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# INTRODUCTION

## GENERAL

This specification covers the minimum requirements for the design, manufacture, supply, inspection and testing of skid mounted packages.

## DEFINITIONS

Following definitions apply throughout this document:

|  |  |
| --- | --- |
| Company / Owner | Oil & Gas Development Company Limited (OGDCL) |
| Contractor | “Contractor” means the person or persons, firm or Proprietor whose proposal has been accepted by the Company for verification of FEED package, engineering design, procurement, inspection, supply of material and equipment, construction/ commissioning, performance testing, one year of defect liability period and training of Company’s personnel for the project and includes the Contractor’s representative(s), successors and permitted assignees. |
| Vendor / Supplier | The organization, firm or agency with whom order for the supply of equipment and or material has been placed. |

## ERRORS OR OMISSIONS

The review and comment by the COMPANY of any drawings, procedures or documents referred to in this Specification shall only indicate acceptance of general requirements and shall not relieve the CONTRACTOR / SUPPLIER of its obligations

to comply with the requirements of the purchase order.Any errors or omissions noted by the CONTRACTOR / SUPPLIER in this Specification shall be immediately brought to the attention of the COMPANY.

## DEVIATIONS

All deviations to Technical Requirements shall be made in writing and communicated to COMPANY at the bidding stage. Written approval of the COMPANY shall be obtained prior to executing the work.

## CONFLICTING REQUIREMENTS

In the event of conflict, inconsistency or ambiguity between the contract scope of work, this Specification, National Codes and Standards referenced in the Project Specification or any other documents, the CONTRACTOR / SUPPLIER shall refer to the COMPANY whose decision shall prevail.

## REPORTING PROCEDURE

A full reporting and recording system, to be agreed with the COMPANY, shall be implemented and maintained throughout the duration of the Contract. CONTRACTOR / SUPPLIER shall provide reports and summaries for production performance and testing operations in conformance with a manufacturing schedule approved by COMPANY.Daily, weekly monthly and run summaries of all major aspects of the production process shall be provided as reports to the COMPANY.

Further, the CONTRACTOR / SUPPLIER shall make testing records available for inspection at any time upon request.

## THIRD PARTY INSPECTION

In addition to the inspection and witnessing of tests by the inspectors to be appointed by the CONTRACTOR / SUPPLIER during the manufacturing and shipment of the Equipment Material, COMPANY may appoint a third party or its own inspector for witnessing of the inspection and tests to be carried out at manufacturer’s facility under this specification.

## UNIT RESPONSIBILITY

The CONTRACTOR / SUPPLIER shall be responsible for the complete design, manufacture supply, inspection and testing of the skid mounted packages, including full compliance with all applicable design codes and standards, including those listed in Section 2.0 of this document, and the requirements of the certifying authority (if applicable).

# CODES AND STANDARDS

* 1. **Codes, Standards and Regulations**

The skid mounted packages covered by this specification shall be designed, manufactured and tested in accordance with the requirements of this specification, the attached data sheets, other referenced Project Specifications and the following Codes, Standards (latest edition) and Statutory Regulations (where applicable):

|  |  |
| --- | --- |
| AISC Standard | American Institute of Steel Construction, Specification for the Design, Fabrication & Erection of Structural Steel for Buildings. |
| API 615 | Sound Control of Mechanical Equipment for Refinery Services. |
| API Publication 700 | Checklist for Plant Completion. |
| ASME VIII Div. 1 | Pressure Vessels |

### APPLICABLE PROJECT SPECIFICATIONS

* Specification for Positive displacement Pumps
* Specification for Export Packing & Crating
* Specification for Painting and Surface Preparation
* Specification for Production Welding
* Specification for Unfired Pressure Vessel
* Specification for Motor
* Specification for Cable system Installation work

# SCOPE OF SUPPLY

The overall scope of supply for each Skid Mounted Package(s) shall be as indicated in the appropriate requisition. Each package shall be supplied as a self-contained unit mounted on a structural steel skid base, complete with the following as a minimum:

* All necessary interconnecting pipework and valves, terminating at the one edge of the skid, complete with any heat tracing, insulation and supports.
* All necessary instrumentation and controls.
* All necessary electric cabling and cable trays.
* All necessary start-up and commissioning spares.
* All special tools required for maintenance of the package.
* All necessary noise suppression equipment.

All documentation as requested in this specification and its attachments.Inspection and testing as called for in this specification and its attachments.

The CONTRACTOR / SUPPLIER shall be responsible for the complete design, engineering, coordination, fabrication, construction, installation/erection, inspection, testing, delivery and proper functioning of the equipment, not withstanding any omissions from this specification.

To enable the CONTRACTOR / SUPPLIER to offer performance and mechanical guarantees in accordance with the requirements of this specification and the appropriate section of the other referenced specifications, the CONTRACTOR / SUPPLIER, as a minimum, shall be responsible for:

* Sizing of all equipment.
* Selection of materials of construction together with design temperatures and pressures.
* Layout of items of equipment within the specified skid dimensions.
* Procurement and testing of individual items of equipment.
* Assembly and testing of the skid mounted package.
* Full compliance with the requirements of any nominated certifying authority and the supply of all documentation as required to obtain final acceptance certification.
* Confirmation of the final weight, Centre of gravity position and dimensions of the skid mounted assembly and its suitability for transportation.

