MAZAGON DOCK SHIPBUILDERS LIMITED

EXPRESSION OF INTEREST (EOI) INVITATION TO REPUTED FIRMS FOR FORMING A CONSORTIUM AGREEMENT FOR ONGC'S PROJECT -"ADDITIONAL DEVELOPMENT OF RATNA–I (ADR-I) AND NLM-14 PROJECT BY MDL".
(EOI No. EY/OP/T&I/01 dated 12 Nov 2025)

Corrigendum No. 1

Date: 19 Nov 2025

The Corrigendum No.1 is being issued for following:

1. For amendment of EoI Clause No. 6.2 and Clause No. 16 as below

Sr.	Existing as per Tender	To be read as
a)	Closing Date : 19 Nov 2025, 17:00 Hrs	Closing Date : 26 Nov 2025, 17:00 Hrs
b)	Clause 3.2 Enclosure-01	Clause 3.2 Revised Enclosure-01 uploaded with complete scope of work of the tender.

2. Rest all other terms & conditions of this EOI will remain unchanged.

For Mazagon Dock Shipbuilders Limited

Manoj Gawande
DGM/HoS
Marketing-Offshore Projects

ENCLOSURE-1

VOLUME-II

Section-1

ADDITIONAL DEVELOPMENT OF R-SERIES - 1 (ADR-1) AND NLM-14

TABLE OF CONTENTS

SECTION – 1

Background and General Requirement

1.0 INTRODUCTION

Oil and Natural Gas Corporation Limited (ONGC), hereinafter called as 'ONGC', is engaged in exploration and exploitation of Western Offshore Field in the Arabian Sea on the continental shelf of Western India. The field well developed with an extensive infrastructure of wellhead platforms, process platforms and pipelines. Western offshore consists of three assets viz. Mumbai High Asset, Neelam & Heera (N&H) Asset and Bassein & Satellite (B&S) Asset. The present work package comprises of development work in two distinct fields viz. ADR-1 and NLM-14 of N&H Asset.

Ratna-R series field's part of N&H Asset is located about 130 km south-west of Mumbai and about 41 km from Heera field in the western offshore at an approximate water depth of 40-50 meter.

ONGC has developed Ratna & R Series fields for production of well fluid and transport to Heera Process Complex. With the present tender for **ADR-1 Wellhead and Pipeline Project**, ONGC plans to develop 02 new wellheads platforms 01 Riser Jacket Platform (RJP), intra field submarine pipelines for intra field well fluid transportation and for evacuation to Heera. A MOPU and MOPU bridge (A separate tender/contract) landing at new RJP (part of this tender) is proposed for processing well fluid and dispatching separated gas and liquid to existing HRA platform. The handling/separation/pumping of well fluid was supposed to be carried out on ONGC hired jack up mobile offshore processing unit (MOPU separate tender/contract). RJP (Riser platform) is also bridge connected with existing R-10A platform.

At present well fluid of existing Ratna field (Well Platforms) is directly flowing to HRA platform which creating higher back pressure to well and therefore wells are not flowing with full potential.
Subsequently some upside potential has been discovered from 2 new locations viz. R-12-6A, & VGN-A. ONGC intends to further develop the Ratna field with 2 new well platforms, one riser platform named RJP, bridge connected to existing R-10A and a MOPU (by others).

NLM-14: The proposed NLM-14 platform will be located around 12 km from Neelam Process Complex. NLM-14 will be conventional 4 legged conventional well platforms without sub-sea cable.

Wells configuration:

Platform	Total Slots	Producer	Water injectors	Free Slots (**)	Well Conductors	G/L (*)
NLM-14	9	7	0	2	9	9

* Gas lift injection is to be provided for the proposed wells.
** Well fluid flow arms shall be provided for free slots as well.

Submarine pipelines

Segments	Nominal dia. (inch)	Length (km)	Service	MOC
NLM-14→ NLG	12"	12	Well fluid	API 5L, X-60 NACE
NLM-9→ NLM-14	6"	5.7	Gas lift	API 5L, X-60 NACE

1.1 GENERAL

1.1.1 STRUCTURE OF BID DOCUMENTS.

The Bid document consists of five volumes as follows:

VOL. I (Commercial part)

Part – I: Instruction to Bidders including the price Proforma.

Part – II: General Conditions of Contract

Part – III: Project Instructions

Part - IV: Technical Part consists VOL. II, III, IV and V

The Technical Part of bid package broadly comprises of the following:

Vol-II (Technical Part):

Section – 1: Background and General

The Background and General section broadly covers the overview of the facilities being envisaged in this project.

Section – 2: Description of work (Basic Bid Work)

The Description of Work describes the various facilities and systems that are envisaged to be provided on the new platforms and existing platforms.

Section – 3: Design Criteria to be used by the Contractor in performing design & detailed engineering for the facilities.

Section – 4: Design Criteria of submarine Pipeline & Riser and detailed specification of offshore installation works related to submarine pipelines and risers.

The Design Criteria defines the design philosophy for the various systems envisaged under the project.

This section covers Pre-commissioning and Commissioning Procedures of well head Platforms along with Hook-up and Pre-Commissioning of Pipeline.

VOL. III (Technical Part)

This section consists of Functional Specifications applicable for total Scope of Work of the project. Functional Specifications for items pertaining to structural, piping, mechanical, electrical, safety and instrumentation disciplines required for this project are covered in this part. The Functional Specifications describe the essential and minimum required functional considerations regarding selection, installation, calibration, testing and commissioning of individual equipment, items and systems.

VOL. IV (Technical Part)

It comprises of drawings, including P&IDs, PFDs, single line diagram, Flow Scheme, layouts, soil reports etc.

1.2 DESIGN PHILOSOPHY

The Bid document provides the following:
Functional design and engineering requirements for the structural design of platform, which includes jacket, piles and deck design. Bidder is required to furnish the cost effective, industry proven design of platform, based on applicable International Codes and content of the bid document.
Minimum indicative P&ID, PFD for designing topside facilities on the Platform. However, bidder to carry out the detailed engineering & design as per design requirements and functional specifications given in the Bid Documents.

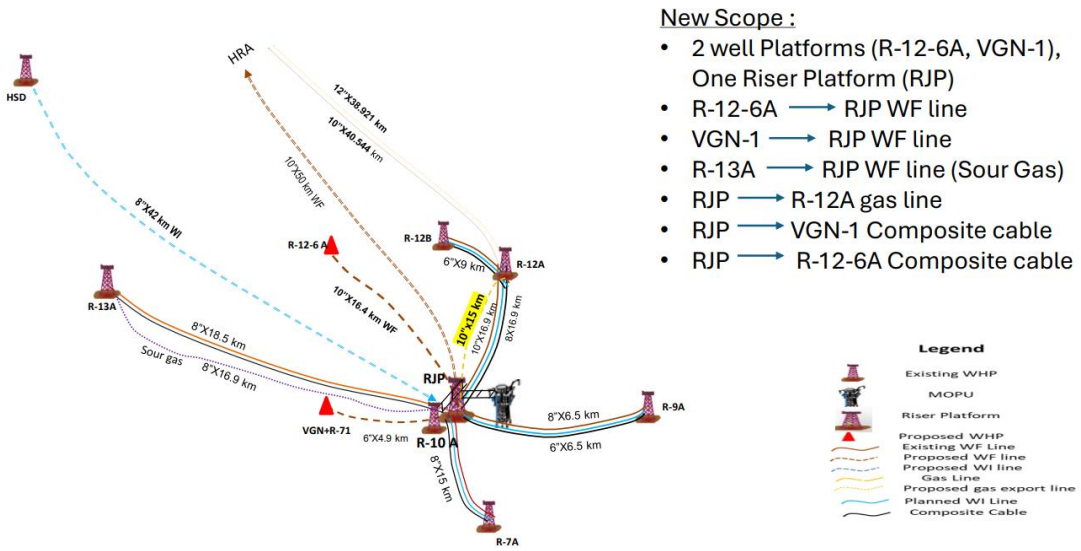
Minimum indicative basic engineering documents of sub marine pipeline and top side facilities. However, bidder to carry out the detailed engineering & design as per requirements given in the bidding documents and generates AFC drawings.

The contractor shall carry out the detailed engineering design based on Design criteria given in section 3 Vol-II, however selection of equipment / assemblies shall be governed by the Functional specifications given in the Bid Document.

1.3 Overview of Wellhead and Pipeline Project

1.3.1 ADR-1

- 02 Nos. of new Well Head Platforms (R-12-6A and VGN-A) and 01 No. of Riser platform RJP.
- Bridge between RJP and existing well platform R-10-A.
- Associated in field Well Fluid pipe lines of approximately 56 km.
- Subsea composite cable of approximate total length 22 km.
- All required topside modification as described in detail elsewhere at R-10-A.



*VGN-1 is to be read as VGN-A

1.3.2 NLM-14

- 01 Nos. of new conventional Well Head Platform (NLM-14)
- Associated in field Well Fluid pipe lines of approximately 12 km.
- Gas lift pipeline approximate total length 5.7 km
- All required topside modification as described in detail elsewhere at NLG and NLM-9.

1.4 PRE-COMMISSIONING / COMMISSIONING OF PLATFORM & FACILITIES

The Contractor shall carry out the pre-commissioning and commissioning activities as described section-5 and 5103W (Pre Commissioning, Commissioning Procedure & Performance Test–Well Platform). It shall be Contractor's responsibility to carry out all pre-commissioning and commissioning activities applicable for each component of the facilities in accordance with general guidelines provided in API-700 and hand over the platform to the Company duly commissioned and complete in all respects. It shall be responsibility of Contractor to provide all men and materials including Vendor's representatives for execution of the Work and hand over the platform as per schedule indicated in the Bid Package.
Specification 5103W and Hook-up and Pre-commissioning Procedure is at Section-5 of Vol-II.

MOPU (In the scope of other contractor) is essential part of this project to handle process fluid, gas, power generation and Instrumentation (control and monitoring). MOPU installation and final commissioning and interface with RJP may or may not sync with this project schedule. In view of that Process, Power and Instrumentation OEM assistance for well heads and RJP shall be done after MOPU installation or contractor has to provide OEM assistance/support within maximum 1 year from platform installation pre commissioning date. Subsea cable charging shall be done by temporary DG set and transformer at RJP to individual well heads for integrity check.

1.5 SPECIAL REQUIREMENTS

1.5.1 Company reserves the right to participate in the selection of vendor for major equipment and items. For equipment other than those indicated in recommended vendor list (enclosed), at the time of selection of the vendor, prior to placement of the order, the Contractor shall notify company in writing of their intended vendor and furnish company with two copies of the vendor's complete technical bid offer, all technical correspondence/clarification furnished by vendor to contractor and his past experience. Company shall have right to hold detailed technical discussion with the vendor and visit vendor's works to satisfy about vendor's capability to execute the job. The contractor shall issue the purchase order only after written approval of the company regarding acceptance of the selected vendor.

After pre-commissioning of water injection pipelines, bidder shall ensure filling-up of submarine pipelines with treated water consisting of chemicals including bactericide, oxygen scavenger etc. so that the pipelines remain protected for at least one year, in case, these remain

non-operational due to drilling/completion activities.

Approval of purchase specification does not absolve the contractor from supplying equipment of proven design as per company's specification, International codes etc requirements.

1.6 SPECIFIC WARNING SIGNS AND OPERATING INSTRUCTIONS

1.6.1 Bidder is required to install special notices in English and Hindi and signs on the platform and on vessels and equipment as noted below: -

Necessary safety precautions at strategic locations including landing/arrival points at boat landing etc.

'NO SMOKING' signs at/near strategic locations viz. building module, well head, boat landing etc. To stop intrusion from boat landing, a stainless steel rolling shutter or suitable door, automatic/mechanical operated and lockable shall be provided at the end of stair landing at cellar deck.

Platforms designation code viz. RJP,R-12-6A, VGN-A & NLM-14 shall be permanently and conspicuously displayed on two sides of the platform and on the roof top of deck so that it can be seen in clear visibility by sea going vessels or air borne aircraft.

1.7 SPARES, CHEMICALS, LUBRICANTS AND CONSUMABLES

1.7.1 Spares, chemicals, lubricants, consumables, tools (including special tools) as required for mechanical completion, pre-commissioning, and initial fill for the entire facilities shall be procured and supplied by the Contractor as part of this bid firm scope of work. This would include any chemicals, lubricants, consumables etc. required for flushing and/or during trial/performance run of the system. The Contractor shall also supply all initial fill of chemicals & lubricants (including six months requirement), etc. for the entire facilities as part of bid scope of work, before company takes over the facilities for operation.

1.7.2 Contractor shall be responsible for supply of all spare parts required during hook-up, testing and pre-commissioning. Contractor shall furnish complete list with details for such spare parts procured and keep an inventory of these parts actually used. All unused parts shall be handed over to the company as part of Contractor' scope of work.

1.8 MANUFACTURERS' SERVICE REPRESENTATIVES

Contractor shall have manufacturers' service representatives on board the platforms during mechanical completion/ pre-commissioning & commissioning of the top side facilities as indicated in Part-IV, Section-6 of this bid document. All costs for these shall be included in bidder's lump sum amount.

1.9 SCOPE OF SUPPLY

1.9.1 Company's scope of supply

Company shall make available wherever applicable, the as-built documents, drawings and other relevant information to the extent possible depending upon their availability.

The Company will be responsible for the following:

- Review and approval of Bidder documentation as per the Bidder's document approval matrix
- Provision of relevant Company personnel to attend major project review meetings conducted by the Bidder, including, but not limited to CHAZOP, HAZID, HAZOP, SIL, QRA, engineering, design, fabrication, constructability, pre commissioning and Commissioning where ever applicable.

1.9.2 Contractor's scope of supply

1.9.2.1 The procurement and supply in sequence and at the appropriate time, of all materials and consumables required for the completion of work in accordance with the technical specifications/time schedule shall be entirely the responsibility of the Contractor and his quoted price shall include the provision of all such materials. Contractor's scope of supply shall consist of the following but not limited to: -

All materials (pipes, flanges, fittings, valves, instruments, cables, wirings, structural steel, pipeline materials etc.) including operational/maintenance spares other than those defined in Company's scope.

1.9.2.2 The procurement of material shall be from Company's approved Vendor/sub-vendors and necessary documents; test certificates shall be furnished for Company's review/approval.

Transportation of materials to/from Contractor's/Vendor's stores/workshop worksite/field for fabrication/installation including handling loading/unloading etc. included in Contractor's scope.

1.10 QUALITY ASSURANCE

The Contractor and his sub-Contractor, shall operate a quality system satisfying the applicable provisions of BS 5750/ISO 9000 (Series) latest edition.

Contractor shall include in his bid the quality assurance plan containing overall quality management procedures which is required to be adhered to during execution of contract. After the award of the contract, detailed QA plans to be followed for execution of contract under various division of works will be mutually discussed and finalized.

The Contractor shall establish document and maintain an effective quality assurance system as outlined in recognized codes.

Quality assurance system plans/procedures of the 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/procedures to be followed for quality control in respect of design engineering, procurement, fabrication, installation, hook-up and testing. The quality assurance system

should indicate organizational approach for quality control and quality assurance of the constructional activities at all stages of work at site as well as workshop.
The Company or its representative shall reserve the right to witness/inspect review any or all stages of work at shop or site as deemed necessary for quality assurance.

The Contractor has to ensure the deployment of quality control and quality assurance Engineer depending upon the quantum of work. The QA/QC group shall be fully responsible to carry out the work as per contract. In case the Engineer in-charge feels that the Contractor's QA/QC Engineers are incompetent or insufficient, Contractor has to deploy other experienced Engineers as per site requirement and to the full satisfaction of Engineer in-charge.

1.11 HEALTH, SAFETY & ENVIORNMENT REQUIREMENTS

The Contractor shall be responsible to comply with code requirements of International Maritime Organization (IMO), International Convention of Safety of life on sea (SOLAS), Occupational Safety & Health Administration (OSHA), ISO – 14000 series, American Petroleum Institute (API) RP-14A, 14B, 14C, 14D, 14E, 14F, 14G, 14H, 14J and the international practices and the requirements as stipulated in Vol.-I of the bid document with regards to Health, Safety & Environment.(Refer Spec no 5101,5102,5104). In addition, Contractor shall follow International Maritime Contractors Association (IMCA) Guidelines or International code of practice for offshore Diving work. Contractor shall indicate proposed code in bid offer.
During execution of the project, Contractor shall ensure compliance of various activities related to Safety, Health & Environment as per applicable codes and submit the compliance report to Company.
The Contractor shall carry out safety studies as per Functional specification for safety studies No: 5101 and carry out necessary changes wherever required as per the findings of the safety studies without any time and cost impact to the Company. The contractor shall provide as a minimum all operation / safety equipment as per Functional safety specifications No. 5102 included in the bid package. The contractor shall also take care of Health, Safety, and Environmental requirement for any other works specified elsewhere in the bid package
Contractor shall develop all the applicable reports as per the requirements of IEC 61511, ISA 84 & IEC 61508. As minimum consolidated report shall include Hazard & Risk Analysis, Allocation of Safety functions to protection layers, SIS safety requirements specification, SIL analysis of SIF (Safety Instrumented Functions). Contractor to note that for the purpose of project scope all Guidelines/ Technical report/ Recommended practices sections of IEC 61511, ISA 84 & IEC 61508 are applicable.

1.12 RESPONSIBILITIES OF THE CONTRACTOR

As described herein and in the instructions in Part-III of this bid document, it will be the Contractor's responsibility to carry out the following:

- All surveys such as pre-engineering, pre-construction, post-construction, as built etc. as described in the bid document.

- Design and detailed engineering of all facilities in accordance with design parameters and International Codes and Standards but incorporating changes/revisions which are not adequately covered and reflected, considering that bid document is solely based on functional specifications.
- Preparation of all fabrication drawings, purchase specifications, specifications and procedures for fabrication, load out tie-down, transportation, offshore installation, hook-up, testing, pre-commissioning and commissioning (wherever applicable) including the existing facilities where modifications are to be carried out or where loose material are to be handed over.
- Procurement including expediting and inspection of all materials and equipment for construction and incorporation in the facilities. In addition to Company or Company appointed inspection agency, the Contractor has to carry out the inspection of material/equipment through third part inspection agency duly approved by the Company.
- The procurement of all equipment and material shall preferably be from Company's approved Vendors /Sub-vendors (Suggested Vendors' List enclosed). All necessary documents including test certificates shall be furnished for Company's review and approval.
- Company reserves the right to participate in the selection of vendor for major equipment and items. Vendor, other than those indicated in the suggested vendor list, if proposed then contractor shall notify the company in writing of the name / details of the intended vendor and furnish company with two sets of the vendor's complete technical bid offer including past experience of supplying similar items and all technical correspondence / clarification furnished by the vendor to the contractor. Contractor shall ensure that the vendor's technical offer shall be duly vetted by their engineering sub-contractor incorporating observations / recommendations, before submission to the company.
- Company shall have right to hold detail technical discussion with the vendor and visit vendor's works to satisfy about the vendor's capability to execute the job. The contractor shall issue the purchase order only after written approval of the company regarding acceptance of the selected vendor. Approval of purchase specifications does not absolve the Contractor from supplying equipment of proven design as per company's specification, International codes etc requirements.

  Contractor's scope includes all materials (pipes, flanges, fittings, valves, instruments, cables, wirings, structural steel, pipeline materials etc.) including operational / maintenance spares other than those defined in Company's scope.

  - All matching flange, gaskets, bolts etc. wherever new piping/instruments are being hooked unto the existing piping.
  - All types of welding consumables, electrodes, filler wires etc.
  - All types of structural members as required for pipe supports, temporary supports, scaffolding materials etc.

- Primers and paints as specified in Spec.No.2005.
- Spool pipes, blinds, plugs, gaskets and other materials/arrangement required for testing of pipe work.
- Radiography/UT/MPI/DP machines and materials as required for NDT as per welding Functional Specifications.
- Any other material not-specifically mentioned above but required for completeness of the work as per specifications, drawings and instructions of Engineer-in-charge within, scheduled time shall be the Contractor's responsibility.
- Fabrication and assembly of all facilities including installation of equipment, piping, piping supports, cabling, ducting tubing etc. into the facilities in accordance with approved drawings and specifications.
- Providing corrosion coating & weight coating (only in case of Rigid Pipeline & Riser option) and cathodic protection for submarine pipelines and risers.
- Load out of all fabricated and bought out components for facilities, coated/wrapped pipelines onto transport barges, sea fastening and transportation to the offshore site.
- Offshore installation of all facilities hook-up, testing, pre-commissioning and commissioning. Contractor shall perform leak test of all well platforms as part of pre- commissioning work. Further, Contractor shall pre-commission all hydrocarbons handling system and fire suppression system (wherever applicable). All necessary hook up & pressure reduction provisions for taking hydrocarbons for different systems shall be provided by contractor. All such pre-commissioning activities shall be witnessed by Company for their satisfactory completion.
- Procurement and delivery of spare parts for one year of operation and maintenance of the facilities as described elsewhere in the bid document.
- Design engineering of all future facilities as described in the Bid Document.
- System Design & System engineering
- Design & Engineering of unified Security & video surveillance and Intruder protection/ access control system integrated with RTU.
- All licence and latest software from OEM coming under this project shall be as per platform life.
- Manufacture, Procurement, Fabrication, load-out, tie-down & Supply of items.
- Packing, Forwarding and Transportation to yard as well as offshore site
- Custom clearance and Insurance, as required / applicable

- Receipt and storage of equipment /items/ instruments at yard and offshore site
- Calibration, Installation, hook-up, testing/Field Testing, pre-commissioning and Commissioning wherever applicable.
- Documentation and warranty
- As built documents
- Contractor is also required to meet any additional requirements spelt out in subsequent sections and drawings and specifications of this bid document.

1.13 AS-BUILT DATA

Contractor shall develop intelligent 3D models of all platforms under scope of present project in the latest version of Hexagon Intergraph's PDS/ SP3D or Aveva's PDMS/ E3D software. The intent of generation of an intelligent 3D Model is to consolidate complete project "As-Built" documentation in soft copy with a single source of data repository. The model shall facilitate instant access to all relevant information e.g. technical specifications, data sheets, design write-ups, installation manuals, operation manuals, fabrication drawings, vendor details, maintenance history, safety instruments etc. by a click of a button on any item of the 3D Model. Updation and maintenance of the Information stored in the 3D Model shall be simple and automatic.
Complete project data, which includes reference data base, project directory, RIS dump files or equivalent files of project database, Design data base and reference database, customization done for equipment, cranes etc. and extraction of reports, orthographic, isometric etc. shall be made available along with the project.

PROJECT DOCUMENTATION

It shall be the contractor's responsibility to prepare project documentation including as built drawings & documents, specifications, operation and maintenance manual, vendor data book etc. Soft copies of all as built drawings on Portable Hard disc using latest version of software shall be provided tabulated below.
During detailed engineering all drawings and documents shall be generated for submission to the company in electronic form and hard copy, wherever required.
Contractor shall upload detailed engineering documents as per approved project DCI-MCI in Company's on-line documentation portal Online Project Monitoring and Control (OPMAC) system. Review & approval process of engineering documents shall be through this portal. Necessary training shall be provided to Contractor's personnel in this regard.
Final Project documentation including As-Builts shall be submitted in hard copy (Except 3D models) as well as in soft also in following formats:

S No.	Description	Format
1	Project documents	Latest version of Microsoft Office
2	Vendor drawings, specifications, Operation and maintenance manual, Vendor data book	Latest version of PDF

	etc. (All documents pertaining packaged items delivered by third party)	
3	All drawings pertaining to modification job	Latest version of AUTOCAD and/ or MICROSTATION.
4	All drawings for new platform	Latest version of AUTOCAD/ MICROSTATION.
5	As-Built P&IDs	Intelligent P&IDs compatible with PDS/ SP3D/ PDMS/ E3D/ selected for 3D Modelling and AUTOCAD/ MICRO STATION.
6	Data sheets and PS	Using suitable intelligent format to facilitate future querying, data analysis and updating.
7	Engineering Analysis	Approved final calculations along with the corresponding native files (e.g. SACS files)
8.	3D Model	PDS/ SP3D/ PDMS/ E3D. A separate review file in 'Navisworks' (.nwd) format of each 3D model shall also be submitted.

Contractor shall generate and submit complete intelligent 3D Model of new unmanned platforms in latest versions of Hexagon-Intergraph's PDS/ SP3D or Aveva's PDMS/ E3D software.

All As-Built information required to build the model such as PFD, P&ID etc. should be intelligent and shall be seamlessly integrated with the model enabling querying, data retrieval and automatic updation. The associated 2D drawings, GADs, Piping isometrics etc. shall be generated from the 3D model using the automatic drawing extraction feature available in the PDS/ SP3D/ PDMS/ E3D software.

Contractor shall follow general guidelines while modelling the project and independent online checking at various facets of the modelling shall be made available to the Company during model review workshop sessions to be carried out by the contractor in presence of company personnel. Contractor shall make suitable provision of PDS/ SP3D/ PDMS/ E3D terminal loaded with requisite software module/ review module with dedicated PDS/SP3D/ PDMS/ E3D designer for the Company. Contractor shall submit the details of the project setup of each module for Company's review. Contractor shall attend to queries and satisfy the queries, if any, while modelling the project. Bidder shall model the project by areas like Piping, Equipment, Instrumentation, Structural, Electrical, Pipelines etc. using relevant PDS/ SP3D/ PDMS/ E3D Design Tool for Piping, Equipment, Instrumentation, Structural, Electrical, Pipelines respectively. Deliverables shall also include automatic generation of piping isometrics and GAD through drawing manager interface. Contractor shall also model all skid items and pipe supports in real shape.

Contractor shall follow the following methodology while generating the intelligent 3D Model of the project-

a. Contractor shall generate an intelligent P&ID with complete discipline database such as Instrumentation, Piping, Process Data etc. The Instrumentation area shall have the Instrument Data Sheets, Instrument Installation Hook-Ups, Instruments Loop Schematics, Junction Box Schematics, and Nozzle Elevation etc.

b. The intelligent 2D drawings/ model shall be seamlessly integrated with the 3D Model. All necessary data for 3D Modelling, such as Process Data, Piping component data line etc. shall be picked up from the intelligent P&ID while routing the piping in 3D Model.

c. During the project setup and finalizing the settings for extraction, care shall be taken so that deliverables are as per good engineering practices. Before any deliverables are extracted, clash detection shall be performed.

d. The above exercise will result in generation of PDS/ SP3D/ PDMS/ E3D 3D model of AFC engineering deliverables, which Contractor shall submit to the Company before the start of yard/ fabrication activities. Contractor shall also submit As-Built intelligent 3D Model along with deliverables specified elsewhere in the bid as a part of documentation after the installation and commissioning of the project.

e. ONGC has an existing setup of Intelligent As-Built documents retrieval system using AvevaNet software. Contractor shall deliver AvevaNet compatible As-Built deployment files. Contractor shall load the intelligent as-built data in company server and demonstrate the data retrieval through existing system. Along with deployment files, source files of 3D Model, Intelligent P&IDs, Data sheets, PS, Vendor document, Navisworks' review file of 3D Model (.nwd), Autocad (.dwg) files of P&IDs and layout etc. shall be provided separately as part of As-Built deliverables.

f. In addition to As-Built indicated above, Contractor shall also submit 4 soft copies of complete As-Built documentation on portable external hard disc/ SSD with indexing and hyper-linking in the Main and sub-indexes. The documents shall be grouped Platform wise→ Discipline wise→ Drawings/ PS wise/ Manufacturer wise for easy access.

Contractor is permitted to generate **3D Model with other software** (AUTO PLANT/ PLANT SPACE/ PLANT 4D) in place of PDS/ SP3D/ PDMS/ E3D provided **the following conditions are met**:

- In case the contractor uses a 3D Modelling software other than PDS/ SP3D/ PDMS/ E3D, complete **licensed** software package (latest version) along with all the modules shall be provided. Licenses for all the necessary modules shall be in the name of ONGC.
- 3D Modelling software shall have all the technical features as mentioned in this clause and shall have validity of 05 (five) years beyond the commissioning of the software.
- It is also required to provide:
  i. Necessary hardware (workstation server grade machine with minimum

specifications: DELL PowerEdge R430 Server with Intel Xeon E5-2630 v3 2.4Gz processor or equivalent) and external technical services for installation and configuration of the software at ONGC premises, and

ii. In depth training for various discipline engineers in respective/ identified modules. Also, it shall support unlimited number of models with which further editing, reviewing and updating should be possible as and when required.

- Further, Contractor must have executed 3D Modelling with all relevant data using the same software set-up in the last 5 years in minimum TWO projects, preferably in Oil /Gas industry.

In accomplishing the above tasks, the Contractor shall take total responsibility of executing the project in accordance with this bid document including supply of all materials and consumables, construction equipment etc. and will adhere to bid document instructions and requirements in respect of all matters relating to the project.

Contractor shall furnish all the information as sought by the company in defined formats for its data storage and retrieval system at no extra cost to company. Any formats left out shall be provided to the Contractor during detailed engineering.

1.14 SOME ABBREVIATIONS & ACRONYMS (For Reference only)

Abbreviations & Acronyms	
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BCM	Billions of Cubic Meters
BLPD	Barrels of Liquid Per Day
BOPD	Barrels of Oil Per Day
BS	British Standard
BS EN	British Standard European Norm

Abbreviations & Acronyms	
BS&W	Basic Sediment & Water
BWPD	Barrels of Water Per Day
CAA	Civil Aviation Authority
CENELEC	European Committee for Electro technical Standardization
CEN	European Committee for Standardization
CPT	Cone Penetration Test
DNV	Det Norske Veritas
EEMUA	Engineering Equipment & Materials User's Association
EIA	Electronic Industries Alliance
E & P	Exploration and Production
EPS	Early Production System
ESP	Electric Submersible Pump
FPSO	Floating Production, Storage and Offloading vessel
GOR	Gas Oil Ratio
HAT	Highest Astronomical Tide
HCl	Hydrogen Chloride (Hydrochloric Acid)
IALA	International Association of Light House Authorities
IBP	Initial Boiling point
ICS	International Chamber of Shipping
IEC	International Electro technical Committee
IMO	International Maritime Organization
IP	Institute of Petroleum
IRI	Industrial Risk Insurers
IS	Indian Standards
ISA	Instrument Society of America
ISF	International Shipping Federation
ISO	International Standards Organization
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
IUGG	International Union of Geodesy & Geophysics

Abbreviations & Acronyms	
LAT	Lowest Astronomical Tide
MMSCMD	Millions of Standard Cubic Meters per Day
MMtPA	Millions of tons Per Annum
MSL	Mean Sea Level
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
AIA	Aerospace Industries of America
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NORSOK	Norsk Sokkels Konkuranseposisjon
OCIMF	Oil Companies International Marine Forum
OGP	International Association of Oil and Gas Producers
ONGC	Oil and Natural Gas Corporation
OSHA	Occupational Health and Safety Administration
PLEM	Pipeline End Manifold (subsea manifold)
ppm(v)	Parts per million (volume basis)
PVT	Pressure-Volume-Temperature
RTJ	Ring Type Joint
SBM	Single Buoy Mooring
RVP	Reid Vapour Pressure
SG	Specific Gravity
SIS	Swedish Standards Institution
SSIV	Subsea Isolation Valve
SSPC	Steel Structures Painting Council
TEMA	Tubular Exchanger Manufacturers Association
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TVP	True Vapour Pressure
UL	Underwriters Laboratory

Abbreviations & Acronyms	
UNS	Unified Numbering System
UTM	Universal Transverse Mercator
UU	Unconsolidated Undrained
WGS	World Geodetic System

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2.1 A SCOPE OF WORK (PROCESS)

2.1A.1 Introduction

This section of the bid document i.e. Description of Work defines in general terms, the major components of the facilities, which will form, amongst other things, the Contractor's scope of work. This section is intended only to give a general description of the major components of the facilities. It shall be the responsibility of the Contractor to design, engineer, procure, fabricate, load-out, tie down, transport, install, hook-up, pre-commission and make ready for use the facilities such that they meet the specific description of various facilities and the design requirements as given in the subsequent sections of the bid document.

Bidder to note

- R-12-6A & VGN-A well head platforms shall henceforth be referred as 'new well head platforms' and RJP as "new riser platform".
- R-10A, R-13A and other already existing WHPs shall henceforth be referred as 'existing well platform'

For all the items and systems described in this document, the Contractor's scope of work shall in general include the following:

- Pre-engineering survey by contractor's manpower only.
- System Design & System engineering.
- Manufacture, Procurement, Fabrication, Load-out, Tie-down & Supply of items.
- Packing, Forwarding and Transportation to yard as well as offshore site
- Custom clearance and Insurance, as required / applicable
- Receipt and storage of equipment /items/ instruments at yard and offshore site
- Calibration, Installation, hook-up, testing/Field Testing, pre-commissioning and Commissioning wherever applicable.
- Documentation and warranty
- As built documents

Contractor is also required to meet any additional requirements spelt out in subsequent sections and drawings and specifications of this bid document.

2.1A.2 Survey Requirement

In addition to the Survey Requirements indicated in General Conditions of Contract (GCC) Volume -I of the bid documents, Contractor shall be fully responsible for carrying out all the pre-engineering survey, pre-construction surveys and post-construction surveys for platforms & risers and surveys for pipelines using their own manpower only. Further the Contractor shall confirm all environmental & geotechnical data before the design & detailed engineering and shall be responsible for the interpretation of the data and finalization of the accurate water depth and sea bed features etc. at the locations of above well head platforms. The Contractor shall be responsible for the interpretation of the data and following jobs:-

- Determination of the accurate positioning of the well platforms/ riser platform and related structures.
- Identification of conditions on the seabed with relation to pipelines and composite cables if any that exist now or which may exist at the time of Installation.
- Composite cable laying routes.
- Identification of existing submarine pipelines/templates/obstructions etc.
- Determination of seabed conditions and slope of seabed in the way of the Structure.
- Determination of and confirmation of the accuracy of as-built data for topsides as well as subsea for different elevation supplied by the Company. The contractor shall modify those at as appropriate.
- Measurement and determination of the actual water depth at the site of the Works
- Contractor shall provide copies of all survey reports to the Company.

2.1A.3 Scope Of Work For Well Platforms & Riser Platform

2.1A.3.1 Functional Description

Two new well head platforms namely R-12-6A & VGN-A shall be 4 legged, 9 slot platforms having Remote Control & Monitoring through composite cables from Jack-up MOPU (to be bridge connected to new riser platform, RJP). **MOPU is not in present tender scope**. New wellhead platforms shall be designed for the jack-up type drilling rig approachable from north side of the platforms for drilling and completion of wells which shall be subsequently worked over whenever required by the cantilever type Jack-up drilling / work-over rigs.

The sub-structure shall mainly comprise of jacket, piles, cathodic protection (without monitoring system), pre-installed 30” well conductors (driven to the depth of 70 meters below sea bed in each slot), barge bumpers, walk ways at jacket top level, rub strips, three stage boat landing with four pairs of swing

ropes (Nylon, Marine duty) hung from cellar deck and CCTV camera for intruder detection system with monitoring facility at MOPU.

The super-structure shall mainly comprise of Sub-Cellar deck, Cellar deck, Main deck and Helideck. Main deck shall have space for accommodating Coil Tubing Unit (CTU) along with sufficient operational area for well work-over, servicing and maintenance. The super structure shall house the various topside facilities including building module, walkways, stairways, ladders, railings and stairs up to the jacket level etc.

Building module shall house switch gear room, HT/LT transformer room (for ESPs and VFDs), battery room with battery bank, distribution panels, UPS, PLC System for remote monitoring and control, Voice Communication System, F&G detection system, shelter room with two beds and bio-toilet. All rooms shall have anti-theft locking device.

Well configurations as below:

Platform	Total Slots	Producer Well	Water injectors	Free Slots (note-1)	Well Conductors	No. of ESP
R-12-6A	9	7	0	2	9	9
VGN-A	9	7	0	2	9	9
RJP (note-2)	Riser platform					

Notes

1. Well flow arms shall be provided for free slot wells also.
2. RJP is riser platform. Well fluid from new platforms (R-12-6A and VGN-A) shall be received at RJP. RJP shall have receivers, manifolds, piping, instrumentation etc. NO wells are envisaged in RJP. It shall be bridge connected with existing wellhead platform R-10A.

Electrical Submersible Pumps (ESP) shall be installed in producer wells by the Company. Supply of ESP not in scope of present tender. However, Contractor shall provide LV feeders in 415 V switch gear as per indicative SLD, provided elsewhere in the SoW.

The topside facilities on R-12-6A and VGN-A shall primarily consist of –

1. A barrier wall with passive fire protection between well head area and process. (Min H60 rated).
2. 30” conductors shall be driven to the depth of 70 meters below sea bed in all slots.
3. Production header & Test header

4. Two phase inline test separator with V-cone meter and MVT for gas flow measurement and coriolis meter + water cut meter for oil /water flow measurement.
5. Riser and launchers/receivers as applicable for well fluid
6. J-tubes for composite cables
7. Corrosion Inhibitor and PPD injection system.
8. Electro-hydraulic shut down panel.
9. Process cum ESD PLC (SIL-3) for process control and shutdown logic execution including logic for SSSVs and SSVs.
10. FSD PLC (SIL-3) for Fire & Gas detection voting logic.
11. Vent system consisting of Vent/ relief header, glycol seal pot, flame arrestors, vent boom, CO2 snuffing system.
12. Drain system consisting of crude condensate vessel with motor operated pumps, open deck drain (ODD), open hydrocarbons drain (OHD) and closed drain (CD) system.
13. Deck crane (Dynamic Capacity-15) ton and shall be capable to reach farthest location on the platform.
14. Fire & Gas Detection System including HC, H_2S, H_2, Triple-IR, Smoke, Heat Detectors.
15. Fire suppression system including Portable CO_2, Dry Chemical Fire Extinguishers, Fixed DCP Skids and Clean agent system.
16. Life Saving Equipment i.e. two life rafts (Cap. 10 persons each), Life Jackets, Life Buoys, Navigational Aids, Escape Ladders, Scramble Net, First Aid Kits.
17. Cathodic protection system.
18. E&I room with HVAC to accommodate control system
19. Shelter room with four beds and bio-toilet.
20. Solar System (for navigational aids only).
21. Breathing apparatus as per Mechanical scope of work
22. FRP tank for potable water storage and distribution network
23. Space for 1 x 8” future risers and pig barrels on each of the new wellhead platform.
24. Two wells of R-71 structure under DSF-III will be monetized from VGN-A platform, a dedicated header with Nucleonic MPFM (1+1) shall be provided at VGN-A for continuous metering of well fluid from R-71 wells.

RJP riser platform

RJP riser platform shall be hub platform for new wellhead platforms as well as for existing R-series platforms. Well fluid from new platforms shall be received directly at RJP and also well fluid from existing R-series platforms (R-7A, R-9A, R-10A, R-13A, R-12B) shall be received at RJP via existing R-10A. Well fluid shall be routed to MOPU for separation and stabilization. Stabilized oil and compressed gas shall be received back for further dispatch to HRA via RJP/R-10A.

Riser platform (RJP) is 4 legged platform. The sub-structure shall mainly comprise of jacket, piles, cathodic protection (without monitoring system), barge bumpers, walk ways at jacket top level, rub strips, three stage boat landing with three pairs of swing ropes (Nylon, Marine duty) hung from cellar deck.

The super-structure shall mainly comprise of Cellar deck, and Main deck with a provision to accommodate CCD Vessel on the access platform below cellar deck. The super structure shall house the various topside facilities including building module, walkways, stairways, ladders, railings and stairs up to the jacket level etc.

Building module shall house switch gear room with battery bank, distribution panels, UPS, PLC System for remote monitoring and control, Voice Communication System, F&G detection system, HT/LT transformer room.

Topside facilities on riser platform (RJP) as follows.

1. Well fluid receiver from R-12-6A and VGN-A.
2. 2 nos. production manifold (sour manifold and non-sour manifold)
3. Riser and launchers/ receivers as applicable for well fluid and crude oil / gas lines from MOPU
4. J-tubes for composite cables
5. Electro-hydraulic shut down panel.
6. Process cum ESD PLC (SIL-3) for process control and shutdown logic execution.
7. FSD PLC (SIL-3) for Fire & Gas detection voting logic.
8. Associated instrumentation, control and safety system.

9. Well fluid launcher for crude oil line to R-12A.
10. E&I room with HVAC to accommodate control system
11. Space for 4 nos. x 8" future risers and pig barrels in RJP
12. Deck crane (15MT)
13. Closed drain vessel with CCD pumps
14. Fire & Gas Detection System including HC, H_2S, H_2, Triple-IR, Smoke, Heat Detectors.
15. Fire suppression system including Portable CO2, Dry Chemical Fire Extinguishers, Fixed DCP Skids and clean agent system.
16. Life Saving Equipment i.e. two life rafts (Cap. 10 persons each), Life Jackets, Life Buoys, Navigational Aids, Escape Ladders, Scramble Net, First Aid Kits.
17. One H2S capsule with capacity of 5 PAX and 5 H2S kits (mask) at RJP platform
18. Two life boats of minimum 20 PAX capacity each.
19. Firewater network ring on all decks shall be provided on RJP platform only, taking source from Water Injection Network / Bridge fire water connection from MOPU. Deluge valves shall cover all process equipment as per Hazardous area classifications.

2.1A.4 Description Of Modification Scope

2.1A.4.1 Modification At R-10A

1. Deck extension (approx. 4mx9m) at cellar deck for R-10A→RJP bridge landing.
2. Extension of two number of 10" production headers at R-10A to RJP riser platform via bridge.
3. NRV on exiting 10" R-10A→R-12A well fluid line to be reversed, in order to receive the well fluid from R-12A to R-10A through same line and convert the Well Fluid Launcher to a Receiver.
4. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
5. Hook-up of new instruments with existing instrumentation and control system.
6. Extension of F&G detection system to new facilities, if applicable.

2.1A.4.2 Modification At R-13A

1. Installation of riser and well fluid launcher for 6" sour well fluid line to RJP.
2. Hook-up of new well fluid launcher with existing 8" production header, with proper isolation for interoperability.
3. Hook-up of sour wells with new 6" sour production header.
4. Installation of SDV on departing pipeline along with required instrumentation.
5. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
6. Hook-up of new instruments with existing instrumentation and control system.
7. Extension of F&G detection system to new facilities, if applicable.

2.1A.4.3 Modification at R-12A

1. Installation of riser and pig receiver for 10" gas line from RJP to R-12A
2. Hook of new incoming line with existing crude oil header.
3. Installation of SDV on incoming pipeline along with instrumentation.
4. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
5. Hook-up of new instruments with existing instrumentation and control system.
6. Extension of F&G detection system to new facilities, if applicable.
7. NRV on exiting 10" R-10A→R-12A well fluid line to be reversed, in order to flow the well fluid from R-12A to R-10A through same line and convert the Well Fluid Receiver to a Launcher.

2.1A.4.4 Modification At R-7A

1. New Switchgear shall be constructed by deck extension at main deck which shall house new LV switchgear and 02 nos. future ESP VFD (Space for 04 nos. Step up transformer of ESP already available in existing electrical switchgear room). Same shall be integrated with existing Switchgear systems.
2. Deck Extension on Main Deck of approximately 12 m x 5 m is required.

3. Space shall be created at cellar deck transformer area by deck extension and one additional step up transformer of ESP. (Space for 08 nos. Step up transformer of ESP already available in existing transformer room).
4. Deck Extension on Cellar Deck of approximately 4 m x 4 m is required.
5. For further details, Electrical and Structural SoW in the bid is to be referred.
6. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
7. Hook-up of new instruments with existing instrumentation and control system.
8. Extension of F&G detection system to new facilities, if applicable.

2.1A.4.5 Modification At R-9A

1. New Switchgear shall be constructed at main deck which shall house new LV switchgear and 02 nos. future ESP VFD (Space for 04 nos. Step up transformer of ESP already available in existing electrical switchgear room). Same shall be integrated with existing Switchgear systems.
2. Deck Extension on Main Deck of approximately 7 m x 5 m is required.
3. For further details, Electrical and Structural SoW in the bid is to be referred.
4. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
5. Hook-up of new instruments with existing instrumentation and control system.
6. Extension of F&G detection system to new facilities, if applicable.

Details of Deck Extensions envisaged in the project:

S.No.	Platform	Deck Extension (approx.)	Purpose
1	R-10A	4m x 9m @ Cellar Deck	R10A→ RJP Bridge Landing
2	R-13A	NIL	NIL
3	R-12A	NIL	NIL
4	R-7A	12m x 5m @ Main Deck	1 no. New LV Switch Gear
		4m x 4m @ Cellar Deck	1 no. ESP Transformer

5	R-9A	7m x 5m @ Main Deck	1 no. New LV Switchgear

2.1A.5 Submarine Pipelines & Composite Cables

Sl. No.	Pipeline Segment	Nom. Dia. (Inch)	Approx. length, km (note-1)	No. of Risers	Service	Material of Construction.
1	R-12-6A→RJP	10	16.6	2	Well Fluid	CS NACE (API X – 60)
2	VGN-A→RJP	6	4.9	2	Well Fluid	CS NACE (API X – 60)
3	R-13A → RJP	6	17.1	2	Well Fluid	CS NACE (API X – 60)
4	RJP→R-12A	10	16.7	2	Well fluid	CS NACE (API X – 60)

Composite Cables (note-2)				
Sl.	**Segments**	**Size (mm^2)**	**Length (km) (note-1)**	**J-tubes (min. 12")**
1	RJP→R-12-6A	240	16.6	2
2	RJP→VGN-A	240	4.9	2

Notes:

1. Pipeline & composite cable length is indicative only. Length shall be firmed up as per actual pipeline route survey during detail engineering.
2. Submarine composite cables 24 Core fiber optic + 3 phase power cable in min.12" J tube (**refer elsewhere in the scope of work for further details**).

2.1A.6 Description Of Facilities On Well Head Platforms

2.1A.6.1 Wellhead Facilities (X-Mass Tree)

Installation of Christmas tree is part of Company's scope of work. The battery limit for Contractor's scope of work start from choke valve (on flow arm) and bleed valves (on annulus) downwards. The Christmas tree shall have hydraulically actuated SSSV & SSV.

All piping, fittings, instrumentation etc. between well heads and production, injection water manifold shall be provided. PI & PT on Christmas tree shall be supplied loose and their installation shall be in Company scope, however routing of associated electrical and communication cable up to well head area and any other job required for completion of work shall be carried out by the contractor. Scope of supply shall also include PI & PT on future Christmas trees (free slots wells). All the instruments shall be supplied along with its associated accessories required for installation.

Working platform shall be provided in well head area to facilitate operation of valves & instrumentation on Christmas tree. It shall be removable type to facilitate work over operations.

Sufficient and adequate clearance surrounding well head area for easy access from all sides. Well head area shall be isolated through fire wall/barrier for hazard protection & also to avoid mud spilling over/ splashing to other areas. Well head instrumentation shall be relocated behind the firewall for safety and longevity.

2.1A.6.2 Flow Arms

All the producer wells shall be connected to production and test header through 6" flow arms. The well fluid flow arms shall be provided with PI, TI, PT, TT, PZTs, sampling arrangement. Vent and drain provision shall be provided from highest and lowest position of flow arms respectively for complete venting and draining of flow arms when required.

The well fluid flow arms for producer wells as well as free slots from production manifold to well head area, complete with required piping and instrumentation items, shall be provided. The piping of flow arms shall be inclusive of supply, fabrication and erection of piping and end flange (including blind flange) which will be left 300 mm above cellar deck plating near Christmas tree. In addition, Contractor shall supply loose piping material for the balance portion from the above referred end flange to the Christmas tree of all wells (50% extra material shall be supplied considering worst case of orientation and elevation of Christmas tree).

Platform wise details of flow arms to connected with production header & test header as follows:

Platform	Total Slots	Producer well	Water injectors	Free Slots	No. of Flow arms
R-12-6A	9	7	0	2	9
VGN-A	9	7	0	2	9

2.1A.6.3 Production And Test Manifold

Production and test manifold consist of production header and test header for connecting well fluid flow arms. All well slots (present + future) with flow arms, piping, valves (NRV and Ball valve), flanges, fittings etc. as applicable to be hooked-up with the production and test header. Production header shall be routed to well fluid launcher for transportation of well fluid to destination platform via sub-sea pipeline and test header shall be routed to test separator and further to production header.

The production header shall be provided with PI, TI, PT, TT, corrosion coupon and sampling arrangement. Vent and drain provision shall be provided on each production headers & test headers for complete venting and draining of headers as and when required.

Flushing/purging connection with one number of hose and suitable end coupling shall be provided at each production headers and test headers. Flushing connection shall be located at minimum distance from end flanges of headers to ensure complete flushing of headers.

Corrosion inhibitor dosing point including injection quill shall be provided on both production and test header.

2.1A.6.4 Inline Test Separator

Well testing facilities shall comprise of an inline separator which will be used for measurement of gas & liquid flow rate from individual wells. Inline separator shall receive well fluid from individual wells via common test header and separate gas and liquid streams for measurement of gas flow rate using V-cone meter and liquid/oil/water flow rate using coriolis meter with online water cut meter.

Inline separator is a vertical pipe with internal swirling device for gas/liquid separation. It works on the principle of g-force. Liquid phase separated out in the periphery of pipe & gas phase comes out from centre. To achieve desired separation, demister is used in gas outlet. To ensure complete draining of inline separator shall be provided from the lowest point.
PCV, LCV shall be provided in gas and liquid outlet lines respectively. Separated gas and liquid stream is combined again before connecting it to main production header

2.1A.6.5 Launcher/Receivers (Pig Barrels)

Pig barrels shall be provided on each sub-sea pipeline segment to facilitate the pig launching and receiving during pipeline pigging operations. Suitable pig handling facility shall be provided. Pig trap door opening mechanism shall be so constructed that the door cannot be opened unless barrel is fully depressurized.

Pig barrel of launchers / receivers shall be provided be 2 nos. of PI one of full operating pressure range another one is 0-1 kg/cm2g.

Launchers shall be provided with one number pig indicator, which shall be installed as far as possible from launcher. Receivers shall be provided with two number of pig indicator, one shall be installed as far as possible from receiver and other as close as possible to receiver.

Platform wise details launcher/receiver for different services as follows:

Sl. No.	Launcher/ Receiver	Location	Size	Service
1	Launcher	R-12-6A	10”x12”	Well Fluid to RJP
2	Launcher	VGN-A	6”x8”	Well fluid to RJP
3	Receiver	RJP	10”x12”	Well fluid from R-12-6A
4	Receiver	RJP	6”x8”`	Well fluid from VGN-A
5	Launcher	RJP	10”x12”	Well fluid to R-12A
6	Receiver	RJP	6”x8”	Well fluid from R-13A
7	Launcher	R-13A	6”x8”	Well fluid to RJP

2.1A.6.6 Chemical Injection System (CI, PPD)

The corrosion inhibitor injection shall be provided in well fluid manifold and departing pipeline. The CI injection system shall consist of chemical storage tank and hand operated chemical transfer pump (2 nos. for each platform, common for CI and PPD) and motor operated (1+1) injection pumps. The system shall be completed with all inter-connecting piping, instrumentation, safety and control systems.

PPD injection shall be provided in production header, departing pipeline. System shall consist of separate storage tank and dosing pumps (1+1) with associated safety, instrumentation system.

2.1a.6.8 Diesel System

Hand Operated diesel transfer pump shall be provided to transfer diesel from barrel to crane day tank as and when required.

2.1A.6.9 Utility/Pot Water System

Utility water system shall be provided to the cater requirement of utility water in wash basin and toilets. Utility water system shall consist of a potable water storage tank with distribution network. MOC of tank shall be FRP. Tank shall be caged with lifting arrangement to transfer by crane to/from supply vessel.

2.1A.6.10 Vent System

Low pressure gas venting/ relief system shall comprise of vent header, flame arrestors, vent boom, CO2 snuffing system, etc. along with associated piping, instrumentation and control system. The vent connections from well head flow arms, production manifold, receivers/ launchers, etc. shall be hooked-up with vent header which in turn shall be routed to vent boom via glycol seal pot.

2.1A.6.11 Drain System

The drainage facilities shall consists of Open Deck Drain (ODD) with removable strainer/basket, Open Hydrocarbon Drain (OHD) with removable strainer/basket and Closed Hydrocarbon Drain (CHD) system for collection and disposal of non-hydrocarbon and hydrocarbon liquids. To avoid water / fluid accumulation, proper slope with adequate no. of drain cups shall be provided on decks. All the drain headers shall be provided with several flushing points to de-choke the headers. Flushing points shall be located at approachable locations.

Open deck drain system for the collection of rainwater shall be capable of disposing of the heaviest monsoon rainfall and deluge. All rainfall and monsoon water entering the open drain shall be discharged direct to sea.

Open Hydrocarbon Drain (OHD) and Closed Hydrocarbon Drain (CHD) headers shall route hydrocarbon liquid drained from vessels, equipment and lines to crude condensate vessel located below cellar deck. Crude condensate vessel shall be internally lined with suitable lining/paint as per specification 2005.
The evacuation of crude condensate vessel shall be done with the help of motor operated pump. The discharge line of crude condensate vessel shall be routed to departing well fluid pipeline. The evacuation shall be done manually as and when required depending upon the liquid level in CCD.

2.1A.6.12 Control & Monitoring System

- Process cum ESD PLC shall be provided for process control, monitoring and shutdown. The system shall have installed capacity for planned as well as future producers.
- The instrumentation and control system on all platforms shall communicate on a redundant fiber optic network as indicated in the indicative system architecture drawing attached with the bid
- Remote control and monitoring shall be from MOPU. Necessary hardware and software shall be provided in MOPU. MOPU is not in the SoW of current scope. However, platform instrumentation shall be provided for monitoring, control, testing of wells locally as well as remotely from MOPU. The same shall be installed, in this project, at RJP and later shifted to MOPU. Bidder to ensure that system is designed such that easy shifting and integration with MOPU is ensured.
- ESP shall be installed in all producer wells. Electrical PLC shall be provided for control, monitoring, trip actions of all ESP along with other electrical loads in the platform.
- Electrohydraulic shut down panel for all well slots (producers planned +future) as applicable along with one spare module.
- SIL-3 process cum ESD, F&G PLC system.

- Distribution network of Composite cable and power distribution for top side facilities of ESPs like HT/LT transformer, VFD etc.
- Composite cable (Power + Fiber optic) at new Wellhead Platforms shall also be designed to meet the requirement for Voice Communication System along with Data Communication System.
- Two nos. of analog telephone lines from MOPU shall be extended at each Wellhead Platform.

2.1A.6.13 Safety System

- Safety system shall comprise of Fire & Gas Detection System including HC, H_2S, H_2, Triple-IR, Smoke, Heat Detectors.
- Fire suppression system including Portable CO_2, Dry Chemical Fire Extinguishers, DCP Skids.
- Life Saving Equipment i.e. two life raft 10 persons each, Life Jackets, Life Buoys, Navigational Aids (no fog horn), Escape Ladders, Scramble Net, First Aid Kits, Breathing air apparatus.
- SIL-3 certified process cum ESD PLC
- SIL-3 certified PLC based FSD Systems
- SIL-3 Electrical PLC

2.1A.6.14 Building Module

- Building module shall house Switch gears, HT/LT Transformer room for ESPs, VFD, battery room with battery bank, distribution panels, UPS, various instrumentation and control systems, voice communication system, F & G detection system and shelter room with 4 beds.
- Building module will house E&I room with HVAC facilities.
- The transformer section & VFD room should be well demarked/isolated.
- Shelter room shall be insulated and provided with HVAC with basic amenities.
- Clean agent fire extinguishing system for VFD, battery room etc.

2.1A.6.15 Facilities On Riser Platform (RJP)

Well Fluid Receiver

RJP shall work as hub and shall receive well fluid from R-12-6A & VGN-A, and well fluid from existing platforms (R-7A, R-9A, R-10A, R-12-B, R-13A) via R-10A.

Pig barrels shall be provided on each sub-sea pipeline segment to facilitate the pig launching and receiving during pipeline pigging operations. Suitable pig handling facility shall be provided. Pig trap door opening mechanism shall be so constructed that the door cannot be opened unless barrel is fully depressurized.

Production Header (Sour Service)

A dedicated header shall be provided to receive sour well fluid from R-13A and send to sour gas separator at MOPU (by others) via Sour Gas header. Sour well fluid line from R-10A shall be hooked up with sour header. Incoming lines from new platforms also shall be hooked up with sour header. Vent and drain shall be provided on the header for depressurization and draining purpose.

Production Header (Non-Sour Service)

A dedicated header shall be provided to receive non-sour well fluid and send to non-sour separator at MOPU (by others). Non-Sour well fluid line from R-10A shall be hooked up with non-sour header. Incoming lines from new platforms also shall be hooked up with sour header. Vent and drain shall be provided on the header for depressurization and draining purpose. Provision for isolating non-sour header from sour header shall be provided.

Closed drain System

Closed drain system consist of drain header, closed drain vessel (crude condensate drum) and slop oil pump (CCD pump). A closed drain vessel shall be provided below cellar deck to collect all the hydrocarbon drains from the manifold, receiver, pig barrel, deck etc. Individual drain points shall be connected to a common drain header and drain header shall be routed to closed drain vessel.

Slop Oil Pump / CCD pump

2 (1+1) motor operated pumps shall be provided d/s of closed drain vessel to pump the liquid from the vessel to production header for further transfer to MOPU.

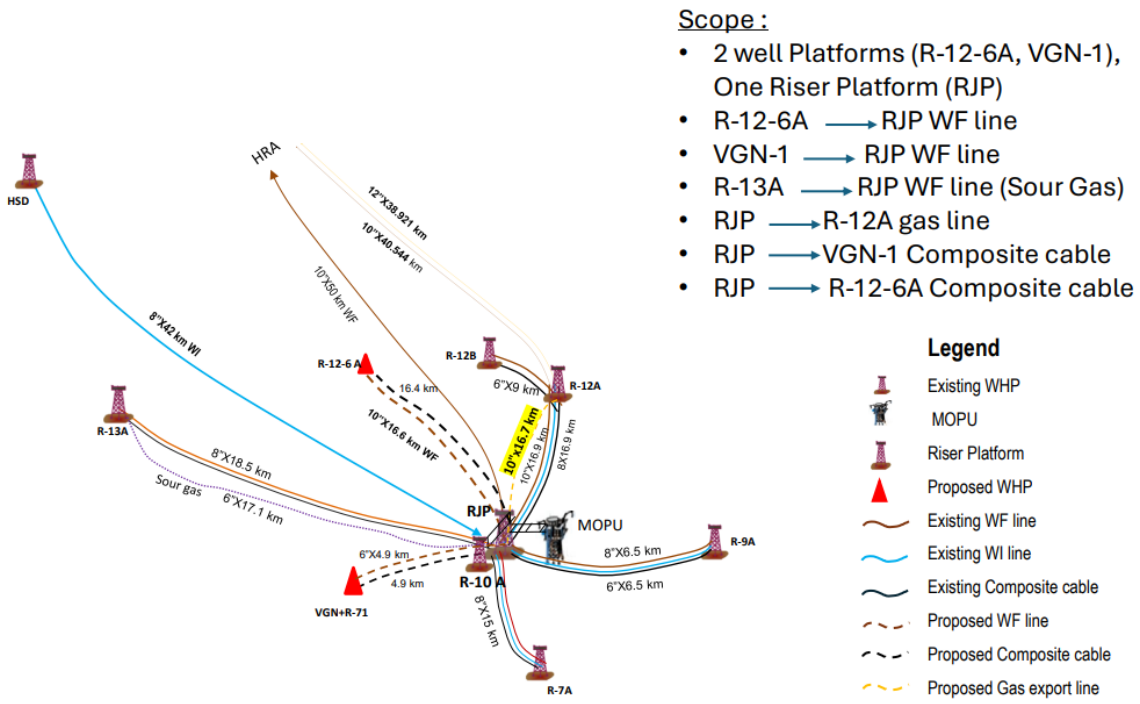
Firewater System

The complete fire water system (water sourced from injection water header) comprising of pressure reduction system along with deluge valve and sprinkler system shall be provided. This system will mitigate or control a fire after it has been positively identified. The system shall be designed to be actuated either manually or automatically.

Fire water header shall be provided with SAPCV to dump excess water overboard. Deluge valve operated water sprinkler system shall be designed in accordance with NFPA-15 and API-2030. This system shall be located over cellar deck, sub-cellar deck & main deck area covering well head area and adjacent area where process facilities/ equipment's are installed or proposed to be installed.

2 nos. foam water hose reels of suitable length shall be provided at each deck and shall be installed at most suitable locations to cover total deck area. 1" flushing connection along with hose reel

shall also be provided on each deck. Fire water equipment and network shall be designed for 14 kg/cm^{2}g design pressure and 55°C design temperature.



*VGN-1 is to be read as VGN-A

2.1A.7 FACILITIES FOR FUTURE

All such requirements for facilities specified as provision for future in the bid document shall be considered / taken care in the design / engineering of the platform as scope of work covered under this bid document, such that the said future facilities can be easily installed, hooked-up and integrated with the facilities being provided now and commissioned smoothly.

2.1A.8 PROJECT SPECIFIC REQUIREMENTS

All Stores and Equipment Rooms shall be provided with adequate mobile racks for storing Documents, spares and equipment in orderly manner.

2.1A.9 MANUFACTURERS' SERVICE

Contractor shall have manufacturers' service representatives on board the platforms during mechanical completion, pre-commissioning & commissioning (wherever applicable) of the facilities as indicated in this bid document. All costs for these shall be included in bidder's lump sum amount.

2.1A.10 PRE-COMMISSIONING & COMMISSIONING OF WORKS

Pre commissioning & commissioning procedures for works (including modification works) shall be submitted by the contractor. Detailed requirements are given elsewhere in the bid document.

2.1B SCOPE OF WORK (PROCESS)

2.1B.1 Introduction

This section of the bid document i.e. Description of Work defines in general terms, the major components of the facilities, which will form, amongst other things, the Contractor's scope of work. This section is intended only to give a general description of the major components of the facilities. It shall be the responsibility of the Contractor to design, engineer, procure, fabricate, load-out, tie down, transport, install, hook-up, pre-commission and make ready for use the facilities such that they meet the specific description of various facilities and the design requirements as given in the subsequent sections of the bid document.

Bidder to note

- NLM-14 well head platforms shall henceforth be referred as 'new well head platform'.
- NLM-9, NLG shall henceforth be referred as 'existing platform'

For all the items and systems described in this document, the Contractor's scope of work shall in general include the following:

- Pre-engineering survey by contractor's manpower only.
- System Design & System engineering.
- Manufacture, Procurement, Fabrication, Load-out, Tie-down & Supply of items.
- Packing, Forwarding and Transportation to yard as well as offshore site
- Custom clearance and Insurance, as required / applicable
- Receipt and storage of equipment /items/ instruments at yard and offshore site
- Calibration, Installation, hook-up, testing/Field Testing, pre-commissioning and Commissioning wherever applicable.
- Documentation and warranty
- As built documents

Contractor is also required to meet any additional requirements spelt out in subsequent sections and drawings and specifications of this bid document.

2.1B.2 Survey Requirement

In addition to the Survey Requirements indicated in General Conditions of Contract (GCC) Volume -I of the bid documents, Contractor shall be fully responsible for carrying out all the pre-engineering survey, pre-construction surveys and post-construction surveys for platforms & risers and surveys for pipelines using their own manpower only. Further the Contractor shall confirm all environmental & geotechnical data before the design & detailed engineering and shall be responsible for the interpretation of the data and finalization of the accurate water depth and sea bed features etc. at the locations of above well head platforms The Contractor shall be responsible for the interpretation of the data and following jobs:-

- Determination of the accurate positioning of the well platforms/ riser platform and related structures.
- Identification of conditions on the seabed with relation to pipelines and composite cables if any that exist now or which may exist at the time of Installation.
- Identification of existing submarine pipelines/templates/obstructions etc.
- Determination of seabed conditions and slope of seabed in the way of the Structure.
- Determination of and confirmation of the accuracy of as-built data for topsides as well as subsea for different elevation supplied by the Company. The contractor shall modify those at as appropriate.
- Measurement and determination of the actual water depth at the site of the Works
- Contractor shall provide copies of all survey reports to the Company.

2.1B.3 Scope Of Work For Well Platform

2.1B.3.1 Functional Description

NLM-14 well head platform shall be 4 legged, 9 slot platforms having Remote Control & Monitoring through RTU from Neelam Process Complex. New wellhead platforms shall be designed for the jack-up type drilling rig approachable from north side of the platforms for drilling and completion of wells which shall be subsequently worked over whenever required by the cantilever type Jack-up drilling/ work-over rigs.

The sub-structure shall mainly comprise of jacket, piles, cathodic protection (without monitoring system), pre-installed 30” well conductors (driven to the depth of 70 meters below sea bed in each slot), barge bumpers, walk ways at jacket top level, rub strips, three stage boat landing with four pairs of swing

ropes (Nylon, Marine duty) hung from cellar deck, CC camera for intruder detection system with monitoring facility at Neelam Process Complex.

The super-structure shall mainly comprise of Sub-Cellar deck, Cellar deck, Main deck and Helideck. Main deck shall have space for accommodating Coil Tubing Unit (CTU) along with sufficient operational area for well work-over, servicing and maintenance. The super structure shall house the various topside facilities including building module, walkways, stairways, ladders, railings and stairs up to the jacket level etc.

Building module shall house E&I room with battery bank, distribution panels, Solar Power System, PLC System for remote monitoring and control, Voice Communication System, F&G detection system and shelter room with four beds and bio-toilet. All rooms shall have anti-theft locking device.

Wells configuration:

Platform	Total Slots	Producer	Water injectors	Free Slots (**)	Well Conductors	G/L (*)
NLM-14	9	7	0	2	9	9

* Gas lift injection is to be provided for the proposed wells as well.

** Well fluid flow arms shall be provided for free slots as well.

The topside facilities on NLM-14 shall primarily consist of –

1. A barrier wall with passive fire protection between well head area and process. (Min H60 rated).
2. 30” conductors shall be driven to the depth of 70 meters below sea bed in all slots.
3. Production header & Test header
4. Inline test separator with V-cone meter for gas flow measurement and coriolis meter for oil/condensate/water flow measurement.
5. Pig launchers/ receivers as applicable for well fluid and gas injection lines.
6. Gas injection header
7. CI & Biocide injection system.
8. Hydro-Pneumatic shut down panel (SDP) for shutdown logic execution including logic for SSVs & SSSVs
9. RTU for process control and monitoring
10. F&G PLC (SIL-3) for Fire & Gas detection voting logic.
11. IUG system with associated gas + H2S adsorber bed

12. Vent system consisting of vent/ relief header, flame arrestors glycol seat pot, vent boom and CO2 snuffing system.
13. Drain system consisting of crude condensate vessel with pneumatic pumps, open deck drain (ODD), open hydrocarbons drain (OHD) and closed drain (CD) system.
14. Deck crane (15T).
15. Fire & Gas Detection System including HC, H2S, H2, Triple-IR, Smoke, Heat Detectors.
16. Fire suppression system including Portable CO2, Dry Chemical Fire Extinguishers, and Fixed DCP Skids.
17. Life Saving Equipment i.e. two life rafts (Cap. 10 persons each), Life Jackets, Life Buoys, Navigational Aids, Escape Ladders, Scramble Net, First Aid Kits.
18. FRP pot water tank
19. Solar System.
20. Space for 1x12" future riser and pig barrel
21. One additional production header with 1+1 Nucleonic MPFM for monitoring of DSF-III block wells from B-37 field.

2.1B.4 Modification Scope

2.1B.4.1 Modification at existing NLG platforms

1. Deck extension of approximate 12m x 2m at cellar deck for pig receiver.
2. Installation of 12" riser and pig barrel for incoming well fluid line
3. Installation of SDV on incoming pipeline along with instrumentation
4. Hook up safety instrumentation with existing safety system
5. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
6. Hook-up of new instruments with existing instrumentation and control system.
7. Extension of F&G detection system to new facilities, if applicable.

2.1B.4.2 Modification at NLM-9

1. Deck extension of approximate 8m x 1.5m at cellar deck for pig barrel
2. Installation of riser and pig barrel for 6" lift gas line to NLM-14
3. Hook of new gas lift launcher with existing gas lift header
4. Installation of SDV on departing pipeline along with instrumentation
5. Hook up safety instrumentation with existing safety system
6. Hook-up of vent, drain and PSV outlet lines of any new facilities, as applicable, to the existing vent and drain system.
7. Hook-up of new instruments with existing instrumentation and control system.
8. Extension of F&G detection system to new facilities, if applicable.

Details of Deck Extensions envisaged in the project:

S.No.	Platform	Deck Extension (approx.)	Purpose
1	NLG	12m x 2m @ Cellar Deck	12" Pig Receiver from NLM-14
2	NLM-9	8m x 1.5m @ Cellar Deck	6" Pig Launcher to NLM-14

2.1B.5 Submarine pipelines

Segments	Nom. dia. (inch)	Length (km)	Riser	Service	MOC
NLM-14→ NLG	12"	12	2	Well fluid	API 5L, X-60 NACE
NLM-9→ NLM-14	6"	5.7	2	Gas lift	API 5L, X-60 NACE

Note-1: Pipeline length is indicative only. Length shall be firmed up as per actual pipeline route survey during detail engineering.

2.1B.6 Description Of Facilities On Well Head Platforms

2.1B.6.1 Wellhead Facilities (X-Mass Tree)

Installation of Christmas tree is part of Company's scope of work. The battery limit for Contractor's scope of work start from choke valve (on flow arm) and bleed valves (on annulus) downwards. The Christmas tree shall have hydraulically actuated SSSV & SSV.

All piping, fittings, instrumentation etc. between well heads and production, injection water manifold shall be provided. PI & PT on Christmas tree shall be supplied loose and their installation shall be in Company scope, however routing of associated electrical and communication cable up to well head area and any other job required for completion of work shall be carried out by the contractor. Scope of supply shall also include PI & PT on future Christmas trees (free slots wells). All the instruments shall be supplied along with its associated accessories required for installation.

Working platform shall be provided in well head area to facilitate operation of valves & instrumentation on Christmas tree. It shall be removable type to facilitate work over operations.

Sufficient and adequate clearance surrounding well head area for easy access from all sides. Well head area shall be isolated through fire wall/barrier for hazard protection & also to avoid mud spilling over/ splashing to other areas. Well head instrumentation shall be relocated behind the firewall for safety and longevity.

2.1B.6.2 Flow Arms

All the producer wells shall be connected to production and test header through 6" flow arms. The well fluid flow arms shall be provided with PI, TI, PT, TT, PSH, PSL, sampling arrangement. Vent and drain provision shall be provided from highest and lowest position of flow arms respectively for complete venting and draining of flow arms when required.

The well fluid flow arms for producer wells as well as free slots from production manifold to well head area, complete with required piping and instrumentation items, shall be provided. The piping of flow arms shall be inclusive of supply, fabrication and erection of piping and end flange (including blind flange) which will be left 300 mm above cellar deck plating near Christmas tree. In addition, Contractor shall supply loose piping material for the balance portion from the above referred end flange to the Christmas tree of all wells (50% extra material shall be supplied considering worst case of orientation and elevation of Christmas tree).

2.1B.6.3 Production And Test Manifold

Production and test manifold consist of production header and test header for connecting well fluid flow arms. All well slots (present + future) with flow arms, piping, valves (NRV and Ball valve), flanges, fittings etc. as applicable to be hooked-up with the production and test header. Production header shall be routed to well fluid launcher for transportation of well fluid to destination platform via sub-sea pipeline and test header shall be routed to test separator and further to production header.

The production header shall be provided with PI, TI, PT, TT, corrosion coupon and sampling arrangement. Vent and drain provision shall be provided on each production headers & test headers for complete venting and draining of headers as and when required.

Flushing/purging connection with one number of hose and suitable end coupling shall be provided at each production headers and test headers. Flushing connection shall be located at minimum distance

from end flanges of headers to ensure complete flushing of headers. Corrosion inhibitor dosing point including injection quill shall be provided on both production and test header.

A dedicated additional production header with MPFM shall be provided for monitoring of DSF-III wells, 5 wells shall be connected to this new header as well. After metering through MPFM well fluid shall join to departing pipeline for onward transportation to NLG process platform.

2.1B.6.4 Inline Test Separator

Well testing facilities shall comprise of an inline separator which will be used for measurement of gas & liquid flow rate from individual wells. Inline separator shall receive well fluid from individual wells via common test header and separate gas and liquid streams for measurement of gas flow rate using V-cone meter and liquid/oil/water flow rate using coriolis meter with online water cut meter.

Inline separator is a vertical pipe with internal swirling device for gas/liquid separation. It works on the principle of g-force. Liquid phase separated out in the periphery of pipe & gas phase comes out from centre. To achieve desired separation, demister is used in gas outlet. To ensure complete draining of inline separator shall be provided from the lowest point.
PCV, LCV shall be provided in gas and liquid outlet lines respectively. Separated gas and liquid stream is combined again before connecting it to main production header

2.1B.6.5 Launcher/Receivers (Pig Barrels)

Pig barrels shall be provided on each sub-sea pipeline segment to facilitate the pig launching and receiving during pipeline pigging operations. Suitable pig handling facility shall be provided. Pig trap door opening mechanism shall be so constructed that the door cannot be opened unless barrel is fully depressurized.

Launcher/Receivers shall be provided with PT, PI, Pig indicator and PSV.

Pig barrel of launchers / receivers shall be provided be 2 nos. of PI one of full operating pressure range another one is 0-1 kg/cm2g.

Launchers shall be provided with one number pig indicator, which shall be installed as far as possible from launcher. Receivers shall be provided with two number of pig indicator, one shall be installed as far as possible from receiver and other as close as possible to receiver.

Platform wise details launcher/receiver for different services as follows:

Sl.	Launcher/ Receiver	Location	Size	Service
1	Launcher	NLM-14	12”x16”	Well fluid to NLG

2	Receiver	NLM-14	6”x8”	Lift gas from NLM-9
3	Launcher	NLM-9	6”x8”	Lift gas to NLM-14
4	Receiver	NLG	12”x16”	Well fluid from NLM-14

2.1B.6.6 Chemical Injection System (CI, Biocide)

The corrosion inhibitor injection shall be provided in well fluid manifold and departing pipeline. The CI injection system shall consist of chemical storage tank, hand operated chemical transfer pump (2nos, common for CI & biocide) and pneumatic operated chemical injection pumps. The system shall be completed with all inter-connecting piping, instrumentation, safety and control systems.

Biocide injection shall be provided in production header, departing pipeline. System shall consist of storage tank and dosing pumps with associated safety, instrumentation system.

2.1B.6.7 Lift Gas System

The lift gas system consist of lift gas flow arms for individual wells and lift gas supply header.

The lift gas flow arms for oil wells/ free slots from lift gas header up to well head area, complete with required piping and instrumentation items, shall be provided. The piping for such flow arms shall be left 300 mm above cellar deck plating near Christmas tree with blind flange. In addition, Contractor shall supply loose piping material for the balance portion from the above referred end flange to the Christmas tree of all wells (50% extra material shall be supplied considering worst case of orientation and elevation of Christmas tree).

Each flow arm shall be fitted with PI, PT, TI, TT, PSH, PSL, XSDV, FE and FCV. FCV shall have provision to control flow locally (with hand wheel) as well as through remote operation from process complex. Straight line adjustable choke assembly shall be provided in parallel to FCV.

V-cone meter with flow transmitter to cover flow range as per process design criteria shall be provided on each lift gas flow arm. On lift gas common header, cone meter shall be provided with flow range sufficient to cater to entire lift gas flow to the flowarms. The flow computation shall be done by the dedicated MVT with pressure and temperature correction and result shall be displayed in Sm^3/hr.

2.1B.6.8 IUG System

Instrument and utility gas system primarily consists of pipe separator, associated gas cooler, Utility Gas Filter separator, H2S adsorber bed, double pipe heat exchanger & Instrument gas receiver. Associated gas from Pipe Separator after single stage pressure reduction and passing through finned pipe cooler is fed to Utility Gas Filter Separator. After filter coalescer and H2S adsorber bed, gas shall

be super-heated in DPHE and stored in instrument gas receiver. Instrument gas shall be distributed to field instrument from the receiver.

2.1B.6.9 Diesel System

Hand Operated diesel transfer pump shall be provided to transfer diesel from barrel to crane day tank as and when required.

2.1B.6.10 Utility/Pot Water System

Utility water system shall be provided to the cater requirement of utility water in wash basin and toilets. Utility water system shall consist of a potable water storage tank with distribution network. MOC of tank shall be FRP. Tank shall be caged with lifting arrangement to transfer by crane to/from supply vessel.

2.1B.6.11 Vent System

Low pressure gas venting/ relief system shall comprise of vent header, flame arrestors, vent boom, CO2 snuffing system, etc. along with associated piping, instrumentation and control system. The vent connections from well head flow arms, production manifold, receivers/ launchers, etc. shall be hooked-up with vent header which in turn shall be routed to vent boom via glycol seal pot.

2.1B.6.12 Drain System

The drainage facilities shall consists of Open Deck Drain (ODD) with removable strainer/basket, Open Hydrocarbon Drain (OHD) with removable strainer/basket and Closed Hydrocarbon Drain (CHD) system for collection and disposal of non-hydrocarbon and hydrocarbon liquids. To avoid water / fluid accumulation, proper slope with adequate no. of drain cups shall be provided on decks. All the drain headers shall be provided with several flushing points to de-choke the headers. Flushing points shall be located at approachable locations.

Open deck drain system for the collection of rainwater shall be capable of disposing of the heaviest monsoon rainfall and deluge. All rainfall and monsoon water entering the open drain shall be discharged direct to sea.

Open Hydrocarbon Drain (OHD) and Closed Hydrocarbon Drain (CHD) headers shall route hydrocarbon liquid drained from vessels, equipment and lines to crude condensate vessel located below cellar deck. Crude condensate vessel shall be internally lined with suitable lining/paint as per specification 2005.
The evacuation of crude condensate vessel shall be done with the help of pneumatic operated reciprocating pump. The discharge line of crude condensate vessel shall be routed to departing well

fluid pipeline. The evacuation shall be done manually as and when required depending upon the liquid level in CCD.

2.1B.6.13 Control & Monitoring System

Refer instrumentation scope and design criteria.

2.1B.6.14 Safety System

- Safety system shall comprise of Fire & Gas Detection System including HC, H_2S, H_2, Triple-IR, Smoke, Heat Detectors.
- Fire suppression system including Portable CO_2, Dry Chemical Fire Extinguishers, DCP Skids.
- Life Saving Equipment i.e. two life raft 10 persons each, Life Jackets, Life Buoys, Navigational Aids (no fog horn), Escape Ladders, Scramble Net, First Aid Kits, Breathing air apparatus.
- SIL-3 certified FSD Systems

2.1B.6.15 Building Module

Building module shall house E&I room with distribution panels, Battery Bank, Solar Power System, various instrumentation and control systems, voice communication system, F & G detection system and shelter room with four no. foldable beds. Shelter room shall be insulated and provided with basic amenities.

2.1B.7 FACILITIES FOR FUTURE

All such requirements for facilities specified as provision for future in the bid document shall be considered / taken care in the design / engineering of the platform as scope of work covered under this bid document, such that the said future facilities can be easily installed, hooked-up and integrated with the facilities being provided now and commissioned smoothly.

2.1B.8 PROJECT SPECIFIC REQUIREMENTS

All Stores and Equipment Rooms shall be provided with adequate mobile racks for storing Documents, spares and equipment in orderly manner.

2.1B.9 MANUFACTURERS' SERVICE

Contractor shall have manufacturers' service representatives on board the platforms during mechanical completion, pre-commissioning & commissioning (wherever applicable) of the facilities as indicated in this bid document. All costs for these shall be included in bidder's lump sum amount.

2.1B.10 PRE-COMMISSIONING & COMMISSIONING OF WORKS

Pre commissioning & commissioning procedures for works (including modification works) shall be submitted by the contractor. Detailed requirements are given elsewhere in the bid document.

2.2 PIPING

2.2.2 PIPING

2.2.2.1 GENERAL

a. The piping scope of work envisaged under this tender broadly consists of but not limited to design, supply, fabrication, installation, testing, pre-commissioning and commissioning & other assistance of piping systems, instruments etc. Hook up and modification works at existing platforms as per the Description of Work (Basic Bid Work) and approved P & IDs including interface jobs as indicated elsewhere in the bidding documents.

b. The materials, design and workmanship shall conform to relevant codes, piping design criteria & functional specifications contained in the bid package.

c. Contractor shall make detailed specification and datasheet (including PMS & VMS) for piping and piping specialty items as per process requirements and submit the same for review & approval during detailed engineering.

d. Contractor to ensure below cellar deck piping routing shall be kept within the platform deck boundary and at the highest elevation to the extent possible.

e. Corrosion coupons and retrieval tool kit shall be provided as per process requirement and specification attached elsewhere in the bid package.

f. Contractor shall be responsible for complete execution of the project as per design criteria, functional specifications, Description of Work (Basic Bid Work), approved/reviewed DCI & MCI documents and approved P&IDs.

g. Supply, design, fabrication and installation of pipe supports are in contractor's scope. Contractor shall develop piping support standards and submit the same for review and approval.

h. If any details/information required to for detail engineering shall be collected by bidder during pre-engineering survey from the respective platform for modification jobs.

i. In case where emergency shutdown valves (ESDV) are to be installed on the risers just above the jacket level platform, then necessary maintenance and operational platform shall be provided for the actuator. Necessary Mechanical Guard/Protector shall be provided to prevent regress of splash water in to valve, actuator and instrument. Necessary material handling arrangements shall also be provided for loading/unloading of valve/actuator at jacket level.

j. The contractor shall develop Equipment Layouts, Safety Equipment Layouts, Piping General Arrangement drawings, Isometrics & Piping support drawings etc. in accordance with piping design criteria, functional specifications, codes and standards, Description of Work (Basic Bid Work), approved P & IDs, recommendations of Safety Studies, Material Handling Studies etc. during project stage and submit the same for review & approval. However, indicative layouts of Platforms are enclosed with the bid for understanding of scope of work.

k. Piping Material for pot water services for non-drinking application shall be SS316.

2.2.2.2 (New Well Head Platforms)

i. The piping scope of work envisaged under this tender broadly consists of but not limited to design, supply, fabrication, installation, testing, pre-commissioning and commissioning & other assistance of piping systems, instruments etc. of new platforms & Submarine Pipelines, Hook up and modification works at existing platforms as per the Description of Work (Basic Bid Work) and approved P & IDs including interface jobs as indicated elsewhere in the bidding documents

ii. For the flow arms envisaged near X-mass tree on all well platforms, the Contractor shall make the following provisions: Piping from Production Manifold, Lift gas manifold (wherever applicable), Water Injection manifold (wherever Applicable) to Well head area up-to and inclusive of supply, fabrication and Erection of piping and end flange (including matching blind flange) which will be Left 300 mm above the deck plating near X-mass tree. Further, Contractor shall Supply loose material like piping and fittings viz. elbows, flanges etc. with 50%Contingency for the worst case of orientation and elevation of the X-mass tree as Loose material for the balance portion from the above referred end flange up to the X-mass tree for all wells. Contingency material as a minimum shall consists of Two 90 Deg. Elbow for each flow arm of wells.

iii. Any other work not specifically mentioned above but required for completeness of work as per specification / drawings shall be in contractor's scope.

2.2.2.3 Piping (Modification works) on Well Head platform

I. The entire scope of piping work related to modification works at existing platforms shall be as per the Description of Work process (Basic Bid Work) and approved P & IDs.

II. The material, design and workmanship shall conform to relevant codes and standards, piping design criteria & functional specifications contained in the bid package.

III. Equipment layout drawings for existing well/process platforms where new equipment/vessels/facilities are being installed shall be prepared by contractor based on pre-engineering survey. During pre-engineering survey, in case any unforeseen or unidentified structure/ piping/ equipment etc. found to exist at the platform for which installation of new equipment is hindrance, Contractor shall readjust/ relocate the equipment/ piping as part of scope of work under this tender and submit the modified drawing for Company's approval.

IV. It is contractor's responsibility to ascertain exact pipe routing/pipe sizes/rating/MOC/relocation of Equipment/Requirement of deck extension etc. for meeting the requirement of Basic Bid Work and approved P&IDs. Contractor shall conduct necessary site surveys to collect as built data/drawings not enclosed in the bid

package and ensure that piping/ equipment clears all existing structures, cable trays, instrument racks, nearby supporting structure or any other equipment. Wherever as built drawings are not available, Contractor shall carry out detailed site survey, gather information from existing well platforms, develop the drawings and submit these for Company's review/ approval.

V. Contractor shall prepare detailed survey report for complete scope of work including hook-up details and submit the same for approval.

VI. Routing of new lines shall be same as the old one being replaced to the extent possible.

VII. Contractor shall provide/extend all safety equipment and systems, as required in the areas where new facilities are provided.

VIII. Contractor shall provide deck drains on the extended portions of the platforms and hook it up with existing deck drains.

IX. Contractor shall provide necessary material handling provisions for the new facilities.

X. Contractor's scope of work shall include modification/ integration as per approved P&IDs and other requirements listed in elsewhere in the Bid Documents. Contractor may be required to open/dismantle/realign/modify any facility or instrument or piping or equipment of the existing facilities. It will be the contractor's responsibility to make good, test and re-commission all such facilities during and after completion of works with minimum period of platform shutdown. Details of total shutdown required for each modification/integration shall be submitted to company for approval.

XI. Contractor shall perform the necessary modification/ integration work on the basis of actual physical conditions/ data/ parameters found during the site survey. Contractor shall not be entitled to any cost and time compensation on this account.

XII. Contractor shall also do the necessary patch up insulation work where insulation is opened up during tapping/ tie-in/ hook-up. Contractor shall plan & carry out suitable positive isolation, depressurization, cleaning, purging, flushing, hydro-testing, drying, and painting & removal of temporary supports, scaffolding etc. Contractor shall take all precautions & follow safety procedures to execute the job safely without any operational hazard.

XIII. Contractor shall ensure, before submission of bid offer, that the space allocated for the various facilities for the modification is adequate and satisfactory. In case, any additional space/ facility such as provision of any walkway/operating platform for maintenance and operation of valve etc. are warranted, the contractor shall indicate the same in bid offer and the cost shall be included in the lump sum price.

XIV. In case any existing facility is to be relocated or existing piping is to be altered in order to carryout platforms' modifications, Contractor shall execute these changes including testing etc. without any major shut down.

XV. Contractor shall modify the support design wherever necessary to finalize the new support without any intervention with the existing facilities. Installation of pipe work,

pipe supports, instruments etc. shall be such that existing walkways / escape routes / maintenance access to existing facilities are not encroached.

XVI. If the bid document / P & IDs specially require any existing facility to be altered or reused, the same shall be done by the Contractor after verifying/ checking the condition of existing facility. If any part of hookup location as per approved P&ID is found to be defective/repairable, contractor shall replace/ repair the same without any extra time and cost.

XVII. Contactor shall show the existing piping & Equipment on both sides of the new piping in GAD for modification works to ensure easy location of the piping.

XVIII. Contractor shall be responsible to complete the scope of work with minimum shut down. To achieve the objective, contractor shall make arrangement like temporary connection/modification in safe manner so that shut down is reduced to minimum. Arrangement/ Procedure for the same shall be finalized during pre-engineering survey and submit the same for company's approval. Company shall have right to change the proposal made by contractor based on production and availability of the platform.

XIX. Contractor shall bring out all the possible piping routing option in the pre engineering survey report.

XX. Contractor shall collect all the necessary data regarding current ongoing projects from ONGC for intended modification site prior to carrying out the actual pre engineering survey. This is to avoid interfacing issues prior to modification jobs executions.

XXI. Contractor to note wherever ONGC provide 3D model of existing platforms on as is basis, contractor shall be updating the same with their modification scope of works.

XXII. It is to be noted that drawings of existing platforms to the extent available have already been included in the bid document. Any further details/information required to for detail engineering shall be collected by bidder during pre-engineering survey from the respective platform for modification jobs.

XXIII. Contractor to ensure that any modifications for completion of scope of work shall in no way interfere with operating philosophy of the existing platform unless approved otherwise by company.

XXIV. Contractor shall prepare 3D model for topside modification scope of work. The intent of 3D model is to generate piping GAD, Equipment Layout, piping BOM (Bill of Material) for topside modification work. Contractor during pre-engineering survey shall collect all the relevant data related to modelling of its scope of work including existing nearby piping, Structure framing, broad nearby equipment dimension etc. The 3D model should include the modification scope of work and its interaction with existing facility for the purpose of review during detailed engineering.

XXV. Any other work not specifically mentioned above but required for completeness of work as per specification / drawings shall be in contractor's scope.

XXVI. Approximate deck extension/space required for existing platforms (for Piping Scope only)

Platform Name	Item To Be Installed	Deck Extension/Space Required
R-10A	R-10A to RJP Bridge Landing	9m x 4m (Deck Extension Required)
NLG	12” Pig Receiver from NLM-14	12m x 2m (Deck Extension Required)
NLM-9	6” Pig Launcher to NLM-14	8m x 1.5m (Deck Extension Required)

2.3 STRUCTURAL

The Scope of Works detailed below shall be read in combination with "Background and General", "Structural Design Criteria (Sec 3.4-Part-I & Part-II)", "Architectural Design Criteria (Sec 3.10)", FS 6001F, FS 6011, FS 2005 and "Scope of Work & Design Criteria for other Discipline" of the Bid.

2.3.1 General

The Scope shall include the structural work for facilities / requirements detailed elsewhere in the bid documents but not limited to following:

i) Pre-engineering survey for the locations including Bathymetric Survey for site investigations to establish water depth w.r.t chart datum, seabed profile using high resolution Multi-beam echo-sounder (to obtain 3-D colour Data), High resolution Shallow seismic profiling upto 125m depth from sea bed to establish seabed surface feature & shallow geology. Verification of top 3.0 meter Soil Characteristics for Mud-mat Design analysis. Identification of existing submarine pipelines /Platforms/Cables / templates/ any other obstructions. Verification of As-built data supplied by the Company with the existing platform and incorporation of deviation, if any, in preparation of equipment layouts during detailed engineering.

ii) Detailed Design & Engineering in compliance with Structural, Architectural design criteria along with all relevant functional specifications.

iii) Procurement of Structural steel materials including other materials as applicable.

iv) Fabrication.

v) Load-out.

vi) Transportation.

vii) Installation.

viii) Pre-Construction Surveys is to be taken up before installation. Data obtained from Pre-Construction Surveys is to be compared with data obtained during Pre-Engineering Survey and remedial action, if any, is to be taken up. Survey for anchor locations and Jacket launching and installation locations is also to be taken up to ensure that the required area is free from obstruction, debris and pipelines are at safe distance.

ix) Post Construction Surveys include As-built status of installed platform (Topside and substructure) covering sacrificial anodes. Sea bed contact with mud-mat and pile surroundings including scour etc.

x) Jacket and its surroundings shall be made free of debris after Installation.

xi) Supply of loose items, if any.

xii) As-built documentation of the project shall be submitted as defined in Bid document. As-Built documents shall include drawings (as-built drawings shall have marking showing changes with respect to AFC drawing), pile driving records including pile monitoring & re-strike test record, all In-service and pre service design reports along with native files (SACS, GRLWEAP etc.), Daily Progress Reports (DPRs) .

xiii) Elevation w.r.t chart datum shall be marked at jacket walkway level, sub cellar deck, cellar deck, main deck, helideck.

xiv) Any other works to complete the project

The work is to be executed in accordance with Structural design criteria and specifications as provided in the Bid documents.

2.3.2 R-12-6A, VGN-A, RJP and NLM-14 Wellhead Platforms

A) Details of Wellhead Platforms

The Scope for above stated platforms shall include the structural work for facilities / requirements detailed elsewhere in the bid document but not limited to following:

Sl. No	Platform name	No of slot /conductors	Size of conductors
1	R-12-6A	9	30”diameter & 1” thickness
2	VGN-A	9	30”diameter & 1” thickness
3	RJP	NIL	-
4	NLM-14	9	30”diameter & 1” thickness

R-12-6A, VGN-A, RJP and NLM-14 platforms shall be designed as 4 legged well head fixed platforms having Jacket Walkway Level at minimum (+) ≈ 7.6 M above Chart Datum level.

R-12-6A, VGN-A & NLM-14 shall have sub-cellar Deck, Cellar Deck, Main Deck, solar panel deck with Aluminium Helideck & Building Module. Riser platform RJP shall have sub-cellar

Deck, Cellar Deck, Main Deck and Building Module. The Building module shall house the facilities described elsewhere in the bid document. Location and size of building module shall be as per approved equipment layout.

Intruder Protection on stair at sub-cellar deck level shall be provided for all four platforms. The emergency exit cut out in cellar deck level shall be provided with easy removable & re-fixable type cover.

Pre-installed riser shall be provided at R-12-6A, VGN-A, NLM-14 and RJP platforms. Details and location of pre-installed riser shall be as indicated elsewhere in the bid document.

The substructure shall also be designed with provision of following facilities:

1) Three stage boat landing for R-12-6A, VGN-A, NLM-14 & RJP platforms. Boat landings of R-12-6A, VGN-A & NLM-14 shall be preferably at south face of the platform. Boat landing face of RJP platform shall be decided during detail engineering.
2) Standalone barge bumpers to protect the jacket legs in each leg except in the north face on all well-head platforms.
3) Standalone barge bumpers to protect the jacket legs in each leg for RJP.
4) Integrated type barge bumpers with boat landing to protect the jacket legs.

The jacket shall also be provided with cathodic protection in addition to application of protective coatings/corrosion allowance as per respective and relevant Functional Specifications.

All Conductor shall be driven up to 70m below the seabed or up to point of refusal whichever is earlier.

The super structure shall support all process facilities and utilities detailed elsewhere in the bid document. It shall also have space for smooth operations, escape routes from different levels to the boat landings complying international practices, codes and safety study. Requirements for future utilities/facilities, if any, in terms of space or appurtenances detailed elsewhere in the bid shall also be provided consistent with safe and practicable future installation. Project specific requirements and Geometrical constraints shall be as per structural design criteria 3.4 part - II. The deck sizes and deck heights shall have to be selected for meeting the functional requirements of the various process, operational and other activities described elsewhere in the bid documents

and consistent with the best practices for lay out of offshore platforms and also ease and flexibility of installation of the topsides.

Aluminium Helideck shall be provided comply with CAP 437 requirement and supported by Structural Steel Frame Work.

These platforms shall be designed to allow jack up drilling rigs approachable from well head (north) side of the platform for drilling and completion of wells.

A barrier wall with passive fire protection between well head area and process area (min. H60 rated) shall be provided.

The superstructure shall house the various topside facilities including building module, walkways, stairways, ladders, railings and stairs up to the jacket level etc.

The scope of work for all the well head platforms includes provision of Coil tubing unit (CTU) space. Deck Crane with crane boom rest shall be provided as per Mechanical & Process Scope of work.

RJP platform shall have bridge landing area for receiving MOPU Bridge. MOPU bridge details shall be provided during detail engineering.

Well Platforms jacket installation shall be carried out using either by launch or lifting method and topside installation shall be carried by lift method of installation.

Contractor shall select and provide suitable marine spread for load out, transportation & installation of the platform based on pre-service analysis of various activities/structures of platform.

For jacket & topside installation, the bidder shall furnish/ submit the breakup of the proposed details of all offshore lifts at bidding stage as per the format in the Table- 6 of Structural Design Criteria 3.4 (Part-II) of Section 3 of Vol-II.

B) Jacket Pile Configuration of Wellhead Platforms

The substructure of the Well head platforms shall be designed as 4 legged Jacket with one of the following option for pile configurations.

1. Main piles only
2. Combination of main & skirt piles
3. Skirt pile only.

C) Soil Report

Soil Report at R-12-6A, VGN-A, RJP and NLM-14 locations are enclosed with this Bid document. No structural tonnage adjustment shall be applicable for sub-structure for above said four platforms (Jacket, piles, conductors, Jacket appurtenances etc.) and super-structure (deck and modules etc.).

2.3.3 Bridge from R-10A to RJP

The Contractor shall perform pre-engineering survey to verify the dimensions of existing structure at R10-A for installation of the new Bridge structure & removal of obstructions, if any, before carrying out detailed engineering.

The RJP platform shall be Bridge connected to the existing R-10A Wellhead Platform at Cellar deck level. Pinned support shall be provided at R-10A location at cellar Deck level.

The bridge shall be single tier and it shall cater for piping, electrical, process and instrumentation scope of work as indicated elsewhere in the bid. Bridge length shall be kept 50 m (approx.). The exact length, width and height of bridge shall be firmed-up during detailed engineering. 1.2 m wide walkway with handrail & grating shall be provided at the middle of bridge cross section. The bridge shall have rain protection having provision of roofing with GI corrugated sheet. Monorail (capacity specified elsewhere in the bidding document) shall be provided at connecting Bridge for material handling between two platforms. Bridge shall be coated as per spec.2005.

Elevation of existing R-10A platform shall be verified during pre-engineering survey.

Structural Tonnage for Bridge shall be under adjustment as specified in Appendix-A3 of Volume I of the Bid Document.

2.3.4 R-10A DECK EXTENSION AND STRENTHENING OF EXISTING R-10A FOR BRIDGE LANDING

Deck extension on Cellar Deck (9m x 4m approx.) at south-west corner (tentative) at R-10A Platform is required for supporting new bridge from existing R-10A Platform to RJP.

Deck extension location & exact details including deck extension sizes shall be firmed up during pre-engineering survey & detail engineering. The scope includes deck Global Inplace analysis and strengthening /addition/alterations of structural members at R-10A Platform for supporting the new Bridge.

To facilitate bridge connectivity at Cellar Deck of existing R-10A platform, modification to be carried out based on pre-engineering survey & landing details of new bridge.

Wherever required, existing facilities to be relocated to facilitate bridge landing as part of the scope. Peripheral walkway as per safety requirement shall be maintained after provision of bridge landing at R-10A Platform.

Deck Global Analysis for the proposed extensions of R-10A platform is included in the Scope of Work and shall be carried out as per structural Design Criteria Part – I of Section 3 of Vol-II of Bid for the proposed extensions with strengthening of existing structural members & Joints. Strengthening of existing corroded structural members/replacement, provision of additional diagonal braces and knee braces below cellar deck to support deck extensions as per Global In place analysis during detail engineering is part of the scope. Deck leg Joint portion at brace connection shall be strengthened for bridge support of R-10A topside.

Extended decks shall have proper weather proof protection to safeguard the critical equipment and instruments from hostile and corrosive marine environment.

The replacement of Plating & Gratings at Piping/equipment/Process modification areas of R-10A Platform shall be carried out by the Contractor as defined elsewhere in the bid.

The Strengthening scope of existing R-10A Deck Structure due to Global Inplace analyses as per bid & meeting the requirements of structural design criteria, shall be carried out by the Contractor, irrespective of any existing R-10A Deck status.

The demolition & relocation of facilities wherever required shall be carried out as part of scope of work. Any structural Strengthening at R-10A platform due to facilities & modifications shall be carried out by the Contractor as part of the scope.

Any problems envisaged for the modification works shall be brought to the Company's notice in the pre-engineering survey report and feasible solution shall also be proposed. If required, one more round of pre-engineering survey is to be carried out.

Strengthening and modification and/or providing any new members in existing deck on account of Deck extension/ Bridge Landing shall be included in lump-sum quoted price.

Structural steel tonnage adjustment shall be applicable for deck extension and additional

diagonal braces & knee braces provided only for supporting extended deck as specified in Appendix-A3 of Volume I of the Bid Document.

2.3.5 General scope for Deck Extension (list of platforms shall be as indicated elsewhere in the bid package):

The Contractor shall perform pre-engineering survey to verify the deck elevation, dimensions of the existing Primary Structural Members of beam components & tubular before carrying out detailed engineering of the proposed Deck Extension and/ or Modification and examine if there are any obstructions in the way of installation of deck extension and/ or modification. If required, carrying out one more-round of pre-engineering survey shall be included in scope of work. Any problems envisaged in the offshore installation shall be brought to Company's notice in the pre-engineering survey report and feasible solution shall be put up for review and approval of Company. Deck extension and modifications shall be designed as per structural design criteria and functional specifications.

Scope of work includes Demolition and / or relocation and/ or reinstallation of existing facilities/ provisions (such as existing equipment(s), piping(s), cable(s), structure(s) etc.) and/ or any other obstruction(s) on existing platform to carry out the scope of work which is covered in this contract.

Exact location, size and requirement of deck extension/ modification shall be finalized based on pre-engineering survey and approved equipment layout during detailed engineering. (Refer scope of work of other disciplines for details related to deck extension).

The strengthening of existing deck members and/ or addition of new members in the existing deck on account of deck extension and/ or modification works, wherever found to be required, from the results of local deck analysis is also in contractor's scope of work. Strengthening of Existing members shall also be included in scope even those were overstressed prior to execution scope of this bid package. Repair/ replacement/ providing new Hand rails/ gratings/ chequered plates are included in scope of work in relation to Deck extensions.

Local Deck analysis and strengthening shall be carried out based on As-built document including SACS file (if available) and pre-Engineering survey reports. In case SACS file is

not available Contractor shall develop SACS model file from pre-Engineering survey report.

Local deck analysis shall be as detailed below:

1. For deck extension:

   Local in-place analysis shall be carried out as per structure design criteria part-1 Rev.14.

2.3.6 Modification Works (list of platforms shall be as indicated elsewhere in the bid package):

Structural modifications & strengthening/ replacement of structural members as required to meet process/ piping/ other operational requirement mentioned elsewhere in the bid document are included in scope of work and these modification works shall be based on Local analysis to be carried out as per 2.3.6.1 and as per structural design criteria and functional specifications. Repair/ replacement/ providing new Hand rails/ gratings/ chequered plates are included in scope of work in relation to above mentioned structural modifications & strengthening/ replacement of structural members. Modifications to be carried out based on pre-engineering survey and approved equipment layout during detailed engineering.

2.3.6.1 For Modification work:

Local analysis of impacted member(s) and joint(s) shall be carried out.

2.3.6.2 Cost of modification /strengthening/ replacement shall be included by contractor in lump-sum quoted price & the same is not to be considered in tonnage adjustment.

2.3.7 Member replacement at jacket walkway level of NLM-9 platform

Replacement of two damaged members MA74 and MA45cC at NLM-9 platform jacket walkway level shall be carried out. Refer drawing in the bid document for details.

2.3.8 Architectural Scope of Work

The Contractor shall carry out Architectural design, engineering, procurement, fabrication of the complete Building Module as described in section 3.10 of Architectural Design Criteria and Functional spec 6011 of Bid document.

2.3.9 Deliverables for Detail Engineering

a) Structural

Refer Section 3.4, Structural design criteria of the bid document. Purchase Speciation for Rubber products shall be submitted. Structural Steel Tonnage to be provided in each framing drawings.

b) Architectural

As a minimum, the following detail engineering deliverables for all the facilities shall be prepared by the contractor confirming to section. 3.10 Architectural Design Criteria.

- Building Module Elevations & Sections.
- Furniture layouts at all levels.
- Floor, ceiling, and other furnishing details.
- Door & Window Schedule & Details.
- Fire Insulation & blast wall Details.
- PS for Architectural Items.

2.4. MECHANICAL

2.4.1 INTRODUCTION

The following sub-sections describe the Mechanical works envisaged under Additional Development of R Series-1 (ADR-I) and NLM-14 Project. This section is to be read in conjunction with the Basic bid work of Process, Structural, Electrical, Piping & Instrumentation, Process Design Criteria, Design Criteria of Mechanical Safety & Life Saving Equipment, Indicative P&IDs and Functional Specifications placed in the bid package for the complete assessment of Mechanical/Rotary & Life Saving Equipment scope of work.

Further it is to be noted that the standard design criteria of "Mechanical, Safety and Lifesaving Equipment" is enclosed in the bid package which covers various equipment of an offshore platform, therefore only the relevant portions of the design criteria as applicable to this project need to be followed. Bidder to note that anything not mentioned here but nevertheless required to make the system safe and complete shall be supplied and executed.

2.4.2 SCOPE OF WORK

The scope of work shall include design, detail engineering, preparation of drawings and documents, sizing, selection and procurement of Mechanical, Safety and Life Saving Equipment, supply of all material, equipment, tools & tackles and fabrication, installation, hook-up, testing, commissioning and handing over of all mechanical facilities complete in all respects. Mechanical equipment and facilities shall meet the requirements given in the Process Scope of work, Process Design Criteria, Design Criteria of Mechanical Safety & Life Saving Equipment for Well platform/Process platform, Functional specifications etc., specified in the bid package.

The description and requirements contained in this section /specification are concise by necessity and cannot include all details. However, it is the responsibility of the Contractor to execute the job in accordance with bid specifications, relevant codes/standards/ recommended practices/regulations/statutory guidelines /Petroleum & Natural Gas (Safety in Offshore Operations) Rules, 2008 OISD codes and good engineering practices for smooth and successful operation of the Platform.

2.4.3 EQUIPMENTS / PACKAGES:

Contractor shall follow description of work/basic bid work in totality, various discipline's design criteria, relevant functional specifications, other respective codes and standards specified / attached with the Bid package and shall carry out design & detail engineering for various equipment envisaged under this project.

All equipment/packages shall be procured as per the specifications attached with the bid package. In case any new specification, not included in the bid package, is required to be generated, the contractor shall prepare the specification and shall submit to Company for approval.

Wherever equal but conflicting requirements arise between this Scope /Specification and the referenced documents, such conflict shall be brought to the attention of the Company in writing.

Contractor shall carry out the following activities for procurement of Equipment / Packages:

- Contractor shall prepare the enquiry specifications / documents for each Equipment / Packages and materials to be purchased including spare parts for erection & commissioning, special tools and tackles and also provide list of spare parts for one year normal operation.
- Equipment data sheets (as per relevant API codes, wherever applicable) and as specified in functional specifications shall be submitted for company's review.
- Contractor shall prepare the detailed Purchase Specification for each Equipment/Packages. Contractor shall obtain the approval of Purchase Specification of all Equipment/Packages and items from Company/ Company's representative before placement of order on Vendors selected by them.
- Contractor shall carry out the detailed design review, checking and approval of equipment engineering and all drawing and technical data from Vendors for equipment and materials, to ensure adequacy and consistency with the design, safety and operability requirements.
- Equipment shall be designed for saliferous environment and outdoor location on an offshore platform, unless otherwise stated.
- All equipment shall be designed and selected for continuous duty, unless specified otherwise.
- Contractor shall prepare Inspection and Test Plan (ITP), indicating inspection stages wherever required, in accordance with Company provided Inspection Requirement Table (IRT), Functional Specifications, Codes and Standards etc. covering relevant components, complete equipment / systems and submit it for review and approval by the company.
- Contractor shall include all the commissioning spares as required in the equipment vendor's scope. Contractor shall procure the same from the equipment vendors and make it available well before commissioning of equipment. In case, any additional spares are consumed during commissioning the same to be provided by the contractor at no additional cost to the Company.
- For all Equipment / Packages, Vendor shall furnish the list of special tools/ tackles required for assembly and maintenance. Such tools/ tackles shall be supplied by the vendor and shall form part of firm supply of Contractor. Unless otherwise specified, for multiple identical Equipment's / Packages (2 or more), at least Two (2) sets of special

tools and tackles shall be supplied else one set shall be supplied if the number of equipment/ package is one.

- Contractor's scope shall include complete supply, transportation of equipment package from vendor's shop to site, receipt of material at site, handling at site and arrange for storage at site.
- Equipment which are transported by sea shall have sea-worthy packing. The Contractor shall strictly follow the recommended preservation procedures during the period of storage for all equipment.
- Contractor shall carry out the Erection of each Equipment/ Packages at the specified location on the properly designed foundation/support as per requirement stated elsewhere in Bid.
- Contractor shall carry out the inter-connections at all interface points such as main process and utility connections.
- A consolidated list for equipment / packages shall be provided indicating type of chemicals, lubricant, grease, oil etc. required for the equipment / package. Specifications, quantities required, brand name (and their Indian equivalent) of the chemicals, lubricant, grease, oil etc. shall also be indicated in the list.
- Contractor shall supply & install maintenance facilities sized for handling the heaviest single piece of equipment for maintenance. The maintenance facilities like Manual hoist (with or without geared trolley), chain pulley blocks and monorails shall be provided. Contractor shall provide sufficient space for maintenance, dismantling/assembly for the equipment. Also suitable facilities to handle major assemblies for taking out and in to the platform shall be provided.
- Contractor shall carry out the pre-commissioning, commissioning and Performance Test for Equipment/Packages covered under the project as per Commissioning Procedure and Performance Test attached in the Bid. Prior to performing said activities, contractor shall submit a procedure for the same well in advance for Company's review. The procedure shall be as per guidelines indicated in the specifications for commissioning Procedure and Performance test 5103W attached in the bid.
- Contractor shall ensure the presence of equipment manufacturer's representative at yard and site (offshore platform) for supervision of erection, testing and commissioning for major Equipment/Packages.
- All pressurized cylinders like clean agent cylinders, CO2 cylinders, Nitrogen cylinders etc. shall have PESO approval for refilling in India. All statutory guidelines shall be adhered to in this regard. PESO certificate shall be submitted at the time of detailed engineering to Company.
- Contractor to refer Design Criteria – Mechanical, Safety and Life Saving equipment for various documentations required for information, review and approval.

- Complete package under Packaged Equipment identified in Mechanical Design Criteria shall be supplied by the vendor and it shall be covered in one PS.
- All packaged equipment shall be supplied as skid mounted fully assembled, piped, wired and tested as per specifications. Structural steel base frame of skid shall be designed for single lift operation. For equipment prone to leakage / moisture condensation, Drip pan with suitably connected drains shall be provided so as to avoid spillage of fluids / liquids on deck.
- Minimum space between/around equipment shall be 750mm. Escape & safety route may be used as O&M space provided there is no permanent hindrance/obstruction caused by such activity on the escape & safety route.

2.4.4 LAY DOWN AREA

Lay down areas shall be provided to allow removal of equipment for maintenance/repair. Lay down areas shall be adequate in size, number and location for the operations and maintenance activities. Suitable hatch at main deck with corresponding lay down areas at cellar deck shall be provided for handling of items/ equipment/ sub-assemblies by the crane. Areas above and below the hatches shall be clear of piping, cabling, supports etc.to allow unobstructed lifting of equipment.

2.4.5 MATERIAL HANDLING EQUIPMENT (CRANAGE AND LIFTING):

Material handling facilities are broadly categorized as:

- Pedestal-mounted, diesel-operated deck cranes.
- Manually-operated, trolley-mounted / hook-mounted chain pulley blocks etc.
- Platform Deck Trolley of adequate capacity (one each at Main Deck and Cellar Deck for transportation of Equipment /parts/ accessories to loading/ unloading Area)
- Hydraulic Pallet truck (for Chemical/ Oil Drum Transfer)

Material handling facilities envisaged in each new well platforms R-12-6A, VGN-1, Riser platform RJP and NLM-14 are as follows:

a) **Pedestal Mounted Deck Crane** – One no. of Pedestal Mounted Diesel Engine Operated Deck Crane of 15 MT capacity (both dynamic and static) for each new platforms **R-12-6A, VGN-1, Riser platform RJP and NLM-14** shall be provided (with API-2C medallion affixed on the crane). As a minimum, it shall be capable to lift dynamic load of 15 metric Tons at a radius of 14.5 meters from supply vessel and should also be capable of lifting DCP skid placed at Helideck (No helideck on RJP). Also, crane boom length shall cover entire platform area. Also Deck crane shall be capable to lift hose from the manifold provided on the riser platform RJP.

Diesel Storage facility in crane pedestal is not envisaged. Crane pedestals and the supporting structure shall be designed in accordance with the strength and fatigue provisions of API RP 2A and API SPEC

2C, except that the impact factors shall conform to design requirements for the cranes. The supporting structure is defined as the pedestal and all members directly connected to the pedestal.

Deck crane shall be capable for:-

- Lifts from supply boats / vessels & barges etc. and certified for transfer of personnel through personnel baskets by auxiliary hook from Boat Landing/Supply Vessels/Barges at appropriate locations on decks.

Deck crane should be positioned:

- To minimize blind lifts.
- To reduce risk of dropped objects on live hydrocarbon equipment.
- To access lower decks through use of lay down areas or access hatches.

Alternator of deck crane engine shall be rated as per requirement given in Electrical Scope of Work for NLM-14 platform.

For more details on Crane, refer Design Criteria Mechanical, Safety and Life Saving Equipment, P&ID, Process scope of work and Functional Specification of Deck Crane (FS 5301).

b) **Hook mounted Chain Pulley Blocks**: Sufficient nos. of Chain Pulley Block (to be finalized during detailed engineering) shall be provided as store items for use during repair and handling of platform equipment which are otherwise not serviceable by the material handling facilities. Hooks/ Beam clamps, Pad eye etc. shall be provided for fixing Chain Pulley blocks near the major maintenance prone equipment, at strategic locations where permanent material handling facilities or deck crane access is not available. The location of hooks shall be indicated on the layout drawings. For more details on Chain Pulley blocks, refer to Design Criteria Mechanical Safety and Life Saving Equipment given elsewhere in this bid document. Chain pulley blocks shall be approved by statutory authority (IS or equivalent).

As a minimum, following numbers of chain pulley blocks shall be supplied on each new wellhead platforms and Riser platform:

Sr. No.	Capacity	Quantity
1	5 MT	2
2	2 MT	2
3	1 MT	2

c) Based on the requirement, adequate nos. of manually operated monorail hoist of minimum 5T capacity shall be provided. Same shall be firmed up during detailed engineering as per material handling study report and 3D model review.

d) Hand trolley of adequate capacity shall be provided (one each at Main Deck and Cellar Deck for transportation of Equipment / parts / accessories to loading / unloading Area). Same (capacity of trolley) shall be firmed up during detailed engineering as per material handling study report and 3D model review.

e) Suitable material handling facility shall be provided for handling/replacement of Life Raft and Scramble net.

f) Jumping rope installed for person transfer shall be with hatch/suitable mechanism from cellar deck for convenient replacement & servicing.

2.4.6 MECHANICAL EQUIPMENT

Various equipment, their capacity and quantity envisaged in the project are indicated elsewhere in the bid. For process parameters and other details for these equipment, refer Process Design Criteria, process scope of work and P&IDs. Also refer Mechanical Design Criteria and respective functional specifications for equipment design.

(A) Major Mechanical Equipment/Packages for new platforms (R-12-6A & VGN-1) shall include but not be limited to the following:

1) **Crude Condensate drum & Transfer System**: One No. Crude condensate drum on new well platforms shall be provided. CCD shall have evacuation system using motor driven crude transfer pump one operating and one standby.

2) **Potable water system:** One no. potable water storage tank (MOC of the tank shall be FRP) Cap- 1.0 m3 with gravity distribution shall be provided on the new platforms. Tank shall have provision of lifting by crane.

3) **Diesel Storage and Transfer System**:
Diesel System shall primarily consist of diesel barrel handling and storage on main deck along with hand operated transfer pump on each platform to transfer diesel from barrels to diesel day tank of crane engine. The system shall be complete with associated piping, instrumentation & safety system. MOC of Hand operated diesel transfer pump shall be SS316L.

4) **Chemical Storage and dosing System (CI, PPD):**
Chemical injection system shall be provided consisting of chemical storage vessel, PPD storage vessel, hand operated chemical transfer pump and motor operated reciprocating controlled volume injection pump one each for CI and PPD along with associated piping, instrumentation, safety and control systems.
Facilities on the platform:
Chemical Transfer pump:

No. of pumps: 2 no.
Type of Pump: Hand operated pump (drum mounted) shall be provided with necessary piping/hose connection for supply of chemical from drum rack to chemical storage tank/vessel.

Chemical Storage Vessel
No. of vessels: Two

Chemical Injection Pump
No. of pumps: 2 nos. (1 operating + 1 Standby) each for CI and PPD dosing
Type of pump: Motor operated reciprocating controlled volume pumps (API 675).

5) **Vent Boom** - Vent boom with glycol seal pot for disposal of vent gases shall be provided on each well platforms.

6) **CO2 Snuffing System:** CO2 snuffing system shall be provided for vent boom for each new well platforms as a fire suppression system. The equipment shall be skid mounted, automatically activated snuffing system complete with all necessary accessories to make it a complete operable unit. Vendor to ensure that CO2 flow rate is sufficient to extinguish the flame and also cool the vent tip below the auto ignition temperature in case the vent tip has been ignited. CO2 snuffing system shall be sized for two consecutive firing (for initial charge) of CO2 cylinders with necessary piping, pressure switches, gauges, valves, associated controls. The system shall be completely assembled and installed on the platform in ready for operation condition. 100% spare charged CO2 cylinder shall be provided. CO2 cylinders shall be stored in the weather proof cabinet.

7) **HVAC System for Building Module:** New HVAC system for meeting requirement of Building module consisting of switchgear room, VFD room, shelter room etc. shall be provided at new platforms. Ventilation system for Battery room shall be provided.

8) **Clean Agent**: Clean Agent unit for various equipment room in building module such as Switchgear, VFD, battery room etc. shall be provided at all new platforms.

9) **H2S capsule** (One No. of Five men capacity) will be provided at each platform. Two H2S kits (mask) shall also be provided.

(B) Mechanical Equipment/Packages for RJP Riser platform shall include but not be limited to the following:

1) **H2S capsule** (One No. of Five men capacity) will be provided at RJP riser platform. Two H2S kits (mask) shall also be provided.

2) **Slop Oil pump** - 2 (1+1) motor operated pumps shall be provided downstream of closed drain vessel to pump the liquid from the vessel to production header for further transfer to MOPU.

3) **HVAC System for Building Module:** New HVAC system for meeting requirement of Building module consisting of switchgear room etc. shall be provided at Riser platform RJP. Ventilation system for Battery room shall be provided.

4) **Clean Agent**: Clean Agent unit for various equipment room in building module shall be provided at Riser Platform RJP.

5) **Life Boat**: Two life boats of minimum twenty persons capacity shall be provided at RJP Riser platform.

(C) Mechanical equipment/s for new well head platforms NLM -14 shall include but not be limited to the following:

1) **Crude Condensate drum & Transfer System**: One No. Crude condensate drum shall be provided. CCD shall have evacuation system using crude transfer pump one operating and one standby – Utility gas driven crude oil transfer pump. Crude Condensate Transfer Pump shall be API 674.

2) **Potable water system**: One no. potable water storage tank (MOC of the tank shall be FRP) Cap-1.0 m3 with gravity distribution shall be provided on the new platforms. Tank shall have provision of lifting by crane.

3) **Diesel Storage and Transfer System**: Diesel System shall primarily consist of diesel barrel handling and storage on main deck along with hand operated transfer pump on each platform to transfer diesel from barrels to diesel day tank of crane engine The system shall be complete with associated piping, instrumentation & safety system. MOC of Hand operated diesel transfer pump shall be SS316L.

4) **Instrument and Utility gas System** – Instrument & utility gas system shall be provided on each new platform. H2S adsorber shall be part of IUG package for **NLM-14** platform only.

5) **Chemical Storage and dosing System:**

NLM-14: Chemical injection system shall be provided consisting of chemical storage vessel, biocide storage vessel, hand operated chemical transfer pumps, and pneumatic operated reciprocating controlled volume injection pump one each for CI and biocide along with associated piping, instrumentation, safety and control systems.
Facilities on each of the platform:

Chemical Transfer pump:
No. of pumps: 2 no's.
Type of Pump: Hand operated pumps (drum mounted) shall be provided with necessary piping/hose connection for supply of chemical from drum rack to chemical storage tank/vessel. MOC of Hand operated transfer pump shall be SS316L.
Chemical Storage Vessel
No. of vessels: Two
Chemical Injection Pump
No. of pumps: 2 nos. (1 operating + 1 Standby) for each type of chemical
Type of pump: Pneumatic operated reciprocating controlled Volume pumps (API 675)

6) **Vent Boom** - Vent boom with glycol seal pot for disposal of vent gases shall be provided on each well platforms.

7) **CO2 Snuffing System:** CO2 snuffing system shall be provided for vent boom for each new well platforms as a fire suppression system. The equipment shall be skid mounted, automatically activated snuffing system complete with all necessary accessories to make it a complete operable unit. Vendor to ensure that CO2 flow rate is sufficient to extinguish the flame and also cool the vent tip below the auto ignition temperature in case the vent tip has been ignited. CO2 snuffing system shall be sized for two consecutive firing (for initial charge) of CO2 cylinders with necessary piping, pressure switches, gauges, valves, associated controls. The system shall be completely assembled and installed on the platform in ready for operation condition. 100% spare charged CO2 cylinder shall be provided. CO2 cylinders shall be stored in the weather proof cabinet.

D) Mechanical equipment/s for Modification Work at R-7A and R-9A shall include but not be limited to the following:

1) **HVAC System for New Switchgear Room:** New HVAC system for meeting requirement of New Switchgear room at R-7A and R-9A shall be provided.
2) **Clean Agent**: Clean Agent unit for New Switchgear room at R-7A and R-9A shall be provided.

2.4.7 FIRE PROTECTION / SUPPRESSION SYSTEM FOR NEW WELL PLATFORMS

Various fire protection / suppression system shall be designed and provided on the platforms as described below and as per relevant applicable codes specified in Mechanical Design Criteria. Design of the system shall be based on the basis that no firefighting resource from outside the platform will be available in case of fire emergency and fire within the platform shall be controlled and extinguished by the platform resource only.

Firefighting equipment shall be provided at all strategic locations determined by the safety studies.

DCP Skids with Hose Reels: Dry Chemical Powder Skid of minimum 350 lbs capacity, one each on cellar deck, main deck and helideck on each new platform shall be provided. Actual capacity however is to be finalized during detail engineering, complying with NFPA-17. For more details, refer Process scope of work, P&ID, Functional Specification for DCP skids with hose reels (FS 5067) and Design criteria -Mechanical, Safety and Life Saving Equipment.

Water Mist System: Water Mist & CAF Fire Extinguisher Trolley Mounted (Design: High pressure) using AFFF compound with minimum Fire Rating of 21A, 233B and Electrical fires up to 1000V at 1 meter shall be provided on each new Platform.

Quantity on each Platform:
- One no. on Cellar Deck
- One no. on Main deck

For more details on Water Mist & CAF Fire Extinguisher refer Functional Safety Specification (FS-5102) given elsewhere in the bid document.

Portable Fire Extinguishers: Firefighting system, consisting of portable fire extinguishers, both dry chemical and carbon dioxide type, shall be provided at strategic locations on new platforms in adequate numbers. For more details, refer Section 3.7 Design criteria -Mechanical, Safety and Life Saving Equipment. All portable firefighting equipment shall have compliance with applicable codes/standards/regulations.

Minimum Quantities of various fire protection facilities are listed below. However based on the safety studies any additional facilities/ quantities required shall be in the firm scope of the Contractor.

As a minimum following fire extinguishing equipment shall be supplied for each new platforms-

i) 10 nos. 9 kg (20 lbs) dry chemical extinguishers with UL rating of 120: BC (8 nos. on cellar deck & 2 nos. by the side of helideck / Main deck of RJP)
ii) 2 nos. 4.5 kg (10 lbs) CO2 extinguisher with UL rating of 10: BC located near the shutdown panel.
iii) 2 nos. 4.5 kg (10 lbs) CO2 extinguishers with UL rating of 10: BC located inside the E&I room.
iv) 2 no. 4.5 kg CO2 extinguishers with UL rating of 10: BC located in the shelter room.
v) 4 nos. 4.5 kg (10 lbs) CO2 extinguisher with UL rating of 10: BC located near stair leading main deck.

2.4.8 LIFE SAVING AND PERSONNEL SURVIVAL EQUIPMENT FOR NEW WELL PLATFORMS

As a minimum, following shall be provided on each new platforms:

i) Minimum 30 (Thirty) nos. life jackets (15 nos. each on cellar deck and main deck) located in watertight lockers to be placed adjacent to life raft and minimum 10 (ten) nos. work vests. Also

minimum 20 (Twenty) nos. life jackets located in watertight lockers to be placed adjacent to each Life boats at RJP riser platform

ii) Minimum 20 nos. (Twenty) life ring buoys shall be placed on the platform. Life Ring Buoys shall be equivalent to United States Coast Guard approved type. Each life ring buoy shall be placed on a suitable permanent rack such that the buoy can be easily removed for use. Life Ring Buoy shall have a self- igniting light capable of withstanding an immersion test up to 0.5 meters and capable of burning for not less than 45 minutes with a luminous intensity of not less than 2 candle power. A buoyant lifeline shall be there, length of the same shall be decided based on location of life ring buoy on the platform. In addition to this, for each new Well head platform, two lifebuoys with self-activating smoke signal lights capable of quick release as per clause 4.9 of OISD-STD-184 is to be provided.

iii) 2 (Two) nos. gravity type inflatable life raft (10 men capacity each), one each on cellar deck and main deck, mounted in self- launching mode (inclined at angle 30^0) to be installed at the most frequented areas. The Stowage height of each life raft shall be such that it is suitable for each specific location where it is to be mounted on the deck.

iv) 2 (Two) nos. personnel basket (6 men capacity each) to be kept in an accessible location. The personnel Transfer Basket shall be rigid type during transfer operations but shall be collapsible for storage.

v) 2 (Two) nos. scramble net (To be placed adjacent to each life raft).

vi) Separate muster area for 4 persons on each deck to be provided.

vii) No life-saving equipment is envisaged for existing platform for modification scope of work.

All lifesaving equipment shall have compliance with applicable regulations. Refer Section-3.7 Design Criteria for Mechanical, Safety and Life Saving Equipment and Functional Safety Specification (FS-5102) for details given elsewhere in the bid document.

2.4.9 OCCUPATIONAL HEALTH AND SAFETY (OHS)/PERSONAL PROTECTION EQUIPMENT FOR NEW WELL PLATFORMS

Following items as a minimum shall be provided on each new platforms**:**

- 2 (Two) no. of First Aid Kit
- 2 (two) nos. of Stretcher
- 2 (two) nos. of Fire Blanket
- 2 (two) sets of Fireman's Outfit
- 02(two) set of Helicopter Rescue Kit (not for Riser Platform)
- 20 (twenty) nos. of Portable Eye Wash Bottle
- 10 (ten) nos. of Portable Breathing Apparatus of 30 minutes capacity

- 2 (two) nos. of Safety Torch (the safety torch should be rechargeable LED and intrinsically safe.)
- 100 nos. of Lead Acetate Paper
- 50 (fifty) nos. of Ear Plugs
- 10 (ten) nos. of Eye Goggles
- 10 (ten) nos. of Escape Mask and
- 10 (ten) nos. of Safety Helmet

These items are to be provided in weatherproof containers at easily accessible location. Any other item/equipment as per Safety Studies and Occupational Health and Safety (OHS) guidelines shall be provided on each new platform and shall be in the firm scope of the contractor. All OHS/PPE items shall have compliance with applicable codes/standards/regulations. Refer Section-3.7 Design Criteria for Mechanical, Safety and Life Saving Equipment for details.
Safety shower and eye wash stations are not envisaged for new platforms.

2.4.10 PASSIVE FIRE PROTECTION SYSTEMS

A barrier wall with Passive Fire Protection between well head and process area shall be installed on platform and if required, the muster area may also be provided with Passive Fire Protection.

Passive fire protection shall provide effective fire protection without introducing additional failure modes, such as corrosion, or inhibiting other things to safety, such as inspection.
Based on Safety studies; an assessment of credible fire scenarios, passive fire protection shall be applied to critical structures, boundaries, vessels and equipment proposed to be installed on the new Well platforms. No credit shall be taken for the cooling effects of Active Fire Protection systems on main structural elements when developing the extent of the Passive Fire Protection. The requirement for and rating of passive fire protection of structural members shall be established during detailed design phase by the Contractor. For further details, refer Functional Safety Specification (FS-5102) and structure design criteria.

2.4.11 SAFETY SIGNS, SAFETY PLANS AND PLATFORM IDENTIFICATION SIGNS:

Safety signs shall be provided on new well platforms. Safety plans shall be strategically located throughout the new well platforms. Safety Plan shall consist of simplified plan view of the applicable platform deck and clearly identifying major items / equipment, room/walls, points of access and escape routes, walkways, fire and safety equipment and major structural members. These shall comply with SOLAS / Life Saving Appliances Code.

2.4.12 HOT SURFACE PROTECTION

Personnel protection against accidental contact with hot surface shall be provided. Bidder to follow FS 2006.

2.4.13 SAFETY STUDY:

Contractor shall engage an internationally reputed third party agency having expertise in carrying out HAZID, HAZOP, SIL studies etc. The Contractor shall carry out relevant safety studies safety studies as per Functional specification for safety studies (FS-5101) and carry out necessary changes wherever required as per the recommendations/findings of the safety studies without any extra time and cost impact to the Company.

The contractor shall also comply with the requirement of functional safety Specifications (FS-5102) for the scope of work as defined in the bid package and shall provide as a minimum all operation / safety equipment as per the specification No. (5102). Any conflicting requirement shall be brought to company's notice and clarification shall be sought.

SCOPE OF WORK

Instrumentation

PART A: ADDITIONAL DEVELOPMENT OF R-SERIES-I (ADR-1)

2.5A INSTRUMENTATION SCOPE OF WORK

2.5A.1 Introduction

This section defines the general requirements of instrumentation, monitoring and controls, necessary for the job on the new and existing platforms as per the Process Scope of Work (SOW) and relevant P&IDs. This document covers the minimum requirements for Design, Engineering, Procurement, Supply, Calibration and Installation. Hook-up, Testing, Loop Checking, Pre-commissioning and Commissioning of Instrumentation and Controls required for this project and shall be done as per the Basic bid work, Piping & Instrumentation Diagrams (P&IDs), Process SOW and Design Criteria, Instrumentation Functional Specifications, Instrumentation Design Criteria and other Functional Specifications in the bid package.

Unless specified otherwise, the term **Instrumentation** shall mean instruments, control system and safety instrumented system, along with the applicable accessories, utilities and hook-up material.

The present project broadly envisages –

- Two new Well-Head Platforms (R-12-6A and VGN-A).
- One riser platform (RJP).
- Modification at R-10A, R-13A and R-12A.
- Associated pipelines and composite cables.

Bidder to note that

- R-12-6A and VGN-A Wellhead platforms shall henceforth be referred as ‘New Well Head Platforms’.
- RJP shall be referred as ‘Riser Platform’
- R-7A, R-9A, R-10A, R-13A, R-12B and R-12A shall be referred as ‘Existing Well Head platforms.

2.5A.2 General Guidelines

a. This section shall be read in conjunction with the other sections of Basic Bid Work, Design Criteria, Process Scope of Work including P&IDs and Functional Specifications- Instrumentation.

b. Any proprietary or non-proprietary sub-system/ facility or instruments/ equipment/ accessories/ any hardware or software (including any up-gradation requirements), Firmware up-gradation/ licensing, not specifically mentioned in the scope but are implied and found essential (during any stage of the project such as pre-engineering survey, detailed engineering, P&ID approvals, Safety studies, HAZOP, CHAZOP, Commissioning etc.) for project completion, commissioning and making the system fully functional for the Safe and Normal operation of the plant as well as to

fulfill the functional and technical requirements of the project shall be in Contractor's scope of work and form part of the bid.

c. During execution of the project, the Contractor shall, at various stages of the project, submit to the Company as a part of his Detailed Engineering, all the drawings and documents for review/ information/ approval as the case may be, incorporating all the scope, design, selection, methodology of installation, etc., as detailed elsewhere in the document.

d. Contractor's scope of work for instrumentation and control system shall include but not limited to :

i. Pre-bid and Pre-Engineering Site Survey as applicable.
ii. Design and Engineering for all Instrumentation including Control, Monitoring and Safety Systems.
iii. Procurement, Shop testing and Supply.
iv. Installation, Field Calibration/ Testing, Integration and Commissioning
v. Documentation of Design & Engineering

e. Wherever equal but conflicting requirements arise between this Scope/ Specification and the referenced documents, such conflict shall be brought to the attention of the Company in writing. For resolution, unless specified in the Volume-I of the bid document, the order of precedence shall be:

i. National Statutory Requirements (the Law)
ii. Basic Bid Work (Description of Work)
iii. Design Criteria
iv. Functional Specifications
v. Industry Codes and Standards

f. All instruments shall be procured from the Suggested Vendor List enclosed in the bid document. Wherever vendor list is not available for any item, the Contractor shall consider reputed vendors meeting the FS and with proven track record (as indicated in Instrumentation Design Criteria clause 3.6.6.4) and put up the Pre-qualification Documents for such cases for Company's approval. (Refer Vol. – I of the Bid document for the procedure).

Unless specified otherwise, the term **Instrumentation** shall mean instruments, control system and safety instrumented system, along with the applicable accessories, utilities and hook-up material, licensed versions of System related as well as Third-party software that may be required for completion of the specified Scope of Work.

2.5A.3 Scope of Work

a. The Scope of Work shall include Design & Engineering for all instrumentation including control, monitoring, shutdown, safety instrumentation and controls systems, Procurement, shop testing, inspection, supply and installation, field testing/ calibration, loop checking, logic implementation, pre-commissioning, commissioning (where applicable), hook-up and interfacing/ integration and relevant documentation as per the requirements of Bid package.

b. The Scope of supply shall include all instrumentations for control and monitoring, shutdown and safety instrumentation, as indicated in the various sections of the Bid document

c. All the necessary installation materials and hardware like Cables, Junction Boxes, instrument tubing, tube and cable trays, instrument fittings, bug screens, instrument valves, instrument valve manifolds, interconnecting cables, cable glands, shrouds, plugs, cable trays, SS tags binded with SS wire, supports, MCTs, stanchions, connectors, terminals, termination accessories, canopies etc., shall be the part of the scope of supply of the LSTK Contractor.

d. All instruments shall be procured from the Suggested Vendor List enclosed in the bid document. Wherever vendor list is not available for any item, the Contractor shall consider reputed vendors meeting the FS and with proven track record (as indicated in Instrumentation Design Criteria clause 3.6.6.4) and put up the Pre-qualification Documents for such cases for Company's approval. (Refer Vol. – I of the Bid document for the procedure).

e. The selection, design, testing and installation of the various instrumentation items shall be as per the Instrumentation Design Criteria and relevant FS included in the bid package. For items whose Functional Specifications have not been provided, the Contractor shall generate the specifications and submit to the Company for review and approval. The data sheets generated for the various instrumentation items shall be in accordance with the relevant FS. For items whose typical data sheets have not been included in the bid documents, the Contractor shall generate the data sheets in line with clause 3.6.6.2.3.2 of Instrumentation Design Criteria/ as per ISA formats for company approval. The hook-up of the various Instrumentation items shall be as per the relevant FS and as per clause 3.6.4.6 of Instrumentation Design Criteria.

f. Successful Bidder shall carry out pre-engineering survey, for the existing platforms to assess the extent of work and collect required details from respective platforms for the purpose of 'Detailed Engineering'. Contractor shall prepare a 'Survey Report' and submit to company for review and approval, before commencement of Engineering works.

g. Power consumption calculations for instrumentation and control shall be performed by bidder and the same shall be bidder's responsibility. Bidder to verify type and adequacy of existing power supply at existing platforms during pre-engineering survey for this project. In case adequate power is not available at existing platforms bidder shall provide necessary power supply system for new instrumentation and controls. If, any other voltage level is required the same shall be derived by bidder from existing power supply using redundant components.

h. Control Valve/ Safety Valves/ Orifice/ Flow instruments etc. sizing indicated in P&ID are minimum indicative. Sizing adequacy shall be carried out by the respective instrument vendors as per approved Process data sheet during detail engineering.

i. Well Platforms shall have Process Control & Monitoring System, Safety Instrumentation Systems (ESD/ FSDs), Shut Down Panel, metering, Fire Suppression, Water Injection etc. as defined in the scope of work. Well platform monitoring and controls shall be from local as well as from remote locations. ESD/ Shutdown and safety related signals shall be conveyed via discrete hardwired signals within or across the platforms wherever needed.

j. It shall be Contractor's responsibility to get the support of respective OEMs (Original Equipment Manufacturers) of existing systems for any modification/ up-gradation/ expansion required for total completion of work as mentioned in Bid. Contractor shall involve the Original Equipment Manufacturer (OEM) of existing Systems, Package Items etc. in the engineering, installation and commissioning modification jobs at the modification platforms.

2.5A.4 Facilities for New Well Platforms (R-12-6A, VGN-A and RJP)

Table - 1

Sl. No.	Name of the Platform	Brief Instrumentation SOW for Each Platform
1.	**R-12-6A** Well Platform	(i) Instruments as per approved P&IDs and Process SOW. (ii) Well Head Control and Shutdown Panel for each platform (Electro-Hydraulic Type). (iii) SIL-3 certified Process cum ESD PLC for Process Control & Monitoring and ESD System. (iv) SIL 3 certified PLC Based F&G Detection System. (v) Electrical PLC as per Electrical Scope of work (vi) All the PLCs shall have individual 19" Panel mounted HMI. (vii) Fiber Optic Cable (FOC) as a part of composite cable shall be provided as per Process and Electrical SOW. Further, dual redundant FOC shall be provided between RJP and MOPU for remote monitoring and control of the existing and new wellhead platforms. (viii) Refer indicative OFC network communication and System Architecture of new well platforms at Annexure-1 &2. (ix) Monitoring & control parameters and remote operability shall be made available in the Operator/ Engineering Workstation(s) through Redundant Servers. The workstations, servers (system and OPC), switches etc. shall be initially installed in E&I Room of RJP Platform under
	VGN-A Well Platform	

		present scope, and later they will be shifted to MOPU Control Room by the MOPU Contractor.
2.	**RJP** Platform	(i) Instruments as per approved P&IDs and Process SOW. (ii) Shutdown Panel for RJP platform (Electro-Hydraulic Type). (iii) SIL-3 Certified Process cum ESD PLC for Process Control & Monitoring and ESD System (iv) SIL 3 PLC Based F&G Detection System (v) All the PLCs shall have individual 19" Panel mounted HMI. One Engineering cum Operator Work Station feature in Industrial Laptop of screen size of minimum 14" shall be provided common for R-12-6A, VGN-A & RJP. (vi) New OFC cable from existing well Platform R-10A to RJP for connecting the existing well platforms (R-7A, R-9A, R-13A, R-12A, R-12B and R-10A) to MOPU via RJP ~~(vii)~~ New OFC cables from VGN-A and R-12-6A to RJP~~.~~ (viii) New OFC around 500 m for communication between RJP and MOPU. (MOPU is not under the present project) (ix) Remote monitoring and control data from the new well platforms (R-12-6A, VGN-A and RJP) and from existing six well platforms (R-7A, R-9A, R-13A, R-12A, R-12B and R-10A) will be sent to MOPU via RJP. (x) Remote Control & Monitoring System (RCMS)- New redundant Server (Primary and Secondary Sever) and EWS cum OWS for remote monitoring and control of all the well platforms (existing & new) shall be initially installed and commissioned at E&I Room of RJP, which shall be later shifted to MOPU control room by the MOPU contractor. (xi) Ref Annexure-1, 3 & 4 System Architecture.

Note:

1) The Control & Monitoring system of individual platforms shall work independently without any kind of dependency with other systems/ servers.
2) The entire OFC network shall be dual redundant. All the necessary hardware, software, Optical fiber network accessories, any licenses, third party hardware & software etc. required to complete the OFC network shall be in LSTK contractor scope of work.

2.5A.5 Facilities For Existing Well Platform

(i) Existing platforms R-7A, R-9A, R-13A, R-12A, R-12B and R-10A have their own PLC based Control, Monitoring & Shutdown Systems. R-7A, R-9A, R-13A, R-12A are individually connected to R-10 A and R-12B connected to R-10A via R-12A. (Ref Annexure -1 and Annexure-5). New OFC cable from existing well Platform R-10A to RJP shall be provided for connecting the existing well platforms (R-7A, R-9A, R-13A, R-12A, R-12B and R-10A) to Remote Control & Monitoring System of MOPU via RJP.

(ii) All the necessary hardware, software, Optical fiber network accessories, any licenses, third party hardware & software etc. required to complete the OFC network and integration of existing well platforms with the Remote Control and Monitoring System (RCMS) of MOPU shall be under present scope of work.

2.5A.6 Facilities Remote Control & Monitoring System (RCMS) at MOPU

(i) Remote monitoring and control data from the new platforms (R-12-6A, VGN-A and RJP) and from existing six well platforms (R-7A, R-9A, R-13A, R-12A, R-12B and R-10A) shall be sent to MOPU via RJP through OFC network.

(ii) All existing and new platforms shall be remotely controlled and monitored by Remote Control & Monitoring System (RCMS).

(iii) RCMS shall have following major components:

a) System Servers and OPC Servers. Both the servers shall be dual redundant.

b) Sequence of Event (SOE) Server

c) 24" Engineering Cum Operator Work Stations (LED/ IPS display), EWS-cum-OWS 03(three) Nos., with all the necessary licenses and software. Their configuration shall be as follows:

- 01 No. for PCS cum ESD System
- 01 No. for Fire & Gas System
- 01 No. for Electrical PLC

Each EWS-cum-OWS shall be loaded with necessary software for Programming, HMI Development, Runtime, SOE and OPC as a minimum.

d) 24" Dual stacked 02 (two) Nos. Operator Workstations (LED/ IPS display), OWS, with all the necessary licenses and software. The dual stack workstations shall be capable of simultaneously displaying graphics of different wellhead platforms.

Each OWS shall be loaded with necessary software Runtime and OPC Software as a minimum.

e) Hardwired Console comprising of ESD and FSD push buttons for individual well head platforms (new and existing).

- One No. A3 size multifunction monochrome Laser Printer.
- Any other hardware like LIU, switches, patch cables etc. required to make the system completely functional shall also be under present scope.

Refer indicative Remote Control & Monitoring System (RCMS) System Architecture at Anneure-4 for control & monitoring of the new and existing platforms.

(iv) MOPU will come under different contract. Initially the complete RCMS shall be installed and commissioned at the E&I Room of RJP under present scope. Eventually, this RCMS shall be shifted and commissioned at MOPU control room by the MOPU Contractor.

2.5A.7 Broad Instrumentation Scope of Work at New Platforms (R-12-6A, VGN-A and RJP)

The instrumentation & control systems envisaged on the new Platforms shall consist of following items as a minimum and shall be provided as a part of Scope of Work and PIDs:

(i) The new platforms shall have Safety Instrumented Systems as defined in the clause 3.6.4.1.6 of Instrumentation Design Criteria.

(ii) All electronic instrumentation shall be selected with due consideration to minimum power requirement technologies (proven) as available in the market without violating any safety norms and without sacrificing any part of the bid requirements

(iii) All data from each of the platforms shall be made available in the data network with the primary and redundant servers of Remote Monitoring and Control System (RCMS) which shall be located at RJP platform E&I Room and later shifted to MOPU control room.

(iv) Indicative System architectures attached at Annexure-1 to 4 is only indicative and shall be developed & modified during detail engineering. The LSTK contractor shall develop a detailed system architecture in-line with this indicative architecture and the same shall be approved by ONGC during detailed engineering before its use for final execution in the field. The ONGC approved system architecture shall form part of scope of work for the LSTK contractor. This entire process of approval of the system architecture and associated refinements / modifications during detailed engineering shall form part of scope of LSTK contractor without any time and cost implication to ONGC.

(v) For New Well Platforms - SIL- 3 Process cum ESD PLC and SIL-3 F&G PLC are envisaged. FS-C101 shall be followed for PLC specification.

Electrical PLC shall be provided as per Electrical Scope of Work and Electrical Design Criteria.

(vi) All PLCs shall have 19” Panel Mounted HMI which can be independent work as Engineering cum operator workstation without any inter dependency of any other system.

(vii) For new platforms – One industrial grade laptop with screen of minimum 14” having feature of Engineering cum operator workstation, and necessary accessories with furniture (Steel Table/ Console, 4 nos. of chairs etc.) shall be provided at respective control rooms.

(viii) Engineering Cum Operator Work Stations for RCMS at RJP shall have Programming Software, HMI Development Software, Runtime Software, SOE Software and OPC Software as minimum.

(ix) Industrial grade laptop having feature of Engineering Cum Operator Workstation for new smart well head platforms and RJP shall have Programming Software, HMI Development Software,

Runtime Software, OPC Software etc. as minimum.

(x) Process control system consisting of process cum ESD PLC and associated instrumentation for monitoring and control functions. Process PLC with HMI is envisaged for monitoring & control of various well head facilities, including monitoring & control of in-line Test Separator and all other process and packaged equipment. The Graphics for these controllers shall be so developed that an operator can easily work on them without many levels of access. The process control system shall have complete installed capacity for the current as well future wells (the number of current and future wells shall be as per Process scope of Work of the bid). Additionally, spares as indicated in Instrumentation Design Criteria and respective functional specifications shall be provided.

(xi) Process cum ESD PLC (SIL-3) with HMI shall be provided to cater to shutdown logic execution. The Process cum ESD PLC shall have logic for all the shutdown functions including the SSVs and SSSVs. Electro-hydraulic Shutdown Panel (SDP) shall be provided for the hydraulic supply to SSVs, SSSVs and Shutdown valves. The final element shall be hydraulic based. All the electronic signals to / from the field instruments (shutdown transmitters, shutdown valves, electrical ESD loops etc.) shall be connected with the Process cum ESD PLC and not with the SDP. The PLC shall be further interfaced with the SDP in the field.

(xii) SIL-3 PLC based F&G System with HMI shall be provided for FSD logic execution. The Fire & Gas detectors shall be provided as per FS-3500. Electrical FSD loop shall be connected to the F&G PLC.

(xiii) The HMIs on Process cum ESD PLC, F&G PLC and Electrical PLC shall be configured such that they continue to operate even in the absence of servers or communication with associated MOPU/ RJP. Also, engineering changes done in graphics and logics should synchronize automatically at WHP and RCMS.

(xiv) Well testing facilities along with all the associated instrumentation as per Scope of Work, Process and P&IDs.

(xv) All process control and monitoring signals, Shutdown Panel status, alarm status, ESD/ FSD status, well test status and testing Parameters, Electrical Systems status, and F&G Panel status etc. shall be integrated with process cum ESD PLC of the respective wellhead platforms for onwards transmission to the Remote Control & Monitoring System (RCMS) of MOPU via RJP.

(xvi) Field Instruments including Flow Meters, Transmitters, Switches, Gauges, Final Control Elements Instruments are envisaged as indicated in the Process Design Criteria and approved P&IDs. There shall be provision of obtaining all the self-diagnostic information of all the electronic instruments.

(xvii) Electro- Hydraulic based Shutdown Valves shall be provided. For supply pressure of shutdown valves bidder to refer FS-3511 and FS-3506.

(xviii) The control valves with Electrical Actuator and Smart Positioner with feed-back features shall be provided.

(xix) Installed provisions for future facilities shall be made in the SDP, process cum ESD PLC, and F&G system cabinets, etc. The system shall be in a "ready to work" status for any future facilities. All the instrumentation systems shall have inbuilt installed capacity for the present as well as future wells.

1no. of Industrial grade Laptop common for all new platforms with latest configuration shall be provided for downloading well testing data, gas flow computer data, accessing system data. This laptop will be used to access the dedicated Flow Computing Devices (MVT for Test Separator Gas, and NOC for liquid measurement) and the F&G PLC. Also, the laptop will be used as portable calibrators and for configuration. The laptop shall have data logging facility. The laptop shall be provided with applicable signal converters as required for signal protocols depending on the type of meter/ systems as mentioned above.

The following shall be considered as a minimum for selection of industrial grade laptops:

- Weatherproof: IP 65.
- Able to withstand 5-95% RH non-condensing.
- Operating Temperature: 10° C to 60 °C.
- Certified for use in Class 1, Div.1, Group C & D, T3 hazardous area.
- Operating System: Windows 11 Professional or latest at the time of execution (64-bit).
- Storage & Memory: 8 x 2 GB RAM + 512 GB SSD Storage.
- Serial Ports (Minimum one each serial, Ethernet, HDMI etc.)
- Minimum 13" LCD/ Full Array LED/ IPS display.
- M-Disc compatible portable DVD-RW drive.
- Inbuilt application software with suitable links for accessing MVTs, NOC and F&G PLC under the scope through its ports
- Back-up/ recovery copy of all licensed software loaded in the laptop for calibration/ configuration/ communication with various instrumentation/ facilities on the platform.
- Laptops shall be loaded with following latest version application software:
  - MS Office including Microsoft Word, Excel & Power point
  - Antivirus software with 03 years validity.
  - Back up of software of MVTs, PLCs etc.
- Standard test certificates for industrial grade laptops including drop test.
- All the licensed software loaded in the laptop for calibration/ configuration/ maintenance of various instrumentation/ facilities (like MVTs, NOCs, PLC, Third Party Systems etc.) shall be provided in DVD / portable SSD as back up copy

The laptop shall have 4 years built in warranty. Warranty Certificate/ Documentary evidence of the same shall be provided. The laptops shall have latest licensed Operating System (OS) and Application Software for communication with various instrumentation/ facilities on the platforms provided in this project.

(xx) Space and Power requirement provision shall be kept in the Instrumentation Room to accommodate instrumentation of current as well as future wells along with Down-hole Instruments. Space requirement for Down Hole Monitoring System shall be approximately 2m x 2m. Power requirement shall be of approximately 25W/ well. Also, a minimum of one spare serial and TCP-IP Ethernet port shall be provided in the Process cum ESD PLC for interfacing with down-hole instrument panel. The down-hole instruments shall be procured separately by ONGC.

2.5A.8 FIELD INSTRUMENTS/ INSTRUMENTATION SYSTEM:

(i) The instrumentation system on platform shall be designed such that various process parameters may be monitored and controlled locally as well as from remote location. All field instruments such as control valves, safety valves, electronic transmitters, pressure gauges, temperature gauges, differential pressure gauges, flow meters, etc., as shown in the P&IDs and ask required conforming the process requirements shall be provided on the platform.

(ii) Bid P&IDs are indicative. Bidder shall size all the flow meters & Control valves associated with the In-Line Separator as per production profile given in the Process Design Criteria. Based on this quantity shall be finalized during Detailed Engineering

(iii) The design, selection, procurement, installation and commissioning of the instruments shall be as per the relevant Functional Specifications enclosed in the bid document. The design of the field instruments shall take care of the process requirement of pressure, temperature and material rating

(iv) All electronic instrumentation shall be selected with due consideration satisfying to the proven minimum power requirement technologies without violating safety norms and without sacrificing the bid requirements

(v) The Contractor shall provide adequate number of MCT, Junction Boxes, Tubing, Fittings, interconnection cables, cable glands, cable trays; cable tray supports etc. to take care of all installation requirements.

(vi) HART latest SIL2 based Transmitters shall be used for control and monitoring purpose for all platforms.

(vii) Instrument isolation valves, 3W and 5W valve manifolds for transmitters, impulse tubing, piping, fittings, bug screens, adequate supports and other erection material for all field instruments as required shall be provided.

(viii) Appropriate signal barriers and isolators for the signals being terminated at the control panels/ telemetry units shall be provided. In general, active barriers shall be used.

(ix) Supply, laying and termination of all types of cables, such as signal, alarm, control, F&G system cables, power supply cables, earthing cables etc. is part of the scope. The scope includes cable trays, structural supports and consumables for cable laying and routing, SS tags binded with SS wire, junction boxes, cable glands, shrouds etc. also.

(x) Electrical type ESD and FSD pull stations shall be provided at all the strategic locations on all the new Platforms. Manual ESD will be integrated with process cum esd plc, FSD Stations, Triple IR Fire Detector and their integration with the F&G PLC

(xi) Separate earthling shall be provided for Panels/ Junction Boxes, systems, IS earth and cable shields.

(xii) The Scope includes supply, erection and fixing of pipes & pipe fittings and tubes & tube fittings for hydraulic supply distribution

(xiii) All the main line XSDV shall have local closing facility. Lamps test facility of SDP wherever applicable shall be provided.

(xiv) Instruments are envisaged as indicated in the P&IDs. There shall be provision of obtaining all the self-diagnostic information of all the electronic instruments and making them available at local as well as remote locations.

(xv) Supply of all types and quantity of spares and consumables as per Clause 3.6.4.8 of Instrumentation Design Criteria.

(xvi) Magnetic type Level Gauge shall be preferred wherever feasible.Level gauges of hermetically sealed magnetic type shall be preferred. If the same is not being provided for certain cases e.g. equipment package, other type can be used with prior approval of Company.

(xvii) Guided Wave Radar (GWR) type Level Transmitters shall be provided for level measurement and trip functionality.

(xviii) Well testing facilities, Water Injection Facility along with all the associated instrumentation as per Scope of Work, Process Design Criteria and P&IDs.

(xix) 02 (Two) Intrinsically Safe Multifunction Calibrators suitable for HART-based instrumentation shall be provided to carry out on-line diagnostics and configuration of electronic instruments.

(xx) Three (03) Nos. (one for each new Platform) Portable Multifunction Calibrators shall be provided as per FS-3605. The calibrator (intrinsically safe) shall have facility to calibrate DPT (0-400 inches WC), PT (0-400 Kg/cm2g), vacuum gauge (0 to - 1 kg/cm2), TT (for 0-100° C, RTD: Pt-100) of accuracy of span ±0.05% or better. The calibrator shall be capable of generating mA signal (0-20 mA) and resistance of Pt-100.

(xxi) Manual ESD pull stations (electronic switches) shall be integrated with the Process cum ESD PLC, and manual FSD pull stations (electronic switches) with the F&G PLC as per relevant codes & standards in all the well platforms. The platform ESD/ FSD system shall have appropriate provision for its hook-up/ integration with 3rd party ESD/FSD system (i.e. modular/ work-over rig, if applicable). Whenever a modular/ work-over rig will be placed on the platform, their ESD/ FSD systems shall be integrated with the platform ESD/ FSD system.

(xxii) All critical Shutdown Valves (XSDVs) including on main well fluid export/ import lines and main line shall be provided with local PST and Manual operation facility. This requirement shall be finalized based on P&IDs and Process scope of work.

(xxiii) Control valves shall be electrically and shutdown valves shall be hydraulically operated. Hand-wheel/ hydraulic mechanism shall be provided for manual opening/ closing in all shutdown

valves. Hand-wheel for control valves shall be application specific and will be decided during detail engineering.

(xxiv) All the electrical actuator operated Control Valves shall be provided with smart positioners and valve position feedback to Process Cum ESD PLC

(xxv) Pressure transmitters used for tripping applications shall have bypass provision in the Process cum ESD PLC for calibration/ maintenance.

(xxvi) At the new platforms for the purpose of trip functions, electrical switches shall be used and integrate with the Process cum ESD PLC for logic execution. The Process cum ESD PLC shall be further integrated with Electro- Hydraulic Shutdown Panel.

(xxvii) Fire & Gas Detection System for detection of unwanted/ dangerous accumulation of toxic and flammable gases, detection of imminent/ established fire and initiation of appropriate control action to ensure safety of the facility/ platform and the personnel.

(xxviii) Well testing facilities shall be provided as per Description of Work – Process & other related bid documents.

(xxix) In order to protect electronic instruments against monsoon rains, fully covered weather proof canopies shall be provided for all the electronic instruments, located in the open or under the decks. IP rated canopies are not envisaged.

(xxx) Any other erection material necessary for installation and commissioning of instruments and any special instrument items required for satisfactory completion of the scope shall be the part of scope. This includes any special tools and tackles as applicable

(xxxi) Supply of start-up and commissioning spares for all instrumentation items shall be provided.

(xxxii) Instruments, F&G detectors and control and monitoring systems shall be designed and provided in areas defined for future wells and future facilities indicated in the Basic Bid Work.

(xxxiii) Canopy shall be provided for all Field Transmitters, MVT, Flow Computer & Switches in Open Area.

(xxxiv) For other instruments, F&G detectors and junction boxes shall be installed such that they are protected from the effects of rain and sun, ensuring easy access and visibility. Where this is not possible, a fixed cover or hood shall be provided to protect instruments, without impairing access or visibility.

(xxxv) Pressure gauges (PI) and Pressure transmitters (PT) at well head area shall be loosely supplied. The location shall be decided during detail engineering .Cabling of all instruments shall be done by the contractor. Impulse tubing between PTs and X-mass tree shall be handed over to company.

(xxxvi) PI & PT mounted on well tubing as well as PI & PT on annulus vent lines for free slot wells, shall also be supplied as loose supply items. These are in addition to those supplied as loose supply items for identified/ designated wells.

(xxxvii) Stanchion etc. for all the loosely supplied field Instruments shall be installed at appropriate locations such that they can be readily connected for operation.

2.5A.9 WELL HEAD CONTROL & SHUTDOWN SYSTEM

(i) Electro-hydraulic type Shutdown Panels(SDP) are envisaged on the new platforms. The shutdown logic for SSVs and SSSV shall be executed in the Process cum ESD PLC (SIL-3 certified). All Shutdown valves , SSVs and SSSVs opening closing and control circuitry shall be hydraulic. Field signals shall come electrically to the Process cum ESD PLC. After logic implementation in the Process cum ESD PLC, digital outputs shall be sent to the field mounted SDP. The SDP shall send hydraulic action signals to the final field elements like XSDV, SSVs, SSSVs etc. This system shall execute logic functions to cater to the control and shutdown requirements of platforms as described in the Basic Bid Work. There shall be one Well Head Control and Shutdown System (WHCS) Panel on the platform. This system shall be interfaced with respective F&G System on the platform.

(ii) The WHCS panel shall be of modular design with removable draw-out Well Control Modules including spare modules.

(iii) The WHCS on the new well platforms shall cater to the Shutdown requirements of Test Separator also.

(iv) All functionalities as outlined in FS-3501, FS-3511, Safe Chart, C&E diagrams and IDC shall be incorporated in the WHCS SDP including audio-visual indications and operator interfaces like push-pull knobs, indicators, bypass switches and push buttons.

(v) Manual over-ride facility shall be provided, wherever required under the Process scope.

(vi) Remote functionality for closing/ opening of all the wells and ESD andFSD through WHCS SDP shall be provided from Remote Control & Monitoring System (RCMS) of MOPU. Remote actuation shall be achieved through soft switches in the HMI as well as through hardwired key enabled push buttons on the RCMS console/ panel. Details are as follows:

– Remote SSV opening and closing from RCMS of MOPU .Remote SSSV opening/ closing is not envisaged.

- Remote ESD from RCMS. It shall close SSV only and not SSSV.

- Remote FSD from RCMS. It shall close SSSV also after the closure of SSV with a timing circuit in the WHCS.

a) All the alarm status, SSSV and SSV status of the Well Head Control and Shutdown Panel shall be made available to the RCMS for real time remote monitoring and data-logging.

b) Further details on remote operations shall be decided during detailed engineering.

(vii) A. SSVs & SSSVs opening and closing facility shall be provided at Each new well platforms-

i) ESD HMI through soft switch

ii) Front door of the Process cum ESD PLC Cabinet through Hardwired key enabled push buttons.
iii) Front Panel of SDP 100
iv) Hardwired key enabled push buttons shall be provided for that particular wellhead platform only.

B. Remote functionality for each wellhead platform SSVs & SSSVs opening and closing facility shall be made available at MOPU through
i) Operator's Work Stations (soft push button with Password protection)
ii) Hardwired Console

(viii) The Shutdown Panel shall have following Well Control Modules at each of the new well platforms. In addition, Control logic modules for gas lift system shall be provided in the panel as per the following requirements :

Table - 3

Platform	Producer Well (Single Completion)	Water Injection Well	Future Slots	Total Slot	Spare	Total Well Control Module
R-12-6A	07	-	02	09	01	10
VGN-A	07	-	02	09	01	10
RJP		-	-	-	-	-

(ix) WHCS panel shall be covered at the top by SS Canopy sufficiently extended at all the sides for weather protection. All well control modules shall also be protected by means of a hinged transparent acrylic windows. For further details of SDP refer FS-3501 and FS-3511.

(x) For existing Process platform modification jobs, the ESD signals shall be integrated with existing shutdown system as per the existing philosophy. The completion, commissioning and making the system fully functional for the Safe and Normal operation of the plant as well as to fulfill the functional and technical requirements of the project shall be part of present Scope of Work only.

2.5A.10 FIRE & GAS DETECTION SYSTEM FOR NEW PLATFORMS

(i) The F&G system on the new Wellhead Platforms shall be designed as per Scheme-A defined in the FS-3500. Conventional non-addressable type F&G detectors shall be used for Wellhead Platforms.

(ii) The F&G panel shall be located in the E&I room of the respective well platforms. This F&G system of each platform shall be integrated with the ElectroHydraulic - Well Head Control and Shutdown System (WHCS) through Process cum ESD PLC.

(iii) All functionalities of FSD as outlined in FS-3500, Safe Chart, C&E diagrams and IDC shall be incorporated in the F&G System including audio-visual indications

(iv) The F&G system shall have provision for individual detector bypass and alarm detection and other functionalities as mentioned in the corresponding functional specifications. PLC based F&G detection system shall be provided with all F&G detector loops like HC, H_2, H_2S flame detectors, Thermal detector, Smoke detector, MCP etc. The execution of voting logic and executive action command shall be carried out by SIL-3 certified F&G PLC. PLC based F&G system and detectors shall be designed as per FS-3500 and FS-C101.

(v) The quantity and location of various F&G detectors (HC, H_2S, H_2, Triple IR, Smoke, Heat etc.) shall be as per 3D F&G Mapping Study as indicated in FS-3500. When placing detectors, prominent wind direction and air currents shall be taken into account. If multiple release sources are present in a particular area, then both point and line-of-sight detection shall be used. Detector placement for lighter-than-air gases shall be above the release point. Heavier-than-air gases (e.g., C3+) require the detector placement to be 300-450 mm above the Top of Steel (TOS) grade. Sensors shall be provided with rain hoods. (For complete details refer FS-3500 of F&G systems)

(vi) The F&G System shall be suitable for the desired offshore service and shall be suitable for housing in the building module on the platform without HVAC. The F&G System shall be suitable for continuous operation in harsh marine environment (temperature: 16°C to 60°C and RH: up to 95%). All the electronic circuit boards (PCBs) installed in the F&G System including the Panel HMI shall be G3-GX compliant cards with conformal coating and necessary certificates

(vii) Both Smoke and Thermal detectors in combination shall be provided in enclosed areas such as E&I Room, Electrical Room, Battery Room (in addition to H_2 gas detectors) and Shelter Room etc.

(viii) Triple –IR type Flame detectors shall be provided at transformer and other deck areas.

(ix) 6 (Six) Nos. each dedicated handheld portable H_2S and HC detectors shall be provided.

(x) One (01) No. handheld re-chargeable portable multi gas detectors (HC, H_2S, O_2 and CO2) shall be provided for each new well platform. Total Four (03) Nos. multi gas detectors shall be provided.

2.5A.11 WELL TESTING FACILITY FOR NEW WELLHEAD PLATFORMS (R-12-6A and VGN-A)

(i) In-Line Separator along with associated instrumentation for well testing are envisaged at all well platforms (R-12-6A and VGN-A) All the necessary instrumentation as indicated in the P&IDs and mentioned in the instrumentation and process scope of work shall be provided.

(ii) All separator related ESD functionalities shall be implemented through the main ESD system only. The shutdown logic shall be executed in the SIL-3 Process cum ESD PLC and the hydraulic supply through a dedicated module mounted in the main WHCS-SDP to the shutdown valves shall be provided from the platform Electro-Hydraulic SDP.

(iii) The analog control loops of the test separator shall be configured in the Process cum ESD PLC. Operator-friendly graphics and interfaces shall be provided for the PLC.

(iv) Flow, pressure and temperature monitoring during well testing as defined under process scope is envisaged locally as well as remotely at RCMS of MOPU.

(v) The level transmitter shall be of GWR type with local keypad based configuration facility. GWR type level transmitters shall have minimum configuration facilities locally via keypad in addition to via HART communicators.

(vi) Pressure and Level switches shall be provided as per P&IDs.

(vii) On the gas outlet of Inline Test Separator, V-cone meter with isolation valves and bypass arrangement, a field mounted Multi Variable Transmitter (MVT as per FS-3202) having inbuilt flow calculation and compensation capability as per latest international standards (AGA-3 and AGA-8) shall be provided. A temperature element shall be connected to MVT separately.

MVT shall have the facility of local display of instantaneous and totalized values of uncompensated and compensated flows, compensation parameters etc. All measured as well as calculated parameters from MVT shall be made available in the Process cum ESD PLC. For data transmission, the MVT shall be linked to Process cum ESD PLC, preferably using TCP-IP Ethernet. MVT shall also have provision of hardwire-interface to Process cum ESD PLC for closed loop control.

(viii) Coriolis type Mass Flow Meter (CMFM) with Net Oil Computer (NOC) capability and online Water Cut Meter (WCM) shall be provided in the Test Separator liquid outlet line to measure complete range of Oil and Water quantity of all the wells. Strainer cum Gas Eliminator shall be provided at the upstream of the CMFM. Parameters such as Instantaneous Oil flow rate, cumulative oil flow, Instantaneous Water flow rate, and cumulative water Flow, Total Liquid Flow, density of oil & water, online temperature etc. shall be made available in Process cum ESD PLC. Successful bidder shall furnish the Functional Specifications for online water cut meter for Company's approval.

The Net Oil Computer shall have data logging and archiving capability. It shall be capable of archiving well testing data of at least 30 days for a minimum of 15 points/ tags. The time interval of data capturing/ frequency of data logging shall be user programmable with standard 1 hour, 10 minutes and 1 minute intervals.

Net oil and water volume flow rate, density of oil and water and online temperature from NOC shall be transmitted to RCMS through respective Process cum ESD PLC. NOC shall be suitably interfaced with Process cum ESD PLC preferably through TCP-IP Ethernet link. NOC shall also have alternate provision of these outputs to be hardwired to the Process PLC.

2.5A.12 Modification in existing well head platforms(R-7A, R-9A, R-10A, R-12A, R-13A)

a) All field instruments associated with new facilities/ equipment (as indicated in battery limits in P&IDs and Scope of Work) shall be provided by the LSTK contractor. The Contractor shall hook up the transmitters and switches (as indicated in the P&IDs) with the existing Systems (DCS/ESD etc.)

Related graphics and logic shall be configured in HMIs.

In case the supplied instrumentation item is an 'upgraded version', the compatibility with other loop instrumentation shall be ensured before finalizing the new field instrument

b) If new scope envisages additional I/Os requirement, same shall be installed and interfaced with the existing Control System along with necessary license. Additional I/Os shall be configured in the existing SCADA System/ DCS/ ESD system, as applicable. Relevant System OEM's support shall be taken by LSTK Contractor under present scope. Upgraded I/O version shall be compatible with the existing Control Sub-system.

All associated instrument accessories, supports, instrument isolation valves, impulse tubing, air supply distribution and other installation material for instrumentation (cable trays, cabling, MCTs, terminals, JBs etc.) for the new instruments shall be in LSTK Contractor's scope.

2.5A.13 F&G system for existing well head platform(R-7A, R-9A, R-10A, R-12A, R-13A)

i. For all the new hydrocarbon facilities as per P&ID/ Process scope of work, the supply of associated'F&G detectors and Fusible Plugs' is in the scope of LSTK contractor. The new fire and gas detectors shall be compatible with the existing F&G system/ Control Cards.

ii. Types of F&G detectors (HC/ H2S/ flame IR etc.) shall be provided as per existing philosophy of the respective platform.

iii. Where the deck extension is not envisaged Contractor shall provide minimum 2 Nos. of each type (as applicable) of F&G detectors on each platform to cover the new hydrocarbon facilities.

iv. Wherever deck extension is envisaged, Contractor shall provide minimum 3 Nos. of each type (as applicable) of F&G detectors to cover the new facilities on each platform.

v. New Fusible Plug loop with other required accessories shall be extended from existing loop in the new Launcher/ Receiver area and shall be interfaced with the existing system. The location and quantity of new fusible plugs shall be as per API RP 14C and based on the equipment layout for the upcoming facilities.

vi. The new tags shall be configured in the existing F&G system retaining the functionality as per existing voting and shutdown philosophy after the provision and inclusion of new components/ cards/ software/ logic changes etc. Necessary OEM support shall be considered by the Contractor.

vii. Extension of Manual ESD/ FSD stations shall be as per operation & safety requirement and shall be finalized during detailed engineering.

2.5A.14 METER FACILITY

At VGN-A, nucleonic MPFMs shall be provided in the production header of DSF-III wells. The details are as under:

i. Two numbers of Nucleonic Multi Phase Flow Meters (MPFM) shall be provided in 1+1 configuration at as per P&ID for three phase measurement of oil, gas and water. The sizing and selection of the meter shall be done as per the Process Design Basis. For specifications refer FS-3209.

ii. The Meters shall be installed in 1+1 configuration with provision for operating them in series or in parallel.

iii. Each MPFM shall have its dedicated 'Stream Flow computer' for computation of oil, gas and water in the flow line. A Master Flow Computer shall be considered in line with the fiscal type metering flow computer for the arrangement, to provide the final corrected flow parameters. The two stream flow computers shall be connected to the Master Flow Computer to give the final corrected flow rates. Real Time Measured Data shall be transmitted to MOPU RCMS. The corrected flow from the Master Flow Computer will be transmitted through Process PLC to associated MOPU.

2.5A.15 CONTROL & COMMUNICATION FACILITY

(i) Remote monitoring and control data from the new well platforms (R-12-6A, VGN-A and RJP) shall be sent to Remote Monitoring and Control System (RCMS) at MOPU via RJP.

(ii) Existing well platforms R-7A, R-9A, R-13A, R-12A are individually connected to R-10 A and R-12B connected to R-10A via R-12A. (Ref Annexure -1 and Annexure-5) through OFC Network. Presently, monitoring and control of R-7A, R-9A, R-13A, R-10A and R-12A is being done from R-12A by means of composite cable.

(iii) Under this project:

- R-7A, R-9A , R-13A platforms will continue to transmit data to R-10A platform as per the existing network. R-12A data and R-12B data (via R-12A) will be transmitted to R-10A by using existing composite cable.
- Data transmission from R-10 A to R-12A is not envisaged after this scheme implementation. The existing workstations, system servers, OPC servers, network switches, LIUs etc., installed at R-12A shall not be shifted to RJP. Instead, facilities described at Clause 2.5.6 above shall be made use of for monitoring and control of the 06 existing platforms.
- From R-10 A, communication data of all existing platforms (R-7A, R-9A , R-13A, R-10A, R-12 A & R-12B) and New well platforms (VGN & R-12-6A) data shall also be transmitted to MOPU via RJP for Remote Control & Monitoring using new composite and dual redundant FO cable.
- Modification in control systems of existing platforms shall be done so as to facilitate their monitoring and control from MOPU RCMS.

(iv) The Control Systems (including PLCs, HMIs etc.) at the existing platforms shall also be upgraded by means of additional hardware, software, licenses etc. to ensure the following –

- They continue to operate even in the absence of servers or communication with associated MOPU/ RJP.
- Engineering changes done in graphics and logics should synchronize automatically at WHP and RCMS.

(v) New Dual Redundant OFC cable from existing well Platform R-10A to RJP and required hardware/accessories, connectors, switches etc. shall be provided for connecting the existing well platforms (R-7A, R-9A, R-13A, R-12A, R-12B and R-10A) to Remote Control & Monitoring System(RCMS) of MOPU via RJP.

(vi) New Dual Redundant OFC Network for communication between RJP and MOPU (MOPU is not under the present project) shall be provided. Length of FO shall be approximately 500m.

(vii) All data from each of the platforms shall be made available in the data network with the primary and redundant servers of Remote Monitoring and Control System (RCMS) which shall be located at RJP platform E&I Room and later shifted to MOPU control room. The system shall be so designed that it shall be able to access, monitor and control any of the platform (Old Platforms- R-7A, R-9A, R-13A, R-12A, R-12B, R-10A and New Platforms - R-12-6A, R-12C, VGN-A and RJP) from the RCMS.

(viii) MOPU is not considered under the present scope of work. Hence, initially the complete Remote Monitoring and Control System (RCMS) shall be installed and commissioned at the

E&I Room of RJP. After arrival of MOPU, RCMS shall be shifted and commissioned at MOPU control room (shifting shall be done under separate MOPU contract).

(ix) Hardware Console (HWC) in RCMS shall cater to all the existing as well as new well platforms. The hardwired key enabled push buttons for ESD and FSD of all existing and new platforms shall be provided. Push buttons for a particular platform shall be placed together

(x) Platform under this project will not be manned and hence all monitoring and control will be done from MOPU. To facilitate this, all Instrumentation and Safety systems shall be designed for being remotely managed through a REDUNDANT FIBER OPTIC based data/signal link.

(xi) All the hardware and software for required to make the Control & Monitoring system and Safety System complete shall be under present scope.

(xii) Additional tags licenses required for the new tags of the existing platforms under this project to integrate with existing Instrumentation control systems described as above, if required, shall be provided under present SOW only.

(xiii) System and Marshaling Cabinet shall be located in the safe area (E&I Room/ Control Room) and shall be capable of catering to all the parameters measured and to be transmitted though telemetry units. Details related to this setup shall be finalized during the detailed engineering. Active type barriers shall be provided for all instrumentation. Parameters for monitoring and/ or control shall be as per the process requirements and safe operation of the platform.

(xiv) Platform's Monitoring, Control & safety Systems shall be located in a safe area and shall be capable of catering to all the parameters which are measured and to be transmitted though redundant OFC cable and also shall be capable of receiving remote commands.

(xv) The control/ monitoring parameters of Well platforms as shown in P&IDs and scope of work.

(xvi) The Contractor has to prepare the details of the control-communication scheme indicating the integration of systems and shall submit the same to ONGC for approval.

(xvii) The contractor shall demonstrate the remote operability well control and well testing systems on the new well-head platforms through simulation from the Remote Control & Monitoring System (RCMS). This refers to the remote opening and closing of wells and ESD/ FSD in the proposed well head platforms and remote analog loop control of test separator from the RCMS.

(xviii) The contractor shall route OFC network of the existing Well Platform R-10A and the new Well Platforms R-12-6A and VGN-A till MOPU via new platform RJP. In order to facilitate this, supply, installation and integration of dual redundant network switches/SDH/additional hardware at R10A, RJP and MOPU shall be in Contractor's scope. Appropriate bandwidth and ports shall be made available by the bidder to cater this requirement of transmitting signals (including those of CCTV) to MOPU.

(xix) Hardwired Consoles and Remote monitoring of all the WHPs at MOPU with data transmitted by FO Cable Initially the complete Remote Control & Monitoring System (RCMS)& Hardware console of MOPU shall be installed & commissioned at RJP E&I Room, later same shall be shifted to MOPU control Room as per the Final Control Scheme.

(xx) Safety/ Control network and monitoring network shall have different dual redundant OFC link.

(xxi) Bidder shall ensure the periodic installation of patches/up-gradation of OS onto HMIs and servers in-

- Offline mode (in form of CDs), or
- Online mode (by means of Intermediate servers)
- Network security shall be ensured through measures such as firewall etc. for remote accessibility of servers.
- NMS shall be provided for real-time management of network switches and OFC.

(xxii) Though the SCADA server on MOPU shall be provided by other contractor, its integration with facilities coming under present project e.g. all accessories, graphics generation, point configuration, report generation, No. of licenses (if required) etc. at MOPU shall be under present Scope of Work. All the signals in OPC enabled System Server under present scope shall be made available in such a way that these can be readily integrated with the upcoming MOPU SCADA Server,

2.5A.16 Electrical Submersible Pumps (ESP) Integration With Platform Control & Monitoring System

(i) Each ESP shall have their own Control panel/system (dedicated PLC for the ESP supplied by ESP system contractor/Vendor).

(ii) One Electrical PLC (as described in Electrical scope of work) supply & installation shall be under present contractor's scope of work as per the BID requirement.

(iii) The parameters from ESP Control System (dedicated PLC for the ESP monitoring and Control, with the VFD panel, supplied by ESP system contractor / vendor) to & from Process cum ESD PLC shall be via Ethernet (TCP/IP) and hardwired links.

(iv) The contractor shall provide additional Ethernet TCP/IP and I/O cards dedicated for 20 nos. of DI/DO, for ESP signal monitoring and control, in platform process cum ESD PLC. This additional Ethernet and DI/DOs shall be common for all ESPs on a particular wellhead platform. The platform process cum ESD PLC shall be connected to the "Servers 1 &2 on MOPU for the Process monitoring and control of WHP, including the ESP sub-system.

(v) Following are the tentative details of requirement of remote monitoring and control for ESPs which shall be configured in Electrical PLC:

A. ESP Controls: -

1. Pump Start
2. Pump Stop (normal)
3. Speed Raise / lower
4. Emergency Stop
5. Fault reset

B. ESP Indications:

1. Motor current
2. Motor Frequency
3. Drive ready to run & Drive running
4. Drive Alarm
5. Fault / Drive tripped
6. Pump Alarm
7. Pump tripped
8. Down hole Monitoring

C. Breaker Indications:

1. Breaker ON , OFF & AUTO- TRIP
2. Trip circuit-Healthy
3. D.C.failure
4. Current & Voltage at each section of cable

D. Breaker Control:

1. Breaker ON
2. Breaker OFF

These signals are read from the surface panel of Downhole gauge which is again required in the same format at MOPU, per ESP wise.

1. Intake & Discharge pressure
2. Intake temperature
3. Motor temperature
4. Pump vibrations
5. Current leakage

In addition to above, One serial port (MODBUS-RS485) and approximately 20 nos. DI/DO for the ESP signal monitoring and control.
The above shall be again reviewed and finalized during detail engineering.

2.5A.17 POWER SUPPLY AND CONDITIONING EQUIPMENT

(vi) Contractor shall be responsible for carrying out design, engineering procurement, installation, testing and commissioning of power supply system and conditioning equipment, quantitatively

and qualitatively, to provide uninterrupted power supply for data monitoring, controls and communications as detailed in the bid.

(vii) The design of backup power supply/ battery bank for uninterrupted operation of the well platforms shall also meet the requirement as detailed in the respective Functional Specification and Electrical Scope of Work.

(viii) Contractor shall arrange for temporary power supply required for testing of all well platform operations during pre-commissioning/commissioning in the absence of platform power.

2.5A.18 TEST RUN

Upon conclusion of the Site Acceptance Testing, the contractor shall keep the facilities commissioned i.e. perform test-run for 72 hours. For detailed test-run requirements, refer Commissioning Procedure and Performance Test (CPP) document provided in the bid elsewhere.

During this period contractor shall provide specialist engineers and technicians including experts to maintain the total log, incidents, failures and for assisting site engineers and for total coordination. However, the normal operation and maintenance shall be performed by the owner personnel trained for the purpose.

2.5A.19 DOCUMENTATION

The Contractor shall provide the following documents for each Wellhead Platform and Process Complex as a minimum:

i) Operating philosophy of the system.

ii) System and Network Architecture drawings.

iii) Interface details of all the new Instrumentation System with existing systems.

iv) Detector Location Plan

v) System layout/ Instrument layout & cable tray routing drawings.

vi) Calibration procedures/ Cable schedule, Instrument & Junction box location plans/ layouts.

vii) Loop schematics, Interconnection diagrams, Cable termination details, Installation standards/ drawings/ Junction box wiring scheme/ Field test and loop checking report/ MCT block sizing and arrangement drawing.

viii) Bill of material/ material take off.

ix) Equipment specifications, Catalogues, Data sheets.

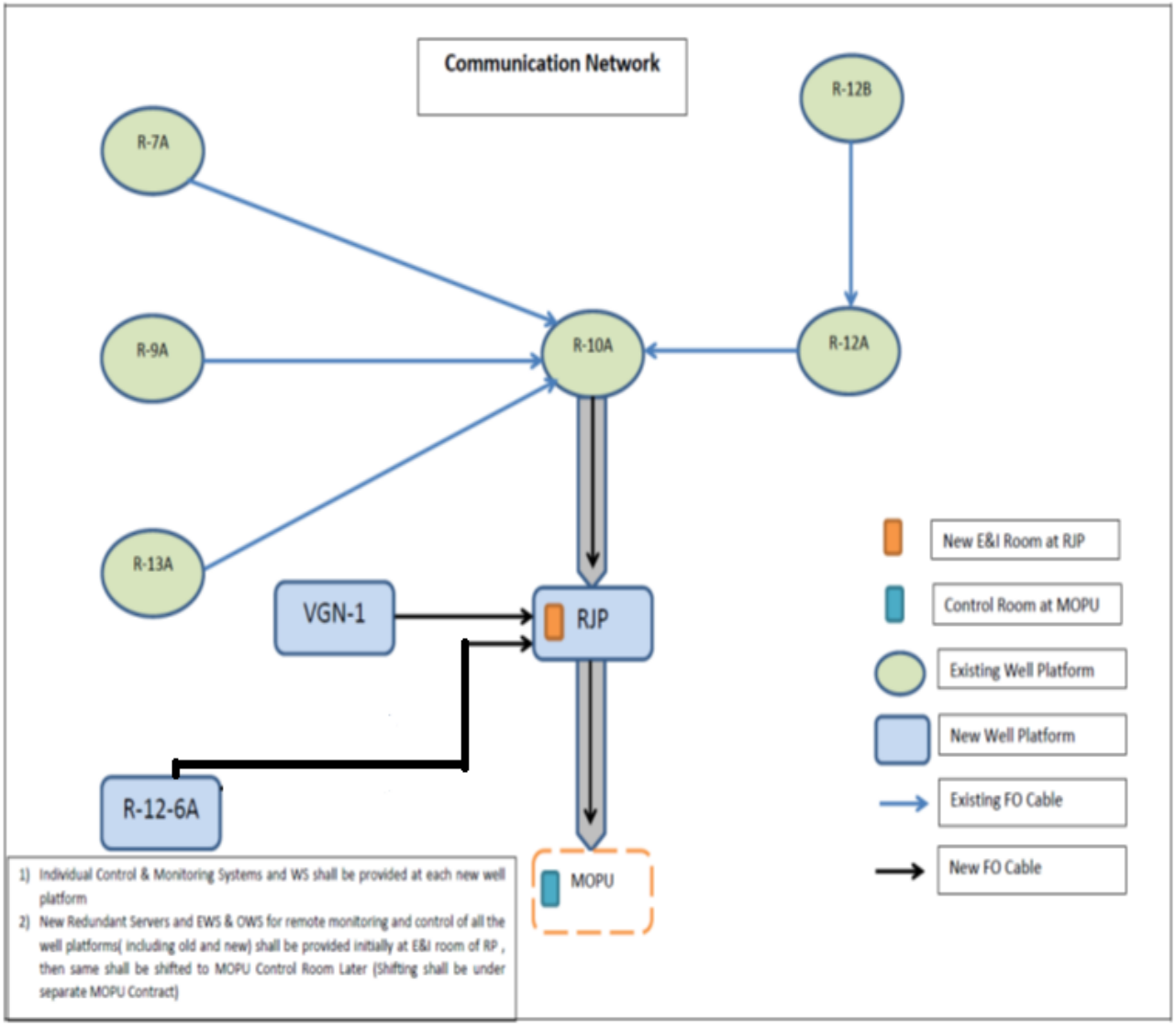
x) Deviation schedule, Functional schematic, Test certificates.

xi) Proposed maintenance schedule of all major components, for the design life of the system, and their replacement requirements.

xii) As-built drawings.

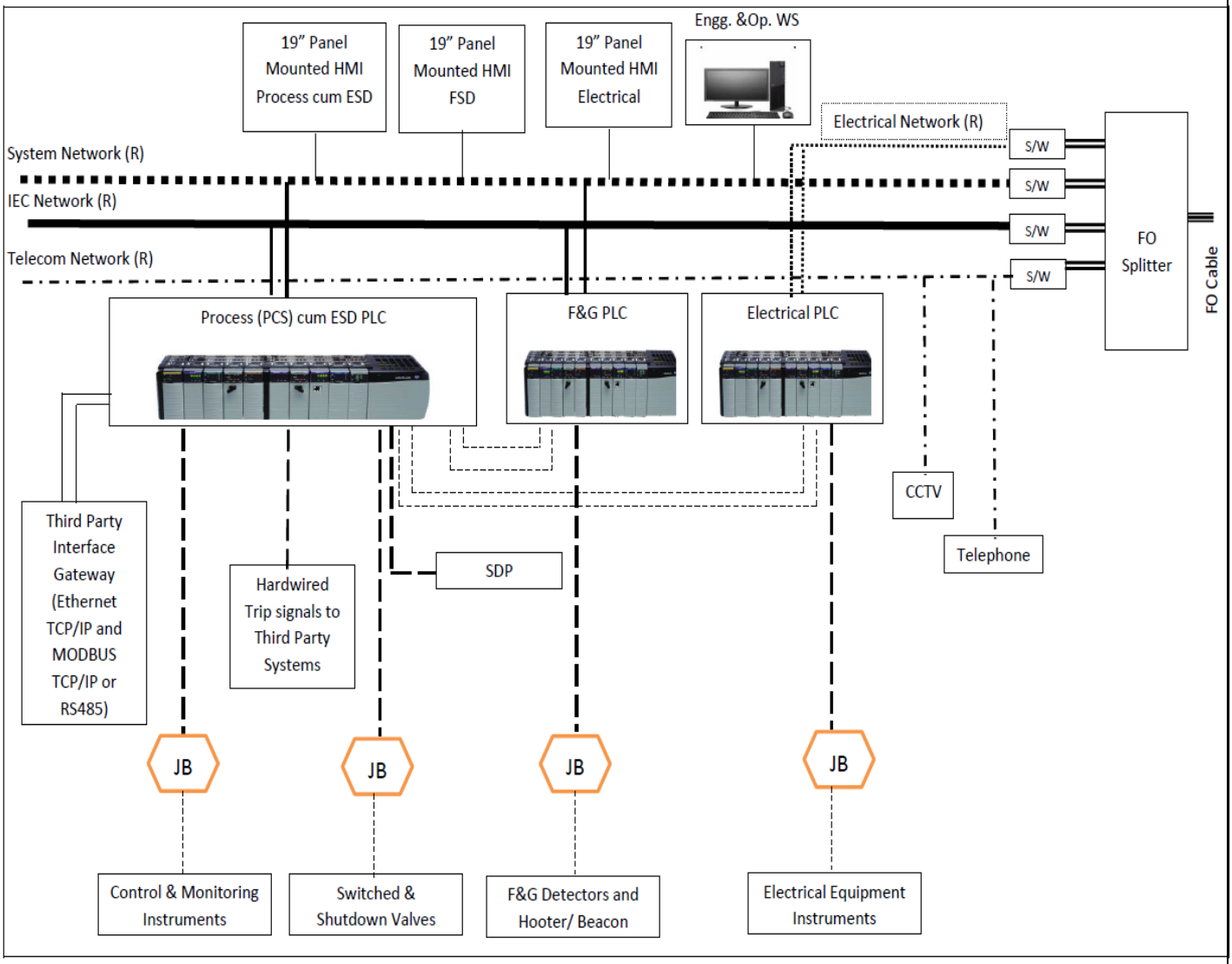
Annexure-1.

Annexure-1



Annexure-2

Annexure-2 (Indicative System Architecture of New Well Platforms- R-12-6A, R-12-C and VGN-1)

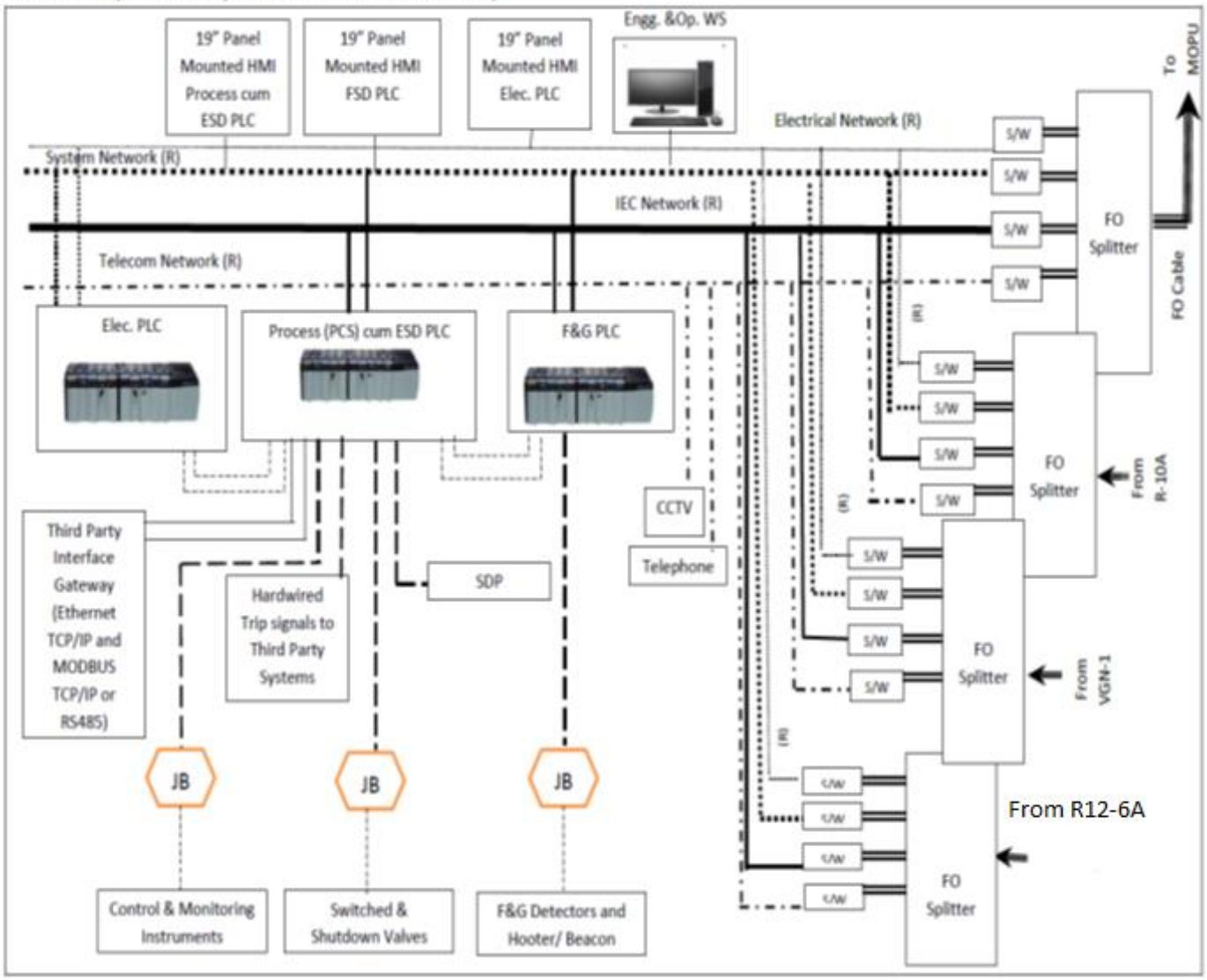


Note-

1. **Engg. & operating station to be read as Industrial grade laptop.**
2. **VGN-1 is to be read as VGN-A.**
3. **R-12-C does not exist.**

Annexure-3

Annexure-3 (Indicative System Architecture of New RJP)



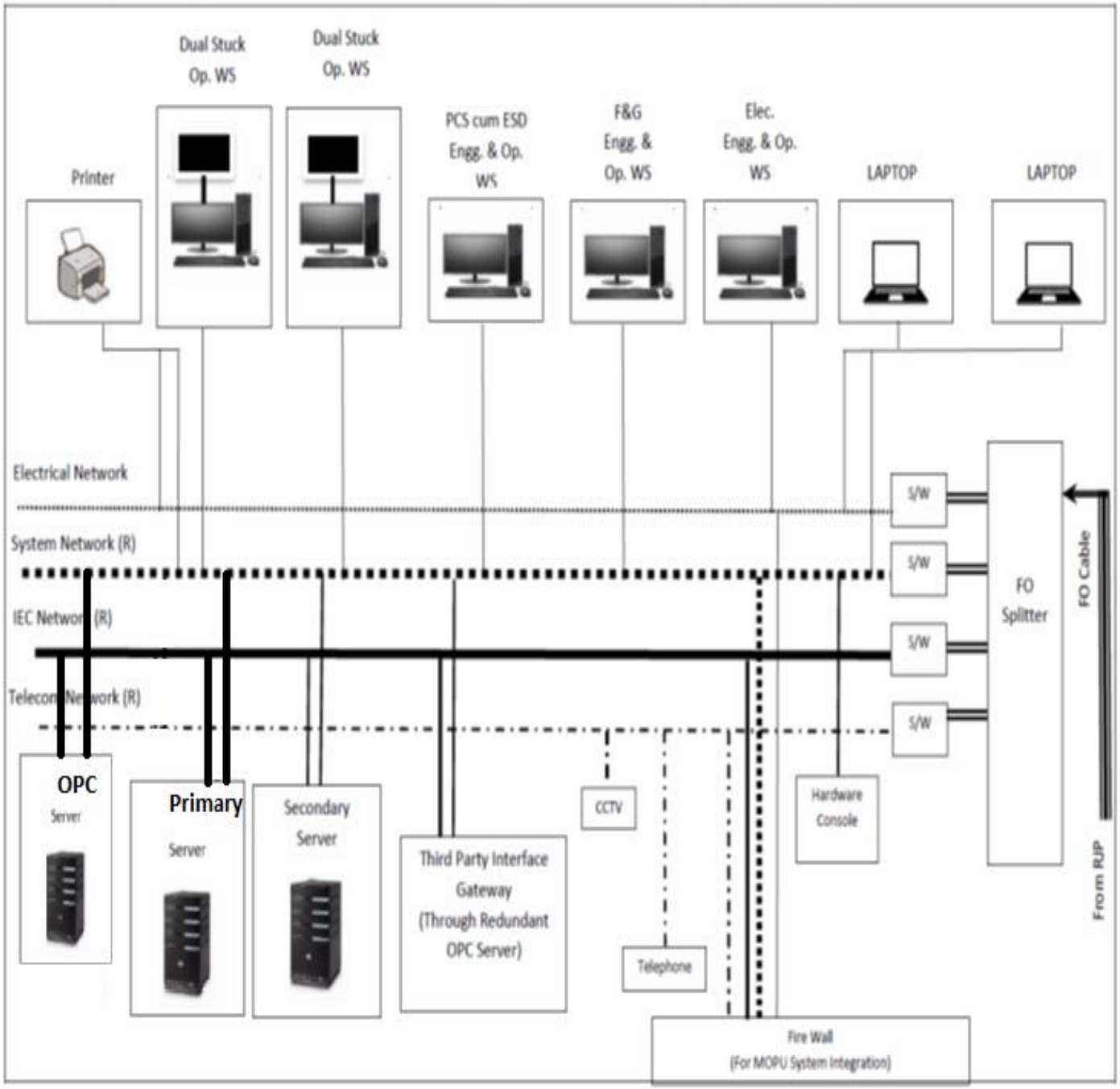
Note-

a. **Engg. & operating station to be read as Industrial grade laptop.**

b. **Drawing related to R-12C is not SOW.**

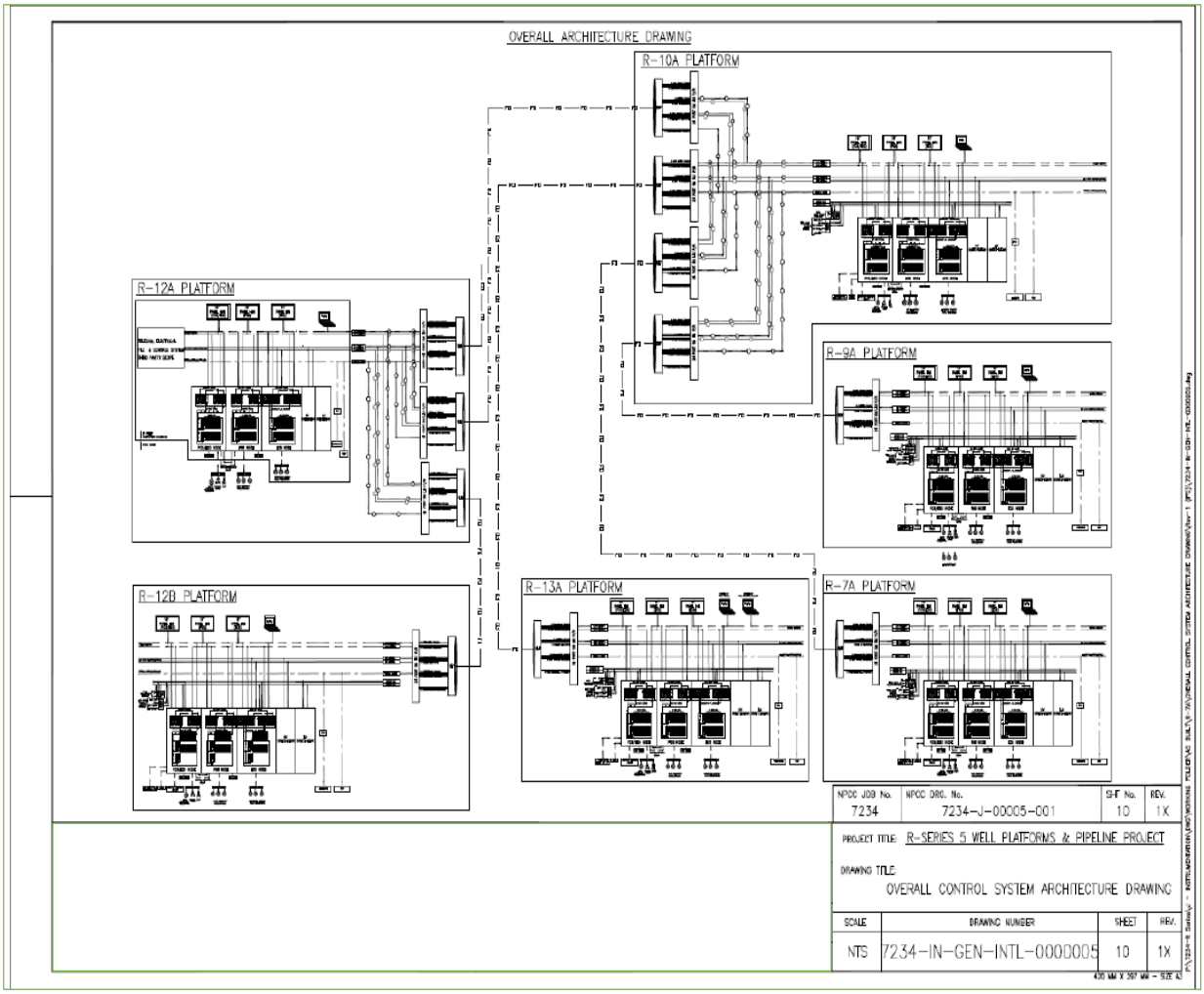
Annexure-4

Annexure-4 [Indicative System Architecture of Remote Control and Monitoring System (RCMS) at MOPU]



Annexure-5

Annexure-5 (Existing System Architecture of Existing Platforms)



2.5B INSTRUMENTATION SCOPE OF WORK

2.5B.1 INTRODUCTION

This section defines the general requirements of instrumentation, monitoring and controls, necessary for the job on the new and existing platforms as per the Process Scope of Work (SOW) and relevant P&IDs.

Unless specified otherwise, the term **Instrumentation** shall mean instruments, control system and safety instrumented system, along with the applicable accessories, utilities and hook-up material.

In the present project Instrumentation Scope of Work broadly envisages at-

- One new Conventional type Well-Head Platforms (NLM-14)
- Modification at existing well platforms (NLG, NLM-9).

2.5B.2 General Guidelines

a. This section shall be read in conjunction with the other sections of Basic Bid Work, Design Criteria, Process Scope of Work including P&IDs and Functional Specifications-Instrumentation.

b. Any proprietary or non-proprietary sub-system/ facility or instruments/ equipment/ accessories/ any hardware or software (including any up-graduation requirements), Firmware up-gradation/ licensing, not specifically mentioned in the scope but are implied and found essential (during any stage of the project such as pre-engineering survey, detailed engineering, P&ID approvals, Safety studies, HAZOP, CHAZOP, Commissioning etc.) for project completion, commissioning and making the system fully functional for the Safe and Normal operation of the plant as well as to fulfill the functional and technical requirements of the project shall be in Contractor's scope of work and form part of the bid.

c. During execution of the project, the Contractor shall, at various stages of the project, submit to the Company as a part of his Detailed Engineering, all the drawings and documents for review/ information/ approval as the case may be, incorporating all the scope, design, selection, methodology of installation, etc., as detailed elsewhere in the document.

d. Contractor's scope of work for instrumentation and control system shall include but not limited to :

vi. Pre-bid and Pre-Engineering Site Survey as applicable.
vii. Design and Engineering for all Instrumentation including Control, Monitoring and Safety Systems.
viii. Procurement, Shop testing and Supply.
ix. Installation, Field Calibration/ Testing, Integration and Commissioning

x. Documentation of Design & Engineering

e. Wherever equal but conflicting requirements arise between this Scope/ Specification and the referenced documents, such conflict shall be brought to the attention of the Company in writing. For resolution, unless specified in the Volume-I of the bid document, the order of precedence shall be:

vi. National Statutory Requirements (the Law)
vii. Basic Bid Work (Description of Work)
viii. Design Criteria
ix. Functional Specifications
x. Industry Codes and Standards

f. All instruments shall be procured from the Suggested Vendor List enclosed in the bid document. Wherever vendor list is not available for any item, the Contractor shall consider reputed vendors meeting the FS and with proven track record (as indicated in Instrumentation Design Criteria clause 3.6.6.4) and put up the Pre-qualification Documents for such cases for Company's approval. (Refer Vol. – I of the Bid document for the procedure).

Unless specified otherwise, the term **Instrumentation** shall mean instruments, control system and safety instrumented system, along with the applicable accessories, utilities and hook-up material, licensed versions of System related as well as Third-party software that may be required for completion of the specified Scope of Work.

2.5B.3 Scope of Work

a. The Scope of Work shall include Design & Engineering for all instrumentation including control, monitoring, shutdown, safety instrumentation and controls systems, Procurement, shop testing, inspection, supply and installation, field testing/ calibration, loop checking, logic implementation, pre-commissioning, commissioning (where applicable), hook-up and interfacing/ integration and relevant documentation as per the requirements of Bid package.

b. The Scope of supply shall include all instrumentations for control and monitoring, shutdown and safety instrumentation, as indicated in the various sections of the Bid document

c. All the necessary installation materials and hardware like Cables, Junction Boxes, instrument tubing, tube and cable trays, instrument fittings, bug screens, instrument valves, instrument valve manifolds, interconnecting cables, cable glands, shrouds, plugs, cable trays, SS tags binded with SS wire, supports, MCTs, stanchions, connectors, terminals, termination accessories, canopies etc., shall be the part of the scope of supply of the LSTK Contractor.

d. All instruments shall be procured from the Suggested Vendor List enclosed in the bid document. Wherever vendor list is not available for any item, the Contractor shall consider reputed vendors

meeting the FS and with proven track record (as indicated in Instrumentation Design Criteria clause 3.6.6.4) and put up the Pre-qualification Documents for such cases for Company's approval. (Refer Vol. – I of the Bid document for the procedure).

e. The selection, design, testing and installation of the various instrumentation items shall be as per the Instrumentation Design Criteria and relevant FS included in the bid package. For items whose Functional Specifications have not been provided, the Contractor shall generate the specifications and submit to the Company for review and approval. The data sheets generated for the various instrumentation items shall be in accordance with the relevant FS. For items whose typical data sheets have not been included in the bid documents, the Contractor shall generate the data sheets in line with clause 3.6.6.2.3 of Instrumentation Design Criteria/ as per ISA formats for company approval. The hook-up of the various Instrumentation items shall be as per the relevant FS and as per clause 3.6.4.6 of Instrumentation Design Criteria.

f. Successful Bidder shall carry out pre-engineering survey, for the existing platforms to assess the extent of work and collect required details from respective platforms for the purpose of 'Detailed Engineering'. Contractor shall prepare a 'Survey Report' and submit to company for review and approval, before commencement of Engineering works.

g. Power consumption calculations for instrumentation and control shall be performed by bidder and the same shall be bidder's responsibility. Bidder to verify type and adequacy of existing power supply at existing platforms during pre-engineering survey for this project. In case adequate power is not available at existing platforms bidder shall provide necessary power supply system for new instrumentation and controls. If, any other voltage level is required the same shall be derived by bidder from existing power supply using redundant components.

h. Control Valve/ Safety Valves/ Orifice/ Flow instruments etc. sizing indicated in P&ID are minimum indicative. Sizing adequacy shall be carried out by the respective instrument vendors as per approved Process data sheet during detail engineering.

i. Well Platforms shall have Safety Instrumentation Systems (ESD/ FSDs), Shut Down Panel, SCADA/ RTU for data communication (refer separate scope for RTU/ SCADA in this bid), metering, , etc. as defined in the scope of work. Well platform monitoring and controls shall be from local as well as from remote locations. ESD/ Shutdown and safety related signals shall be conveyed via discrete hardwired signals within or across the platforms wherever needed.

j. It shall be Contractor's responsibility to get the support of respective OEMs (Original Equipment Manufacturers) of existing systems for any modification/ up-gradation/ expansion required for total completion of work as mentioned in Bid. Contractor shall involve the Original Equipment Manufacturer (OEM) of existing Pneumatic shutdown panel, RTU, DCS, ESD and F&G Systems, Package Items etc. in the engineering, installation and commissioning modification jobs at the modification platforms.

2.5B.4 BRIEF OF INSTRUMENTATION FACILITIES ON THE NEW WELL PLATFORM (NLM-14)

Table - 1

Sl. No.	Name of the Platform / Complex	Brief Instrumentation SOW for Each Platform
1.	NLM-14 Well Platform	(i) New Instruments as per approved P&IDs and Process SOW. (ii) Well Head Control and Shutdown Panel for each platform (Conventional Hydro-Pneumatic Type). (iii) New SIL 3 PLC Based F&G Detection System. (iv) Process Control and Monitoring shall be done through RTU. (v) Critical Monitoring Parameter shall be integrated with New RTU for further transmission to the existing Platform NLW through RTU SCADA. (vi) MPFM (1+1) at Production manifold for real time measurement of DSF-II wells. Measured Data shall be transmitted through SCADA to NLW platform.

(i) Each well head platform shall have well head instrumentation, well testing facility, well and platform shutdown system, RTU, PLC (SIL-3) based Fire & Gas detection system along with associated instrumentation, Process Control and monitoring and associated instrumentation with shutdown logic implemented in the Main SDP (for ESD/ FSD), Instrument/ Utility Gas System with associated instrumentation and other field instrumentation shall be as indicated in the P&ID and Process scope of work.

(ii) The new platforms shall have Safety Instrumented Systems as defined by the clause 3.6.4.1.6 of Instrumentation Design Criteria.

(iii) Interfacing of SDP, F&G systems etc. shall be done with respective RTUs, as applicable.

(iv) All process control and monitoring signals, Shutdown Panel status, alarm status, ESD/ FSD status, well test status and testing Parameters, Electrical Systems status, and F&G Panel status, etc. shall be integrated with RTU of the respective wellhead platforms for onwards transmission to respective process platform. All closed-loop control logics shall be executed in the RTU.

(v) PID module of the RTU shall be used for Inline Test Separator Process control. The Graphics for these controllers shall be so developed that an operator can easily work on them without many levels of access. A provision shall be made in the RTU so that the related analog controller

graphics along with tuning parameters can be directly accessed via the HMI screen (soft keys) or push buttons.

(vi) Two distinct pneumatic switch shall be used to achieve High- High and Low-Low Trip function where ESD signals are connected with SDP.

(vii) All electronic transmitters shall be in HART protocol.

(viii) Space and Power requirement provision shall be kept in the Instrumentation Room to accommodate instrumentation of current as well as future wells along with Down-hole Instruments. Space requirement for Down Hole Monitoring System shall be approximately 2m x 2m. Power requirement shall be of approximately 25W/ well. Also, a minimum of one spare serial and TCP-IP Ethernet port shall be provided in the RTU for interfacing with down-hole instrument panel. The downhole instruments shall be procured separately by ONGC.

(ix) SIL-study shall be conducted for the new wellhead platforms.

2.5B.5 BRIEF OF INSTRUMENTATION FACILITIES FOR TOPSIDE MODIFICATIONS AT EXISTING PLATFORMS (NLG, NLP-9 WELL PLATFORMS)

Table – 2

Sl. No.	Name of the Platform / Complex	Brief Instrumentation SOW
1.	NLG Well Platform	For each Modification Well head Platform following instrumentation shall be provided: (i) New instrumentation signals/package as per ONGC approved P&IDs (ii) Extension of the existing fusible plug loop to cover the new / modification of process facilities on the existing platforms (iii) Extension of Fire & Gas detection for the new facilities and supply of F&G Detectors, its Cables, Cards and relevant requirements etc. are under contractor's scope of work. It is the responsibility of the contractor to make F&G System fully operational by executing erection and commissioning. (iv) New stand-alone shutdown panel (SDP) [along with one spare module] shall be provided for the new facilities by contractor and the same shall be integrated with existing platform SDP
2.	NLM-9 Well Platform	

		(v) **Existing System Make/ Model details** **(a) NLG Platform :** • Process Control & Monitoring System: Type: DCS; Make: Honeywell Automation India Limited, Model:C300 Controller,; • ESD : Type: Safety Manager PLC; Make: Honeywell Automation India Limited , Model: QPP -0002 CCV • F&G System: Type: Safety Manager PLC; Make: Honeywell Automation India Limited, Model: QPP -0002 CCV 2.0 **(b) NLM-9 Platform:** • Process Control & Monitoring: Through RTU (Well Head control & monitoring data are remotely monitored through SCADA from NLW) • ESD System: Through Hydro Pneumatic Shutdown Panel • F&G System: Make: General Monitors; HC Detector & H2 Detector Control Card Mode: TA102A, HC-Detector Model: IR4000S, H2 detector- S4000CH; Programmable relay: Make: Omron, Model: 12-24VDC , ZEN-10C1DR-D-V2; Programmable relay expansion module: Make: Omron, Model: 12-24VDC , ZEN-8E1DR

(i) Supply and Installation of new instrumentation as per process documents such as P&IDs, process scope of work etc. on all the platforms under modification job.

(ii) Control and monitoring Devices and Shutdown Devices for all new facilities shall be integrated with existing Control and Monitoring System and existing ESD and FSD System as per the existing philosophy. Any hardware, software (any license) etc. required for the same to make the systems completely functional shall be in contractor's scope. Providing all the required software and hardware, configuration / mapping of new instrumentation as per existing philosophy/SAFE Charts/Voting Logics shall be under the present scope of work.

(iii) Extension of F&G system to cover the new facilities on the platforms is under present scope of work. Extended F&G shall be integrated with existing F&G system.

(iv) Extension of Fusible plug loop to cover the new equipment /facilities and operational area.

(v) On existing Platforms, scope of work shall be of integrating all new instrumentation with respective existing RTU, DCS, ESD and F&G Systems, providing all the required software and hardware (like I/O cards etc.), configuration / mapping of new instrumentation as per existing philosophy/SAFE Charts/Voting Logics. In addition, providing vendor assistance (OEMs) for carrying out the work for commissioning of new instrumentation in respective systems shall also form part of scope.

(vi) This scope shall be finalized by the successful bidder during the pre-Engineering surveys undertaken for the respective platforms. For any hardware of the existing systems used up while implementing this scope, an equivalent hardware component shall be provided in a fully mounted and connected condition i.e. ready for use in addition to the spare hardware as mandated by IDC.

(vii) Instruments for tripping i.e. PZT(HH), PZT (LL)/ PSH, PSL/ PSHL in existing platforms shall be selected as per existing philosophy.

(viii) All field instruments shall be in HART protocol and as per existing philosophy.

(ix) Contractor have to involve the Original Equipment Manufacturer (OEM) of existing Pneumatic shutdown panel, RTU, F&G panel, PLC and DCS, Package Items etc. in the engineering, installation and commissioning at the modification platforms.

2.5B.6 FIELD INSTRUMENTS/ INSTRUMENTATION SYSTEM:

(i) The instrumentation system on platform shall be designed such that various process parameters may be monitored and controlled locally as well as from remote location. All field instruments such as control valves, safety valves, electronic transmitters, barriers, pressure gauges, temperature gauges, differential pressure gauges, flow meters, etc., as shown in the P&IDs and as required conforming the process requirements shall be provided on the platform.

(ii) The design, selection, procurement, installation and commissioning of the instruments shall be as per the relevant Functional Specifications enclosed in the bid document. The design of the field instruments shall take care of the process requirement of pressure, temperature and material rating

(iii) All electronic instrumentation shall be selected with due consideration satisfying to the proven minimum power requirement technologies without violating safety norms and without sacrificing the bid requirements

(iv) The Contractor shall provide adequate number of MCT, Junction Boxes, Tubing, Fittings, interconnection cables, cable glands, cable trays; cable tray supports etc. to take care of all installation requirements.

(v) HART latest SIL2 based Transmitters shall be used for control and monitoring purpose for all platforms

(vi) The Contractor shall provide instrument isolation valves, 3W and 5W valve manifolds for transmitters, impulse tubing, piping, fittings, bug screens, adequate supports and other erection material for all field instruments as required.

(vii) Appropriate signal barriers and isolators for the signals being terminated at the control panels/ telemetry units shall be provided. In general, active barriers shall be used.

(viii) Supply, laying and termination of all types of cables, such as signal, alarm, control, F&G system cables, power supply cables, earthing cables etc. is part of the scope. The scope includes cable trays, structural supports and consumables for cable laying and routing, SS tags binded with SS wire, junction boxes, cable glands, shrouds etc. also.

(ix) Separate earthling shall be provided for Panels/ Junction Boxes, systems, IS earth and cable shields.

(x) All the main line XSDV shall have local closing facility. Lamps test facility of SDP wherever applicable shall be provided.

(xi) Instruments are envisaged as indicated in the P&IDs. There shall be provision of obtaining all the self-diagnostic information of all the electronic instruments and making them available at local as well as remote locations.

(xii) The spare instruments as described in Instrument Design Criteria clause 3.6.4.8.6.

(xiii) Level gauges of hermetically sealed magnetic type shall be preferred. If the same is not being provided for certain cases e.g. equipment package, other type can be used with prior approval of Company.

(xiv) V-Cone meters shall be with dedicated Multivariable Transmitters (MVT). The flow computation shall be done by the dedicated MVT as per latest AGA-3 and AGA-8 with pressure and temperature correction and each MVT shall be connected to Remote Control and Monitoring System (RTU) for monitoring and control. All the instruments, flow measurement system and controls shall be as per P&IDs and the scope of work for Process.

(xv) Wherever MVTs are envisaged for flow measurement, MVT shall have one 4-20 MA Analog output and one RS-485 communication port as a minimum. Laptop PC loaded with MVT configuration cum calibration software shall be supplied. To configure/ calibrate the MVT at site, necessary connectors/cables and other accessories shall also be provided.

(xvi) Manual ESD, FSD valves and Fusible plugs shall be integrated with the well SDP as per relevant codes & standards in all the well platforms. The platform ESD/ FSD system shall have appropriate provision for its hook-up/ integration with 3rd party ESD/FSD system (i.e. modular/ work-over rig, if applicable). Whenever a modular/ work-over rig will be placed on the platform, their ESD/ FSD systems shall be integrated with the platform ESD/ FSD system.

(xvii) All critical Shutdown Valves (XSDVs) including on main well fluid export/ import lines and the main lines shall be provided with local PST and Manual operation facility. This requirement shall be finalized based on P&IDs and Process scope of work.

(xviii) Control valves and shutdown valves shall be pneumatically operated. Hand-wheel/ hydraulic mechanism shall be provided for manual opening/ closing in all shutdown valves.

Hand-wheel for control valves shall be application specific and will be decided during detail engineering.

(xix) All the pneumatically operated Control Valves shall be provided with smart positioners and valve position feedback to RTU/ Process PLC.

(xx) At the new well platform for the purpose of trip functions, pneumatic switches shall be used and integrate with the conventional type shutdown panel (Hydro- Pneumatic Type).

(xxi) Pressure switch bypass shall be provided in the shutdown panels for calibration/ maintenance.

(xxii) Fire & Gas Detection System for detection of unwanted/ dangerous accumulation of toxic and flammable gases, detection of imminent/ established fire and initiation of appropriate control action to ensure safety of the facility/ platform and the personnel.

(xxiii) Well testing facilities shall be provided as per Description of Work – Process & other related bid documents.

(xxiv) 1 No. of Intrinsically Safe Hand-Held Universal Configurator/ Communicators capable for both HART & FF calibrations shall be provided to carry out on-line diagnostics and configuration.

(xxv) 1 No. of Intrinsically Safe Portable Multifunction Calibrators shall be provided as per FS-3605. The calibrator shall have facility to calibrate DPT (0-400 inches WC), PT (0-400 Kg/cm2g), vacuum gauge (0 to - 1 kg/cm2), TT (for 0-100° C, RTD: Pt-100) of accuracy of span ±0.05% or better. The calibrator shall be capable of generating mA signal (0-20 mA) and resistance of Pt-100.

(xxvi) In order to protect electronic instruments against monsoon rains, weather proof canopies shall be provided for all the electronic instruments, located in the open or under the decks. IP rated canopies are not envisaged.

(xxvii) Any other erection material necessary for installation and commissioning of instruments and any special instrument items required for satisfactory completion of the scope shall be the part of scope. This includes any special tools and tackles as applicable

(xxviii) Instruments, F&G detectors and control and monitoring systems shall be designed and provided in areas defined for future wells and future facilities indicated in the Basic Bid Work.

(xxix) All the pneumatic field instruments shall be suitable as per instrument gas/ air as applicable.

(xxx) 1 No. Industrial grade Laptops of latest configuration (shall be provided for downloading well testing data, gas flow computer data, accessing system data etc.

The following shall be considered as a minimum for selection of industrial grade laptops:

- Weather proof: IP 65.
- Able to withstand 5-95% RH non-condensing.
- Operating Temperature: 10 °C to 60 °C.
- Certified for use in Class 1, Div.1, Group C & D, T3 hazardous area.
- Operating System: Windows 11 Professional or latest at the time of execution (64-bit).
- Storage & Memory: 8 x 2 GB RAM + 512 GB SSD Storage.
- Ports (Minimum one each serial, Ethernet, HDMI etc.)

- Minimum 13" LCD/ Full Array LED/ IPS display.
- M-Disc compatible portable DVD-RW drive/ portable SDD.
- Application Software for communication with various instrumentation/ facilities on the platforms provided in this project.
- Back-up/ recovery copy of all licensed software loaded in the laptop for calibration/ configuration/ communication with various instrumentation/ facilities on the platform.
- Laptops shall be loaded with following latest version application software:
  - MS Office including Microsoft Word, Excel & Power point
  - Anti-virus software with 03 years validity.
  - Back up of F&G PLC and HIPPS software, as applicable.
- Standard test certificates for industrial grade laptops including drop test.

The laptop shall have 4 years built in warranty. Warranty Certificate/ Documentary evidence of the same shall be provided.

2.5B.7 WELL HEAD CONTROL & SHUTDOWN SYSTEM

(i) The Well Head Control and Shutdown System (WHCS) on the well platforms shall be of Hydro-pneumatic type. This system shall execute logic functions to cater to the control and shutdown requirements of well platforms as described in the Basic Bid Work and P&IDs. There shall be one Well Head Control and Shutdown System (WHCS) Panel on each of the platforms. This system shall be interfaced with the respective new F&G System and RTU to be provided in each platform.

(ii) The WHCS panel shall be of modular design with removable draw-out Well Control Modules including spare modules.

(iii) The WHCS on the new well platforms shall cater to the Shutdown requirements of inline Test Separator also.

(iv) All functionalities as outlined in FS-3501, Safe Chart, C&E diagrams and IDC shall be incorporated in the WHCS SDP including audio-visual indications and operator interfaces like push-pull knobs, indicators, bypass switches and push buttons.

(v) Manual over-ride facility shall be provided, wherever required under the Process scope.

(vi) Remote functionality using RTU/ SCADA for closing/ opening of all the wells and ESD/ FSD through WHCS SDP shall be provided at respective Process Platforms. Remote actuation shall be achieved through soft switches in the HMI as well as through hardwired key enabled push buttons on the DCS console/ panel. Details are as follows:

– Remote SSV opening and closing from respective Process Platform. Remote SSSV opening/ closing is not envisaged.

- Remote ESD from respective Process Platform. It shall close SSV only and not SSSV.

- Remote FSD from respective Process Platform. It shall close SSSV also after the closure of SSV with a timing circuit in the WHCS.

- All the alarm status, SSSV and SSV status of the Well Head Control and Shutdown Panel shall be made available to the RTU for real time remote monitoring and data-logging.

(vii) Standalone SDP shall be provided at all the modification well platforms for the new facilities and same shall be integrated with the existing ESD system as per the existing philosophy including alarm and trip.

(viii) The Shutdown Panel shall have following Well Control Modules at each of the new well platforms as per the following requirements :

Table - 3

Sl. No.	**Platform**	**Producer Well (Single Completion)**	**Future Slots**	**Total Slot**	**Spare**	**Total Well Control Module**
1.	NLM-14	07	02	09	01	10

(ix) In addition to the above, two modules (dedicated for the Inline Test Separator Shutdown functionality) shall also be provided in the WHCS (one in service and one spare)

(x) WHCS panel shall be covered at the top by SS Canopy sufficiently extended at all the sides for weather protection. All well control modules shall also be protected by means of a hinged transparent acrylic windows. For further details of SDP refer FS-3501.

(xi) For existing Process platform modification jobs, the ESD signals shall be integrated with existing shutdown system as per the existing philosophy. The completion, commissioning and making the system fully functional for the Safe and Normal operation of the plant as well as to fulfill the functional and technical requirements of the project shall be part of present Scope of Work only.

2.5B.8 FIRE & GAS DETECTION SYSTEM

A. For New Well Platforms

(i) The F&G system on the new Wellhead Platforms shall be designed as per Scheme-A defined in the FS-3500. Conventional non-addressable type F&G detectors shall be used for Wellhead Platforms.

(ii) The F&G panel shall be located in the RTU/ Telemetry/ E&I room of the respective well platforms. This F&G system of each platform shall be integrated with the Hydro-Pneumatic Well Head Control and Shutdown Panel (WHCS).

(iii) The F&G system shall have provision for individual detector bypass and alarm detection and other functionalities as mentioned in the corresponding functional specifications. PLC based F&G detection system shall be provided with all F&G detector loops like HC, H_2, H_2S, flame detectors, Thermal detector, Smoke detector, MCP etc. The execution of voting logic and executive action command shall be carried out by SIL-3 certified F&G PLC. PLC based F&G system and detectors shall be designed as per FS-3500 and FS-C101.

(iv) The quantity and location of various F&G detectors (HC, H_2S, H_2, Smoke, Heat etc.) shall be as defined in FS-3500, API RP 14C and other relevant codes and as per HSE studies (like HAZID, HAZOP, QRA etc.) on the respective platforms.

(v) The quantity and location of various F&G detectors (HC, H_2S, H_2, Triple IR, Smoke, Heat etc.) shall be as per 3D F&G Mapping Study as indicated in FS-3500. When placing detectors, prominent wind direction and air currents shall be taken into account. If multiple release sources are present in a particular area, then both point and line-of-sight detection shall be used. Detector placement for lighter-than-air gases shall be above the release point. Heavier-than-air gases (e.g., C3+) require the detector placement to be 300-450 mm above the Top of Steel (TOS) grade. Sensors shall be provided with rain hoods. Refer FS-3500 for details.

(vi) The F&G System shall be suitable for the desired offshore service and shall be suitable for housing in the building module on the platform without HVAC. The F&G System shall be suitable for continuous operation in harsh marine environment (temperature: up to 60°C and RH: up to 95%). All the electronic circuit boards (PCBs) installed in the F&G System including the Panel HMI shall be G3-GX compliant cards with conformal coating and necessary certificates

(vii) Smoke and Thermal detectors shall be provided in combination in enclosed areas such as RTU/ TIC/ E&I Room, Electrical Room, Battery Room (in addition to H_2 gas detectors) and Shelter Room etc.

(viii) Provide handheld portable HC detectors (2 Nos. for NLM-14) and handheld portable H_2S detectors (total 02 Nos. for NLM-14 well platform).

B. For Existing Platforms

(i) Extension of Fire & Gas detection system for the new facilities and supply of F&G Detectors, associated cables, cards and relevant requirements etc. are under contractor's scope of work. It is the responsibility of the contractor to make F&G System fully operational by executing erection & commissioning.

(ii) All necessary hardware, software etc. required for the same shall be in Contractor's scope. The requirement for this extension will be based on pre-engineering survey and firmed up during safety studies.

(iii) Extension of the Fusible Plug Loop to cover the new equipment/ facilities and operational area, is part of the Contractor's scope.

(iv) Detectors etc. shall be provided to cover the new facilities on the platforms under modification scope of work as per the existing philosophy. The detectors shall be hooked up to the existing F&G system and as per FS-3500. F&G system and detectors shall be designed as per FS-3500 and FS-C101.

2.5B.9 WELL TESTING (For New Wellhead Platforms- NLM-14)

(i) Wellhead Platforms shall have Inline Test Separator along with associated instrumentation for well testing. All the necessary instrumentation as indicated in the P&IDs and mentioned in the instrumentation and process scope of work shall be provided.

(ii) The inline Test Separator shall not have a separate dedicated shutdown panel. All separator related ESD functionalities shall be implemented through a dedicated module mounted in the main WHCS SDP.

(iii) The analog control loops of the inline Test Separator shall be configured in the RTU itself allowing local as well as remote auto-control. Operator-friendly graphics and interfaces shall be provided for the same.

(iv) Flow, pressure and temperature monitoring during well testing as defined under process scope is envisaged locally as well as remotely through the RTU.

(v) The level transmitter shall be of GWR type with local keypad based configuration facility. GWR type level transmitters shall have minimum configuration facilities locally via keypad in addition to via HART communicators.

(vi) Pressure and Level switches shall be provided as per P&IDs.

(vii) On the gas outlet of Inline Test Separator, V-cone meter with isolation valves and bypass arrangement, a field mounted Multi Variable Transmitter (MVT as per FS-3202) having inbuilt flow calculation and compensation capability as per latest international standards (AGA-3 and AGA-8) shall be provided. A temperature element shall be connected to MVT separately.

MVT shall have the facility of local display of instantaneous and totalized values of uncompensated and compensated flows, compensation parameters etc. All measured as well as calculated parameters from MVT shall be made available in the RTU. For data transmission, the MVT shall be linked to in the RTU on real time basis for onwards transmission to respective Process Platforms. Necessary software to configure the MVTs shall be loaded in the industrial

grade laptop provided in the project. Back up of software with licenses in DVD with portable drive/ portable SDD shall be provided.

(viii) Coriolis type Mass Flow Meter (CMFM) with Net Oil Computer (NOC) capability and online Water Cut Meter (WCM) shall be provided in the inline Test Separator liquid outlet line to measure complete range of Oil and Water quantity of all the wells. Strainer cum Gas Eliminator shall be provided at the upstream of the CFM. Parameters such as Instantaneous Oil flow rate, cumulative oil flow, Instantaneous Water flow rate, and cumulative water Flow, Total Liquid Flow, density of oil & water, online temperature etc. shall be made available in RTU.

The Net Oil Computer shall have data logging and archiving capability. It shall be capable of archiving well testing data of at least 30 days for a minimum of 15 points/ tags. The time interval of data capturing/ frequency of data logging shall be user programmable with standard 1 hour, 10 minutes and 1 minute intervals.

Net oil and water volume flow rate, density of oil and water and online temperature from NOC shall be telemetered to respective Process complex through RTU/ SCADA. NOC shall be suitably interfaced with RTU preferably through TCP-IP Ethernet link. NOC shall also have alternate provision of these outputs to be hardwired to the RTU.

(ix) One Industrial grade Laptop Computer of latest configuration (fully loaded with necessary software and Licenses) shall be provided with necessary back up in DVD with portable drive/ portable SSD. The laptops shall be able to cater to the facilities of the platforms. These laptops will be used to access the dedicated Flow Computing Devices (MVT for inline Test Separator Gas and NOC for liquid measurement) and the F&G PLC. Also, the laptop will be used as portable calibrators and for configuration. The laptop shall have data logging facility. The laptop shall be provided with applicable signal converters as required for signal protocols depending on the type of Meter/ Systems as mentioned above.

All the licensed software loaded in the laptop for calibration/ configuration/ maintenance of various instrumentation/ facilities (like MVTs, NOCs, F&G PLC, MPFM etc.) shall be provided in DVD with portable/ portable SSD as back up copy. The configuration details for these laptops shall be submitted to the company during detailed engineering for review and approval. These laptops shall form part of the Purchase specifications. The laptops provided shall have 4 years built in warranty. Documentary evidence of the same shall be provided.

2.5B.10 METERING FACILITY

(i) Production & Test Manifolds shall have necessary instrumentation as indicated in the P&IDs and mentioned in the instrumentation and process scope of work.

(ii) The control/ monitoring parameters shall be as shown in P&IDs and scope of work shall be made available in the RTU.

(iii) Two numbers of *nucleonic type* Multi Phase Flow Meters (MPFM) shall be provided in 1+1 configuration at the production header at NLM-14 well platform as per P&ID for three phase measurement of oil, gas and water. The sizing and selection of the meter shall be done as per the Process Design Basis. For specifications refer FS-3209.

(iv) The Meters shall be installed in 1+1 configuration with provision for operating them in series or in parallel.

(v) Each MPFM shall have its dedicated 'Stream Flow computer' for computation of oil, gas and water in the flow line. A Master Flow Computer shall be considered in line with the fiscal type metering flow computer for the arrangement, to provide the final corrected flow parameters. The two stream flow computers shall be connected to the Master Flow Computer to give the final corrected flow rates. Real Time Data and corrected flow from the Master Flow Computer shall be transmitted through SCADA RTU to associated respective Process Platforms.

2.5B.11 CONTROL & COMMUNICATION FACILITY

(i) A new Remote Telemetry Unit (RTU) system shall be provided at each wellhead platform for data and signal communication. All the electronics instruments/ status signals at the Wellhead Platforms shall be connected to this RTU. RTU shall further transmit all these Instrumentation signals/ data to the existing SCADA system at NLW Platform. All the parameters of well head platform shall be shown in a schematic which will be developed in the existing SCADA system. All the hardware and software for required interface to maintain the existing philosophy of the existing SCADA system shall be under present scope.

(ii) Additional tags licenses required for the new tags under this project to integrate with existing Instrumentation control systems described as above, if required, shall be provided under present SOW only.

(iii) For modification platforms all the control and monitoring parameter shall be integrated with existing system as per the existing system as per the existing philosophy.

(iv) Telemetry and telecommunication system including one Telemetry Interface Cabinet (TIC) shall be designed as per FS-3502. Barriers shall be used in TIC for all intrinsically safe loops.

(v) Marshaling Cabinet/ Telemetry Interface Cabinet (TIC) shall be located in the safe area (Telemetry/ RTU / E&I room) and shall be capable of catering to all the parameters measured and to be transmitted though telemetry units. Details related to this setup shall be finalized during the detailed engineering. Active type barriers shall be provided for all instrumentation. Parameters for RTU monitoring and/ or control shall be as per the process requirements and safe operation of the platform.

(vi) RTU shall be located in a safe area and shall be capable of catering to all the parameters which are measured and to be transmitted though RTU and also shall be capable of receiving remote commands. Parameters for RTU monitoring and/ or control shall be as per the process requirements and safe operation of the platform.

(vii) The control/ monitoring parameters of Well platforms as shown in P&IDs and scope of work shall be made available in the RTU.

(viii) The Contractor has to prepare the details of the control-communication scheme indicating the integration of systems and shall submit the same to ONGC for approval.

(ix) The contractor shall demonstrate the remote operability well control and well testing systems on the new well-head platforms through simulation from the corresponding process platform/ complex. This refers to the remote opening and closing of wells and ESD/ FSD in the proposed well head platforms and remote analog loop control of inline Test Separator from the associated Process Complex.

(x) The instrumentation scope of work for data transmission will only cover upto signal termination at TIC in individual platforms. Further signal processing, transmission and integration with SCADA will be covered under the telecommunication/ SCADA scope. The scope for SCADA and specifications including RTU are provided in Telecommunication/ SCADA scope in the bid document. (refer Infocom Scope of Work 2.9)

2.5B.12 POWER SUPPLY AND CONDITIONING EQUIPMENT

(i) Contractor shall be responsible for carrying out design, engineering procurement, installation, testing and commissioning of power supply system and conditioning equipment, quantitatively and qualitatively, to provide uninterrupted power supply for data monitoring, controls and communications as detailed in the bid.

(ii) The design of backup power supply/ battery bank for uninterrupted operation of the well platforms shall also meet the requirement as detailed in the respective Functional Specification and Electrical Scope of Work.

(iii) Contractor shall arrange for temporary power supply required for testing of all well platform operations during pre-commissioning/commissioning in the absence of platform power.

2.5B.13 TEST RUN

Upon conclusion of the Site Acceptance Testing, the contractor shall keep the facilities commissioned i.e. perform test-run for 72 hours. For detailed test-run requirements, refer Commissioning Procedure and Performance Test (CPP) document provided in the bid elsewhere.

During this period contractor shall provide specialist engineers and technicians including experts to maintain the total log, incidents, failures and for assisting site engineers and for total coordination. However, the normal operation and maintenance shall be performed by the owner personnel trained for the purpose.

2.5B.14 DOCUMENTATION

The Contractor shall provide the following documents for each Wellhead Platform and Process Complex as a minimum:

i) Operating philosophy of the system.

ii) System and Network Architecture drawings.

iii) Interface details of all the new Instrumentation System with existing systems.

iv) Detector Location Plan

v) System layout/ Instrument layout & cable tray routing drawings.

vi) Calibration procedures/ Cable schedule, Instrument & Junction box location plans/ layouts.

vii) Loop schematics, Interconnection diagrams, Cable termination details, Installation standards/ drawings/ Junction box wiring scheme/ Field test and loop checking report/ MCT block sizing and arrangement drawing.

viii) Bill of material/ material take off.

ix) Equipment specifications, Catalogues, Data sheets.

x) Deviation schedule, Functional schematic, Test certificates.

xi) Proposed maintenance schedule of all major components, for the design life of the system, and their replacement requirements.

xii) As-built drawings.

2.6 ELECTRICAL

2.6.1 INTRODUCTION

This section shall be read in conjunction with the basic bid work of process, mechanical, instrumentation, architecture, structure, electrical design criteria for well platform connected by submarine cable and functional specifications placed in bid package for the complete assessment of electrical work. The bidder shall note that any item not mentioned here but nevertheless required to make the system safe and complete shall also be supplied and executed by the contractor.

The works under this tender include pre-engineering survey for modifications work, design and engineering, preparation of drawings & documents, sizing, selection and procurement of electrical equipment, transportation & supply of all material & equipment tools & tackles, installation, hook-up, testing ,pre-commissioning and commissioning etc. of electrical facilities for two new subsea cable connected wellhead platforms namely VGN-A and R-12-6A, one new riser platform namely RJP and one solar powered wellhead platform namely NLM-14, topside modifications at existing platforms (R-7A, R-9A, R-10A, R-13A, R-12A, NLM-9 and NLG platforms), cathodic protection system for offshore structures, pipelines, I/J tubes & risers, supply & laying of submarine composite cables as described elsewhere in the bid.

2.6.2 DESIGN AND ENGINEERING:

Upcoming WHP (VGN-A and R-12-6A), Riser Platform (RJP) And Existing WHP (R-7A, R-9A and R-10A platforms)

The Contractor shall develop, design and detail engineering all data/ drawings/ documents required, based on the functional specifications and electrical design criteria described elsewhere in the bid package. Engineering activities to be performed by the contractor shall include but not limited to the following:-

- Basic engineering calculations viz. voltage drop calculations, cable sizing, cathodic protection system calculations etc.
- Sizing of various electrical equipment.
- Preparation of final single line diagram and power distribution scheme.
- Preparation of control schematics for electric power systems, navigational aids system etc.
- Developing all lighting, cabling and earthing layouts including cable termination details, cable tray sizing, MCT sizing and complete cable schedules etc.
- Developing the navigational aids equipment layout.
- Developing the equipment layouts of Electrical switchgear room, VFD Panels, Transformer room etc. including preparation of all drawings for mounting and installation of various electrical equipment.

- Calculating and finalizing the total number of anodes required for cathodic protection of jacket and J tubes and developing the cathodic protection system drawings indicating location of anodes, anode distribution drawing etc.
- 3-D modeling of electrical system using relevant PDS/ PDMS module, and clash check of electrical cable trays on model.
- Preparation of area classification drawings based on the equipment layouts.
- Preparation of final "As Built" drawings and operation manual.
- Any other works/ activities those are not listed above, however, necessary for the completeness of the electrical system.

2.6.3 DESCRIPTION OF WORK FOR SUBMARINE CABLE AND PIPELINES

2.6.3.1 SUBMARINE CABLE

The Contractor shall supply and install the following submarine composite cables:

1) 11 KV system voltage at 50 Hz:

Supply and laying of submarine cable with optical fiber unit with rated voltage of the subsea cable:

Table-1

S.N.	From	To	Indicative Length (KM)	Indicative Minimum Size of Subsea Composite Cable (SQMM)
1.	RJP	R-12-6A	16.7	240
2.	RJP	VGN-A	5.2	240

The length mentioned above is indicative only and based on pipeline route. It shall be firmed up during detail engineering, as per actual pipeline route survey.

2) The contractor shall undertake pre-engineering survey for arriving at the best possible routes and actual length for submarine cables. The Contractor shall work out the exact lengths of the cables in the pre-engineering survey. The Contractor shall terminate the cables at appropriate termination boxes. The scope of work for submarine cable includes:

a) Selection of route for the cable, avoiding obstacles, planning over bridges / Uraduct or equivalent wherever crossings with pipes, fluid lines etc. is unavoidable. Assess soil condition,

slopes for terrain at the seabed or any other parameters/criteria as may be required for deciding cable laying on seabed in the best possible manner.

b) Design and selection of submarine cables for developing power distribution systems based on design criteria and cable route survey.

c) Supply, installation, testing and commissioning of 11 KV submarine cable, jointing kits etc. as per specifications. The cable shall be free of lead content. The housing of the cable shall be slotted with stainless steel tube.

d) Shipment of submarine cable with all the equipment required for laying up to the site of working.

e) Laying of submarine cable.

f) Bringing cable through J tube to the deck at respective platforms (Refer Table-1) and termination at splitter box/straight through joint. Interconnection and termination of HV surface cable from splitter box/ straight through joint to HV switch gear at Electrical switchgear room at respective well platforms. The J tubes shall be sealed.

g) Preparation of map showing the cable routes.

2.6.3.2 CATHODIC PROTECTION OF SUBMARINE PIPELINES

This section describes the scope of cathodic protection for sub-sea rigid/flexible pipelines and their structures, risers, I/J tubes etc. (as per Pipeline scope of work section 2.1.5 SUB-SEA PIPELINES & RISERS). The major electrical facilities shall include sacrificial anode type cathodic protection system for sub-sea rigid/flexible pipelines and their structures, risers, I/J tubes. The scope of work shall include the following:-

2.6.3.2.1 DESIGN AND ENGINEERING FOR CP SYSTEM OF PIPELINES

The contractor shall develop, design and detail engineer the CP system based on the FS 4002. Engineering activities to be performed by Contractor shall include but not limited to the following:

- Design of CP system, detailed calculations for CP system for calculating the total quantity of anodes, anode weight, and anode output current, current demand, etc.
- Developing the purchase specification and carry out all procurement activities.
- Developing anode installation drawings, drawings for anode location, distribution etc.
- Preparation of final “As Built” drawings.
- Any other works/ activities that are not listed above, however, necessary for the completeness of the electrical system

2.6.3.2.2 SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF CATHODIC PROTECTION SYSTEM FOR PIPELINES

Supply, installation, testing of sacrificial anodes, all cables and accessories etc. for the complete cathodic protection system including post installation survey of same shall be under the scope of work for the contractor.

2.6.4 ELECTRICAL SCOPE OF WORK FOR: UPCOMING WHP (VGN-A AND R-12-6A) AND RISER PLATFORM (RJP)

This section describes the scope of work for the electrical facilities for two new unmanned subsea cable connected well platforms viz. VGN-A and R-12-6A and one riser platform RJP.

2.6.4.1 SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT & FACILITIES FOR: UPCOMING WHP (VGN-A AND R-12-6A) AND RISER PLATFORM (RJP)

Scope of supply, installation, testing and commissioning of electrical equipment & facilities on VGN-A, R-12-6A and RJP platforms shall include, but not limited to the following:

i. A switchgear room for HV/LV switchgear to be installed under this project in safe area on well platforms. Indicative electrical schematic is attached elsewhere in the bid. Space for VFD panels (not in the scope of this contract) shall be provided in the Electrical switchgear room. Equipment layout for Electrical switchgear room shall be prepared accordingly.

ii. A transformer room with natural ventilation shall be provided which will house two distribution transformers as per the scope of this tender.

iii. Only Space provision shall be made as per following numbers of VFD panels and Transformers for ESP at respective well platforms. Supply of ESPs and its VFDs and Transformers are not part of Scope.

Table-2

Platform	No. of ESP	No. of VFD Panel	No. of Step up Transformer
R-12-6A	09	09	09
VGN-A	09	09	09

ESP Rating: 75 KW to be considered for R12-6A, R-7A, R-9A and R-10A platforms, 55 KW to be considered for VGN-A platform for load calculations.

Indicative Size of the Each VFD Panel and Transformer:

VFD Panel : 1300 mm (W) x1200 mm (D) x 2700 mm (H)
Step up Transformer for VFD : 1300 mm (W) x1700 mm (D) x 1600 mm (H)

Space Provision for VFD panels shall be kept in the Electrical switchgear room at main deck and Space for VFD Transformers shall be provided in safe area fully protected from rain and storm water at cellar deck.

HVAC as described elsewhere shall be provided in Electrical switchgear room.

Heat load of VFD panels to be considered 10 KW each of VFD panel for HVAC calculations.

iv. Supply, installation, testing and commissioning of two identical 11KV/440V, 3 phase cast resin, copper wound indoor distribution transformer for platform power supplies. Each transformer shall be designed to supply the total electrical power of the well platform independently. The transformer shall be complete with all accessories, marshalling box, off load tap changer (OLTC). The OLTC shall be able to compensate for voltage variations in all conditions ranging from full load to no load.

v. Supply, installation, testing and commissioning of two nos. of 3 phase, 440V/240V (phase to phase), indoor lighting transformers for lighting power requirements. Each lighting transformer shall be rated to supply the complete lighting power independently.

vi. Supply, installation, testing and commissioning of 11KV, 50 Hz, 3 phase, sheet steel enclosed, floor mounted switchboard as per functional specifications and design criteria. All HV breakers, including incomer shall have identical ratings to ensure interchangeability. Switchgear assemblies shall be complete with circuit breakers, intelligent numerical relays, meters, components etc. for power distribution to various switchboards/ Panels etc. All feeder panels shall be digitally communicable having facility to be remotely operated and controlled from MOPU as per Electrical Design criteria for well platforms connected by submarine cable. All protection relays including differential protection for submarine cables shall be numerical relays capable of communicating digitally with network equipment (network switches and control system).

All upstream and downstream relays shall be properly coordinated so that faults are discriminated. The Contractor shall implement a well-designed relay coordination scheme as per international standards for proper discrimination of fault.
Source of the electrical power is from MOPU (Mobile Offshore Production Unit). MOPU is not in the scope of this project.

All relays shall be interfaced with the new HMI/PLC based console for communication of all monitoring and control of electrical signals between RJP and well platforms. These facilities shall be provided at both ends of the platforms.

a) There shall be one 11 KV HV panel at RJP Riser platform having total nine feeders: one incoming from MOPU, one incoming for future use, two outgoing transformer feeders, three outgoing to other platforms: VGN-A, R-12-6A & R-10A and two spare feeders (one transformer feeder and one HV feeder respectively) as indicated in schematic 7132-EL-RJP-SLD-4001 Rev 0.

b) There shall be one 11 KV HV panel at VGN-A and R-12-6A well platforms with one incoming, two outgoing transformer feeders and two spare feeders (one transformer feeder and one HV feeders respectively) as indicated in schematic 7132-EL-VGN-A-SLD-4002 Rev 0 and 7132-EL-R-12-6A-SLD-4003 Rev 0 respectively.

vii. Supply, installation, testing and commissioning of 440V, 50 Hz, 3 phase & neutral LV switchboard as per functional specifications and design criteria with two incoming, one bus coupler and required number of ESP feeders and ACB/MCCB outgoing feeders and spare feeders.

viii. At RJP platform, each transformer shall be sized to supply the LV power of RJP platform and 07 nos. ESP power (75 KW each) of the R-10A platform independently. VFD panels (07 nos.) and step up transformer (07 nos.) of ESP of R-10A platform shall be installed at RJP platform in future. ESP VFD panels shall be located in the Electrical switchgear room of RJP platform. Space for ESP VFD panels shall be provided in electrical switchgear room. Space for ESP step up transformers shall be provided in safe area fully protected from rain and storm water.

ix. At RJP platform, Supply, installation, testing and commissioning of AC UPS system (230 V AC, 1 phase, 50Hz dual redundant with bypass) with maintenance free Ni-Cd batteries as per FS-4025 to feed the MOPU Remote Control and Monitoring System (RCMS) comprising of dual stacked workstations, servers, operator-cum-engineering workstations, hardwired console etc. (Refer Instrumentation Scope of works for details)

x. Supply, installation, testing and commissioning of DC electric power system (24V DC) for communication and instrumentation loads such as PLC, telemetry & data transmission system, video monitoring system for well head area, gas detection, well shutdown control, well testing systems etc., consisting of Ni-Cd battery bank with battery rack, battery chargers as per FS 4023. Backup time for this system shall be 24 hours.

xi. Supply, installation, testing and commissioning of 24V DC dedicated floating power supply system with Ni-Cd battery banks with battery rack, battery chargers as per FS-4023 for F&G System. Backup time for this system shall be 48 hours. Refer Instrumentation Scope of works for 24 V DC load.

xii. Supply, installation, testing and commissioning of 110V DC power supply system with Ni-Cd battery banks with battery rack, battery chargers as per FS-4023 for supplying power to switchgear control supply and critical lighting. Backup time for this system shall be 24 hours.

xiii. Supply, installation, testing and commissioning of 24V DC navigational aid system with Ni-Cd battery banks with battery rack, battery chargers as per FS-4023, photovoltaic solar panels, solar controller panel, navigational aid lanterns, lantern JBs, cables, mounting/supporting structure for solar panels etc. Battery for Navigational Aids shall have backup time of 7 days. Complete Solar power system without battery backup for Navigational Aid shall be provided as per FS 4007A as a backup of main power.

xiv. Supply and installation of FRP cable trays along with accessories for complete cabling. Minimum 20% free space shall be left in the cable trays for future use.

xv. Supply and installation of MCTs for the proposed cabling system complete with steel frames, insert blocks, solid blocks, compression plate etc.

xvi. Supply, installation, testing & commissioning of lighting system for Electrical switchgear room, Transformer room, shelter room, other indoor housing, pig launching/receiving area etc. The selection of lighting fixtures shall be as per area classification. LUX levels shall be maintained as per Electrical Design Criteria for well platform connected by submarine cable.

xvii. Supply & installation of complete earthing including supply of materials i.e. earthing conductor/cable, nuts & bolts, lugs, washers etc.

xviii. All erection and installation material like cable glands, cable lugs, connectors, cable tray supports, structural steel, nuts, bolts and other required hardware, commissioning spares etc. shall be supplied by the Contractor. Cabling work shall include cable laying, end terminations, clamping, tagging, cleating of cables etc. Modular cable tray ladder support and earthing shall be fixed with steel structure using welding or direct metal fastening technology.

xix. Supply and installation of cathodic protection system without monitoring for jacket complete with standoff type sacrificial anodes, all mounting accessories etc. as per FS 4001.

xx. Supply and installation of cathodic protection system for J tubes and risers complete with sacrificial anodes as per FS 4002.

xxi. Flameproof Welding receptacles as required.

xxii. Any other equipment not specifically mentioned herein but nevertheless necessary for the completion of the job is included in Contractor's scope of supply. Supply and installation of all accessories as required are included in Contractor's scope of supply.

2.6.4.2 HMI for Well Platform

i. A communication and control network along with an HMI system for electrical system as per Electrical design criteria for platform connected by submarine cable between the RJP and well platform through fiber optics shall be installed and commissioned at the E&I room of RJP under present scope and later shifted to MOPU control room by the MOPU Contractor.
(Refer Instrumentation scope of work for details)

ii. The details of parameters to be monitored and operated are given elsewhere in the bid document.

iii. Sufficient spare capacity to be provided for ESPs which will be installed in future by ONGC.

iv. In addition, the following electrical functions of well platform shall also be monitored.

- Video monitoring system.
-

-
- of Electrical switchgear and VFD panel rooms.

2.6.4.3 List of Major Electrical Equipment

Major Electrical equipment to be supplied by the Contractor shall include but not limited to the following: -

- Submarine composite Cable.
- Electrical switchgear room with HV and LV switchboards and space for VFD panels.
- Power and lighting transformers.
- DC Electric Power System for instrumentation and communication.
- Navigational Aids System complete with battery charger, battery bank, photovoltaic solar panels, solar controller panel, navigational aid lanterns & Electric Power System.
- DC Electric power system for switch gear.
- Facilities to accommodate remote monitoring and control system for electrical equipment including ESPs.
- Battery and battery charger.
- Lighting fixtures, switches and junction boxes as per area classification.
- Power and Control cables.
- Fiber glass cable trays and accessories.
- Multi cable transits (MCTs).
- Earthing material and accessories.
- Cathodic Protection System without monitoring for the jacket and J tubes.
- Flameproof welding receptacles.
- Any other equipment with accessories to make the electrical installation complete in all respects.

2.6.5 SCOPE OF WORK FOR MODIFICATION AT EXISTING PLATFORMS

This section defines the Contractor's electrical scope of work for modification works to be done on the R-7A, R-9A, R-10A and R12-A platforms.

a. At R-7A Platform:

i) Existing 02 nos. distribution transformers (11/0.433KV, 630KVA) shall be replaced with higher capacity new transformers (Min 1600KVA) to cater the existing LV loads and upcoming ESP loads (09 nos.) Space creation for installation of higher capacity of 11/0.433 KV distribution transformer by replacing of existing transformers.

ii) Space shall be created at cellar deck transformer area by deck extension (if required) and one additional step-up transformer of ESP. (Space for 08 nos. Step up transformer of ESP already available in existing transformer room).

iii) New Switchgear room shall be constructed by deck extension (as required) at main deck which shall house new LV switchgear and 05 nos. future ESP VFD (Space for 04 nos. VFD Panels of ESP already available in existing electrical switchgear room). The new switch-gear room shall be provided with electrical facilities such as lighting, convenience outlet etc. and HVAC.

iv) New LV switchgear (3 phase and neutral) consists of two incoming, one bus coupler, two outgoing feeders for supplying power to existing LV switchgear, 09 nos. ESP feeders with 02 nos. spare feeders for ESP and required number ACB/MCCB outgoing feeders and spares as per functional specification and design criteria. The existing transformers shall be disconnected from the existing switchgear and the primary of the new transformers will be connected to the existing HV switchgear, while the secondary will be connected to the new LV switchgear. Any modifications or repairs are also in the scope of the contractor.

b. At R-9A Platform:

i) Existing 02 nos. distribution transformers (11/0.433KV, 630KVA) shall be replaced with higher capacity new transformers (Min 1600KVA) to cater the existing LV loads and upcoming ESP loads (06 nos.). Space creation for installation of higher capacity of 11/0.433 KV distribution transformer by replacing of existing transformers.

ii) New Switchgear room shall be constructed by deck extension (as required) at main deck which shall house new LV switchgear and 02 nos. future ESP VFD (Space for 04 nos. Step up transformer of ESP already available in existing electrical switchgear room. The new switchgear room shall be provided with electrical facilities such as lighting, convenience outlet etc. and HVAC.

iii) New LV switchgear (3 phase and neutral) consists of two incoming, one bus coupler, two outgoing feeders for supplying power to existing LV switchgear, 06 nos. ESP feeders with 02 nos. spare feeders for ESP and required number ACB/MCCB outgoing feeders and spares as per functional specification and design criteria. The existing transformers shall be disconnected from the existing switchgear and the primary of the new transformers will be connected to the existing HV switchgear, while the secondary will be connected to the new LV switchgear. Any modifications or repairs are also in the scope of the contractor.

c. At R-10A Platform

Surface cable shall be laid to HV switchgear from HV switchgear of RJP Riser platform. One HV feeder available at R-10A platform shall be utilized for providing power to R-10A. Necessary modification, engineering etc. as required are in the scope of the contractor. Supply and installation of all accessories like MCT, cable trays, glands, lugs etc. are included in Contractor's scope of supply.

d. **At R-12A Platform**

Required modifications are made to the HV switchgear and cable terminations at R-12A platform.

e. General

Power required for instrumentation loads coming on other process/well platforms as described in process scope of work shall be fed from existing electrical system. For this purpose, distribution of electrical power shall be done from existing spare feeders. In case there is no spare present in distribution board/switchboard, existing distribution board/switchboard shall be modified or one additional distribution board shall be installed to provide power to upcoming instrumentation loads. Necessary modifications, cablings, MCT etc. required for the providing power to upcoming instrumentation loads is in the scope of the contractor.

The contractor's electrical scope of work shall also include the following:-

1. Relocation of any electrical items such as cable trays, junction boxes, lighting pole etc. wherever required.
2. Bidder shall generate area classification drawings for all modification areas.
3. Supply, installation, testing and commissioning of LED lights, cabling and extension of existing lighting circuits as per required illumination levels at modification areas of process/well platforms.
4. Supply and installation of electrical equipment and accessories such as cable, cable trays, MCT, glands, lugs etc. to make the electrical installation complete in all respects.
5. Supply & installation of complete earthing for all new launcher/receivers including supply of materials i.e. earthing conductor/cable, nuts & bolts, lugs, washers etc.
6. Any other works/ activities those are not listed above, however, necessary for the completeness of the electrical system.

2.6.6 ELECTRICAL SCOPE OF WORK FOR: NLM-14 PLATFORMS (SOLAR POWERED)

This section describes the scope of work for the electrical facilities for one new unmanned solar powered wellhead platforms NLM-14.

2.6.6.1 DESIGN AND ENGINEERING FOR: NLM-14 PLATFORM

The Contractor shall develop, design and detail engineer all data/ drawings/ documents, based on the scope of work, functional specifications and electrical design criteria placed in the bid package. Engineering activities to be performed by the contractor shall include but not limited to the following:-

- Basic engineering calculations viz. Voltage drop calculations, cable sizing, solar power system sizing calculations, cathodic protection system calculations etc.

- Sizing of various electrical equipment.
- Preparation of single line diagrams and power distribution schemes.
- Developing the complete electrics for package equipment such as deck crane, etc.
- Preparation of control schematics for solar power systems, navigational aid system etc.
- Developing lighting, cabling and earthing layouts including cable termination details, cable tray sizing, MCT sizing and complete cable schedules etc.
- Developing the navigational aids equipment layout.
- Developing the equipment layouts of E&I room, Battery room including preparation of drawings for mounting and installation of various electrical equipment.
- Developing the interconnection drawings including preparation of all hook-up drawings.
- Calculating and finalizing the total number of anodes required for cathodic protection of jacket and developing the cathodic protection system drawings indicating location of anodes, anode distribution drawing etc.
- Preparation of drawings for mounting and erection of various electrical equipment, equipment installation and cable termination details etc.
- 3-D Modeling of electrical system using relevant PDS/ PDMS module, and clash check of electrical cable trays on model.
- Developing the inspection and testing procedures for all electrical equipment.
- Preparation of Area Classification drawings based on the equipment layouts.
- Preparation of final "As Built" drawings and operation manual.
- Any other works/ activities that are not listed above, however, necessary for the completeness of the electrical system.

2.6.6.2 SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT & FACILITIES FOR: NLM-14 PLATFORM

Scope of supply, installation, testing and commissioning of electrical equipment & facilities on NLM-14 platform shall include, but not limited to the following:

(i) Supply, installation, testing and commissioning of Solar electric power system for entire loads coming under System I, II, III and IV (as described in DS 4007A of FS 4007A), consisting of VRLA batteries with battery rack/ stack, photovoltaic solar panels, solar controller panel, JBs, cables, mounting/supporting structure for solar panels etc. in line with FS 4007 A attached elsewhere in the bid package.

(ii) 30 KVA alternator of deck crane, AVR, MCCB and power transfer system (flameproof system) driven with deck crane engine (For more details on deck crane please refer mechanical scope of work).

(iii) One no. of 30 KVA, 415 VAC, 3 Ph. (input), boost battery charger to charge the battery banks through change over switch at each platform.

(iv) Power cable with cable tray (to transfer 30 KVA, 415 VAC power from alternator end to battery charger and ACDB). ACDB (01 incomer, 01 outgoing feeder for battery charger, 02 nos. 63 Amps, 02 nos. 32 Amps and 02 nos. welding receptacle).

(v) DC distribution boards as per FS 4035 attached elsewhere in the bid package for above Solar Systems to feed electric Loads.

(vi) Nav-Aid system in line with FS 4003 attached elsewhere in the bid package.

(vii) Four position changeover switch shall be provided in the E&I room for charging any of four systems through battery charger.

(viii) LED lighting system for E&I room, Battery room as per Electrical design criteria for Wellhead platform consisting of flameproof lighting fixtures with lamps & mounting accessories, flameproof lighting switches, JBs, cables etc. The sizing of Battery backup for lighting shall be as per the Electrical Design Criteria for Wellhead platform enclosed in the bid.

(ix) Power & control cables for all equipment along with supply of accessories like cable marker/ identification tags etc. as per FS 4011 placed in the bid package.

(x) FRP cable trays as per FS 4005 along with accessories for the complete cabling of package. Minimum 20% free space shall be left in the cable trays for future use.

(xi) MCTs for the proposed cabling system complete with steel frames, insert blocks, solid blocks, compression plate etc. as per FS 4021 placed in the bid package.

(xii) Al/Magnesium anodes for tanks/ vessels as required.

(xiii) Complete earthing using Earth Boss / Cad weld Kit, including supply of materials i.e. earthing conductor/cable, cad weld kits, nuts & bolts, lugs, washers etc.

(xiv) All erection and installation material like cable glands, cable lugs, connectors, cable tray supports, structural steel, nuts, bolts and other required hardware, commissioning spares etc. shall be supplied by the Contractor. Cabling work shall include cable laying, end terminations, clamping, tagging, cleating of cables etc. Modular cable tray ladder support and earthing shall be fixed with steel structure using welding or direct metal fastening technology.

(xv) AC (240V) and DC (24V) utility power outlet sockets shall be provided in shelter room (04 nos.) and E&I room (02 nos.).

(xvi) Cathodic protection system for jacket, Pre-installed Risers and all mounting accessories etc. as per FS 4001 & FS 4002 attached elsewhere in the bid package.

(xvii) Copper cables shall be laid in metallic pipe of schedule 60 for a) Solar panel MJB (Main Junction Box) to solar controller placed in E&I room and b) Solar controller to Battery room, if cable routing is outside room.

(xviii) Any other equipment not specifically mentioned herein but nevertheless necessary for the completion of the job is included in Contractor's scope of supply. Supply and installation of all accessories as required are included in Contractor's scope of supply.

2.6.6.3 LIST OF MAJOR ELECTRICAL EQUIPMENT FOR: NLM-14 PLATFORM

Major Electrical equipment to be supplied by the Contractor for each platform shall include but not limited to the following:

- 4 Nos. of Solar Power System for each platform.
- Battery Bank
- Navigational Aids System
- DC Distribution boards
- Flameproof DC Lighting fixtures, flameproof switches and junction boxes
- Power and Control cables
- FRP cable trays and accessories
- Multi cable transits (MCTs)
- Earthing material and accessories

- Erection installation & hardware material
- Cathodic Protection System for jacket & Pre-installed Risers.
- Any other equipment with accessories to make the electrical installation complete in all respects.

2.6.6.4 GENERAL

Power required for instrumentation loads coming on other process/well platforms as described in process scope of work shall be fed from existing electrical system. For this purpose, distribution of electrical power shall be done from existing spare feeders. In case there is no spare present in distribution board/switchboard, existing distribution board/switchboard shall be modified or one additional distribution board shall be installed to provide power to upcoming instrumentation loads. Necessary modifications, cablings, MCT etc. required for the providing power to upcoming instrumentation loads is in the scope of the contractor.

The contractor's electrical scope of work shall also include the following:-

- Relocation of any electrical items such as cable trays, junction boxes, lighting pole etc. wherever required.
- Bidder shall generate area classification drawings for all modification areas.
- Supply, installation, testing and commissioning of LED lights, cabling and extension of existing lighting circuits as per required illumination levels at modification areas of process platforms.
- Supply and installation of electrical equipment and accessories such as cable, cable trays, MCT, glands, lugs etc. to make the electrical installation complete in all respects.
- Supply & installation of complete earthing for all new launcher/receivers including supply of materials i.e. earthing conductor/cable, nuts & bolts, lugs, washers etc.
- Any other works/ activities those are not listed above, however, necessary for the completeness of the electrical system.

2.7 INFOCOM AND SCADA SCOPE

2.7.1 INTRODUCTION

The scope of work for this project shall include but not limited to Site Survey, System Design & Engineering, Project Management, Procurement, Inspection, Supply, Transportation and Delivery, Installation, configuration and integration with ONGC existing Network, commissioning & acceptance, System familiarization etc. as per details given in the document elsewhere. Further, the requirements indicated in the bid are minimal, and contractors are required to comply and quote for all the necessary modules/ components/ equipment for successful implementation/ completion of the project. Notwithstanding meeting the

individual sub-system specifications specified under various sections of this tender, the successful bidder/ contractor shall be totally responsible for the overall integration of the system and meeting all the functional and Technical requirements.

2.7.2 BRIEF SCOPE OF WORK

The project envisages installation and commissioning of R-12-6A & VGN-A new smart well head platforms and RJP new riser platform in Ratna field and NLM-14 new conventional well head platform in Neelam field. The SOW covers:

1. Supply, installation & commissioning of PLC system with LDU at smart platforms R-12-6A & VGN-A in Ratna field. The scope also includes SITC of HMIs for R-12-6A, VGN-A and RJP.

   Under this scope, the contractor should provide redundant server to be installed at RJP in which data from 2nos. new smart platforms should flow. Also, data from existing 6nos. smart platforms viz. R-12A, R-7A, R-9A, R-10A, R-12B and R-13A should be integrated in the newly supplied Server.

   Supply, installation & commissioning of RTU system with LDU at NLM-14 conventional wellhead platform.

   Integration of data of PLC System at **R-12-6A, VGN-A** with existing **Heera Tier-1** SCADA System, Tier-2 Delhi & SCADA DR Site.

   Integration **NLM-14** RTU data with existing **Neelam Tier-1** SCADA System, Tier-2 Delhi & SCADA DR Site.

2. Bidder's scope includes design, engineering, documentation, supply, installation, integration, testing & commissioning of 24 (12+12) Core Fiber optic cable (All cables shall be Submarine composite cable except cable going through bridge connected platforms.) between R-12-6A to RJP, VGN-A to RJP, and RJP to future MOPU along with associated termination panel, LIU, all required accessories etc. to meet the functional requirements of Voice & data communication System. Details of existing and proposed communication facility is given at Instrumentation Scope of work Clause 2.5A.13.
3. Bidder's scope includes design, engineering, documentation, supply, installation, testing & commissioning of LAN Infrastructure for each well platform under ADR-1 project including extension of LAN infrastructure up to RJP to MOPU.
4. Design, Engineering, Documentation, Supply, Installation, Testing & Commissioning of 01 no. each I Sat Phone 2 with docking station, external Antenna along with associated accessories, cables etc. at R-12-6A and VGN-A.
5. Design, Engineering, Documentation, Supply, Installation, Testing & Commissioning of CCTV system at new smart platforms R-12-6A, VGN-A & RJP with server.

6. Design, Engineering, Documentation, Supply, Installation, Testing & Commissioning of CCTV system at NLM-14 along with point-to-point microwave radio link between NLM-14 and Neelam process complex.
7. Supply of walkie-talkies - 3 nos. each at R-12-6A, VGN-A & RJP and walkie-talkies- 3 nos. at NLM-14.
8. Installation of PTP microwave radio link-with MIMO technology between and NLM-14 & NPC/ NLG.
9. 25 mtr high self-supporting Microwave tower above main deck at RJP. No Helideck is planned at this platform and its main deck height is approximately 30 mtr from MSL.
10. All instrumentation in NLM-14 and NLG to be integrated and configured in respective RTU/ DCS/ Tier-1 SCADA System along with graphics shall be in the scope of contractor.
11. The Programmable PLC based Remote Telemetry Units (RTUs) at New WHPs and RJP shall meter and control the Wellhead platform process parameters through hardwire between RTU and field instrumentation. These Process parameters shall further get processed at RJP/ MOPU (Tier-1) (in future) and New Delhi (Tier-2) in SCADA servers and HMIs through BWA wireless radio systems viz PMP, PTP microwave radio, Fiber Optic Cable (FOC) subsea composite cables between Wellhead platforms and RJP/ MOPU platform.

Broadly the Infocom Scope of Work (SOW) is divided under the following sections:

A. Telecommunication Systems

B. IT & Network Systems

C. SCADA Systems

D. Security and Surveillance Systems

2.7.3 TELECOMMUNICATION SYSTEM

Following **Communication Systems** shall be provided at new **RJP** platform:

1) Radio Systems: Walkie-talkies
2) ISAT phones with docking station
3) Microwave Links - Local
4) Self-Supporting Microwave Tower - 25m high

2.7.3.1 RADIO SYSTEMS – WALKIE-TALKIES

Walkie-talkies with charging docks shall be provided in loose for all the platforms under scope.

2.7.3.1.1 Technical Specifications for Walkie-talkie sets

A. Technical Specifications: Walkie-Talkies

i. Walkie-talkie shall be intrinsically safe. Certification for safety (intrinsic type for class-I, Division-I, Group-D or Zone 2 of Gas GROUP IIB or higher classified areas.) issued by FMRC, USA/ Department of Explosives, Nagpur, UL (Underwriters laboratories), ATEX.

ii. The Walkie-talkies shall conform to STD 810 C/D/E standards and IP-54 for sealing, shock, vibration, dust and humidity.

iii. It shall be programmable through PC/ self-programmable. Operating manual shall be supplied for each intrinsically safe Walkie-talkie set.

iv. Full Keypad with Colour screen, Voice and data communication and shall have integrated WiFi, Blue tooth Audio and Data

B. Detail Specifications

i. Frequency : 136-174 MHz

ii. Channel capacity : Minimum 32 channels

iii. **Transmitter:**

a) Channel Spacing : 12.5/ 25kHz

b) Freq. Stability : ± 0.5 ppm

c) Power Output : 5W or better

d) Adjacent Channel Power : 60db (12.5kHz Channel)

: 70 dB (25 KHz Channel)

e) Audio Distortion : 3% or better

iv. **Receiver:**

a) Sensitivity (12dB SINAD) EIA : 0.16 micro volt

b) Intermodulation (TIA603D) : 70dB

~~c)~~ Adjacent Channel Selectivity : 70dB @ 25kHz

d) Audio Distortion : <3%

e) Hum & Noise : -45dB@25 KHz or better

C. Accessories for each Walkie-Talkie

i. OEM supplied/ OEM recommended intrinsically safe battery of Li-Ion with minimum 2000 mAH rating for intrinsically safe Walkie-talkies with average battery life of upto 11 hrs. Or more.

ii. OEM supplied/ OEM recommended battery charger docks for rapid charging for the above batteries which can be operated on 230V, 50Hz AC supply.

iii. OEM supplied/ OEM recommended Helical VHF Antenna.

iv. OEM supplied/ OEM recommended Carrying case along with belt clip and a belt for wearing around the neck / shoulder for hands free operation of Walkie-talkie.

2.7.3.2 <u>ISAT Phone2 with docking stations : 02 Nos.</u>

Design, Engineering, Documentation, Supply, Installation, Testing & Commissioning of ISAT Phone2 with docking station, Antenna unit, required cable and accessories 01 no. each at R-12-6A, VGN-A.

2.7.3.3 <u>MICROWAVE LINKS (license free) - LOCAL</u>

The MW License free Radio Link between RJP and its Well Head Platforms (WHP) shall be established as per following details:

1. Functional Requirement
2. Detailed Scope
3. Supply, Installation, Integration & Commissioning
4. Technical Specifications for MW PTP BWA radio link – unlicensed band :
   i. 5Ghz MW radio unlisenced band for PTP radio link
   ii. 0.9 mtr (3 Ft) Marine Grade Directional Antenna (external) for PTP Station NLM-14 and NPC/NLG
   iii. 1.2 mtr and 1.8 mtr Marine Grade Directional Antenna (external) for PTP Stations RJP and HPC
   iv. Network management Software and Hardware
   v. 24 port and 8 port Switch
5. Bill of Material

2.7.3.3.1 Functional Requirement

The objective of the Microwave radio link is to establish Scalable, Reliable, free band Microwave P2P link, capable of carrying multi-service traffic with high spectral efficiency between the locations as depicted below in detailed scope. Following shall be provided:

- Setting up of Remote radio at wellhead platforms. BWA system shall operate in PTP BWA in licensed free band which shall be informed to successful bidder.
- The frequency shall be chosen as per viewing sector. Minimum Data throughput shall be as per link details provided below.
- Supply, installation and commissioning of Remote Radio and its Integration with proposed RTUs at Remote stations, Base station and SCADA servers, FOC integration etc.
- Integration of Remote radio with existing EPABXs/ IP based EPABX at Base stations for voice communication.
- Radio and Telephone equipment at Remote stations (NLM-14) shall operate on 24 VDC power Refer Electrical scope also.

2.7.3.3.2 Detailed Scope

The contractor shall provide the following items:

Point-to-Point BWA MW License free Radio Links shall be provided for NLM-14 to NPC/NLG with minimum 100 mbps throughput.

Locations LAT & LONGS for NLM-14 & NLM PTP Link

Note: The below mentioned latitude/ longitude for existing and new WHPs are indicative (Refer bid document elsewhere)

Location	Lat	Long	Distance in Km	Type of link envisaged
For PTP Link				
Neelam	18°42' 36.6912" N	72º 20' 19.23460" E	**0.00**	
NLM-14	18°47'17.4700"N	72°16'30.1821"E	**9.00**	PTP 1 from Neelam

- Finalization of location of antenna poles at Remote station for proper LOS direction with master station for fixing of Radio with antenna, lightening arrestor, if required and surge protection, cabling etc.
- RF, PoE (Power over Ethernet), Encryption device and LAN and Power Cables routing shall be evaluated.

- Finalization of location for indoor equipment.
- Finalization of system design, network diagram, mounting arrangement etc. for antenna and Radio system.
- Radio system shall include router to route data to voice network as well as to Data Network (RTU) including encryption.
- Submission of detailed link design and network diagram for the system to ONGC.

2.7.3.3.3 Supply, Installation, Integration & Commissioning

Design and system engineering shall meet the Functional Requirements mentioned in the bid. Link design shall be made using reliable, uninterrupted, field-proven, bandwidth efficient, carrier-class Broadband Wireless Access (BWA) System, suitable for harsh marine environment, to cater VoIP & IP data (SCADA) communication facility (suitable for round- the- clock continuous operation) between RJP and WHPs. The Radio shall be integrated in such a way for supporting Network Management System for configuration, control, monitor and maintenance. Wireless network deployments over water shall be designed to overcome propagation challenges that can affect radio link reliability. The nature of the terrain, including fluctuating water levels and its reflections, coupled with changing meteorological conditions such as high humidity, temperature and barometric pressure can severely attenuate the radio signal. Following is the scope of work:

- Supply of miscellaneous items as mentioned elsewhere to meet the end-to-end functionalities.
- Supply, Installation & Commissioning of remote radio system with all mounting accessories, Switch, Data interface converters, integration with NMS Hardware, software and all required accessories and integration with the existing SCADA Server/ EPABX/ RTU/ Radios.
- Data cables armoured (STP Cat-5e or Cat-6 or OFC) and connectors at WHPs. Cable(s) shall be routed and laid through cable tray, MCT, false roof/ floor, wherever required.
- Power supply available at wellhead platforms is 24/ 48 VDC or specified in Electrical scope of work. The required converters shall be provided.
- For integration of data & voice circuits accessories like LAN cable (Cat-6 or OFC), RJ-45 connectors & patch cords, RJ-45 I/O boxes, RJ-11 connectors, telephone cables, Rossette boxes etc. shall be required wherever necessary.
- Earthing of radio equipment and antennae at all required locations.
- Supply of surge suppressors at all required locations.

- Software licenses for all the software supplied, if any.
- Any other items (hardware, software or license) including tools etc. required to make system fully operational and to complete the project in all respects shall be in the scope of the contractor.
- Any other installation & commissioning activities to complete the project in all respects not covered above shall be included.
- **NMS System:** The Radio system shall consist of a Network Management System with perpetual licenses for configuration, control, monitor & maintenance including addition of Radios/ Sites.

2.7.3.4 SELF SUPPORTING MICROWAVE TOWER

2.7.3.4.1 General

1. Standard heavy duty self-supporting, four legged, angular communication tower of **25M** height shall be erected at **RJP** platform. Exact location and height will be finalized during detail engineering stage based on relevant inputs of structure and other disciplines. While designing tower, all the requisite details e.g. clear Line-of-Site, helicopter movement safety, tower foundation support, installation of radio, antennae, cable tray, safety climbing ladder and its orientation etc. The pre-engineering site survey inputs, if any, shall also be considered while designing towers.
2. The tower shall be designed with following considerations:
   i) Designed for medium to heavy loads for meeting Microwave backbone networks and capable to mount **04 Nos. of 1.8 M solid parabolic antenna along with radio ODUs and accessories**. Antenna supply is not under present scope.
   ii) Modular Design and less number of Parts
   iii) Bolted construction with angle
   iv) Hot dipped galvanized
   v) High tensile steel and lower Weights
   vi) Less base width and lower foundation forces
   vii) Easy for installation
   viii) Combined climbing and inclined cable ladder
   ix) Work Platforms
   x) Follow standard safety & accessories
   xi) Towers design, material, painting, aviation lights, etc. shall be as per the relevant industry standards or bid provisions, whichever is stringent.

2.7.4 IT AND NETWORK SYSTEMS

The following **LAN/ WAN Infrastructure** shall be provided at RJP and associated wellhead platforms as below:

A. 24 Port L2 Switch (at RJP)

B. 24 Port L3 Switch (at RJP)

C. 8 Port Router (at RJP)

D. Industrial Standard 16 Port Switches for conventional wellhead platforms.

E. 19”; 42U, Built-in Air-Conditioned Rack

F. OFC Cables/ Copper Cables

2.7.4.1 LAN/ WAN Infrastructure

a) Contractor’s scope includes design, engineering, documentation, supply, installation, testing & commissioning of LAN/ WAN Infrastructure for each wellhead platform under scope, and integration of LAN/ WAN network of LAN infrastructure from RJP to MOPU.

b) The scope includes providing LAN network with 02 Nos. 24 port layer-2 network switch at each of the platform under scope. Each office/ operational room shall be provided with LAN connection using armoured Cat-6a Ethernet cable. The LAN network/ switch shall have 100% excess capacity for future use. Any hardware, cabling, accessories, wall sockets etc. to complete the setup with full functionalities and integration of individual platform LAN network with ONGC main WAN shall be in the present scope.

c) Scope of integration of the new IT/ Network systems with the existing IT/ Network systems is under the present scope. Any additional equipment/ accessory/ cables required for meeting the scope of work and functional requirement shall also be in the present scope.

2.7.5 SCADA SYSTEMS

2.7.5.1 Supervisory Control & Data Acquisition (SCADA)

a) For all SMART Well Head Platforms, OPC enabled system shall be provided in HMIs at **RJP** for communication with existing ABB make SCADA system.

b) Communication shall be preferably Ethernet based and not on "proprietary" protocols. HMI/ MTU at RJP shall be **OPC enabled** (OPC UA is to be used for integration of smart platform data with SCADA at Heera- Digital data point should be provided with Boolean Datatype.

ABB SCADA Software supports digital data of Datatype "Boolean". However, the PLC HMI/Server should support OPC DA protocol as well) for data transfer and connectivity to DCS/ SCADA. If PLC communicates on proprietary protocols, then "in built" OPC enabling is mandatory for that system. (PLC shall be OPC enabled for reading **writing** *(Single point of control is to be implemented for security reasons.*

Control action shall be initiated by Ratna Users through PLC HMI only.

So the feature of writing from SCADA through OPC UA protocol is not required. SCADA will be only reading process data from PLC HMI/Server System through OPC UA protocol.) into it from DCS/ SCADA, with secure communication). Integration & configuration of PLC process tags, development of graphics with ABB make SCADA system shall be in the scope of contractor.

c) Contractor's scope shall include:
(i) Firewall protection between DCS to third party SCADA system and between SCADA to ONGC main LAN.

(ii) Necessary software/s, tags etc. with required number of Read-Write licenses.

d) Integration & configuration of all process tags of R-12A & R-series 5 WHPs (viz. R-7A, R-9A, R-10A, R-12B and R-13A) and all well heads including RJP under proposed ADR-1 platform with main control systems/ DCS/ SCADA including obtaining necessary support from third party OEM/ vendors as may be necessary.

2.7.5.2 Introduction to Upgraded SCADA System (for conventional wellhead platforms NLM-14)

M/s. ABB make Enterprise Production SCADA System was in operation and recently its Operating system, SCADA application Version and IT Hardware has been upgraded by ONGC. The SCADA software is upgraded to ABB SCADAvantage 5.6.5. ABB AC800F RTU Firmware has also been upgraded to the latest version.

A Two-tier system architecture has been implemented with Tier-1 locations at different offshore Process Complexes, Tier-2 location at New Delhi. At Offshore Tier-1 locations, SCADA Servers are installed in High Availability mode and acquire data from local DCS through OPC Server. SCADA Servers at Tier-1 locations transfer data in real time and replicate data for closing data gaps, if any with SCADA Infrastructure at Tier-2 location. Data from Tier-2 is available for end users across the organization through Web Server. A Disaster Recovery Centre (DRC) is also established at Vadodara in case the Main Tier-2 at Delhi goes down due to any Natural Calamity or Disaster.

The salient technical features of the installed SCADA System are as follows:

- ABB SCADAvantage Software 5.6.5 version at Tier-1 and Tier-2 with Central Licensing policy.
- Common Tag license for T1, T2 and DR locations.

- OSI Soft PI Historian platform at Tier-2 which acts as Corporate OT Historian and is also integrated with SAP and DR.
- Production data from all T1 locations across the organization is pushed into SAP every day at specific time for Production Revenue Allocation.
- All SCADA systems are timed with GPS based Time Server located at SCOPE MINAR, Delhi.
- IP Whitelisting in SCADA application to restrict access to SCADA database.
- DATA Quality validation at source.
- Webserver at Tier-2 for accessing SCADA Graphics with 150 Licenses each for VMWare Horizon client and MS Windows CAL.
- Tag Licenses are to be taken for the total number of tags including derived tags as per the requirement. All the tags configured in Tier-1 SCADA must be replicated in Tier-2 SCADA.
- RTU Specifications:

  1. RTU should support protocols like OPC, IEC 60870-5-104 (IEC 104), IEC 60870-5-101 (IEC 101), etc. for communication with SCADA Servers.
  2. RTU controller should be latest available from OEM.
  3. RTU should be equipped with 25 % extra I/O hardware for future expansion. Corresponding extra I/O tag licenses should also be provided with Engineering Station.
  4. Redundant controller setup should be provided.
  5. RTU should be equipped with Local Display Unit. Configuration of LDU should be in the contractor's scope.

2.7.6 SECURITY AND SURVEILLANCE SYSTEMS

2.7.6.1 Functional Requirements of the CCTV System

- The CCTV system shall be installed at RJP, Neelam and associated wellhead platforms under scope (2 nos. smart WHP of Ratna and 1 No. conventional WHP of Neelam) for the Day and Night surveillance of the operational areas. The strategic locations shall be platform entry/ exit points i.e. Boat Landing and Helicopter Landing/ Take-off areas at Helideck. The offered CCTV system shall be compliant with Zone-1 Hazardous location
- CCTV cameras shall work even at zero lux using Infrared illuminators. The recording system shall be far away at central location RJP, Neelam process complex and in future at MOPU. The data will be transmitted to central location through Radio system/ fiber connectivity.

- The CCTV system offered shall be suitable for installation and satisfactory operation under extremely saline atmosphere, humid and harsh marine environment e.g. splashing of sea water on and around Camera conforming to applicable standards. Accordingly, all protections, covers, mounting structures, junction boxes, cables, cable clamps etc. need to be of appropriate material and designed for such applications and durable for the operating life. The equipment located in hazardous area shall be suitable for class I, Div. I, Group C, D / zone-1 area classification. Explosive gas atmosphere is likely to occur in normal operation or can be expected to be present frequently.
- The CCTV system shall comprise of, but not limited to, following equipment, components and accessories, etc. to perform required surveillance operations:
  - IP based Explosion proof fixed Camera with SS 316L housing unit having appropriate environmental protection and supports.
  - Day/ Night or Low light IP based Video Cameras capable to work outdoors in both day and night light conditions with appropriate environmental protection and supports.
  - Infrared illuminator shall be used for night detection. Infrared illuminator shall be part of camera housing or may be a separate unit.
- 02 numbers of fixed cameras shall be installed at each well head platform (viz.R-12-6A, VGN-A and NLM-14). configured for intrusion detection at boat landing.
- Total 03 numbers of fixed cameras shall be installed at RJP at the locations to be decided later as per the platform layout.
- All the CCTV cameras shall be equipped with Varifocal lens for coverage distance of 5 – 20 M approx. with viewing angle of approx. 40 – 80 deg.
- All the cameras shall be equipped with local storage with adequate capacity for recording video and events for a continuous period of 15 days in 1080p (full HD) and 25 FPS format. The camera shall have features for selective retrieval of the stored content.
- All the cameras installed at RJP and all the well head platforms shall be equipped with edge-based analytics for motion/ object detection. The cameras installed at the boat landings **shall be configured with intrusion detection.**
- Video Management Servers shall be installed at RJP and Neelam (NPC/ NLG). Recording of the video streams from the cameras installed at R-12-6A and VGN-A shall be stored in the server installed at RJP. For the cameras installed at NLM-14, the video streams should be recorded in the server located at Neelam· All the servers along with video storage arrays shall be provided with n+1 redundancy having auto and manual failover functionality. Adequate storage capacity in RAID 5 configurations shall be provisioned for 180 days of video recording of all the associated cameras conforming to video resolution of 1080p (full HD) and 25 FPS. All the necessary hardware, software, licenses for video analytics, monitoring,

management, management, control, recording required for proper functioning of the solution shall be provided.

- Workstation along with 32" display for monitoring/ play back of camera video streams shall be provided at RJP, Neelam and all the Smart WHPs (R-12-6A and VGN-A). Necessary software and licenses shall be included in the workstation.
- Any alarm or event/ live view from wellhead platforms will reach central location through IP Radio systems/ fiber connectivity. The integration with existing/ proposed data and communication systems is part of scope.
- All Software and Software licenses necessary for operation, monitoring & diagnosis of the CCTV System shall be provided under present scope.
- All equipment at conventional wellhead platforms shall work on 24 VDC. Whereas 230 Volt, 50/ 60 Hz AC Power will be made available at single place for the CCTV system at RJP, Neelam and smart platforms. The required power converters, if required, shall be provided under present scope.
- Equipment, in general, work on solar power at wellhead platforms. Hence the components chosen shall be power efficient.
- Total required power and bandwidth calculation for complete CCTV system at each platform shall be submitted for review and approval by contractor.
- Camera mounting structures, support hooks for ladders, if necessary, mounting brackets, accessories, FRLS Cat-6 Cables/ OFC, 8 port switch, FRLS Power and control cables, patch chords, switches, router, media converters, cable trays, clamps, connectors, ex-proof junction boxes, ex-proof power distribution boxes etc. shall be provided as per site requirements.
- The CCTV system monitoring and control Software shall have following features as minimum:
    - Password protection.
    - Display multiplexing pictures.
    - Alarm display on monitors
    - Selection of cameras to monitors.
    - Viewing/ sequencing options of cameras in multiple combinations.
    - Full Screen display.
    - Programming/ defining camera titles for easy and quick identification.
    - Simultaneous recording and play back.
    - Start and stop of recording, recording modes viz. continuous/ event based
    - Selection of Frame Rates for each Camera.
    - Integration with existing Ethernet LAN/ WAN.

- Provision of fetching CCTV events on USB drives, Disk Drives etc. from camera or local recording in workstation/ server. The recording shall be in the popular video formats so that it can be played back using Windows Media Player.

- The offered Cameras, software etc. shall be from single vendor/ packager.
- Any other item/ equipment not mentioned here but considered essential for safe and reliable operation of the CCTV system shall be provided.

2.7.6.2 Setup of CCTV System

1) 2 Nos. ex-proof IP based fixed CCTV Cameras with intrusion detection video analytics feature shall be installed at each associated wellhead platform under scope and 3 Nos. ex-proof IP based fixed cameras at RJP. CCTV system shall include the requisite licenses capable of handling minimum 20 cameras so that additional cameras can be added in future to the system without adding/ changing Central System hardware & software of CCTV System.
2) CCTV System shall be provided with n+1 redundancy for the Video Management/Analytics servers.
3) Monitoring Workstations at RJP, Neelam and Smart Platforms shall have required Cameras Display in the Monitor as **Workstations** with necessary accessories. All the required Software and Hardware for monitoring, recording, play back, management of cameras shall also be provided.
4) **Servers** shall be provided at RJP and Neelam. The video streams and alarms from R-12-6A and VGN-A shall be made available on the central location at RJP and in future at MOPU through OFC. The video streams and alarms from NLM-14 shall be made available on the server located at Neelam. Controls of Play back of Video, Selection of 16 Cameras at a time for viewing shall also be available with required Software & Hardware at these locations. Any hardware, software and accessories required for the same shall be in Contractor's scope.
5) The system shall have its own LAN and separate IP scheme.
6) In case of power restoration after tripping, all the system components shall automatically boot itself and work normally without manual intervention at both remote and central location.
7) All CCTV Cameras shall have Ex-Proof housings to operate at hazardous offshore oil/ gas platforms and shall be supplied with required mounting structure as per the site requirement.
8) All junction boxes shall be explosion proof.
9) Schematic/ CCTV network diagram shall be submitted conforming to the bid requirement. The contractor shall submit storage capacity calculations certified by OEM of the proposed CCTV camera system.

10) Space is a major constraint at offshore platforms. Rack shall be of superior quality, elegant look and compact. Exact dimensions of the rack for keeping the equipment shall be finalized during detail engineering.

11) The Warranty period of the CCTV System shall be 12 months. The contractor shall be fully responsible for the CCTV system with respect to the proper design, quality workmanship and operation of the system for a period of 12 months from the date of taking over/ issue of completion certificate of the CCTV system by ONGC. The defects surfaced at any stage are to be corrected without undue delay. In case malfunction is revealed during operation, even after taking over and within the warranty period, Contractor shall modify and/ or replace the same at free of cost.

12) **Approvals and clearances:** It shall be the responsibility of the Contractor to obtain prior approval of ONGC for all engineering and installation drawings, design documents based on site survey, specifically for existing platforms under scope, details of required pre-commissioning tests and commissioning procedures of CCTV system.

2.7.6.3 BOM for CCTV System

Sl. No.	Description	Qty	Remarks
1.	Edge analytics based (for motion/intrusion detection), Zone-1 Varifocal CCTV Camera System	09	02 each at R-12-6A, VGN-A and NLM-14 and 03 Nos. at RJP
2.	Workstation with 32” display	04	1 each at R-12-6A, VGN-A, NPC/ NLG and RJP
3.	Video Management and Recording Server	02	At RJP and Neelam

2.7.7 SUMMARY OF QUANTITIES

The summary of quantities of communication systems is tabulated as below:

a) 24 (12+12) Core Fiber optic cable/ Submarine Composite:

SNo.	Material Description	Qty. (Nos.)	Remarks

1.	24 (12+12) Core Fiber optic cable between R-12-6A to RJP	01	Submarine Composite along with associated termination panel, LIU, all required accessories etc. to meet the functional requirements of Voice & data communication System
2.	24 (12+12) Core Fiber optic cable between VGN-A to RJP	01	
3.	24 (12+12) Core Fiber optic cable between existing R10A to RJP	01	
4.	24 (12+12) Core Fiber optic cable between RJP to future MOPU	01	

Note: Details of existing and proposed communication facility is given at Instrumentation Scope of work Clause 2.5A.13.

b) NLM-14 to NPC/NLG(PTP):

1.	License free (5 GHz) Microwave MW Radio (PTP) with Power Injector & Surge Protector	02	01 at NLM-14 01 at NPC/NLG
2.	Marine Grade License Free Directional Antenna (0.9 mtr) with GPS, MIMO Antenna	02	01 at NLM-14 01 at Neelam
3.	5 mtrs self-support Hot dip galvanized Pole.	02	01 each at NLM-14 and 01 at NPC/NLG
4.	Communication Equipment Rack (19") (Min 9 U) with 8 port PDU,	01	at NLM-14

2.7.8 Maintenance Materials/ Measuring instruments required

SNo.	Material Description	Qty.
1.	**Digital Multimeter:** Intrinsically safe for field usage with voltage range 0.1 mV to 1000V, current 10 A. IP rating shall be IP 67 or better.	02
2.	**Clamp-on Meters**: Non-contact, True RMS, AC/ DC with accuracy of 2% ± 5 Digits.	02
3.	FOC measurement **Power meter** with suitable connectors, patch chords cables, ready to measure	01
4.	**Splicing** Kit with sufficient no sleeves and connectors, patch chords cable	02
5.	Portable **OTDR** with connectors/ patch chords cable, ready to measure	01

2.7.9 Other General Terms & Conditions

2.7.9.1 Telecommunication system Earthing

Three separate earthing systems shall be provided:

1. **Electrical Safety Earth -** Bonded to the site structure and utilized for electrical safety of metal enclosures and chassis on all instruments and electrical components
2. **Clean Earth -** Insulated from the site structure and other metal work utilized for cable screens and bonded to the main electrical earthing system at a single point.
3. **Intrinsically Safe Earth -** Insulated from the site structure and other metal work, utilized for termination of IS earth connections and bonded to the main electrical ear thing system at a single point.

2.7.9.2 RFI/ EMI compatibility

The telecommunications systems shall meet all applicable RFI emission standards and not cause RFI interference to ONGC equipment, nor pose any danger to operating or maintenance personnel.

The telecommunications systems shall be suitable for use in the high electromagnetic noise environment encountered on offshore installations and as a minimum comply with the relevant EMC immunity and emission requirements.

Where existing EMC standards are not applicable the supplied telecommunications equipment shall comply with the requirements of the appropriate IEC-61000 immunity and emission standards, or other internationally recognized EMC standards applicable to the system.

2.7.9.3 Radio Frequency Non-Ionizing Radiation

Where telecommunications systems have the potential to create a radio frequency non-ionizing radiation hazard, the supplied equipment shall, when correctly installed and maintained, not pose any danger to the installation or the people working on the installation.

Where telecommunications equipment may, under normal operating conditions, cause a radio frequency non-ionizing radiation hazard to maintenance personnel, the system documentation and maintenance procedures shall clearly explain the hazard and identify any lock-out requirements. The hazard shall also be clearly indicated by barriers and high visibility radio frequency radiation hazard signage.

2.7.9.4 Surge & Lightning Protection

In the case of solid state or other devices which are prone to the effects of voltage surge, the devices shall be provided with protection devices.

The power supply equipment shall incorporate all necessary devices for protection of the equipment against the effects of voltage surges on the power supply line due to lightning, switching transients or other causes.

All antenna feeder cables shall be supplied with appropriate lightning surge protection.

2.7.9.5 General Requirements

1. The selection of the MOC for field instruments used for SCADA shall be as per the Instrumentation Design Criteria and the relevant Functional Specifications enclosed in the bid document.
2. It shall be Contractor's responsibility to get the support of respective OEMs of existing systems for any modification/ up-gradation/ expansion required for total completion of work as mentioned in Bid Package.
3. Contractor shall be responsible for the smooth operation of new systems as well as the operation of the existing systems which have been modified to take care of the scope of this project. The Contractor shall ensure that the normal operation of the existing systems on the platform is not hampered during and after all modification jobs have been carried out. After successful commissioning of new systems, the same shall be integrated with existing systems.
4. I/O cards, MCTs, Isolators, terminations, Tag Blocks etc. required for integration of the new parameters for the modification jobs at the well head platforms with the RTU/ SCADA/ PLC shall be provided by the contractor. All components of RTU/ SCADA/ PLC shall be of the same make and model of the existing system at the respective platforms.
5. Verification and testing of data from SCADA system at Tier-1 (Corresponding SCADA System of process platform) from RTU and also from RTU and filed instrumentation in presence of ONGC engineer

2.7.9.6 Inspection, Testing & Acceptance

The material offered shall be suitable for Marine environment. All outside cables shall be FRLS, Armored. The required test data sheets, certification from manufacturer/ supplier must be enclosed along with dispatch note. The contractor shall also give an undertaking that material supplied shall be suitable for marine offshore environment and suitable for oil & gas applications and ready to replace any equipment found not suitable for marine offshore/ oil & gas environment in future during contract (including AMC) period. Based on above certifications material clearance will be given for delivery to offshore location by the contractor. It shall be

contractor's responsibility to replace any equipment/ system component if found any item not meeting the requirement during entire contract period.

2.7.9.7 Physical inspection of material at site

Contractor's representative, in the presence of ONGC representative, shall physically verify the correct inventory of hardware/ software/ documentation at site, as specified in the contract and its physical condition on receipt

2.7.9.8 Site Acceptance Test (SAT)

On the basis of standard tests recommended by OEM, Contractor shall submit the SAT Plan covering installation testing of functionality, interface, integration & performance commissioning and acceptance procedure.

After commissioning, contractor shall carry out SAT in presence of ONGC engineer from the platform or base for proving the functionality and satisfactory performance of the system as per the specification for Radio, SCADA system, Security System and FOC. Contractor shall test full functionality systematically for all hardware and software as a total integrated system and demonstrate the same to ONGC. After the successful demonstration, a 72 Hrs. continuous run of the WHPs remote radio, RTUs and FOC communication shall be performed.

Failure to pass the tests shall result in contractor rectifying the faults at his expense and fresh tests shall be carried out. Contractor shall arrange all required test & measuring equipment for field acceptance testing.

2.7.9.9 Documentation

Contractor shall prepare detailed commissioning document containing Equipment installed, test report of performance parameters measured during site acceptance test, link design, network diagram etc.

2.7.9.10 Abbreviations and Acronyms

Term	Definition
IEC	International Electro Technical Commission
PTP	Point to Multipoint Radio
IP	Internet Protocol
ISO	International Organization for Standardization
ITU	International Telecommunications Union
LAN	Local Area Network

LDU/ LPD	Local Display Unit
PMP	Pont to Multipoint Radio
RTU	Remote Telemetry Unit
PLC	Programmable Logic Control
AIS	Automatic Identification System
API	American Petroleum Institute
SCADA	Supervisory Control and Data Acquisition
IMO	International Maritime Organization
LAN	Local Area Network
MTTR	Mean Time to Restore/ Repair
MTBF	Mean Time Between Failure
POE	Power Over Ethernet
RTU	Remote Telemetry System
RFI	Radio Frequency Interference
FOC	Fiber Optical Cable
FOPP	Fiber Optic Patch Panel
SFP	Small Form-Factor Pluggable
L3 switch	Layer 3 Switch
L2 switch	Layer 2 Switch
STP	Shielded Twisted Pair (Ethernet Cable)
EPABX	Electronic Private Branch Exchange
WPC	Wireless Programming and Coordination Wing
SACFA	Standing Advisory Committee on Radio Frequency Allocation
HH	Hand Held
VHF-FM	Marine VHF
HH VHF-FM	Hand Held Walkie-talkies
MCT	Multi Cable Transit System
NMS	Network Management System
FRLS	Flame Retardant Low Smoke Cable
VSWR	Voltage Standing Wave Ratio

ANNEXURE
TO
SECTION-4A

SUBMARINE PIPELINES AND RISERS
(RIGID PIPELINE)

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Prepared By	Reviewed By	Approved By	Remarks	No. of Pages	Date	Rev.

TABLE 4.1A
ENVIRONMENTAL PARAMETERS

A.0 The following represents the minimum requirements for the stability of proposed submarine pipelines and risers (Field-wise)

A.1 Heera and Ratna Fields

A.1.1 Submarine Pipeline (Heera and Ratna)

		During Installation	**During Operation**
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	6.61 m	9.14 m
c)	Significant Wave Period	10.3 Sec.	12.3 Sec.
d)	Wave direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud line (Tidal + Wind drift)	0.45 m/sec	0.45 m/sec
f)	Current Direction	Perpendicular to Pipeline	Perpendicular to Pipeline
g)	Force Coefficients:		
	i) Drag Coefficient	0.75	0.75
	ii) Lift coefficient	0.75	0.75
	iii)Inertia co-efficient	3.29	3.29
h)	Bottom Friction coefficient		
	i) For thermal analysis	0.5	0.5
	ii) For lateral Stability	0.5	*Based on Soil data as per pre-engg. Survey Report restricted to 0.7
	*In case, the value of Bottom Friction Coefficient as per pre-Engg. Survey exceeds 0.7; same shall be restricted to 0.7 for On-Bottom Stability Design.		
i)	Astronomical Tide	3.66 m	4.0 m
j)	Storm Surge	0.61 m	1.3 m
k)	Water depth (Chart datum)		
	For stress calculation & stability	Min. along route	Min. along route + storm Surge
	For checking of pipe buckling	Max. along route + max. tide + storm surge + crest	Max. along route + max. tide + storm surge + crest
l)	Sea water density (Kg/m^3)	1030	1030

A.1.2 Riser (Heera and Ratna)

A.	**Environmental Parameters:**		
		During Installation	**During Operation**
a)	Max. wave height	11.58 m	17.7 m
b)	Max. wave period	11.0 sec	14.3 sec.
c)	Astronomical tide	3.66 m	4.0 m
d)	Storm tide/total tide	0.61 m/4.27 m	1.3 m/5.3 m
e)	Current velocity		
	i) Bottom (mud line)	0.45 m/sec	0.45 m/sec
	ii) 1/4 depth	0.878 m/sec	0.94 m/sec
	iii) 1/2 depth	1.049 m/sec	1.16 m/sec
	iv) 3/4 depth	1.22 m/sec	1.37 m/sec
	v) Surface	1.387 m/sec	1.60 m/sec
B.	The risers shall be designed for operational condition considering the following marine growth:		
-	from mud line to 30 m below chart datum	50 mm (on radius)	
-	from 30 m below chart datum to EL. (-) 2.0 M CD	100 mm (on radius)	
-	from EL. (-) 2.0 M CD to EL. (+) 6.0 M CD	150 mm (on radius)	
	The marine growth density shall be taken as 1400 kg/m³		
C.	The riser shall be provided with splash zone external corrosion allowance in addition to Monel wrap. This allowance shall be as per Table 4.2A enclosed.		
D.	The splash zone for the riser is defined as zone between elevation (-) 2.0 m and up to the bottom of hanger clamp, or (+) 6.0 m elevation w.r.t CD, whichever is higher.		
E.	Internal corrosion allowance in wall thickness for steel pipeline and risers shall be as per Table 4.2A enclosed.		
F.	**Other Parameters**		
	Force Coefficients	During Installation	During Operation
	Drag Coefficient, CD	0.6	0.6
	Inertia Coefficient, CM	2.0	2.0
G.	**Sea Water Temperature**		
	Minimum	22.8 °C	
	Maximum	30.0 °C	
H.	**Air Temperature**		
	Minimum	16 °C	
	Maximum	40 °C	

A.2 Neelam Field

A.2.1 Submarine Pipeline (Neelam)

		During Installation	During Operation
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	7.2 m	9.7 m
c)	Significant Wave Period	10.16 Sec.	10.69 Sec.
d)	Wave Direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud Line (Tidal + Wind Drift)	0.44 m/s	0.44 m/s
f)	Current Direction	Perpendicular to Pipeline	Perpendicular to Pipeline
g)	Force Coefficients:		
	i) Drag Coefficient	0.75	0.75
	ii) Lift Coefficient	0.75	0.75
	iii)Inertia Coefficient	3.29	3.29
h)	Bottom Friction Coefficient		
	i) For Thermal Analysis	0.5	0.5
	ii) For Lateral Stability	0.5	*Based on Soil data as per pre-Engg. Survey Report
	*In case, the value of Bottom Friction Coefficient as per pre-Engg. Survey exceeds 0.7; same shall be restricted to 0.7 for On-Bottom Stability Design.		
i)	Astronomical Tide	3.66 m	4.6 m
j)	Storm Surge	0.61 m	1.23 m
k)	Water Depth (Chart Datum)		
	For stress calculation & stability	Min. along route	Min. along route + Storm Surge
	For checking of pipe buckling	Max. along route + max. tide + storm surge + crest	Max. along route + max. tide + storm surge + crest
l)	Sea water density (Kg/m^3)	1030	1030

A.2.2 Riser (Neelam)

A.	**Environmental Parameters:**		
a)	Max. Wave Height	11.58 m	18.0 m
b)	Max. Wave Period	11.0 sec	14.4 sec
c)	Astronomical Tide	3.66 m	4.6 m
d)	Storm Tide/Total Tide	0.61 m / 4.27 m	1.23 m / 5.83 m
e)	Current Velocity		
	i) Bottom (mud line)	0.44 m/sec	0.44 m/sec
	ii) 3/4 depth	0.77 m/sec	0.90 m/sec
	iii) 1/2 depth	0.92 m/sec	1.12 m/sec
	iv) 1/4 depth	1.1 m/sec	1.31 m/sec
	v) Surface	1.25 m/sec	1.55 m/sec
B.	The risers shall be designed for operational condition considering the following marine growth:		
-	from mud line to EL. (-) 30 m CD	50 mm (on radius)	
-	from EL. (-) 30 m CD to EL.(-) 2.0 m CD	100 mm (on radius)	
-	from EL. (-) 2.0 m CD to EL.(+) 6.0 m CD	150 mm (on radius)	
	The marine growth density shall be taken as 1400 kg/m³		
C.	The riser shall be provided with splash zone external corrosion allowance in addition to Monel wrap. This allowance shall be as per Table 4.2A enclosed.		
D.	The splash zone for the riser is defined as zone between elevation (-) 2.0 m and up to the bottom of hanger clamp, or (+) 6.0 m elevation w.r.t. CD, whichever is higher.		
E.	Internal corrosion allowance in wall thickness for steel pipeline and risers shall be as per Table 4.2A enclosed.		
F.	**Other Parameters:**		
	Force Coefficients	During Installation	During Operation
	Drag Coefficient, CD	0.6	0.6
	Inertia Coefficient, CM	2.0	2.0
G.	**Sea Water Temperature**		
	Minimum	22.8 °C	
	Maximum	30.0 °C	
H.	**Air Temperature**		
	Minimum	16 °C	
	Maximum	40 °C	

TABLE 4.2A
SUBMARINE PIPELINE DESIGNATION TABLE

PART A: PIPELINE SEGMENTS UNDER ADR-1

Sl. No.	Segment No.	1	2
1	Originating platform	R-12-6A (New)	VGN-A (New)
2	Terminating Platform	RJP (New)	RJP (New)
3	Approximate Pipeline length (km)	16.6	4.9
4	Pipeline OD (mm)	273.1	168.3
5	Pipeline OD (inch)	$10\ ^{3}/_{4}$	$6\ ^{5}/_{8}$
6	Material Specification		
a	Pipeline/Riser	C.S.NACE	C.S.NACE
7	Pipeline/Riser Grade	X-60	X-60
8	Wall thickness (mm), including corrosion allowance		
a	Pipeline	12.7	11.0
b	Riser (including Riser bend, splash zone and Zone 2 pipe)	20.6	18.3
9	Corrosion Allowance (mm)		
a	Pipeline/Riser /Zone-2 Pipe (Internal)	6	6
b	Riser Splash Zone (External)	6	6
10	Service	W.F.	W.F.
11	Design Pressure (kg/cm^2)	As per Process Design Basis	
12	Design Temperature (°C)	As per Process Design Basis	
13	Offshore hydro test pressure (kg/cm^2)	1.25 times the Design Pressure	
14	Design Life	25 Years	
15	External Anti-Corrosion Coating		
a	Material	As per Specification No. 2012A Rev 1	
b	Density	900 kg/ m^3	
c	Thickness (mm)	3	2.5
16	Internal Anti-Corrosion Coating	Yes, FBE	No
17	Concrete Coating		
a	Material	As per Specification No. 2013 Rev 2	
b	Density	3044 kg/m^3	
c	Minimum Thickness (mm) – pipeline	40	50
d	Thickness (mm) – Riser	30	30

Sl. No.	Segment No.	1	2
18	Number of risers to be installed	2	2
a	Originating platform	1 (Internal)	1 (Internal)
b	Terminating Platform	1 (Internal)	1 (Internal)
19	P/L crossings (Nos.)	3	0
20	Pipeline Free Span (Nos.)	17	5
21	Trenching and Burial of pipelines	Not Required	
22	Approximate water depth w.r.t Chart Datum C.D (m)		
a	Originating Platform	*	*
b	Terminating Platform	*	*
23	ANSI Flange Rating		
a	Originating Platform	900#	900#
b	Terminating Platform	900#	900#
24	Platform Co-ordinates		
a	Originating Platform	R-12-6A	VGN-A
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
b	Terminating Platform	RJP	RJP
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
25	Riser Location (Platform Face)		
a	Originating Platform	East	East
b	Terminating Platform	West	West
26	Riser Protector to be provided on jacket face		
a	Originating Platform	No	No
b	Terminating Platform	No	No
27	Field	Ratna	

(*) Refer Structure Scope of Work for details

Sl. No.	Segment No.	3	4
1	Originating platform	R-13A	RJP (New)
2	Terminating Platform	RJP (New)	R-12A
3	Approximate Pipeline length (km)	17	17.7
4	Pipeline OD (mm)	168.3	273.1
5	Pipeline OD (inch)	6 5/8	10 3/4
6	Material Specification		
a	Pipeline/Riser	C.S.NACE	C.S.NACE
7	Pipeline/Riser Grade	X-60	X-60
8	Wall thickness (mm), including corrosion allowance		
a	Pipeline	11.0	15.9
b	Riser (including Riser bend, splash zone and Zone 2 pipe)	18.3	23.8
9	Corrosion Allowance (mm)		
a	Pipeline/Riser /Zone-2 Pipe (Internal)	6	6
b	Riser Splash Zone (External)	6	6
10	Service	W.F.	W.F.
11	Design Pressure (kg/cm^2)	As per Process Design Basis	
12	Design Temperature (°C)	As per Process Design Basis	
13	Offshore hydro test pressure (kg/cm^2)	1.25 times the Design Pressure	
14	Design Life	25 Years	
15	External Anti-Corrosion Coating		
a	Material	As per Specification No. 2012A Rev 1	
b	Density	900 kg/m^3	
c	Thickness (mm)	2.5	3
16	Internal Anti-Corrosion Coating	No	Yes, FBE
17	Concrete Coating		
a	Material	As per Specification No. 2013 Rev 2	
b	Density	3044 kg/m^3	
c	Minimum Thickness (mm) – pipeline	40	40
d	Thickness (mm) – Riser	30	30

Sl. No.	Segment No.	3	4
18	Number of risers to be installed	2	2
a	Originating platform	1 (External)	1 (Internal)
b	Terminating Platform	1 (Internal)	1 (External)
19	P/L crossings (Nos.)	3	6
20	Pipeline Free Span (Nos.)	17	18
21	Trenching and Burial of pipelines	Not Required	
22	Approximate water depth w.r.t Chart Datum C.D (m)		
a	Originating Platform	*	*
b	Terminating Platform	*	*
23	ANSI Flange Rating		
a	Originating Platform	N.A.	1500#
b	Terminating Platform	900#	N.A.
24	Platform Co-ordinates		
a	Originating Platform	R-13A	RJP
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
b	Terminating Platform	RJP	R-12A
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
25	Riser Location (Platform Face)		
a	Originating Platform	East	East
b	Terminating Platform	West	East
26	Riser Protector to be provided on jacket face		
a	Originating Platform	Yes	No
b	Terminating Platform	No	Yes
27	Field	Ratna	
(*) Refer Structure Scope of Work for details			

PART B: PIPELINE SEGMENTS UNDER NLM-14

Sl. No.	Segment No.	5	6
1	Originating platform	NLM-14 (New)	NLM-9
2	Terminating Platform	NLG	NLM-14 (New)
3	Approximate Pipeline length (km)	11.7	5.2
4	Pipeline OD (mm)	323.9	168.3
5	Pipeline OD (inch)	12 3/4	6 5/8
6	Material Specification		
a	Pipeline/Riser	C.S.NACE	C.S.NACE
7	Pipeline/Riser Grade	X-60	X-60
8	Wall thickness (mm), including corrosion allowance		
a	Pipeline	14.3	11.0
b	Riser (including Riser bend, splash zone and Zone 2 pipe)	20.6	18.3
9	Corrosion Allowance (mm)		
a	Pipeline/Riser /Zone-2 Pipe (Internal)	6	6
b	Riser Splash Zone (External)	6	6
10	Service	W.F.	G.L.
11	Design Pressure (kg/cm^2)	As per Process Design Basis	
12	Design Temperature (°C)	As per Process Design Basis	
13	Offshore hydro test pressure (kg/cm^2)	1.25 times the Design Pressure	
14	Design Life	25 Years	
15	External Anti-Corrosion Coating		
a	Material	As per Specification No. 2012A Rev 1	
b	Density	900 kg/ m3	
c	Thickness (mm)	3	2.5
16	Internal Anti-Corrosion Coating	Yes, FBE	No
17	Concrete Coating		
a	Material	As per Specification No. 2013 Rev 2	
b	Density	3044 kg/m3	
c	Minimum Thickness (mm) – pipeline	40	50
d	Thickness (mm) – Riser	30	30

Sl. No.	Segment No.	5	6
18	Number of risers to be installed	2	2
a	Originating platform	1 (Internal)	1 (External)
b	Terminating Platform	1 (External)	1 (Internal)
19	P/L crossings (Nos.)	9	0
20	Pipeline Free Span (Nos.)	12	5
21	Trenching and Burial of pipelines	Not Required	
22	Approximate water depth w.r.t Chart Datum C.D (m)		
a	Originating Platform	*	*
b	Terminating Platform	*	*
23	ANSI Flange Rating		
a	Originating Platform	#900	N.A.
b	Terminating Platform	N.A.	#900
24	Platform Co-ordinates		
a	Originating Platform	NLM-14	NLM-9
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
b	Terminating Platform	NLG	NLM-14
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
25	Riser Location (Platform Face)		
a	Originating Platform	East	West
b	Terminating Platform	West	East
26	Riser Protector to be provided on jacket face		
a	Originating Platform	No	Yes
b	Terminating Platform	No	No
27	Field	Neelam	
(*) Refer Structure Scope of Work for details			

Notes to Table 4.2A

1. LSTK Contractor's scope includes survey, design, engineering, procurement, transportation, fabrication, internal and external anti-corrosion & concrete weight coating, cathodic protection, installation, free span correction, crossing installation, sub-sea tie-ins / hook-ups, pigging, hydro-testing, pre-commissioning, and commissioning assistance.

2. The Pipeline lengths indicated in Table 4.2A are indicative only as per indicative route given in the field layout drawings. These shall be firmed up as per actual pipeline route survey during detailed engineering to be carried out by the contractor. While finalizing the pipeline route, very high levels of seabed undulations shall be avoided but keeping the pipeline alignment within the survey corridor. LSTK Contractor's scope for survey for all pipeline route corridors includes all route surveys (pre-engineering, pre-construction, post-installation surveys and CP survey). Tentative jacket face for risers is indicated in Table 4.2A. However, these riser locations at existing platforms shall be finalized after pre-engineering/ riser face survey of platform during detail engineering. Contractor shall carry out Spider Deck survey of each platform for existing riser locations and then finalize new riser location and respective pipeline route. The proposed riser location drawing and pipeline route survey corridor drawing shall be submitted to Company for review prior to start of the jacket face survey activities.

3. Line pipe material for pipelines and risers for all above well fluid pipelines/risers shall conform to relevant Function Specifications along with corresponding Addendums as indicated at Appendix B of this Annexure to Section 4A. Monogramming of the line pipes shall be done as per latest Edition of API 5L.

4. Pipeline and Riser wall thicknesses provided in Table 4.2A are firm for S-lay method and are inclusive of internal corrosion allowance and external corrosion allowance wherever applicable. Contractor shall, however, design and verify the wall thickness of pipelines and risers during detail engineering. If the Contractor during detail engineering proposes additional wall thickness for pipeline and riser on-account of lay-ability considerations (based on lay barge configurations), same shall be done without additional time and cost to the Company.

5. ID of Riser, riser splash zone and zone-2 pipe is to be kept same as ID for pipeline. Furthermore, ID of topside piping from minor barrel up to riser transition bend is to be kept as same as ID of pipeline riser system.

6. Risers shall be provided with Monel sheathing in splash zone in accordance with bid specifications.

7. Risers shall be preinstalled in case of all new platforms.

8. In case of existing platform's jackets, Risers shall be installed external to the jacket by stalk on method with Welded joints at riser base. However, external riser installation with flanged connection (Set of WNRTJ type flange of required pressure rating with corresponding swivel flange) to the pipeline at subsea is also acceptable where stalk-on riser installation is not feasible/possible due to overhang of top side deck/other safety considerations. Also, the flanged Tie-in spool for riser-pipeline connection shall be designed for Zone-II. Riser includes 12.20 meters horizontal length of Zone-2 pipe for stalk-on risers and tie-in spool length in case of flanged tie-in of riser with pipeline. Riser and pipeline connection with expansion spool, if any, at the riser end shall be considered in the Zone-II.

9. Riser protector as per the structural design criteria shall be provided in case the riser protector is not available at the proposed riser location. However, in case riser protector / boat landing exists on the

jacket face, where new riser is to be installed, removal & re-installation of riser protector/ boat landing along with strengthening complying with the Structural design criteria shall be in the scope of work of the Contractor.

10. Number/type of clamps and their locations for risers at existing platform shall be finalized/ designed during detail engineering on the basis of existing jacket geometrical configuration. Cost for providing these riser clamps and new structural members, wherever required, shall be included in the lump sum price of the turnkey contract. Further, there is no unit adjustment price for riser and riser clamps.

11. If riser clamps exist at new riser location on existing platform jacket, the same shall be removed as part of riser installation. Demolished/removed pipes and any other material shall be disposed of.

12. Number of crossings and free spans shall be firmed up on the basis of as-laid survey. Only grout filled bag supports shall be used for pipeline crossings and free span corrections.

13. Supply and application of field joint internal FBE coating in offshore by robotic arm method in order to maintain same ID of Pipeline at joints. Detailed specification and procedure for internal FBE coating of line pipes at yard including the procedure for internal coating of field girth weld joint at offshore with QA/ QC plans for this activity shall be developed by the successful bidder and shall be submitted to ONGC for review and approval.

14. Concrete coating thickness for pipelines mentioned in Table 4.2A is minimum only. Actual concrete thickness of pipelines shall be finalized during detail engineering.

15. All subsea flanges, fittings and Specialties shall be suitably coated with marine Epoxy coating and anti-fouling paint, suitable for long term sub-sea service. Contractor shall prepare and submit details of the coating and painting scheme suitable for the prevailing conditions for Company approval.

16. Pigging and Hydro-testing of submarine pipeline shall be carried out by the Contractor as per Company specification attached with the bid package. Pigging and hydrotesting of pipeline segments shall be done from pig barrel to pig barrel.

17. Contractor shall provide 04 Nos. of poly pigs as loose supply material to company for each pipeline segment.

18. All the pipeline segments shall be filled up with sea water dozed with corrosion inhibitor, bactericide and oxygen scavenger as per ONGC FS 2022.

19. Design life of the pipelines & risers shall be as mentioned in Table 4.2A.

20. Contractor shall firm up Table 4.2A during detail engineering and shall get the same approved by the company.

21. Contractor shall submit all drawings/layouts/as-built/Survey Report in WGS-84-UTM; Zone-42 System.

TABLE 4.3A
COMPOSITE CABLE DESIGNATION TABLE

Following Composite Cables shall be laid standalone along with installation of associated J-Tubes:

Sl.	Segments	Size (sq. mm)	Length (km)	J-tubes (12")
1	RJP to R-12-6A	240	16.6	2 (1 no. at each platform)
2	RJP to VGN-A	240	4.9	2 (1 no. at each platform)

Notes to Table 4.3A

1. Composite Cables are to be laid in route corridor of respective pipelines in Table 4.2A. Pre-engineering survey, pre-construction survey and post-construction survey of respective pipelines to also include required surveys for laying of composite cable. LSTK Contractor's scope also includes pre-engineering, pre-construction and post-construction jacket face survey for I/J tube for Composite Cable.

2. Length of Composite Cables shall be as per detailed engineering to be carried out by Contractor. Contractor to confirm the suitability of I/J-Tubes based on the Composite Cable size.

3. Scope includes engineering, procurement and installation of I/J-Tube for pulling of Composite Cable at platforms as per pre-engineering survey to be carried out by the Contractor. Further the drawing of I/J tube shall be vetted by Composite Cable Vendor.

4. Scope of LSTK Contractor includes carrying out lay analysis, laying of Composite Cable standalone on the seabed as per the route alignment firmed up during detailed engineering. Scope of work for the contractor also include installation of I/J-tubes for the Composite Cable on the respective host platforms. Pulling/installation of cable within the I/J-tube for all the platforms along with the hook up of termination is within the scope of the LSTK Contractor. Functional testing of Composite Cable shall be carried out by the Vendor(s) at their premises, which shall be witnessed by the Contractor of this tender before taking over by them as FOB. Refer Electrical and Instrumentation Scope of Work for further details.

APPENDIX 'A'
LIST OF DRAWINGS (REFER DRAWING VOLUME OF BID DOCUMENT)

Sl. No.	Document/Drawing Title	Doc. /Drawing No.	Rev No.
1	Ratna Field Layout	7126-OGEP-PL-3001	0
2	Neelam Field Layout	7126-OGEP-PL-3001	0
3	Clearance for Drilling Rig (Sheet 1 of 2)	PL-EP-DRC-008-1	0
4	Clearance for Drilling Rig (Sheet 2 of 2)	PL-EP-DRC-008-2	0

APPENDIX 'B'
LIST OF SPECIFICATIONS

Sl. No.	Functional Specification	Functional Specification Name	Rev. No.
1	FS 2011	Route Survey	Rev 2
2	FS 2012A	Corrosion Protection Coating (3LPP)	Rev 1
3	FS 2013	Concrete Weight Coating	Rev 2
4	FS 2014	Field Joint Coating	Rev 1
5	FS 2015	Installation Of Submarine Pipelines & Related Facilities	Rev 2
6	FS 2018	Long Radius Bends	Rev 0
7	FS 2020B	C.S. Seamless Line Pipe for Submarine Pipeline (Sour Service) along with Addendum and Addendum 2	Rev 5
8	FS 2022	Hydrostatic Testing of Submarine Pipeline	Rev 1
9	FS 2024B	Fittings And Flanges for Submarine Pipeline (Sour Service)	Rev 0

APPENDIX 'C'
JACKET DEFLECTIONS

Following jacket movements for existing well platforms from mud line to hanger clamps are to be considered:

Neelam Field

100 year storm				
	North/South	Mudline	:	125 mm
		Spider Deck	:	217 mm
	East/West	Mudline	:	61 mm
		Spider Deck	:	125 mm
1 year storm				
	North/South	Mudline	:	125 mm
		Spider Deck	:	217 mm
	East/West	Mudline	:	61 mm
		Spider Deck	:	125 mm

R10A Platform:

100 year storm	:	North/South	Mudline	:	400 mm
			Hanger Clamp	:	420 mm
		East/West	Mudline	:	154 mm
			Hanger Clamp	:	176 mm
1 year storm	:	North/South	Mudline	:	180 mm
			Hanger Clamp	:	200 mm
		East/West	Mudline	:	112 mm
			Hanger Clamp	:	127 mm

APPENDIX 'D'
WAVE EXCEEDENCE TABLE

Number of Waves Exceeding Specified Height in 1 Year:

Offshore Bombay Area:

WAVE HEIGHT (Ft.)	NUMBER OF WAVE EXCEEDANCES				
	S DIR	SW DIR	W DIR	NW DIR	ALL DIR
0	1276045	770535	1015713	1220511	4282804
5	61704	219347	220985	69788	571824
10	3132	37929	31902	3764	76727
15	167	5878	4073	177	10295
20	11	869	493	8	1381
25	0	126	59	0	185
30	-	18	7	-	25
35	2	1	-	-	3
40	-	0	-	0	-

PART-IV

SECTION-4A

SUBMARINE PIPELINES AND RISERS

(RIGID PIPELINE)

R.P. PUROHIT CE(C&M)	ROHIT PANT DGM(M)	SANJAY NARAIN DGM(C&M)	
R.K. GUPTA Dy.G.M.(C&M)	N.V.PAI Dy.G.M.(C&M)	B.P.MALIK Dy.G.M.(C&M)	K.P.VARGHESE Dy.G.M.(C&M)
PREPARED BY			
A.K.MISHRA Dy.G.M. (C&M)		D.R.KAMBLE GM (C&M)	
REVIEWED BY		APPROVED BY	
25	01.08.2016	5	
TOTAL NO. OF PAGES	DATE	REV.NO.	

SECTION-4A

SUBMARINE PIPELINES & RISERS
(RIGID PIPELINE SYSTEM)

CONTENTS

TABLES & APPENDICES
(PLACED AT ANNEXURE TO SECTION 4A)

4.1 GENERAL

4.1.1 Oil and Natural Gas Corporation Ltd. (ONGC) is planning for installation of a number of submarine pipelines.

Details/data of pipeline and riser system to be installed and platforms to be connected by these pipelines are given in field layout, Table 4.2 A (placed at Annexure to Section 4A) & other drawings including specifications.

This section includes the minimum requirements for the survey, design, engineering, material procurement, fabrication, transportation, installation, hook-up and testing/pre-commissioning of the submarine pipeline & risers covered within this Bid Package.

The final design of the pipeline & riser system shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR shall ensure that the final design of the pipeline system complies fully with the design criteria and operating philosophy as presented in this Bid Package.

The CONTRACTOR shall also be responsible for the supply of material, fabrication, transportation, installation, hook-up, testing/pre-commissioning and making the entire pipeline system as described herein operational to the extent that they fulfill the intent of the system.

Company shall accept either of or a combination of S-lay or Reel-lay methods for laying of pipelines on overall cost economics.

4.1.2 As used in this specification, the following definitions shall apply:

COMPANY : Oil and Natural Gas Corporation Ltd

CONTRACTOR : Turnkey Contractor for the Project

4.1.3 CONTRACTOR shall obtain COMPANY's written approval for any deviations from the requirement of the bid specifications. This document is not intended to be all-inclusive and the use of the guidelines set forth does not relieve the CONTRACTOR of his responsibility in performing the work for its intended service.

Design/installation requirements shall be in accordance with Table 4.1A and 4.2A, drawings and specifications listed at Appendix A & B (placed at Annexure to Section 4A).

4.2 **SCOPE**

4.2.1 **Requirements**

This section includes the minimum indicative requirements for the design, detailed engineering, material supply, inspection, coating & wrapping, expediting & transportation to site, fabrication, installation as per approved drawings/procedures and testing/pre-commissioning of the submarine pipeline & riser system covered within this bid package.

4.2.2 **Scope of Work**

The scope of work to be performed by the CONTRACTOR shall be but not limited to the following:-

a) Pre-engineering and pre-construction surveys:

Carrying out seabed survey along the proposed routes, collection/ interpretation of survey results/data, selection and recommendation of final route (keeping the pipeline length and crossings as minimum and clearance with respect to jacket legs of existing well platforms as shown in relevant drawing) after finalizing departure and approach angles of pipelines at various platforms based on the survey carried out within the corridor or within additional corridor / area duly surveyed / investigated by CONTRACTOR and approved by the COMPANY. Pre-installation survey shall be carried out to ensure the installation in the designated slot/route with control during installation supervision.

The scope of work shall also include survey and inspection of jacket face to check the dimensions of existing members and to check the adequacy of space available for installation of risers and clamps. Interference or obstruction, if any, shall be identified by the CONTRACTOR.
The survey shall be carried out as per Spec. 2011.

b) Finalization of design data/basis for COMPANY's approval for carrying out design, detailed engineering, procurement, preparation of construction drawings and documents, installation and testing of pipelines/risers and other associated works. Finalization of design basis shall be done in accordance with Table 4.1A, & 4.2A (placed at Annexure to Section 4A) and design criteria, codes, standards and specifications contained in the bid package.

c) Design, detailed engineering of all submarine pipeline and riser system, including clamps, CP system, fittings, all tie-ins, pipeline crossings and free span corrections and anchoring etc., all complete in

accordance with approved design basis and requirements of this bid package. CONTRACTOR's scope shall also include furnishing of design reports, calculations and drawings etc. as per the requirement of bid package.

d) Preparation of material requisition, purchase and supply, expediting, inspection, fabrication, testing and transportation of all materials to intermediate storage/plant locations and job site(s) including sea fastening , for successful execution of works at site.

e) Supply and application of external corrosion protection coating as per Spec. no.2012A.

f) Supply and application of internal corrosion protection coating for Water Injection Pipelines for 200mmm ND and above sizes. Bidder to submit the specifications for the same including the procedure for internal coating of field girth joint for Company's review and approval.

g) Supply and application of concrete weight coating as per Spec. no. 2013 Rev.1 for S-Lay method only. In case of Reel Lay Method, only corrosion coating shall be provided and no concrete coating is required. For Reel Lay Method, additional wall thickness, if required, shall be worked out and provided for on-bottom stability and reeling/unreeling requirements of the pipeline in addition to the requirement covered for S-Lay Method given in table 4.2 A (placed at Annexure to Section 4A).

h) Design, engineering, supply, installation and testing of sacrificial anode type cathodic protection system for all pipelines and risers. The cathodic protection system shall be as per scope of work, design criteria and specification No. FS 4002 enclosed in the bid package.

i) Removal and cleaning of marine growth/fouling from jacket braces/members to facilitate installation and proper fit up of new riser clamps/brace clamps of additional member.

j) Riser clamps and new structural members wherever required shall be designed, supplied, fabricated and installed by the CONTRACTOR. Riser clamps, wherever existing in the same location where the new riser clamps are to be installed, shall be replaced by new clamps by the CONTRACTOR after cutting existing clamps. Procedure for the same shall be approved by the COMPANY.

The location of risers shall be finalized during survey/detailed engineering.

All works incidental to installation of risers such as design and provision of additional/new members/braces wherever necessitated by detailed engineering, removal of interfering structures/members, boat landing, riser protector, barge bumper, anodes etc., and modifications thereof, if any, and reinstallation of the same as per original design conditions shall form part of CONTRACTOR's scope of work and cost of such works shall be deemed to be included in the price quoted by the CONTRACTOR. The removal/re-installation procedures of riser protector, boat landing, jacket anodes etc. to facilitate installation of risers shall be approved by the COMPANY.

k) Providing & installing Monel sheathing on splash zone part of the riser as per Spec no.2015 Rev.1.

l) Finalization and submission of installation procedures including analysis/calculations for safe installation of pipeline & risers, for Company's approval, as per the bid package requirement. Installation of all pipelines & risers as per Company's approved procedure including rectification of all unsupported spans to design permissible limit, pipeline crossings etc.

Both S-lay and Reel-lay methods are kept as alternative pipeline laying methods. Bidders are allowed to propose any of or a combination of the two methods. Company shall accept the above based on economic considerations.

m) Testing of pipelines for possible buckling during installation by passing a 'gauging pig' through the entire pipeline and riser system. This must be done for each pipeline segment as per the requirement of the bid package in addition to the use of buckle detector during pipe laying.

n) Cleaning and hydrostatic pressure testing of all installed submarine pipeline and riser system in accordance with the specification enclosed with the bid package.

n) All pipelines including associated risers after hydrostatic testing, shall be left with treated seawater and hooked-up with the existing deck piping. Contractor shall supply minimum 4 Nos. of Dewatering/poly pigs of appropriate sizes for each segment, after hydrostatic testing. Commissioning shall be done by the Company for which necessary assistance required shall be provided by the Contractor.

o) Carrying out post installation survey including C.P survey, all clean-up operations and preparation of as built drawings and documents as per bid package requirement.

p) Each valve of 200 mm NB and above on pipeline laterals shall be provided with a hydraulic actuator. Further, for valves up to 150mm NB, valve vendor shall provide the valve operating torque values corresponding to valve pressure rating. In case, maximum hand wheel force required to operate the valve is within 35kgf, valve shall be operated manually. Further, in case for valves up to 150mm NB, maximum hand wheel force exceeds 35kgf, valve shall be provided with hydraulic actuator.

q) All valves provided on idle laterals shall be kept in closed condition after completion of pigging and hydrotesting of pipeline with laterals.

4.2.3 CONTRACTOR's Responsibility

a) Entire work(s) defined above shall be carried out by CONTRACTOR in accordance with the specifications, drawings and other requirements of the bid package, and instructions/directions of the COMPANY. Quality control shall be carried out as per the governing code(s) and Company's specification.

b) Review and approval of CONTRACTOR's entire work(s) by COMPANY shall in no way relieve the CONTRACTOR of his sole responsibility for safe and efficient design, engineering, supply, installation and subsequent operation of all the pipeline(s)/riser(s) by COMPANY in accordance with applicable codes and standards for intended use of the pipeline(s) system.

c) The CONTRACTOR is deemed to have recognized any restrictive features of the site(s) and/or specific requirements of the work and made due allowances for it in the work to be performed by him.

d) The CONTRACTOR is cautioned to exercise extreme care and take necessary precautions to prevent damage to the existing offshore pipeline(s), riser(s), electrical and other cables, marine structures and/or jackets during execution of the entire works. It is CONTRACTOR's sole responsibility to obtain sufficient information on these existing facilities for safe and sound execution of the work. Entire cost of repair or replacement of these facilities damaged due to CONTRACTOR's negligence shall be to CONTRACTOR's account including any production loss to the owner/COMPANY thereof. COMPANY shall be the sole judge for deciding the same.

4.2.4 **COMPANY's Responsibilities**

COMPANY has provided available information on the existing pipelines and other facilities. It is the CONTRACTOR's responsibility to obtain relevant additional information on these existing facilities to allow safe and sound design and installation of the new pipelines and risers.

4.3 **DESIGN CRITERIA**

4.3.1 **Design Parameters**

The design of pipelines, risers, tie-ins, pipeline crossings and free span corrections shall follow the guidelines of Det Norske Veritas Rules for submarine pipeline system 1981 (DNV). The design and loading conditions and design criteria shall be as defined in Section 3 & 4 of the above rules. Constants and coefficients to be used for the design calculations can also be taken from these rules except as specified below:

i) Maximum allowable steel stresses during installation. loading condition "b" (SMYS- Specified Minimum Yield Strength). : 85% SMYS

During Hydrotest: : 90% SMYS

ii) Zone-1
Maximum allowable steel stress during operation

Pipeline, load condition 'a' : 72% SMYS

Pipeline, load condition 'b' : 85% SMYS

iii) Zone-2 (upto a distance of 12.2M from bottom end of the riser bend)

Load Condition 'a' : 50% SMYS

Load Condition 'b' : 67% SMYS

Von Mises Stress Hypothesis shall be used for determination of combined stresses in the riser/pipeline

iv) Environmental Parameters

Table 4.1A (placed at Annexure to Section 4A) represents minimum environmental requirements.

v) Pipeline sizes, design temperature/pressure etc. are presented in Table 4.2A (placed at Annexure to Section 4A).

vi) The geo-technical data shall be collected by CONTRACTOR during surveys as per Spec. 2011 Rev.2. The soil data collected should be enough to determine strength and index properties required for engineering, areas prone to scour & instability.

vii) Internal/External corrosion allowance as indicated in Table 4.2A (placed at Annexure to Section 4A) shall be used in pipeline & riser design.

4.3.2 Codes and Standards

The design, fabrication and installation of all pipe-lines and risers shall meet the requirements of Det Norske Veritas, "Rules for Submarine Pipeline System" 1981 (DNV). Additionally, latest edition of the following codes and standards shall be followed wherever applicable:

ANSI B31.4	-	Liquid Petroleum Transportation Piping Systems.
IP Part 6	-	Institute of Petroleum, Model code of safe Practice.
ANSI B31.8	-	Gas Transmission and Distribution Piping Systems.
API Std.1104	-	Standard for Welding Pipelines and Related Facilities.
API RP 1110	-	Recommended Practice for the Pressure Testing of Liquid Petroleum Lines.
API RP 1111	-	Recommended practice for design construction, operation and maintenance of offshore hydrocarbon pipeline.
United States	-	Minimum Federal Safety Standards for Gas Lines. Part 191,192
	-	Minimum Federal Safety Standards for Liquid Pipelines. Part 195

SIS 05-5900	-	Swedish Standards Institution for Surface Preparation.
DNV RPB-401	-	Cathodic Protection System
NACE Std. RP-06-75	-	Recommended Practices : Control of Corrosion on Offshore Steel Pipelines.
API RP 5L1	-	Recommended practice for Rail – Road Transportation of Line pipe.
API RP 2A	-	Recommended practice for planning, designing, construction of fixed offshore platforms.
API RP 5L5	-	Recommended practice for marine transportation of line pipe.
DNV OS-F101	-	Submarine pipeline systems.

ASTM Standards where applicable and all relevant specifications contained in the Bid Package.

Where conflicting statements exist between the different codes and standards, the most stringent regulations shall apply unless directed or agreed otherwise by the COMPANY.

4.3.3. Pipe diameters as indicated in Table 4.2A (placed at Annexure to Section 4A) are already decided and shall not be revised by the CONTRACTOR. The grade of pipe, wall thickness, thickness of corrosion protection coating & weight coating as given in Table 4.2A are the minimum requirement to be provided by the CONTRACTOR for S-Lay method only.

4.3.4 All calculation methods which bidder proposes to use in detail design, the installation procedures, testing procedure and marine equipment etc. proposed to be used shall be in sufficient details to allow the COMPANY to verify the design basis and technical suitability of bidder's proposal. If computer output is proposed, bidder shall furnish a brief description of the analytical methods employed in the programme and identify the basis and theory used. CONTRACTOR shall also perform detailed flexibility analysis for pipeline including checking spans for vortex shedding criteria.

4.3.5 **PIPELINE DESIGN METHODS**

4.3.5.1 Pipeline and related facilities shall be designed as per the requirements stated herein and complying with the requirements indicated in Table 4.1A & 4.2A (Annexure to Section 4A), drawings (enclosed elsewhere in the bid document) and specifications listed in Appendix A & B (placed at Annexure to Section 4A).The Contractor shall design the entire pipeline system in such way to ensure the piggability of pipelines from pig barrel to pig barrel.

4.3.5.2 **Wall Thickness Design**

Wall Thickness Analysis shall be carried out for installation, testing & operating conditions for selection of pipeline wall thickness. The pipeline wall thickness shall be checked for pressure containment (hoop stress) and against collapse due to external over-pressure.

In addition, local buckling (due to external over-pressure and combined effect of axial tension and bending), propagation buckling due to external over-pressure bar buckling and upheaval buckling shall be analyzed. Allowable out-of-of roundness of the pipe to be used for the analysis, where applicable shall be 2%. The selected wall thickness shall comply the equivalent stress criteria considering thermal & curvature stresses etc. For thickness verification under operating condition, corroded thickness shall be used.

4.3.5.3 **Stability Analysis**

The stability requirements shall be evaluated by lateral and vertical stability analysis of the pipeline during installation, testing and operation. The lateral stability analysis shall include all environmental forces such as drag, inertia and lift as well as frictional resistance. The vertical stability analysis shall include pipe buoyancy, an assessment of soil liquefaction potential, trenching depth and backfill material requirements. The following design cases shall be considered:

- Pipe resting on the seabed
- Pipe in a Trench (if applicable)
- Pipe resting on seabed and stabilized by other means such as placing additional restraints e.g. grout bags etc.
- Pipe crossing with pipe resting on supports.

Unless otherwise specified by the COMPANY, the stability requirements shall primarily be met by increasing the submerged weight of the pipe. The required submerged weight shall as far as practicable be achieved by applying concrete weight coating to the pipe in case of conventional lay method or by providing additional wall thickness to the pipe in case of Reel Lay method.

The required submerged weight of the pipe for the stability analysis shall be determined for the following design conditions:

- Pipe empty during installation
- Pipe filled with product during operation.

On-bottom stability analysis shall be carried out considering the passive resistance of soil due to settlement of pipeline using Veritec RP E305/DNV RP F109/AGA level 2 such that the pipeline will not move from as installed position, apart from movements corresponding to permissible deformation, thermal expansion and limited amount of settlement after installation in line with the requirement of DNV 1981.

4.3.5.4 Expansion & Stress Analysis and Unsupported Span

Expansion analysis of pipeline shall be carried out in accordance with Design and Operating conditions, Temperature decay along the pipeline shall be calculated based on process design parameters.

The criteria for pipe stress analysis shall be to maintain all stresses during installation, testing and operation within the allowable limits set by Section 4.3.1 of this specification.
Operational stress limits specified for risers shall also be applied to Zone-II pipe upto a distance of 12.2 meter from the end of the riser bottom bend. The riser is defined as the portion extending from top of transition bend to the end of Zone-II pipe / end of expansion spool/ Tie-in spool (if any).

To keep pipeline stresses within the allowable limits, the unsupported spans shall not exceed certain maximum values. The static allowable spans shall be calculated for the following three pipeline conditions:

- Pipe empty after installation
- Pipe flooded during hydrostatic testing
- Pipe filled with product during operation.

In addition, the pipeline shall be designed to avoid excessive vibrations due to vortex shedding by limiting span lengths so that resonance does not occur. If this is not feasible, safety against fatigue failure shall be analyzed.

For each of the three pipeline conditions mentioned above, the shortest calculated span length shall be used as the maximum allowable span length.

In the event, the touch down length of proposed pipeline is less than one pipe length (12.2 mtrs.) between two consecutive free span corrections, then the entire configuration shall be treated as ONE free span correction.

4.3.5.5 **Collapse and Buckling Analysis**

Wall thickness shall be checked against collapse in addition to hoop stress.

Local buckling due to external over pressure, bending and propagation buckling due to external over-pressure shall also be analyzed. Allowable out-of-roundness of the pipe to be used for the analysis shall be 2 %.

4.3.5.6 **Corrosion Protection**

Pipeline external and internal corrosion protection shall be provided by corrosion protection coating. This external coating shall be as per the specification attached in Appendix B. Specification for internal coating (for Water Injection Pipelines) including coating of the field girth weld joint is to be submitted for Company's review and approval. The CONTRACTOR shall check the serviceability of such coating for the operating temperature and fluid characteristics of the pipeline.

4.3.5.7 **Cathodic Protection**

The cathodic protection of all pipelines shall be provided by Contractor in accordance with the attached specification No. FS 4002. As the Contractor is responsible for post-installation C.P. surveys and results of survey ensuring proper response of the system provided, Contractor shall inspect the installed anodes for appropriate mounting and electric connection.

4.3.5.8 **Route and Profile**

Utilizing the survey information, the CONTRACTOR shall finalize the pipeline alignment. The pipeline route shall be selected such that the pipeline follows a smooth seabed profile, and avoid, wherever possible, coral reefs, and soft or liquefied soils. Where it is not practical to avoid seabed irregularities, capable of causing significant stresses in the pipeline, stress levels shall be checked against the allowable stresses. In the event that the stress levels exceed the allowable limit, the pipeline profile shall be modified such that the stress levels are within the allowable limits. Unsupported pipeline spans shall not exceed the allowable limits calculated.

4.3.5.9 **Offshore Pipeline Crossings**

The crossings shall be designed, such that the existing or proposed pipeline shall not be over-stressed, either during installation, hydrotest or operation,

according to criteria mentioned in Section 4.3.1 and the resulting spans shall not exceed their allowable limits. The minimum clearance shall be subject to the COMPANY's approval and shall be based upon the predicted settlement of pipes and supports, size and type of supports and allowable span length.

The stability analysis of the pipeline and supports at the crossing shall be based on maximum wave heights/significant wave height at operating conditions.

On-bottom stability of the pipeline and supports including check for settlement of pipeline & supports based on soil bearing capacity, sliding and overturning of support.

The minimum factor of safety to be considered for support design shall be as follows :

- Factor of safety against settlement shall be considered as 2.0
- Factor of safety against sliding shall be considered as 1.5
- The eccentricity of the resultant force (against overturning) shall lie within middle third of the base of the support.

The newly installed pipeline should normally cross the existing line at an angle not less than 30 Degree. In case of any specific case involving restriction in maintenance of crossing angle as stipulated above, the same shall be reviewed by the COMPANTY during detailed engineering review. CONTRACTOR shall design the supports for crossings considering the parameters given in Table 4.1A (placed at Annexure to Section 4A) and submit to the COMPANY for review and approval. Grout bag supports shall be provided to maintain physical separation of 350mm or more between the existing pipeline and the proposed pipeline for the life span of the proposed pipeline.

4.3.5.10 **Pipelay analysis**

The laying analysis shall be performed using the details of the proposed barge/laying method to confirm that pipelines can be laid with proposed barge and the design thickness without exceeding allowable stresses.

4.3.6 **RISER DESIGN METHOD**

The design of all pipeline & risers including the 12.2 meters horizontal length of Zone-II pipe shall be done in compliance with the code and standards specified in Section 4.3.2 and design parameters defined in Section 4.3.1.

4.3.6.1 **Riser Location**

The indicative location of risers for each submarine pipeline connecting the existing platforms are shown in the various drawings enclosed in the bid

package. These shall be finalized during pre-engineering survey / detailed engineering. For new platforms to be installed, the location of risers shall be finalized during detailed engineering. The risers shall be pre-installed within the confinement of the jacket at the new platforms. These risers shall have flanged connection at riser base.

4.3.6.2 **Stress Control**

The criteria for the riser stress analysis shall be to provide a safe and functional riser design. Stresses during installation, operation and testing shall not exceed the allowable limits as per Section 4.3.1. Expansion of pipelines and movement of jacket due to operational and environmental load shall be considered in the riser design.

For stress analysis of riser, the temperature decay along the pipeline shall be considered for thermal expansion of the pipeline based on process design parameters.

The Contractor shall endeavor to absorb in the riser any expansion/contraction in the pipeline or deflection of the platform caused by environmental and functional forces without the use of expansion loop by locating the first riser clamp as high as possible from the seabed or increasing the submerged weight of the pipe-line near the riser end, thus ensuring that the stresses in the riser are below the allowable limits and the loads transferred from the risers to the jacket are minimized. CONTRACTOR shall also perform a flexibility analysis.

4.3.6.3 **Clamps and Location**

Riser shall be supported by hanger flange and guided by non-frictional riser clamps attached to the platform. All new riser clamps shall be designed in accordance with the API RP 2A-WSD and provided as per approved Riser design reports.

The clamp spacing shall be such that the risers are safely supported and that calculated allowable spans are not exceeded. Number of clamps and their location shall be selected by the CONTRACTOR to prevent the riser from becoming over-stressed during design storm conditions while the pipeline remains in full operation. Spacing of riser clamps shall be based on risers withstanding storm conditions, temperature stresses and vortex shedding criteria given in Appendix-A to DNV rules for submarine pipeline system. Clamps shall be internally padded with 12mm thick neoprene bonded to the clamps steel surface by adhesion. However, contractor shall submit detailed procedure for company's approval. Where adjustable clamps are provided, electrical continuity for cathodic protection of clamps shall be provided between jacket and clamps. All bolting on the riser clamps shall utilize fully

tightened double nuts on each end of the struts. All nuts and bolts used for clamping the risers shall be XYLAN coated.

4.3.6.4 The internal and external corrosion allowance for the risers shall be considered in Design as per Table 4.2A (placed at Annexure to Section 4A).

4.3.6.5 **Coating of Risers and Bends**

i) All risers, including bends, shall be coated and wrapped with the corrosion protective coating as described in the specification attached with the bid package, from the sea bed upto the splash zone.

ii) All risers shall be coated with a concrete weight coating upto splash zone. The minimum thickness of concrete coating on risers shall be 30 mm. The field joint coating at the riser to pipeline connection and on risers shall follow the guidelines set for pipeline field joints.

iii) Riser extending above the splash zone shall be painted in accordance with general specification 2005 "Protective Coating".

iv) For splash zone (Portion extending from (-)2.0m w.r.t. Chart Datum upto (+) 5.5m or bottom of hanger flange "Monel Jacket" shall be applied. A 5mm thick monel sheet shall be welded to the riser pipe at top and bottom to form a tight jacket which should have facilities for future testing for tightness. At onshore yard, the monel jacket shall be checked for tightness by an air pressure test to 1.5 kg/cm^2. Installation tolerances and tolerances in surveyed water depth shall be considered for meeting the above requirements. Monel Sheathing shall meet the requirements of Clause 8.13 of Spec. No. 2015 Rev.1. All the welds shall be coated with epoxy/resin to prevent corrosion.

Specification and application procedure for splash zone protection shall be submitted by CONTRACTOR for approval by COMPANY.

4.3.6.6. **Riser Bend**

i) Prefabricated shop pipe bends as described in the specification attached with the Bid package shall be used at the bottom and at the top of risers. Bends radius shall be at least 5 times the outside diameter of pipe and should be suitable for pigging with fault detection/intelligent pig.

ii) Transition from one pipe wall thickness to another shall be by internal bevel not exceeding 1 to 4 taper.

iii) Diagonal bracing shall be attached to the bottom riser bends by clamps during fabrication. These bracing shall be removed or a 600 mm

section cut out of the brace after riser installation is completed and clamps are tightened. The brace shall not be welded to the pipeline. The clamps shall be padded with 12 mm thick neoprene padding as per Clause 8.10 of specification No. 2015 Rev.1.

4.3.6.7 **Cathodic Protection of Risers**

Cathodic protection of risers shall be provided by Contractor to conform to enclosed Spec. No. FS 4002 and Electrical design criteria.
No insulating joints are envisaged on pipeline- riser system.

4.3.6.8 **Hanger Flanges**

All pipelines shall be provided with suitable hanger flanges for supporting the risers. The riser hanger flanges shall be designed, manufactured and installed by the CONTRACTOR as per relevant Codes and Standards. The material for hanger flanges shall meet the provisions of clause 5.7 of DNV, 1981 Rules for Submarine pipeline System.

CONTRACTOR shall perform detailed piping flexibility analysis for all risers and connected deck piping to determine the design loads.

The complete details, design, fabrication and installation of riser hanger flange shall be approved by the COMPANY.

4.3.7 In addition to the technical requirements and conditions stated herein above, specifications and drawings enclosed as Appendix - A & B shall be complied with for various works to be performed by the CONTRACTOR.

4.4 **DESIGN REVIEW**

4.4.1 **Requirements**

CONTRACTOR shall be required to present written substantiation of all proposed designs, installation, and testing procedures for approval by COMPANY. This shall be done thirty (30) days prior to the commencement of any phase of fabrication or installation. The work shall begin only after COMPANY approval has been obtained. The presentation may be in the form of one or more reports and shall contain the design calculations to substantiate CONTRACTOR's proposed materials and construction techniques. The report shall contain the design assumptions, design calculations, material specifications, and details of construction. Data included in the report shall be sufficient to show that all factors listed in section 4.3 have been considered. Calculations shall also be submitted for any other factor not listed in Section 4.3 but which are necessary to prove the validity of CONTRACTOR's design or proposed construction methods. CONTRACTOR shall furnish his document

schedule, indicating clearly sequencing of the documents. The following paragraphs cover the minimum requirements for the design document which includes:

i) Reports

ii) Drawings

iii) Calculation Books.

The above mentioned items shall be a part of design documentation by the CONTRACTOR and shall be the property of the COMPANY.

4.4.1.1 **REPORTS**

The CONTRACTOR shall prepare the following reports as applicable:

a) Pipeline Design Criteria Report

b) Pipeline Design Report

c) Riser Design Report

d) Installation/Testing Method Report

e) Specifications

f) Cathodic Protection System design report.

a) **Pipeline Design Criteria Report**

Pipeline Design Criteria Report shall include the following items:

- Appraisal of Data (environmental, bathymetry, soils, etc.) submitted by the COMPANY and collected by CONTRACTOR after survey.
- Selection of the Pipeline Route and pipeline length.
- Pre-engineering, pre-construction and post-installation survey reports.

b) **The Pipeline Design Report shall include:**

- Pipeline wall thickness analysis
- Pipeline Lateral & Vertical Stability Analysis

- Pipeline Construction, Testing and Operating Stress Analysis.
- Pipe lay analysis
- Pipeline Buckle & Collapse Analysis
- Pipeline Unsupported Span Analysis
- Pipeline Crossing Stability and Stress Analysis
- Pipeline expansion analysis.
- Pipe Cathodic Protection Analysis
- Pipeline Fracture Analysis, if required

c) **The riser design reports shall include**:

- Riser Flexibility Analysis
- Riser Construction, Testing & Operating Stress Analysis.
- Clamp Loads
- Vortex shedding analysis
- Clamps and clamps spacing/allowable spans

d) **The Installation Methods Report shall include:**

- Offshore Pipeline Section
- Risers
- Hydrotest
- Spacing between existing & installed pipelines & method Contractor proposes to use ensure that related spacing is maintained.

e) **Specification for:**

i) Pipe

ii) Pipe Bends

iii) Pipe Fittings & Flanges, if any

iv)Riser Hanger Flange/Riser Clamps

v) Knee Brace

vi)Corrosion Protection Coating (internal & external)

vii) Concrete weight coating

viii) Field Joint Coating (internal & external)

ix)Splash Zone Materials

x) Pipeline Crossings

xi)Tie-ins fittings

xii) Cathodic Protection System

xiii) Trenching and burial, if required

4.4.1.2 **DRAWINGS**

The CONTRACTOR shall prepare all the design drawings required to complete the design. The drawings shall include pipeline alignment drawings, schematics, lay-outs and isometrics, riser location and make up, riser clamps, tie-ins etc.

The drawings index shall be divided into the following major categories:

- Area Maps
- Pipeline Alignment Drawings
- Anode Installation drawings
- Pipeline Approach to and Departure from platforms
- Pipeline Crossings.
- Riser Elevation and Clamps spacing, riser makeup
- Clamps details

- Sketches and Illustrations.

A scale 1:5000 for the pipeline alignment sheets and a scale of 1:250 for the platform approach covering a distance of minimum 200 m shall be used unless otherwise specified by the COMPANY.

4.4.1.3 CALCULATION BOOKS

The calculation books shall include all calculations and computer analysis. The books shall have separate sections for pipelines and risers.

4.5 PIPELINE INSTALLATION

All works related to pipeline installation by S lay or Reel Lay method shall be performed in accordance with the specifications listed at Appendix B.

Rigid pipelines may be installed by "REEL LAY" method. In this method the pipes shall be welded together at the shore based yard. Also, corrosion coating has to be applied at the onshore yard. Next, welded pipes shall be spooled on to the pipe laying vessel's reel (normally a D.P. vessel).

To initiate pipe lay, the end of pipe stalk shall be anchored, and the pipe-laying vessel then shall move along the pipeline route, unreeling pipes, as it shall advance.

Also, in this method, concrete weight coating cannot be applied, and hence on bottom stability may be achieved by increasing the wall thickness of the pipe, if required.

However, based on the brief methodology, mentioned above the Contractor shall furnish detailed methods/procedures at the time of bidding for Company's evaluation.

For submarine pipeline to be laid by Reel Lay Method, pipe material & procedures, etc. shall comply to the requirements of Section 7H of DNV OS-F101 Offshore Standard for Submarine Pipeline Systems 2000 edition.

4.6 TIE-IN-OPERATIONS

4.6.1 Procedure

CONTRACTOR shall submit tie-in procedures for riser installation, connections to stub lines & laterals mechanical connections as applicable, to the COMPANY for approval.

4.6.2 The tie-in between pipeline and riser at the existing platforms shall be of welded connection, performed at the lay vessel and subsequently lowered. However, in case of new platforms the riser shall be pre-installed within the confinement of jacket. These risers shall have flanged connection (set of WN flange and Swivel flange) at riser base.

4.6.3 CONTRACTOR shall furnish the tie-in details to the COMPANY for approval. The following information shall be furnished as a minimum:

i) Description and specification of components which will be introduced as permanent parts of the pipelines.

ii) Calculation of stresses occurring during installation and operation.

iii) Procedure specification covering all tie-in operations.

iv) Description and specification of equipment and instruments to be used for the installation.

v) Description and specification of methods of inspection and testing.

4.6.4 **Other Tie-Ins**

The tie-in between riser and deck piping shall be provided by welding.

4.7 HYDROSTATIC TESTING OF PIPELINE SYSTEM

Testing of pipeline & riser system shall be done as per the specification attached with bid package after completion of all installation works of pipelines, risers, crossing, operations and remedial works, if any. Before hydrostatic testing, the pipeline & riser shall be cleaned with a mechanical pig. Testing procedure and equipment shall be subject to Company's approval and shall include cleaning, gauging and hydrotesting of the pipeline & riser system. COMPANY's Representative must be present to witness all pipeline tests conducted by the CONTRACTOR. CONTRACTOR shall carry out hydrostatic test for a minimum continuous period of 24 hrs. after stabilization, all lines and risers to a test pressure of 1.25 times the design pressure given in Table 4.2A (placed at Annexure to Section 4A).

4.8 POST-TEST PROCEDURE

4.8.1 Following completion of the hydrostatic tests, all completed pipelines shall be left full of inhibited test water by CONTRACTOR, unless cleaning & purging is required by the COMPANY. CONTRACTOR will then make all above water tie-in-connections.

4.8.2 CONTRACTOR shall also remove all appurtenances that were installed to facilitate pigging & hydrotesting.

4.9 POST-CONSTRUCTION SURVEY

4.9.1 The CONTRACTOR shall carryout a survey of the installed pipeline system, with all necessary equipment, such as sub-bottom profiler, side scan sonar, echo sounder etc. for determining the extent of unsupported spans, damage etc.

4.9.2 Testing of Cathodic Protection System - Refer Section 3.5, Part-IV of the bid package.

4.9.3 Details of all subsea works, such as crossings, repair to pipeline system, supports to free spans. etc., shall also be Video recorded after carrying out the works and submitted to COMPANY for record.

4.10 CLEAN-UP

Any stakes, buoys, or temporary obstructions placed along the pipeline right of way in the water or on land, shall be removed by CONTRACTOR or COMPANY shall remove at CONTRACTOR's expense unless COMPANY specifically requests that they be left in place. Work spaces furnished to the CONTRACTOR by COMPANY shall be cleaned of all scrap and debris and restored to their original conditions.

CONTRACTOR shall remove all surplus materials from the work site and shall deliver such material belonging to COMPANY to the points designated by the COMPANY.

4.11 AS BUILT PIPELINE SYSTEM REPORT

4.11.1 On completion of hydrostatic testing, the CONTRACTOR shall prepare As built Drawings/Reports for all pipeline system. The COMPANY will specify the Coordinate system and scale to be used. Alignment details shall be obtained from plotted data taken during construction and post-construction surveys. All pertinent data such as pipeline appurtenances, fittings, crossings, unsupported spans, burial details, location of anodes, elevation of riser clamps, monel sheath, hanger flange etc. shall be accurately located on the "As Built Drawings".

4.11.2 The CONTRACTOR shall also prepare As Built Report which will include the following as a minimum:

a) Pipeline installation record showing pipeline material, diameter, wall thickness, reference to pipe tally sheet numbers, length of such pipe, cumulative length, weld joint number, NDT results.

b) Pipeline route/alignment maps at a scale of 1:5000 and Approaches to platform to a scale of 1:250 for 200 mtrs portion in vicinity of platform.

c) Hydrostatic testing and pigging details.

d) Riser Details showing riser makeup, pipe material, diameter, wall thickness, weld joint number, details of coating, riser bend diameter, wall thickness and radius, approach angle of pipe-line, locations/elevations of riser clamps, field joints, anodes, monel sheathing etc. exact placing, location and orientation of all risers installed shall be furnished on the "AS BUILT DRAWINGS".

e) Location of Anodes, and post-installation potential measurement survey report.

f) Spanning of pipelines, if any and remedial measures.

g) Corrosion coating and concrete coating details for pipelines and risers.

h) Details of field joints.

i) Pipeline crossing details

j) Pop-up Buoy details and locations.

k) Other miscellaneous details, such as diary of events, list of video recordings, photo-graphic records etc.

l) Table 4.2A (placed at Annexure to Section 4A) which shall be updated based on as build data and coordinates of originating/terminating platforms/stub end shall also be mentioned.

4.11.3 Six copies of the As Built Drawings and "As Built" Report and three copies of all photographic records and video recordings for each pipeline system shall be submitted to the COMPANY. Contractor shall also provide two copies on Compact Disc (CD) of all reports (in MS Office) and drawings in AUTOCAD 2000 or latest Version.

Section 5.0

Pre-Commissioning, Commissioning Procedure & Performance Tests (Well Platform)

PN/RS	AKG	SVB	25	28.06.2021	2A
MSA	BS	RKS	34	31.03.2017	2
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Prepared / Revised By	**Reviewed By**	**Approved By**	**No. of Pages**	**Date**	**Rev. No.**

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7.2. Pre-commissioning documents:
7.3. Modification/hook up procedure
7.4. Commissioning procedure
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7.7. Manpower for Assistance during Commissioning & start of Production

Pre-Commissioning checklist (Attachment A)

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1.2. Packing and Seals
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1.4. Alignment of Rotating Equipment
1.5. Tie-ins at Unit Limits
1.6. System Check/Inspection
1.7. Site Modifications
1.8. Flushing
1.9. Temporary Screens, Strainers and Blinds
1.10. Leak Tests
1.11. Safety Devices
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1.16. Equipment Protection and Spare Parts
1.17. Chemical Cleaning
1.18. Fire Fighting & Life Saving Equipment
1.19. Miscellaneous
1.20. Operability test for a system/equipment

1. INTRODUCTION

Contractor shall pre-commission, commission (such as crane etc.) and carry out the Performance Tests on the Works including all the facilities of the Well Platform, listed in Description of work in the bid package and make them ready for Platform commissioning Prior to performing said activities Contractor shall submit a procedure for the same well in advance as per guidelines stated herein for Company's review and approval.

This procedure defines the following stages of the Works:

- Mechanical Completion
- Pre Commissioning activities
- Commissioning activities
- Performance Tests

For other requirements of testing refer Basic Bid Work, respective Design Criteria and respective Functional Specification given elsewhere in Bid Package.

A Pre-commissioning activity shall be considered to be complete only when it has been witnessed and the procedure and the results of successfully carrying out that procedure have been signed off by both Contractor and Company. Company may also require Vendor's representative to witness and sign that document.

During the pre-commissioning & commissioning activities, the Contractor shall involve Company's operating staff (nominated by the Company) and impart necessary techniques and know-how required for operation and maintenance of the facilities.

2. MECHANICAL COMPLETION

2.1 Definition

Mechanical Completion of the Well Platform and modification work is defined as the state when all systems including utility and auxiliary facilities have installed in accordance with the drawing and specifications and ready for pre-commissioning in safe manner and in compliance with project requirements and accordingly certified by the Company or company authorized representative.

Mechanical completion of a system includes following but not limited to:

- All design and engineering has been completed
- All installation work for that system including all equipment has been completed in accordance with "Approved for Construction" drawings, specifications, applicable codes and regulations and good engineering practices, all tie-in connections have been made,

all testing and inspection completed and system/ facilities are ready for pre-commissioning.

- All instruments have been installed as per Installation Standards.
- All tie-in connections have been made.
- All Factory Acceptance Tests and all other testing and inspection activities have been completed.
- Contractor has obtained all relevant approvals from the company.
- Safety Studies have been completed and satisfaction of all the Safety Studies' requirements has been met and all documentation put in place.
- All required documentation and certification documents required by the Contract have been supplied.
- All operating procedures and maintenance procedures have been forwarded to the
- Company well in advance for review.
- All items for which Contractor is responsible for obtaining third party, regulatory or Company approval have been obtained and confirmation documentation has been provided to Company.
- All software systems have been loaded and proved
- Construction-related equipment has been removed from the platform, leaving only that is necessary to pre-commission and commission the works.

2.2 Ready for pre-commissioning

The work is Ready for pre-commissioning when the Company has issued a certificate for Mechanical Completion and notification in writing that the Works is Ready for Pre – commissioning.

2.3 Pre – commissioning activities

Pre-commissioning activities are activities to be performed after Mechanical Completion of a piece of equipment or system or sub-system to make it safe and ready to receive hydrocarbons and Ready for Commissioning. This includes:

- Performance of all remaining works other than commissioning and Performance Tests.
- Making operational and commissioning all systems that can be made operational before process fluids are introduced.
- The completion and testing of the platform, equipment & systems
- Testing of all parts and systems of the Works including the communications systems (if required).

- Provision of initial fill of packing, chemicals, inhibitors, lubricants, glycol, water and other stocks has been made.
- Provision of temporary launcher/ receiver, if required, to carry out pre - commissioning activities for the pipelines, Checking site modifications.
- Internal inspection of the vessels
- Flushing/cleaning of vessels & piping
- Hydro testing and pneumatic testing of vessels (at vendor place ⚠2), piping and pipelines.
- Calibration of Pressure safety valves (PSVs) etc.
- Calibration of all the instruments & documentation /report.
- Loop checking including HIPPS & Corrosion system.
- Complete checking of the safety system.
- Checks on electrical system and other vendor packages.
- The delivery, storage and cataloguing of all spare.
- Items for which a defect Notices are issued by company at any earlier stage are to be rectified and all defect Notices shall have been closed out prior to this activity.
- The Completion Documents along with all Design Documents to As-Built.
- The preparation of the commissioning plan and submission to Company for review.
- Removal of all debris and construction equipment from Site. Further details are given in Attachment A.

2.4 Ready for Commissioning

Ready for Commissioning means the point at which the Company issues a certificate to the Contractor saying that the system is ready for commissioning. Ready for commissioning status shall be jointly reviewed by the company/ contractor. At this point all systems and equipment shall be at a stage where process fluids can be safely introduced and all equipment can be safely operated with all controls and safety devices in service to meet the requirement as per design specification

2.5 Design Capacities

The maximum design capacity and minimum design capacity are defined elsewhere in bid package.

3. EXECUTION OF PRE-COMMISSIONING ACTIVITIES

Contractor shall complete all the pre-commissioning activities in accordance with conditions stipulated under Attachment A and as per instructions from vendor's of individual equipment. Contractor shall write necessary procedures and obtain approval from Company prior to commencing work and shall carry out the work in accordance with approved procedures.

The Contractor shall complete as many of the pre-commissioning activities as possible at the fabrication yard to minimize the working time in offshore. A guideline for carrying out the pre-commissioning activities at yard/offshore is given below. These are minimum requirements only.

Contractor shall repeat these yard tests offshore in so far as is necessary to demonstrate that the equipment has not been damaged during transit from yard to offshore site and during erection/installation ⚠2 at offshore and that it is in the same condition as it was when first tested.

The Contractor shall submit a detailed schedule and procedure for carrying out these activities for approval by the Company before starting work.

3.1 Factory Acceptance Test Requirements (FAT)

As a minimum Factory Acceptance Test shall be required on the following packages:

- HIPPS System
- HPU System
- DCP skid with hose reel
- Well/ Fire shutdown system (SDP)
- Nav-Aid system along with battery,
- F& G Detector
- Fire & Gas detection system
- Multi-phase flow meter
- Coriolis Flow meter, Ultra sonic meter, Magnetic flow meter
- Multi-port valve
- Testing of PSV
- Communications system.
- Emergency Shutdown System (ESD)
- Deck Crane (pedestal), All Pumps ⚠2
- Instrument & Utility gas system

- Sacrificial anode, Solar Electric power system, submarine cable,
- SSIV actuator △2
- Solar Panel and solar power controller △2
- Subsea umbilical, TUTA △2
- PLC-based safety and control systems △2
- Control valves, Shutdown valves, transmitters, gauges, etc. △2

The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications. The Contractor shall define factory Acceptance Testing Requirements as a part of all Purchase Requisitions. This requirement shall be submitted to the Company for approval prior to the award of a purchase order. The packages shall be tested with the ancillary equipment that is to be supplied with them.

Factory acceptance testing of instrumentation related equipment shall be as per functional specifications of the respective instrument items.

A Factory Acceptance Testing shall be conducted prior to dispatch from the Vendors works to determine that the assembled equipment meets the design requirements.

The Contractor shall submit a full Factory Acceptance Test procedure 6 weeks prior to the Factory Acceptance Test to detail the full extent of testing of the equipment. The testing procedure shall be approved by the Company prior to the commencement of testing and shall be complete with all equipment procedures, checklists and safety requirements to be taken. The Contractor shall be responsible for providing all necessary equipment and utility services to conduct the tests. The Contractor shall ensure that an opportunity is given to all relevant parties to attend all hold and witness points during Factory Acceptance Testing.

3.2 Minimum pre-commissioning activities to be carried out at yard

- Check systems conforming to the requirements of the P&IDs, drawings and datasheets.
- Leak Testing
- Internal Inspection of Vessels
- Inspection of strainers/filters, orifice plates and other piping specialties.
- Operability test of utility systems (except those which cannot be operated at the yard) Equipment shall be operated for a minimum of 4 hrs.
- System Flushing and Cleaning
- Operability test of pump and rotating equipment.

- Load test and operability test for crane.

Pre-commissioning activities related to instrumentation at yard shall be as follows:

1. Off line testing and calibration of instruments as reflected in P&IDs, safe charts and other project documents.
2. Installation and hook-up as per installation & hook-up drawing.
3. Hydro testing of impulse tubing and other associated tubing. Leak test of instrument isolation valves / manifolds.
4. On line testing and calibration checks of all instruments and loop checking of all such instruments.
5. Installation and hook-up of gas detector fusible plug, ESD/FSD stations etc.
6. ESD/FSD loop testing.
7. Functional test of well /fire shutdown panel inclusive of all related field devices, controls signals.
8. Functional test of gas detection system inclusive of all related field devices, controls signals.
9. Functional test of Telemetry Interface cabinet inclusive of all related field devices, controls signals.
10. Any other instrument related activity not listed above but mentioned in the relevant functional specifications elsewhere in the bid package.

3.3 Minimum activities to be carried out at offshore after installation and hook-up

- Calibration checks of instruments and loop checking. All the system/equipment including Vendor's packages and Company supplied equipment (if any) shall be included. Operability test of Fire water pump for 8 hours Operability test of other pumps for 4 hours
- Load test and operability test for Crane
- Charging of filter media, packing, lubes, chemicals etc.
- Repeat testing of PSVs
- System flushing
- System drying (Where applicable).
- System leak test. Water lines are also included.
- Emergency Shut down and Fire and Gas system. All such tests to be carried out at offshore after installation.
- Pre-Commissioning checks for Switch gear, MCC etc. as recommended by the manufacturer.
- Testing and checking of electrical equipment for proper earthing, continuity, insulation resistance. ⚠
- Post Installation CP Survey as per FS 4001. ⚠

3.4 Site Acceptance test (SAT) ⚠2

As a minimum Site Acceptance test shall be required on the following packages which has to be inspected by ONGC/ Certification Agency.

- HIPPS
- Process Control System
- F&G Detection system
- Subsea umbilical
- Well head shutdown panel & standalone shutdown panel
- SSIV Actuator & HPU
- PLC based system
- Deck crane (pedestral)
- Instrument & utility gas system

The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications.

3.5 Pre-commissioning of modification works

Contractor shall carry out modification works, interconnection and hook-up operation as given in Description of work in bid package. It shall be 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 contractor's responsibility to arrange and provide steam, chemicals, nitrogen etc. required for gas freeing operation. It shall be contractor's responsibility to ensure proper safety during tie-in / modification operation.

4. COMMISSIONING

Commissioning of the Well Platform by introducing well fluid shall not be in the scope of this present contract. However commissioning of equipment such as Crane(s), Portable DG set and DCP Skid shall be carried out along-with pre-commissioning of platform. Also contractor shall pre-commission all the instrumentation and control system by nitrogen gas. Further contractor shall be required to provide man-power assistance during commissioning and start of production by Company after completion of drilling of wells.

4.1 Shut down Requirements

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipment in the existing process/ well platforms shall remain operational. The Contractor shall schedule all activities to minimize disruption to the production of existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the existing platform.

The platform Operations Group will control the scheduling and duration of any shutdown of the platform. The contractor shall submit Shutdown Schedule to the Company for approval as part of the Pre-commissioning and Commissioning Procedure.

The shutdown schedule shall include the following as a minimum:

- A detailed list of all activities
- Estimated duration of each activity
- Float calculations for each activity
- Manpower Histogram for each shifts of the shutdown.

Contractor shall also provide any requests for services and access required e.g. requests for accommodation, access to utilities, crane usage requirements, deck area access requirements, permit requirements etc.
Contractor shall note that its use of Company's facilities is limited and the availability of these facilities cannot be assumed or assured (as is described elsewhere in the contract documents).

4.2 Purging and Cleaning Requirements

Contractor shall prepare procedures for all work on existing systems and submit them for approval before starting work. Before modifications work is carried out on any system, pipe work and equipment shall be prepared in accordance with approved procedures, gas freed and purged as appropriate and as required by Company.

Contractor shall arrange and supply nitrogen required for purging. The final oxygen content in process system shall be brought down to less than 2% (V/V).

The contractor shall develop procedures for the purging of systems prior to the introduction of hydrocarbons. Included in this procedure shall be the purging and gas freeing of existing lines of the platform requiring modification. This procedure shall include the proposed method of purging to be used, the duration of the purge, the purge medium and the

acceptance criteria used to determine a successful purge. This procedure shall be approved by the Company prior to the commencement of any works at the platform.

4.3 Preservation of Systems:

After completion of pre-commissioning and before handover of platforms, Contractor shall ensure the preservation of Equipment, systems, facilities etc., for 6 (six) months so as to the platform shall be ready for Commissioning / Start of Production soon after drilling of wells is completed. Piping shall be preserved by filling Nitrogen or Water as required. Preservation of equipment etc. shall be done as recommended by respective vendors.

5. HSE / RISK MANAGEMENT ⚠

Work onsite shall comply with ONGC's Health and Safety Manuals, Work Permit System and other relevant documents.

The HSE program during Project Hook-up & Commissioning shall focus on the following six (6) main areas:

1) Site Supervision
2) Personnel Awareness
3) Personnel Capability
4) Accident Prevention
5) Management involvement and visibility
6) Pre-Startup Assessment

5.1 Personnel Awareness

Briefing on safety expectations for Project Hook-up & Commissioning supervisory team and Contractor's personnel will be conducted prior to mobilization.

The briefs shall be immediately prior to mobilization. All personnel will again undergo briefing once they arrive at the work site for specific health, safety and security procedures.

The Contractor shall publish and disseminate his HSE manuals and programs to his supervisory and all other personnel prior to mobilization.

Daily tool-box meetings and Job Safety Analysis (JSA) shall be carried out to ensure personnel are aware of work to be performed and the risk, if any, associated with the days work and mitigate steps to take. The work group foreman shall lead the daily morning discussion prior to commencing with work. The Project Hook-up & Commissioning supervisors or discipline engineer or operations personnel shall periodically monitor and participate in the toolbox meeting.

5.2 Personnel Capability

All personnel involved in the Project Hook-up & Commissioning are required to attend mandatory safety training as required by ONGC as a minimum. Contractor's personnel, e.g. rigger / scaffolder, welder, crane operator, grinder, etc. shall undergo trade competence training as required.

Safety investigation training shall be provided for supervisory, inspection personnel for both Project Hook-up & Commissioning and Contractor to provide them knowledge in recognizing root causes of safety incidence and encourage them to be pro-active in safety matters.

5.3 Accident Prevention

Project Hook-up & Commissioning shall carry out inspection on construction tools and equipment prior to issuance to the Project Hook-up & Commissioning personnel to ensure they are fit for service. The inspection shall be done periodically.

Once the tools and equipment have been issued, inspection will be by the user, supervisor, safety officer and discipline inspectors, as appropriate.

All lifting equipment shall be tested, certified and assigned a color code signifying its certification period.

The Project Hook-up & Commissioning contractor shall screen its personnel prior to their employment to confirm that they are qualified for their assignment and are free from Drug & Alcohol (D&A) abuse. This shall be supplemented by random testing and testing for cause after mobilization.

Contractor Management will carry out safety audits on a regular basis.

Contractor shall implement a hazard identification program as part of daily routine.

ONGC Operation shall administer the work permitting procedure for simultaneous operations (SIMOPS) and simultaneous production & drilling (SIPROD) of Project Hook- up & Commissioning.

ONGC Operation shall administer the Emergency Response Plan (ERP). Project Hook-up

& commissioning group and its contractor shall formulate an ERP in-line with Operations established ERP procedures.

Contractor shall implement Job Safety Analysis (JSA) or Critical Work Analysis for engineered control of hazards on non-routine or critical activities with high hazard potential.

5.4 ONGC Supervisor's Responsibility

Publish the Project Hook-up & Commissioning Execution Plan after management endorsement and ensure its availability at work site.

Ensure that the Emergency Response Procedure (ERP) and Simultaneous Operations (SIMOPS), Health Safety Environment Management System and other safety documents are available at the Worksite.

Ensure that the Project Hook-up & Commissioning contractor assigns a safety engineer / officer full-time onsite to provide the supervisors with HSE advice.

Daily supervisory planning meeting shall be held between different groups, i.e. Operations, Drilling, Project Hook-up & Commissioning and their contractors. This meeting shall serve as a forum to provide the different groups the guidance to plan / modify each group's activity as necessary to avert any conflict or interference.

5.5 Management Involvement and Visibility

Onsite visits by ONGC management and contractor's management shall be conducted on a regular basis at least once a month. The timing of such visits can be planned that they coincide so that any pertinent HSE issues can be discussed together first hand.

5.6 Pre-Startup Assessment

A pre-startup assessment of the Facilities shall be performed prior to introduction of hydrocarbon into the system. The assessment is performed and documented to confirm that:

- Construction is in accordance with design specifications.
- Safety, environment, emergency, operations and maintenance procedures are in place and adequate.
- Risk management recommendations have been addressed and the required actions taken.
- Training of personnel has been accomplished.

6. GENERAL

6.1 Vendor's representatives

The Contractor shall arrange manufacturer's representative(s) (at fabrication yard and offshore) of at least the following major equipment/systems (as applicable as per Scope of Works) during operability tests, pre- commissioning and until the satisfactory completion of the Performance Tests. The period required to be on the platform shall be that needed by contractor and that required and approved by company.

- HIPPS system

- HPU System
- Instrument Air Compressor
- Crane(s)
- Shut down system
- Fire & Gas detection system
- Test separator
- MPFM system (MPFM, MPV, PLC, FCV etc.).
- Hybrid Solar Power System
- Chemical dosing system
- DCP Skid
- Portable DG Set
- IUG System
- SCADA System
- Hinge closure

The contractor shall reconfirm the schedule and duration (of vendor representative) three weeks prior to pre-commissioning, which shall be strictly complied. It is contractor's responsibility to retain vendor's representatives 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 yard/ offshore.

6.2 Spares, Utilities etc.

The contractor shall be responsible for submission of list of one year operational spares. The contractor shall provide list of spares and responsible for initial fill up and six month supply of consumables (like lube oil, lubricants, etc.) for the platform operations after modification works are mechanically completed, pre- commissioned/ commissioned and handed over to the company. Contractor shall refer section 5.16 of 3.0 part II general condition of contract. ⚠

All utilities required during pre-commissioning of the facilities including power, water, air, cranes, 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 supply lubes, chemicals, purging materials and other pre-commissioning aids required till the platform is handed over to 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 facilities.

The contractor shall maintain a record of the start-up spares consumed during pre-commissioning and hand over the balance items to the company.

6.3 Handing over of Materials

After the mechanical completion and completion of pre-commissioning activities for all the systems installed on the platform by the contractor, the contractor shall hand over to the company all the materials which shall include but not limited to the following:

- All loose supply material
- Special tools and tackles
- Commissioning spares
- Spares as specified in relevant functional specifications

6.4 Special requirements

It shall be Contractor's responsibility to install, calibrate and make all laboratory and workshops equipment operable. Contractor shall involve Company's chemist and maintenance engineers and impart necessary techniques and know-how required for operation and maintenance of this equipment.

7. DOCUMENTS TO BE SUBMITTED

7.1 Operating manual

The Contractor shall prepare a draft start-up and Operating Manual for all of the facilities that are included in the Works and submit to Company at least 150 days prior to start of pre-commissioning activities for approval. Quantity of operating manuals requirement for all equipment shall be provided as per respective specification given elsewhere in bid package. The related attachments will go with each manual. The following information shall be included:

- Design basis
- Description of facilities
- Pre-commissioning check
- Start-up, normal operation & shut down procedures for each equipment.
- Platform start-up procedure.
- Platform normal operation procedure

- Platform shut down procedure (normal/emergency)
- Vendor instructions for all equipment for normal operation and trouble shooting.
- Emergency procedures.
- Operating parameters and set points of different alarms and trip devices
- Summary of chemical consumption including list of recommended Indian equivalent.
- Summary of utilities consumption for each equipment.
- Lubrication Schedule (include Indian equivalent, initial fill, frequency of change of lubricant and 6 months requirement).
- Gas detection and associated safety system operation, calibration and maintenance procedure.
- Life saving devices operation and maintenance procedure.
- Routine structural maintenance check.
- List of equipment (showing skid size, weight, purchase order no., vendor data book reference tag no.)
- Effluent disposal.

The manual shall have the following attachments as a minimum:

- Reduced size copies (275 mm x 425 mm) of line lists
- Equipment and instrument data sheets in accordance with purchase order
- Electrical Single line diagrams, area classification drawings and control schemes
- Pump characteristic curves
- Process Flow Diagrams (PFDs) & Piping and Instrumentation Drawings (P & IDs)
- Recommended proforma for recording routine parameters during normal operation for all equipment.
- Equipment layout.
- Safety escape routes
- Field location maps.
- Layout and location Maps for fire and safety equipments.
- All hardware and schematic drawings of system packages like PCS, PLC-based ESD etc. shall be as-built. ⚠2

The contractor shall submit the draft Operating Manual to the Company for approval. The Contractor shall discuss the comments with Company & incorporate the 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 representative. This manual shall be followed during start-up and commissioning of the facilities. Vendor operating and maintenance manuals shall be submitted along with the final operating manual.

The operation manual can be divided into two or three parts if the thickness of manual exceeds 80 mm. It shall describe, pre-start up checks, start-up procedures, shut down

procedure and normal operation for an equipment vendor recommended procedure and integration of that equipment with other facilities. Contractor shall also submit 150 days before the commissioning the system operating Manual for the distributed control system (DCS), which shall contain system description, operating instructions and necessary information for the familiarization of the operator.

7.2 Pre-commissioning documents:

Contractor shall prepare detailed format of checklists of pre-commissioning and commissioning activities for each equipment/system. The Contractor shall submit the said format for approval of the Company. These check lists shall describe the checks/test to be carried out on each equipment/system, shall also indicate if a particular check/test is to be carried out at the yard or offshore.

All the check list points shall be dealt by the Contractor. Determination of the system readiness for commissioning shall be determined based on the relevant portion of check lists have been completed by the Contractor.

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

- System / sub-system identification.
- Detail procedures for the various pre-commissioning activities, such as system check, flushing, de-watering, drying, leak test, purging etc. with format to record the observations of the activities carried out.
- Procedures and formats for recording the operability test/performance test for different equipment/system.
- Lube schedule, indicating the nomenclature (Indian equivalent) of lubes, quantity of initial fills.
- Listing of commissioning and start up spares.
- List of pre-commissioning activities to be carried out at fabrication yard, or offshore, or at both places.
- High-pressure leak check procedure of gas system.
- A detailed procedure for management of any special bypass or defaults required for commissioning.

The Contractor shall submit a draft pre-commissioning documents 180 days before the activities are to be carried out. This should include the schedule for Yard Pre- commissioning and commissioning also to suit ONGC's key milestone target dates and scheduled mechanical completion dates. The document shall be reviewed by the Company. The Contractor shall submit a revised document after incorporating Company's comment for approval to the Company. The approved document shall be submitted 120 days prior to starting of the pre-commissioning activities.

At the end of pre-commissioning activities, all the pre-commissioning test records (duly signed) shall be compiled by the Contractor. Three copies of documents for each system shall be delivered to the Company.

7.3 Modification/hook up procedure

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipments of the existing platform shall remain operating. The Contractor shall schedule all activities to minimize disruption to the Production of the existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the platform.

Contractor shall produce a procedure with his detailed shut down requirements for the various hook-ups required to be carried out on the platform. This shall be presented to company for approval within 120 days of Notification of Award.

Contractor shall submit, along with Pre-commissioning procedure, a detailed procedure for carrying out modification works, interconnections and hook-up operations for the facilities. An Isolation scheme to be prior to carrying out modification works shall be worked out in advance and detailed in this document.

7.4 Commissioning procedure

Contractor shall prepare this document to detail out the procedures and sequence of commissioning of the project facilities including the log sheets for logging of parameters of different equipment / system during commissioning. The contractor shall have required inputs from the company and the vendor's representatives. The document shall include the shift rosters for the contractor/vendor's representative to be deployed during commissioning operation. This document shall be submitted to the company for approval, 120 days prior to the commencement of commissioning operation.

The Pre-commissioning and Commissioning Procedure shall be submitted to ONGC for approval.

For any system that is not possible to Pre-commission or Commission as full system, then partial Pre-commissioning shall be conducted (e.g. multi Module systems, Onsite systems that are connected to the Modules).

Once the system is reasonably complete and ready for Pre-commissioning or Commissioning, Contractor shall advise ONGC to proceed with the Pre-commissioning or Commissioning. A final joint line check with all parties shall be conducted and shall be collectively agreed that the system is ready for Pre-commissioning or Commissioning.

During the Pre-commissioning or Commissioning, all parties required to witness shall be available including Vendor Representatives and Operations Representatives.
The Commissioning Team will do full system Commissioning after Hook-up of all the Piping, Electrical, Instruments, etc. is completed.

After the Module are installed Onsite, partially Pre-commissioned systems will then be integrated and commissioned. The handing-over Document will then be signed-off by all parties to check the completeness of the whole system.

7.5 Other requirements

The Contractor shall provide safety equipment locations, H2S safety information chart, warning signs and escape route drawings (framed). These drawings must be placed in locations approved by the Company before the platform is commissioned. The Contractor shall also provide adequate numbers of NO SMOKING boards, which will be installed where required by the Company.

An emergency plan shall be prepared and shall be in place prior to commencement of Pre-commissioning and commissioning activities. The plan shall define the actions, personnel and facilities required in case of an emergency.

In addition to the other requirements of the Contract, Contractor shall supply adequate sets (A3 size) of Process & Instrument Drawings, electrical single line diagrams to the company to facilitate system check before start of hook-up work. The Contractor shall also provide two sets of PFDs on acrylic sheets which will be installed at locations specified by the Company.

7.6 Yard checkout before load out

Prior to load out, the Contractor shall carry out, at the yard, a check of the facilities for correct erection and installation, operability, maintenance requirement and safety of plant and personnel during operation in accordance with accepted international good engineering practices; this will be witnessed by the Company. The Contractor shall carry out all modifications and corrections in accordance with the final punch list prepared jointly by the Contractor and the Company.

7.7 Manpower for assistance during commissioning and start of production

The Contractor shall arrange & provide all categories of personnel i.e. shift engineers, operators, technician, chemist; safety engineer etc. required for manning the platform during commissioning and starts of production. For assistance during commissioning by Company and start of production of platforms, Contractor shall deploy vendor representatives for the following equipment's (as applicable as per scope of work). Vendor representatives shall be deployed for maximum 4 (four) days for each well platform as

required. Company shall provide one week advance notice for deployment of the vendor representatives.

ATTACHMENT - A

Pre-Commissioning Check List

1. PRE-COMMISSIONING CHECKLIST

This checklist represents the absolute minimum of work which has to be performed by the Contractor prior to commissioning of the facilities. It is not intended to be a complete list of activities required. Manufacturer's instructions for pre-commissioning checks/ testing shall be followed for all equipment.

1.1. General procedures

The general work procedures listed below outline the work to be performed by the Contractor. Other procedures applicable to specific system or items of equipment may be covered elsewhere in the contract.

1.2. Packing and seals

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

1.3. Removal of temporary supports

Removal all temporary supports, bracing or other foreign objects that were installed in vessels, transformers, piping, rotating machinery or other equipment to prevent damage during shipping, storage and erection/ installation.

1.4. Alignment of rotating equipment

- Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
- Make cold alignment to the manufacturer's tolerances along with Company. Provide all the alignment readings records to Company. Contractor shall prepare the formats (unfilled) and submit to Company for approval.
- Check all lubricants and their quality, fill etc. before operating the equipment. Carry out uncoupled run of motors, check bearing temperatures, vibration, no load currents, over current trips, function of different safety devices and carry out adjustments as required.
- Make hot alignment and any dowelling required after equipment has been put in operation.
- Obtain manufacturer representative for equipments as required during installation and/or pre-commissioning and commissioning.

1.5. Tie-ins at unit limits

Prepare all systems for safe tie-ins with bridge connected platform or with existing operating systems. Contractor shall prepare the systems for Tie-ins in consultation with Company and will

be responsible for safety during tie-ins being made. Contractor shall gain approval of Company for the safety measures to be taken by them before any tie-in work is taken up.

1.6. System check / inspection

- Provide inspection facilities to the Company to check that erected facilities conform to Process & Instrumentation Diagrams, construction drawings, vendor drawings and specifications approved for construction.
- Verify and approve the facility check. Note exceptions, if any, on a separate work order list (punch list).

1.7. Site modifications

Carry out site modifications as found necessary during system checks and inspection from the viewpoint of routine operations, maintenance and safety of the platform. A list of such jobs shall be prepared by the Company and shall be handed over to the Contractor for execution.

1.8. Flushing

Perform flushing and blowing of all piping to remove dirt, welding slag, etc. Arrange for cleaning media (potable water or compressed dry air, as applicable) for carrying out flushing/blowing and disposal of the cleaning media in accordance with minimum procedures to be developed by the Contractor and approved by the Company.
Following is the minimum velocity of cleaning media to be maintained for flushing/blowing of piping:

AIR: 2.4 – 2.7 m/sec
WATER: 1 – 1.2 m/sec.

1.9. Temporary screens, strainers and blinds

- Provide and install temporary strainers where 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 or operation.
- Change gasket if necessary.

1.10. Leak tests

- Leak test of complete process facilities including piping, equipment, instrument connections etc. to be carried out in accordance with ASME 31.3 latest addition after completion of pre-commissioning activities, safety checks and hydro test. ⚠
- Notify the Company of test schedule at least two weeks in advance. All the tests are to be witnessed and the test record on satisfactory completion of the test be signed by Company.
- Provide 4 copies of all the test records to the Company.

- Provide any special media, if required for test purpose and provide facilities for disposal.
- Conduct all operational tightness testing.
- Carry out vacuum test to rectify any leakage

1.11. Safety devices

- Provide the Company with a list of proper settings for safety devices.
- Install all safety devices on the equipment.
- Test and adjust all safety devices such as PSVs, TSVs at offshore and seal wherever necessary. Other safety instruments/ instruments systems inclusive of field devices, Well / fire shutdown panel, gas detection system shall also be tested.

1.12. Purging

Install necessary purge connections and carry out system purging including that of flare and vent with Nitrogen in accordance with Company approved procedure. The final Oxygen content in purged systems shall be reduced to an approved safe limit. Contractor shall arrange & supply the Nitrogen required for purging.

1.13. Drying out

Dry out necessary facilities wherever required by Company.

1.14. Lubricants and chemicals

- Procure and supply initial fill of all lubricants, chemicals, resins, desiccants and other similar materials, replenish the chemicals consumed during pre- commissioning and commissioning.
- Inspect vessel interior along with Company representative/ certifying authority before filling of chemicals for proper cleanliness.

1.15. House keeping

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

1.16. Equipment protection and spare parts

- Protect equipment from normal weather conditions, corrosion or damage before commissioning.
- Provide all installation and commissioning spares.
- Chemical Cleaning.

- Perform special chemical cleaning or pickling of the critical piping and compressor suction piping, etc. in accordance with vendors approved procedures.

1.17. Firefighting & lifesaving equipment

- Ensure correct installation of all firefighting and lifesaving equipment.
- Carry out function test of fire detection devices, foam and fire water spray system.
- Carry out Visual inspection of portable apparatus and ensure that these are installed at critical locations.
- Ensure that the escape drawings duly framed are installed at critical locations.

1.18. Miscellaneous

To carry out any other check/test as required by Company and provide all test certificate as required by the Company.

1.19. Operability test for a system/equipment

- The Contractor shall provide a procedure for carrying out the operability test of each equipment/system to prove that the equipment/system installed meet the design specification. This procedure shall include log sheets wherein the operating parameters shall be recorded hourly.
- Each system / equipment shall be subjected to an operability test to determine that it operates in accordance with its specifications and the design intent over the full range required by the Design Criteria. The operability test shall be conducted, using all ancillary equipment, auxiliaries and controls, continuously for the duration specified in these documents after stability conditions have been attained. If no duration is specified the test shall be conducted for 4 hours after stability has been attained. If the test is interrupted due to any reason, the test shall be started afresh.
- The operability test shall be carried out by the Contractor and the vendor's representatives, wherever applicable and witnessed by Company.
- The Contractor shall make necessary checks, adjustment, repairs required for normal operation of the system/equipment. All the safety devices shall be tested for their proper operation.
- Upon completion of the Operability test, the log sheet with all observation shall be signed by the Contractor, Vendor, Company representatives. The Performance shall be evaluated based on the data and observations made during the operability test. In case of any dispute, the decision of Company shall be final.

Section 5.0

Pre-Commissioning, Commissioning Procedure & Performance Tests (Process Platform)

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CONTENT

9.1. Operating manual
9.2. Pre-commissioning documents:
9.3. Modification/hook up procedure
9.4. Commissioning procedure
9.5. Other requirements
9.6. Yard check out before Load out
9.7. Modification and Hook-up
9.8. Manpower for Commissioning

Attachment A

1. Commissioning Checklist
   1.1. General Procedure
   1.2. Packing and seals
   1.3. Removal of temporary supports
   1.4. Alignment of rotating Equipment
   1.5. Tie-ins at unit limits
   1.6. System check/ inspection
   1.7. Site modifications
   1.8. Flushing
   1.9. Temporary screens, Strainers and Blinds
      1.9.1. Leak Test
      1.9.2. Vacuum Test
   1.10. Safety Devices
   1.11. Purging
   1.12. Drying out
   1.13. Lubricants and chemicals
   1.14. House keeping
   1.15. Equipment protection and spare parts
   1.16. Chemical Cleaning
   1.17. Firefighting & lifesaving equipment
   1.18. Miscellaneous
   1.19. Operability test for a system/equipment

2. SPECIFIC PROCEDURE
   2.1. Vessels
   2.2. Shell and tube exchanger

2.3. Air-cooled exchanger
2.4. Pumps, compressors and drivers
2.5. Piping system
2.6. Electrical power and lighting system
2.7. Instrument system
2.8. Portable water system
2.9. Water system (fire water system and sea water systems)
2.10. Sewage treatment and disposal
2.11. Building and Accessories
2.12. Cranes and hoists
2.13. Fire and Gas detection & Fire Fighting system
2.14. Shutdown system
2.15. Control Panels
2.16. Generals

1. INTRODUCTION

Contractor shall pre-commission, commission and carry out the Performance Tests on the Works including all the facilities of the Platform and associated Modifications of the facilities as listed in Description of work in the bid package. Prior to performing said activities Contractor shall submit a procedure for the same well in advance as per guidelines stated herein for Company's review and approval.

This procedure defines the following stages of the Works:

- Mechanical Completion
- Pre Commissioning activities
- Commissioning activities
- Performance Tests

For other requirements of testing refer Basic Bid Work, respective Design Criteria and respective Functional Specification given elsewhere in Bid Package.

A Pre-commissioning activity shall be considered to be complete only when it has been witnessed and the procedure and the results of successfully carrying out that procedure have been signed off by both Contractor and Company. Company may also require Vendor's representative to witness and sign that document.

During the pre-commissioning & commissioning activities, the Contractor shall involve Company's operating staff (nominated by the Company) and impart necessary techniques and know-how required for operation and maintenance of the facilities.

2. DEFINITIONS

2.1. Mechanical Completion

Mechanical Completion of the process Platform and modification work is defined as the state when all systems including utility and auxiliary facilities have been installed in accordance with the drawing and specifications and ready for pre-commissioning in safe manner and in compliance with project requirements and accordingly certified by Company or Company authorized representative.

Mechanical completion of a system includes following but not limited to:

- All design and engineering has been completed
- All installation work for that system including all equipment, piping, cables, etc., has been completed in accordance with "Approved for Construction" drawings, specifications, applicable codes and regulations and good engineering practices.
- All instruments have been installed as per installation Standards.
- All tie-in connections have been made.
- All factory acceptance tests and all other testing and inspection activities have been completed
- Contractor has obtained necessary approvals, which are the responsibility of the Contractor to obtain.
- Safety Studies have been completed and recommendation/observation of the Safety Studies reports has been met and all documentation put in place.
- All required documentation and certification documents required by the Contract have been supplied.
- All operating procedures and maintenance procedures have been forwarded to the Company well in advance for review.
- All items for which Contractor is responsible for obtaining third party, regulatory or Company approval have been obtained and confirmation documentation has been provided to Company.
- All software systems have been loaded and proved.
- Most construction-related equipment has been removed from the Platform, leaving only that necessary to pre-commission and commission the Works.

2.2. Ready for Pre-Commissioning

The works is Ready for pre-commissioning when the Company/company's authorized representative has issued a certificate for Mechanical Completion and notification in writing that the Works is Ready for Pre – commissioning.

2.3. Pre – commissioning Activities

Pre-commissioning activities are activities to be performed after Mechanical Completion of a piece of equipment, sub-system or system to make it safe and ready to receive hydrocarbons and Ready for Commissioning. This includes:

- Performance of all remaining works other than commissioning and Performance Tests.
- Making operational and commissioning all systems that can be made operational before well fluids are introduced.

- The completion and testing of connections between different Platforms and the platform equipment & systems
- Testing of all parts and systems of the Works including the communications systems (if requires).
- Provision of initial fill of packing, chemicals, inhibitors, lubricants, glycol, water and other stocks has been made.
- Checking site modifications.
- Internal inspection of the vessels
- Flushing/cleaning of vessels, piping, pipelines etc.
- Calibration of Pressure safety valves (PSVs) and Temperature safety valves (TSVs) etc.
- Calibration of all the instruments with documentation of results.
- Loop checking.
- Complete checking of the safety system
- Checks on electrical system and other vendor packages including Distributed control system (DCS) etc.
- The delivery, storage and cataloguing of all spares
- Items for which a Defect Notice are issued to be rectified and all Defect Notices shall have been closed out.
- The Completion Documents along with all Design Documents to As-Built
- The preparation of the commissioning plan and submission to Company for review.
- The hydro testing and pneumatic testing of vessels, piping, pipeline etc.
- Training and briefing of the Company's and Contractor's personnel involved in commissioning
- Removal of all debris and construction equipment from Site.

Further details are given in Attachment A.

2.4. Ready for Commissioning

Ready for Commissioning means the point at which the Company issues a certificate to the Contractor to say that the system is ready for commissioning. Ready for commissioning status shall be jointly reviewed by the company/ contractor.

At this point all systems and equipment shall be at a stage where process fluids can be safely introduced and all equipment can be safely operated with all controls and safety devices in service to meet the requirement as per design specification.

2.5. Design Capacities

The Maximum Design Capacity and Minimum Design Capacity are defined elsewhere in bid package

3. Execution of Pre-Commissioning Activities

Contractor shall complete all the pre-commissioning activities in accordance with conditions stipulated under Attachment A and as per instructions from vendor's of individual equipment. Contractor shall write necessary procedures and obtain approval from Company prior to commencing work and shall carry out the work in accordance with approved procedures.

The Contractor shall complete as many of the pre-commissioning activities as possible at the fabrication yard to minimize the working time in offshore. A guideline for carrying out the pre-commissioning activities at yard/offshore is given below. These are minimum requirements only.

Contractor shall repeat these yard tests at offshore in so far as is necessary to demonstrate that the equipment has not been damaged during transit from yard to offshore site and during erection/installation at offshore and that it is in the same condition as it was when first tested.

The Contractor shall submit a detailed schedule and procedure for carrying out these activities for approval by the Company before starting work.

3.1. Factory Acceptance Test Requirements (FAT)

As a minimum Factory Acceptance Test shall be required on the following packages:

- HIPPS System
- HPU System
- DCP skid with hose reel
- Navigational -Aid system along with battery ⚠
- F& G Detector ⚠
- Hypo chlorinator ⚠
- Fire & Gas system
- Multi-phase flow meters
- Multi-port flow selection valves (MPV)
- Pumps
- Compressors
- Turbine
- Well Fluid Heater, air coolers, any other exchangers
- Generator
- Water Maker
- Nitrogen Generator Package
- Pressure Vessel
- Inline separators ⚠

- Hydro-cyclone ⚠
- PSV & TSV
- Communications system.
- Distributed Control System (DCS)
- Fire/Emergency Shutdown System (FSD/ESD)
- Deck Crane (pedestal), All Pumps ⚠
- Chemical Dosing/ Injection Pumps
- Oil/ Gas Metering system
- Analyzers ⚠
- Instrument & Utility gas system
- Sacrificial anode, Solar Electric power system, submarine cable, ⚠
- Solar Panel and solar power controller ⚠
- Sub-sea umbilical ⚠
- PLC-based safety and control systems ⚠
- Control valves & Shutdown valves ⚠
- Transmitters & gauges ⚠

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The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications. The Contractor shall define factory Acceptance Testing Requirements as a part of all Purchase Requisitions. This requirement shall be submitted to the Company for approval prior to the award of a purchase order.

The packages shall be tested with the ancillary equipment that is to be supplied with them. Factory acceptance testing of instrumentation related equipment shall be as per functional specifications of the respective instrument items.

A Factory Acceptance Testing shall be conducted prior to dispatch from the Vendors works to determine that the assembled equipment meets the design requirements.

The Contractor shall submit a full Factory Acceptance Test procedure 6 weeks prior to the Factory Acceptance Test to detail the full extent of testing of the equipment. The testing procedure shall be approved by the Company prior to the commencement of testing and shall be complete with all equipment procedures, checklists and safety requirements to be taken. The Contractor shall be responsible for providing all necessary equipment and utility services to conduct the tests. The Contractor shall ensure that an opportunity is given to all relevant parties to attend all hold and witness points during Factory Acceptance Testing

3.2. Minimum Pre-Commissioning Activities to be carried out at yard

Factory acceptance test as brought out above shall be completed prior to pre commissioning activities at yard can be commenced. At least the following pre-commissioning activities shall be carried out at the fabrication yard.

- Check systems conforming to the requirements of the P&IDs, drawings and datasheets
- Leak Testing
- Internal Inspection of Vessel
- Inspection of strainers/filters, orifice plates and other piping specialties.
- Operability test of utility systems (except those which cannot be operated at the yard). Equipment shall be operated for a minimum of 4 hrs.
- System Flushing and Cleaning
- Operability test of pump and rotating equipment.
- Testing of PSV and TSV
- Complete unit test (Full load string test) of Turbine generator (TG) and Process gas compressor (PGC)

Pre-commissioning activities related to instrumentation at yard shall be as follows: ⚠

1. Off line testing and calibration of instruments as reflected in P&IDs, safe charts and other project documents.
2. Installation and hook-up as per installation & hook-up drawing.
3. Hydro testing of impulse tubing and other associated tubing. Leak test of instrument isolation valves / manifolds.
4. On line testing and calibration checks of all instruments and loop checking of all such instruments.
5. Installation and hook-up of gas detector fusible plug, ESD/FSD stations etc.
6. ESD/FSD loop testing.
7. Functional test of gas detection system inclusive of all related field devices, controls signals.
8. Any other instrument related activity not listed above but mentioned in the relevant functional specifications elsewhere in the bid package.
9. Additional test requirements are detailed in FAT Procedure.
10. All above tests are to be performed on the assembled systems to check their integrity, completeness and correctness before dispatch from vendor's works
11. All the tests will be witnessed by the Company.

3.3. Minimum operation checks for Distributed Control System (DCS) at vendor works.

Once the system is made ready at Vendor's works the Contractor shall carry out Operation and functional checks necessary to confirm that the system meets the Contract requirements of hardware, software & integration including the following:

- Debugging and graphics to ensure the correct display.
- Debugging alarms with respect to correct color codes, descriptions, priority and correct tag numbers.
- Checking and correction of the various control loops for conformance with the Platform systems safety philosophy.
- Functional test for the special assigned soft keys with respects to correct display.
- Debugging of guided messages display.
- Checking of all I/O through to field terminals
- Trip point simulation ⚠
- Logic function simulation ⚠
- Alarm generation and resetting ⚠
- Operator functions testing like normal functions, bypass operation, manual shutdown etc. ⚠
- System and process alarm diagnostic functions ⚠

Additional test requirements are detailed in FAT Procedure.
All above tests are to be performed on the assembled systems to check their integrity, completeness and correctness before dispatch from vendor's works.
All the tests will be witnessed by the Company.

3.4. Minimum Activities to be carried out at Offshore after Installation and Hook – up

The Contractor shall carry out the following activities after installation and Hook Up.

- Calibration checks of instruments and loop checking. All the system/equipment including Vendor's packages and Company supplied equipment (if any) shall be included.
- Charging of filter media, packing, lubes, chemicals, etc.
- Repeat testing of PSVs and TSVs.
- System flushing
- System drying (Where applicable).
- System leak test. Water lines are also included.

- Inert gas purging (wherever applicable) for hydrocarbon system. ⚠
- The acceptance criteria for purging will be safe tie-in site condition accepted by both company and contractor. ⚠
- Complete functional checks of DCS, Emergency Shut down and Fire and Gas Programmable Logic Controllers. All such tests to be carried out at offshore after installation and shall be followed as per functional specification of DCS and respective control system given in S.A.T
- Pre-Commissioning checks for UPS, Switch gear, MCC etc.
- Testing and checking of electrical equipment for proper earthing, continuity, insulation resistance and relay testing as per OEM recommendation, illumination level checking. ⚠
- Testing and checking of all lifesaving equipment and operability test (including load test) for survival craft (load testing of survival craft davit either at yard or offshore).
- Operability test of all utilities and fire water pumps for 8 hours.
- Repeat operability test of IA/UA air compressors & dryers, emergency (starting) Air compressor, utility/potable water pumps, chlorinators etc. for 8 hours.
- Calibration of gas/fire/smoke and H2S detectors. Testing and calibration of F&G System including various type of detector shall be followed as per Functional Specification of F&G System given elsewhere in Bid Package & SAFE Charts.
- Functional test and check of Central Control Panel, local Shutdown Panels and startup & shut down logics for injection pumps and booster compressors as per respective
- Functional Specification given elsewhere in Bid Package.
- Operability test of TG sets (8 hours each unit).
- Operability test for utility water lift pumps, injection pumps, chemical dosing pumps and operability test of deck cranes. (Load test of deck cranes will be required if the deck crane is installed at offshore or if it cannot be tested adequately at onshore).
- Operability and load test of material handling system.
- Operability test of firefighting equipment including hose reels, clean agent system and sprinklers system etc.
- Operability test of HVAC, radio, paging, intercom, CCTV, telephone system, EPABX and all living quarters equipment ⚠

- Run test of gas turbines, process gas compressor, booster compressors and generators for 24 hours at no load. All control logic, start-up & shutdown features shall be tried.
- Run test of Fuel Gas Compressors for minimum 4 hours at rated condition in conjunction with FG conditioning skid to demonstrate fulfillment of their purpose as per Process Design Criteria. All control logic, start-up & shut down features shall be tested.
- Installation & calibration of all laboratory equipment/instruments and put them on operation. Detail requirement to be firmed up in detailed design phase.
- Installation and placing in service of the machines provided in workshop.
- Checking of electrical power system, CP monitoring system, Battery capacity, etc. ⚠
- Functional test of ESD and Fire and Gas systems and associated start-up and maintenance by-passes
- Operability Test for Flare System ⚠
- Operability Test for Clean agent system

3.5 Site Acceptance Test (SAT) ⚠

As a minimum Site Acceptance test shall be required on the following packages which has to be inspected by ONGC/ Certification Agency.

- HIPPS
- DCS
- F&G Detection system
- Subsea umbilical
- Well head shutdown panel & standalone shutdown panel
- SSIV Actuator & HPU
- PLC
- Produce water Conditioning
- Fuel gas system
- Deck crane (pedestal)
- Instrument & utility gas system
- HVAC System

The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications.

3.6. Preservation of systems:

After completion of pre-commissioning and before handover of platforms, Contractor shall ensure the preservation of Equipment, systems, facilities etc., for 6 (six) months so as to the platform shall be ready for Commissioning / Start of Production Piping shall be preserved by filling Nitrogen or Water as required. Preservation of equipment etc. shall be done as recommended by respective vendors.

4. COMMISSIONING

Commissioning of the Platform and the Modifications involves the programmed introduction of hydrocarbons and the operation of all systems in the manner intended.

At least three months in advance of the planned date for the issue of Ready for Commissioning, Contractor shall submit for approval a procedure to the Company giving complete details of the programme and procedures to be followed for commissioning. The procedure shall describe all activities and methods for executing these activities safely. It shall provide details of the rates, ramp up rates, configurations of equipment, throughput, train combination, operation of standby equipment and all other matters required to introduce hydrocarbons to the Works, ramp up flows, test and prove the Works on hydrocarbons and do all other things required by Company to commission the Works.

After Company has given approval to commission the Works, well fluids will be introduced to into the Works. The flow of well fluids will be modulated as Company judges appropriate. At a time to be determined by the Company, the Company will determine that the Works is ready for Performance Tests and these tests will be conducted in accordance with the requirements of the Company.

4.1. Shut down Requirements

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipment in the existing process/ well platforms shall remain operational. The Contractor shall schedule all activities to minimize disruption to the production of existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the existing platform.

The platform Operations Group will control the scheduling and duration of any shutdown of the platform. The contractor shall submit Shutdown Schedule to the

Company for approval as part of the Pre-commissioning and Commissioning Procedure. The shutdown schedule shall include the following as a minimum:

A detailed list of all activities
Estimated duration of each activity
Float calculations for each activity
Manpower Histogram for each shifts of the shutdown.

Contractor shall also provide any requests for services and access required e.g. requests for accommodation, access to utilities, crane usage requirements, deck area access requirements, permit requirements etc.

Contractor shall note that its use of Company's facilities is limited and the availability of these facilities cannot be assumed or assured (as is described elsewhere in the contract documents).

4.2. Purging and Cleaning Requirements

Contractor shall prepare procedures for all work on existing systems and submit them for approval before starting work. Before modifications work is carried out on any system, pipe work and equipment shall be prepared in accordance with approved procedures, gas freed and purged as appropriate and as required by Company. Contractor shall arrange and supply nitrogen required for purging. The final oxygen content in process system shall be brought down to less than 2% (V/V). ⚠

The contractor shall develop procedures for the purging of systems prior to the introduction of hydrocarbons. Included in this procedure shall be the purging and gas freeing of existing lines of the platform requiring modification. This procedure shall include the proposed method of purging to be used, the duration of the purge, the purge medium and the acceptance criteria used to determine a successful purge. This procedure shall be approved by the Company prior to the commencement of any works at the platform

5. HSE / RISK MANAGEMENT ⚠

Work onsite shall comply with ONGC's Health and Safety Manuals, Work Permit System and other relevant documents.

The HSE program during Project Hook-up & Commissioning shall focus on the following six (6) main areas:

1) Site Supervision
2) Personnel Awareness
3) Personnel Capability
4) Accident Prevention
5) Management involvement and visibility
6) Pre-Startup Assessment

5.1 Personnel Awareness

Briefing on safety expectations for Project Hook-up & Commissioning supervisory team and Contractor's personnel will be conducted prior to mobilization.

The briefs shall be immediately prior to mobilization

All personnel will again undergo briefing once they arrive at the work site for specific health, safety and security procedures.

The Contractor shall publish and disseminate his HSE manuals and programs to his supervisory and all other personnel prior to mobilization.

Daily tool-box meetings and Job Safety Analysis (JSA) shall be carried out to ensure personnel are aware of work to be performed and the risk, if any, associated with the days work and mitigate steps to take. The work group foreman shall lead the daily morning discussion prior to commencing with work. The Project Hook-up & Commissioning supervisors or discipline engineer or operations personnel shall periodically monitor and participate in the toolbox meeting.

5.2 Personnel Capability

All personnel involved in the Project Hook-up & Commissioning are required to attend mandatory safety training as required by ONGC as a minimum. Contractor's personnel, e.g. rigger / scaffolder, welder, crane operator, grinder, etc. shall undergo trade competence training as required.

Safety investigation training shall be provided for supervisory, inspection personnel for both Project Hook-up & Commissioning and Contractor to provide them knowledge in recognizing root causes of safety incidence and encourage them to be pro-active in safety matters.

5.3 Accident Prevention

Project Hook-up & Commissioning shall carry out inspection on construction tools and equipment prior to issuance to the Project Hook-up & Commissioning personnel to ensure they are fit for service. The inspection shall be done periodically.

Once the tools and equipment have been issued, inspection will be by the user, supervisor, safety officer and discipline inspectors, as appropriate.

All lifting equipment shall be tested, certified and assigned a colour code signifying its certification period.

The Project Hook-up & Commissioning contractor shall screen its personnel prior to their employment to confirm that they are qualified for their assignment and are free from Drug & Alcohol (D&A) abuse. This shall be supplemented by random testing and testing for cause after mobilization.

Contractor Management will carry out safety audits on a regular basis.

Contractor shall implement a hazard identification program as part of daily routine.

ONGC operation shall administer the work permitting procedure for simultaneous operations (SIMOPS) and simultaneous production & drilling (SIPROD) of Project Hook-up & Commissioning.

ONGC Operation shall administer the Emergency Response Plan (ERP). Project Hook-up & commissioning group and its contractor shall formulate an ERP in-line with Operations established ERP procedures.

Contractor shall implement Job Safety Analysis (JSA) or Critical Work Analysis for engineered control of hazards on non-routine or critical activities with high hazard potential.

5.4 ONGC Supervisor's Responsibility

Publish the Project Hook-up & Commissioning Execution Plan after management endorsement and ensure its availability at work site.

Ensure that the Emergency Response Procedure (ERP) and Simultaneous Operations (SIMOPS), Health Safety Environment Management System and other safety documents are available at the Worksite.

Ensure that the Project Hook-up & Commissioning contractor assigns a safety engineer / officer full-time onsite to provide the supervisors with HSE advice.

Daily supervisory planning meeting shall be held between different groups, i.e. Operations, Drilling, project hook-up & commissioning and their contractors. This meeting shall serve as a forum to provide the different groups the guidance to plan / modify each group's activity as necessary to avert any conflict or interference.

5.5 Management Involvement and Visibility

Onsite visits by ONGC management and contractor's management shall be conducted on a regular basis at least once a month. The timing of such visits can be planned that they coincide so that any pertinent HSE issues can be discussed together first hand.

5.6 Pre-Startup Assessment

A pre-startup assessment of the Facilities shall be performed prior to introduction of hydrocarbon into the system. The assessment is performed and documented to confirm that:

- Construction is in accordance with design specifications.
- Safety, environment, emergency, operations and maintenance procedures are in place and adequate.
- Risk management recommendations have been addressed and the required actions taken.
- Training of personnel has been accomplished.

6. MODIFICATION WORKS

Contractor shall carry out modification works, interconnection and hook-up operation as given in Description of work in bid package. It shall be 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 contractor's responsibility to arrange and provide steam, chemicals, nitrogen etc. required for gas freeing operation. It shall be contractor's responsibility to ensure proper safety during tie-in / modification operation.

7. PERFORMANCE TESTS FOR WORKS

The Contractor shall carry out Performance Tests. The Contractor shall develop a detailed procedure for the performance tests in accordance with the requirements of the Contract and submit them to Company for Approval.

If sufficient well fluid is not available to test all streams and compressors simultaneously, the streams and compressors shall be tested individually in a manner approved by the Company and the Contract requirement shall be met at the approved rate used for the test.

7.1 Maximum Rate Performance Test of Platform

A performance test of the platform shall be carried out to demonstrate that everything (including process facilities and utilities) meets its Contract requirement.

The test shall be arranged such that the inlet flow rate to the facilities is ramped up in suitable steps until the Maximum Design Capacity is reached. A 72 hour test period will commence once the process is in a stable operating mode at the Maximum Design Capacity. Any reduction/change to the throughout (outside a band of ± 3%) during the 72 hours will negate the test and it will be recommended for another 72 hours once the flow rate has again stabilized at the design throughput.

During the ramp up period process controls can be tuned. The appropriate process measurements shall be recorded from the beginning of the test, throughout the 72 hours period and during the ramp down.

The performance test shall demonstrate that the works meet the requirements of the Contract. All equipment shall be tested to see that it meets the requirements specified (including capacities). These tests shall include demonstrations of the following (note that this list below is not an exhaustive list of the tests and demonstrations that shall be carried out on these systems);

Well stream heaters - these must also be shown to achieve the desired outlet temperature of the well stream fluids at the design throughput. Critical variables are the inlet and outlet temperature from the exchanger and the shell and tube side pressure drops.

Inlet separators - the ability of the separators to perform the gas/oil/water separation shall be tested. The test must be carried out with the addition of demulsifier to the feed to the well stream heaters. Testing will be required to determine the water-in-oil content of the outlet oil stream, the oil-in-water content of the separated water, and the liquid carryover in the gas stream.

Water treatment – the hydrocyclone system must be tested to ensure the water being discharged to the sea meets the specifications for discharged water. This shall be tested at lower rates during the ramp as well as at the maximum design capacity.

Process gas compression – the compressor train must be run and achieve the required pressure at the connection point to the main compressor outlet whilst achieving the inter- stage and discharge temperature requirements.

Gas dehydration – the gas dehydration package unit must operate in a stable condition and achieve the water dew point specification and glycol carryover specification for the gas. The glycol regeneration unit must operate and produce on specification glycol for return to the TEG column.

Booster gas compression – the booster gas compressors must achieve the desired outlet pressure at the design suction pressure and throughput. The pressure at the inlet to the PGC must be achieved at the maximum design capacity.

Hot oil system – the hot oil system must achieve the required hot oil supply temperature under all operating scenarios during the test. This will require that the well-stream heaters be on line so that the supply to these units can be confirmed.

The Instrument air package – the instrument air system shall be capable of providing the required air quality at the required flow rate. The air drier must operate for the design period before regeneration commences.

Fuel gas – the fuel gas system shall be shown to be capable of providing sufficient dry, superheated gas to the users.

Potable water – the potable water maker must produce the specified water quality and be shown to meet its design capacity requirements.

The test must successfully demonstrate that all equipment operates to specification and the shutdown systems for each system and the overall facility, work as required. As part of the test, the process simulation model of the process must be updated and validated against operating data. This will require some sampling and analysis of the Process streams in the facility.
At the end of the 72 hour test period the flow rates shall be ramped down and process recordings continued unit flow is stopped. The shutdown systems can be tested during the ramp up and ramp down period, but should not be tested during the 72 hour stable operation period.

The Contractor shall develop an extensive test procedure for the above, including details of all process measurements and analyses to be carried out.

7.2 Minimum Rate Performance test of Platform

The test procedure described above shall be repeated at the Design Minimum Capacities but for a period of 12 hours.
The Performance test shall demonstrate the works meets the Design requirements and demonstrate those things described in Section 6.1.

7.3 Performance Test of the Modifications

Performance test of the Modifications shall be carried out in a similar manner and scope to these nominated in Section 6.1 and 6.2.

They shall demonstrate that the Modifications meet the requirements of the Contract over the range of rates between Maximum Design Capacity and Minimum Design Capacity.

8. GENERAL

8.1. Vendor's representatives

The Contractor shall arrange manufacturer's representative(s) (at fabrication yard and offshore) of at least the following major equipment/systems (as applicable as per Scope of Works) during operability tests, pre- commissioning and until the satisfactory completion of the Performance Tests. The period required to be on the platform shall be that needed by contractor and that required and approved by company.

- ✓ Process Gas compressors
- ✓ Booster compressors
- ✓ Turbine generator package
- ✓ Emergency Generator
- ✓ Well fluid heater
- ✓ Separator
- ✓ HIPPS
- ✓ Multiport Valve
- ✓ HPU
- ✓ Gas dehydration packages
- ✓ Hot oil package/ WHRU
- ✓ Air compressor package
- ✓ HVAC
- ✓ Water maker
- ✓ Nitrogen Generator Package
- ✓ Fuel Gas conditioning skid
- ✓ Main injection pump package
- ✓ Sea water lift pump package/Utility Water pump package.
- ✓ Chlorinator package
- ✓ Sewage treatment plant package
- ✓ Main oil transfer pump package
- ✓ Produced water treatment system

- ✓ Communications systems
- ✓ Distributed Control System (DCS)
- ✓ Emergency Shutdown System (ESD)
- ✓ Fire and Gas System
- ✓ Battery and Battery charger
- ✓ HT/LT transformers.
- ✓ CP system
- ✓ Pedestal deck crane
- ✓ UPS
- ✓ Fire water pump
- ✓ Survival craft
- ✓ MPFM & MPV
- ✓ Chemical dosing / Injection Pumps.
- ✓ Oil Metering Systems.
- ✓ Gas Metering System.
- ✓ Online corrosion Monitoring
- ✓ Flare system
- ✓ SSIVs

In addition to above the contractor shall retain manufacturer's representatives for at least the following equipment on the platform during commissioning and at least two (2) weeks after successful commissioning of the platform facilities.

- ✓ Booster compressors
- ✓ Gas compressors
- ✓ Gas dehydration packages
- ✓ Turbine generator package
- ✓ Emergency Generator package
- ✓ HVAC
- ✓ Water Maker
- ✓ Sewage treatment plant package
- ✓ Hot oil package
- ✓ Main Oil transfer pump
- ✓ Separator
- ✓ Communications systems
- ✓ Distributed Control System (DCS)
- ✓ Emergency Shutdown System (ESD)
- ✓ Fire and Gas System
- ✓ Oil Metering System

- ✓ Gas Metering System.

The contractor's key commissioning personnel (at least one for each discipline, i.e. mechanical, electrical, instrumentation, electronics & process) shall be retained on platform for 30 days after successful commissioning of the complex.

8.2. Spares, Utilities ⚠

The contractor shall be responsible for submission of list of one year operational spares. The contractor shall provide list of spares and responsible for initial fill up and six month supply of consumables (like lube oil, lubricants, etc.) for the platform operations after modification works are mechanically completed, pre-commissioned/ commissioned and handed over to the company. Contractor shall refer section 5.16 of 3.0 part II general condition of contract.

All utilities required during pre-commissioning of the facilities including power, water, air, cranes, 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 supply lubes, chemicals, purging materials and other pre-commissioning aids required till the platform is handed over to 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 facilities.

The contractor shall maintain a record of the start-up spares consumed during pre-commissioning and hand over the balance items to the company.

8.3. Handing over of Materials ⚠

After the mechanical completion and completion of pre-commissioning activities for all the systems installed on the platform by the contractor, the contractor shall hand over to the company all the materials which shall include but not limited to the following:

- ✓ All loose supply material
- ✓ Special tools and tackles
- ✓ Commissioning spares
- ✓ Spares as specified in relevant functional specifications

8.4. Special requirements

It shall be Contractor's responsibility to install, calibrate and make all laboratory and workshops equipment operable. Contractor shall involve Company's chemist and maintenance engineers and impart necessary techniques and know-how required for operation and maintenance of this equipment.

9. DOCUMENTS TO BE SUBMITTED

9.1. Operating Manual

The Contractor shall prepare a draft start-up and Operating Manual for all of the facilities that are included in the Works and submit to Company at least 150 ⚠days prior to start of pre-commissioning activities for approval. Quantity of operating manuals requirement for all equipment shall be provided as per respective specification given elsewhere in bid package. The related attachments will go with each manual. The following information shall be included and hyperlinked in one single soft manual for easy maneuvering:

- ✓ Design basis of facilities
- ✓ Detailed process/ facilities description.
- ✓ Pre-commissioning check
- ✓ Start-up, normal operation & shut down procedures for each equipment.
- ✓ Platform start-up procedure.
- ✓ Platform normal operation procedure
- ✓ Platform shut down procedure (normal/emergency)
- ✓ Vendor instructions for all equipment for normal operation and trouble shooting.
- ✓ Emergency procedures.
- ✓ Operating parameters and set points of different alarms and trip devices
- ✓ Summary of chemical consumption including list of recommended Indian equivalent.
- ✓ Summary of utilities consumption for each equipment.
- ✓ Lubrication Schedule (include Indian equivalent, initial fill, frequency of change of lubricant and 6 months requirement).
- ✓ Gas detection and associated safety system operation, calibration and maintenance procedure.
- ✓ Life saving devices operation and maintenance procedure.
- ✓ Routine structural maintenance check.

- ✓ List of equipment (showing skid size, weight, purchase order no., vendor data book reference tag no.)
- ✓ Effluent disposal.

The manual shall have the following attachments as a minimum:

- Reduced size copies (275 mm x 425 mm) of line lists
- Equipment and instrument data sheets in accordance with purchase order
- Electrical Single line diagrams, area classification drawings and control schemes
- Pump characteristic curves
- Process Flow Diagrams (PFDs) & Piping and Instrumentation Drawings (P & IDs)
- Booster compressor start & shutdown procedure, logics and protection system. ⚠
- Process gas compressor start-up & shutdown procedure, logics and protection systems ⚠
- Gas turbine generator start-up & shutdown procedure, logics and protection system ⚠
- Safety Logic Diagrams and Safe charts.
- Recommended proforma for recording routine parameters during normal operation for PGC, booster compressor, TG, DG set, IA/UA compressor and fire water pump and cathodic protection system and all process equipment.
- Equipment layout.
- Safety escape routes
- Field location maps.
- Layout and location Maps for fire and safety equipment's.
- All hardware and schematic drawings of system packages like PCS, PLC-based ESD etc. shall be as-built ⚠

The contractor shall submit the draft Operating Manual to the Company for approval. The Contractor shall discuss the comments with Company & incorporate the 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/ engine r's representative. This manual l shall be followed during start-up and commissioning of the facilities.

Vendor operating and maintenance manuals shall be submitted along with the final operating manual. ⚠

The operation manual can be divided into two or three parts if the thickness of manual exceeds 80 mm. It shall describe, pre-start up checks, start-up procedures, shut down procedure and normal operation for an equipment vendor recommended procedure and integration of that equipment with other facilities. Contractor shall also submit 150 days before the commissioning the system operating Manual for the distributed control system (DCS), which shall contain system description, operating instructions and necessary information for the familiarization of the operator.

9.2. Pre-commissioning documents:

The Contractor shall submit a detailed schedule for carrying out the pre-commissioning activities in a network form.
Contractor shall prepare detailed format of checklists of pre-commissioning and commissioning activities for each equipment/system. The Contractor shall submit the said format for approval of the Company. These check lists shall describe the checks/test to be carried out on each equipment/system, shall also indicate if a particular check/test is to be carried out at the yard or offshore.

All the check list points shall be dealt by the Contractor. Determination of the system readiness for commissioning shall be determined based on the relevant portion of check lists have been completed by the Contractor.

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

- System / sub-system identification.
- Detail procedures for the various pre-commissioning activities, such as system check, flushing, de-watering, drying, leak test, purging etc. with format to record the observations of the activities carried out.
- Procedures and formats for recording the operability test/performance test for different equipment/system.
- Lube schedule, indicating the nomenclature (Indian equivalent) of lubes, quantity of initial fills.
- Listing of commissioning and start up spares.

- List of pre-commissioning activities to be carried out at fabrication yard, or offshore, or at both places.
- High-pressure leak check procedure of gas system.
- A detailed procedure for management of any special bypass or defaults required for commissioning.

The Contractor shall submit a draft pre-commissioning documents 180 days before the activities are to be carried out. The document shall be reviewed by the Company. The Contractor shall submit a revised document after incorporating Company's comment for approval to the Company. The approved document shall be submitted 120 days prior to starting of the pre-commissioning activities.

At the end of pre-commissioning activities, all the pre-commissioning test records (duly signed) shall be compiled by the Contractor. Three copies of documents for each system shall be delivered to the Company.

9.3. Modification/hook up procedure

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipment of the existing platform shall remain operating. The Contractor shall schedule all activities to minimize disruption to the production of the existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the platform.

Contractor shall produce a procedure with his detailed shut down requirements for the various hook-ups required to be carried out on the platform. This shall be presented to company for approval within 120 days ⚠ of Notification of Award. Contractor shall submit, along with Pre- commissioning procedure, a detailed procedure for carrying out modification works, interconnections and hook-up operations for the facilities. An Isolation scheme to be prior to carrying out modification works shall be worked out in advance and detailed in this document.

A Separate Hook-up Procedure for modification at platform along with pre-engineering survey document shall also be submitted to Company for review as part of the Commissioning Procedure.

9.4. Commissioning procedure

Contractor shall prepare this document to detail out the procedures and sequence of commissioning of the project facilities including the log sheets for logging of parameters of different equipment/ system during commissioning. The contractor shall have required inputs from the company and the vendor's representatives. The document shall include the shift rosters for the contractor/vendor's representative to be deployed during commissioning operation. This document shall be submitted to the company for approval, 120 days prior to the commencement of commissioning operation.The document shall also include log sheets for the Performance Test. The document shall be submitted to the company for approval as described in Section 4.

9.5. Other requirements

The Contractor shall provide safety equipment locations, H2S safety information chart, warning signs and escape route drawings (framed). These drawings must be placed in locations approved by the Company before the platform is commissioned. The Contractor shall also provide adequate numbers of NO SMOKING boards, which will be installed where required by the Company.

An emergency plan shall be prepared and shall be in place prior to commencement of Pre-commissioning and commissioning activities. The plan shall define the actions, personnel and facilities required in case of an emergency.

In addition to the other requirements of the Contract, Contractor shall supply adequate sets (A3 size) of Process & Instrument Drawings, electrical single line diagrams and wiring diagram to the company to facilitate system check before start of hook-up work. The Contractor shall also provide two sets of PFDs on acrylic sheets which will be installed at locations specified by the Company.

9.6. Yard checkout before Load out

Prior to load out, the Contractor shall carry out, at the yard, a check of the facilities for correct erection and installation, operability, maintenance requirement and safety of plant and personnel during operation in accordance with accepted international good engineering practices, this will be witnessed by the Company. The Contractor shall carry out all modifications and corrections in accordance with the final punch list prepared jointly by the Contractor and the Company.

9.7. Modification and Hook up with platform

Contractor shall carry out hook-up operation of modification works at Platform. Contractor shall obtain and produce details of all existing platforms for this purpose during a pre-engineering survey of existing platforms.

The Contractor shall carry out the required pre-commissioning activities for the existing system which are either modified or hooked up to the new facilities. Contractor shall carry out all preparatory work necessary including: draining, venting, gas freeing, purging etc. for facilities at platform required for safe tie-ins. It shall be the Contractor's responsibility to arrange everything required to safely complete these operations. Contractor shall also ensure safety of personnel during tie-in operations.

9.8. Manpower for Commissioning

For commissioning of the platform, Contractor shall deploy personnel with experience in operation of similar facilities, commissioning shall be round the clock uninterrupted operation. The Contractor shall arrange & provide all categories of personnel i.e. shift engineers, operators, technician, chemist, safety engineer etc. required for manning the platform during commissioning operations. The Contractor shall submit the commissioning organization chart with details of the experience and qualifications of key commissioning personnel for approval to the Company. Contractor shall modify the charts to incorporate Company requirements. Contractor shall submit this chart along with pre-commissioning documents.

ATTACHMENT A

Pre-Commissioning Check List

1. PRE-COMMISSIONING CHECKLIST

This checklist represents the absolute minimum of work which has to be performed by the Contractor prior to commissioning of the facilities. It is not intended to be a complete list of activities required. Manufacturer's instructions for pre-commissioning checks/ testing shall be followed for all equipment.

1.1. General procedure

The general work procedures listed below outline the work to be performed by the Contractor. Other procedures applicable to specific system or items of equipment may be covered elsewhere in the contract.

1.2. Packing and seals

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

1.3. Removal of temporary supports

Removal all temporary supports, bracing or other foreign objects that were installed in vessels, transformers, piping, rotating machinery or other equipment to prevent damage during shipping, storage and erection/ installation.

1.4. Alignment of rotating equipment

- Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
- Make cold alignment to the manufacturer's tolerances along with Company. Provide all the alignment readings records to Company. Contractor shall prepare the formats (unfilled) and submit to Company for approval.

- Check all lubricants and their quality, fill etc. before operating the equipment.
- Carry out uncoupled run of motors, check bearing temperatures, vibration, no load currents, over current trips, function of different safety devices and carry out adjustments as required.
- Make hot alignment and any dowelling required after equipment has been put in operation.
- Obtain manufacturer representative for equipment as required during installation and/or pre-commissioning and commissioning.

1.5. Tie-ins at unit limits

Prepare all systems for safe tie-ins with bridge connected platform or with existing operating systems. Contractor shall prepare the systems for Tie-ins in consultation with Company and will be responsible for safety during tie-ins being made. Contractor shall gain approval of Company for the safety measures to be taken by them before any tie-in work is taken up.

1.6. System check / inspection

Provide inspection facilities to the Company to check that erected facilities conform to Process & Instrumentation Diagrams, construction drawings, vendor drawings and specifications approved for construction.

Verify and approve the facility check. Note exceptions, if any, on a separate work order list (punch list).

1.7. Site modifications

Carry out site modifications as found necessary during system checks and inspection from the viewpoint of routine operations, maintenance and safety of the platform. A list of such jobs shall be prepared by the Company and shall be handed over to the Contractor for execution.

1.8. Flushing

Perform flushing and blowing of all piping to remove dirt, welding slag, etc. Arrange for cleaning media (potable water or compressed dry air, as applicable) for carrying out flushing/blowing and disposal of the cleaning media in accordance with minimum procedures to be developed by the Contractor and approved by the Company. Following is the minimum velocity of cleaning media to be maintained for flushing/blowing of piping:

AIR: - 2.4 – 2.7 m/sec
WATER: - 1 – 1.2 m/sec.

1.9. Temporary screens, strainers and blinds

- Provide and install temporary strainers where 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 or operation.
- Change gasket if necessary.

1.9.1. Leak Test ⚠

- Leak test of complete process facilities including piping, equipment, instrument connections etc. to be carried out in accordance with ASME 31.3 latest addition after completion of pre-commissioning activities, safety checks and hydro test.

- Notify the Company of test schedule at least two weeks in advance. All the tests are to be witnessed and the test record on satisfactory completion of the test be signed by Company.
- Provide 4 copies of all the test records to the Company.

- Provide any special media, if required for test purpose and provide facilities for disposal.

- Conduct all operational tightness testing

1.9.2. Vacuum tests

Carry out vacuum test to rectify any leakage

1.10. S a f e t y devices

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

- Install all safety devices on the equipment.
- Test and adjust all safety devices such as PSVs, TSVs at offshore and seal wherever necessary. Other safety instruments/ instruments systems inclusive of field devices, Well / fire shutdown panel, gas detection system shall also be tested.

1.11. Purging

Install necessary purge connections and carry out system purging including that of flare and vent with Nitrogen in accordance with Company approved procedure. The final Oxygen content in purged systems shall be reduced to an approved safe limit. Contractor shall arrange & supply the Nitrogen required for purging.

1.12. Drying out

Dry out necessary facilities wherever required by Company.

1.13. Lubricants and chemicals

Procure and supply initial fill of all lubricants, chemicals, resins, desiccants and other similar materials, replenish the chemicals consumed during pre- commissioning and commissioning.

Inspect vessel interior along with Company representative/ certifying authority before filling of chemicals for proper cleanliness.

1.14. House keeping

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

1.15. Equipment protection and spare parts

Protect equipment from normal weather conditions, corrosion or damage before commissioning.

Provide all installation and commissioning spares.

1.16. Chemical Cleaning.

Perform special chemical cleaning or pickling of the critical piping and compressor suction piping, etc. in accordance with vendors approved procedures

1.17. Firefighting & lifesaving equipment

- Ensure correct installation of all firefighting and lifesaving equipment.
- Carry out function test of fire detection devices, foam and fire water spray system.
- Carry out load test of survival crafts in accordance with company approved procedure.
- Carry out Visual inspection of portable apparatus and ensure that these are installed at critical locations.
- Visual inspection of survival crafts, checking the inventory of items, starting of engine by battery and manual cranking.
- Mock demonstration of complete operation of survival craft including a run of 10-15 kms.

1.18. Miscellaneous

To carry out any other check/test as required by Company and provide all test certificate as required by the Company.

1.19. Operability test for a system/equipment

The Contractor shall provide a procedure for carrying out the operability test of each equipment/system to prove that the equipment/system installed meet the design specification. This procedure shall include log sheets wherein the operating parameters shall be recorded hourly.

Each system / equipment shall be subjected to an operability test to determine that it operates in accordance with its specifications and the design intent over the full range required by the Design Criteria. The operability test shall be conducted, using all ancillary equipment, auxiliaries and controls, continuously for the duration specified in these documents after stability conditions have been attained. If no duration is specified the test shall be conducted for 4 hours after stability has been attained. If the test is interrupted due to any reason, the test shall be started afresh.

The operability test shall be carried out by the Contractor and the vendor's representatives, wherever applicable and witnessed by Company.

The Contractor shall make necessary checks, adjustment, repairs required for normal operation of the system/equipment. All the safety devices shall be tested for their proper operation.

Upon completion of the Operability test, the log sheet with all observation shall be signed by the Contractor, Vendor, Company representatives. The Performance shall be evaluated based on the data and observations made during the operability test. In case of any dispute, the decision of Company shall be final.

2. 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. Vessels

- Open vessel after erection and put in place any internals requiring field installation.
- These internals shall be inspected before and after installation. Open both internal and external man ways for inspection of vessels by the company.

Check filter media/packing for correct level (if applicable)

Note: Vessels that have been pressure tested in the shop may require retesting offshore if required by the company. They shall, however, be included in the testing of attendant piping systems whenever practical and approved by the company.

2.2. Shell and Tube Exchangers

- Perform internal inspection/testing as required by specifications or drawings
- Perform separate field testing, if desired by the company of Exchangers that have been shop tested.
- Cross leakage for exchangers may be tested at company's discretion
- Check electrical earthing of vessel.
- Check piping connections flange face alignments and remove any blinds installed while construction/testing
- Check mounting of instruments & safety valve
- Check for correct insulation/paint/name plate

NOTE: Shell and tube exchangers that have been pressure tested in the shop may require testing offshore if required by the company. They shall, however, be included in the testing of attendant piping system whenever practical and approved by the company. If shell and tube exchanger is taken in piping system test and the exchanger is designed for differential pressure, proper care shall be taken to ensure that differential pressure between shell and tube side is not exceeded beyond the maximum recommended differential pressure during the testing.

2.3. Air Cooled Exchangers

- Inspect exchangers to ensure that temporary shipping supports and erection material have been removed.
- Check fins and fan for shipping damage.
- Perform separate field testing, if desired, of exchangers that previously have been shop tested

Note: - Air cooled exchangers that have been pressure tested in the shop may require retesting offshore if required by the Company. They shall, however, be included in the testing of attendant piping systems whenever practical and approved by the Company.

2.4. Pumps, Compressors, and Drivers

- Level base plates and sole plates.
- Alleviate any excess piping stresses that may be imposed on pumps, compressors, and drivers.
- Chemically clean lube oil, seal oil system, when specified. Dispose of wastes and cleaning media in accordance with Company's instructions.
- Change the lube oil, seal oil, and cooling systems with flushing oil and circulate for cleaning purpose. Dispose of any flushing oil in accordance with the Company's approved procedure.
- Change the lube oil, seal oil and oil cooling systems with the operating oil after removal of flushing oil recommended by the manufacturer
- Provide service engineer for technical assistance during installation and/or pre-commissioning and commissioning as specified

2.5. Piping Systems

- Notify the Company of hydro test schedule at least two weeks 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.
- Hydrostatically or pneumatically test all piping as required by the Drawings or specifications.
- After testing, drain and dispose of the test media in accordance with the Company's instructions. All the piping will be dried using air and sealed.
- Check pipe hangers, supports, guides, and pipe specialty items for the removal of all shipping and erection stops and for the correctness of cold settings for the design service.
- Check pipe hangers, supports, guides, and pipe specialty items for hot settings and make minor adjustments as necessary.
- Install seals on valves where necessary.
- Correct support, vibration, and thermal expansion problems detected during commissioning.
- Ensure appropriate permanent gaskets are installed and all flanges are tightened properly.

Refer Functional Specification Piping Fabrication & Installation (2004B).

2.6. Electrical Power and Lighting systems

- Notify the Company of the test schedule prior to commencement of work.
- Using a megger, make insulation tests on all wiring.
- Insulation tests are to be carried out on all HT/LT cables, HT/LT panels & lighting boards etc.
- Using a megger, make insulation tests on generators, motors, and transformer windings from phase to phase and phase to ground.
- Make grounding system test to determine the continuity of ground connections and the value of resistance to ground.
- Carry out insulation tests on all dry transformers
- Make trials and adjustments and functional tests on all switchgear, control panels, and motor control equipment.
- Test-set switchgear relays for proper coordination.
- Check phase sequence and polarity.
- Energize the complete power system with approval of the Company after completion of all tests.
- Check installation and operation of emergency power systems.
- Check that all electrical equipment is certified for the environment in which they are located.
- All relays are to be tested as per OEM recommendation.
- No load current of all the equipment is to be recorded. Three copies of all the test results to be provided to Company representative
- Make function test at LT / HT switch gear.
- Illumination level checks are to be done for entire lighting system.
- Check phase sequence & polarity.
- All UPS Powered systems shall be operated for 8hrs on UPS power.
- All HMI Functionalities shall be checked in HT/LT switchgears

2.7. Instrument Systems

- The Contractor will make all non-operating checks that will ensure instrument operability, i.e. remove all shipping stops; check pointer travels' and verify instrument capability to measure, operate and stroke in the direction and manner required by the process application.
- Clean all transmission and control tubing by blowing with cooled and filtered clean air before connecting to instrument components.
- Clean all air-supply headers by blowing with clean air and check them for tightness.
- Leak test pneumatic control circuits in accordance with ISA Recommended
- Practice RP 7.1. Pneumatic Control Circuit Pressure Test, 1956.
- Check piping from instruments to process piping for tightness.
- Install and connect all system components and verify their conformance to specifications and design criteria for function and range using dummy transmission signals as needed.

- Check all electrical signals and alarm wiring for continuity, correct source of power, and polarity.
- Check thermocouples f o r proper joining of wires, position of elements in wells, proper polarity & continuity of receiving instruments.
- Identify orifice plates by tagging and check for proper installation of upstream side of plate.
- Isolate, or remove if necessary, online components such as control valves, positive displacement meters, and turbine meters for pressure testing. Reinstall these items after testing the system.
- Check bores of orifice plates and install these plates after completion of flushing operations.
- As dictated by the Company's specification, calibrate instruments with standard test equipment and make all required adjustments and control point settings.
- 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.
- Check settings of all alarm and shutdown switches.
- Check all shutdown systems before commissioning.
- Check all safety valves and settings. Ensure that safety valve isolation valves are locked open in accordance with drawings.

2.8. Potable Water System

- Inspect for completeness and correctness of installations and make any non- operating checks that may be required.
- Make the necessary operating tests and adjustments to water maker systems.
- Provide all water treatment chemicals.
- Carry out quality checks on potable water.

2.9. Water System (Fire Water System and Sea Water Systems)

- **I**nspect for completeness and correctness of installation and make any non-operating checks that may be required.
- Clean and install screens in the suction line before water circulation.
- Operate pumps to check correct operation and output of system.
- Obtain and install all required firefighting chemicals and portable equipment such as houses, fire extinguishers, and related equipment.

2.10. Sewage Treatment and Disposal

- Inspect facilities for completeness and correctness of installation and make any non-operating checks to ensure their conformance to specifications.

- Operate all equipment and supply all chemicals and agents dedicated to waste treatment.

2.11. Building and Accessories

- Check installation of buildings and accessories, including all heating, ventilation and air conditioning equipment, to ensure their completeness and conformance to specifications.
- Operate heating, ventilation and air conditioning systems and make all performance tests.
- Check for correct pressurization achieved where ever provided, with reference to the start-up purging and alarm system.

2.12. Cranes and Hoists

Check all materials and equipment handling systems to assure freedom, direction of movement, and proper operation

Load test of deck cranes will be required if the deck crane is installed offshore or if it cannot be tested adequately onshore or if required by the company.

2.13. Fire and gas detection and firefighting system

After installation work of detector heads is complete, all the fire detection systems and the fire safety panels such as UV detectors, thermal detector, and smoke detector shall be tested to demonstrate that the system and its components work in accordance with the contract and the design. This shall include annunciation at fire & safety panel, shutdown of the facilities, starting of the fire suppression system etc. procedures for testing the clean agent system shall be produced and carried out after approval of company.

The dry chemical system shall be checked for proper Nitrogen cylinder, quality & quantity of powder, and actuation system. Each hose station shall be tried for its intended application. A separate Nitrogen cylinder shall be used for the trial run. All the foam and fire hose stations, monitors shall be tried.

All the portable fire extinguishers & other safety equipment shall be installed at company's approved locations. Deluge valve testing shall be carried out

2.14. Shutdown system

The ESD system shall be checked for closure of all valves, shutdown of generator & other rotating equipment, etc. the ESD and FSD systems shall be checked by manual pull switches and by removal of fusible plug from fusible plug loop.

2.15. Control panels

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

2.16. General

All utilities, namely running of utility pumps, firewater pumps, air compressor, air conditioning, pressurization system, crane and essential lighting system shall be operational before fuel gas is fed to the platform.