**NTPC LIMITED**

**3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.**

# VOLUME -IIB

# TECHNICAL SPECIFICATION
# FOR
# MISCELLANEOUS PUMPS

**Specification No. : PE-TS-405-100-N001 (REV. 0)**

**BHARAT HEAVY ELECTRICALS LIMITED**
**POWER SECTOR**
**PROJECT ENGINEERING MANAGEMENT**
**PPEI BUILDING, SECTOR 16 A**
**NOIDA - 201301**

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 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).

1.2.2 Volume - III TECHNICAL SCHEDULES

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 checklist,sec B7 in vol 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.

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- STANDARD TECHNICAL SPECIFICATIONS FOR VERTICAL PUMPS- NO. PE-TS-179-07
- DATA SHEETS-A FOR ABOVE PROJECT ALONGWITH LIST OF MANDATORY SPARES & WATER ANALYSIS.
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# SECTION A

# SCOPE OF ENQUIRY

## 1.0 SCOPE

1.1 This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and installation checks and replacement of gland packing with Mechanical Seal arrangement (if applicable) at site, PG Testing at site ( as specified in section C) for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification for following project

3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.

The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.

1.2 The miscellaneous pumps covered under this specification shall be Horizontal pumps.

**NOTE:-**

**a) The bidder shall include complete supplies for the Project/Group as above in his scope. Part supplies offered for the Project/Group shall disqualify the bidder's offer for that Project/Group.**

1.3 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning. Replacement of gland packing with Mechanical Seal (If applicable) as per Cl. No. 2.0 of Section C1 & Cl. No. 9.08.04 of section D of this volume. The charges for these shall be included by bidder in his offer.

1.4 The miscellaneous pumps and drives covered under this specification for various projects are as per Annexure I. HT drives, wherever applicable and irrespective of motor ratings, shall be issued free of cost by BHEL. The details of pumps with HT drives shall be as per Annexure II.

The Capacity, Head, Materials of construction, Mandatory spares and other particulars of these pumps, are detailed in Data Sheet-A annexed with Section-D of the specification.

1.5 For detailed scope of supply & services refer clause 3.00.00 of Standard technical Specification for Horizontal Centrifugal pumps specified under Section-D of this volume.

1.6 Electrical scope between BHEL and Vendor for Miscellaneous pumps and drives of this specification shall be as per annexure I of section C-2 of this volume.

## 2.0 GENERAL TECHNICAL INSTRUCTIONS

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

2.2 The ommission of specific reference to any component/accessory necessary for the proper performance of Miscellaneous Pumps and drives shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.

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

2.4 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.

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

2.6 Unpriced copy of the price bid shall be furnished alongwith the technical bid.

**Annexure I**

## List of Miscellaneous Pumps and drives for :

### A. 3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.

| Sl. No. | Pump Description | Total Qty. | Type of Pumps |
|---|---|---|---|
| | **Horizontal Pumps (Group I)** | | |
| 1 | DMCW TG Aux's PUMP | 9 nos. | Horizontal |
| 2 | DMCW SG Aux's PUMP | 6 nos. | Horizontal |
| 3 | ACW PUMP | 9 nos. | Horizontal |
| 4 | AHS COOLING PUMP | 2 nos. | Horizontal |
| 5 | SERVICE WATER PUMPS | 4 nos. | Horizontal |
| 6 | HVAC M/U PUMP | 2 nos. | Horizontal |
| 7 | APH/ESP WASH PUMP | 2 nos. | Horizontal |
| 8 | ACW M/U PUMP | 3 nos. | Horizontal |
| 9 | CONDENSATE TRANSFER PUMP | 3 nos. | Horizontal |
| 10 | DM WATER M/UP PUMP | 4 nos. | Horizontal |
| 11 | BOILER FILL PUMP | 2 nos. | Horizontal |

| Sl. No. | Pump Description | Total Qty. | Type of Pumps |
|---|---|---|---|
| | **Vertical Pumps (Group II)** | | |
| 1 | PLANT POTABLE WATER PUMP | 2 nos. | Vertical |
| 2 | COLONY POTABLE WATER PUMPS | 2 nos. | Vertical |

**Annexure II**

**Following HT drives for 3X 660 MW NORHT KARANPURA STPP, irrespective of Motor ratings shall be issue free, by BHEL:**

**Horizontal Pumps (Group I):**

1 DMCW TG Aux's Pumps
2 ACW Pumps
3 APH/ESP Wash Pumps

**Vertical Pumps (Group II): NIL**

# SECTION B

# PROJECT INFORMATION

# SECTION B1

# PROJECT INFORMATION

## 3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.

1.00.00 **BACKGROUND**

North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.

The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.

1.01.00 **Location and Approach**

The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site.
Major rail/road distances from the project site are as under:

| **City** | | **Distance Approx. (kms)** |
|---|---|---|
| Ranchi | : | 150 |
| Khalari | : | 40 |

The site is located near Tandwa town having latitude and longitude of about $23^0$ 50' N to 23º 52' N and $84^0$ 59' E to 85º 2' E respectively. The Vicinity Plan of the project is placed at **Annexure-I.**

Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.

1.02.00 **Land**

About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township.
Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.

1.03.00 **Water**

Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.

1.04.00 **Fuel (Coal)**

1.04.01 **Coal Requirement, Availability and Linkage**

Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.

Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.

1.04.02 **Coal Transportation**

Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.

1.05.00 **Meteorological Data**

Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II**.**

1.06.00 **Plant Water Scheme**

The Plant water scheme is described below.

1.06.01 **Condenser Cooling System**

It is proposed to adopt Air Cooled Condenser for the project.

1.06.02 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.

1.06.03 **Ash Water System**

It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.

1.06.04 **Other Miscellaneous Water Systems**

(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc.

(b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash 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.

(c) The drinking water requirement of the plant shall be provided from water treatment plant.

(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.

(e) The quality of Raw water is enclosed with this sub-section as Annexure-III.

1.07.00 **Criteria for Earthquake Resistant Design of Structures and Equipment**

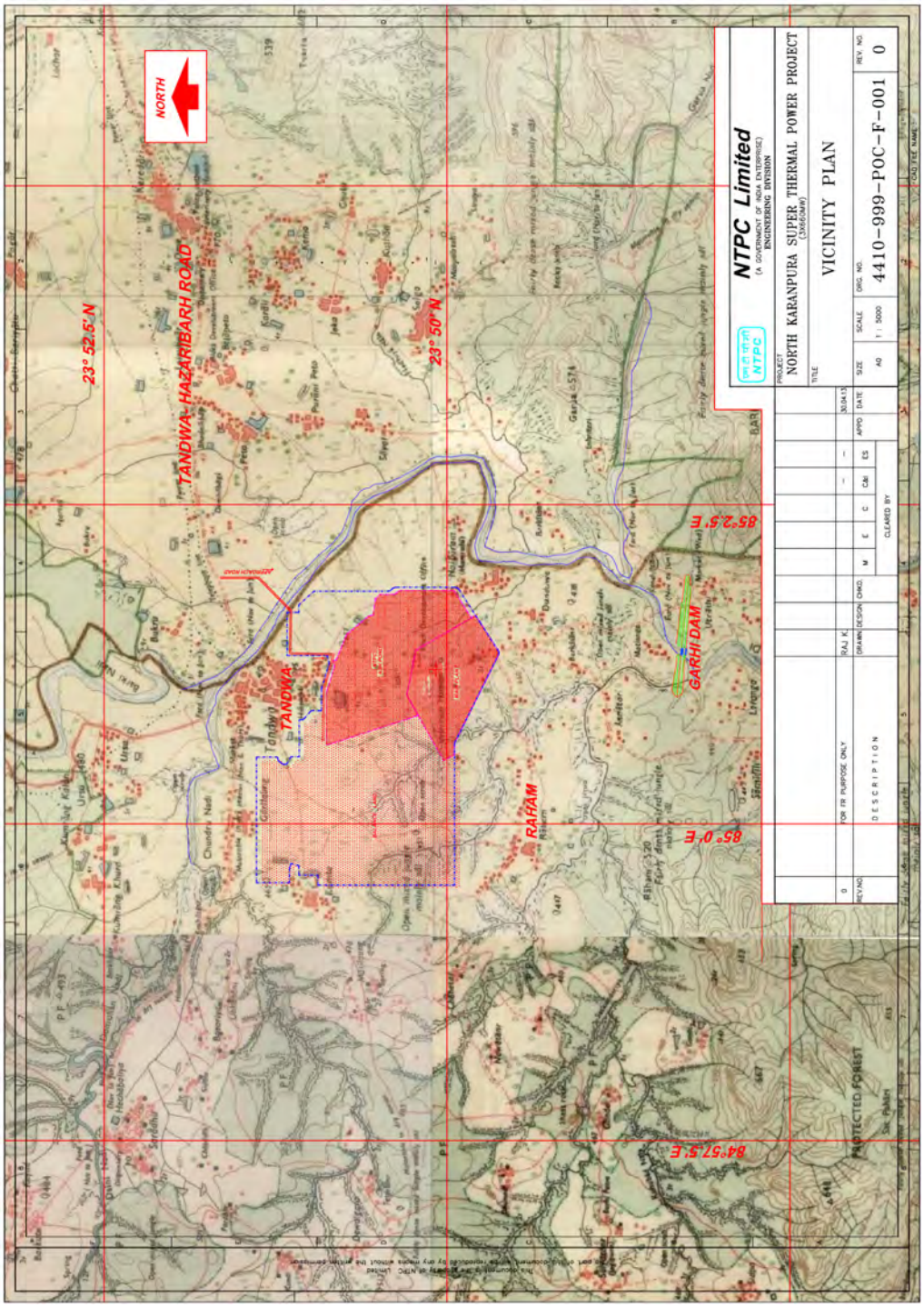
All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.

1.08.00 **Criteria for Wind Resistant Design of Structures and Equipment**

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.

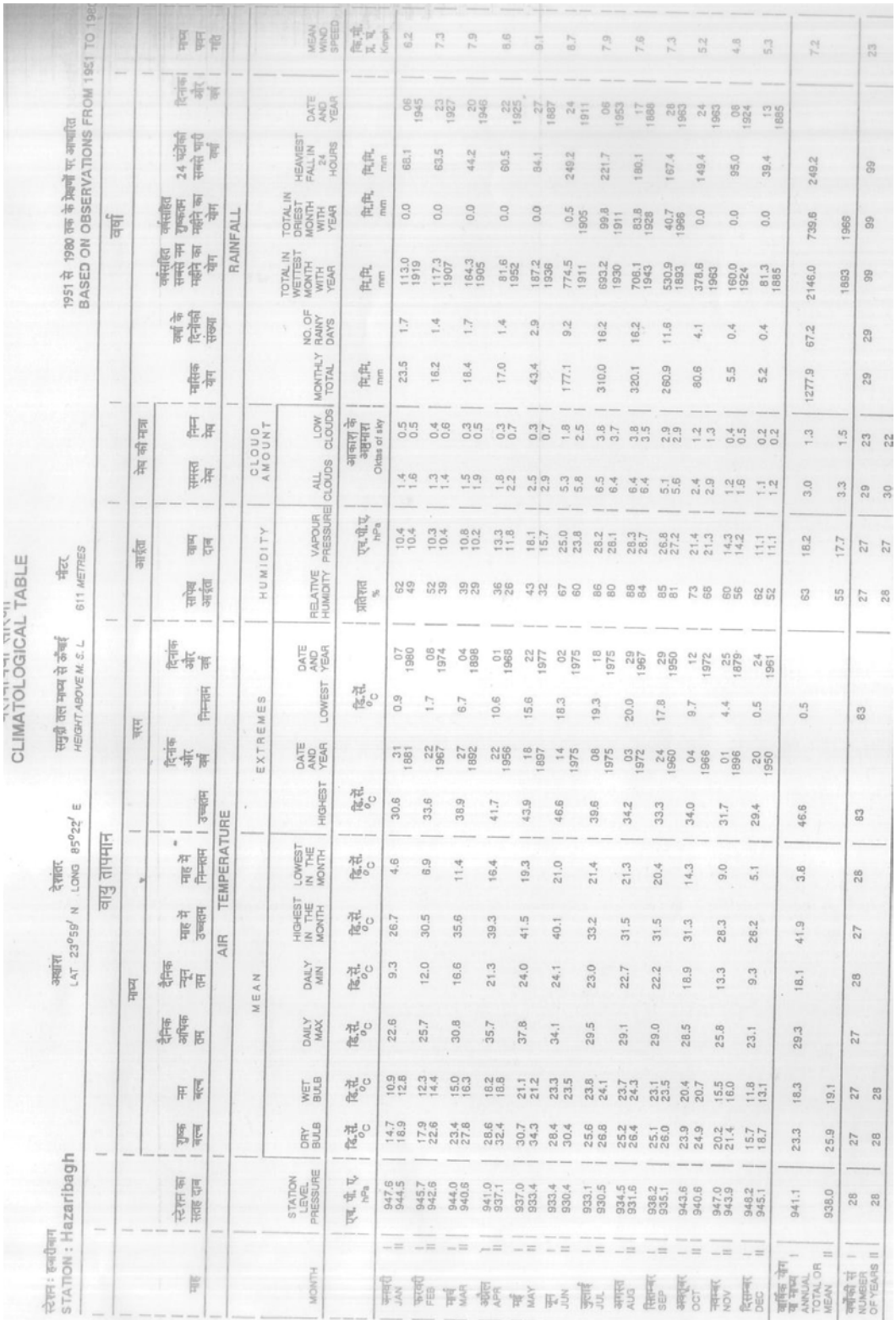
Annexure-I

## VICINITY PLAN



Annexure-II

## CLIMATOLOGICAL TABLE



CLIMATOLOGICAL TABLE

स्टेशन : हजारीबाग STATION : Hazaribagh

अक्षांश LAT 23°59′ N देशांतर LONG 85°22′ E समुद्री तल माप से ऊँचाई HEIGHT ABOVE M.S.L. 611 METRES

1951 से 1980 तक के प्रेक्षणों पर आधारित BASED ON OBSERVATIONS FROM 1951 TO 1980

| MONTH | स्टेशन स्तर वायुदाब STATION LEVEL PRESSURE एच. पी. ए. hPa | वायु तापमान AIR TEMPERATURE MEAN शुष्क बल्ब DRY BULB डि.से. °C | नम बल्ब WET BULB डि.से. °C | दैनिक अधिक तम DAILY MAX डि.से. °C | दैनिक न्यून तम DAILY MIN डि.से. °C | माह में उच्चतम HIGHEST IN THE MONTH डि.से. °C | माह में निम्नतम LOWEST IN THE MONTH डि.से. °C | चरम EXTREMES उच्चतम HIGHEST डि.से. °C | दिनांक और वर्ष DATE AND YEAR | निम्नतम LOWEST डि.से. °C | दिनांक और वर्ष DATE AND YEAR | आर्द्रता HUMIDITY सापेक्ष आर्द्रता RELATIVE HUMIDITY प्रतिशत % | वाष्प दाब VAPOUR PRESSURE एच.पी.ए. hPa | मेघ की मात्रा CLOUD AMOUNT समस्त मेघ ALL CLOUDS आकाश के अष्टमांश Oktas of sky | निम्न मेघ LOW CLOUDS | वर्षा RAINFALL मासिक योग MONTHLY TOTAL मि.मि. mm | वर्षा के दिनों की संख्या NO. OF RAINY DAYS | वर्षासहित समस्त नम महीने का योग TOTAL IN WETTEST MONTH WITH YEAR मि.मि. mm | वर्षारहित शुष्कतम महीने का योग TOTAL IN DRIEST MONTH WITH YEAR मि.मि. mm | 24 घंटों में समस्त भारी वर्षा HEAVIEST FALL IN 24 HOURS मि.मि. mm | दिनांक और वर्ष DATE AND YEAR | MEAN WIND SPEED माध्य पवन गति कि.मी. प्र. घं. Kmph |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| जनवरी JAN | I 947.6 | 14.7 | 10.9 | 22.6 | 9.3 | 26.7 | 4.6 | 30.6 | 31 1881 | 0.9 | 07 1980 | 62 | 10.4 | 1.4 | 0.5 | 23.5 | 1.7 | 113.0 1919 | 0.0 | 68.1 | 06 1945 | 6.2 |
| | II 944.5 | 18.9 | 12.8 | | | | | | | | | 49 | 10.4 | 1.6 | 0.5 | | | | | | | |
| फरवरी FEB | I 945.7 | 17.9 | 12.3 | 25.7 | 12.0 | 30.5 | 8.9 | 33.6 | 22 1967 | 1.7 | 08 1974 | 52 | 10.3 | 1.3 | 0.4 | 16.2 | 1.4 | 117.3 1907 | 0.0 | 63.5 | 23 1927 | 7.3 |
| | II 942.6 | 22.6 | 14.4 | | | | | | | | | 39 | 10.4 | 1.4 | 0.6 | | | | | | | |
| मार्च MAR | I 944.0 | 23.4 | 15.0 | 30.8 | 16.6 | 35.6 | 11.4 | 38.9 | 27 1892 | 6.7 | 04 1898 | 39 | 10.8 | 1.5 | 0.3 | 18.4 | 1.7 | 164.3 1905 | 0.0 | 44.2 | 20 1946 | 7.9 |
| | II 940.6 | 27.8 | 18.3 | | | | | | | | | 29 | 10.2 | 1.9 | 0.5 | | | | | | | |
| अप्रैल APR | I 941.0 | 28.6 | 18.2 | 35.7 | 21.3 | 39.3 | 16.4 | 41.7 | 22 1956 | 10.6 | 01 1968 | 36 | 13.3 | 1.8 | 0.3 | 17.0 | 1.4 | 81.6 1952 | 0.0 | 60.5 | 22 1925 | 8.6 |
| | II 937.1 | 32.4 | 18.8 | | | | | | | | | 26 | 11.8 | 2.2 | 0.7 | | | | | | | |
| मई MAY | I 937.0 | 30.7 | 21.1 | 37.8 | 24.0 | 41.5 | 19.3 | 43.9 | 18 1897 | 15.6 | 22 1977 | 43 | 18.1 | 2.5 | 0.3 | 43.4 | 2.9 | 187.2 1936 | 0.0 | 84.1 | 27 1887 | 9.1 |
| | II 933.4 | 34.3 | 21.2 | | | | | | | | | 32 | 15.7 | 2.9 | 0.7 | | | | | | | |
| जून JUN | I 933.4 | 28.4 | 23.3 | 34.1 | 24.1 | 40.1 | 21.0 | 46.6 | 14 1975 | 18.3 | 02 1975 | 67 | 25.0 | 5.3 | 1.8 | 177.1 | 9.2 | 774.5 1911 | 0.5 1905 | 249.2 | 24 1911 | 8.7 |
| | II 930.4 | 30.4 | 23.5 | | | | | | | | | 60 | 23.8 | 5.8 | 2.5 | | | | | | | |
| जुलाई JUL | I 933.1 | 25.6 | 23.8 | 29.5 | 23.0 | 33.2 | 21.4 | 39.6 | 08 1975 | 19.3 | 18 1975 | 86 | 28.2 | 6.5 | 3.8 | 310.0 | 16.2 | 693.2 1930 | 99.8 1911 | 221.7 | 06 1953 | 7.9 |
| | II 930.5 | 26.8 | 24.1 | | | | | | | | | 80 | 28.1 | 6.4 | 3.7 | | | | | | | |
| अगस्त AUG | I 934.5 | 25.2 | 23.7 | 29.1 | 22.7 | 31.5 | 21.3 | 34.2 | 03 1972 | 20.0 | 29 1967 | 88 | 28.3 | 6.4 | 3.8 | 320.1 | 16.2 | 706.1 1943 | 83.8 1928 | 180.1 | 17 1886 | 7.6 |
| | II 931.6 | 26.4 | 24.3 | | | | | | | | | 84 | 28.7 | 6.4 | 3.5 | | | | | | | |
| सितम्बर SEP | I 936.2 | 25.1 | 23.1 | 29.0 | 22.2 | 31.5 | 20.4 | 33.3 | 24 1960 | 17.8 | 29 1950 | 85 | 26.8 | 5.1 | 2.9 | 260.9 | 11.6 | 530.9 1893 | 40.7 1966 | 167.4 | 28 1963 | 7.3 |
| | II 935.1 | 26.0 | 23.5 | | | | | | | | | 81 | 27.2 | 5.6 | 2.9 | | | | | | | |
| अक्तूबर OCT | I 943.6 | 23.9 | 20.4 | 28.5 | 18.9 | 31.3 | 14.3 | 34.0 | 04 1966 | 9.7 | 12 1972 | 73 | 21.4 | 2.4 | 1.2 | 80.6 | 4.1 | 378.6 1963 | 0.0 | 149.4 | 24 1963 | 5.2 |
| | II 940.6 | 24.9 | 20.7 | | | | | | | | | 66 | 21.3 | 2.9 | 1.3 | | | | | | | |
| नवम्बर NOV | I 947.0 | 20.2 | 15.5 | 25.8 | 13.3 | 28.3 | 9.0 | 31.7 | 01 1896 | 4.4 | 25 1879 | 60 | 14.3 | 1.2 | 0.4 | 5.5 | 0.4 | 160.0 1924 | 0.0 | 95.0 | 06 1924 | 4.8 |
| | II 943.9 | 21.4 | 16.0 | | | | | | | | | 56 | 14.2 | 1.6 | 0.5 | | | | | | | |
| दिसम्बर DEC | I 948.2 | 15.7 | 11.8 | 23.1 | 9.3 | 26.2 | 5.1 | 29.4 | 20 1950 | 0.5 | 24 1961 | 62 | 11.1 | 1.1 | 0.2 | 5.2 | 0.4 | 81.3 1885 | 0.0 | 39.4 | 13 1885 | 5.3 |
| | II 945.1 | 18.7 | 13.1 | | | | | | | | | 52 | 11.1 | 1.2 | 0.2 | | | | | | | |
| वार्षिक योग ANNUAL TOTAL OR MEAN | I 941.1 | 23.3 | 18.3 | 29.3 | 18.1 | 41.9 | 3.6 | 46.6 | | 0.5 | | 63 | 18.2 | 3.0 | 1.3 | 1277.9 | 67.2 | 2146.0 1893 | 739.6 1968 | 249.2 | | 7.2 |
| | II 938.0 | 25.9 | 19.1 | | | | | | | | | 55 | 17.7 | 3.3 | 1.5 | | | | | | | |
| वर्षों की संख्या NUMBER OF YEARS | I 28 | 27 | 27 | 27 | 28 | 27 | 28 | 83 | | 83 | | 27 | 27 | 29 | 23 | 29 | 29 | 99 | 99 | 99 | | 23 |
| | II 28 | 28 | 28 | | | | | | | | | 28 | 27 | 30 | 22 | | | | | | | |

# SECTION C

## SPECIFIC TECHNICAL REQUIREMENTS

## C1: SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS

## C2: SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS

# SECTION C1

# SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS

**1.0 SPECIFIC TECHNICAL REQUIREMENTS:**

**DELIVERY:**

Delivery of miscellaneous pumps shall be as per NIT requirement.

