









TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED

2X660MW ENNORE SEZ STPP

TECHNICAL SPECIFICATION FOR ANUBAR

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|---|--|-----------------------|--|---|------|---------|--|---|--|----------|--|------|--|------|------|--|--|--|--|-------|--|--|--|--|------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--------|--|--|--|--|--|--|--|--|--|
| JOB NO. 412 | | | | | PROJECT— 2 X 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STATUS CONTRACT | | | | |  | | OWNER | | TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRINT SCALE  | | | | | | | OWNER'S CONSULTANT | | DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | |  | | EPC CONTRACTOR | | BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA | | | | DEPT CODE | | NAME | | SIGN | | DATE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | I | | DSGN NJ | |  | | 14.05.15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | CHD SK | |  | | 14.05.15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REV. 01 | | | | | DATED | | | | | ALTD | | | | | CHD | | | | | APPD | | | | | TITLE | | | | | TECHNICAL SPECIFICATION FOR ANUBAR | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | DEPT. | | | | | SCALE | | | | | DRAWING NO. | | | | | PE-TS-412-145-1916 | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | SIGN | | | | |  | | | | | SHEET 1 OF 42 | | | | | REV 00 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | DATE | | | | |  | | | | | | | | | | | | | | |

| | | |
|---|---|--------------------------------------|
|  | 2X660MW SEZ ENNORE STPP TECHNICAL SPECIFICATION FOR ANUBAR | SPECIFICATION NO. PE-TS-412-145-I916 |
| | | DATE: |
| | | REV NO. 00 |
| | | SHEEE 1 OF 1 |

PREAMBLE

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-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 vendor is 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 SPECIFICATIONS

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 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 and 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 - 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, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Volume-III.

2.0 The requirements mentioned in Section-C / Data Sheets-A of section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-D.

**2X660MW SEZ ENNORE STPP****TECHNICAL SPECIFICATION
FOR ANUBAR**

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME -

SECTION -

REV. NO. 00

DATE: 14.05.15

CONTENTS**VOLUME- II B**

| SECTION | TITLE | NO. OF SHEET(s) |
|----------------|---------------------------------|------------------------|
| A | Scope of Enquiry | 1 |
| B | Project Information | 5 |
| C | Specific Technical Requirements | 1 |
| D | - Specification for Anubar | 2 |
| | - Data sheets A & B for Anubar | 2 |
| | - Data sheets C for Anubar | 2 |
| | - Anubar Installation Drawing | 2 |
| | - Quality Plan for Anubar | 2 |
| | - Bill of Quantity for Anubar | 1 |

VOLUME III

| | | |
|-----------|--|---|
| 1. | Schedule of Drawings, Data sheets, Documents, Catalogues submitted with the bid. | 1 |
| 2. | Schedule of prices | 1 |
| 3. | Schedule of unit prices | 1 |
| 4. | Inspection Schedule | 1 |
| 5. | Deviation Schedule | 1 |

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

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VOLUME-IIB

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916


VOLUME IIB

SECTION -

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SECTION – A
SCOPE OF ENQUIRY

| | | | |
|---|---|---------------------------------------|-----|
|  | 2X660MW SEZ ENNORE STPP TECHNICAL SPECIFICATION FOR ANUBAR | SPECIFICATION NO.: PE-TS-412-145-I916 | |
| | | VOLUME | IIB |
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| | | REV. NO. | 00 |
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SCOPE OF ENQUIRY

1.0 SCOPE

- 1.1 This specification covers the Design, Manufacture, Inspection and Testing at manufacturer's works, proper packing for transportation and delivery to site of the Anubar with accessories as mentioned in different sections of this specification for Ennore SEZ, NCTPP stage IV, 2 x 660 MW Coal Based Thermal Power Plant.
- 1.2 The quality plan enclosed, forms the minimum requirement but not limited to be adhered to by the bidder. Bidder to sign and stamp the same and submit along with the offer as an acceptance.
- 1.3 Scope of supply shall be anubar, stub nipples, root valves, spares etc. as indicated in specification.
- 1.4 Following formats to be signed, stamped with company seal and submitted :
 - a) Complete offer including calculation sheets, catalogues etc.
 - b) Quality Plan
 - c) Datasheets A & B, duly filled
 - d) Schedule of submission of drawings/documents, equipment manufacture inspection and dispatch.
 - e) Schedule of price, unit prices, inspection schedule.

2.0 GENERAL TECHNICAL INSTRUCTIONS

- 2.1 It is not the intent here to specify all the details of design and manufacture. However, the equipment shall conform in all respects to high standard of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to the customer / consultant, who will interpret the meaning of drawing and specification and shall be entitled to reject any component or material which in his judgment is not in full accordance herewith.
- 2.2 The omission of specific reference to any component / accessory necessary for the proper performance of the equipments shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.
- 2.3 BHEL's/Customer's representative shall be given 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 equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and Material Dispatch Clearance Certificate (MDCC) is issued by BHEL.

