# CHAPTER-2

# CHAPTER – 2

# SCOPE OF WORK, SERVICES , GUARANTEES & PAYMENT TERMS

## 1.0 SCOPE OF WORK OF THE LSTK CONTRACTOR

### 1.1 GENERAL

The successful bidder **(LSTK CONTRACTOR)** selected by **APL** as a result of this Tender Process, shall be fully **responsible** for the **scope of work** detailed in this Chapter.

**1.2** The **basic guidelines for design / engineering / execution work** detailed under the scope of work to be outlined in this Chapter shall be applicable.

**1.3** As mentioned under **Clause 1.5** of **Chapter–1** of this **ITB, APL** proposes to set up a **Formaldehyde Plant** with a nominal production capacity of **200 MTPD** (330 stream days basis). Detailed specifications of the product to be guaranteed by the **LSTK CONTRACTOR** are given below:

**OWNER's** requirement is of **Aqueous Formaldehyde (AF-37)** Product of the following composition:

**AQUEOUS FORMALDEHYDE SOLUTION (AF-37)**

| | |
|---|---|
| **Formaldehyde Wt %** | 37% ± 1% |
| **Methanol Wt%.** | 1.0 Max. |
| **Acidity as Formic Acid Wt%** | 0.03 max |
| **Color APHA** | 10 max |
| **Iron, ppm** | 0.5 max |
| **Specific Gravity at 25°C** | 1.1125 ± .0025 |
| **Flash Point** | 180° F closed cup |
| **Odour** | Pungent |
| **Appearance at 70°F** | Colourless liquid |

The **PLANT** should have the flexibility for production of **Various stabilized grades of Aq. Formaldehyde** with appropriate downstream infusion arrangement. Capability to produce

Aqueous Formaldehyde with concentration upto 55% **(AF-55)** will be an added notable feature of the **PLANT** being offered.

**1.4** The proposed **PLANT** is to be based on raw material feedstock **Methanol** which shall be made available by **APL** through road transport to the Project site.

The range of composition of the feedstock Methanol is given below :

**Commercial Grade "AA" quality of Methanol** shall be available for use as Raw Material for the Production of Aqueous Formaldehyde (**AF-37)**. Detailed Specifications are as under :

**COMMERCIAL GRADE 'AA' METHANOL**

| **Parameter** | **Value** |
|---|---|
| Methanol Percent | 99.85 Wt% Min |
| Aldehyde and Keytone as Acetone | 0.003 Wt % Max |
| Acetone | 0.002 Wt % Max |
| Ethanol | 0.001 Wt % Max |
| Acidity (As Acetic Acid) | 0.003 Wt % Max |
| Appearance and Hydrocarbons | Clear and Colourless |
| Carbonizable Substances | Not darker than standard No.30 |
| Colour | Not darker than standard No.5 |
| Distillation range | Not more than1$^{o}$C and shall include 64.6 ± 0. 1$^{o}$C at 760 mm Hg |
| Specific gravity | Max 0.7928 at 20$^{o}$C / 20$^{o}$C |
| Non Volatile Content | 1.0 mg / 100 ml Max |
| Odour | Characteristics, Non – residual |
| Per manganate Fading time | No discharge of colour in 30 minute Min |
| Water Content | Wt % 0.10 Max |
| Iron | 0.002% W/W Max |

**1.5** The **PLANT** is to be designed to be able to deliver the guaranteed product quality at guaranteed raw material / utility specific consumption levels and specified production capacity. The guarantees / warrantees of the bidder shall inter-alia include :

**a.** Guaranteed Product Quality
**b.** Specific Consumptions guarantees for raw materials' and utilities' consumptions per unit production
**c.** **PLANT** Capacity
**d.** Discharge of liquid and Gaseous effluents conforming to exceptable norms.
**e.** Design / Engineering warranty

**1.6** As mentioned at **Clause 2.3** of **Chapter–1**, Formaldehyde Production facility is to be designed and engineered along with the required **utility** and **auxiliary units**. The **PLANT** shall include (but not be limited to) the following units:

- ❖ Raw Water Intake, Pumping, Storage and Distribution Facility
- ❖ Raw Material Storage and Handling Facility
- ❖ Formaldehyde Production Unit (ISBL PLANT)
- ❖ Product Storage Facility and Products Dispatch Station
- ❖ Associated Utilities / Auxiliaries, viz.
- ✓ Steam Generation by Package Boiler (if required) and Steam Distribution Network
- ✓ De-Mineralized (D. M) Water Unit and D. M. Water Distribution System
- ✓ Cooling Tower and Cooling Water Treatment System and Distribution Network
- ✓ Instrument Air System including desiccant type Drying System, Receiver Storage and Distribution System
- ✓ Electrical Power Receiving facilities, substation and distribution Network including High Voltage (H.V.) Switchgear, Transformers including Lighting Transformers, Power Control Centres (PCCs), Bus Ducts, Diesel Generator (Emergency) Set, Motor Control Centres (MCCs), Capacitor Banks, Lighting Fixtures, Electrical Polls, Cables (Copper conductors), Heat Ventilation Air Conditioning (HVAC), Earthing equipment, Lightning arresters, Centralized Control Room including Distributed Digital Control System including marshaling cabinets, Uninterrupted Power Supply (UPS) System, Operator Change Rooms with lockers, Quality Control (Q.C.) Laboratory and Intercom Communication system.
- ✓ Fire Water Intake, Storage and Distribution System
- ✓ Fire Detection System
- ✓ Maintenance work shop including lathe machines, overhead cranes, cranes, tools and tackles, fork lifts
- ✓ Non Plant Buildings including Administrative, Technical Services, Workshop, Inventory / Materials Storage, Fire Station / First Aid Post, Factory Gate / Guard Posts .
- ✓ Sanitary installations
- ✓ First-Aid equipment
- ✓ Drinking water systems
- ✓ Hoists and mobile lifting equipment
- ✓ Furniture/fixtures
- ✓ Laboratory equipment
- ❖ Structures including gratings, handrails, cat ladders, toe plate, safety chains etc. as required
- ❖ Civil foundations for structures, pipe racks and process equipment / machineries of all the units comprising the Plant.
- ❖ Pipe Supports, turn buckles, spring supports etc.

**1.7** Power shall be made available at a (tentative) supply voltage of **33.0KV** (Detailed specifications of **Available Power** shall be provided by the **Project OWNER APL**), which will have to be hooked up to the power receiving and distribution network at Project site.

**1.8** As indicated at **Chapter–1**, River water is contemplated to be used for the Project. Specifications of River water for the Project shall be provided by the **Project OWNER APL**.

Necessary Scheme for bringing the Raw Water from the source for hook up and distribution at Project site shall be worked out and executed by the **LSTK CONTRACTOR.**

**1.9** As mentioned at **Clause 2.4 of Chapter–1**, the proposed **PLANT** would be located on an approximate lay **36,000 Square Metre Plot** at the proposed Project Site in Western Assam shall be provided by the **Project OWNER APL**. Based on the interaction with **APL** an indicative **plot plan** of the said **Formaldehyde PLANT Complex** shall be provided by the **LSTK CONTRACTOR.**

**1.10** The **PLANT** shall include an appropriate **effluent treatment** / **disposal** facility to ensure that all gaseous emissions and liquid effluents from the **PLANT** and related utilities conform to the **environmental regulations** of the **Ministry of Environment and Forests**.

**1.11** Plant design / engineering will have to conform to noise level, and steam exhaust statutory standards applicable to the region where the **PLANT** shall be installed.

**1.12** The design / engineering of the **PLANT** shall fully take in to account the **meteorological** and **hydrological** design information of proposed Project site.

**1.13** The design / engineering shall also take into account **topographical and geo-technical factors** of the site and the selected bidder shall be responsible for carrying out a complete **Geo Technical Survey** of the **PLANT Site** for determining whether piling shall be required or not and specifying the parameters for civil foundation designs including seismic factor etc.

**1.14** Process, Civil, Mechanical, Electrical and Instrumentation design standards to be followed in the design/engineering are spelt out in **Appendix–1**.

**1.15** The operating capacity turn-down ratio of the **PLANT** shall be at least **35% (Thirty Five percent)**.

## 2.0 DETAILED SCOPE OF WORK

**2.1** The Scope of Work of the successful bidder (**LSTK CONTRACTOR** for the **PROJECT**) selected by **APL**, shall include both Inside battery limit (**ISBL)** as well as Outside battery limit (**OSBL)** facilities for the operation of **200 TPD Formaldehyde PLANT** and is spelled out as under:

**2.2** **GENERAL**

**LSTK CONTRACTOR**'s Scope of Work shall include land development including leveling, fencing, storm water drains and road works including culverts, paving and tarring, civil foundations and Steel structure for piping racks and process equipment and supply of Process license, Know-How, Basic design, Detailed engineering, Procurement, Supply, Manufacture, Fabrication, Transportation of all equipment & material to site including loading, Unloading, Storage, insurance during transit, storage and construction, Maintenance, Construction and Erection of all civil, mechanical, electrical and instrumentation works, Installation, obtaining all necessary statutory approvals from concerned government authorities as applicable, Testing, Mechanical completion, Pre-commissioning, Commissioning, Performance guarantee test runs including total project management and handing over of new Formaldehyde Plant (Green field project) comprising Single stream **200 MTPD** Formaldehyde **PLANT** including all utility / auxiliary units required, to be located in Western Assam, for **Assam Petro-Chemicals Ltd**.

**2.3** The Scope of Work of the **LSTK CONTRACTOR** for the **PLANT** shall include but not limited to the following:

- Power and water required during the construction period will be arranged by the contractor.
- The Material of Construction for critical items should be as mentioned in **Appendix-2** or better.
- Geo Technical Survey of the Site
- Compilation of meteorological data
- Preparation of exhaustive Design Basis
- Grant of License and Transfer of Know How.
- Basic Design.
- Detailed Engineering.

- HAZOP Study and implementation of its recommendations.
- Drawings and Documents with necessary software and hardware.
- Procurement of all equipment / machinery & materials.
- Assistance to the **OWNER** Government / Statutory clearances.
- Preparation of Project Master Schedule on PERT / CPM basis using Primavera software
- Supply of erection / commissioning and two years operation Spares parts
- Construction Tools.
- Shipment, Transportation and Storing of equipment at site. Insurance during Transit, storage and construction.
- Inspection & Expediting.
- Construction & Erection of all civil & structural items, mechanical, electrical, & instrumentation works.
- Project Planning, Scheduling & Monitoring
- Quality Assurance & Quality Control
- Safety and Plant Security.
- Pre-Commissioning.
- Achieving guaranteed completion point heralding Mechanical Completion of the **PLANT**
- Start Up and Commissioning.
- Demonstration of Performance Guarantees by conducting appropriate and adequate Test Runs
- Laws and Regulations compliance.
- Progress Monitoring and Reporting.
- Submission of Technical Information.
- Supervision of work of LSTK CONTRACTOR's Sub-Contractor.
- Training of Owner's Personnel at extra cost as agreed.
- Co-ordination with all organizations concerned with implementation of the project.
- Payment of all applicable Taxes and Duties etc.
- All Design features should be as per relevant standards and a list as **Appendix-1** is enclosed for reference.

## 2.4 ROLE OF LSTK CONTRACTOR AT A GLANCE

### a. SUPPLY OF LICENCE / KNOW-HOW

**LSTK CONTRACTOR** shall arrange to grant License to Owner for operation of plants from the supplier of Process Technology for Formaldehyde Plant.

### b. PROCESS DESIGN & BASIC ENGINEERING

Preparation of Process Design and Basic Engineering Package for the plant shall include all the details that may be necessary and sufficient to permit a competent Engineering and Construction Company to prepare the detailed mechanical design/drawings for construction and operation of the plant. Such technical information and the process design and basic engineering package shall be established in the English language and submitted.

### c. PREPARATION OF DETAILED ENGINEERING DOCUMENTS

Preparation of Detailed engineering documents for process compliance (list of such mandatory review documents shall be provided by **LSTK CONTRACTOR**).

### d. PIPING & INSTRUMENT (P&I) DIAGRAM

Piping & Instrument (P & I) Diagram after HAZOP Study.

## 3.0 DETAILED SCOPE OF BASIC ENGINEERING SERVICES

## 3.1 ENGINEERING DESIGN SPECIFICATIONS

The Engineering Design Specifications shall comprise of technical data and information required for the Detailed Design and Engineering, Procurement/supply of Equipment and Material, Construction, Pre-Commissioning, Start-up and Operation of the Process Unit. Such information shall be prepared for each Process Unit separately and independent of other Process Unit. It shall include, but not limited to the following :

- ❖ Basis of Design.
- ❖ Optimized Heat and Material Balance.
- ❖ Detailed Process Description.
- ❖ Piping and Instrumentation Diagrams (P & IDs).
- ❖ Basic control schemes and interlocking requirements to have safe and efficient operations.

- Specifications and properties of Feed and Product for Process Unit.
- Specifications, Quantities and Points of emissions and effluent and respective procedures for safe treatment of emissions and disposal of effluent streams economically. Similar details for solid waste and its management shall also be furnished.
- Physical and Chemical properties of major flow streams.
- Battery Limit definitions and conditions for various streams coming to and leaving of Process Unit.
- Design calculation results with respect to the Equipment, Piping and hydraulic design of Process Unit.
- Material specifications including corrosion allowance for effluent collection system.
- Specifications of the required utilities with allowable tolerances, giving minimum, normal and peak consumption figures with duration for Process Unit.
- Specifications, Properties and Consumption figures of all Catalysts, Chemicals and Consumables.
- Specifications, Quantities and Qualities of the Utilities which are generated in Process Unit.

