# PROJECT

# 4 X 270MW BHADRADRI TPS

# AT MANUGURU, KHAMMAM

# TELENGANA STATE

TECHNICAL SPECIFICATION

FOR

FIRE WATER TENDER AND FOAM TENDER

SPECIFICATION NO: - PE-TS-411-550-A001

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR-PROJECT ENGINEERING MANAGEMENT

PPEI, NOIDA (INDIA)

# INDEX

# 4 x 270MW BHADRADRI TPP

## SECTION – I

# INTENT OF SPECIFICATION

1.1 This specification covers the design, engineering, material, fabrication, manufacturing, inspection and testing at manufacturer's work, or at their sub-vendor's work, suitable painting and performance requirement of fire water tender (1 No.) and Foam tender (1 No) with all accessories as specified, transportation to project site, freight and insurance including performance demonstration at site.

1.2 It is not the intent to specify completely all details and construction of the equipment. However, all the equipment shall conform, in all respect, to high standard of engineering, design and workmanship and shall be capable of performing in continuous commercial operation up to desired period.

1.3 Bidder's guarantee shall be in a manner acceptable to the PURCHASER who will interpret the meaning of drawing and specification and shall be entitled to reject any work or material which, in his judgement, are not in full accordance with specified specification and technical parameter

1.4 The general terms and conditions, instructions to the bidder and other attachment referred to elsewhere are hereby made part of this specification and the bidder shall be responsible for and governed by all requirements stipulated in this specification.

1.5 In case bidder requires any clarification on technical specification before submission of bid, the same has to be submitted in required format (pre bid clarification format as given in **section-III**) within two weeks from date of N.I.T, there after no further clarification shall be entertained and BHEL's interpretation will be binding on the bidder.

1.6 No deviation is permitted in normal case. Deviations if any shall be clearly brought out in BHEL's deviation format given under **section-III**, otherwise it will be presumed that the bidder's offer is in line with what has been stated/asked for in this specification.

1.7 In the event of conflict between requirements of two clauses of this specification/documents or requirements of different codes/standard specified, the more stringent requirement as per interpretation of owner shall apply.

1.8 The inspection and testing of all the equipments shall be as per approved quality plan/inspection checklist.

# 4 x 270MW BHADRADRI TPP

SECTION – I

PROJECT INFORMATION

## 1. INTRODUCTION

4x270 MW Bhadradri TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

## 2. APPROACH TO SITE

**The distance from Manuguru to Major cities in state:** Hyderabad-345KM, Warangal-180km, Bhadrachalam-38km, Kothagudem-70km and Khammam-130km, Vijayawada-195km.

**District:** KHAMMAM

**State:** TELANGANA

**Nearest Airport:** The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.

**Nearest Railway Station:** Manuguru railway station is 10KM from nearby town. However Warangal/Vijaywada railway Station is major railway station near to Manuguru.

## 3. TEMPERATURE

a. Mean daily minimum ambient temperature during oldest month of the year=11.5 Deg.C

b. Mean daily minimum ambient temperature during hottest month of the year=45.1 Deg.C

## 4. RAINFALL

Intensity of rainfall @ 80 mm/hr considering heaviest fall in 24 hrs

## 5. WIND DATA

a. Basic wind speed at 10m height : 44 m/sec

b. Wind pressure : As per IS: 875 Part III- 1987

## 6. SEISMIC ZONE

Zone III as defined in IS: 1893 (part-1)-2002 according to Indian Standard Seismic Zoning Map

## 7. POWER SUPPLY & FAULT LEVELS

| **The power supplies for distribution and auxiliaries shall be as under:** | |
|---|---|
| a) In plant generation | 16.5kV ±5% , 3ph, 50Hz ±5%, high resistance earthed. |
| b) MV distribution | 6.6kV ±10 %, 3ph, 3w , 50 Hz, + 5 % to –5%, Medium Resistance grounding |
| c) LT distribution | 415V ±10%, 3ph, 3W, 50Hz + 5% to –5%, High Resistance Grounding for all plant area shall be provided. |
| d) Motor rated 160kW and above 160kW | 6.6kV ±10 %, 3 ph, 3W,50Hz +5% to -5%. |
| e) Motor rated below 160kW and all motorized actuators. | 415V ±10%, 3 ph,3w, 50Hz +5% to -5%. |
| f) For motors equal and below 30kW winding heating | 24V AC ±10, 50 Hz %, [to be generated in 415V switchgear by vendor] |
| g) DC Motors | 220V DC + 10% to - 15%, 2 wire ungrounded system |
| h) Control supply for relay panel/ 6.6kV breakers/415V breakers and DC emergency lighting. | 220V DC + 10% to - 15%, 2 wire ungrounded system |
| i) UPS for instrumentation & Control system | 240V AC ±1 %, 1 ph ,50Hz ±0.5% 2 Wire AC system |
| j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor] | 110V AC ±10%, 50Hz + 5% to –5%. |
| k) Diesel Generator emergency supply | 415V ±10%, 3ph,3W, 50Hz +5%to –5%. |
| **Fault levels** | |
| a) 400kV | 40kA rms for 1 sec |
| b) 6.6kV | 40 kA rms for 1 sec. |
| c) 415V | 50 kA rms for 1 sec. |

# SECTION - I

# SPECIFICATION

# FOR

# FIRE WATER TENDER AND FOAM TENDER

## 1.0.0 SCOPE

### 1.1.0 SCOPE OF SUPPLY

i. Fire water tender (1 no.), conforming to latest IS: 950 Type B, complete with all accessories and equipments as specified herein & including those specified in **Annexure-I**.

ii. Foam tender (1 no.), conforming to IS: 10460, complete with all accessories and equipments as specified herein & including those specified in **Annexure-II**.

iii. First fill of chemicals & consumables and replenishment of consumables & chemicals consumed during performance demonstration of tenders (**separate for each tender**)

iv. Maintenance tools & tackles as per **Annexure-III (separate for each tender)**

v. Permanent registration and one-year insurance of the vehicles in the name of the ultimate customer will be in bidder's scope

vi. Temporary registration and on-road insurance for the vehicles also is in bidder's scope.

### 1.2.0 SCOPE OF SERVICES

Performance demonstration of fire water and foam tenders at site and training of owner's personnel.

## 2.0.0 CODES AND STANDARDS

The design, material of construction, workmanship & finish, performance testing, accessories and equipments of fire water tender and foam tender specified herein shall comply with the requirements of codes/standard as follows:

Latest IS: 10460 - Functional requirements for small foam tender for fire brigade use.
Latest IS: 950 Type-B - Functional requirements for fire water tender, Type-B for fire brigade use.

## 3.0.0 DESCRIPTION ON FOAM TENDER

### 3.0.1 VEHICLE CHASSIS

The chassis for carrying out fabrication work of foam tender shall be of Make-TATA/Ashok Leyland/equivalent. The chassis shall be equipped with power assisted steering and power brake.

**Note: The chassis shall be of BS-IV compliant as per prevailing emission norms and shall totally comply with the central motor vehicle rules / Ministry of road transport & highways notification etc, for Bhadradri plant where the vehicle is intended to be used.**

### 3.0.2 GENERAL REQUIREMENTS

3.0.2.1 The appliance shall incorporate a fire pump of 1800 L/min at 8.5 kg/cm2 (min) capacity, a water tank of 1800 ltr capacity, a foam tank of 500 ltr capacity, connected equipment for foam production and supplementary extinguishing agent **as specified in section-IIA.**

| | | |
|---|---|---|
| a) | Gross vehicle weight. | Not less than 11000 Kg including crew, water and equipment. |
| b) | Maximum speed on level road fully laden. | 72 Km / h. |
| c) | Acceleration from a standing start through the gears, fully laden. | 64 Km/h in 55 seconds |

d) The appliance shall be capable of being started from rest on a gradient of 1 in 4

e) When travelling at 48 km / h on a level dry surface the foot brake shall be capable of stopping the vehicle within a distance of 15 m from the point at which the brake is applied. The hand brake shall be capable of holding the fully laden appliance on a dry surface gradient of 1 in 4 when in neutral gear.

f) The appliance shall have the following overall dimensions:

| | |
|---|---|
| Wheel base | not more than 4500 mm |
| Turning circle | not more than 20 m |
| Road clearance | not less than 260 mm |
| Overall width | not more than 2.50 m |

3.0.2.2 The monitor shall employ the self-aspiration type of foam production system where aeration is done at the branch pipe. The expansion ratio of the foam produced shall not be less than eight times with the use of foam compound as prescribed in IS: 4989 (latest edition).

3.0.2.3 The foam induction shall be automatic if one branch is in operation, all further addition and removal of branches shall automatically adjust the rate of foam compound induction within variation of 0.5 percent, the induction ratio not exceeding 6 percent.

3.0.2.4 A hose reel service shall be provided on the appliance. In addition to water carried on it, it shall also be possible to use water from a hydrant/ a static supply.

3.0.2.5 The supplementary agent used for firefighting shall be dry chemical powder (2x75 Kg capacity).

3.0.2.6 The unit shall be designed to be as compact as possible, compatible with ease of accessibility to all service parts. The pump and foam making equipment controls shall be so arranged that one man can operate foam or water lines from the pump control panel.

3.0.2.7 Lever type valve controls shall be preferred throughout.

3.0.2.8 All parts, which shall form waterways or come into contact with foam solution, shall be of corrosion resisting materials suitably treated with corrosion resistant compound. All metal parts exposed to atmosphere shall either be of corrosion resisting material or treated suitably to resist corrosion.

3.0.2.9 Lubricating nipples shall be provided wherever necessary.

3.0.2.10 For detailed design and construction of individual components of the foam tender, pls refer **section-IIA** of this specification.

## 4.0.0 DESCRIPTION ON FIRE WATER TENDER

### 4.0.1 VEHICLE CHASSIS

The chassis for carrying out fabrication work of fire water tender shall be of Make-TATA /Ashok Leyland/equivalent. The chassis shall be equipped with power assisted steering and power brake.

**Note: The chassis shall be of BS-IV compliant as per prevailing emission norms and shall totally comply with the central motor vehicle rules / Ministry of road transport & highways notification etc, for Bhadradri plant where the vehicle is intended to be used.**

### 4.0.2 GENERAL REQUIREMENTS

4.0.2.1 The appliance shall incorporate a high and low pressure fire pump of **min. 2000** lpm capacity at 0.7 MPa and 300 lpm capacity at 3.5 MPa respectively. The appliance shall carry a water tank of min 4500ltr capacity. It shall carry an extension ladder and shall be capable of towing a trailer pump.

4.0.2.2 The water tender shall be fabricated in a manner so as to conform to the following characteristics:

| | | |
|---|---|---|
| a) | Gross vehicle weight | not less than **16000 kg including crew**, water and equipment |
| b) | Maximum speed on level road fully laden | 72 km/h |
| c) | Acceleration from a standing start through the gears (fully laden) | 64 km/h in 55 second |

d) The appliance shall be capable of being started from rest on a gradient of 1 to 4.

e) When travelling at 48 km/h on a level dry surface the foot brake shall be capable of stopping the vehicle within a distance of 15 m from the point at which the brake is applied. The hand brake shall be capable of holding the fully laden appliance on a dry surface gradient of 1 in 4 when in neutral gear.

f) The appliance shall have the following overall dimensions:

| | |
|---|---|
| Wheel base | Not more than 4500 mm |
| Turning circle | Not more than 20 m |
| Road clearance | Not less than 23 cm |
| Overall width | Not more than 2.50 m |

4.0.2.3 All parts, which shall form waterways or come into contact with water shall be of corrosion-resisting material or should be made of material duly treated for anti-corrosion. All metal parts exposed to atmosphere shall either be of corrosion-resisting material or treated.

4.0.2.4 Lubricating nipples shall be provided wherever necessary.

4.0.2.5 For detail design and construction of individual components of the fire water tender, refer **section-IIA** of this specification.

4 X 270MW BHADRADRI TPS AT MANUGURU

# TECHNICAL SPECIFICATION
# FOR
# FIRE TENDER AND FOAM TENDER

## SECTION I

## **GENERAL TECHNICAL REQUIREMENT** ( CUSTOMER SPECIFICATION PORTION)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

# CONTENT

## GENERAL TECHNICAL REQUIREMENTS

### 1.00.00 CODES AND STANDARDS

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 The plant will be designed in compliance with applicable National and International Codes and Standards such as ASME, ASTM, DIN, BS, IEC, IEEE, IS, etc. Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Explosives Act, Indian Factories Act, Indian Electricity Act, Environmental Regulations, etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Contractor.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.05.00 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect.

1.06.00 Successful Bidder to furnish two (2) sets of latest of national/inter-national codes and standards to owner.

### 2.00.00 RESPONSIBILITY FOR DESIGN

2.01.00 The Contractor shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.

2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.

2.03.00 The successful bidder shall have to carry out surge analysis, BFP transient analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.

2.04.00 The Bid shall include a detailed discussion on the development status of, and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.

2.05.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.

## 3.00.00 NAME PLATES (RATING PLATES)

3.01.00 Instruction plates, name plates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.

3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.

3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.

3.04.00 The size and location of nameplates shall be subject to Approval of the Engineer.

## 4.00.00 SAFETY AND SECURITY

4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and

property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

4.02.00 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.

4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localise and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.

4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

## 5.00.00 GUARDS

5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.

5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.

5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.

5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.

## 6.00.00 LOCATION AND LAYOUT REQUIREMENTS

The majority of plant and equipment (excluding steam generator and some other auxiliaries) shall all be of indoor installation. A broad list of buildings housing such equipment is given elsewhere in this specification. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner/Engineer finds the proposal more attractive in terms of techno-economic consideration.

While developing the layout of buildings the following criteria shall be given effect :

a) The minimum width of clear access corridors around equipment shall be 1.2 meter.

b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.

c) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of 2.5m shall be maintained between the floor and any overhead piping/ cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.

d) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.

e) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified

elsewhere in this specification shall be complied with.

f) All rail/road crossings for pipe/cable racks shall be done with minimum 8 meters headroom from top of rail/road to bottom of rack. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II.

g) Cubicle for operating personnel shall be located at safe place near the equipment.

h) Interplant cable routing will be on overhead cable trays on pipe cum cable trestle or on cable trestle except where approved by purchaser/consultant. In exceptional case, small stretch of outdoor run of interplant cable routing may be taken through cable trench only with the Employer's prior approval.

i) Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered to. Any departure from this suggestive layout is primarily not recommended.

## 7.00.00 OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.01.00 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

7.02.00 Ample space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.03.0 Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part having weight in excess of 2000 Kg. Suitable beams, hooks etc. for this purpose shall be provided in the buildings.

No lifting arrangement is necessary for part having weight less than 500 Kg. Hoist shall be well protected by environment. Suitable painting and coating covering hoist at outdoor shall be provided.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.

7.04.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common

components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

## 8.00.00 MATERIALS

8.01.00 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.02.00 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Owner to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

## 9.00.00 LUBRICATION

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.06.00 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

10.00.00 **LUBRICANTS AND CONTROL FLUIDS**

10.01.00 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of the unit.

