# 3 X 660 MW NORTH KARANPURA STPP

# VOLUME II B

## TECHNICAL SPECIFICATION
## FOR
## ELECTRICAL LABORATORY EQUIPMENTS

**SPECIFICATION NO. : PE–TS–405–556–E001, REV. 0**


## BHARAT HEAVY ELECTRICALS LIMITED
### POWER SECTOR PROJECT ENGINEERING MANAGEMENT
**NOIDA, 201301**

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**TOTAL NO. OF SHEETS = 39**

**(INCLUDING COVER/ SEPARATOR SHEETS)**

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BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')

## INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer :

   a) Unpriced Price Schedule (Annexure-A as enclosed with the specification) with bidder's signature and company stamp.
   b) Datasheet-B filled with required details along with bidder's signature and company stamp.
   c) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" with bidder's signature and company stamp.
   d) A copy of sheet "List of Contents" with bidder's signature and company stamp.
   e) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
   f) Technical leaflets/ Catalogues on following
      i) Testing of equipment
      i) Instruments
      ii) Misc. Equipment

2. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.

3. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

4. Any changes made by the bidder in the price schedule with respect to the item description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

5. Bidder to furnish "No deviation" against each item quoted by them unless specifically indicated in Deviation sheet (part of GCC (General conditions of contract)). Deviations from technical specification are generally not acceptable. In case of deviations from technical specification, the tenderer shall give cost of withdrawl of such deviation in Sealed Cover as per Annexure-II of GCC. In absence of any cost of withdrawl by bidder in sealed envelope, no price implication on any deviation withdrawl by bidder shall be acceptable.

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BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF ABOVE)

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

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:-

**Volume – IA** This part contains Instructions to bidders for making bids to BHEL.

**Volume – IB** This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

**Volume – IC** This part contains Special Conditions of Contract.

**Volume – ID** This part contains Commercial conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIICATIONS**

Technical requirements are stipulated in Volume – II, which comprises of:-

**Volume – IIA** General Technical Conditions.

**Volume – IIB** Technical Specification including Drawings, if any.

1.2.1 **VOLUME – IIB**

This volume is sub-divided in to following sections:-

**Section – A** This section outlines the Intent of Specification

**Section – B** This section provides “Projection Information”.

**Section – C** This section indicates Technical Requirements specific to Contract, not covered in Section - D

**Section – D** This section comprises of Technical Specifications of Equipments Complete with Data Sheets A , B , C.

**Data sheet - A :-** Specific data and other requirements pertaining to the equipments.

**Data sheet - B :** Specific Data to be filled by 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).

2.0 This requirements mentioned in Section – C / Data Sheet – 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.

## SECTION- A

## SCOPE OF ENQUIRY

1. This specification covers the design, manufacture, inspection and testing at manufacturer's work, proper packing and delivery to site of **ELECTRICAL LABORATORY EQUIPMENTS** as mentioned in different sections of this specification for **3x660 MW NORTH KARANPURA STPP.**

2. It is not intent to specify herein all the details of design and manufacture. However the equipment shall confirm in all respect to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to vendors guarantee.

3. The general terms and condition, instruction to bidders and other attachment referred to elsewhere are hereby made part of the tender specification.

4. The bidder shall be responsible for and governed by all requirements stipulated herein after.

5. The offer should be complete with technical data, catalogue, brochures and drawings, as applicable.

6. The bid shall be in English language and MKS system of unit.

7. Qualification data: in order to be able to present to the client the provision of the equipment offered, the bidder is requested to elaborate details of experience, capabilities reference list etc. in this offer.

# SECTION – B

# PROJECT INFORMATION

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**

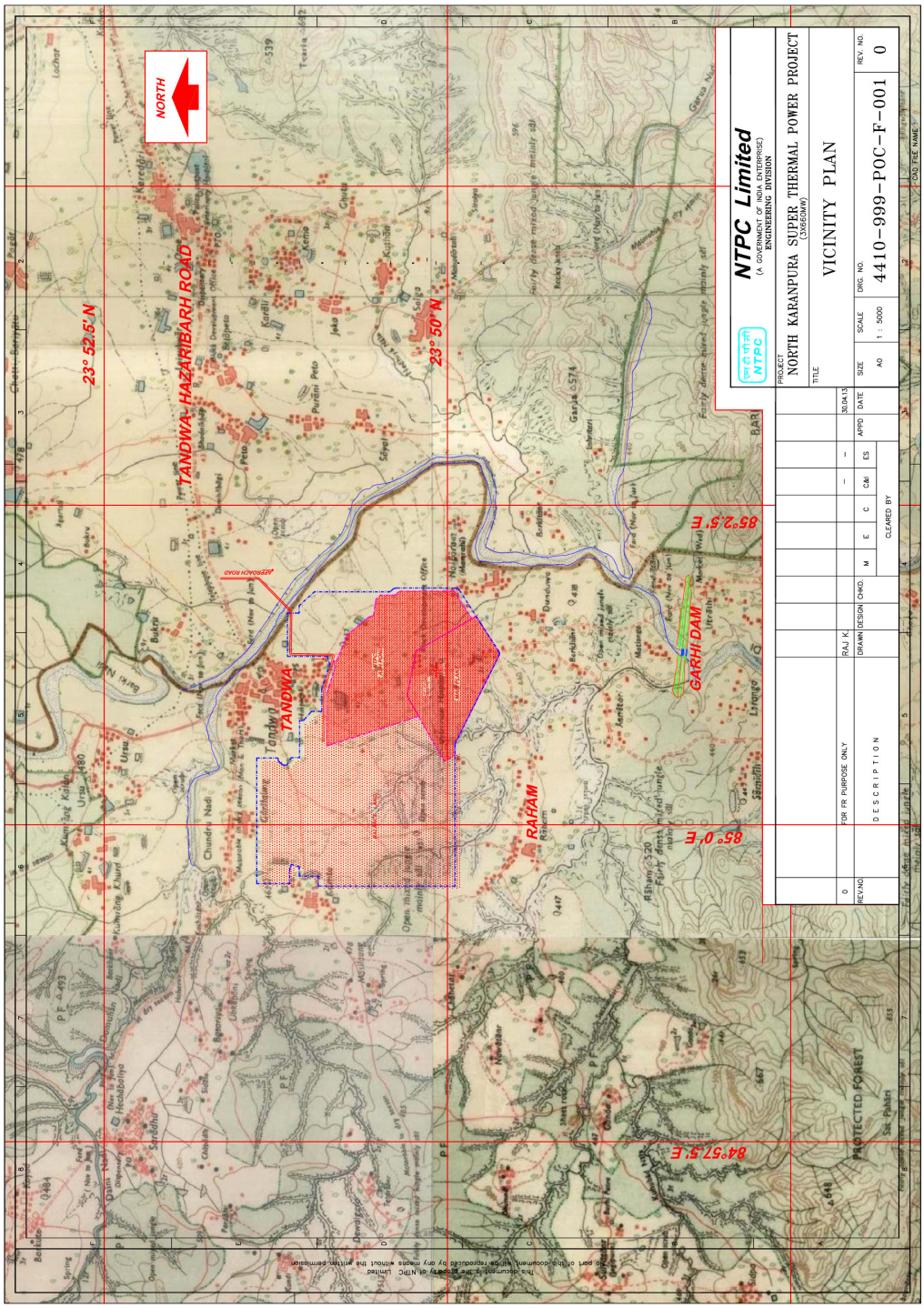
All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.

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.

