                  |  |
| Ball Vessel   |  | 12                    |  |  |  |                                  |  |
| Raw Material  |  | 13                    |  |  |  |                                  |  |
| 2.1.0   |  | 14                    |  |  |  |                                  |  |
| [a]   |  | 15                    |  |  |  |                                  |  |
| Chemical properties & Physical properties   |  | 16                    |  |  |  |                                  |  |
| Major   |  | 17                    |  |  |  |                                  |  |
| Minor   |  | 18                    |  |  |  |                                  |  |
| Surface defects   |  | 19                    |  |  |  |                                  |  |
| Sub-surface defects   |  | 20                    |  |  |  |                                  |  |
| 2.2.0 Inprocess Quality Control   |  | 21                    |  |  |  |                                  |  |
| Correctness   |  | 22                    |  |  |  |                                  |  |
| Critical  |  | 23                    |  |  |  |                                  |  |
| 2.2.1 Welding procedure specification   |  | 24                    |  |  |  |                                  |  |
| Weld soundness  |  | 25                    |  |  |  |                                  |  |
| Critical  |  | 26                    |  |  |  |                                  |  |
| 2.2.2 Welding procedure qualification   |  | 27                    |  |  |  |                                  |  |
| Weld soundness  |  | 28                    |  |  |  |                                  |  |
| Critical  |  | 29                    |  |  |  |                                  |  |
| 2.2.3 Welder performance qualification  |  | 30                    |  |  |  |                                  |  |
| Dimensions  |  | 31                    |  |  |  |                                  |  |
| Major   |  | 32                    |  |  |  |                                  |  |
| 2.2.4 Dished end for ball vessel  |  | 33                    |  |  |  |                                  |  |
| Surface defects   |  | 34                    |  |  |  |                                  |  |
| Critical  |  | 35                    |  |  |  |                                  |  |
| LEGEND  |  | 36                    |  |  |  |                                  |  |
| * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. |  | 37                    |  |  |  |                                  |  |
| ** M: Manufacturer / Manufacturer's Sub-contractor  |  | 38                    |  |  |  |                                  |  |
| C: Contractor   |  | 39                    |  |  |  |                                  |  |
| O: Owner  |  | 40                    |  |  |  |                                  |  |
| Indicate : "P" - Perform, "W" - Witness and "V" - Verification                                    |  | 41                    |  |  |  |                                  |  |
| Manufacturer / Sub-Contractor Signature   |  | 42                    |  |  |  |                                  |  |
| Contractor  |  | 43                    |  |  |  |                                  |  |
| Reviewed By   |  | 44                    |  |  |  |                                  |  |
| Name & Sign. Of approving authority & Seal  |  | 45                    |  |  |  |                                  |  |



| Manufacturer's Name & Address   |   |          |   | STANDARD QUALITY PLAN                    |                         |                                |   | BHEL Doc No.: PE-QP-999-165-N008 |    |    |    |
|---|---|----------|---|--|-------------------------|--------------------------------|---|----------------------------------|----|----|----|
| P.O. No.  |   |          |   | Item : Ball Vessel & Ball Injection Pipe |                         |                                |   | PROJECT:                         |    |    |    |
| P.O. No.  |   |          |   | Injection Pipe                           |                         |                                |   | CUSTOMER:                        |    |    |    |
| P.O. No.  |   |          |   | Injection Pipe                           |                         |                                |   | PURCHASER:                       |    |    |    |
| P.O. No.  |   |          |   | Injection Pipe                           |                         |                                |   | CONSULTANT:                      |    |    |    |
| P.O. No.  |   |          |   | Injection Pipe                           |                         |                                |   | Date :                           |    |    |    |
| P.O. No.  |   |          |   | Injection Pipe                           |                         |                                |   | Page 08 of 15                    |    |    |    |
| P.O. No.  |   |          |   | Injection Pipe                           |                         |                                |   | Remarks                          |    |    |    |
| Sl. No.   | Component / Operation                               | Class    | Type of Check   | Quantum of Check                         | Reference Documents     | Acceptance Norms               | Format of Record  | Agency                           | M  | C  | O  |
| 1   | 2   | 3        | 4   | 5  | 6                       | 7                              | 8   | 9                                | 10 | 11 | 12 |
| 2.2.5   | Fit-up of butt weld                                 | Major    | Measurement   | 100%                                     | Manufacturing Drawing   | ASME Sec VIII Div.1            | Log book  |                                  | P  | WV | -  |
| 2.2.6   | Fit-up of shell flange and nozzle assembly to shell | Major    | Template, visual  | 100%                                     | Manufacturing Drawing   | ASME Sec VIII Div.1            | Log book  |                                  | P  | -  | -  |
| 2.2.7   | Weld quality for Pressure Parts                     |          |   |  |                         |                                |   |                                  |    |    |    |
|   | (a) Root run  | Major    | Penetrant test / Visual   | 100%                                     | ASME Sec VIII Div.1     | ASME Sec VIII Div.1 Appendix 8 | Operation Process Sheet   |                                  | P  | V  | V  |
| 2.2.8   | (a) Completed butt welds                            | Major    | Penetrant test  | 100%                                     | ASME Sec VIII Div.1     | ASME Sec VIII Div.1 Appendix 8 | Inspection report   |                                  | P  | V  | V  |
|   |   | Critical | Radiography test  | 10% of total weld length & 100% T Joints | ASME Sec VIII Div.1     | ASME Sec VIII Div.1 Appendix 8 | Radiographs and Inspection report                                 |                                  | P  | V  | V  |
|   | (b) Completed fillet welds                          | Major    | Penetrant test  | 100%                                     | ASME Sec VIII Div.1     | ASME Sec VIII Div.1 Appendix 8 | Inspection report   |                                  | P  | V  | V  |
| 2.2.9   | Fabricated Shell                                    | Major    | Measurement   | 100%                                     | Manufacturing Drawing   | ASME Sec VIII Div.1            | Inspection report   |                                  | P  | V  | V  |
|   |   | Critical | Hydrostatic Pr. @ 1.5 times design pr. (positive) (Duration 30 minutes) | 100%                                     | ASME Sec VIII Div.1     | ASME Sec VIII Div.1            | Inspection report   |                                  | P  | W  | V  |
| 2.2.10  | Pickling and Passivation                            | Major    | Visual  | 100%                                     | IS: 10117               | IS: 10117                      | Log Book  |                                  | P  | -  | -  |
| 2.2.11  | Ball Injection Pipe                                 | Major    | Chemical & Physical properties  | One sample/test                          | Approved drg/Data sheet | drg/Data sheet                 | Mill Test Certificate / lab test report / raw material flow sheet |                                  | P  | V  | V  |
|   | Surface defects                                     | Minor    | Visual  | 100%                                     | Approved drg/Data sheet | Approved drg/Data sheet        | MTC / Inspection report   |                                  | P  | V  | V  |
|   | Leak Tightness                                      | Major    | Hydrostatic test  | 100%                                     | Approved drg/Data sheet | Approved drg/Data sheet        | Manufacturer's Test Certificate                                   |                                  | P  | V  | V  |
| <p><b>LEGEND</b></p> <p>* Records identified with "ST AP" shall be essentially included by contractor in QA Documentation.</p> <p>** M: Manufacturer / Manufacturer's Sub-contractor</p> <p>C: Contractor</p> <p>Indicate : "P" - Perform, "W" - Witness and "V" - Verification</p> |   |          |   |  |                         |                                |   |                                  |    |    |    |
| <p>Manufacturer / Sub-Contractor Signature</p>  |   |          |   |  |                         |                                |   |                                  |    |    |    |
| <p>Reviewed By</p>  |   |          |   |  |                         |                                |   |                                  |    |    |    |
| <p>Name &amp; Sign. Of approving authority &amp; Seal</p>   |   |          |   |  |                         |                                |   |                                  |    |    |    |



| Manufacturer's Name & Address   |  |          |   | STANDARD QUALITY PLAN  |  |                                 |                                   | BHEL Doc No.: PE-QP-999-165-N008 |                        |
|---|--|----------|---|------------------------|--|---------------------------------|-----------------------------------|----------------------------------|------------------------|
| P.O. No.  |  |          |   | Vendor Q.P. NO:        |  |                                 |                                   | PROJECT:                         |                        |
| Item : RECIRCULATING PUMP   |  |          |   | PACKAGE : COLTCS       |  |                                 |                                   | CUSTOMER:                        |                        |
| Date :  |  |          |   | Date :                 |  |                                 |                                   | PURCHASER:                       |                        |
| Page 9 of 15  |  |          |   | Page 9 of 15           |  |                                 |                                   | CONSULTANT:                      |                        |
| Formet of Record  |  |          |   | Formet of Record       |  |                                 |                                   | Remarks                          |                        |
| M   |  |          |   | M                      |  |                                 |                                   | 11                               |                        |
| Sl. No.   | Component / Operation                      | Class    | Type of Check   | Quantum of Check       | Reference Documents                          | Approved dtg/ sheet             | Data dtg/ sheet                   | Manufacturer's Certificate       | Test                   |
| 2.3.0   | Raw material control                       | 4        | 5   | 8                      | 7  | Approved dtg/ sheet             | Data dtg/ sheet                   | Manufacturer's Certificate       | Test                   |
| 2.3.1   | Casing                                     | Major    | Chemical & Physical analysis  | One Sample/Cast / Heat | Approved dtg/ sheet                          | Data dtg/ sheet                 | Manufacturer's Certificate        | Test                             |                        |
| 2.3.2   | Impeller, Sleeve                           | Minor    | Visual  | 100%                   | Approved dtg/ sheet                          | Data dtg/ sheet                 | Manufacturer's Certificate        | Test                             |                        |
| 2.3.3   | Shaft                                      | Major    | Physical and Chemical analysis                                      | One Sample/Cast / Heat | Approved dtg/ sheet                          | Data dtg/ sheet                 | Manufacturer's Certificate        | Test                             |                        |
| 2.3.4   | In-process control                         | Major    | Ultrasonic Test   | 100%                   | ASME SA 745                                  | ASME SA 745                     | MTC / Inspection report           | Test                             | Only for shaft >= 50mm |
| 2.3.5   | Casing                                     | Critical | Hydro test @ 1.5 times design P.C. (positive) (Duration 30 minutes) | 100%                   | Manufacturing Standard                       | Approved dtg/ sheet             | Data dtg/ sheet                   | Inspection report                |                        |
| 2.3.6   | Shaft                                      | Critical | Penetrant test  | 100%                   | ASME Sec.VIII Div.1                          | ASME Sec.VIII Div.1             | Inspection report                 | Test                             |                        |
| 2.3.7   | Impeller                                   | Major    | Static dynamic balancing  | 100%                   | ISO 1940                                     | ISO 1940                        | Inspection report                 | Test                             |                        |
| 2.3.8   | All components                             | Major    | Measurement, visual examination                                     | 100%                   | Manufacturing drawing                        | Manufacturing drawing           | Log book / job card               | Test                             |                        |
| 2.3.9   | Assembly, control, final inspection / test | Major    | Performance test  | 100%                   | Approved curve, approved data sheet, IS:5120 | Approved data sheet             | Inspection report, plotted curves | Test                             |                        |
| 2.3.10  | Complete pump                              | Major    | Visual examination  | 100%                   | Approved data sheet / Mfg. Dwg.              | Approved data sheet / Mfg. Dwg. | Check list / Inspection report    | Test                             |                        |
| <b>LEGEND</b><br>* Record identified with "STAR" shall be essentially included by contractor in QA Documentation.<br>** M Manufacturer / Manufacturer's Sub-contractor<br>C: Contractor<br>O: Owner<br>Indicate : "P" - Perform, "W" - Witness and "V" - Verification |  |          |   |                        |  |                                 |                                   |                                  |                        |
| Manufacturer / Sub-Contractor Signature<br>Reviewed By<br>Name & Sign. Of approving authority & Seal  |  |          |   |                        |  |                                 |                                   |                                  |                        |



| Manufacturer's Name & Address   |                                      | STANDARD QUALITY PLAN        |               |                              |                        | BHEL Doc No.:  | PE-QP-998-165-N008       |
|---|--------------------------------------|------------------------------|---------------|------------------------------|------------------------|--|--------------------------|
| P.O. No.  |                                      | Item : BALL VALVES           |               | Vendor Q.P. NO:              | PROJECT:               |  |                          |
|   |                                      |                              |               | PACKAGE : COLTCS             | CUSTOMER:              |  |                          |
|   |                                      |                              |               | Date :                       | PURCHASER:             |  |                          |
|   |                                      |                              |               | Page 10 of 15                | CONSULTANT:            |  |                          |
| Sl. No.   | Component / Operation                | Class                        | Type of Check | Reference Documents          | Quantum of Check       | Format of Record   | Remarks                  |
| 1   | 2                                    | 3                            | 4             | 5                            | 6                      | 7  | 8                        |
| 2.4.0   | Ball valves                          |                              |               |                              |                        |  |                          |
| 2.4.1   | Materials                            |                              |               |                              |                        |  |                          |
|   | Body and Tail end pieces             | Chemical/Physical properties | Major         | Chemical & Physical analysis | One Sample/Cast / heat | Approved drg/ Data sheet   | Approved drg/ Data sheet |
| 2.4.2   | Ball                                 | Chemical/Physical properties | Major         | Chemical & Physical analysis | One Sample/Cast / heat | Approved drg/ Data sheet   | Approved drg/ Data sheet |
| 2.4.3   | Stem                                 | Chemical/Physical properties | Major         | Chemical & Physical analysis | One Sample/Cast / heat | Approved drg/ Data sheet   | Approved drg/ Data sheet |
| 2.4.4   | In-process inspection                |                              |               |                              |                        |  |                          |
| 2.4.5   | Machining of body, end, pieces, ball | Dimension                    | Major         | Measurement                  | 100%                   | Approved drg/ Data sheet   | Log book                 |
| 2.4.6   | Ball                                 | a) Surface defects           | Critical      | Penetrant test               | 100%                   | ASME Sec.VIII Div.1 Appendix 8   | Inspection report        |
|   |                                      | b) Hardness                  | Major         | Hardness testing             | Random                 | Approved drg/ Data sheet   | Inspection report        |
| 2.4.7   | Assembly                             | a) Dimensions                | Major         | Measurement                  | 100%                   | EN ISO 17292   | Manufacturer's T.C.      |
|   |                                      | b) Opening / Closing         | Major         | Operation                    | 100%                   | As per approved data sheet   | --                       |
| 2.4.8   | Testing                              |                              |               |                              |                        |  |                          |
|   | (a) Body                             | Leakage                      | Critical      | Hydraulic test               | 100%                   | EN 12266-1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100 | Manufacturer's T.C.      |
|   | (b) Seat test                        | Leakage                      | Critical      | Hydraulic test               | 100%                   | EN 12266-1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100 | Manufacturer's T.C.      |
|   | (c) Seat                             | Leakage                      | Critical      | Air test                     | 100%                   | EN 12266-1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100 | Manufacturer's T.C.      |
| <b>LEGEND</b><br>* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.<br>** M: Manufacturer / Manufacturer's Sub-contractor<br>C: Contractor<br>Indicate : "P" - Perform, "W" - Witness and "V" - Verification |                                      |                              |               |                              |                        |  |                          |
| Manufacturer / Sub-Contractor Signature   |                                      | Contractor Signature         |               | Reviewed By                  |                        | Name & Sign. Of approving authority & Seal   |                          |



| Manufacturer's Name & Address  |                         | STANDARD QUALITY PLAN          |          |  |                               | BHEL Doc No.:                  |                                |   |        |             |                       |  |  |
|--|-------------------------|--------------------------------|----------|--|-------------------------------|--------------------------------|--------------------------------|---|--------|-------------|-----------------------|--|--|
| P.O. No.   |                         | Vendor Q.P. NO:                |          | PROJECT:   |                               | PE-QP-989-165-N008             |                                |   |        |             |                       |  |  |
| Item : RECIRCULATING PUMP MOTOR  |                         | PACKAGE : COLTOS               |          | CUSTOMER:  |                               |                                |                                |   |        |             |                       |  |  |
| V PIECE  |                         | Date :                         |          | PURCHASER:   |                               |                                |                                |   |        |             |                       |  |  |
| Page 11 of 15  |                         | CONSULTANT:                    |          |  |                               |                                |                                |   |        |             |                       |  |  |
| Sl. No.  | Component / Operation   | Characteristics                | Class    | Type of Check  | Quantum of Check              | Reference Documents            | Acceptance Norms               | Format of Record  | Agency | Remarks     |                       |  |  |
| 1  | 2                       | 3                              | 4        | 5  | 6                             | 7                              | 8                              | 9   | 10     | 11          |                       |  |  |
| 2.5.0  | Motor                   | Routine test, Load test & IR   | Major    | Electrical test  | 100% test                     | IS:325                         | IS:325                         | Manufacturer test certificate                                     | P      | V           | Review of supplier TC |  |  |
|  |                         | Make, Rating                   | Major    | Verification   | 100%                          | Appd drg/Data sheet            | Appd drg/Data sheet            | Inspection report   | V      | V           |                       |  |  |
|  |                         | Degree of Protection           | Critical | Verification   | Type test                     | IP 55                          | IP 55                          | Manufacturer's test Certificate                                   | V      | V           |                       |  |  |
| 3.1.0  | V - Piece               |                                |          |  |                               |                                |                                |   |        |             |                       |  |  |
|  | Raw material Inspection | Chemical & Physical properties | Major    | Chemical mechanical tests  | One sample/heat               | Approved sheet                 | Approved sheet                 | Mill Test Certificate / lab test report / raw material flow sheet | P      | V           |                       |  |  |
|  | In process Inspection   | b) Surface defects             | Major    | Visual   | 100%                          | Approved drg / Data sheet      | Approved drg / Data sheet      | MTC / Inspection report   | P      | V           |                       |  |  |
|  |                         | c) Sub-surface defects         | Critical | Radiography test   | 10% of total butt weld length | ASME Sec.VIII Div.1 Appendix 4 | ASME Sec.VIII Div.1 Appendix 4 | Radiographs and inspection report                                 | P      | V           |                       |  |  |
|  |                         | d) Hydro Static Test           | Critical | Hydrostatic Pr. @ 1.5 times design pressure (positive) (Duration 30 minutes) | 100%                          | ASME Sec.VIII Div.1            | ASME Sec.VIII Div.1            | Inspection report   | P      | V           |                       |  |  |
| <b>LEGEND</b><br>* Records Identified with "STAR" shall be essentially included by contractor in QA Documentation.<br>** M- Manufacturer / Manufacturer's Sub-contractor<br>C- Contractor<br>O- Owner<br>Indicates : "P" - Perform, "V" - Witness and "V" - Verification |                         |                                |          |  |                               |                                |                                |   |        |             |                       |  |  |
| Manufacturer / Sub-Contractor Signature  |                         |                                |          |  |                               |                                |                                |   |        | Reviewed By |                       | Name & Sign. Of approving authority & Seal |  |