10.02.00 The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.00.00 **OPERATION AND MAINTENANCE**

11.01.00 The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimised.

The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.

11.02.00 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.

11.03.00 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.

11.04.00 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.

11.05.00 On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

11.06.00 All equipment and major valves should be provided with adequate maintenance approach and facility.

12.00.00 **PLANT LIFE AND MODE OF OPERATION**

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall discuss this aspect in his technical proposal.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

| | | |
|---|---|---|
| Cold start-up ( >72 hrs. shutdown) | : | 6 per year |
| Warm start-up (between 10 to 72 hrs. of shutdown) | : | 40 per year |
| Hot start-up (less than 10 hrs. shutdown) | : | 160 per year |

13.00.00 **PACKAGING & MARKING**

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below :

| | | | |
|---|---|---|---|
| a) | Width of the Package (from centre-line of rails - 1.6 metres on both sides) | : | 3.2 Meters |
| b) | Height of the package from rail top | : | 4.47 Meters |

The above indicates the dimensions which can be normally transported on the

wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/ site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services of the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

## 14.00.00 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of

piping, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

## 15.00.00 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

### 15.01.00 Environment Protection

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulate any other conditions not specified hereunder while clearing the project shall be complied with the plant by the contractor.

15.01.01 For Liquid Effluent

a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A : Effects of Environmental (protection) Rules 1986, as amended till date.

b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

15.01.02 For Air Emission

a) Suspended Particulate Matter i.e. dust burden at chimney outlet - Maximum 50 mg/$Nm^3$ (with worst coal and one field out at TMCR).

b) $NO_x$ - 365 ppm Max. or 750 mg/$Nm^3$ (Equivalent $NO_2$).

c) $SO_2$ - Concentration based standard 2000 mg/$Nm^3$. Load based standard 0.2 metric tonne /MWe/day (for first 500 MW and 0.1 metric tonne/MWe/day for rest of the capacity above 500 MW)

In absence of Indian Standard for emission from power plants as on date, for certain gaseous effluents, the internationally accepted World Bank Standard is to be followed. Indian Standard for emission of power plants are under formulation. Should this standard is published before finalisation of the contract, the bidder has to comply the more stringent of the above norm or the new Indian Standard.

The bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

15.02.00 **Noise Level Requirement**

The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.

b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, `Ambient Air Quality Standards' in respect of noise.

c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the contractor shall comply with the requirement.

An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.

16.00.00 **INSPECTION AND TESTING**

16.01.00 **Inspection and Tests during Manufacture**

16.01.01 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

16.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

16.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

16.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the

consultant for record purpose.

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library / record.

16.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Owner's Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer along with Defect Map.

16.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.

16.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material or any other test as required by approved QAP/ Material specification.

16.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure or as required by design code of that part, for a period not less than one hour.

16.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

16.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.

16.01.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.

16.02.00 **Performance Tests at Site**

16.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

16.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

16.02.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.

16.03.00 For details of specific tests required on individual equipment refer to respective section of this specification.

## 17.00.00 TRAINING OF OWNER'S PERSONNEL

The Contractor shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

### 17.01.00 Training at Contractor's Premises

The Contractor shall conduct training of sixty (60) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contractor.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up :

| Discipline | No. of Engineers | No. of Man-month |
|---|---|---|
| Operation | 20 heads | 20 |
| Maintenance<br>Boiler, Turbine, Mechanical | 20 heads | 20 |
| Electrical Maintenance | 8 heads | 4 |
| Control & Instrumentation | 8 heads | 4 |
| Maintenance Planning | 4 heads | 2 |
| | --- | --- |

| | |
|---|---|
| 60 heads | 60 |
| --- | --- |

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to:

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

2. Plant operation and systems training for operators including simulator training as applicable.

3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Contractor shall provide qualified English speaking instructors and training

coordinator(s) during the tenure of the training programme.

17.02.00 **Operation and Maintenance Training at Site**

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first Unit.

The following instructors shall be at the Site continuously during the training :

a) One (1) for Steam Generator and Auxiliaries ;

b) One (1) for Turbine Generator and Auxiliaries ;

c) One (1) for Electrical Works ;

d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;

e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).

17.03.00 **On-the-Job Training**

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

17.04.00 For detail C&I training refer to Volume-VI, Section-9.

18.00.00 **DEVIATIONS**

The Bidder is required to submit with his proposal in the relevant schedules a detail list of any and all deviations taken by him clearly without any ambiguity. In the absence of such a list it will be understood and agreed that the Bidder's proposal is based on strict conformance to this specification and no post-contract negotiations would be allowed in this regard.

Unless otherwise specifically indicated in the deviation list, it will be construed and agreed that details indicated in documents & drawings furnished by the Bidder along with the offer is in-line with the specification requirement.

## ANNEXURE-I

## LIST OF STANDARDS FOR REFERENCE

a) International Standards Organisation (ISO).

b) International Electro-technical Commission (IEC).

c) American Society of Mechanical Engineers (ASME).

d) American National Standards Institute (ANSI).

e) American Society for Testing and Materials (ASTM).

f) American Institute of Steel Construction (AISC).

g) American Welding Society (AWS).

h) Architecture Institute of Japan (AIJ).

i) National Fire Protection Association (NFPA).

j) National Electrical Manufacturer's Association (NEMA).

k) Japanese Electro-technical Committee (JEC).

l) Institute of Electrical and Electronics Engineers (IEEE).

m) Federal Occupational Safety and Health Regulations (OSHA).

n) Instrument Society of America (ISA).

o) National Electric Code (NEC).

p) Heat Exchanger Institute (HEI).

q) Tubular Exchanger Manufacturer's Association (TEMA).

r) Hydraulic Institute (HIS).

s) International Electro-Technical Commission (IEC) Publications.

t) Power Test Code for Steam Turbines (PTC).

u) Applicable German Standards (DIN).

v) Applicable British Standards (BS).

w) Applicable Japanese Standards (JIS).

x) Electric Power Research Institute (EPRI).

y) Standards of Manufacturer's Standardization Society (MSS).

z) Bureau of Indian Standards Institution (BIS).

aa) Indian Electricity Rules.

bb) Indian Boiler Regulations (IBR).

cc) Indian Explosives Act.

dd) Indian Factories Act.

ee) Tariff Advisory Committee (TAC) rules.

ff) Emission regulation of Central Pollution Control Board (CPCB).

gg) Pollution Control regulations of Dept. of Environment, Govt. of India

hh) Central Board of Irrigation and Power (CBIP) Publications.

ii) The Air Prevention and Control of Pollution Act.

jj) The Environmental Protection Act

kk) The Public Liability Insurance Act.

ll) The Forest Conservation Act

mm) The Wildlife protection Act.

nn) The EIA Notification, 1994.

oo) IS: 14665-Specification for Electric Traction Lift

pp) Any other statutory Codes/Standards/Regulations

## ANNEXURE-II

## CRITERIA FOR LAYOUT

PLOT PLAN LAYOUT REQUIREMENTS

| | ITEM | SPECIFICATION REQUIREMENT |
|---|---|---|
| A. | Site conditions to be considered | |
| 1. | Prevalent wind direction | See wind-rose in plot plan. Also refer Metrological Data. |
| B. | Layout Requirements | |
| 1. | Maximum permissible slope in | |
| a) | Rail track | 1 in 400 |
| b) | Road | 1 in 30 |
| c) | Sides of unpaved embankment | 1 in 2 |
| 2. | Required road width | |
| a) | Main roads | As per Civil DBR |
| b) | Auxiliary interconnections | |
| c) | Road to the power house unloading bay : | |
| | • Only for entry to the unloading bay | Yes |
| | • To pass through the unloading bay | No |
| 3. | Required minimum horizontal distance between the nearest points of | |
| a) | Plant boundary and the boundary of residential area | (Local municipality/factory rule) |
| b) | Electrical transformer and any other building/facility | As per the Tariff Advisory Committee/ LPA Rules |
| c) | Fire water supply installation and any building/facility subject to fire risk. | As per the Tariff Advisory Committee/ LPA Rules |
| d) | Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities. | Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code |

| | ITEM | SPECIFICATION REQUIREMENT |
|---|---|---|
| 4. | Required minimum vertical clearance | |
| a) | Under pipes/cable racks at road crossings | 8.0 Metres |
| b) | Soil coverage over underground pipes | 1.0 Metre (minimum) |
| 5. | Railway Wagon clearance | Rules of the Indian Railways |
| 6. | Minimum Clearance between any road edge and building/structure/ any fixed installation. | 3 Metres |
| 7. | Required level, above the local developed grade level, of | |
| a) | top of all roads | 150 mm above FGL |
| b) | all outdoor paved areas | 100 mm above FGL |
| c) | Temporary storage areas, workshops, offices, residence etc. required at the time of erection work. | Yes |
| d) | Green belt around power plant area | As per environmental guidelines of MOEF, Govt. of India. |
| BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS | | |
| A. | Minimum clear space required at all working and walking areas for operating & maintenance personnel | |
| 1. | Horizontal, in all directions | |
| a) | Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C. | 1200 mm |
| b) | Adjacent to any other plant facilities (including walls/structures) | 1000 mm |
| 2. | Vertical (head-room clearance) | |
| a) | Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items. | 2.5 Metre |
| b) | Under any other plant facilities (including structures, pipes etc.) | 2.5 Metre |

| | ITEM | SPECIFICATION REQUIREMENT |
|---|---|---|
| 3. | For all areas where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver. | Minimum 500 mm clear in all direction from the outer edges of the equipment |
| 4. | Minimum clear hand space required for | |
| a) | The application of thermal insulation | 100 mm |
| b) | Welding work | 150 mm |
| c) | Bolt tightening | 150 mm |
| B. | Floors, platforms, staircase, ladders, walls, doors & windows | |
| 1. | Statutory Requirement | As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc. |
| 2. | Operation & Maintenance Requirement | |
| a) | Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required. | Yes |
| b) | Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained. | Yes |
| 3. | Plinth level of all buildings, above the finished grade level | 500 mm |
| 4. | Minimum access opening required (with rolling shutter) for transportation, wherever entry of truck for material handling is envisaged | 3.5M wide x 4M high or, more depending upon the equipment size to be handled. |

| | ITEM | SPECIFICATION REQUIREMENT |
|---|---|---|
| C. | Other Maintenance Requirement | |
| 1. | Generator stator handling<br>In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept. | Yes |
| 2. | Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, compressors, blowers, heat exchangers, fuel oil pumps, filters etc. | Shall be possible without disconnecting or dismantling any piping/ducting. |
| 3. | Overhauling and handling of the casings for the above items | Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them. |
| 4. | Crane Approach<br>Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible. | Yes |
| D. | Central Control Room<br>All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room. | Yes |
| | The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.<br>However, as a guide line, following features are given : | |
| a) | False ceiling and false flooring shall be provided. | |
| b) | Uniform height, colouring schemes for cabinets etc. shall be available. | |

| | ITEM | SPECIFICATION REQUIREMENT |
|---|---|---|
| c) | The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area. | |
| d) | No opening shall be provided from Boiler side. | |
| e) | Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor. | |
| f) | Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided. | |
| g) | The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX. | |
| h) | Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc. | |
| i) | Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room. | |
| E. | Toilet and drinking water facility | Required in all buildings and on all floors wherever operating personnel are to be deployed. |

# PROJECT MANAGEMENT AND SITE SERVICES

# CONTENT

## PROJECT MANAGEMENT AND SITE SERVICES

### 1.00.00 PROJECT MANAGEMENT SERVICES

#### 1.01.00 Responsibility

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

a) Planning and Monitoring

b) Engineering Management

c) Contracts Management

d) Project Safety Management

e) Quality Assurance, Inspection & Expediting

f) Construction Management

g) Spares Management

h) Erection & Commissioning Management

Detailed responsibilities in the above areas are discussed below :

#### 1.02.00 Organisation

1.02.01 Headquarters

The headquarters of the project management team shall be headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters relative to this contract.

1.02.02 Central Co-ordination Cell

The central coordination cell shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or

references made by Owner and his Consultants without having the need to refer to his headquarters each time.

1.02.03 Site Organisation

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

1.02.04 Organisation Chart

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

1.03.00 **Implementation Schedule**

The schedule for the completion of the Project would be as follows :

As per project specific special condition of contract.

To achieve these targets, the Contractor shall furnish to the Owner, various schedules as defined below:

1.03.01 Engineering Schedules

These schedules shall cover various design submissions indicating different engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment item covered in the scope of this specification.

1.03.02 Manufacturing Schedule

The Contractor shall submit to the Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Intent (LOI). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

1.03.03 Erection Schedules

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/ agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules alongwith requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award of contract. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, SAP.

1.04.00 **Detailed Responsibilities**

1.04.01 Planning & Monitoring

a) Planning

The Bidder shall prepare a Master Network Schedule in the form of PERT network.

The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

b) Monitoring & Progress Reporting

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

i) Report on key milestones.

ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.

iii) Action needing attention of the Owner/Consultant.

iv) Detailed packagewise status of engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

i) Report on key milestones.

ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.

iii) Action needing attention of the Owner/Consultant.

iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

1.04.02 Engineering Management

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for engineering activities.

Based on (L-2) network, the Contractor shall further develop the Level-3 (L-3) network for engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

Detailed (L-2) and (L-3) networks would be submitted sequentially by the Contractor within two months from the date of issue of Letter of Intent and finalised within one (1) month thereafter.

All such networks shall be provided in MS PROJECT software as well as in other format / software suitable to Owner.

The engineering management team should also co-ordinate all interface engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related engineering documentation before the same is submitted to the Owner.

TSGENCO is implementing SAP ERP. Hence the bidder apart from submission of the hard copies shall upload all the documents, drawings etc. in soft format in the relevant C- folder environment (web based) and comply with the additional requirements, if any.

1.04.03 Contracts Management

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacture can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of boughtout items, detailed shipping schedule and cash flow statement for Owner's approval.

1.04.04 Quality Assurance, Inspection and Expediting

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacture is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior

to placement of Letter of Intent. This approved list will be binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list would be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list Owner reserves the right to include vendors of his own choice. No further vendor approval will be given after twelve (12) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would issue a material despatch clearance certificate (MDCC) after the inspection clearance which will enable the Contractor to despatch the equipment and claim the payment. In the despatch programme, the Contractor shall indicate a schedule of estimated programme, tonnages specifically identifying various oversize dimensioned consignments (ODC). Further the Contractor will also be required to ensure at all stages of shipment that packing of all shipments despatched are suitable for ocean freight to India, handling at the port of entry, inland transportation and preservation at site upto erection. All despatch details & item lists shall be made available to both Owner & site immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.04.03 above.

1.04.05 Construction Management

Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Intent, the Contractor shall submit a programme of construction/ erection/ commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.

The L-3 programme would be jointly finalised by the site in charge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme will also identify the sequential erectable tonnages that are required for various equipment which should be taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.

1.04.06 Spares Management

Alongwith the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:

a) Mandatory spares

b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised thereafter.

1.05.00 **Project Progress Review Meetings**

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution of the project will be held initially at least once in two (2) months at Hyderabad/site/ at the discretion of the Owner.. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.