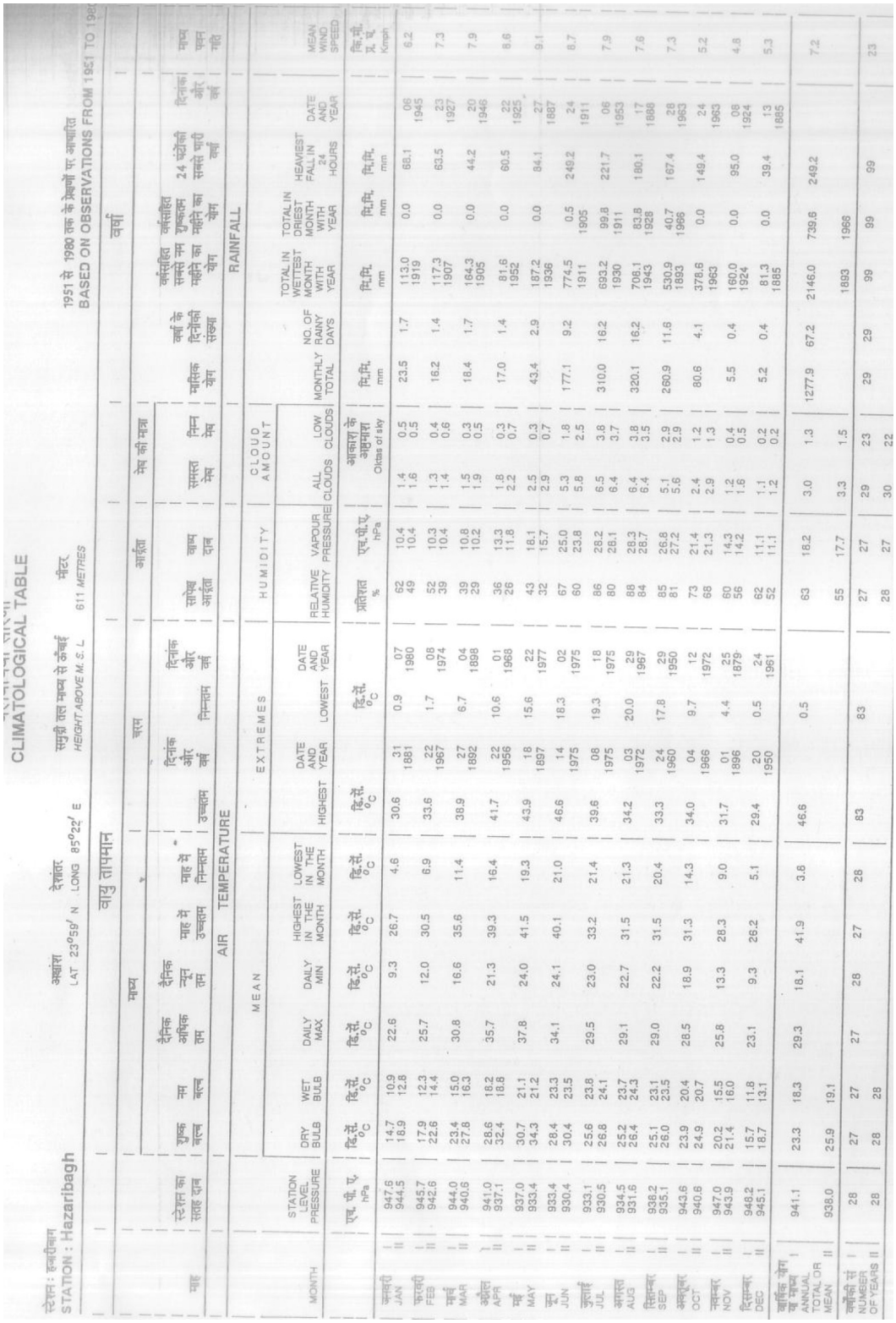
Annexure-I

## VICINITY PLAN



Annexure-II

## CLIMATOLOGICAL TABLE



CLIMATOLOGICAL TABLE

स्टेशन : हजारीबाग STATION : Hazaribagh

अक्षांश LAT 23°59′ N देशांतर LONG 85°22′ E समुद्री तल माध्य 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 | STATION LEVEL PRESSURE एच. पी. ए. hPa | AIR TEMPERATURE MEAN DRY BULB शुष्क बल्ब डि.से. °C | WET BULB नम बल्ब डि.से. °C | DAILY MAX दैनिक अधिक तम डि.से. °C | DAILY MIN दैनिक न्यून तम डि.से. °C | HIGHEST IN THE MONTH माह में उच्चतम डि.से. °C | LOWEST IN THE MONTH माह में निम्नतम डि.से. °C | EXTREMES HIGHEST उच्चतम डि.से. °C | DATE AND YEAR दिनांक और वर्ष | LOWEST निम्नतम डि.से. °C | DATE AND YEAR दिनांक और वर्ष | HUMIDITY RELATIVE HUMIDITY प्रतिशत % | VAPOUR PRESSURE एच.पी.ए. hPa | CLOUD AMOUNT ALL CLOUDS समस्त मेघ आकाश के अष्टांश Oktas of sky | LOW CLOUDS निम्न मेघ | MONTHLY TOTAL मि.मि. mm | NO. OF RAINY DAYS वर्षा के दिनों की संख्या | TOTAL IN WETTEST MONTH WITH YEAR वर्षासहित समस्त नम महीने का योग मि.मि. mm | TOTAL IN DRIEST MONTH WITH YEAR वर्षासहित समस्त शुष्क महीने का योग मि.मि. mm | HEAVIEST FALL IN 24 HOURS 24 घंटों में समस्त भारी वर्षा मि.मि. mm | DATE AND YEAR दिनांक और वर्ष | 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 | 6.9 | 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 | 16.3 | | | | | | | | | 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 | 708.1 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 938.2 | 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 | | | | | | | | | 68 | 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 | I 941.1 | 23.3 | 18.3 | 29.3 | 18.1 | 41.9 | 3.8 | 46.6 | | 0.5 | | 63 | 18.2 | 3.0 | 1.3 | 1277.9 | 67.2 | 2146.0 | 739.6 | 249.2 | | 7.2 |
| वर्ष का माध्य OR MEAN | II 938.0 | 25.9 | 19.1 | | | | | | | | | 55 | 17.7 | 3.3 | 1.5 | | | 1893 | 1968 | | | |
| 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 | | | | | | | |

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% shall be considered. The equipment shall operate in a highly polluted environment. However, for equipment in air conditioned areas, design ambient temperature shall be 35 deg.C, if 2x100% air conditioning system is provided.

1.02.00 All equipments shall be suitable for rated frequency of 50Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification. The step-up voltage level for the project shall be 400 KV. The turbo generator unit will be connected to its own step-up transformers for feeding power into the EHV grid. The overall system shall be designed considering voltage variation of +/- 5% and fault level of 50kA for 400KV and 40kA for 220 KV system. Under black start condition the minimum fault level of 1000 MVA shall be considered at 400KV voltage level and voltage variation at 400kV may be considered as +/-10% till system stabilization.

1.03.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services for the entire station/plant in his scope as well as those specifically required by the Employer.

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 The auxiliary AC voltage supply arrangement shall have 33 kV, 11 kV, 3.3KV and 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition:

| | | |
|---|---|---|
| a) | 33KV/11KV/3.3KV (MV) | +/- 6% |
| b) | 415 V/240 V | +/- 10% |
| c) | 220V DC | -15% to +10% However the nominal continuous DC power supply shall be 240V. |

1.06.00 The voltage level for motors shall be as follows:

| | | |
|---|---|---|
| a) Upto 0.2 KW | : | Single phase 240V AC / 3 phase 415V AC |
| b) Above 0.2 KW and upto 200 KW | : | 3 phase, 415V AC |
| c) Above 200 KW and upto 1500 KW | : | 3 phase, 3.3 kV AC |
| d) Above 1500 KW | : | 11 kV |

The bidder may adopt 415V/3.3 KV for the drives rated in the range of 160-210 KW.

For CHP conveyor motor's rating above 160 kW, 3.3 KV, three phase AC supply is to be used.

The voltage rating of the drives indicated above is for basic guideline. Minor variations in above can be accepted on case to case basis based on techno-economic considerations of the various sub-systems.