CONTRACTOR / SUPPLIER shall provide at the bidding stage, statement of complete compliance with COMPANY supplied approved Contractor / Vendor list.CONTRACTOR / SUPPLIER shall provide a detailed schedule and programmed of work for the design, procurement and manufacturing phases of the contract and shall mention explicitly the delivery period for the complete scope of supply.

# DESIGN

* 1. **ITEM DEFINITION**

A skid package is a self-contained, skid-mounted, operational piece of equipment with all interconnecting piping and wiring installed for connecting to utility and process systems. A skid package includes the following items:

* Major equipment
* Auxiliary equipment
* Control panels
* Pressure vessels
* Instrumentation and controls
* Electrical Equipment
* Structural skid base

# Characteristics

## PERFORMANCE

* 1. A skid package shall be suitable for the operating conditions and design life specified in the Technical Requirements.
  2. A skid package shall have a minimum service life of 20 years in the specified environment.
  3. In addition to the design operating point of major equipment, CONTRACTOR / SUPPLIER shall also guarantee performance at the alternate or "off" operating conditions; i.e., additional cases, minimum turndown, or upsets.

## PROTECTION OF EQUIPMENT

Protection of equipment during manufacture shall be in accordance with Technical Requirements.

## RELIABILITY

Reliability shall be in accordance with Technical Requirements. The package / complete skid mounted equipment shall be designed for high reliability and minimum downtime.

## DESIGN AND CONSTRUCTION

General

* + 1. The skid package shall be designed and constructed to ensure maximum compatibility with other process and/or utility equipment of the plant.
    2. The skid package shall be designed to minimize installation, pre-commissioning, and start-up time.
    3. The skid package shall be laid out to provide for easy access to all equipment and appurtenances. Permanent maintenance and safe access must be provided to all equipment, instruments, electrical items, etc. on the skid.
    4. Changes in process conditions may occur during the life of the equipment. The possibility for changes shall be taken into consideration in determining operational flexibility, layout, and sizing of equipment.

## EQUIPMENT LAYOUT AND INSTALLATION

1. Major equipment such as drivers, driven machinery, pressure vessels, and heat exchangers shall include a base plate or another structural support system in accordance with Technical Requirements.
2. Unless otherwise specified by the individual equipment specification, all equipment shall be attached to the main skid members with high-strength bolts as appropriate.
3. The placement of all major and auxiliary equipment shall provide sufficient clearance for safe and easy operation and maintenance of the entire package.
4. If the equipment is fully enclosed, hazard detection and protection equipment and a cooling/ventilating air supply shall be included within the enclosure.
5. Equipment enclosures shall include access doors, removable sidewalls, or roof panels for operation/maintenance access.
6. Coolers shall be located to avoid the intake of engine exhaust gases and recirculation of cooler discharge air.
7. No cabling piping or instrument tubing shall be routed within the skid base.
8. All equipment shall be located within the package so as to afford easy access for maintenance and personnel safety. No part of the equipment shall overhang the boundaries of the skid.

## SKID BASE

The complete package (including all major components, vessels, auxiliary equipment, and local controls) shall be mounted on a rigid structural-steel skid. Interconnecting piping and wiring shall be installed and ready for operation.Individual skids for packaged equipment shall not exceed the dimensions specified in the Technical Requirements without prior written approval of COMPANY.

If more than one skid is necessary to mount equipment packages, the skids shall be designed to be rigid when joined. The design shall be submitted to the COMPANY for approval. Where the skid is too large for handling or transportation on land, it may be subdivided into sections for re-joining and bolting together on site. In such cases, all equipment upon the skid, including interconnecting piping and cabling, shall be preassembled and match marked before disassembly to assist re-assembly on site.

Skids shall be designed in full accordance with sound structural engineering principles and the American Institute of Steel Construction (AISC) specifications, where applicable. Skids shall be of all welded construction. The skid shall be fabricated in accordance with the Technical Requirements.

When a single lift point from the skid base is impractical due to location of on-skid equipment, CONTRACTOR / SUPPLIER shall supply suitable spreader beams or lifting frame, complete with all slings and shackles. Spreader beams/lifting frames shall be of all welded construction using full penetration welds and shall be designed

for the same load factor as skid lifting lugs. The primary beams (longitudinal base members) shall be considered to be simply supported with the support locations occurring at the extreme ends of the beams. The maximum allowable deflection of any primary beam shall be 1/500 of the span between supports under conditions of dead, plus superimposed, loads.

Cross members shall be designed on a similar basis and sized such that the top faces are in line and flush with the top faces of the primary beams, whilst the lower faces shall be such so as to give a minimum of 40mm ground clearance.The spacing of cross members shall not exceed the maximum allowable unbraced length of compression flange for the primary beams (defined in the AISC specification).