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

SECTION -

REV. NO. 00

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SECTION – B**PROJECT INFORMATION**

PROJECT SYNOPSIS

GENERAL BACKGROUND AND SALIENT FEATURES

1.1 Introduction

Tamilnadu Generation and Distribution Corporation owns the proposed green-field 1320 MW (2 units of 660 MW each) Coal Based Thermal Power Station at Katupalli. This is an expansion of North Chennai Thermal Power Station (NCTPS) and located on some portion of the ashdyke of NCTPS.

1.2 Location

The proposed site for main power plant is located near Ennore port (approx 5 kms).

The nearest Railway station is at Athipattu Pudunagar (approx 5 kms)

All weather road from Pattamandri on the Thiruvottiyur-Ponneri district highway is the nearest road access.

The nearest airport is at Chennai at a distance of 60 km.

1.3 Type of Plant

The proposed 2x660 MW Super-Critical Power Project consists of coal fired steam generator connected to a reheat type steam turbine generator along with all the required auxiliaries. Circulating cooling water system is envisaged for condenser cooling. The description and salient technical data of the Steam Generator, Steam Turbine Generator, Auxiliary systems, Electrical, Control & Instrumentation, Civil etc. are explained elsewhere in the specification:

1.4 PROJECT INFORMATION

Project Title : **2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS**
DESEIN Volume-II: General & Schedules
General Background and Salient Features
2 x 660 MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS.

Owner : **TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

LOCATION

The site is located near Vayalur Village, Ennore

Latitude : 13⁰17' N to 13⁰18' N

Longitude : 80⁰18' E to 80⁰19' E

Distance from Chennai City : 35 km

Nearest Airport is at Chennai at a

Distance of : 60 km

Nearest Seaport is : Ennore

Nearest Railway Station is : Athipattu Pudunagar (approx 5 kms)

Meteorological Condition

Climate : Tropical ,very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind.

Climatological data : Ambient temp. (°C)
Annual Maximum Mean Temp 41.5(°C)
Annual Minimum Mean Temp 24(°C)
Design Ambient temperature 35(°C)

Relative Humidity

Maximum 100%

Minimum 36%

Design 75%

Annual Rainfall

Maximum 2540 mm

Average 1600 mm

Minimum 1175 mm

Prevailing Wind Direction

Nov to Jan – From NW & NE

Feb to Mar – From East & SE
Apr to May – From South & SE
June – From SW
July to Aug – From NW
Sept to Oct – From SE & SW
Wind Speed 11.8 kmph (avg)
50 kmph (max)
Seismic Zone III as per
IS:1893-2002

1.5 Access to Site

Site is well connected to all weather road from Pattamandri on the Thiruvottiyur – Ponneri district highway. Site is located adjacent to the Chennai – Howrah broad gauge line and thus well connected by rail also.

1.6 Plant Rating, Capacity, Availability, PLF

Each of the two units shall have a Turbine maximum continuous rating (TMCR) of 660 MW at generator terminals based on the following site conditions.

- Ambient air temperature
- Condenser cooling water inlet temperature of 33°C and 9°C temperature rise across the condenser.
- Generator power factor of 0.85.
- Fuel specification as given elsewhere.
- Design temperature for electrical equipment is 50°C.

The VVO capacity of the steam turbine shall not be less than 105% of TMCR flow at rated parameters. Boiler maximum Continuous Rating (BMCR) will be established to match the steam flow at VVO conditions, but BMCR flow shall not less than 108% of TMCR flow.

The capacity of the unit is selected so as to deliver the rated output even after ageing that will occur between overhauls, as a result of deposition of salts in turbine blades, wear and tear etc.

The plant load factor (PLF) being considered is 85%.