1.06.00 **Owner's Consultant**

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner / Owner’s Consultant and Contractor/ Contractor's project management team shall be finalised during contract negotiations.

1.07.00 **Commissioning Management**

1.07.01 For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

a) Steering Committee
b) Commissioning Panel.
c) Working Parties
d) Testing Teams.

1.07.02 Commissioning documents shall be prepared by the Contractor in the

following manner and submitted for Owner's approval :

a) Field Quality Plan

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

i) Establish design data against which Plant Performance will be compared.

ii) Set-out the testing objectives and proposals.

iii) Define the documentation required.

b) Testing/Commissioning Schedule

These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.

c) Standard Check Lists

Standard check lists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.

1.07.03 Test Reports

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-a-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

2.00.00 **SITE SERVICES**

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.

2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/ F.O.B. port of shipment by Contractor till receipt of the same at site.

2.03.00 Unloading of materials at Railway Station/Railway Siding inside project area/ Road Transportation, transportation to site store, assessment of lost/ damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Engineer a report detailing all the receipts during the week as well as storing, preservation of material at site.

2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.

2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.

2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

Apart from Boiler, proper chemical cleaning shall be carried out in following pipe lines/equipment before commissioning

a) Deaerator

b) Boiler feed suction, recirculation leak-off lines

c) Boiler Feed discharge line by passing heaters

d) Attemperation lines

e) Condensate suction & discharge piping upto deaerator by passing the feed water heaters.

f) Fuel oil lines.

Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

Safe disposal of effluent after chemical cleaning shall be done by the contractor.

2.07.00 Supply and application of the final paints and first fill lubricants on all the equipment to be erected under this specification. Supply of chemicals, lub oils and other consumables upto COD.

2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :

2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to

be rendered under this specification.

2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.

2.08.03 Supply of all consumables, e.g. welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection work except those listed under exclusion elsewhere in this specification.

2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.

2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.

2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.

2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives, Electrical Inspector etc. for respective portions of work under the jurisdiction of such statutes or laws.

2.08.08 The Contractor shall provide `Industrial Relations' unit and `Medical' unit to take care of his erection staff and the Owner shall have no obligation in the regard.

2.08.09 The successful Bidder shall arrange for Tower cranes of adequate capacity for speedy erection activities.

2.09.00 **Site Organisation**

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel

proposed by the Contractor. The persons, whose bio-data have been approved by the Owner, will have to be posted at site and deviations in this regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

2.10.00 **General Guidelines for Field Activities**

2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.

2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication.

2.10.03 The Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called will also attend such meetings.

2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall take necessary action to make good of such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

2.10.05 The Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

2.10.06 The works under execution shall be open to inspection & supervision by the Owner's engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.

2.10.07 Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.

2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.

2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.

2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Engineer and as per the Standards.

2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Engineer, will have to be done by the Contractor.

2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :

a) Product groups under which these items are re-leased are not covered in the scope of this tender.

b) Items are supplied by an agency other than the Contractor.

2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by

the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub. oil system, carryout the hydraulic test of oil coolers, etc.

2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Engineer, with all the necessary tools & tackle, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.

2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.

2.10.16 Equipment and material which are wrongly installed shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.

2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.

2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.

2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.

2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the same operation of valves will be arranged by the Contractor.

2.11.00 **Safety**

Safety and overall cleanliness of work site shall be given top priority.

2.11.01 The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.

2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be

handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.

2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.

2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.

2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be done by the Contractor and certified copies shall be supplied to the Owner. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.

2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.

2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.

2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.

2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.

2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.

2.11.11 All safety precautions shall be taken for welding and cutting operations as per IS-818.

2.11.12 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

2.12.00 **Taking Delivery & Storage**

2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the

materials so issued shall be submitted to the Owner.

2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.

2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.

2.13.00 **Site Welding & Heat Treatment**

2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.

2.13.02 All welders shall be tested and approved by Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Engineer shall be stamped by the welder on each joint done by them. The Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.

2.13.03 The Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.

2.13.04 All charges for testing of welders including destructive and non- destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.

2.13.05 All welded joints shall be subject to acceptance by Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.

2.13.06 Preheating/post heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing

type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Engineer prior to the commencement of each cycle and handed over to Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo-chalks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.

2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.

2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.

2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.

2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.

Fillet weld shall be made by shielded metal arc process as per applicable codes.

However, the Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.

In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.

2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.

2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.

2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

2.13.14 Each layer of welding shall have an even and smooth appearance.

2.13.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.

2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surface to be welded are wet from any cause.

2.13.17 Following will be stages of inspection during welding :

a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Engineer.

b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.

c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.

2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.

## 3.00.00 PROJECT INFORMATION AND MANAGEMENT SYSTEM, INCLUDING DCOUMENT MANAGMENT SERVER (DMS)

3.01.00 Contractor shall submit as part of its Work Scope detailed documentation as outlined in this section and / or required by the Technical Requirements. The content and format of the documentation to be submitted are subject to Owner's approval.

3.02.00 Contractor shall utilise a computer based system for control and management of project documentation. The system must be capable of producing customized reports and information on demand. This control system should have been successfully applied to similar projects and be familiar to the project control personnel selected. Contractor's detailed project documentation plan shall identify all documentation requirements for the project, the party responsible for production of the document, the basic content of the document and the required timing for issue. This plan shall include, but not be limited to the details of all Drawings to be produced, plant specification / definition documentation, equipment orders and manuals. The documentation identified shall be entered into the computer based control system The database thus created shall be capable of being sorted and

ordered on a variety of selected parameters such as document type, subject description, responsible party, start date and finish date, to enable review and update to be conducted only on those documents which are relevant.

3.03.00 Regular documentation control progress reports shall be prepared by the Contractor to record the status of documentation. In the event either Party or Engineer expresses concern with the content of such progress reports, the accuracy of progress reports, status of documentation production and other such matters, the concern will be identified to the Project Manager. Within five days of notification of this concern, the Project Manager will attend a meeting with relevant Owner Representatives and provide details of specific actions to be initiated to satisfactorily overcome the difficulties identified. It will be the Project Manger,s responsibility to initiate whatever action is necessary to ensure that the production of documentation is completely in accordance with Project Information Management System (PIMS).

3.04.00 Within 90 days after Effective Date of Contract, the Contractor shall establish an integrated PIMS which will support the needs of Project and management, detail design and engineering, procurement, construction and operation, and maintenance.

PIMS shall utilise software which links various software and database programs to form a composite system. The typical scope of PIMS shall include, but not be limited to, the following:

(a) Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. The Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. This data shall include, but not be limited to, the following:

(i) System descriptions and design requirements and design criteria

(ii) Equipment and material technical specifications for all engineering disciplines

(b) Detail engineering data to create flow diagrams, plant arrangements, piping configurations, equipment layout and design, electrical and instrumentation systems, structures, and other systems. The software tool used shall be capable of manipulation and storage of plant layout and design information. The 3D model of the plant shall also contain details of the various components like pipe, structural steel work, etc., and relevant information shall be available on-line from relevant data base. Software shall be multi-user, multi-access nature allowing the designers of Contractor and major Sub-Contractors, if required, to work in interactive real time environment and software shall be capable of interference checking. The software shall allow access to different types of information held in the database. It shall estimate the type and quantity of materials required to build the plant and it shall be possible for such data to be taken off the system at any time.

(c) Construction data to monitor and manage site activities, including material control, scheduling and progress, quality control, start-up and testing, operation, maintenance, training, and all other site functions.

(d) Plant design and construction records to provide data for safe and efficient maintenance and operation. Records to include may be maintenance schedule, man power tracking, tools, spare parts, and test equipment inventory, equipment list, drawing, control, technical specifications, and equipment instruction manuals.

3.05.00 The PIMS shall be installed in a distributed processing array system and operated through personal computer work stations at the Contractor's site office. A complete integrated system shall be implemented. This system shall be utilised by Contractor during the Project execution.

# ENGINEERING SERVICES

# CONTENT



**ATTACHMENTS**

## ENGINEERING SERVICES

1.00.00 **GENERAL**

1.01.00 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

2.00.00 **DESIGN COORDINATION MEETING**

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant’s office in Kolkata or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.00.00 **CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS**

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with copies of all correspondences addressed by the Contractor to other Sub- contractors and Consulting Engineers in respect of such exchange of technical information.

4.00.00 **GUIDELINES FOR ENGINEERING SERVICES**

4.01.00 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed engineering work.

4.02.00 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.

4.03.00 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/ drawing/other documents which are applicable to 800 MW Unit, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution / operation of similar units. Such changes / modifications/ improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.

4.04.00 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.

4.05.00 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.

4.06.00 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:

4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations / floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's / Consultant's

approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-contractors.

4.06.03 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.

4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.

4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.

4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.

4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support engineering.

4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.

4.06.09 Certification and submission of final as-built drawings for all areas.

4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.

4.06.11 All erection and assembly drawings which may be required at site.

4.06.12 For all bought out item packages, the Contractor shall provide complete material / component list along with detail specification, drawings, component part no. etc. during detail engineering stage prior to final approval. Such approved drawing/document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD)

4.06.13 Preparation of necessary documentation, design calculations etc. required for submission to statutory authorities like IBR, Chief Electric Inspector, Factory Inspector etc.

5.00.00 **OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS**

5.01.00 The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies as per distribution schedule (Annexure-1).

5.02.00 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

a) A complete inventory of all main items of plant, with identification details.

b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.

c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.

d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.

e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.

f) Manufacturer's literature.

5.03.00 The instruction manual shall be subject to the approval of Owner.

6.00.00 **PLANT HANDBOOK**

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Intent. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted as per distribution schedule.

7.00.00 **CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE**

7.01.00 Within fifteen (15) days to one month of issue of Letter of Intent (LOI) by the Owner, the Contractor shall furnish a schedule of drawings and design

document to be submitted by him to the Owner/Engineer indicating dates against each document.

The documents shall be divided into two categories : a) for approval and b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow two (2) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/ Engineer.

7.02.00 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

7.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval / information of the Owner/Engineer.

7.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

a) List of sub-vendors (from Owner only)

b) System scheme and instrumentation diagrams

c) Design basis justifying selection of equipment & process parameters where not specified in the Contract

d) Equipment data sheets and general arrangement drawings

e) Materials of construction

f) Layout drawings.

g) Operation logic diagrams.

h) Typical control circuit.

i) Drawings of Instrumentation and control.

7.05.00 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

a) Equipment foundation drawings.

b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.

c) Predicted performance curves of equipment.

d) Various bills of quantity, schedules etc.

e) Piping fabrication drawings, isometrics etc.

f) Panel wiring diagrams.

g) Instruction/Operation manuals.

h) Service manuals and trouble shooting guide for C & I system including field instruments.

i) Cable schedule and interconnection chart.

j) Drive/feederwise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

7.06.00 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

a) A - Drawing submitted as approved, proceed with fabrication

b) B - Drawing approved subject to comments noted, proceed with fabrication, considering our comments. Correct as necessary and resubmit for record.

c) C - See attached memo.

d) D - Correct your original drawing incorporating our comments and resubmit for approval.

e) E - Information furnished is noted.

f) F - Prints not enclosed

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/ Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/ Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

7.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

7.08.00 For review by the Consulting Engineer, the Contractor shall furnish soft copies of drawings & documents and three (3) prints of each drawing/ document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/ Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

7.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

**ANNEXURE-1**

**DISTRIBUTION SCHEDULE**

| S. No | Description | TSGENCO | | | | | | | | Consultant | | | Equipment Vendor | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Director Projects | Director Technical | CE/Civil Thermal Projects Hyd. | CE/ TPC-I, Hyd | CE/ O&M/ [illegible] | SE/ Civil [illegible] | SE/E&M / [illegible] | DE Constr. [illegible] | | HYD | BTPS | | |
| A | **Letter Of Intent or Contract Documents** | 1 | 1 | 1 | S | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | |
| B | **Vendor Drawings** | | | | | | | | | | | | | |
| 1. | Preliminary | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 12 | 1 | - | S | |
| 2. | Return preliminary with comments | - | - | 1 | 2 | 1 | 1 | 1 | 1 | S | 1 | - | 1 | |
| 3. | Final and any revision thereof | | | | | | | | | | | | | |
| | a. Civil | 1 | 1 | 6+1T | 1 | 1 | 6+1T | 1 | - | 2+1T | 1 | 1 | S | |
| | b. E&M | 1 | 1 | 1 | 6+1T | 1 | 1 | 6+1T | 1 | 2+1T | 1 | 1 | S | |
| C. | **Design Drawings** | | | | | | | | | | | | | |
| 1. | Preliminary | | | | | | | | | | | | | |
| | a. Civil | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 4 | 1 | 1 | S | |
| | b. E&M | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 4 | 1 | 1 | S | |
| 2. | Released for construction | | | | | | | | | | | | | |
| | a. Civil | 1 | 1 | 2 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 2 | S | |
| | b. E&M | 1 | 1 | 1 | 1 | 2 | 1 | 6 | 1 | 1 | 1 | 2 | S | |
| 3. | Return marked 'As built' | | | | | | | | | | | | | |
| | a. Civil | - | - | 1 | - | - | 1 | - | - | 1 | 1 | S | 1 | |
| | b. E&M | - | - | - | 1 | - | - | 1 | 1 | 1 | 1 | S | 1 | |
| 4. | As built drawings | | | | | | | | | | | | | |
| | a. Civil | - | - | 1+1T | - | 2+1T | 5+1T | - | 1 | 1+1T | - | 1 | S | |
| | b. E&M | - | - | 1 | 2+1T | 2+1T | - | 5+1T | 1+1T | 1+1T | - | 1 | S | |

| S. No | Description | TSGENCO | | | | | | | | Consultant | | | Equipment Vendor | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Director Projects | Director Technical | CE/Civil Thermal Projects Hyd. | CE/ TPC-I, Hyd | CE/ O&M/ | SE/ Civil | SE/E&M / | DE Constr. | | HYD | BTPS | | |
| D | Progress Report Monthly | | | | | | | | | | | | | |
| 1. | Equipment vendor | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | S | |
| 2. | Consultant | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | S | 1 | 1 | Nil | |
| E | Test & Inspection Reports | | | | | | | | | | | | | |
| 1. | Equipment manufacturer | | | | | | | | | | | | | |
| | a. Civil | 1 | 1 | 1 | 2 | 1 | 1 | 1 | - | 11 | 1 | 1 | S | |
| s | b. E&M | 1 | 1 | - | 2 | 1 | - | 1 | 1 | 11 | 1 | 1 | S | |
| 2. | Consultant | 1 | 1 | - | 2 | 1 | - | 1 | 1 | S | - | 1 | - | |
| F | Instruction Manuals/Data Books | | | | | | | | | | | | | |
| 1. | Equipment manufacturer | | | | | | | | | | | | | |
| | a. Civil | 1 | 1 | 1+1T | 1 | 1 | 6+1T | 1 | 1 | 2+1T | 1 | 1 | S | |
| | b. E&M | 1 | 1 | - | 3+1T | 1 | - | 6+1T | 2 | 3+1T | 1 | 1 | S | |
| 2. | Consultant | 1 | 1 | - | 10+1T | 1 | - | 15+1T | - | S | 1 | 1 | Nil | |
| G | Consultant | 1 | 1 | 1 | 8+1T | 1 | 1 | 2 | 1 | 1 | 1 | 1 | S | |
| H | Design Calculations | 1 | 1 | 1 | 8+1T | 1 | 1 | 2 | 1 | 1 | 1 | 1 | S | |
| I | Final consulting Engineering Report | 1 | 1 | 1 | 10 | 1 | 1 | 2 | 1 | S | 1 | 1 | Nil | |

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited

Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082

# QUALITY ASSURANCE REQUIREMENTS

# CONTENT

## QUALITY ASSURANCE REQUIREMENTS

### 1.00.00 QUALITY ASSURANCE PROGRAMME

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following :

a) His organisation structure for the management and implementation of the proposed quality assurance programme.

b) Documentation control system.

c) Qualification data for Bidder's key personnel.

d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

f) Control of non-conforming items and system for corrective actions.

g) Inspection and test procedure both for manufacture and all site related works.

h) Control of calibration and testing of measuring and testing equipments.

i) System for quality audit.

j) System for indication and appraisal of inspection status.

k) System for authorising release of manufactured product to the Owner.

l) System for handling storage and delivery.

m) System for maintenance of records.

n) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section for Owners approval

o) Internal standards, if referred in the quality plans shall generally be compatible with National / International standards and shall be mentioned in the quality plans. Alternatively bidder shall furnish extracts of the internal standards detailing out acceptance norm for the product / material.