## 3.2 BASIS OF DESIGN

**Basis of Design for the Process Unit shall include the following:**

- Introduction, Function and scope of the Process Unit, Site location and existing facilities.
- Definition and Description of Process Design Case.
- Process Design Criteria and Contingencies.
- Mechanical Design Criteria and Contingencies.
- Feed Specifications including Tests Methods.
- Utilities Specifications.
- Products – Specifications Start of run (SOR) & End of run (EOR) including Test Methods.
- Products – Expected Yields (SOR & EOR).
- Reactor's Yields (SOR & EOR) and Bed Temperature Profile (BPT) data (if applicable).
- Battery Limit Conditions.
- Chemistry of all reactions involved in the each Process Unit.

## 3.3 SAFETY ASPECTS AND REQUIREMENTS OF THE PROCESS UNIT

Specifications, Quantities, Properties and Locations of gaseous, liquid and solid wastes of the Process Unit and proposed procedures for safe disposal of wastes (Environmental requirements).

## 3.4 PROCESS FLOW DIAGRAMS AND PROCESS DESCRIPTION

Process flow Diagrams and Process description shall include :

- ✓ Required flow diagrams including necessary and sufficient information, data and detailed description, shall be provided individually for all sections of the Process Unit included in the plants.
- ✓ Detailed process description (based on Process and Utility Flow Diagrams) shall be provided giving technical information which would determine optimum operating conditions and all expected alternative operations.
- ✓ Detailed process description shall be submitted together with first issue of the process flow diagrams.

**The Process Flow Diagrams shall contain at least the following information:**

- ✓ Operating temperature, Pressure, Total flow rates, Composition, Vapour and liquid flow rates' content and composition.
- ✓ Process lines (marked with stream numbers) showing direction of flow and all interconnections between the Process Unit/Units.
- ✓ **Process controls with all active control loops.**
- ✓ All lines essential for understanding the mass balance around each piece of equipment shall be shown.
- ✓ **All units shall be given in SI or metric system.**
- ✓ **Feed tray locations, number of trays and their efficiency, type of packing and side draw-off location.**
- ✓ **Type of the heat exchangers and indication of shell and tube side**

Streams essential towards an understanding of the mass balance shall be numbered and a table on the same diagram provided including the Componential molar flows, Mass flows, Mole percent, Molecular weight, Pressure, Temperature, Enthalpy, Density or Specific gravity, Specific heat and Viscosity and other thermodynamic data which will be used in the process design of the Process Unit for each numbered stream at actual flowing condition. Operating Temperatures and Pressures shall additionally be provided for equipment.

## 3.5 BLOCK FLOW DIAGRAM

Overall schematic diagram of Process Unit showing process sections and major Equipment. For each of the Process Unit terminal material balances shall also be shown individually as a table on the same diagram.

## 3.6 MATERIAL AND HEAT BALANCE SHEETS

For each stream number shown on the Process Flow Diagrams, the material of each Process Unit. and heat balance shall be specified indicating the stream properties Flow rate, Composition, Phase, Temperature, Pressure, Operating and Standard specific gravity or density, Enthalpy, Specific heat, Viscosity, Molecular weight for gases and vapours and all other thermodynamic information and data as are used and applied in the Basic Design.

## 3.7 CATALYSTS AND CHEMICALS

Following information shall be submitted :

- ✓ Consumption figures.
- ✓ Physical and Chemical and Qualitative properties including all thermodynamic data as required for design and operation.
- ✓ Material safety datasheet and disposal procedures for hazardous materials.
- ✓ Loading, unloading and make-up procedures.
- ✓ Detailed regeneration procedures, if applicable.
- ✓ Shelf life.
- ✓ Any specific warehousing requirements

## 3.8 UTILITY DATA, SUMMARY AND DIAGRAM

Utility data, Summary and Diagrams including all necessary and sufficient information, Data and Specification and Detailed description, shall be provided individually for the Process Unit.

**Utility data and summary list** shall include Fuel, Electrical power, Steam, Condensate, Boiler feed water, Cooling water, DM water, Nitrogen, Plant air, Instrument air, Fire water, Refrigerants etc. shall give schedule of estimated quantities for producer / user, totaling up to the maximum estimated utility quantities for the Process Unit.

This overall maximum shall be for one consistent case for each utility, where the estimated maximum utility quantity for a particular item of equipment is not part of this consistent case, this maximum shall be stated separately.

**Emergency utilities requirement** (type, duration, condition and flow rate) shall be indicated with identification of producer / user. Minimum, average and peak consumption figures for utilities shall be indicated as well.

**Simplified schematic diagrams** showing the Process Equipment, Utility producer / User mass flow, Operating Temperature and Pressure within the Process Unit and major instrumentation for operation of the system. These shall include the following:

- ✓ Process water distribution.
- ✓ DM water distribution.
- ✓ Cooling water distribution.
- ✓ Fire water requirement & distribution.
- ✓ Refrigeration and Chilling Distribution System, if any.
- ✓ Boilers feed water and steam distribution, condensate recovery, gathering and return.
- ✓ Effluent gathering system.
- ✓ Chemical feed distribution.
- ✓ Plant air and instrument air distribution.
- ✓ Battery Limit piping arrangement and Yard piping diagram

**P&I Diagrams for utility / auxiliary units** shall show all Process Equipment and Piping, Instruments and control systems, for all anticipated operating conditions (Start-up, Normal operation, Shutdown and Emergency conditions etc.). Number and sizes shall be indicated for Valves, Check valves and Safety valves. The extent of steam and/or electrical tracing and the extent and type of insulation shall also be shown. Such details as Steam-out and purge connections, Process equipment vents and lines for alternative operations and start-up/shutdown shall be shown. Utilities shall be shown entering or leaving each Process Unit/Units including distribution of each utility to all utility user/producer together with utility control systems specific to that user/producer.

Definitions of Piping and Instrument Diagram symbols (which shall be in accordance with Owner's requirements) and abbreviations used shall be provided on legend sheets of P&IDs. The said **P&I Diagrams** shall inter alia include but not be limited to the following :

- ✓ All Process Equipment including installed stand-by equipment.
- ✓ Line size and line identification including material specifications for all lines. For inlet and outlet lines of safety valves only preliminary sizes will be given and final sizes will be shown in Detailed Engineering P&IDs.
- ✓ Insulation requirements of lines (Heat conservation, Process stabilization or "not insulated") shall be shown on the P&IDs Steam, hot Equipment title and number.
- ✓ Relevant trays columns and all internals in vessels shall be shown.
- ✓ All nozzles on columns, heat exchangers, vessels and tanks and all Required line slope, relative location of equipment or special conditions such as required vertical loop dimensions, gravity lines with or without pockets, etc.

- ✓ Vents and drains required for process or operating reasons (not hydraulic testing).
- ✓ Water or solvent tracing of lines and instruments.
- ✓ Gas or liquid purging or flushing of control valves, instruments or relief valves, including their inlet and outlet isolating valves.
- ✓ All start-up, by-pass, shutdown and emergency lines and lines for anticipated alternative operations.
- ✓ All instruments required for proper operation of the Process Unit.
- ✓ Instrumentation control loops including interlocks, sequence and emergency shutdown.
- ✓ Control valves response on air failure (fail safe philosophy shall be adopted in design).
- ✓ Instrument tag numbers.
- ✓ All details shall be consistent with the appropriate process flow diagram and other process documents.
- ✓ Process specific installation position of piping components (if applicable).
- ✓ Kind and item number of special components.
- ✓ Battery limits of the Process Unit
- ✓ Measuring and control signals transmission.
- ✓ Flow direction of signals when combining several measuring and control circuits
- ✓ Electrical consumers other than motors, such as electrical heat tracings and heating systems.
- ✓ Kind of signal or specific representation of signaling lines, such as pneumatic, electric, hydraulic, function line, capillary tubing.
- ✓ Principal separate able connections (e.g. Flanges, Spectacle blinds).
- ✓ Sample connections.
- ✓ Size and set pressure of safety valves and their inlet and outlet isolating valves and rupture disks.

## 3.9 PLOT PLAN

This shall be a plot plan based on **LSTK CONTRACTOR'**s Know-how, Requirements of Normal and Emergency operation, Safety and Maintenance requirements including heavy crane movements. It shall include Preliminary layout of control room, Analyzer room, Substation, Laboratory, Equipment layout and location. **LSTK CONTRACTOR** shall suggest the areas required for storage of Feed, Chemicals, Intermediate Streams and Products and so on in addition to general storage.

The **Process Unit Plot Plan** shall be prepared with due consideration to the overall plot plan layout and interrelations of the Process Unit.

**LSTK CONTRACTOR** shall use all of the available know-how and techniques and shall do his best to propose Process Unit plot plan which is optimized from every respect.

## 3.10 EQUIPMENT LIST

This list shall show the equipment title, duty, size, tag number, type and quantity of each equipment including Design temperatures / pressures, Equipment characteristics, parameters or dimensions and material of construction.

## 3.11 EQUIPMENT DATA SHEETS

Specification sheets giving all Process and Mechanical design data required for designing the equipment, including turn down ratio.

Further specific design information shall be as follows:

### ❖ REACTORS

Specification sheets containing all data required with relevant sketches and drawings including all other information and data which are used and applied in the Basic Design and are necessary for operation of the Process Unit / Units.

The Information/Item which is marked by an asterisk (*), shall be supplied elsewhere in ENGINEERING DESIGN SPECIFICATION or OPERATING MANUAL.

**THE INFORMATION MAY INCLUDE:**

- ✓ Capacity.
- ✓ Design Temperature and Pressure.
- ✓ *Recycling ratio (Normal and Design conditions).
- ✓ *Reactor Pressure Drop (SOR & EOR).
- ✓ Reactor catalyst bed life.
- ✓ Catalyst, adsorbent resins, and its characteristics (as required for design).
- ✓ Reactor inlet and outlet operating conditions.
- ✓ *Reactor bed temperature profile (if applicable).
- ✓ Corrosion allowances.
- ✓ *Process fluid physical and thermodynamic properties (normal and design conditions at inlet and outlet).

### ❖ RECIRCULATION BLOWER

- ✓ Materials of construction.

- ✓ Corrosion allowance.
- ✓ Minimum, normal and maximum flow rates required considering all defined modes of operations.
- ✓ Special mechanical features required.
- ✓ Operating and Design Temperatures and Pressures, Physical and Thermodynamic Properties at Inlet and Outlet.
- ✓ Control requirements and Safety device.
- ✓ Suction and discharge conditions (Normal and Design).
- ✓ Specific Design and Fabrication requirement.
- ✓ Estimated Efficiency and Hydraulic Power.
- ✓ Sealing Requirements.
- ✓ Type of Blower.
- ✓ Type of Driver.
- ✓ Estimated Power Consumption.
- ✓ Recommended RPM.
- ✓ Noise protection requirements.

❖ **PUMPS**

- ✓ Fluid Physical Properties.
- ✓ Alternative Specifications if necessary for specific service.
- ✓ Minimum, Normal and Maximum flow rates.
- ✓ Sealing Requirements.
- ✓ Suction and Discharge conditions.
- ✓ Specific Design and Fabrication requirements.
- ✓ Operating and Design Temperature and Pressure, Physical and Thermodynamic Properties.
- ✓ Estimated Efficiency and Hydraulic Power.
- ✓ Flushing requirements.
- ✓ NPSH required.
- ✓ Materials of Construction (MOC).
- ✓ Corrosion allowance.

**TYPE AND SPECIAL FEATURES REQUIRED**

- ✓ Type of Driver.
- ✓ Recommended RPM.
- ✓ Principal requirement for Operation Control (Minimum from spill back).
- ✓ Estimated Shut-off Pressure.
- ✓ Estimated Power Consumption.

## ❖ VESSELS, COLUMNS AND INTERNALS

Data sheet including standard process sketch and tray/packing specification shall be provided showing:

- ✓ Process vapor / liquid loading.
- ✓ Maximum Operating Temperature and Pressure.
- ✓ Mechanical Design Temperature and Pressure.
- ✓ Pressure drop.
- ✓ Materials of Construction (MOC) and corrosion allowance.
- ✓ Foaming characteristics (if any).
- ✓ Diameter and height or length.
- ✓ Number, type and spacing of beds for columns.
- ✓ Packing material, if required.
- ✓ Number, size, rating and location of nozzles (Location of nozzles with respect to special height requirements).
- ✓ High and low liquid levels.
- ✓ Jacketing, if any.
- ✓ Fluid Physical and Thermodynamic Properties (Density, K value, Enthalpy, Critical properties, Viscosity, Liquid Surface Tensions, and etc).
- ✓ Any Special surface finish requirement.
- ✓ Insulation Requirements.
- ✓ Type, Number and Efficiency of trays.

❖ **Details for Columns, including tray layout and tray pressure drop. (to be confirmed by Vendor) shall also include :**

- ✓ Fatigue analysis requirement (Operating cycles)
- ✓ Shutdown conditions (if applicable)
- ✓ Vacuum condition (Pressure and Temperature).
- ✓ Internal details.
- ✓ Tray and packed beds process loading data.
- ✓ Tray/packed bed loading profile (if required for detail design).
- ✓ Skirt height.
- ✓ Details of special internals such as Pans, Distributors, etc.
- ✓ Mist eliminators, Supports, Mesh or Packing, etc.
- ✓ *Basic recommendation for spares for Commissioning and 2 years operation.
- ✓ Instrumentation requirements.

