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SECTION - 5

HOOK UP

AND

PRE-COMMISSIONING

**OIL AND NATURAL GAS CORPORATION LTD.
INDIA**

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APPENDIX - 5.1 PRE-COMMISSIONING CHECK LIST

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5.0 PRE-COMMISSIONING

5.1 General

It shall be the responsibility of the Contractor to pre-commission and provide assistance during commissioning of the *Pipelines* listed in the scope of work in the Bid Package defined elsewhere.

Contractor shall ensure all necessary pre-commissioning activities applicable for each component of the facilities to be carried out in accordance with the general guidelines provided in Appendix-5.1.

The pre-commissioning activity shall be considered to be completed only when it has been witnessed by Company or its authorized representative and the pre-commissioning formats have been signed by Contractor, Company, vendor's representative (where ever applicable) and others as indicated on the approved format, as a token of successful completion of the said activity.

Contractor shall hand over the pipelines to the Company after successful pre-commissioning activities.

During all the pre-commissioning activities, the contractor shall involve Company's operating staff (nominated by the Company) and impart necessary techniques and know- how for operation and maintenance of the pipeline system.

5.2 DEFINITIONS

5.2.1 Mechanical completion


"Mechanical Completion" of a system means that all installation works of that system have been completed in accordance with 'approved for construction' drawings, specifications, applicable codes and good engineering practices; all tie-in connections have been made, all testing and inspection completed and the system/facilities are ready for pre-commissioning.

5.2.2 Pre-commissioning activities

"Pre-commissioning activities" are defined as the activities to be performed after erection/installation of the pipeline and risers to make them "Ready for Commissioning". This includes but is not limited to the activities like system checking, site modifications, flushing/cleaning of piping, checking of the safety system, operability test of equipment and system as a whole plus recommended checks on CP system etc. Further details are available in Appendix-5.1.

5.3 EXECUTION OF PRE-COMMISSIONING ACTIVITIES

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It shall be the Contractor's responsibility to complete all the pre-commissioning activities, as per conditions stipulated under Appendix-5.1. In case of any ambiguity, contractor shall formulate necessary procedure and obtain approval from Company/Engineer's Representative and shall carry out the work as per approved procedure.

It shall be Contractor's responsibility to complete maximum of the pre-commissioning activities at onshore to minimize the working time offshore. A guideline for carrying out pre-commissioning activities at onshore/offshore is given below:

These are only indicative. Based on that, Contractor shall submit a detailed schedule and procedure for carrying out these activities, which shall be approved by the Company.

5.3.1 List of minimum pre-commissioning activities to be carried out before bringing materials at offshore

- i. Testing of PSVs
- ii. List of pre-commissioning activities related to Instrumentation.
- Off line testing and calibration of instruments as reflected in P&IDs.


5.3.2 List of minimum activities to be carried out at offshore after installation and hook-up.

- i. Calibration check of instruments and loop checking. All the systems/equipments including vendor's packages and Company supplied equipments, if any shall be included.
- ii. Repeat testing of PSVs
- iii. System flushing
- iv. System leak test
- v. System drying (where applicable)
- vi. Calibration and functional check of fire and HC Gas Detectors and on line testing of Fire and Gas detection system.
- vii. Functional check of well/fire SDP and Gas Detection Panel.
- viii. Checking of electrical equipment for proper earthing, continuity, insulation resistance and secondary injection of relays after insulation resistance test.
- ix. Purging of hydrocarbon system with nitrogen to bring down the oxygen content to less than 2%, by volume.
- x. Checking of all life saving equipments.
- xi. Operability test of fire fighting system after interconnection of the fix water header with water injection network.
- xii. Pipeline be filled-up with chemically treated water to prevent bacteria formation and corrosion.
- xiii. Any other work as called for by design criteria and punch list.

5.3.3 Pre-commissioning of Modification Works

Contractor shall carry out modification works, inter-connection and hook-up operations as indicated in Sec.5.1, keeping in view that shutdown period of all the existing facilities should be minimum. Contractor shall arrange to get details of all existing facilities for this purpose.

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It shall be the Contractor's responsibility to carry out all necessary preparatory work like draining, venting, gas freeing, purging etc., for all the existing facilities required for modification and safe tie-in. It shall be the Contractor's responsibility to arrange and provide steam, chemicals, nitrogen etc. required for gas freeing operations. It shall be Contractor's responsibility to ensure proper safety during tie-in/modification operation.

It shall also be the responsibility of the Contractor to carry out the required pre-commissioning activities, as indicated in Sec. 5.3.2, for the existing systems at various platforms described elsewhere in the bid which are either modified or hooked up with the new facilities.

5.4 READY FOR COMMISSIONING

After completion of pre-commissioning activities **including dewatering of pipeline segments following hydro test**, Contractor shall notify to the Company that the systems are ready for commissioning.

"Ready for Commissioning" status shall be then jointly reviewed by the Company / Engineer / Contractor.

Pipelines facilities shall be considered to be pre-commissioned successfully when all the systems as mentioned above including the required utilities and support system have reached a stage where it can be operated with all its controls and safety devices in line to meet the requirement as per design specifications.

Once the facilities are successfully pre-commissioned, it shall be handed over to the Company for commissioning along with tools, kits, commissioning spares and list of operating spares etc. The list of such items shall be prepared by the Contractor and handed over to the Company.

5.5 VENDOR'S REPRESENTATIVE


The Contractor shall arrange to have manufacturer's representative(s) present during mechanical completion / pre-commissioning of the following at offshore. This service shall be included in the lump sum costs quoted by the Contractor.

- i. Shutdown Panel
- ii. Fire and Gas Detection System including Fire and Gas Panel
- iii. Fire and Gas Panel etc. where modifications are envisaged.
- iv. Telemetry interface cabinet.

The Contractor shall submit in their offer at Bid stage to the Company the schedule and minimum duration for calling Vendor's representative at onshore/offshore.

The Contractor shall reconfirm the schedule and duration (of Vendor Representative) three weeks prior to pre-commissioning which shall be strictly complied.

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It is Contractor's responsibility to retain Vendor's representative at site if job is not completed within the period indicated in the offer.

Contractor shall inform the Company about completion of job and shall take approval from the Company before sending Vendor's representative back from onshore/offshore.

5.6 DOCUMENTS TO BE SUBMITTED


5.6.1 Operating Manual

The Contractor shall prepare a draft start up and operating manual for all of the pipelines and submit to Company representative at least 90 days prior to start of pre-commissioning activities. In particular the following information shall be covered in this manual.

- i. Design basis
- ii. Description of facilities
- iii. Pre-commissioning checks
- iv. Vendor instructions for all equipment for normal operation and trouble shooting.
- v. Operating parameters and set points of different alarms and trip devices
- vi. Fire and Gas detection systems operation, maintenance and calibration procedures.
The manual shall have the following attachments as minimum.
 - i) Reduced size copies (275 mm x 425 mm) of line lists.
 - ii) Equipment and instrument data sheets as per purchase order
 - iii) Electrical Single line diagrams
 - iv) PFD & Piping and Instrumentation Drawing (P&IDs)
 - v) Safety Logic Diagrams, all shutdown schemes and Safe Charts.
- vii. Equipment layout
- viii. Safety Escape Routes
- ix. Field Location Map
- x. Layout and Location Maps for Fire and Safety Equipments.
- xi. Recommended proforma for routine parameters during normal operation for C.P. System etc.

The Contractor shall submit the draft operating manual to the Company for review. Review of start-up and operating manual shall be done by the Company/Engineer's Representative within 45 days after receipt of draft. The Contractor shall discuss the comments with Company/Engineer's Representatives and incorporate the mutually agreed comments in the final document. The Contractor shall submit the final document for approval to the Company. After the document is approved by the Company/Engineer's Representative, Contractor shall make the required number of copies, specified elsewhere and submit to the Company/Engineer's Representatives. This manual shall be furnished to the owner at least 30 days prior to the commissioning and followed during start up and commissioning of the facilities. Vendor operating maintenance manuals shall be submitted along with the final operating manual.

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The operation manual can be divided into two or three parts if the thickness of manual is exceeding 3 inches. While describing, pre-startup checks, start-up procedures, shutdown procedure and normal operation for an equipment, vendor's recommended procedure and integration of that equipment with other facilities must be considered.

5.6.2 Pre-Commissioning Procedure

At least 120 days in advance of start of pre-commissioning activities, Contractor shall prepare detailed format of check lists of pre-commissioning and commissioning activities for pipeline system. The Contractor shall submit the said format for approval of the Company.

All the check list points shall be dealt by the Contractor. System readiness for commissioning shall be determined based on completion of relevant portion of check list as per the approved format prepared by the Contractor. The Contractor shall submit a detailed schedule for carrying out the pre-commissioning activities in a network form.

For the purpose of execution of these pre-commissioning activities, the entire unit shall be divided into systems and sub systems. The pre-commissioning document shall contain the following:

- i) System/sub-system identification
- ii) Detailed procedure for the various pre-commissioning activities such as system check, flushing, leak test, etc. with formats to record the observations of the activities carried out.
- iii) List of commissioning spares.
- iv) List of spares and vendor recommended spares for vendor's package items.
- v) List of pre-commissioning activities to be carried out at yard, at offshore, or at both places.

The Contractor shall submit the draft pre-commissioning document 120 days before the activities are to be carried out. The document shall be reviewed by the Company/Engineer's representative. The contractor shall submit a revised document after incorporating Company's comment for approval to the Company/Engineer's Representative. The approved document shall be submitted 60 days prior to starting of the pre-commissioning activities.


5.6.3 Modification/Hook-up Procedure

Contractor shall submit along with pre-commissioning document, detailed procedure for carrying out modification works, interconnection and hook-up operations as indicated in Sec. 5.1. While detailing the hook-up procedure, Contractor shall keep in view that shut-down period of all the existing facilities should be minimum.

The procedure should also contain the pre-commissioning activities, as indicated in Sec. 5.3.2, for the existing pipeline systems which are either modified or hooked-up with the new pipelines.

5.7 SPARES, UTILITIES, ETC.

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The Contractor shall be responsible for supply of all the spares and consumables till the platform including any modifications till the pipelines are mechanically completed, pre-commissioned/commissioned and handed over to the Company.

All utilities required during pre-commissioning/commissioning of the facilities, including power, air, water, crane, etc. shall be provided by the Contractor. In no case the facilities provided on the platform shall be used for this purpose unless authorized by the Company.

It shall be Contractor's responsibility to repair any damage to the system occurred during load out, transportation and installation and pre-commissioning of the pipelines.


The Contractor shall maintain a record of the start-up spares consumed during pre-commissioning and handover the balance items to the Company.

5.8 HANDING OVER OF MATERIALS

After the mechanical completion and completion of the pre-commissioning activities for all the pipelines installed on the platform by the Contractor, the Contractor shall handover to the Company all the materials which shall include but not limited to the following:

- Special tools and tackles
- Commissioning spares

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APPENDIX - 5.1 PRE-COMMISSIONING

The checklist represents the minimum of work which has to be performed but not limited to, by the Contractor prior to commissioning of the facilities. However it is not intended to be a complete list of activities required to be carried out by the Contractor. Manufacturer's instructions for pre-commissioning checks, testing must also be followed for all equipment.

1.0 GENERAL PROCEDURES FOR PRE-COMMISSIONING

The general work procedures listed below outline the work to be performed by the Contractor. Procedures applicable to specific system or items of equipment are covered separately.

1.1 Packing Seals for Valves, pig barrel doors

- a) Install mechanical seals, permanent packing and accessories wherever required.
- b) Adjust and replace mechanical seals, packing and accessories, as necessary, during pre-commissioning/commissioning period.

1.2 Removal of Temporary Bracing

Remove all temporary supports, bracing, or other foreign objects that were installed in vessels, piping, or other equipment to prevent damage during transportation, storage and erection.

1.3 Tie-ins at Unit Battery Limit

Prepare all systems for safe tie-ins with utilities and auxiliary systems. Contractor shall prepare the existing operating systems for tie-ins in consultation with company and will be responsible for safety during tie-ins. Contractor shall take approval of the Company for the safety measures to be taken by him before any tie-in work is taken-up.


1.4 Systems Check/Inspection

- a) Provide inspection facilities to Company/Engineer's Representative to check that erected pipeline facilities conform to the process and instrumentation drawings, construction drawings, vendor drawings and specifications approved for construction.
- b) Verify and approve the facility check. Note exceptions, if any on a separate work order list before taking decision on continuation of pre commissioning process.

1.5 Site Modifications

Carry out site modifications as found necessary during system check/inspection from view point of routine operations, maintenance and safety of the plant. A list of such jobs shall be prepared by the Company/Engineer's Representative and shall be handed over to the Contractor for execution.

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1.6 Flushing and Drying

Perform flushing and blowing of all piping to remove dirt, welding slug, etc. after hydro testing. Arrange for cleaning media for carrying out flushing/blowing and disposal of the cleaning media in accordance with procedures to be adopted by the Contractor and approved by Company.

Following flow rates of cleaning media are to be maintained for flushing/blowing of piping:

Air - 8-9 ft/sec.

Water - 3-4 ft/sec.

Carry out drying operation of all piping after flushing/blowing is over as per the approved procedure.

1.7 Temporary Spools, Strainers and Blinds

Provide and install all temporary strainers (20-40/in mesh) wherever required. Install permanent strainers after initial operation.

Clean strainers as required during pre-commissioning and commissioning.

Provide, install and remove all blinds required for flushing operation.

Install and dismantle temporary pipe spools as and when required for pre-commissioning and commissioning.

Change gaskets, if necessary.

1.8 Leak Tests

a) Make non-operating leak tests on piping. Conduct all tests in accordance with applicable codes and specifications.

b) Detailed procedure for leak tests on piping shall be submitted to Company for approval.

c) In no case the leak test pressure shall exceed the system design pressure. If any special media for test purposes is used, provide facilities for its disposal.

d) Notify Company of test schedule at least two days in advance. All the tests are to be witnessed and test record on satisfactory completion of the test be signed by Company/Engineers Representative.

e) Provide four copies of all the test records to the Company.

f) Conduct all operational tightness test.

1.9 Safety Devices

a) Provide the Company with a list of proper settings for safety devices.

b) Install all safety devices (including pressure relief valves) on the equipment after calibration.


c) Test and adjust all safety devices such as PSVs, at Offshore.

1.10 Purging

Install necessary purge connections and carry out system purging with inert gas including that of flare and vent as per Company's approved procedure. The final oxygen content in purged system shall be brought down to less than 2% (v/v). Contractor shall arrange and supply the nitrogen required for purging.

1.11 House Keeping

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Provide continuous clean-up the construction and operational area. Remove excess materials, temporary facilities and scaffolding and pick-up thrash. Perform washing for further clean-up as required.

1.12 **Equipment Protection and Spare Parts**

- Protect equipment from normal weather conditions, corrosion or damage before commissioning.
- Provide all installations and commissioning spares.
- Mark escape routes on the platform. Install duly framed escape route drawings at all strategic locations.

1.13 **Miscellaneous**

To carry out any other check/test as required by Company/Engineer's Representative and provide all test certificates of the items supplied by the contractor as required by the Company/Engineer's Representative.

1.14 **Operability Test**

- The Contractor shall provide his proposal/procedures for carrying out the operability test to prove that the pipeline installed meet the design specifications.
- This shall also include the supply of log sheets wherein the operating parameters shall be recorded hourly.
- The operability test shall be carried out by the Contractor and the Vendor's Representative wherever applicable.
- The Contractor shall make necessary checks, adjustments, repairs required for normal operation of the pipeline. The safety devices shall be tried for their proper operation.
- Upon completion of the operability test, the log sheet with all observations shall be signed by the Contractor/Vendor's Representative. The performance should be evaluated based on the data and observations made during the operability test. In case of any dispute, the decision of Company/Engineer's Representative shall be final.


2.0 **SPECIFIC PROCEDURES**

In addition to the work to be performed in accordance with the above, the detailed procedures outlined below further define the work responsibilities of the Contractor for specific systems and items of equipment.

2.1 **Piping Systems**

- Notify the Company of hydrotest schedule at least two days in advance.
- Orifice plates, control valves and any other on-line instruments should not be installed before testing and flushing. If installed, they shall be removed and necessary spool pieces shall be provided in their place wherever required.
- Piping system shall be thoroughly flushed and cleaned to the satisfaction of the Company/Engineer's Representative.
- Hydrostatically or pneumatically test all piping as required by the drawing or specifications.

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e) After testing drain and dispose of the test media as per the Company's instructions. All the piping will be dried using air and boxed up. Air for drying purpose shall be arranged by Contractor.

NB: Air used for drying shall be free from oil, in other words non-lubricated air compressors shall be used.

f) Check pipe hangers, supports, guides and pipe specialities for the removal of all transportation and erection stops and for the correctness of cold settings for the design services.

g) Check pipe supports, hangers, guides and pipe specialities for hot settings and make minor adjustments as necessary.

h) Install seals on valves where necessary. Replace dried up graphite seals with fresh ones.

i) Correct support, vibration and thermal expansion problems detected during commissioning.

j) Ensure appropriate permanent gaskets are installed.

2.2 Electrical Power and Lighting Systems

a) Notify Company of the test schedule.

b) Using a megometer make insulation tests on all wiring.

c) Insulation tests are to be carried out on all HT/LT cables, HT/LT panels and lighting boards etc.

d) Make grounding system tests to determine the continuity of ground connections and the value of resistance to ground.

e) Check that all electrical equipments are certified for the environment in which they are located.

f) Continuity check of anodes for C.P.System

2.3 Instrument Systems

a) The Contractor will make all non-operating checks that will ensure instrument operability, i.e., remove all transportation stops, check pointer travels and verify instrument capability to measure, operate and stroke in the direction and manner required by process application.

b) Clean all transmission and control tubing by blowing with cooled and filtered clean air before connecting to instrument components.

c) Clean all transmission air supply headers by blowing with cooled and filtered clean air and check them for tightness.

d) Leak test pneumatic control circuits in accordance with ISA recommended practice RP 7.1, Pneumatic Control Circuit Pressure Test, 1956.

e) Check impulse piping from instruments to process piping for tightness.


f) Install and connect all system components and verify their conformance to specifications and design criteria for functioning and range using dummy transmission signals as needs.

g) Check thermocouple for proper joining of wires, position of elements in wells, proper polarity and continuity of receiving instruments.

h) Identify orifice plates by tagging and check for proper installation of upstream side of plate.

i) Isolate or remove if necessary on line components such as control valves, positive displacement meters and turbine meters for pressure testing. Reinstall these items after testing the system.

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j) Check bores and flow direction of orifice plates and install these plates after completion of flushing operations.

k) As indicated by the Company's specifications, calibrate instruments with standard test equipment and make all required adjustments and control points settings.

l) Fully pressurize and energize the transmitting and control signal system(s) by opening process connections at primary sensors and final regulators and by making control mode settings for automatic operation of equipment as the process unit is charged and brought on-stream.

m) Check settings of all alarm and shutdown switches.

n) Check all shutdown systems before commissioning.

o) The Contractor shall arrange for testing and re-calibration of all safety valves settings at offshore. Ensure that isolation valves of safety valves are locked open/close as per drawing.

p) Check all electrical signals and alarm wiring for continuity, correct source of power and polarity.

q) Hydro testing of impulse tubing and other associated tubing.

r) On line testing & calibration checks of all instruments and loop checking of all such instruments.

s) Installation and hook-up of Gas detector fusible plug, ESD / FSD stations etc.

t) ESD / FSD loop testing.

u) Functional test and associated loop testing incoming and outgoing (to and fro) from well / fire shutdown panel.

v) Functional test and associated loop testing related to Fire and Gas Detection system.

w) Functional test and associated loop testing related to telemetry interface cabinet.

x) Any other instrument related activity not listed above but mentioned elsewhere in bid package.

2.4 Shutdown System

The ESD and FSD systems shall be provided for new pipelines. These will be checked by manual pull switches and by removal of fusible plug from fusible plug loop, if such a loop is provided on the launcher/ receiver.

2.5 Control Panel Alarm System

The shutdown panel shall be checked for all process, fire, gas and ESD/FSD signals. The panel shall be checked for visual as well as audible alarms.

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