SEA WATER ANALYSIS

| S.No. | Parameter | Unit | Value (Range) |
|-------|---|-------------------------------|---|
| 1 | General | | |
| a | pH | | 7.94-8 |
| b | Conductivity | millisiemens/cm | 43.8-44.1 |
| c | Temperature | Deg C | 25-32 |
| d | Turbidity | NTU | 20-40 |
| e | Total Organic carbon (total/ dissolved) | PPM of C | 2.4-2.84 |
| f | CO ₂ | Mg/l | <2 |
| g | TDS | Mg/l | 39600-39740 |
| h | BOD | Mg/l | 10-12 |
| i | COD | Mg/l | 88-96 |
| j | Oil & Grease | Mg/l | <10 |
| k | Phenols | Mg/l | 0.08-0.09 |
| l | Free Residual Chlorine | Mg/l | <0.2 |
| 2 | Cations | | |
| a | Calcium | Mg/l | 459-478 |
| b | Magnesium | Mg/l | 1510-1516 |
| c | Sodium | Mg/l | 10100-12000 |
| d | Potassium | Mg/l | 358-450 |
| e | Ammonia | Mg/l | 4.43-5.42 |
| f | Strontium | Mg/l | 12.9-12.4 |
| g | Barium | Mg/l | 1.55-1.58 |
| h | Aluminum Total | Mg/l | 1-1.8 |
| i | Aluminum Dissolved | Mg/l | 0.8-1.0 |
| j | Manganese Total | Micro g/l | 0.2-0.6 |
| k | Manganese Dissolved | Micro g/l | 0.1-0.2 |
| l | Iron total | Micro g/l | 220-260 |
| m | Iron Dissolved | Micro g/l | Below detectable limit (detectable Limit : 10) |
| 3 | Anions | | |
| a | Chloride | Mg/l | 18994-19194 |
| b | Sulphate | Mg/l | 3710-3949 |
| c | Nitrate | Mg/l | 136-152 |
| d | Nitrite | Mg/l | 0.46-0.62 |
| e | Bicarbonate | Mg/l | 144-148 |
| f | Carbonate | Mg/l | Nil |
| g | Fluoride | Mg/l | 2.64-2.8 |
| h | Boron | Mg/l | 0.14-0.17 |
| i | Phosphate | Micro g/l | 240-380 |
| j | Sulphide | Micro g/l | Below detectable limit (detectable Limit : 100) |
| k | Silica Dissolved | Micro g/l as SiO ₂ | 200-250 |
| 4 | Heavy Metals | | |
| A | Arsenic | Micro g/l | Below detectable limit (detectable Limit : 2) |
| B | Mercury | Micro g/l | Below detectable limit (detectable Limit : 1) |
| C | Cadmium | Micro g/l | 120-130 |
| D | Copper | Micro g/l | 200-220 |
| E | Nickel | Micro g/l | 470-490 |
| F | Molybdenum | Micro g/l | Below detectable limit (detectable Limit : 100) |

| | | | |
|---|--------------------------------------|---------|---|
| 5 | Suspended Particle Size Range | | |
| A | 10 micron & above | Mg/l | Below detectable limit (detectable Limit : 10) |
| B | 5 micron to 10 micron | Mg/l | Below detectable limit (detectable Limit : 10) |
| C | 1 micron to 5 micron | Mg/l | Below detectable limit (detectable Limit : 10) |
| D | 0.1 micron to 1 micron | Mg/l | 20-26 |
| 6 | Colloidal Particle Size Range | | |
| A | SDI (10 Minutes) | - | 10-20 |
| B | SDI (5 Minutes) | - | 20-40 |
| 7 | Density of sea water | Kg/ cum | 1030 |

Note : Unless otherwise indicated all elements shall be expressed in respective ionic form only.

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916


VOLUME IIB

SECTION -

REV. NO. 00

DATE: 14.05.15

SECTION – C**SPECIFIC TECHNICAL REQUIREMENTS**

| | | | |
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|  | 2X660MW SEZ ENNORE STPP TECHNICAL SPECIFICATION FOR ANUBAR | SPECIFICATION NO.: PE-TS-412-145-I916 | |
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SPECIFIC TECHNICAL REQUIREMENTS

The technical requirements in this section are specific for this project and shall override the specification under Section-D in case of any contradiction.

- 1.0** Bidder to note that duly filled up Data sheet-B, Quality Plan, Format “Schedule of submission of Drawings / Documents, Equipment Manufacture, Inspection and Dispatch” enclosed in Section-D of Volume IIB, to be signed and stamped and submitted with the bid.
- 2.0** Each Anubar shall be supplied with two sets of gaskets for each Tag as start-up / commissioning spares.
- 3.0** The Data sheets enclosed is for Unit #1 only. The same shall be applicable for Unit #2 as well.

4.0 DOCUMENTATION:

(A) Along with the bids: No separate documentation required at the time of bids except those specifically listed under Cl. No. 6.0 of Sec-D of Vol-II B.

(B) After the award of contract: 10 sets of the following documents to be enclosed along with the contract documents for approval:

- a) Datasheet C completely filled-up.
- b) Quality plan duly signed and stamped.
- c) All Differential pressure vs Flow graphs.
- d) Anubar calculation Sheet.
- e) Anubar assembly dimensional drawings.
- f) GA Drawing.

(C) Final documentation: The documentation as listed below shall be submitted as a part of final documentation.

- | | |
|--|--------------------------|
| 1. Approved final drawings/data sheets, | – 10 sets with 2 CD-ROMS |
| 2. All Test certificates | – 10 sets. |
| 3. Operation & Maintenance Manuals for Anubars | – 10 sets |
| 4. Assembly drawings and QP for approval | – 10 sets. |
| 5. “As built” drawings | – 10 sets. |

- 5.0** In case during erection/commissioning of the Anubar, any spares are required which have not been specified in the Start-up/commissioning spares list, the same will have to be supplied by the vendor free of cost.

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

SECTION -

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SECTION – D**EQUIPMENT SPECIFICATION
DATA SHEET / DRGS / CALCULATION
QUALITY PLAN**

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
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SECTION -

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SECTION – D**EQUIPMENT SPECIFICATION**

**2X660MW SEZ ENNORE STPP****TECHNICAL SPECIFICATION
FOR ANUBAR**

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

SECTION -

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EQUIPMENT SPECIFICATION**1.0 SCOPE**

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Anubar for use in Ennore SEZ, NCTPP stage IV, 2 x 660 MW Coal Based Thermal Power Plant.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

3.0 TECHNICAL REQUIREMENT

The anubar and the accessories shall be suitable for **sea water application** and continuous operation under an ambient temperature of 0-55°C and Relative Humidity of 0-95% unless specified otherwise in volume IIB Section-B or Section-C.