**2.0 Horizontal Pumps:**

**2.1** Horizontal Pumps with Mechanical seal shall be supplied with gland packing arrangement to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be despatched alongwith main supply for this purpose. Shaft sleeve and any other item required for satisfactory operation of Mechanical seal after replacement at site shall be provided by the pump supplier without any cost implication to BHEL.

**2.2** Sucessful bidder (vendor) to demonstrate Vibration, Parallel operation and Noise level at site (at rated duty points) for each Horizontal Pump. Vendor to bring necessary instrumentation for the same at site.

**2.3** End customer specfic requirements are also to be complied. Same are attached as Annexure-I.

**3.0** For all HT Motor driven pumps, Pump bearing temperature measurement instruments (RTD) along with provision for mounting/ Installation of RTDs on the pump shall be in vendor scope. The Technical Specificationfor RTDs is attached as Annexure II.

**4.0 Vertical Pumps:**

**4.1** All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow.

**4.2** For Vertical pumps no thrust block is being provided. Bidder to design the pump foundation system (base plate,discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.

**5.0 Important Note :**

**5.1** MDCC after final inspection shall be provided to vendor on the basis of following:-

**5.1.1** List of items packed in each box with description & quantity.

**5.1.2** Photograph of each box in open & closed condition.

**5.1.3** Bidder to include handling instructions in engineering drg/doc and packing to be done in such a way to avoid damage of items in transit and long storage at site and same shall be approved in ontract stage by BHEL/Customer

**Annexure-1**

**HORIZONTAL CENTRIFUGAL PUMPS**

**1.00.00 SCOPE**

General requirements in respect of design, material, constructional features, manufacture, inspection, testing the performance at the Vendor's/ Sub-Vendor's works and delivery to site erection, field testing and commissioning of Horizontal Centrifugal Pumps.

**2.00.00 CODES AND STANDARDS**

2.01.00 Design, material, construction manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Indian standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.

2.02.00 **List of Applicable Standards**

| | | | |
|---|---|---|---|
| i) | IS : 1520 | - | Horizontal Centrifugal Pumps for clear cold fresh water. |
| ii) | IS : 5120 | - | Technical requirements of roto-dynamic special purpose pumps |
| iii) | API - 610 | - | Centrifugal pumps for general refinery service. |
| iv) | IS : 5639 | - | Pumps Handling Chemicals & corrosion liquids. |
| v) | IS : 5659 | - | Pumps for process water |
| vi) | HIS | - | Hydraulic Institute Standards; USA |
| vii) | ASTM-I-165-65 | - | Standards Methods for Liquid Penetration Inspection. |

2.03.00 In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.

**3.00.00 DESIGN REQUIREMENTS**

3.01.00 The maximum efficiency of pumps shall be preferably within + 10% of the rated design flow indicated in data sheets.

3.02.00 Total head capacity curve shall be continuously rising from the operating point towards shut - off without any zone of instability and with a minimum shut off head of 15% more than design head.

3.03.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.

3.04.00 Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation.

| Speed | Antifriction bearing | Sleeve bearing |
|---|---|---|
| 1500 rpm and below | 75.0 micron | 75.0 micron |
| 3000 rpm | 50.0 micron | 65.0 micron |

| | |
|---|---|
| | The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface. |
| 3.05.00 | The pumps shall be capable of starting with discharge valve fully open and close condition. |
| **4.00.00** | **DESIGN CONSTRUCTION** |
| 4.02.00 | Pump casing shall have radially/axially split type construction. The casing shall be designed to withstand the maximum shut - off pressure developed by the pump at the pumping temperature. |
| 4.03.00 | Pump casing shall be provided with a vent connection and piping with fittings & valves Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pr. Gauge as standard feature. |
| 4.04.00 | **Impeller**<br>Impeller shall be closed or semi-closed as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled. The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying pinning or lock rings. |
| 4.05.00 | **Impeller/ Casing Wearing Rings**<br>Replaceable type wearing rings shall be provided at suitable locations pumps. Suitable method of locking the wearing ring shall be used. |
| 4.06.00 | **Shaft**<br>The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. |
| 4.07.00 | **Shaft Sleeves**<br>Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening shaft and shaft sleeve assembly should ensure concentric rotation. |
| 4.08.00 | **Bearings**<br>Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble - free operation shall be furnished.<br>The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Anti-friction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hours of continuous operation at maximum axial and a radial loads and rated speed.<br>Proper lubricating arrangement for the bearings shall be provided such that lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearing assembly.<br>Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearing housing. |
| 4.09.00 | **Stuffing Boxes**<br>Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standard. If external gland sealing is required, it shall be done from the pump |

discharge. The Bidder shall provide the necessary piping, valves, fitting etc. for the sealing connection.

4.10.00 **Mechanical Seals:**

Wherever specified in pump data sheet, mechanical seals shall be provided The sealing face should be highly lapped surfaces of material known for their low frictional co-efficient & resistance to corrosion against the liquid being pumped.

4.11.00 **Pump Shaft Motor Shaft Coupling**

The Pump and motor shaft shall be connected with a adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor.

4.12.00 **Base Plate**

A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be of fabricated steel and of rigid construction, suitable ribbed and reinforced.

4.13.00 **Assembly and Dismantling**

Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.

4.14.00 **Drive Motor (Prime Mover)**

The KW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps is specified, the actual motor rating is to be selected considering overloading of the pump in the event of tripping of operating pumps. Continuous motor rating (at 50 deg. Cent, ambient) for pump shall be at least 10% above the maximum load demand of the driven equipment in the complete range.

**3X660 MW NORTH KARANPURA STPP**
**(UNIT NO. 1, 2 & 3)**

## SCOPE OF C&I FOR MISC. PUMPS

1. For each HT drives vibration pad is to be provided by pump supplier for mounting of vibration block of size 40mmx40mmx40mm. A key slot (30mmx15mmx3 mm) is to be provided on the drive shaft for phase marker.
2. RTD with thermo-well shall be provided for bearing temperature measurement by bidder.
3. The make/model of various instruments/items/systems shall be as per NTPC approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
4. Termination of cable from RTD with thermo-well to TB(Mounted on pump, TB in bidder scope) shall be in bidder scope.
5. The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
6. The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation a No deviation certificate is to be furnished.
7. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication.
8. Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However any instrument/ analyzer installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.
9. In addition to requirements specified here, all C&I systems/ sub-systems/ equipment/ devices shall also meet other requirements stipulated under other Sub-sections/ parts/ sections of specification.
10. Bidder shall supply any other instrument/Equipment required for proper functioning of the Pump system, as deemed necessary during contract without any price implication to BHEL.

| | | | |
|---|---|---|---|
| | 4 | Sheathing of Thermocouple | : Swaged type magnesium oxide insulation. |
| | 5 | Calibration and accuracy | : As per IEC-751/ANSI-C-96.1(special class) for T/C. |
| | 6 | Characteristic | : Linear with respect to temp, within ±1/2 percent of top range value. |
| | 7 | Accessories | : Thermo well (as specified below) and shall be spring loaded for positive contacts with the well. |
| | 8 | Standard | : ANSI C 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well. |

**3.02.00 Resistance Temperature Detector ( RTD )**

| Sr. No. | Features | | Essential/Minimum Requirements |
|---|---|---|---|
| 1 | Type of RTD. | : | Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade). |
| 2 | No. of element | : | Duplex |
| 3 | Housing/Head | : | IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. |
| 4 | Sheathing of RTD | : | Metal sheathed, ceramic packed |
| 5 | Calibration and accuracy | : | As per DIN-43760 Class-A for RTD |
| 6 | Characteristic | : | Linear with respect to temp, within ±1/2 percent of top range value. |
| 7 | Accessories | : | Thermo well (as specified below) and shall be spring loaded for positive contacts with the well. |
| 8 | Standard | : | DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well. |

**NOTES :**

1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.

2) The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.

**3.03.00** **Metal Temperature Thermocouples**

| | |
|---|---|
| Measuring Medium | Metal Temperature |
| Material of Thermocouple. | Chromel Alumel Type K |
| Type of Thermocouple | Duplex with separate hot junctions, ungrounded |
| Insulation | Mineral Insulation Magnesium Oxide. |
| Thermocouple wire gauge | 16 AWG |
| Protective sheath | SS 321 |
| Protective sheath dia | 8 mm O.D |
| Characteristics of Thermocouple | Special limits of error as in ANSI thermocouple MC 96.01, 1975 |
| Mounting accessories | 1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310. |
| Cold end sealing | SS pot weal with colour coded PTFE headed sleeve Insulated flexible tails. Sealing compound- Epoxy resin. |
| Minimum bending radius | 30 mm |
| Length of T/C | 30 Mtr. (minimum) |

**Notes :**

1) The specification for thermocouples of bearings metal temp measurements can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However type of thermocouples shall be K-type.

**3.04.00** **Thermo well** (for all process temp. elements)

(a) Shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974)

(b) For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided.

(c) For Air & Flue gas 316 SS protecting tube with welded cap. (However contractor shall provide better material for Flue gas service if required based on the specified boiler design parameters).

(d) For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.

**3.05.00** **~~Cold Junction Compensation ( CJC) Boxes~~**

| | | |
|---|---|---|
| a) | Ref. temp. | 60℃ ± 1.3 ℃ for type K Thermocouple<br>60℃ ± 2℃ for type R Thermocouple |
| b) | Effect of ambient temp. variation | ± 0.1% per 10℃ |
| c) | Material | 4 mm thick fiberglass reinforced polyester with Polyeutherene paint & glazed finish. |
| d) | Protection class | IP 55 |
| e) | Cable entry | Bottom with gland plates suitable for cables used along with blanking facility. |
| f) | Temp. control | Automatic with remote temperature monitoring. |
| g) | Power supply | 24 V DC. |

**3.06.00** **TEMPERATURE TRANSMITTER**

Following types of 2-wire temperature transmitter (directly powered from 4-20mA input cards of DDCMIS/PLC) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the contractor as well as Employer. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself.

a. Single Input Head mounted Temperature Transmitter

These shall be suitable for mounting in the head of temperature element itself. The protection class of head of thermo well along with its plug-in connector shall be min. IP65.

b. Single Input DIN-rail mounted Temperature Transmitter

These shall be suitable for mounting on DIN-rails in JBs. The specifications of the JBs shall be same as indicated in Subsection INST CABLE with additional DIN-rails and IP 65 Protection class . This temperature transmitter shall be the ones which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail.

**3.00.00** **TYPE TEST REQUIREMENT FOR C&I SYSTEMS**

| Sl. No | Item | Test Requirement | Standard | Test To Be Specifically Conducted | NTPC's Approval Req. On Test Certificate |
|---|---|---|---|---|---|
| Col 1 | Col 2 | Col 3 | Col 4 | Col 5 | Col 6 |
| 1 | Elect. Metering instruments | As per standard (col 4) | IS-1248 | No | Yes |
| 2 | Transducers | As per standard (col 4) | IEC-60688,IS12784 | No | Yes |
| 3 | Thermocouple | Degree of protection test | IS-13947 | No | No |
| 4 | RTD | As per standard (col 4) | IEC-60751 | No | No |
| 5 | Electronic transmitter | As per standard (col 4) | BS-6447 / IEC-60770 | No | Yes |
| 6 | E/P converter | As per standard (col 4) | Mfr. standard | No | Yes |
| 7 | Dust emission monitor | Degree of protection test | IS-13947 | No | Yes |
| 8 | Instrumentation Cables Twisted & Shielded* | | | | |
| | -Conductor | Resistance test | VDE-0815 | No | Yes |
| | | Diameter test | IS-10810 | No | Yes |
| | | Tin Coating test (Persul-phate test) | IS-8130 | No | Yes |
| | -Insulation | Loss of mass | VDE 0472 | No | Yes |
| | | Ageing in air ovens** | VDE 0472 | No | Yes |

**STANDARD CHECK LIST FOR C&I INSTRUMENTS**

## CHECK LIST FOR TEMPERATURE ELEMENT - RTD

| Sl. No. | Test / Checks | Quantum of check | Reference Doc. / Acceptance Norms | Agency ** | | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | M | C | B | |
| 1 | CHECK FOR | SEE NOTE-1 BELOW | APPROVED SPEC./ DATA SHEETS | P | W | V | |
| | TYPE | | | | | | |
| | MODEL No./TAG No. | | | | | | |
| | PROCESS CONNECTION | | | | | | |
| 2 | STABILITY | -do- | -do- | P | W | V | |
| 3 | INSULATION RESISTANCE | -do- | -do- | P | W | V | |
| 4 | ENCLOSURE CLASS | -do- | -do- | P | W | V | |
| 5 | RESPONSE TIME | -do- | -do- | P | W | V | |
| 7 | ACCURACY | -do- | -do- | P | W | V | |
| 8 | HYDROSTATIC TEST | -do- | -do- | P | W | V | |
| 9 | ELECTRICAL CHARACTERISTIC OF SENSOR (CONTINUTY OF T/C WIRES & INSULATION RESISTANCE OF RTD LEADS w.r.t. BODY | -do- | -do- | P | W | V | |
| 10 | TEMP CURVES / CHARTS | | | P | V | V | |
| 11 | AMBIENT TEMP. EFFECT CHECK | -do- | -do- | P | W | V | |
| 12 | HV TEST | -do- | -do- | P | W | V | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**Legend :**

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

**Note :**

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.
4. IBR certificate to be provided, if applicable

# SECTION C2

# SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS

# TECHNICAL SPECIFICATION FOR

# MISCELLANEOUS PUMP

# (ELECTRICAL PORTION)

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) Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
f) 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
g) 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.
h) Motor shall meet minimum requirement of motor specification.
i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
j) Cable BOQ worked out based on routing of cable listing provided by the vendor for " both end equipment in vendor's scope"shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

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) Electrical scope between BHEL & vendor (Annexure –I)
b) NTPC Technical specification and standard BHEL speicification for motors.
c) Datasheets(A&C) & quality plan for motors(BHEL & NTPC).
d) Electrical Load data format (Annexure –II)
e) BHEL cable listing format (Annexure –III)

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

PACKAGE: MISC. PUMP (Supply Package)

PROJECT: KARANPURA

| S.NO | DETAILS | SCOPE SUPPLY | SCOPE E&C | REMARKS |
|---|---|---|---|---|
| 1 | 415 V MCC | BHEL | BHEL | 1. BHEL will provide two suitable Power supply feeders to incoming terminal point of vendor equipment. |
| 2 | Local Push Button Station ( for motors) | BHEL | BHEL | Located near the motors. |
| 3 | Power cables, control cables and screened control cables | BHEL | BHEL | 1. Incoming cable from BHEL supplied MCC will be informed by BHEL. Screened control cable between DCS & field equipment will also be informed by BHEL. Vendor shall provide lugs & glands accordingly. |
| 4 | Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc | Vendor | BHEL | |
| 5 | Cable trays, accessories & cable trays supporting system | BHEL | BHEL | |
| 6 | Cable glands and lugs for equipments supplied by Vendor | Vendor | BHEL | 1. Tinned brass, double compression 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 | BHEL | 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 NTPC/ BHEL approval at contract stage. |
| 8 | Equipment grounding & lightning protection | BHEL | BHEL | |
| 9 | Junction box/Terminal Box for control &instrumentation cable | Vendor | - | |
| 10 | Below grade grounding | BHEL | BHEL | |
| 11 | LT Motors with base plate and foundation hardware | Vendor | BHEL | Makes shall be subject to BHEL 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 | BHEL | |
| 15 | a) Input cable schedules<br>b) Cable interconnection detail for the above<br>c) Cable block diagram | vendor<br>vendor<br>vendor | -<br>-<br>- | Cable listing for control cables for vendor supplied equipment (soft copies in the CUSTOMER cable schedule format) shall be furnished during detail engineering by vendor. |

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

PACKAGE: MISC. PUMP (Supply Package)

| | | | | |
|---|---|---|---|---|
| 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 routing details marked on the drawing as per CUSTOMER interface comments. Electrical equipment layout drawing shall be to CUSTOMER 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 after award of contract.
2. All QPs shall be subject to approval of BHEL after award of contract without any commercial implication.

## SPECIFIC ELECTRICAL REQUIREMENT FOR MISC PUMPS

**DATA SHEET-A**

| SL.NO. | PARAMETERS | UNIT | NORHT KARANPURA |
|---|---|---|---|
| | **MOTOR** | | |
| 1 | DESIGN AMBIENT TEMP | DEG. C | 50 |
| 2 | VOLTAGE SUPPLY AND VARIATION | VOLT | 415V, ± 10% |
| 3 | FREQUENCY WITH VARIATION | Hz | 50(+ 3% to - 5%) |
| 4 | COMBINED VOLTAGE & FREQUENCY VARIATION | | 10% (absolute) |
| 5 | MAX ACCEPTABLE RATING OF MOTOR AT 415 V | KW | (Upto) 160 KW, 3.3kv for 160kW and above |
| 6 | SYSTEM FAULT LEVEL AND ITS DUARTION | KA | 50kA for 1sec |
| 7 | SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION | | 50 KA, 0.2 sec |
| 8 | CLASS OF INSULATION & TEMP RISE LIMITED TO | | THERMAL CLASS B or better |
| 9 | MIN. STARTING VOLTAGE | | 85% below 110kW<br>80% from 110kW to 200kW |
| 10 | MOTOR RATING FOR SINGLE PHASE SUPPLY | | 0.2 kW & Below |
| 11 | RATIO OF LOCKED ROTOR KVA at rared voltage to RATED KW | | 10 for BELOW 110kW 9 for 110 kW to 200kW |
| 12 | ACCEPTABLE NOISE LEVEL | DB | 85dB(A) |
| 13 | TYPE OF STARTER PROVIDED IN MCC | | DOL |
| 14 | DOP OF ENCLOSURE | | IP-55 & IP-54 for outdoor & indoor resp as per IS 4691 & IEC 60034-05. |
| 15 | SPACE HEATER REQUIREMENT | >30kW | 30KW & ABOVE |
| 16 | PAINT SHADE | | RAL - 5012 (blue) |
| 17 | SPECIAL REQUIREMENT | | TYPE TEST REPORTS MORE THAN 10 YEARS OLD FROM THE DATE OF BID OPENING ARE NOT ACCEPTABLE |
| 18 | ENERGY EFFICIENT | | PREMIUM EFFICIENCY IE3 up to 160kW conforming to IS 12615 & IEC-60034-30 |
| 19 | LIST OF MAKE | | BHARAT BIJLI,KEC,MARATHON,CGL,ABB (list is tentative, subject to customer approval during detailed engineering) |

## MOTORS

**1.00.00 GENERAL REQUIREMENTS**

1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

1.02.00 All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.

1.03.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services.

1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.

1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.

1.07.00 Degree of Protection

Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :-

| | | | |
|---|---|---|---|
| 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 CODES AND STANDARDS**

| | | | |
|---|---|---|---|
| 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** **TYPE**

3.01.00 **AC Motors:**

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 **Premium Efficiency class-IE3**, conforming to IS 12615, or IEC:60034-30.

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** **RATING**

(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.

(b) Whenever the basis for motor or driven equipment 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.

( c) For BFP motors starting MVA shall be restricted to 60 MVA.

**5.00.00** **TEMPERATURE RISE**

**Air cooled motors**

70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.