## 2.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

Contractor shall furnish list of Manufacturing Quality Plans of major equipments indicating proposed inspection catagorisation indicating items that will be offered for Owner’s inspection etc and the Field Quality Plans

2.02.00 Manufacturing Quality Plan for all the major equipment will detail out their respective important components, their in-process various tests/inspection & final inspection / tests, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization. The relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing are to be comprehensibly documented by Contractor.

Manufacturing Quality Plan for all major equipments/ items will be approved by owner. In these approved quality plans, Owner / Authorised representative shall identify customer hold points (CHP), test / checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work shall not proceed without consent of Owner / Authorised representative in writing. Inspection/ Test reports are to be submitted to owner as specified in final approved Manufacturing Quality Plans.

2.03.00 Field Quality Plans / Procedures for all field activities shall be submitted to

owner for review / approval. These Quality Plans / procedures will detail out, for all equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/ equipment at site.

2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and major deviations in the form of Non Conformity Report shall be referred to Owner/Authorised representative for approval and dispositioning.

2.05.00 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/ Authorised representative for “CHP” and “W” points marked in quality plans , and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC). For items which is not under owner’s inspection the contractor shall apply for despatch clearance (MDCC) from owner by submitting their internal inspection reports and quality records

2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet serial numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

2.08.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section - IX (latest edition) or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's/ Sub-Contractor's works or at site shall be qualified as per ASME Section-IX (latest edition) or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner / his authorised representative or owner approved Third Party Inspection Agency(TPIA). Previously qualified WPS & PQR shall be acceptable if witnessed by owner’s approved TPIA.

For welding of pressure parts and high pressure piping coming under IBR purview, the requirements of IBR shall also be complied with.

2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with LIST OF STANDARDS FOR REFERENCE as given below in this section.

The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT for the list major equipments / items identified for owner's inspection shall be properly recorded and submitted for review and approval. Other items not covered under owner's inspection, contractor shall review and approve the NDT results and such reports shall be submitted to owner in the final documentation of the items / equipments

2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalised with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 **QUALITY ASSURANCE DOCUMENTS**

3.01.00 The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms / CDs of the following Quality Assurance documents within three (3) weeks after despatch of the equipment:

a) Material mill test reports on components as specified by the specification.

b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

c) Non-destructive examination results /reports including radiography interpretation reports.

d) Factory tests results for testing required as per applicable codes and standards referred in the specification.

e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.

f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

   i) When some important repair work is involved to make the job acceptable.

   ii) The repair work remains part of the accepted product quality.

i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

## 4.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.01.00 The Owner’s Engineer, or his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access inside the workshops, test labs, establishments at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Owner’s Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.02.00 The Contractor shall give the Owner’s Engineer/ Authorized Inspector twenty one (21) days written notice for “CHP” / “W” points of any material being ready for testing by owner’ engineer / Authorized inspector. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/ Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection. If owner’s Engineer / Authorised Inspector fail to attend the inspection, next mutually convenient date for test shall be agreed with Contractor. Contractor shall, in

no case proceed with the test without owner or his authorized inspectors, unless the witnessing is officially waived and advised Contactor to proceed with the test. Contractor shall forthwith forward duly certified completed test report and a product quality certificate in six (6) copies to owner upon completion of such test.

4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract / QAP or other approved quality documents. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract / QAP or other approved quality documents.

4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests excluding the test completion date subject to submission of all certified documents related to the test, If the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the owner’s Engineer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract / QAP or other approved quality documents.

4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the owner’s Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contract / QAP or other approved quality documents. Contractor and shall give facilities to the owner’s Engineer/ Inspector or to his authorised representative to accomplish testing.

4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating proposed schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

## LIST OF STANDARDS FOR REFERENCE

a) International Standards Organisation (ISO).

b) International Electro-technical Commission (IEC).

c) American Society of Mechanical Engineers(ASME)

d) American National Standards Institute (ANSI).

e) American Society for Testing and Materials (ASTM).

f) American Institute of Steel Construction (AISC).

g) American Welding Society (AWS).

h) Architecture Institute of Japan (AIJ).

i) National Fire Protection Association (NFPA).

j) National Electrical Manufacturer's Association (NEMA).

k) Japanese Electro-technical Committee (JEC).

l) Institute of Electrical and Electronics Engineers (IEEE).

m) Federal Occupational Safety and Health Regulations (OSHA).

n) Instrument Society of America (ISA).

o) National Electric Code (NEC).

p) Heat Exchanger Institute (HEI).

q) Tubular Exchanger Manufacturer's Association (TEMA).

r) Hydraulic Institute (HIS).

s) International Electro-Technical Commission Publications.

t) Power Test Code for Steam Turbines (PTC).

u) Applicable German Standards (DIN).

v) Applicable British Standards (BS).

w) Applicable Japanese Standards (JIS).

x) Electric Power Research Institute (EPRI).

y) Standards of Manufacturer's Standardization Society (MSS)

z) Bureau of Indian Standards Institution (BIS).

aa) Indian Electricity Rules.

bb) Indian Boiler Regulations (IBR).

cc) Indian Explosives Act.

dd) Indian Factories Act.

ee) Tariff Advisory Committee (TAC) rules.

ff) Emission regulation of Central Pollution Control Board (CPCB).

gg) Pollution Control regulations of Dept. of Environment, Govt. of India

hh) Central Board of Irrigation and Power (CBIP) Publications

## ANNEXURE-I
## FORMAT OF QUALITY ASSURANCE PROGRAMME

| VENDOR'S LOGO , NAME & ADDRESS | MANUFACTURING QUALITY ASSURANCE PLAN | DOC NO: | XXXXX-CAL-QAP-M-0001 | | | | |
|---|---|---|---|---|---|---|---|
| | - | REV NO : | 0 | 1 | 2 | 3 | 4 |
| | ITEM : | DATE : | | | | | |

| | | | |
|---|---|---|---|
| CLIENT : | | LOCATION : | |
| PROJECT : | | REFERENCE PURCHASE ORDER NO. & DT : | |
| VENDOR : | | REFERENCE APPROVED DATA SHEET : | |
| SUB VENDOR : | | REFERENCE APPROVED DRAWING. NO. : | |

**ABBREVIATIONS :**

| | | |
|---|---|---|
| QAP - QUALITY ASSURANCE PLAN, | MATL - MATERIAL, | AGENCY : |
| CR - CRITICAL, | APP - APPROVED, | 1 - PROJECT AUTHORITY |
| MA - MAJOR, | DWG - DRAWING, | 2 - SUPPLIER |
| MI - MINOR | SUPL - SUPPLIER, | 3 - SUB-SUPPLIER |
| SPEC - SPECIFICATION, | PROC - PROCEDURE | 4 - MANUFACTURER |
| TC - TEST CERTIFICATES | | 5 - THIRD PARTY INSPECTION AGENCY |
| P - PERFORM | | |
| w - WITNESS | | |
| V - VERIFY | | |
| CHP - CUSTOMER HOLD POINT | | |

**GENERAL REMARKS**

1 THE ITEMS WHICH ARE FALLING UNDER ANY STATUTORY AUTHORITY'S (LIKE I.B.R. ETC.) SCOPE SHALL BE SUBJECTED TO THAT STATUTORY AUTHORITY'S INSPECTION CLEARENCE.

**NOTES:**

1. EXACT MATERIAL / PROCESS / INSPECTION / TESTS FOLLOWED BY THE MANUFACTURER SHALL BE SPECIFIED
2. EXACT REFERENCE DOCUMENT/ACCEPTANCE STANDARD SHALL BE SPECIFIED
3. IN CASE SPECIFIED ACCEPTANCE STANDARD / NORMS IS OTHER THAN NATIONAL / INTERNATIONAL STANDARDS
. STANDARD / COPY OF THE ACCEPTANCE NORMS FOLLOWED BY THE MANUFACTURER SHALL BE SUBMITTED FOR REVIEW RECORD
4 FINAL INSPECTION DOSSIER SHALL BE PREPARED BY MANUFACTURER & SHALL BE ENDORSED BY INSPECTIONTION AGENCY

| | Prepared by | | | Checked by | | | Approved By | | |
|---|---|---|---|---|---|---|---|---|---|
| Revision | R0 | R1 | R2 | R0 | R1 | R2 | R0 | R1 | R2 |
| DATE | | | | | | | | | |

| VENDOR'S LOGO, NAME & ADDRESS | ITEM : | DOC NO: | | | |
|---|---|---|---|---|---|
| | | REV NO : | R0 | R1 | R2 |
| | | DATE : | | | |

| SL NO. | DESCRIPTION | CHECKS | | | CATEGORY | REF DOCS | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TYPE | METHOD | QUANTUM | | | | | P | W | V | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 12 | 13 | 14 | 15 |
| 1.00 | | | | | | | | | | | | |
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Notes:

| Prepared by | | | | Checked by | | | Approved By | | |
|---|---|---|---|---|---|---|---|---|---|
| Revision | R0 | R1 | R2 | R0 | R1 | R2 | R0 | R1 | R2 |
| DATE | | | | | | | | | |
| | | | | | | | | | |

**ANNEXURE-II**

**FIELD WELDING SCHEDULE**

| | | | |
|---|---|---|---|
| PROJECT | : | FWS NO | : |
| CONTRACTOR | : | REV NO. | : |
| PACKAGE | : | FIELD WELDING CODE | : |
| SYSTEM | : | PAGE NO. | : |

| Sl No. | Drawing No. for Weld Locations & Identi-fication mark | Descrip-tion of parts to be welded | Material specifica-tion | Dimen-sions | Pro-cess of Weld-ing | Type of Weld | Electrode Filler Specifica-tion | WPS No. | Minimum Pre-heat Tempera-ture | Heat Treat-ment Tempe-rature [Holding Time in secs] | NDT Method Quantu m | NDT Speci-fication Number | Accep-tance Norm Ref. | Re-marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

The Field Welding Schedule should be submitted for :

- Pressure Parts
- Tanks/Vessels
- Piping
- Heavy/Important Structural Steel
- Heat Exchangers
- Bus Ducts

# REQUIREMENTS OF SPARES, TOOLS & TACKLE, LUBRICANTS/OIL/CONSUMABLES

# CONTENT

## REQUIREMENTS OF SPARES, TOOLS & TACKLE, LUBRICANTS/OIL/CONSUMABLES

### 1.00.00 TOOLS & TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackle as required for the erection, assembly, dismantling & maintenance of the equipment. These special tools will also include special material handling equipment, jigs & fixtures for maintenance and calibration/ readjustment, checking & measurement aids etc. A list of such tools & tackle shall be submitted by the Bidder along with the offer. Detailed description of each tools/tackle, its function along with the equipment/part for which it is meant for and the price of each tools/tackle shall also be indicated in the offer. These tools & tackle shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

### 2.00.00 SPARES

#### 2.01.00 General

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

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

2.01.03 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Engineer.

2.01.04 All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.

2.01.05 The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Purchaser for 30 years after commissioning of the plant.

2.02.00 **Recommended Spares**

2.02.01 The Contractor shall provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.

2.02.02 The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner, and shall be finalised after mutual discussion.

2.03.00 **Start-up Commissioning Spares**

2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval.

2.03.02 The Contractor shall submit a complete BBU list inclusive of recommended, mandatory, initial start-up and commissioning spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.

2.04.00 **Mandatory Spare Parts**

2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.

Since the components involved can not be foreseen at the bidding stage, only

broad requirements of the Owner in this respect are outlined hereinafter. The bidder shall include his proposal, on the basis of this guideline, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.

2.04.02 The mandatory spares should be supplied to the Owner at least one month before the trial run. The despatch programme is subject to approval of the Owner/Consultant after award of contract.