Slots shall be provided within the skid base members to allow retained liquids to drain away e.g. during wash-down.The primary members shall be adequately cross-braced to prevent flexing or distortion of the skid during transportation and installation. Equipment mounted on the skid shall not be considered as contributing to the structural strength or bracing of the skid.

The underside of skid frames shall be left flat to provide a continuous bearing surface and bolt holes or bearing pads shall only be provided where so indicated on the data sheet.Where alignment of machinery is critical CONTRACTOR / SUPPLIER shall propose a point-mounted skid, using bearing pads, as an alternative to his standard. The position of the support parts shall be agreed with the COMPANY. Where required all machinery shall have suitable anti-vibration mounts provided between the machine and the skid or between the skid and the deck.

Where required flexible bellows shall be fitted to prevent vibration transmission through ducting or piping.All other types of skids should be reviewed against the calculated or known deflection of the platform deck and the exciting forces.

Foundation bolts shall be supplied by CONTRACTOR / SUPPLIER. CONTRACTOR

/ SUPPLIER shall provide full details of the size and number required.The skid base, associated steelwork and all equipment shall be designed for a basic wind speed of 50 m/s at 10 m above sea level. Wind pressure and stress analysis shall be computed in accordance with ANSI A58.1.

Skids shall have hot dipped galvanized steel bar floor grating covering the entire top surface with cutouts for supports and/or equipment. Floor grating shall not be used as a mounting surface for equipment or supports. Floor grating shall be fully located by side and end stops and suitably bolted or clipped.Grating to be in removable sections, each section and all cutouts to be completed with flat edging bars. Where grating sections are cutout around equipment and edging bars welded in to suit, complete section of flooring shall be re-galvanized to original specification. Cold galvanizing of re-worked areas is not acceptable.

Metal thicknesses at the point of equipment bolting shall not be less than 10mm.Pad-eye type lifting lugs shall be welded to the skid with full penetration welds. The pad-eyes shall be designed for a minimum load factor of 2.0, with no increase in AISC permissible stresses, on the calculated force and for all sling angles between 45 and 75 degrees to the horizontal, as obtained from a single point lift.

Jacking screws, of robust design and construction shall be provided on all skids supporting heavy machinery in order to facilitate lateral and axial movement of each equipment during alignment.Skid bases shall be provided with two earthing bosses suitable for termination of 70 sq. mm earth cable.

All items such as equipment, valves, controls, instruments, and piping forming a part of the skidded assembly shall be installed such that they are located entirely within the confines of the skid base. The projection of such items beyond the edge of the skid base is strictly prohibited, unless approved in writing by COMPANY.Valve hand wheels and equipment requiring frequent or regular maintenance shall be positioned on the skid for easy access.Additional details such as the deck-support structures

and weight control requirements shall be furnished to COMPANY as required.

## ANCILLARY STRUCTURES

All ancillary support structures shall be designed so as to withstand all superimposed loads, including wind loadings in accordance with the AISC specifications.

Access ways, handrails and ladders shall conform to the requirements of API RP 2A, and shall be provided for operating and maintenance access to all instruments, controls and valves when located more than 1.5m above the skid floor.

All piping and cabling shall be suitably supported for service and shipment. The support and installation shall be designed to allow for piping and cabling to be removed without the cutting of structural members.

Where filter type units with removable heads and/or internal elements form part of the package equipment, permanent handling facilities shall be provided on the package for removal of head/elements. This requirement applies when the weight of any single component exceeds 25kg or where easy access is not available.

## VESSELS

All vessels shall comply with the Technical Requirements. Vessel internals shall be designed in accordance with the particular service of the vessel and shall be readily removable through a convenient manway. The internals shall be designed so that the performance of the vessel will meet the minimum requirements specified in the data sheet and shall be suitably fixed in position by the provision of bolts or clamps. Loose internal equipment is not permitted.

Any internals, which require periodic maintenance or are liable to heavy wear shall

be designed for ease of removal from the unit and shall be provided with permanent access facilities.

All liquid outlet nozzles shall be fitted with vortex breakers unless otherwise stated in the data sheet.

## EXCHANGERS

Thermal and mechanical design of exchangers and other equipments, including vibration analysis for shell and tube type shall be provided by the CONTRACTOR / SUPPLIER. Fouling factors used shall be specified on the data sheets.

## PIPING, VALVES & FITTINGS

Piping shall provide proper flexibility and shall be easily accessible for operation, maintenance, and thorough cleaning. Piping systems shall be routed and supported so as to have sufficient flexibility to allow for thermal expansion and contraction, and for platform movement. CONTRACTOR / SUPPLIER shall demonstrate to the COMPANY that suitable flexibility analyses have been carried out.

CONTRACTOR / SUPPLIER shall minimize forces and movements imposed on Offskid pipework and shall provide a complete set of forces and moments at each Termination point in order that COMPANY may complete analysis of adjacent piping systems. Alternatively, piping which interfaces with off-skid piping shall be anchored such that it places no resultant forces or moments on the off-skid piping.

Piping within the package shall be installed, fabricated, inspected and tested in compliance with Technical Requirements.Piping and tubing shall be firmly mounted in a neat and orderly arrangement. Piping and tubing shall not obstruct access for operation, maintenance, or adjustment.