3.1 DP flow measurement

The flow devices producing a differential pressure signal, or DP having a high accuracy & reliability with rigid structure & shall be suitable for larger diameter pipe. The sensor comprises of a signal outer tube & an inner tube. The inner tube conveys the high-pressure signal & outer conveys the low pressure signal. The sensor can also be provided with dual averaging chambers with circular / pear shaped profile, which will convey the high pressure & low-pressure signal. This shall be suitable for online mounting.

3.2 Element / Probe

This shall be constructed of Duplex Stainless Steel material, suitable for sea water application.


3.3 Assembly

Flow devices shall be complete with stub, flanged end, isolating valve with counter flanges, nipple, elbow, packing, etc. and shall be terminated with root valves for remote measurement. Each device shall also be provided with SS nameplate with tag number.

4.0 TEST & INSPECTION

4.1 The bidder shall follow quality assurance plan to ensure that the equipments offered will meet the specification requirements in full.

4.2 The Quality Plan shall be discussed and finalized with the technically accepted bidders before opening the price bid. The purchaser in the Quality Plan before approval would indicate the stages where the purchaser would like to be associated for witnessing or verification.

| | | | |
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4.3 Quality Plan/Quality Assurance programme shall be submitted for owner approval. The following tests are to be included & test certificate/report shall be furnished.

1. Material Test Certificate
2. Hydro Test
3. Visual/Dimensional inspection report.

4.4 BHEL and/or their authorized representatives as per the agreed inspection schedule will conduct inspection. The bidder for BHEL's approval at contract stage will submit the inspection schedule. The cost of all tests and inspections will be deemed to have been included in the bid. For all the type tests "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL and/or their authorized representatives or in independent Test House/Laboratory approved by BHEL.

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

As part of the main equipment supply, the bidder shall supply all commissioning spares and consumables required during Start-up,

5.2 Recommended Spares

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

5.3 Special Tools & Tackles

The bidder shall furnish a list of Special Tools & Tackles included in the bid.

6.0 DRAWINGS & DOCUMENTS

6.1 To be furnished with the Bid:

The offer shall include the following technical documents in 5 copies each:

1. Technical data sheets for each anubar and accessories, in the proforma enclosed under Data sheet-B.
2. Catalogues/Technical literature for flow element and accessories.
3. Schedules listed under Vol. III-A duly completed with bidder's signature and seal.
4. Test & Inspection schedules.
5. Deviations sought by bidder, if any, from the specification.



2X660MW SEZ ENNORE STPP

TECHNICAL SPECIFICATION FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

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6.2 To be furnished after award of contract

6.2.1 For approval:

1. Technical data sheets for each anubar and accessories, in the proforma enclosed under Data sheet-B.
2. Calculation Sheets for Anubar.
3. Installation drawings for Anubar.
4. Differential pressure vs flow curve for Anubar.

6.2.2 For Information :

1. Storage and Commissioning Instruction.
2. O&M are to be supplied as specified.

7 PACKING & MARKING

1. Each item shall be properly packed with adequate protection against friction, stresses, vibration & shock during transportation. Each packing box shall have marking as per Purchase Order.
2. Each assembly shall be identified with the following information.
 - Tag No.
 - Service.
 - Line size & thickness.
 - Direction of flow.

8 APPLICABLE DATA SHEETS

This document shall be read in conjunction with following data sheets.