**Water cooled**

80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

**6.00.00** **OPERATIONAL REQUIREMENTS**

6.01.00 **Starting Time**

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 | **Torque Requirements** |
| 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 | **Starting voltage requirement**<br>(a) 85% below 110 KW<br>(b) 80% from 110 KW to 200 KW<br>(c) 85% above 200 KW to 1000 KW<br>(d) 80% from 1001 KW to 4000 KW<br>(e) 75% above 4000KW<br>Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%. |
| **7.00.00** | **DESIGN AND CONSTRUCTIONAL FEATURES** |
| 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). Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below<br>(a) Fuel oil area : Group – IIB |

| | | | |
|---|---|---|---|
| | (b) Hydrogen generation | | :Group - IIC or (Group-I, Div-II as per plant area NEC) or ( Class-1, Group-B, Div-II as per NEMA /IEC60034) |
| 7.03.00 | Winding and Insulation | | |
| | (a) Type | : | Non-hygroscopic, oil resistant, flame resistant |
| | (b) Starting duty | : | Two hot starts in succession, with motor initially at normal running temperature. |
| | (c) 11kV & 3.3 kV AC motors | : | Thermal class 155 (F) insulation.<br>The winding insulation process shall be total Vacuum Presure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15 |
| | (d) 240VAC, 415V AC & 220V DC motors | : | Thermal Class( B ) or better |
| 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 | 11 KV motors shall be offered with Separate Insulated Connector (Elastimould or Equivalent make) as per IEEE 386. The offered Elastimould terminations shall be provided with protective cover and trifurcating sleeves. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds. | | |
| 7.10.00 | 3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 | | |

| | |
|---|---|
| | MVA for 0.12 sec. 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. |
| 7.11.00 | The spacing between gland plate & centre of terminal stud shall be as per Table-I. |
| 7.12.00 | 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. |
| 7.13.00 | 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. |
| 7.14.00 | For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box. |
| 7.15.00 | 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 | 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.<br>(a) Below 110KW : 10.0<br>(b) From 110 KW & upto 200 KW : 9.0<br>(c) Above 200 KW & upto 1000KW : 10.0<br>(d) From 1001KW & upto 4000KW : 9.0<br>(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 tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer. |
| 10.01.02 | 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.

10.01.03 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 waival 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.

10.01.04 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.

10.01.05 **LIST OF TYPE TESTS TO BE CONDUCTED**

**The following type tests shall be conducted on each type and rating of HT motor**

(a) No load saturation and loss curves upto approximately 115% of rated voltage

(b) Measurement of noise at no load.

(c) Momentary excess torque test (subject to test bed constraint).

(d) Full load test(subject to test bed constraint)

(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.

10.01.06 **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

The following type test reports shall be submitted for each type and rating of HT motor

(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.

(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.

(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15

(d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

10.02.00 **LT Motors**

10.02.01 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.

10.02.02 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.

10.02.03 **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

**The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only**

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors ( in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip .
5. Temperature rise test .
6. Momentary excess torque test.
7. High voltage test .

8. Test for vibration severity of motor.

9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)

10. Test for degree of protection and

11. Over speed test.

12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

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.

**TABLE - I**

**DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS**

| **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 |

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

**PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:**

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

| **Motor MCR in KW** | **Clearance** |
|---|---|
| UP to 110 KW | 10mm |
| Above 110 KW and upto 150 KW | 12.5mm |
| Above 150 KW | 19mm |

# MOTOR

| TESTS/CHECKS / TEMS/COMPONENTS | Visual | Dimensional | Make/Type/Rating /General 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 | | | | Y |
| Shaft | Y | Y | Y | Y | Y | Y | | | Y |
| Magnetic Material | Y | Y | Y | Y | | | Y | | |
| Rotor Copper/Aluminium | Y | Y | Y | Y | | | Y | | Y |
| Stator copper | Y | Y | Y | Y | | | Y | | Y |
| SC Ring | 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 | 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, Space heater, antifriction bearing, gaskets etc. | Y | Y | Y | | | | | | |
| Complete Motor | Y | Y | Y | | | | | | |

**Note**: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. ~~However, No QP for LT motor upto 50KW.~~ Refer separate QP for motors below 50kw.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

# MOTOR

| TESTS/CHECKS / ITEMS/COMPONENTS | Magnetic Characteristics | Hydraulic/Leak/Pressure Test | Thermal Characteristics | Run out | Dynamic Balancing | Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I | vibration | Over speed | Tan delta, shaft voltage & polarization index test | Paint shade, thickness & adhesion |
|---|---|---|---|---|---|---|---|---|---|---|
| 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, , Space heater, antifriction bearing, gaskets etc. | | | | | | | | | | |
| Complete Motor | | | | | | Y | Y | Y | Y1 | Y |

**Note**: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

# SECTION D

## STANDARD TECHNICAL SPECIFICATIONS

## D1: STANDARD TECHNICAL SPECIFICATIONS FOR PUMPS

## D2: STANDARD TECHNICAL SPECIFICATIONS FOR MOTORS

# SECTION D1

**STANDARD TECHNICAL SPECIFICATIONS FOR HORIZONTAL PUMPS NO. PE TS-179-06**

**STANDARD TECHNICAL SPECIFICATIONS FOR VERTICAL PUMPS NO. PE TS-179-07**

**DATA SHEET A ALONGWITH LIST OF MANDATORY SPARES & WATER ANALYSIS**

**DATA SHEET C**

**QUALITY PLAN**

## 1.00.00 GENERAL INFORMATION

1.01.00 The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for horizontal centrifugal pumps to be procured under the scope of this package.

## 2.00.00 CODES AND STANDARDS

2.01.00 In addition to the requirements spelt out elsewhere in the specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments subsequent to the year of publication as mentioned below.

| | | |
|---|---|---|
| 2.01.01 | IS-1520/1980: | Horizontal Centrifugal pumps for clear, cold and fresh water. |
| 2.01.02 | IS-5120/1977: | Technical requirements for Rotodynamic special Purpose pumps. |
| 2.01.03 | IS-5639/1970: | Pumps for handling chemicals & corrosive liquids. |
| 2.01.04 | IS-5659/1970: | Pumps for process water. |
| 2.01.05 | IS-6536/1972: | Pumps for handling volatile liquids. |
| 2.01.06 | IS-9137/1978: | Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'. |
| 2.01.07 | ISO 3555/1977: BS 5316/1977 Part 2 | Acceptance test for centrifugal, mixed flow and axial flow pumps - Class 'B' tests. |
| 2.01.08 | ISO 2548/1973: BS 5316/1976 Part 1 | - Do - Class 'C' tests. |
| 2.01.09 | API-610/1989: | Centrifugal pumps for general refinery services. |
| 2.01.10 | HIS | Hydraulic Institute Standards, USA |
| 2.01.11 | PTC 8.2/1965: | Power Test Codes - Centrifugal pumps. |
| 2.01.12 | ASTM-1-165-55 | Standard Methods for Liquid Penetration Inspection. |

2.02.00 In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.

**3.00.00 SCOPE OF SUPPLY & SERVICES:**

3.01.00 The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section A.

3.02.00 The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet A of the specification.

3.03.00 Accessories:

All the pumps under this specification shall be complete with following standard/special accessories.

3.03.01 Standard accessories:

a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end.
(The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00).

b) Pump motor coupling along with coupling guard.

c) Common base plate for pumps and motor.

d) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.

e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.

f) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations.

g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.

h) Suitable drain connections with isolating valves as applicable.

i) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.

j) Set of "Special" Tools & Tackles for Pumps and motors, if any.

k) Erection and commissioning spares, "on as required" basis.

l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.

m) Mandatory spares as specified in respective Data Sheet-A of this section.

3.04.00 Services included in Bidder's Scope:

3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A 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.

3.04.02 Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose.

3.04.03 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning.

3.04.04 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project will be conducted by BHEL at project site to ensure that the pumps meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site at no additional cost to BHEL.

3.04.05 Performance Guarantees for pumps shall stand valid till the satisfactory completion of performance testing by BHEL and its acceptance by purchaser / customer.

3.05.00 Works excluded from Bidder's Scope:

a) All HT motors and those LT Motors which are specifically excluded.
b) Civil foundation
c) Suction/ discharge pipe works
d) MCC/ Switchgear/Power supply
e) Power and Control Cables, unless specifically specified in Electrical/ Systems portion of the specification.
f) Erection of equipments.

**4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:**

4.01.00 The bids received shall be evaluated for power consumption at inlet to the motors, in respect of pumps specified in Data Sheet-A (working pump only viz. not the standby), for the purpose of price comparisons as briefed below:

The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump as follows.

$$KW = \frac{Q \times H \times S}{P \times M \times 367.2}$$

Where Q = Rated capacity $M^3$/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

4.02.00 The efficiencies for pumps and motors for arriving at benchmark power for Bid Evaluation shall be as indicated in Data Sheet A for various pumps.

No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 *above, considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A*. However the bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.

NOTE:
1. Efficiencies for HT motors and LT motors not in bidder's scope, for bid evaluation purpose shall be taken based on the maximum value as furnished in Data Sheet A.
2. During contract stage the Guaranteed power consumption of Pumps with BHEL supplied drives (HT/LT) for successful bidder shall be reworked by BHEL as below:

Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 *above, where P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor.*

4.03.00 Liquidated damages for shortfall in Guaranteed KW

The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.

For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.

The liquated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.

**5.00.00 TECHNICAL REQUIREMENTS:**

5.01.00 The pumps shall meet the technical requirements of section "D" as well as Data Sheet - A. Wherever there is contradiction between Section D and Data Sheet-A, the latter shall prevail. In the event of any contradiction of section "D" with Section-C, the Section-C will prevail.

5.02.00 The pumps shall be Electric motor driven.

5.03.00 The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements of HIS are also met.

5.04.00 The horizontal pumps shall be Horizontal split casing type with speeds not exceeding 1500 RPM or as indicated in Data Sheet-A.

5.05.00 No negative tolerance shall be permitted in rated capacity & TDH.

5.06.00 No negative tolerance shall be permitted in efficiency at rated capacity.

5.07.00 The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:

i. 10-15% for pumps of specific speed up to 1000 US units,
ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,
iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,
iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.

5.08.00 All HT motors and those LT motors which are not in bidder's scope of supply : bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder.

Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.

5.09.00 For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft:

- Purchaser's probes in both DE/NDE bearings of pumps
- Key slots on pump shaft with dimensions as specified in Data Sheet A.
- Other components as finalized during detailing.
- For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.

5.10.00 The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.

5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.

5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.

5.13.00 The pumps shall be capable of running over the entire range of NPSH conditions required without any noise, vibration or cavitations.

The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.

5.14.00 The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.

5.15.00 Pumps and motors shall run smooth without undue noise and vibration.

The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO.

The noise level shall be limited to 85 dB at distance of 1.0M.

5.16.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.

5.17.00 After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.

5.18.00 High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.

5.19.00 The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of two years. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.

5.20.00 The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.

If water handled by pump is dirty/ not suitable for lubrication/ cooling, the bidder shall provide requisite strainer/ filters, tanks, motorized valves, etc. after the tap off for the required service, the arrangement provided shall be subject to Purchaser's approval.

**6.00.00 MANDATORY SPARES:**

6.01.00 Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.

6.02.00 Bidder shall include the cost of Mandatory Spares in the base price of the pump, unless specified otherwise in Sec-C of the specification or NIT.

**7.00.00 OTHER REQUIREMENTS:**

7.01.00 The quality of water handled by various pumps shall be as per Data Sheet-A.

7.02.00 The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.

7.03.00 The makes of various bought out items of bidder (i.e. motor, bearings, mechanical seal etc.) shall be subject to purchaser's approval in the event of order.

7.04.00 Painting for Pumps

a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.

b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.

c) For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness DFT of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness DFT of 50 microns shall be applied. The top coat shall consist of two coats each of min. thickness DFT of 50 microns of synthetic enamel paint and thus total DFT shall be min. 200 microns.

d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50

microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.

**7.05.00** **It is mandatory for the bidder 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 full conformity with the specification, "not-withstanding" anything else stated elsewhere in bidder's offer. The implied/indirect deviations shall not be binding on the purchaser.**

8.00.00 **PERFORMANCE REQUIREMENTS**

8.01.00 Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with this section.

8.02.00 Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated in the Data Sheet - A attached with this section.

8.03.00 Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation.

Under all circumstances, the 'range of operation' of the pumps shall exclude any unstable operating zone of the head-capacity curve.

8.04.00 Wherever specified in the Data Sheet - A attached to this section, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.

8.05.00 The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.

9.00.00 **DESIGN AND CONSTRUCTION**

9.01.00 **Pump Casing**

9.01.01 Pump casing shall be provided with adequate number of vents and priming connections with valves unless the pump is made self-venting and priming. Casing drain, as required, shall be provided complete with drain valves. It shall be provided with a connection for suction and discharge pressure gauge as standard feature.

9.01.02 Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.

9.01.03 In case where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to the foundation. This additional thrust shall be taken into the consideration of pump design.

9.02.00 **Impeller**

9.02.01 The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.

9.03.00 **Wearing Rings**

9.03.01 Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing.

9.04.00 **Shaft**

9.04.01 Shaft size shall be selected considering that the critical speed shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall be at least 30% higher than the rated speed.

9.05.00 **Shaft Sleeves**

9.05.01 Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the other faces of gland packing or seal end plate so as to distinguish between the leakage past Shaft and shaft sleeve and that past the seals/glands.

9.05.02 Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening. Shaft sleeve assembly should ensure concentric rotation.

9.06.00 **Bearings**

9.06.01 Bearings shall be easily accessible without disturbing the pump assembly. A drain shall be provided at the bottom of each bearing housing.

9.06.02 Heavy-duty sleeve/ball/roller type bearings shall be provided to take care of the radial loads.

9.06.03 In case of sleeve type radial, axial thrust shall be absorbed in suitable hydraulic devices and/or thrust bearings.

9.06.04 Bearings and hydraulic devices (if provided for balancing axial thrust) shall be of adequate design for taking the entire pump load arising from all probable conditions of continuous operation. Life of the bearings shall be guided by the design standard of the pump. Antifriction bearings of standard type, if provided, shall be selected for a minimum

life 20,000 hrs. of continuous operation at maximum axial and radial loads at rated speed. Thrust bearing shall be capable of running continuously at maximum load.

9.06.05 The bearing shall be oil/grease lubricated. Suitable lubricating arrangement for the bearings shall be furnished with the pump complete with all accessories like pump, filters, piping, fittings, valves, interlocking and supervising instruments etc. as necessary. The design shall be such that the bearing lubricant does not contaminate the liquid being pumped.

9.06.06 Bearings of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.

9.07.00 **Stuffing Boxes**

9.07.01 Stuffing box design shall permit replacement of packing without removing any part other than the gland.

9.07.02 Stuffing boxes shall be sealed/cooled by the fluid being pumped/external clear water, as specified in the Annexure. All necessary pumps, piping, fittings, valves, instruments etc. as required for safe and trouble-free operation of the pumps and as specified in the Annexure shall be included in the scope of supply.

9.08.00 **Mechanical Seals**

9.08.01 Mechanical seals (cartridge type) shall be provided if specified in the Data Sheet-A of this section. The pump supplier shall co-ordinate with the seal maker in establishing the direct circulation rate for maintaining a stable film at the seal in the chamber. The seal piping system shall form an integral part of the pump assembly.

9.08.02 When handling liquids near boiling point, suitable arrangement for external cooling shall be provided so as to prevent flashing at the seal faces.

9.08.03 For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure, even when the pumps are not operating.

9.08.04 Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose. The special tools (if any) required for above shall be arranged by bidder.

9.08.05 Mechanical seals of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.

9.09.00 **Drive Unit**

9.09.01 The pumps shall be driven by electric motor directly coupled as specified in the Data Sheet-A of this section. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.

9.09.02 Unless otherwise specified in Data Sheet-A of this section, drive unit power rating shall be the maximum of the following requirements.

a) 15% margin over the pump shaft input power at the rated duty point.

b) 5% margin over the maximum pump shaft input power required within the 'Range of Operation'.

c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.

9.10.00 **Coupling for pump & Motor Shaft**

9.10.01 The pump and motor shafts shall be connected with adequately sized flexible coupling of proven design with spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guard shall be provided.

9.10.02 No. of coupling holes for joining coupling hubs shall be even in number and preferably in multiples of four.

10.00.00 **INSPECTION AND TESTING**

10.01.00 The Quality Plans enclosed in the specification are for bidder's guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in the event of order based on the guidance given as above, for approval by BHEL/Customer.

10.02.00 The Bidder shall carry out the following specific tests inspections to ensure that the equipment furnished lies in strict conformance with the specification and also in accordance with applicable codes/standards and good engineering practice.

a) **Identification and Testing**

i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner.

ii) 100% PMI (Process Material Identification) inspection for material grade of pump casing, shaft and impeller shall be done by vendor & certification shall be submitted for review of BHEL. Further BHEL reserves the right to conduct

random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works.

iii) Tests for each pump included under this section shall include but not be limited to the following:

- The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65.

- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.

- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.

- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.

- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.

- Inspection of finished castings for impeller and verification of materials.

- Inspection of pump shaft and verification of material.

- Witnessing of NDT/review of NDT reports.

- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.

- Complete Inspection of assembled pump.

b) **Hydraulic Testing**

The pump casing shall be hydrostatically tested at maximum of the following:

i. 2 times the TDH (Total Dynamic Head) at rated capacity (or)
ii. 1.5 times the shut-off pressure (or)
iii. System Design pressure indicated in Data Sheet-A of this section.

The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.

c) **Performance Test at Shop**

i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute

of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.

ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals.

iii) Tests shall be conducted with actual drive motors being furnished.

iv) NPSH tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.

v) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply.

**11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE**

11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C.

11.02.00 The no. of drawings/documents to be submitted shall be as per Annexure to Data Sheet-C.

12.00.00 The various Sections-C's & D's along with Data Sheets attached in this specification together with the specification for Miscellaneous Pumps shall be complied with by the bidders.

13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy within 2 weeks from placement of LOI's in the event of order.

Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here only for further submission to customer.

Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to

Customer. The representative shall be available here till Category-I approval of all the drawings and documents.

14.00.00 Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.

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

a) Compliance certificate duly signed and stamped (enclosed at Vol. III of specn.).
b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
   - Civil static & dynamic loads.
   - Foundation details.
c) Guarantee Schedule duly signed and stamped (enclosed at Vol. III of specn.).
d) Technical deviation schedule (if reqd.) (enclosed at Vol. III of specn.).
e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable): Load torque speed curves of the pumps, selected motor rating, rpm, $GD^2$ of driven equipment.

**Apart from above no other Drgs./Docs./Data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.**

## 1.00.00 GENERAL INFORMATION

1.01.00 The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for vertical pumps to be procured under the scope of this package.

## 2.00.00 CODES AND STANDARDS

2.01.00 In addition to the requirements spelt out elsewhere in the specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments subsequent to the year of publication as mentioned below.

| | | |
|---|---|---|
| 2.01.01 | IS-1710/1989: | Vertical Turbine Pumps for Clear, Cold and Fresh Water. |
| 2.01.02 | IS-5120/1977: | Technical requirements for Rotodynamic special Purpose pumps. |
| 2.01.03 | IS-5639/1970: | Pumps for handling chemicals & corrosive liquids. |
| 2.01.04 | IS-5659/1970: | Pumps for process water. |
| 2.01.05 | IS-6536/1972: | Pumps for handling volatile liquids. |
| 2.01.06 | IS-9137/1978: | Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'. |
| 2.01.07 | BS 5316 | Acceptance tests for Centrifugal, mixed flow Part-I/1976 and axial flow pumps - Class 'C' Tests (ISO 2548/1973) |
| 2.01.08 | BS 5316 | Acceptance tests for Centrifugal, mixed flow Part-II/1977 and axial flow pumps - Class 'B' Tests (ISO 3555/1977) |
| 2.01.09 | ANSI B 73.2M 1984 | Vertical inline centrifugal pumps for chemical process |
| 2.01.10 | API-610/1989: | Centrifugal pumps for general refinery services. |
| 2.01.11 | HIS | Hydraulic Institute Standards, USA |
| 2.01.12 | PTC 8.2/1965: | Power Test Codes - Centrifugal pumps. |
| 2.01.13 | ASTM-1-165-55 | Standard Methods for Liquid Penetration Inspection. |

2.02.00 In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.

**3.00.00 SCOPE OF SUPPLY & SERVICES:**

3.01.00 The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section A.

3.02.00 The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet-A of the specification.

3.03.00 Accessories:

All the pumps under this specification shall be complete with following standard/special accessories.

3.03.01 Standard accessories:

a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end.
(The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00).

b) Pump motor coupling along with coupling guard.

c) Common base/sole plate for pumps and motor.

d) Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope), as per clause 5.23.00.

e) Thrust bearing temp. measurement devise to be provided.

f) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.

g) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.

h) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations.

i) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.

j) Suitable drain connections with isolating valves as applicable.

k) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.

l) Set of "Special" Tools & Tackles for Pumps and motors, if any.

m) Erection and commissioning spares, "on as required" basis.

n) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.

o) Mandatory spares as specified in respective Data Sheet-A of this section.

3.04.00 Services included in Bidder's Scope:

3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A 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.

3.04.02 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning.

3.04.03 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project will be conducted by BHEL at project site to ensure that the pumps meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site at no additional cost to BHEL.

3.04.04 Performance Guarantees for pumps shall stand valid till the satisfactory completion of performance testing by BHEL and its acceptance by purchaser / customer.

3.05.00 Works excluded from Bidder's Scope:

a) All HT motors and those LT Motors which are specifically excluded
b) Civil foundation
c) Suction/ discharge pipe works
d) MCC/ Switchgear/Power supply
e) Power and Control Cables, unless specifically specified in Electrical/ Systems portion of the specification.
f) Erection of equipments.