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION
FOR
FIRE TENDER AND FOAM TENDER

SECTION I

**QUALITY ASSURANCE AND INSPECTION REQUIREMENT**

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

# STANDARD MANUFACTURING QUALITY PLAN FOR FIRE TENDER AND FOAM TENDER

**Note: The requirements indicated in the standard quality plans are the minimum requirements. Any other requirement as required by final customer/BHEL, during detail engineering, shall be incorporated by bidder without any commercial implication to BHEL.**

| MANUFACTURERS NAME & ADDRESS | | | MANUFACTURING QUALITY PLAN | | | | | BHEL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ITEM | FOAM TENDER | BHEL QAP NO.<br>REV NO :<br>DATE :<br>PAGE NO :<br>BIDDER DOC. NO. | | | | | | | |
| | | | SUB SYSTEM<br>PO NO<br>DTD | | | | | | | | | |
| SR.NO. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASSIFICATION | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
| | | | | | | | | | P | W | V | |
| **1.0** | **MATERIAL & COMPONENTS** | | | | | | | | | | | |
| a. | M.S. Plate for Water tank | Chemical Property | Minor | Chemical Property | Lot | IS:2062 | IS:2062 | T.C. | - | - | 1/2/3 | |
| b. | S.S. Plate for Foam tank | Chemical Property | Major | Chemical Property | Lot | SS | SS | T.C. | - | - | 1/2/3 | |
| d. | Gun metal (pump casing) | Chemical Property | Major | Chemical Property | Lot | IS:318 Gr:2 | IS:318 Gr:2 | T.C. | - | - | 1/2/3 | |
| e. | Stainless Steel (Pump Shaft) | Chemical Property | Major | Chemical Property | Lot | SS 304 | SS 304 | T.C. | - | - | 1/2/3 | |
| f. | G.M. (Impeller) | Chemical Property | Major | Chemical Property | Lot | IS:318 Gr:2 | IS:318 Gr:2 | T.C. | - | - | 1/2/3 | |
| 1A. | Engine & Chassis (TATA) | Make,Type | Minor | Chassis Document | Lot | Chassis Document | Chassis Document | Chassis Document | - | - | 1/2/3 | |
| **2.0** | **IN PROCESS INSPECTION** | | | | | | | | | | | |
| a.0 | (Structural ) Fabrication of water & foam Tank | Visual & Dimension incl. Thickness | Minor | Dimensional (Visual) | 100% | As per G.A./WT/FT Drawing | As per G.A./WT/FT Drawing | Approved G.A./WT/FT Drawing | 2 | - | 1/3 | |
| b.0 | Hydro test of water tank & foam tank | Hydro test of water & foam tank | Major | Hydro Test 0.3bar | 100% | As per Specification. | No Leakage | I.R. | 2 | 1/3 | - | |
| c.0 | Pump casing | Hydro test | Major | 21kg/cm. Sq. | 100% | at 21kg/cm. Sq. | No Leakage | I.R. | 2 | 1/3 | - | |
| d.0 | Impeller | Dynamic Balancing | Major | - | 100% | Balancing certificate | Balancing certificate | T.C. | 2 | - | 1/3 | |
| **3.0** | **COMPLETE ASSEMBLY INSPECTION** | | | | | | | | | | | |
| a. | Pump (Primer) Assembly | Visual Check | Major | Visual/Completeness | 100% | As per Specification. | As per Specification. | I.R. | 2 | - | 1/3 | |
| b. | Hose reel Assembly | Visual Check | Minor | do- | 100% | As per Specification. | As per Specification. | I.R. | 2 | - | 1/3 | |
| **4.0** | **FINAL INSPECTION OF COMPLETE FIRE TENDER** | Performance Test of Pump for 4 hour & deeplift Test of primer, Stability test, road test, tilting test, | Major | Performance Test and Verification of list of equipments and accessories as per IS:10460 and approved datasheet. | 100% | Approved data sheet, approved Drawing, As per IS:10460 and P.O No. PW/PE/PG/NCH//P-356/10 | Approved data sheet, approved Drawing, As per BHEL IS 10460 and P.O No. PW/PE/PG/NCH//P-356/10 | I.R. | 2 | 1/3 | - | |

| MANUFACTURER SIGNATURE | LEGEND :<br>** 1 : BHEL, 2: BIDDER 3: CUSTOMER<br>W: WITNESS<br>P: PERFORMAR<br>V: VERIFIER<br>I.R. = INSPECTION REPORT<br>T.C. = TEST CERTIFICATE | FOR BHEL USE :<br>REVIEWED BY<br>NAME & SIGNATURE OF APPROVING AUTHORITY & SEAL |
|---|---|---|

| | MANUFACTURERS NAME & ADDRESS | | MANUFACTURING QUALITY PLAN | | | | | BHEL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ITEM | WATER TENDER | BHEL QAP NO.<br>REV NO :<br>DATE :<br>PAGE NO : | | | | | | | |
| | | | SUB SYSTEM | FIRE FIGHTING VEHICLE | BIDDER DOC NO ). - | | | | | | | |
| SR.NO. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASSIFICATION | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | | | REMARKS |
| | | | | | | | | | P | W | V | |
| **1.0** | **MATERIAL & COMPONENTS** | | | | | | | | | | | |
| a. | M.S. Plate for Water tank | Chemical Property | Minor | Chemical Property | Lot | IS:2062 | IS:2062 | T.C. | 2 | - | 1/2 | |
| c. | Gun metal (pump casing) | Chemical Property | Minor | Chemical Property | Lot | IS:318 Gr:2 | IS:318 Gr:2 | T.C. | 2 | - | 1/2 | |
| d. | Stainless Steel (Pump Shaft) | Chemical Property | Major | Chemical Property | Lot | SS 304 | SS 304 | T.C. | 2 | - | 1/2 | |
| e. | G.M. (Impeller) | Chemical Property | Major | Chemical Property | Lot | IS:318 Gr:2 | IS:318 Gr:2 | T.C. | 2 | - | 1/2 | |
| 1A. | Engine & Chassis (TATA) | Make,Type | Major | Chassis Document | Lot | Chassis Document | Chassis Document | Chassis Document | 2 | - | 1/2 | |
| **2.0** | **IN PROCESS INSPECTION** | | | | | | | | | | | |
| a.0 | (Structural ) Fabrication of water Tank | Visual & Dimension incl. Thickness | Minor | Dimensional (Visual) | 100% | As per G.A./WT Drawing | As per G.A./WT Drawing | Approved G.A./WT Drawing | 2 | - | 1 | |
| b.0 | Hydro test of water tank | Hydro test of water tank | Minor | Hydro Test 0.3bar | 100% | As per Specification | No Leakage | I.R. | 2 | 1 | - | |
| c.0 | Pump casing | Hydro test | Major | 21kg/cm. Sq. | 100% | 21kg/cm. Sq. | No Leakage | I.R. | 2 | 1 | - | |
| d.0 | Impeller | Dynamic Balancing | Major | - | 100% | Balancing certificate | Balancing certificate | T.C. | 2 | - | 1 | |
| **3.0** | **COMPLETE ASSEMBLY INSPECTION** | | | | | | | | | | | |
| a. | Pump (Primer) Assembly | Visual Check | Major | Visual/Completeness | 100% | As per Specification. | As per Specification. | I.R. | 2 | - | 1 | |
| b. | Hose reel Assembly | Visual Check | Minor | do- | 100% | As per Specification. | As per Specification. | I.R. | 2 | - | 1 | |
| **4.0** | **FINAL INSPECTION OF COMPLETE FIRE TENDER** | Performance Test of Pump for 4 hour & deeplift Test of primer | Major | Performance Test | 100% | Approved data sheet, approved Drawing | Approved data sheet, approved Drawing | I.R. | 2 | 1 | - | |

| MANUFACTURER SIGNATURE | LEGEND : | FOR BHEL USE : |
|---|---|---|
| | ** 1 : BHEL/CUSTOMER, 2: BIDDER<br>W: WITNESS<br>P: PERFORMAR I.R. = INTERNAL REVIEW<br>V: VERIFIER T.C. = TEST CERTIFICATE | REVIEWED BY<br>NAME & SIGNATURE OF APPROVING AUTHORITY & SEAL |

**ANNEXURE-I**

List of equipments to be supplied with the fire water tender

| S.No. | Equipment / Item | Quantity |
|---|---|---|
| 1.0 | Aluminium Extension ladder –10.5 m (IS 4571) | 01 |
| 2.0 | a) Rubber lined delivery hose according to Type-II of IS: 636 in 22.5 m or 15 m length fitted with 63 mm delivery hose couplings (IS: 903) | 180 m |
| | b) Unlined flax canvas hose according to IS 4927 in 30m lengths fitted with delivery hose coupling ( as per IS 903) | 150 m |
| | c) Controlled percolating hose as per IS8423 in 30 m lengths fitted with delivery hose couplings ( as per IS 903) | 150 m |
| 3.0 | a) Hose clamps (IS: 5612, part-1)<br>b) Hose bandages (IS: 5612, part-II)<br>c) Hose slings<br>d) Hose straps | 25<br>25<br>20<br>20 |
| 4.0 | Suction hose of rubber of 100 mm internal diameter in 2.5 m length fitted with 100 mm suction hose couplings (as per IS 902). | 10 m |
| 5.0 | 3 way suction collecting head 100 mm size (IS: 904) | 01 |
| 6.0 | Suction wrenches for 100mm suction coupling (IS: 4634) | 02 |
| 7.0 | Suction Strainer 100 mm size (IS: 907) | 01 |
| 8.0 | Basket strainer, cylindrical type (IS: 3582) | 01 |
| 9.0 | Dividing breeching with control instantaneous Pattern 63 mm (IS 5131) | 1 |
| 10.0 | Collecting breaching with control instantaneous Pattern 63 mm (IS 905) | 01 |
| 11.0 | a) Hydrant-stand pipe-two way (IS: 5714)<br>b) Double female coupling (IS: 901)<br>c) Hydrant connection, 63mm female instantaneous pattern delivery coupling at both end. (IS: 901) | 01<br>02<br>02 |
| 12.0 | Combined key for hydrant, hydrant cover and lower valve ( IS 910) | 02 |
| 13.0 | Fog nozzle with extension applicator with fog head (IS: 952) | 01 |
| 14.0 | Hand controlled branch for 63 mm size hose coupling | 01 |
| 15.0 | Branch pipe universal (IS: 2871) | 01 |
| 16.0 | Branch with revolving head (IS: 906) | 01 |
| 17.0 | Branch pipe | 4 |
| 18.0 | Nozzles of sizes 12 mm, 16 mm, 20 mm and 32 mm (two | 10 |

| | | |
|---|---|---|
| | each) (IS: 903) | |
| 19.0 | a) Adopter for 100 mm suction female screw Coupling and 63 mm male instantaneous<br>b) Adopter double female instantaneous pattern 63 mm<br>c) Adopter double male instantaneous pattern 63 mm | 02<br>02<br>02 |
| 20.0 | Nozzle spanners (IS: 903) | 02 |
| 21.0 | Portable electric box lamp with rechargeable accumulator. | 02 |
| 22.0 | Hand lamp (torch – 4 cells) | 02 |
| 23.0 | Flame proof lamp (useable in the presence of inflammable gases and vapours. | 02 |
| 24.0 | Self-contained breathing apparatus (compressed air type) complete with spare cylinder and tool kit.( IS 10245 Part 2) | 1 set |
| 25.0 | Portable fire extinguisher, dry powder type, 2 kg (IS: 2171) | 01 |
| 26.0 | Foam making branch FB-4 with pick up tube (IS 2097) | 01 |
| 27.0 | Lowering Line: 50 mm hmp or terylene 40 m long having two ends spliced in and one end with a running noose (IS: 1084) | 01 |
| 28.0 | Long line, 50mm manila, 30 m long (IS 1084) | 01 |
| 29.0 | Short line, 50mm manila, 15 m long (IS 1084) | 01 |
| 30.0 | Canvas buckets | 02 |
| 31.0 | First aid box for 10 persons | 01 |
| 32.0 | Rubber gloves (in case) (IS: 4770) | 1 pair |
| 33.0 | Asbestos gauntlets | 1 pair |
| 34.0 | Axe large (IS: 703) | 01 |
| 35.0 | Spade | 01 |
| 36.0 | Pick Axe (IS: 273) | 01 |
| 37.0 | Crow Bar (IS: 704) | 01 |
| 38.0 | Sledge Hammer (IS: 841) –6.5 Kg | 01 |
| 39.0 | Carpenter saw 60 cm (IS: 5098) | 01 |
| 40.0 | Spanner – adjustable, 30 cm length handle (IS: 6149) | 01 |
| 41.0 | Door breaker | 01 |

| | | |
|---|---|---|
| 42.0 | Hydraulic jack –7.5 tonnes | 01 |
| 43.0 | Fire Hook (IS 927) | 1 |
| 44.0 | Tool kit | 01 |
| 45.0 | Grease gun | 02 |
| 46.0 | Oil feeder | 01 |
| 47.0 | Can oil – 2 litres | 01 |
| 48.0 | Oil can – 10 litres | 01 |
| 49.0 | Funnel for oil or fuel filing – 250 mm | 01 |

## ANNEXURE-II

Schedule of equipments to be supplied with foam tender.

| S.No. | Equipment / Item | Quantity |
|---|---|---|
| 1.0 | Aluminum Extension ladder-10.5 meter (IS: 4571 or IS: 930) | 1 |
| 2.0 | Armoured suction hose complete with round thread with gun metal couplings to suit the pump inlet-2.5 m long (IS: 2410 and IS: 902) | 4 lengths |
| 3.0 | Delivery hose, 63 mm, rubber lined in 30 m lengths (type II of IS: 636) complete with instantaneous couplings (IS: 903) | 10 lengths |
| 4.0 | Suction strainers for item 2.0 (IS: 907) | 1 |
| 5.0 | Basket strainers for item 2.0 (IS: 3582) | 1 |
| 6.0 | Dividing breaching made of light alloy (IS: 5131) | 2 |
| 7.0 | Collecting breaching made out of light alloy (IS: 905) | 2 |
| 8.0 | Suction wrenches (IS: 4643) | 1 pair |
| 9.0 | Long lines, 50 mm circumference, 30 m long (IS: 1084) | 2 lengths |
| 10.0 | Short lines, 50 mm circumference, 15 m long (IS: 1084) | 2 lengths |
| 11.0 | Hose, bandages, rubberised (IS: 5612) | 12 |
| 12.0 | Hose clamps (IS: 5612) | 6 |
| 13.0 | Hydrant valve key and bar (IS: 910) | 1 set |
| 14.0 | Protective clothing for fire men complete with gloves, boots, helmets with suitable face shield made out of material capable of reflecting at least 95% of radiant heat temperature around 1500 to 2000 degree C and afford some protection against direct flame. The suit will be of sufficient size to accommodate a breathing apparatus to users. | 2 Set |
| 15.0 | Fog nozzle (IS: 952) with extension applicator to fog head. | 1 |
| 16.0 | Hand controlled branch for 63 mm size hose coupling. | 1 |
| 17.0 | Branch pipe universal (IS: 2871) | 1 |
| 18.0 | Branch with revolving head (IS: 906) | 1 |
| 19.0 | Branch pipes (IS: 903) | 4 |
| 20.0 | Nozzle of size 12 mm, 16 mm, 20 mm and 32 mm (two each) (IS: 903)<br>a) Adaptor for 100 mm suction female screw coupling and 63 mm male instantaneous.<br>b) Adaptor double female instantaneous pattern 63 mm.<br>c) Adaptor double male instantaneous pattern 63 mm. | 10<br>2<br>2<br>2 |
| 21.0 | Nozzle spanners (IS: 903) | 2 |
| 22.0 | Portable electric box lamp with rechargeable accumulator. | 2 |
| 23.0 | Hand lamp (torch-4 cells) | 2 |
| 24.0 | Flameproof lamp (usable in the present of inflammable gases of vapours) | 2 |
| 25.0 | Self-contained breathing apparatus (compressed air type) complete with spare cylinder and tool kit. | 1 Set |
| 26.0 | First aid box for 10 persons. | 1 |
| 27.0 | Rubber gloves (in case) (IS: 4770) | 1 pair |
| 28.0 | Asbestos gauntlets (in case) | 1 pair |

| | | |
|---|---|---|
| 29.0 | Axe, large (IS: 703) | 1 |
| 30.0 | Spade | 1 |
| 31.0 | Pick axe (IS: 273) | 1 |
| 32.0 | Crow bar (IS: 704) | 1 |
| 33.0 | Sledge hammer, 6.5 kg (IS: 841) | 1 |
| 34.0 | Carpenter's saw, 60 cm (IS; 5098) | 1 |
| 35.0 | Hydraulic jack-7.5 tonne. | 1 |
| 36.0 | Fire hook (IS: 927) | 1 |
| 37.0 | Tool kit | 1 |

## ANNEXURE - III

MAINTENANCE TOOLS AND TACKLES (**to be supplied separately for each tender**)

| **Sl. No** | ITEM | QUANTITY |
|---|---|---|
| 1. | DE spanner set 6.25 mm | 1 set |
| 2. | Ring spanner set 6.25 | 1 set |
| 3. | Adjustable wrench 200 mm | 1 No. |
| 4. | Pliers cutting | 1 No |
| 5. | Pliers round nose 150 mm | 1 No |
| 6 | Pipe wrench 300 mm | 1 No |
| 7 . | Screw driver 150 mm | 1 No |
| 8 | Screw driver 250 mm. | 1 No |
| 9 | File half round smooth 150 mm | 1 No |
| 10 | Hammer ball pen ½ kg. | 1 No |
| 11 | Grease gun. | 1 No |
| 12 | Oil feeder. | 1 No |
| 13 | Carpenter saw 450/500 | 1 No |

Note: The above list is bare minimum, if any other maintenance tools & tackles required as per system requirement same shall be provided to BHEL without any additional cost.