1. Data Sheet - A & B
2. Data Sheet - C.

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FOR ANUBAR

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VOLUME IIB

SECTION -

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SECTION – D
QUALITY PLAN



PEM: C&I

**QUALITY PLAN
FOR
ANUBAR
2X660 MW ENNORE SEZ STPP**

QUALITY PLAN NO.: **PE-QP-412-145-I009**

VOLUME IIB

SECTION D

REV. NO. 00 DATE: 14.05.15

SHEET 1 OF 2

| Sl. No. | Component / operation | Characteristics Checked | * Category | Type/Method of Check | Extent of Check | Reference documents | Acceptance Norms | Format of Records | Agency \$ | | | Remarks |
|---------|------------------------------------|-------------------------|------------|--|-----------------|------------------------|------------------------|-------------------|-----------|---|---|---|
| | | | | | | | | | M | C | N | |
| A1 | RAW MATERIAL | | | | | | | | | | | |
| 1 | Sensor | Chemical Properties | MA | Lab Analysis | 1/batch | BHEL Apprd drgs/ spec. | BHEL Apprd drgs/ spec. | Test Certificate | V | V | V | Relevant compliance certificate shall be verified by BHEL |
| 2 | Sensor Tube | Chemical Properties | MA | -do- | -do- | BHEL Apprd drgs/ spec. | BHEL Apprd drgs/ spec. | -do- | V | V | V | |
| 3 | Sensor Flange | Chemical Properties | MA | -do- | -do- | BHEL Apprd drgs/ spec. | BHEL Apprd drgs/ spec. | -do- | V | V | V | |
| 4 | Interpolating Tube | Chemical Properties | MA | -do- | -do- | BHEL Apprd drgs/ spec. | BHEL Apprd drgs/ spec. | -do- | V | V | V | |
| 5 | Mounting Hardware | Chemical Properties | MA | -do- | -do- | BHEL Apprd drgs/ spec. | BHEL Apprd drgs/ spec. | -do- | V | V | V | |
| B1 | IN PROCESS INSPECTION | | | | | | | | | | | |
| 1 to 5 | Sensor, Sensor Tube, Interpolating | Dimensions | CR | Measurement | 100% | BHEL Apprd drgs/ spec. | BHEL Apprd drgs/ spec. | Inspection Report | P | W | V | |
| 6 | Welding | Die Penetration Test | CR | Visual | 100% | ASTM-E-165 | ASTM-E-165 | -do- | P | W | V | |
| 7 | | Pressure Test | CR | Hydraulic Pressure Test (at 200% of Max. pressure) | 100% | BHEL Apprd drgs/ Spec. | BHEL Apprd drgs/ Spec. | -do- | P | W | V | |

LEGEND: * CR - Critical characteristics \$ P - Agency Performing the Test. M - Manufacturer
 MA - Major characteristics W - Agency Witnessing the Test. C - BHEL nominated Inspection agency
 MI - Minor characteristics V - Agency Verifying the Test. N - TANGEDCO



PEM: C&I

**QUALITY PLAN
FOR
ANUBAR
2X660 MW ENNORE SEZ STPP**

QUALITY PLAN NO.: **PE-QP-412-145-I009**

VOLUME IIB

SECTION D

REV. NO. 00 DATE: 14.05.15

SHEET 2 OF 2

| Sl. No. | Component / operation | Characteristics Checked | * Category | Type/Method of Check | Extent of Check | Reference documents | Acceptance Norms | Format of Records | Agency \$ | | | Remarks |
|---------|-----------------------|-------------------------|------------|----------------------|-----------------|------------------------|------------------------|-------------------|-----------|---|---|---|
| | | | | | | | | | M | C | N | |
| 8 | Finished Products | Dimensions | CR | Measurement | 100% | BHEL Apprd drgs | BHEL Apprd drgs | Inspection Report | P | V | V | Material test & leakage test certificate of root valves shall be submitted. |
| | | Finish | CR | Visual | 100% | BHEL Apprd drgs/ Spec. | BHEL Apprd drgs/ Spec. | -do- | P | V | V | |
| | | Root Valves BOQ | MA | Measurement | 10% | BHEL Apprd drgs/ Spec. | BHEL Apprd drgs/ Spec. | -do- | P | V | V | |
| 9 | Packing | Soundness of Packing | MA | -do- | 100% | BHEL Spec. | BHEL Spec. | Log Book | P | V | - | |

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

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

M - Manufacturer
C - BHEL nominated Inspection agency
N - TANGEDCO

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916


VOLUME IIB

SECTION -

REV. NO. 00

DATE: 14.05.15

SECTION – D**DATA SHEETS A&B**

| | | | |
|---|---|---------------------------------------|-----|
|  | 2X660MW SEZ ENNORE STPP TECHNICAL SPECIFICATION FOR ANUBAR | SPECIFICATION NO.: PE-TS-412-145-I916 | |
| | | VOLUME | IIB |
| | | SECTION | - |
| | | REV. NO. | 00 |
| | | DATE: 14.05.15 | |