❖ **HEAT EXCHANGERS (all types)**

- ✓ Data sheets giving all Process and Thermal Design of all heat exchangers with relevant sketches and drawings including but not limited to the following:
- ✓ Operating and Design Pressures and Temperatures (Inlet and Outlet).
- ✓ Surface areas.
- ✓ Heat load and Fouling factors.
- ✓ Limiting transfer rates where applicable
- ✓ Limiting Viscosities and Pour points.
- ✓ Specific Design and Fabrication requirements.
- ✓ Tube and Baffle arrangement (if applicable).
- ✓ Permissible Pressure drop.
- ✓ Material of Construction (MOC).
- ✓ Corrosion allowances.
- ✓ Fluid properties such as Specific heat, Boiling Temperature, Thermal Conductivity, Density, Surface tension, Vapor and Liquid enthalpy, Critical properties and etc.
- ✓ Any specific foundation requirement.
- ✓ Nozzle location (if applicable) and Gasket material.
- ✓ The Exchanger type and Configuration to be specified via relevant standard data sheet.
- ✓ Mean Metal Temperature of tube side component of the Shell & Tube heat exchanger (if applicable).
- ✓ For Tubular Exchangers, Vibration analysis to be indicated by LSTK LSTK CONTRACTOR.
- ✓ Instrumentation requirement.

## 3.12 INSTRUMENTATION

The following documents shall be compiled under the same numbers and titles:

- ✓ Control philosophy description and drawing: explaining and showing the concept of DCS/PLC/ESD, local panels and packages control system regarding design basis and monitoring/control, remote/local, master/slave, dedicated/shared systems aspects, start-up location, systems location and interconnection.
- ✓ Specification for DCS/PLC/ESDS.

❖ **SPECIFICATION FOR INSTRUMENTATION.**

Specifications for instruments shall include :

- ✓ Cause and effect diagrams showing electrical and instrument interlocking and trip requirement.

- ✓ Sequence and interlock (normal and safety) description as well as simplified logic diagram/flowcharts according to IEC 6 1131.3.
- ✓ Preliminary Alarm and Trip set points.
- ✓ List and Specification for Special Systems/Instruments and requirements.
- ✓ Electrical Power and Air Consumption for Instrumentation.
- ✓ Control room general information regarding HVAC, Fire Alarm, Fire Fighting Systems, etc.
- ✓ Preliminary control room layout.
- ✓ Preliminary console front arrangement.
- ✓ Basis requirements for DCS Configuration: including Special displays, Grouping for displays, reports etc.
- ✓ Instrument index including Tag no's, Service, Process conditions, Type, Size, Range, Alarm/trip set points, P&IDs No., reference to other documents etc.
- ✓ DCS/PLC/ESDS I/O summary.

## ❖ INSTRUMENT DATA SHEETS

Instrument data sheets shall include the following information:

- ✓ Tag number
- ✓ Name
- ✓ Service
- ✓ Equipment or Line number
- ✓ P&IDs Number

**All data which is necessary for sizing, selection and specifying the instrument such as:**

- ✓ Stream data in Minimum, Normal and Maximum or other Specific operating conditions (to ensure proper range ability, reading and control).
- ✓ Vaporization across Valves, Sealing, Purging or Flushing requirements including any special process design considerations such as pour point.
- ✓ Consideration and recommendation regarding Explosion, Corrosion/Erosion effect, Toxicity and Suspended particles of process medium.
- ✓ Response time.
- ✓ Leakage class.
- ✓ Accuracy (according to process requirements).
- ✓ Type of Instrument (Principle of Measurement code).
- ✓ Preliminary Size and Range.
- ✓ Material of Construction (MOC).
- ✓ Impulse line and Instrument Casing Heating/Insulation requirement.
- ✓ Relief valve, Rupture disk, Breather valve summary.

A summary of the loads from each relief device shall be provided for each emergency condition under which the relief valve opens, e.g. fire, power and other utility failures, blocked-in condition etc. Relief and flow data summary sheets shall be provided.

## 3.13 ELECTRICAL

### ❖ GENERAL ELECTRICAL SPECIFICATIONS

The Specifications will provide sufficient information for Detailed Engineering and shall include the following :

- ✓ Specifications of Normal and Emergency Power supply and Electrical installation.
- ✓ Single Line Diagram (SLD) to be used as the basis for Detailed Engineering.
- ✓ Interlocking method with Instrumentation system.
- ✓ Plant Telecommunication system.
- ✓ Fire alarm system.
- ✓ Lighting system.
- ✓ Electrical consumers with indication of Estimated Power consumption except illumination.
- ✓ Consumers requiring Emergency Power Supply and its duration.

### ❖ CLASSIFICATION OF HAZARDOUS AREAS

Hazardous area classification shall include the following :

- ✓ Electrical area classification drawing showing the extent of hazardous areas (elevation and plan).
- ✓ List of Inflammable and flammable materials to be handled along with their properties such as Ignition temperature, Applicable gas group, etc.
- ✓ Equipment selection criteria for areas having Flammable and/or Inflammable materials.
- ✓ Energy requirement of Process Unit in Kilowatt hours per ton of product and the total expected power (kW) requirement with details of high/medium voltage and low voltage loads.
- ✓ Implications of power failure and recommended Plant's emergency supply scheme for all types of electrical loads which require emergency power.
- ✓ List of drives requiring emergency power feed along with their power consumption. Any specific requirement for lightning protection, where applicable.
- ✓ Main specifications of critical drives/variable speed drives and their controls (to be added in equipment data sheets).

❖ **UNINTERRUPTED POWER SUPPLY SYSTEM (UPS)**

Following details shall be provided:

- ✓ Total load.
- ✓ Reacted voltage and permissible variation. Duration for which UPS system shall be designed.
- ✓ Step load/permissible voltage dip.
- ✓ In-rush current in worst case.
- ✓ Load power factor.
- ✓ Redundancy, if needed.
- ✓ Any specific requirement of type/material of conductor to be used for grounding, (if applicable).
- ✓ Details of the preventive measures or means to be furnished for type of cables and their insulation cover, (if applicable).
- ✓ List of drives requiring acceleration features to ensure faster start-up and/or to minimize Plant shutdown time in case of process disturbances due to momentary voltage dip or brief interruption (5-10 sec.) in normal power supply.

## 3.14 PIPING

- ✓ Piping lay-out plans shall be provided indicating the critical areas of piping including general arrangement of piping in plan view.
- ✓ General specification for piping material including pipe classifications according to process requirement for Process, Utility and Service lines included in entire Plants.
- ✓ Typical Piping specifications (for each classification).
- ✓ Special Insulation requirements for critical piping.

## 3.15 PIPE CLASS SUMMARY (BASIC PIPING SPECIFICATION)

A summary of piping class for all the process, utility and service lines for entire Plants shall be provided. A standard process, utility and service lines summary shall include:

- ✓ Piping material specifications and ratings.
- ✓ Flange material and ratings.
- ✓ Design pressure and temperature.
- ✓ Gasket types and bolting.
- ✓ Corrosion allowances.
- ✓ Valve types, size, material and rating.

- ✓ Type of fluid.
- ✓ Fittings.
- ✓ Strainers.
- ✓ Expansion joints.
- ✓ Check valves.

## 3.16 LINE LIST

Line index keyed to line numbers on piping and instrument diagrams showing Line numbers, Line size, Class, Design and Operating data, Type of insulation, Flowing phase, Pressure drop per unit length, Flowing velocity, Extremities, to be provided.

## 3.17 OTHER REQUIRED INFORMATION

Any other documents or data which are reasonably necessary to perform the detailed design, Procurement and construction, Pre-commissioning, Commissioning, Start-up and Operation of the plants.

Estimated Manpower requirement with number and qualification for start-up and normal operation of the Process Unit to be submitted.

## 3.18 LSTK CONTRACTOR'S ENGINEERING DESIGN SPECIFICATIONS AND DRAWINGS

Any specific Standard Specifications, Instructions and Procedures which **LSTK CONTRACTOR** deems necessary to be taken into account for Detailed engineering, Procurement, Design and Manufacturing of the equipment, Transportation and Erection, Pre-Commissioning, Commissioning, Start-up and Operation of the Plants shall be pointed out and to be included in the **ENGINEERING DESIGN SPECIFICATIONS.**

## 3.19 EFFLUENT TREATMENT

**LSTK CONTRACTOR** shall provide Basic design Inputs/ Outputs data and information for treatment of Process Unit effluents with due regard to type, quantity and composition of the effluents and waste disposal (which is to be prepared and included in the respective **ENGINEERING DESIGN SPECIFICATION**) considering specific requirements of Assam Pollution Control Authority, and as are necessary for Design and operation of effluents and waste disposal system.

## 3.20 SAFETY

**LSTK CONTRACTOR** shall perform the Hazard Analysis, and Operability (HAZOP) using PFD and P&ID together with Plot Plan and Equipment data sheets and Safety-related equipment checklist. **LSTK CONTRACTOR** shall provide information about the reported accidents in similar Plants in the world during **HAZOP** meetings.

**LSTK CONTRACTOR** shall also undertake the following activities :

- Geo Technical Survey of the Site
- Boundary wall, Land development, Site preparation, Leveling, Paving, Tarring, Roads and Culverts etc.
- Recommendation for Fire-fighting facilities required for the Process Unit and Rate of water/foam required, cooling or deluge system (sprinkler system) and identification of the areas which require it.
- Recommendation for fire-fighting facilities for control room. Recommendation for firefighting for all buildings and facilities which need firefighting facilities.
- Recommendations for Handling/Storage of various Chemicals, Catalysts, Adsorbents Resins and etc.
- Proposed methods of Fire fighting for different types of fires and for different areas.
- Whether or Not shutdown of specific Process Unit/Units or Plants is necessary in case of any type of fire.
- Any other Specific safety requirements.

## 3.21 HAZOP STUDY REPORT

**LSTK CONTRACTOR** shall carry out **HAZOP** study through an independent agency specialized in this field, implement its recommendations and submit **HAZOP** Report for the approval of the Owner during following stages:

- Basic Design and Detailed Engineering.
- Construction, Erection and Mechanical Completion.
- Plant Start-up and Commissioning.

# 4.0 SCOPE OF DETAILED ENGINEERING SERVICES

## 4.1 GENERAL

The minimum requirements for Detailed Design and Engineering of the Plants shall be according to Standards, Specifications and Procedures. **LSTK CONTRACTOR** shall

prepare/provide all the drawings and documents as detailed below. Coordination shall be done through Owner for the Plants to ensure uniformity and standardization of Engineering, Designs and Specifications of all major Equipment, Piping, Mechanical parts, Instrumentation, Electrical items, Insulation, Painting and other bulk materials. This would minimize spare parts and facilitate operation and maintenance of the Plants.

## 4.2 DRAWINGS AND DOCUMENTATION

### GENERAL

**LSTK CONTRACTOR** shall prepare/provide all such Drawings and Documentation which shall be necessary for performing the procurement of Equipment and Materials, Construction, Pre- commissioning, Commissioning and Operation of the Plants.

The above drawings and documentation shall include, but is not limited to the following:

### ❖ PROCESS UNIT DETAILED PLOT PLAN

- ✓ **LSTK CONTRACTOR** shall prepare/provide detailed plot plan for Process Unit based on overall Plot Plan of the Complex. Detailed plot plan shall be to the scale and shall show exact location of each equipment with their Tag number, Interconnections between the equipment, Configuration of pipe racks, access ways, Sewerage and Trenches inside the Process Unit.
- ✓ The Detailed Process Unit plot plan including shall be prepared taking into account, Package unit detailed layout (through vendor), battery limit connections all of the Process and Utility lines (Incoming and outgoing) etc. with easy operation and maintenance of each individual equipment and accessories and parts included in the Process Unit.

### ❖ UNIT LIMIT DRAWINGS

**LSTK CONTRACTOR** shall prepare the Process Unit limits' drawings showing details of all over ground and underground interconnections at Battery limit (Process and Utility Incoming and Outgoing lines) for the Process Unit.

### ❖ PIPING & INSTRUMENTATION DIAGRAMS

These drawings shall show all Process Equipment and Piping, Instruments and Control systems, for all anticipated operating conditions (Start-up, Normal operation, Shutdown and Emergency conditions and etc.). Sizes shall be indicated for Valves, Check valves and

Number and Size for safety valves. The extent of Steam and/or Electrical tracing and the extent and type of insulation shall be shown. Such details as Steam out and Purge connections, Process equipment vents and lines for alternative operations and Start-up/Shut-down shall be shown. Utilities shall be shown entering and leaving the Process Unit including distribution of each utility to all utility users and/or producers together with utility control systems specific to that user and/or producer. Definitions of Piping and Instrumentation symbols used shall be provided on a cover sheet for Process Unit P&I Diagrams.

**PIPING AND INSTRUMENTATION DIAGRAMS SHALL INCLUDE:**

- ✓ All Process Equipment including installed stand-by equipment.
- ✓ Line size and Line identification for all lines.
- ✓ Insulation requirements of lines (Heat conservation, Personnel protection, Process stabilization).
- ✓ Equipment Title and Number.
- ✓ All nozzles on Columns, Vessels, Heat exchangers and Tanks and all trays in columns and all internals in vessels shall be shown.
- ✓ Required line slope, Relative location of equipment or special conditions such as required vertical loop dimensions, Gravity lines with or without pockets, etc.
- ✓ Vents and Drains required for process or operating reasons (not hydraulic testing).
- ✓ Steam, Hot water or Solvent tracing of lines and instruments.
- ✓ Gas or liquid purging or flushing of control valves, Instruments or relief valves.
- ✓ All Start-up, By-pass, Shutdown and Emergency lines.
- ✓ All Instruments required for proper operation of Process Unit.
- ✓ Instrumentation control loops including Interlocks, Sequence and Emergency shutdown.
- ✓ Control valves response on air failure.
- ✓ Instrument tag numbers.
- ✓ All details shall be consistent with the appropriate Process Flow Diagram and other process documents.
- ✓ Process specific installation position of piping components.
- ✓ Kind and Item number of special components.
- ✓ Battery Limits and Limits of Process Unit.
- ✓ Measuring and Transmission of control signals.
- ✓ Flow direction of signals when combining several measuring and control circuits.
- ✓ Electrical consumers other than motors, such as heating systems.
- ✓ Kind of signal for specific representation of Signalling lines, such as Pneumatic, Electric, Hydraulic, Function line, Capillary tubing.
- ✓ Principal separable connections.

