

## 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<br>(from centre-line of rails<br>- 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

pipings, 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<sup>3</sup> (with worst coal and one field out at TMCR).
- b) NO<sub>x</sub> - 365 ppm Max. or 750 mg/Nm<sup>3</sup> (Equivalent NO<sub>2</sub>).
- c) SO<sub>2</sub> - Concentration based standard 2000 mg/Nm<sup>3</sup>. 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 magnafux 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                |
|                                            | -----            | -----            |

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

## 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.<br>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                                                                                                            | Refer VII-A, B, C.                                                              |
| b) Auxiliary interconnections                                                                                            | Refer VII-A, B, C.                                                              |
| 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 |

|    |                                                                                                    |                                                          |
|----|----------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 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><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                                                                                                                                                                                                                                                                                                                              |                                                                                                     |
| 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.                                                                                                   |                                                                                                     |
| 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

| CLAUSE NO. | DESCRIPTION                                                                             |
|------------|-----------------------------------------------------------------------------------------|
| 1.00.00    | PROJECT MANAGEMENT SERVICES                                                             |
| 2.00.00    | SITE SERVICES                                                                           |
| 3.00.00    | PROJECT INFORMATION AND MANAGEMENT SYSTEM,<br>INCLUDING DCOUMENT MANAGMENT SERVER (DMS) |

## **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 :

Period in Months from Zero date (Taken as advance payment date of EPC Package)

- |    |                      |           |
|----|----------------------|-----------|
| a) | Boiler Hydro-test    | By Bidder |
| b) | Boiler light up      | By Bidder |
| e) | Commercial operation | 50        |

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

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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) Attenuation 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.
- 2.10.21 For civil, structural and architectural works, volume VII-A, VII-B, VII-C may be referred. For Instrumentation and Electrical works Vol. VI, V-A and V-B may be referred.
- 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.
- 2.14.00 For further details on procedures of work at site on civil, architectural, electrical and instrumentation & control services, refer Volume : V, VI & VII of this specification.
- 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 Manager'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**

| <b>CLAUSE NO.</b> | <b>DESCRIPTION</b>                                                 |
|-------------------|--------------------------------------------------------------------|
| 1.00.00           | GENERAL                                                            |
| 2.00.00           | DESIGN COORDINATION MEETING                                        |
| 3.00.00           | CO-OPERATION WITH OTHER<br>CONTRACTORS AND CONSULTING<br>ENGINEERS |
| 4.00.00           | GUIDELINES FOR ENGINEERING<br>SERVICES                             |
| 5.00.00           | OPERATING MANUALS AND MAINTENANCE<br>INSTRUCTIONS                  |
| 6.00.00           | PLANT HANDBOOK                                                     |
| 7.00.00           | CONTRACT STAGE DOCUMENT<br>SUBMISSION AND APPROVAL PROCEDURE       |
| 8.00.00           | TENDER STAGE DOCUMENT SUBMISSION                                   |

## **ATTACHMENTS**

|            |                       |
|------------|-----------------------|
| ANNEXURE-1 | DISTRIBUTION SCHEDULE |
|------------|-----------------------|

## **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.

7.10.00 For details of documentation for Civil, Structural and Architectural works, VII-A, VII-B and VII-C may be referred.

## 8.00.00 **TENDER STAGE DOCUMENT SUBMISSION**

8.01.00 The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following :

- a) All Bid proposal sheets duly filled up.
- b) Detailed experience list and financial resources of the prime bidder his collaborators/associates in this bid as well as the sub-vendors proposed.
- c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.
- d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

- e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.
- f) L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied; This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.
- g) List of suppliers for all bought out items.

### 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/ KTPS | SE/ Civil KTPS | SE/E&M / KTPS | DE Constr. KTPS | Kolkata    | HYD | KTPS |                  |         |
| A     | <b>Letter Of Intent or Contract Documents</b> | 1                 | 1                  | 1                              | S              | 1             | 2              | 2             | 1               | 1          | 1   | 1    | 2                |         |
| B     | <b>Vendor Drawings</b>                        |                   |                    |                                |                |               |                |               |                 |            |     |      |                  |         |
| 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.    | <b>Design Drawings</b>                        |                   |                    |                                |                |               |                |               |                 |            |     |      |                  |         |
| 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/ KTPS | SE/ Civil KTPS | SE/E&M / KTPS | DE Constr. KTPS | Kolkata    | HYD | KTPS |                  |         |
| D     | Progress Report Monthly             |                   |                    |                                |                |               |                |               |                 |            |     |      |                  |         |
| 1.    | Equipment vendor                    | 1                 | 1                  | 1                              | 2              | 1             | 1              | 2             | 1               | 1          | 1   | 1    | S                |         |
| 2.    | M/s DCPL, Kolkata                   | 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.    | M/s DCPL, Kolkata                   | 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.    | M/s DCPL, Kolkata                   | 1                 | 1                  | -                              | 10+1T          | 1             | -              | 15+1T         | -               | S          | 1   | 1    | Nil              |         |
| G     | M/s DCPL, Kolkata Criteria          | 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

- a) Bidder shall apply in writing to Owner for handing over of the complete Control & Instrumentation System after successful demonstration of tests as specified up to "Availability Guarantee Test".
- b) Owner shall take over charge of the C&I system subject to fulfillment of the conditions enumerated hereunder :
- i) Site check-list prepared by Owner are fruitfully attended by Bidder and certified by Owner.
  - ii) Operation/ Instruction manuals are updated to incorporate changes made up to Availability Test Run.
  - iii) Drawings/ sketches are submitted as per Contract, on as- built basis.
  - iv) Close loop controls, Binary & Sequential controls should be working on auto and interlocks are demonstrated to be functional.
  - v) Equipment and system supplied by Bidder are in working condition.
  - vi) Short supply items, as per Contract, are refurbished by Bidder.
  - vii) The above conditions are in addition to fulfillment of any/all other contractual obligations of Bidder towards Owner. Partial handing-over of systems /equipments shall not be permissible, except if desired so by Owner in special cases.