| Manufacturer's Name & Address   |                                     | STANDARD QUALITY PLAN            |          | BHEL Doc No.: PE-QP-999-165-N008                                      |                            |                                |                                  |                          |        |  |  |
|---|-------------------------------------|----------------------------------|----------|---|----------------------------|--------------------------------|----------------------------------|--------------------------|--------|--|--|
| P.O. No.  |                                     | Vendor Q.P. NO:                  |          | PROJECT:  |                            |                                |                                  |                          |        |  |  |
| Item : Ball Monitoring System (Ball Overhaul Monitor)   |                                     | PACKAGE : COLTCS                 |          | CUSTOMER:   |                            |                                |                                  |                          |        |  |  |
| Date :  |                                     | Page 12 of 15                    |          | PURCHASER:  |                            |                                |                                  |                          |        |  |  |
|   |                                     |                                  |          | CONSULTANT:   |                            |                                |                                  |                          |        |  |  |
| Sl. No.   | Component / Operation               | Characteristics Checked          | Class    | Type of Check   | Quantum of Check           | Reference Documents            | Approval                         | Format of Record         | Agency | Remarks  |  |
| 1   | 2                                   | 3                                | 4        | 5   | 6                          | 7                              | 8                                | 9                        | 10     | 11   |  |
| 4.1.0   | Raw Material Housing shell, Flanges | Chemical properties              | Major    | Chemical Analysis   | One sample/heat            | Approved sheet                 | Approved sheet                   | drg/Data report/lab test | M      | if fabricated type   |  |
|   |                                     | Physical properties              | Major    | Physical test   | One sample cast/heat/batch | Approved sheet                 | Approved sheet                   | drg/Data report/lab test | P      |  |  |
|   |                                     | Surface defects                  | Minor    | Visual  | 100%                       | Approved sheet                 | Approved sheet                   | drg/Data report/lab test | P      |  |  |
|   |                                     | Sub-surface defects              | Major    | Ultrasonic test   | 100%                       | ASME SA 435                    | ASME SA 435                      | MI Test Certificate      | P      | Plates > 20mm Thick only (UT - Full Volume)  |  |
| 4.2.0   | Inprocess Quality Control           |                                  |          |   |                            |                                |                                  |                          |        |  |  |
| 4.2.1   | Welding procedure specification     | Correctness                      | Critical | Scrutiny  | 100%                       | ASME Sec IX                    | ASME Sec IX                      | QW 482 of ASME Sec IX    | P      |  |  |
| 4.2.2   | Welding procedure qualification     | Weld soundness                   | Critical | Physical test   | 100%                       | ASME Sec IX                    | ASME Sec IX                      | QW 483 of ASME Sec IX    | P      | Welding procedure already approved by BHEL/RQAGL/DNV/TUV shall be employed for this job. |  |
| 4.2.3   | Welder performance qualification    | Weld soundness                   | Critical | Radiography   | 100%                       | ASME Sec IX                    | ASME Sec IX                      | QW 484 of ASME Sec IX    | P      | Welders already qualified by BHEL/RQAGL/DNV/TUV shall be employed for this job.          |  |
| 4.2.4   | Fabricated Shell                    | 1.Surface defects (fillet welds) | Major    | Penetrant test  | 100%                       | ASME Sec VIII Div.1 Appendix 8 | ASME Sec VIII Div.1 Appendix 8   | Inspection report        | P      |  |  |
|   |                                     | 2.Dimensions, Orientation        | Major    | Measurement by visual   | 100%                       | Approved doc / Data sheet      | Approved documents / Data sheets | Inspection report        | P      |  |  |
|   |                                     | 3. Hydro test                    | Critical | Hydrostatic Pr. @ 1.5 times design pr. (positive Duration 30 minutes) | 100%                       | ASME Sec VIII Div.1            | No leakage                       | Inspection report        | P      | Hydrostatic test shall be conducted alongwith Rectrulating skid assembly                 |  |
|   |                                     | 4. Functional Test               | Major    | Functional  | 100%                       | Approved procedure             | Approved procedure               | -                        | P      | Functional test to be done at site   |  |
| <b>LEGEND</b><br>* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.<br>** M: Manufacturer / Manufacturer's Sub-contractor<br>C: Contractor<br>O: Owner<br>Indicate "P" - Perform, "W" - Witness and "V" - Verification |                                     |                                  |          |   |                            |                                |                                  |                          |        |  |  |
| Manufacturer / Sub-Contractor Signature   |                                     |                                  |          |   |                            |                                |                                  |                          |        | Reviewed By  |  |
| Name & Sign. Of approving authority & Seal  |                                     |                                  |          |   |                            |                                |                                  |                          |        |  |  |








| Manufacturer's Name & Address   |   | STANDARD QUALITY PLAN                              |          | BHEL Doc No.:       |                  |                        |                        |                   |        |                   |
|---|---|--|----------|---------------------|------------------|------------------------|------------------------|-------------------|--------|-------------------|
| P.O. No.  |   | Item : Starter Panel                               |          | PROJECT:            |                  |                        |                        |                   |        |                   |
|   |   | Vendor Q.P. NO:                                    |          | CUSTOMER:           |                  |                        |                        |                   |        |                   |
|   |   | PACKAGE : COLTCS                                   |          | PURCHASER:          |                  |                        |                        |                   |        |                   |
|   |   | Date :   |          | CONSULTANT:         |                  |                        |                        |                   |        |                   |
| Page 14 of 15   |   |  |          |                     |                  |                        |                        |                   |        |                   |
| Sl. No.   | Component / Operation                         | Characteristics Checked                            | Class    | Type of Check       | Quantum of Check | Reference Documents    | Acceptance Norms       | Format of Record  | Agency | Remarks           |
| 1   | 2   | 3  | 4        | 5                   | 6                | 7                      | 8                      | 9                 | 10     | 11                |
| 8.0.0   | Starter panel                                 |  |          |                     |                  |                        |                        |                   |        |                   |
| 08.1.0  | Incoming Material                             |  |          |                     |                  |                        |                        |                   |        |                   |
| 08.1.1  | Fabricated & Painted Panel                    | Dimension  | Major    | Measurement         | 100%             | Approved Drgs.         | Approved Drgs.         | Inspection report | P      |                   |
|   |   | Panel G.A.   | Major    | Measurement         | 100%             | Approved Drgs.         | Approved Drgs.         | Inspection report | P      |                   |
|   |   | Paint colour                                       | Major    | Visual              | 100%             | Approved Drgs.         | Approved Drgs.         | Inspection report | P      |                   |
|   |   | Paint thickness                                    | Major    | Measurement         | 100%             | Approved Drgs.         | Approved Drgs.         | Inspection report | P      |                   |
|   |   | Paint Shade, Adhesion                              | Major    | Visual              | Sample           | Approved Drgs.         | Approved Drgs.         | Inspection report | P      |                   |
| 08.1.2  | Wire  | Size / Colour / Rating / Surface Defects           | Major    | Visual / Dimension  | Sample           | IS 694                 | Specification drawings | Inspection report | P      | ISI Marked wire   |
| 08.1.3  | Panel Mounting                                | Make, Functional, Type & Rating                    | Major    | Visual / Electrical | 100%             | Approved BOM           | Approved BOM           | Inspection report | P      | V V               |
| 08.2.0  | In Process Inspection                         |  |          |                     |                  |                        |                        |                   |        |                   |
| 10.2.1  | Name, Plate, Component Mounting, Etc.         | Workmanship, Finish, Correctness                   | Major    | Visual              | 100%             | Approved Drgs.         | Approved Drawings      | Inspection report | P      |                   |
| 08.2.2  | Electrical Wiring of Panels                   | Continuity, Colour of wires, Bundling and Grouping | Major    | Visual              | 100%             | Approved Drgs.         | Approved Drawings      | Inspection report | P      |                   |
| 08.2.3  | Ferruling of Cables                           | Start & End  | Major    | Visual              | 100%             | Manufacturer's drawing | Manufacturer's drawing | Inspection report | P      |                   |
| 08.3.0  | Final Inspection                              |  |          |                     |                  |                        |                        |                   |        |                   |
| 08.3.1  | Workmanship, Finish & Paint shade / Thickness | Visual   | Major    | Visual              | 100%             | G.A Drawing            | Approved drgs.         | Inspection report | P      | W V               |
| 08.3.2  | Overall Dimension, G.A of starter panel       | Measurement  | Major    | Visual              | 100%             | G.A Drawing            | Approved drgs.         | Test Certificate  | P      | V V               |
| 08.3.3  | Component Identification                      | Visual   | Major    | Visual              | 100%             | G.A Drawing            | Approved drgs.         | Inspection report | P      | V V               |
| 08.3.4  | Degree of Protection                          | Ingress Protection IP55                            | Critical | Environmental       | Verification     | Approved drgs.         | IS 2147                | Inspection Report | P      | V V for enclosure |
| 08.3.5  | IR - HV - IR                                  | Electrical   | Critical | Electrical          | 100%             | Approved Procedure     | Approved Procedure     | Inspection report | P      | V V               |
| 08.3.6  | Functional & Continuity                       | Functional   | Major    | Functional          | 100%             | Appd Drawing           | Appd Drawing           | Inspection report | P      | W W               |
| LEGEND  |   |  |          |                     |                  |                        |                        |                   |        |                   |
| * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. |   |  |          |                     |                  |                        |                        |                   |        |                   |
| * Manufacturer/ Sub-contractor  |   |  |          |                     |                  |                        |                        |                   |        |                   |
| C - Buyer   |   |  |          |                     |                  |                        |                        |                   |        |                   |
| IO - Owner  |   |  |          |                     |                  |                        |                        |                   |        |                   |
| Indicate : P - Perform, W - Witness and V - Verification  |   |  |          |                     |                  |                        |                        |                   |        |                   |
| Manufacturer / Sub-Contractor Signature   |   |  |          |                     |                  |                        |                        |                   |        |                   |
| Contractor  |   |  |          |                     |                  |                        |                        |                   |        |                   |
| Name & Sign. Of approving authority & Seal  |   |  |          |                     |                  |                        |                        |                   |        |                   |








|   |  |  |  |   |  |
|---|--|--|--|---|--|
|  |  | <b>TITLE : STANDARD TECHNICAL SPECIFICATION</b><br><b>DATA SHEET-A</b> |  | <b>SPEC. NO. PE-TS- 387/388-165-N001</b>        |  |
| <b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM (Sponge Rubber Ball Type)</b> |  | <b>VOLUME : II B</b>   |  | <b>SECTION-D</b>                                |  |
| <b>PROJECT</b>  |  | <b>REV. NO. 0</b>  |  | <b>DATE: 04.02.2013</b>                         |  |
| <b>SL NO</b>  |  | <b>PROJECT</b>   |  | <b>NTPC VINHYACHAL STAGE-V STPP (1X500MW)</b>   |  |
| <b>1</b>  |  | <b>GENERAL</b>   |  | <b>2X660MW NTPC MOUDA STPP STAGE-II STG PKG</b> |  |

|     |  |                        |   |   |
|-----|--|------------------------|---|---|
| 1.1 | Nos. of tube cleaning systems sets required for station  | NOS.                   | Two (02) Nos. for one Unit viz. One independent set for each half of condenser        | Four (04) Nos. for two Unit viz. One independent set for each half of condenser       |
| 1.2 | Liquid handled   | Nb                     | Clarified Water as per Analysis Attached along with project information in section B. | Clarified Water as per Analysis Attached along with project information in section B. |
| 1.3 | Size of COLTCS   |                        | 2200 NB   | 2300 NB   |
| 2.0 | DESIGN   |                        |   |   |
| 2.1 | Operating pressure at Condenser inlet flange   | kg/cm <sup>2</sup> (g) | Approx 1.5 to 2.0   | Approx 1.5 to 2.0   |
| 2.2 | Design Pressure for ball separator   | kg/cm <sup>2</sup> (g) | 5.0 kg/cm <sup>2</sup> (g) & vacuum 0.1 kg/cm <sup>2</sup> (abs)                      | 5.0 kg/cm <sup>2</sup> (g) & vacuum 0.1 kg/cm <sup>2</sup> (abs)                      |
| 2.3 | Design Mechanical Temperature  | Deg. C                 | 60  | 60  |
| 2.4 | Condenser Details  |                        |   |   |
|     | a) Type of Condenser   |                        | Double pass   | Single Pass   |
|     | b) No. of Condenser sections   | Nos.                   | 2 (Two)   | 2 (Two)   |
|     | c) No. of passes per condenser section (viz. condenser half)   | Nos.                   | 2 (Two)   | 1 (One)   |
|     | d) No. of tubes per condenser  | Nos.                   | 24398   | 29668   |
|     | • Top two rows   |                        | 378   | 2080  |
|     | • Remaining  |                        | 24020   | 27588   |
|     | e) Tube Dia. OD x Thickness  |                        |   |   |
|     | • Top two rows   | mm x mm                | 31.75 x 0.889   | 22.225X0.889,   |
|     | • Remaining  | mm x mm                | 31.75 x 0.7112  | 22.225X0.7112,  |
|     | f) Length of tubes between ends.   | mm                     | 13300   | 17900   |
|     | g) Tube material   | MWC                    | SS: ASTM A 249 TP 304 (Welded)  | SS: ASTM A 249 TP 304 (Welded)  |
|     | h) Pressure drop across condenser  |                        | 4.05 MWC  | 4.15 MWC  |
|     | - At Normal flow   |                        | (However the actual value can vary +/-10% of the design value)                        | (However the actual value can vary +/-10% of the design value)                        |
|     | (between Inlet and Outlet flanges of condenser)  |                        |   |   |
| 2.5 | CW flow rate through each ball separator   |                        |   |   |
|     | - Normal   | cu.m/hr                | 27150   | 33350   |
|     | - Maximum  | cu.m/hr                | 32580   | 40020   |
| 2.6 | Design differential pressure for ball separator strainer/screen  | Kg/cm <sup>2</sup> (g) | 0.2   | 0.2   |
| 2.7 | Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow. | MWC                    | 0.15  | 0.15  |
| 2.8 | Pressure drop across ball separator in choked condition when strainer backwashing starts                   | MWC                    | Not to exceed 0.30  | Not to exceed 0.30  |
| 2.9 | No. of balls required for COLTCS per condenser section   | Nos.                   | Minimum 10% of number of condenser tubes  | Minimum 10% of number of condenser tubes  |
| 3   | CONNECTING PIPE DETAILS  |                        |   |   |
| 3.1 | Condenser inlet pipe   |                        |   |   |
|     | a) Material  |                        | Carbon Steel to IS – 2062 Gr. B   | Carbon Steel to IS – 2062 Gr. B   |
|     | b) O.D. X Thickness  | mm x mm                | 2235 X 17.5   | 2340x20   |
| 3.2 | Condenser outlet pipe  |                        |   |   |




| TITLE : STANDARD TECHNICAL SPECIFICATION<br>DATA SHEET-A                |   |  | SPEC. NO. PE-TS-387/388-165-N001   |  |  |
|---|---|--|--|--|--|
| CONDENSER ON - LOAD TUBE CLEANING<br>SYSTEM ( Sponge Rubber Ball Type ) |   |  | VOLUME : II B  |  |  |
|   |   |  | SECTION-D  |  |  |
|   |   |  | REV. NO. 0 DATE: 04.02.2013  |  |  |
| SL.NO   | PROJECT   | NTPC VINHYACHAL STAGE-V STPP (1X500MW) | 2X660MW NTPC MOUDA STPP STAGE-II STG PKG   |  |  |
|   |   | CS                                     | Carbon Steel to IS – 2062 Gr. B<br>2235 X 17.5   | Carbon Steel to IS – 2062 Gr. B<br>2340x20   |  |
| 3.3   | a) Material<br>b) O.D. X Thickness<br>Manhole     | mm x mm                                | Yes, 600 NB size   | Manhole :Yes, 600 NB size<br>Drain : 150NB drain stub inside the body of<br>COLTCS   |  |
| 4.0   | <b>MATERIALS OF CONSTRUCTION</b>                  |  |  |  |  |
| 4.1   | <b>BALL SEPARATOR</b>                             |  |  |  |  |
|   | a) Body / housing                                 |  | Carbon Steel to IS -2062 Gr.B. with epoxy<br>painted inside (with minimum housing<br>thickness same as connecting pipe thickness)<br>Provision for future installation of cathodic<br>protection with sacrificial anodes<br>shall be provided. | Carbon Steel to IS -2062 Gr.B. with epoxy<br>painted inside (with minimum housing<br>thickness same as connecting pipe thickness)<br>Provision for future installation of cathodic<br>protection with sacrificial anodes<br>shall be provided. |  |
|   | b) Screen / Strainer                              |  | SS-316   | SS-316   |  |
|   | c) Strainer shaft                                 |  | SS-316   | SS-316   |  |
|   | e) Internal Hardware including nuts, bolts , etc. |  | SS-316   | SS-316   |  |
|   | f) Site Glass provision                           |  | Yes  | Yes  |  |
| 4.2   | <b>BALL RECIRCULATING PUMP</b>                    |  | Non Clog type  | Non Clog type  |  |
|   | a) Casing   |  | 2.5% Ni. Cl to IS 210 FG 260   | 2.5% Ni. Cl to IS 210 FG 260   |  |
|   | b) Impeller                                       |  | SS-316   | SS-316   |  |
|   | c) Shaft  |  | SS-316   | SS-316   |  |
| 4.3   | <b>BALL COLLECTOR</b>                             |  |  |  |  |
|   | a) Body / housing                                 |  | Carbon steel-IS 2062 Gr. B with epoxy<br>painted inside  | Carbon steel-IS 2062 Gr. B with epoxy<br>painted inside  |  |
|   | b) Screen / Strainer                              |  | SS-316   | SS-316   |  |
|   | c) Site Glass Provision                           |  | Yes  | Yes  |  |
| 4.4   | Differential pressure measuring system            |  | SS-316   | SS-316   |  |
| 4.5   | Injection nozzle                                  |  | SS-316   | SS-316   |  |
| 4.6   | Valves  |  |  |  |  |
| 4.6.1   | Check Valves (all sizes)                          |  | For size 50 NB and below-Piston type<br>For sizes 65 NB and above-Swing check type<br>or dual plate type.  | For size 50 NB and below-Piston type<br>For sizes 65 NB and above-Swing check type<br>or dual plate type.  |  |
|   | a) Body & Bonnet                                  |  | Cl, IS 210, Gr.FG 260 / BS 1452 Gr. 14,<br>Flanged Ends  | Cl, IS 210, Gr.FG 260 / BS 1452 Gr. 14,<br>Flanged Ends  |  |
|   | b) Seating surface &<br>rings                     |  | 13% Chromium Steel   | 13% Chromium Steel   |  |
|   | c) Disc for Check Valve                           |  | Cl, IS 210 Gr. FG 260/ BS 1452 Gr. 14  | Cl, IS 210 Gr. FG 260/ BS 1452 Gr. 14  |  |
|   | d) Hinge Pin for Check<br>Valve                   |  | AISI-316   | AISI-316   |  |
|   | e) Backseat for check<br>valve                    |  | 13% Chromium Steel   | 13% Chromium Steel   |  |



|   |  |   |  |  |  |
|---|--|---|--|--|--|
|  |  | <b>TITLE : STANDARD TECHNICAL SPECIFICATION</b><br><b>DATA SHEET-A</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b> |  | <b>SPEC. NO. PE-TS- 387/388-165-N001</b> |  |
| <b>PROJECT</b>  |  | <b>NTPC VINHYACHAL STAGE-V STPP (1X500MW)</b>   |  | <b>VOLUME : II B</b>                     |  |
| <b>SL NO</b>  |  | <b>SECTION-D</b>  |  | <b>DATE: 04.02.2013</b>                  |  |
| <b>REV. NO. 0</b>   |  | <b>2X660MW NTPC MOUDA STPP STAGE-II STG PKG</b>   |  |  |  |


|       |   |  |  |  |
|-------|---|--|--|--|
| 4.6.2 | Globe Valves 50 Nb & Below<br>Body, Bonnet & trim         |  | Gun metal as per IS 318 Gr. 2,<br>screwed ends   | Gun metal as per IS 318 Gr. 2,<br>screwed ends   |
| 4.6.3 | > BF/Gate Valves (65 Nb & above)                          |  |  |  |
|       | > Body & Disc   |  | 2% NiCl as per IS 210, FG 260, epoxy coated<br>SS – 410 / BS 970 431 S-291   | 2% NiCl as per IS 210, FG 260, epoxy coated<br>SS – 410 / BS 970 431 S-291   |
|       | > Shaft   |  | Nitrile rubber   | Nitrile rubber   |
|       | > Seal  |  | 18 – 8 SS  | 18 – 8 SS  |
|       | > Sealing, Retaining segment & internals                  |  | Self lubricating   | Self lubricating   |
|       | > Bearings  |  | IS 2062, Gr. B   | IS 2062, Gr. B   |
|       | > Companion Flange  |  |  |  |
|       | <b>C) Ball valves</b>                                     |  |  |  |
|       | i) Body   |  | SA 351 CF8M  | SA 351 CF8M  |
|       | ii) Ball  |  | SA 351 CF8M  | SA 351 CF8M  |
|       | iii) Stem   |  | SS 316   | SS 316   |
| 4.7   | Interconnecting Piping<br>Material                        |  | By Bidder  | By Bidder  |
|       |   |  | a) Upto 150NB - Carbon steel ERW,<br>IS:1239 (Heavy Grade)<br>b) Greater than 150NB – CS to IS 2062<br>Gr. B, rolled & butt welded, conforming<br>to IS 3589 | a) Upto 150NB - Carbon steel ERW,<br>IS:1239 (Heavy Grade)<br>b) Greater than 150NB – CS to IS 2062<br>Gr. B, rolled & butt welded, conforming<br>to IS 3589 |
| 5     | <b>COUNTER FLANGES for Ball Separator</b>                 |  |  |  |
|       | a) Flanges  |  | Carbon Steel to IS 2062 Gr. B or eq for<br>thickness, drilling etc refer<br>Annexure II in section C1<br>(In Bidder's scope)                                 | Carbon Steel to IS 2062 Gr. B or eq for<br>thickness, drilling etc refer<br>Annexure II in section C1<br>(In Purchaser's scope)                              |
|       | b) Fasteners  |  | A 193 & A 194<br>(In Bidder's scope)   | A 193 & A 194<br>(In Purchaser's scope)  |
|       | c) Gaskets  |  | Min 4 mm thick rubber  | Min 4 mm thick rubber  |
| 6     | <b>OTHER COUNTER FLANGES (for interconnecting piping)</b> |  | In Bidder's scope  | In Bidder's scope  |
| 6.1   | <b>MATERIALS</b>  |  |  |  |
|       | a) Flanges  |  | Carbon Steel to IS 2062 Gr. B  | Carbon Steel to IS 2062 Gr. B  |
|       | b) Fasteners  |  | A 193 & A 194  | A 193 & A 194  |
|       | c) Gaskets  |  | Min 4 mm thick rubber  | Min 4 mm thick rubber  |