- ✓ Start-up, Normal and Emergency shutdown, Catalyst regeneration, Catalyst/Chemical/Resin loading, unloading and Emergency provisions which shall be necessary for safe operation of the Plants.
- ✓ Sample points and details of sampling.
- ✓ Details of Pump flushing, cooling water, Drains, Vents, etc.

## 4.3 EQUIPMENT / MACHINERY

- ❖ Drawings and documentation shall include but not limited to the following:
- ❖ Engineering drawings and/or Specifications for each individual Equipment, Materials, etc.
- ❖ Equipment drawings and/or specifications for Towers, Reactors, Drums, Heat exchangers (all types), Heaters, Tanks and Non-code vessels and Machinery such as Compressors, Pumps, etc. containing sufficient information to enable equipment manufacturers to prepare detailed drawings for manufacturing of equipment.
- ❖ Equipment arrangement drawings.
- ❖ Detailed drawings and documents of equipment required for Proper erection, Pre-commissioning, Commissioning, Operation and Maintenance.
- ❖ Material requisitions containing all required Process and Engineering information and data and all necessary Standard Drawings and Specifications to permit the purchase of equipment. Material requisitions shall be up to date with all relevant and required information and data to enable any vendor to prepare and submit a proper quotation before final issuance for inviting bids.
- ❖ Stress analysis due to piping on equipment considering Temperature, Pressure and all other expected loads.
- ❖ Calculation result sheets of Vessel design (through manufacturer) and Calculation result of Thermal Stress of Piping, Structural design and so on.
- ❖ Equipment "Sketches and Data sheet" for Towers, Reactors, Drums, Heat exchangers (all types), Tanks and Non-coded Vessels and Machinery such as Compressors, Pumps, etc..
- ❖ Detail procedure for preservation of equipment during Short time and Long time of Non operation.
- ❖ Equipment List shall contain at least the following information:
- ✓ Item number (Tag number).
- ✓ Item descriptions including Duty, Design and Normal conditions.
- ✓ Overall dimensions of Equipment.
- ✓ Erection Weight of Equipment.
- ✓ Type of equipment (e.g. Centrifugal or Reciprocating pump; Tubular or plate heat Exchanger etc.) and Material of Construction (MOC).
- ✓ Tangent to Tangent length (for Vessels).
- ✓ Absorption and Rate of Power Consumption (Steam or Electric).

- ✓ Type (s) of Driver(s).
- ❖ Performance curves for Pumps.
- ❖ Project Engineering specifications for each Individual Equipment and/or Components including but not limited to Piping material and drawings, Electrical, Instrumentation, Insulation and Painting specifications incorporating of all requirements of Owner's and **LSTK CONTRACTOR**'s standard drawings and specifications.

## 4.4 CIVIL WORK, STRUCTURAL WORK AND BUILDINGS WORK

### ❖ SITE PREPARATION ACTIVITIES

Site preparation activities shall include preparation of general site grading design drawings including specifications and procedures to perform all Site preparation activities including land development and to make Site ready for next steps (e.g. foundation works) as under:

- ✓ **LSTK CONTRACTOR** shall Design and prepare construction drawings & specifications for all civil & steel structural works required to complete Formaldehyde Plant and associated RCC Cooling Towers and OSBL Units required as given in scope of work.
- ✓ **LSTK CONTRACTOR** shall Design and prepare construction drawings, specifications including procedures for construction of Pipe racks, Culverts and Retaining walls.
- ✓ **LSTK CONTRACTOR** shall Design and prepare road layouts and all other necessary drawings, specifications including procedure to build all roads within the Plants.

### ❖ SEWERS, DRAINS AND UNDERGROUND LINES AND PIPING

This will include the following :

- ✓ Preparation of schematic Sewer Layouts.
- ✓ Preparation of Sewer Flow Rate Diagram.
- ✓ Preparation of Detailed Underground layout drawings, Specifications including procedures required for construction. It shall show all Sewers, Manholes, Catch basins, Cable trenches, Electric cable road crossings and Underground normal and pressure piping etc, within the Plants.
- ✓ Preparation of Storm Water Drain Layout.
- ✓ Preparation of Detailed drawings for layout of Storm Water Drain.

❖ **FOUNDATIONS, CONCRETE STRUCTURES AND PAVING**

This will include the following :

- ✓ Preparation of Soil Improvement Schemes and Drawings.
- ✓ Establishment of loading data for foundation and equipment supporting structures.
- ✓ Piling specification design, Drawings and Construction procedures wherever required within the Plants.
- ✓ Preparation of all required Drawings for foundations of all Equipment and Machinery, Structures, Pipe racks, Buildings, Compressor shelters etc and all foundation drawings, specifications and procedures required for proper and efficient construction.
- ✓ Loading data and calculation results of foundation designs to be specified and submitted to Owner.
- ✓ Preparation of construction drawings specifications and procedures to build all reinforced concrete structures. Where supply of equipment requires the provision of items of civil engineering nature e.g. concrete sumps, **LSTK CONTRACTOR** shall undertake the design in accordance with vendor requirements.
- ✓ Preparation of Anchor bolt detail schedules, and specification.
- ✓ Construction drawings, specifications and procedures for all other civil work. e.g. Paving, Culverts and Trenches.
- ✓ Bills of quantities and specifications of materials for civil works (e.g. Reinforcing bars, Cements, Anchor bolts etc)
- ✓ Bar bending schedules.
- ✓ All detailed drawings, Specifications and Procedures required to perform all civil works of the Plants.

❖ **PLANT BUILDINGS**

This will include but not limited to :

- ✓ Preparation and submission of at least the following Documents/Drawings for construction of all plant buildings like sub-stations and control room :
- ✓ Building sketches, Layouts and Design drawings, Specifications and Procedures for construction of buildings.
- ✓ Project engineering specifications for construction of buildings.
- ✓ Detailed Architectural, Mechanical and Electrical drawings, required for construction of the buildings.

- ✓ Plan drawings for buildings, indicating skeleton with major dimensions.
- ✓ Design Structural, Mechanical and Electrical calculation results for all buildings.
- ✓ Bills of quantities and specifications for all required Materials for Construction of buildings.
- ✓ Requirements of the buildings for Air Conditioning.
- ✓ Requirements of the buildings for Firefighting and Fire protection.
- ✓ Requirements of the buildings for Fire alarm system.

❖ **STRUCTURES**

**LSTK CONTRACTOR** shall prepare and submit at least following documents / drawings on structure works :

- ✓ Complete arrangement drawings for Steel structures with all member sizes, Plan and framing elevation, Typical sections, and Details for preparation of shop detailed drawings and Fabrication work.
- ✓ Loading diagrams and calculation results for all structures.
- ✓ Steel structure drawings for Equipment supports, Racks, Platforms, Ladders and stairways, etc with sufficient details required for preparation of shop detailed drawings and fabrication work.
- ✓ Steel structure project engineering specifications and standard details for Hand rails, Equipment supports, Racks, Stairs, Cat ladders, Platforms, Fire proofing, etc.
- ✓ Material requisition for steel structures.
- ✓ Develop and design special members of structural steel which may become necessary for handling or supporting of special equipment and items during manufacturing, transportation and construction of the Plants.
- ✓ All required specifications including Procedures, Standard and Specification for manufacturing and construction of structures.
- ✓ Shop fabrication drawings.

## 4.5 PIPING

**LSTK CONTRACTOR** shall prepare at least the following documents / drawings for piping:

- ✓ Piping design, Fabrication, Erection, Testing and Flushing specifications.
- ✓ Piping materials classification and specifications for Process and various services in the Plants and **LSTK CONTRACTOR**s' requirement considering Corrosion, Erosion, High Temperature and High Pressure, all expected special conditions and etc.

- ✓ Piping arrangement for all pipes on the pipe racks included in the Plants.
- ✓ Cross-sectional drawings of all piping entering and leaving Process Unit Battery limits.
- ✓ Layout drawings.
- ✓ Isometric drawings, Fabrication, Erection, Surface preparation, Painting and Insulation in accordance with the specifications and procedures. Test pressure and it's media shall also be specified.
- ✓ Piping arrangement drawings for all underground piping included in the Plants.
- ✓ Detailed drawings and specifications for under-ground piping and its protection device.
- ✓ Detailed Piping arrangement drawings or Isometrics for Process, Utility, Instrument air and all other various services and Steam/Electric tracing in the Plants. These shall cover requirements for Pre fabrication, Fabrication, Erection, Pre-commissioning, Commissioning, Operation and Maintenance in accordance with the Approved for Construction P&ID's.
- ✓ Detailed drawings or catalogue drawings and specifications of Valves, Fittings, Traps, Safety valves, Control valves and all other piping components included in the Plants.
- ✓ Piping drawings for match lines (interconnections) at Battery Limit.
- ✓ Detailed piping drawings for Vent and Drains required for process and operating reasons in the Plants including hydraulic testing.
- ✓ Piping Drawings indicating location of required Supports, Anchors and guides, for all piping within the Plants.
- ✓ Steam tracing detail drawings and specifications. Such drawings shall contain all information, data and procedures required for Construction/Erection, Operation and Maintenance.
- ✓ Flexibility calculations and Stress analysis results for all piping systems as set out under Project Specifications including piping supports, especially for those systems subject to High Temperatures/Pressures and other loadings.
- ✓ Vessel trims and special support design.
- ✓ Colour coding of painting for piping suitable from safety and operation point of view.
- ✓ Initial, Intermediate and Final material take-off for all Piping materials, Components and items included in the Plants. These take-offs shall cover all required Piping materials, Components and items of the Plants, otherwise supplementary take-offs shall be performed up to complete fulfillment of the requirements.
- ✓ Material requisitions for all Piping materials, Components.
- ✓ Line lists showing complete line identification (Line size, Service, Unit No, P&ID No, Pipe class, Operating and Design Temperatures and Pressures, Type of Insulation and etc), Line extremities, Maximum Pressure, Maximum Temperature, Material flowing and it's condition (Vapour, Liquid, Mixture), Quantity, Velocity, Pressure drop per unit length, Density etc.

## 4.6 INSTRUMENTATION

**LSTK CONTRACTOR** shall prepare, but not limited to, the following drawings/ documents:

- ✓ Instrument index containing Tag no's, Service, Process conditions, Type, Size, Range, Alarm/trip set points, Manufacturer, Model No etc., P & ID No, reference to other documents etc.
- ✓ Systems Architecture (Hardware configurations) drawings.
- ✓ General specifications for Instruments, Control systems and accessories in respect of Engineering, Procurement, Manufacturing, Inspection, Construction and Operation. (One document for instrumentation overall practice and individual documents for further attachment to material requisitions).
- ✓ Sizing calculations.
- ✓ Instrument data sheets (for further attachment to material requisitions).
- ✓ Cause and Effect diagrams.
- ✓ Interlock and Sequence (ESDS and non ESDS) description and Logic diagrams / flow charts according to IEC – 61131.3.
- ✓ Alarm / trip set points.
- ✓ Loop sketches.
- ✓ Loop diagrams.
- ✓ Instrument hook-up drawings with material requirements.
- ✓ Instrument mounting drawings with material requirements.
- ✓ Instrument Cable tray / Ladder / Trench layout.
- ✓ Instrument location drawings (layouts) showing positions of Instruments, Junction boxes, Local panels, Cable routing, and Instrument air header take off valves and cables on trays / ladders and/or in trenches.
- ✓ Control / Auxiliary / Analyzer room layout, showing all necessary details including locations, cable entry and route, tray/trench details etc.
- ✓ Front view drawings of Control panels/Consoles with dimensions.
- ✓ Earthing layout for instrumentation system.
- ✓ Data required for Instruments/System Configuration such as I/O summary, Host Connection, Diagrams, Flow charts, Mathematics, Graphics, Layouts, Grouping lists, Ranges, Scales, Parameters, Set points, Colour codes etc.
- ✓ Instrument cable lists and schedules.
- ✓ Material take off (MTO) lists.
- ✓ Material requisitions, Bid evaluations and Purchase orders for Instruments/Systems and bulk materials.
- ✓ Instrument JB Diagram/Connection.

- ✓ Vendors technical drawings, Catalogues and Documents including Installation, Operation, Calibration, Configuration, Programming and Maintenance manuals for Instruments/Systems with illustrated parts lists.
- ✓ Instruments/Systems configuration documents including Device Description/ Capability files, Software details, Source and application programs etc.
- ✓ Panels/Consoles/Cabinets' internal layout.
- ✓ Panels/Consoles/Cabinets Interconnection block diagram with cable nos.
- ✓ Power supply distribution drawings.
- ✓ Interfacing diagrams/Philosophy between control systems and MCC.
- ✓ Termination and Wiring diagrams as well as hardware configuration for construction and troubleshooting purposes.
- ✓ Tests, inspections and QC certificates and reports.
- ✓ UPS Power consumption for Instruments.
- ✓ Connection between Auxiliary and HMI Interface.