Tag No. **PAB10BP001** --**DATA SHEET – A & B**

| DATA SHEET – A (TO BE FILLED BY PURCHASER) | | | DATA SHEET – B (TO BE FILLED UP BY BIDDER) |
|---|----------------------------------|--|--|
| GENERAL | PROJECT | ENNORE SEZ STPP 2 X 660 MW | ..... |
| | OFFER REFERENCE | Bidder to indicate | ..... |
| | TAG NO. : QUANTITY | PAB10BP001 \| ONE PER UNIT (TOTAL 2 NOS) | .....\|..... |
| | SERVICE | CONDENSER COOLING WATER | .....\|..... |
| | MAKE : MODEL | Bidder to indicate | |
| ELEMENT | TYPE | DELTA TUBE (AVERAGING PITOT TUBE) | ..... |
| | PITOT ASSEMBLY | Bidder to indicate FLG SIZE & RATING | ..... |
| | PROBE DIAMETER & SHAPE | Bidder to indicate | ..... |
| | MATERIAL | DUPLEX STAINLESS STEEL SUITABLE FOR SEA WATER | ..... |
| | ACCURACY | ± 1% OF ACTUAL VALUE | ..... |
| | REPEATABILITY | ± 0.1% OF ACTUAL VALUE | ..... |
| | No. OF TAP | ONE | |
| PROCESS DATA | FLUID | COOLING WATER (SEA WATER) | ..... |
| | RATE OF FLOW (m3/hr) | NORMAL : 76620 m3/hr | ..... |
| | UPSTREAM WORKING PRESS (Kg/cm2g) | DESIGN : 92000 m3/hr | ..... |
| | DESIGN PRESS (Kg/cm2g) | 2.3 Approx. | ..... |
| | MAX. ALLOWABLE PRESS LOSS | 5.0 | ..... |
| | DIFF. PRESS AT MAX FLOW | 0.01 MWC at DESIGN FLOW | ..... |
| | NORMAL TEMP (Deg C) | Bidder to indicate | ..... |
| | MAXIMUM TEMP (Deg C) | 33 | ..... |
| | | 60 | ..... |
| PIPE LINE DATA | DUCT SIZE (OD x THK) mm | RCC DUCT OF INTERNAL DIMENSIONS 3000MM | ..... |
| | DUCT MATERIAL | (H) X 4000MM (W) (Refer Installation Diagram) | ..... |
| | AVAILABLE PIPE STRAIGHT LENGTH | UPSTREAM : 40M | ..... |
| | | DOWNSTREAM : 20M | ..... |
| | RESTRICTION | UPSTREAM : NIL | ..... |
| | | DOWNSTREAM : NIL | ..... |
| | LINE ORIENTATION | HORIZONTAL | ..... |
| | | | |

**2X660MW SEZ ENNORE STPP****TECHNICAL SPECIFICATION
FOR ANUBAR**

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME -

SECTION -

REV. NO. 00

DATE: 14.05.15

Tag No.

PAB10BP001**DATA SHEET – A & B****DATA SHEET – A
(TO BE FILLED BY PURCHASER)****DATA SHEET – B
(TO BE FILLED UP BY
BIDDER)**

| | | | |
|---|-------------------------|-----------------------------------|-------------------|
| END CONNECTION | STUB / NIPPLE | SIZE : (Bidder to indicate) | RATING : |
| | SPOOL PIECE WITH FLANGE | SIZE : (Bidder to indicate) | RATING : |
| | ROOT VALVES | SIZE : 1/2" \| RATING : Class 800 | ..... |
| | | MATERIAL : DUPLEX STAINLESS STEEL | ..... |
| BIDDER TO FURNISH INSTALLATION DIAGRAM FOR ANUBAR MOUNTING ON RCC DUCT. | | | |
| NAME SIGN DATE | PRPED BY | CHKD BY | APPD BY |
| | | | |
| | COMPANY SEAL | | |
| NAME SIGN DATE | | | |

NOTE :

1. ALL WETTED PARTS SHALL BE CORROSION RESISTANT DUPLEX STAINLESS STEEL OR BETTER, SUITABLE FOR SEA WATER APPLICATION.
2. FLUSHING ARRANGEMENT SHALL BE PROVIDED.
3. THE SAME DATASHEET IS APPLICABLE FOR BOTH UNITS.

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

SECTION -

REV. NO. 00

DATE: 14.05.15

SECTION – D**DATA SHEET - C**

**2X660MW SEZ ENNORE STPP****TECHNICAL SPECIFICATION
FOR ANUBAR**

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

SECTION -

REV. NO. 00

DATE: 14.05.15

Tag No. **PAB10BP001****DATA SHEET – C**

DATA SHEET – C FOR ANUBAR (DELTA TUBE)
(TO BE FILLED BY THE CONTRACTOR AFTER AWARD OF CONTRACT)

| | | |
|----------------|--|--|
| GENERAL | PROJECT TAG NO. : QUANTITY SERVICE MAKE : MODEL | |
| ELEMENT | TYPE PITOT ASSEMBLY PROBE DIAMETER & SHAPE MATERIAL ACCURACY REPEATABILITY No. OF TAP | |
| PROCESS DATA | FLUID RATE OF FLOW (T/HR) UPSTREAM WORKING PRESS (Kg/cm2g) DESIGN PRESS (Kg/cm2g) MAX. ALLOWABLE PRESS LOSS DIFF. PRESS AT MAX FLOW NORMAL TEMP (Deg C) MAXIMUM TEMP (Deg C) | |
| PIPE LINE DATA | DUCT SIZE (OD x THK) mm DUCT MATERIAL AVAILABLE PIPE STRAIGHT LENGTH RESTRICTION | |
| | | |

**2X660MW SEZ ENNORE STPP****TECHNICAL SPECIFICATION
FOR ANUBAR**

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME -

SECTION -

REV. NO. 00

DATE: 14.05.15

Tag No. **PAB10BP001****DATA SHEET – C**

DATA SHEET – C FOR ANUBAR (DELTA TUBE)
(TO BE FILLED BY THE CONTRACTOR AFTER AWARD OF CONTRACT)

| | | |
|------------------------------|--|---|
| END CONNECTION | STUB / NIPPLE | SIZE : RATING : MATERIAL : |
| | SPOOL PIECE WITH FLANGE | SIZE : RATING : MATERIAL : |
| | ROOT VALVES | SIZE : \| RATING : MATERIAL : END CONNECTION : \| QTY. : |
| | BIDDER TO FURNISH INSTALLATION DIAGRAM FOR ANUBAR MOUNTING ON RCC DUCT. | |
| NAME SIGN DATE | COMPANY SEAL | |

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

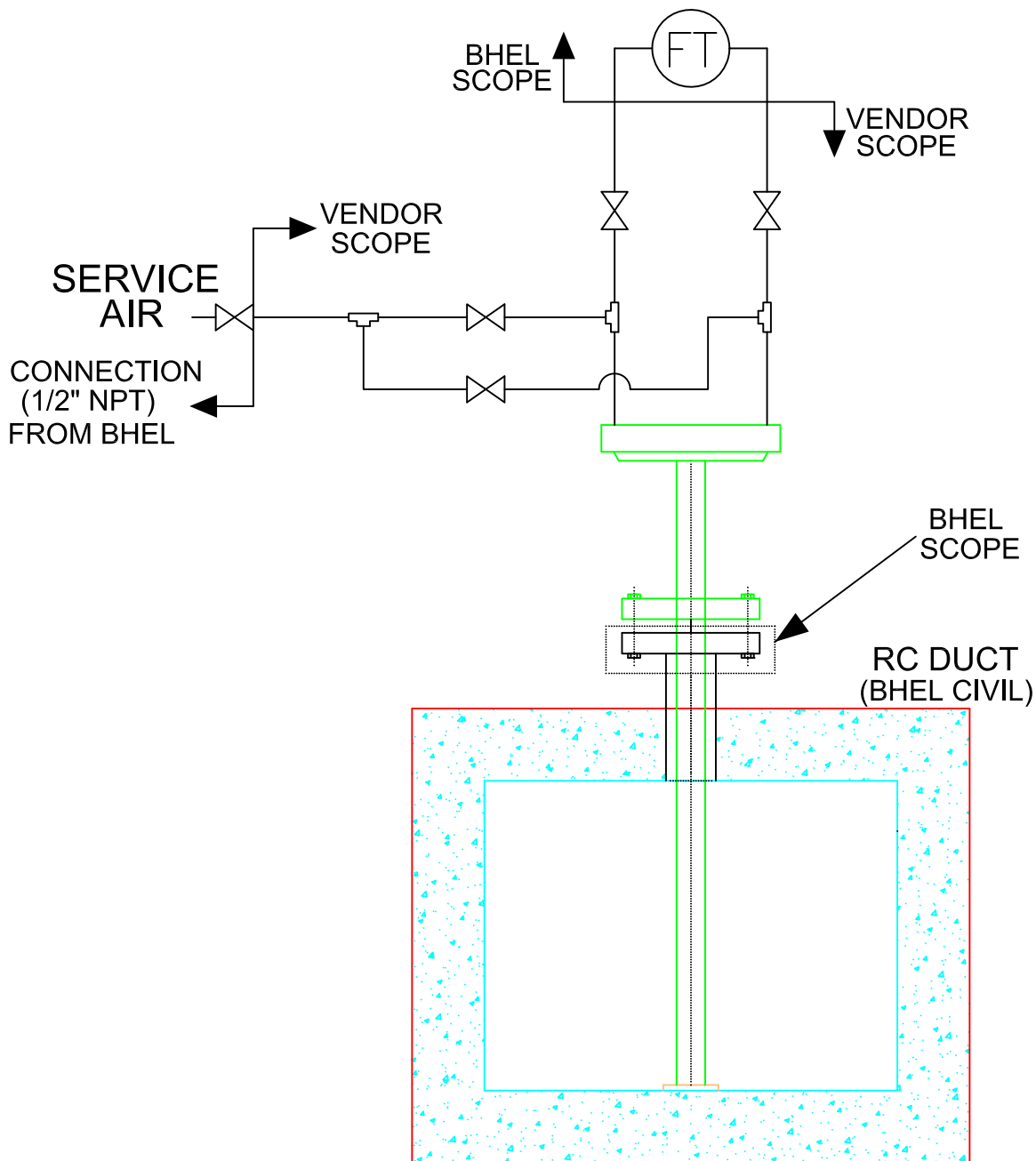
VOLUME IIB

SECTION -

REV. NO. 00

DATE: 14.05.15

SECTION – D**ANUBAR INSTALLATION DRAWING**



NOTE: –

1. ALL ITEMS LIKE SENSOR, MATING FLANGE, SENSOR FLANGE, ROOT VALVES, IMPULSE PIPING SHALL BE IN VENDOR SCOPE OF SUPPLY.



PROJECT:–

2 X 660 MW ENNORE SEZ STPP

TITLE:–

GENERAL ARRANGEMENT OF ANUBAR

DRG.
No.

REV.
No.

00

DATE

14.05.2015

SHEET Page 31 of 42 OF 2

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

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DATE: 14.05.15

SECTION – D

SCHEDULE OF SUBMISSION OF DRAWINGS / DOCUMENTS, EQUIPMENT MANUFACTURE INSPECTION AND DESPATCH

SCHEDULE OF SUBMISSION OF DRAWINGS / DOCUMENTS, EQUIPMENT MANUFACTURE INSPECTION AND DESPATCH

- | | |
|--|--|
| 1. Date | Date of LOI / FOI / TOI |
| 2. Submission of Data Sheets / documents / catalogues / Valve sizing calculations / Noise calculations for approval. | 2 Weeks from the Zero date. |
| 3. Resubmissions of documents for Approval (if required) | 7 days from the Submission of BHEL comments. |
| 4. Inspection of Equipment as per Approved (Category-I) drawings / documents. | 12 Weeks from the date of approval of documents. |
| 5. Dispatch (Packaging & Dispatch) | 14 Weeks from the date of approval of documents. |
| 6. Final documents submission as per Contract | 16 Weeks from the date of approval of documents. |

NOTE: Delays due to non-fulfillment of the requirements of approved Quality Plan and approved Data sheets; Drawings, Catalogues and Sizing Calculations observed during inspection shall be to the Vendor's account.

Delays due to INCOMPLETE (Partly) submission of Data sheets, Drawings, Catalogues and Sizing Calculations also be considered as '**DOCUMENTS NOT SUBMITTED**'.

(Signature and Stamp of the Bidder)

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

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DATE: 14.05.15

SECTION – D
BILL OF QUANTITY

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME IIB

SECTION -

REV. NO. 00

DATE: 14.05.15

BOQ FOR ANUBAR

[A] COMPLETE ANUBAR ASSEMBLY including Purge Air System as per specification & GA drawing.

| S. No. | TAG NO. | SERVICE | QTY/UNIT | TOTAL QTY |
|--------|------------|-------------------------|----------|-----------|
| 1. | PAB10BP001 | CONDENSOR COOLING WATER | 1 no. | 2 nos. |

**2X660MW SEZ ENNORE STPP**TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME III

SECTION -

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DATE: 14.05.15

VOLUME-III

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME III

SECTION -

REV. NO. 00

DATE: 14.05.15

CONTENTS

1. SCHEDULE OF DRAWINGS, DATA SHEETS, DOCUMENTS, CATALOGUES SUBMITTED WITH THE BID.
2. SCHEDULE OF PRICES
3. SCHEDULE OF UNIT PRICES
4. INSPECTION SCHEDULE
5. DEVIATION SCHEDULE

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME III

SECTION -

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**SCHEDULE OF DRAWINGS, DATASHEETS, DOCUMENTS, CATALOGUES
SUBMITTED WITH THE BID**

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

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

TECHNICAL SPECIFICATION FOR ANUBAR

REV. NO. 00

DATE: 14.05.15

SCHEDULE OF PRICES

[A] COMPLETE ANUBAR ASSEMBLY including Purge Air System as per specification & GA drawing.

| S. No. | ITEM DESCRIPTION | QTY FOR 2 UNITS | UNIT PRICE (Rs) | TOTAL PRICE (Rs) |
|--------|--|-----------------|-----------------|------------------|
| | Anubar assembly along with accessories (i.e. Flanges, Spool piece, gaskets, root valves, fasteners, nuts, bolts, etc.) | 2 nos. | | |
| | | | | |

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

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

**2X660MW SEZ ENNORE STPP****TECHNICAL SPECIFICATION
FOR ANUBAR**

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME III

SECTION -

REV. NO. 00

DATE: 14.05.15

SCHEDULE OF UNIT PRICES**[A] COMPLETE ANUBAR ASSEMBLY including Purge Air System as per specification & GA drawing.**

| S. No. | ITEM DESCRIPTION | UNIT PRICE (Rs) |
|--------|---|-----------------|
| 1 | Impulse pipe, DUPLEX STAINLESS STEEL | |
| 2 | Isolation valve, DUPLEX STAINLESS STEEL. | |
| 3 | Price change due to change of length of Spool piece per 6" over and above specified length. | |

**[B] START-UP/COMMISSIONING SPARES
(1 SET OF GASKET OF EACH TYPE)****TOTAL (Rs)****[C] RECOMMENDED SPARES**

FOR THREE (3) YEARS OF OPERATION (ITEM WISE BREAK-UP TO BE ATTACHED BY THE BIDDER)

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

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

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME III

SECTION -

REV. NO. 00

DATE: 14.05.15

INSPECTION SCHEDULE

(PLACE & ADDRESS OF TESTING/ INSPECTION AND ITS SCHEDULE DATE & DURATION IN
NUMBER OF DAYS ITEM/COMPONENTWISE TO BE LISTED)

PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE

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

**2X660MW SEZ ENNORE STPP**

TECHNICAL SPECIFICATION
FOR ANUBAR

SPECIFICATION NO.: PE-TS-412-145-I916

VOLUME III

SECTION -

REV. NO. 00

DATE: 14.05.15

DEVIATION SCHEDULE**PARTICULARS OF THE BIDDER / AUTHORISED REPRESENTATIVE**

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