**11.00.00 TRAINING OF PERSONNEL**

11.01.00 Bidder shall include in the proposal training of Owner's personnel of different categories for operation, maintenance and troubleshooting of the supplied equipment. Training courses shall be conducted by experienced personnel of Bidder. Course participants shall receive individual copies of technical manuals at the time the course is conducted. Upon completion of each course, training manuals shall be property of Owner. Bidder shall supply all updates and revisions to the manuals.

11.02.00 Training shall be provided to operating, programming and maintenance personnel. The training shall be conducted at original equipment designer / manufacturer's works. While the exact content and duration of such training shall be guided by Bidder's experience , following gives the basic and minimum requirement of operation and maintenance , troubleshooting training from Owner's point of view.

**11.03.00 PLANT OPEARTION TRAINING**

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                      | DURATION     |
|-----------------|-----------------------|------------------------------|--------------|
| 12              | Control Engineer      | Main plant through DDCMIS OS | 8 weeks each |
| 16              | Control Engineer      | PADO System Usage            | 2 weeks each |

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                                   | DURATION     |
|-----------------|-----------------------|-------------------------------------------|--------------|
| 12              | Control Engineer      | Each type of utility plant through PLC OS | 4 weeks each |

## 11.04.00 SYSTEM MAINTENANCE TRAINING

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                                                         | DURATION     |
|-----------------|-----------------------|-----------------------------------------------------------------|--------------|
| 6               | C&I Engineer          | DCS Hardware and Software.                                      | 8 weeks each |
| 6               | C&I Engineer          | PLC system Hardware and Software.                               | 2 weeks each |
| 8               | Maintenance Engineer  | CMIMS System Functioning and Maintenance.                       | 2 weeks each |
| 2               | C&I Engineer          | MIS Hardware and Software                                       | 1 week each  |
| 2               | C&I Engineer          | HART Management System                                          | 1 week each  |
| 2               | C&I Engineer          | SWAS Hardware and Software                                      | 1 week each  |
| 2               | C&I Engineer          | CEMS Hardware and Software                                      | 1 week each  |
| 2               | C&I Engineer          | Ambient Air Quality and Monitoring System Hardware and Software | 1 week each  |
| 2               | C&I Engineer          | CCTV Hardware and Software                                      | 1 week each  |
| 2               | C&I Engineer          | Plant Telephone And PA System                                   | 1 week each  |
| 2               | C&I Engineer          | PADO Hardware and Software                                      | 1 week each  |

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                           | DURATION          |
|-----------------|-----------------------|-----------------------------------|-------------------|
| 4               | C&I Engineer          | RMCMAS Hardware and Software      | 2 weeks each      |
| 4               | C&I Engineer          | All other Instruments and Systems | Adequate Training |

## 11.05.00 TRAINING ON TG SYSTEM

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                                                                | DURATION          |
|-----------------|-----------------------|------------------------------------------------------------------------|-------------------|
| 4               | C&I Engineer          | Turbine Governing Control and protection system Hardware and Software. | 2 weeks each      |
| 4               | C&I Engineer          | Turbine Supervisory Instruments                                        | 2 weeks each      |
| 4               | C&I Engineer          | TDBFP Governing and protection system                                  | 1 week each       |
| 4               | C&I Engineer          | All other Instruments and Systems                                      | Adequate Training |

## 11.06.00 TRAINING ON SG SYSTEM

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                                                             | DURATION     |
|-----------------|-----------------------|---------------------------------------------------------------------|--------------|
| 4               | C&I Engineer          | BMS / Boiler protection system Hardware and Software.               | 2 weeks each |
| 4               | C&I Engineer          | Furnace Flame monitoring and Analysis System Hardware and Software. | 1 week each  |

| NO.OF PERSONNEL | CATEGORY OF PERSONNEL | SUBJECT                           | DURATION          |
|-----------------|-----------------------|-----------------------------------|-------------------|
| 4               | C&I Engineer          | Boiler tube leak detection System | 1 week each       |
| 4               | C&I Engineer          | All other Instruments and Systems | Adequate Training |

11.07.00 Training for the Engineers & operators shall be based on direct hands-on use of the offered system supported by lectures. Bidder shall train Owner's personnel in the programming and maintenance of the equipment to the extent that Owner's personnel can make corrections and changes to the system and maintain the systems hardware independently. Bidder shall include in his proposal a detailed description of the training course proposed by him (class-room lecture, audio-visual presentation, hands-on). If Bidder conducts Owner's training on regular periodic basis, a printed brochure of such program may be enclosed for reference.

11.08.00 Bidder shall provide all additional training deemed necessary by Owner , if there are modifications to Bidder's system and software after completion of the regular training period.



**VOLUME : X**

**SECTION - I**

**PERFORMANCE GUARANTEES**

**CONTENT**

| <b>CLAUSE NO.</b> | <b>DESCRIPTION</b>                                                                                      |
|-------------------|---------------------------------------------------------------------------------------------------------|
| 1.00.00           | PERFORMANCE GUARANTEES, PERFORMANCE/ ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE |
| 2.00.00           | START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS                                      |
| 3.00.00           | SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]                                    |
| 4.00.00           | SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES [CATEGORY-B]                             |

**VOLUME : X****SECTION-I****PERFORMANCE GUARANTEES****1.00.00 PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE**

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

- a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.
- b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The guaranteed parameters shall be without any tolerance values. The Bidder shall demonstrate all the guarantees covered in various volumes and sections of this specification during Performance/Acceptance test. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modification to make the equipment/system comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion :

- i. reject the equipment and recover the payment already made or accept the equipment only after levying liquidated damages as identified in this section for those guarantees which are covered under category "A".

**OR**

- ii. reject the equipment and recover the payment already made or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements

specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.

1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.

#### 1.06.00 **Performance/Acceptance Tests**

1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.

1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.

1.06.03 For instrument inaccuracies during PG Test, refer subsequent clauses of this section.

1.06.04 For Total Auxiliary Power Consumption, the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.

#### 2.00.00 **START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS**

For the purpose of Taking over of the Plant, the following activities shall have to be completed successfully.

- i) Mechanical Completion
- ii) Preliminary Operation
- iii) Initial Operation
- iv) Reliability Operation
- v) Trial Operation
- vi) Performance Guarantee Tests

#### 2.01.00 **Mechanical Completion**

- (a) Mechanical completion is defined as the state of readiness of works and completeness of Field Quality checks under the scope of contract to undergo the pre-commissioning checks, followed immediately thereafter by commissioning including preliminary operation, initial operation, reliability operation, performance tests including unit characteristics tests for functional or operational occupation of the

works.

- (b) Mechanical completion shall be deemed to occur when the contract erection/installation/construction and Field Quality check works are completed as per specifications for all equipment / systems including standby. It also include but not limited to the following:
  - (i) all installation/erection and Field Quality checks duly carried out and individual protocol viz. erection, FQA (Field Quality Assurance) and commissioning protocol to be signed.
  - (ii) all defects/deficiencies notified by the Purchaser during installation/erection rectified to the satisfaction of Purchaser which, in the opinion of the Purchaser, will not affect the safe operability and maintainability of the works, and
  - (iii) the contract works, in the opinion of Purchaser, subject to sub-clause (ii) above, being fit, sound, safe and operable for undertaking the pre-commissioning checks, preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests followed by subsequent commercial operation without interruption for reason of defect/deficiency or unfulfilled obligations of the Contractor in the erection/installation work.

2.02.00

#### **Specific Requirements of Mechanical Completion**

- (a) Mechanical completion in different disciplines shall be determined based on the following characteristics, signifying the readiness of the works/plants and systems for undertaking the pre-commissioning checks and subsequent preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests as applicable to the contract works:
  - (i) All plant construction/installation in various disciplines, as detailed under (b) below and as applicable to the contract are completed including aesthetic and workmanship and safety aspects, with all installation/construction checks as per specification, relevant codes, standards and practices ensuring conformity to contract and meeting any applicable statutory requirements.
  - (ii) All contractual obligations up to the stage of completion of construction / installation are fulfilled to the satisfaction of the Purchaser.
- (b) All contract works or otherwise ready to be taken into service, or for functional or operational occupation save pre-commissioning/ commissioning checks, preliminary operation, initial operation, reliability operation, performance tests, unit characteristics tests are to be carried out as per approved commissioning procedure submitted by the contractor including but not limited to the following:

- (i) Areas inclusive of all roads, accesses, structures, housings, platforms, walkways, stairs, ladders, safe approach to equipments, safety/ protective guards, covers, hand rails and such items of work are constructed as per specification and approved for use.
- (ii) Drains, sewers, waste disposal channels, vents, chutes, ducts and such works are constructed and connected to treatment and other disposal systems.
- (iii) Equipment and piping in different systems/disciplines with all appurtenances, auxiliaries and accessories along with supporting structures, hangers, mounts, etc., are erected/ installed, supported, anchored, aligned, grouted and adjusted for operating conditions.
- (iv) Electrical power supply, control, communication and lighting equipment along with control panels, control desks, switchgear, local starters and such accessories along with protective systems, interlocks and integral and auxiliary systems are permanently installed, aligned and adjusted, with megger, continuity and specified installation checks duly carried out.
- (v) Cables are laid, routed, supported, dressed, clamped, tagged, ferruled and terminated with clamp terminals designated and all continuity and megger checks duly carried out.
- (vi) Safety/relief valves are calibrated and set to operating conditions and tried out. All safety systems are installed, calibrated, checked and accepted.
- (vii) Plant identification numbers, colour codes, tags, nameplates are duly mounted / painted/affixed.
- (viii) All painting, lining and insulation works are completed with specified checks to the satisfaction of the Purchaser.

#### 2.03.00 Other Prerequisites for Mechanical Completion

The Contractor shall also meet the following prerequisites for mechanical completion:

- (a) Submit a compilation of all reports of shop tests, material tests and various stage inspection establishing total compliance to contract specification in manufacturing items of supply of contract.
- (b) Submission of a certificate by the Contractor in a format agreed by the Purchaser that the contract works have been designed, selected, manufactured, furnished and installed under the full responsibility of the Contractor.
- (c) All erected plants, structures, equipment and systems are maintained and preserved in sound condition and are fit and sound to undertake

pre-commissioning checks and 'tests before commercial operation' for operational and functional occupation immediately thereafter.

- (d) All areas and constructed works are cleared daily upto the satisfaction of the Owner of all construction materials, temporary works, debris, rubbish water and all such impediments to render the contract works safe, sound and operable.
- (e) All safety features and safety equipment are functional.
- (f) Fire prevention and fire extinguishing system in all fire prone areas are to be made functional.
- (g) Any specific statutory approvals pre-requisite to commissioning of the plant are duly obtained.

#### 2.04.00 Preliminary Operation

Preliminary operation shall mean all activities undertaken as part of commissioning after mechanical completion upto commencement of initial operation and shall include mechanical and electrical checkouts, calibration of instruments and protection devices, commissioning of sub/supporting systems covered under the contract.

#### 2.05.00 Initial Operation

Initial operation shall include all operations undertaken as part of commissioning after completion of preliminary operation upto commencement of reliability operation. It shall be the first integral operation of the complete BOP integrated with Boiler, Turbine Generator package covered under the contract and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out no-load / partial load /full loads runs for mechanical / electrical tryout and gathering of operational data, calibration, setting and commissioning of controls systems; and shutdown inspection and adjustment after running trails of the plant under the contract.

During initial operation each and every activity wise commissioning protocols are to be jointly signed by the Purchaser and Contractor commissioning team.

The auto loop control tuning shall continue upto the commencement of 72 hour full load operation of trial run.

The initial operations shall include operation of unit as a whole under normal operating conditions for twenty four (24) consecutive hours at the 100% TGMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TGMCR load unless otherwise agreed to by the Purchaser or restricted by system load conditions. The completion of initial operation will be certified in writing by the Purchaser.

#### 2.06.00 Reliability Operation

- (a) After the initial operations, the plant shall be on reliability operation. During the reliability operation, the Contractor will be allowed to make

minor adjustments as may be necessary, provided that such adjustments do not interfere with or prevent the commercial use of the plant or result in significant reduction of output. The duration of the reliability operation of plant shall be spread over a period of thirty (30) days. The maximum number of interruption attributable to Contractor shall be of four (4) numbers each not exceeding four (4) hours duration. In case either the number of interruptions, attributable to the Contractor, exceeds four (4) or the duration of any of the four (4) interruptions exceeds four (4) hours the reliability test shall be repeated.

- (b) For the period of reliability operation, the time of actual operation shall be counted. In case the duration of actual continuous operation of any of the above modes is discontinued for reasons, which are not due to Contractor's fault or negligence, that particular test would be deemed to have satisfied the reliability operation test. However, should the test be discontinued due to Contractor fault, the test shall be restarted for that particular case.
- (c) Should any failure (other than of an entirely minor nature) due to or arising out of faulty design, materials, or workmanship (but not otherwise) occur in any item of the plant, sufficient to prevent commercial use of the plant, the reliability test period of thirty (30) days shall recommence for that item after the defect has been remedied by the manufacturer/Contractor. The onus of proving that any failure is not due to faulty design, materials and workmanship will lie with the Contractor.
- (d) A 'reliability operation' report comprising observations and recordings of various parameters measured in respect of the 'reliability operation' shall be prepared and submitted to the Purchaser. This report, besides recording the details of various observations during 'reliability operation' shall also include the dates of start and finish of the reliability operation and shall be signed by the representatives of both the parties. The report shall have recordings of all details of interruptions that occurred, adjustments made and any repairs carried out during the 'reliability operation'.

Also a punch list is to be prepared during the reliability test and the defects are to be rectified by the contractor before commencement of 72 hour operation at full load during trial operation.

- (e) Should any failure or interruption occur in any portion of the tests due to or arising from faulty design, materials, workmanship, omissions, incorrect erection, or inadequate instructions by the Contractor's supervisors, sufficient to prevent safe commercial use of the plant, the reliability operation test at the particular load shall be considered void and the reliability test shall recommence after the Contractor has remedied the cause of the defect.
- (f) During the reliability operation all the equipments, Raw/ DM water system and sub-systems, control loops, interlocks and protection including switchyard installations will be in service and change over to standby equipments are to be done on running condition of the unit.



- (g) The 'reliability operations' shall be considered successful, provided that each item of plant can meet the above requirements.
- (h) Upon the completion of 'reliability operations', as soon as practicable, or at such time as may be otherwise agreed to by the parties concerned, the Contractor shall notify in writing to the Purchaser that the Plant is ready for performance tests.

## 2.07.00

**TRIAL OPERATION:**

1. On completion of erection of any major items along with its auxiliaries, the same shall be thoroughly inspected by the Contractor together with the TSGENCO's Engineers for correctness and completeness and acceptability for pre-commissioning tests. Though the TSGENCO's Engineers associate themselves with such inspection, the responsibility for declaration for correctness, completeness and acceptability shall rest with the Contractor and the pre-commissioning tests and inspections shall be carried out after such declaration. The pre-commissioning tests to be performed at site as well as necessary documentation and formats for the protocols to be signed during and after the tests shall be prepared by the Contractor taking into account relevant Indian/International/ Manufacturers standard as applicable and finalized by the TSGENCO sufficiently in advance through mutual discussions. On conclusion of satisfactory pre-commissioning tests of each individual equipment, the trial operation of the unit shall start consistent with parameters of the technical specifications.
2. The duration of trial operation shall be for 14 days during which period the unit shall be run from half to full load or any other load cycle mutually agreed to during which period the unit shall run at full load for 72 hours continuously. However, if required, the Purchaser and the Contractor may mutually agree for economical load operation for 48 hours continuously. Any interruption caused by the Contractor up to 24 hours will not effect the period of 14 days indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly. During the above trial operation the standby auxiliary equipment shall also be run for a minimum period of more than 72 hours during which period the equipment shall run at its rated capacity for a minimum period of 24 hours. Further the above trial operation shall be carried out in full fledged manner with the associated instruments and controls. The unit is deemed to be commissioned on successful completion of the above trial operation.
3. A document shall be prepared on the results of trial operation. This document besides recording of the details of the various observations during the trial run will also include the date of start and finish of the trial operation and will be signed by the representative of both the parties. The document of the trial operation shall have log sheets and all adjustments, repairs, interruptions etc., shall be recorded therein. If any major adjustment is carried out which has been changed from the initial operation value, then the reason for it is to be furnished in the

report in detail.

The Purchaser and the Contractor will observe the plant overall reliability and shall test the equipment runback, rundown, auto start of equipments, CMC function and its reliability, complete automation of the plant system etc.

4. The readiness of the unit for the trial operation shall be intimated by written notice to the TSGENCO after mutual discussions. After receipt of such notice if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor and if the situation continues, the Contractor shall be absolved of the responsibility for the delay and the plant shall be deemed to have been taken over by the TSGENCO at the end of 60 days after the Contractor's notifications of readiness of the same.
5. The trial operation shall be carried out in compliance with relevant manufacturer's standards and/or relevant Indian/International standards and manufacturer's operation directions before starting them.
6. Defects which are minor in nature and do not endanger the safe operation of the plant, shall not be considered as reasons for not taking over the plant by the TSGENCO. These defects shall be listed in the above mentioned documents and shall be rectified by the Contractor in accordance with the agreement made in this respect.

## 2.08.00

### Performance Tests

- (a) PG test notification to be given by the contractor to the purchaser after COD. The performance tests shall be conducted at site on all major systems by the Contractor. The Contractor's commissioning Engineers shall make the entire plant ready for such tests and assist the Purchaser in operation during the tests. The test shall be commenced after the 'Plant/Equipment' has attained stable operation at the end of 'reliability operation'. The date of commencement of the performance tests shall be as soon as practicable on completion of the 'reliability operation' or as may be mutually agreed upon between the Contractor and Purchaser.

Final trial operation shall be carried out for a period of seventy two (72) hours at 100% TGMCR before 'taking over'.

- (b) **Independent Inspector**

The Purchaser reserves his right to appoint an independent inspector at his own cost as his representative to discuss the test programme, to approve the instrumentation, to witness the tests and to analyze the test results.

- (c) The tests shall be binding on both the parties of the contract to determine compliance of the 'plant'/equipment' with the performance

guarantees.

- (d) The performance tests shall be carried out to prove the guarantees. The purpose of the performance tests is to check whether the plant meets the guaranteed performances.
- (e) The performance test procedure, the instrumentation to be installed, the instrument accuracy classes, including the definition of the calculation method to be used, the areas of responsibility and the items which specifically require preparation and agreement shall be submitted by the Contractor for review and approval during detail engineering phase. The schematics identifying the guarantee test instrumentation shall be submitted along with procedure. It shall be ensured that necessary test points and spool pieces are installed during the detail-engineering phase and also identified in process and instrumentation drawings. Code of the PG test is to be fixed up during detail engineering stage. The Contractor shall furnish detail test programme during detail engineering stage.
- (f) The performance test instruments shall be of precision type with instrument accuracy limits as required and defined in the applicable performance test codes such that measurement uncertainty does not exceed the values agreed to by the Contractor in the Schedule of Performance Guarantees.
- (g) All test instrumentation for the performance tests as required shall be supplied by the Contractor on loan basis. All costs associated with the supply, calibration, installation and return of the test instrumentation are deemed to have been included in the contract price. The test shall be in accordance with those specified or as per agreed performance test codes. Batch calibration shall not be accepted.
- (h) Any special equipment, tools and tackle required for successful completion of the performance tests shall be provided by the Contractor.
- (i) It is Contractor's responsibility to co-ordinate for carrying out the performance tests. The duration of the test shall be in accordance with the agreed test codes. All other tests to prove the guarantees as indicated in the Contractor's offer shall also be conducted.
- (j) The plant parameters during the performance test shall be adjusted as far as practicable to the guaranteed performance test conditions. The tests shall be conducted to provide guaranteed parameters as defined in the contract.
- (k) Category-B tests are to be completed before Category-A PG test. Protocols are to be signed jointly by the Purchaser and Contractor for each Category-B test.
- (l) **Reporting of Test Results**

- (a) Within two weeks after the conclusion of the performance test,

the Contractor shall submit ten (10) copies of test reports to the Purchaser stating whether the plant passed or failed such test(s), accompanied by sufficient test data and calculations to demonstrate the level of performance attained with respect to each of the tested parameters.

(b) The report(s) shall include as a minimum, the following:-

- (i) Scope
- (ii) Various guaranteed parameters & tests as per the contract.
- (iii) Codes/standards used
- (iv) . Description of the test procedures
- (v) Full schematic diagrams with indication of test instruments locations and identification tags of same.
- (vi) Instrumentation details and calibration.
- (vii) Duration of test, frequency of readings and number of test runs
- (viii) Test logs and summary of test readings used for performance calculations.
- (ix) Full set of correction curves.
- (x) Computation of test results.
- (xi) Sample calculation
- (xii) Performance calculation
- (xiii) Computations to prove measurement uncertainty is within acceptable limits.
- (xiv) Acceptance criteria
- (xv) Any other information required for conducting the test
- (xvi) Conclusions of performance tests.

(m) Within fifteen (15) days of receipt of such test report(s), the Purchaser shall submit a notice to the Contractor stating either:-

- (i) That Purchaser concurs with the information provided in the test report(s), or
- (ii) That Purchaser disputes some or all of the information provided

in the Contractor's test report(s), the areas being disputed, and the levels of performance being disputed.

- (n) If Purchaser concurs with the information in the Contractor's test report(s), the Purchaser shall, within fifteen (15) days of receipt of the test report, provide a written notice to the Contractor accepting the results of the tests.
- (o) If Purchaser disputes any or all of the results contained in the Contractor's test report(s), the Contractor and Purchaser shall meet within fifteen (15) days of the receipt of the Purchaser notice at a mutually acceptable location to review and discuss the dispute.

All the category-B test results are to be computed and to be submitted along with the PG test report for detail study by the Purchaser.

#### 2.08.00 **Notice of Tests**

The Contractor shall issue 21 days notice to the Purchaser of the date after which he will be ready to commence the tests and the Contractor shall commence the tests promptly thereafter.

#### 2.09.00 **Delayed Tests**

- (a) If the tests could be carried out but are being unduly delayed by the Contractor, the Purchaser may by notice inform the Contractor to conduct the tests within 14 days after the receipt of such notice. The Contractor shall conduct the tests on such days within that period as the Contractor may fix and of which he shall issue notice to the Purchaser.
- (b) If the Contractor fails to conduct the tests within such notice period, the Purchaser may himself proceed with the tests. All tests so conducted by the Purchaser shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the contract price or charged to the Contractor. The tests shall then be deemed to have been conducted by the Contractor and the test results shall be binding on the Contractor.

#### (c) **Facilities for Tests on Completion**

Except where otherwise specified, the Contractor shall provide and bear costs for these items, as may be required to carry out the tests on completion.

#### (d) **Retesting**

If the plant fails to pass the test (which in the case of performance tests means not achieving the acceptable limits), the Purchaser may require such tests to be repeated on the same terms and conditions save that only reasonable notice of the date and time of such tests shall be required to be given by the Contractor to the Purchaser.

(e) **Disagreement as a Result of Tests**

If the Purchaser and the Contractor disagree on the interpretation of the test results, each shall give a statement of his views to other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence.

3.00.00

**SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES  
[CATEGORY-A]**

| Sl. No. | Plant/<br>System                    | Parameter for Performance<br>Guarantee                                                                                                                                                                                                                                                        | Liquidated<br>Damages |
|---------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 3.01.00 | <b>Plant</b>                        |                                                                                                                                                                                                                                                                                               |                       |
| 3.01.01 | Efficiency of<br>steam<br>generator | Efficiency of the steam generator at 100% & 80% TMCR while firing the Design coal at rated steam parameters, rated coal fineness and rated excess air. <b>(Refer Note-1 for estimation of weightage factor.)</b> Design coal shall be blended coal (50% imported coal + 50% indigenous coal). | As per Volume-I.      |
| 3.01.02 | Steam<br>generating<br>capacity     | Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working) with the coal being fired from within the range specified.                                                                                                 | As per Volume-I.      |
| 3.01.03 | Turbine Cycle<br>Heat rate          | Turbine Cycle Heat rate in kcal/kWh under rated steam conditions, design condenser pressure with zero make up at 100% & 80% of rated load <b>(Refer Note-1 for estimation of weightage factor.)</b>                                                                                           | As per Volume-I.      |
| 3.01.04 | Output                              | Continuous output (MW) of 100% TMCR at Generator terminals under rated steam conditions at Turbine Inlet (247 kg/cm <sup>2</sup> (a), 565°C, 593°C) and CW temperature of 33°C with 0% make-up with excitation power deducted                                                                 | As per Volume-I.      |
| 3.01.05 | Condenser<br>Pressure               | Condenser pressure in mm Hg (abs) under VVO conditions, 3% make up, design CW temperature and CW flow.                                                                                                                                                                                        | As per Volume-I.      |

| Sl. No. | Plant/<br>System                           | Parameter for Performance<br>Guarantee                                                                                                                                                                                                                                                                                                                          | Liquidated<br>Damages |
|---------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 3.01.06 | Total Auxiliary<br>Power<br>Consumption    | The total auxiliary power consumption for all the auxiliaries of boiler, turbine Generator and turbine cycle equipments required for continuous unit operation at 100% and 80% of rated load under rated steam conditions and at design condenser pressure with 0% make-up. <b>(Refer Note 1, 2, 3 &amp; 4 for the basis of computation of Auxiliary power)</b> | As per Volume-I.      |
| 3.01.07 | Cooling Tower<br>Cold Water<br>Temperature | Cooling tower cold water at 100% TMCR under rated steam conditions and at design condenser pressure.                                                                                                                                                                                                                                                            | As per Volume-I.      |

**Note :**

1. The weightage factor shall be estimated considering the following:
  - a) 80% rating for 2000 hrs in a year,
  - b) 100% rating for 6300 hrs in a year.
2. For computation of Auxiliary Power, output measured at Generator terminals minus sent out power measured downstream of Generator Transformer, applicable Losses (No load loss + Load loss+ auxiliary loss for coolers) for Standby Transformers, Unit Transformers and Bus duct losses shall be considered.
3. The equipment for auxiliary power consumption to be considered by the bidder shall include the equipment as per Annexure-C of Volume-I as minimum.
4. Power consumption for Fire Pumps, Sump Pumps, Elevators, EOT Cranes shall not be considered in the Auxiliary Power consumption estimate.
5. Heat Rate of TG Cycle : Maximum 1850 Kcal/kwh with Steam Turbine driven BFP.
6. Steam Generator Efficiency : Not less than 85%
7. Auxiliary Power Consumption shall be limited to 6% with Steam Turbine driven BFP and NDCT.
8. Normal Availability of the Plant : 98% (2% forced outage)
9. Plant Reliability : Minimum 95%
10. The condenser pressure measurement while conducting the guarantee tests for CI Nos 3.01.03, 3.01.04 and 3.01.05 above shall be measured at 300 mm above the top row of condenser tubes.

**4.00.00 SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES FOR VARIOUS EQUIPMENT WHICH INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING [CATEGORY-B]:****4.01.00 Steam Generator**

4.01.01 Capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working as per Owner's discretion) and the coal being fired within range specified, corresponding to 100% BMCR at 33°C CW temperature.

4.01.02 Efficiency in percentage at 100% & 80% TMCR and 27°C ambient air temperature and 60% RH with zero make-up, condenser vacuum of 77 mm Hg(a) or better while firing the Design coal at rated steam parameters at Superheater and Reheater outlet and rated excess air and with any combination of mills working as per Owner's discretion. Design coal shall be blended coal (50% imported coal + 50% indigenous coal).

4.01.03 Air heater air-in-leakage after 3000 hrs. of operation from taking over date. To be demonstrated.

4.01.04 NOx emission

NOx emission from the unit – shall not be more than 365 ppm or 750 mg/Nm<sup>3</sup> (equivalent NO<sub>2</sub>) at the ESP outlet at 6% excess oxygen.

4.01.05 Mill capacity at rated fineness.

4.01.06 Gas tightness efficiency of Guillotine dampers.

4.01.07 No fuel oil support shall be required above 30% of BMCR.

4.01.08 Performance characteristics of pumps, fans, etc. viz; capacity, head developed etc.

4.01.09 Capabilities of all drives.

4.01.10 Margins on fans. Through operation of single fan at a time.

4.01.11 Equal load sharing of pumps/fans while running in parallel shall be demonstrated.

4.01.12 Run back capabilities.

4.01.13 Ramp/sudden load change withstand capability.

4.01.14 Life of mill wear parts

4.01.15 Furnace Exit Gas Temperature

The Bidder shall demonstrate by direct measurements that the Furnace Exit Gas Temperature (FEGT) at the specified location does not exceed the



specified maximum temperature of BMCR. The test equipment to be used for this demonstration shall be latest, state of the art, to the approval of Owner.

4.01.16 Flue Gas Temperature

The Bidder shall also demonstrate that the flue gas temperature at the entry and exit of various boiler heating surfaces and also the variation across the cross section perpendicular to gas flow do not exceed the values considered for the pressure parts design.

4.01.17 Steam Temperature Imbalance

The Bidder shall guarantee and demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10°C.

4.01.18 SH/RH Attenuation System

The Bidder shall guarantee and demonstrate that the spray water flow to SH attenuation system does not exceed the value considered for design (to be indicated in the bid) while maintaining the rated SH outlet steam temperature at BMCR. The Bidder shall also guarantee and demonstrate that the RH temperature is maintained at the rated value without any spray water requirement, for the secondary attenuation system, at all loads for which the specified RH steam temperature is required to be maintained at the rated value.

4.02.00 **Electrostatic Precipitator**

4.02.01 Pressure drop across the electrostatic precipitator.

4.02.02 Collection efficiency and outlet dust concentration shall be as per cl. no. 3.01.00 of Section-II in Volume-II-B.

4.03.00 **Turbine Generator**

4.03.01 Turbine Generator-Set Capability

The steam turbine generator unit shall be capable of delivering continuously at generator terminals the output as indicated by the Bidder in the following heat balances detailed out elsewhere with equipment specification submitted along with the bid.

- a) Output corresponding to top HP heaters out of operation.
- b) Output corresponding to all HP heaters out of operation.
- c) Output corresponding to VWO flow, at rated steam conditions with condenser CW temperature 33°C & condenser of vacuum 77 mm HgA or better with 0% make-up.
- d) Output corresponding to overpressure operation of the boiler-turbine-generator set, at rated main steam and hot reheat steam

temperature with condenser CW temperature corresponding to  
Condenser vacuum of 77 mm HgA or better with zero percent make-up.

4.03.02 Operating Frequency Range

As per the stipulations of Cl. No. 7.06.00 Vol. II-C, Section-I.

4.03.03 Constant Pressure and Sliding Pressure Operation

The constant pressure operation and sliding pressure operation from 30% turbine MCR to VWO condition of the unit in conjunction with the steam generator, HP-LP bypass system and instrumentation & control system shall be demonstrated.

In sliding pressure mode of operation, during quick load increase the idle control valve (s) must respond rapidly to pick up 20% of operating load, so that immediate increase of boiler pressure is not required. The load response capability shall be demonstrated in steps of 5 %.

Change-over from constant pressure mode to sliding pressure mode and vice-versa shall also be demonstrated.

4.03.04 Start-up, Loading, Unloading and Shutdown Capabilities

Start-up, loading, unloading and shutdown characteristics and startup time and loading capabilities for the steam turbine generator and steam generator both operating as a unit for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) under constant pressure and variable pressure mode and suitability for cyclic operation as indicated by the Bidder in the offer and accepted by the Owner shall be demonstrated ensuring the parameters of vibration, differential expansion, etc.

4.03.05 Vacuum Pulling time

Vacuum pulling time from condenser at atmospheric pressure to rated vacuum compatible to start Steam Turbine

4.03.06 Sudden Total Loss of External Load

On occasions, the steam turbine generator system may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip on overspeed but shall continue in operation under the control of its speed governor to supply power for the plant auxiliary load station transformers, while staying within the prescribed permissible limits of steam metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity acceptable to the Owner.

4.03.07 Capacity with Reduced Hydrogen Pressure

Generator shall be capable of operating at reduced capacity at reduced generator hydrogen pressure in accordance with values furnished by the Bidder in his proposal and accepted by the Owner.

## 4.03.08 HP/LP Bypass Capabilities

- i. HP/LP bypass capacity and capabilities under various modes of operation shall be demonstrated.
- ii. Condenser performance with HP-LP Bypass operating at rated conditions.

## 4.03.09 Lube Oil Purification System - Capacity and Purity

Lube oil purification system capacity and the purity of purified oil at the outlet of the centrifuge and the outlet of the polishing filter, shall be demonstrated. If purity check is not possible at site, this shall be carried out at Vendor's works.

## 4.03.10 Extraction and CRH NRVs

Operation of the valves under turbine trip and high water level in the heaters, shall be demonstrated.

## 4.03.11 The performance of the condenser, i.e., the back pressure achieved at design CW flow and inlet temp. and cleanliness factors, VWO heat load shall be demonstrated.

## 4.03.12 Temp. of condensate at outlet of condenser shall not be less than saturation temp. corresponding to the condenser pressure at all loads.

## 4.03.13 Oxygen content in condensate at hot-well outlet shall not exceed the limit prescribed by HEI over the entire load range and shall be determined according to an internationally approved codes/standard.

## 4.03.14 When one half of the condenser is isolated, condenser capability shall be demonstrated to take at least 60% T.G. load under TMCR conditions.

4.04.00 **Deaerator**

## 4.04.01 The dissolved oxygen content in feed-water measured at deaerator outlet shall not exceed 0.005 cc/litre at all loads from no load to VWO condition with 3% cycle make-up with normal pressure and overpressure with incoming condensate presumed to be saturated with oxygen (without any chemical dosing).

## 4.04.02 Free carbon dioxide in deaerator effluent shall be non-traceable at all loads from zero to VWO with 3% cycle make-up with normal pressure according to ASTM standards.

4.05.00 **Power Cycle Pumps**

Performance of each pump (flow, head, vibration, noise, parallel operation) to be demonstrated.

4.06.00 **Automatic On Line Turbine Testing (ATT) System**

Demonstrated without disturbing normal operation.

4.07.00 **Coal Handling Plant**

Refer Cl. No. 10.00.00 in Volume-IV-A.

4.08.00 **Water Treatment System**

Performance Guarantee of Chemical Feed System shall be in accordance with Cl. No. 8.04.00 in Section-IV, Volume-II-B of the EPC Bid Specification.

Performance Guarantee of Condensate Polishing System shall be in accordance with Cl. No. 8.04.00 in Section-VI, Volume-II-C of the EPC Bid Specification.

Performance Guarantee of River Water Pre-Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-I, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Demineralisation System shall be in accordance with Cl. No. 8.04.00 in Section-II, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Circulating Water Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-III, Volume-III-C of the EPC Bid Specification.

Performance Guarantee of Waste Water Treatment System shall be in accordance with Cl. No. 8.04.00 in Section-IV, Volume-III-C of the EPC Bid Specification.

4.09.00 **Instrumentation and Control**

The Bidder shall demonstrate that the Instrumentation and Control system meets all the functional/performance requirements, specified in technical specifications.

4.10.00 **Noise Level**

The Bidder shall demonstrate Noise Level of various plants/equipments/systems as per Clause no. 17.02.00 in Section-IV of Volume-II-A.

4.11.00 **Air Conditioning & Ventilation system**

The rating and performance figures of the AC & Ventilation system & equipment as indicated in the respective technical specification shall be guaranteed by the Bidder. In the event of any deficiencies in meeting the guarantees as indicated in the technical specification after conducting the performance test, the bidder shall put all his efforts to rectify the deficiencies or will replace the equipment / accessories to achieve the specified performance parameters within a reasonable time.

## **VOLUME : IIA**

### **SECTION-VII**

# **QUALITY ASSURANCE REQUIREMENTS**

## CONTENT

| CLAUSE NO. | DESCRIPTION                                   |
|------------|-----------------------------------------------|
| 1.00.00    | QUALITY ASSURANCE PROGRAMME                   |
| 2.00.00    | GENERAL REQUIREMENTS QUALITY ASSURANCE        |
| 3.00.00    | QUALITY ASSURANCE DOCUMENTS                   |
| 4.00.00    | INSPECTION, TESTING & INSPECTION CERTIFICATES |

### ATTACHMENTS

|             |                                       |
|-------------|---------------------------------------|
| ANNEXURE-I  | FORMAT OF QUALITY ASSURANCE PROGRAMME |
| ANNEXURE-II | FIELD WELDING SCHEDULE                |

**VOLUME : IIA****SECTION-VII****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 categorisation 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 comprehensively 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.

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- 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.

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- 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 Contractor 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