Voltage rating for special purpose motors viz, VFD and screw compressors, shall be as per manufacturer's standard. All the motors ratings on Stacker/ reclaimer shall be 415V ac supply only.

| | |
|---|---|
| 1.07.00 | The preferred AC control supply voltage shall be 110V for all 415 V non breaker controlled feeders. Control supply voltages other than above may be offered by bidder based on the bidder's standard proven practice. |
| 1.08.00 | The designed fault levels for 11 KV & 3.3 KV systems shall be restricted to 40 kA rms for 1 second and 50 kA rms for 1 second for 415 V systems. The 33 KV system equipments shall have a minimum short circuit fault withstand rating of 12.5 kA for 1 second. |
| 1.09.00 | The nominal voltage of main DC system shall be 220V. DC batteries shall be designed for continuous float operation with trickle charge, hence all the associated components like batteries, battery chargers, DC motors, relays, contactors, timers etc shall be suitable for continuous operation at the maximum continuous battery float voltage including suitable temperature correction factors. The operational limits of variation of DC voltage is (+)10 % to (-)15%.<br><br>In addition, the bidder may propose 110V, 48V or 24V systems as per requirements of control and instrumentation of his equipment and design. |
| 1.10.00 | The Contractor shall furnish calculations of maximum loading and fault levels under the most onerous conditions for the various equipment/systems as defined else where in the specification to prove adequacy of their parameters. In case any equipment or system is found to be inadequate, it shall be changed/ modified without any additional liability to the Employer. |

# SECTION-C

# SPECIFIC REQUIREMENTS

## 1.0 SCOPE OF SUPPLY

Electrical Laboratory Equipment (including Electrical workshop equipment) mentioned in this section along with all essential accessories required for the successful operation of the equipment.

The bill of quantities shall be as per enclosed Annexure – A with technical specification.

Technical requirements of Electrical Laboratory Equipment (including Electrical Workshop equipment) shall be as per Annexure – II of Section-C with technical specification.

## 2.0 CODES AND STANDARDS

Some of the standards, which shall generally be followed, are listed below. Other applicable Indian standards for any component part, even if not covered in listed standards shall be followed.

i) IS – 6103 Method of test for specific resistance (resistivity) of electrical insulating fluid.

ii) IS – 6700 Requirements of general purpose Cathode Ray Oscilloscope.

iii) IS – 722 Specification for AC electricity meters.

iv) IS – 8143 Specification for plugs & keys for resistance boxes.

v) IS – 6104 Method of test for interfacial tension of oil against water.

vi) IEC-51 Direct acting indicating analogue electrical measuring instruments and their accessories.

vii) Any other relevant National/ International standards as mentioned in the Annexure – II of Section-C with technical specification.

## 3.0 DESIGN CRITERIA:

3.1 Electrical Laboratory Equipment (including Electrical workshop equipments) shall be used for testing various electrical equipment/ devices during Commissioning, Operation and Maintenance of power plant.

3.2 The Equipment will be kept in a clean but hot, humid and tropical atmosphere when not in use. Equipment will be placed in dust laden, hot, humid atmosphere during its use.

3.3 For continuous operation at specified rating, temperature rise of various equipment/ components shall be limited to the permissible value stipulated in the relevant standards and this specification.

## 4.0 SPECIFIC REQUIREMENTS & RATINGS:

4.1 The Bidder may note that the equipment range, rating, quantities as detailed herein, are the minimum requirement only. All accessories for the equipment not covered here, if necessary for satisfactory and trouble free operation of the equipment, shall be quoted by the Bidder.

4.2 Equipment's shall be complete with applicable accessories like power supply, mains leads, screened guard test leads, screened line test leads, earth leads, connectors and clips leather carrying case, input card, clip on current transformers with measurement leads and connectors, suitable hand spikes, main adopter, spare fuses, range extending devices, acoustic calibrator, extension cable input lead, microphones of suitable capacities, vibration pickup, probe pick up cable, camera, external hull detector, hammer, test cell with spherical and mush room type electrodes, spacing gauges, stirrers, inductive sensing heads suitable for different cable sizes etc.

4.3 The instrument shall be suitable for satisfactory operation at an ambient temp. from 0°C to 50°C.

4.4 The Analog instruments shall be provided with knife-edge pointer and anti – parallax mirror.

4.5 Instrument/ meters suitable for DC supply should be provided with re–chargeable batteries, chargers and low battery charge indication.

4.6 All bidders to be advised to quote only 'one' make/model against each equipment best to suit specification requirement.

4.7 The instrument shall be suitable for hand held operation, rugged in construction and suitable for field use.

4.8 Power supply for AC operating instruments shall be 240V AC, 50Hz, single phase.

4.9 **Bidder to note that "In case any recommended make / model become obsolete or is stopped manufacturing by manufacturer, next higher make / model of the same company may be considered for ordering / supply at contract stage and no additional cost shall be paid by BHEL to supplier. Bidder is required to furnish confirmation that "next higher make / model is technical equivalent or better" in case of above condition.**

## 5.0 TESTS:

5.1 All acceptance and routine tests as per relevant standards and specification shall be carried out by the manufacturer. Charges for all these routine and acceptance tests for all the material shall be deemed to be included in the bid price.

5.2 Equipment shall be completely assembled, wired, adjusted and tested in factory as per the latest edition of relevant standards.

5.3 Bidder shall follow his standard procedure for quality control. However the said procedure/ quality checks shall be submitted for purchaser's approval.

## 6.0 DRAWING DATA & MANUAL:

6.1 To be submitted with the bid

a) Compliance to Technical requirement of various equipments as specified in technical specification. Also, bidder to furnish Data Sheet – B.
b) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
c) Technical leaflets/ Catalogues on following
    i) Testing of equipment
    i) Instruments
    ii) Misc. Equipment
d) "No Technical Deviation" sheet/ Deviation sheet as per Annexure II of GCC (General conditions of contract). Deviations from technical specification are generally not acceptable. In case of deviations from technical specification, the tenderer shall give cost of withdrawl of such deviation in Sealed Cover as per Annexure-II of GCC. In absence of any cost of withdrawl by bidder in sealed envelope, no price implication on any deviation withdrawl by bidder shall be acceptable.

The Bidder may note that the drawing, data and manual listed herein are minimum requirement only. The Bidder shall ensure that the other necessary write-ups, curves and information required to fully describe the equipment are submitted with the bid.

6.2 To be submitted after award of contract for BHEL/customer approval:

a) General arrangement drawing showing constructional features, accessories, connections, range and rating, mounting arrangement, space requirement etc.
b) Detail instructions for application, assembly & testing of equipments.
c) Wiring and schematic diagrams.

d) Tests Reports and calibration curve
e) Technical Catalogues & leaflets.
f) Instruction manual of individual equipment
g) Technical Data sheet .

Technical documentation such as Technical Particulars, GA sectional drawings, Technical leaflets, Catalogues etc. are required to be submitted within 2 weeks of LOI by the successful bidder for BHEL approval.

6.3 Instruction manual of individual equipment

The manual shall clearly indicate in English the installation and connection method, check list of the tests to be carried out before commissioning of equipment. Maintenance and Calibration method shall also be provided in the manual.

6.4 Number of copies of document/data to be submitted by the successful bidder shall be as per enclosed ANNEXURE – I.

6.5 Bidder to furnish all user instruction manuals, maintenance, handling, installation manuals & all test reports complete in all respect in bound volumes & soft copies to BHEL / BHEL's customer at the time of handing over the same to BHEL / BHEL's Customer.

6.6 Bidder to note that quoted item cost shall include cost of main item, cost of all accessories required for successful operation of equipment and testing cost of all acceptance & routine test as per relevant standard. Test certificates/ Test reports shall be furnished by bidder to BHEL at contract stage for review/acceptance. No additional cost for the same shall be payable by BHEL.

7.0 **PACKING:**

The equipment shall be properly packed in Galvanized sheet steel trunk/box with proper lock & key arrangement.