**4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:**

4.01.00 The bids received shall be evaluated for power consumption at inlet to the motors, in respect of pumps specified in Data Sheet-A (working pump only viz. not the standby), for the purpose of price comparisons as briefed below:

The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump as follows.

$$KW = \frac{Q \times H \times S}{P \times M \times 367.2}$$

Where Q = Rated capacity $M^3$/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

4.02.00 The efficiencies for pumps and motors for arriving at benchmark power for Bid Evaluation shall be as indicated in Data Sheet A for various pumps.

No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 *above, considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A*. However the bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.

NOTE:
1. Efficiencies for HT motors and LT motors not in bidder's scope, for bid evaluation purpose shall be taken based on the maximum value as furnished in Data Sheet A.
2. During contract stage the Guaranteed power consumption of Pumps with BHEL supplied drives (HT/LT) for successful bidder shall be reworked by BHEL as below:

Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 *above, where P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor.*

4.03.00 Liquidated damages for shortfall in Guaranteed KW

The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.

For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.

The liquated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.

**5.00.00 TECHNICAL REQUIREMENTS:**

5.01.00 The pumps shall meet the technical requirements of section "D" as well as Data Sheet - A. Wherever there is contradiction between Section D and Data Sheet-A, the latter shall prevail. In the event of any contradiction of section "D" with Section-C, the Section-C will prevail.

5.02.00 The pumps shall be Electric motor driven.

5.03.00 The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements are also met.

5.04.00 The type of Vertical pumps shall be as follows (if specifically not indicated otherwise in Data Sheet-A) :

a) Vertical turbine type pumps with 1500rpm. (if no. of stages <=5) shall be preferred.

b) If stages of vertical turbine pumps are more than 5, then sump pump construction shall be preferred with 1500 rpm speeds.

5.05.00 No negative tolerance shall be permitted in rated capacity & TDH.

5.06.00 No negative tolerance shall be permitted in efficiency at rated capacity.

5.07.00 The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:

i. 10-15% for pumps of specific speed up to 1000 US units,
ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,
iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,
iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.

5.08.00 All HT motors and those LT motors which are not in bidder's scope of supply : bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder..

Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.

5.09.00 For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft:

- Purchaser's probes in both DE/NDE bearings of pumps
- Key slots on pump shaft with dimensions as specified in Data Sheet A.
- Other components as finalized during detailing.
- For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.

5.10.00 The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.

5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.

5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.

5.13.00 The pumps shall be capable of running over the entire range of submergence/ NPSH requirement conditions required without any noise, vibration or cavitations.

The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.

5.14.00 The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.

5.15.00 Pumps and motors shall run smooth without undue noise and vibration.

The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO.

The noise level shall be limited to 85 dB at distance of 1.0M.

5.16.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.

5.17.00 After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.

5.18.00 High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.

5.19.00 The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of two years. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.

5.20.00 The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.

5.21.00 If water handled by pump is sea water/ dirty/ not suitable for lubrication/ cooling:

5.21.01 The bearing lubrication/cooling may be specifically reviewed by bidders for the suitability with water analysis enclosed with Data Sheet-A of this section.

These pumps shall necessarily be provided with Thordan type line shaft bearings even if the other type of bearings are claimed suitable by the manufacturers.

The bidder's shall satisfactorily establish the adequacy of self water lubrication if provided, for similar rating pumps installed for the duty condition in the event of order. In absence of adequate documentary evidence to the satisfaction level of BHEL, the bidder shall provide force water lubrication as per clause 5.21.02 below without any cost implication.

5.21.02 In the event, the forced water lubrication is envisaged by the bidder, the following minimum requirements shall be complied with further details subject to Purchaser's approval during detailed engineering after the award of order.

One set of common water lubrication system shall be provided separately for each type of pumps. The lubricating system shall provide continuous lubrication to all the pumps during operation and the minimum requirements shall be as follows:

- 2X100 % duty self cleaning strainers of suitable size and mesh opening shall be installed on the common pump discharge and outlet shall be led to 1 no. 6 hrs. storage or min. 10 M3 capacity Sintex tank, to be placed on roof of pump house .

- 2X100 % duty horizontal centrifugal lubricating pumps with TDH more than the shut off head of the subject pumps shall be provided. The capacity of each pump shall be sufficient to lubricate all of the subject pumps including 10% margin on capacity and head to suit requirement with 10 % margin with head.

- These horizontal pumps shall take suction from the overhead Sintex tank as explained above.

- Associated piping, fittings, Tank inlet motor operated valve, lubricating pumps suction & discharge isolating valves, motorised/ solenoid valves (as per purchaser's approval), lubricating pumps discharge check valves and lubricating pipe isolating valve at inlet to each of subject pump, etc. as required shall be provided.

- Instrumentation – Level Gauge, high level & low level switches for tank, pressure gauges at suction & discharge of each lubricating water pumps, low pressure switch on lubricating pipe at inlet to each of subject pump for subject pump start interlock, pressure switch on lubricating pipe at common discharge of subject pump for start up of stand by pump etc., as required subject to purchaser's approval shall be provided.

- Bidder shall supply any other equipment/ instrument required for proper functioning of the lubricating system, as deemed necessary during contract without any price implication to BHEL.

- Bidder shall also provide a relay based local control panel for proper functioning of the above system. The system shall be suitable for fully automatic operation as per approved write-up during detailed stage.

- Subject pumps shall be provided with shaft enclosing tube in the event above Lubrication system is envisaged by bidder. MOC for shaft enclosing tube shall be equivalent/ superior to MOC for column pipe for subject pump.

The complete forced water lubrication as above – if applicable, shall be in bidder's scope. Bidder to inform in schedule of deviation at bid submission stage, if fresh water is required for forced water lubrication system.

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5.22.00 For Vertical pumps no thrust block is being provided except for pumps of projects, specified in Sec-C1 of this specification. Bidder to design the pump foundation system (base plate/ sole plate, discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.

5.23.00 If specified in Sec-C1 of specification, thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope) to be provided by bidder.

**6.00.00 MANDATORY SPARES:**

6.01.00 Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.

6.02.00 Bidder shall include the cost of Mandatory Spares in the base price of the pump, unless specified otherwise in Sec-C of the specification or NIT.

**7.00.00 OTHER REQUIREMENTS:**

7.01.00 The quality of water handled by various pumps shall be as per Data Sheet-A.

7.02.00 The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.

7.03.00 The makes of various bought out items of bidder (i.e. motor, bearings etc.) shall be subject to purchaser's approval in the event of order.

7.04.00 Painting for Pumps

a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.

b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.

c) For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness DFT of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness DFT of 50 microns shall be applied. The top coat shall consist of two coats each of min. thickness DFT of 50 microns of synthetic enamel paint and thus total DFT shall be min. 200 microns.

d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50 microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.

**7.05.00 It is mandatory for the bidder 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 full conformity with the specification, "not-withstanding" anything else stated elsewhere in bidder's offer. The implied/indirect deviations shall not be binding on the purchaser.**

8.00.00 **PERFORMANCE REQUIREMENTS**

8.01.00 Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with this section.

8.02.00 Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated in the Data Sheet - A attached with this section.

8.03.00 Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation.

Under all circumstances, the 'range of operation' of the pumps shall exclude any unstable operating zone of the head-capacity curve.

8.04.00 Wherever specified in the Data Sheet - A attached to this section, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.

8.05.00 The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.

9.00.00 **DESIGN AND CONSTRUCTION**

Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories. General design and constructional features of the pumps shall be as follows:

9.01.00 **Bowl Assembly**

9.01.01 This will be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of handling fluid.

9.01.02 Pumps (s) shall have provision for adjustment of impellers in vertical direction from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.

9.02.00 **Discharge Head**

9.02.01 Pump (s) shall have above/below floor discharge, as specified in the Data Sheet-A, attached to this section.

9.03.00 **Column pipe**

9.03.01 Column pipe shall be flanged and of bolted connection. Column pipes shall be designed

for full internal vacuum.

9.03.02 In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps, etc. necessary for such purpose shall be supplied by the Bidder under this section.

The bidder shall also submit a write-up describing clearly the procedure of handling the pump.

9.04.00 **Impeller shaft, line shaft and head shaft**

9.04.01 Shaft size shall be selected on the basis of maximum torque to be applied on the pump shaft.

The critical speed shall be at least 30% higher than the rated speed.

9.04.02 Impeller shaft shall be guided by bearings provided in each bowl or above and below the impeller shaft assembly. The butting faces of the shaft shall be machined square to the assembly and the shaft shall chamfered at the edges.

9.04.03 Line shaft may be single or multiple pieces as required. In case of multiple pieces, line shaft shall be coupled as per the standard practice of the manufacture. For screwed coupling, directions shall permit tightening of the joint during pump operation.

9.04.04 Replaceable shaft sleeves shall be furnished at applicable location, particularly under stuffing box and at other locations, as considered necessary.

9.05.00 **Shaft enclosing tube**

Shaft enclosing tube shall be required, unless self lubricated (and cooled) type of shaft bearings are asked for. Length of the shaft enclosing tube shall be in conformity with the shaft piece lengths.

9.06.00 **Seal rings**

Replaceable seal/wear rings both on impeller and on casing shall be provided in case it is asked for in this specification.

9.07.00 **Bearings**

9.07.01 **Shaft bearings**

Adequate number of properly designed bearings shall be provided for smooth and trouble free operation of the pump. Number of bearings shall consider the number of shaft pieces used and the critical speed of the shaft. Bearings shall be either lubricated by external clear water/oil/grease or self lubricated as specified in the Data Sheet-A of this section.

In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. In case of forced water lubrication of the shaft bearings, the system and other accessories shall be in the scope of supply of Bidder as per clause 5.21.02.

9.07.02 **Thrust Bearing**

Thrust bearing of adequate size and capacity shall be provided to take the vertical thrust of the impeller arising out of the pump operation and dead weight of the rotating components. Life of the thrust bearing shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.

Thrust bearing shall be either grease or oil lubricated. Lubrication arrangement shall be such that the lubricant does not contaminate the handing fluid. The arrangement shall also be adequate to protect the bearing, while the pump coast down to stop in case of power failure of the station. Pre-lubrication of the thrust bearing, if recommended by the pump manufacturer, shall be taken care of in designing the lubrication system.

Cooling of the thrust bearing, if necessary, shall be done by the handing fluid/external water, depending on the fluid handled.

Location of the thrust bearing may be at the pump body or at the driver, or at both depending on the requirement indicated in this specifications or as per the recommendation of the pump manufacturer (and approved by Purchaser).

9.07.03 Bearings of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.

9.08.00 **Reverse Rotation**

9.08.01 If indicated at Section-C of the specification, the pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow at rated pump discharge head.

9.09.00 **Drive Unit**

9.09.01 The pumps shall be driven by electric motor directly coupled as specified in the Data Sheet-A of this section. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.

9.09.02 Unless otherwise specified in Data Sheet-A of this section, drive unit power rating shall be the maximum of the following requirements.

a) 15% margin over the pump shaft input power at the rated duty point.

b) 5% margin over the maximum pump shaft input power required within the 'Range of Operation'.

c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.

9.09.03 All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow through pump.

10.00.00 **INSPECTION AND TESTING**

10.01.00 The Quality Plans enclosed in the specification are for bidder's guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in the event of order based on the guidance given as above, for approval by BHEL/Customer.

10.02.00 The Bidder shall carry out the following specific tests inspections to ensure that the equipment furnished lies in strict conformance with the specification and also in accordance with applicable codes/standards and good engineering practice.

a) **Identification and Testing**

i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner. Material identification and testing shall include, but shall not be limited to the following components :

- Bowls and suction bells
- Impeller and wearing rings
- Shafts and shaft sleeves
- Couplings
- Bearings
- Column pipes
- Discharge heads
- Bowl Assembly

ii) 100% PMI (Process Material Identification) inspection for material grade of pump casing, shaft and impeller shall be done by vendor & certification shall be submitted for review of BHEL. Further BHEL reserves the right to conduct random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works.

iii) Tests for each pump included under this section shall include but not be limited to the following:

- The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65.

- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.

- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.

- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.

- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.

- Inspection of finished castings for impeller and verification of materials.

- Inspection of pump shaft and verification of material.

- Witnessing of NDT/review of NDT reports.

- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.

- Complete Inspection of assembled pump.

**b) Hydraulic Testing**

Bowls/ Suction bells, Columns pipe, Discharge head & Any other applicable pressure parts shall be hydrostatically tested at maximum of the following:

i. 2 times the TDH (Total Dynamic Head) at rated capacity (or)
ii. 1.5 times the shut-off pressure
iii. System Design pressure indicated in Data Sheet-A of this section.

The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.

**c) Performance Test at Shop**

i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.

ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated

capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals.

iii) Tests shall be conducted with actual drive motors being furnished.

iv) Minimum submergence/ NPSH required tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.

v) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests.

vi) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply.

**11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE**

11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C.

11.02.00 The no. of drawings/documents to be submitted shall be as per Annexure to Data Sheet-C.

12.00.00 The various Sections-C's & D's along with Data Sheets attached in this specification together with the specification for Miscellaneous Pumps shall be complied with by the bidders.

13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy within 2 weeks from placement of LOI's in the event of order.

Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here only for further submission to customer.

Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to

Customer. The representative shall be available here till category I approval of all the drawings and documents.

14.00.00 Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.

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

a) Compliance certificate duly signed and stamped (enclosed at Vol. III of specn.).
b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
   - Civil static & dynamic loads.
   - Foundation details.
   - Minimum Submergence required.
   - Clearances - Side, Back & Bottom
   - Min. Recommended crane capacity
c) Guarantee Schedule duly signed and stamped (enclosed at Vol. III of specn.).
d) Technical deviation schedule (if reqd.) (enclosed at Vol. III of specn.).
e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable): Load torque speed curves of the pumps, selected motor rating, rpm, $GD^2$ of driven equipment.

**Apart from above no other Drgs./Docs./Data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.**

| | DATA SHEET - A | | | | | | | | | SPECIFICATION NO.: | PE-TS-405-100-N001 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MISCELLANEOUS PUMPS (HORIZONTAL) | | | | | | | | | REV. NO.: 00 | DATE : 04/02/2015 |
| | 3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3. | | | | | | | | | VOLUME : II B | SECTION : D |
| PROJECT/PACKAGE | **3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.** | | | | | | | | | | |

| Sl. No. | DESCRIPTION | DMCW TG AUX'S PUMPS | DMCW SG AUX'S PUMPS | ACW PUMPS | AHS COOLING PUMPS | SERVICE WATER PUMPS | HVAC M/U PUMP | APH/ESP WASH PUMP | ACW M/U PUMP | CONDENSATE TRANSFER PUMP | DM WATER M/UP PUMP | BOILER FILL PUMP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **HORIZONTAL PUMPS (GROUP-I)** | | | | | | | | | | |
| **1.0** | **SERVICE** | | | | | | | | | | | |
| 1.1 | Total no. of pumps for Project | 9 | 6 | 9 | 2 | 4 | 2 | 2 | 3 | 3 | 4 | 2 |
| 1.2 | No. of working & standby pumps | (2W+1S) per unit | (1W+1S) per unit | (2W+1S) per unit | (1W+1S) for station | (3W+1S) for station | (1W+1S) for station | (1W+1S) for station | (2W+1S) for station | (3W+0S) for station | (3W+1S) for station | (1W+1S) for station |
| 1.3 | Liquid Handled (ref. water analysis enclosed herein) | PH corrected DM Water | PH corrected DM Water | Clarified water | Clarified water | Clarified water | Clarified water | Clarified water | Clarified water | DM water | DM water | DM water |
| 1.4 | Location (Indoor / Outdoor) | Indoor | Indoor | Outdoor | Outdoor | Outdoor | Outdoor | Outdoor | Outdoor | Outdoor | Outdoor | Outdoor |
| 1.5 | Duty | Continuous | Continuous | Continuous | Continuous | Continuous | Continuous | Intermittent | Continuous | Intermittent | Continuous | Intermittent |
| 1.6 | No. of pumps working in parallel | 2 | - | 2 | - | 3 | - | - | 2 | 3 | 3 | - |
| 1.7 | Specific gravity | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1.8 | System design pressure (kg/sqcm) | 10 | 12 | 7.5 | 7.5 | 12 | 12 | 12 | 12 | 10 | 10 | 20 |
| **2.0** | **DESIGN PARAMETERS** | | | | | | | | | | | |
| 2.1 | Design capacity each, $M^3$/hr | 1290 | 470 | 1735 | 820 | 185 | 130 | 840 | 125 | 335 | 70 | 140 |
| 2.2 | Total dynamic head (MWC) | 37 | 55 | 40 | 43 | 78 | 52 | 80 | 35 | 50 | 65 | 160 |
| 2.3 | Suction Pressure(MWC) | 25 | 25 | Flooded Suction | Flooded Suction | Flooded Suction | Flooded Suction | Flooded Suction | Flooded Suction | Flooded Suction | Flooded Suction | Flooded Suction |
| 2.4 | Design Temperature (°C) | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 50 | 50 | 50 |
| 2.5 | Maximum permissible speed of pump (RPM) | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| 2.6 | Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz | Not to exceed 68 MWC | Not to exceed 85 MWC | Not to exceed 60 MWC | Not to exceed 60 MWC | Not to exceed 100 MWC | Not to exceed 100 MWC | Not to exceed 100 MWC | Not to exceed 100 MWC | Not to exceed 81 MWC | Not to exceed 81 MWC | Not to exceed 200 MWC |
| 2.7 | Operating range | ----------40-120% of design duty point flow---------- | | | | | | | | | | |
| 2.8 | Motor rating | Motor rating (at 50 deg. C ambient) shall be either 10% above the maximum power requirement at any condition of the entire characteristic curve of the pump (viz. 0-120%). | | | | | | | | | | |
| 2.9 | Permissible tolerance in rated capacity & TDH | No negative tolerance | | | | | | | | | | |
| 2.10 | Permissible tolerance in efficiency at rated capacity(%) | No negative tolerance | | | | | | | | | | |
| 2.11 | Performance/Design Standard | HIS | | | | | | | | | | |
| **3.0** | **CONSTRUCTION FEATURES** | | | | | | | | | | | |
| 3.1 | Pump type | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal | Horizontal Centrifugal |
| 3.2 | Impeller type | Closed | Closed | Closed | Closed | Closed | Closed | Closed | Closed | Closed | Closed | Closed |
| 3.3 | Casing type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type | Axially/Radially Split type |
| 3.4 | Coupling type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type | Spacer type |
| 3.5 | Sealing arrangement | Gland packing initially & Mechanical seal finally after commisioning | Gland packing initially & Mechanical seal finally after commisioning | Gland packing | Gland packing | Gland packing | Gland packing | Gland packing | Gland packing | Gland packing initially & Mechanical seal finally after commisioning | Gland packing initially & Mechanical seal finally after commisioning | Gland packing initially & Mechanical seal finally after commisioning |
| 3.6 | Type of Lubrication | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid | Oil/ Grease/ Self Liquid |
| 3.7 | Pump characteristics | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable | Non Overloading type & stable |
| 3.8 | Drain Plugs, vent, lifting lugs, priming connection | Required | | | | | | | | | | |
| **4.0** | **MATERIALS OF CONSTRUCTION** | | | | | | | | | | | |
| 4.1 | Casing | ASTM A-351 CF8M | ASTM A-351 CF8M | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | ASTM A-351 CF8M | ASTM A-351 CF8M | ASTM A-351 CF8M |
| 4.2 | Impeller | ASTM A-351 CF8M | ASTM A-351 CF8M | Bronze to IS 318 Gr. I/II or SS316 | Bronze to IS 318 Gr. I/II or SS316 | Bronze to IS 318 Gr. I/II or SS316 | Bronze to IS 318 Gr. I/II or SS316 | Bronze to IS 318 Gr. I/II or SS316 | Bronze to IS 318 Gr. I/II or SS316 | ASTM A-351 CF8M | ASTM A-351 CF8M | ASTM A-351 CF8M |
| 4.3 | Shaft | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 | SS-316 |
| 4.4 | Shaft Sleeves | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 | SS-410 |
| 4.5 | Impeller Wearing rings | SS-316 | SS-316 | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | SS-316 | SS-316 | SS-316 |
| 4.6 | Wetted fasteners | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS |
| 4.7 | Fasteners (others) | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS | SS |
| 4.8 | Gland/Seal Cover | ASTM A-351 CF8M | ASTM A-351 CF8M | 2.5% Ni CI to IS 210 Gr. FG | 2.5% Ni CI to IS 210 Gr. FG | 2.5% Ni CI to IS 210 Gr. FG | 2.5% Ni CI to IS 210 Gr. FG | 2.5% Ni CI to IS 210 Gr. FG | 2.5% Ni CI to IS 210 Gr. FG | SS 316 | SS 316 | SS 316 |
| 4.9 | Lantern Ring | SS 316 | SS 316 | Bronze | Bronze | Bronze | Bronze | Bronze | Bronze | SS 316 | SS 316 | SS 316 |
| 4.10 | Mech. seal | Manufacturer standard | Manufacturer standard | - | - | - | - | - | - | Manufacturer standard | Manufacturer standard | Manufacturer standard |
| 4.11 | Gland Packing | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil | PTFE/ Grafoil |
| 4.12 | Base Plate | MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated | | | | | | | | | | |
| 4.13 | Stuffing Box | ASTM A-351 CF8M | ASTM A-351 CF8M | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | 2.5% Ni CI to IS 210 Gr. FG 260 | ASTM A-351 CF8M | ASTM A-351 CF8M | ASTM A-351 CF8M |
| 4.14 | Casing Wearing rings (If applicable) | SS 316 | SS 316 | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller) | SS 316 | SS 316 | SS 316 |
| 4.15 | Connecting Pipe material (for deciding counterflange material) | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589 | SA312 TP304(ERW) | SA312 TP304(ERW) | SA312 TP304(ERW) |
| **5.0** | **MANDATORY SPARES** | | | | | | | | | | | |
| 5.1 | Fasteners | 1 Set | 1 Set of each type and size | 1 Set | 1 Set | NA | NA | NA | NA | NA | NA | NA |