Where appropriate all piping on the skid that is common, i.e. drains or vents should be piped together and terminate with a single flange at the skid edge.Interconnecting piping and fittings shall be prefabricated and mounted permanently within the package prior to testing and acceptance.

Interconnecting skids shall be joined by flanged piping and such piping shall be checked for proper fit-up by assembly in the CONTRACTOR / SUPPLIER’S shop.Package piping connections to plant Off-skid process and utility systems shall be grouped at a single location at the skid edge.

All piping shall be routed to provide a neat and economical layout, to have the shortest run consistent with Good Engineering Practice and to ensure easy access to all in-line valves and instrumentation. No piping shall be routed across walkways or access-ways unless they are elevated a minimum of 2.13m above the top of grating level.

Sufficient space shall be allowed between lines to permit ready access for removal/repair but in no instance shall there be a distance of less than 25mm between a pipe and the outside of the largest flange or fitting in the adjoining pipe. Insulation thicknesses and thermal movement of piping shall be taken into account when determining these spacing’s.The minimum vertical clearance for all piping systems from top of flooring shall be 200mm.

Piping at all equipment shall be supported so that equipment, control valves etc can be readily removed without provision of temporary piping supports and arranged so as to minimize pipework dismantling.Pipe supports shall be provided adjacent to skid edge for all external piping connections. Plate type supports with rigid fixing through pipework flange bolting are not acceptable.

All access platforms and walkways shall have a minimum clear width of 800mm. No

piping, instrumentation or cable runs shall impinge on this minimum requirement. Equipment and piping shall be installed with supports so as to prevent vibration.

All piping termination points, including inlets, outlets, utilities and drains shall terminate in ANSI B.16.5 flanges of the appropriate rating having a minimum size of 2 in unless otherwise approved by the COMPANY. The pipework shall be constructed to allow complete draining of equipment and shall have plugged vents at high points to facilitate venting and hydro testing.

All piping connections shall terminate at the edge of the skid. CONTRACTOR / SUPPLIER shall provide a suitable termination flange schedule with the general arrangement drawing(s). Final orientation of termination points shall be subject to COMPANY’S approval.Flanged Piping connections shall have minimum 02 threads exposed beyond nuts.

If standby components are provided, valves shall be installed as necessary to bypass and/or allow removal of the components for maintenance without the necessity of draining systems or shutting down the driver or driven equipment.Piping supports shall comply with the Technical Requirements. Piping supports shall allow piping to be removed without cutting the main structural members.

## MATERIALS OF CONSTRUCTION

CONTRACTOR / SUPPLIER shall ensure that the design and selection of materials of construction for equipment are chosen to avoid the possibility of galvanic corrosion where necessary by the use of suitable insulation gaskets or spools.

## INSTRUMENTATION & CONTROL

Unless otherwise specified, the package control and instrumentation systems shall

provide sequential start-up, stable operation, warning of abnormal conditions, monitoring of operating conditions, and shutdown of the associated equipment in the event of impending damage to the equipment or operating personnel.

System shall be designed for failsafe operation. The package control system shall be pneumatic and/or electrical, as specified.

CONTRACTOR / SUPPLIER shall supply all piping, tubing, valves, and fittings for all instruments and instrument panels.All instrumentation and controls shall be furnished in accordance with the Technical Requirements as given in project scope of work and specifications.

Where instrument air is required on the package,air header shall be 1" NB minimum and shall be mounted adjacent to all instrument air users. Each user shall be connected to the main header using suitable tubing, fittings or adapter as required. The main header shall also have 2 Nos. spare connections with block valves. All take-offs shall be from the top of header.

All instrument cables shall be run in conduits on the skid. Sizing of conduit and routing shall be decided by the CONTRACTOR / SUPPLIER as per the skid layout requirements.

Conduits shall be installed with proper supports and all necessary accessories complete in all respects. All instrument cables shall be terminated properly using proper lugs.

Cables from all instruments shall be terminated in skid mounted Junction Boxes, (and terminal block in PLC cabinet).The junction box shall be suitable for respective hazardous area classification and shall have cable entries fitted with explosion proof seals, myer hubs, unionsetc and standard earthing terminal sails.

Where a Local Control Panel or Annunciation is provided the equipment shall be protected with a suitable weather hood.Control panels shall be locally mounted on the skid or remotely mounted in a nonhazardous control room as defined in the Technical Requirements.

Independent control panels shall be provided for each equipment package.Locally mounted electrical and pneumatic control panels shall be in accordance with the Technical Requirements. Control panels shall be suitable for an uncontrolled environment and the area classification specified.

Control panels and controls shall be completely piped, wired, and tested.The necessary alarms and shutdown devices for each piece of equipment in the package shall be installed on control panels.Alarms and shutdown devices shall include fail-safe circuitry.

Status indicators shall be provided to indicate running, service functions, and fault conditions with first out indication dependent on the equipment contained within the package.

All non in-line instruments shall be provided with suitable stands. Instruments may be supported on Package Steelwork where location and access is suitable. Instruments shall not be supported off Process Pipework.CONTRACTOR / SUPPLIER shall supply Instrument location drawing separate from Package General Arrangement, highlighting true positions of all instruments in both Plan and Elevation.

Tubing shall be in accordance with the Technical Requirements and shall comprise of Swagelok or similar fittings. Mixing of fitting manufacturers is not allowed.Tubing connections from the package to the platform controls or control panels shall be completely piped to a bulkhead plate. The bulkhead plate shall be located at the skid edge. Tubing connections shall be terminated with bulkhead fittings.

Bulkhead fittings shall have Female National Pipe Threads (FNPT).Tubing shall not block equipment requiring access for operation and maintenance, and shall permit easy removal of items for servicing.Flexible stainless steel braided hose shall be installed in applications requiring adjustment or flexibility such as belt tensioning, equipment alignment, or vibration isolation.

## ELECTRICAL

Refer project scope of work, “Specifications for Electrical Design criteria”In general electrical wiring within the package shall comply with Technical Requirement. Unless otherwise specified, wiring shall be through unarmoured cable installed in G.I. conduit and/or copper-free aluminum cable trays. Mineral-insulated cable shall not be accepted unless specified by the Technical Requirement.

All cabling requiring to be connected to CONTRACTOR’S supplies/cabling, shall be provided with junction boxes adjacent to the skid edge and located to suit the COMPANY’S layout requirements. Junction boxes shall be positioned at the edge of the skid to facilitate connecting with external services and control systems. Where Local Control Panel or Annunciation is provided complete hook-up to Panel shall be carried out by CONTRACTOR / SUPPLIER.

Electrical cable shall be routed to minimize the likelihood of mechanical damage.

Electrical lines greater than 208 VAC, such as power leads and motor starters, shall have empty cable tray running to the skid edgein case these are to be connected to outside skid systems. Cable trays shall be of heavy duty type with deep flange to further protect cable runs. The cable will be installed and interconnected at the fabrication site by CONTRACTOR.

All electrical equipment provided on skid including and pump motors shall be provide

with explosion proof terminal block suitable for Class I, Div. 1;

The power equipment voltage rating for all skid mounted electrical equipment shall be communicated to the COMPANY by the CONTRACTOR / SUPPLIER.Power supplies available to the package shall be as specified in the equipment requisition or attachments. If any voltages outside this supply are required these must be generated by the Package Equipment from these supplies.

Electrical equipment, which requires external support shall be provided with purpose built stands or may be supported from Package Steelwork where suitable. Electrical equipment shall not be supported off Process Pipework.

Where junction box/control panel cable glands are bottom entry (preferred arrangement) equipment shall be so located as to allow adequate space for routing and glanding off cables.

## BOLTING

All internal bolts shall be provided with double locking nuts or other suitable securing device approved by the COMPANY.All external bolting shall be cadmium plated for protection.

## INSULATION

Unless otherwise agreed the CONTRACTOR / SUPPLIER shall be responsible for the provision of all necessary insulation for heat conservation or the safety and protection of personnel in accordance with the applicable statutory requirements. This shall include the provision of suitable lagging and cladding on hot & cold surfaces within easy reach of operatives. The insulation shall comply with the Technical Requirements. In no circumstances shall insulation materials contain

asbestos.

## LUBRICATION

Each piece of equipment in the package shall be provided with the necessary lubrication system and fittings.

## NOISE

The noise levels from each skid shall comply with the requirements of API 615 but shall not exceed 85 dBA at 1 m unless stated otherwise on the data sheets, or separately approved by the COMPANY.

## PAINTING & PROTECTIVE COATINGS

Painting and application of protective coatings shall be done in accordance with project Specification for Painting & Surface Preparation

## IDENTIFICATION & MARKING

Corrosion-resistant, 316L stainless steel nameplates or tags shall be securely attached to all identifiable pieces of equipment.

Rotating equipment shall have arrows indicating the direction of rotation. Rotation shall be cast into the equipment or stamped on 316L stainless steel plates and mounted with 316L stainless steel fasteners.

Major equipment such as pumps and compressors shall be supplied with a permanently attached, 316L stainless steel nameplate with the following information as a minimum:

* Manufacturer
* Manufacturer’s type
* Serial Number
* Item or tag number
* Size
* Maximum allowable design conditions – pressure, flow, temperature and speed
* Equipment weight in Kg
* Power rating or kilowatt (KW)
* Year of Production

Nameplates on engine drivers shall include the following information as a minimum:

* Manufacturer
* Manufacturer’s type
* Serial number
* Rated speeds
* Trip speeds
* Ambient ratings
* Power rating (KW)
* Year of manufacturer
* Weight in kg

Instrumentation shall include securely attached stainless steel tags. Each tag shall

Include the identification shown on the process and instrumentation drawings as a minimum. Piping connections shall be tagged for identification as designated on the flowsheet diagram.

Bulkhead fittings shall have numbered identification tags to facilitate field hook-up.Nameplates and tags shall be attached to equipment with stainless steel screws or rivets. Adhesive shall not be acceptable. Tags may be attached to items with stainless steel wire only if screws or rivets are impractical.

Field connections shall be identified with a stamped or engraved stainless steel tag attached with stainless steel wire. The tag shall be painted red and shall identify connection points and applicable reference drawings.Instrument tubing shall be clearly identified at both ends and at junction points. Instrument and electrical cables shall be clearly identified at both ends and at junction points.

## SAFETY

Safety precautions shall be in accordance with the internationally accepted standards with the following additional requirements:

The noise under normal operating conditions shall not exceed 85dB.

Sufficient instrumentation shall be provided for safe operation of the package. The instrumentation shall include an automatic shutdown system.

CONTRACTOR / SUPPLIER shall pay particular attention to ensure that all electrical equipment and installations are suitable for specified area classifications.

Metal guards shall be provided. The guards shall not be more than 13 mm (1/2 inch) away from stationary housings adjacent to all moving parts. This includes parts such

as drive belts, cooler fans, and extension shafts. Wood or plastic shall not be acceptable guard materials.

Exposed surfaces subject to temperatures in excess of 60°C shall be insulated for personnel protection. The thermal insulation shall be suitable for extended service life in the specified environment and shall be in accordance with Technical Requirements.

Asbestos and asbestos products shall be specifically prohibited.

## CONTRACTOR / SUPPLIER REQUIREMENT

CONTRACTOR / SUPPLIER requirements shall be in accordance with the Technical Requirement with the additional qualification that the CONTRACTOR / SUPPLIER shall assume full responsibility for engineering coordination of the major equipment, auxiliary equipment, piping, and other appurtenances within the package.

## DOCUMENTATION REQUIREMENTS

Documentation shall be provided in accordance with the following requirements:

**GENERAL**

CONTRACTOR / SUPPLIER shall provide documentation that verifies:

* Equipment of similar size and configuration has been supplied within the past 5 years
* The equipment has been performing satisfactorily for at least one year.
* Equipment list, comprehensive startup, operating and maintenance documentation for all equipment shall be provided in hard copy and electronically to COMPANY. The number of required hard copies andelectronic versions shall be determined within the Tender document.

A lubrication schedule shall be provided to ensure maximum equipment service life. The lubricating schedule shall detail the location, type, and frequency of service requirements for each system.

**Drawings**

CONTRACTOR / SUPPLIER shall provide the COMPANY with drawings showing the number, type, and location (in plan and elevation) of all piping, electrical, and instrumentation connections and associated sizing and specifications. Skid connections shall be referenced on the drawings from one common reference point. CONTRACTOR / SUPPLIER shall provide piping drawings with bills of material and verify compliance with the piping and instrumentation diagrams and the piping and instrumentation specifications. All dimensions shall be in metric units. The drawings shall also include the following:

Arrangement, location, and method of fastening all equipment to skids or baseplates;

Center of gravity for:

* Lift condition. This is comprised of the total weight of the skid package ready for shipment.
* Non-operating, dry in-place condition. This shall encompass the total weight of the skidded package when installed but not operating. No live loads are to be considered and all vessels and piping are to be empty.
* Operating in-place condition. This shall encompass the total weight of the installed skid and all live loads that will occur during normal operation of the unit. The weight of fluids and solids in the process equipment and piping shall be included.
* Hydrostatic test in-place condition. This condition applies only to skidded units that will be hydrostatically tested. It does not apply to equipment that will be pressure tested with air. Weights to be considered shall be those for the nonoperating in-place condition plus the weight of water when all vessels and piping are filled.

CONTRACTOR / SUPPLIER shall determine the total weight of the package for each of the conditions indicated above. CONTRACTOR / SUPPLIER shall indicate the units of weight measured in metric. This data shall be included on the drawing showing the locations of the centers of gravity.

# FABRICATION AND ASSEMBLY

## GENERAL

Approval of all CONTRACTOR / SUPPLIER'S drawings, weld procedures, calculations, etc. is required by the COMPANY and the certifying authority, where applicable, prior to the commencement of fabrication.

* 1. **WELDING**

All welding shall be in accordance with the requirements of the appropriate code i.e.:

|  |  |
| --- | --- |
| Structural | ANSI / AWS-D 1.1 Project Specification for Structural Steel & the Welding and Inspection of Offshore Structures. |
| Piping | ANSI B31.3 |
| Vessel / Exchanger | ASME VIII DIV 1, ASME IX |

Welders shall be suitably qualified for the work undertaken.

## ASSEMBLY

The CONTRACTOR / SUPPLIER shall be required to submit an assembly procedure for the skid mounted assembly detailing the order of erection.

## MATERIALS

Materials of construction of the skid shall comply with the requirements of the Project Specification for Structural steelwork ,where applicable.

# QUALITY ASSURANCE PROVISIONS

Quality assurance provisions shall comply with the following requirements.

## TESTS

### RESPONSIBILITY FOR TESTS & INSPECTIONS

The overall installation and testing program shall be incorporated in the master schedule. CONTRACTOR / SUPPLIER shall notify the COMPANY in writing at least 30 calendar days prior to the following events:

* Initiation of fabrication
* Completion of final assembly
* Final inspection
* Pressure tests
* Shipping of equipment
* Mechanical tests

CONTRACTOR / SUPPLIER shall be responsible for furnishing COMPANY with all specified certification on materials and with shop test data verifying that the specifications are being met.

CONTRACTOR / SUPPLIER shall maintain a record of shop test data for at least 18 months after the date of shipment. If specified, certified copies of test data shall be submitted to COMPANY prior to shipment.

### TESTS& INSPECTIONSFOR COMPONENTS& SYSTEMS

The mechanical operation of all equipment shall be satisfactory duringthe running test. Speed governors, alarm and trip functions, and overspeed shutdown devices shall be tested to verify proper operation. Pressure parts shall not be painted until inspections are complete. Parts, material, and equipment purchased by CONTRACTOR / SUPPLIER shall be subject to the shop inspection.

Equipment installed on skid-mounted packages shall receive a mechanical running test prior to shipment as per details given in Technical Requirements. The proper mechanical operation of all auxiliary equipment, prime movers, and driven equipment shall be confirmed during testing.

Welding of piping and vessels shall be inspected in accordance with the Technical Requirements.Hydrostatic and mechanical testing procedures should be submitted to the approval by COMPANY.

Component quantities, description, and test data shall be checked for compliance with the Technical Requirements.Point-to-point electrical continuity tests shall be conducted.Equipment shall be checked for proper voltage, phase, and frequency.

Equipment shall be energized and equipment functional tests shall be conducted, including the running of all motors. The final operational tests shall cause relays and solenoids to function by simulation of control actions. This test shall demonstrate the functional integrity of all control circuits.In cases involving explosion proof equipment, seals shall not be poured until inspection is completed and approval to pour has been granted by COMPANY.Proper installation of grounding points shall be verified.

### SPECIAL TESTS & EXAMINATIONS

Piping on assembled skid units shall be pressure tested.

Tanks fabricated into the skid shall be pressurized with air to 0.05 barg and tested for leaks with a soap bubble test.

Drip pans shall be filled with water and checked for leaks and proper drainage.

Minimum standards for pressure testing shall be in accordance with the Technical Requirements.

**Hydrostatic Tests**

Hydrostatic tests shall be performed on vessels, piping, etc, as required by the Technical Requirements. All pressure vessels and piping shall be hydro tested in accordance with the appropriate project specification and code requirements. Process piping or tubing shall be tested with water after shop fabrication into subassemblies.

The normal test pressure for piping shall be 1.5 times the adjusted cold pressure rating of the valves, fitting, expansion joints or other limiting elements in the line. The normal test pressure for vessels, etc, shall be as per requirements governed by applicable codes or standards. Pressure testing shall be maintained long enough to permit complete inspection but shall not be less than 60 minutes.

**Equipment Performance Tests**

All equipment shall be subjected to an individual performance test where appropriate in accordance with the Standard Technical Requirements. Performance test curves

and certificates shall be provided.

When required by the COMPANY’S Inspector, all equipment, after performance testing shall be dismantled for a visual inspection of the internals.

**Assembled Skid Testing**

Piping on assembled skid units shall be pressure tested as per requirements given in ASME B31.3. Hydrostatic tests shall be witnessed by the COMPANY. Minimum standards for pressure testing shall be in accordance with the Technical Requirements.

The completed pipe work assembled on the package shall be subject to leak test to a pressure as proposed by the CONTRACTOR / SUPPLIER and approved by the COMPANY in the CONTRACTOR / SUPPLIER’s works to verify integrity of all joints. Drip pans shall be filled with water and checked for leaks and proper drainage. The completed assembly shall be given a full functional test including instrumentation and electrical equipment at the CONTRACTOR / SUPPLIER's works. During the test all alarms, shutdown and remote signals shall be simulated.

The CONTRACTOR / SUPPLIER shall be required to submit a full testing procedure, including a check list in accordance with API 700, at least 6 weeks prior to the commencement of testing and covering the full extent of testing on the completed assembly. The testing procedure shall be approved by the COMPANY prior to the commencement of testing and shall be complete with all equipment procedures and check lists. The CONTRACTOR / SUPPLIER shall be responsible for providing all necessary utility services to conduct the tests.

**Functional Tests**

The CONTRACTOR / SUPPLIER shall be responsible for ensuring all calibration and test equipment has valid certification.All instrument functions shall be verified by using water or instrument quality air as a substitute for the process liquid/gas to prove the integrity of the control equipment/instrumentation.

### CLEANLINESS INSPECTIONS

COMPANY reserves the right to a final inspection for cleanliness of all equipment components and all piping and appurtenances furnished by or through CONTRACTOR / SUPPLIER prior to final assembly of any of the components. CONTRACTOR / SUPPLIER shall provide 5 days prior written notice to COMPANY that the equipment is clean and ready for inspection.

Special care shall be taken to wash fingerprints from highly polished machine surfaces prior to the application of rust preventatives. Equipment shall be promptly closed after acceptance of the equipment.

Pressure lubrication systems shall meet the cleanliness requirements of API 614.

# Quality Conformance Inspections by CONTRACTOR / SUPPLIER

## STRUCTURAL

All structural members shall be designed to comply with the Technical Requirements.

Welds shall be examined by magnetic particle or other approved inspection methods in accordance with the Technical Requirements.

Pad eyes shall be designed in accordance with Technical Requirements and with the International standards and codes.

### FINAL INSPECTION & TEST

**GENERAL**

The package shall be complete in all respects before inspections and tests. The functional operation of the complete package shall be tested.

**FINAL INSPECTION**

Unless otherwise advised by COMPANY in writing, final inspections and hydrostatic testing shall not be performed unless COMPANY Representatives are present, or has waived right to inspection in writing. Such inspections and testing made in the

COMPANY’S absence without COMPANY waiver shall be repeated in the COMPANY’S presence at the CONTRACTOR / SUPPLIER's expense.

The dimensions of all components including interconnecting piping shall be checked for compliance with the Technical Requirement. COMPANY shall be notified if a component is not found to be within the tolerances allowed by the Technical Requirement.

The adequacy of piping and equipment supports, lifting lugs, slings, and clamps, including size and location, shall be verified. Painting inspection shall be comprised of the following:

* CONTRACTOR / SUPPLIER shall verify that painting complies with the Technical Requirement.
* CONTRACTOR / SUPPLIER shall check general appearance.
* CONTRACTOR / SUPPLIER shall verify that paint has been removed from all control valve stems, instrument glass, nameplates, flange faces, and other machined surfaces, and other items that are not specified to be painted.

Miscellaneous checks shall comprise the following:

* CONTRACTOR / SUPPLIER shall check adequacy of the compartment or skid drains.
* CONTRACTOR / SUPPLIER shall check general appearance, workmanship, and operability for things such as correct height of push button stations.
* CONTRACTOR / SUPPLIER shall check for safety hazards such as conduit installed over walking surfaces (tripping), and burrs on surface of handrails.

## MATERIAL TESTING& CERTIFICATION REQUIREMENTS

Material requirements shall be as detailed in the Technical Requirement.

Inspection procedures and acceptance criteria shall be in accordance with the requirements of the applicable design code and the certifying authority (where applicable).

# PERFORMANCE GUARANTEES

The CONTRACTOR / SUPPLIER shall be required to guarantee that the completed assembly will meet the minimum performance requirements as stated in the data sheets, when operating under the stated design conditions.

The CONTRACTOR / SUPPLIER may, at the option of the COMPANY, be required to be present at, or to perform, site tests on the assembly in order to prove its performance.

# PAINTING AND PREPARATION FOR SHIPMENT

## PAINTING & PROTECTIVE COATING

Painting and protective coating and the procedures for preparation for painting shall be in accordance with the Technical Requirements.

## PREPARATION FOR SHIPMENT

Preparation for shipping and storage shall be in accordance with the Technical Requirements, with the following additional requirements.

### GENERAL

Each skidded component shall be either securely anchored to the skid or removed to prevent damage during shipment. All instruments and any equipment removed from the skid for shipment shall be tagged and crated in waterproof boxes constructed from 51 mm (2-inch) lumber. Instruments shall be packed with sufficient desiccant for protection in transit and during storage at the job site. Boxes shall be securely attached to the skid for shipment. The contents of each box shall be clearly stated on the outside of that box.

Any equipment extending beyond the skid edge together with any other equipment or component parts removed for shipment purposes shall be tagged and crated in waterproof boxes constructed from 51mm (2-inch) lumber.

Exposed machined and threaded surfaces shall be coated with an easily removable rust preventative.

All flanged openings shall be protected with steel plate covers attached by proper

bolting and sealed with a plastic compound.

Openings, threaded connections, wires, valve stems, and other component parts subject to mechanical damage or corrosion shall be adequately protected. Such protection shall consist of, but not be limited to, bolted metal flange covers, sealing with waterproof tape, enclosing with temporary metal housings, and coating all machined and threaded surfaces with a rust preventative. This protection shall be applied to all components, those removed and boxed and those remaining in place on the skid assembly.

Piping and handrails removed for shipment shall be properly tagged and secured to the skid from which it was removed.

Doors and windows in modules shall be protected from damage by covering with 19 mm (3/4-inch) plywood.

Overhead cranes shall be secured with a temporary locking device and bolted shipping blocks to prevent movement during shipment.

### INVENTORIES& APPROVAL

Inventories as indicated below shall be made by CONTRACTOR / SUPPLIER and submitted to COMPANY prior to shipment. Such inventories shall account for all items deliverable according to the governing equipment specification.

An inventory of all major or tagged items installed on the skid for shipment an inventory of all items removed and secured to the skid for shipment a complete inventory of all boxes and the detailed inventory of the contents of each box.Each crate, bag or package shall be clearly identified with the purchase order number and identification symbol and shall be securely fastened to the skid.

The skid shall not be shipped before compliance with the Technical Requirements has been verified, and released by COMPANY. If components are dismantled during preparation for shipment, instructions for their reassembly shall be included.