**8.0 DELIVERY:**

The delivery of Equipment shall be completed as per NIT (Notice Inviting Tender)

9.0 Bidder shall furnish unit rate for each item in the "Schedule of prices for Electrical Lab Equipment" enclosed in Technical Specification as Annexure –A. Purchaser reserves the right to add/ delete any item during detailed engineering as finally required for the project. Unit rate quoted shall be applicable for price adjustment in such cases.

10.0 All the equipment components shall be procured from reputed manufacturers and make of equipment shall be subject to the approval of BHEL/ BHEL's Customer.

11.0 The modality of approval of technical documentation & priority of supply shall be mutually discussed & agreed upon with successful bidder in kick – off meeting after placement of LOI.

12.0 **Demonstration & Handing over to BHEL / BHEL's Customer**

The bidder shall be responsible for demonstration of the supplied equipment at site to BHEL / BHEL's customer and ensure handing over the same to the satisfaction of BHEL / BHEL's Customer.

Bidders to identify the equipment requiring commissioning by expert(s) from vendor.

The charges for the same has been fixed as per enclosed "Annexure- B".

13.0 **Performance Guarantee**

The bidder shall guarantee that the equipment offered shall meet the requirement as stipulated in this specification and as confirmed by them in Technical Data Sheet. In case the performance of equipment is not as per performance guarantee, the bidder will have to replace the equipment at site free of cost.

ANNEXURE – I

(VENDOR DRAWING/DOCUMENT SCHEDULE)

| S. NO. | DESCRIPTION | THROUGH DMS | HARD PRINTS | CD-ROMs |
|---|---|---|---|---|
| 1 | Docs. /drgs. for approval (First submission) | YES | - | - |
| 2 | Docs. / drgs. for approval (Second & subsequent submission till approval) | YES | - | - |
| 3 | Final approved docs. / drgs. for Distribution | YES | As per NIT | As per NIT |

## Annexure-II of SECTION-C

## TECHNICAL REQUIREMENTS

**FOR GENERATOR & IP BUSDUCT**

1. **Fully automatic DC high voltage 0-70 KV/ 50 mA test kit 1 No.**

   Make: Megger ,Biddle or reputed Indian/foreign make

   Voltage Range: 0-70kV DC

   Current Range: 0-50mA

   It shall be suitable for testing Generator & associated bus duct.

   The HV transformer shall be either dry type or hermetically sealed liquid filled type. The equipment shall be portable roller/trolley mounted. Shall be protected against short circuits and overloads. It shall be possible to switch-on the high voltage only when the control setting is at minimum. The instrument is provided with accurate indication of high voltage and leakage current.

2. **Fully automatic AC high voltage test kit, upto 50kV/5A 1 No.**

   Make: Megger, Biddle or reputed Indian/foreign make

   Voltage Range: 0-50 kV AC

   Current Range: 0-5 A

   It shall be suitable for testing Generator & associated bus duct.

   The HV transformer shall be either dry type or hermetically sealed liquid filled type. The equipment shall be portable roller/trolley mounted. Shall be protected against short circuits and overloads. It shall be possible to switch-on the high voltage only when the control setting is at minimum. The instrument is provided with accurate indication of high voltage and leakage current.

3. **One complete set of torque wrenches of different sizes 1 No.**

   Make: Reputed Indian /foreign make

   It shall be suitable for testing Generator & associated bus duct.

4. **Fully automatic insulation analyser test kit 1 No.**

   Make: Megger, Yokogawa, Hioki, Fluke, Agilent or reputed Indian/foreign make

   Salient features

   - Fully automatic insulation analyser (power factor & capacitance measurement) with resonating inductor(suitable for Generator having per phase winding capacitance to earth as 0.295 μF and winding capacitance to earth with all phases connected together as 0.885 μF) test kit
   - based on schering bridge method of measurement
   - contains necessary software for data storage and analysis

5. **Portable AC high voltage test kit, upto 50kV/100 mA. 1 No.**

   Make: Megger,Biddle or reputed Indian/foreign make

Voltage Range: 0-50 kV AC

Current Range: 0-100 mA

It shall be suitable for testing Generator & associated bus duct.

**FOR PROTECTION SYSTEM(RELAYS)**

1. **Precision grade Fully automatic DC earth fault locator- 1 No.**

Make: Taurus,Megger or reputed Indian/foreign make

Receiver sensitivity 25 kilo ohms fault resistance

It shall be capable of detecting earth faults where fault resistance is as high as 25-kilo ohms. The instrument shall operate by injecting a low frequency, low voltage signal to the Dc system at the main DC DB from a transmitter and sensing head to the fault.

2. **Fully automatic three phase dynamic relay test kit with necessary software for control and data storage. 1 No.**

The equipment shall be latest model with software full version (required for power plant applications) with license of atleast five years

Make: Doble,Omicron, Megger, Freja

**FOR EARTH RESISTANCE MEASUREMENT**

1. **Portable earth resistance measurement kit based on three spike method 1 No.**

Measuring frequency shall be able to avoid interference.

Make : Megger, Chauvin Arnoux, Fluke

| | |
|---|---|
| Earth resistance: | 0-1999 Ohms (Auto ranging) |
| Accuracy: | 5% |
| Display: | Alpha numeric LCD |

2. **Portable earth resistance measurement kit based on Stakeless method (Clamp on type) 1No.**

Make: Kyoritsu, Fluke or reputed Indian/foreign make

Description same as above.

**FOR CURRENT TRANSFORMERS**

1. **Fully automatic Instrument transformer test set capable of measuring & printing ratio, polarity and knee point voltage by secondary injection method 1 No.**

Make: Vanguard,SCOPE,Omicron,ISA or reputed Indian/foreign make

It shall be suitable for Current transformers having secondary current rating of 1A & 5A.

2. **Fully automatic precision grade primary injection kit suitable for testing 0.2 class EHV Current transformers 1 No.**

The equipment shall be portable roller/trolley mounted.

Make: ISA, Omicron or reputed Indian/foreign make

Output current: 0-2000A,
Accuracy- 1.5%
It shall be suitable for current transformer mounted on 400 kV system also.

**3. Precision grade digital AC clamp on meter 1 No.**

Make: Reputed Indian /foreign make

Input Voltage: Upto 600 Volts
Current Range: 0 -2000 Amp
Accuracy: ± 2.5%
Frequency Range: 45 – 55 Hz
The equipment should have facility to change the range 2/20/200/2000 Amp.

**FOR MOTORS**

1. **Fully automatic motor current signature analyser for HT & LT motors with necessary software for data storage and analysis 1 No.**

   Make: PdMA,ERICKS or reputed Indian/foreign make
   The software shall be full version with license.
   Highest rating HT (11kV) motor is of 12 MW pf 0.91 & efficiency 97.6%
   Highest rating LT (415 V) motor is of 200 KW pf 0.85 & efficiency 95%**.**

2. **Motor surge tester 1 No.**

   Make: SAMATIC,MEA or reputed Indian/foreign make

   Highest rating HT (11kV) motor is of 12 MW pf 0.91 & efficiency 97.6%
   Highest rating LT (415 V) motor is of 200 KW pf 0.85 & efficiency 95%**.**

3. **Precision grade upto 5 kV motorised megger** 1 No.

   Make: Megger, Kyoritsu, Chauvin Arnoux or reputed Indian/foreign make
   Test voltages: 5kV DC either variable in steps or standard test voltages of 500/1000/2500/5000 Volts
   Mega ohm Range: upto 100,000 Mohms either on multiple scales or provided with suitable range multiplier.
   Accuracy: ±5%

4. **Motor bearing puller based on induction heating method 1 No.**

   Make: SKF,Simatool or reputed Indian/foreign make
   Highest rating HT (11kV) motor is of 12 MW pf 0.91 & efficiency 97.6%
   Highest rating LT (415 V) motor is of 200 KW pf 0.85 & efficiency 95%**.**

**FOR BATTERIES**

**1. Fully automatic Battery impedance measurement test kit 1 No.**

Make : Megger, Omicron,Mpower or reputed Indian/foreign make

- capable of measuring and storing specific gravity of acid, temperature of cell etc. with data storage facility.
- Suitable to determine the condition of lead-acid batteries upto 2X1610 Ah and nickel- cadmium batteries up to 2X760 Ah.