| | DATA SHEET - A | SPECIFICATION NO.: | PE-TS-405-100-N001 |
|---|---|---|---|
| | MISCELLANEOUS PUMPS (HORIZONTAL) | REV. NO.: 00 | DATE : 04/02/2015 |
| | 3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3. | VOLUME : II B | SECTION : D |

| PROJECT/PACKAGE | | 3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **DESCRIPTION** | **DMCW TG AUX'S PUMPS** | **DMCW SG AUX'S PUMPS** | **ACW PUMPS** | **AHS COOLING PUMPS** | **SERVICE WATER PUMPS** | **HVAC M/U PUMP** | **APH/ESP WASH PUMP** | **ACW M/U PUMP** | **CONDENSATE TRANSFER PUMP** | **DM WATER M/UP PUMP** | **BOILER FILL PUMP** |
| 5.2 | Sleeve nuts & O Rings | 1 Set | 1 Set of each type and size | 1 Set | 1 Set | NA | NA | NA | NA | NA | NA | NA |
| 5.3 | Gland & Gland Packing (if Applicable) | NA | 2 Sets of each type and size | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 5.4 | Gland Packing | 2 Sets | NA | 2 Sets | 2 Sets | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.5 | Impeller | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 5.6 | Impeller with Nuts | NA | NA | NA | NA | 1 No. | 1 No. | 1 No. | 1 No. | 1 No. | 1 No. | 1 No. |
| 5.7 | Bearings for the pumps | 2 Sets | 2 Sets of each type | 2 Sets | 2 Sets | NA | NA | NA | NA | NA | NA | NA |
| 5.8 | Bearing for the Pumps & Drives | NA | NA | NA | NA | 2 Sets | 2 Sets | 2 Sets | 2 Sets | 2 Sets | 2 Sets | 2 Sets |
| 5.9 | Shafts | NA | 1 No | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 5.10 | Shafts with Fasteners | NA | NA | NA | NA | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.11 | Thrust Bearings ( if applicable) | 2 Sets | 2 Sets of each type and size | 2 Sets | 2 Sets | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.12 | Shaft sleeve | 1 Set | 2 Nos. | 1 Set | 1 Set | 2 Sets | 2 Sets | 2 Sets | 2 Sets | 2 Sets | 2 Sets | 2 Sets |
| 5.13 | Complete coupling (Pump & Motors) | 1 Set | 1 Set of each type and size | 1 Set | 1 Set | NA | NA | NA | NA | NA | NA | NA |
| 5.14 | Pump &Drive Coupling with all fastenres & Coupling Guard | NA | NA | NA | NA | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.15 | Casing Wearing rings (if applicable) | 2 Sets | 2 sets | 2 Sets | 2 Sets | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.16 | Impeller Wearing rings ( If applicable) | 2 Sets | 2 sets | 2 Sets | 2 Sets | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.17 | Mechanical Seals ( If applicable) | NA | 1 Set of each type and size | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 5.18 | Mechanical Seals (both DE and NDE) | 1 Set | NA | 1 Set | 1 Set | NA | NA | NA | NA | NA | NA | NA |
| 5.19 | Set of impeller for each type of pump | 1 Set | NA | 1 Set | 1 Set | NA | NA | NA | NA | NA | NA | NA |
| 5.20 | Pump shaft for each type of pump | 1 Set | NA | 1 Set | 1 Set | NA | NA | NA | NA | NA | NA | NA |
| 5.21 | All Gaskets | NA | NA | NA | NA | 1Set | 1Set | 1Set | 1Set | 1Set | 1Set | 1Set |
| 5.22 | All shaft couplings with fastners ( as applicable). | NA | NA | NA | NA | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.23 | Pin and Bushes for the all Coupling as applicable. | NA | NA | NA | NA | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set | 1 Set |
| 5.24 | Motor | NA | 1 Set of each type | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 5.25 | Motor Bearings | NA | 1 Set of each type | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **6.0** | **BID EVALUATION RATE** | | | | | | | | | | | |
| 6.1 | Bid evaluation rate | Rs.2.10 Lacs/KW | Rs.2.10 Lacs/KW | Rs.2.10 Lacs/KW | Rs.2.10 Lacs/KW | Rs.2.10 Lacs/KW | Rs.2.10 Lacs/KW | NA | Rs.2.10 Lacs/KW | NA | Rs.2.10 Lacs/KW | NA |
| 6.2 | Maximum permissible efficiency for Bid evaluation | | | | | | | | | | | |
| 6.2.1 | Pump Efficiency | 85 | 83 | 86 | 84 | 80 | 79 | NA | 84 | NA | 70 | NA |
| 6.2.2 | Motor Efficiency | 93 | 94.9 | 93 | 95.3 | 94.5 | 92.9 | NA | 91.8 | NA | 92.7 | NA |

| **Notes :** | |
|---|---|
| 1 | Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval. |
| 2 | For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage. |
| 3 | For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker. |
| 4 | Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion. |

| | DATA SHEET - A | SPECIFICATION NO.: | PE-TS-405-100-N001 |
|---|---|---|---|
| | MISCELLANEOUS PUMPS (Vertical Type) | REV. NO.: 00 | DATE : 04/02/2015 |
| | 3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3. | VOLUME : II B | SECTION : D |
| | | VERTICAL PUMPS(GROUP-II) | |
| **Sl. No.** | **DESCRIPTION** | **PLANT POTABLE WATER PUMPS** | **COLLONY POTABLE WATER PUMP** |
| **1.0** | **SERVICE** | | |
| 1.1 | Total no. of pumps for Project | 2 | 2 |
| 1.2 | No. of working & standby pumps | (1W+1S) for Station | (1W+1S) for Station |
| 1.3 | Liquid Handled (ref. water analysis enclosed herein) | Filtered water | Filtered water |
| 1.4 | Location | Filtered water P/H | Filtered water P/H |
| 1.4.1 | Indoor / Outdoor | Outdoor | Outdoor |
| 1.5 | Duty | Intermittent | Intermittent |
| 1.6 | No. of pumps working in parallel | - | - |
| **2.0** | **DESIGN PARAMETERS** | | |
| 2.1 | Design capacity each, $M^3$/hr | 25 | 130 |
| 2.2 | Total dynamic head (MWC) **(Excluding Pumps Internal Losses for Vertical Pumps)** | 65 | 47 |
| 2.3 | • Suction Pressure(MWC) | Submerged Suction | Submerged Suction |
| | • Floor Level- for Pump Mounting | 0.0 M | 0.0 M |
| | • Min. W.L | EL (-1.5 M) | EL (-1.5 M) |
| | • Max. W.L. | EL (-0.5 M) | EL (-0.5 M) |
| | • Sump Invert Level | EL (-3.5 M) | EL (-3.5 M) |
| | • Crane Hook Level | NA | NA |
| | • Crane Capacity Available | NA | NA |
| 2.4 | Design Temperature (°C) | 50 | 50 |
| 2.5 | Maximum permissible speed of pump (RPM) | 3000 | 1500 |
| | | | |
| 2.6 | Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz | Not to exceed 75 MWC | Not to exceed 55 MWC |
| 2.7 | Pump Discharge - above floor / below floor | Above floor | Above floor |
| 2.8 | Suction pipe (ODXTHK),(mmxmm) | - | - |
| 2.9 | Discharge pipe (ODXTHK),(mmxmm) | 89.5 x 4.8 | 219.0 X 6.0 |
| 2.10 | Operating range | 40-120% of design duty point | |
| 2.11 | Motor rating | Continous motor rating ( at 50 0C ambient ) for all pumps shall be at least 10% above the max. power requirement at any condition of the entire characteristic curve of the pump (viz; 0-120% flow). | |
| 2.12 | Permissible tolerance in rated capacity & TDH | No negative tolerance | |
| 2.13 | Permissible tolerance in efficiency at rated capacity(%) | No negative tolerance | |
| 2.14 | Performance/Design Standard | HIS | |
| **3.0** | **CONSTRUCTION FEATURES** | | |
| 3.1 | Pump type | Vertical | Vertical |
| 3.2 | Impeller type | Closed | Closed |
| 3.3 | Casing type | Preferable Vertical turbine type.If stages are more than 5, then sump pump construction may be offered. | |
| 3.4 | Coupling type | Flexible | Flexible |
| 3.5 | Sealing arrangement | Self Water/Gland | Self Water/Gland |
| 3.6 | Type of Lubrication | Oil/ Grease/ Self Water | Oil/ Grease/ Self Water |
| 3.7 | Pump characteristics | Non Overloading type & stable | Non Overloading type & stable |
| 3.8 | Drain Plugs, vent, lifting lugs, etc. | Required | Required |
| **4.0** | **MATERIALS OF CONSTRUCTION** | | |
| 4.1 | Casing & Suction Bell | 2.5% Ni CI to IS 210 Grade FG 260 | 2.5% Ni CI to IS 210 Grade FG 260 |
| 4.2 | Column Pipe (Only In Case of Vertical Pump) | MS FAB. IS-2062 | MS FAB. IS-2062 |
| 4.3 | Minimum column pipe thickness, mm | 6 mm | 6 mm |
| 4.4 | Impeller | ASTM -A351- CF8M | ASTM -A351- CF8M |
| 4.5 | Shaft | SS-410 | SS-410 |
| 4.6 | Shaft Sleeves | SS-304 | SS-304 |
| 4.7 | Wearing rings | SS-316 | SS-316 |
| 4.8 | Wetted fasteners | SS-304 | SS-304 |
| 4.9 | Fasteners (others) | SS-304 | SS-304 |
| 4.10 | Gland | 2.5% Ni CI to IS 210 grade FG 260 | 2.5% Ni CI to IS 210 grade FG 260 |
| 4.11 | Lantern Ring | SS-316 | SS-316 |

| | | | |
|---|---|---|---|
| 4.12 | Intermediate stage bearings | - | - |
| 4.13 | Mech. seal | N/A | N/A |
| 4.14 | Gland Packing (Asbestos Free) | PTFE/ Grafoil | PTFE/ Grafoil |
| 4.15 | Base Plate | Fabricated Steel to IS 2062 with epoxy coated (minimum 10 mm | |
| 4.16 | Connecting Pipe material | Piping upto 150NB shall be Carbon Steel ERW, IS:1239 (Heavy Grade) and piping 150 NB and above shall be Carbon Steel (IS:2062), rolled and welded conforming to IS:3589. | |
| **5.0** | **MANDATORY SPARES -** | | |
| 5.1 | Shaft sleeve | 2 Sets | 2 Sets |
| 5.2 | Bearings of pumps ( all bearing ) including thrust bearing as applicable. | 1 Set | 1 Set |
| 5.3 | Bearings of motor ( all bearing including thrust bearing as applicable. | 1 Set | 1 Set |
| 5.4 | Wearing ring or equivalent for impeller( if applicable) | 1 Set | 1 Set |
| 5.5 | Wearing ring or equivalent for Casing/Bowl( if applicable) | 1 Set | 1 Set |
| 5.6 | Impeller Shaft and line shafts with fasteners (as applicable) | 1 Set | 1 Set |
| 5.7 | All shaft couplings wth fastners ( as applicable) | 1 Set | 1 Set |
| 5.8 | Coupling between pump and motor & coupling Guards | 1 Set | 1 Set |
| 5.9 | Bushes for the eall Coupling as applicable | 1 Set | 1 Set |
| 5.1 | Gland Packing | 1 Set | 1 Set |
| 5.11 | Thrust Bearing Pads ( if applicable) | 2 Sets | 2 Sets |
| 5.12 | All Gaskets | 1 Set | 1 Set |
| 5.13 | Impeller with Impeller nut | 1 Set | 1 Set |
| | | | |
| **6.0** | **Bid Evaluation** | | |
| 6.1 | Bid evaluation rate | NA | NA |
| 6.2 | Maximum permissible efficiency for Bid evaluation | | |
| 6.2.1 | Pump Efficiency | NA | NA |
| 6.2.2 | Motor Efficiency | NA | NA |

**Notes :**

| | |
|---|---|
| 1 | Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval. |
| 2 | For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage. |
| 3 | For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.. |
| 4 | Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion. |

**GENERAL NOTE:**

1. Unless stated otherwise a 'set' (marked by **), it will include the total requirement of the item for a unit module or the station as specified. Where it is specified as "set" (marked by *) it would mean the requirement for the singe equipment/system as the case may be. Also are set for the particular equipment e.g. 'set' of bearings for a pump would include the total number of bearings in a pump. Also the 'set' would include all components required to replace the item; for example a set of bearing shall include all hardware normally required while replacing the bearings. It is further, intended that the assembly/sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/sub-assembly, these shall be considered as different types of assembly/sub-assembly.

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

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

4. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.

5. Interchangeability and Packings:

   All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be pre set and/or preprogrammed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre setting/pre programming before putting them in to service. The spare shall be treated and properly packed for long term storage

6. Identification:

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

| CLAUSE NO. | PROJECT INFORMATION |
|---|---|

Annexure-III

**RAW WATER ANALYSIS**

| Sl. No. | Constituent | as | mg per litre |
|---|---|---|---|
| 1. | Calcium | CaCO3 | 65 |
| 2. | Magnesium | CaCO3 | 41 |
| 3. | Sodium | CaCO3 | 98 |
| 4. | Potassium | CaCO3 | 5 |
| 5. | Total Cations | CaCO3 | 209 |
| 6. | Total Alkalinity | CaCO3 | 150 |
| 7. | Chloride | CaCO3 | 25 |
| 8. | Sulphate | CaCO3 | 34 |
| 9. | Total Anions | CaCO3 | 209 |
| 9. | Silica (Reactive) | SiO2 | 9 |
| 11. | Iron | Fe | 1.2 |
| 12. | pH Value | - | 7.6-8.2 |
| 13. | Turbidity | NTU | 200 |
| 14. | Organics(As per KMnO4 method) | Number | 2 |

DM WATER ANALYSIS

3. Effluent from the mixed bed unit shall be guaranteed to meet the following requirements, at rated capacity, throughout the period between two successive regenerations:

   i). Reactive Silica not to exceed - 0.01 ppm as $SiO_2$

   ii). Iron as Fe - Not detectable as per ASTM (ASTM-D-1068)

   iii). Total Hardness - Not detectable

   iv). pH Value - 6.8 - 7.3

   v). Conductivity - Not more than 0.1 micromhos/cm at 25 deg.C.

**Drawings / documents distribution schedule to be followed by successful bidder :**

1.0 Drawings/documents submission schedule, shall be as per NIT. The successful bidder shall submit following drawings/ documents.

1.1 Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate and sole plate details as applicable, civil foundation and anchor bolt details and loading data, points of connections of external piping and cables and mounting of devices furnished by the supplier.

1.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.

1.3 Characteristic curves of pump showing the following:

a) Flow Vs Head
b) Flow VS Power
c) Flow Vs Efficiency
d) Flow Vs NPSHR

1.4 Operation and maintenance manual

1.5 Lubrication arrangement drawings for external lubrication (if applicable).

2.0 Within the stipulated time period as per vendor's drawings/ documents schedule as per NIT, the O&M Manual comprising of minimum following shall be submitted

a) Drawings of components & details as deemed necessary.
b) Instruction manual for erection, operation & maintenance.
c) Storage instruction.

3.0 Before despatch of the equipment the bidder shall furnish the following.

a) Material test certificates.
b) Shop test reports & certificates.
c) Fulfilment of packing instructions as indicated in section C1 of this specification.

4.0 Distribution of drawings / documents for all projects:

The no. of drawing/ documents to be submitted by the successful bidder, after the award of the contract shall be intimated after award of contract.

# BHARAT HEAVY ELECTRICALS LIMITED
## PROJECT ENGINEERING MANAGEMENT
## STANDARD QUALITY PLAN

**Rev-01**

| | | | |
|---|---|---|---|
| **QUALITY PLAN FOR MISCELLANEOUS PUMPS** | CUSTOMER | PROJECT TITLE | |
| | BIDDER/VENDOR | QUALITY PLAN NUMBER | PE-QP-999-100-N004 For Hor Pumps)<br>PE-QP-999-100-N004 (For Ver. Pumps) |
| SHEET 1 OF 6 | SYSTEM | ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL) | |

| S. No. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 1 | MATERIALS CONTROL | | | | | | | | | | | |
| 1.1 | CASINGS (INCLUDING BOWLS,DIFFUSERS, STAGE BODIES, DISCH HEAD (IF CAST)). ETC, - (AS APPLICABLE) AND IMPELLER | MECHANICAL AND CHEMICAL PROPS | CR | MECHANICAL AND CHEM. ANALYSIS | ONE/HEAT/BATCH | APPROVED CS DRAWING/DATA SHEET | RELEVANT MATERIAL SPECN. | LAB REPORT/ MTC | 3/2. | | 2,1 | |
| 1.2 | STUFFING BOX, SUCTION BELL, WEARING RINGS,NECK RINGS, SHAFT SLEEVES | DO- | MA | MECHANICAL AND CHEM. ANALYSIS | ONE/HEAT/BATCH | APPROVED CS DRAWING/DATA | RELEVANT MATERIAL SPECN. | LAB REPORT/ MTC | 3/2. | | 2,1 | |
| | | HARDNESS DIFFERENCE BETWEEN CASING / IMPELLER AND WEARING RING | MA | LAB. TEST | 100% | APPROVED CS DRAWING/ DATA SHEET | 60 BHN MIN. | LAB. REPORT | 3/2. | | 2,1 | |
| 1.3 | BARS/FORGINGS FOR SHAFTS, LINE SHAFTS | 1.PHYSICAL & CHEMICAL PROPS | CR | 1.MECHANICAL & CHEMICAL ANALYSIS. | 1/CAST OR 1/BARS | APPROVED CS DRAWING/DATA SHEET | RELEVANT MATERIAL SPECN. | MILL T.C. OR LAB.REPORT | 3/2. | | 2,1 | CORRELATION REQUIRED. IDENTIFICATION AS PER TC |
| | | 2.DIMENSIONS | CR | 2.MEASURMENT | 100% | MFR. DRAWING | MFR. DRAWING | INSP.REPORT | 3/2. | | 2,1 | |
| | | 3.INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS. | CR | 3.ULTRA SONIC TEST | 100% | ASTMA388 BACK WALL ECHO 100% | DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX | NDT CERTIFICATE | 3/2. | | 2,1 | |
| 1.4 | STRESS RELIEVING/ HEAT TREATMENT OF CASTING OF ALL ABOVE (IF APPLICABLE) / SOLUTION ANNEALING OF SS CASTING | 1. VARIFICATION OF HT CHART | MA | VERIFICATION OF SR/HT CHART | ALL BATCHES | RELEVANT MATERIAL SPECN. | DO- | CORRELATED SR/HT.CHARTS | 3/2. | | 2,1 | |
| | | 2. IGC TEST FOR SS CASTING | MA | LAB. TEST | ONE SAMPLE/ HT BATCH | ASTM A 262 | ASTM A 262 Gr A | LAB. REPORT | 3/2. | | 2,1 | |
| 1.5 | SHAFT ENCLOSING TUBES, COLUMN PIPES & DISCHARGE ELBOW | 1. MECHANICAL & CHEMICAL PROPS.<br>2. DIMENSIONS.<br>3. SURFACE FINISH | MA | 1. MECH & CHEM TEST<br>2. MEASUREMENT<br>3. VISUAL EXAM | 1/BATCH<br>100%<br>100% | APPROVED GA ORG./DATA SHEET | RELEVANT MATERIAL SPECN./MAFG./ APPROVED DOCS | MFR T.C OR LAB. REPORT | 3/2. | | 2,1 | |

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER/VENDOR SEAL |

| | Prepared By | Reviewed By | Approved By |
|---|---|---|---|
| NAME | AJAY JAIN | ASHWANI KHANNA | I. J. SINGH |
| SIGN. | | | |
| DATE | 23-07-2012 | 23-07-2012 | 23-07-2012 |