## 4.7 ELECTRICAL

**LSTK CONTRACTOR** shall prepare/provide, but is not limited to the following drawings/documents for electrical works:

- ✓ Area classification drawings.
- ✓ Schematic One-Line Diagrams of Power wiring and Instrument power supply.
- ✓ Load summary and analysis.
- ✓ System design including Voltage profile, Reacceleration.
- ✓ Relay Setting Schedule.
- ✓ Grounding System layout.
- ✓ Communication and paging system and their respective specifications.
- ✓ Lightning protection system design, layout and general specifications indicating any special requirement in the entire Plant.
- ✓ Telephone system design layout and general specifications.
- ✓ Emergency supply including Uninterrupted Power Supply system design and specifications.
- ✓ Battery charger specifications and Storage battery capacity requirements.
- ✓ Complete Fire alarm system design, Layout, Details and Specifications.
- ✓ Schematic Wiring diagrams for all Circuit breakers and Electrical items having internal wiring or relays.
- ✓ Cable schedules and Routing showing the Service, Type, Size and Number of cores.
- ✓ Complete list of Starters with sufficient Capacity and specifications for each.
- ✓ Complete list of Switchgear with sufficient capacity and specifications for each and all categories.

- ✓ Layout of Switchgear rooms.
- ✓ All Lighting, Earthing, Control station and other miscellaneous equipment fixing and mounting details including specifications.
- ✓ Initial and final Material take-offs for all Electrical equipment, Accessories and materials.
- ✓ Material requisitions for all Electrical accessories, Equipment and Materials including heat tracing material, if any
- ✓ Design, Drawings and Specifications for materials required for electric heat tracing (if any).
- ✓ Detailed drawings and documents of Transformers required for Erection, Operation and Maintenance.
- ✓ Complete One Line Diagram covering all circuits from incoming lines to major equipment indicating Metering, Relaying and Main Interlocking Systems.
- ✓ Specifications of all electrical equipment and all electrical component and accessories showing Connection diagram, External view with Physical dimensions, Specifications of apparatuses and accessories and instruction manual in sufficient detail.
- ✓ Motor schedule showing Service, Number (Normal Operation and Stand by), Number of poles, Output capacity, Type, Classification and remarks indicating any special requirement.
- ✓ Impedance map and calculations results of fault current on every feeder bus bar.
- ✓ Calculation analysis and results sheets, Start-up detail (taking into account power consumption and requirements for start-up of motors) for large capacity motors, Line failure, Instant load transferring in case of important line failure and so on.
- ✓ Protection co-ordination curves in the whole electrical system, including protection in main substation.
- ✓ Block diagrams, Connection diagrams, Design philosophy and Instruction manuals for interlocking systems, Alarm system and other complicated Power and Control systems.
- ✓ Plot plan showing the location of major Equipment, Battery charger room and Classification of hazardous locations.
- ✓ Physical location of Lighting fixtures, Receptacles and wiring as well as their installation details, as per area classification.
- ✓ As their installation details.
- ✓ Engineering, Manufacturing, Inspection requirements, Construction/Erection, Pre-commissioning and Commissioning specification and procedures for all electrical components, Equipment, Accessories and Materials.
- ✓ Symbols
- ✓ Cable cutting schedule
- ✓ Cable orientation on Trays and/or Trenches
- ✓ Cable room tray orientation.
- ✓ Physical location of Electrical Equipment and Wiring installed and installation details.
- ✓ Physical location of Grounding electrodes, equipment to be grounded and wiring layouts as well.

## 4.8 INSULATION

**LSTK CONTRACTOR** shall prepare the following detailed documents as minimum requirements on insulations.

- ✓ Insulation specification and schedule for each vessel, tower, drum, heat exchanger, pipelines and so on indicating operating and design temperatures, type of insulation, service, thickness of insulation and insulation specifications including type and number of tracers all required drawings and procedures for construction/erection of insulation and all other related material to be provided.
- ✓ Wrapping requirements and specifications shall be provided in detail.
- ✓ Initial and final material take-off and requisitions, for pipe lines and equipment insulation material including wrapping and all other required material for insulation.

## 4.9 PAINTING

**LSTK CONTRACTOR** shall prepare the following documents as minimum requirements on painting:

- ✓ Painting schedule with references to the applicable Painting Specifications and Codes.
- ✓ Initial material take-offs.
- ✓ Methods and procedures of Surface preparation in detail.
- ✓ Methods and procedures of painting of Equipment and Material in the manufacturer workshop and at site in detail.

## 4.10 MISCELLANEOUS EQUIPMENT AND MATERIALS

**LSTK CONTRACTOR** shall prepare the following documents as minimum requirements :

- ✓ Specifications for Design and Fabrication, for other Equipment and Materials, Electric motors, Valves and all package units. These shall also include Catalyst, , Chemicals and Solid handling, , Chemical feed system fillers etc.
- ✓ Specifications and Procedures for Construction/Erection, Pre-commissioning, Commissioning and Operation (all expected modes) for all of the Equipment, Machinery and Materials named and specified in item 1 above in detail.
- ✓ Data sheets including all required information and data for all of the Equipment, Machinery and Materials named and specified in item 1 above in detail.
- ✓ Standard drawings for all of the Equipment, Machinery and Materials named and specified in item 1 above in detail (if applicable).

- ✓ Any other drawings which are necessary to prepare shop fabrication by manufacturer and assembly drawings for all of the Equipment, Machinery and Materials named and specified in item 1 above in detail.

## 4.11 VENDOR DRAWINGS & DOCUMENTS

**LSTK CONTRACTOR** shall provide at least the following vendor documents:

- ✓ Certified drawings for all equipment to be approved by **LSTK CONTRACTOR**. Vendor drawings shall include Foundation loading plans, General arrangement and detailed drawings.
- ✓ Construction Installation and operation instructions to be issued at least eight weeks prior to shipping of respective items, equipment, etc.
- ✓ Equipment dossier for Pressure Vessels, Columns, Drums, Silos and Heat exchangers, including Design Calculations, Welding procedures, Welding qualifications, Material Test Certificates, Inspection certificates, etc.
- ✓ Recommended spare parts list for Pre-Commissioning, Commissioning and 2 years operation.
- ✓ Performance test certificates for all rotating equipment for tests carried out at the manufacturer's shop. All inspection reports with necessary and sufficient information for all of the Equipment, Machinery and Materials to be submitted to Owner at right time to be reviewed and commented or Approved (wherever applicable) by Owner.
- ✓ Special measures to protect the Bearings, Shafts, Gears and other parts of rotating machines during Transportation, Storage at Site and against emergency (partial or total) shutdowns of the Plants, or as a result of a cut-off of steam or electric power, due to lack of oil or cooling water.
- ✓ Electrical and Instrument diagrams, wherever applicable.

## 4.12 HEAT TRANSFER EQUIPMENT DATA

The thermal and mechanical design information to be provided by **LSTK CONTRACTOR** shall at least include but is not limited to the following:

### ❖ PROCESS INFORMATION FOR EACH SHELL

### SHELL AND TUBE EXCHANGERS INCLUDING PLATE HEAT EXCHANGERS

The information shall include but not limited to the following:

- ✓ Type of shell side baffling, number of shell side baffles, baffle cut and baffle orientation.

- ✓ Flow rates (design and in different modes of operations) and required physical and Exchanger type and its Duty in design condition and different modes of operations including Shell and Tube side Inlet and Outlet Temperatures.
- ✓ Total Gross and Effective Heat Transfer Surfaces.
- ✓ Outside diameter, Wall thickness, Pitch type, Configuration and Length of tubes.
- ✓ Number of tubes and passes.
- ✓ Shell and tube side thermodynamic data for the fluids flowing in both sides.
- ✓ Shell pass configuration, inside diameter and length of the shell.
- ✓ Number, location and size of nozzle connections, tube sheet thickness, number and size of bolts.
- ✓ Calculated and allowable pressure drops (shell side and tube side).
- ✓ Heat transfer coefficients in shell and tube side as well as overall heat transfer coefficient.
- ✓ Calculation result sheets for all and any individual exchangers.
- ✓ Specific requirement, if any.
- ✓ Fouling factor, on both sides.

## ❖ MECHANICAL DESIGN INFORMATION

### SHELL AND TUBE EXCHANGERS

Mechanical Design Information, overall dimensions, diameters and elevations of exchanger and its supports and connections, scanting thickness of all pressure parts and major non-pressure parts with following details :

- ✓ Tube sheet layout and general arrangement drawings with sufficient details. Design and operating pressure and temperatures.
- ✓ Nozzle diameters and flange ratings.
- ✓ Weight of equipment empty and filled with water.
- ✓ Materials of construction of shell, tubes, tube sheet and other parts including corrosion allowances, shell wall thickness, tube sheet thickness, number and size of bolts.
- ✓ The weight of removable tube bundles.
- ✓ Insulation requirements, thickness, type and materials as well as painting materials and surface preparation.
- ✓ Any special requirements (e.g. seal welding).
- ✓ Any special manufacturing procedures to be followed by vendor.

### PLATE TYPE HEAT EXCHANGERS

- ✓ Exchanger process specifications e.g. flow rate, pressure drop, etc.

- ✓ Exchanger duty/heat transfer coefficient
- ✓ Adopted fouling factor/excess surface area (1)
- ✓ Type, area and number of flow plates (1)
- ✓ Plate thickness (1)
- ✓ Dimensional outline drawing (1)
- ✓ Mechanical calculation results
- ✓ Inspection reports including material certificates
- ✓ Maintenance instructions.
- ✓ Note: (1) To be provided by Vendor.

## 4.13 DRAWINGS AND DOCUMENTS ISSUED FOR CONSTRUCTION

**LSTK CONTRACTOR** shall provide, construction drawing/document stamped as "APPROVED for Construction" and shall be signed by a responsible person to confirm that the drawings/documents are certified in all respects and in all details. Drawings and documents issued by **LSTK CONTRACTOR** for construction purposes shall be sufficient from all respects and shall be so detailed in order to perform and execute all activities satisfactorily for construction/erection, pre-commissioning, commissioning and all modes of operations of the Plants, Machinery and Materials included in the Plants.

**LSTK CONTRACTOR** shall also provide complete set of technical procedures and specifications for satisfactory performance of the installation/construction/erection, pre-commissioning, commissioning and all modes of operations of all of the Equipment, Machinery and Materials included in the Plants.

## 4.14 SELECTION OF EQUIPMENT AND MATERIALS

### GENERAL DESIGN

**LSTK CONTRACTOR** shall carry out design and select Equipment and Materials (in accordance to the procedures specified in the Contract) which reflect up-to-date proven and established technology. Prototype designs shall not be acceptable.

### STANDARDIZATION

**LSTK CONTRACTOR** shall give close consideration to the need for standardization to restrict and minimize the number of types and sizes of the similar equipment, machinery, materials, parts, components and items in the Plants such as electric motors, machinery, control valves and/or some of their parts, accessories and components such as mechanical

seals and so on, in order to simplify maintenance and reduce spares requirements for the inventory at site.

## 4.15 LUBRICANTS, CHEMICALS, CATALYSTS, ADSORBENT, RESINS, ETC.

**LSTK CONTRACTOR** shall prepare and furnish to Owner lists of lubricants required for initial fill and two years operation, with consumption for all equipment which need lubricants, based on information from Vendors and approved Vendor list. **LSTK CONTRACTOR** shall also indicate equivalent lubricant brands available in India which can be used alternatively.

**LSTK CONTRACTOR** shall prepare and furnish to Owner lists of chemicals, resins, catalysts, adsorbents, solvents, refrigerants chemicals and other consumables necessary and required for efficient operations and all similar requirements for initial fill (if applicable) and two years operation, consumptions (wherever applicable) together with all necessary information and data.

## 4.16 OPERATION MANUAL

**LSTK CONTRACTOR** shall supply detailed Operation, Safety and Laboratory manual for all plants. The operation manual shall include detailed description of Pre-Commissioning; Commissioning.

Initial startup, Normal Operation, Shut Down and Emergency & Safety procedures .It shall also include suggested Log Sheets for recording plant operation and analytical data.

The Laboratory Manual shall include detailed description of analytical procedures, collection of samples, frequency of analysis etc. along with quality control for raw materials, intermediate and finished product. The manual shall include list of laboratory instruments/equipment and list of chemicals with their specifications.

# 5.0 PROCUREMENT, SUPPLY AND EXECUTION

**LSTK CONTRACTOR** shall be responsible for Procurement and supply of all equipment, machinery and materials (including bulk materials) for the main plant and related utilities like Cooling towers, DM water unit, Instrument Air Unit, Nitrogen Unit, Fire water & Fire Alarm system, Plant communication system, Methanol Storage tank, Product Storage Tanks, Loading/Unloading stations, Steam generation, Power receiving and Distribution system,

Laboratory and any other requirement for smooth and uninterrupted running of the **PLANT** including the following :

**All items as above will be procured from vendors with the prior approval of the OWNER on the list of VENDORS.**

- ❖ Preparation of procurement bid packages, floating of enquiries, evaluation of bids, preparation of bid summaries and recommendations, preparation of purchase orders and obtaining Vendor's guarantees.
- ❖ Providing Inspection & Expediting services.
- ❖ Providing assistance to various suppliers for arranging transportation and shipping of equipment / machinery / materials to the plant site.
- ❖ Preparation of erection / construction bid packages for selection of site construction / erection
- ❖ Preparation and supply of Network Schedules for all project activities including those of suppliers / vendors and sub-LSTK CONTRACTORs for progress monitoring.
- ❖ Providing erection / construction supervision and management services.
- ❖ Compliance with statutory laws and regulations of India.
- ❖ Observance of safety and security regulations
- ❖ Arranging practical experience / training for OWNER's personnel in a similar Plant/manufacturing facility.
- ❖ Providing pre-commissioning and commissioning supervision services.
- ❖ Providing post commissioning services at the option of OWNER.
- ❖ Performance of sustained load test and guarantee test runs of the main plant / utility / auxiliary units (i.e. the PLANT) to prove performance guarantees.
- ❖ Furnishing additional technical information and know-how as may be required for the operation and maintenance of the Plant and related utility / auxiliary units.
- ❖ Preparation and supply of drawings and documentation complete with as-built drawings in 8 sets including soft copies as required.
- ❖ Preparation and supply of quality control manual and safety manual.
- ❖ Responsibility of overall project management and coordination in accordance with the project master schedule.