|  |                |   |  |  |                         |
|--|----------------|---|--|--|-------------------------|
|  |                | <b>TITLE : STANDARD TECHNICAL SPECIFICATION</b><br><b>DATA SHEET-A</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b> |  | <b>SPEC. NO. PE-TS- 387/388-165-N001</b> |                         |
|  |                |   |  | <b>VOLUME : II B</b>                     |                         |
|  |                |   |  | <b>SECTION-D</b>                         |                         |
|  |                |   |  | <b>REV. NO. 0</b>                        | <b>DATE: 04.02.2013</b> |
| <b>SL NO</b>   | <b>PROJECT</b> | <b>NTPC VINDHYACHAL STAGE-V STPP (1X500MW)</b>  |  |  |                         |
|  |                | <b>2X660MW NTPC MOUDA STPP STAGE-II STG PKG</b>   |  |  |                         |


|      |   |  |  |  |  |
|------|---|--|--|--|--|
| 7.0  | Material of Other components not specified above  |  |  | Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.    | Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.    |
| 8.0  | <b><u>PAINTING</u></b>  |  |  |  |  |
| 8.1  | <b>INTERNAL SURFACE</b>   |  |  |  |  |
|      | a) Surface preparation  |  |  | SA - 2.5 of Swedish Specn. SIS-05-59-00-1967   | SA - 2.5 of Swedish Specn. SIS-05-59-00-1967   |
|      | b) Primer   |  |  | Two coat of Epoxy Resin based Zinc Phosphate primer  | Two coat of Epoxy Resin based Zinc Phosphate primer  |
|      | c) Final paint  |  |  | Adequate no. of coats of coal tar epoxy paint to achieve total dry film thickness of 200 to 250 microns                | Adequate no. of coats of coal tar epoxy paint to achieve total dry film thickness of 200 to 250 microns                |
| 8.2  | <b>EXTERNAL SURFACE</b>   |  |  |  |  |
|      | a) Surface preparation  |  |  | SA-2.5 of Swedish Specn. SIS-05-5900-1967  | SA-2.5 of Swedish Specn. SIS-05-5900-1967  |
|      | b) Primer   |  |  | Two coat of Epoxy resin based zinc phosphate primer  | Two coat of Epoxy resin based zinc phosphate primer  |
|      | a) Intermediate   |  |  | Epoxy based TiO2 pigmented coat  | Epoxy based TiO2 pigmented coat  |
|      | d) Final paint  |  |  | Synthetic enamel paint to achieve total DFT of 175 to 200 microns. Colour- code shall be as per IS 9404 (Appendix - A) | Synthetic enamel paint to achieve total DFT of 175 to 200 microns. Colour- code shall be as per IS 9404 (Appendix - A) |
| 9.0  | Adequate provision for future installation of cathodic protection (Sacrificial type anodic protection by Purchaser) |  |  | YES  | YES  |
| 10.0 | Flow straightner for streamlining the CW flow in ball collecting strainer   |  |  | If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.              | If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.              |
| 11.0 | Performance Guarantee & Bid Evaluation  |  |  |  |  |
| 11.1 | Performance Parameters to be Guaranteed   |  |  |  |  |
|      | ❖ Pressure drop in ball separator in clean condition  |  |  | As per Guarantee schedule of bidder  | As per Guarantee schedule of bidder  |
|      | ❖ Percentage recovery of balls  |  |  | Min. 90 % recovery   | Min. 90 % recovery   |
|      | ❖ Life of sponge Rubber Balls   |  |  | Min. 3 weeks   | Min. 3 weeks   |
| 11.2 | Bid evaluation Criteria & Liquidated damages  |  |  | As per clause no 8.00.00 of Section C1   | As per clause no 8.00.00 of Section C1   |
| 11.3 | Bid evaluation rate   |  |  | @ Rs. 9.0 Lacs per 0.05 MWC pr. drop across each balls collecting strainer   | @ Rs.11.0 Lacs per 0.05 MWC pr. drop across each balls collecting strainer   |
| 11.4 | Liquidated damages  |  |  | Twice the bid evaluation rate  | Twice the bid evaluation rate  |
| 12.0 | The tube cleaning system shall be designed for following operation modes  |  |  |  |  |
|      | a) Automatic start up initiated by push button  |  |  | YES  | YES  |



|   |  |   |  |   |  |
|---|--|---|--|---|--|
|  |  | <b>TITLE : STANDARD TECHNICAL SPECIFICATION</b><br><b>DATA SHEET-A</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b> |  | <b>SPEC. NO. PE-TS- 387/388-165-N001</b>        |  |
| <b>PROJECT</b>  |  | <b>NTPC VINDHYACHAL STAGE-V STPP (1X500MW)</b>  |  | <b>VOLUME : II B</b>                            |  |
| <b>SL NO</b>  |  | <b>SECTION-D</b>  |  | <b>DATE: 04.02.2013</b>                         |  |
|   |  | <b>REV. NO. 0</b>   |  | <b>2X660MW NTPC MOUDA STPP STAGE-II STG PKG</b> |  |

|  |  |  |     |     |
|--|--|--|-----|-----|
|  | b) Automatic shut down with ball collection effected by :<br>i. Push button<br>ii. Adjustable timer<br>iii. Ball monitoring system   |  | YES | YES |
|  | c) Automatic backwashing of ball separator with ball collection effected by :<br>a. Push button<br>b. Adjustable timer<br>c. Diff. Pressure measuring system   |  | YES | YES |
|  | d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system   |  | YES | YES |
|  | e) Automatic ball sorting initiated by push button   |  | YES | YES |
|  | f) Provision for manual operation of complete tube cleaning system in case of control system failure   |  | YES | YES |
|  | g) Whether the contacts for DPG, DPS and DPT are independent   |  | YES | YES |
|  | h) Timer for Backwashing   |  | YES | YES |
|  | i) Whether the ball monitoring system is designed to perform the following functions :<br>i. Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses when the number of balls falls below a set value<br>ii. Continuously measuring the size of the balls in circulation and initiating the shutdown of the tube cleaning system with alarm calling for replacement of balls when the no. of oversized balls falls below a set value |  | YES | YES |
|  | j) Whether the electronic processor of the ball monitoring system is provided with the following :<br>i. Indicators for required basic ball charge<br>ii. Indicators for recirculating ball quantity<br>iii. Indicators for oversized ball quantity<br>iv. Time counters for total cleaning system operating hours<br>v. Time counters for cleaning system operating hours with sufficient no. of oversized balls<br>vi. Recorders for ball consumption                                  |  | YES | YES |
|  | k) Whether provision for self testing and self calibration are made  |  | YES | YES |



|   |   |   |  |   |  |
|---|---|---|--|---|--|
|  |   | <b>TITLE : STANDARD TECHNICAL SPECIFICATION</b><br><b>DATA SHEET-A</b><br><b>CONDENSER ON - LOAD TUBE CLEANING</b><br><b>SYSTEM ( Sponge Rubber Ball Type )</b> |  | <b>SPEC. NO. PE-TS- 387/388-165-N001</b><br><b>VOLUME : II B</b><br><b>SECTION-D</b><br><b>REV. NO. 0</b> <b>DATE: 04.02.2013</b>   |  |
| SL NO   | PROJECT   | NTPC VINDHYACHAL STAGE-V STPP (1X500MW)   |  | 2X660MW NTPC MOUDA STPP STAGE-II STG PKG  |  |
| 13.0  | Mandatory Spares to be supplied under this specification.                                     |   |  | 1. Sponge rubber balls for condenser on-load tube cleaning system<br>(a. 20% -Abrasive Balls- 10000 Nos).<br>(b. 80%- Normal Balls – 40000 No).<br><br>2. Ball Recirculating Pump (Set Consisting of Shaft, Rotor, , Seals, Gland Package shafts sleeves for Complete replacement in one Pump)--- 1 No. |  |
| 14.0  | Documents enclosed for bidder's reference<br>❖ Water Analysis<br>❖ GA of CW piping in TG hall |   |  | Indicated in project information in Section B.<br>Attached in Annexure-III  |  |





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**

**VOLUME : IIB**

**SECTION : D**

**REV. NO. 0**

**DATE : 04.02.2013**

**SHEET 1 of 1**

**SECTION D2**

**STANDARD TECHNICAL SPECIFICATION  
FOR  
ELECTRICAL SYSTEMS**





TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
  
**FOR**  
  
**LV MOTORS**

SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 29/08/2005  
SHEET : 1 OF 1


## **GENERAL TECHNICAL REQUIREMENTS**

**FOR**


**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**




|   |  |  |
|---|--|--|
|  | <b>TITLE :</b><br><b>GENERAL TECHNICAL REQUIREMENTS</b><br><br><b>FOR</b><br><br><b>LV MOTORS</b>  | <b>SPECIFICATION NO.</b><br>PE-SS-999-506-E101   |
|   |  | <b>VOLUME NO. :</b> II-B   |
|   |  | <b>SECTION :</b> D   |
|   |  | <b>REV NO. :</b> 00 <b>DATE :</b> 29/08/2005   |
|   |  | <b>SHEET :</b> 1 OF 4  |
| <b>1.0</b>  | <b>INTENT OF SPECIFICATION</b>   |  |
|   | The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.   |  |
|   | Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.  |  |
| <b>2.0</b>  | <b>CODES AND STANDARDS</b>   |  |
|   | Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:  |  |
|   | IS:325   | Three phase Induction motors   |
|   | IS : 900   | Code of practice for installation and maintenance of induction motors  |
|   | IS: 996  | Single phase small AC and universal motors   |
|   | IS: 4722   | Rotating Electrical machines   |
|   | IS: 4691   | Degree of Protection provided by enclosures for rotating electrical machines                                 |
|   | IS: 4728   | Terminal marking and direction of rotation rotating electrical machines                                      |
|   | IS: 1231   | Dimensions of three phase foot mounted induction motors  |
|   | IS: 8789   | Values of performance characteristics for three phase induction motors                                       |
|   | IS: 13555  | Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment |
|   | IS: 2148   | Flame proof enclosures for electrical appliance  |
|   | IS: 5571   | Guide for selection of electrical equipment for hazardous areas  |
|   | IS: 12824  | Type of duty and classes of rating assigned  |
|   | IS: 12802  | Temperature rise measurement for rotating electrical machines  |
|   | IS: 12065  | Permissible limits of noise level for rotating electrical machines   |
|   | IS: 12075  | Mechanical vibration of rotating electrical machines   |
|   | In case of imported motors, motors as per IEC-34 shall also be acceptable.   |  |
| <b>3.0</b>  | <b>DESIGN REQUIREMENTS</b>   |  |
| <b>3.1</b>  | Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A   |  |
| <b>3.2</b>  | Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information<br>Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above. |  |
| <b>3.3</b>  | <b>Starting Requirements</b>   |  |
| <b>3.3.1</b>  | Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.   |  |
| <b>3.3.2</b>  | Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.   |  |




|  |   |  |
|--|---|--|
|   | <b>TITLE :</b><br><b>GENERAL TECHNICAL REQUIREMENTS</b><br><br><b>FOR</b><br><br><b>LV MOTORS</b> | <b>SPECIFICATION NO.</b><br>PE-SS-999-506-E101 |
|  |   | <b>VOLUME NO. :</b> II-B                       |
|  |   | <b>SECTION :</b> D                             |
|  |   | <b>REV NO. :</b> 00 <b>DATE :</b> 29/08/2005   |
|  |   | <b>SHEET :</b> 2 OF 4                          |
| <p>The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.</p> <p>3.3.3 The following frequency of starts shall apply</p> <ul style="list-style-type: none"> <li>i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.</li> <li>ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)</li> <li>iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor</li> </ul> <p>3.4 <b>Running Requirements</b></p> <p>3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.</p> <p>3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.</p> <p>3.5 <b>Stress During bus Transfer</b></p> <p>3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.</p> <p>3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.</p> <p>3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.</p> <p>3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.</p> <p>4.0 <b>CONSTRUCTIONAL FEATURES</b></p> <p>4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy</p> <p>4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.</p> <p>Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled</p> <p>4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.</p> |   |  |



|  |  |  |
|--|--|--|
|   | <b>TITLE :</b><br><b>GENERAL TECHNICAL REQUIREMENTS</b><br><br><b>FOR</b><br><br><b>LV MOTORS</b>  | <b>SPECIFICATION NO.</b><br>PE-SS-999-506-E101 |
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|  |  | <b>SHEET :</b> 3 OF 4                          |
| 4.4.<br>4.5.<br>4.6.<br>4.7.<br>4.7.1<br><br>4.7.2<br>4.7.3<br>4.7.4<br>4.7.5<br>4.7.6<br>4.7.7<br>4.7.8<br>4.7.9<br>4.8.<br><br>4.9 | <p>Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.</p> <p>Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.</p> <p>In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.<br/>In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.</p> <p><b>Terminals and Terminal Boxes</b></p> <p>Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.</p> <p>Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".</p> <p>unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.</p> <p>Connections shall be such that when the supply leads R, Y &amp; B are connected to motor terminals A B &amp; C or U, V &amp; W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W &amp; V respectively.</p> <p>Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.</p> <p>Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.</p> <p>Degree of protection for terminal boxes shall be IP 55 as per IS 4691.</p> <p>Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.</p> <p>Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.</p> <p>Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.</p> <p>Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.</p> <p><b>General</b></p> |  |



|   |  |   |
|---|--|---|
|  | TITLE :<br><b>GENERAL TECHNICAL REQUIREMENTS</b><br><br><b>FOR</b><br><br><b>LV MOTORS</b> | SPECIFICATION NO.<br>PE-SS-999-506-E101 |
|   |  | VOLUME NO. : <b>II-B</b>                |
|   |  | SECTION : <b>D</b>                      |
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|   |  | SHEET : 4 OF 4                          |

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

**5.0 INSPECTION AND TESTING**

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

**6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

a) OGA drawing showing the position of terminal boxes, earthing connections etc.

b) Arrangement drawing of terminal boxes.

c) Characteristic curves:  
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).

i) Current vs. time at rated voltage and minimum starting voltage.

ii) Speed vs. time at rated voltage and minimum starting voltage.


iii) Torque vs. speed at rated voltage and minimum voltage.  
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.

iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.









| CLAUSE NO.  | TECHNICAL REQUIREMENTS  |                     |  |
|---|---|--|--|
|   | iii) CW motors (in case of Screen protected Drip proof) - IP 23<br>iv) Cable box - indoor area - IP 54<br>v) Cable box - outdoor area - IP 55   |  |  |
| 2.00.00   | <b>CODES AND STANDARDS</b>  |  |  |
|   | 1) Three phase induction motors : IS:325, IEC:60034<br>2) Single phase AC motors : IS:996, IEC:60034<br>3) Crane duty motors : IS:3177, IEC:60034<br>4) DC motors/generators : IS:4722<br>5) Energy Efficient motors : IS 12615   |  |  |
| 3.00.00   | <b>TYPE</b>   |  |  |
| 3.01.00   | <b>AC Motors:</b><br>(a) Squirrel cage induction motor suitable for direct-on-line starting.<br>(b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature) ,shall be Energy Efficient motors ,Efficiency class-Eff1, conforming to IS 12615.<br>(c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.  |  |  |
| 3.02.00   | DC Motors Shunt wound.  |  |  |
| 4.00.00   | <b>RATING</b><br>(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.<br>(b) Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. |  |  |
| 5.00.00   | <b>TEMPERATURE RISE</b><br><b>Air cooled motors</b><br>70 deg. C by resistance method for both thermal class 130(B)& 155(F) insulation.<br><b>Water cooled</b><br>80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.   |  |  |
| <b>MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE</b> |   | <b>TECHNICAL SPECIFICATION SECTION-VI</b><br><b>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2</b> | <b>PART-B</b><br><b>SUB SECTION-III: E1 (MOTORS)</b> |
|   |   |  | <b>PAGE 2 OF 8</b>                                   |




| CLAUSE NO.   | TECHNICAL REQUIREMENTS  |             |   |
|--|---|--|---|
|  | 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.  |  |   |
| 6.00.00  | <b>OPERATIONAL REQUIREMENTS</b>   |  |   |
| 6.01.00  | <b>Starting Time</b>  |  |   |
| 6.01.01  | For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.   |  |   |
| 6.01.02  | For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.  |  |   |
| 6.01.03  | For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.  |  |   |
| 6.01.04  | Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.  |  |   |
| 6.02.00  | <b>Torque Requirements</b>  |  |   |
| 6.02.01  | Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.   |  |   |
| 6.02.02  | Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.   |  |   |
| 6.03.00  | <b>Starting voltage requirement</b>   |  |   |
|  | (a) 85% upto 1500KW   |  |   |
|  | (d) 80% from 1501 KW to 4000KW  |  |   |
|  | (e) 75% > 4000KW  |  |   |
| 7.00.00  | <b>DESIGN AND CONSTRUCTIONAL FEATURES</b>   |  |   |
| 7.01.00  | Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.   |  |   |
| 7.02.00  | All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below |  |   |
|  | (a) Fuel oil area : Group - IIB   |  |   |
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP<br>(2 x 660MW) / NABINAGAR STPP (3x 660MW) /<br>MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP<br>PHASE-II (2 x660MW)<br>STEAM GENERATOR PACKAGE |   | TECHNICAL SPECIFICATION<br>SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/<br>0360/ 9586-102-2 | PART-B<br>SUB SECTION-III: E1<br>(MOTORS) |
|  |   |  | PAGE 3 OF 8                               |




| CLAUSE NO.   | TECHNICAL REQUIREMENTS   |             |   |             |
|--|--|--|---|-------------|
| 7.03.00  | <p>Winding and Insulation</p> <p>(a)Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b)Starting duty : Two hot starts in succession, with motor initially at normal running temperature</p> <p>(c) 11kV, 3.3 kV AC motors : Thermal Class 155(F) insulation with winding temperature rise limited to thermal class 130(B). The winding insulation process shall be total Vacuum Pressure Impregnated i.e.resin poor method. The lightning impulse &amp; interturn insulation surge withstand level shall be as per IEC-60034 Part-15.</p> <p>(d)415V AC &amp; 220V DC motors : Thermal Class130(B) or better</p> |  |   |             |
| 7.04.00  | Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.   |  |   |             |
| 7.05.00  | Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.  |  |   |             |
| 7.06.00  | Noise level for all the motors shall be limited to 85dB (A). Bearing housing vibration shall be limited within the limits prescribed in IEC 60034-14/IS:12075 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.  |  |   |             |
| 7.07.00  | In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and duplex platinum resistance type temperature detectors preferably 2 numbers.  |  |   |             |
| 7.08.00  | Motor body shall have two earthing points on opposite sides.   |  |   |             |
| 7.09.00  | HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable terminal boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable terminal box is offered, then Employer shall provide termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel for three core cables) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable terminal boxes.   |  |   |             |
| 7.10.00  | The spacing between gland plate & centre of terminal stud shall be as per Table-I.   |  |   |             |
| 7.11.00  | All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.   |  |   |             |
| 7.12.00  | The motors shall be suitable for bus transfer schemes provided on the11kV, 3.3 kV /415V systems without any injurious effect on its life.  |  |   |             |
| 7.13.00  | For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.   |  |   |             |
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP<br>(2 x 660MW) / NABINAGAR STPP (3x 660MW) /<br>MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP<br>PHASE-II (2 x660MW)<br>STEAM GENERATOR PACKAGE |  | TECHNICAL SPECIFICATION<br>SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/<br>0360/ 9586-102-2 | PART-B<br>SUB SECTION-III: E1<br>(MOTORS) | PAGE 4 OF 8 |




| CLAUSE NO.   | TECHNICAL REQUIREMENTS  |       |  |  |             |
|--|---|--|--|--|-------------|
| 7.14.00  | 11kV and 3.3 kV motors Cable Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively.Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.   |  |  |  |             |
| 7.15.00  | The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box, cable glands & lugs suitable for the same.   |  |  |  |             |
| 7.16.00  | The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance).  |  |  |  |             |
|  | (a) Upto 110KW:   | 11.0   |  |  |             |
|  | (b) Above 110KW & upto 1500KW:  | 10.0   |  |  |             |
|  | (c) Above 1500KW & upto 4000KW:   | 9.0  |  |  |             |
|  | (d) Above 4000KW:   | 6 to 6.5   |  |  |             |
| 8.00.00  | TYPE TEST   |  |  |  |             |
| 8.01.00  | HT MOTORS   |  |  |  |             |
| 8.01.01  | The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.   |  |  |  |             |
| 8.01.02  | The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.  |  |  |  |             |
| 8.01.03  | In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.   |  |  |  |             |
| 8.01.04  | Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval. |  |  |  |             |
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW) STEAM GENERATOR PACKAGE |   | TECHNICAL SPECIFICATION SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2 |  | PART-B<br>SUB SECTION-III: E1 (MOTORS) | PAGE 5 OF 8 |