# BHARAT HEAVY ELECTRICALS LIMITED
## PROJECT ENGINEERING MANAGEMENT
## STANDARD QUALITY PLAN

Rev-01

| QUALITY PLAN FOR MISCELLANEOUS PUMPS | CUSTOMER | PROJECT TITLE |
|---|---|---|
| | BIDDER/VENDOR | QUALITY PLAN NUMBER |
| SHEET 2 OF 6 | SYSTEM | ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL) |

| S. No. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE/METHOD OF CHECKED | EXTENT OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 1.6 | PLATE FLANGE, C/FLANGE | 1. MECHANICAL & CHEMICAL PROS. 2. DIMENSIONS. 3. SURFACE FINISH | MA | 1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM | 1/CAST 100% 100% | APPROVED GA DRG./DATA SHEET | RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC | MILL TC/ LAB REPORT | 3/2. | | 2,1 | CORRELATION REQ. FOR MAT OTHER THAN IS 2062 |
| 1.7 | SUCTION STRAINER (IF APPLICABLE) | MECHANICAL & CHEMICAL PROS. | MI | MECH. & CHEMICAL TEST | 1/HEAT | APPROVED GA DRG./DATA SHEET | RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC | MILL TC/ LAB REPORT | 3/2. | | 2,1 | |
| 1.8 | MECHANICAL SEAL (IF APPLICABLE) | TYPE, SIZE, MFRS, NO., MAKE | MA | VISUAL EXAM | 100% | APPROVED DATASHEET / GA MECH. SEAL | APPROVED DATASHEET | | 3/2. | | 2,1 | COMPLIANCE TC FOR APPROVED MAKE |
| 1.9 | PUMP BEARINGS | TYPE, SIZE, MFRS, NO., MAKE | MA | VISUAL EXAM | 100% | APPROVED DATASHEET | APPROVED DATASHEET | | 3/2. | | 2,1 | COMPLIANCE TC FOR APPROVED MAKE |
| 2.0 | IN PROCESS CONTROL | | | | | | | | | | | |
| 2.1 | ALL COMPONENTS UNDER 1.00 ABOVE | VISUAL DEFECTS, DIMENSIONS | MA | VISUAL EXAM, MEASUREMENT | 100% | MFG. DRAWING | MFG. DRAWING | COMPLIANCE TC | 3/2. | | 2,1 | |
| 2.2 | IMPELLER | CLEANING AND DEBURRING | MA | VISUAL | 100% | MFG. DRAWING | MFG. DRAWING | | 3/2. | | 2,1 | |
| | IMPELLER | DYNAMIC BALANCING | CR | DYNAMIC BALANCING | 100% | ISO 1940 | ISO1940 Gr 6.3 | BALANCING CERTIFICATE | 3/2. | 2,1 | | WTNESSING ONLY FOR SIZE GREATER THAN 10KW |
| 2.3 | IMPELLER-ALL ACCESSIBLE SURFACES, DIFFUSERS | DP TEST | MA | DP TEST ON M/CED AREA | 100% | APPENDIX 8 OF ASME SEC. VIII DIV. 1 | | NDT CERTIFICATE | 3/2. | 2,1 | | WITNESS BY BHEL & VARIFICATION BY CUSTOMER |
| 2.4 | WERING RING, SHAFT SLEEVES, CASING | DP TEST | MA | DP TEST ON M/CED AREA | 100% | APPENDIX 8 OF ASME SEC. VIII DIV. 1 | | NDT CERTIFICATE | 3/2. | | 2,1 | |
| 2.5 | SHAFT | DP TEST | MA | DP TEST ON M/CED AREA | 100% | ASTM E 165 | NO RELEVANT INDICATION ALLOWED | NDT CERTIFICATE | 3/2. | 2,1 | | WITNESS BY BHEL & VARIFICATION BY CUSTOMER |
| 2.6 | CASINGS/ BOWLS, STAGE BODIES, DISCHARGE HEAD (IF CAST), SUCTION HOUSING, COLUMN PIPE DISCHARGE PIPE ETC | LEAK TIGHTNESS | CR | VISUAL | 100% | TECHNICAL DATA SHEET AND NOTE 2 | NO LEAKAGE FOR TEST DURATION OF 30 MIN. | HT CERTIFICATE | 3/2. | 2,1 | | HAMMERING OF CASTINGS WITH WOODEN/ RUBBER MALLET BEFORE HYDRO TEST |

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER/VENDOR SEAL |

| | Prepared By | Reviewed By | Approved By |
|---|---|---|---|
| NAME | AJAY JAIN | ASHWANI KHANNA | I. J. SINGH |
| SIGN. | | | |
| DATE | 23-07-2012 | 23-07-2012 | 23-07-2012 |

# BHARAT HEAVY ELECTRICALS LIMITED
## PROJECT ENGINEERING MANAGEMENT
## STANDARD QUALITY PLAN

Rev-01

| QUALITY PLAN FOR MISCELLANEOUS PUMPS | CUSTOMER | PROJECT TITLE |
|---|---|---|
| | BIDDER/VENDOR | QUALITY PLAN NUMBER |
| SHEET 3 OF 6 | SYSTEM | ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL) |

| S. No. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 2.7 | FABRICATED COMPONENTS | | | | | | | | | | | |
| 2.7.1 | WELDING PROCEDURE SPECIFICATION | CORRECTNESS | MA | EXAM. | 100% | ASME SEC.IX | ASME SEC.IX | QW 482 OF ASME SEC.IX | 3/2. | | 2,1 | WELDING PROCEDURE APPROVAL BY BHEL ALT. 3RD PARTY (LLYODS,8VQI OR EQ.) IS ACCEPTABLE. |
| 2.7.2 | WELDING PROCEDURE QUALIFICATION | WELD SOUNDNESS | MA | VISUAL,PHYS. TESTS RT (AS APPLICABLE) | 100% | ASME SEC.IX | ASME SEC.IX | QW 483 OF ASME SEC.IX | 3/2. | | 2,1 | |
| 2.7.3 | WELDER PERFORMANCE QUALIFICATION | WELD SOUNDNESS | MA | VISUAL,PHYS. TESTS RT (AS APPLICABLE) | 100% | ASME SEC.IX | ASME SEC.IX | QW 484 OF ASME SEC.IX | 3/2. | | 2,1 | |
| 2.7.4 | WELD FIT-UPS | DIMENSION & ALIGNMENT | MA | MEAS.VISUAL EXAM | 100% | WPS, MFG . DRAWING | WPS, MFG . DRAWING | IR/LOGBOOK | 3/2. | | | |
| 2.7.5 | ROOT RUNS | SURFACE DEFECTS | MA | PENETRANT TEST | 100% | ASTM E 165 | NO SURFACE DEFECT | DO. | 3/2. | | 2, 1 | |
| 2.7.6 | WELDMENTS | SURFACE DEFECTS | MA | PENETRANT TEST | 100% | ASTM E 165 | ASME-VIII,DIV I | INSPN REPORT | 3/2. | | 2,1 | |

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER/VENDOR SEAL |

| | Prepared By | Reviewed By | Approved By |
|---|---|---|---|
| NAME | AJAY JAIN | ASHWANI KHANNA | I. J. SINGH |
| SIGN. | | | |
| DATE | 23-07-2012 | 23-07-2012 | 23-07-2012 |

# BHARAT HEAVY ELECTRICALS LIMITED
## PROJECT ENGINEERING MANAGEMENT
## STANDARD QUALITY PLAN

Rev-01

| QUALITY PLAN FOR MISCELLANEOUS PUMPS | CUSTOMER | PROJECT TITLE |
|---|---|---|
| | BIDDER/VENDOR | QUALITY PLAN NUMBER |
| SHEET 4 OF 6 | SYSTEM | ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL) |

| S. No. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | P | W | V | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 2.7.7 | BUTT WELDS | INTERNAL DEFECT | MA | UT/RT | 100% | | | IR | 3/2. | | 2.1 | |
| 2.7.8 | DICHARGE HEAD, COLUMN PIPE, DISCHARGE PIPE, ETC. | 1. LEAK TIGHTNESS 2. DIMENSION | CR | 1. HYDROTEST 2. MEASUREMENT | 100% | TECHNICAL SPEC/ DATA SHEET, MFR DRAWING | 1. NO LEAKAGE 2. MFR. DRAWING | IR | 3/2. | 2.1 | | |
| 3.0 | SUB-ASSEMBLY CONTROL | | | | | | | | | | | |
| 3.1 | ROTOR ASSEMBLY | ECCENTRICITY | MA | MEASUREMENT | 100% | MFR.DRAWING | MFR.DRAWING | IR/LOG BOOK | 3/2. | | 1 | |
| 3.2 | ROTOR ASSEMBLY RESIDUAL UNBALACE | STATIC & DYNAMIC | CR | STATIC & DYNAMIC BALANCING | 100% | ISO 1940 | ISO1940 Gr 6.3 | BALANCING CERTIFICATE | 3/2. | 2.1 | | WTNESSING ONLY FOR SIZE GREATER THAN 10KW |
| 3.3 | COMPLETE PUMP ASSEMBLY | COMPLETENESS, CORRECTNESS, CLEANLINESS, CLEARANCES, FREENESS, ALIGNMENT | MA | VISUAL EXAM MEASUREMENT | 100% | APPROVED DRG & MFG STANDARDS | APPROVED DRG & MFG STANDARDS | I.R. & CHECK LISTS | 3/2. | | 2.1 | |

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER/VENDOR SEAL |

| | Prepared By | Reviewed By | Approved By |
|---|---|---|---|
| NAME | AJAY JAIN | ASHWANI KHANNA | I. J. SINGH |
| SIGN. | | | |
| DATE | 23-07-2012 | 23-07-2012 | 23-07-2012 |

DMS (BHEL-PEM) 604468-20140505/03

BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

| QUALITY PLAN FOR MISCELLANEOUS PUMPS | CUSTOMER | PROJECT TITLE |
|---|---|---|
| | BIDDER/VENDOR | QUALITY PLAN NUMBER |
| SHEET 5 OF 6 | SYSTEM | ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL) |

| S. No. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 4 | FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL | | | | | | | | | | | |
| 4.1 | PUMP WITH JOB/SHOP MOTOR ASSEMBLED ON INDIVIDUAL BASE FRAME | 1. Q V/S HEAD,<br>2. Q V/S POWER,<br>3. Q V/S PUMP EFF.<br>4. VIBRATION<br>5. NOISE<br>6. BEARING TEMP.<br>7. LEAKAGES | CR | PERFORMANCE TEST | 100% | APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES | FOR VIBRATIONS - AS PER ANSI/HIS 9.6.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEACKAGE - MINOR LEKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT. | I.R., PERF. TEST RECORD, PLOTED CURVES | 3/2. | 2,1. | | * MINIMUM 7 POINTS FROM SHUT-OFF TO MAX. OPERATING FLOW COVERING ENTIRE OPERATION RANGE OF PUMP SHALL BE TAKEN. |
| | | NPSH/ MIN. SUBMERGENCE REQUIRED | CR | NPSH TEST | 1/MODEL | DO. | | I.R. NPSH/MIN. SUBMERGENCE TEST RECORD, PLOTED CURVES | 3/2. | 2,1. | | IF SPECIFIED or INSISTED BY CUSTOMER. |
| 4.2 | STRIP DOWN AFTER PERFORMANCE TEST | 1UNDUE WEAR TEAR AND RUBBING | MA | VISUAL EXAM AFTER STRIPPING | 1/MODEL | NO UNDUE WEAR TEAR & RUBBING ON IMPELLER & WEAR RING | | INSP. REPORT | 3/2. | 1 | | WITNESS REQUIRED ONLY WHEN ABNORMAL SOUND OBSERVED DURING PERFORMING TEST. |
| 4.3 | COMPLETE PUMP WITH UNIT MOTOR BASE FRAME, COUNTER FLANGES ETC. INCLUDING ALL ACCESSORIES AS PER SECTION C OF SPECN. | COMPLETENESS, CLEANLINESS, OVERALL DIMENSIONS ORIENTATION, WORKMANSHIP AND FINISH | MA | VISUAL EXAM MEASURMENT | 100% | APPD. G.A DRAWING | APPD. G.A DRAWING | INSP. REPORT | 3/2. | 1 | | |

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER/VENDOR SEAL |

| | Prepared By | Reviewed By | Approved By |
|---|---|---|---|
| NAME | AJAY JAIN | ASHWANI KHANNA | I. J. SINGH |
| SIGN. | | | |
| DATE | 23-07-2012 | 23-07-2012 | 23-07-2012 |

DMS (BHEL PEM) 6044468 2014/05/03

# BHARAT HEAVY ELECTRICALS LIMITED
## PROJECT ENGINEERING MANAGEMENT
## STANDARD QUALITY PLAN

Rev-01

| QUALITY PLAN FOR MISCELLANEOUS PUMPS | CUSTOMER | PROJECT TITLE |
|---|---|---|
| | BIDDER/VENDOR | QUALITY PLAN NUMBER |
| SHEET 6 OF 6 | SYSTEM | ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL) |

| S. No. | COMPONENT / OPERATION | CHARACTERISTIC CHECKED | CATEGORY | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENTS | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | P | W | V | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 4.4 | COMPLETION OF ALL STAGES | 1.COMPLETION | MA | VERIFICATION OF IR/T.C.ETC. | 100% | MFG. DRG./TECHNICAL DOCS. | APPD. MFG. DRG./TECHNICAL DOCS | IR. | 3/2. | 2,1 | | WTNESSING ONLY BY BHEL, CUSTOMER VARIFICATION ONLY BUT CHP |
| 4.5 | PAINTING | 1.SURFACE FINISH, DFT, MARKINGS ETC. | MA | VISUAL EXAM MEASURMENT AESTHETIC | 100% | APPD.DRG. | APPD.DOCS | IR. | 3/2. | | 2 | |
| 4.6 | PACKING, MARKING | SOUNDNESS OF PACKING | MI | VISUAL AESTHETIC | 100% | MFG. STANDARD | MFG. STANDARD | | 3/2. | | 2 | |

QMS (BHEL-PEM) 80-4468-2014/05/05

MTC -Mill Test Certificate, MA-Major, MI-Minor, TC-Test Certificate, CR-Critical, IGC- Inter Granular Corrosion

1.AS CAST HEAT MARKS SHALL BE PROVIDED ON CI CASTING LIKE TOP & BOTTOM CASING.

2. HYDRO TEST PRESSURE SHALL BE AT LEAST 2(TWO) TIMES THE DUTY POINT (OR) 1.5 TIMES OF SHUT OFF HEAD (OR) SYSTEM DESIGN PRESSURE, WHICHEVER IS HIGHER.

3. THIS QAP IS ALSO APPLICABLE FOR SPARES.

4. NO WELD REPAIRS PERMISSIBLE ON CI CASTING.

5. MATERIAL SHALL BE AS PER APPROVED CROSS SECTION DRG./ DATA SHEET.

6. STRIP TEST- INCASE OF ABNORMAL NOISE OBSERVED DURING PERF. TEST, THOSE PUMP WILL BE STRIPPED DOWN FOR VISUAL INSPECTION OF IMPELLER & WEAR SHALL BE OFFERED FOR VISUAL INSPECTION FOR WEAR /RUBBING MARKS.

7. PUMPS WITH MECHANICAL SEAL ARRANGEMENT TO BE TESTED AND SUPPLIED WITH GLAND PACKING ARRANGEMENT. HOWEVER MANUFACTURER TO ENSURE DIMENTIONAL MATCHING OF MECHANICAL SEAL WITH PUMP GA DRAWING.

LEGEND : 1- BHEL OR BHEL NOMINATED THIRD PARTY /END CUSTOMER OF BHEL,
2- VENDOR,
3-SUB-VENDOR

P- PERFORM, W- WITNESS, V-VERIFICATION

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER/VENDOR SEAL |

| | Prepared By | Reviewed By | Approved By |
|---|---|---|---|
| NAME | AJAY JAIN | ASHWANI KHANNA | I. J. SINGH |
| SIGN. | | | |
| DATE | 23-07-2012 | 23-07-2012 | 23-07-2012 |

# SECTION D2

## STANDARD MOTOR SPECIFICATION

## STANDARD QUALTY PLAN FOR MOTORS

# GENERAL TECHNICAL REQUIREMENTS

# FOR

# LV MOTORS

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

## 1.0 INTENT OF SPECIFIATION

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.

## 2.0 CODES AND STANDARDS

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 ofr rotating electrical machnines |
| IS: 12065 | Permissible limits of noise level for rotating electrical machines |
| IS: 12075 | Mechnical vibration of rotatinf electrical machines |

In case of imported motors, motors as per IEC-34 shall also be acceptable.

## 3.0 DESIGN REQUIREMENTS

3.1 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

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
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.

### 3.3 Starting Requirements

3.3.1 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.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

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.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

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)

iii) Motors for coal conveyor and coal crusher application shall be suitable fro three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be sutable fro mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

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.

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.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechnical 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.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

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.

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.

4.0 **CONSTRUCTIONAL FEATURES**

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: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

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.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
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.

4.7 **Terminals and Terminal Boxes**

4.7.1 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.

Unless otherwise statedin 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".

4.7.2 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.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & 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 V W & V respectively.

4.7.4 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.

4.7.5 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.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 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.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 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.

4.8 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.

4.9 **General**

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.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **QUALITY PLAN** | CUSTOMER : | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | | | | |
| | | BIDDER/ VENDOR : | | QUALITY PLAN NUMBER PED-506-00-Q-006/0 50 | | | SPECIFICATION TITLE | | | | | |
| | SHEET 1 OF 2 | SYSTEM | | ITEM AC ELECT. MOTORS BELOW 50KW (LV) | | | SECTION | | VOLUME III | | | |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 1.O | PAINTING | 1.SHADE | MA | VISUAL | SAMPLE | MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD | BHEL SPEC. SAME AS COL.7 | LOG BOOK | 3 | - | - | |
| 2.0 | ASSEMBLY | 1.WORKMANSHIP | MA | VISUAL | 100% | MANUF'S SPEC | MANUF'S SPEC | -DO- | 3 | - | - | |
| | | 2.DIMENSIONS | MA | -DO- | -DO- | MFG. DRG./ MFG. SPEC. | MFG. DRG./ MFG. SPEC. | -DO- | 3 | - | - | |
| | | 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE | MA | VISUAL | 100% | MFG.SPEC./ RELEVANT IS | MFG.SPEC. RELEVANT IS | -DO- | 3 | - | - | |
| 3.0 | TESTS | 1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC. | MA | -DO- | 100% | IS-325/ BHEL SPEC./ DATA SHEET | SAME AS COL.7 | TEST REPORT | 3 | 2,1 | 2,1 | NOTE -1 |
| | | 2.OVERALL DIMENSIONS & ORIENTATION | MA | MEASUREMENT & VISUAL | 100% | APPROVED DRG/DATA SHEET | APPROVED DRG/DATA SHEET & RELEVANT IS | INSPN. REPORT | 2 | 1 | - | |

| | | | |
|---|---|---|---|
| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
| | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

| | QUALITY PLAN | CUSTOMER : | | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PED-506-00-Q-006/0 | | | SPECIFICATION : TITLE : | | | |
| | SHEET 2 OF 2 | SYSTEM | | | ITEM AC ELECT. MOTORS BELOW 50KW (LV) | | | SECTION | | | VOLUME III |

| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| | | 3.NAMEPLATE DETAILS | MA | VISUAL | 100% | IS-325 & DATA SHEET | IS-325 & DATA SHEET | INSPN. REPORT | 3 | 1 | - | |

NOTES:

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

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

| BHEL | PARTICULARS | BIDDER/VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER'S/VENDORS COMPANY SEAL |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT<br>TITLE | | | SPECIFICATION :<br>NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION :<br>TITLE | | | |
| | SHEET 1 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY<br>**P** | **W** | **V** | REMARKS |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | | **11** |
| 1.0 | RAW MATERIAL & BROUGHT CONTROL | | | | | | | | | | | |
| 1.1 | SHEET STEEL, PLATES, SECTION, EYEBOLTS | 1.SURFACE CONDITION | MA | VISUAL | 100% | - | FREE FROM BLINKS, CRACKS, WAVINESS ETC | LOG BOOK | 3 | - | - | |
| | | 2.DIMENSIONS | MA | MEASUREMENT | SAMPLE | MANFR'S DRG./SPEC | MANFR'S DRG./SPEC | -DO- | 3 | - | - | |
| | | 3.PROOF LOAD TEST (EYE BOLT) | MA | MECH. TEST | -DO- | -DO- | -DO- | INSPEC. REPORT | 3 | - | - | |
| 1.2 | HARDWARES | 1.SURFACE CONDITION | MA | VISUAL | 100% | | FREE FROM CRACKS, UN-EVENNESS ETC. | -DO- | 3 | - | - | |
| | | 2.PROPERTY CLASS | MA | VISUAL | SAMPLES | MANFR'S DRG./SPEC BOOK | RELEVENT IS/SPEC. | SUPPLIERS TC & LOG | 3 | - | 2 | PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR |
| 1.3 | CASTING | 1.SURFACE CONDITION | MA | VISUAL | 100% | | FREE FROM CRACKS, BLOW HOLES ETC. | LOG BOOK | 3 | - | - | |
| | | 2.CHEM. & PHY. PROP. | MA | CHEM & MECH TEST | 1/HEAT NO. | MANFR'S DRG./SPEC | RELEVENT IS/ | SUPPLIER'S TC | 3 | - | 2 | HEAT NO. SHALL BE VERIFIED |
| | | 3.DIMENSIONS | MA | MEASUREMENT | 100% | MANUFR'S DRG. | MANUFR'S DRG. | LOG BOOK | 3 | - | - | |
| 1.4 | PAINT & VARNISH | 1.MAKE, SHADE, SHELF LIFE & TYPE | MA | VISUAL | 100% CONTINUOUS | MANFR'S DRG./SPEC | MANFR'S DRG./SPEC | LOG BOOK | 3 | - | - | |