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION

FOR

FIRE WATER TENDER AND FOAM TENDER

**SECTION - II**

**STANDARD TECHNICAL SPECIFICATIONS**

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI,
NOIDA-INDIA

## A DESCRIPTION OF FOAM TENDER

### 1.0.0 DESIGN AND CONSTRUCTION

#### 1.1.0 Engine

1.1.1 The engine shall be provided with cooling system to permit its continuous stationary running without overheating. Indirect cooling system shall be incorporated which shall be of the open circuit type discharging water to the waste.

1.1.2 The operating temperature of the engine cooling water shall preferably be thermostatically controlled.

1.1.3 The oil in the oil sump shall be prevented from overheating

1.1.4 Suitable gauge for cooling water and glow lamp for lubricating system shall be provided in the driver's cab and on the pump panel. This shall be marked with operating temperature.

1.1.5 External filter shall be provided for the lubricating system and a tubular dip-stick to gauge the level of oil in the oil pump shall be provided.

#### 1.2.0 Electrical System

1.2.1 A sealed maintenance free battery of adequate capacity with a trickle type battery charger shall be provided for recharging the battery in situ. A red pilot lamp, indicating when the batteries are being charged from an external supply, shall be provided.

1.2.2 All important electrical circuits shall have separate fuses suitably indicated and shall be grouped into a common fuse box located in an accessible position in driver's cab and fitted with means for carrying spare fuses. The wiring shall be single pole and shall not be exposed to the atmosphere. Conduits shall be used wherever necessary.

#### 1.3.0 Water Tank

1.3.1 A water tank of not less than 2000 litres capacity shall be mounted on the chassis. It shall be fabricated out of mild steel sheet of minimum 3.0 mm thickness. Bottom sheet shall be minimum 5 mm thick. The tank shall be treated for anti-corrosion with epoxy paint consisting of one coat of primer and two coats of finish paint after clean blasting of inside surface and shall be suitably baffled to prevent surge when the vehicle is braking, accelerating or concerning. The baffle shall be arranged in a manner to facilitate the passage of a man throughout the tank for cleaning purposes. Minimum thickness of baffle plate shall be 3.0 mm. It shall be mounted on the chassis in a manner keeping in view the proper load distribution on the axles and shall be so designed as to bring the centre of gravity as low as possible in the chassis. It shall be rectangular in shape and the mounting of the tank shall be flexible type to prevent the tank's distortion due to the chassis flexion. The

mounting shall permit full contents of the tank to flow into the pump. The tank with its fitments shall withstand hydrostatic pressure of 0.3 bar.

1.3.2 Suitable eyes shall be provided on the shell of the tank to enable the tank to be lifted off the vehicle for repairs or replacement as necessary.

1.3.3 The tank shall be fitted with two filling orifices, a drain cock, a manhole and a cleaning hole (at the bottom of the tank). The filling orifice shall be of not less than 250 mm diameter and shall be fitted with a manhole cover of 450 mm dia. minimum and a filler cap clearly marked 'water' preferably cast in metal. In addition, a 63 mm instantaneous hydrant connection, incorporating a strainer, shall be provided close to the pump pane control for filling the tank through 75 mm diameter pipe or feeding the hose reel equipment. A 100 mm dia. pipe line shall be taken from the tank to the suction inlet of the pump incorporating a 100 mm quick action spherical type valve. Separate valve (s) for performing different functions shall be provided to control the flow of water. Manhole shall be located at the top of the tank.

Drain plugs or cocks shall be provided wherever necessary. Cleaning hole of not less than 250 mm diameter shall be provided at the bottom of the tank and it shall be fitted with bolted cover.

1.3.4 The tank shall be fitted with a 100 mm diameter overflow pipe. The discharge ends of the overflow pipe shall be taken down to a point well below the chassis without reducing the effective ground clearance when fully loaded and shall discharge away from the wheels.

1.3.5 Dial gauge water level indicator for the tank shall be provided preferably in the driver's cab or a visual level gauge of the glass tube shall be provided at the control panel calibrated ¼, ½, ¾ and ft. (preferably calibrated in litres).

1.3.6 The tank shall be connected to the pump and hose reel in such a manner that pressurization of water tank or water tank-pump connection is not possible when pumping water from an outside source supply.

1.3.7 The plumbing between the pump and the hose reel shall have a clear and unobstructed water way not less than 25 mm throughout without any obstruction.

**1.4.0 Hose Reel**

1.4.1 One hose reel conforming to IS: 884 shall be provided at the rear of the appliance with 60 m length of 20 mm bore hose connected by screw 'C' type quick couplings and terminating with a control branch and 5 mm nozzle. The reel shall be fitted with over brake or locking device. Nozzle shall be dual purpose shut off type.

**1.5.0 Pump**

1.5.1 The pump shall preferably be made of any suitable alloy, compatible with all types of synthetic protein foam compound, with stainless steel shaft suitable for use with brackish water. The pumps be capable of delivering not less than 1800 l/min. of water at a pressure not less than 8.5 kg/cm2. The pump shall preferably be of the single stage type. The pump shaft shall preferably be designed with two deep-groove ball bearings lubricated by oil both to ensure long trouble-free service. A

mechanical seal shall be provided which shall be capable of running dry for long periods without damage.

**1.5.2 PUMP TEST**

1.5.2.1 The pump shall run for a period of 4 hours non-stop delivering the rated output at 7 kg/cm2 with the lift of 3 m. During the test the water shall not be replenished for the cooling system as the temperature of the engine oil should not exceed 150 deg. C at highest ambient or the engine manufacturers rated temperature for continuous working whichever is less. The engine should show no sign of stress during the stress. The temperature of the cooling water (radiator water) shall not exceed 85 deg.C. The PTO sump oil temperature shall not exceed the manufacturers recommended temperature for the grade of oil used. The pump casing and impeller shall be subjected to a hydraulic pressure of 21 kgf/cm2 to detect leakages, performance, etc.

1.5.2.2 The pump shall be preferably rear mounted. The pump control panel shall be located on the rear of the appliance.

1.5.2.3 The suction inlet and delivery outlets of the pump shall, as far as possible, be fitted on or near the pump control panel.

1.5.2.4 A removable strainer and blank cap shall be provided for the suction inlets(s) for the pump.

1.5.2.5 The suction inlet shall be fitted with a standard round thread connection of 100 mm size conforming to IS: 902.

1.5.2.6 The delivery outlets of the pumps shall terminate in 63 mm female instantaneous coupling incorporating a blank cap and means for relieving pressure between the valve and the cap. The 63 mm female instantaneous coupling shall be in accordance with IS: 903-1988.

**1.6.0 Primer**

1.6.1 The primer may be semi-automatic in action and it shall dis-engage automatically as soon as the pump is primed. It shall be integral with the pump. It shall be capable of lifting water at least through 7.0 m at a rate of not less than 30 cm per second.

**1.7.0 Power take off**

1.7.1 The gear ratio shall be suitable for continuous operation of engine at stationary condition.

**1.8.0 Foam Equipment**

1.8.1 Foam compound tank of 500 ltr capacity shall be mounted on the chassis in addition to the water tank and as a separate & distinct unit that can be removed separately for replacement.

1.8.1.1 The foam compound tank shall be of rigid type, and shall preferably be of stainless steel welded construction.

1.8.1.2 The tank shall have a filling orifice not less than 150 mm diameter with a removable strainer fitted to it. The strainer shall be of such material so that it shall not be affected by constant contact with foam compound and its total screening area shall be adequate to permit quick filling of foam compound into the tank. The filler cap shall be clearly marked 'FOAM' preferably by pressing, casting or embossing.

1.8.1.3 The tank shall have its top dished tunnelling arrangement and a trough provided to enable easy filling from 20 litre drums. Suitable sharp-edged tin opener may also be provided at the foam tank so that the foam compound drum can be puncture easily for facilitating quick filling of the foam compound directly from the drums into the tank. The tank shall be suitably baffled to prevent surge while the vehicle is in motion or standing on uneven ground or brakes are applied to the moving appliance. The design of the tank shall incorporate a removable sump fitted with a drain valve. The foam compound draw off tube shall be positioned in the centre of the sump in such a manner that foreign matter or sludge shall not pass into the compound line. The draw-off tube shall be fitted with a gauge strainer of suitable material, mesh, size, and adequate staining area. The tank top shall be removable and it shall be ensured that the joint between the top and the body of the tank is leak proof.

1.8.1.4 Means shall be provided for automatic venting of the foam compound tank when the foam is being produced or the tank is being filled. This shall not be incorporated with the cap. The device employed shall be as simple as possible and shall not get clogged easily during normal use of the appliance.

1.8.1.5 The draw-off tube shall be connected to the foam compound proportionator / inductor and pump as necessary, and automatic flow control valve shall be incorporated in it so as to maintain a constant induction rate of not more than 6 percent with varying foam output. The plumbing for this purpose shall have a clear and unobstructed passage of not less than 50 mm throughout and shall:

a) be as short as possible;

b) be capable of being easily dismantled for internal cleaning;

c) be provided with means of thorough flushing after use;

d) not form 'U' bend or abrupt angle at any portion and be capable of being drained easily without dismantling.

1.8.1.6 A suitable transfer pump shall be provided for transferring foam compound from drums to the foam compound tank without causing any frothing in the tank. Necessary connection shall also be provided for transferring the foam compound through this pump.

1.8.1.7 Provision shall also be made for drawing foam compound into the foam producing system from an external source through a pick-up tube while producing foam.

1.8.2 Foam compound proportionator or inductor automatic proportionating arrangement shall be provided where the induction ratio of foam compound /water solution and flow of water are automatically varied as desired merely by opening and closing the monitor or hand lines. This shall be achieved without any complex system of linkage that may be susceptible to distortion due to chassis flexion. The system shall be reliable and shall not require frequent calibration checks.

**1.8.3 Foam Monitor**

1.8.3.1 Foam monitor shall be mounted on the top of the appliance in such a manner that it can be manually operated by a member of the crew. The monitor shall be capable of traversing through 360 deg. In a horizontal plane, elevating from horizontal to 45 deg and depressing from horizontal to not less than 15 deg and fully rotating in both directions.

1.8.3.2 The aggregate foam discharge shall be not less than 7000 L/min. through monitor.

1.8.3.3 The monitor shall be capable of projecting the foam discharge to an effective distance of not less than 35 m in still air when operated at the designed pressure in a straight jet pattern without dripping.

**1.9.0 Control panels**

1.9.1 One (1) No. adequately illuminated control panel shall be provided and shall be positioned at the rear of the appliance.

1.9.2 The control panel shall include the following:

a) Throttle control for engine;

b) Pressure gauge 0 to 2.0 N/mm2 (20 Kgf/cm2)

c) Compound gauge calibrated as under;

(i) Vacuum - 0 to 75 cm Hg preferably in black

(ii) Pressure - 0 to 0.6 N/mm2 (6 kgf / cm2); preferably in black

d) Primer control (if the primer is not fully automatic);

e) Gauge for cooling water and glow lamp for lubricating system;

f) Cooling water circuit control.

g) Control for using monitor.

1.9.3 The following shall also be provided at a convenient position near the control panel(s);

a) Control for using monitor;

b) Water level indicator;

c) Hydrant connections;

d) Control for using auxiliary foam compound pic up tube;

e) Control(s) for flushing out the foam making equipment and its plumbing;

**1.10.0 Body Work and Stowage**

1.10.1 Enclosed accommodation for six persons (1+1 at front, 1full seat at the rear which will accommodate 4 people) shall be provided in the driver cab-crew compartment including the driver and the in-charge of the crew. Two doors on each side shall be provided on the driver cab-cum-crew compartment. The doors shall be hinged opening outwards and shall be hung forward and shall have catch locks and flush type handles.

1.10.2 The cab and lockers shall be of composite construction with sufficient rigidity and reinforcement and shall be kept as light as possible. Pressed sections of sufficient strength shall be used for the superstructure.

1.10.3 Two nos. of lockers on each side shall be provided for secure stowage of all equipment as detailed enclosed in Annexure-I. The height of the lockers from the bottom to the top of the opening shall be not less than 600 mm and the depth not less than 600 mm.

1.10.4 All lockers shall be provided with internal automatic lighting arrangement with the master switch in the cab. The doors of the side lockers shall not be hinged at the bottom.

1.10.5 Hose tunnels shall be provided to carry four 2.5 m lengths of suction hoses in convenient location. The tunnels shall be sloped in such a way so that these allow the water or contents left in the hose after use to flow out.

1.10.6 Ladder Gallows – Gallows shall be provided to carry a 10.5 m extension ladder at a suitable position in a manner that does not provide any obstruction to the working of monitor. The design shall be such that the ladder can be released without difficulty from a reasonably accessible position and shall embody rollers to permit easy withdrawal by one man. Means shall also be provided for locking the ladder when stowed.

1.10.7 Tool Kit Container – A specially fitted recessed tray for the normal kit of tools, carried on the appliance shall be provided.

1.10.8 Stability – The stability of the appliance shall be such that when under fully equipped and loaded conditions (but excluding crew), if the surface on which the appliance stands is titled to either side, the point at which overturning occurs, is not passed at an angle of 30 degrees from the horizontal.

## 2.0.0 WORKMANSHIP AND FINISH

2.1.0 All parts of the appliance shall be of good workmanship and shall have streamlined finish

2.2.0 The appliance shall be pained in fire red colour conforming to Shade No. 536 of IS: 5. The paint shall conform to IS: 2932-1974.

## 3.0.0 ACCESSORIES

3.1.0 The following accessories shall be provided in addition to those normally fitted on modern commercial vehicles.

a) Fire bell - A 250 mm diameter fire bell shall be mounted externally and shall be capable of being operated from within the driving compartment. The bell shall be the hand-operated type.

b) Hand Lamps - Two

c) Fog lamps - Two

d) Reversing Light - Lamp suitably situated to assist reversing.

e) Amber blinker lights - Situated on the head of the driving compartment.

f) Trafficators - Illuminated with indicating lights on instrument panel or in any other prominent position in driving compartment.

g) Wind screen wipers electrically operated.

h) Tools - All tools required for normal maintenance of the appliance that are not included in the kit for the chassis.

i) Siren - Battery operated.

j) Search light – Adjustable to give flood or beam light, mounted in a convenient position but capable of being readily disconnected and mounted on a tripod away from the appliance, complete with tripod and with not less than 30 m of TRS cable on a reel mounted on the appliance.

k) Spot light - Adjustable, mounted in a convenient position on the near side of the driving compartment.

l) Inspection lamp – Protected type on wander lead with plug. A socket shall be provided in the control panel in the driver’s cab for plugging in the lamp.

m) Tail lamps - Two of combined stop and tail.

n) Rear reflectors

o) Wind screen-washer-Fitted in a suitable location with controls in driving compartment.

p) Cab, Instrument panel and locker, light.

q) Public address system.