**FOR CABLES**

**1. Fully automatic portable cable fault locator 1 No.**

Make: HIPOTRONICS,APLAB or reputed Indian/foreign make

Type : Surge generator not less than 15kV(100 mA), surge capacity not less than 512 joules, 10/20 pulse per minutes.

It shall be suitable for testing cables upto 33 kV.

**COMMON TEST EQUIPMENT**

**1. Analog Phase sequence indicator 2No.**

Make: Crompton, Matic or reputed Indian/foreign make

- Indicates the phase rotation sequence of 3-phase voltage.
- Voltage: 100 to 500 V (line to line)
- Frequency: 45-55 Hz

**2. Precision grade 3 1/2 digit digital multimeter with suitable clamp on meters 10 No.**

Make: Fluke, Hioki, Yokogawa, Ch BEHA Gmbh, Megger, Kyoritsu

Features : -

| | |
|---|---|
| 1. DC voltage: | 0 - 1000 volts |
| 2. AC voltage: | 0 - 1000 volts |
| 3. DC current: | 0 - 10 amps |
| 4. AC current: | 0 - 10 amps |
| 5. Resistance: | 0 - 20 Mega ohms |
| | 0 - 200 kilo-ohms |
| | 0 - 2 kilo-ohms |
| 6. Accuracy: | i) DC range ± 1% |
| | ii) AC range ± 2% |
| | iii) Resistance ± 5% |

**3. Precision grade clamp on current measurement kit suitable for measuring spill current in mA accurately. 3 No.**

Make: Megger, Kyoritsu, or reputed Indian/ foreign make

Current range: 0-1000 mA

Accuracy class: ±2%

**4. Decade resistance box. 2 No.**

Make: PASCO, Yokogawa, EMCO or reputed Indian/ foreign make

Range: 1k ohm to 1 Tera ohm

Resolution : 1k ohm

Accuracy: ±2%

**5. Fully automatic digital megger (0-2.5kV) 2 No.**

Make: Megger , fluke or reputed Indian/ foreign make

Test voltages: 2.5kV DC either variable in steps or standard test voltages of 500/1000/2500 Volts

Mega ohm Range upto 50,000 Mohms either on multiple scales or provided with suitable range multiplier.

Accuracy: ±5%

**6. Fully automatic digital megger (0-5kV) 2 No.**

Make: Megger , fluke or reputed Indian/ foreign make

Test voltages: 5kV DC either variable in steps or standard test voltages of 500/1000/2500/5000 Volts

Mega ohm Range: upto 100,000 Mohms either on multiple scales or provided with suitable range multiplier.

Accuracy: ±5%

**7. Fully automatic digital megger (0-15kV) 2 No.**

Make: Megger , fluke or reputed Indian/foreign make

Test voltages: 15kV DC either variable in steps or standard test voltages of 1000/2500/5000/10000/15000 Volts

Mega ohm Range: upto 300,000 Mohms either on multiple scales or provided with suitable range multiplier

Accuracy: ±5%

**ELECTRICAL WORKSHOP EQUIPMENTS**

**1. Oven for drying of HT & LT motors insulation**

HT Oven (suitable for drying highest rating HT motor) 1 No.

Make: Reputed Indian /foreign make

Highest rating HT (11kV) motor- 12 MW, pf 0.91 & efficiency 97.6%

LT Oven (suitable for drying highest rating LT motor) 1 No.

Make: Reputed Indian /foreign make

Highest rating LT motor- 200 kW, pf- 0.85, efficiency 95%

**2. Workshop T&Ps**

**High voltage AC test kit 25kV – 1A** **1 No.**

Make: Megger, Biddle or reputed Indian/foreign make

Voltage Range: 0-25 kV AC

Current Range: 0-1 A

**High voltage DC test kit 30kV – 200 mA** **1 No.**

Make: Megger, Biddle or reputed Indian/foreign make

Voltage Range: 0-30 kV DC

Current Range: 0-200 mA

3. **Hydraulic Bearing & coupling half pullers and hydraulic jacks** **1 set**

**Suitable for highest rating HT & LT motors**

Make: Reputed Indian /foreign make

Highest rating HT (11kV) motor is of 12 MW pf 0.91 & efficiency 97.6%.

Highest rating LT (415 V) motor is of 200 KW pf 0.85 & efficiency 95%.

4. **Set of box, D-shape, ring spanners** **2 sets of each**

Make: Reputed Indian /foreign make

5. **Induction heating machine suitable for highest rating motor bearing/coupling half.** **1 No.**

Make: Reputed Indian /foreign make

Highest rating HT (11kV) motor is of 12 MW pf 0.91 & efficiency 97.6%

Highest rating LT (415 V) motor is of 200 KW pf 0.85 & efficiency 95%.

6. **Electrical test bed for HT & LT drives**

Make: Reputed Indian /foreign make

It shall be used to test the repaired equipment during the O & M phase of the project.

Separate HT and LT motor test bed shall be provided to facilitate carrying out the site test on repaired motors i.e. no load trials. It shall have 11 kV panel for HT test bed and 415 V LT supply panel to LT test bed. The slotted foundation bed (metallic) to accommodate HT/LT motors of various frame sizes shall be provided.

Each of the test bed shall have separate Control panel for starting /stopping of drive & Associated cables & cabling.

The no load trials on motors shall include but not be limited to following tests-

- No load running of motor and reading of voltage, current, power, bearing temperature under steady state condition
- Measurement of vibrations during no load run
- Measurement of shaft voltage during no load run

Provision for Other site tests which are necessary to ensure the proper functioning of repaired motors shall also be provided in the test bed.

Highest rating HT (11kV) motor is of 12 MW pf 0.91 & efficiency 97.6%.
Highest rating LT (415 V) motor is of 200 KW pf 0.85 & efficiency 95%.

Note-

1. The GA drawing of largest rating HT motor & largest rating LT motor is attached for reference. However, dimensions specified are tentative & may change. The equipment for motors shall be suitable for highest rating HT & LT motors.
2. All the above equipments should be suitable for power plant applications.

**3X660 MW NORTH KARANPURA STPP**
**PACKAGE- ELECTRICAL LABORATORY EQUIPMENTS**

**(ANNEXURE-A)**

**BOQ-CUM PRICE SCHEDULE**

**ELECTRICAL TESTING LAB EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | UNIT PRICE (Rs.) | TOTAL PRICE (Rs.) |
|---|---|---|---|---|---|---|
| I | **FOR GENERATOR & IP BUSDUCT** | | | | | |
| 1 | Fully automatic DC high voltage 0-70 KV/ 50 mA test kit . | Megger,Biddle or reputed Indian/foreign make | 1 | no | | |
| 2 | Fully automatic AC high voltage test kit, upto 50 kV/ 5A suitable for testing Generator and associated busduct. | Megger,Biddle or reputed Indian/foreign make | 1 | no | | |
| 3 | One complete set of torque wrenches of different sizes | Reputed Indian/foreign make | 1 | no | | |
| 4 | Fully automatic insulation analyser (power factor & capacitance measurement) with resonating inductor(suitable for Generator) test kit based on schering bridge method of measurement with necessary software for data storage and analysis | Megger,Yokogawa,Hioki, Fluke,Agilent or reputed Indian/foreign make | 1 | no | | |
| 5 | Portable AC high voltage test kit, upto 50 kV/ 100 mA. | Megger,Biddle or reputed Indian/foreign make | 1 | no | | |
| II | **FOR PROTECTION SYSTEM(RELAYS)** | | | | | |
| 1 | Precision grade Fully automatic DC earth fault locator | Tauras,Megger or reputed Indian/foreign make | 1 | no | | |
| 2 | Fully automatic three phase dynamic relay test kit with necessary software for control and data storage. | Doble,Omicron, Megger, Freja. | 1 | no | | |
| III | **FOR EARTH RESISTANCE MEASUREMENT** | | | | | |
| 1 | Portable earth resistance measurement kit based on three spike method | Megger, Chauvin Arnoux, Fluke | 1 | no. | | |
| 2 | Portable earth resistance measurement kit based on Stakeless method( clamp on type) | Kyoritsu, Fluke or reputed Indian/foreign make | 1 | no. | | |
| IV | **FOR CURRENT TRANSFORMERS** | | | | | |
| 1 | Fully automatic Instrument transformer test set capable of measuring & printing ratio, polarity and knee point voltage by secondary injection method | Vanguard,SCOPE,Omicron,ISA or reputed Indian/foreign make | 1 | no. | | |
| 2 | Fully automatic precision grade primary injection kit suitable for testing 0.2 class EHV Current transformers (Current range: 0-2000 amp.) | ISA, Omicron or reputed Indian/foreign make | 1 | no. | | |
| 3 | Precision grade digital AC clamp on meter (0 -2000 Amp) | Reputed Indian/foreign make | 1 | no. | | |
| V | **FOR MOTORS** | | | | | |
| 1 | Fully automatic motor current signature analyser for HT & LT motors with necessary software for data storage and analysis | PdMA,ERICKS or reputed Indian/foreign make | 1 | no. | | |
| 2 | Motor surge tester | SAMATIC,MEA or reputed Indian/foreign make | 1 | no. | | |
| 3 | Precision grade upto 5 kV motorised megger | Megger, Kyoritsu,Chauvin arnoux or Reputed Indian/foreign make | 1 | no. | | |
| 4 | Motor bearing puller based on induction heating method. | SKF,Simatool or Reputed Indian/foreign make | 1 | no. | | |
| VI | **FOR BATTERIES** | | | | | |
| 1 | Fully automatic Battery impedance measurement test kit capable of measuring and storing specific gravity of acid, temperature of cell etc. with data storage facility. | Megger, Omicron,Mpower or reputed Indian/foreign make | 1 | no. | | |
| VII | **FOR CABLES** | | | | | |
| 1 | Fully automatic portable cable fault locator | HIPOTRONICS,APLAB or Reputed Indian/foreign make | 1 | no. | | |
| VIII | **COMMON TEST EQUIPMENT** | | | | | |
| 1 | Analog Phase sequence indicator | Crompton,Matic or reputed Indian/foreign make | 2 | no. | | |
| 2 | Precision grade 3 1/2 digit digital multimeter with suitable clamp on meters | Fluke, Hioki, Yokogawa, Ch BEHA Gmbh, Megger, Kyoritsu | 10 | no. | | |
| 3 | Precision grade clamp on current measurement kit suitable for measuring spill current in mA accurately.( Current range:0-1000 mA) | Megger, Kyoritsu, or Reputed Indian/foreign make | 3 | no. | | |
| 4 | Decade resistance box. | PASCO, Yokogawa,EMCO or Reputed Indian/foreign make | 2 | no. | | |
| 5 | Fully automatic digital megger(0-2.5 kV) | Megger, Fluke or Reputed Indian/foreign make | 2 | no. | | |
| 6 | Fully automatic digital megger(0-5 kV) | Megger, Fluke or Reputed Indian/foreign make | 2 | no. | | |
| 7 | Fully automatic digital megger(0-15 kV) | Megger, Fluke or Reputed Indian/foreign make | 2 | no. | | |

**ELECTRICAL WORKSHOP EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | UNIT PRICE (Rs.) | TOTAL PRICE (Rs.) |
|---|---|---|---|---|---|---|
| 1 | Oven for drying of HT & LT motors insulation | | | | | |
| 1.1 | HT Oven (suitable for drying highest rating HT motor) | Reputed Indian/foreign make | 1 | no | | |
| 1.2 | LT Oven (suitable for drying highest rating LT motor). | Reputed Indian/foreign make | 1 | no | | |
| 2 | Workshop T&Ps | | | | | |
| 2.1 | High voltage AC test kit 25kV – 1A | Megger, Biddle or Reputed Indian/foreign make | 1 | no. | | |
| 2.2 | High voltage DC test kit 30kV – 200 mA | Megger, Biddle or Reputed Indian/foreign make | 1 | no. | | |
| 3 | Hydraulic Bearing & coupling half pullers and hydraulic jacks | Reputed Indian/foreign make | 1 | set | | |
| 4 | Set of box, D-shape, ring spanners | Reputed Indian/foreign make | 2 | sets. of each | | |
| 5 | Induction heating machine suitable for highest rating motor bearing/coupling half. | Reputed Indian/foreign make | 1 | no. | | |
| 6.1 | Electrical test bed for HT drives | Reputed Indian/foreign make | 1 | no. | | |
| 6.2 | Electrical test bed for LT drives | Reputed Indian/foreign make | 1 | no. | | |

**NOTE :-**

**1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSSNTIAL ACCESSORIES FOR SUCCESSFUL OPERATION OF EQUIPMENT AT SITE .i.e. CLAMPS, CLIPS,LEADS ,CARRYING CASE etc.**

**2) ALL EQUIPMENTS SHALL BE SUPPLIED WITH VALID CALIBRATION CERTIFICATE, WHEREVER APLLICABLE.**

**3) IN ADDITION TO NORMAL PACKING OF THE EQUIPMENTS, THE EQUIPMENTS TO BE PROPERLY PACKED IN GALVANIZED SHEET STEEL TRUNK/BOX WITH PROPER LOCK & KEY ARRANGEMENT.**

## ANNEXURE – B

## SCHEDULE OF PRICES FOR DEMONSTRATION & HANDING OVER TO BHEL / BHEL'S CUSTOMER

| SL. NO. | DETAILS | ACTIVITY | UNIT CHARGES |
|---|---|---|---|
| 1 | LUMP SUM ALL INCLUSIVE CHARGES PER VISIT FOR EXPERIENCED / CAPABLE ENGINEER (EXCEPT DAILY CHARGES) | 1 VISIT | **20000/** |
| 2 | LUMP SUM ALL INCLUSIVE CHARGES FOR EXPERIENCED / CAPABLE ENGINEER PER DAY | 1 DAY | **5000/** |

**Note:**

1. TOTAL CHARGES = (Charges as per S.No.1) + [No. of Days(*) x Unit Charges as per Sl. No. 2]

*: To be certified by BHEL site

2. Bidder to note that provision of maximum 4 visits amounting to total 15 man days is envisaged for respective bidders.

# DATASHEET B

**ELECTRICAL TESTING LAB EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | MAKE | MODEL No | COUNTRY OF MANUFACTURE | EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO) | ADDITIONAL ACCESSORIES RECOMMENDED | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| I | **FOR GENERATOR & IP BUSDUCT** | | | | | | | | | |
| 1 | Fully automatic DC high voltage 0-70 KV/ 50 mA test kit . | Megger,Biddle or reputed Indian/foreign make | 1 | no | | | | | | |
| 2 | Fully automatic AC high voltage test kit, upto 50 kV/ 5A suitable for testing Generator and associated busduct. | Megger,Biddle or reputed Indian/foreign make | 1 | no | | | | | | |
| 3 | One complete set of torque wrenches of different sizes | Reputed Indian/foreign make | 1 | no | | | | | | |
| 4 | Fully automatic insulation analyser (power factor & capacitance measurement) with resonating inductor(suitable for Generator) test kit based on schering bridge method of measurement with necessary software for data storage and analysis | Megger,Yokogawa,Hioki, Fluke,Agilent or reputed Indian/foreign make | 1 | no | | | | | | |
| 5 | Portable AC high voltage test kit, upto 50 kV/ 100 mA. | Megger,Biddle or reputed Indian/foreign make | 1 | no | | | | | | |
| II | **FOR PROTECTION SYSTEM(RELAYS)** | | | | | | | | | |
| 1 | Precision grade Fully automatic DC earth fault locator | Tauras,Megger or reputed Indian/foreign make | 1 | no | | | | | | |
| 2 | Fully automatic three phase dynamic relay test kit with necessary software for control and data storage. | Doble,Omicron, Megger, Freja. | 1 | no | | | | | | |
| III | **FOR EARTH RESISTANCE MEASUREMENT** | | | | | | | | | |
| 1 | Portable earth resistance measurement kit based on three spike method | Megger, Chauvin Arnoux, Fluke | 1 | no. | | | | | | |
| 2 | Portable earth resistance measurement kit based on Stakeless method( clamp on type) | Kyoritsu, Fluke or reputed Indian/foreign make | 1 | no. | | | | | | |