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
|---|---|---|---|
| | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION : TITLE | | | |
| | SHEET 2 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | | **11** |
| 1.5 | SHAFT (FORGED OR ROLLED) | 1. SURFACE COND. | MA | VISUAL | 100% | - | FREE FROM VISUAL DEFECTS | -DO- | 3 | - | - | VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED |
| | | 2. CHEM. & PHYSICAL PROPERTIES | MA | CHEM. & PHYSICAL TESTS | 1/HEAT NO. OR HEAT TREATMENT BATCH NO | MFG. DRG. SPEC. | RELEVANT IS | SUPPLIER'S TC | 3 | - | 2 | |
| | | 3. DIMENSIONS | MA | MEASUREMENT | 100% | -DO- | MANUFR'S DRG. | LOG BOOK | 3 | - | - | |
| | | 4.INTERNAL FLOWS | CR | UT | -DO- | ASTM-A388 | MANUFR'S SPEC. BHEL SPEC. | -DO- | 3 | 2 | 1 | FOR DIA OF 55 MM & ABOVE |
| 1.6 | SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S | 1. MAKE & RATING | MA | VISUAL | -DO- | MANUFR'S DRG. SPEC. | MANUFR'S DRG. SPEC. | -DO- | 3 | - | - | |
| | | 2. PHYSICAL COND. | MA | -DO- | -DO- | - | NO BREAKAGE ON OTHER PHY. DESIGN | -DO- | 3 | - | - | |
| | | 3.DIMENSIONS (WHEREVER APPLICABLE) | MA | MEASUREMENT | SAMPLE | MANUFR'S DRG./ SPEC. | MANUFR'S DRG. / SPEC. | -DO- | 3 | - | - | |
| | | 4.PERFORMANCE/ CALIBRATION | MA | TEST | 100% | -DO- | -DO- | INSP. REPORT | 3 | - | - | |

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
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| | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

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| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT<br>TITLE | | | SPECIFICATION :<br>NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION :<br>TITLE | | | |
| | SHEET 3 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | | **11** |
| 1.7 | OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC. | 1. SURFACE COND. | MA | VISUAL | 100% | - | NO VISUAL DEFECTS | INSPT. REPORT | 3 | - | - | |
| | | 2. OTHER CHARACTERISTICS | MA | TEST | SAMPLE | MANUF'S SPEC. | MANUF'S SPEC. | LOG BOOK AND OR SUPPLIER'S TC | 3 | - | 2 | |
| 1.8 | SHEET STAMPING (PUNCHED) | 1. SURFACE COND. | MA | VISUAL | 100% | - | NO VISUAL DEFECTS (FREE FROM BURS) | LOG BOOK | 3 | - | - | |
| | | 2.DIMENSIONS INCLUDING BURS HEIGHT | MA | MEASUREMENT | SAMPLE | MANUFR'S DRG. . | MANUFR'S DRG. | -DO- | 3 | - | 2 | FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT |
| | | 3. ACCEPTANCE TESTS | MA | ELECT. & MECH TESTS | -DO- | MANUF'S SPEC./ RELEVANT IS | RELEVANT IS | SUPPLIER'S TC | 3 | - | 2 | |
| 1.9 | CONDUCTORS | 1. SURFACE FINISH | MA | VISUAL | 100% | - | FREE FROM VISUAL DEFECTS | LOG BOOK | 3 | - | - | |
| | | 2.ELECT. PROP, & MECH. PROP | MA | ELECT. & MECH.TEST | SAMPLES | RELEVANT IS/ BS OR OTHER STANDARDS | RELEVANT IS/ BS OR OTHER STANDARDS | SUPPLIERS TC & VENDOR'S INSPN. REPORTS | 3/2 | - | 2 | |

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
|---|---|---|---|
| | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

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| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION : TITLE | | | |
| | SHEET 4 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| | | 3.DIMENSIONS | MA | MEASUREMENT | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| 1.10 | BEARINGS | 1.MAKE & TYPE | MA | VISUAL | 100% | MANFR'S DRG. | MANFR'S DRG. | -DO- | 3 | - | - | |
| | | 2.DIMENSIONS | MA | MEASUREMENT | SAMPLE | BHEL DATA SHEET | BHEL DATA SHEET BEARING MANUF'S CATALOGUES | -DO- | 3 | - | - | |
| | | 3.SURFACE FINISH | MA | VISUAL | 100% | - | FREE FROM VISUAL DEFECTS | -DO- | 3 | - | - | |
| 1.11 | SLIP RING | 1.SURFACE COND. | MA | VISUAL | 100% | - | -DO- | -DO- | 3 | - | - | |
| | | 2.DIMENSIONS | MA | MEASUREMENT | SAMPLE | MANUF'S DRG | MANUF'S DRG | -DO- | 3 | - | - | |
| | | 3.TEMP.WITH-STAND CAPACITY | MA | ELECT.TEST | -DO- | MANUF'S SPEC. | MANUF'S SPEC. | -DO- | 3 | - | - | |
| | | 4.HV/IR | MA | -DO- | 100% | -DO- | -DO- | -DO- | 3 | - | - | |
| 1.12 | OIL SEALS & GASKETS | 1.MATERIAL OF GASKET | MA | VISUAL | 100% | MANUF'S DRG/SPECS | MANUF'S DRG./ SPECS. | -DO- | 3 | - | - | |
| | | 2.SURFACE COND. | MA | VISUAL | 100% | - | FREE FROM VISUAL DEFECTS | -DO- | 3 | - | - | |
| | | 3.DIMENSIONS | MA | MEASUREMENT | SAMPLE | MANUF'S DRG | MANUF'S DRG | -DO- | 3 | - | - | |

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| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
| | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

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| | | **QUALITY PLAN** | CUSTOMER : | | | PROJECT<br>TITLE | | | SPECIFICATION :<br>NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION :<br>TITLE | | | |
| | | SHEET 5 OF 9 | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY | | | REMARKS |
| | | | | | | | | | **P** | **W** | **V** | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | | **11** |
| 2.0 | IN PROCESS | | | | | | | | | | | |
| 2.1 | STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR ) | 1.WORKMANSHIP & CLEANNESS | MA | VISUAL | 100% | -DO- | GOOD FINISH | LOG BOOK | 3 | - | - | |
| | | 2.DIMENSIONS | MA | MEASUREMENT | -DO- | MANUF'S DRG | MANUF'S DRG | -DO- | 3 | - | - | |
| 2.2 | MACHINING | 1.FINISH | MA | VISUAL | 100% | -DO- | GOOD FINISH | LOG BOOK | 3 | - | - | |
| | | 2.DIMENSIONS | MA | MEASUREMENT | -DO- | MANUF'S DRG | MANUF'S DRG | -DO- | 3 | - | - | |
| | | 3.SHAFT SURFACE FLOWS | MA | PT | -DO- | RELEVENT SPEC./ ASTM-E165 | MANUFR'S SPEC./ BHEL SPEC./ | -DO- | 3 | - | 1 | |
| 2.3 | PAINTING | 1.SURFACE PREPARATION | MA | VISUAL | 100% | MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND | BHEL SPEC. SAME AS COL.7 | LOG BOOK | 3 | - | - | |
| | | 2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT) | MA | MEASUREMENT BY ELCOMETER | SAMPLE | -DO- | -DO- | -DO- | 3 | - | 2 | |
| | | 3.SHADE | MA | VISUAL | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 4.ADHESION | MA | CROSS CUTTING & TAPE TEST | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
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| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION : TITLE | | | |
| | SHEET 6 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | W | V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 2.4 | SHEET STACKING | 1.COMPLETENESS | MA | MEASUREMENT | SAMPLE | MANUFR'S SPEC. | MANUFR'S SPEC. | Log Book | 3 | - | - | |
| | | 2.COMPRESSION & TIGHTENING | MA | MEASUREMENT | 100% | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 3.CORE LOSS & HOTOPOT | MA | ELECT.TEST | -DO- | -DO- | -DO- | Log Book | 3 | - | 2 | (FOR MOTORS OF 2MW AND ABOVE) |
| 2.5 | WINDING | 1.COMPLETENESS | CR | VISUAL | 100% | MANUFR'S SPEC./BHEL SPEC. | MANUFR'S SPEC./BHEL SPEC. | Log Book | 3 | - | - | |
| | | 2.CLEANLINESS | CR | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 3.IR-HV-IR | CR | ELECT. TEST | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 4.RESISTANCE | CR | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | - | 2 | |
| | | 5.INTERTURN INSULATION | CR | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | 2 | - | |
| | | 6.SURGE WITH STAND AND TAN. DELTA TEST | CR | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | 2 | 1 | FOR MV MOTOR |
| 2.6 | IMPREGNATION | 1.VISCOSCITY | MA | PHY. TEST | AT STARTING | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 2.TEMP. PRESSURE VACCUM | MA | PROCESS CHECK | CONTINUOUS | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 3.NO. OF DIPS | MA | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | - | 2 | THREE DIPS TO BE GIVEN |

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| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
| | **NAME** | | |
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| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT<br>TITLE | | | SPECIFICATION :<br>NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN<br>NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION :<br>TITLE | | | |
| | SHEET 7 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY | | | REMARKS |
| | | | | | | | | | **P** | **W** | **V** | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | | | **11** |
| | | 4.DURATION | MA | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | - | 2 | |
| 2.7 | COMPLETE STATOR ASSEMBLY | 1.COMPACTNESS & CLEANLINESS | MA | VISUAL | 100% | -DO- | -DO- | Log Book | 3 | - | - | |
| 2.8 | BRAZING/COMPRESSION JOINT | 1.COMPLETENESS | CR | -DO- | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 2.SOUNDNESS | CR | MALLET TEST & MV TEST | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 3.HV | MA | ELECT. TEST | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| 2.9 | COMPLETE ROTOR ASSEMBLY | 1.RESIDUAL UNBALANCE | CR | DYN. BALANCE | -DO- | MFG SPEC./ ISO 1940 | MFG. DWG. | Log Book | 3 | 2 | 1 | VERIFICATION FOR MV MOTOR ONLY |
| | | 2.SOUNDNESS OF DIE CASTING | CR | ELECT. (GROWLER TEST) | -DO- | MFG. SPEC. | MFG. SPEC. | Log Book | 3 | 2 | - | |
| 2.10 | ASSEMBLY | 1.ALIGNMENT | MA | MEAS. | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 2.WORKMANSHIP | MA | VISUAL | -DO- | -DO- | -DO- | Log Book | 3 | - | - | |
| | | 3.AXIAL PLAY | MA | MEAS. | -DO- | -DO- | -DO- | Log Book | 3 | - | 2 | |
| | | 4.DIMENSIONS | MA | -DO- | -DO- | MFG.DRG./ MFG SPEC. | MFG. DRG/ RELEVANT IS | Log Book | 3 | - | - | |
| | | 5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE | MA | VISUAL | 100% | MFG SPEC. RELEVANT IS | MFG SPEC. RELEVANT IS | Log Book | 3 | - | - | |

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
|---|---|---|---|
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| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION : TITLE | | | |
| | SHEET 8 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | | VOLUME III |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| 3.0 | TESTS | 1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC. | MA | ELECT.TEST | 1/TYPE/SIZE | IS-325/ BHEL SPEC./ DATA SHEET | IS-325/ BHEL SPEC./ DATA SHEET | TEST REPORT | 3 | 1 | 1,2 | NOTE - 1 |
| | | 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. | MA | -DO- | 100% | -DO- | -DO- | -DO- | 3 | 1,2 | 1,2 | NOTE - 2 |
| | | 3.VIBRATION | MA | -DO- | 100% | IS-12075 | IS-12075 | -DO- | 3 | 1,2 | - | |
| | | 4.OVERALL DIMENSIONS AND ORIENTATION | MA | MEASUREMENT & VISUAL | 100% | APPROVED DRG/DATA SHEET | APPROVED DRG/DATA SHEET & RELEVANT IS | INSPC. REPORT | 3 | 2,1 | - | |
| | | 5.DEGREE OF PROTECTION | MA | ELECT. & MECH. TEST | 1/TYPE/ SIZE | RELEVANT IS | BHEL SPEC. AND DATA SHEET | TC | 3 | - | 2,1 | TC FROM AN INDEPENDENT LABORATORY NOTE-3 |
| | | 6.NAMEPLATE DETAILS | MA | VISUAL | 100% | IS-325 & DATA SHEET | IS-325 & DATA SHEET | INSPC. REPORT | 3 | 2,1 | - | |
| | | 7.EXPLOSION FLAME PROOF NESS (IF SPECIFIED) | MA | EXPLOSION FLAME PROOF TEST | 1/TYPE | IS-3682 IS-8239 IS-8240 | IS-3682 IS-8239 IS-8240 | TC | 3 | - | 2,1 | NOTE-3 |
| | | 8.PAINT SHADE, THICKNESS & FINISH | MA | VISUAL & MEASUREMENT BY ELKOMETER | SAMPLE | BHEL SPEC. & DATA SHEET | BHEL SPEC. & DATA SHEET | TC | 3 | 2,1 | - | SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY |

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
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| | **QUALITY PLAN** | | CUSTOMER : | | | PROJECT TITLE | | | SPECIFICATION : NUMBER : | | |
| | | | BIDDER/ VENDOR : | | | QUALITY PLAN NUMBER PED-506-00-Q-007/2 | | | SPECIFICATION : TITLE | | |
| | SHEET 9 OF 9 | | SYSTEM | | | ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV) | | | SECTION | | VOLUME III |

| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

| **BHEL** | **PARTICULARS** | **BIDDER/VENDOR** | |
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| | **NAME** | | |
| | **SIGNATURE** | | |
| | **DATE** | | BIDDER'S/VENDORS COMPANY SEAL |

**NTPC LIMITED**

**3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.**

# VOLUME -III

# TECHNICAL SPECIFICATION
# FOR
# MISCELLANEOUS PUMPS

**Specification No. : PE-TS-405-100-N001 (REV. 0)**

**BHARAT HEAVY ELECTRICALS LIMITED**
**POWER SECTOR**
**PROJECT ENGINEERING MANAGEMENT**
**PPEI BUILDING, SECTOR 16 A**
**NOIDA - 201301**

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 - 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 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).

1.2.2 Volume - III TECHNICAL SCHEDULES

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 checklist, sec B7 in vol 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.

**INDEX**

| SECTION | TITLE |
|---|---|
| A | DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER |
| A.1 | COMPLIANCE CERTIFICATE |
| A.2 | SCHEDULE OF DEVIATIONS |
| A.3 | SCHEDULE OF PERFORMANCE GUARANTEE |
| A.4 | UNPRICED SCHEDULE OF PRICES (AS PER NIT FORMAT) |
| A.5 | INPUTS FOR HT MOTORS |
| A.6 | GENERAL ARRANGEMENT DRAWING |
| B | DOCUMENTS TO BE SUBMITTED ON PLACEMENT OF LOI |
| B.1 | PUMP DATA SHEET -B ALONG WITH PERFORMANCE CURVE |
| B.2 | GA & CROSS SECTIONAL DRAWING |
| B.3 | PUMP QAP |
| B.4 | MOTOR DATASHEET -C ALONG WITH OTHER MOTOR DOCUMENTS |
| B.5 | MOTOR QAP |
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| B.7 | SCHEDULE AS PER LIST |

## DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER

A1 COMPLIANCE CERTIFICATE
A2 SCHEDULE OF DEVIATIONS
A3 SCHEDULE OF PERFORMANCE GUARANTEES
A4 UNPRICED SCHEDULE OF PRICES (AS PER NIT FORMAT)
A5 INPUTS FOR HT MOTORS
A6 GENERAL ARRANGEMENT DRAWING

| | | | | | |
|---|---|---|---|---|---|
| | TECHNICAL SPECIFICATIONS | SPECN. NO.: | PE-TS-405-100-N001 | | |
| | MISCELLANEOUS PUMPS | VOLUME: | III | SECTION: | A1 |
| | COMPLIANCE CERTIFICATE | REV. NO. | 0 | DATE: | 04.02.15 |

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

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.

b) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.

QP will be subject to BHEL/ CONSULTANT/ CUSTOMER approval in the event of order & 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.

c) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/ CONSULTANT/ CUSTOMER approval.

d) There are no other deviation with respect to specification other than those furnished in the 'Schedule of Deviations'.

e) Mandatory spares as indicated in Datasheet A shall be included in the base price

Any mandatory spares stated as not applicable, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.

f) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty. All materials shall be subject to approval in the event of order.

g) Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price.

h) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).

i) All sub vendors shall be as per BHEL/CONSULTANT/CUSTOMER approved list.

j) Tests for noise, vibration, parallel running etc. for pumps shall be conducted at site by vendor and if the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.

k) Any special tools & tackles, if required, shall be in bidder's scope.

l) All models offered have been supplied by bidder in the past and are meeting the experience qualifying criteria of BHEL/CONSULTANT/CUSTOMER (viz. offered model is successfully operating in two separate stations for at least two years as on the date of submission of the offer). Any deviation to this criteria shall be suitably highlighted in deviation schedule.

m) All selected motor ratings have minimum margins as per Datasheet A, Section D1 of Vol IIB

We the undersigned hereby undertake to meet the compliance requirements as listed above on the conditions as elsewhere specified.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

| NAME | DESIGNATION | SIGNATURE | DATE | COMPANY SEAL |
|---|---|---|---|---|

FORM No. PEM - 6036-0

| | TITLE | SPECIFICATION NUMBER |
|---|---|---|
| | *** SCHEDULE OF DEVIATIONS**<br>( ) From Conditions of Contract (Volume - I)<br>( ) From General Technical Conditions (Volume - II A)<br>( ) From Technical Specifications (Volume - II B) | **PE-TS-405-100-N001**<br>VOLUME III PART - A<br>SHEET .....OF..... |

* Each type of deviation shall be listed on a seperate sheet. ☑ Tick the applicable

We the undersigned hereby certify that the above mentioned are the only deviations.

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

| | | | | | |
|---|---|---|---|---|---|
| | **SCHEDULE OF PERFORMANCE GUARANTEES** | SPECN. NO.: | PE-TS-405-100-N001 | | |
| | | VOLUME: | III | SECTION: A3 | Sheet 1 of 2 |
| | **3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.** | REV. NO. | 0 | DATE: | 04.02.2015 |

**Following parameters are guaranteed for following pumps**

| Sl. No. | Pump Description | Guaranteed Capacity | Guaranteed TDH | Guaranteed Pump Eff. | Guaranteed Motor Eff. | Guaranteed Power consumption at inlet to motor | Pump model | Motor Rating | Pump $GD^2$ Value for HT motor only | Pump RPM | T/S Curve attached for HT motor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (M3/Hr) | (MWC) | % | % | (KW) | | (KW) | | | |
| | **Horizontal pumps ( Group I)** | | | | | | | | | | |
| 1 | # DMCW PUMPS (FOR TG AUX.) | 1290 | 37 | | 93 | | | | | | YES |
| 2 | # DMCW PUMPS (FOR SG AUX.) | 470 | 55 | | | | | | | | |
| 3 | # ACW PUMPS | 1735 | 40 | | 93 | | | | | | YES |
| 4 | # AHS COOLING PUMPS | 820 | 43 | | 93 | | | | | | YES |
| 5 | # SERVICE WATER PUMPS | 185 | 78 | | | | | | | | |
| 6 | # HVAC M/U PUMPS | 130 | 52 | | | | | | | | |
| 7 | APH/ ESP WASH PUMPS | 840 | 80 | | | | | | | | |
| 8 | # ACW MAKE UP PUMPS | 125 | 35 | | | | | | | | |
| 9 | CONDENSATE TRANSFER PUMPS | 335 | 50 | | | | | | | | |
| 10 | # DM WATER MAKE UP PUMPS | 70 | 65 | | | | | | | | |
| 11 | BOILER FILL PUMPS | 140 | 160 | | | | | | | | |

Note: 1 # Bid evaluation and LD is applicable for these pumps only as per clause 4.00.00 & Data Sheet-A of Standard Technical Specification for pumps, Section D1, Volume IIB.

We the undersigned hereby undertake to meet the performance guarantees as listed in the table above on the conditions as elsewhere specified. Any variation of the specified conditions during official tests will be taken in account by the customer

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME DESIGNATION SIGNATURE DATE COMPANY SEAL

**Following parameters are guaranteed for following pumps**

| Sl. No. | Pump Description | Guaranteed Capacity | Guaranteed TDH | Guaranteed Pump Eff. | Guaranteed Motor Eff. | Guaranteed Power consumption at inlet to motor | Pump model | Motor Rating | Pump $GD^2$ Value for HT motor only | Pump RPM | T/S Curve attached for HT motor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (M3/Hr) | (MWC) | % | % | (KW) | | (KW) | | | |
| | **Vertical pumps ( Group II)** | | | | | | | | | | |
| 1 | PLANT POTABLE WATER PUMPS | 25 | 65 | | | | | | | | |
| 2 | COLONY POTABLE WATER PUMPS | 130 | 47 | | | | | | | | |

Note: 1 # Bid evaluation and LD is applicable for these pumps only as per clause 4.00.00 & Data Sheet-A of Standard Technical Specification for pumps, Section D1, Volume IIB.