**r) VHF Radio Telephone set Bracket. A self-contained VHF transmitting/receiving set for communication.**

**4.0.0 MARKING**

4.1.0 The appliance shall be clearly and permanently marked with the following information:

a) Manufacturer's name, or trademark, if any.

b) Capacity of the pump in litres/minute, capacity of the water tank and foam tank in litres;

c) Year of manufacturer

**5.0.0 ADDITIONAL ACCESSORIES (over and above accessories mentioned against Cl 3.0.0)**

The additional accessories that are normally required to assist in operation of appliance are detailed in enclosed **Annexure II** to this specification. Bidder to include these accessories in their scope of supply.

**6.0.0 SUPPLEMENTARY EXTINGUISHING AGENT**

6.1.0 The supplementary extinguishing agent shall be dry chemical powder.

6.2.0 The total quantity of supplementary agent shall be not less than 150 kg. Of dry powder and shall conform to IS: 4308.

6.3.0 The dry powder system shall comply with the following minimum requirement.

6.4.0 The dry powder system shall comprise of two self-contained units, each having a capacity of 75 kg of dry powder.

6.5.0 The expellant employed for the dry powder units shall be nitrogen. The capacity of the nitrogen cylinders employed for this purpose shall be adequate to ensure complete discharge of the dry powder contents at a rate of not less than 2.25 kg/s from each units. A well-designed pressure control system shall be provided to regulate the pressure of nitrogen gas and maintain a constant powder discharge pressure throughout operation of the unit.

6.6.0 The dry powder unit shall have a discharge outlet fitted with not less than 22 m of minimum 25 mm bore hose terminating in a trigger control shut-off nozzle, capable of producing either a straight jet or fan-spray pattern of discharge. The range of jet shall be not less than 12 m.

6.7.0 The hose and nozzle shall be stowed suitably in lockers on either side of the appliance to facilitate speedy run out on arrival at an accident.

**7.0.0 ACCEPTANCE TESTS**

The following acceptance tests on various equipment shall be conducted to meet guaranteed parameters and shall be carried out in accordance with relevant IS Code.

a) Pump test
b) Primer test
c) Road test
d) Stability

## B DESCRIPTION OF FIRE WATER TENDER

### 8.0.0 DESIGN AND CONSTRUCTION

### 8.1.0 Engine

8.1.1 The engine shall be provided with cooling system to permit its continuous stationery running without overheating. Indirect cooling system shall be incorporated, if necessary, which shall be of the open circuit type discharging water to the waste. Arrangements shall be made to divert the cooling discharge water to water tank, if necessary.

8.1.2 The operating temperature of the engine cooling water shall preferably be thermostatically controlled.

8.1.3 The oil in the oil sump shall be prevented from overheating.

8.1.4 Suitable gauge for cooling water and glow lamp for lubricating system shall be provided in the driver's cab and on the pump panel. This shall be marked with operating temperature.

8.1.5 External filter shall be provided for the lubricating system and a tubular dip-stick to gauge the level of oil in the oil sump shall be provided.

8.1.6 The heat exchanger tank shall be made from minimum 1.22 mm thick mass sheet and the coil in the coolant tank shall be of copper for effective cooling. The design of the heat exchanger shall be such that the temperature of the engine shall not exceed for the operating temperature specified by the chassis manufacturer when the vehicle is being tested in stationary conditions.

### 8.2.0 Electrical System

8.2.1 A trickle type battery charge shall be provided for recharging the battery *in situ*. A red pilot lamp, indicating when the batteries are being charged from an external supply, shall be provided.

8.2.2 All important electrical circuits shall have separate fuses suitably indicated and shall be grouped into a common fuse-box located in an accessible position from driver's cab and fitted with means for carrying spare fuses. The wiring shall be single pole and shall not be exposed to the atmosphere. Conduits shall be used wherever necessary.

8.3.0 **Water Tank** - It shall have minimum capacity of **4500 litres as per latest IS-950.**

8.3.1 A single tank shall be used with a capacity of 4500 liters. The tank body and baffles shall be of minimum 5 mm thick mild steel plates. The tank shall be mounted on the chassis and suitably baffled in a manner keeping in view the proper load distribution on the axles. The baffling provided in the tank shall be able to prevent surge when the vehicle is breaking, cornering or accelerating. The baffles shall be arranged in a manner to facilitate the passage of a man throughout the tank for cleaning purpose. The tank shall be mounted on minimum three cross members to counter act the stresses caused by chassis flexion and shall be so secured that it can be easily removed. The tank shall be mounted on the vehicles using metacone mounting. U-bolts shall not be used in the vehicle.

Suitable eyes shall be provided on the shell of the tank to enable it to be lifted from the vehicle for repairs/ replacement as and when required.

8.3.2 The tank shall be fitted with a 50 mm bore overflow pipe. A 63 mm instantaneous hydrant connection, incorporating a strainer, shall be provided close to the pump panel control for filling the tank through 75 mm bore pipe work or feeding the hose reel equipment. Minimum 100 mm bore pipe line shall be taken from the tank to the suction inlet of the pump incorporating minimum 100 mm quick action spherical type valve. Separate valve(s) for performing the function given in **8.3.6** shall be provided to control the flow of water to the hose reel equipment. Drain plugs or drain cocks shall be provided, wherever necessary.

8.3.3 The tank shall be given adequate anti-corrosive epoxy treatment consisting of one coat of primer with two coats of finish paint after preparing the surface by sand blasting from inside and outside after fabrication if it is not galvanized. The open end of the overflow pipe should be taken down to a point well below the chassis without affecting the effective ground clearance when fully loaded and shall discharge away from the wheels.

8.3.4 Dial gauge water level indicator for the tank shall be provided preferably in the driver's cab or a visual level gauge of the glass tube shall be provided at the control panel calibrated 1/4, 1/2 3/4 and full (preferably calibrated in liters).

8.3.5 The tank shall have a bolted manhole of 450 mm diameter minimum and shall have a threaded ring and cap of 300 mm diameter for filling the water tank from the top. The manhole cover shall be made from 5 mm thick mild steel plate and epoxy coated from inside and outside. A cleaning hole of at least 250 mm diameter shall also be provided at the bottom.

8.3.6 The tank shall be connected with the pump and hose reel and valve (s) shall be provided in such a way that any of the following operation are possible

a) Hydrant - tank,

b) Hydrant - reel,

c) Tank-pump-high and low pressure hose reel,

d) Hydrant- pump- high and low pressure hose reel, and

e) Tank-Pump-Monitor

f) Off.

8.3.7 The tank shall be connected to the pump and hose reel in such a manner that pressurization of water tank or water tank pump connection is not possible when pumping water from an outside source of supply.

8.3.8 The plumbing between pump and hose reel shall have a clear and unobstructed water way of not less than 25 mm throughout without any obstruction.

**8.4.0 Hose Reel**

8.4.1 Two nos. hose reel (conforming to IS: 884) shall be provided at the rear of the appliance with 60 m lengths of 20 mm bore hose connected by screw 'C' type quick release couplings and terminating with a control branch and fog nozzle. The reel shall be fitted with over brake or locking device. The gun shall be of constant flow type and shall have a discharge capacity of 150 litre/min approximately. Provision shall be made in the gun controls to achieve combat mode (straight jet) or a fog shield in split second. The fog gun shall be made of stainless steel or aluminum alloy.

**8.5.0 Pump**

8.5.1 A centrifugal pump high and low pressure pump shall be mounted at rear side of the appliance. The low and high pressure sections of the pump may be either single-stage or multi stage type. Anti-friction bearings external to the casing be provided so as to avoid any bearings within the pump casing. The bearing used in the pump shall be of reputed make. The gland shall be of the mechanical self-adjusting type. The pump shall be provided with in-built filter assembly of easily removable type, which shall filter the water before entering into pressure stage impeller. A filter capable of filtering particle size up to 0.75 mm or less shall be used. This filter shall be of stainless steel and shall be easily accessible for cleaning.

The normal and high pressure impeller shall be mounted on a single shaft. The impeller(s) of the low pressure section shall be closed type and shall be dynamically balanced. The impeller(s) of the high pressure section shall be closed or regenerative type. A drain cock plug shall be provided at the bottom of the casing in a way to prevent the cock being opened due to vibrations. Studs, bolts etc., used in the pump casing coming in contact with the water shall be of stainless steel. The castings shall be without any blow holes, internal cracks, etc. The interior of the casting shall be smooth finished. The castings shall withstand the hydraulic pressure as specified against Cl. No. 14.5.5.

The bearing housing will be made of C.I. the delivery outlet, delivery valves and high pressure circuitry shall be made of Gun metal conforming to Gr.II of IS: 318.

The pump shall be provided inbuilt (integrated in the pump outlet manifold) pressure relief valve which shall operate automatically and shall not allow the high pressure to increase beyond 45 Kg/cm2.

8.5.2 The pump shall be completely covered. However, all the controls on the panel and the gauges shall be uncovered.

The pump shall be coupled to the prime-mover of the chassis through a power take-off (PTO) capable of transmitting full torque of the engine used for the appliance. All propeller shafts and all fittings used for coupling the PTO, pump, etc., shall be of the same size and type as used by the chassis manufacturer for the drive line.

The PTO shall have a step up gear ratio of not less than 1:1.27. A cooling coil made of copper pipe shall be provided in the bottom of the PTO casing.

A control lever for engaging and disengaging the pump, with suitable locking devices, shall be provided in the driver's cab.

8.5.3 The pump shall be designed to give its rated output with an engine and pump input at shaft speed safe enough to operate the engine. The pump shall give performance as detailed below when working with strainers (except basket strainer) at 27±2 $^0$C.:

The pump shall be capable of delivering 2000 LPM @ 7 Kg/cm$^2$ and 300 LPM @ 35 Kg/cm$^2$ at 3 mtrs. Suction lift at NTP condition.

The pump shall follow the following performance parameters:

| | |
|---|---|
| Normal Pressure Output | : 2000 LPM @ 7 Kg/cm$^2$ |
| High pressure Output | : 300 LPM @ 35 Kg/cm$^2$ |
| Maximum Pressure in Normal Pressure mode | : 14 Kg/cm$^2$ (shut off pressure) |
| Maximum Pressure in High Pressure mode | : 45 Kg/cm$^2$ |
| Deep Lifting Capacity of Pump | : 30 m3/sec max. up to 7 M in 30 Sec. at NTP conditions |

The above performance data shall be considered when working through 2.45 m lengths of specified suction hose.

The design of pump shall be such that the normal pressure and high pressure stages can be operated simultaneously. Simple mechanism shall be provided to change over from normal pressure to high pressure, preferably a single lever operation. However, at any given pump/engine speed, the low pressure registered shall not exceed 1/4$^{th}$ (one quarter) of the registered high pressure.

The pump housing shall have provision to connect normal pressure hose reel and cooling water line.

The efficiency of the pump shall be such that the power and the RPM required shall not be more than that available with the engine.

8.5.4 The material of construction for pump & its control panel shall be as follows:

| | | |
|---|---|---|
| a) | Pump casing and low pressure impeller | Lead tin bronze (Grade LTB2 of IS: 318) |
| b) | High pressure impeller | Phosphorous-bronze or stainless steel or aluminum bronze (IS 617) |
| c) | Impeller ring and impeller neck ring | Lead tin bronze (Grade LTB2 of IS: 318) |

| | | |
|---|---|---|
| d) | Pump shaft | Stainless steel (Grade 04Cr18Ni10 of IS: 6603). |
| e) | Pump panel | Aluminum sheets/ chequered plates (IS 737) or mild steel sheets (IS: 513 ordinary grade) |

8.5.5 Pump Test

When tested in accordance with pump specification, the efficiency shall not deviate from the value specified by the pump manufacturer by more than ± 5%. However, in no case the efficiency of the pump shall be less than 60 percent. The pump shall run for a period of 3 hours non-stop delivering the rated output at 0.7MPa and for 1 hour at 3.5 MPa with a lift of 3 m.
The pump shall be run dry for a period of minimum two minutes at 2000 RPM to check the integrity of the mechanical carbon seal. After this test there shall not be any leakage of water through carbon seal.
During the test the water shall not be replenished for the cooling system and the temperature of the engine oil should not exceed 115°C or of the engine manufacturer rated temperature for continuous working whichever is less. The engine should show no sign of stress during the test. The temperature of the cooling water (radiator water) tank shall not exceed 85 °C. The PTO sump oil temperature shall not exceed 100 percent of the manufacturers recommended temperature for the grade of oil used. The pump casing and impeller shall be subjected to a hydraulic pressure of 2.1 MPa to detect leakage, perforation, etc. Foam induction test shall be done to check calibration of the metering valve.

**8.6.0 Suction inlet and Delivery Valves**

8.6.1 The pump shall have suction inlet(s) having 125 mm standard suction connection as per IS: 902 with internal strainer(s) and blank cap(s). The strainer(s) shall be retained firmly when in use but shall be easily removable. The mesh size of the pump inlet screen shall be smaller than the outlet size of the impeller.

8.6.2 The pump shall be provided with 2 delivery valves for the 2000 litres/min pump having 63 mm standard hose couplings as per IS: 903 with screwed wheel type quick closing clack valve conforming to IS: 4928. Blank caps fastened with chains and incorporating means to relieve pressure between the valve and the cap shall be provided one for each delivery valve.

**8.7.0 Primer**

8.7.1 The primer shall be capable of lifting water at least 7.0 m (measured form water level to the center of pump) in not more than 24 seconds and shall preferably be fully automatic. The allowance shall be 30 cm for every 300 m elevation above sea level and 1 percent for 2.5°c rise in water temperature.

8.7.2 If case of the reciprocating type primer, means shall be provided to automatically limit the speed of engine while the primer is engaged.

8.7.3 The primer shall be constructed of gun metal/light alloy casting, shall have stainless steel shaft and shall be fitted with suitable lubricated bearing depending upon the type of primer. The caps of primer and springs shall be properly secured. The primer lever shall be easily accessible from the operator(s) position.

8.7.4 In the case of reciprocating type, the primer shall be preferably designed with a view to primer when the pump is running at speed of 1000 to 1500 rpm. The primer shall disengage automatically at pump pressure of 1.5 to 2.0 bars without manual intervention.

**8.8.0 Water/Foam Monitor**

One water-cum-foam monitor shall be provided on the top at suitable location. The monitor shall confirm to IS 8442.

**8.9.0 Control Panels**

8.9.1 Adequately illuminated control panel shall be provided and positioned as follows:

a) Rear mounted pump - One control panel at the rear of the appliance.