## 6.0 GENERAL TERMS & CONDITIONS OF PURCHASE

Procurement and supply of all equipment / machinery / materials for the **PLANT** by the **LSTK CONTRACTOR** shall be carried out following **APL's** standard **"General Terms and Conditions of Purchase"** which shall be provided by the LSTK contractor and duly approved by **OWNER APL.**

**6.1** For all purchase, prior approval will be taken from the OWNER on the VENDOR'S list.

## 7.0 GENERAL DESCRIPTION OF LSTK CONTRACTOR'S RESPONSIBILITIES & PROJECT GUARANTEES

**7.1** Bidders should take note of the following general guidelines elaborating the scope of work to be entrusted to the selected **LSTK CONTRACTOR**, as well as some important features of the **PROJECT CONTRACT** to be entered in to by and between the **OWNER** and the successful bidder (**LSTK CONTRACTOR**).

## 7.2 PROJECT EXECUTION PHILOSOPHY

The project shall be executed under the full and complete responsibility of the **LSTK CONTRACTOR** commencing with the effective date of contract to be entered into by and between the **OWNER** and the **LSTK CONTRACTOR.**

**OWNERS'S REVIEW :**

- If OWNER requests changes, CONTRACTOR shall consider such changes. In the event such changes are not acceptable, CONTRACTOR shall give in writing its reasons for not accepting such changes and/or indicate implications due to such changes. It is understood that no change shall become effective until it has been mutually agreed in writing between OWNER and CONTRACTOR.
- Approval or acceptance given by OWNER shall not relieve CONTRACTOR of its obligations under CONTRACT, guarantee, warranty and liability.

## 7.3 CHANGES IN SCOPE OF WORK

**A.** OWNER may request for changes within the general scope of the CONTRACT by giving notice to CONTRACTOR and subsequently confirming it in writing. CONTRACTOR shall endeavour to accommodate such changes within the project cost and time schedule by considering various options for quantity adjustments, deletion or change in nature of related works and other possible technical changes in consultation with OWNER. If the suggested changes cannot be accommodated as above, and result in alteration of cost, time schedule for WORK , performance of PLANT or any of the other obligations of CONTRACTOR, CONTRACTOR shall within ten(10) days of receipt of such notice from owner, advise owner of related changes in the terms of the Contract. Owner may agree upon equitable adjustment in the terms so affected by the change.

**B.** No change in scope of WORK by CONTRACTOR shall be recognized unless it has the prior approval of OWNER in writing.

**C.** Requests by OWNER for making good omissions or setting right errors in the WORK carried out by CONTRACTOR or consequent to requirement of statutory regulations will not be treated as request for change in scope and such modifications are deemed included within the scope of CONTRACTOR's obligations under the contract.

**D.** OWNER and CONTRACTOR shall agree upon the basis and terms of the change in WORK in writing.

**E.** The CONTRACTOR may request for extension of time for the completion of works agreed upon if;

**F.** Any improvement/variation interferes in works / quality/quantity in such a manner that affects the progress of WORK and it cannot be accomplished in the period agreed upon.

**G.** For the application of above provisions, the CONTRACTOR shall make a request to the OWNER within 30 days from the date of occurrence of the cause in view of which the CONTRACTOR requests extension stating the full and exact details of any request for extension of time. Such requests may be investigated and granted in full or in part or otherwise by the OWNER.

## 8.0 PAYMENT TERMS AND PROCEDURE

OWNER shall pay to CONTRACTOR a lump-sum fixed CONTRACT PRICE, for the due and faithful completion of CONTRACTOR'S obligations under the CONTRACT including proving of PERFORMANCE GUARANTEES and ACCEPTANCE OF PLANT.

NOTE:- For foreign bidder quoting in U.S.Dollars (USD) the payments will be done in USD only.

**TERMS OF PAYMENT**

**The below mentioned in A, B and C are applicable in the payment terms even if not specified elsewhere.**

**A. ALL ADVANCES WOULD BE INTEREST BEARING.**

**B. FOR ALL ADVANCES BANK GUARANTEE EQUAL TO THE AMOUNT OF ADVANCE TO BE SUBMITTED.**

**Payment against License and Know how:**

**a)** 5% of the License and know how fee shall be paid as an advance to the CONTRACTOR on presentation of following documents.

**i)** CONTRACT copy duly signed by CONTRACTOR

**ii)** Invoice raised by the Contractor and Certified by APL.

**b)** 60 % on mile stone completion and on submission of License and Know-how with drawing and documents duly approved by the OWNER within 30 DAYS of submission of invoices. Detail milestone to be accompanied in the bid.

**c)** 15% on mechanical completion and receipt of operating manual and Engineering information for plant operation within 30 DAYS of submission of invoices.

**d)** 20% on final acceptance of the plant duly commissioned and certified by the OWNER within 45 DAYS of such certification.

**Payment against Basic / Design engineering:**

**a)** 5% of the Basic Engineering fee shall be paid as an advance to the CONTRACTOR on presentation of following documents.

**i)** Invoice raised by the Contractor and Certified by APL

**b)** 60 % on mile stone completion and on submission of invoices of Basic / Design Engineering, drawings and documents duly approved by the owner within 30 DAYS of submission of invoices. Detail milestone to be accompanied in the bid.

**c)** 15% on mechanical completion and receipt of operating manual and Engineering information for plant operation within 30 DAYS of submission of invoices.

**d)** 20% on final acceptance of the plant duly commissioned and certified by the OWNER within 45 DAYS of such certification.

**Payment against Detailed engineering:**

**a)** 5% of the, design & engineering fee shall be paid as an advance to the CONTRACTOR on presentation of following documents.

**i)** Invoice raised by the Contractor and Certified by APL.

**b)** 60 % on mile stone completion on submission of Detail Engineering with drawings and documents duly approved by the owner within 30 DAYS of submission of invoices. Detail milestone to be accompanied in the bid.

**c)** 15% on mechanical completion and receipt of operating manual and Engineering information for plant operation within 30 DAYS of submission of invoices.

**d)** 20% on final acceptance of the plant duly commissioned and certified by the OWNER within 45 DAYS of such certification.

**Payments against supply of indigenously procured items :**

**a)** 70 % against receipt of material at site and within 30 DAYS of submission of invoices.

**b)** 10% on mechanical completion of PLANT within 30 DAYS of submission of invoices.

**c)** 20% on final ACCEPTANCE OF PLANT and certified by the OWNER within 45 DAYS of such certification.

**Payments against supply of imported items:**

**a)** 70 % against receipt of material at site and within 30 DAYS of submission of invoices.
**b)** 10% on mechanical completion of PLANT within 30 DAYS of submission of invoices.
**d)** 20% on final ACCEPTANCE OF PLANT and certified by the OWNER within 45 DAYS of such certification.

**Payments against supply of Proprietary items:**

**a)** 70 % against receipt of material at site and submission of Commercial Invoice
**b)** 10% on mechanical completion of PLANT within 30 DAYS of submission of invoices.
**c)** 20% on final ACCEPTANCE OF PLANT and certified by the OWNER within 45 DAYS of such certification.

**Payments against Erection and Construction:**

**a)** 60% against progressive payment on completed milestone of the work.
**b)** 20% on completion of erection work duly certified by OWNER within 15 DAYS of such certification.
**c)** 20% on final acceptance of plant duly commissioned on certification by OWNER within 45 DAYS of such certification.

**Payments against pre-commissioning Commissioning, PGTR:**

**a)** 50% against running bills for Pre-commissioning on milestone basis.
**b)** 30% on successful commissioning of the plant duly certified.
**c)** 20% on final acceptance of plant duly commissioned on certification by OWNER within 45 DAYS of such certification.

## 8.1 FINAL PAYMENTS

**8.1.1** Within 15 (fifteen) days after receipt of the Final Acceptance of the plant, the Contractor must submit a payment claim and endorse it as the "**Final Bill**". The Contractor must include in that claim:

**(a)** statements for the Contract Price, summarising and reconciling all previous payments made by Owner and adjustments in the Contract Price; and
**(b)** any further sums which the Contractor considers to be due to it under the Contract.

**8.1.2** Within 45 (forty five) Business Days after the receipt of the Final Bill complete in all respects in accordance with the Contract, Owner must pay to the Contractor the amount mentioned in the Final Bill and certified by the Engineer-in-Charge, less any disputed amounts, subject to Owner's right to set off against amounts due from the Contractor. If the amount that the Contractor owes to Owner is greater than the amount mentioned in the Final Bill and certified by the Engineer-in-Charge, then the Contractor must pay the excess amount which is a debt due and payable to Owner within 90 (ninety) days after Owner's receipt of the Final Bill.

**8.1.3** After the expiry of the 15 (fifteen) days period referred to in Clause 8.1.1, a claim which the Contractor was entitled to make, but has not made in the Final Bill, is barred and the Contractor waives any right to bring such a claim.

**8.1.4** The amount certified in the Final Bill will not become due under Clause 8.1.2 until the Contractor submits to Owner:

**(a)** a certificate of release certifying that the Contractor waives all rights to bring any claims which the Contractor is entitled to make, but which are not included in the Final Bill;

**(b)** if requested by Owner, other data establishing payment or satisfaction, including receipts, releases, and waivers as may be required by Owner;

**(c)** a confirmation from the Contractor that there has been no Change of Law that it has not notified Owner which may result in a reduction in the Contract Price; and

**(d)** any and all outstanding documentation required to be given to Owner by the Contractor.

**8.1.5** No interim payment by Owner constitutes acceptance by Owner of the Works or any part thereof, or releases the Contractor from any of its obligations or liabilities under the Contract.

**8.1.6** Payment of the amount mentioned in the Final Bill by Owner shall not mean release of the Contractor from all of its liabilities under the Contract. The Contractor shall be liable to fulfill and discharge all his liabilities and responsibilities under the Contract until the end of the Contract Validity Period and release of the Contract Performance Bank Guarantee.

**8.1.7** Without limiting Clause of Payments With-held and Final Payments, Owner may at any time deduct from any moneys which are or may be payable to the Contractor (including

security), any sums which may be or are payable by Owner pursuant to the Contract. Nothing in this Clause Payment With-held affects the right of Owner to recover from the Contractor, the whole of the debt or any balance that remains owing after any deduction.

**8.1.8** If the Contractor fails to pay a Subcontractor on time such sum as is properly due under the agreement between the Contractor and such Subcontractor, then Owner may, on behalf of the Contractor, make the payment direct to the Subcontractor and the amount so paid will be a debt due and payable from the Contractor to Owner.

## 8.2 PAYMENTS WITHHELD

Owner may withhold from any payment due to the Contractor amounts Owner deems reasonably necessary or appropriate because of any one or more of the following reasons :

**(a)** Defects and deficiencies in any Works, whether or not payment has been made in relation to that part of the Works;

**(b)** failure by the Contractor to provide certificates of insurance or insurance policies in accordance with the terms of the Contract;

**(c)** reasonable evidence that completion of the Works will not occur within the Time for Completion;

**(d)** failure, in any material respect, to perform the Works or any of the Contractor's other obligations under the Contract;

**(e)** any overpayments made by Owner in a previous payment;

**(f)** any payment required to be withheld under any Applicable Laws;

**(g)** a dispute exists as to the accuracy or completeness of any Running Bill (but only with respect to the amount then in dispute);

**(h)** amount of Taxes which Owner may have to pay if conditions of Clause 9 are not fulfilled; and

**(i)** any amount expected to be paid by Owner to any person, on behalf of the Contractor or its affiliates under any agreement or any Applicable Laws for the time being in force or any court order or any other reason or purpose.

**(j)** Any amount otherwise specified under the Contract, as being deductible from the payments to be made by Owner to the Contractor.

## 9.0 TAXES AND DUTIES

**a.** Indian income tax or any other tax / amounts which OWNER is required by law to deduct / recovered from CONSULTANT for the purpose of execution of this Contract, shall be done at source and the same shall be paid to the respective authorities from the account of CONSULTANT and OWNER shall provide CONSULTANT with evidence of having made such payments.

**b.** CONSULTANT shall furnish all information required by the Government of India / Indian income tax authorities for assessment/ or deduction at source of taxes in respect of payments under the CONTRACT.

**c.** CONSULTANT shall indemnify OWNER against liability for any tax, interest or penalty levied by the Indian tax authorities on OWNER as an agent of CONSULTANT or of EXPATRIATES deputed by CONSULTANT to India under this CONTRACT or in respect of works awarded/ implemented by CONTRACTOR of the CONSULTANT.

**d.** Taxes/ duties/ imports/ Octroi / stamp duty etc. in respect of CONSTRUCTION contracting works awarded by OWNER shall be borne by the CONTRACTOR.

**e.** **GOODS AND SERVICE TAX**

The quoted price shall be deemed to be inclusive of all taxes and duties except "Goods and Service Tax" (hereinafter called GST) (i.e. IGST or CGST and SGST / UTGST applicable in case of interstate supply or intra state supply respectively.)

Contractor /vendor shall be required to issue tax invoices in accordance with GST Rules so that input credit can be availed by OWNER / APL. In the event that the contractor / vendor fails to provide the invoice in the form and manner prescribed under the GST Act read with GST Invoicing Rules there under, OWNER / APL shall not be liable to make any payment against such invoice.

GST shall be paid against receipt of tax invoice and proper of payment of GST to government in India. In case of non- receipt of tax invoice or nonpayment of GST by the contractor / vendor, OWNER / APL shall withhold the payment of GST.