We the undersigned hereby undertake to meet the performance guarantees as listed in the table above on the conditions as elsewhere specified. Any variation of the specified conditions during official tests will be taken in account by the customer

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME DESIGNATION SIGNATURE DATE COMPANY SEAL

## DOCUMENTS TO BE SUBMITTED ON PLACEMENT OF LOI

B.1 PUMP DATA SHEET -B ALONG WITH PERFORMANCE CURVE

B.2 GA & CROSS SECTIONAL DRAWING

B.3 PUMP QAP (REFER STANDARD PUMP QP ATTACHED AT SECTION D OF VOL II B)

B.4 MOTOR DATASHEET -C ALONG WITH OTHER MOTOR DOCUMENTS

B.5 MOTOR QAP (REFER STANDARD MOTOR QP ATTACHED AT SECTION D OF VOL II B)

B.6 ELECTRICAL LOAD DATA

B.7 SCHEDULE AS PER LIST

| | PROJECT: MISCELLANEOUS PUMPS DATASHEET - B | VENDOR DOC. NO. | | REV NO. | |
|---|---|---|---|---|---|
| | | BHEL DOC. NO. | | REV NO. | |

| SL. | DESCRIPTION | UOM | PUMP DATA | PUMP DATA | PUMP DATA |
|---|---|---|---|---|---|
| **1.0** | **GENERAL** | | | | |
| 1.1 | Desgination of the Pump | | | | |
| 1.2 | Manufacturer | | | | |
| 1.3 | Model No. | | | | |
| 1.4 | No. of pumps | Nos. | | | |
| 1.5 | System Design Pressure | $Kg/cm^2$ | | | |
| 1.6 | Specific Gravity of fluid to be handled | - | | | |
| **2.0** | **PERFORMANCE PARAMETERS** | | | | |
| 2.1 | Performance standard | | | | |
| 2.2 | Rated capacity. (No negative tolerance) | $M^3/hr$ | | | |
| 2.3 | Total Dynamic Head (TDH) at rated capacity (No negative tolerance) | MWC | | | |
| 2.4 | Shut off head | MWC | | | |
| 2.5 | Range of Operation of the Pump | | | | |
| | a) Min.Flow | $M^3/hr$ | | | |
| | b) Max.Flow | $M^3/hr$ | | | |
| 2.6 | The pumps offered have continuously rising head capacity curves from the duty point towards shut off point. | | | | |
| 2.7 | The pumps offered have stable rising H--Q curves within the "Range of Operation" | | | | |
| 2.8 | Pump rated speed | RPM | | | |
| 2.9 | Vibration measurements (2.9.2 is applicable in addition to 2.9.1 for Pumps with speed less than 600 RPM ) | | | | |
| 2.9.1 | Max.value of vibration on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4 for speed > 600 RPM | | | | |
| | a) Guaranteed at manufacturer's works | mm/s | | | |
| | b) Guaranteed at site | mm/s | | | |
| 2.9.2 | Max.value of vibration on any pump /motor bearing w.r.t. peak to peak amplitude as per ANSI/ HIS 9.6.4 for speed <= 600 RPM | | | | |
| | a) Guaranteed at manufacturer's works | microns | | | |
| | b) Guaranteed at site | microns | | | |
| 2.10 | Max. noise Level (Guaranteed at site) | dB | | | |
| 2.11 | Guaranteed Pump efficiency at rated head & rated capacity without -ve tolerance | % | | | |
| 2.12 | Power consumption | | | | |
| | a) Guaranteed pump input power at duty point | KW | | | |
| | b) Guaranteed max. Pump input power within range of operation. | KW | | | |
| | c) Max. pump input power at shut off | KW | | | |
| | d) Guranteed power at motor input | KW | | | |
| 2.13 | NPSH required at rated capacity | MWC | | | |
| **3.0** | **DESIGN & CONSTRUCTION FEATURES** | | | | |
| 3.1 | Type of pump casing | | | | |
| 3.2 | Pump duty | | | | |
| 3.3 | Type of Impeller | | | | |
| 3.4 | Location | | | | |
| 3.5 | Pump suitable for parallel operation | | | | |
| 3.6 | Torque speed curve of the pump & drive motor furnished for pumps with drive motor rating of 100 KW and above. | | | | |
| 3.7 | Pump number of stages | | | | |

| | PROJECT: MISCELLANEOUS PUMPS DATASHEET - B | VENDOR DOC. NO. | | REV NO. | |
|---|---|---|---|---|---|
| | | BHEL DOC. NO. | | REV NO. | |

| SL. | DESCRIPTION | UOM | PUMP DATA | PUMP DATA | PUMP DATA |
|---|---|---|---|---|---|
| 3.8 | Specific speed<br>N = RPM x (Flow in USGPM)$^{1/2}$<br>(Head in Ft.)$^{3/4}$ | | | | |
| 3.9 | Minimum suction head required in MLC for pump operation at maximum discharge point within the 'Range of Operation' specified (NPSHR at max. flow). | | | | |
| 3.10 | Whether pump is suitable/designed so that pump internals can be attended without disturbing suction and discharge piping. | | | | |
| 3.11 | Type of coupling between pump & motor | | | | |
| 3.12 | Bearing (DE & NDE) | | | | |
| | a) Type and manufacturer | | | | |
| | b) Bearing no. | | | | |
| | c) Type of lubrication | | | | |
| | d) Design life (Hrs.) | | | | |
| 3.13 | Shaft Sealing arrangement | | | | |
| | a) Type and manufacturer | | | | |
| | b) Sealing liquid | | | | |
| | c) Requirement of external water if any | | | | |
| | i) Quality | | | | |
| | ii) Quantity/ Pump | $M^3$/hr | | | |
| 3.14 | In case separate oil/grease/water pump or any such equipment required for bearing lubrication/stuffing box gland sealing,furnish full technical details of these equipment and their drive. | | | | |
| **4.0** | **MATERTIAL OF CONSTRUCTION (Indicate applicable code/ standard)** | | | | |
| 4.1 | Casing | | | | |
| 4.2 | Impeller | | | | |
| 4.3 | Shaft | | | | |
| 4.4 | Shaft sleeves | | | | |
| 4.5 | Wear ring | | | | |
| 4.6 | fasteners | | | | |
| 4.7 | Gland | | | | |
| 4.8 | Lantern ring | | | | |
| 4.9 | Mechanical seals (faces)/ | | | | |
| | Gland packing | | | | |
| 4.10 | Base plate | | | | |
| **5.0** | **CONNECTIONS AND OTHER DIMENSIONAL DETAILS** | | | | |
| 5.1 | Impeller diameter | mm | | | |
| **6.0** | **DRIVE DATA** | | | | |
| 6.1 | Drive unit output at 50$^{o}$C ambient condition | KW/ P | | | |
| **7.0** | **INSPECTION & TESTING** | | | | |
| 7.1 | Material test | | | | |
| 7.2 | Hydrostatic test pressure | Kg/cm$^2$ | | | |
| 7.3 | Hydrostatic test duration | Min. | | | |
| 7.4 | Performance test on pump at shop | | | | |
| 7.5 | Dyanamic balance test | | | | |
| **8.0** | **WEIGHT AND LOADING DATA** | | | | |
| 8.1 | Weight of the pump & drive assembly | Kg | | | |
| 8.2 | Weight of the heaviest piece to be handled | Kg | | | |

| SL. | DESCRIPTION | UOM | PUMP DATA | PUMP DATA | PUMP DATA |
|---|---|---|---|---|---|
| 8.3 | Size of base plate (length x width) | mm | | | |
| **9.0** | **ADDITIONAL INFORMATION FOR VERTICAL PUMPS** | | | | |
| 9.1 | Type of pump | | | | |
| 9.2 | No. of stages for Vertical Turbine Pump | Nos. | | | |
| 9.3 | Bowl Head | MLC | | | |
| 9.4 | Bowl Efficiency | % | | | |
| 9.5 | Setting Length | m | | | |
| 9.6 | Column pipe OD X Thickness | mm X mm | | | |
| 9.7 | No of column pieces | Nos. | | | |
| 9.8 | No of intermediate shafts | Nos. | | | |
| 9.9 | No of bearings | Nos. | | | |
| 9.10 | Type & make of Bearing | | | | |
| 9.11 | Sealing/lubrication arrangement of bearings | | | | |
| 9.12 | Capacity of overhead forced lubrication tank | $m^3$ | | | |
| 9.13 | Nos of forced lubrication pumps | Nos. | | | |
| 9.14 | Capacity of forced lubrication pumps | $m^3$/Hr | | | |
| 9.15 | TDH of forced lubrication pumps | MLC | | | |

| | TITLE | SPECIFICATION NO. |
|---|---|---|
| | **MOTOR** | **VOLUME II B** |
| | | **SECTION D** |
| | **DATA SHEET - C** | **REV NO. 00 DATE 28.07.14** |
| | | **SHEET** 1 **OF** 2 |

| S. No. | Description | Data to be filled by successful bidder |
|---|---|---|
| **A.** | **General** | |
| 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.** | **Design and Performance Data** | |
| 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 | | | |

| S. No. | Description | Data to be filled by successful bidder |
|---|---|---|
| | c) At starting | |
| **C.** | **Constructional Features** | |
| 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) | |
| D. | **Characteristic curves/ drawings**<br>(To be enclosed for motors of rating ≥ 55KW) | |
| | a) Torque speed characteristic | |
| | b) Thermal withstand characteristic | |
| | c) Current vs time | |
| | d) Speed vs time | |

| LOAD TITLE | RATING (KW / A) | | UNIT (U)/STN (S) | Nos. | | VOLTAGE CODE* | FEEDER CODE** | EMER. LOAD (Y) | CONT.(C)/ INTT.(I) | STARTING TIME >5 SEC (Y) | LOCATION | BOARD NO. | CABLE | | BLOCK CABLE DRG. No. | CONTROL CODE | REMARKS | LOAD No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NAME PLATE | MAX. CONT. DEMAND (MCR) | | RUNNING | STANDBY | | | | | | | | SIZE CODE | NOs | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| ANNEXURE-II | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
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NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

| | | | | | | |
|---|---|---|---|---|---|---|
| BHEL | LOAD DATA (ELECTRICAL) | JOB NO. | 405 | ORIGINATING AGENCY | | PEM (ELECTRICAL) |
| | | PROJECT TITLE | 3x 600 MW NORTH KARANPUA STPP | NAME | | DATA FILLED UP ON |
| | | SYSTEM | MISC PUMP | SIGN. | | DATA ENTERED ON |
| | | DEPTT. / SECTION | ELECTRICAL | SHEET 1 OF 1 | REV. 00 | DE'S SIGN. & DATE |

**FORM NO. PEM 6020-3**

# CHECKLIST - LIST OF SCHEDULES

| Sl. No. | Form No. | Description | Tick Applicable Forms |
|---|---|---|---|
| 1. | PEM-6024 | Schedule of Drawings/Catalogues submitted with Bid. | ✓ |
| 2. | PEM-6025@ | Schedule of Occurrence of Key Events of Delivery, Erection & Commissioning | |
| 3. | PEM-6026 | Schedule of Equipment Manufacture. Despatch and Shipment to Site. | ✓ |
| 4. | PEM-6027 | Schedule of Weights & Dimensions. | |
| 5. | PEM-6028@ | Schedule of Performance Guarantee | |
| 6. | PEM-6030 | Inspection Schedule | ✓ |
| 7. | PEM-6031 | Schedule of Cement and Steel and Quarterly Cement Requirement. | |
| 8. | PEM-6032 | Schedule of Quarterly Requirement of Reinforcing Bars and Structural Steel. | |
| 9. | PEM-6033@ | Bill of Quantities (Civil Works) | |
| 10. | PEM-6035 | Schedule of Bidder's Proposed Construction/ Site Fabrication Facilities. | |
| 11. | PEM-6036 | Schedule of Deviations. | ✓ |
| 12. | PEM-6040 | Schedule of Declaration | ✓ |
| 13. | PEM-6041 | Quality Plan | ✓ |
| 14. | PEM-6042 | Vendor's Drawings/ Documents Schedule | ✓ |
| 15. | PEM-6043@ | Schedule of Occurrence of Key Events for Civil/Structural Works | |
| 16. | PEM-6046 | Inspection Request. | ✓ |
| 17. | PEM-6051@ | Schedule of Prices. | ✓ |
| 18. | PEM-6052@ | Schedule of Unit prices | ✓ |
| 19. | PEM-6053 | Schedule of Prices for Commissioning & Mandatory Spares. | ✓ |
| 20. | PEM-6054 | Schedule of Prices for Recommended Spares. | ✓ |
| 21. | PEM-6055 | Schedule Prices for Erection and Maintenance Tools & Tackles. | ✓ |
| 22. | PEM-6057 | Schedule of Daily & Overtime Rates. | |
| 23. | PEM-6058 | Schedule of Hire charges for Construction/ Site Fabrication Facilities. | |

**For Forms marked with @ certain information to be filled by DEs before issuing to bidder.**

**FORM NO PEM 6024-1**

| | | |
|---|---|---|
| | **SCHEDULE OF DRAWINGS/CATALOGUES SUBMITTED WITH BID** | SPECIFICATION NO:<br>VOL III<br>SHEET…….. OF…… |

**Section C/D enclosed with the specification indicate the drawings / catalogues to be furnished with the bid. The bidder in addition to furnishing the same, can also include any other drawings / catalogues which he may desire to submit with the bid. This schedule duly lists out such drawings as enclosed by the bidder with the bid.**

| DRAWING/ CATALOGUE NUMBER | DESCRIPTION | NUMBER OF SHEETS |
|---|---|---|
| | | |

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

**FORM NO PEM 6026-1**

| | | |
|---|---|---|
| | **SCHEDULE OF EQUIPMENT, MANUFACTURE, DESPATCH AND SHIPMENT TO SITE** | SPECIFICATION NO:<br>VOL III<br>SHEET…….. OF…… |

| Equipment/Major Bought-out items | Time for Manufacture/ Procurement from Date of issues of Letter of intent (Weeks) | Time for Test Dismantling Packing & Ready for Despatch (Weeks) | Time required fro Shipment to Site (Weeks) | Total Time from Date of Issue of Letter of intent to Shipment to Site (Weeks) |
|---|---|---|---|---|
| | | | | |

We, the undersigned hereby undertake to meet the schedule in weeks fro manufacture, dispatch and shipment of each equipment and procurement of major boughtout items as listed above.

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

**FORM NO PEM 6027-1**

| | | |
|---|---|---|
| | **SCHEDULE OF WEIGHTS & DIMENSIONS** | SPECIFICATION NO:<br>VOL III<br>SHEET…….. OF…… |

The bidder shall state below the weights and dimensions of various packages for shipment covering the complete scope.

| Description of Package(S) | Dimension (in meters) | Weight (in tones) |
|---|---|---|
| | | |

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

**FORM NO PEM 6030-1**

| | | |
|---|---|---|
| | **INSPECTION SCHEDULE** | SPECIFICATION NO<br>VOL III<br>SHEET…….. OF…… |

| S No. | ITEM/COMPONENT | PLACE & ADDRESSOF TEST / INSPECTION | SCHEDULE D DATE OF INSPECTION | DURATION OF TEST / INSPECTION (IN DAYS) |
|---|---|---|---|---|
| | | | | |

This schedule shall be in the line with specification and quality plan requirements. The information in this form shall be furnished after receipt of LOI/PO.

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

**FORM NO PEM 6036-1**

| | | |
|---|---|---|
| | **TITLE**<br>*** SCHEDULE OF DEVIATIONS**<br>( ) From Conditions of Contract (Volume – 1)<br>( ) From General Technical Conditions (Volume – II A )<br>( ) From Technical Specifications (Volume –II B) | SPECIFICATION NO<br>VOL III<br>SHEET…….. OF…… |

We the undersigned hereby certify that the above mentioned are the only deviations.

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

FORM NO PEM 6040-1

| | TITLE | SPECIFICATION NO |
|---|---|---|
| | *** SCHEDULE OF DECLARATIONS** | VOL III |
| | | SHEET…….. OF…… |

*** Bidder shall include this schedule both in technical and Price offers**

## DECLARATION

I ……..……certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Biders Company Name …….

Authorised representative's
Signature ……..

Name …….

Bider's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

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

FORM No. PEM — 6041-0

| | | | | |
|---|---|---|---|---|
| BHEL | QUALITY PLAN | CUSTOMER | PROJECT TITLE | SPECIFICATION NUMBER |
| | | BIDDER / VENDOR | QUALITY PLAN NUMBER | SPECIFICATION TITLE |
| | SHEET OF | SYSTEM | ITEM | SECTION VOLUME III |

| S. NO. | COMPONENT / OPERATION | CHARACTE-RISTIC CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | P | W | V | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 |
| | | | | | | | | | | | | |

| BHEL | PARTICULARS | BIDDER / VENDOR | |
|---|---|---|---|
| | NAME | | |
| | SIGNATURE | | |
| | DATE | | BIDDER'S / VENDOR'S COMPANY SEAL |

# INSTRUCTIONS FOR FILLING QUALITY PLAN

(Form No. PEM-6042 ?)

The Quality Plan shall include all the Quality Control Measures and Checks adopted by the Vendor to ensure that the material/ component/assembly/services supplied by him meet/will meet the requirements as per specifications and good practices. They shall include all stages of operation such as materials, processes, manufacture, assembly, packing and despatch. The followir.J guide lines may be noted:

Column 1- Serial Number

Column 2- - Component/Operation- The component and/or operation being checked shall be given here.

Column 3- Characteristics check- The characteristics being checked shall be given here, e.g., chemical composition, mechanical properties, leak tightness, surface defects etc..

Column 4- Category - 'CR' stands for critical characteristic - affecting safety of equipment and personnel
'MA' stands for major Characteristic - affecting safety of equipment and personnel
MI' stands for minor characteristic - affecting appearance etc.

Column 5- Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.

Column 6- Extent of check, such as, 100, 10, 1 per heat etc.

Column 7- Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.

Column 8- Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.

Column 9- Format of Record - Formats, log shets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here.

Column 10- Agency - The agency which performs the test/instruction shall be written in sub-column 'W'
The agency which verifies test certificates/inspection records and carries out audit check of the components/ operation shall be written in sub-column 'V'

The agencies are codified as 1,2 & 3

'1' stands for (BHEL)
'1' * means the operation shall be cleared by BHEL before the start of the next operation.
'2' Stands for Vendor
'3' stands for sub-Vendor of the Vendor and so on.

Example :

Entry '3' in column 'P' means test./inspection to be performed by sub-Vendor's QC

Entry '2' in column 'W' means test./inspection to be witnessed by Vendor's QC

Entry '1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL

Column 11- Remarks - Any special remarks shall be given here.

NOTES

1. In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn bgy BHEL and all tests as per relevent specifications shall be carried out in their presence or in recognized Government Laboratory

2. When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be presserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless other wise agreed.

3. For castings and forgings integral test specimens shall be provided. When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise, if witnessing of test by BHEL is called for.

4. When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.

5. This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings specifications, the latter shall prevail.

6. Wherever inspection by BHELs Purchaser/Third Party/Statutory authorities are mandatory, this shall be compiled with.

7. Inspection reports, log sheets, test reports/certificate, etc. shall be furnished to BHEL at the approproate stages or at the time of final inspection, as required.

8. This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.

9. The quality plan shall be submitted in septuplicate (7 Copies).

**FORM NO PEM 6053-1**

| | | |
|---|---|---|
| | ***SCHEDULE OF PRICES FOR COMMISSIONING AND MANDATORY SPARES** | SPECIFICATION NO<br>VOL III<br>SHEET…….. OF…… |

***Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid**

The bidder shall indicate here the quantity required for erection / commissioning and mandatory spares for equipment as listed in Section C / Section – D. If the listed spares are not adequate then the bidder shall indicate those and additional spares considered necessary by him.

| Type | Manufacturer's Drawing No / Part of spare | Description | Material | Quantity per Unit / Equipment | Quantity Recommended | If Set, Nos. Per Set | Delivery Period (Weeks) | Unit Price (Rs.) | Total Price (Rs.) |
|---|---|---|---|---|---|---|---|---|---|
| Erection & Commissioning | | | | | | | | | |
| Mandatory Spares | | | | | | | | | |
| Additional Spares Mandatory Erection / Commissioning | | | | | | | | | |

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

**FORM NO PEM 6054-1**

| | | |
|---|---|---|
| | ***SCHEDULE OF PRICES FOR RECOMMENDED SPARES** | SPECIFICATION NO<br>VOL III<br>SHEET…….. OF…… |

***Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid**

The bidder shall give below a list of spares recommended for three years (or as otherwise specified in section – C) for trouble free performance of the equipment / system offered.

| S. No. | Manufacturer's Drawing No / Part of spare | Description | Material | Quantity per Unit / Equipment | Quantity Recommended | If Set, Nos. Per Set | Delivery Period (Weeks) | Unit Price (Rs.) | Total Price (Rs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

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

**FORM NO PEM 6055-1**

| | | |
|---|---|---|
| | **TITLE**<br>*** SCHEDULE OF PRICE FOR ERECTION AND MAINTENANCE TOOLS & TACKLES** | SPECIFICATION NO<br>VOL III<br>SHEET…….. OF…… |

***Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid**

The bidder shall be given below the list of erection and maintenance tools and tackles as offered by him. This shall also include the customer's list of maintenance tools. If specified in Section – C / Section - D

| S. No | DESCRIPTION OF TOOLS & TACKLES | QUANTITY OFFERED | UNIT PRICE (Rs.) | TOTAL PRICE (Rs.) |
|---|---|---|---|---|
| | | | | |

NOTE : The hire charges for vendors equipment called for in this schedule shall include the cost of consumables, operation services, descriptions, wear and tear as well as vendor's over head and profit (These rates will be payable by customer to the vendor, only if the customer's requires the use of this equipment for carrying out his own work out side the scope of this contract).

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