**ELECTRICAL TESTING LAB EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | MAKE | MODEL No | COUNTRY OF MANUFACTURE | EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO) | ADDITIONAL ACCESSORIES RECOMMENDED | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| **IV** | **FOR CURRENT TRANSFORMERS** | | | | | | | | | |
| 1 | Fully automatic Instrument transformer test set capable of measuring & printing ratio, polarity and knee point voltage by secondary injection method | Vanguard,SCOPE,Omicron,ISA or reputed Indian/foreign make | 1 | no. | | | | | | |
| 2 | Fully automatic precision grade primary injection kit suitable for testing 0.2 class EHV Current transformers (Current range: 0-2000 amp.) | ISA, Omicron or reputed Indian/foreign make | 1 | no. | | | | | | |
| 3 | Precision grade digital AC clamp on meter (0 -2000 Amp) | Reputed Indian/foreign make | 1 | no. | | | | | | |
| **V** | **FOR MOTORS** | | | | | | | | | |
| 1 | Fully automatic motor current signature analyser for HT & LT motors with necessary software(full version with license) for data storage and analysis | PdMA,ERICKS or reputed Indian/foreign make | 1 | no. | | | | | | |
| 2 | Motor surge tester | SAMATIC,MEA or reputed Indian/foreign make | 1 | no. | | | | | | |
| 3 | Precision grade upto 5 kV motorised megger | Megger, Kyoritsu,Chauvin arnoux or Reputed Indian/foreign make | 1 | no. | | | | | | |
| 4 | Motor bearing puller based on induction heating method. | SKF,Simatool or Reputed Indian/foreign make | 1 | no. | | | | | | |
| **VI** | **FOR BATTERIES** | | | | | | | | | |
| 1 | Fully automatic Battery impedance measurement test kit capable of measuring and storing specific gravity of acid, temperature of cell etc. with data storage facility. | Megger, Omicron,Mpower or reputed Indian/foreign make | 1 | no. | | | | | | |
| **VII** | **FOR CABLES** | | | | | | | | | |
| 1 | Fully automatic portable cable fault locator | HIPOTRONICS,APLAB or Reputed Indian/foreign make | 1 | no. | | | | | | |

**ELECTRICAL TESTING LAB EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | MAKE | MODEL No | COUNTRY OF MANUFACTURE | EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO) | ADDITIONAL ACCESSORIES RECOMMENDED | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| VIII | COMMON TEST EQUIPMENT | | | | | | | | | |
| 1 | Analog Phase sequence indicator | Crompton,Matic or reputed Indian/foreign make | 2 | no. | | | | | | |
| 2 | Precision grade 3 1/2 digit digital multimeter with suitable clamp on meters | Fluke, Hioki, Yokogawa, Ch BEHA Gmbh, Megger, Kyoritsu | 10 | no. | | | | | | |
| 3 | Precision grade clamp on current measurement kit suitable for measuring spill current in mA accurately.( Current range:0-1000 mA) | Megger, Kyoritsu, or Reputed Indian/foreign make | 3 | no. | | | | | | |
| 4 | Decade resistance box. | PASCO, Yokogawa,EMCO or Reputed Indian/foreign make | 2 | no. | | | | | | |
| 5 | Fully automatic digital megger(0-2.5 kV) | Megger, Fluke or Reputed Indian/foreign make | 2 | no. | | | | | | |
| 6 | Fully automatic digital megger(0-5 kV) | Megger, Fluke or Reputed Indian/foreign make | 2 | no. | | | | | | |
| 7 | Fully automatic digital megger(0-15 kV) | Megger, Fluke or Reputed Indian/foreign make | 2 | no. | | | | | | |

**ELECTRICAL WORKSHOP EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Oven for drying of HT & LT motors insulation | | | | | | | | | |
| 1.1 | HT Oven (suitable for drying highest rating HT motor) | Reputed Indian/foreign make | 1 | no | | | | | | |
| 1.2 | LT Oven (suitable for drying highest rating LT motor). | Reputed Indian/foreign make | 1 | no | | | | | | |
| 2 | Workshop T&Ps | | | | | | | | | |

**ELECTRICAL TESTING LAB EQUIPMENTS**

| SL. NO. | ITEM DESCRIPTION | MAKE | QUANTITY | UNITS | MAKE | MODEL No | COUNTRY OF MANUFACTURE | EQUIPMENT & ACCESSORIES CONFIRMS TO ALL TECHNICAL REQUIREMENTS IN TOTALITY - (YES/NO) | ADDITIONAL ACCESSORIES RECOMMENDED | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | High voltage AC test kit 25kV – 1A | Megger, Biddle or Reputed Indian/foreign make | 1 | no. | | | | | | |
| 2.2 | High voltage DC test kit 30kV – 200 mA | Megger, Biddle or Reputed Indian/foreign make | 1 | no. | | | | | | |
| 3 | Hydraulic Bearing & coupling half pullers and hydraulic jacks | Reputed Indian/foreign make | 1 | set | | | | | | |
| 4 | Set of box, D-shape, ring spanners | Reputed Indian/foreign make | 2 | sets. of each | | | | | | |
| 5 | Induction heating machine suitable for highest rating motor bearing/coupling half. | Reputed Indian/foreign make | 1 | no. | | | | | | |
| 6.1 | Electrical test bed for HT drives | Reputed Indian/foreign make | 1 | no. | | | | | | |
| 6.2 | Electrical test bed for LT drives | Reputed Indian/foreign make | 1 | no. | | | | | | |

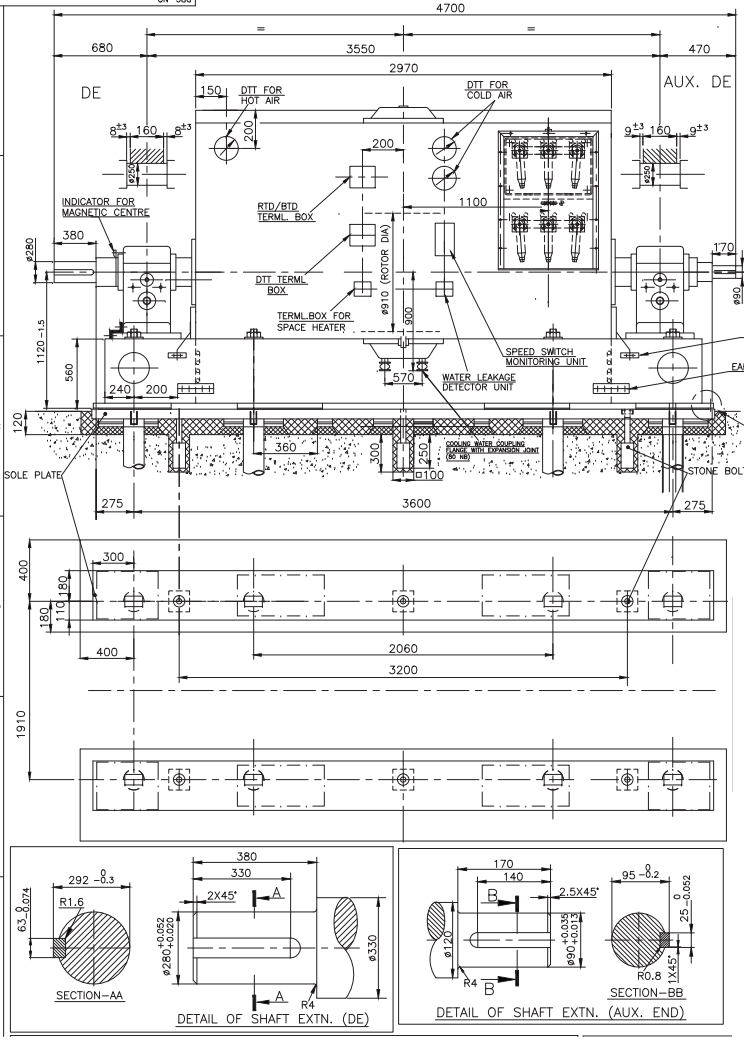
1) EQUIPMENT TO BE SUPPLIED ALONG WITH ESSSNTIAL ACCESSORIES FOR SUCCESSFUL OPERATION OF EQUIPMENT AT SITE .i.e. CLAMPS, CLIPS,LEADS ,CARRYING CASE etc.