| CLAUSE NO.  | TECHNICAL REQUIREMENTS   |             |   |             |
|---|--|--|---|-------------|
| 8.01.05   | <p><b>LIST OF TESTS TO BE CONDUCTED</b></p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <ul style="list-style-type: none"><li>(a) No load saturation and loss curves upto approximately 115% of rated voltage</li><li>(b) Measurement of noise at no load.</li><li>(c) Momentary overload test (subject to test bed constraint).</li><li>(d) Full load test (subject to test bed constraint).</li><li>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</li><li>(f) Lightning Impulse withstand test on the sample coil shall be as per clause 5.1.3.2, IEC-60034, Part-15.</li><li>(g) Surge withstand voltage test on interturn insulation as per IEC 60034-15</li></ul> |  |   |             |
| 8.01.06   | <p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <ul style="list-style-type: none"><li>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</li><li>(b) Fault level withstand test for each type of cable terminal box of HT motors.</li></ul>  |  |   |             |
| 8.02.00   | <p><b>LT Motors</b></p>  |  |   |             |
| 8.02.01   | <p>LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>  |  |   |             |
| 8.02.02   | <p>However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>   |  |   |             |
| 8.02.03   | <p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p>  |  |   |             |
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW)<br>STEAM GENERATOR PACKAGE |  | TECHNICAL SPECIFICATION<br>SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/<br>0360/ 9586-102-2 | PART-B<br>SUB SECTION-III: E1<br>(MOTORS) | PAGE 6 OF 8 |



| CLAUSE NO.   | TECHNICAL REQUIREMENTS   |             |   |
|--|--|--|---|
|  | <div><div>1. Measurement of resistance of windings of stator and wound rotor.</div><div>2. No load test at rated voltage to determine input current power and speed</div><div>3. Open circuit voltage ratio of wound rotor motors ( in case of Slip ring motors)</div><div>4. Locked rotor readings of voltage, current and power input at a suitable reduced voltage.</div><div>5. Full load test to determine efficiency power factor and slip .</div><div>6. Temperature rise test .</div><div>7. Momentary overload test .</div><div>8. Insulation resistance test .</div><div>9. High voltage test .</div><div>10. Test for vibration severity of motor.</div><div>11. Test for noise levels of motor .</div><div>12. Test for degree of protection and</div><div>13. Overspeed test.</div></div> |  |   |
| 8.03.00  | All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.  |  |   |
| 8.04.00  | The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.  |  |   |
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP<br>(2 x 660MW) / NABINAGAR STPP (3x 660MW) /<br>MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP<br>PHASE-II (2 x660MW)<br>STEAM GENERATOR PACKAGE |  | TECHNICAL SPECIFICATION<br>SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/<br>0360/ 9586-102-2 | PART-B<br>SUB SECTION-III: E1<br>(MOTORS) |
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| CLAUSE NO.  | TECHNICAL REQUIREMENTS   |  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
|---|--|--|---|-----------------|---|------------|---------------------------------|------------------------|----|-------------------------|-----|--------------------------|-----|--------------------------|-----|--------------------------|-----|--------------------------|-----|---------------------------|-----|--------------------------|-----|-----------------|-----------|--------------|------|------------------------------|--------|--------------|------|
|   | <p>TABLE - I</p> <p>DIMENSIONS OF TERMINAL BOXES</p> <p>FOR LV MOTORS:</p> <table><thead><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of stud and gland plate in mm</th></tr></thead><tbody><tr><td>UP to 3 KW</td><td>As per manufacturer's practice.</td></tr><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>249</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>203</td></tr></tbody></table> <p>FOR HT MOTORS:</p> <p>The distance between gland plate and the terminal studs shall not be less than 500 mm.</p> <p>PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:</p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p> <table><thead><tr><th>Motor MCR in KW</th><th>Clearance</th></tr></thead><tbody><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></tbody></table> |  |   | Motor MCR in KW | Minimum distance between centre of stud and gland plate in mm | UP to 3 KW | As per manufacturer's practice. | Above 3 KW - upto 7 KW | 85 | Above 7 KW - upto 13 KW | 115 | Above 13 KW - upto 24 KW | 167 | Above 24 KW - upto 37 KW | 196 | Above 37 KW - upto 55 KW | 249 | Above 55 KW - upto 90 KW | 277 | Above 90 KW - upto 125 KW | 331 | Above 125 KW-upto 200 KW | 203 | Motor MCR in KW | Clearance | UP to 110 KW | 10mm | Above 110 KW and upto 150 KW | 12.5mm | Above 150 KW | 19mm |
| Motor MCR in KW   | Minimum distance between centre of stud and gland plate in mm  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| UP to 3 KW  | As per manufacturer's practice.  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 3 KW - upto 7 KW  | 85   |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 7 KW - upto 13 KW   | 115  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 13 KW - upto 24 KW  | 167  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 24 KW - upto 37 KW  | 196  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 37 KW - upto 55 KW  | 249  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 55 KW - upto 90 KW  | 277  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 90 KW - upto 125 KW   | 331  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 125 KW-upto 200 KW  | 203  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Motor MCR in KW   | Clearance  |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| UP to 110 KW  | 10mm   |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 110 KW and upto 150 KW  | 12.5mm   |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 150 KW  | 19mm   |  |   |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW)<br>STEAM GENERATOR PACKAGE |  | TECHNICAL SPECIFICATION<br>SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/<br>0360/ 9586-102-2 | PART-B<br>SUB SECTION-III: E1<br>(MOTORS)<br><br>PAGE 8 OF 8                        |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |







| CLAUSE NO.   | TECHNICAL REQUIREMENTS   |  |  |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
|--|--|--|---|----|---|---|-------------------|-----|---|---|-------------------|------|---|---|--------------------|-----|------------------------|---|---------|----|-------------------------|---|------------------------|
| 1.07.00  | Fault level shall be limited to 40kA RMS for 1 second for 11kV & 3.3 kV system and 45 kA RMS 1 second for 415V system. 415V system shall be solidly grounded and 220 VDC system shall be isolated type.  |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 1.08.00  | Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.  |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 1.09.00  | The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.   |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 1.10.00  | <p>Degree of Protection</p> <p>Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :-</p> <table><tr><td>i)</td><td>Indoor motors</td><td>-</td><td>IP 54</td></tr><tr><td>ii)</td><td>Outdoor motors</td><td>-</td><td>IP 55</td></tr><tr><td>iii)</td><td>Cable box-indoor area</td><td>-</td><td>IP 54</td></tr><tr><td>iv)</td><td>Cable box-Outdoor area</td><td>-</td><td>IP 55</td></tr></table>  |  |   | i) | Indoor motors   | - | IP 54             | ii) | Outdoor motors  | - | IP 55             | iii) | Cable box-indoor area   | - | IP 54              | iv) | Cable box-Outdoor area | - | IP 55   |    |                         |   |                        |
| i)   | Indoor motors  | -  | IP 54   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| ii)  | Outdoor motors   | -  | IP 55   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| iii)   | Cable box-indoor area  | -  | IP 54   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| iv)  | Cable box-Outdoor area   | -  | IP 55   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 2.00.00  | <p><b>CODES AND STANDARDS</b></p> <table><tr><td>1)</td><td>Three phase induction motors</td><td>:</td><td>IS:325, IEC:60034</td></tr><tr><td>2)</td><td>Single phase AC motors</td><td>:</td><td>IS:996, IEC:60034</td></tr><tr><td>3)</td><td>Crane duty motors</td><td>:</td><td>IS:3177, IEC:60034</td></tr><tr><td>4)</td><td>DC motors/generators</td><td>:</td><td>IS:4722</td></tr><tr><td>5)</td><td>Energy Efficient motors</td><td>:</td><td>IS 12615, IEC:60034-30</td></tr></table>   |  |   | 1) | Three phase induction motors  | : | IS:325, IEC:60034 | 2)  | Single phase AC motors  | : | IS:996, IEC:60034 | 3)   | Crane duty motors   | : | IS:3177, IEC:60034 | 4)  | DC motors/generators   | : | IS:4722 | 5) | Energy Efficient motors | : | IS 12615, IEC:60034-30 |
| 1)   | Three phase induction motors   | :  | IS:325, IEC:60034   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 2)   | Single phase AC motors   | :  | IS:996, IEC:60034   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 3)   | Crane duty motors  | :  | IS:3177, IEC:60034  |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 4)   | DC motors/generators   | :  | IS:4722   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 5)   | Energy Efficient motors  | :  | IS 12615, IEC:60034-30  |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 3.00.00  | <b>TYPE</b>  |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| 3.01.00  | <p><b>AC Motors:</b></p> <table><tr><td>a)</td><td colspan="3">Squirrel cage induction motor suitable for direct-on-line starting.</td></tr><tr><td>b)</td><td colspan="3">Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or High efficiency (IE2) as per IEC:60034-30.</td></tr><tr><td>c)</td><td colspan="3">Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.</td></tr></table> |  |   | a) | Squirrel cage induction motor suitable for direct-on-line starting. |   |                   | b)  | Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or High efficiency (IE2) as per IEC:60034-30. |   |                   | c)   | Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement. |   |                    |     |                        |   |         |    |                         |   |                        |
| a)   | Squirrel cage induction motor suitable for direct-on-line starting.  |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| b)   | Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or High efficiency (IE2) as per IEC:60034-30.  |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| c)   | Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.  |  |   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B | B-2<br>MOTORS   |    |   |   |                   |     |   |   |                   |      |   |   |                    |     |                        |   |         |    |                         |   |                        |
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| CLAUSE NO.   | TECHNICAL REQUIREMENTS   | एन टी पी सी<br>NTPC                              |  |                                      |
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| 3.02.00  | DC Motors                      Shunt wound.  |  |  |                                      |
| 4.00.00  | <p><b>RATING</b></p> <p>(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.</p> <p>(b) Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.</p> <p>(c) For BFP motors starting MVA shall be restricted to 58 MVA.</p> |  |  |                                      |
| 5.00.00  | <p><b>TEMPERATURE RISE</b></p> <p><b>Air cooled motors</b></p> <p>70 deg. C by resistance method for both thermal class 130(F) &amp; 155(F) insulation.</p> <p><b>Water cooled</b></p> <p>80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) &amp; 155(F) insulation.</p> <p>41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.</p>  |  |  |                                      |
| 6.00.00  | <b>OPERATIONAL REQUIREMENTS</b>  |  |  |                                      |
| 6.01.00  | <b>Starting Time</b>   |  |  |                                      |
| 6.01.01  | For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.  |  |  |                                      |
| 6.01.02  | For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.   |  |  |                                      |
| 6.01.03  | For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.   |  |  |                                      |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B |  | B-2<br>MOTORS<br><br>PAGE<br>3 OF 10 |



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| 6.01.04  | Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.,  |  |
| 6.02.00  | <b>Torque Requirements</b>   |  |
| 6.02.01  | Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.  |  |
| 6.02.02  | Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.  |  |
| 6.03.00  | <b>Starting voltage requirement</b><br><br>(a) 85% below 110 KW<br><br>(b) 80% from 110 KW to 200 KW<br><br>(c) 85% above 200 KW to 1000 KW<br><br>(d) 80% from 1001 KW to 4000 KW<br><br>(e) 75% > 4000KW<br><br>Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.  |  |
| 7.00.00  | <b>DESIGN AND CONSTRUCTIONAL FEATURES</b>  |  |
| 7.01.00  | Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors , space heater terminals inside the main terminal box may be acceptable.   |  |
| 7.02.00  | All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below<br><br>(a) Fuel oil area : Group – IIB<br><br>(b) Hydrogen generation plant area : Group - IIC (or Group-I, Div-II as per NEC) |  |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B |
|  |  | B-2<br>MOTORS                                    |
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| 7.03.00  | <p><b>Winding and Insulation</b></p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. However the conveyor motor shall be suitable for 3 consecutive hot starts.</p> <p>(c) 11kV &amp; 3.3 kV AC motors :<br/>Thermal class 155 (F) insulation.<br/><br/>The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse &amp; interturn insulation surge withstand level shall be as per IEC-60034 part-15</p> <p>(d) 240VAC, 415V AC &amp; 220V DC motors : Thermal Class( B ) or better</p> |                                   |
| 7.04.00  | Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.  |                                   |
| 7.05.00  | Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.   |                                   |
| 7.06.00  | Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.   |                                   |
| 7.07.00  | In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.   |                                   |
| 7.08.00  | Motor body shall have two earthing points on opposite sides.  |                                   |
| 7.09.00  | HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable box is offered, then Employer shall provide  |                                   |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW) — —<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B  | B-2<br>MOTORS<br><br>PAGE 5 OF 10 |



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|  | termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 7.10.00  | The spacing between gland plate & centre of terminal stud shall be as per Table-I.   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 7.11.00  | All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 7.12.00  | The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 7.13.00  | For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 7.14.00  | 11kV and 3.3 kV motor Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.  |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 7.15.00  | The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 8.00.00  | <p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.</p> <table><tr><td>(a) Below 110KW</td><td>: 10.0</td></tr><tr><td>(b) From 110 KW &amp; upto 200 KW</td><td>: 9.0</td></tr><tr><td>(c) Above 200 KW &amp; upto 1000KW</td><td>: 10.0</td></tr><tr><td>(d) From 1001KW &amp; upto 4000KW</td><td>: 9.0</td></tr><tr><td>(e) Above 4000KW</td><td>: 6 to 6.5</td></tr></table> | (a) Below 110KW                  | : 10.0 | (b) From 110 KW & upto 200 KW | : 9.0 | (c) Above 200 KW & upto 1000KW | : 10.0 | (d) From 1001KW & upto 4000KW | : 9.0 | (e) Above 4000KW | : 6 to 6.5 |  |
| (a) Below 110KW  | : 10.0   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| (b) From 110 KW & upto 200 KW  | : 9.0  |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| (c) Above 200 KW & upto 1000KW   | : 10.0   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| (d) From 1001KW & upto 4000KW  | : 9.0  |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| (e) Above 4000KW   | : 6 to 6.5   |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 10.00.00   | TYPE TEST  |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 10.01.00   | HT MOTORS  |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| 10.01.01   | The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type  |                                  |        |                               |       |                                |        |                               |       |                  |            |  |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X506 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B   | B-2<br>MOTORS<br>PAGE<br>6 OF 10 |        |                               |       |                                |        |                               |       |                  |            |  |




| CLAUSE NO.   | TECHNICAL REQUIREMENTS   |  |
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|  | <p>tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.</p>   |   |
| 10.01.02   | <p>The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.</p>  |   |
| 10.01.03   | <p>In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.</p>   |   |
| 10.01.04   | <p>Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.</p> |   |
| 10.01.05   | <p><b>LIST OF TYPE TESTS TO BE CONDUCTED</b></p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <ul style="list-style-type: none"> <li>(a) No load saturation and loss curves upto approximately 115% of rated voltage</li> <li>(b) Measurement of noise at no load.</li> <li>(c) Momentary excess torque test (subject to test bed constraint).</li> <li>(d) Full load test(subject to test bed constraint)</li> </ul>  |   |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B   | B-2<br>MOTORS<br><div style="text-align: right;"> PAGE<br/> 7 OF 10 </div>          |



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|  | <p>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</p> <p>(f) * Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15</p> <p>(g) Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15</p> |                  |
| 10.01.06   | <p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <p>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</p> <p>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</p>  |                  |
| 10.02.00   | <p><b>LT Motors</b></p>  |                  |
| 10.02.01   | <p>LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>   |                  |
| 10.02.02   | <p>However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.</p>   |                  |
| 10.02.03   | <p><b>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</b></p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p>  |                  |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE |  | PAGE<br>8 OF 10  |
| TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B   |  | B-2<br>MOTORS    |



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|--|---|---|-----------------|--|
|  | <ol style="list-style-type: none"> <li>1. Measurement of resistance of windings of stator and wound rotor.</li> <li>2. No load test at rated voltage to determine input current power and speed</li> <li>3. Open circuit voltage ratio of wound rotor motors ( in case of Slip ring motors)</li> <li>4. Full load test to determine efficiency power factor and slip .</li> <li>5. Temperature rise test .</li> <li>6. Momentary excess torque test.</li> <li>7. High voltage test .</li> <li>8. Test for vibration severity of motor.</li> <li>9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)</li> <li>10. Test for degree of protection and</li> <li>11. Overspeed test.</li> </ol> |   |                 |  |
| 10.03.00   | All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.   |   |                 |  |
| 10.04.00   | The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.   |   |                 |  |
| VINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B  | B-2<br>MOTORS   | PAGE<br>9 OF 10 |  |



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|--|---|---------------|------------------|--|-----------------|---|------------|---------------------------------|------------------------|----|-------------------------|-----|--------------------------|-----|--------------------------|-----|--------------------------|-----|--------------------------|-----|---------------------------|-----|--------------------------|-----|-----------------|-----------|--------------|------|------------------------------|--------|--------------|------|
|  | <p style="text-align: center;">TABLE - I</p> <p style="text-align: center;">DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS</p> <table><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of stud and gland plate in mm</th></tr><tr><td>UP to 3 KW</td><td>As per manufacturer's practice.</td></tr><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>219</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>203</td></tr></table> <p>For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.</p> <p><b>PHASE TO PHASE/ PHASE TO FARTH AIR CLEARANCE:</b></p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p> <table><tr><th>Motor MCR in KW</th><th>Clearance</th></tr><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></table> |               |                  |  | Motor MCR in KW | Minimum distance between centre of stud and gland plate in mm | UP to 3 KW | As per manufacturer's practice. | Above 3 KW - upto 7 KW | 85 | Above 7 KW - upto 13 KW | 115 | Above 13 KW - upto 24 KW | 167 | Above 24 KW - upto 37 KW | 196 | Above 37 KW - upto 55 KW | 219 | Above 55 KW - upto 90 KW | 277 | Above 90 KW - upto 125 KW | 331 | Above 125 KW-upto 200 KW | 203 | Motor MCR in KW | Clearance | UP to 110 KW | 10mm | Above 110 KW and upto 150 KW | 12.5mm | Above 150 KW | 19mm |
| Motor MCR in KW  | Minimum distance between centre of stud and gland plate in mm   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| UP to 3 KW   | As per manufacturer's practice.   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 3 KW - upto 7 KW   | 85  |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 7 KW - upto 13 KW  | 115   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 13 KW - upto 24 KW   | 167   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 24 KW - upto 37 KW   | 196   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 37 KW - upto 55 KW   | 219   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 55 KW - upto 90 KW   | 277   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 90 KW - upto 125 KW  | 331   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 125 KW-upto 200 KW   | 203   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Motor MCR in KW  | Clearance   |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| UP to 110 KW   | 10mm  |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 110 KW and upto 150 KW   | 12.5mm  |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| Above 150 KW   | 19mm  |               |                  |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |
| JINDHYACHAL SUPER THERMAL POWER PROJECT<br>STAGE-V (1X500 MW)<br>STEAM TURBINE GENERATOR PACKAGE | TECHNICAL SPECIFICATIONS<br>SECTION-VI<br>PART-B  | B-2<br>MOTORS | PAGE<br>10 OF 10 |  |                 |   |            |                                 |                        |    |                         |     |                          |     |                          |     |                          |     |                          |     |                           |     |                          |     |                 |           |              |      |                              |        |              |      |



| CLAUSE NO. | LT SWITCHGEAR (Star/Tr Panel)  |
|------------|--|
| 1.00.00    | <p><b>CODES AND STANDARDS</b></p> <p>IEC : 947, IS : 13947</p>   |
| 2.00.00    | <p><b>TYPE</b></p> <p>Circuit Breakers      Shall be air break, three pole, spring charged, horizontal drawout type, suitable for electrical operation.</p> <p>Switchgear      Fully drawout type single front</p> <p>MCC      Fully drawout type single front/Double front.</p> <p>ACDB/DCDB      Fixed type single front</p>                           |
| 3.00.00    | <p><b>SYSTEM PARAMETERS</b></p> <p>415VAC +/- 10 % (SOLIDLY GROUNDED)</p> <p>50 Hz +3%/-5%</p> <p>45KA RMS / 1 SEC (FAULT LEVEL)</p> <p>220V DC NOMINAL (190V DC-240V DC) ISOLATED TYPE</p>  |
| 4.00.00    | <p><b>TEMPERATURE RISE</b></p> <p>The temperature rise of the horizontal and vertical busbars and main bus link including all power drawout contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg. C with silver plated joints and 40 deg. C with all other types of joints over an ambient of 50 deg C.</p> |
| 5.00.00    | <p><b>OPERATIONAL REQUIREMENTS</b></p>   |
| 5.01.00    | <p><b>Breakers</b></p>   |
| 5.01.01    | <p>Breakers shall have anti-pumping feature.</p>   |
| 5.01.02    | <p>The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.</p>  |
| 5.01.03    | <p>Breakers shall have inherent fault making and breaking capacities. They shall have shunt trip coils. In case releases are offered, the same shall have contact for energisation of lockout relay. All breakers shall have built in interlocks for equipment and personnel safety.</p>   |
| 5.01.04    | <p>Paralleling of two supplies shall be avoided by interlocking except for switchgear where auto-changerover is provided. Breaker contact multiplication, if required, shall be through latch relay.</p>   |



| CLAUSE NO. | LT SWITCHGEAR  |
|------------|--|
| 01.05      | Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.  |
| 01.06      | Provision of mechanical closing of breaker only in 'Test' and 'Withdrawn' position shall be made. Alternatively, mechanical closing facility should be normally inaccessible, accessibility rendered only after deliberate removal of shrouds. It shall be possible to close the door with breaker in test position. |
| 01.07      | Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.  |
| 01.08      | Supervision relay shall be provided for trip coil monitoring.  |
| 02.00      | Switches, Contactors and Fuses   |
| 02.01      | Incomers for MCCs and DBs rated upto 630A could be load break isolators.   |
| 02.02      | Motor starter contactors shall be of air break, electromagnetic type suitable for DOL starting of motor, and shall be of utilisation category AC-3 for ordinary and AC-4 for reversing starters. DC contactor shall be of DC-3 utilisation category.   |
| 02.03      | Fuses shall be HRC type with operation indicator. Isolating switches shall be of AC 23A category when used in motor circuit, and AC 22A category for other applications. Fuse switch combination shall be provided wherever possible.  |
|            | Isolating switches and MCCBs shall have door interlocks and padlocking facility.   |
|            | Panels   |
|            | All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved identification plates.  |
| 02         | Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall have DOP of IP-55. Push buttons shall be of latch type with mushroom knobs.   |
| 03         | Where breaker/starter module front serves as compartment cover, suitable blanking covers, one for each size of modules per switchboard shall be supplied for use when carriage is withdrawn.   |
|            | All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galvanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.  |
|            | Suitable trolley arrangement shall be provided for breaker/starter modules. Two trolleys per switchgear room shall be provided so that top most breaker module of all types, sizes and rating can be withdrawn on trolley and lowered for maintenance purpose.   |
|            | The incoming connection to transformer of more than 1000KVA and inter-connecting sections between switchboards shall preferably be of busducts. The busduct enclosure  |



| CLAUSE NO. | LT SWITCHGEAR   |
|------------|---|
|            | shall be made of minimum 3mm thick aluminium alloy. The section of the busduct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor busduct enclosure joints to provide additional protection against water ingress. The busduct top shall be sloped to prevent retention of water. The busduct shall have DOP of IP55.  |
| 5.03.07    | It should be possible to carryout maintenance on a feeder with adjacent feeders alive.  |
| 5.04.00    | Control, Protection & Metering Requirements   |
| 5.04.01    | Control circuits shall operate at suitable voltage of 110V AC or 220V DC. Necessary control supply transformers having primary and secondary fuses shall be provided for each MCC, 2 x 100% per section. However the breakers shall operate on 220V DC. The auxiliary bus bars for control supply shall be segregated from main bus bars. The control supplies shall be monitored.  |
| 5.04.02    | Contractor shall fully co-ordinate overload and short circuit tripping of breaker with up-stream and down stream breakers/fuses/MCCBs motor starters. Various equipments shall meet requirement of Type-II class of coordination as per IEC.  |
| 5.04.03    | All relays and timers shall operate on available DC supply and not have any inbuilt batteries. They shall be provided with hand-reset operation indicator (flags) or LEDs with pushbuttons for resetting.   |
| 5.04.04    | All equipments shall have necessary protections. However, following minimum protections shall be provided:  |
|            | <ol style="list-style-type: none"> <li>1) Contactor controlled motor feeders (Motors up to 150 kW) <ol style="list-style-type: none"> <li>a) Instantaneous short circuit protection on all phases through HRC cartridge type fuses rated for 80 kA rms (prospective breaking capacity at 415V).</li> <li>b) Thermal overload protection.</li> <li>c) Single phasing protection for motors protected by fuses.</li> </ol> </li> <li>2) Breaker controlled motors feeders (motors rated above 160kW) <ol style="list-style-type: none"> <li>a) Instantaneous short circuit protection on all phases</li> <li>b) Overload protection on two phases</li> <li>c) Over load alarm on third phase</li> <li>d) Earth fault protection</li> <li>e) Under voltage protection</li> </ol> </li> </ol> |



| CLAUSE NO. | LT SWITCHGEAR  |
|------------|--|
|            | <ul style="list-style-type: none"> <li>f) hand reset lockout relay with a blue lamp for monitoring</li> <li>3) Incomers/bus coupler/outgoing breaker feeders other than motor feeders               <ul style="list-style-type: none"> <li>a) Definite time delay short circuit protection</li> <li>b) Hand reset lockout relay with a blue lamp</li> </ul> </li> <li>4) Incomer From DG Set.               <ul style="list-style-type: none"> <li>a) Differential Protection (87) - Three Pole</li> <li>b) Reverse Power Protection.</li> <li>c) Overload Alarm on one phase</li> <li>d) Earth Fault Detection Relay (64)</li> <li>e) Voltage controlled overcurrent relay</li> <li>e) Generator under/over voltage Protection</li> <li>f) Hand Reset/Lockout Relay with a blue lamp.</li> <li>g) 3 Phase Energy Meter having accuracy of 1.0 class.</li> </ul> </li> </ul> |
| 5.04.05    | <p>Meters / instruments</p> <p>All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. size with 90 degree linear scales and accuracy class of 2.0.</p>   |
| 5.04.06    | <p>All motors of 30kW and above shall have an Ammeter. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. Adequate control and selector switches, push buttons and indicating lamps shall be provided. Thermostatically controlled space heaters with switches shall be provided to prevent condensation.</p>  |
| 5.04.07    | <p>In case of remote controlled breaker panels, following shall be ensured.</p> <p>Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test position whereas closing from remote shall be possible in either service or test position. Tripping from local shall be possible only when local/remote selector switch is in local position. Tripping from remote shall be either breaker in service position or selector switch being in remote position.</p>  |
| 05.00      | <p>Control from Remote</p> <p>Necessary hardware shall be provided in the switchgear panel like coupling relays(24V DC, with max burden 2.5VA), auxiliary relays, current &amp; voltage transducers(4-20 mA, dual output) etc. to effect interlocks, exchange information / status and exercise control from remote.</p>   |




| CLAUSE NO. | LT SWITCHGEAR   |
|------------|---|
| 6.00.00    | DESIGN AND CONSTRUCTIONAL FEATURES  |
| 6.01.00    | <p>All 415V switch gear motor control centers (MCCs), AC &amp; DC distribution boards (DBs), etc shall have following features :</p> <ol style="list-style-type: none"> <li>1) Shall be of metal enclosed, indoor, floor mounted and free standing type.</li> <li>2) All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2mm.</li> <li>3) Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels.</li> <li>4) All switchboards/panels shall be of dust and vermin proof. All cutouts shall have synthetic rubber gaskets.</li> <li>5) For motors above 160kW, remote controlled electrical circuit breakers, and for smaller motors, switch-fuse contactor feeders shall be provided. The other outgoing feeders would be switch-fuse units or moulded case circuit breakers.</li> <li>6) All switchboards, MCCs and DBs shall have following distinct vertical sections. <ol style="list-style-type: none"> <li>a) Completely enclosed bus bar compartment for horizontal and vertical bus bars.</li> <li>b) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or switch-fuse feeder).</li> <li>c) Compartment for cable alley or cable box for power and control cables<br/>In case of cable box, they shall be segregated with complete shrouding for individual feeders at the rear for direct termination of cables.</li> <li>d) For cable connection to circuit breaker, a separately enclosed cable compartment shall also be acceptable.</li> <li>e) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary.</li> <li>f) The switchboards/MCC/DBs of 1600A &amp; above rating shall be of DOP IP42 &amp; of IP52 for less than 1600A rating</li> <li>g) All 415V switchgears, MCC's, AC &amp; DC distribution boards etc. shall be painted by powder coating process. Paint shade shall be as follows</li> </ol> </li> </ol> |



| CLAUSE NO. | LT SWITCHGEAR   |          |
|------------|---|----------|
|            | (i) Front & Back  | RAL 9002 |
|            | (ii) Extreme end covers   | RAL 5012 |
| 7)         | Busbars shall be of high conductivity aluminium alloy or copper.  |          |
| 8)         | Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances shall be at least 10mm. Wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit. |          |
| 9)         | Busbar insulators shall be of track-resistant high strength non-hygro-scoptic, non-combustible type and suitable to withstand stresses due to over-voltages and short circuit current. Insulators and barrier of inflammable material such as Hylam shall not be accepted.  |          |
| 10)        | All types of relays and timer shall be subject to Employer's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, drawout construction for easy replacement and testing facility. The auxiliary relays and timer may be provided in fixed cases.  |          |
| 11)        | Maxi terminal /cage clamp type terminal blocks shall be provided for signals to be interfaced with DDCMIS/PLC.  |          |
| 12)        | The switchgears/MCC shall be designed to offer adequate level of safety to operating/maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Bidder shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switchgear/MCC room describing various safe operating procedure/safety precautions for safe operation and maintenance of switchgear/MCC.  |          |
| 13)        | All current and voltage transformers as required for metering & protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer REF protection. All current and voltage transformers as required for metering and protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer restricted earth fault protection. The accuracy shall be as follows:  |          |
|            | CTs   | PTs      |
| Protection | 5P20  | 3P       |
| Metering   | 10  | 10       |
| REF        | PS  |          |




|   |                |                            |
|---|----------------|----------------------------|
|  | TITLE          | SPECIFICATION NO.          |
|   | MOTOR          | VOLUME II B                |
|   | DATA SHEET - C | SECTION D                  |
|   |                | REV NO. 00 DATE 29/08/2005 |
|   |                | SHEET 1 OF 2               |

| S. No.    | Description  | Data to be filled by successful bidder |
|-----------|--|--|
| <b>A.</b> | <b>General</b>   |  |
| 1         | Manufacturer & country of origin                                   |  |
| 2         | Motor type   |  |
| 3         | Type of starting   |  |
| 4         | Name of the equipment driven by motor & Quantity                   |  |
| 5         | Maximum Power requirement of driven equipment                      |  |
| 6         | Rated speed of Driven Equipment                                    |  |
| 7         | Design ambient temperature   |  |
| <b>B.</b> | <b>Design and Performance Data</b>                                 |  |
| 1         | Frame size & type designation                                      |  |
| 2         | Type of duty   |  |
| 3         | Rated Voltage  |  |
| 4         | Permissible variation for  |  |
| 5         | a) Voltage   |  |
| 6         | b) Frequency   |  |
| 7         | c) Combined voltage & frequency                                    |  |
| 8         | Rated output at design ambient temp (by resistance method)         |  |
| 9         | Synchronous speed & Rated slip                                     |  |
| 10        | Minimum permissible starting voltage                               |  |
| 11        | Starting time in sec with mechanism coupled                        |  |
| 12        | a) At rated voltage  |  |
| 13        | b) At min starting voltage   |  |
| 14        | Locked rotor current as percentage of FLC (including IS tolerance) |  |
| 15        | Torque   |  |
|           | a) Starting  |  |
|           | b) Maximum   |  |
| 16        | Permissible temp rise at rated output over ambient temp & method   |  |
| 17        | Noise level at 1.0 m (dB)  |  |
| 18        | Amplitude of vibration   |  |
| 19        | Efficiency & P.F. at rated voltage & frequency                     |  |
|           | a) At 100% load  |  |
|           | c) At 75% load   |  |

|                |           |      |      |      |  |
|----------------|-----------|------|------|------|--|
| NAME OF VENDOR |           |      | SEAL | REV. |  |
| NAME           | SIGNATURE | DATE |      |      |  |
|                |           |      |      |      |  |



|   |   |  |
|---|---|--|
|  | <b>TITLE</b><br><br><b>MOTOR</b><br><br><b>DATA SHEET - C</b> | <b>SPECIFICATION NO.</b>                 |
|   |   | <b>VOLUME</b> II B                       |
|   |   | <b>SECTION</b> D                         |
|   |   | <b>REV NO. 00</b> <b>DATE 29/08/2005</b> |
|   |   | <b>SHEET</b> 2 <b>OF</b> 2               |

| S. No.    | Description  | Data to be filled by successful bidder |
|-----------|--|--|
|           | c) At starting   |  |
| <b>C.</b> | <b>Constructional Features</b>   |  |
| 1         | Method of connection of motor driven equipment   |  |
| 2         | Applicable Standard  |  |
| 3         | DOP of Enclosure   |  |
| 4         | Method of cooling  |  |
| 5         | Class of insulation  |  |
| 6         | Main terminal box  |  |
|           | a) Type  |  |
|           | b) Power Cable details (Conductor, size, armour/unarmour)                                    |  |
|           | c) Cable Gland & lugs details (Size, type & material)  |  |
|           | d) Permissible Fault level ( kArms & duration in sec)  |  |
| 7         | Space heater details (Voltage & watts)   |  |
| 8         | Flame proof motor details (if applicable)  |  |
|           | a) Enclosure   |  |
|           | b) suitability for hazardous area  |  |
|           | i Zone   | O / I / II                             |
|           | ii Group   | IIA / IIB / IIC                        |
| 9         | No. of Stator winding  |  |
| 10        | Winding connection   |  |
| 11        | Kind of rotor winding  |  |
| 12        | Kind of bearings   |  |
| 13        | Direction of rotation when viewed from NDE   |  |
| 14        | Paint Shade & type   |  |
| 15        | Net weight of motor  |  |
| 16        | Outline mounting drawing No (To be enclosed as annexure)                                     |  |
| <b>D.</b> | <b>Characteristic curves/ drawings</b><br>(To be enclosed for motors of rating $\geq 55KW$ ) |  |
|           | a) Torque speed characteristic   |  |
|           | b) Thermal withstand characteristic  |  |
|           | c) Current vs time   |  |
|           | d) Speed vs time   |  |

|                       |                  |             |             |             |  |
|-----------------------|------------------|-------------|-------------|-------------|--|
| <b>NAME OF VENDOR</b> |                  |             | <b>SEAL</b> | <b>REV.</b> |  |
|                       |                  |             |             |             |  |
| <b>NAME</b>           | <b>SIGNATURE</b> | <b>DATE</b> |             |             |  |



CLAUSE NO.

QUALITY ASSURANCE



INDUCTION MOTOR & SYNCHRONOUS MACHINE

| TESTS/CHECKS<br>TEMS/COMPONENTS  | Visual | Dimensional | Make/Type/Rating/TC/General<br>Physical Inspection | Mech/Chem. Properties | NDT /DP/MPI/UT | Metallography | Electrical Characteristics | Welding/Brazing(WPS/PQR) | Heat Treatment |
|--|--------|-------------|--|-----------------------|----------------|---------------|----------------------------|--------------------------|----------------|
| Plates for stator frame, end shield, spider etc.   | Y      | Y           | Y  | Y                     |                |               |                            |                          | Y              |
| Shaft  | Y      | Y           | Y  | Y                     | Y              | Y             |                            |                          | Y              |
| Magnetic Material  | Y      | Y           | Y  | Y                     | Y              |               | Y                          |                          |                |
| Rotor Copper/Aluminium   | Y      | Y           | Y  | Y                     |                | Y             | Y                          |                          | Y              |
| Stator copper  | Y      | Y           | Y  | Y                     |                |               | Y                          |                          | Y              |
| SC Ring  | Y      | Y           | Y  | Y                     | Y              | Y             | Y                          | Y                        | Y              |
| Insulating Material  | Y      |             | Y  | Y                     |                |               | Y                          |                          |                |
| Tubes for Cooler   | Y      | Y           | Y  | Y                     | Y              |               |                            |                          | Y              |
| Sleeve Bearing   | Y      | Y           | Y  | Y                     | Y              |               |                            |                          | Y              |
| Stator/Rotor, Exciter Coils  | Y      | Y           | Y  |                       |                |               | Y                          | Y                        |                |
| Castings, stator frame, terminal box and bearing housing etc.  | Y      | Y           | Y  | Y                     | Y              |               |                            | Y                        |                |
| Fabrication & machining of stator, rotor, terminal box   | Y      | Y           |  |                       | Y              |               |                            |                          | Y              |
| Wound stator   | Y      | Y           |  |                       |                |               | Y                          | Y                        |                |
| Wound Exciter  | Y      | Y           |  |                       |                |               | Y                          | Y                        |                |
| Rotor complete   | Y      | Y           |  |                       |                |               | Y                          |                          |                |
| Exciter, Stator, Rotor, Terminal Box assembly  | Y      | Y           |  |                       |                |               | Y                          |                          |                |
| Accessories, RTD, BTD, CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc. | Y      | Y           | Y  |                       |                |               |                            |                          |                |
| Motor ( IS 325 / 4722/ 9283)   | Y      | Y           | Y  |                       |                |               |                            |                          |                |


MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW)  
STEAM GENERATOR PACKAGE

TECHNICAL SPECIFICATION  
SECTION-VI  
BID DOC NO.: CS-9575/ 9571/ 0370/  
0360/ 9586-102-2

PART-B  
SUB-SECTION-VII:QE1  
MOTOR

PAGE 1 OF 2



| CLAUSE NO.   |  | QUALITY ASSURANCE        |                              |                         |         |                   |  |           |            |  |  |
|--|--|--------------------------|------------------------------|-------------------------|---------|-------------------|--|-----------|------------|---|--|
| INDUCTION MOTOR & SYNCHRONOUS MACHINE  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| TESTS/CHECKS<br>ITEMS/COMPONENTS   |  | Magnetic Characteristics | Hydraulic/Leak/Pressure Test | Thermal Characteristics | Run out | Dynamic Balancing | All routine & acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC 60079-1 | Vibration | Over speed | Tan delta, shaft voltage & polarization index test                                  |  |
| Plates for stator frame, end shield, spider etc.   |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Shaft  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Magnetic Material  |  | Y                        |                              | Y                       |         |                   |  |           |            |   |  |
| Rotor Copper/Aluminium   |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Stator copper  |  |                          |                              | Y                       |         |                   |  |           |            |   |  |
| SC Ring  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Insulating Material  |  |                          |                              | Y                       |         |                   |  |           |            |   |  |
| Tubes for Cooler   |  |                          | Y                            |                         |         |                   |  |           |            |   |  |
| Sleeve Bearing   |  |                          | Y                            |                         |         |                   |  |           |            |   |  |
| Stator/Rotor, Exciter Coils  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Castings, stator frame, terminal box and bearing housing etc.  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Fabrication & machining of stator, rotor, terminal box   |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Wound stator   |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Wound Exciter  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Rotor complete   |  |                          |                              |                         | Y       | Y                 |  |           |            |   |  |
| Exciter, Stator, Rotor, Terminal Box assembly  |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Accessories, RTD, BTD, CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.   |  |                          |                              |                         |         |                   |  |           |            |   |  |
| Motor ( IS 325 / 4722 / 9283/2148/IEC 60079-1)   |  |                          |                              |                         |         |                   | Y  | Y         | Y          | Y1  |  |
| <p>Note : 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices &amp; Procedure followed along with relevant supporting documents during QP finalisation. However, No QP for LT motor upto 50KW.</p> <p>2. Makes of all major bought out items will be subject to NTPC approval.</p> <p>Y1 = for HT Motor / Machines only.</p> |  |                          |                              |                         |         |                   |  |           |            |   |  |

|   |   |  |             |
|---|---|--|-------------|
| MOUDA STPP-II (2x660MW) / SOLAPUR STPP (2 x 660MW) / NABINAGAR STPP (3x 660MW) / MEJA TPP-I (2 x 660MW) / RAGHUNATHPUR TPP PHASE-II (2 x660MW)<br>STEAM GENERATOR PACKAGE | TECHNICAL SPECIFICATION<br>SECTION-VI<br>BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2 | PART-B<br>SUB-SECTION-VII:QE1<br>MOTOR | PAGE 2 OF 2 |
|---|---|--|-------------|



| CUSTOMER :                    |     | PROJECT                               |    | SPECIFICATION :      |        |                                |               |   |     |     |        |
|-------------------------------|-----|---------------------------------------|----|----------------------|--------|--------------------------------|---------------|---|-----|-----|--------|
| BIDDER/ VENDOR                |     | TITLE                                 |    | NUMBER :             |        |                                |               |   |     |     |        |
| SYSTEM                        |     | QUALITY PLAN                          |    | SPECIFICATION        |        |                                |               |   |     |     |        |
| CAT.                          |     | ITEM AC ELECT. MOTORS BELOW 75KW (LV) |    | TITLE                |        |                                |               |   |     |     |        |
| SHEET 1 OF 2                  |     | REFERENCE DOCUMENT                    |    | SECTION              |        |                                |               |   |     |     |        |
| CHARACTERISTICS CHECK         |     | ACCEPTANCE NORM                       |    | VOLUME III           |        |                                |               |   |     |     |        |
| EXTENT OF CHECK               |     | FORMAT OF RECORD                      |    | REMARKS              |        |                                |               |   |     |     |        |
| TYPE/ METHOD OF CHECK         |     | P                                     |    | W                    |        |                                |               |   |     |     |        |
| CAT.                          |     | 4                                     |    | 10                   |        |                                |               |   |     |     |        |
| 3                             |     | 5                                     |    | 11                   |        |                                |               |   |     |     |        |
| 2                             |     | 6                                     |    | 7                    |        |                                |               |   |     |     |        |
| 1                             |     | 8                                     |    | 9                    |        |                                |               |   |     |     |        |
| 1. SHADE                      |     | 10                                    |    | 11                   |        |                                |               |   |     |     |        |
| 1.0 PAINTING                  |     | 11                                    |    | 12                   |        |                                |               |   |     |     |        |
| 2.0 ASSEMBLY                  |     | 12                                    |    | 13                   |        |                                |               |   |     |     |        |
| 3.0 TESTS                     |     | 13                                    |    | 14                   |        |                                |               |   |     |     |        |
| BHEL                          |     | 14                                    |    | 15                   |        |                                |               |   |     |     |        |
| PARTICULARS                   |     | 15                                    |    | 16                   |        |                                |               |   |     |     |        |
| NAME                          |     | 16                                    |    | 17                   |        |                                |               |   |     |     |        |
| SIGNATURE                     |     | 17                                    |    | 18                   |        |                                |               |   |     |     |        |
| DATE                          |     | 18                                    |    | 19                   |        |                                |               |   |     |     |        |
| BIDDER/VENDOR                 |     | 19                                    |    | 20                   |        |                                |               |   |     |     |        |
| BIDDER'S/VENDORS COMPANY SEAL |     | 20                                    |    | 21                   |        |                                |               |   |     |     |        |
| 1                             | 1.0 | PAINTING                              | MA | VISUAL               | SAMPLE | MANUF'S SPEC. SAME AS COL.7    | LOG BOOK      | 3 | -   | -   | 11     |
| 2                             | 2.0 | ASSEMBLY                              | MA | VISUAL               | 100%   | MANUF'S SPEC                   | -DO-          | 3 | -   | -   | 11     |
| 3                             | 3.0 | TESTS                                 | MA | -DO-                 | 100%   | MFG. DRG./ MFG. SPEC.          | -DO-          | 3 | -   | -   | 11     |
| 4                             | 4.0 | TESTS                                 | MA | VISUAL               | 100%   | MFG. SPEC./ RELEVANT IS        | -DO-          | 3 | -   | -   | 11     |
| 5                             | 5.0 | TESTS                                 | MA | -DO-                 | 100%   | IS-325/ BHEL SPEC./ DATA SHEET | TEST REPORT   | 3 | 2.1 | 2.1 | NOTE-1 |
| 6                             | 6.0 | TESTS                                 | MA | MEASUREMENT & VISUAL | 100%   | APPROVED DRG/DATA SHEET        | INSPN. REPORT | 2 | 1   | -   |        |



| BHEL   |                     | QUALITY PLAN          |      | CUSTOMER :            |                 | PROJECT TITLE                         |                     | SPECIFICATION :<br>NUMBER : |                |
|--|---------------------|-----------------------|------|-----------------------|-----------------|---------------------------------------|---------------------|-----------------------------|----------------|
| BHEL   |                     | QUALITY PLAN          |      | BIDDER/ VENDOR        |                 | QUALITY PLAN                          |                     | SPECIFICATION :             |                |
| SHEET 2 OF 2   |                     | CHARACTERISTICS CHECK |      | SYSTEM CAT.           |                 | ITEM AC ELECT. MOTORS BELOW 75KW (LV) |                     | TITLE :                     |                |
| SL. NO.  | COMPONENT/OPERATION | 3                     | 4    | 5                     | 6               | 7                                     | 8                   | 9                           | 10             |
|  |                     | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT                    | ACCEPTANCE NORM     | FORMAT OF RECORD            | SECTION AGENCY |
|  |                     |                       |      |                       |                 |                                       |                     |                             | P W V          |
| 1  | 2                   | 3                     | 4    | 5                     | 6               | 7                                     | 8                   | 9                           | 10             |
|  |                     | 3.NAMEPLATE DETAILS   | MA   | VISUAL                | 100%            | IS-325 & DATA SHEET                   | IS-325 & DATA SHEET | INSPN. REPORT               | 3 1 -          |
| <p>NOTES:</p> <p>1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p>2 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW, ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</p> <p>3</p> |                     |                       |      |                       |                 |                                       |                     |                             |                |
| <p>BHEL</p> <p>PARTICULARS</p> <p>NAME</p> <p>SIGNATURE</p> <p>DATE</p>  |                     |                       |      |                       |                 |                                       |                     |                             |                |
| BIDDER'S/VENDORS COMPANY SEAL  |                     |                       |      |                       |                 |                                       |                     |                             |                |





**TITLE : TECHNICAL SPECIFICATION  
FOR  
CONDENSER ON LOAD TUBE CLEANING  
SYSTEMS (COLTCS)**

**SPEC. NO. PE-TS- 387/388-165-N001**

**VOLUME : IIB**

**SECTION : D**

**REV. NO. 0**


**DATE : 04.02.2013**

**SHEET 1 of 1**


**SECTION D3**

**STANDARD TECHNICAL SPECIFICATION  
FOR  
C&I SYSTEMS**




|   |   |   |   |        |
|---|---|---|---|--------|
|  | <b>SPECIFICATION<br/>FOR<br/>MOTORISED VALVE ACTUATOR</b> |   | SPECIFICATION NO.:                          |        |
|   |   |   | VOLUME                                      |        |
|   |   |   | SECTION                                     |        |
|   |   |   | REV. NO.                                    | DATE:  |
|   |   |   | SHEET                                       | 1 OF 3 |
| <b>Data Sheet A &amp; B</b>   |   |   |   |        |
| DATA SHEET-A<br>(TO BE FILLED BY PURCHASER)                                       |   |   | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER) |        |
| <b>GENERAL*</b>   | * PROJECT   | 2x660 MW MOUDA STPP, 1X500 MW VINDHYACHAL STPP  |   |        |
|   | OFFER REFERENCE   |   |   |        |
|   | * TAG NO. SERVICE   |   |   |        |
|   | * DUTY  | <input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING  |   |        |
|   | * LINE SIZE (inlet/outlet): MATERIAL                      |   |   |        |
|   | * VALVE TYPE  | <input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE<br><input type="checkbox"/> BUTTERFLY  |   |        |
|   | * OPENING / CLOSING TIME                                  |   |   |        |
|   | * WORKING PRESSURE  |   |   |        |
|   | AMBIENT CONDITION   | SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%  |   |        |
|   | VALVE SEAT TEST PRESS                                     | BIDDER TO SPECIFY   |   |        |
|   | REQUIRED VALVE TORQUE                                     | BIDDER TO SPECIFY   |   |        |
|   | ACTUATOR RATED TORQUE                                     | BIDDER TO SPECIFY   |   |        |
| <b>CONSTRUCTION AND SIZING</b>  | CONSTRUCTION  | TOTALLY ENCLOSED, WEATHER PROOF, IP:55  |   |        |
|   | MECHANICAL POSITION INDICATOR                             | TO BE PROVIDED FOR 0-100% TRAVEL  |   |        |
|   | BEARINGS  | DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.   |   |        |
|   | GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION       | METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.  |   |        |
|   | SIZING  | OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING(REGULATING) SERVICE 150 STARTS/HR MINIMUM   |   |        |
| <b>HANDWHEEL</b>  | * REQUIRED  | <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO   |   |        |
|   | * ORIENTATION   | <input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED  |   |        |
|   | TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.        |   |   |        |
| <b>ELECTRIC ACTUATOR</b>  | ACTUATOR MAKE/MODEL                                       | BIDDER TO SPECIFY   |   |        |
|   | MOTOR MAKE / MODEL / TYPE / RATING (KW)                   | BIDDER TO SPECIFY   |   |        |
|   | MOTOR TYPE  | SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.   |   |        |
|   | ACTUATOR APPLICABLE WIRING DIAGRAM                        | <input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM)<br>A: <input type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00<br>B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00<br>C: <input checked="" type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00<br>D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11 |   |        |
|   | COLOUR SHADE  | <input checked="" type="checkbox"/> BLUE (RAL 5012) ENAMEL <input type="checkbox"/> .....   |   |        |
|   | SHAFT RPM   | BIDDER TO SPECIFY   |   |        |
|   | OLR SET VALUE   | BIDDER TO SPECIFY   |   |        |
|   | STARTING / FULL LOAD CURRENT                              | BIDDER TO SPECIFY   |   |        |
|   | NO. OF REV FOR FULL TRAVEL                                | BIDDER TO SPECIFY   |   |        |
|   | @ PWR SUPP TO MTR / STARTER                               | 415 VAC±10%, 3PH, 50Hz±5%, 3 wire, 10 % (ABSOLUTE) COMBINED VOLTAGE & FREQUENCY VARIATIONS  |   |        |
|   | @ CONTROL VOLTAGE REQUIREMENT                             | TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 230 V AC <input checked="" type="checkbox"/> 110 V AC   |   |        |
|   | @ ENCLOSURE CLASS OF MOTOR                                | <input type="checkbox"/> IP 65 <input checked="" type="checkbox"/> IP 67 FOR OUTDOOR <input type="checkbox"/> FLAME PROOF<br><input checked="" type="checkbox"/> IP 55 FOR INDOOR, TOTALLY ENCL, SELF VENTILATED.   |   |        |
|   | @ INSULATION CLASS  | <input type="checkbox"/> CLASS-B <input checked="" type="checkbox"/> CLASS-F WITH TEMPERATURE RISE LIMITED TO CLASS-B   |   |        |



|   |   |  |                    |   |       |
|---|---|--|--------------------|---|-------|
|  | <b>SPECIFICATION<br/>FOR<br/>MOTORISED VALVE ACTUATOR</b>   |  | SPECIFICATION NO.: |   |       |
|   |   |  | VOLUME             |   |       |
|   |   |  | SECTION            |   |       |
|   |   |  | REV. NO.           |   | DATE: |
|   |   |  | SHEET              | 2   | OF    |
| <b>Data Sheet A &amp; B</b>   |   |  |                    |   |       |
| DATA SHEET-A<br>(TO BE FILLED BY PURCHASER)                                       |   |  |                    | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER)                                 |       |
| <b>INTEGRAL<br/>STARTER</b>   | @ WINDING TEMP PROTECTION   | <input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE)<br><input type="checkbox"/> _____   |                    |   |       |
|   | SINGLE PHASE / WRONG PHASE<br>SEQUENCE PROTECTION   | REQUIRED   |                    |   |       |
|   | INTEGRAL STARTER  | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |                    |   |       |
|   | TYPE OF SWITCHING DEVICE  | <input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS   |                    |   |       |
|   | TYPE  | <input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)  |                    |   |       |
|   | IF SMART  |  |                    |   |       |
|   | a) SERIAL LINK INTERFACE  | <input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED   |                    |   |       |
|   | b) SERIAL LINK PROTOCOL   | <input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS<br><input type="checkbox"/> TCP/IP <input type="checkbox"/> .....   |                    |   |       |
|   | c) SERIAL LINK MEDIA  | <input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL<br><input type="checkbox"/> OFC                                |                    |   |       |
|   | d) HAND HELD PROGRAMMER   | <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED  |                    |   |       |
|   | e) MASTER STATION   | <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED  |                    |   |       |
|   | f) MASTER STN INTRFACE WITH DCS   | <input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP  |                    |   |       |
|   | g) DETAILS OF SPECIAL CABLE   | <input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED  |                    |   |       |
|   | STEP DOWN CONT. TRANSFORMER   | <input checked="" type="checkbox"/> REQUIRED   |                    |   |       |
|   | OPEN / CLOSE PB   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |                    |   |       |
|   | STOP PB   | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |                    |   |       |
|   | INDICATING LAMPS  | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |                    |   |       |
|   | LOCAL REMOTE S/S  | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |                    |   |       |
|   | STATUS CONTACTS FOR MONITORING  | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |                    |   |       |
| INTEGRAL STARTER DISTURBED<br>SIGNAL  | REQUIRED (O/L RELAY OPERATED,<br>THERMOSTAT OPERATED, CONT./POWER<br>SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH<br>OPTD. MID WAY) |  |                    |   |       |
| <b>INTERPOSING<br/>RELAY</b><br>(Applicable for<br>integral Starter)              | INTERPOSING RELAYS  | REQUIRED   |                    |   |       |
|   | INTERPOSING RELAY (QUANTITY)  | <input checked="" type="checkbox"/> 2 NOs. <input type="checkbox"/> 3 NOs.   |                    |   |       |
|   | DRIVING VOLTAGE   | <input type="checkbox"/> 20.5 – 24V DC <input checked="" type="checkbox"/> 24 V DC   |                    |   |       |
|   | DRIVING CURRENT   | <input type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX   |                    |   |       |
|   | LOAD RESISTANCE   | <input type="checkbox"/> > 192 ohms - <25 k ohms<br><input type="checkbox"/> > _____ ohms - < _____ ohms   |                    |   |       |
|   | COIL BURDEN   | 2.5 VA   |                    |   |       |
| <b>TORQUE<br/>SWITCH</b><br>(Not Applicable<br>for Smart<br>Actuator)             | MECHANICAL LATCHING DEVICE  | REQUIRED(REFER NOTE-5)   |                    |   |       |
|   | MFR & MODEL NO.   | BIDDER TO SPECIFY  |                    |   |       |
|   | OPEN / CLOSE  | <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.   / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos |                    |   |       |
|   | CONTACT TYPE  | 2 NO + 2 NC  |                    |   |       |
|   | RATING  | 5A 240V AC AND 0.5A 220V DC  |                    |   |       |
|   | ENCLOSURE   | IP 55  |                    |   |       |
|   | CALIBRATED KNOBS(OPEN&CLOSE TS)   | REQUIRED FOR SETTING DESIRED TORQUE  |                    |   |       |
|   | ACCURACY  | +3% OF SET VALUE   |                    |   |       |
| <b>LIMIT<br/>SWITCH</b><br>(Not Applicable<br>for Smart<br>Actuator)              | MFR & MODEL NO.   | BIDDER TO SPECIFY  |                    |   |       |
|   | OPEN : INT : CLOSE  | <input type="checkbox"/> 1 No<br><input checked="" type="checkbox"/> 2 Nos.  | 2 Nos. (ADJ.)      | <input type="checkbox"/> 1 No.<br><input checked="" type="checkbox"/> 2Nos. |       |
|   | CONTACT TYPE  | 2 NO + 2 NC  |                    |   |       |
|   | RATING (AC / DC)  | 5A ,240V AC AND 0.5A,220V DC   |                    |   |       |
|   | ENCLOSURE CLASS   | IP 55  |                    |   |       |



|   |   |   |       |
|---|---|---|-------|
|  | <b>SPECIFICATION<br/>FOR<br/>MOTORISED VALVE ACTUATOR</b> | SPECIFICATION NO.:                          |       |
|   |   | VOLUME                                      |       |
|   |   | SECTION                                     |       |
|   |   | REV. NO.                                    | DATE: |
|   |   | SHEET 3                                     | OF 3  |
| <b>Data Sheet A &amp; B</b>   |   |   |       |
| DATA SHEET-A<br>(TO BE FILLED BY PURCHASER)                                       |   | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER) |       |

|                             |  |  |  |           |
|-----------------------------|--|--|--|-----------|
| <b>POSITION TRANSMITTER</b> | POSITION TRANSMITTER (For inching duty)            | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED   |  |           |
|                             | MFR & MODEL NO.                                    | BIDDER TO SPECIFY  |  |           |
|                             | TYPE   | <input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER<br><input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS  |  |           |
|                             | SUPPLY   | <input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....  |  |           |
|                             | OUTPUT   | <input checked="" type="checkbox"/> 4-20mA   |  |           |
|                             | ACCURACY   | ± 1% FS  |  |           |
| <b>SPACE HEATER</b>         | @SPACE HEATER                                      | REQUIRED   |  |           |
|                             | @ POWER SUPPLY                                     |  |  |           |
|                             | @ RATING   |  |  |           |
| <b>TERMINAL BOX</b>         | MOTOR TERMINAL BOX                                 | REQUIRED   |  |           |
|                             | ACTUATOR TERMINAL BOX                              | REQUIRED   |  |           |
|                             | ENCL CLASS MTR T.B. / ACTUATOR T.B.                | <input type="checkbox"/> IP 65 <input checked="" type="checkbox"/> IP-67..... <input type="checkbox"/> IP65 <input checked="" type="checkbox"/> IP-67.....                                   |  |           |
|                             | @ EARTHING TERMINAL                                | REQUIRED   |  |           |
|                             | PLUG & SOCKET(9 PIN)<br>(ADDITIONAL 1 NO. FOR PoT) | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> 1 NO. <input checked="" type="checkbox"/> 1 NO. ADDITIONAL FOR PoT |  |           |
| <b>CABLE GLANDS</b>         | @ POWER CABLE GLAND                                | SIZE: .....  |  |           |
|                             | @ SPACE HEATER CABLE GLAND                         | SIZE: .....  |  |           |
|                             | OTHER CONTROL CABLE GLANDS-1                       | <input type="checkbox"/> 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)   |  |           |
|                             | OTHER CONTROL CABLE GLANDS-2                       | QUANTITY & SIZE : .....  |  |           |
| <b>WEIGHT</b>               | TOTAL WEIGHT (ACTUATOR + ACCESSORIES)              | BIDDER TO SPECIFY  |  | _____ Kg. |

**NOTES:**

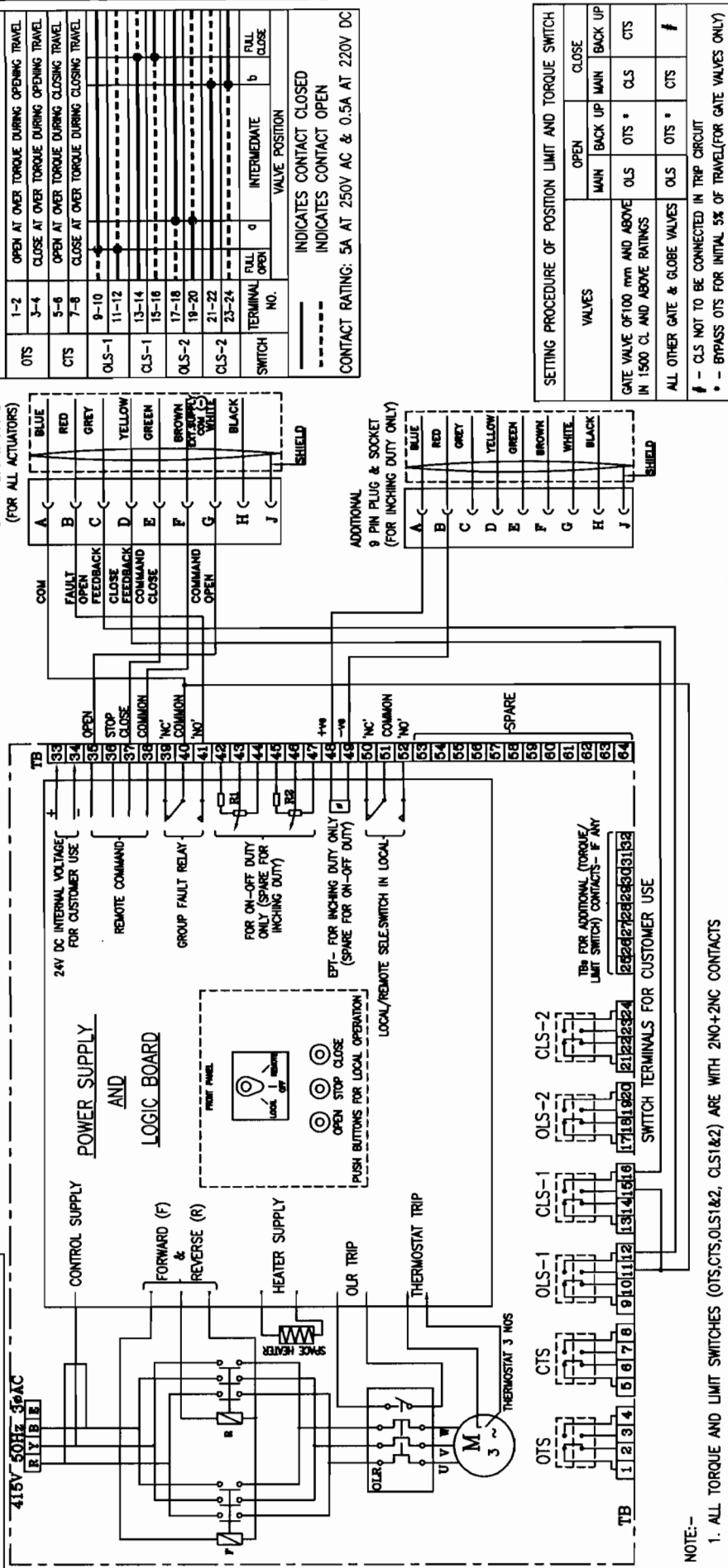
- SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
- CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:  
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
- TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
- CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
- THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
- THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

|  |                    |                   |                    |  |
|--|--------------------|-------------------|--------------------|--|
| <b>NAME</b><br><br><b>SIGNATURE</b><br><br><b>DATE</b>               | <b>PREPARED BY</b> | <b>CHECKED BY</b> | <b>APPROVED BY</b> | <b>VENDOR COMPANY SEAL</b><br><br><b>NAME</b><br><br><b>SIGNATURE</b><br><br><b>DATE</b> |
|  |                    |                   |                    |  |
|  |                    |                   |                    |  |
|  |                    |                   |                    |  |
| NOTES* = TO BE FILLED BY MPL (LEAD AGENCY).    @= TO BE FILLED BY ES |                    |                   |                    |  |



ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.


3-V-MISC-24283




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

|  |      |  |            |
|--|------|--|------------|
| TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT  |      | ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES) |            |
| BHARAT HEAVY ELECTRICALS LTD.,<br>UNIT: HIGH PRESSURE BOILER PLANT,<br>THROCKMORPALL-880014. |      | 385-121  |            |
| DEPT   | VL   | SCALE  | NTS        |
| CODE   |      |  |            |
| REV  | DATE | ALTERED  | CHD & APPD |
| WIRING DIAGRAM (TERMINAL PLAN)   |      | DRAWING NO.  |            |
| FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS                      |      | 3-V-MISC-24283   |            |
| CARD CODE  |      | REV  |            |
| U 01   |      | 0  |            |



|  |  |   |                    |       |
|--|--|---|--------------------|-------|
|                 | <b>DATA SHEET FOR<br/>PRESSURE / DIFFERENTIAL PRESSURE GAUGE</b>     |   | SPECIFICATION NO.: |       |
|  |  |   | VOLUME             |       |
|  |  |   | SECTION            |       |
|  |  |   | REV. NO.           | DATE: |
|  |  |   | SHEET 1 OF 2       |       |
| Data Sheet No.: PE-DC-999-145-I026-A   |  |   |                    |       |
| 2x660 MW MOUDA STPP, 1X500 MW VINDHYACHAL STPP   |  |   |                    |       |
| TECHNICAL REQUIREMENTS FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE<br>(TO BE FILLED BY PURCHASER) |  |   |                    |       |
| TO BE FILLED-UP /CONFIRMED BY BIDDER   |  |   |                    |       |
| <b>GENERAL</b>   | MANUFACTURER   |   |                    |       |
|  | MODEL NUMBER   |   |                    |       |
| <b>TECHNICAL</b>   | SENSING ELEMENT  | <input type="checkbox"/> BOURDON <input type="checkbox"/> DIAPHRAGM<br>(BOURDON FOR HIGH PRESS AND DIAPHRAGM FOR LOW PRESS APPLICATION)   |                    |       |
|  | MATERIAL   | SENSING ELEMENT – AISI 316 SS<br>MOVEMENT – AISI 304 SS<br>CASING – <input checked="" type="checkbox"/> DIE CAST AL <input type="checkbox"/> SS   |                    |       |
|  | ENCLOSURE  | CLASS: <input checked="" type="checkbox"/> IP-55 <input type="checkbox"/> IP-65 <input type="checkbox"/> EXPL PROOF<br>PAINT: <input checked="" type="checkbox"/> ENAMEL <input type="checkbox"/> EPOXY |                    |       |
|  | DIAL   | SIZE: 150 MM<br>COLOR: WHITE NUMERALS: BLACK<br>SCALE: LINEAR, 270° ARC GRADUATED IN METRIC UNITS   |                    |       |
|  | CASE   | COLOUR : BLACK  |                    |       |
|  | SPAN/ ZERO ADJUSTMENT  | INT. MICRO SCREW  |                    |       |
|  | RANGE SELECTION  | SHOULD COVER 125% OF OPERATING PARAMETER  |                    |       |
|  | OVER RANGE PROTECTION  | 1.5 TIMES OF FSD  |                    |       |
|  | BLOW OUT DISC  | REQUIRED  |                    |       |
|  | SWITCHING FACILITY (IF APPLICABLE)                                   | NOT REQUIRED  |                    |       |
| TYPE   | <input type="checkbox"/> MICRO SWITCH <input type="checkbox"/> OTHER |   |                    |       |
| NO. / TYPE OF CONTACTS   | 2 NOS. SPDT  |   |                    |       |
| CONTACT RATING   | 5A 230V AC, 0.25A 220V DC  |   |                    |       |
| SETTING RANGE  | FIELD ADJUSTABLE OVER FULL RANGE                                     |   |                    |       |
| REPEATABILITY  | ± 1% OF FSR  |   |                    |       |
| POWER SUPPLY   | <input type="checkbox"/> 230V AC <input type="checkbox"/> 110V AC    |   |                    |       |
| <b>PERFORMANCE</b>   | ACCURACY   | ± 1% OR BETTER OF FULL SCALE DEFLECTION   |                    |       |
| <b>CONNECTION</b>  | PROCESS  | <input type="checkbox"/> M20 x 1.5 (M) <input checked="" type="checkbox"/> ½" NPT (M) <input type="checkbox"/> ½" NPT (F)<br><input type="checkbox"/> OTHER   |                    |       |
|  | LOCATION   | BOTTOM  |                    |       |
| <b>ACCESSORIES</b>   | NAME PLATE / METAL TAG   | SS  |                    |       |
|  | OTHER  | SIPHON FOR STEAM, SNUBBER FOR PUMP DISCHARGE, CHEMICAL SEAL DIAPHRAGM FOR CORROSSIVE, OIL SERVICES and SLURRY APPLICATION TO BE PROVIDED  |                    |       |
| <b>OTHER REQUIREMENT</b>   | INSTRUMENT LIST  | INSTRUMENT LIST COMPRISING OF TAG NO., SERVICE, DESIGN/OPERATING PRESSURE & TEMPERATURE TO BE ATTACHED  |                    |       |
| <b>QUALITY REQUIREMENT</b>   | CHECK LIST FOR PG/DPG  | REFER CHECK LIST NO PE-CL-999-145-I 026-0   |                    |       |
|  |  |   |                    |       |
|  |  |   |                    |       |
|  |  |   |                    |       |



|   |   | <b>CHECK LIST FOR<br/>PRESSURE / DIFFERENTIAL PRESSURE GAUGE<br/>(Mechanical Auxiliary Packages)</b> |  | SPECIFICATION NO.:<br>VOLUME<br>SECTION<br>REV. NO.      DATE:<br>SHEET      2      OF      2 |   |   |   |
|--|---|--|--|---|---|---|---|
|  |   |  |  | Data Sheet No.: PE-CL-999-145-1026-0  |   |   |   |
| SL NO  | TESTS/CHECKS                                | QUANTM OF CHECK  | REFERENCE DOC. ACCEPTANCE NORMS            | AGENCY  |   |   | REMARKS   |
|  |   |  |  | P   | W | V |   |
| 1.0  | CHECK FOR                                   |  | APPROVED TECHNICAL REQUIREMENT/ DATA SHEET |   |   |   | MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED |
|  | 1.1 DIAL SIZE                               | 100%   |  | M   | C | C |   |
|  | 1.2 MODEL NO/TAG NO                         | 100%   |  | M   | C | C |   |
|  | 1.3 RANGE/SCALE                             | 100%   |  | M   | C | C |   |
|  | 1.4 END CONNECTION                          | 100%   |  | M   | C | C |   |
|  | 1.5 SWITCH CONTACT RATING & NOS             | 100%   |  | M   | C | C |   |
| 2.0  | CALIBRATION                                 |  |  |   |   |   |   |
|  | 2.1 ACCURACY                                | 100%   |  | M   | C | B |   |
|  | 2.2 REPEATABILITY (FOR SWITCH)              | 100%   |  | M   | C | B |   |
|  | 2.3 SET POINT ADJUSTMENT FOR SWITCH         | 100%   |  | M   | C | C |   |
| 3.0  | OVER PRESSURE & LEAK TEST                   | 100%   |  | M   | C | C |   |
| 4.0  | OPERATION OF PR. RELIEF DEVICE              | ONE PER TYPE   |  | M   | C | C |   |
| 5.0  | REVIEW OF T.C. FOR MATERIAL OF-             |  |  |   |   |   |   |
|  | 5.1 SENSOR                                  | FOR LOT  |  | -   | - | B |   |
|  | 5.2 MOVEMENT                                |  |  | -   | - | B |   |
|  | 5.3 PROCESS CONNECTION                      |  | -  | -   | B |   |   |
|  | 5.4 HOUSING                                 |  | -  | -   | B |   |   |
| 6.0  | REVIEW OF T.C. FOR DEGREE OF PROTECTION     | TYPE TEST  | -  | -   | B |   |   |
| 7.0  | REVIEW OF T.C. FOR CONTACT RATING OF SWITCH | ONE PER TYPE   | -  | -   | B |   |   |
| 8.0  | ACCESSORIES AS APPLICABLE                   | 100%   | M  | C   | C |   |   |
| <b>LEGEND:</b><br>M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.                                   |   |  |  |   |   |   |   |
| <b>NOTE:</b><br>CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL. |   |  |  |   |   |   |   |





### DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER

2x660 MW MOUDA STPP, 1X500 MW VINDHYACHAL STPP

SPECIFICATION NO.:

VOLUME

SECTION

REV. NO.

DATE:

SHEET 1 OF 3

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

Data Sheet No.: PES-145-01-DS1- A


#### Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER  
(TO BE FILLED BY PURCHASER)


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

|                  |  |  |  |
|------------------|--|--|--|
| <b>GENERAL</b>   | MANUFACTURER   |  |  |
|                  | MODEL NUMBER   |  |  |
| <b>TECHNICAL</b> | TYPE   | TRANSMITTER OF MICROPROCESSOR BASED 2 WIRE TYPE ,HART PROTOCOL COMPATIBLE  |  |
|                  | TRANSMITTER MEASUREMENT  | <input type="checkbox"/> PRESSURE <input checked="" type="checkbox"/> DIFF. PRESSURE   |  |
|                  | OUTPUT RANGE   | SIGNAL 4-20MA DC (ANALOG) along WITH SUPERIMPOSED DIGITAL SIGNAL (BASED ON HART PROTOCOL )   |  |
|                  | TURN DOWN RATIO  | 10:1 FOR VACUUM /VERY LOW PRESSURE APPLICATION<br>30:1 FOR OTHER APPLICATION   |  |
|                  | ACCURACY   | ± 0.1% OF CALIBRATED SPAN(MINIMUM)   |  |
|                  | STABILITY  | ± 0.1% OF CALIBRATED SPAN FOR 6 MONTHS FOR RANGE UPTO AND INCLUDING 70 Kg/cm <sup>2</sup><br>± 0.25% OF CALIBRATED SPAN FOR 6 MONTHS FOR RANGE MORE THAN 70 Kg/cm <sup>2</sup> |  |
|                  | LOAD IMPEDANCE   | 500 OHM (MIN)  |  |
|                  | RESPONSE TIME (TIME TAKEN FROM CHANGE IN PHYSICAL PARAMETER INPUT CHANGE TO TRANSMITTER , OUTPUT REACHING 63.2 % OF IT'S TOTAL CHANGE INCLUDING THAT TIME) | 100 ms OR BETTER   |  |
|                  | HOUSING  | IP 55(with corrosion resistance epoxy coating)   |  |
|                  | OVER PRESSURE  | 150 % OF MAX OPERATING PRESSURE  |  |
|                  | CONNECTION (ELECTRICAL)  | PLUG & SOCKET TYPE   |  |
|                  | PROCESS CONNECTION   | 1" , 150# RF   |  |
|                  | ZERO DRIFT & SPAN DRIFT  | +/- 0.015 PER DEG C AT AT MAX SPAN<br>+/- 0.11 PER DEG C AT AT MAX SPAN  |  |
|                  | SPAN & ZERO  | CONTINUOUS TEMPER PROOF,REMOTE AS WELL AS ADJUSTABLY MANUAL FROM INSTRUMENT WITH ZERO SUPPRESSION & ELEVATION FACILITY   |  |
|                  | DAIGNOSTICS  | SELF INDICATING FEATURE  |  |
| POWER SUPPLY     | 24 V DC ± 10%  |  |  |




|  |  |  |   |       |
|--|--|--|---|-------|
|             | <b>DATA SHEET FOR PRESSURE /<br/>DIFFERENTIAL PRESSURE TRANSMITTER</b> |  | SPECIFICATION NO.:                          |       |
|  |  |  | VOLUME                                      |       |
|  |  |  | SECTION                                     |       |
|  |  |  | REV. NO.                                    | DATE: |
|  |  |  | SHEET 2                                     | OF 3  |
| TAG No. .... Qty.....  |  | Data Sheet No.: PES-145-01-DS1- A  |   |       |
| <b>Data Sheet A &amp; B</b>  |  |  |   |       |
| DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER<br>(TO BE FILLED BY PURCHASER) |  |  | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER) |       |
|  | ADJUSTMENT/CALIBRATION/MAINTENANCE                                     | HAND HELD CALIBRATOR/HART .  |   |       |
|  | ACCESSORIES  | DIAPHRAGM SEAL,PULSATIONS<br>DAMPENERS,SYPHON ETC AS REQUIRED<br>BY SERVICE & OPERATING CONDITION, 2<br>VALVE MANIFOLD FOR ABSOLUTE<br>PRESSURE TRANSMITTER (3 -VALVE<br>MANIFOLD FOR GAUGE /VACUUM<br>PRESSURE TRANSMITTER )AND 5 VALVE<br>MANIFOLD FOR DP /LEVEL/FLOW<br>TRANSMITTER |   |       |




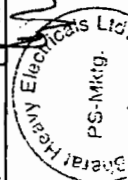

|   |                                      | <b>CHECK LIST FOR<br/>PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER<br/>(Mechanical Auxiliary Packages)</b> |  | SPECIFICATION NO.:<br>VOLUME<br>SECTION<br>REV. NO.      DATE:<br>SHEET <u>3</u> OF <u>3</u><br>Data Sheet No.: <b>PE-CL-999-145-1026-0</b> |   |   |   |
|--|--------------------------------------|--|--|---|---|---|---|
| SL NO  | TESTS/CHECKS                         | QUANTM OF CHECK  | REFERENCE DOC. ACCEPTANCE NORMS            | AGENCY  |   |   | REMARKS   |
|  |                                      |  |  | M   | C | B |   |
| 1.0  | CHECKS FOR VISULA, MODEL TAG NO.     | SEE NOTE-1 BELOW   | APPROVED TECHINCAL REQUIREMENT/ DATA SHEET | P   | W | V | MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATERIAL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED |
| 2.0  | PROCESS CONNECTION                   | -do-   |  | P   | W | V |   |
| 3.0  | ACCURACY                             | -do-   |  | P   | W | V |   |
| 4.0  | REPEATEABILITY                       | -do-   |  | P   | W | V |   |
| 5.0  | HYSTERISIS                           | -do-   |  | P   | W | V |   |
| 6.0  | EFFECT OF TEMP VARIATION ON ACCURACY | -do-   |  | P   | W | V |   |
| 7.0  | SPAN /ZERO ADJUSTMENT                | ONE/TYPE   |  | P   | W | V |   |
| 8.0  | EFFECT OF SUPPLY VOLTAGE VARIATION   | ONE/TYPE   |  | P   | W | V |   |
| 9.0  | HIGH PRESSURE TEST                   | SEE NOTE-1 BELOW   |  | P   | W | V |   |
| 10.0   | BURN IN TEST                         | ONE/TYPE   |  | P   | W | V |   |
| 11.0   | DEGREE OF PROTECTION                 | ONE/TYPE   |  | P   | W | V |   |
| <b>LEGEND:</b><br>M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.<br><br><b>NOTE:</b><br>1. QUANTUM OF CHECK SHALL BE AS BELOW<br>100 % - BY MANUFACTURER<br>RANDOM FOR EACH TYPE - BY BHEL & CUSTOMER<br>2. MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.<br>3. IN CASE OF IMPORTED ITEMS CONTRACTORS SHALL REVIEW TC's AND NOT INSPECT.<br><br>CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL. |                                      |  |  |   |   |   |   |



|   |   |  |                          |
|---|---|--|--------------------------|
|  | <b>TITLE : TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER ON LOAD TUBE CLEANING<br/>SYSTEMS (COLTCS)</b> | <b>SPEC. NO. PE-TS- 387/388-165-N001</b> |                          |
|   |   | <b>VOLUME : IIB</b>                      |                          |
|   |   | <b>SECTION : D</b>                       |                          |
|   |   | <b>REV. NO. 0</b>                        | <b>DATE : 04.02.2013</b> |
|   |   | <b>SHEET 1 of 1</b>                      |                          |
| <p><b>LIST OF SUBVENDORS</b></p>  |   |  |                          |




| <div style="border: 1px solid black; padding: 5px; text-align: center;">NTPC</div> |   | PROJECT : 12X660 MW MOUDA STPP, STAGE-II<br>1X500 MW VINDHYACHAL STPP |                                |                   |                 |                        |           | LIST OF ITEMS REQUIRED |                   | REF. NO :         |   |
|--|---|---|--------------------------------|-------------------|-----------------|------------------------|-----------|------------------------|-------------------|-------------------|---|
|  |   | PACKAGE : TG PACKAGE  |                                |                   |                 |                        |           | APPROVAL & ACCEPTABLE  |                   | REVISION NO : 00  |   |
|  |   | CONTRACTOR : BHEL - PEM, HYD, EDN, BHOPAL, Trichy                     |                                |                   |                 |                        |           | VENDOR AS APPROVED BY  |                   | DATE : 11/11/2010 |   |
|  |   | CONTRACT NO : 9575-110 and 9586-110                                   |                                |                   |                 |                        |           |                        |                   |                   |   |
| No.  | Major Equipment                               | QP Inspection Category  | QP No. 9575-110/9586-110-QVI-Q | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier  | Country   | SS Approval Status     | SS Detail Sub.SCH | SS Approval SCH   | Remark  |
| 9  | Electronic transmitters (pressure, DP & flow) | III   |                                |                   |                 | EMERSON (Rosemount)    | USA/Daman | A                      |                   |                   |   |
|  |   | III   |                                |                   |                 | FUJI ELECTRIC YOKOGAWA | JAPAN     | A                      |                   |                   | Testing and Calibration at M/s YIL, Bangalore is also acceptable. |
|  |   | III   |                                |                   |                 | ABB                    | FARIDABAD | A                      |                   |                   | Model - 2600 T  |
|  |   | III   |                                |                   |                 | ABB                    | GERMANY   | A                      |                   |                   | Model - 2600 T  |

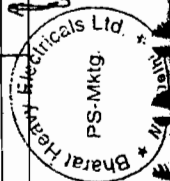


|  |                    |  |   |                         |                       |                                 |                              |                          |                         |                       |        |
|--|--------------------|--|---|-------------------------|-----------------------|---------------------------------|------------------------------|--------------------------|-------------------------|-----------------------|--------|
| <div style="border: 1px solid black; padding: 5px; text-align: center;">NTPC</div> |                    | PROJECT : 2X660 MW MOUDA STPP, STAGE-II<br>1X500 MW VINDHYACHAL STPP |   |                         |                       | LIST OF ITEMS : PURING QP       |                              | REF. NO :                |                         |                       |        |
|  |                    | PACKAGE : TG PACKAGE   |   |                         |                       | APPROVAL & ACCEPTABLE           |                              | REVISION NO : 00         |                         |                       |        |
|  |                    | CONTRACTOR : BHEL - PEM, HYD, EDN, BHOPAL, Trichy                    |   |                         |                       | VENDOR AS APPROVED BY           |                              | DATE : 11/11/2010        |                         |                       |        |
|  |                    | CONTRACT NO : 9575-110 and 9588-110                                  |   |                         |                       |                                 |                              |                          |                         |                       |        |
| No.  | Major Equipment    | QP<br>Inspection<br>Category   | QP No.<br>9575-110/<br>9588-110-<br>QVI-Q | QP<br>Submission<br>SCH | QP<br>Approval<br>SCH | Proposed Sub Supplier           | Country                      | SS<br>Approval<br>Status | SS<br>Detail<br>Sub.SCH | SS<br>Approval<br>SCH | Remark |
| 13   | Pressure, DP Gauge | III  |   |                         |                       | BALIGA<br>BUDENBERG<br>ASHCROFT | CHENNAI<br>UK<br>USA/Germany | DR<br>A<br>A             |                         |                       |        |


  
 AT



| NTPC |                      | PROJECT : 2X660 MW MOUDA STPP, STAGE-II<br>1X500 MW VINDHYACHAL STPP |                                |                   |                 |                       | LIST OF ITEMS RECEIVING QP |                    |                   | REF. NO :         |                                 |
|------|----------------------|--|--------------------------------|-------------------|-----------------|-----------------------|----------------------------|--------------------|-------------------|-------------------|---------------------------------|
|      |                      | PACKAGE : TG PACKAGE   |                                |                   |                 |                       | APPROVAL & ACCEPTABLE      |                    |                   | REVISION NO : 00  |                                 |
|      |                      | CONTRACTOR : BHEL - PEM, HYD, EDN, BHOPAL, Trichy                    |                                |                   |                 |                       | VENDOR AS APPROVED BY      |                    |                   | DATE : 11/11/2010 |                                 |
|      |                      | CONTRACT NO : 9575-110 and 9586-110                                  |                                |                   |                 |                       |                            |                    |                   |                   |                                 |
| No.  | Major Equipment      | QP Inspection Category   | QP No. 9575-110/9586-110-QVI-Q | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier | Country                    | SS Approval Status | SS Detail Sub SCH | SS Approval SCH   | Remark                          |
|      |                      | I  |                                |                   |                 | ECIL                  | Hyderabad                  | DR*                |                   |                   | Record updation - See footnotes |
|      |                      | I  |                                |                   |                 | Prammen               | Puddukottai                | A                  |                   |                   |                                 |
|      |                      | I  |                                |                   |                 | Chemlin               | Pondicherry                | A                  |                   |                   |                                 |
| 29   | Instrument Cables    | I  |                                |                   |                 | Paramount             | Khushkhera                 | A                  |                   |                   | PVC, FRLS type, RQP             |
|      |                      | I  |                                |                   |                 | Polycab               | Daman                      | A                  |                   |                   | PVC, FRLS type, RQP             |
|      |                      | I  |                                |                   |                 | Delton                | Faridabad                  | A                  |                   |                   | PVC, FRLS type, RQP             |
|      |                      | I  |                                |                   |                 | KEI                   | Bhiwadi                    | A                  |                   |                   | PVC, FRLS type                  |
|      |                      | I  |                                |                   |                 | Elkey Telelinks       | Faridabad                  | A                  |                   |                   | PVC, FRLS type                  |
|      |                      | I  |                                |                   |                 | CORDS                 | Bhiwadi                    | A                  |                   |                   | PVC, FRLS type, RQP             |
|      |                      | I  |                                |                   |                 | RELIANCE              | Bangalore                  | DR*                |                   |                   | PVC, FRLS type, RQP             |
|      |                      | I  |                                |                   |                 |                       |                            |                    |                   |                   | Record updation - See footnotes |
|      |                      | I  |                                |                   |                 | Nicco                 | Kolkata                    | A                  |                   |                   | PVC, FRLS type                  |
|      |                      | II   |                                |                   |                 | TEW & C               | USA                        | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Habia cables          | Sweden                     | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Kerpen cables         | Germany                    | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Lapp cables           | Germany                    | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Thermo electric Bv    | Netherland                 | A                  |                   |                   |                                 |
|      |                      | I  |                                |                   |                 | Universal Cable       | Sathia                     | A                  |                   |                   | PVC, FRLS type                  |
| 30   | Electrical actuator  | II   |                                |                   |                 | Auma                  | Germany                    | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Limitorque            | USA                        | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Rotorq                | UK                         | A                  |                   |                   |                                 |
|      |                      | I  |                                |                   |                 | Limitorque            | Faridabad                  | A                  |                   |                   |                                 |
|      |                      | II / I   |                                |                   |                 | Rotork                | Chennai/ Bangalore         | A                  |                   |                   | For Bangalore - CAT - I         |
|      |                      | II   |                                |                   |                 | Nippon gear           | Japan                      | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | Auma                  | Bangalore                  | A                  |                   |                   |                                 |
| 31   | Flow nozzle assembly | II   |                                |                   |                 | Microprecision        | Faridabad                  | A                  |                   |                   | Except P-91 Material            |
|      |                      | II   |                                |                   |                 | SEKO                  | Austria                    | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | TECHNOMATIC           | Italy                      | A                  |                   |                   |                                 |
|      |                      | II   |                                |                   |                 | ABB/ H&B              | UK                         | A                  |                   |                   |                                 |



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NTPC

PROJECT : 2X660 MW MOUDA STPP, STAGE-II  
1X500 MW VINDHYACHAL STPP

LIST OF ITEMS PURCHASING QP

REF. NO :

PACKAGE : TG PACKAGE

APPROVAL & ACCEPTABLE

REVISION NO : 00

CONTRACTOR : BHEL - PEM, HYD, EDN, BHOPAL, Trichy

VENDOR AS APPROVED BY

DATE : 11/11/2010

CONTRACT NO : 9575-110 and 9586-110

| No. | Major Equipment             | QP Inspection Category | QP No. 9575-110/9586-110-QVI-Q | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier | Country     | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH | Remark  |
|-----|-----------------------------|------------------------|--------------------------------|-------------------|-----------------|-----------------------|-------------|--------------------|-------------------|-----------------|---|
|     |                             | II                     |                                |                   |                 | IL                    | Palghat     | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | Daniel                | USA         | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | Starmedh              | Pune        | A                  |                   |                 |   |
|     |                             | *                      |                                |                   |                 | MINCO                 | GOA         | DR                 |                   |                 | Except P-91 Material  |
|     |                             | *                      |                                |                   |                 | Engg. Specialities    | Kolkata     | DR                 |                   |                 | * - Inspection category to be decided during vendor evaluation. |
| 32  | HIGH Temp. cable (PTFE/FEP) | III                    |                                |                   |                 | Habla cables          | Sweden      | A                  |                   |                 |   |
|     |                             | III                    |                                |                   |                 | Lapp cables           | Germany     | A                  |                   |                 |   |
|     |                             | III                    |                                |                   |                 | Kerpen cables         | Germany     | A                  |                   |                 |   |
|     |                             | III                    |                                |                   |                 | TEW & C               | USA         | A                  |                   |                 |   |
|     |                             | III                    |                                |                   |                 | Thermo-Electra Bv     | Netherland  | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | HFCL                  | Goa         | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | R&M                   | Switzerland | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | Aksh Fibre            | Bhiwadi     | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | Finolex               | Pune/Goa    | A                  |                   |                 |   |
|     |                             | II                     |                                |                   |                 | Birla Ericson         | Rawa        | A                  |                   |                 |   |

PS-Mktg. Bharat Heavy Electricals Ltd. New Delhi



NTPC

PROJECTS 2X660 MW MOUDA STPP, STAGE-II  
 CONTRACTOR 1X500 MW VINDHYACHAL STPP  
 CONTRACT NO:- 9575-110-2

LIST OF ITEMS REQUIRED FOR QUALITY PLAN  
 AND SUB-CONTRACTOR'S APPROVAL

Ref. No.  
 Revision No.

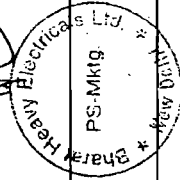
DATE :

| SR<br>NO | ITEM                                   | QP<br>/INS-<br>PN<br>CAT | QP<br>NUMB<br>ER | QP<br>SUB<br>MISS<br>ION<br>SCH | QP<br>APPL<br>SCH | PROPOSED<br>SUB-SUPPLIER            | PLACE          | SS<br>APPL<br>L<br>STA<br>TUS/<br>CAT | SS<br>DE<br>TAI<br>L<br>SU<br>B<br>SC<br>H | SS<br>APPL<br>SCH<br>EDUL<br>E | REMARK                                |
|----------|--|--------------------------|------------------|---------------------------------|-------------------|-------------------------------------|----------------|---------------------------------------|--|--------------------------------|---------------------------------------|
| 2        | MISC PUMPS - HORIZONTAL<br>CENTRIFUGAL | 1                        |                  |                                 |                   | WPIL                                | GAZIABAD       | A                                     |  |                                | CAPACITY REF NTPC<br>LTR DTD 03.03.08 |
|          |  | 1                        |                  |                                 |                   | JYOTI PUMPS                         | VADODRA        | A                                     |  |                                | CAP UPTO 2350 M3/HR                   |
|          |  | 1                        |                  |                                 |                   | SULZER<br>PUMPS INDIA               | MUMBAI         | A                                     |  |                                | CAP UPTO 1900 M3/HR                   |
|          |  | 1                        |                  |                                 |                   | BEST &<br>CROMPTON/BE<br>ACON WEAR) | CHANNAI        | A                                     |  |                                |                                       |
|          |  | 1                        |                  |                                 |                   | VOLTAS                              | MUMBAI         | A                                     |  |                                |                                       |
|          |  | 1                        |                  |                                 |                   | SAM                                 | COIMBATO<br>RE | A                                     |  |                                | CAPCITY UPTO 1350<br>M3/HR            |
|          |  | 1                        |                  |                                 |                   | KBL                                 | PUNE           | A                                     |  |                                |                                       |

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| NTPC                     |  | PROJECTS 2X660 MW MOUDA STPP, STAGE-II<br>CONTACTOR 1X500 MW VINDHYACHAL STPP |                  | LIST OF ITEMS REQUIRED FOR QUALITY PLAN<br>AND SUB-CONTRACTORS APPROVAL |                   |                          |          | Ref. No.<br>Revision No.              |  |                                |                             |
|--------------------------|--|---|------------------|---|-------------------|--------------------------|----------|---------------------------------------|--|--------------------------------|-----------------------------|
| CONTRACT NO:- 8575-110-2 |  |   |                  |   |                   | DATE :                   |          |                                       |  |                                |                             |
| SR NO                    | ITEM                                   | QP<br>/INS-<br>PN<br>CAT  | QP<br>NUMB<br>ER | QP<br>SUB<br>MISS<br>ION<br>SCH   | QP<br>APPL<br>SCH | PROPOSED<br>SUB-SUPPLIER | PLACE    | SS<br>/APP<br>L<br>STA<br>TUS/<br>CAT | SS<br>DE<br>TAI<br>L<br>SU<br>B<br>SC<br>H | SS<br>APPL<br>SCH<br>EDUL<br>E | REMARK                      |
| 2                        | MISC PUMPS - HORIZONTAL<br>CENTRIFUGAL | 1   |                  |   |                   | BDK<br>MARKETING         | HUBLI    | DR                                    |  |                                |                             |
|                          |  | 1   |                  |   |                   | FLOWMORE                 | GAZIABAD | A                                     |  |                                | CAPACITY UPTO 2000<br>M3/HR |
|                          |  | 1   |                  |   |                   | KSB                      | PUNE     | A                                     |  |                                |                             |
|                          |  | 1   |                  |   |                   | MATHER &<br>PLATT        | PUNE     | A                                     |  |                                |                             |

Suman N. S. P.



NTPC

PROJECTS 2X660 MW MOUDA STPP, STAGE-II  
CONTACTOR 1X500 MW VINDHYACHAL STPP

CONTRACT NO:- 9575-110-2

QUALITY PLAN  
AND SUB-CONTRACTORS APPROVAL

Revision No.

DATE:

| SR NO | ITEM   | QP /INS-<br>PN CAT | QP<br>NUMB<br>ER | QP<br>SUB<br>MISS<br>ION<br>SCH | QP<br>APPL<br>SCH | PROPOSED<br>SUB-SUPPLIER | PLACE       | SS<br>APPL<br>L<br>STA<br>TUS/<br>CAT | SS<br>DE<br>TAI<br>L<br>SU<br>B<br>SC<br>H | REMARK   |
|-------|--|--------------------|------------------|---------------------------------|-------------------|--------------------------|-------------|---------------------------------------|--|--|
| 13    | CCS VALVES OTHER THAN BHEL TRICHY                                | I                  |                  |                                 |                   | BDK                      | HUBLI       | A                                     |  | REFER NTPC LETTER DATED 24/02/00 :01/CQA/3520-001/C-04 |
|       |  | I                  |                  |                                 |                   | AUDCO(L&T)               | CHENNAI     | A                                     |  |  |
|       |  | I                  |                  |                                 |                   | KSB                      | COIMBATO RE | A                                     |  | UPTO 250 NB -600CL : & 400NB -300 CL : 600NB - 150 CL  |
|       |  | I                  |                  |                                 |                   | FOURESS ENGG.            | AURANGAB AD | A                                     |  |  |
|       |  | I                  |                  |                                 |                   | KBL                      | PUNE        | A                                     |  | GATE /GLOBE UPTO 300 NB - 600 CL, 600 NB-150 CL, CH    |
|       |  | I                  |                  |                                 |                   | PETROL VALVE             | ITALY       | A                                     |  | REFER NTPC LETTER DATED 24/02/00 :01/CQA/3520-001/C-04 |
| 14    | GM VALVES (UPTO 100 NB)  | II                 |                  |                                 |                   |                          |             |                                       |  | VENDOR APPROVAL BY NTPC NOT ENVISAGED.                 |
|       | CI VALVES (GATE UPTO 500 NB, GLOBE UPTO 250 NB, NRV UPTO 650 NB) | I                  |                  |                                 |                   | BANKIM                   | KOLKATTA    | A                                     |  | UPTO 350 NB -PN1.0                                     |
|       |  | I                  |                  |                                 |                   | KBL                      | KONDHAPU RI | A                                     |  | ONLY GATE UPTO 600 NB -PN1.0                           |
|       |  | I                  |                  |                                 |                   | H SARKAR                 | KOLKATTA    | A                                     |  | UPTO 350 NB -PN1.0                                     |
|       |  | I                  |                  |                                 |                   | LEADER ENGG. WORKS       | JULLUNDH ER | A                                     |  | GATE UPTO 600 NB ; GLOBE /CHECK UPTO 300 NB            |



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| NTPC     |                                  | PROJECTS 2X660 MW MOUDA STPP,STAGE-II<br>CONTACTOR 1X500 MW VINDHYACHAL STPP<br>CONTRACT NO:- 9575-110-2 |                  |                                 |                   | LIST OF ITEMS REQUIRED FOR QUALITY PLAN<br>AND SUB-CONTRACTORS APPROVAL |                              |                                      |  | Ref. No.<br>Revision No.       |                  |
|----------|----------------------------------|--|------------------|---------------------------------|-------------------|---|------------------------------|--------------------------------------|--|--------------------------------|------------------|
| SR<br>NO | ITEM                             | QP<br>/INS-<br>PN<br>CAT   | QP<br>NUMB<br>ER | QP<br>SUB<br>MISS<br>ION<br>SCH | QP<br>APPL<br>SCH | PROPOSED<br>SUB-SUPPLIER  | PLACE                        | SS<br>APP<br>L<br>STA<br>TUS/<br>CAT | SS<br>DE<br>TAI<br>L<br>SU<br>B<br>SC<br>H | SS<br>APPL<br>SCH<br>EDUL<br>E | REMARK           |
| 15       | BALL VALVES (NON FIRE SAFE TYPE) | I  |                  |                                 |                   | FLOWCHEM  | AHMEDABAD                    | A                                    |  |                                | UPTO 350 NBX150# |
|          |                                  | I  |                  |                                 |                   | AUDCO(L&T)  | CHANNAI /<br>KANCHIPU<br>RAM | A                                    |  |                                |                  |
|          |                                  | I  |                  |                                 |                   | BDK   | HUBLI                        | A                                    |  |                                | UPTO 400 NBX150# |
|          |                                  | I  |                  |                                 |                   | PEC   | NASIK                        | A                                    |  |                                | UPTO 400 NBX150# |
|          |                                  | I  |                  |                                 |                   | VAAS<br>AUTOMATION  | CHENNAI                      | DR                                   |  |                                |                  |
|          |                                  | I  |                  |                                 |                   | AKAY<br>INDUSTRIES  | HUBLI                        | A                                    |  |                                | UPTO 50 NB.      |
|          |                                  | I  |                  |                                 |                   | LEADER  | JALANDHAR                    | A                                    |  |                                | UPTO 50 NB.      |
|          |                                  | I  |                  |                                 |                   | MICROFINISH<br>VALVES   | HUBLI                        | A                                    |  |                                | UPTO 400NB, #300 |





NTPC

PROJECTS 2X660 MW MOUDA STPP, STAGE-II  
 CONTRACTOR 1X500 MW VINDHYACHAL STPP  
 CONTRACT NO:- 9575-110-2

LIST OF ITEMS REQUIRED TO QUALITY PLAN  
 AND SUB-CONTRACTOR'S APPROVAL

Ref. No.  
 Revision No.

DATE :

| SR NO | ITEM   | QP /INS-<br>PN<br>CAT | QP<br>NUMB<br>ER | QP<br>SUB<br>MISS<br>ION<br>SCH | QP<br>APPL<br>SCH | PROPOSED<br>SUB-SUPPLIER | PLACE      | SS<br>APP<br>L<br>STA<br>TUS/<br>CAT | SS<br>DE<br>TAI<br>L<br>SU<br>B<br>SC<br>H | SS<br>APPL<br>SCH<br>EDUL<br>E | REMARK  |
|-------|--|-----------------------|------------------|---------------------------------|-------------------|--------------------------|------------|--------------------------------------|--|--------------------------------|---|
| 18    | CRH-7,8,9, DEAERATOR PEGGING VALVES  | I                     |                  |                                 |                   | PETROL VALVES            | ITALY      | A                                    |  |                                |   |
| 19    | ANGLE VALVES   | I                     |                  |                                 |                   | IL                       | PALGHAT    | A                                    |  |                                | UP TO 2 INCH SIZE                                 |
|       |  | I                     |                  |                                 |                   | VELAN INC                | CANADA     | A                                    |  |                                | UP TO 2 INCH SIZE                                 |
|       |  | I                     |                  |                                 |                   | SAMPELL AG               | GERMANY    | A                                    |  |                                |   |
|       |  | I                     |                  |                                 |                   | REINEKE                  | GERMANY    | A                                    |  |                                |   |
| 20    | BUTTERFLY VALVES IN CI / CCS / CSS CONST(UPTO PN 10 & SUBJECT TO LIFE CYCLE TEST). | I                     |                  |                                 |                   | KBL                      | KONDHAPURI | A                                    |  |                                | CI/CCS UPTO 1400 MM SIZE                          |
|       |  | I                     |                  |                                 |                   | FOURESS ENGG.            | BANGALORE  | A                                    |  |                                |   |
|       |  | I                     |                  |                                 |                   | AUDCO                    | CHANNAI    | A                                    |  |                                |   |
|       |  | I                     |                  |                                 |                   | BDK PROCESS CONTROL      | HUBLI      | A                                    |  |                                | CI/CCS UPTO 1050 MM SIZE                          |
|       |  | I                     |                  |                                 |                   | INTERVALVE               | PUNE       | A                                    |  |                                | UPTO 500 NB                                       |
|       |  | I                     |                  |                                 |                   | TYCO                     | HALOL      | A                                    |  |                                | UPTO 500NB PN16, & UPTO 900NB PN10, (2200NB PN 08 |



Sunder Mehta



| NTPC  |   | PROJECTS 2X660 MW MOUDA STPP, STAGE-II<br>CONTACTOR 1X500 MW VINDHYACHAL STPP<br>CONTRACT NO:- 8575-110-2 |                  |                                 |                   | LIST OF ITEMS REQUIRED<br>AND SUB-CONTRACTORS APPROVAL |         |                                      |  | IG QUALITY PLAN                |                          | Ref. No.<br>Revision No. |  |
|-------|---|---|------------------|---------------------------------|-------------------|--|---------|--------------------------------------|--|--------------------------------|--------------------------|--------------------------|--|
| SR NO | ITEM  | QP<br>/INS-<br>PN<br>CAT  | QP<br>NUMB<br>ER | QP<br>SUB<br>MISS<br>ION<br>SCH | QP<br>APPL<br>SCH | PROPOSED<br>SUB-SUPPLIER                               | PLACE   | SS<br>APP<br>L<br>STA<br>TUS/<br>CAT | SS<br>DE<br>TAI<br>L<br>SU<br>B<br>SC<br>H | SS<br>APPL<br>SCH<br>EDUL<br>E | REMARK                   | DATE :                   |  |
| 20    | BUTTERFLY VALVES IN CI / CCS / CSS<br>CONST (UPTO PN 10 & SUBJECT TO<br>LIFE CYCLE TEST). | I   |                  |                                 |                   | IL   | PALGHAT | A                                    |  |                                |                          |                          |  |
|       |   | I   |                  |                                 |                   | STAFFORD<br>CONTROLS                                   | PUNE    | DR                                   |  |                                |                          |                          |  |
| 21    | AIR RELEASE VALVES  | III   |                  |                                 |                   |  |         |                                      |  |                                | BHEL APPROVED<br>SOURCES |                          |  |





- 1 MOTORS LV E1027 BHARAT BIJLEE LTD. PB NO 7011,MILAP NIKETAN 4th FLR 8-A  
BAHADUR SHAH ZAFAR MARG,N.DELHI-110002 3354613,3319694
- 2 MOTORS LV C02 CROMPTON GREAVES VANDHANA BUILDING 11, TOLSTOY MARG  
NEW DELHI-110001 3730445,3721534
- 3 MOTORS LV A24 ASEA BROWN BOVERI IST FLOOR,QUTUB HOTEL SHAHID JEET  
SINGH MARG NEW DELHI-110016 6856205,206,208
- 4 MOTORS LV K01 KIRLOSKAR ELECTRIC CO LTD. P.O. BOX 5555 MALLESWARAM WEST  
BANGALORE 560055 3322111,3322771
- 5 MOTORS LV A35 NGEF BANK OF BARODA BDG PBNO.633,16,SANSAD MARG NEW  
DELHI-110001 3320893,3328983
- 7 MOTORS LV S01 SIEMENS 4A, RING ROAD I.P. ESTATE NEW DELHI 110002  
3318144,3317152
- 8 MOTORS LV M01 MARATHON 708, EROS APARTMENT 56, NEHRU PLACE NEW DELHI-  
110019 1146519440
- 9 MOTORS LV A35 GE-POWER 150 AIRPORT ROAD BANGALORE-560017  
5263671,5268413
- 10 MOTORS LV E1115 RAJINDRA ELECT INDUSTRIES 14 SHAH IND.ESTATE VEERA DESAI  
RD,ANDHERI(W) MUMBAI-400053 6367943,6367944
- 11 MOTORS LV L04 LAXMI HYDRAULICS PVT. LTD 129/130, INDUSTRIAL ESTATE PATIL  
NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA