OIL AND GAS DEVELOPMENT COMPANY LIMITED (OGDCL)

SECTION - III
Scope of Work

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1.0 Scope of Work

1.1 General

1.1.1 The Contractor shall be responsible for execution of the project on complete responsibility basis and accordingly carry out all activities necessary to have in place an operational Nashpa Compression Facility including vetting and endorsement of Basic Design for Compressor Packages, their suction & discharge headers, piping and associated tie in points for all required services & facilities, detailed design engineering, procurement (supply) of equipment and material, construction, installation/erection, testing and complete all the civil, mechanical, electrical and instrumentation works, hook-up, tie-ins, pre-commissioning, commissioning & startup until issuance of Final Acceptance Certificate. When completed, the works shall be fit for the purposes for which it is intended and as defined in the Contract.

1.1.2 OGDCL intends to have a complete workable safe and operable plant meeting all the performance parameters, guarantees and warranty requirements. The Scope of Work described in this document is to enable the EPCC Contractor to bid for Nashpa Compression Facility Project.

The EPCC Contractor's Scope of Work shall include, but not be limited to:

- Prior to performing Detailed Engineering of the project, EPCC Contractor shall vet and endorse the Basic Design of Compressor Packages, their suction & discharge headers, piping and associated tie in points for all required services & facilities.
- Detailed Design Engineering of the project.
- Detailed HAZOP study of Compressors (Nashpa Compression Facility Project) and its associated equipment/items outside the compressor packages.
- EPCC Contractor to measures the actual required lengths of new and modified piping/header and vet & endorse their hydraulic calculations.
- Material selection study for entire project is in EPCC Contractor scope of work which includes new compressor packages, lines, equipment, instrumentations etc.

- EPCC Contractor shall provide proper double block & bleed and positive isolation for all process piping tie-ins.
- Procurement (Supply) of all equipment / material including preparation and placement of Purchase Orders, expediting, inspection, quality control, shipping, delivery and offloading at site for Nashpa Compression Facility project.
- Deployment of all construction/erection, equipment, materials, tools/tackles consumable, manpower etc. for execution of the project.
- Pre-commissioning, commissioning, performance testing, Reliability Guarantee Test (RGT) of Nashpa Compression facility and training of staff.
- Construction, fabrication, erection and hook-up/tie-ins to existing mechanical, electrical, instrument, civil and safety system of existing Nashpa Gas plant.
- Project Management, Planning & Control of the whole project from contract award throughout to final acceptance by OGDCL.
- QA / QC.
- Health, Safety and Environment (HSE).
- Provision of detailed construction drawings.
- EPCC Contractor shall be responsible for providing softcopies (editable and pdf) of all engineering work/documents.
- Scheduling of project for material, procurement, fabrication, installation, construction of all the mechanical, civil, electrical and instrumentation with milestones, followed by monthly presentations on each discipline.
- Approvals from OGDCL/Consultant for all engineering, material, equipment & consumables.

- Arrange delivery of initial fills, consumables, lubricants, commissioning spares (including startup and operation during Performance Test and until successful completion of Reliable Guarantee Test).

- Supply of OEM recommended Consumables & spare parts for one (01) year operation.

- Item-wised price list of OEM recommended consumables & spare parts supply for two (02) years operation. (as optional price)

- Preparation of all documentation (including as-built drawings / documents and operations / maintenance manuals etc) and their submission to OGDCL in both hard & soft form.

- The EPCC Contractor shall be responsible for liaison and coordination with OGDCL/ENAR Consultant and other Suppliers. Liaising with certifying Local Authorities (provincial and federal government) to obtain the permissions and licenses for executing the work and preparation of all the necessary documentation shall be in the EPCC Contractor's scope of work.

- Construction and maintenance of temporary site facilities warehouse & security arrangements.

- If EPCC Contractor is not complying with any requirement of tender document, it shall be explicitly mentioned under exceptions/exclusions section of the bid. Anything not mentioned in exceptions/exclusion will be considered in EPCC Contractor's scope of work and supply irrespective of scope of supply as may be given in the bid.

- During preparation of bid, if bidder feels that such piece of equipment can be optimized to reduce cost then EPCC contractor shall provide as an alternate option with justification.

- EPCC Contractor shall consider 25 years design life of the project and equipment.

- All the reference documents to be provided to OGDCL/Consultant for review and record.

The EPCC Contractor shall perform the work in an efficient manner with due diligence, high professional standards, and good industry's practices, internationally accepted codes/standards in accordance with the requirement set out in the Contract Documents.

The EPCC Contractor shall not be relieved of any of its obligations under the Contract as a result of any inspection, examination, review, instruction, approval, consent or certificate given / issued by OGDCL/Consultant.

The Contractor shall comply with all applicable laws including environmental regulations, OGDCL's HSE & Security requirements in the performance of the Contract and shall ensure that the Project is fully compliant with all applicable laws.

1.1.3 The Scope of Work is intended to cover the design and construction of the Nashpa Compression Facility Project described in the Tender documents in accordance with good engineering practice accepted in the Industry. Any work or detail, which is not expressly set forth, but which is necessary to complete the job to the true intent and meaning of this Scope of Work, shall be furnished by EPCC Contractor as though specifically noted herein, without extra charge to OGDCL.

1.1.4 EPCC Contractor shall furnish all materials and equipment (including initial charges of any lubricants, portable fire extinguishers and chemicals, tools, construction materials and consumable supplies required for the project and shall make the complete installation of the Nashpa Compression Facility covered in this Scope of Work. The Nashpa Compression Facility when turned over to OGDCL shall be in a commissioned condition and successfully performance tested.

1.1.5 The EPCC Contractor shall provide all ordinary and special tools, test equipments, transport, labor, supervision and all other necessary arrangements regarding the execution of the specified work and arrangements for the security of its personnel, supply of equipment and materials. All material furnished by EPCC Contractor shall be approved by

the OGDCL / Consultant before work is commenced. Only new, top quality materials from approved vendors/manufacturers will be acceptable to OGDCL.

1.1.6 The EPCC Contractor shall transport to Project site all (for EPCC's own use) materials, equipment, vehicles, consumables, labor and personnel necessary for the work.

1.1.7 The EPCC Contractor shall provide a temporary camp for his own personnel, equipment and materials in the vicinity but outside the Nashpa Gas Plant. The EPCC Contractor shall establish a fenced and guarded ware-house/store inside Nashpa Gas Plant for secured storage (security to be in line with Clause 11.11 of Condition of Contact) of material and equipment procured for the project. The EPCC Contractor shall maintain stores record of all such equipment and material and handover the records to OGDCL after completion of the Project to facilitate reconciliation of consumed/installed and left over equipment/material.

1.1.8 The EPCC Contractor shall also establish all necessary workshops/fabrication shops inside the Nashpa Gas Plant for execution of Project construction activities. Demobilization of all equipment, camps stockyard, works shops, fabrication shops, etc. and clean and reinstate these areas, shall also be the responsibility of the EPCC Contractor.

1.1.9 The EPCC Contractor shall carryout the necessary temporary works, and construct, install and mechanically complete all the works and submit all documentation as required by this Scope of Work.

1.1.10 The construction, installation and mechanical completion activities shall take full account of other work being carried out. The EPCC Contractor should bear in his mind that all major construction activities shall be performed when the existing Nashpa Gas plant is in operation. During construction works the EPCC Contractor shall ensure, together with his own personnel and equipment the safety of the existing equipment and material at Nashpa gas plant as well. The EPCC Contractor shall abide by the OGDCL's safety policies/procedures and shall ensure that his work in any way shall not affect normal plant operation of existing plant. The EPCC Contractor shall clearly identify the areas of works inside the plant in operation and shall make all arrangements required for safe execution of construction related activities. The EPCC Contractor shall also be responsible for

obtaining all hot or cold work permits or any other permits as deemed necessary by the OGDCL on day-to-day basis.

1.1.11 The EPCC Contractor shall make all necessary work plans/procedures as required by the OGDCL and shall submit the same for approval prior to execution. It is also intended to specifically mention that all the final tie-ins/hookup works will be completed during Nashpa gas Plant's shutdown. The duration of plant's shutdown shall be limited but will be mutually agreed between the EPCC Contractor and the OGDCL. The EPCC Contractor shall ensure completion of all such works within the agreed time schedule with due diligence and shall make all necessary arrangements, thereof. A detailed schedule shall also be required prior to commencement of construction activities during shutdown.

1.1.12 The information and data given is not intended to be an exhaustive list of all the requirements of the Contract. The EPCC Contractor's scope of work must be read in conjunction with the Tender documents and all parts of the Contract. EPCC Contractor's scope of works shall comprise all activities necessary to complete the project in accordance with the requirements of all of these documents.

1.1.13 All work shall be carried out by EPCC Contractor under the supervision of experienced personnel in accordance with OGDCL procedures, and the best and latest approved practices in the oil and gas industry.

1.1.14 Health, Safety and Environment requirements and provisions shall be in accordance with the requirements of the Contract and shall fully comply with OGDCL's policies/ procedures and international standard.

1.1.15 The EPCC Contractor shall also comply with the QA/QC, Safety, Planning and Scheduling requirements of the Contract throughout the execution of the Project.

1.2 Design & Engineering

1.2.1 General

1.3 Prior to performing Detailed Engineering of the project, EPCC Contractor shall vet and endorse the Basic Design of Compressor Packages, their suction & discharge headers, piping and associated tie in points for all required services & facilities.

1.3.1.1 The Vetting and Endorsement of Basic-Design of Compressor Packages, their suction & discharge headers, piping and associated tie in points for all required services & facilities, shall include studies, calculations, etc to confirm and verify the process design and equipment sizing basis. The Design Vetting/Endorsement and Optimization Report shall be submitted to OGDCL/Consultant for approval. However, detailed engineering will include preparation of process data sheets, Heat and Material balance, review and updating of existing PFDs and development of new Process Flow Diagrams (PFDs), development of piping and instrument diagrams (P&IDs), development of operating control philosophy, startup/commissioning spares, emergency and shutdown system and details of first fills/consumables requirements.

The EPCC Contractor shall be responsible for the provision of all engineering and design services necessary to complete the project in conformity with the requirements indicated within this scope of work. The general requirement will also include but not be limited to:

- Verification of the provided design data. EPCC Contractor shall, by site visit (s) and otherwise, familiarize himself with existing facilities, field operation and site details, clarify any inconsistencies and obtain any additional information he may require to complete his work; and check, correct and supplement any existing drawings required as a basis for his work. Updating of all received data as a result of site visit, information received from OGDCL/Consultant shall be the responsibility of the EPCC Contractor.

- EPCC Contractor shall develop all necessary Documents (including) for the procurement, fabrication, transportation, installation, construction, pre-

commissioning, commissioning, performance test, Reliability Guarantee Test and start-up of the facility.

- Performance of any additional studies or calculations required to further define equipment or system requirements, or to demonstrate the adequacy of the proposed design.

- Risk Studies (HAZOP, HAZID and Safety Assessment) due to installation of New Compressor Packages will be arranged by EPCC Contractor in the presence of OGDCL/Consultant which shall be chaired by the Third party chairman to find out any gaps / risks / hazards, by using a Systematic Approach.

  After completion of RISK studies, all recommendations will be incorporated by EPCC Contractor in design/drawings and technical specifications.

- Preparation and updating on a regular basis of all drawings, specifications, requisitions and other documents required for the purchase, fabrication, testing and installation of all equipment, materials and facility defined herein.

- Provision of procurement, expediting and inspection services for all equipment, materials and skids/packages.

- Review of vendor data, drawings and other documentation to ensure compliance with specifications.

- The Detailed Design to be performed by the EPCC Contractor shall include but not limited to the following:

  i. Updating, completing, (re-drawing if necessary) of the Design Documents provided by OGDCL / Consultant.

  ii. Preparation and issuuance of all necessary MTO's, requisitions, and other technical documents for the procurement of Equipment and Bulk Material.

  iii. Preparation and issuance of all design documents for construction, installation, pre-commissioning, commissioning and start-up procedures, approvals.

iv. Liasing with Certifying and Local Authorities to obtain necessary design appraisal reports, including preparation of all necessary documents.

v. Checking and co-ordinating for all Vendor's detailed Engineering and Final Documentation.

vi. Performance of all detailed studies, procedures, calculation notes and the like for the Vendors supplied items. Implementation of field mismatches and changes desired by Operation/Maintenance, etc.

vii. The Detailed Design shall include in particular but shall not be limited to the preparation and issue of the documents which require "Approval" prior to implementation for procurement, construction and/or installation.

viii. The Detailed Design Documents including all drawings, specifications, MTO's and Manuals shall contain all essential and adequate details in a manner that this project can be carried out independently without too much interdepartmental dependence and that start-up, commissioning, operation, safety and maintenance procedures can be implemented smoothly and without confusions.

- EPCC Contractor shall develop and submit to the OGDCL / Consultant a comprehensive list of drawings/documents with the Work Program for control purposes.

- The EPCC Contractor shall ensure that the plant facilities to be implemented as part of this project shall be capable of continuous, safe and efficient operation at all anticipated conditions during the active life of the installation.

1.4 Project Management, Planning & Control

1.4.1.1 Management

1.4.1.1.1 The EPCC Contractor shall carry out all activities according to a pre-approved project plan. Contractor shall prepare and submit, for OGDCL's approval, procedures for all Works. These procedures shall strictly comply with the requirements of the Contract where applicable. After the approval, these procedures

shall be strictly followed in the performance of the Works and any deviation will require prior approval of OGDCL.

1.4.1.1.2 As a minimum, management of the Works will include the means to ensure that:

a. EPCC Contractor shall manage all internal coordination between Contractor departments involved in the execution of the Works such that the Works, and the transitions and interactions between all particular phases of the works, are executed in an efficient, safe, environmentally sound and timely manner and EPCC Contractor initiates and implements such procedures as are appropriate to achieve the execution of the Works in that manner.

b. The EPCC Contractor shall manage and coordinate with all of its Sub-Contractors involved in execution of the Works in accordance with the requirements identified in this document.

1.4.1.1.3 The EPCC Contractor shall co-ordinate and control all major phases of the work including:

- Detailed engineering, design and specification of all equipment, materials and facilities in the EPCC Contractor's Home Office.
- Erection, construction and hook-up of the facilities at site.
- Pre-commissioning, commissioning, performance testing, handover of the completed facility to OGDCL.
- Material reconciliation as required.
- Compilation and provision of a Completion File as well as a formal Closeout Report to OGDCL on completion of the EPCC Contractor's Scope of Work.

1.4.1.1.4 The primary project management function of the EPCC Contractor is to ensure that all parties, including Sub-contractors contributing to the project, comply with their established duties and responsibilities and take corrective action where necessary to ensure that the project is completed in a timely and satisfactory manner.

1.4.1.1.5 Where applicable Pakistani law and regulations conflict with Company's Specifications as detailed herein, Pakistani law and regulations shall govern. (EPCC

Contractor shall promptly inform OGDCL in writing of any conflict, which arise for Company's comment before any design/procurement activities commence).

1.4.1.2 Planning

The EPCC Contractor shall plan and schedule all major activities listed above, prior to the commencement of that activity. Such plans and activities will be updated, at least monthly, and take into account the current status of proceeding activities. These detailed plans and schedules will be summarized in Master Schedules and Networks, etc. for approval by OGDCL.

1.4.1.3 Project Control & Administration

1.4.1.3.1 The EPCC Contractor shall develop and implement detailed project control procedures and effective systems applicable to all phases of the Works, covering all aspects of planning, scheduling, progress reporting, estimating, quality control, cost control, accounting and administration to be implemented under, and as part of, and in accordance with the Approved Project Plan.

1.4.1.3.2 As a minimum, the project control and administration works to be carried out pursuant to this section will include the following requirements:

- Project planning and progress measurement shall be in accordance with OGDCL's requirements as detailed in subsequent section of this document and shall be reported to OGDCL/Consultant.

1.4.1.3.3 The EPCC Contractor shall control all aspects of the project using network analysis, schedules, Gant charts, etc. Project controls will include:

- All aspects of estimating, cost control, planning, scheduling, change orders, extra works, and claims and back charges. An effective system for quantitative measurement of physical progress shall be incorporated.
- Details of computer programs to be used.
- Details of codes of accounts to be used.

The EPCC Contractor shall also submit Level-1 to Level-4 Schedule along with the bid.

1.4.1.4 Progress Measurement and Reporting

1.4.1.4.1 The EPCC Contractor shall maintain up to date networks, document control register procurement schedules, etc. to demonstrate day-to-day progress and control of the project. These documents will be supplemented by weekly and formal monthly reports covering all aspects of the project, and will be of sufficient detail to enable Company to satisfy itself that the project is proceeding in a timely manner.

1.4.1.5 Construction Planning

1.4.1.5.1 The EPCC Contractor shall pre-plan all construction activities to ensure full definition of an optimum construction plan, procedures and scope of work. Such plans will cover construction strategy, coordination and interfacing of all on-site activities, quality control and safety procedures. The plans will be subject to review and approval by OGDCL.

1.4.1.6 Quality Assurance and Control

1.4.1.6.1 The EPCC Contractor shall be responsible for ensuring that Approved Quality Assurance Procedures are complied with throughout the various phases of the project. The procedures will include but not be limited to:

- Identification of quality standards
- Implementation of Quality Assurance procedures for design
- Document controls
- Procurement controls
- Vendor surveillance programs including witnessing performance and run-in tests
- Implementation of Quality Assurance procedure during construction and Pre-commissioning
- Reviews and disposition of non-conforming items
- Maintenance of records

- Implementation of Quality Assurance

The EPCC Contractor shall ensure that all sub-contractors/suppliers he appoints comply in all respects with the approved Quality Assurance procedure.

1.4.1.7 General Services

1.4.1.7.1 Sub-Contractor

The EPCC Contractor shall be responsible for all the activities of its Sub-Contractors and shall arrange for necessary assistance and attendance of Sub-Contractors and their respective representatives at Site or at any as may be required for EPCC Contractor to execute the Works in accordance with the Contract.

2.0 Process Engineering

This section describes the general process related technical requirements of the Nashpa Compression facility to be provided by the EPCC Contractor. Furthermore, the cases considered for the compression study project are as follows:

Case-1a: 600 psig Compressor Suction with High Reception Pressure (i.e. 1050 psig).

Case-1b: 600 psig Compressor Suction with 600 Psig Reception Pressure.

Case-2: 200 psig Compressor Suction with 200 Psig Reception Pressure.

Reference: Design Basis (0193-A-1000) and Process Design Package in Volume-IIA

Note: *Compressors shall be designed in such a way that safe, continuous and trouble free operation shall be carried for both Rated and Normal Conditions of Case-Ib and Case-2 as well as on Turndown conditions as stipulated in compressor datasheet..*

The EPCC Contractor's process engineering will include all studies, calculations, reports, documents/drawings etc for the adequate process design and equipment sizing. It will include the preparation of process data sheets, heat and material balances, utility balances, development of PFD's, UFD's and P&ID's for all systems, including preparation and implementation of the control, startup and shutdown philosophies and the detail engineering of tie-ins with existing facilities/systems. Development of the process and utility systems will take full account of environmental requirements in particular the safe disposal of liquid and vapor effluents to flare or drain. The EPCC contractor's engineering team will also take part in the HAZOP review, and perform any Hazards Analysis arising there from. The EPCC contractor's engineering team will review plot plans, layouts etc for safety, operability and ease of maintenance.

EPCC Contractor shall design all the systems/Units/modifications according to codes and standards and perform all the necessary works (i.e. detailed design engineering, procurement of equipment and material, construction, installation/erection, testing and technically complete all the civil, mechanical, electrical and instrumentation works, hookup Tie-ins, pre-commission and provide commissioning and startup) from all aspects so that safe, continuous and trouble free operation of the compression facility is assured.

The EPCC Contractor's scope with respect to process engineering shall include but not limited to the following:

2.1 New Compressor Packages

Front End Compressors shall be packaged reciprocating compressor according to (API SPEC 11P) which is self contained (on skid) and reduced the compressor occupied area/space, modular design, complete in all respects, machine supplied in pre-assembled, pre-wired conditions.

Four (04) Front End Compressors shall be installed in parallel configuration. The suction pressure of compressors ranges from 600 psig to 200 psig with constant operating discharge pressure of 1050 psig, however for the early high suction pressure scenario, PCV shall be installed at suction of each compressor.

The above specific areas shall be addressed by the EPCC Contractor within his scope, as well as detailed design and engineering of Nashpa Compression Facility Project along with interconnections/tie-ins in all respects with the existing systems.

2.2 Modifications in the Existing Process System

Following modifications in the existing process system of Nashpa Gas Plant shall include in the EPCC Scope of work:

1. Gas Outlet Line of existing finger type slug catcher shall be changed from 10" dia to 16" dia. All the existing instrumentation/connections in the same line shall remain exist for the new line size with new tie-ins except FT-2001, PT-2004 and TT-2001 which shall be relocated to the discharge header of new FEC.
2. Routing/Connection of slug catcher (SC-2001) liquid hydrocarbon from inlet of MP separator (V-2102) to liquid hydrocarbon discharge line of MP separator (V-2102).

2.3 Offsites and Utility Systems

The following offsites and utility systems shall be provided under the scope of work of this project.

2.3.1 **Instrument Air System**

EPCC Contractor shall finalize the quantity of instrument air required for the compression facility and finalize the line size and tie in points accordingly. Moreover, a new air compressor (K-3401 C) (same model as existing air compressors) is to be installed in addition to the existing air compressors (K-3401 A/B).

Furthermore, EPCC scope of work shall also include detailed design in all aspects (Process, Mechanical, Piping, Instrumentation & Control, Electrical and Civil works), procurement, installation, construction, commissioning, startup etc. of new air dryer package (having same capacity and same model as existing air dryer package installed at Nashpa Plant) parallel to existing air dryer package. Furthermore, EPCC Contractor shall also finalize the line size and tie in points accordingly. For technical specifications of new dryer package, refer to the detail technical specifications and data sheet of existing dryer package as attached herein the Addendum.

New Instrument Air Dryer shall be designed as per specification of Unfired Pressure Vessel (0193-VA-001). A steel structure shed shall be designed and fabricated for new Instrument Air Compressor & new Air dryer Package for preventing them from ambient condition.

2.3.2 **Fuel Gas System**

In order to provide the fuel gas to the new compressor Packages for engine, the EPCC Contractor shall vet and endorse the existing fuel gas system of Nashpa Gas Plant and finalize the tie in points in case the existing system found adequate to cater the additional load for the new compression facility and resolve the bottlenecks (if any).

2.3.3 **Fire Water System**

Existing fire water tanks, pumps and associated piping headers are adequate for the compression facility fire fighting. However, bidder shall take respective tie-ins from existing fire water header(s) for compression facility and shall further design, procure, construct and install proper fire fighting system for compression facility based on international codes and standards.

EPCC Contractor shall finalize the fire water requirement for the compression facility. In order to provide the required fire water for the new compressor Packages, EPCC Contractor will determine number of Hydrants / monitors around Nashpa Compression Facility considering finalized fire water requirement as per NFPA codes and standards and develop their specifications accordingly. Further, EPCC Contractor shall also check the possibility/requirement of installation of fixed spray system in each Front End Compressor package.

2.3.4 **Flare System**

Existing flare system is adequate for the compression facility. However, bidder shall take respective tie-ins from existing flare system for compression facility and shall further design (considering the governing load of blowdown/PSV), procure, construct and install proper flare system for compression facility based on international codes and standards. EPCC Contractor shall finalize the Flare load for the Nashpa Compression Facility considering the worst case scenario.

EPCC Contractor shall ensure that the flare system study for compression facility shall be carried out as per API STD-521, which guides that the system to be depressurize within a fire zone shall reduce the pressure of the equipment to 50% of the design pressure or 100 psig, whichever is lower within 15 minutes. Furthermore, the allowable mach velocity of 0.5 in sub header/ header is acceptable for intermittent service. However, for tail pipe, 0.7 Mach velocities are allowed.

NEQS data is attached in the data sheet of compressors in **Volume-IIA** of the tender document**.**

2.3.5 **Plant Air and Utility Water**

EPCC Contractor shall provide Plant air and utility water connections to compression facility as mentioned in respective P&IDs.

2.4 Design Reviews (HAZOP)

The EPCC Contractor shall be responsible for timely and adequate engineering and design reviews to ensure that a safe, operable and easily maintainable facility is designed

and constructed. The EPCC Contractor will be responsible for a formal HAZOP review of the proposed facilities at "Approved for Design" stage, to be conducted at Packager's facility by third party approved by OGDCL/Consultant. EPCC Contractor is to justify his design at the HAZOP any modification as a result of HAZOP, which EPCC Contractor cannot justify, shall be accommodated by EPCC Contractor at no cost to the OGDCL. For design and HAZOP review OGDCL/Consultant shall participate. Before the commencement of Hazop review, the EPCC Contractor shall submit a detailed procedure and methodology statement, and execution plan to OGDCL for approval.

OGDCL shall be given at least eight (08) weeks' notice of the HAZOP review such that OGDCL's operations personnel should attend. EPCC Contractor shall make sure that all the recommendations of HAZOP study are included in the design and implemented during installation of the project.

The following, but not limited to, documents must be reviewed in the HAZOP Study meeting:

a. Basis of Design

b. PFD(s) and H&MB

c. Operating Control & Safeguarding Philosophy

d. ESD and F&G system

e. UFD(s)

f. P&ID(s)

g. C&E Matrix

h. Plot Plan(s)

i. Hazardous Area Classification Drawings

The EPCC contractor shall provide HAZOP report for the OGDCL/Consultant review and approval. EPCC Contractor must ensure that all recommendations of HAZOP study are implemented/ incorporated in the proposed design. The EPCC contractor shall incorporate all HAZOP recommendations in P&IDs, C&E and any other design

document and, provide close-out on HAZOP recommendations and provide final version of all the process design documents for the OGDCL/Consultant review and approval.

3.0 Mechanical Engineering

3.1 The Mechanical Engineering area shall include all design calculations, sizing, specification and selection of equipment including compressors, prime movers, vessels, exchangers, filters, piping, fittings, valves, insulation etc. It will also include the development of requirements and specification for hoist, lifting beams, trolleys, etc., as required.

3.2 The Contractor shall review and approve all vendors' drawings and other documents to ensure compliance with specification, and witness testing of equipment in the vendors' works, prior to shipment. The Contractor shall review both the Supplier and Vendors' drawings to ensure that adequate operating and maintenance access is provided to all equipment

3.3 Contractor is encouraged to shop fabricate and skid mount as much of the equipment as practical to minimize field construction. The tropical weather conditions experienced in Pakistan may put a significant constraint on field construction work. The Contractor shall ensure to the extent possible that most of the processing unit can be shop fabricated and assembled, then the necessary disassembly done to permit shipment to the compression facility.

3.4 The Mechanical features shall incorporate high quality equipment in accordance with the best industry practices and shall embody the Specifications for the equipment included herein. The equipment and mechanical features specified are intended as a guide to the building of an economic, reliable and safe plant.

3.5 Contractor shall develop detailed 3D layouts of compression facility with piping, which clearly show the skid mounted construction of the packages, layout of piping sleepers / supports, steel structures and piping of the compression facilities. The 3D layouts of compression facility shall be submitted to the OGDCL/Consultant for their review and approval.

3.6 Mechanical engineering works shall include but not limited, to the following:

a. Mechanical design philosophies

b. Provide equipment List including process and auxiliary equipments and long lead items.

c. Provide specification for piping, fittings, valves, insulation, etc.

d. Provide all equipment specification and mechanical design data sheets.

e. Sizing of mechanical equipment.

f. Establish fire Protection requirement for equipment, structure, etc and provide design, specification and data sheets for the same.

g. To perform material selection study based on corrosion management philosophy and expected life of compression facility.

h. Provide Tie-in schedule for tie-in of Nashpa Gas Compression Facility with the existing Nashpa Gas plant (wherever require) including tie-in methodology.

i. Provide specifications of all equipments/systems of, but not limited to, the following:

- Gas engine driven reciprocating compressors
- Instrument Air System (Instrument Air Dryer, Instrument Air Compressor etc).
- Knockout drum
- Fire Fighting/Protection
- Piping, pipe fittings, valves and all piping components

j. Provide design details of all skid specifications including sizing, fabrication, painting etc. and their mechanical drawings.

k. Provide compression facility piping design documents such as, piping plans, piping layout tie-in study and design, drawings and material take off piping material and class specification, piping isometrics, 3D modeling, mechanical structures & foundations design, pipe supports MTO and weight estimates, fabrication, painting, insulation, stress analysis reports etc. Consultant shall provide list of applicable codes and standards.

l. Any other aspect related to mechanical design and engineering.

m. Provide details related to static and dynamic load stress analysis including piping for equipment such as compressors, vessels, heat exchangers etc.

3.7 Mechanical equipment design, sizing and arrangements shall provide for full compression facility capacity, unless otherwise specified. If Contractor is able to devise mechanical arrangements acceptable to OGDCL/Consultant, which will result in reduced costs, while retaining required features of dependable operation with proven equipment, OGDCL/Consultant may consider such improvements.

3.8 The attached plot plans show the minimum/stringent requirement with respect to spacing. However, Contractor has to ensure compliance with OGRA standards. All equipment, pipe racks, Pipe Bridge, pipe sleepers must be placed in aesthetical order with the intent of minimum piping routes, ease in maintenance and adequate vehicles (crane) movements.

A bolted steel structure shed shall be provided on each compressor package in such a way that during maintenance, the roof of the shed would be detachable for crane boom movement for lifting any Compressor/Engine part. EPCC Contractor shall also provide fixed spray system for each Front End Compressor package.

A steel structure shed shall also be provided on the new Instrument Air System and local control panel of Reciprocating Compressor Package similar to existing shed.

EPCC Contractor shall also submit detailed calculation and software analysis report of all steel structure sheds for review.

3.9 The attached fire water layout drawings show the minimum requirement of Fire hydrant & monitor. However, it shall be finalized by Contractor during detail engineering phase. Further please refer to General Specification of Fire Water System.

3.10 Contractor shall provide all details drawings and Vendor/Supplier drawings for OGDCL/Consultant review and approval.

4.0 Electrical Engineering

4.1 This section describes the general electrical related technical requirements of the Nashpa Compression Facility to be provided by the EPCC Contractor.

4.2 The EPCC Contractor shall be responsible for the design, procurement, storage, installation, commissioning and testing of the complete electrical system of NASHPA Compression Facility.

4.3 For Electrical Works Package please refer Vol-II C. The EPCC Contractor shall vet and endorse the design and data presented to him and make sure that the design and data within the package complies with all the requirements of specifications and documents, and is consistent with good engineering practice.

4.3.1 The EPCC Contractor shall be responsible to clarifying any inconsistencies and obtain any additional information, by site visits that may be required to complete the works. The EPCC Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project.

4.3.2 The EPCC Contractor shall be responsible for complete design and engineering works including performance study of electrical equipments, selection for power distribution, electrical design calculations, specifications/ datasheets, drawings etc. The EPCC Contractor shall also be responsible to identify the complete requirement in order to ensure the reliable and safe continued operation of the electrical system of NASHPA Compression Facility.

4.3.3 Any work or detail, which is not expressly set forth, but which is necessary to complete the job to the true intent and meaning of this Scope, shall be furnished by EPCC Contractor as though specifically noted herein, without extra charge.

4.3.4 Equipment sizing and design will be based on the individual “worst case” for each equipment. The detailed design shall comply with the requirements set forth in the design codes, recommended practices, safety design codes and other specification as provided in the Basic Design Package documents. Due care shall be exercised for the ease of construction and expansion, commissioning and start-up, repair and maintenance, and

safety to operate under all conditions. Consideration shall be given to the design of facility in order that no environmental hazards are created to upset the ecology of the surroundings.

4.3.5 The EPCC Contractor shall submit the design calculations, sizing and selection of electrical equipments to OGDCL/Consultant for review and approval.

4.3.6 The EPCC Contractor shall review and approve all vendors' drawings and documents to ensure compliance with specification, and witness testing of equipment in the vendors' works prior to shipment. Final drawings and test reports shall be submitted to OGDCL/Consultant for their record.

4.4 In general, the design shall include sizing of equipment, design for safe installation & operation, and preparation & issue of specifications, data sheets, calculations, design and construction drawings for the complete electrical system which shall include, but not be restricted to, the following: -

a. Calculation of electrical load and updation of electrical load list.

b. Design, sizing, selection and supply of complete electrical system including LV electrical motors, lighting & small power outlets systems, earthing system, lightening protection, electrical heat tracing, cathodic protection system (for oily water sewerage & fire water network underground pipeline), lighting distribution boards (LDBs), package electrical equipments etc. Complete in all respects.

c. Preparation of single line diagram, schematic and control circuit drawings, MCC – Compressor Control Panel interface & interconnection drawings for each Front end compressor and instrument Air compressor's MCC.

d. Updation of existing single line diagram of main distribution board (MDB), UPS & lighting for new electrical loads.

e. Preparation of schematic and control circuit drawings, junction box (JB) wiring diagrams etc.

f. Preparation/Updation of specifications and datasheets for all the electrical

equipments like LV electric motors, field mounted motor control stations (MCS), lighting system, LV power cables & control cables, cable glands, cathodic protection system, heat tracing system for liquid level instruments, earthing system, lightening protection system, lighting distribution boards (LDBs), electrical cable tray-ladder type etc.

g. Calculations for cable sizing and preparation of cable schedule. The cable schedules shall detail all electrical power, control, indication and alarm cables of all voltages. Cable details shall also include individual cable lengths, to and from locations with equipment references, cable types, sizes and number of cores.

h. Updation of existing power & control cable route layout

i. Preparation of layouts including earthing system layout, lighting system layout, lightening protection, cathodic protection system layouts, electric heat tracing drawings/layouts, standard details etc.

j. Updation of electrical installation specification and electrical typical installation detail drawings.

k. Updation of electrical hazardous areas classification drawings in line with local and international codes, standards and regulations. This also includes selection and supply of electrical equipment in line with hazardous area classification.

l. Updation of layout drawings (equipment arrangement layout plans etc.) for electrical switchgear/ MCC room showing equipment locations (if required).

4.5 The EPCC Contractor will undertake the following Design Calculations:

a. Cable sizing calculations and drum schedule

b. Lighting level calculations

c. Earthing/Lightning system calculations

4.5.1 All power cables to motors shall be based on a maximum 15% volt drop during motor starting. All power cables shall be of fire retardant material. Cu/XLPE/PVC/SWA/PVC cables shall be used for power & control cabling. The most appropriate installation method for individual plant areas shall be selected to compute the cable deration factor on grounds of ensuring the lowest risk of failure/damage, longest life expectancy and most economic installation.

4.5.2 The EPCC Contractor shall carry out the area lighting study and provide the number, location and distribution of luminaries within the new front end compressors & Instrument Air Compressor area for a safe working environment for 24 hours plant operation. Lighting is to be provided for new Front End Compressors area & new Instrument Air Compressor as follows:

a. Area Flood Lighting

b. Skid Lighting

c. Emergency Lighting

4.5.2.1 Area & skid lighting shall be provided for new Front End Compressor's (K-2001, K-2002, K-2003 & K-2004) area & additional Instrument Air Compressor (K-3401 C). Power supply to luminaries shall be at 230V, 1-phase 50Hz, derived from strategically placed new lighting distribution boards (LDBs) supplied from the plant main distribution system. The lighting distribution boards (LDBs) shall cater for new Front End Compressor & Instrument Air Compressor area and skid lighting. Lighting sub-circuits shall be connected in a radial pattern and shall be provided with isolators arranged to switch phase and neutral at the distribution board. Isolators shall be pad lockable in the "OFF" position.

4.5.2.2 The emergency lighting design shall provide sufficient illumination to indicator safe escape routes for operating personnel from all plant areas, as well as providing illumination at essential control positions. Emergency lighting shall form a minimum of 15-20% of the total number of luminaries.

4.5.2.3 The emergency lighting luminaries shall also include the essential luminaries, and shall be fitted with a battery pack that shall provide 1 hour of power for one tube of the fitting. Essential lighting shall be either maintained or non-maintained type emergency light fixtures (with battery backup). In the event of total power failure (normal and emergency), the essential lighting luminaries shall provide reduced lighting, adequate for personal safety and escape,(minimum two lux) for the minimum backup time of 1hrs. These luminaries shall be positioned to illuminate escape routes and emergency exits.

4.6 The EPCC Contractor shall seek approval of the electrical inspector as required in the local law/regulations.

4.7 The EPCC Contractor shall be responsible for Factory Acceptance Test (FAT) / Site Acceptance Test (SAT) for the supplied equipment and material.

4.8 The electrical materials to be supplied by the EPCC Contractor include, but are not limited to the following:

a. Modification works in the existing Main Distribution board as per SLD# NGP-010-ELE-15.01-0002-13.

b. LV MCC/Distribution board for each Front end compressor and instrument Air compressor's auxiliaries.

- Motor control center/control cabinet rated for operation at 400/230 V, 50 Hz shall be of the factory built assembly type & IEC certified
- Refer Specification for LV switchgear MCC Document# NGP-000-ELE-15.03-0005-13.

c. LV power and control cabling with termination kits, cable glands and accessories.

d. Earthing, bonding and lightening protection material.

e. Electrical cable tray (ladder type) including of horizontal/vertical elbows, horizontal tees, cable ties etc.

f. Lighting system including of lighting distribution boards, lighting fixtures, lighting

poles, cable glands, junction boxes etc. for new front end compressors & instrument air compressor area.

g. Industrial welding socket outlets 32A, 5Pin (3phase+neutral+earth).

h. Modification works (if required) in the existing UPS and Main Distribution board.

i. Cathodic protection (CP) system material.

j. Electrical heat tracing material.

4.9 The EPCC Contractor shall be responsible for the installation and testing of all the electrical items. Complete installation material along with installation shall be included in EPCC Contractor's scope

4.10 The EPCC Contractor will perform pre-commissioning, commissioning of all electrical equipment and complete start-up of NASHPA Compression Facility.

4.11 The placement of LV MCC/Distribution board for each Front end compressor's auxiliaries shall be as per proposed location marked in DWG# NGP-010-ELE-15.01-009-13. However, EPCC Contractor shall be responsible to update the respective layouts as per vendor data and site conditions during detailed engineering.

4.12 Supply and Installation of Cable Gland Box which includes MS-Base plates, MS-channels, supports, nuts, bolts, washers, clamps etc. required for complete installation of Switchgear/MCC panels is EPCC Scope.

4.13 The new switchgear panel shall be coupled with the existing Main distribution board in existing Electrical building.

4.14 Floor Opening/Core Cutting for Extension of the new Switchgear & MCC Panels including installation material for construction related civil works is included in EPCC contractor's scope. Complete in all respects.

4.15 Supply & installation of Cable tray in ground floor of existing Electrical building for additional cables is in EPCC Contractor scope.

4.16 The EPCC Contractor shall be responsible for the electrical works for all on-skid, off-skid equipment, and all associated utilities/ accessories of the project including all cabling, lighting, earthing, cable tray (ladder type), etc. It shall be the EPCC Contractor's responsibility to see that all equipment is designed, constructed, procured and installed in accordance with the Specifications, drawings, Projects applicable Codes and Standards.

4.17 The equipment and material selection, manufacturing, testing and inspection shall conform to the relevant standards of the latest edition. Any changes or alteration to the equipment to make it meet standards and codes requirements shall be at the expense of the EPCC Contractor.

4.18 Hazardous Area Classification

4.18.1 Hazardous Area Classification shall be in accordance with Area Classification Code for Petroleum Installation (API-505) and IEC 60097.

4.18.2 All electrical equipment to be used in classified areas shall be selected in accordance with API Std. RP 505 "Recommended Practice Classifications of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1 Zone 0, 1 and 2 and IEC 79 – 14 and approved by OGDCL/Consultant.

4.18.3 Existing Area Classification drawing shall be updated for the new front end compressors area, which shall be used as a basis for the selection of electrical equipment. Existing Classification drawing shall be updated showing the type and extent of hazardous areas in both plan view and elevation (s).

4.18.4 The classification shall be carried out as a joint study involving Process, Mechanical, Electrical, Instrumentation and Safety engineering disciplines.

4.18.5 A "Hazardous Equipment Schedule" document shall be produced which shall contain, as a minimum, the following information:

- Equipment number
- Fluid contained/handled
- Details of type of release (i.e. normal/abnormal operating)

- Density relative to air
- Details of any vents
- Allocated electrical classification (i.e. zone, apparatus group, temperature class).

4.18.6 All equipment and materials installed in hazardous areas on the plant shall be certified by an internationally recognized certifying authority (e.g. BASEEFA, PTB, INIEX, CENELEC, FM, UL, LCIE etc.) for use in the respective "Classified Area".

4.18.7 When certified equipment is not available to meet the specific requirements of a "Classified", equipment certified for a use in a more severe condition should be employed. For example, in a Zone-2 area where equipment certified for use in Zone-2 is not available, then equipment certified for use in a Zone-1 Area should be employed.

4.19 Refer Electrical Design basis Document 0193-ELA-6500 for the design, selection of electrical equipments.

5.0 Instrumentation and Control Engineering

5.1 The Contractor shall be responsible for the engineering, procurement, supply, storage, installation, testing etc of complete instrumentation and control system of NASHPA Compression facility.

5.2 EPCC Contractor shall be responsible for complete design and engineering works including validation of FEED documents, sizing / selection of instruments, preparation of detail design documents specifications/ datasheets, drawings etc. The EPCC Contractor shall also be responsible to identify the complete requirement in order to ensure the reliable and safe continued operation of the instrumentation and control system of NASHPA Compression Facility. Any work or detail, which is not expressly set forth, but which is necessary to complete the job to the true intent and meaning of this Scope, shall be furnished by EPCC Contractor as though specifically noted herein, without extra charge.

5.3 The detailed design shall comply with the requirements set forth in the design codes, recommended practices, safety design codes and other Specification as provided in the Basic Design Package documents and good engineering practices. Due care shall be exercised for the ease of construction and expansion, commissioning and start-up, repair and maintenance, and safety to operate under all conditions. For Instrumentation and controls Works Package, please refer FEED Vol-II D.

5.4 EPCC Contractor shall check and verify the design and data presented to him, clarifying any inconsistencies and obtain any additional information, by OGDCL/Consultant or site visits that may be required to complete the works. The Contractor shall acquaint himself fully with the existing conditions and limitations at site and all works necessary to complete the project.

5.5 EPCC Contractor shall review and approve all vendors' drawings and documents to ensure compliance with specification, and witness testing of equipment in the vendors' works prior to shipment. Final drawings and test reports shall be submitted to OGDCL/ Consultant for their record.

5.6 EPCC contractor is responsible for Supply and installation of Package and Off-Package instruments as per the basic requirements mentioned in project documents Specification for General Instrumentation, Specification for Instrument Installation, P&IDs and relevant project documents.; however the project Documents/Specifications and Drawings do not relieve the Contractor of any responsibility to provide equipment and services that are suitable for the intended duty.

5.7 EPCC Contractor shall consider 2oo2 (2 out of 2) voting system and configuration for all Instruments (transmitters & switches) serving process shutdown in compressor package. Voting logic shall be applied to minimize the occurrence of complete loss of production caused by single instrument (transmitters & switches) fault or spurious trip shutdown. Also Maintenance Override Switch (MOS) bypass system shall also be configured for each of the variables that causes a shutdown sequence to start or for maintenance, calibration, etc. under password protection.

5.8 EPCC Contractor is responsible for Supply and installation of fire and gas detectors and devices for complete compression area and within Compressor Package Skids.

Basic engineering and selection of F&G Detector and devices for only compression area has been done at FEED stage and Preliminary F&G Detector quantities and locations for Compression facility have been shown in the project F&G detector layout drawing, however EPCC contractor shall carry out a detailed F&G mapping for finalization and revalidation of the F&G detectors quantities, locations, height and coverage for the complete Compression area which also includes the fire and gas detectors installation within the Compressor Package Skids which is not shown in F&G detector layout.

5.9 Complete monitoring and control of each Compressor Package shall be done by SIL-2 rated PLC based Unit Control System. The Compressors PLCs shall meet the requirements mentioned in Specification for Package Control System (Document No. 0193-IMA-6001) and relevant project documents.

5.10 Each Compressor package shall be supplied with control panel mounted touch screen type HMI/MMI for monitoring and controls from field.

5.11 New industrial type dedicated One Operator and One Engineering HMI Workstations shall be supplied, configured and installed in plant existing control room for remote operation, monitoring and control. New Operator and Engineering Workstations shall be common for entire Compression Facility (four Compressors).

5.12 PLC of each Compressor package shall communicate with the Operator and Engineering HMI Workstations in Control room over dual redundant Ethernet/Fiber Optic communication link. Establishment of above mentioned communication link, complete supply and installation of communication equipments and accessories including cables, Switches, Connectors etc shall be in EPCC Contractor scope.

5.13 Each Compressor package control panel shall be installed with a Selector Switch with Local & Remote option to either operate compressor from field through Panel mounted HMI or remotely through Operator/Engineering Workstations from Control Room.

5.14 Below mentioned signals from/to the Compressor packages PLCs shall be hardwired interfaced with Plant existing Safety System.

- DI Signal (Fire ESD to Plant Safety System).
- DI Signal (Process ESD to Plant Safety System).
- DO Signal (ESD Signal from Plant Safety System).

5.15 EPCC Contractor shall supply and install ESD/MOS OPERATOR CONSOLE in Plant Control room for indication of Shutdown/trip & F&G Alarms, ESD Push Buttons, MOS (maintenance override switch) and Reset Switches for Gas Compressors, Instrument Air Compressor & dryer package. This shall also include supply and termination of cables between MOS panel to ESD system marshalling panel and any other accessories required.

5.16 Any Hardware and software modification works required in Plant existing Safety System for interfacing of above mentioned signals shall be included in EPCC Contractor scope. This shall also include supply of any hardware and software for mentioned modification works.

5.17 EPCC contractor is responsible for dismantling of existing instruments PT-2004, FT-2001 & TT-2001 from downstream of Slug Catcher and installation at downstream of

front end compressor's gas discharge header with complete installation material. EPCC Contractor shall also dismentale and rolled back the existing cables.

5.18 Existing instruments PT-2004, FT-2001 & TT-2001 are already configured in Plant existing DCS system, EPCC Contractor scope shall only include the Supply, Laying, Termination and Loop Testing of new Instrument cables from field to Plant existing DCS System/Marshalling cabinets in Control Room with cable glands, shrouds, cable lugs, cable tagging, cable dressing with cable ties at both end of the termination.

5.19 Dismantling of existing Flow Orifice tag # FE-3002 installed at the existing Fuel Gas Knock-Out Pot (V-301) outlet, which is found un-adequate during FEED stage shall be included in EPCC Contractor scope. Supply and installation of new FE-3002 shall also be in EPCC Contractor scope. FE-3002 shall be supplied in accordance with but not limited to the Project Doc.

5.20 All Package and Off-Package I/Os, instruments, fire and gas instruments/devices shall interface with the respective Compressor packages PLC.

5.21 In addition to above, new flow meter FT-2010 shall also be supplied and installed as per Project Doc. New Flow Meter shall Interface with any of the nearest Compressor Package PLC for Flow Metering data transfer and recording on Operator/Engineering Workstation HMI in control room.

5.22 New Instrument Air Compressor and Dryer Package Package shall be supplied and installed by EPCC Contractor.EPCC Contractor scope includes the supply and installation of all instrumentation & controls for Compressor and Dryer Package. Instruments, Valves, control system and Graphical User Interface HMI/MMI shall be same as installed in existing air compressors and air dryer.

5.23 Hardwired Start/Stop signals between new Instrument Air Compressor & Dryer panel and Plant DCS system shall be terminated in existing marshalling panels and modification in existing logic, HMI screens, programming, etc shall be scope of EPCC contractor accordingly.

5.24 Hardwired Trip/Shutdown signals between new Instrument Air Compressor & Dryer panel and Plant Safety system shall be terminated in existing marshalling panels and modification in existing logic, HMI screens, programming, etc shall be scope of EPCC contractor accordingly.

5.25 Supply, laying and termination of all interconnecting cables for instrument and control, hardware interfacing with DCS and Safety System shall be included in EPCC contractor Scope. Instrumentation and control philosophy for monitoring and controlling for new instrument air compressor and dryer package shall be same as followed in existing instrument air system.

5.26 Instrument Air System shall utilize lead-lag starting sequence with one operating and two standby compressors. EPCC contractor shall interface new Compressor controller with existing Compressors controller to operate in above mentioned operating and stand-by configuration.

5.27 Manual Selector and START/STOP switches shall also be provided with new air compressor package to select and START/STOP the compressor as lead or lag manually from the field.

5.28 Supply of all necessary hardware/Software equipment required for modifications in existing Instrument Air System such as logic, configurations, cabling, power supply etc shall be in EPCC Contractor scope.

5.29 Accordingly New Dryer package shall also be integrated with existing Dryer control system. Manual Selector and START/STOP switches shall be provided with new dryer package to select and START/STOP the new dryer from the field.

5.30 Provision for soft communication (Modbus RS-485) for interfacing Instrument Air Compressor and Dryer package controllers with DCS shall also be in EPCC Contractor scope.

5.31 All instrument and controls cables shall be laid in accordance with but not limited to the Project Document. New cables ladders/trays shall be supplied and installed for over

ground cable lying as mentioned in Instrument Cable Routing Layout, Document No. NGP-000-INS-15.01-0002-24-00.

5.32 EPCC Contractor is responsible for Supply, Laying, Termination, Tagging and Loop Testing of new instrument and control Cables for all new Instruments and I/Os, F&G detectors and devices and relocated Instruments (such as PT-2004, FT-2001 & TT-2001) along with cable glands, shrouds, cable lugs, cable tagging, cable dressing with cable ties at both end of the termination.

5.33 Supply and installation of complete installation materials such as impulse tubing, tube-fittings, valves, G.I conduit and supports, cable glands, all type of consumables and accessories for mounting all instruments (supports, pipe stanchions, brackets, supports, foundations etc) for all instruments installation is in EPCC Contractor scope.

5.34 Spares I/Os are available in existing DCS and Safety System, make and Model of existing Control Systems installed are as follow:

- DCS: Honeywell Experion PKS C300.
- ESD: Honeywell Safety Manager.

5.35 Section 14.6 lists the documentation that will be provided by EPCC Contactor as a minimum.

6.0 Civil and Structural Engineering

6.1 The EPCC Contractor shall undertake the complete design of the civil, structural, architectural, external works, underground services and drainage for the Project. The EPCC Contractor shall prepare and submit basic and detailed calculations, specifications, design and construction detailed drawings for foundation of equipments & other items, drainage systems, roads, paving, pipe supports and sleepers, structures & access steel works etc.

6.2 The Structural Engineering Design & Civil Construction shall include but not limited to making the plot-plans, design of equipment foundations including paving, structures, walkways, stairways, pipe-supports (pipe-sleepers & pipe-racks), sheds etc.

6.3 All other works, which are necessary to provide safe & efficient design and construction of the Project, tie-in & interfacing works shall also be the responsibility of the EPCC Contractor.

6.4 The EPCC Contractor shall undertake the detailed engineering and may be required to provide or develop any data, drawings and specification etc. additional to that provided or referenced in this document.

6.5 The below grade civil works shall include construction and operations, comprising, providing and making pressure grouting, earth work, grading, infilling and compaction, providing and installation of all foundations and plinths, cable and instrument trenches, lighting pole foundations, pipe trenches, pipe tracks, access ways, paved areas, and surface drainage as required.

6.6 The above grade works shall include providing foundations, pipe supports, sunshades, steelwork, etc. to meet the requirements of the facilities.

6.7 The design of drainage, pipe sleepers and other civil or structural facilities with an interface with existing facilities must be such that interfaces are satisfactory e.g. levels are consistent and specifications are compatible.

6.8 The EPCC Contractor shall provide full site drainage to cater for firewater, storm and surface water run-off, and equipment and process areas spillages.

6.9 The EPCC Contractor shall also undertake any additional survey work he considers necessary to verify the soil, survey and other data provided by OGDCL. The additional survey work may include Detail survey and Soil investigations etc, depending upon the requirement of works included in EPCC Contractor's scope.

6.10 The EPCC Contractor should note that certain engineering documents are subject to approval by OGDCL/Consultant and it is the EPCC Contractor's responsibility to obtain such approvals.

7.0 Piping Engineering

7.1 Piping should be design in a way that it does not obstruct gangways and leaves enough head room entrance. Aspect of maintenance and shutdown (ATA) major work should also be kept under consideration. If such requirements are not incorporated, the OGDCL/Consultant shall have the right to have such piping modified at Contractor's cost. The cost of such modifications by OGDCL shall be deducted from any Contractor's invoice or any payments due under the CONTRACT during installation and construction.

7.2 The Contractor shall be responsible for providing all the Piping engineering design and construction for the compression facilities, including all on-skid and off-skid pipe work. Piping Engineering and Design shall include piping studies, including tie-ins of all skid mounted Unit, tie-ins where required / approved by the OGDCL/Consultant with the existing plant, development of equipment layouts and plot plan, and preparation of specification for facilities and equipment.

7.3 The scope shall include calculation of anchor loads for structures and equipment nozzles, performance of stress and other piping calculations, preparation of general arrangements, piping plans, isometrics, pipe crossings, development of line list and support schedule, development of piping tie-in drawings with details.

7.4 The Contractor shall design, specify, procure and install insulation, as deemed necessary, for personnel protection thermal insulation and acoustic control, at all required locations.

7.5 Complete Piping Flexibility analysis of the hot and cold lines. All line equal to greater than 2" dia. and have temperature equal to or greater than 50 degree Celsius OR temperature less than 0 degree Celsius must be stress analyzed. Detailed calculations must be submitted by the Contractor for OGDCL/Consultant review and approval. Stress analysis must also be performed for dynamic loads of compressor and other rotary equipment where ever required.

7.6 All skids piping shall be designed in such a way that it terminated to edge of piping skid with a flanged connection for inter skid or plant piping connections. Connections at boundary limit of the skids must be designed stress free. Similarly all drains and flare

connections must be terminated to respective headers which subsequently provide a common out let from skid.

7.7 Contractor shall design piping within the scope of this project as per relevant code and standards as well as incorporating the OGDCL's existing practices.

7.8 Contractor shall perform the complete stress analysis of the piping. The stress analysis report shall be submitted to the OGDCL/Consultant for review and approval.

7.9 As Nashpa is an operational plant, so field joints shall be minimum. Pipe spools shall be pre-fabricated at shop and joined through flanged connection.

7.10 Piping Engineering & Design shall include piping studies, development of equipment layouts and plot-plan, and preparation of specifications for facilities and equipment. The EPCC Contractor shall be responsible for the design of firewater network of Nashpa Compression Facility. The EPCC Contractor shall also be responsible for any re-location of and piping (above ground or buried) due to any modification.

8.0 Fire and Safety Engineering

8.1 The EPCC Contractor shall be responsible for the design of all Fire and Safety Systems for New Compression Facility. The Fire and Safety Area shall include involvement in all safety related aspects of the design, including development of the plot plan, control & shutdown philosophy, development of fire & gas detection philosophy, layout and specification of fire fighting systems, etc., to ensure that the plant safety systems comply with relevant codes and recommended practices. The facility shall be provided with the following safety facilities:

- Emergency shutdown system
- Fire & gas detection
- Firewater distribution system including, as a minimum, firewater hydrants/Monitors.
- Requirement of oscillating foam monitors at strategic positions or foam pouring system for compressor packages (if necessary).
- Hand held portable firefighting equipment
- Personnel escape routes and warning signs
- Safety showers, douches and eyebaths (if required)
- Safety distances will be established by the EPCC Contractor according to Pakistan Petroleum Act, 1934, NFPA. The EPCC Contractor will also provide the best international guidelines on equipment safety distances for fire and safety.

9.0 Specific Design Requirements

9.1 Design Philosophy

The detailed design shall comply with the requirements set forth in the design codes, recommended practices, safety design codes and other specification as provided in the Basic Engineering Design and good engineering practices. Due care shall be exercised such that the facilities afford ease of construction and expansion, commissioning and start-up, repair and maintenance, and safety to operate under all conditions. Consideration shall be given to the design of facilities in order that no environmental hazards are created to upset the ecology of the surroundings.

It is the OGDCL's intention that as far as possible the plant facilities shall be designed and constructed in skid form, in order to minimize onsite construction. It is the EPCC Contractor's responsibility to ensure that the layout and design within the packages complies with all the requirements of these specifications and documents, and is consistent with good on-shore engineering practice.

9.2 Design Margins & Available Redundancy

In general an overall ten percent (10%) design margin shall be applied to the Nashpa Compression Facility. The overall design margin is for the purpose of ensuring that plant will operate steadily at design capacity and still have a small margin for controllability.

Equipment sizing and design will be based on the individual "Worst case" size for each piece of equipment.

9.3 Codes and Regulations

The EPCC Contractor shall perform the design and engineering of the facilities in accordance with sound engineering practices and, as a minimum, with the following:

- Specifications and standards provided within these documents.
- National codes and regulations as listed within these documents.
- Local regulations as applicable.

9.4 Disposal of Flammable Material

The relief and vent philosophy for the plant is to safely dispose-off all flammable hydrocarbon vapors to continuously ignited flare. In normal operation there should be minimum continuous flaring. Some flaring may be necessary during start-up and shutdown.

9.5 Over Pressure Protection

Equipment shall be protected against over pressure by suitably located relief valves, according to API RP 520 and 521. The EPCC Contractor shall also provide thermal relief of piping as required.

The EPCC Contractor shall endeavor that the relief devices should be located as close as practical to the item being protected. Every effort should be made by the EPCC Contractor to locate the relief devices on the pipe rack above the flare header, so that the tail pipes slope continuously to the header. The EPCC Contractor shall ensure pressure loss in the relief valve inlet piping shall be less than three percent of set pressure.

9.6 Emergency Depressurizing

The depressurizing system shall comprise of solenoid valves on the air lines to blow down valves. The solenoid valves shall be operated by a single, protected, button in the control room to vent the air form the actuators and open the BDV's. The valves shall be sized to depressurize the systems to half design pressure in 15 minutes.

9.7 Valving and Isolation Philosophy

Below is a requirement for valving and isolation philosophy.

a. Emergency Isolation

The purpose of the valves is to be able to stop the flow of flammable material between different parts of the facility in the event of a major leak or fire subject to the final layout.

b. Equipment Isolation for Maintenance and Inspection

Double block valves and positive isolation shall be provided by the EPCC Contractor for equipment that must be isolated and opened relatively frequently while the surrounding process remains on line. This applies to the upstream and downstream of filters.

c. Control and Relief Valve Isolation

All control valves shall be provided by the EPCC Contractor with single block valve isolation at upstream and downstream with bleed valve. Furthermore, bypass of control valves shall be provided with globe valve.

All relief valves shall be provided single block and bleed valves isolation at upstream and only block valve at downstream. Furthermore, bypass of relief valve shall be provided with single block and globe valve.

d. Instrument Isolation

Isolation shall be provided for all instruments.

9.8 Design Units

The following set of units shall be used for the project, and also for all tenders for the work.

- Temperature: º F
- Pressure: psig
- Weight: lb
- Time: hr.
- Length: ft or inch
- Velocity: ft/sec.
- Energy: Btu

- Work: Btu/hr
- Volume: ft^3
- Vapor Density: lb/ft^3
- Petro Density: API
- Volumetric Gas Flow: MMSCFD
- Duty: Btu/hr.
- Heat Transfer Coefficient: Btu/Hr Ft^2 ºF
- Thermal Conductivity: Btu/Hr Ft ºF
- Viscosity: CP
- Kinematic Viscosity: Centistokes

Standard conditions shall be 60 ºF and 14.65 psia.

10.0 Technical Reviews

As the work involves integration with the existing plant, it is imperative that the EPCC maintain effective co-ordination with OGDCL/ Consultant's project personnel. All the detailed engineering documents shall be reviewed by OGDCL /Consultant, so that the control concepts and operating philosophy of the new Compression facility is properly co-ordinate with the existing Nashpa Plant units, Offsite and utilities. Besides, standardization of equipment, instruments and materials is also desirable as far as practicable. To achieve these objectives, meetings and reviews shall be required during the project implementation period.

The following meetings are anticipated at various stages of the project.

a. Upon award of work, a kick-off meeting at OGDCL head office for detailed discussions on the design basis, EPCC Contractor design standards and criteria, and control systems of existing plant and other technical matters.

b. During detailed engineering, a design review meeting to discuss / finalize the design information which would be provided by the EPCC Contractor to OGDCL for the Civil, Structural, piping, electrical, instrumentation and other detailed engineering works for the Project and its tie-in / interconnections with other units as per clause 3.2.2 of ITB.

   Besides, the EPCC Contractor's design documentation would also be reviewed / approved.

c. Project review meetings to identify any areas of concern and to evaluate work progress shall be arranged, as required.

11.0 Procurement Services

11.1 General

The EPCC Contractor shall be responsible for the procurement (supply), expediting, inspection, testing and shipping/transportation of all equipment, skids and materials to complete the facility. Whilst the EPCC Contractor is responsible for equipment and material costs within his fixed price, he will be required to demonstrate that progress on all procurement activities can be assessed and modified as the Project schedule dictates.

EPCC Contractor will source equipment and materials from proven and reputed vendors having track record of providing services for projects related to the oil and gas industry. A list of recommended Vendors is given in Appendix-N. If any deviations are made by the EPCC Contractor from the recommended Vendors list the same will be highlighted in the Bid Proposal giving full justification and shall be subject to OGDCL / Consultant approval. Pakistani manufactured material shall be preferred if complying with project specifications and requirement to promote local industry.

The procurement plan to be submitted as part of the technical bid shall clearly demonstrate EPCC Contractor's capability to procure equipment and material line with project schedule in limited time. The procurement sources shall also be identified.

EPCC Contractor shall cooperate and assist OGDCL / Consultant in checking, marking and maintaining full records of materials.

11.2 Equipment and Materials Supply

It is OGDCL's intention that all equipment shall be purchased as a series of packages in order to minimize on-site construction. The packages will be arranged within steel support structures, skid mounted or freestanding.

All EPCC Contractor's supplied equipment/material shall be 100% traceable and suitably marked for easy identification of manufacturer or supplier, grade, source, size and rating.

11.3 Vendor Co-ordination and Expediting

The EPCC Contractor shall be responsible for all co-ordination within, and expediting of the vendors to ensure that all equipment, packages and materials arrive on site as planned.

11.4 Inspection and Testing

11.4.1 EPCC Contractor shall carry out all inspection including third party inspection from any of the approved Third party inspectors specified in clause 24.2 of Condition of Contract and witness testing for equipment and materials at vendors' works and shall be responsible for ensuring that all items of equipment and materials purchased are supplied strictly in accordance with the specifications as defined in the purchase order. Such inspection shall in no way relieve EPCC Contractor of his own responsibilities. Such third party inspection agency shall function independently and report to OGDCL.

11.4.2 It is required that OGDCL/Consultant will inspect equipment as per 3.2.2 of ITB.

The inspection and testing work shall include:

- Provision of a team of qualified quality control personnel.
- Checking and inspection of construction materials.
- Ensuring that all inspections and tests are carried out in a satisfactory and orderly manner.
- Ensuring that all testing equipment is setup and calibrated in accordance with requirements.
- Ensuring that any rework is carried out in satisfactory manner.

11.4.3 EPCC Contractor shall prepare a detailed inspection and testing plan, which will be subject to approval by OGDCL. Plan shall include but not limited to:

- An inspection and testing program per specific equipment item, or package.
- Details of certification and documentation requested per equipment item, or package.
- Details of inspection and approval agencies being used.

11.4.4 EPCC Contractor shall employ only qualified inspectors for the inspection. Details of personnel and CVs shall be provided to OGDCL for approval.

11.4.5 Factory Acceptance Test (FAT) shall be conducted at manufacturers work place where testing facility with all necessary infrastructure, latest equipment, spare parts and expert human resources are readily available. FAT aims to verify that the supply conforms to the specifications in the order from the stand point of mechanics, safety devices, accessories controls at guaranteed performance parameters, etc. In this respect, shop testing will be required only for each compressor package.

11.4.6 EPCC Contractor shall submit for OGDCL/Consultant review and approval a complete plan for the factory and site acceptance testing. This plan must be complete and provide sufficient detail to indicate the exact nature of each test, time required, expected results and systematic procedure.

11.4.7 Manufacturer shall inform OGDCL/Consultant about the date of test 60 days in advance. No testing shall commence without written approval of OGDCL/Consultant. OGDCL reserves the right to witness any aspects of the assembling process. The Contractor shall submit an inspection and testing procedure of Supplier for review and approval by OGDCL/Consultant prior to shipment.

11.4.8 The Contractor shall prepare and issue written reports for review by OGDCL on all interim and final inspection and tests.

11.4.9 If equipment has to be modified or adapted in order to pass final inspection and test, the Contractor shall compile a complete dossier containing accurate and detailed records of all design changes, alterations, modification, adaptations and the reasons for them, together with minutes of all relevant meetings and notes of all relevant discussions and shall promptly make such dossier available to OGDCL.

11.4.10 The EPCC Contractor shall endorse as correct all fabrication and manufacturing data folders containing, but not limited to equipment test certificates and all other relevant inspection data.

11.4.11 The Contractor shall be responsible for sanctioning the release of completed equipment and material for shipment after final inspections have confirmed satisfactory completion. Such a release shall not relieve Contractor of his contractual obligations.

11.4.12 The Contractor shall perform the Factory Test as per API-618 “Mechanical Running Test” requirements. The unit including integral auxiliary system packages shall receive a 4-hours mechanical running test before shipment. Further, Auxiliary equipment not integral with the unit such as oil pumps, oil coolers, filters, inter-coolers and after-

coolers shall receive both an operational test and a 4-hours mechanical running test before shipment.

11.4.13 All examination methods shall be as per API 11P 2nd edition, ASME VIII and other applicable codes to the relevant equipment, piping, etc.

11.4.14 Company reserves the right to accept or reject any test and ask for retest at no extra cost, specifying reasons for retest.

11.5 Transportation and Freight Forwarding

The EPCC Contractor shall be responsible for the transportation of all equipment, packages and materials from the source of supply to Port of discharge. EPCC Contractor will be responsible for organizing and coordinating these activities to ensure that all equipment and materials arrive on Port of discharge, intact and on schedule. Such activities will include:

i. Preparation of packing, marking, shipping and documentation specification.
ii. Develop optimum plans and procedures for freight forwarding and handling of equipment and materials to ensure that all freight is consigned to arrive at port of discharge on time.
iii. Make shipping forecasts and advise OGDCL/Consultant of predicted arrivals.
iv. Prepare, maintain and issue a monthly shipping forecast summary and shipping progress report to OGDCL.
v. Supply of cranes, trailers and other lifting machinery.
vi. Inspection / checking of list during unloading at Nashpa Gas Plant.
vii. Proper storage of all transported items at Nashpa Gas Plant.

It may be noted that the EPCC Contractor shall be responsible for any delay or damages to equipment packages and material during its installation.

a. Local Material Transportation

EPCC Contractor shall comply with all applicable laws regarding the local transportation of Materials, to include permits, escorts, load limits, signs and diversion construction.

The safe and legal delivery of locally procured Materials shall be a responsibility of EPCC Contractor.

11.6 Equipment and Package Supply

It is OGDCL's intention that all mechanical, electrical, instrumentation and safety equipment will be purchased as a series of packages and installed on prepared foundations, in order to minimize onsite Construction. As far as is feasible, the packages and skids will be fabricated with all equipment, motors, pipe-work and instrumentation pre-installed.

The EPCC Contractor may wish to purchase all equipment and materials for the packages and supply these items free issue to the skid fabricator, or he may place a purchase order on the fabricator, which includes the supply of equipment and materials. In either event, the supply of all equipment / items like Compressors, Engine, Air Coolers / Exchangers, on-skid valve, instruments, panels, etc., shall be from the recommended Vendors lists (refer Appendix-N) and use of different suppliers should be avoided for both ease of maintenance and spares storage. It will be the EPCC Contractor's sole responsibility to ensure that all equipment and materials supplied within the packages conform in all respects with the requirements and specifications in these documents, particularly with regard to operational and maintenance access.

11.7 Bulk Materials

The EPCC Contractor shall be responsible for the provision of all piping, electrical, instrumentation, safety, structural and civil bulk materials and items required to complete the project.

Any mechanical, instrumentation or safety items which need to be shipped loose for installation on site, or any additional items found to be required at site, will be procured by the EPCC Contractor from the recommended Vendors lists (refer Appendix-N) and comply in all respects with the Project Specifications. The local supply from Pakistan shall be done from the provided vendor list (refer Appendix-N).

EPCC Contractor's supplied Bulk Material shall include but shall not be limited to the following activities:

a. Preparation of procurement document which will include the following:

- Request for quotations (RFQ) containing the detailed Bill of Materials, Specifications, design details, delivery dates, shipping instructions, inspecting, testing requirements, vendor documentation, details draft purchase orders. Separate RFQ shall be developed for each kind of Bulk Materials.
- Evaluation of Bids
- Purchase Orders

b. Inspection and non-conformance report.

c. The supply of all Bulk Material for the completion of the Work.

d. Review of Material certification and performance of all tests as specified.

e. The preparation for shipment, packing and marking.

f. The transportation of Bulk Material to Work site i.e. Nashpa Gas Plant.

g. All loading and off-loading operations, handling and movements, protection, storage and maintenance of Bulk Material at the storage area, Work Site fabrication erection or installation area(s), or elsewhere.

h. Compliance with Vendors instructions and recommendations, and the applicable provisions of the material procedures.

i. The provision of Vendors assistance on Site.

j. The supply of Vendors Final Documentation.

k. Marine Insurance (from Port of loading to Project site) Custom Duties, Custom Clearance and Inland Transportation will be done by OGDCL, however, any demurrages or container detention charges/ penalties imposed by custom authorities due to discrepant or late receipt of Original shipping documents will be recovered from the EPCC Contractor.

l. Imported equipment and materials supplies under the contract shall be fully insured against loss or damage by the manufacturer/supplier in the country of export. Thereafter marine insurance shall be the responsibility of OGDCL from the port of loading till the port of discharge & up to Project site. However, the manufacturer/supplier shall send declaration of shipment to the insurer and the manufacturer/supplier shall be responsible for the consequences for not making declaration to the insurer in time.

m. The rectification of any transit damage to the Material or replacement of damaged Material. Compliance with Vendors instruction and recommendations, and the applicable provisions of the Material procedures. Any re-export of the damaged or wrong Material shall be managed by the EPCC Contractor at its own cost.

11.8 Material Certification, Witness Testing and Documentation

Material traceability and equipment conformance certificates will form part of the permanent documentation to be complied and provided by the EPCC Contractor, and will form a specific item on the purchase order for delivery by the Vendor.

The EPCC Contractor supplied Equipment and Bulk Material to be approved by the Third Party Inspector shall include but shall not be limited to the following provisions:

a. EPCC Contractor shall provide in its Purchase Orders for all inspection and certification requirements.
b. EPCC Contractor shall submit in a timely manner to the OGDCL / Consultant all applicable Vendors documentation for Approval.
c. It is understood that inspection by the Third party Inspectors and OGDCL / Consultant shall not release EPCC Contractor from performing its inspection and quality control programs and it shall not release the EPCC Contractor of his obligation of supplying the Equipment and Materials in accordance with the requirement of applicable Project Specification and codes.
d. EPCC Contractor shall incorporate all inspection certificates and/or compliance certificates in Vendors Final Documentation.
e. Wittness Shop inspections and performance testing would be required for all major items of equipment and machinery. Typically, these include:

- Pressure tests of air coolers
- Reciprocating Compressors

- Vessels
- Any new equipment proposed by EPCC Contractor.

The schedule of these visits is to be developed by EPCC Contractor.

11.9 Commissioning (including Performance Test, Reliability Guarantee Test) and Operating/Maintenance Spares

The EPCC Contractor shall be responsible for the provision for one (1) year as compulsory of all the required commissioning spares, lube oils, greases, consumables including startup and operation during Performance Test and Reliable Guarantee Test. as recommended by Vendors. This will form a specific item on the EPCC Contractor's purchase order.

EPCC Contractor shall also submit the price list of two (02) years OEM recommended operating/maintenance spares (optional) on OEM letter head along with the bid.

12.0 Construction, Erection and Facility Hookup

12.1 General

EPCC Contractor shall carry out construction, fabrication, erection and hookups / tie-ins to existing Plant installations necessary for expansion of Plant. EPCC Contractor's responsibilities will include but not limited to the following;

a. Site preparation and civil works as per drawings & specifications.
b. Provision of project management, progress control of the Work, and reporting to OGDCL / Consultant as required in the Contract.
c. Preparation and submission of all engineering, drawings and quality control documentation for review or Approval necessary to satisfy OGDCL / Consultant. Typically these should include but not limited to the following;
    - Execution Plan
    - Design Calculations
    - Site Coordination Procedure
    - Hydrotesting & Water Disposal Procedures
    - Material Control Procedures
    - MTO's verification for bulk materials
    - Tagging and marking procedures
    - Storage procedures
    - Transportation Procedures
    - Refurbishment procedures
    - Construction Procedures
    - Dimensional Control Procedures
    - Construction Safety Procedures
    - Document Control Procedures
    - Quality assurance/quality control plans and procedures/QA/QC Formats
    - Welding procedures complete with all necessary supporting documentation
    - Welder qualification Records
    - NDT Reports
    - Lifting procedures for lifts over 30 ton or abnormal size and any other lifting operation designated by OGDCL / Consultant within the existing plant area.

All of the above shall be submitted to OGDCL / Consultant for approval prior to commencement of the Work.

d. Performance of Work in a workmanlike and professional manner, utilizing sound construction design and fabrication principles and procedures.
e. EPCC Contractor shall be fully liable for the adequacy, stability and safety of all operations and methods of construction, and for the correctness of the position, levels, dimensions and alignment of all parts of the equipment on site.
f. Performance of Work continuously and diligently and in accordance with Work Time Schedule.
g. Compliance with all local regulations including safety and environment regulations and obtaining all permits required for the execution of the Work and bears all the relevant expenses in this regard.
h. Allowing access to OGDCL / Consultant Personnel at EPCC Contractor's work place and Site to enable them to witness and check the quality of Work, and to survey EPCC Contractor's quality control activities, inspections and / or tests.
i. Provision of all fills, for cleaning and first filling (such as oil, greases, etc). EPCC Contractor should submit required fills quantity at least three (3) months prior to commissioning.
j. Providing qualified manpower that shall include design engineers, vendor representatives, technical experts, and construction and engineering personnel at Site during Commissioning and Start-up.
k. Obtaining and maintaining all permits, authorizations and licenses as may be required to be obtained in the name of EPCC Contractor for the performance of the Contract at its own cost.
l. Providing of all Final Documentations (soft & hard copies)
m. Providing of material reconciliation documentation.
n. Clearing Site of scrap, wreckage, debris and other items not forming part of the Facility.
o. Achieving product specifications and production targets set by OGDCL.
p. Maintaining EPCC Contractor tools, tackles, etc in first class working order through Provisional Acceptance.
q. Notwithstanding the omission thereof from the above list of any duty that would be necessary for or incidental to, the performance of Work, EPCC Contractor shall duly perform any such duty.

12.2 Contractor Furnished Site Facilities

12.2.1 The EPCC Contractor shall be responsible for the supply, installation, hookup and maintenance of all facilities and services required to enable him to carry out the work.

12.2.2 These shall include but not limited to office accommodation, messing facilities, workshops, warehouses, prefabrication sheds, power, water, sewage disposal, communications (telephone/telex/Email), etc.

12.2.3 The Contractor shall also be responsible for installation or erection of any temporary facilities required to assist the work including weather protection, lighting, scaffolding, etc., and removes these on completion of the work.

a. Temporary Camp

The EPCC Contractor shall establish a temporary camp in the vicinity but outside the Nashpa Gas Plant for storage of its own use equipment & material, work area and staff residence. Any such establishment shall be self sufficient in all respects, including supply of all utilities.

b. Temporary Site Facilities

The EPCC Contractor shall establish a fenced and guarded ware-house/store inside Nashpa Gas Plant for secured storage of material and equipment procured for the project.

The EPCC Contractor shall provide, erect, construct, furnish, equip, clean, maintain, heat, light and subsequently remove all first aid facilities and workshops, etc, necessary for the completion of the Work and the site and layout of which shall be to the general approval of OGDCL.

Before providing any of the above the EPCC Contractor shall submit detailed proposals for the approval of OGDCL. The workshops shall be constructed of fire retardant materials and located in accordance with the recommendations of the fire prevention officer.

It is the EPCC Contractor's responsibility to provide firefighting equipment. Ownership of temporary buildings and any furniture and equipment provided as aforesaid shall refer to the EPCC Contractor.

The offices shall be lockable and furnished with new or reconditioned furniture and be level ground finished with gravel concrete or paving slabs. Suitable paths shall be ensured by the EPCC Contractor.

c. Material Storage and Control

The EPCC Contractor shall be responsible for receiving, storing, protecting and issuing all materials and consumables as required for fabrication and installation for the Nashpa Compression Facility Project. The EPCC Contractor will develop material control procedures to ensure that the materials are correctly stored and used in the appropriate service and can be readily identified at all times. These procedures will be subject to agreement with OGDCL.

Loading, hauling and unloading shall be performed in such a manner as to prevent damage and if materials sustain damage, EPCC Contractor shall be responsible for all repair and/or replacement costs.

The EPCC Contractor is to ensure that all equipment is properly stored and protected from weather and damage. Whenever possible, unloading of major equipment items shall be scheduled to permit the equipment to be placed directly on foundations.

d. Testing Facilities

The EPCC Contractor shall be responsible for providing adequate Testing Facilities to enable him to complete the work, including radiography and other NDT methods and instrument calibration and testing.

12.2.4 Contractor Furnished Facility and Materials

The EPCC Contractor shall be responsible for the provision and maintenance of Compression Facility consumables and materials. This will include all construction and tools necessary to install and test the work and all consumables such as welding electrodes, etc. It shall also include any transportation requirements the EPCC Contractor's workforce may have, and the provision of all spreader bars, slings, etc.

12.3 Onsite Organization

12.3.1 Construction Supervision

The EPCC Contractor shall provide an onsite supervision team to ensure that the work is carried out and tested in accordance with the drawings, specifications and agreed proce-

dures. EPCC Contractor shall provide a designated site manager who shall be responsible for the day-to-day running of the site and liaison with OGDCL representative(s) on all scheduling, control, inspection and testing approvals, etc. his supervisory team will be responsible for the progress and quality of the work carried out by the individual disciplines and will include:

a. Implementation of agreed construction procedures.
b. Maintenance of construction and testing documentation.
c. Supervision of workforce including any trade and/or qualification tests and maintenance of the records of such tests.
d. Ensuring that all works are constructed in accordance with approved drawings and specifications including the checking of "As-built" drawings.
e. Upon completion of hookup/commissioning tie-ins, and performance test run, EPCC Contractor shall update original documents to "As-built" status and submit to OGDCL.
f. EPCC Contractor shall submit one (1) print of all "As-built" documentation to OGDCL representative(s) for approval.
g. Review, approval and implementation of any design modifications.
h. Reporting and participation in progress meetings.

12.3.2 Field Engineering and Procurement Services

In addition to the provision of construction management services, the EPCC Contractor will be responsible for the provision of any on-site engineering, procurement or other field services, which may be required as a result of design changes, additional work.

12.3.3 Inspection and Testing

The EPCC Contractor shall undertake all inspection and testing of the work carried out in the field in accordance with specifications and procedures.

The inspection and testing work shall include:

i. Provision of a team of qualified quality control personnel.
ii. Checking and inspection of construction materials.

iii. Ensuring that all inspections and tests are carried out in a satisfactory and orderly manner.

iv. Ensuring that all testing equipment is setup and calibrated in accordance with requirements.

v. Ensuring that any rework is carried out in satisfactory manner.

The EPCC Contractor's procedures will ensure that all phases of the work are satisfactorily inspected and tested, and that appropriate signatures are obtained on the relevant documentation.

All inspection and testing work by the EPCC Contractor will be subject to witnessing and approval by OGDCL/Consultant and all planned inspections and tests must be carried out at times acceptable to OGDCL/Consultant. Adequate prior notice of inspection and tests must be given to OGDCL/Consultant to allow its representatives to attend.

12.3.4 **Documents For Fabrication and Installation**

EPCC Contractor shall submit to the OGDCL / Consultant for approval detailed procedures for the fabrication/ installation works. The procedure shall be developed for all disciplines (Civil, Mechanical, Electrical, Instrumentation and Control System, etc.). Fabrication and installation documents shall be transmitted to OGDCL / Consultant for review and approval.

12.3.5 **Procedures For Material Control, Fabrication, Transportation and Installation**

It shall include but shall not be limited to the preparation and issue of detailed procedures including drawings, calculation notes, list of Equipment, list of personnel, planning, back-up procedure if necessary for:

a) Inspection

b) Shipping and forwarding

c) Surveys

d) Material control, storage, handling

e) Assembly of main structural works

f) Lifting

g) Welding procedures specifications and qualifications, including repair

h) Welders qualifications and welding personnel list (updated as necessary)

i) NDT controls

j) NDT operators qualification

k) Welding programme

l) Sand blasting and painting

m) Safety on Worksite

n) Site preparation

o) Installation

12.3.6 **Shop And Construction Drawings**

Shop drawings shall include but shall not be limited to the preparation and issue of shop drawings for the prefabrication, fabrication, and erection works, such as

a) Cut-off drawings

b) Weld locations plan

c) NDT controls location plan

d) Fabrication isometrics for piping. Spooling drawings.

e) Detailed design and fabrication drawings for steel storage tanks and `Package Units.

f) Structural Details Drawings

g) System Schematic Drawings

h) Detailed Equipment Foundation Drawings

i) Detailed drawings for Buildings (Control Room & Generator Building Room)

j) Equipment layout drawings.

k) Cable layout and trenching details.

l) Anyother shop/ fabrication/ construction drawing which may be required for the Works

EPCC Contractor shall provide all vendor drawings, sketches, informaiton and data for the detailed design.

12.3.7 **Material Reconciliation**

- On completion of all works at Site the EPCC Contractor shall prepare a material reconciliation report in accordance with the requirement of the OGDCL / Consultant. The reconciliation report shall give an account of all Equipments and Materials purchased, consumed, wastage and surplus/ scrap.

- The surplus, scrap and packing material shall be the property of the OGDCL and it shall be handed over to the OGDCL at designated place(s) with proper documentation.

12.3.8 **Contractor Provided Documents**

EPCC Contractor shall produce all other documents, procedures required to execute the Works. Typically these should include but not be limited to the following:

- As-built mark-ups of specified drawings
- Completed inspection and test sheets as required by the EPCC Contractor's Quality Plan, including records for material traceability and welder identification.
- Completed inspection and test sheets as required by the EPCC Contractor's Quality Plan.
- Upon completion of the Work, EPCC Contractor shall produce a mechanical completion dossier (five copies) complete with all as built drawings, documents, and all electrical and instrument inspection documentation, Vendor information/manuals.

12.3.9 **As-Built Records**

EPCC Contractor shall maintain a continuous up to date record of the as-built condition throughout the construction, installation and pre-commissioning. This record shall be in the form of marked-up drawings and documents, duly signed by EPCC Contractor.

These records are to be made available to OGDCL / Consultant on demand. Full and final five (05) sets (hard copies) of this documentation along with the softcopies are to be provided to OGDCL / Consultant within four (04) weeks of the completion of the Work. The requirements of each aspect of the Work are given in the relevant OGDCL / Consultant Specifications.

12.3.10 **Completion of Final Punch Lists**

Prior to provisional acceptance of the facility, the EPCC Contractor shall be required to complete any outstanding work. This shall be achieved by the generation of mutually agreed punch lists of a point where the project is substantially complete.

12.3.11 **Miscellaneous**

- The EPCC Contractor shall provide a completely "fitted out" facility, including all painting, insulation, installation of firefighting equipment, installation of general equipment signs and installing safety signs and equipment.
- All facilities within EPCC Contractor's Scope of Work, including structural aspects, piping, equipment, instrumentation and electrical, shall have all protective coatings applied and paintwork touched-up, as required.
- The EPCC Contractor shall be responsible for collecting and disposal of all refuse from the Work Site at regular intervals and after job completion.
- The EPCC Contractor shall be responsible for removing all excess materials from the site at the completion of the Work.
- The EPCC Contractor shall make good all damage to equipment, structures, finishes, etc., caused during the performance of the Work.
- The EPCC Contractor shall reinstate any areas disturbed during the Work including any temporary access ways, roads, etc.
- Painting of well site surface facilities and spur lines according to international standards.

12.3.12 **Civil and Structural Works**

The EPCC Contractor shall undertake the design and construction of all civil and structural works for the Nashpa Compression Facility (NCF). EPCC Contractor's responsibilities include furnishing all material, form work, plant, labor, equipment & appliances etc, associated with the design and construction of project's civil works, which will include, but, not limited to foundations for equipment and other items, Pipe rack & Sleepers, Drainage, Roads & Paving, Steel Structure and Access ways etc. In addition, the EPCC Contractor shall also be responsible for the design and construction of civil works required for the tie-ins of process / utility lines and cables etc.

All construction activities shall be carried out as per the applicable international Codes & Standards and as per the requirement of safety manual.

The EPCC Contractor shall undertake the detailed survey to establish the reference bench mark, requirement of cut & fill for finished ground levels, finished levels of roads, drains and other areas to ensure soundness of design and construction works of the project. The EPCC Contractor shall ensure that FGL of NCF shall be compatible with the FGL(s) of existing plant.

The EPCC Contractor is required to undertake inspection and appropriate tests applicable to the particular work activities e.g. cement, aggregate, excavation and compaction, reinforcement, formwork, foundation and other R.C.C. works concrete cube etc, and is to submit the results of such inspections and tests for review and acceptance by OGDCL.

The Project area would be cleared (by OGDCL) for any other installation, however, cleaning, leveling and site preparation shall be responsibility of EPCC Contractor.

The civil works for the NCF shall be carried out in the vicinity of existing Nashpa Gas Plant, therefore, during the design and construction phase, the EPCC Contractor shall ensure the safety and operation of existing plant and allied facilities.

The EPCC Contractor shall be responsible to undertake all precautionary measures to ensure safety and operation of existing facility, protection of all underground and exposed utility lines and cables etc. whether shown on plans or encountered during the construction activities.

During the construction phase, the EPCC Contractor shall be responsible for the clearance of area. The clearance of area shall be monitored in such a manner that all undesired/surplus material shall be disposed off within two (02) days of completion of individual item/ activity and within ten days of completion of construction phase. The undesired material shall be disposed to a lead as directed by OGDCL / Consultant.

The Scope of civil & structural work for NCF shall include but not limited to the design, supply and construction of the following:

12.3.12.1 **Survey**

The EPCC Contractor shall undertake the detailed survey of the project site to verify the dimensions and coordinates provided on Plot Plan and other documents of OGDCL.

12.3.12.2 **Setting Out**

The EPCC Contractor shall set out the works to correct lines, levels, and coordinates with respect to a Bench Mark (to be established by the EPCC Contractor). In order to establish the Bench Mark the EPCC Contractor shall take into account the reference datum indicated by OGDCL and the levels and coordinates of existing facilities to be interfaced or any other area as deemed necessary for the purpose.

The EPCC Contractor shall have unshared responsibility for correct setting out of work. If any error in this respect shall appear during design or construction phase, the EPCC Contractor shall rectify the same at no extra charge to OGDCL.

12.3.12.3 **Equipment Foundation:**

The EPCC Contractor shall be responsible for the design and construction of foundations for all the equipment as mentioned in the equipment list or may be required in the final design phase.

The design and construction of equipment foundations shall be carried out in strict accordance with relevant codes, standards, project specifications and manufacturer / vendor recommendations.

12.3.12.4 **Foundation for Pipe Racks / Sleepers and Supports:**

The foundations for pipe racks, sleepers and pipe supports shall be designed and constructed as per requirement of approved piping layouts.

The design of above foundations shall be in strict accordance with relevant codes, standards and project specifications.

12.3.12.5 **Fire Proofing**

The EPCC Contractor shall undertake the Fire Proofing of Steel Supports for Equipment, Piping, Pipe Racks, Cable Trays and Conduit Banks etc. located in the fire potential areas. The fireproofing shall be carried out in strict accordance with the OGDCL's approved Specification for Fireproofing; any variation thereof shall be subject to OGDCL's acceptance.

12.3.12.6 **Grouting**

The EPCC Contractor shall be responsible for undertaking the Grouting at the underside of Base Plates of Equipment, Pipe Racks and Supports for equipment etc. The Grouting shall also be required for the pockets in foundations for fixing Anchor Bolts. Generally the type of Grouting Material to be used is Non-Shrinkable Cementitious Grout and Non-Shrinkable Epoxy Grouts.

For the Grouting of Equipments, the recommendations of Vendor, for the type and thickness of Grout shall be strictly followed.

12.3.12.7 **Roads, Concrete Paving and Gravel Paving**

- **Roads**

  The EPCC Contractor shall be responsible for the dismantling and restoration / reinstatement of the existing road(s) for the road crossing / culverts for piping, cables and storm water drain etc.

  OGDCL's standard drawings and specification shall be followed for the restoration / reinstatement of roads.

- **Concrete Paving**

  The EPCC Contractor shall be responsible for the design and construction of RCC/ PCC pavements, as per approval of OGDCL. Concrete Paving shall be required around equipment, pumps and for providing access to certain areas of the Project.

  The Concrete Paving for equipment area shall be slopped towards catch basins and hubs to ensure proper drainage, whereas other paved areas and access ways shall also be slopped to avoid standing water on surface of the paved areas.

- **Gravel Paving**

  The EPCC Contractor shall provide 75 mm thick Gravel Paving at areas shown on Project drawings or as may be decided by OGDCL. As a guideline, the EPCC Contractor shall be required to provide Gravel Paving at space in between Road and paved areas.

12.3.12.8 **Drainage**

The scope of work for the design and construction of drainage system for Nashpa Compression Facility shall include:

- Oily water drainage
- Storm water drainage

The oily water drain system shall be designed / constructed with underground piping network, Catch Basins, Manholes, cleanouts and treatment & tie-in with existing network. The manholes and Catch Basins shall be of R.C.C and seal type.

The storm water drains shall be R.C.C. and shall be designed/ sized as per catchments area. The design of storm water drains shall also include tie-in of the storm water to existing network.

The plant drainage system shall be designed and constructed in accordance with relevant codes, standards and project specifications.

12.3.12.9 **Culverts**

The EPCC Contractor shall be required to design and construct the Culverts for the road crossing of storm water drains, piping and cables etc. The EPCC Contractor may also be required to dismantle the existing Storm Water Drain(s) and roads for construction of culvert(s). The design & construction of Culverts for the Project should be compatible with the Culverts of existing facility.

12.3.12.10 **Survey and Soil Reports**

The below listed Survey and Soil Reports are provided in **Appendix–I** of Volume-IIE of this document.

- Geological Mapping (Report)
- Surface Hydrology Using Climatological Data and Site Topography (Report)
- Down Hole Seismic Survey (Report)
- Geological Hazard Assessment (Report)
- Geological Investigation (Report)

12.3.12.11 **Protection of Environment**

The EPCC Contractor shall be responsible for the protection of environment during the construction activities and shall follow the data / guidelines provided by the local environmental agencies. The EPCC Contractor shall also be responsible for obtaining environmental data from concerned departments.

12.3.13 **Mechanical Construction and Hookup**

12.3.13.1 **General**

The EPCC Contractor shall be responsible for the all mechanical site fabrication, construction and hookup of all mechanical and piping facilities at the Nashpa Compression Facility. This shall include, but not be limited to:

a. Installation of all packages and equipment as described elsewhere.

b. Prefabrication of all interconnecting pipe work & installation on pipe racks.

c. Installation and weld out of closing spool pieces.

d. Interconnection of all ancillary services such as flare, blow-down drains etc.

e. Tie-ins (every Tie-in should be flanged with double block and bleed arrangement).

f. Complete inspection and testing of all mechanical and piping systems.

g. Installation of pipe supports, supporting structures, etc.

h. Preparation and completion of all painting, coating and insulation.

i. Access & stair structures etc.

12.3.13.2 Mechanical Testing of Packaged Units

The packaged Compressor units shall be tested in the Vendor's works prior to shipment. Such tests may include hydro-testing of on-skid pipe work. Under such circumstances, it may not be necessary to retest such systems on site provided that the EPCC Contractor can provide all documentary evidence that the required tests have been carried out at vendor's workplace and witnessed by the EPCC Contractor's & OGDCL/Consultant. Where the documentation is incomplete, or there is evidence of damage in transit, OGDCL may, at its discretion, request that a retest be carried out without any extra cost.

12.3.14 Electrical Installation, Hookup and Testing

12.3.14.1 General

The EPCC Contractor shall be responsible for all the installation, construction, hookup and testing of the electrical work at the Nashpa Compression Facility.

The work performed will include but not be limited to:

– Installation, connection and testing of all electrical equipment, lighting distribution boards, junction boxes.

- Glanding, termination connection, dressing, fixing and identification of all above & below ground cables.
- Megger and Continuity testing of all cables after installation & subsequent sealing in an approved manner.
- Cutting, fabrication, forming and installation of electrical cable tray (ladder type).
- Installation and painting/galvanizing of all cable support and fittings.
- Installation of cable identification makers.
- Installation of cable transits, accessories and protective ducts/sleeves.
- All work associated with building penetrations (if required) for the installation of cables including making good after installation.
- Installation and testing of the earthing system & lightning protection system.
- Installation and testing of all lighting system components, including those fixed to equipment packages.
- Installation and testing of Cathodic Protection system including of TR.
- Installation and testing of Heat Tracing System.
- Approval of Electrical inspector for all electrical equipments installations.
- Supply, laying and termination of electrical cables from existing UPS system to Air Compressor and Dryer Unit Control Panels.

All of the above work shall be carried out by the EPCC Contractor in accordance with the requirements and specifications within these documents.

Existing main distribution board placed inside the MCC room shall be utilized to feed the power supply of new Instrument Air Compressor (K-6401 C). The EPCC Contractor shall check and verify the available spare breaker in non-essential bus-A

as per marked in single line diagram. Any modification with reference to utilization of available spare feeder module shall deem to be part of the EPCC Contractor in all respect with considering all parameters which can be anticipated during the execution phase.

Electric power for heat tracing junction box / or distribution box shall be supplied from emergency source and will be confirmed during detail engineering By EPCC Contractor and accordingly all the relevant document / drawings will be developed for OGDCL /Consultant approval.

A Cathodic protection system shall be supplied and installed by EPCC Contractor for corrosion protection against underground pipes i.e. Oily Water Sewerage pipeline and Fire Water Network lines at new front compressors area as per piping layout (to be developed by EPCC Contractor).

Every metallic structure/ skid, motors shall be earthed from two different ends.

All metal Work used to enclose or contain current carrying conductors or components including the metal sheathing and armoring of cables shall be mechanically and electrically bonded together to form an efficient and effective earth return path for the maximum prospective earth fault current that may occur.

Apparatus shall be connected to the earth system via cable armor, in addition to other means of earthing, except in the case of single core armored cable.

Where package distribution boards, motor starter panels, motors, lighting distribution boards, cable trays (ladder type), piping, steel work, junction boxes, socket outlets, lighting fixtures, as well as frames, supports, pedestals, etc., are connected to the earth system or bonded together by means of earth conductors, the conductors shall be fitted with robust compression lugs and the Equipment shall be provided with earth terminals, lugs or bosses made of flat bar.

Moreover, please refer Electrical Installation Workmanship Document for further details.

12.3.14.2 **Testing of Electric Motors**

During the construction, pre-commissioning, commissioning, startup, Performance test and RGT phases of the work, the EPCC Contractor shall undertake all routine

maintenance and checks of the electric motors including rotating check etc, as recommended by the motor Vendors.

12.3.15 Instrument Installation, Hookup, Calibration and Testing

12.3.15.1 The Contractor shall be responsible for the installation, hookup, calibration and testing of all instrumentation and Controls work at the Nashpa Gas Plant. The work performed shall include but not be limited by:

a. Calibration, testing and re-installation of all instruments and valves supplied on the packages, irrespective of such work being carried out in the Vendor's works.

b. Calibration testing and installation of all loose instruments and valves not pre-installed on packages.

c. Installation and testing of all pneumatic, electrical and hydraulic connections.

d. Installation of all instrument air supply lines and signals transmission tubing including the installation and coating of any supports and ducting.

e. Relocation of existing instruments and valves.

f. Installation of control panels supplied on the packages, irrespective of such work being carried out in the Vendor's works.

g. Provision of all cables, tags and identifiers.

12.3.16 Security, Safety and Work Requirements

Security, Safety Policy & procedures, protection of environment etc. shall be as per clause 11.0 of Condition of Contract.

12.3.16.1 Security and Access

The EPCC Contractor shall be responsible for establishing the facility boundaries and security fencing. The EPCC Contractor shall also be responsible for the security of all facility, equipment and materials until the handover of the facility.

12.3.16.2 Safety Policy and Procedures

Prior to commencement of construction, the EPCC Contractor shall produce a written safety policy and procedure for OGDCL approval, which EPCC Contractor shall enforce during all construction and commissioning activities.

The procedure shall include as a minimum contingency plans for a plant emergency, fire precautions, accident procedure, safety training, levels of authority and responsibilities, etc. The EPCC Contractor shall designate a plant safety officer who shall be responsible for the day-to-day coordination with OGDCL representatives on all safety aspects of the work.

12.3.17 Vendor's Representatives

The EPCC Contractor shall be responsible for all costs associated with the provision of any on-site services, including the attendance of Vendor's representatives during the fabrication, construction, testing, commissioning and Performance Test Run phases of the Project.

12.3.18 Sub-Contracting

The EPCC Contractor may sub-contract any component of the Works. However, the Sub-contractor to be employed shall be approved by the OGDCL. The EPCC Contractor shall at all times be fully accountable and responsible for the sub-contracted work as if no such sub-contracting has been made. No act or omission of Sub-contractors and/or their employees shall in any way relieve the EPCC Contractor of its obligations covenants, warranties and guarantees given in the Contract. The EPCC Contractor shall in no way sub-contract the whole Works.

12.4 Mechanical Testing, Pre-commissioning, Commissioning, Facility Startup Performance Test, Reliability Guarantee Test & Handover

EPCC Contractor to submit a complete program for the erection & commissioning and testing & training of the compression facility for OGDCL's review and approval at least 4 weeks before the scheduled activity. Training shall be arranged before commissioning of the facilities.

EPCC Contractor shall provide all test equipment & communication radios required for construction, pre-commissioning, start-up, commissioning, and performance testing etc. Contractor shall use separate frequency band for its communication and shall arrange VHF license from the concerned authorities accordingly.

12.4.1 Contractors Organization

It is OGDCL's intention that the Nashpa Compression Facility shall be tested, pre-commissioned and commissioned in discrete packages and systems, and the each phase of the work is carried out in an orderly and properly documented fashion. The EPCC Contractor shall be responsible for all these activities and his onsite organization should therefore reflect the importance of these activities and ensure that these can be carried out in a satisfactory manner to OGDCL's approval. OGDCL staff may be involved to assist in all phases of commissioning and plant startup.

12.4.2 Mechanical Testing and Mechanical Completion

12.4.2.1 "Mechanical Testing" shall mean the carrying out of such hydraulic, pneumatic, electrical and other field tests as are specified and are required to demonstrate that the various sections and components of the Works have been constructed in accordance with the Contract.

Mechanical testing would typically include:

- Hydrostatic, pneumatic or other NDT testing of all pressure containing parts of the system.
- Testing of all electrical system components including switchgear and motor starters, motors, etc.
- Calibration and testing of all instruments including those installed on packages or skids.
- Testing of power and instrument cables.
- Testing of Package PLCs.
- Testing of Communication cables.
- Completion of appropriate test sheets and documentation.

All such testing of system components by the EPCC Contractor shall be subjected to witnessing by OGDCL/Consultant.

Mechanical completion of the package by the EPCC Contractor shall be signified after all such tests have been completed and documented and after the following has been carried out:

- Cleaning, flushing, draining, blowing out and drying out of vessels and piping systems and the installation, removal of temporary blinds used for isolation and testing of joints, as necessary.
- Replacing control valves, relief valves and orifice plates as removed for above.
- Replacement of gaskets and tightening of flanges, etc.

When these activities have been carried out by the EPCC Contractor to the satisfaction of OGDCL, the equipment and/or system shall be ready for pre-commissioning.

The EPCC Contractor shall notify OGDCL in writing at least two (2) weeks in advance of his intent to pre-commission the equipment and facilities.

12.4.2.2 **Mechanical Completion Certificate**

The Mechanical Completion date is considered as the date of the last pre-commissioning satisfactory test and issuance of the Mechanical Completion Certificate by OGDCL for the last portion or system of the Works.

Following steps shall be followed for the issuance of mechanical completion certificates for each individual system / equipment;

a. EPCC Contractor shall conduct an in-house inspection of the relevant system and generate a Punch-List.

b. Once the contractor's punch-list items are closed and pre-commissioning requirements/tests related to each individual system (portion of the Works) are completed, Contractor shall invite/request for OGDCL's inspection and provide Contractor's closed punch-list, test results, and Mechanical Completion checklist for OGDCL's review and information.

c. Consultant/OGDCL shall carryout inspection of the system/equipment and issues a punch list to Contractor within 7 days of Contractor's request to OGDCL for inspection. The punch lists will be of two types:

    - Critical (items in the opinion of the OGDCL, without which safe and intended operation of the facility cannot be ensured);

- Non-Critical (items in the opinion of the OGDCL, without which safe and intended operation of the facility is not compromised in any manner and that the same could be carried out without Plant/facility shut-down);

d. EPCC Contractor shall carry out all the necessary activities to clear out the punch list items. The procedure mentioned above shall be repeated until all OGDCL's punch-list items are closed and signed off by OGDCL representatives;

e. EPCC Contractor shall apply for the mechanical completion certificate of the individual system/equipment when all the critical punch-list items have been closed out and signed off by OGDCL representatives.

The duration in which EPCC Contractor shall complete the punch list items of the works shall be agreed by both parties;

The Mechanical Completion Certificate forms, system by system basis, shall be prepared during the procedure set-up stage. Forms shall be prepared by Contractor and submitted to OGDCL at least eight (8) weeks before the first pre-commissioning test.

12.4.2.3 **Mechanical Completion Check Lists**

Detailed Mechanical Completion Check lists (System-wise) will be prepared during detailed engineering phase, as a part of pre-commissioning manual which shall be submitted for OGDCL approval at least eight (8) weeks in advance before the start of any pre-commissioning activities. These check lists shall be prepared based on API 700 guidelines for Mechanical Completion and shall cover, as a minimum, the following sections:

i. Vendor's assistance;

ii. Permits;

iii. Vendor's / special instructions;

iv. Lubricants and consumable supplies

v. Packing and seals;

vi. Removal of temporary supports, bracings, weather protection etc.;

vii. Tie-ins at units limits;

viii. Leak and pressure test;

ix. Inspection;

x. Pressure/vacuum safety relief devices;

xi. Flushing and cleaning;

xii. Temporary screens, strainers and blinds;

xiii. Purging;

xiv. Housekeeping;

xv. Maintenance, spare parts and special tools;

xvi. Noise Survey;

xvii. Specific procedures/checks/tests for electrical, instrumentation, piping, static equipment, rotary equipment and safety systems.

EPCC Contractor shall ensure that all conformity checks, as defined above, shall be carried out in accordance with the Mechanical Completion checklists.

EPCC Contractor shall ensure that the Mechanical Completion checklists shall define the scope of Works which must be systematically performed, individually, on each type of equipment and system. The checklist shall also be used as a log to record the checks made.

EPCC Contractor shall ensure that a Pre-commissioning test sheet be completed for each test performed. All other pre-commissioning activities such as process piping / piping flushing and cleaning, shall be supported by respective documents.

12.4.2.4 **Operations and Maintenance Manuals**

Operations and Maintenance manuals shall be provided by the EPCC Contractor to OGDCL, They shall include Instruction Manuals that are complete and specific, and whose contents conform to the index. Documents shall be used which are specific to the work, including literature of the suppliers or manufacturers that would be useful to the OGDCL in the care, operation and maintenance of the equipment. Nomenclature used to reference each item shall be consistent throughout the manuals.

Information furnished shall be complete for equipment and systems furnished by the EPCC Contractor and its suppliers. Material that does not contribute to the understanding of the design, care, operation and maintenance of the equipment shall be excluded from the Instruction Manuals where practical. If it is necessary to use existing material containing extraneous items, the item referred to shall be clearly and plainly marked, the irrelevant data shall be deleted in an orderly and systematic manner and the date of publication shall be clearly shown.

The Instruction Manual shall be organized as follows:

Section I: Operation shall include the following:

i. General description of equipment, including overall design, specific and special features of design and descriptive drawings.
ii. Performance specifications for equipment stating the basis for calculations and allowable variations.
iii. Information to allow the OGDCL to update existing or create new OGDCL system design descriptions, which shall include but not be limited to detailed operating instructions for start-up, shut-down, normal operation and emergency shut-down as further detailed below.
iv. Starting instructions complete, detailed and specific for equipment furnished, noting the step-by-step procedure to be followed. Precautions and critical points to be observed shall be noted and emphasized as required. These instructions shall be divided into Initial Starting, Normal Starting and Starting after extended shutdown.
v. Operating instructions complete, detailed and specific for equipment furnished. It shall include precautions and critical points to be observed, including suggested form to be used in taking periodic readings to maintain an operations record. There shall be a tabulation of possible operating difficulties with the probable cause listed and remedial action to be taken.
vi. Shutdown instructions complete, detailed and specific for equipment furnished, noting the step-by-step procedure to be followed for shutting down the equipment. Precautions and critical points to be observed shall be divided into "Normal Shutdown" and "Emergency Shutdown."
vii. Design data for equipment and systems specifying horsepower, kilowatts, voltage, amperage, pressure, temperature, revolutions per minute, flow, etc.
viii. Characteristic curves for equipment where called for in the Technical Section(s) of the equipment specifications or when normally furnished for the particular equipment, such as fuel consumption, head, capacity, horsepower, efficiency, etc.

ix. Operator alarm responses for enunciator alarms.
x. Piping and instrument diagrams which provide proper valve alignment for equipment for normal operation.
xi. Composite drawings or color reproductions of computer CRT graphic displays showing type of control board or computer-accessed and displayed operating stations for valves and major equipment.
xii. Normal process operating ranges and set points for all facilities equipment.

Section II: Maintenance shall include the following:

i. Disassembling instructions complete, detailed and specific for assemblies of equipment furnished, noting the step-by-step procedure to be followed. Unusual care and precautions to be taken shall be noted and emphasized. Reassembly instruction shall also be included.
ii. Maintenance instructions complete, detailed and specific for equipment furnished normal preventive maintenance instructions and lubrication information, including periodic inspection, testing and maintenance requirements in accordance with applicable codes and manufacturers' instructions. Schedule covering tests and inspections to be performed after various periods of operation and overtime shall be included. A summary description and identification of special tools required and/or furnished for maintenance shall also be included.
iii. Settings, clearance and adjustment data tabulated for equipment, covering instrument settings for operation, alarm and shutdown and operating clearances and adjustments required for proper operation. Also, a tabulation of recommended and actual operating conditions, such as temperature, pressure, flow, etc., for equipment and systems. The actual shall be entered after installation or field test. Included also shall be calibration procedures and instrument data sheets.
iv. Test reports, mill test certificates and material specifications where the requirement for these items has been specified in the Technical Section(s).
v. Parts Catalogue/manual for spare parts identification/estimation.
vi. OEM recommended spares parts showing frequency of change or minimum/maximum levels.

12.4.3 **Pre-Commissioning**

12.4.3.1 The EPCC Contractor shall be responsible for pre-commissioning, which is defined as the systematic check of equipment and systems, on completion of fabrication

installation and testing i.e. after signature of the mechanical completion certificate, in order to verify that:

- All installation work, including testing, is complete.
- The equipment and systems are fit and safe to be put into operation with the intended service fluids, power sources, etc.

12.4.3.2 The EPCC Contractor shall furnish and install all fuels, lubricants, preservatives and any other consumables necessary for operation of the entire facility.

12.4.3.3 The EPCC Contractor shall be responsible for preparing and submitting for approval to OGDCL, his proposed procedures, acceptance forms and sequences for the pre-commissioning of each section of the work. This shall include, but not be limited to the following:

a. Mechanical

- Running in all drives and compressors and their drives.
- Cleaning screens and filters, replacing and adjusting packing and seals.
- For piping system, installation and removal of temporary blinds as required, circulation and pre-commissioning of systems including service and potable water, effluent and drainage, fire protection, instrument and plant air, relief and blow-down and interconnecting lines.
- For engine driven equipment, the setting of governors, the alignment of coupling, cleaning and removal of temporary screens.
- Vibration checks, alignment checks in accordance with the manufacturer's requirements and subject to OGDCL's approval.
- All running tests to ensure that the sections and components of the Works are ready for operation and safe commissioning.
- Any other checks and running tests required by the Vendor.

b. Electrical

EPCC Contractor shall perform complete Testing, Pre-commissioning and commissioning of all electrical items for new front end compressors & instrument air compressor and shall carry out the following activities at site(s) as a minimum:

– Testing

EPCC Contractor shall carry out all inspection and witness testing for equipment at vendors' works and shall be responsible for ensuring that all items supplied are strictly in accordance with the specifications.

The EPCC Contractor shall be responsible for the factory and field tests of electrical equipment of the project. As a minimum, factory acceptance tests shall be required for Power & Control Cables. Field acceptance testing shall be completed in accordance with internationals standards and procedures. During testing, it will be the responsibility of the EPCC Contractor to correct the malfunctions and problems detected in the electrical equipment/system, documentation of results, witnessing and to manage of a master copy of all documents, which will later be used to make the documentation "As Built".

The EPCC Contractor shall prepare and issue written reports for review by OGDCL/ Consultant on all interim and final inspection and tests. The EPCC Contractor shall keep records of all the tests carried out and provide a copy to OGDCL/Consultant.

– Pre-Commissioning,

The EPCC Contractor will perform pre-commissioning of the Compression facilities. In this regard a complete plan shall be provided for electrical system.

The EPCC Contractor shall perform pre-commissioning and shall be responsible for preparing and submitting for approval to OGDCL/Consultant, his proposed procedures, acceptance forms and sequences for the pre-commissioning of each section of the work. This shall include, but not be limited to the following:

- Function testing and operation of equipment in compliance with Vendor requirements.
- Check of power & control cables i.e. continuity check, megger check.

c. Instrumentation

i. Function testing and operation of control loops.

ii. Set points and action of alarm and shutdown devices.

iii. Stroking of control and shutdown valves.

12.4.3.4 Pre-commissioning of the Package and Off-Package instrumentation shall be carried out by the Contractor systematically, starting with individual instruments and controllers through system instrumentation to a final demonstration of the individual Compressor safety shutdown to overall plant safety shutdown system. All pre-commissioning activities shall be subjected to witnessing by OGDCL/Consultant, and the Contractor shall prepare and submit written reports on all pre-commissioning work carried out together with completed acceptance forms.

12.4.3.5 Receipt of such completed documentation (check lists, acceptance forms, etc duly witnessed and signed by OGDCL's/Consultant's representative) is necessary to enable OGDCL to issue a "Mechanical Certificate of Completion", which is required before plant commissioning may commence.

12.4.3.6 The facilities shall only be accepted by OGDCL / Consultant as mechanically complete and ready to commission after a physical inspection of the installation has been carried out to verify that all piping, electrical and instrument systems, etc. are installed in accordance with final construction drawings. Such inspection shall also consider:

i. The pressure test has been successfully completed.

ii. Electrical and instrumentation loop checks have been executed.

iii. Control valves, motors, engine drivers, etc., are functional.

iv. All other checks (functional and otherwise) have been executed in accordance with the Contract.

v. Operating areas are clear of debris and construction equipment.

The EPCC Contractor shall prepare and submit the detailed program and procedures for approval to OGDCL/Consultant for pre-commissioning of facility so that final

document will be available at site at least six (6) weeks prior to commencement of pre-commissioning.

12.4.4 Commissioning and Performance Testing

12.4.4.1 Commissioning

a. After all pre-commissioning work has been satisfactorily carried out, the Compression facility shall be commissioned with the introduction of hydrocarbons.
b. The EPCC Contractor shall be fully responsible for all commissioning activities and operation until steady state operating conditions (within seven days from commissioning) are achieved and the Compression Facility is meeting flow and pressure specifications. At a mutually agreed time, the EPCC Contractor shall carry out the Performance Test run. Upon satisfactory completion, the facility shall be handed over to OGDCL.
c. EPCC Contractor is required to prepare a schedule in Gant chart format, which summarizes their interpretation and understanding of the completion of contract activities from construction through to final acceptance.
d. The EPCC Contractor shall prepare a detailed program and procedure for approval by Company for commissioning and testing the process plant so that a final document will be available at Site at least Two Months before commencement of pre-commissioning. Immediately after the Compression Facility has been commissioned, guarantee tests shall be carried out as follows;

12.4.4.2 Performance Test

a. The purpose of this Test shall be to demonstrate that the compression facilities meets the performance requirements laid-down in the Technical Specifications and respective data sheets.
b. Performance test shall be carried out by the EPCC CONTRACTOR on peak ambient conditions in order to evaluate the compressor package performance, flow rate, inlet / outlet pressures of the packages.

However, if the Performance Test is performed in peak summer conditions by the EPCC Contractor then OGDCL shall perform performance test in peak winter season. Any

abnormality observed or faults identified during the test perform by the OGDCL, this will be communicated to the EPCC Contactor to rectify the same at its own cost during defect liability period.

Similarly, if the Performance Test is performed in peak winter conditions by the EPCC Contractor then OGDCL shall perform performance test in peak summer season. Any abnormality observed or faults identified during the test perform by the OGDCL this will be communicated to the EPCC Contactor to rectify the same at its own cost during defect liability period.

c. During the PERFORMANCE TEST, the measurements of flow rates (gas and liquid), inlet / outlet pressures, temperatures etc. shall be taken at hourly intervals.

d. The Compression packages shall be operated for seventy two hours (72) continuous running Performance Test under peak load and turndown rates. The procedure for these Tests and methodology for performance evaluation shall be agreed between the EPCC Contractor and OGDCL/Consultant during the design phase. It shall be designed to demonstrate satisfactory operation of the entire Compression Package performance.

e. Particular attention shall be paid by the EPCC Contractor to such things as the level of vibration of all rotary/reciprocating units and other critical operating parameters and gas & liquid stream vessels. Any component malfunction and has an effect on satisfactory plant operation during these Tests, the particular Test being carried out shall be considered void and shall be re-conducted after remedial action has been completed to OGDCL's/Consultant’s satisfaction.

f. Following completion of the Test to OGDCL's/Consultant’s satisfaction it is required that the operation of the Compression Package and all equipment forming part thereof shall be demonstrated to be in accordance with the Technical Specification. For this purpose the following Tests shall be carried out separately by the EPCC Contractor to the satisfaction of OGDCL/Consultant in order to fulfill the requirements of the Performance Guarantee Test. The procedure for the Tests shall be agreed between the EPCC Contractor and OGDCL/Consultant during the design phase:

    i. Each Compressor shall be operated for a continuous period of not less than seventy two (72) hours in the fully automatic mode.

ii. A complete emergency shutdown of each compressor shall be initiated. This shall demonstrate the safe and satisfactory shutdown of all operating equipment and the safe isolating and flaring of the Compressors.

iii. If the PERFORMANCE TEST is interrupted for reasons attributable to the EPCC CONTRACTOR, then EPCC CONTRACTOR shall promptly reengineer and/or carry out such modifications as are required to rectify the causes of the interruption. OGDCL/Consultant will thereafter give notice in writing to the EPCC CONTRACTOR specifying the date on which PERFORMANCE TEST may be recommenced. Additional cost, if any, resulting from such interruption shall be to the EPCC CONTRACTOR'S account.

iv. If the WORKS or any part thereof fail to pass the MECHANICAL TEST or if the Process Guarantees specified (in the specifications and data sheet) are not met for reasons attributable to the EPCC CONTRACTOR; Tests of the WORKS or the said portion shall be repeated within a reasonable time upon the same terms and conditions save that all reasonable expenses which the OGDCL/Consultant may have to incur by the repetition of the Tests shall be deducted from the CONTRACT PRICE

v. A demonstration that Compressor Package cold and hot start under both summer and winter ambient condition and meets all technical specifications and requirements, particularly equipment which are affected by ambient conditions such as liquid production rate, temperature, Compression system performance, etc.

vi. The acceptability of noise levels (85 db @ 1 meter) shall be demonstrated by taking sound pressure level reading during operation of the Compression Facility. Those readings shall be by means of a precision grade sound level meter to BS-4197. Corrections, as agreed between the EPCC Contractor and OGDCL/Consultant during the design phase, shall be applied to the reading in order to forecast the figures that will apply in the future when the Facility is operating under full power and load. Acceptable final sound pressure levels shall be in accordance with the relevant codes and standards.

vii. The satisfactory operation of the automatic fire and gas detection system shall be demonstrated. This Test shall be detailed during the Project design phase.

viii. The EPCC Contractor shall ensure through the Purchase Order that the performance of each cooler, heat exchanger, radiator and compressors shall be demonstrated to OGDCL's/Consultant's satisfaction by a further test to be conducted during the summer at a time when the ambient temperature is close to

the design maximum temperature. The exact procedure for this test shall be agreed between OGDCL/Consultant and the EPCC Contractor during the design phase.

ix. On completion of the Performance Test, to the satisfaction of OGDCL/Consultant a Provisional Acceptance Certificate signifying that the Compression Facility meets the performance requirements of the Technical Specification shall be issued to the EPCC Contractor by OGDCL/Consultant and signed by the representatives of both OGDCL/Consultant and the EPCC Contractor.

12.4.4.3 **Reliability Guarantee Test (RGT)**

The continuing availability of the Nashpa Compression Facility to deliver required gas/ liquid flow rates and pressures up to and including the design maximum day flow at the contractual delivery pressure and temperature shall be demonstrated by means of a Reliability Guarantee Test. This Test shall start on completion of the Performance Guarantee Test to the satisfaction of OGDCL/Consultant and shall continue for a minimum of 30 days.

The EPCC Contractor shall ensure that all defects arising during the Reliability Guarantee Test are properly and expeditiously rectified with no cost to the OGDCL. The EPCC Contractor shall also be responsible for the provision of all spares, consumables, lubricants, etc required for Compression Facility operations and maintenance with no cost to the OGDCL upto the complete RGT.

Completion of the Reliability Guarantee Test shall occur after Compression Facility has completed a continuous period of 30 days with a maximum of four (04) shutdowns of major components of Compression Facility lasting not more than twelve hours (12). EPCC Contractor will require to repeat the RGT for a period of thirty (30) days if four (04) such shutdowns occur during the RGT period.

Further to above condition, EPCC Contractor shall also perform RGT for a particular compressor package for which shutdown is continued more than seventy two (72) hours due to unavailability of spare parts or any other malfunctioning during RGT period, for a thirty (30) days time. In this case, the relevant payment milestone of RGT will be proportionate linearly as per the compression packages completed the RGT.

Should the completion of the Test be delayed or prevented by an occurrence of force Majeure or by direction of OGDCL then the Test shall be recommenced on cessation

of the Force Majeure occurrence or at OGDCL direction from the point at which the Test has been delayed or prevented.

The EPCC Contractor shall be responsible for directing, training and assisting OGDCL's personnel in correct operation and advising and assisting in the correct maintenance of Compression Facility during the whole period of the Reliability Guarantee Test.

If as a result of a deficiency or error in the services provided by the EPCC Contractor, the Suppliers of equipment or Sub-contractors, the Reliability Guarantee Test has not been completed within a period of 30 days from its commencement then the test shall be re-conducted for which the EPCC Contractor shall be responsible for the continued attendance of its personnel at no cost to OGDCL for completion of the test.

12.4.4.4 **Performance Guarantee**

During the Performance Test and RGT, the following reading shall be taken at hourly and four hourly intervals respectively:

1. Gas Flow rates.
2. Inlet and outlet Pressures and temperatures.
3. Fuel gas Consumption.

12.4.4.5 **Training**

EPCC Contractor is required to provide training to all operation and maintenance staff, and therefore appropriate technical personal shall be included as part of his team during the pre-commissioning & commissioning, start up, Performance Test and RGT phases of the project. While the EPCC Contractor shall remain responsible for the Nashpa Compression Facilities until handover, he shall be required to provide such assistance as is necessary during this familiarization phase.

In the pre-commissioning and commissioning phases of the plant, the EPCC Contractor shall provide informal training for OGDCL personnel from time to time. During this time, the OGDCL personnel shall be coordinated by EPCC Contractor's Commissioning Engineer.

The EPCC Contractor shall prepare a training program for the purpose of training OGDCL personnel in the operation and maintenance of Compression Facility. The

EPCC Contractor shall obtain the relevant information relating to training from its Suppliers.

Specialized training of OGDCL personnel in the operation and maintenance of the Compression Facility shall be conducted at site by the EPCC Contractor's site supervisors during the erection of Compression Facility.

Final training of OGDCL personnel in the operation and maintenance of the Compression Facility shall be conducted at site by the EPCC Contractor's site personnel during commissioning of the Compression Facility and for a period thereafter to be agreed when all aspects of the Compression Facility operation will be demonstrated. However the EPCC Contractor shall be required to provide operational management assistance and training services not less than 6 weeks after the facility is handed over to OGDCL.

13.0 Health, Safety & Environment

EPCC Contractor will conform to the OGDCL HSE Policy and principles during the execution of the project. All facilities provided for OGDCL personnel during the execution of the Work will conform to the OGDCL HSE Policy and principles. The Compression Facility will be designed, constructed and commissioned so that during operation it conforms to the OGDCL's HSE Policy and Principles.

The EPCC Contractor shall take all precautions to maintain health & safety of its personnel deputed at site and avoids any adverse effects on the environment of the area. Any incident/accident shall be recorded and brought to the knowledge of OGDCL / Consultant.

The EPCC Contractor will immediately take safety and mitigation measures to minimize the effect of the incident.

Prior to commencement of construction, the EPCC Contractor shall produce a written HSE policy and procedures for OGDCL / Consultant's approval. The policy and procedures Contractor shall enforce during all construction and commissioning activities shall be in lined with OGDCL HSE policies.

As a minimum contingency plan for a plant emergency, fire precautions, accident procedure, safety training, lines of authority and responsibilities, etc. shall be required. The EPCC Contractor shall designate a Construction HSE Officer (who will head a team of watchmen) who shall be responsible for the day-to-day coordination with OGDCL / Consultant on all health safety and environmental aspects of the work.

a) Work Permits

During construction, pre-commissioning, testing and startup a permit to work system shall be required. Details of the system shall be by agreement with OGDCL, but shall involve a formal permit by a nominated OGDCL representative to carry out a specific item(s) of work and a statement of conditions under which the work must be carried out. No Work shall be allowed without proper authorization from Plant's Safety Personnel and OGDCL/Consultant may stop the work if proper safety precautions/procedures are not being followed by EPCC Contractor personnel.

b) Protective Personal Equipment

The EPCC Contractor shall, at his own expense, supply his personnel and Sub-Contractor's personnel, required in connection with the safe performance of the Work, with adequate protective personal clothing and other protective equipment which shall be maintained in good condition or replaced, and shall be worn on all relevant occasions as indicated by notices, instructions and good practice.

c) Security

The EPCC Contractor shall be solely responsible for the safety and security of the Site in its possession until its takeover by OGDCL. The EPCC Contractor shall make appropriate security arrangements and shall strictly comply with security requirements and instruction of OGDCL site security incharge and shall be as per clause 11.11 of Condition of Contract.

d) Housekeeping

The EPCC Contractor shall be responsible for ensuring that the site is kept clean and tidy all times even during execution and installation activities and that all scrap materials and tools are removed from the job site on completion of the Work.

e) Medical Welfare

EPCC Contractor shall be responsible for the medical welfare of his own and Sub-Contractors' employees, servants or agents and shall take care of periodical medical examinations, arrangements for medical attendance, treatment or hospitalization if and when necessary and shall arrange suitable insurance coverage for such contingencies. In cases of emergency, OGDCL may make or provide for, the necessary emergency arrangements, the costs of which shall be reimbursed to OGDCL by EPCC Contractor.

f) Safety Equipment

EPCC Contractor shall at his own expense provide adequate first aid equipment, fire extinguishers and other safety equipment of an approved type, as may be specified (or expected in accordance with good working practice) and shall maintain this in a

professional manner as directed by OGDCL / Consultant or the legal and industry standards.

In addition, EPCC Contractor shall keep up-to-date inspection calibration records of all said equipment. Free access by all persons on site to all fire extinguishing and safety equipment must be maintained at all times. Contractor shall ensure his personnel to conduct the necessary safety drills and make familiar with the existing plant.

13.1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

EPCC Contractor will conform to the recommendations of Environment Impact Assessment (already performed by OGDCL for complete Nashpa Plant through its pre-qualified third party) during the execution of the Work. The Nashpa Compression Facility will be designed, constructed and commissioned so that during operation it conforms to all requirements of the EIA.

13.2 COMMUNITY RELATIONS AND CODE OF BEHAVIOR

EPCC Contractor will at all times behave towards the community in the area of the Site in accordance with the Community Relations and Code of Behavior.

14.0 Deliverables

General

The EPCC Contractor shall produce the following information, as a minimum during the course of the Contract, the EPCC Contractor shall produce but not limited to the following:

14.1 General Facility Information

- Scope of Work
- Project Schedule
- Design and Construction Procedures

14.2 Process Design

- Basis of Design
- Philosophies
- Description of Facilities/Special Features
- Interconnection with all Process Unit
- Facility Utilities
- Control of Facility /Operating Variables/ Facility Surging/ Facility Turndown
- P&IDs/ PFDs / UFDs / Utility Balances, Material Selection, datasheets.
- Detailed Equipment Listing (including design conditions, size/weight information, etc.)

14.3 Facility Layout

- Philosophy
- Separation Requirements
- Updated Plot Plan

- Area Classification Drawings
- Site Drainage Plan of the facility

14.4 Safety

- Philosophy
- Cause and Effect Diagrams
- Fire and Gas Detection/Site Zoning
- Fire & Gas Mapping study Report
- Overpressure Protection
- Facility Blow-down
- Fire Fighting Systems
- Safety Facilities/Drainage Systems
- Vent/Flare Heat Radiation and Dispersion Considerations as well as Liquid Dropout Potential
- HAZOP Study

14.5 Mechanical/Piping

- Plot Plan
- Key Plan
- Piping Layout
- Isometrics
- Mechanical and stress analysis specifications
- Stress Analysis Report

- Compressor Packages Vendor Drawings of all Equipments
- Underground Piping Layout
- Fire Water Layout

14.6 Instrument and Control

- Control & Shutdown Philosophy
- Compressor Control System Architecture Drawing
- Reference documents, codes and standards
- Quality Plan
- Operator Interface Proposals including Screen Animation principles and color standards, display sketches, alarm philosophy
- System hardware configuration
- Power supply details including distribution line diagrams
- Instrument List
- I/O List
- Equipment Interconnection schemes for interfacing compressor PLCs with complete package instrumentation & with plant Safety system
- Equipment Interconnection schemes for interfacing compressor PLCs with Operator and Engineering Workstations.
- F&G Mapping Study report.
- Availability and reliability calculations
- Cause & Effects

- Logic Diagrams
- Loop Drawings
- Typical Engineering Drawings
- Technical Data Sheets of components used
- Instrument & JB Location Layout
- Fiber Optic Cable Layout
- Instrument Cable Layout
- Fire & Gas detectors layout
- Cable Schedule
- Instrument Master Index
- Wiring, termination and interfacing details drawings
- M.T.O.
- BOM (Supply & Installation)

14.7 Electrical

- Electrical equipment specifications
- Electrical equipment data sheets
- Electrical load load list
- Single line diagram
- Hazardous area classification drawings
- Power and Control cable layout drawings

- Earthing layout drawings
- Lighting layout drawings
- Lightening protection drawings
- Distribution board drawings
- Cable schedules
- Material take-off list
- Detail installation drawings
- Supplier drawings and test certificates
- Hazardous Area Equipment certificates provided by international authorities
- Reference documents, codes and standards
- Cathodic protection drawings
- Electrical heat tracing drawings
- Quality Plan

14.8 Structural

- Philosophy
- Equipment Access
- Calculations
- Steel structure Specifications
- Staad Report of all steel structure including pipe bridge, Compressor Shed & pipe Rack
- Steel Structure Drawing of Pipe Bridge, Platform, Compressor Shed & pipe Rack

- Pipe Support Drawings

14.9 Surface Treatment

- Painting

14.10 Calculations

- Process
- Mechanical
- Piping (including stress)
- Safety
- Instrumentation
- Electrical
- Civil
- Structural
- Others as required

14.11 Data Sheets

- Process
- Mechanical
- Instrumentation
- Electrical
- Others as required

14.12 Equipment Specifications/Requisitions

- Mechanical
- Instrumentation
- Electrical
- Unpriced Purchase Orders for all equipment
- Others as required

14.13 Start-up and Operating Procedures (To be included as part of Project Data Book)

The Start-Up and Operating Procedures shall include, but not be limited to, the following generalized information headings:

Introduction

- Processing Scheme Description
- Process Units/Facility.

14.14 Basis of Design

- Capacity/Feed and Product Specifications, etc.

14.15 Description of Compression Facilities/Special Features

- Listing of Major Equipment/Design Conditions, etc.

14.16 Control of Plant

- Description/Philosophy
- Operating Variables/Facility Surging/Facility Turndown
- Fire/Gas and Smoke Detection System
- Emergency Shutdown and Blowdown Systems

14.17 Plant Start-up

- Pre-Start Preparations/Checks
- Start-up Procedures ('Black Start' Conditions)
- Start-up Procedures ('Live Plant' Conditions)

14.18 Deliverables Requirements

Contractor shall provide OGDCL with:

- One (1) reproducible (full size) of drawings in A2, A1, A0 format
- Two (2) prints (full size) of drawings and documents in A4 and A3 format

Only key drawings and documents shall be submitted for review. EPCC Contractor shall provide OGDCL/Consultant with list of key documents including drawings, specifications and calculations for review prior to commencement of work.

Documents for review shall be sent to Consultant and OGDCL head office or documents required by OGDCL will also be submitted.

14.19 Approved for Construction Documents

Contractor shall provide OGDCL/Consultant with:

- Two (2) reproducible (full size) of drawings in A1, A0 format
- Four (4) prints (full size) of drawings and documents in A4 and A3 format
- Four (4) prints A3 size reductions of drawings in A2, A1 or A0 original format
- Delivery of 'Approved for Construction' documents shall be provided to OGDCL site and head office.

14.20 Final and As-built Documentation

Within Two (2) months of completion of construction (i.e. mechanical completion) Contractor shall submit to OGDCL a Project Data Book.

Information to be included in the Project Data Book shall consist of, but not be limited to the following:

- Description of the Project
- Lists of drawings, specifications, calculations, purchase orders, manuals, etc.
- Design Reports
- Basis of Designs
- Calculations
- Specifications
- Data Sheets
- Certification & Traceability Records
- Testing & Pre-commissioning Procedures and Records
- Commissioning Procedures and Records
- Start-up and Operation Procedures and Manual.
- Operation and Maintenance Manuals (Vendors) including parts catalogue.
- Drawings (both EPCC Contractor and Vendor)

Revisions of the above documentation for inclusion in the Data Books shall be the latest including 'As built' where applicable.

Four (4) copies of the Project Data Book shall be presented to OGDCL in the following format:

- A4 size (except for drawings)
- Bound in hard plastic cover volumes
- Each volume shall be marked with title and Company logo and name (both A4 and A3 format)
- Each volume to be indexed
- Drawings to be reduced to A3 size and bound in A3 hard plastic cover volumes
- One (1) copy to be marked 'Original', three (3) other copies to be numbered and marked accordingly

EPCC Contractor shall submit proposed Project Data Book index to OGDCL for review prior to commencement of work.

OGDCL may request specific volumes or sections of the Data Book to be submitted prior to completion date e.g. Purchase Orders, Start-Up Procedures.

14.21 Other Documentation

14.21.1 Progress Reports

Weekly and 'Draft' Monthly Progress Reports shall be in A4 format, stapled only along with soft copies.

'Final' version of monthly progress reports provided by the Contract shall be in A4 format, card covered, with window for title and either comb or thermal bound according to number of pages in the report.

A soft copy of the report shall also be submitted.

14.21.2 Operation & Maintenance Manuals (Including Parts Catalogue)

The Operation and Maintenance manuals shall be provided by the EPCC Contractor at the time of issuance of purchase order prior to mechanical completion of the Facility. EPCC Contractor shall also submit the training manuals.

14.21.3 As-Built Drawings

As well as drawings presented in A3 format in the Project Data Book EPCC Contractor shall provide Company with one (1) full size reproducible, together with one (1) full size print of all A1 and A0 drawings raised to the as built status. EPCC Contractor shall nominate drawings to be 'As Built' and submit to OGDCL for review. Soft copies of the As-built drawings shall be submitted in format and software as specified by the Company.

15.0 Specifications

15.1 Process

0193-A-1000	Design Basis
0193-A-1001	Hydraulic Study Report
0193-A-1002	Equipment Rating Report
0193-A-1003	Blow-down Study Report
0193-A-1004	Operation, Control and ESD philosophy
0193-A-1100	Line List
0193-A-1101	Tie-In List
0193-B-1501	PFDs and HMBs
0193-DS-1701	Data Sheet for Front End Compressors
0193-DS-1702	Datasheet For Air Compressor and Air Dryer Package (K-3401C & PU-3410)
0193-DS-1801	Datasheet For Fire Protection Equipment
NPG-010-INS-15.01-0001	ESD System Cause and Effect Diagrams
NGP-010-INS-15.01-0004-00	F&G System Cause and Effect Diagrams

15.2 Mechanical

0193-MA-001	Specification for Reciprocating Compressor
0193-AEA-001	Specification for Air Cooled Heat Exchanger
0193-PU-001	Specification for Skid Mounted Equipment Packages)
0193-VA-001	Specification for Unfired Pressure Vessel
0193-GS-001	General Specification for Painting
14-0193-STA-001	Specification for Steel Structure
NGP-000-PIP-15.03-0001-00-02	Piping Material Specification
NGP-000-PIP-15.03-0002-00-00	Specification for Stress Analysis
NGP-000-PIP-15.03-0006-00-00	Specification for gaskets
NGP-000-PIP-15.03-0007-00-00	Specification for Stud Bolts and Nuts
NGP-000-PIP-15.03-0008-00-02	Specification for Carbon and Stainless Steel Pipes
NGP-000-PIP-15.03-0009-00-00	Specification for Carbon and Stainless Steel Fittings
NGP-000-PIP-15.03-0010-00-00	Specification for Ball, Gate, Globe and Check Valves
NGP-000-PIP-15.03-0011-00-00	Specification for Steel Flanges
NGP-000-PIP-15.03-0016-01-00	Specification for Induction Bends
NGP-000-PIP-15.05-0001-00-00	Piping Design Basis
NGP-000-PIP-15.17-0001-00-00	Data Sheet for Gate, Globe and Check Valves
NGP-000-PIP-15.17-0002-00-00	Data Sheet for Ball Valves
NGP-000-PIP-15.17-0006-01-00	Data Sheet for Induction Bends

15.3 Instrumentation

0193-IMA-6000	General Specification for Instrumentation

0193-IMA-6001	Specification for package Control system
0193-IMA-6002	Specification for Instrument Installation
0193-LT-6000	I/O List for ESD System
0193-ICD-6000	Compressor Control system Architecture Drawing
0193-LO-6001	F&G Layout
NGP-000-INS-15.01-0002-24	Instrument Cable Routing
0193-DS-6000	Data Sheet for Flow Meter
0193-DS-6001	Data Sheet for Flow Orifice

15.4 Electrical

0193-ELA-6500-00	Electrical Basis of Design
0193-ELA-6501	Electrical Load List
0193-ELA-6502	Specification for LV Power & Control Cable.
0193-ELA-6504	Specification for LV A.C Induction Motor
0193- ELA-6505	Data Sheet for Instrument Air Compressor Motor
0193-ELA-6503	Specification for Electrical Installation Workmanship

15.5 Civil

NGP-000-SCW-15.05-0001-00	Design Basis for Civil and Steel Structures Works
NGP-000-SCW-15.05-2001-00	Design Basis for Roads and Paving
NGP-000-SCW-15.03-0001-00	Specification for Plain and Reinforced Concrete Works
NGP-000-SCW-15.03-0003-00	Specification for Brick Works
NGP-000-SCW-15.03-0002-00	Specification for Grouting
NGP-000-SCW-15.03-0004	Specification for Structural Steel Works
NGP-000-SCW-15.03-2001-00	Specification for Earth Work and Site Preparation
NGP-000-SCW-15.03-0005-00	Specification for Block Masonry
NGP-000-SCW-15.03-2002-00	Specification for Road and Paving Works

Above listed Specifications are provided in Appendix -II of Volume-IIE of this document.

16.0 Drawings

16.1 Piping & Instrument Diagrams (Process)

NGP-001-PCS-15.09-0001-00	Proposed P&ID Legends and Symbols
NGP-007-FIF-15.09-0002-19	P&ID For Fire Water Ring Main
0193-PB-2101	P&ID For Front End Compressors
0193-PB-2102 (Sheet 1 of 2)	Typical P&ID For Front End Compressors
0193-PB-2102 (Sheet 2 of 2)	Typical P&ID For Front End Compressors
NGP-001-PCS-15.09-0002-01	P&ID For Slug Catcher
NGP-001-PCS-15.09-0003-02 (Sheet 1 of 4)	P&ID For Nashpa H.P Production Separator
NGP-001-PCS-15.09-0003-02 (Sheet 3 of 4)	P&ID For Naspha MP Production Separator
NGP-001-PCS-15.09-2005-11	P&ID For Flare System
NGP-001-PCS-15.09-0024-14	P&ID For Fuel Gas System
NGP-001-PCS-15.09-0025-16	P&ID For Closed Drain System
NGP-001-PCS-15.09-0026-17	P&ID For Instrument & Utility Air System
NGP-001-PCS-15.09-0027-17	P&ID For Instrument Air Distribution System

16.2 Mechanical Drawings

0193-PC-001	Unit Plot Plan For FEC Area
NGP-000-GEN-15.01-0001-00-03	General Plot Plan
0193-PD-001-01	Piping Layout For FEC Area
D08PIP1075-DWG00-X2	Slug Catcher Valves Skid (SK-SC-2001-1)
NGP-000-PIP-15.01-0005-24-02	Pipe rack from Process
NGP-000-PIP-15.01-0007-24	Piping GA from Process Unit to As built separator system
NGP-002-PIP-15.01-0003-02	Slug Catcher

NGP-002-PIP-15.01-0004-02	Gathering System-1
NGP-007-FIF-15.01-0004-24-02	Piping Layout for Fire Water System (Unit-35)
0193-PDF-2401	Piping Isometric (10"-20-P-107-A2 & 10"-20-P-106-B2)

16.3 Civil Drawings

NGP-000-SCW-15.01-0001-00 (Sh. 1 of 2)	General Note for Reinforced Concrete Work
NGP-000-SCW-15.01-0001-00 (Sh. 2 of 2)	General Note for Reinforced Concrete Work
NGP-000-SCW-15.01-0002-00	General Notes for Structural Steel Works
NGP-000-SCW-15.01-0003-00	Standard Drawing of Legend and Abbreviation
NGP-000-SCW-15.01-0005-00 (Sh. 1 of 3)	Standard Drawing for RCC Works
NGP-000-SCW-15.01-0005-00 (Sh. 2 of 3)	Standard Drawing for RCC Works
NGP-000-SCW-15.01-0005-00 (Sh. 3 of 3)	Standard Drawing for RCC Works
NGP-000-SCW-15.01-0006-00	Standard Drawing of Anchor Bolts
NGP-000-SCW-15.01-0007-00 (Sh. 1 of 2)	Standard Drawing for Paving Pedestal
NGP-000-SCW-15.01-0007-00 (Sh. 2 of 2)	Standard Drawing for Paving Pedestal
NGP-000-SCW-15.01-0009-00 (Sh. 1 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 2 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 3 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 5 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 6 of 18)	Standard Detail of Valve Pit

NGP-000-SCW-15.01-0009-00 (Sh. 7 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 8 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 9 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 10 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0009-00 (Sh. 11 of 18)	Standard Detail of Valve Pit
NGP-000-SCW-15.01-0010-00 (Sh. 1 of 2)	Standard Drawing for Storm Water
NGP-000-SCW-15.01-0010-00 (Sh. 2 of 2)	Standard Drawing for Storm Water
NGP-000-SCW-15.01-0011-00	Standard Drawing for Vent Pipe, Fire Fighting Equipment and Misc. Step
NGP-000-SCW-15.01-0012-00	Standard Drawing for Cable Trench
NGP-000-SCW-15.01-0017-00	Standard drawing for Grating floor
NGP-000-SCW-15.01-0059-00	Standard drawing for Pipe Connection
NGP-000-SCW-15.01-2001-23	Standard drawing for Road Section
NGP-000-SCW-15.01-2002-23	Standard drawing for Paving
NGP-000-SCW-15.01-2003-23 (Sh. 1 of 7)	Road & Pavement Layout
NGP-000-SCW-15.01-2003-23 (Sh. 2 of 7)	Road & Pavement Layout
NGP-000-SCW-15.01-2003-23 (Sh. 4 of 7)	Road & Pavement Layout
NGP-000-SCW-15.01-2003-23 (Sh. 5 of 7)	Road & Pavement Layout
NGP-000-SCW-15.01-2004-23 (Sh. 1 of 4)	Storm Water Drainage Plan

NGP-000-SCW-15.01-2004-23 (Sh. 2 of 4)	Storm Water Drainage Plan
NGP-000-SCW-15.01-2004-23 (Sh. 3 of 4)	Storm Water Drainage Plan
NGP-000-SCW-15.01-2004-23 (Sh. 4 of 4)	Storm Water Drainage Plan
NGP-000-SCW-15.01-2005-23 (Sh. 1 of 6)	Site Grading and Leveling Plan
NGP-000-SCW-15.01-2005-23 (Sh. 3 of 6)	Site Grading and Leveling Plan
NGP-000-SCW-15.01-2005-23 (Sh. 6 of 6)	Site Grading and Leveling Plan
NGP-000-SCW-15.01-2006-23 (Sh. 1 of 4)	Grading and Vertical Plan
NGP-000-SCW-15.01-2006-23 (Sh. 2 of 4)	Grading and Vertical Plan
NGP-000-SCW-15.01-2006-23 (Sh. 3 of 4)	Grading and Vertical Plan
NGP-000-SCW-15.01-2007-23 (Sh. 1 of 2)	Stone Pinching Protection Layout
NGP-000-SCW-15.01-2008-23	Standard drawing for Stone Pinching Protection
NGP-000-SCW-15.01-2010-23 (Sh. 1 of 6)	Detail drawing for Storm Water Drain Ditch
NGP-000-SCW-15.01-2010-23 (Sh. 2 of 6)	Detail drawing for Storm Water Drain Ditch
NGP-000-SCW-15.01-2010-23 (Sh. 3 of 6)	Detail drawing for Storm Water Drain Ditch
NGP-000-SCW-15.01-2010-23 (Sh. 4 of 6)	Detail drawing for Storm Water Drain Ditch
NGP-000-SCW-15.01-2010-23 (Sh. 5 of 6)	Detail drawing for Storm Water Drain Ditch
NGP-000-SCW-15.01-2010-23 (Sh. 6 of 6)	Detail drawing for Storm Water Drain Ditch
NGP-000-GEN-15.01-0002-00	Underground Services Layout

Above listed Drawings are provided in **Appendix-III** of Volume-IIE of this document.

16.4 Electrical Drawings

NGP-010-ELE-15.01-0004-13	Single Line Diagram for UPS
NGP-010-ELE-15 01-0002-13	Single Line Diagram for Main Distribution Board
NGP-000-ELE-15.01-0002-24-	Cable Routing Layout for General Area
NGP-000-ELE-15.01-0002-24	Cable Routing Layout for General Area
NGP-001-ELE-15.01-5002-17	Cable Layout for Instrument & Utility Air System
NGP-000-ELE-15.01-0001-00-	Hazardous Area Classification Layout
0193-ELF-6800	Typical Installation Detail Drawings