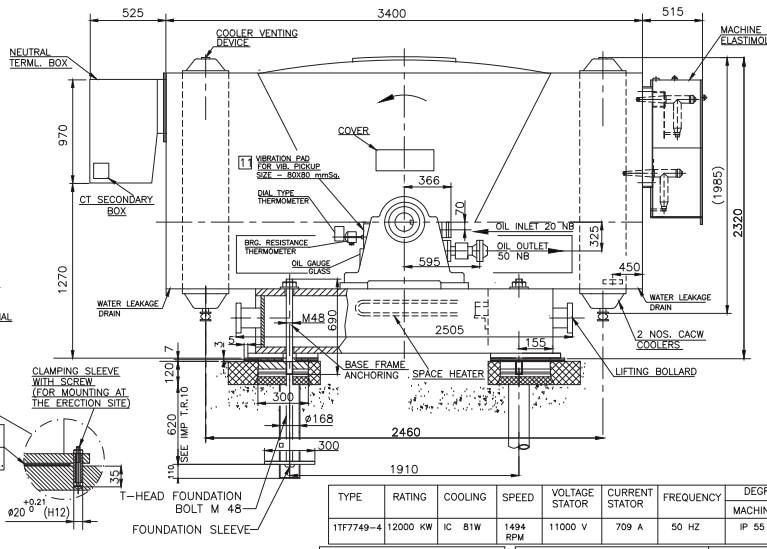
2) ALL EQUIPMENTS SHALL BE SUPPLIED WITH VALID CALIBRATION CERTIFICATE, WHEREVER APLLICABLE.

3), THE EQUIPMENTS TO BE PROPERLY PACKED IN GALVANIZED SHEET STEEL TRUNK/BOX WITH PROPER LOCK & KEY ARRANGEMENT.

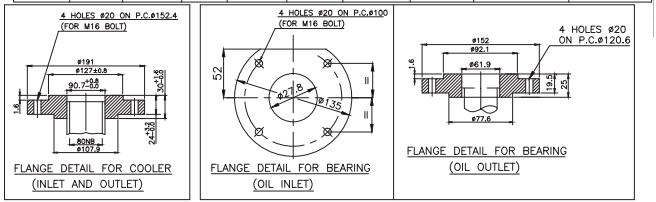
# OGA OF HIGHEST RATING HT MOTOR (TENTATIVE)

**( 12 MW, pf 0.91 & efficiency 97.6%)**




| TYPE | RATING | COOLING | SPEED | VOLTAGE STATOR | CURRENT STATOR | FREQUENCY | DEGREE OF PROTECTION | | DIRECTION OF ROTATION |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | MACHINE | STATOR TERMINAL | |
| 1TF7749–4 | 12000 KW | IC 81W | 1494 RPM | 11000 V | 709 A | 50 HZ | IP 55 | IP 55 | COUNTER CLOCKWISE FROM D.E. |




TENTATIVE OGA OF LARGEST HT MOTOR (12 MW)

# OGA OF HIGHEST RATING LT MOTOR (TENTATIVE)

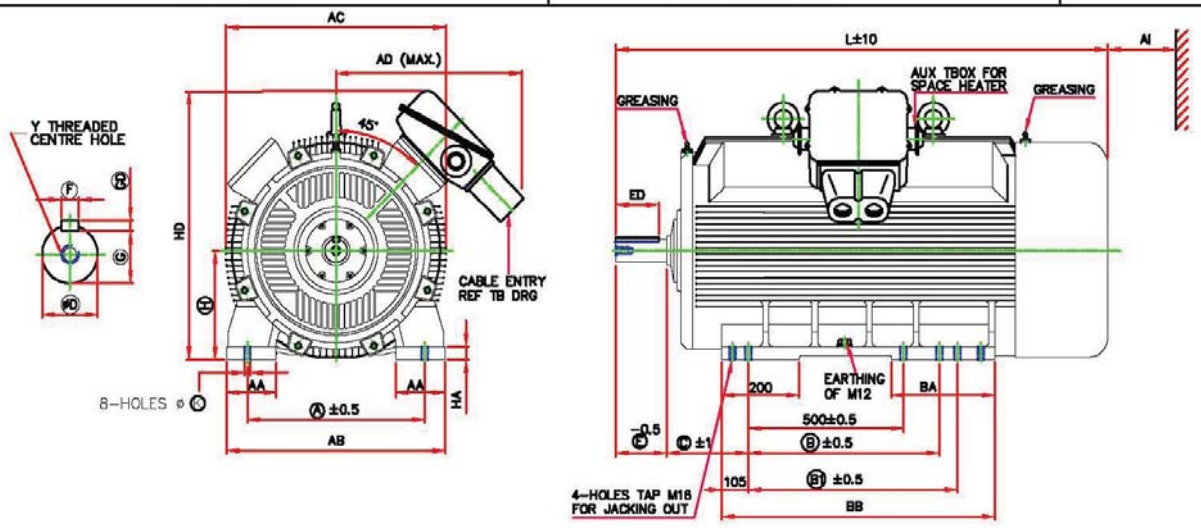
**( 200 kW, pf 0.85 & efficiency 95%)**

TENTATIVE DIMENSIONS OF 200 KW 415 V MOTOR

# DIMENSION DRAWING OF 3 PH SQUIRREL CAGE TEFC FOOT MOUNTED TB ON RHS (FROM DE) INDUCTION MOTOR

PROJECTION

DO NOT SCALE | PLEASE ASK, IF IN DOUBT




| FRAME | FOOT FIXING | | | | | | | | | | OVER ALL | | | | | MOTOR wt (kg) | AI** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | B1 | C | H TOL | AA | AB | BA | BB | K TOL | AD | AC | L | HD | HA | | |
| ND355LX | 610 | 560 | 630 | 254 | 355 / 354 | 110 | 710 | 300 | 850 | 28.0 / 28.5 | 685 | 720 | 1560 | 915 | 40 | 2150 | 140 |

| D END SHAFT EXTENSION AND KEY | | | | | | |
|---|---|---|---|---|---|---|
| D TOL | E | ED | F TOL | GD TOL | G | Y |
| 100.035 / 100.013 | 210 | 160 | 28.00 / 27.948 | 16.0 / 15.9 | 90.0 / 89.8 | M24x50 |

**NOTES**

ONE EARTHING TERMINAL IS PROVIDED INSIDE MAIN TERMINAL BOX.
MOTOR MAY HAVE ADDITIONAL FOOT HOLES FOR CUSTOMER/SITE FLEXIBILITY
**MINIMUM DISTANCE FOR EFFICIENT COOLING OF MOTOR TO BE MAINTAINED BY USER

ALL DIMENSIONS ARE IN mm
RINGED DIMENSIONS ARE AS PER IS:1231/IEC60072