GST payable under reverse charge , if any shall not be paid to the contractor /vendor but will be directly deposited to the government of India.

Notwithstanding anything contained anywhere in the Agreement, in the event that the input tax credit of the GST charged by the Contractor/ Vendor is denied by the tax authorities to OWNER / APL due to reasons attributable to Contractor /Vendor, OWNER / APL shall be entitled to recover such amount from the Contractor/Vendor by way of

adjustment from the next invoice or from Bank Guarantee . In addition to the amount of GST, OWNER / APL shall also be entitled to recover interest at the rate of X% and penalty. In case any penalty is imposed by the tax authorities on OWNER / APL.

TDS under GST, if applicable, shall be made from contractor's /Vendor's bill at applicable rate and a certificate as per rules for tax so deducted shall be provided to the contractor /Vendor.

No variation on account of taxes and duties, statutory or otherwise, shall be payable by Client to contractor/vendor except for GST. However, any statutory variation for GST shall be payable up to contractual date of completion against documentary evidence. Any reduction in taxes and duties included in the price shall be passed on to OWNER / APL.

Any new taxes, duties, cess, levies notified or imposed after the submission of last/ final price bid but before the contractual date of completion of work shall be to OWNER / APL's Account. However, in case of delay in completion period beyond the contractual date, for reasons attributable to contractor, any increase in these rates shall be borne by the contractor, whereas any decrease shall be passed on to the owner. OWNER shall take CENVAT benefit as applicable.

Any other provisions in the GST not mentioned above will be suo-moto applicable.

## 10.0 GUARANTEED COMPLETION POINT

**LSTK CONTRACTOR** shall be responsible for achieving the Guaranteed Completion Point of the Project within 24 months (or earlier) of the effective date of the Contract to be entered into by and between the **LSTK CONTRACTOR** and **OWNER**. CONTRACTOR's guarantee that WORK will be executed with all diligence and care and in the most expeditious manner. It is understood that time is the essence of the CONTRACT and CONTRACTOR shall initiate all actions well in time in order to ensure that all the activity falling within the Scope of LSTK CONTRACTOR is completed as per agreed time schedule.

In case of any delay in the performance of WORK including supply of documents and information by CONTRACTOR, in whole or in part, due to reasons other than force majeure resulting in or likely to result in a delay in the completion of COMMISSIONING of the PLANT, LSTK CONTRACTOR shall pay OWNER a sum calculated at half per cent (0.5%) of the total contract amount hereof for each week of such delay subject to a maximum of twenty percent (20%) of the said total CONTRACT PRICE.

## 11.0 PERFORMANCE GUARANTEES

The Design and Engineering shall be so performed by the **LSTK CONTRACTOR** that using the process provided by the **LSTK CONTRACTOR** and constructed, erected and commissioned by it, the **PLANT** shall be capable of producing the quality and quantity of products and achieving raw material and utility consumptions and effluent pollution levels guaranteed. The **PLANT** as designed / 1engineered by the **LSTK CONTRACTOR** shall be reliable, safe and operable in accordance with sound operational / maintenance practices. The **LSTK CONTRACTOR** shall provide appropriate Engineering Guarantees following the guidelines contained in **Clause 3.0** of this **Chapter–2.**

**LSTK CONTRACTOR** shall guarantee the Performance of the **PLANT** in terms of the following:

- Annual and daily production capacities.
- Quality of the products as defined in their specifications.
- Specific Consumptions of raw materials / utilities / catalyst or other consumables per unit of Formaldehyde in their specifications.
- Pollution Levels as per statutory requirements.
- Life of plant and equipments.

**LSTK CONTRACTOR** will guarantee achievement of the **GUARANTEED COMPLETION PLANT (GCP)** within the contracted time schedule of completion. The **GCP** shall be defined as the point in time at which the **PLANT** is **ready in all respects to receive the feedstock** leading to its start-up and manufacture of the Product.

## 12.0 LIABILITIES

In the event performance of the FACILITY determined through aforesaid procedure does not achieve the required level as specified above the CONTRACTOR is liable to and shall pay to OWNER damages as follows.

Any shortfall in production capacity of Formaldehyde from the average daily capacity the CONTRACTOR shall pay damages as given below.

For every percentage shortfall in required production capacity, CONTRACTOR shall pay penalty at the rate of Two percent (2%) of his total CONTRACT PRICE limited to a maximum liability of ten percent (10%).

Any increase in consumption of raw material from the limit required as specified CONTRACTOR shall pay damages as given below.

For every percentage increase in consumption of raw material from the required limit the CONTRACTOR shall pay penalty at the rate of two percent (2%) of his total CONTRACT PRICE limited to a maximum liability of ten percent (10%).

Any increase in specific energy consumption from the limit required as specified CONTRACTOR shall pay damages as given below.

For every percentage increase in specific energy consumption from the required limit the CONTRACTOR shall pay penalty at the rate of two percent (2%) of his total CONTRACT PRICE limited to a maximum liability of ten percent (10%).

Beyond a shortfall of 5 percentage in the required capacity or increase of 5 percentage in the consumption of raw material or increase of 5 percentage in the energy consumption, the FACILITY shall not be acceptable and in such events the CONTRACTOR shall make good the defects to achieve the guaranteed performance without any cost to the owner and the CONTRACTOR's liability in such case will be unlimited.

Any shortfall in performance of systems or packages installed will not be acceptable and the liability is unlimited. CONTRACTOR shall arrange for rectification of the defects free of cost to OWNER through the VENDORS.

Guarantee and liabilities for performance and life of catalyst shall be covered by a separate contract covering purchase of catalyst.

The facilities will not be accepted by the owner if the product specification / composition is not established as per desired specification during the guarantee period and in such events the CONTRACTOR shall make good the defects to achieve the desired specification of the product without any cost to the owner.

The facilities will not be accepted by the owner if the purity of product is not established as per desired specification during the guarantee period and in such events the contractor shall make good the defects to achieve the desired specification of the product without any cost to the owner and the CONTRACTOR's liability in such case will be unlimited.

## 13.0 VENDORS' GUARANTEES

**LSTK CONTRACTOR** shall obtain (for the exclusive benefit of the **OWNER**) from the vendors of all equipment / machinery / materials, etc. to be procured for the proposed **PLANT**, a Guarantee to replace or repair free of cost any of the equipment / machinery / materials which shall be demonstrated to be defective under normal operating conditions within **12 months** of the start-up of the Plant or **18 months** from the date of dispatch.

## 14.0 SUSTAINED LOAD TEST

After the **Guaranteed Completion Point (GCP)** is achieved, **LSTK CONTRACTOR** shall commence pre-commissioning and commissioning operations of the **PLANT** leading to production of Formaldehyde. After the **PLANT** is in operation and stabilized at full rated capacity OWNER under the direction and supervision of the **LSTK CONTRACTOR** shall operate the **PLANT** under a sustained load test for a period of 15 days to demonstrate that the **PLANT** is capable of achieving the daily rated production capacity and average production of **100%** over the said period.

## 15.0 DURATION OF CONTRACT

Unless terminated under Clause 26 (Termination of Contract) hereof, this contract shall remain in force for a minimum period of seventeen (17) years from the date the effective date of contract or for fifteen (15) years from the date of issue of Acceptance Certificate by owner vide Clause 19.0 hereof which ever expires later.

However, after expiry of warrantee period, the present contract shall be applicable only for services towards licensing guidelines and engineering assistance till the expiry of License agreement. Payments towards the services mentioned above shall be as per mutually agreed terms.

## 16.0 GUARANTEE FOR DESIGN & ENGINEERING AND LIABILITIES

CONTRACTOR shall prepare and be responsible for the design/engineering documentation for the FACILITY wherever required. In the event of any errors/deficiencies/ shortcomings in CONTRACTOR'S design/engineering requiring correction, OWNER shall give written notice within 15 days of its discovery and prior to expiry of Guarantee period hereof; CONTRACTOR shall without limitation to any other of its obligations under CONTRACT , perform such additional design/re-engineering work as may be necessary to correct such error. The cost and expenses for such additional engineering work as well as rectification/replacement shall be borne by CONTRACTOR. Such rectification jobs shall be completed on top priority within a period not exceeding three (3) months. For exceptional cases, extension of time may be considered.

Should at any stage during the execution of the WORK , but prior to START-UP, CONTRACTOR issue a design change requiring amendment or cancellation of any purchase orders or requiring dismantling or reconstruction of WORKS once constructed, resulting in additional cost to OWNER, CONTRACTOR shall fully bear these costs. Payment of such compensation shall not relieve CONTRACTOR of obligations under guarantee for time schedule.

## 17.0 GUARANTEES FOR EQUIPMENT

In respect of EQUIPMENT items for which PROCUREMENT services are provided by CONTRACTOR, CONTRACTOR shall obtain, for the benefit of OWNER, from the respective VENDORS, appropriate WARRANTEES/ GUARANTEES in favour OWNER as may be agreed to and specified in the CONTRACT ; and CONTRACTOR shall use its best efforts, short of litigation, to enforce such guarantees by VENDORS and shall fully cooperate with and assist OWNER in the enforcement of such guarantees. CONTRACTOR shall ensure that proper WARRANTEES/GUARANTEES for EQUIPMENT/ systems are obtained for OWNER.

## 18.0 PERFORMANCE TEST

CONTRACTOR shall prove the guarantees specified above in the following manner. After all sections of the FACILITY have been established and capacity, quality of product and effluents are achieved CONTRACTOR shall give notice in writing to the OWNER that the FACILITIES are ready for the performance test. On receipt of this notice, the OWNER shall make available the PLANTS, the operating staff , services, feedstock , power etc. to the CONTRACTOR to commence the performance test run of the FACILITY as mutually agreed between the OWNER and the CONTRACTOR , under the direction and supervision of the CONTRACTOR for a period of 90 (ninety) days. Interruptions, if any, during the test run shall be made up to achieve the 90 days test run period. However, the total time lost due to the interruptions by way of equipment breakdown and solely attributable to the CONTRACTOR shall not exceed the number of days mutually agreed between the CONTRACTOR and OWNER prior to start of guarantee test.

On successful completion of the Performance Test Run, the consultant will give notice to the OWNER that they are ready to conduct the GUARANTEE TEST. The GUARANTEE TEST will be conducted for a continuous operating run of the plant for 72 hours. If any interruption comes during this period, the operation period will be extended to achieve 72 hours continuous operating run period.

All readings required to prove the guarantee of the PLANT as whole and as well as individual EQUIPMENT wherever applicable shall be recorded in a mutually agreed format and signed by the CONTRACTOR and OWNER.

All the readings shall be measured through appropriate instruments identified and calibrated by CONTRACTOR and OWNER.

Within 7 days of completion of GUARANTEE test run, CONTRACTOR shall determine the results thereof and certify to OWNER that the performance guarantees have been demonstrated successfully.

The performance guarantees shall be deemed to have been demonstrated if CONTRACTOR certifies that the relevant guarantee test run is successful and submits calculations and records in support thereof and the OWNER accepts the same in writing.

## 19.0 ACCEPTANCE OF FACILITIES

As soon as the performance guarantees hereof are successfully demonstrated by CONTRACTOR to the full satisfaction of OWNER, OWNER shall issue an ACCEPTANCE CERTIFICATE (PROVISIONAL).

However, guarantee given by CONTRACTOR vide clause nos. 16 and 17 hereof will continue to be in force and OWNER shall issue a ACCEPTANCE CERTIFICATE only after satisfactory fulfilment of these obligations also by CONTRACTOR.

## 20.0 LIMITATIONS TO LIABILITIES

Without prejudice to provisions of the referred clauses CONTRACTOR'S liability for payment of liquidated damages hereof shall be limited to an aggregate maximum of thirty percent (30%) of the total CONTRACT PRICE payable by OWNER under the CONTRACT.

CONTRACTOR's liability for modification of FACILITIES and for infringement of any patents are unlimited and are not included in the ceiling mentioned above.

## 21.0 REJECTIONS, REMOVAL OF REJECTED EQUIPMENT AND REPLACEMENT

Owner reserves the right to conduct the inspection through its own personnel or any Third party inspector to conduct the inspection of work at manufacturer / fabricator shop or at site.

Preliminary inspection at VENDOR'S WORK by INSPECTOR shall not prejudice OWNER for rejection of the EQUIPMENT on final inspection at site or claim under warranty provisions.

If the EQUIPMENTS are not of specification or fail to perform specified duties or otherwise not satisfactory, the OWNER shall be entitled to reject the EQUIPMENT/ MATERIAL or

part thereof and ask for free replacement within reasonable time failing which obtain his requirements from elsewhere at CONTRACTOR'S cost and risk.

In the event of such rejection, the OWNER shall be entitled to use of the EQUIPMENT in a reasonable and proper manner for a time reasonably sufficient to enable him to obtain replacement.

Nothing in this clause shall be deemed to deprive the OWNER and/or affect any rights under the CONTRACT which he may otherwise have in respect of such defects or deficiencies or in any way relieve the CONTRACTOR of his obligation under the CONTRACT.

EQUIPMENT rejected by the OWNER shall be removed by the CONTRACTOR at his cost within **14 DAYS** of notice after repaying the amounts received against the supply. The OWNER shall in no way be responsible for any deterioration or damage to the EQUIPMENT under any circumstances whatsoever.

In case of rejection of EQUIPMENT, OWNER shall have the right to recover the amounts, if any, paid from any of his invoice pending with OWNER or by alternative method.

## 22.0 SUB- CONTRACTING

Sub- contracting work by the CONTRACTOR can be resorted to only after specific written approval of OWNER who shall give approval for sub-letting/off-loading only after examining the specific work for which sub-letting /off-loading is envisaged by the CONTRACTOR and required qualification criteria based on the nature of job. Wherever possible, CONTRACTOR shall explicitly state who and what items would be given to the SUB-CONTRACTOR. Even so, prime responsibility would be that of the CONTRACTOR.

## 23.0 CONFIDENTIALTY OF INFORMATION

### 23.1 DEFINITION

Confidential information shall mean all information relating directly or indirectly to the WORK and not available in public domain and which is disclosed to CONTRACTOR by or on behalf of OWNER and to OWNER by or on behalf of CONTRACTOR.

### 23.2 DISCLOSURE TO THIRD PARTIES

CONTRACTOR and OWNER shall not disclose confidential information to any third –party without prior written approval of the other PARTY.

**23.3 USE OF CONFIDENTIAL INFORMATION**

Either PARTY to this CONTRACT shall use the confidential information only for the WORK to be performed for implementing this CONTRACT. Either PARTY will limit disclosure of confidential information within its organization to only those of its employees who need to make use of it for the aforesaid purposes.

**23.4 TERMINATION PERIOD**

The obligations contained in paras above shall terminate after seventeen (17) years from the EFFECTIVE DATE of this CONTRACT.

**23.5 DURATION OF CONTRACT**

Unless terminated under clause 26.0 hereof, this CONTRACT shall remain in force for a minimum period of seventeen (17) years from the EFFECTIVE DATE OF CONTRACT or for fifteen (15) years from the date of issue of ACCEPTANCE CERTIFICATE by OWNER vide clause 19.0 hereof whichever expires later.

**24.0 STATUTORY CLEARANCES**

**24.1** All Statutory Clearances are to be obtained by the **LSTK CONTRACTOR** at their cost in the name of the **OWNER** with due approval from the **OWNER**. Some of the clearances required are as listed as under:

- Environment Clearance from Ministry of Environment and Forests.
- Project Clearance from Factory Inspectorate.
- Approval from Inspectorate of Boilers and Explosives.
- Approval from Ministry of Water resources.
- Pollution Clearance.
- Co-ordination with Boiler Inspectors.
- Weights and measures Department during the period of Construction upto Plant Acceptance.
- Any other clearance as required for completion of the Project.

**24.2 PERMITS AND CERTIFICATES**

**LSTK CONTRACTOR** shall procure all necessary Permits, Certificates and Licenses by virtue of all applicable laws, regulations, ordinances and other rules in effect at the place where any of the WORK is to be performed. **LSTK CONTRACTOR** shall hold **OWNER**

harmless from liability or penalty which might be imposed by reason of any asserted or established violation of such laws, regulations, ordinances or other rules.

All Permits, Licenses, Certificates required for setting up of the Plant shall be obtained by **LSTK CONTRACTOR** in the name of **OWNER** with due approval from **OWNER.**

## 25.0 MISCELLANEOUS CONTRACTUAL REQUIREMENTS

Under the **PROJECT CONTRACT** to be entered into by and between the **OWNER** and the **LSTK CONTRACTOR** following miscellaneous provisions shall be included:

- Process and operating license and rights granted by the **LSTK CONTRACTOR** to the **OWNER shall** be perpetual.
- All amounts paid to **LSTK CONTRACTOR** by the **OWNER** shall be net amounts after deduction of levies/taxes (if any) applicable in India. Any levies/taxes applicable in the country of the **LSTK CONTRACTOR** shall be payable by the **LSTK CONTRACTOR**.
- The **LSTK CONTRACTOR** shall warranty that the supply of equipment/machinery/materials and practice of **LSTK CONTRACTOR**'s processes in the **PLANT** do not infringe any valid patent rights of a third party. The **LSTK CONTRACTOR** shall also warranty that it will hold the OWNER harmless from any patent infringement claim by any third party.
- Neither the **OWNER** nor the **LSTK CONTRACTOR** shall be liable for any indirect or consequential damages resulting from a fault attributable to either party.
- The total aggregate liability of the **LSTK CONTRACTOR** under the said **CONTRACT** shall not exceed the total value of the **CONTRACT** except in cases where unlimited liabilities accepted by the **LSTK CONTRACTOR**.
- Upon delivery by the **LSTK CONTRACTOR**, ownership of the equipment/machinery/materials supplied by it shall automatically pass on to the **OWNER**.
- The said **CONTRACT** shall be construed and the legal relations between the **OWNER** and the **LSTK CONTRACTOR** shall be determined in accordance with the laws of India.
- If **LSTK CONTRACTOR'**s performance is impeded by Force Majeure, the same shall not be considered a contractual default.

## 26.0 TERMINATION OF CONTRACT

**26.1** Prior to OWNER invoking any of its rights under clause 26.2 and / or 26.3, the PARTIES shall meet and discuss any outstanding of the other PARTY'S position. All efforts shall be made by the PARTIES to reach an equitable and amicable solution to such issue or dispute.

**26.2** OWNER may by written notice to CONTRACTOR, terminate CONTRACT whenever OWNER deems such termination to be in its best interests of both parties. Upon such termination the provisions of clauses 26.4 shall be applicable.

**26.3** If CONTRACTOR shall neglect to execute WORK with due diligence or expedition, or shall refuse or neglect to comply with any reasonable order given to it in writing by OWNER in connection with WORK, or shall contravene any of the provisions of the CONTRACT, OWNER may give notice in writing to CONTRACTOR calling upon it to make good the failure, neglect or contravention complained of, within a period of 30 (thirty) DAYS. In CONTRACTOR'S default of compliance with any such notice, OWNER may without prejudice to its rights rescind or terminate CONTRACT.

**26.4** Upon notice of termination by OWNER pursuant to clauses 26.2 and 26.3 the OWNER may require CONTRACTOR to:

**a)** Terminate all work
**b)** Release no further purchase order.
**c)** Deliver to OWNER Plans, specifications, and drawings produced, prepared, or acquired for WORK.

**26.5** On termination by OWNER under clause 26.3 OWNER may carry out all remaining WORK either by itself or through it's agents or may re-contract to any person or company to execute the same and provide materials, tools, tackles, or labour for the purpose of completing WORK without any cost to CONTRACTOR.

**26.6** In case of termination under clause 26.2 the OWNER shall elect to carry out by itself or by any other person WORK necessary to complete WORK by using CONTRACTOR's design and engineering.

If CONTRACTOR commences to wind up (not being Members of Voluntary Winding up for the purpose of amalgamation or reorganization) or carry on his business under a Receiver for the benefit of its creditors or any of them, OWNER shall have liberty to:

**a)** Terminate the CONTRACT forthwith by notice in writing to CONTRACTOR Or to the Receiver or Liquidator or
**b)** to any person in whom CONTRACT may have become vested, or give such Receiver, Liquidator or other person, the option of carrying out CONTRACT subject to his providing a guarantee for the due and faithful Performance of CONTRACT up to an amount to be agreed.

## 27.0 RESOLUTION OF DISPUTES/ARBITRATION

### 27.1 APPLICABLE TO PUBLIC SECTOR UNDERTAKINGS (PSU)

Except as otherwise provided elsewhere in the CONTRACT, in the event of any dispute or difference relating to the interpretation and application of the provisions of the CONTRACT, such dispute or difference shall be referred by either PARTY to the arbitration of one of the arbitrators in the Department of Public Enterprises to be nominated by the Secretary to the Government of India, in charge of the Department of Public Enterprises. The Arbitration & conciliation Act, 1996 shall not be applicable to the arbitrator shall be binding upon the PARTIES to the dispute, provided , however , any PARTY aggrieved by such award may make a further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary / Additional Secretary when so authorized by the law Secretary, whose decision shall bind the PARTIES finally and conclusively. The PARTIES in the dispute shall share equally the cost of arbitration as intimated by the arbitrator. The arbitration as intimated by the arbitrator. The arbitrator (s) shall give reasoned award.

### 27.2 APPLICATION TO GENERAL

**27.2.01** Unless otherwise specified, in all cases of dispute which cannot be settled by mutual negotiation the matter shall be referred for arbitration and the disputes of differences shall be finally settled and binding on both PARTIES by arbitration to be held by two arbitrators appointed one by OWNER and one by CONTRACTOR chosen freely and without any limitations, out of any sources, including international sources.

**27.2.02** Arbitration will follow the Arbitration & Conciliation Act 1996 or the rules of the Indian Council of Arbitration, as may be agreed by the two PARTIES.

**27.2.03** Before entering upon the arbitration, the two arbitrators shall appoint an umpire. If the two arbitrators are not able to reach an agreement on the selection of the umpire, the umpire shall be nominated by the Chairman of the Indian Council of arbitration.

**27.2.04** In case the two arbitrators of the PARTIES are not able to agree and decide on the issue(s) on the disputed matter under their arbitration, the final settlement of such issue(s) of the disputed matter shall be referred to the binding decision of the umpire nominated as provided under clause 27.2.03.

## 28.0 GOVERNING LAWS AND REGULATIONS

CONTRACT shall be governed in accordance with laws in India. All prevent Laws of the Land and Statutory norms as applicable shall be bidding on this Contract in every respect even if it is not mentioned in this ITB. The Courts at Guwahati (Assam) only shall have the jurisdiction for the purpose of actions and proceedings arising out of the CONTRACT.

Contractor shall be fully responsible to maintain all laws and orders of the land in executing the contract.

## 29.0 FORCE MAJEURE

**a)** Neither the CONTRACTOR/ SUBCONTRACTOR nor the OWNER shall be considered in default in the performance of their contractual obligations under the CONTRACT, as long as such performance is prevented or delayed, for reasons, such as Acts of God, severe earthquake, typhoon or cyclone (except monsoon), floods, lightning, landslide, fire or explosions, plague or epidemics, strikes, lockouts (lasting more than 10 consecutive calendar DAYS), sabotage, blockade, war, riots, invasion, act of foreign enemies, hostilities (whether war be declared or not) civil war, rebellion, revolution, insurrection/or military usurped power or confiscation or trade embargoes or destruction or requisition by order of any Government or any Public Authority. CONTRACTOR shall within **one week** notify OWNER above the occurrence of the force majeure event and provide OWNER details of the arising and ceasing of the impediment. At the end of the impediment, CONTRACTOR shall provide justificatory documentation countersigned by the local Chamber of Commerce.

**b)** Should one or both the parties be prevented from fulfilling the contractual obligations by a state of Force Majeure lasting continuously for a period of **6 weeks,** the two parties shall consult each other regarding the future implementation of the CONTRACT. The mere shortage of labor, materials or utilities shall not constitute force majeure unless caused by circumstances which are themselves Force Majeure.

**c)** CONTRACTOR and OWNER shall endeavour to prevent, overcome or remove the causes of Force Majeure.

**d)** No ground for exemption can be invoked if CONTRACTOR has failed to give timely notice by registered letter and subsequently supported it by documentary evidence.

## 30.0 DEFECT LIABILITY PERIOD

**30.1** The Defect Liability Period shall be a period of 12 (twelve) months from the date of Completion mentioned in the Completion Certificate.

**30.2** The Contractor warrants that during the duration of the Defect Liability Period, the Works shall be free of all Defects.

**30.3** If, during the Defect Liability Period, any Defects are discovered in the Works or any part thereof; or the Works or any part thereof fails to meet the Guaranteed Performance Levels, Owner will notify the Contractor of such Defects or failure. Upon receipt of such notice, the Contractor shall promptly repair or replace such Work (including any necessary uncovering, covering and recovering) in accordance with the Contract, Good Industry Practices and Applicable Laws. At Owner's option and Contractor's expense, Owner shall have the right to provide labour in connection with such repair or replacement to the extent that such labor can be provided by Owner's then-current permanent employees working at during normal working hours. The Contractor shall provide for all additional labor required for such repair or replacement and shall bear all Costs and expenses associated with repairing or replacing any Work, including costs incurred by Owner in relation to providing labor, employees and personnel for any such repairs or replacement. Upon completion of any repair or replacement work, the Contractor shall, at its own expense, and with Owner's coordination and Approval, perform such tests as necessary to demonstrate that pursuant to cure of Defects under this Clause 30.3, the Works meet the Guaranteed Performance Levels.

**30.4** If the Contractor fails to rectify any Defects in the Work during the Defect Liability Period, Owner (at its sole discretion) may:

**(a)** Carry out the work itself or by others, in a reasonable manner at the risk and Cost of the Contractor; In addition to the costs, Owner shall be entitled to claim 15% (fifteen percent) of such costs towards the genuine pre-estimated damages suffered by Owner; or

(**b)** If the Defect or damage is such that Owner has been deprived of substantially the whole of the benefit of the Works or part of the Works, terminate the Contract in respect of such parts of the Works as cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, Owner shall then be entitled to recover all sums paid for such parts of the Works together with the cost of dismantling the same, clearing the Site and returning Goods and Materials to the Contractor.

**30.5** If the Defect or damage is such that it cannot be remedied expeditiously on the Site and if Owner gives consent, the Contractor may, remove from the Site for the purpose of repair any part of the Works, which is defective or damaged. The consent may require the Contractor to increase the amount of Contract Performance Bank Guarantee by the full replacement cost of items which are to be replaced or to provide other appropriate security acceptable to Owner.

**30.6** If the repair or remedy of any Defect or damage is such that it may affect the performance of the Works, Owner may, within 30 (thirty) Working Days after such repair or remedy, require that certain tests be repeated as may be necessary to demonstrate compliance with the Guaranteed Performance Levels.

**30.7** If any part of the Works has been replaced, renewed or repaired during the Defect Liability Period, the Defect Liability Period in respect of such part shall start again for a period of 12 (twelve) months from the date on which such replacement, renewal or repair has been completed to the satisfaction of APL (**"Extended Defect Liability Period**").