8.9.2 The control panel(s) shall include the following:

a) Throttle control for engine;

b) Pressure gauge -0 to 2 MPa
Pressure gauge – 0 to 5 MPa

c) Compound gauge calibrated as under:
Vacuum - 0 to 75 cm Hg, preferably in black;
Pressure - 0 to 0.6 MPa preferably in black;

d) Primer control (if the primer is not fully automatic)

e) Gauge for cooling water and glow lamp for lubricating system;

f) Cooling water circuit control.

g) Control for using monitor.

8.9.3 The following shall also be provided at a convenient position near the control panel(s):

a) Water level indicator as described under cl.no. 8.3.4

b) Five-way control valve as described under cl.no. 8.3.6

c) Hydrant connections.

**8.10.0 Body Work and Stowage**

8.10.1 Enclosed accommodation for six persons shall be provided in the driver cab-cum-crew compartment including the driver and the in charge of the crew. Two doors in each side shall be provided on the driver cab-cum-crew compartment. The doors shall be hinged opening outwards and shall be hung forward and shall have catch locks and flush type handles.

8.10.2 The cab and lockers shall be of composite construction with sufficient rigidity and reinforcement and shall be kept as light as possible. Pressed sections of sufficient strength shall be used for the superstructure.

8.10.3 Lockers shall be provided for secure stowage of all equipment as detailed enclosed in Annexure-II except aluminium extension ladder and fire hook. The height of the lockers from the bottom to the top of the opening shall be not less than 600 mm and the depth not less than 600 mm. One locker shall be reserved for the storage of batteries. The extra length of battery cable shall be considered by the bidder, if required. The mechanism shall have locking and unlocking facility to ensure proper fixing of battery sets in place.

8.10.4 All lockers shall be provided with internal automatic lighting arrangement with the master switch in the cab. The doors of the lockers shall have efficient means for holding them closed by efficient flush fitting spring loaded locks. The doors boltof the side lockers with the exception low lockers shall not be hinged at the bottom; doors of the low lockers hinged at the bottom shall have not less than 5 cm ground clearance.

8.10.5 Hose tunnels shall be provided to carry four 2.5 m lengths of suction hoses on convenient location. Drain holes shall be provided preferably at the bottom of the tunnel and hose stowage compartment. Hose racks and suitable provision shall be provided in the locker for holding hose fitting.

8.10.6 Ladder Gallows - Gallows shall be provided to carry a 10.5-m, aluminium extension ladder. 1 nos. 10.5M Al. ladder shall also to be provided. The design shall be such that the ladder can be released without difficulty from a reasonably accessible position and shall embody rollers to permit easy withdrawal by one man. Means shall also be provided for locking the ladder when stowed.

8.10.7 Cable Winch - An electrically operated cable winch of 6 t capacity shall be provided. The winch unit shall be complete with minimum 5.5 HP 12 V dc series wound electric reversible motor for increased pulling power, rope drum, and 27 m heavy duty galvanized EIPS wire rope with replaceable self-locking clevis hook and shall be mounted on the front bumper of the vehicle with suitable strong supports.

8.10.8 Telescopic Light Mast or Inflatable Emergency Lighting System- A compact, low profile, roof mounted lighting system, fitted with 4 × 1 000 W metal halide lamps, vertically elevated pneumatically up to 4.6 m shall be installed on the roof of the vehicle. Lighting shall be provided by a 12 V or 24 V dc with remote control, directional lighting system with rotation and tilt lamps to provide total coverage. The remote control unit shall allow a person to operate all the functions of the light mast or inflatable emergency lighting system and accurately aim for complete directional positioning. In addition auto show, a one button command, automatically retracts, turns out the lights and stows the entire system to the compact transport position shall also be included in the remote controller. The complete unit shall comprise of hand held remote control with cable, rotation and tilt positioner, mounting frame with built-in tilt system.

8.10.9 Alternator Unit - A 6.5 kVA capacity portable diesel engine driven generator unit shall be mounted at suitable location with all necessary connections and control panel for providing power to the light mast as well as other electrically operated tools.

8.10.10 Tool-Kit Container- A specially fitted recessed tray for the normal kit of tools, carried on the appliance, and shall be provided.

8.10.11 Stability- The stability of the appliance shall be such that when under fully equipped and loaded conditions (but excluding crew), if the surface on which the appliance stands is tilted to either side, the point at which overturning occurs is not passed at an angle of 30 degrees from the horizontal.

8.10.12 Wireless set Box- Box made from 2 mm gauge aluminium sheet with lid shall be provided just behind the officer seat with 13mm wooden plank for fitting the wireless set bracket. The design and mounting shall be shown at the time of fabrication work.

**9.0.0 WORKMANSHIP AND FINISH**

9.1.0 All parts of the appliance shall be of good workmanship and shall have streamlined finish.

9.2.0 The appliance shall be painted fire red color conforming to Shade No. 536 of IS:5. The paint shall conform to IS: 2932

**10.0.0 ACCESSORIES**

10.1.0 The following accessories shall be provided in addition to those normally fitted on modern commercial vehicles:

a) Instruction book containing general instructions, installation/ assembly details, maintenance and servicing instructions

b) Fire bells - 250 mm diameter fire bell shall be mounted externally and shall be capable of being operated from within the driving compartment. The bell shall be of the hand-operated type.

c) Head lamps - Two.

d) Fog lamps - Two.

e) Reversing light - Lamp suitably situated to assist reversing.

f) Amber blinkers lights - Situated on the head of the driving compartment.

g) Trafficators - Illuminated with indicating lights on instrument panel or in any other prominent position in driving compartment.

h) Wind screen wipers electrically operated.

i) Tools - All tools required for normal routine maintenance of the appliance, which are not included in the kit for the chassis.

j) Siren - Battery operated.

k) Search light - Adjustable to give flood or beam light, mounted in a convenient position but capable of being readily disconnected and mounted on a tripod away from the appliance,

complete with tripod and with not less than 30 mm of TRS cable on a reel mounted on the appliance.

l) Spot light - Adjustable, mounted in a convenient position on the near side of the driving compartment.

m) Inspection lamp - Protected type on wander lead with plug. A socket shall be provided in the control panel in the driver's cab for plugging in the lamp.

n) Tail lamps - Two of combined stop and tail.

o) Rear reflectors

p) Wind Screen Washer

q) Cab, instrument panel and locker, light

r) Public address system.

s) VHF Radio Telephone set Bracket. A self-contained VHF transmitting/receiving set for communication.

**11.0.0 INSTRUCTION BOOK, ACCESSORIES AND EQUIPMENT**

Instruction book(s) for the guidance of the user(s), including both operating and normal maintenance procedure shall be supplied. The book(s) shall include an itemized and illustrated spare parts list giving reference numbers of all the wearing parts.

**12.0.0 MARKING**

12.1.0 Each appliance shall be clearly and permanently marked with the following information:

a) Manufacturer's name, or trademark, if any;

b) Capacity of the pump in liters/minute, and of the water tank in liters; and

c) Year of manufacture.

**13.0.0 ADDITIONAL ACCESSORIES (over & above accessories mentioned against Cl.10.0.0)**

The additional accessories that are normally required to assist in operation of appliance are detailed in enclosed **Annexure-I (of this specification).** Bidder to include these accessories in their scope of supply.

**13.1.0 ACCEPTANCE TESTS**

The following acceptance tests on various equipment shall be conducted to meet guaranteed parameters and shall be carried out in accordance with relevant I S Code.

a) Pump test
b) Primer test
c) Road test
d) Stability

## 4 X 270MW BHADRADRI TPP

## LIST OF DOCUMENTS TO BE FURNIHSED DURING DETAILED ENGINEERING (MDL)

### FOAM TENDER & FIRE WATER TENDER FOR 4 X 270MW BHADRADRI TPP

| S.N | DRWG NO | DRWG TITLE | CATEGORY | SCHEDULED SUBMISSION (NO. OF WEEKS FROM LOA DATE / PO DATE) | RESUBMISSION AFTER COMMENTS INCORPORATION |
|---|---|---|---|---|---|
| 1 | PE-V0-411-550-A001 | TDS AND GA OF FIRE WATER TENDER | I-CUST | 4 | WITHIN 1 WEEK |
| 2 | PE-V0-411-550-A002 | FLOW DIAGRAM FOR FIRE WATER TENDER | I-CUST | 4 | WITHIN 1 WEEK |
| 3 | PE-V0-411-550-A003 | TDS AND GA OF FOAM TENDER | I-CUST | 4 | WITHIN 1 WEEK |
| 4 | PE-V0-411-550-A004 | FLOW DIAGRAM FOR FOAM TENDER | I-CUST | 4 | WITHIN 1 WEEK |
| 5 | PE-V0-411-550-A005 | MQP FOR FIRE WATER TENDER | I-CUST | 4 | WITHIN 1 WEEK |
| 6 | PE-V0-411-550-A006 | MQP FOR FOAM TENDER | I-CUST | 4 | WITHIN 1 WEEK |
| 7 | PE-V0-411-550-A007 | O & M MANUAL FOR FIRE WATER TENDER | I-CUST | 8 | WITHIN 1 WEEK |
| 8 | PE-V0-411-550-A008 | O & M MANUAL FOR FOAMTENDER | I-CUST | 8 | WITHIN 1 WEEK |

Note:
Drawing / Document shall be uploaded by the successful bidder on WRENCH /DMS. Procedure for the same will be informed after award of contract.

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION

FOR

FIRE WATER TENDER AND FOAM TENDER

**SECTION-IIC**

**(FORMAT FOR O& M MANUAL)**

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

# Check List for Operation & Maintenance Manual

*Project name:*

*Project number:*

*Package Name:*

| Sl.no. & Sections | Description | Yes | No | Not Applicable | Remarks |
|---|---|---|---|---|---|
| **1.** | Cover page | | | | |
| **1.1** | Project Name | | | | |
| **1.2** | Customer Name | | | | |
| **1.3** | Name of Package | | | | |
| **1.4** | Supplier details with phone, FAX email address | | | | |
| **1.5** | Name and sign of prepared by , checked by & approved by | | | | |
| **2.0** | Index | | | | |
| **2.1** | showing the sections & related page nos<br>All the pages should be numbered section wise | | | | |
| **3.0** | Description of Plant | | | | |
| **3.1** | Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases | | | | |
| **3.2** | Equipment list and basic parameter with Tag numbers | | | | |
| **3.3** | Data sheets approved by Customer/for information and catalogues provided by original manufacturer | | | | |
| **3.4** | Associated other packages and Interface /terminal points | | | | |
| **3.5** | P&ID & Process Diagrams | | | | |
| **3.6** | GA Layout drawings, As-built drawings | | | | |
| **3.7** | Single line/wiring diagrams | | | | |
| **3.8** | Control philosophy /control write-ups | | | | |
| **4.0** | Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual) | | | | |
| **4.1** | Pre-Commissioning Checks | | | | |
| **4.2** | Transportation and handling at site | | | | |
| **4.3** | Storage at site | | | | |
| **4.4** | Unpacking & Installation procedure | | | | |
| **5.0** | Operation Guidelines for plant personal/user/operator | | | | |
| **5. 1** | Interlock & Protection logic along with the limiting values of protection settings for the | | | | |

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| | equipment along with brief philosophy behind the logic, drawings etc. to be provided. | | | | |
| **5. 2** | Start up and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc with Equipment isolating procedures to be mentioned. | | | | |
| **5. 3** | Do's & Don't of the equipments. | | | | |
| **5. 4** | Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition | | | | |
| **5. 5** | Parameters to be monitored with normal values and limiting values | | | | |
| **5. 6** | Trouble shooting with causes and remedial measures | | | | |
| **5. 7** | Routine operational checks, recommended logs & records | | | | |
| **5. 8** | Changeover schedule if more than one auxiliary for the same purpose is given | | | | |
| **5. 9** | Painting requirement and schedule | | | | |
| **5. 10** | Inspection, repair , Testing and calibration procedures | | | | |
| **6.0** | Maintenance guidelines for plant personal | | | | |
| **6.1** | List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc. | | | | |
| **6.2** | Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given. | | | | |
| **6.3** | Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given | | | | |
| **6.4** | Long term maintenance schedules especially for structural, foundations etc. | | | | |
| **6.5** | Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. | | | | |
| **6.6** | List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given | | | | |

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| **6.7** | List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc. | | | | |
| **6.8** | List of mandatory and recommended spare parts list | | | | |
| **6.9** | Tentative Lead time required for ordering of spares from the equipment supplier | | | | |
| **6.10** | Guarantee and warranty clauses | | | | |
| **7.0** | Statutory and other specific requirements considerations. | | | | |

4 X 270MW BHADRADRI TPS AT MANUGURU

TECHNICAL SPECIFICATION

FOR

FIRE WATER TENDER AND FOAM TENDER

**SECTION - III**

DOCUMENTS TO BE SUBMITTED BY BIDDER


BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI,
NOIDA-INDIA

# 4 X 270MW BHADRADRI TPS AT MANUGURU

## TECHNICAL SPECIFICATION

## FOR

## FIRE WATER TENDER AND FOAM TENDER

## SECTION-IIIA

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI,
NOIDA-INDIA

**BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS ALONG WITH TECHNICAL BID:**

1. Compliance cum confirmation certificate
2. Pre bid clarification schedule
3. No deviation certificate
4. List of Recommended Spares
5. Equipments to be supplied with Fire water tender (Annexure-I of Section - I)
6. Equipments to be supplied with Foam tender (Annexure-II of Section - I)
7. List of Maintenance Tool & Tackles (Annexure-III of Section - I)
8. Unpriced copy of price format.

Please note that all the schedules shall be submitted even though they may not be applicable. Under such circumstances it shall be clearly mentioned across such schedules that these are not applicable. (E.g. in case of there are no technical deviation, it shall be mentioned in the deviation schedule that 'THERE ARE NO DEVIATIONES TO THE TECHNICAL SPECIFICATION').

Name:
Signature:
Designation:
Company:
Date:

Bidder Stamp

## PRE-BID CLARIFICATION SCHEDULE

| S.No. | Section/Clause/ Page No. | Statement of the referred clause | Clarification required |
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The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE:_____

NAME : _____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

**DEVIATION SHEET (COST OF WITHDRAWL)**

**PROJECT:- 4 x 270MW BHADRADRI TPS, MANUGURU**

**PACKAGE:- FIRE TENDERS**

**TENDER ENQUIRY REFERENCE:-**

**NAME OF VENDOR:-**

| SL NO | VOULME/ SECTION | PAGE NO. | CLAUSE NO. | TECHNICAL SPECIFICATION/ TENDER DOCUMENT | COMPLETE DESCRIPTION OF DEVIATION | COST OF WITHDRAWL OF DEVIATION | REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE | NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE) | REASON FOR QUOTING DEVIATION |
|---|---|---|---|---|---|---|---|---|---|
| **TECHNICAL DEVIATIONS** | | | | | | | | | |
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| **COMMERCIAL DEVIATIONS** | | | | | | | | | |
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**PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE**

| | | | |
|---|---|---|---|
| **NAME** | **DESIGNATIONS** | **SIGN & DATE** | |

## NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

## COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

   For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment as applicable, shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

SIGNATURE: _____

NAME : _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL