	PROJECT		Standby SRU & Additional Tanks	
	CLIENT		IOCL Paradip Refinery	
Job specification for Pre-commissioning, Commissioning and Test run	Project No. 080557C001	Document No. 080557C-000-JSC-0093-001	Rev. No. 0	Page 1 of 28

JOB SPECIFICATION FOR PRECOMMISSIONING, COMMISSIONING AND PERFORMANCE TEST RUN (FOR PROCESS/ OFFSITE/UTILITY UNITS)

0	04/12/2019	ISSUED FOR IMPLEMENTATION	KMK	TNVS	TNVS	JMC
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	AUTHORIZED

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1. Introduction:

INDIAN OIL CORPORATION LIMITED (IOCL) has awarded Fax of Acceptance (FOA) dated 29th August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

2. Definitions & Abbreviations

Abbreviation	Definition /Expanded form
IOCL/OWNER/CLIENT	Indian Oil Corporation Limited
PMC/ CONSULTANT	Technip India Limited
LICENSOR	Party selected by IOCL for process technology ownership for any UNIT
CONTRACTOR	Party whose services are obtained for performing the works specified as part of LSTK / packages.
EPCM	Engineering, Procurement & Construction Management Services.
LSTK	Lump Sum Turn Key portion of the work to be executed by CONTRACTOR
FEED	Front End Engineering Design
AUTHORISED REPRESENTATIVE	IOCL's/ CONSULTANT's representative authorized to act for and on behalf of them.
VENDOR	Any third party supplying the equipment/materials for setting up the Plant
PROJECT	Indicates Standby SRU and Additional tanks Project, Paradip Refinery
UNIT	Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related
SRU	Sulphur Recovery Unit
MSDS	Material Safety Data Sheet
ESD	Emergency Shutdown

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3. General

This specification describes the minimum general requirements for pre-commissioning, commissioning and Performance test runs of PROCESS/ OFFSITE/UTILITY units.

4. Scope of the Bidder

LSTK Contractor shall be responsible to carry out Mechanical completion, commissioning and performance test run of the facilities in association with Owner's operating personnel. The LSTK contractor shall be responsible for safety of Personnel, Instruments and equipment under his scope.

LSTK contractor shall provide all the resources required for Mechanical completion as per document **080557C-000-PP-806**

LSTK CONTRACTOR shall deploy adequate manpower in each shift to carry out mechanical completion / startup /commissioning activities without interruption. CV's of key personnel comprising the commissioning team shall be provided to Owner/PMC for approval. In case the member of the commissioning team as proposed is not available at the actual time of commissioning then the LSTK CONTRACTOR shall ensure a replacement with personnel of equivalent qualification and experience.



Detailed procedure for Pre-commissioning and mechanical completion, commissioning, start-up and performance test shall be developed by LSTK Contractor based on guidelines provided in this document. LSTK Contractor shall also prepare operating manual based on the guideline provided in the document. These procedures and manuals shall be approved by OWNER/ PMC.

Facilitate various audits such as OISD audit and implement observations, if any.

Pre-start-up Safety Review (PSSR) checks to be carried out and observation / recommendation (if any) to be implemented by LSTK CONTRACTOR. PSSR team will have members from PMC / Owner / Licensor.

The scope of work for LSTK CONTRACTOR shall comprise of but not limited to the following:

- Develop, review and implement the start-up plan. Same must be approved by PMC / Owner.
- Develop the plan, procedure and schedule for mechanical completion & commissioning, same must be approved by PMC/OWNER.
- Develop standard procedures for start-up, normal operation, shut down and emergency condition.
- To develop the punch list and generate the daily status report on punch point generated and liquidated.
- Pre-start- up inspection of all the equipment and its proper functioning.
- To develop the plan and conduct safety audits of the complete plant / system before starting of mechanical completion activities.
- Ensure adequate manpower, special tools and spare parts necessary for assisting commissioning activities such as operational tightness testing, pre-start- up inspections, chemicals and catalyst loading etc.
- LSTK CONTRACTOR to follow systems approach, formats for handing over of sub- systems, systems and plant to the PMC/Owner including all the required documents, completion certificates, test / inspection reports etc.
- Estimate the quantities of raw material, air, water, nitrogen required for mechanical completion.

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- j) Make provision for disposal of contaminated water during mechanical completion activities.
- k) LSTK Contractor to provide all tools and tackles, studs, anti-seize compounds, fuel, tail blinds for box up, gaskets, hoses for flushing, measuring equipment like RPM meter, vibration meter etc.
- l) LSTK contractor shall complete Mechanical completion, Commissioning, Start- up, and performance test activities in accordance with the project programme leading to provisional acceptance of each of the plants. All activities related to DCS Graphics, Cause and Effect diagram, process control narratives defining philosophy, detailed requirements for logic, fire and gas detector location and CCTV shall be completed by LSTK Contractor.

4.1 List of Documents to be Enclosed by the Bidder

- a) An organization chart of bidder's proposed commissioning team indicating the positions. The team shall have the required qualifications and experience. A typical ORGANOGRAM for commissioning team is attached as per Annexure-I. LSTK Contractor shall deploy adequate manpower in each shift, where required to carry out pre-commissioning/commissioning/plant run stabilization/performance test run activities without interruption.
- b) CV's of key personnel comprising the commissioning team. In case the member of the commissioning team as mentioned in the offer is not available at the actual time of commissioning then the LSTK Contractor shall ensure a replacement with equivalent qualification and experience. The format of bio data is enclosed as Annexure-II.
- c) Proposed pre-commissioning and commissioning schedule
- d) Quantity of first fill chemicals, lube oil, utilities, List of special tools/ tackles/ equipment proposed for deployment at site.
- e) Clause wise list of deviations, if any, in the format given in Annexure-III. In absence of this it shall be taken that Bidder has no deviation.

5. HSE- Health, Safety, Environment

Health safety and environment policy of the OWNER shall be followed in all activities.



HSE plan, HSE Organization chart, emergency plan and communication, simultaneous operations plan (SIMOPS), safety task instructions, procedures of the Bidder shall be submitted to the OWNER/PMC for review at least 90 days before start of pre-commissioning.

The LSTK CONTRACTOR shall follow OWNER's safety practices during execution of pre-commissioning / commissioning works. LSTK CONTRACTOR is required to maintain and follow all safety practices equivalent or better than those being practiced by OWNER for the complex during pre-commissioning and commissioning.

The LSTK CONTRACTOR shall provide necessary PPE for the personnel engaged by them for Pre-commissioning and Commissioning activities.

The CONTRACTOR shall ensure the following safety systems are in place before start of Pre-commissioning and Commissioning activities:

- Fire extinguishers are in place
- Check all electrical closures
- Ensure that all escape routes are clear of obstacles
- Ensure that all eyewash stations are operational
- Wear Personal protective equipment

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- Clear area from unauthorized personnel
- Be aware of the wind direction and provide wind socks
- Be aware of the designated Assembly area in case of any emergency
- Ensure that fire and gas, smoke detection equipment is operational

The CONTRACTOR shall ensure availability of all necessary safety tags and PPE as listed below before proceeding with the pre-commissioning and commissioning activities.

Tags:

- No smoking
- Danger, high voltage
- Do not enter beyond this point PPE:
- Ear protection
- Safety glasses
- Hard hats
- First aid kit
- Face shield
- Chemical gloves
- Safety goggles
- Padlocks with Multi-Lock Clips
- Safety boots
- Safety self-contained breathing apparatus /masks for various chemicals
- Overalls



6. Quality Assurance

LSTK Contractor shall include in his offer the Quality Assurance Programme containing the overall quality management and procedures which is required to be adhered to during the execution of contract. After the Acceptance/ Award of the tender, detailed quality assurance programme to be followed for the execution of contract under various divisions of works will be mutually discussed and agreed. The Contractor shall establish document and maintain an effective quality assurance system as outlined in recognized codes.

Quality Assurance System plans/procedures of the LSTK Contractor shall be furnished in the form of a QA manual. This document should cover details of the personnel responsible for the quality assurance, plans or procedures to be followed for quality control in respect of Design, Engineering, Procurement, Supply, Installation, Testing and Commissioning. The quality assurance system should indicate organizational approach for quality control and quality assurance of the construction activities, at all stages of work at site as well as at manufacturer's works and dispatch of materials.

Pre-commissioning and commissioning execution plan, Resources Mobilization plan, Organization chart, responsibilities with quality control plan for various stages shall be prepared by the LSTK contractor and submit for review by OWNER/ PMC, 90 days before the start of pre-commissioning. Any activity tracking IT tool shall be described and access shall be given to the OWNER/ PMC representatives. Systems approach for pre-commissioning, commissioning shall be followed.

LSTK Contractor shall comply with the Quality Policy/Guidelines of OWNER at all stages of project execution.

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7. Systems Approach to Commissioning.



The process and non-process areas of the unit shall be divided into systems and subsystems. All pre-commissioning, mechanical completions, commissioning activities shall be planned, marked in the system and ensured their timely completion and final handover.

A set of P & IDs must be marked up with system / sub systems prior to setting up the pre-commissioning schedule. The following guideline assists in the setup of system / subsystem P & IDs.

- The full scope of a sub system must be contained within a single system where appropriate.
- All equipment and instruments within a sub system are to be highlighted clearly.
- Sub systems must have a flanged break point at the sub system boundary as a minimum, unless an exception is approved (i.e. in case of welded pipes and valves with no flanged isolation point.)
- A sub system cannot cross a pressure break.
- Where a flange break is available, sub systems must not cross an area boundary.
- The 3D model should be reviewed to confirm logical breaks for sub systems.
- Sub systems must include vendor packages. The boxes will be highlighted as a single sub system and vendor detailed drawings will be marked at a later date (this may result in additional sub systems.)
- Drains, vents and service systems are to be consistently defined. Drains, vents and services are to be broken from process sub systems at the last isolation point before the headers.

Specific cases include:

- Break all closed drains (CD) at the normally closed spectacle blind.
- Select material spec changes.
- Where there are welded valves, the downstream weld on the last valve before the header is the sub system break (i.e. flares).
- Drains & vents are to be part of their own utilities systems from header forward. This applies to all services wherever applicable.
- Chemical injection points are to be split at the process side of the integrated check valve. Power and control systems are to be associated with locations of main control units. If controllers cross sub systems the instrument will be included with the sub system associated with its physical location and the controller (Box) with the sub system of the equipment is controlling.
- Leak test volumes will have an effect on breakdowns. This rule will be followed when appropriate but will not always meet logical sub system breaks.
- Attempt to make logical hydro test breaks for sub systems.
- Where double block and bleed isolations are available choose the logical isolation for the situation.
- All numbers are to be recorded in red/blue on the drawing and not black to clearly show the mark ups separate to P & ID.

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- Sub system numbers must be noted at the bottom of drawing with color coding adjacent to the sub system number (for the master set).
- Individual sub system sets will have sub system number only in lower right hand corner.
- Adjacent sub system numbers are to be noted near to the boundary for each applicable boundary on the individual sets. One will be used for all individual sub system sets. Boundaries to be noted at the point or as close to the boundary as possible. A solid blue arrow indicates a hydro test sub system boundary. A dashed blue arrow indicates a commissioning isolation boundary.
- Clearly identify and uniquely number sub system boundaries. The numbering should follow this system:
 - SS-XX-YYY
 - Where SS indicates system, XX is the system number and yyy is the sub system number.

Systems are to be numbered according to the system reference on the P & IDs. Once complete the sub system drawings are used to group tags (equipment tags, instrument tags and line numbers) in to sub systems.

Each System Dossier file shall include the following reports/documents:



- Mark up of system
- Punch list
- Cleaning witness Quality Control Forms (QCF)
- Box up witness QCF
- Leak test witness QCF
- Vessel Inspection/Cleaning witness QCF
- Vessel Box up witness QCF
- Pump's No load/MRT witness QCF
- Inertisation witness for process systems QCF

8. Sequence of Activities

8.1 Pre-Commissioning Activities

Pre-commissioning activities (as detailed in Annexure-VI) are defined as those activities, which are required to be performed after completion/ installation, inspection, hydrotesting etc. of an equipment/ system to make it ready for commissioning. LSTK Contractor shall raise FORMAT – III (as per format given in Annexure-IV) which certifies that all checklist points are liquidated and the plant /system/sub-system is ready for pre-commissioning.

LSTK Contractor shall start pre-commissioning activities after acceptance of FORMAT-III (Annexure IV) by PMC/OWNER. Pre-commissioning activities shall include, but shall not be limited to activities such as system checking as per P&IDs/drawings, site modifications, internal inspection of equipment/vessels, flushing/steam blowing, air blowing of pipelines including card board gasket blowing, purging of system using inert gas, leak test, calibration of instruments, checking of the electrical equipment for proper earthing, continuity, insulation resistance, conducting operability test on individual equipment/system, charging of lubes & other chemicals.

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Fabrication and supply of temporary facilities, for example, temporary bypasses, spools, blinds, jump overs, vents, strainers, screens etc. which shall be required to carry out pre-commissioning activities shall be the in the scope of the LSTK Contractor. Catalyst/adsorbent loading shall also be responsibility of LSTK Contractor. Procedure for loading as suggested by supplier/Licensors shall be followed and it is to be done under supervision of OWNER/PMC.

All the pre-commissioning activities shall be carried out by LSTK Contractor. Before start-up of the pre-commissioning activities, safety audit shall be conducted by LSTK Contractor and OWNER/PMC. Checklist/deficiency generated by safety audit team shall be corrected/rectified by LSTK Contractor.

The LSTK Contractor shall submit the list of systems and prepare list of pre-commissioning activities to be performed for all applicable disciplines against each system including flushing schemes for the piping sub-systems. The above details shall be prepared and submitted to PMC/OWNER at least 90 days before start of the pre-commissioning activities.

8.2 Mechanical Activities

Mechanical completion of systems shall mean that all installation works of the system have been completed, hydrotested and all pre-commissioning activities completed in accordance with approved construction, approved pre-commissioning specifications, applicable code as defined in the bid package, accepted international good engineering practices and all the activities have been completed in a comprehensive manner by the LSTK contractor. The LSTK contractor's competent representative shall check the system/ subsystem so that the plant/system/sub-system meets the process requirement and is constructed as per the approved drawings.



After liquidating the punch lists / check lists LSTK Contractor shall submit certificate as per FORMAT-I (attached in Annexure-IV) stating system/sub-system, which is mechanically construction and erection) completed. Checklist generated by LSTK Contractor representative and test certificates connected with the system/sub-system shall form a part of the FORMAT-I. Certificates of various statutory bodies for relevant portion of the work completed shall be made available by the LSTK Contractor as part of mechanical completion. OWNER/PMC representative shall check the system along with LSTK Contractor's representative and shall issue FORMAT-II (as per format given in Annexure-IV) which includes deficiencies / modifications required for the portion of the work that is declared by the LSTK Contractor as mechanically (construction, erection) complete. Typical Checklist of some of the activities under mechanical completion is attached as Annexure-VI. However, details of Mechanical completion have also been given elsewhere in the contract document. Refer document: **080557C-000-PP-806** for details.

8.3 Ready for Commissioning

All temporary structures, scaffolding etc. used for carrying out the pre-commissioning works shall be removed, all the blinds shall be put into position as required by P&IDs / Process Licensors and all systems as recommended by Process Licensors shall be purged and pressurized. All pre-commissioning and other documents including blinds list, set pressures of PSVs and TSVs and their test certificates etc. shall be handed over to the OWNER. Necessary prestart up safety reviews shall be done by the LSTK contractor before start of commissioning.

The LSTK Contractor shall issue a certificate of ready for commissioning of process facilities for acceptance by the OWNER/PMC in standard format, FORMAT-IV (as per format given in Annexure-IV) with all exceptions resolved.

After the plant/facility has been declared as 'Ready for Commissioning', the LSTK Contractor shall not carry out any hot work in the plant/facility without prior written permission of the OWNER.

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8.4 Commissioning

It shall be the responsibility of the LSTK Contractor to commission the unit under the scope of the LSTK Contractor. Commissioning shall be carried out under LSTK contractor's responsibility and under necessary guidance and overseeing of representatives of OWNER/PMC after mechanical completion is over successfully, all pre-commissioning activities are carried out and certificate of "Ready for commissioning" is accepted by OWNER. Representatives of designer/process licensor shall provide necessary co-ordination during start up and they shall furnish technical clarifications, as and when required.

Commissioning shall mean taking the feed, passing it through the normal route; establishing the process control parameters first at turn down & then at design value stipulated in the process package along with supplementary instructions, if any, from OWNER/PMC.

It is envisaged that the UNIT will be commissioned within 3 (three) months of Mechanical Completion, and the de-mobilization and /or retention of the CONTRACTOR's personnel until completion of Final Testing and Commissioning shall be included within the Lumpsum Price of services.

The CONTRACTOR shall be responsible to commission the UNIT and to prove the CONTRACTOR's performance guarantees with respect thereto.



The commissioning shall, to the extent necessary, be carried out under the supervision of PMC and with the assistance of the OWNER's personnel. The CONTRACTOR shall, within his responsibilities for and the scope of Commissioning the UNIT, train OWNER's personnel at the site of the UNIT in such number and for such period as the CONTRACTOR considers reasonably necessary for Commissioning the PLANT.

Three months prior to starting commissioning, the LSTK Contractor shall submit proposal to the OWNER's representative giving details of the schedule and milestones to be followed during commissioning. This shall be reviewed by OWNER's / PMC representative.

The LSTK Contractor shall arrange trained operation team comprising of key positions such as commissioning manager, shift foremen, main control room operators (DCS and local panels), field operators, mechanical, electrical and instrument specialists to carry out plant start-up and commissioning and for process operations and maintenance. Owner's key personnel will work in association with LSTK contractor person under the responsibility of LSTK contractor.

The LSTK Contractor is also required to provide on the job training to OWNER's operation personnel by associating them in all day to day pre-commissioning, commissioning and maintenance activities and process operations, however, responsibility for adequate manning the plant shall be that of LSTK Contractor. After successful commissioning of the plant as above, the same shall be handed over to the OWNER for operation. In case of any constraint in achieving the above production in the plant, the same shall be communicated by the LSTK Contractor to the OWNER in writing. This shall be reviewed jointly by OWNER/PMC and Licensor to arrive at a decision on whether the constraint is on account of reasons attributed to LSTK Contractor or not. The action in either case shall be according to the relevant provisions provided elsewhere in the contract.

Final takeover shall be subject to compliance to all the contractual obligations by the LSTK Contractor. Once the plant is successfully commissioned LSTK Contractor shall issue FORMAT-V (as per format given in Annexure IV) to OWNER for takeover of the facilities from LSTK Contractor.

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8.5 Performance Test Run

Before carrying out of the performance test of facilities, LSTK Contractor will develop a procedure/protocol and schedule in consultation with the OWNER/PMC and submit to OWNER for their approval.



Performance tests shall be started when the operation of the UNIT is stabilized under design conditions. The UNIT shall be operated and controlled in accordance with procedures set up beforehand. One or more performance tests shall be carried out for a maximum of 120 hours under the technical direction of OWNER / PMC and/or their designated representatives after successfully commissioning the UNIT in accordance with the procedures and conditions detailed in the Bid documents. At the end of the performance tests, an uninterrupted period of 72 hours shall be selected by OWNER/ Engineering- Charge and average results obtained during that period shall form the basis of comparison between the actual performance and the guaranteed performance.

For the purpose to demonstrate that the UNIT meets CONTRACTOR's contractual guarantees, one or more performance tests shall be carried out by the CONTRACTOR under the technical direction of the CONTRACTOR and the PMC and/or their designated representatives after commissioning the UNIT in accordance with the stipulated and/or agreed procedures and conditions.

The Performance Tests shall be carried out in accordance with a detailed technical program to be drawn up by PMC and the CONTRACTOR in consultation with OWNER prior to the commencement of the performance tests.

Among the other things, the procedure shall broadly include the following.

- Test conditions
- Log sheet for recording operating data
- Sampling methods
- Analytical methods
- Methods of calculations
- Pre-test run period, if any
- Methodology for interpretation and measurement of tests
- Methodology for taking operating data and its frequency
- Methodology for evaluating the performance of the facilities, make up water/utilities/energy consumption, etc
- The LSTK Contractor shall provide the services of his commissioning engineer who was associated with the commissioning of the plant at site during this performance test run period.
- LSTK Contractor shall be held responsible for any defects noted during performance test run and attributable to him and shall be dealt as per the relevant provision of the contract.
- PGTR shall be performed in the presence of OWNER/ PMC/LSTK Contractor.

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- Measuring methods, tolerances, instructions for analysis and calculations shall be as per accepted practices and shall be mutually agreed upon before the start of performance test.
- If a performance test of plant/facilities has been carried out successfully for a period specified by OWNER/PMC and LSTK Contractor's utilities guaranteed values are met, then the performance test shall be deemed to have been successfully completed.
- Within five days after completion of a performance test, all relevant operating and production figures having any bearing on CONTRACTOR's guarantees or in connection therewith and actually achieved during the performance test conducted shall be recorded in a protocol to be signed by authorized representatives of OWNER and the CONTRACTOR.
- Unless the OWNER/PMC indicates in writing that the performance test was successful, the guarantee will not be deemed to have been met. The OWNER/PMC shall specify in writing, within 20 (twenty) days of a performance test, in what way the guarantee has not been met. In case the performance test fails to meet guarantees, the authorized representative of both LSTK Contractor and OWNER/PMC shall mutually discuss and determine the causes of failure of the test. Necessary modifications required shall be suggested by LSTK Contractor in writing and if the cause of failure is attributable to LSTK Contractor, cost of these modifications shall be borne by LSTK Contractor.



9. Documents for Pre-Commissioning/Commissioning/Commissioning Handover

The typical documentation for various stages is indicated which are required to be submitted by LSTK Contractor in each stage. This list is not exhaustive and LSTK contractor shall prepare all the supporting documentation necessary to complete the activities.

9.1 Operating Manual

The LSTK Contractor shall prepare plant specific draft-operating manual of the unit. This should include procedure related with package items if any and submit to OWNER/PMC for review at least 150 days prior to mechanical completion. Five copies of draft operating manual shall be submitted by the LSTK Contractor for review. Following information shall be covered as a minimum requirement.



- Design basis of facilities.
- Chemistry of the process.
- Detailed process description.
- Pre-start checks.
- Pre-commissioning procedures.
- Start-up procedure.
- Normal operating procedure.
- Shutdown procedure (normal & emergency).
- Plant trouble shooting procedure. ☐
- Operating parameters and set points of alarms and trips.

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- Operating conditions of different cases of operation.
- Effect of operating variables on the process.
- Functional description of all complex control schemes.
- Details of interlock logic, trip etc.
- Functional description of safe shut down systems.
- List of emergencies and emergency handling procedures.
- Dosage rate of chemicals used and other related operating information.
- Initial requirement of chemicals for first start-up.
- Safe handling precautions for chemicals used (MSDS).
- List of equipment and their major details.
- Relief valve schedule, tag numbers, location, set pressure, capacity basis, failure scenarios considered etc.
- List of blinds for shut down and start-up.
- Approved/final PFDs/P&IDs, plot plan, equipment layout and equipment datasheets etc.
- Any other special conditions / instructions / information, etc.
- Summary of chemical consumption.
- Summary of utility consumption.
- Lubrication schedule (with equivalent lubricant available in India).
- Hydrocarbon/flammable / toxic gas detection and associated safety system.
- Use of life saving devices.
- Fire and safety system.
- Laboratory analysis requirement and procedure with sampling schedule.
- Procedure for preparation of equipment hand over.
- Work permit procedure (will be provided by owner).
- Chemical solution preparation procedure (if any).
- Safe handling of chemicals

Review of operating manuals shall be done by OWNER/PMC within 30 days after receipt of draft operating manuals. All the changes, additions, deletion required by the OWNER/PMC shall be discussed with the LSTK Contractor and shall be incorporated in the final operating manuals by the LSTK Contractor. 15 (Fifteen) copies of final operating manual shall be submitted by LSTK

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Contractor. The same shall also be forwarded in CD in MS Office/PDF format. The manuals shall be submitted to OWNER at least 90 days prior to mechanical completion. These operating manuals shall be followed during start-up and commissioning of the plant. Instructions in operating manuals provided by equipment suppliers shall not form a part of this operating manual.

In case of any revisions due to any reason, the same shall be incorporated and submitted as revised sheets during the start-up and commissioning stage. However, revised operating manual incorporating changes shall be submitted within one month after the commissioning has been completed.

9.2 Schedule & Organization

The LSTK Contractor shall submit the pre-commissioning and commissioning schedule in the form of network detailing therein the sequence of all the pre-commissioning and commissioning activities and time taken by each individual activity to be carried out in each equipment / sub- system of the facilities. This shall be submitted to OWNER 90 days prior to start of pre-commissioning activities. LSTK Contractor shall submit weekly progress report and the status of pre- commissioning and commissioning activities, likely slippage in schedule and action being taken by the LSTK Contractor to contain this slippage. The LSTK Contractor shall submit the organisation chart of commissioning team and the bio- data of key persons who shall be present at the time of commissioning. LSTK Contractor shall also specify the planned duration of stay of these personnel.



9.3 Pre-Commissioning Documents

It shall be the responsibility of the LSTK Contractor to prepare detailed and integrated check list of pre- commissioning and commissioning activities for each equipment, subsystem, system and plant and submit the said format for approval to the OWNER/PMC.

This checklist shall indicate the checks / test to be carried out on each equipment / system and shall also indicate the sequence and schedule of the activities.

For execution of these pre-commissioning activities, the units shall be divided into system and sub-systems so that pre-commissioning activities of each system/sub-system can be progressively carried out along with the construction activities. The pre-commissioning document shall contain the following as a minimum:

- i) System identifications and mark up on P&IDs.
- ii) Pre-commissioning and start-up schedule.
- iii) Detailed procedure for the various pre-commissioning activities i.e. flushing, blowing, purging, drying, leak checking, system tightness, equipment operability test with forms to record the observation of each of the activities to be carried out.
- iv) Procedure and forms for operability tests of equipment and system, wherever applicable.
- v) Lubrication schedule indicating manufacturer (IOC equivalent to lubes, quality, initial fill recommended, and frequency of changing the lube oil).
- vi) Detailed procedure for carrying out Passivation of cooling water system/compressor circuit, when and if required, shall be approved before implementation. Requirement of tanks, pumps, chemical dosing arrangement and apparatus for chemical analysis shall be detailed out by LSTK Contractor and shall be in LSTK Contractor's scope.

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vii) The LSTK Contractor shall submit the draft of above mentioned pre-commissioning documents 180 days before the activities are to be carried out. The document shall be reviewed by the OWNER/PMC. The LSTK Contractor shall submit 120 days prior starting of activities, a revised document after incorporating OWNER/PMC's comments. The documents shall be followed till the project is completed.

viii) Commissioning of the facilities shall not be permitted till all the documents have been submitted by the LSTK Contractor to the OWNER. Any delay in commissioning on this account shall be considered as a delay in commissioning by the LSTK Contractor.

ix) Hydrotest reports & certificates

x) Functional test reports

9.4 Pre-Commissioning Reports

The LSTK Contractor shall issue the following for review by the OWNER/PMC.

Daily report- mentioning activities, personnel mobilized and progress.



Monthly report- mentioning activities, mobilization chart for resources, progress for the month and forecast for the next month.

9.5 Commissioning Documents

- a) Commissioning schedule
- b) Commissioning System description and system marked drawings
- c) Quality control reports
- d) Punch lists- categorized and status report
- e) Specific procedures, for the activities
- f) Vendor/ process licensor's reports

9.6 Ready For Commissioning-RFC

- a) RFC certificates for the systems
- b) Punch lists categorized- liquidated and pending
- c) Pre-commissioning test reports
- d) MRT/ function tests report
- e) Mechanical report
- f) Supplier manufacturer reports- special procedures
- g) System marked drawings (as pre-commissioning completed)
- h) Relevant parts of final documentation
- i) List of modifications and documentation if any.
- j) Commissioning execution plan and schedule.

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9.7 Ready for Start-Up (RFSU) Documents

- RFSU certificate
- System marked drawings
- Exception punch list, if any.
- Start-up resource mobilization plan

9.8 Handover Documents

- Mechanical completion dossier
- Commissioning dossier
- Prestart safety review report, audit reports.
- Performance test reports
- Operating manual



10. Other Requirements

LSTK Contractor shall ensure that all safety devices like pressure safety valves, emergency shutdown valves are tested, witnessed and certified in the presence of representatives of OWNER/PMC. These certificates are to be handed over to OWNER/PMC prior to start-up of the plant. The LSTK Contractor shall install 'No Smoking' boards & boards for other instructions at designated areas. LSTK Contractor is required to maintain and follow all safety practices, equivalent or better than those being practiced by OWNER for the complex during pre-commissioning and commissioning. LSTK Contractor shall provide necessary communication philosophy during pre-commissioning and commissioning activities. Necessary numbers of walkie talky shall be provided by the LSTK contractor for their personnel and minimum of three nos. each for Owner/ PMC during pre-commissioning / commissioning activities coordination.

10.1 Vendor's/Supplier's Representative

LSTK Contractor shall arrange vendor/supplier's representative during pre-commissioning, commissioning for

- All pumps & compressors.
- All package items
- Specialist for supervision of catalysts loading, chemical cleaning and cooling water system passivation.
- Gas (hydrocarbon and H₂) detection system, fire detection, fire protection systems and safety equipment.
- ESD/PLC/DCS/PAGA system
- Any other critical/proprietary equipment, for which it is felt necessary to call Vendor's representative for proper commissioning. However, the overall responsibility of these will be with the LSTK contractor.

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10.2 Review/Check listing/Inspection Co-ordination

A general guideline on OWNER/PMC interaction with respect to plant pre-start- up activities is given below. However, OWNER/PMC reserve right to witness all works at any stage.

- Review of pre-commissioning documents and schedule (as detailed in section 9.3 & 9.5).
- Review of operating manual (as detailed in section 9.1).
- Check listing (system-wise)
- Preliminary checklist on system completion.
- Final checklist before start of pre-commissioning activities.

10.3 Typical approach to Witness/Inspection

- | | |
|---|----------|
| a) Installation of safety device | Complete |
| b) Provision of temporary strainers and blind at critical locations | Complete |
| c) Water flushing and air blowing of pipelines | Random |
| d) Instrumentation interlock checks | Complete |
| e) Operability test for a system/equipment | Complete |
| f) Blind list as per start- up requirement/normal operation | Complete |
| g) Chemical cleaning of compressor suction line & lube oil circuit | Complete |

Witness/ inspection / approval of OWNER/PMC are not an obligation but a right with no change in LSTK Contractor's liabilities. At the discretion of OWNER/PMC, the extent of witness / inspection may be extended/ reduced as deemed fit.

10.4 Final Inspection before Start of Commissioning

OWNER/PMC shall carry out a final inspection (PRESTART SAFETY REVIEW- PSSR) of the plant/facilities. Record of liquidation of punch lists, checklist points, test records etc., shall be submitted by the LSTK Contractor to OWNER/PMC. Any deficiency/ changes required in the offered system shall be liquidated by the LSTK Contractor.



11. Spares And Consumables

11.1 Commissioning Spares

The LSTK Contractor shall procure and supply all spare parts required during commissioning of the UNIT and various systems. The price of supply shall be deemed to be inclusive of the provision of all such commissioning spares required till successful commissioning of the UNIT. The LSTK Contractor should make available all the commissioning spares required at site at least 4 (four) weeks prior to commissioning.

11.2 Mandatory Spares

The LSTK Contractor shall supply all the mandatory spares as specified elsewhere in Bidding Document required for the UNIT. The handing over of the spares will be followed through SAP system. Methodology/Modalities to be followed for handing over of spares as per SAP system shall be provided by OWNER.

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11.3 Operation And Maintenance(O&M)Spares

The CONTRACTOR shall, within 3 (three) months of finalization of all the suppliers by the CONTRACTOR, furnish to the OWNER the current price list for O&M spares for 2 (two) years operation beyond the Defect Liability Period as recommended by manufacturers of various equipment (other than commissioning, mandatory and O&M spares required during the defect liability period, the lump-sum price quoted shall include cost of O & M Spares required during the Defect Liability Period.). Price lists of these spares are intended for information purpose only shall not be included in quoted Lumpsum Price.

Excess spares shall be handed over by LSTK contractor to the owner after commissioning. LSTK Contractor shall be also responsible for supply of lubes, chemical and other consumables for a quantity equivalent to six months of normal operation after commissioning.



The OWNER shall supply the CONTRACTOR, power, water, DM water, steam, plant air, instrument air and raw materials (required for producing the final product), hydrogen, nitrogen (excluding chemicals & lubricating oil), required exclusively for pre-commissioning and commissioning and Guarantee Performance Tests of the UNIT. The OWNER will also make available its existing facilities for handling and disposal of waste water during pre-commissioning and commissioning. The utilities to the extent of normal consumption of unit like air, nitrogen, power, water, and steam during pre-commissioning /commissioning shall be provided by the Owner at the battery limits. It shall be the LSTK Contractor's responsibility to extend the facilities from the battery limit to the consumption points and to repair any damage to the system occurred during storage, installation, pre-commissioning and commissioning stage. LSTK Contractor shall submit catalogues for all the lubricants, catalysts and chemicals being charged for commissioning.

12. Special Requirement

Any upgrade in utilities, if required, either for pre-commissioning or commissioning shall be carried out by the LSTK Contractor at his own cost. Hook-ups required between various LSTK Contractors shall be provided by the LSTK Contractor wherever it is shown in his scope.

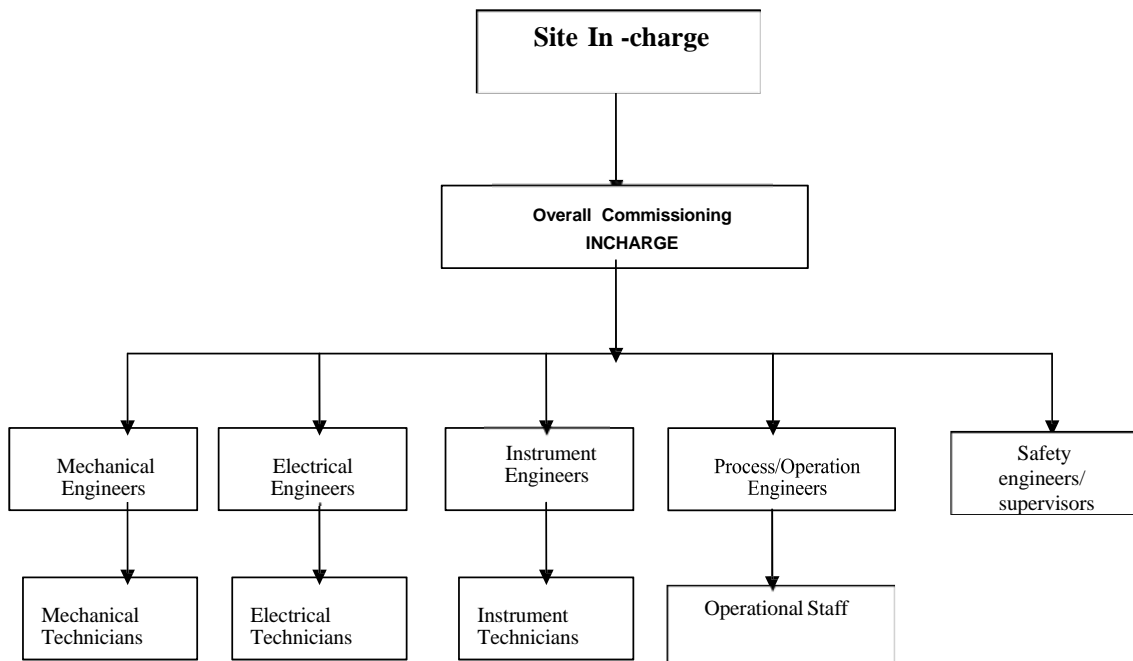
13. Plant Staffing

LSTK Contractor to suggest manning requirement (category) and the plant operation organisation structure to OWNER/PMC for effective operation and maintenance of the facilities. The proposed manning requirement and organization structure to consider the Indian condition. The details shall be submitted 120 days prior to Mechanical completion.



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14. Annexures

14.1 Annex -I -Typical Organogram for Commissioning Team



Technicians shall include Technicians and semi-skilled personnel.

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14.2 Annex-II-Format for Bio data of Key Personnel for Commissioning

1. PROPOSED POSITION IN ORGANISATION CHART:



2. NAME:

3. QUALIFICATION:

4. TOTAL YEAR OF EXPERIENCE IN PLANT OPERATION / COMMISSIONING:



5. DETAILS OF COMMISSIONING EXPERIENCE:

SL NO	PROJECT DESCRIPTION	PLANT CAPACITY	LICENSOR	OWNER	YEAR OF COMMISS.	DURATION OF STAY AT SITE

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14.3 Annex-III -List of deviations

CLAUSE NO.	DESCRIPTION OF CLAUSE	AGREED	NOT AGREED	REMARK
1.0	SCOPE			
2.0	DEFINITIONS			
3.0	DOCUMENT FOR PRE-COMMISSIONING AND COMMISSIONING			
4.0	OTHER REQUIREMENTS			
5.0	MANUFACTURER REPRESENTATIVE			
6.0	REVIEW / CHECKLISTING / INSPECTION / CO-ORDINATION			
7.0	A TYPICAL APPROACH TO WITNESS/ INSPECTION			
8.0	FINAL INSPECTION			
9.0	COMMISSIONING			
10.0	PERFORMANCE TEST RUN			
11.0	CONSUMABLES			
12.0	SPECIAL REQUIREMENTS			
13.0	SAFETY			
14.0	PLANT STAFFING			

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14.4 Annex-IV-Formats to be used during Precommissioning& Commissioning

FORMAT-I

INTIMATION REGARDING SYSTEM CONSTRUCTION COMPLETION

PROJECT: _____

CUSTOMER:

UNIT:

Following system/sub-system has been mechanically (Construction and Erection) completed in all respects with exceptions noted below. The system/sub-system can be taken up for checking and preparation of checklist.

SYSTEM NO.

SYSTEM DESCRIPTION:

EXCEPTIONS:



SIGNATURE

DATE

CONTRACTOR'S CONSTRUCTION:
CO-ORDINATOR

The system is ready / not ready for Check listing

OWNER/ PMC:

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FORMAT-II
CHECKLIST

PROJECT: _____ CUSTOMER: _____ UNIT: _____

SYSTEM/SUB-SYSTEM _____

CHECK LIST TYPE

PRELIMINARY / FINAL

SL.NO.

CHECK LIST ITEMS

REMARKS

SIGNATURE

DATE



PMC :

OWNER:

LICENSOR :

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FORMAT - III

READY FOR PRE-COMMISSIONING CERTIFICATE

PROJECT: _____ CUSTOMER: _____ UNIT: _____

SYSTEM/SUB-SYSTEM _____

This is to certify that the following plant/system/sub- system as detailed below is completely installed and all the Checklist points are carried out except for minor details as given in the attached list.

DESCRIPTION ON PLANT/SECTION/SUB-SECTION _____

SIGNATURE DATE

CONTRACTOR'S CONTRACTION CO-
ORDINATOR:

CONTRACTOR'S COMMISSIONING CO-
ORDINATOR

The system is ready / not ready for pre-commissioning



PMC :

OWNER:

LICENSOR:

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FORMAT - IV

READY FOR COMMISSIONING CERTIFICATE

PROJECT: _____ CUSTOMER: _____ UNIT: _____

SYSTEM/SUB-SYSTEM _____

This is to certify that all the necessary pre-commissioning activities for the system/sub-system as detailed below have been completed and the system/sub-system is ready for commissioning except for the minor details as given below which shall not affect the commissioning trial runs.

DESCRIPTION OF SYSTEM/SUB-SYSTEM _____

SIGNATURE DATE

CONTRACTOR'S COMMISSIONING: CO-ORDINATOR



SIGNATURE DATE

PMC:

OWNER:

LICENSOR:

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FORMAT - V

COMPLETION OF COMMISSIONING CERTIFICATE

PROJECT: _____ CUSTOMER: _____ UNIT: _____

SYSTEM/SUB-SYSTEM _____

This is to certify that the system/sub-system as detailed below has been successfully commissioned and is under operational control of Client's Production department. The minor items, which shall not effect the normal operation of the system/sub-system, are given in the attached list.

DESCRIPTION OF SYSTEM/SUB-SYSTEM _____

SIGNATURE

DATE

CONTRACTOR'S COMMISSIONING: CO-
ORDINATOR

SIGNATURE

DATE



PMC'S COMMISSIONING: CO-
ORDINATOR

OWNER'S COMMISSIONING: CO-
ORDINATOR

LICENSOR:

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14.5 Annex-V

REFER DOCUMENT: 080557C-000-PP-806 for typical list of activities to be performed for mechanical completions including pre-commissioning.