**EXHIBIT IV**

**DIRECTIVES FOR PRODUCT FABRICATION**

**FPSO PETROBRAS XX (P-XX)**

**SUMMARY**

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1. GENERAL
   1. The requirements described in this Exhibit are applicable to the personnel and facilities of SELLER Yards, all Modules Yards, Hull Shipyard and sub-SELLERs sites.
   2. Specific requirements related to activities to be carried out onboard the UNIT, both onshore and offshore, are also provided. The SELLER workforce and its subcontractors shall be aware of such requirements.
   3. SELLER shall provide all necessary resources to execute its activities in compliance with the local legislation and applicable standards where the activities will take place.
   4. Technical specification for general use
2. I-ET-3010.00-1200-955-P4X-001 WELDING
3. I-ET-3010.00-1200-970-P4X-003 REQUIREMENTS FOR PERSONNEL QUALIFICATION AND CERTIFICATION
4. I-ET-3010.00-1200-970-P4X-004 NON-DESTRUCTIVE TESTING REQUIREMENTS FOR METALLIC AND NON-METALLIC MATERIALS
5. I-ET-3010.00-1200-978-P4X-005 REQUIREMENTS FOR MATERIALS TRACEABILITY
6. I-ET-3010.00-1200-200-P4X-115 REQUIREMENTS FOR PIPING FABRICATION AND COMMISSIONING
7. I-ET-3010.00-1200-200-P4X-116 REQUIREMENTS FOR BOLTED JOINTS ASSEMBLY AND MANAGEMENT
8. CONSTRUCTION AND ASSEMBLY EXECUTION PLAN
   1. Within 60 (sixty) days after the Agreement Effective Date, SELLER shall submit the Construction and Assembly Execution Plan (first version) for BUYER approval. The plan shall be a detailed breakdown of SELLER´s Technical Proposal and be a section of the Project Plan.
      1. SELLER shall present an assessment (self or third party) of international construction best practices to be adopted during construction and included in this plan. The suggested list of best practices is presented below:

* Advanced Work Packaging
* Alignment
* Benchmarking & Metrics
* Change Management
* Constructability
* Disputes Prevention & Resolution
* Front End Planning
* Lessons Learned
* Materials Management
* Partnering
* Planning for Modularization
* Planning for Startup
* Project Risk Assessment
* Quality Management
* Team Building
* Zero Accidents Techniques
  1. The Plan shall present site locations, applicable logistics, scope assigned to sub-SELLERs and all sites organization chart.
  2. Each Construction & Assembly yard shall have its own Execution Plan containing, at least, the information below:
     1. Scope assigned to the construction site;
     2. Site logistic plan, layout map, departments division, means of access, escape routes and main internal routes;
     3. Histogram including direct and indirect manpower;
     4. List of site facilities to attend the workforce, such as means of transportation, restaurants, dress rooms, WCs, ambulatories, offices, etc;
     5. In case of subcontracting of third-party Yards, including overseas, the contracts shall meet the requirements of local regulation and SELLER shall present them (contracts) to the BUYER for appreciation;
     6. SELLER shall prove that every site has enough processing capacity for planned gross quantity is planned to be processed at site versus sites capacities, such as steel structures, piping, erection, storage, painting and testing;
     7. The same shall be considered for material storage and utilities such as Site infrastructure and utilities capacities versus gross quantities to be demanded by the project, such as material storage, electrical power supply/distribution, compressed air, inert gas, water reservoirs, fire water, sewage, waste material storage, recycling, water facilities, liquid and gas fuel, etc.;
     8. SELLER shall provide proper storage facilities Site utilities for storage and preservation for mechanical, electrical and electronics equipment, consumables and other kind of material that requires specific preservation conditions such as temperature and humidity control. SELLER shall provide suitable and safe facilities for critical activities such as acid chemical cleaning, x-ray inspection (if applicable), pressure tests, hydroblast, painting, etc.
     9. SELLER shall provide for piping materials (flange, nipples, weldolet, etc.) and welding consumables that have similar visual aspects but different application such as Inconel, stainless steel and duplex family, SELLER shall implement means to segregate (such as color marks) to avoid misapplication of incompatible materials on the field and unnecessary repair works.
     10. The Execution Plan shall clearly inform site location (in or out Yard boundaries) NDT and hydrotests will be performed. Each site manager will be responsible for test results registration, but they shall be all integrated to a main control that should be updated no longer 3 days after tests execution.
         1. For Piping and Structure disciplines, SELLER shall use a computational tool that allows the team to control and register materials, welding, non-destructive tests and hydrostatic tests traceability. In the case of SELLER share its construction scope with other companies, SELLER shall ensure that all subcontractors also meet the same requirements, as those adopted by the SELLER. It is SELLER's responsibility to compile all the data and information in a single database and present in a unified and consolidated environment.
         2. This computational tool shall comply with the requirements from Exhibit XVI and I-ET-3010.00-1200-200-P4X-115 especially to inspections doing by lot, with an automatized process to select joints to inspection and to the penalties, considering all welders, joints, welding positions, materials and all piping specs. The lots shall have a traceability number. SELLER shall guarantee that all kinds of joints and welders have a minimum number of statistical representative inspections. This selection procedure must be detailed in the Execution Plan.
     11. SELLER shall present a “time-saver” strategic plan for piping, electrical, instrumentation and telecommunication tie-ins points including all necessary materials for a quick integration of the modules, using method “plug and play” style. At the same time, the necessary adjustments for all commissioning tests of the pre-installed modules to be carried out shall be planned without delaying the integration schedule.
     12. Hydrostatic tests for piping tie-in points may be accepted as long as it follows and meet the applicable and recognized standard rules;
     13. For pipe and structure fabrication and erection, SELLER shall consider sheltered areas in order to minimize stop working due to weather conditions as well as avoid an increased number of repairs and reworks due to contaminants, especially during welding activities.
     14. Painting wise, SELLER shall have a detailed sequence plan to minimize reworks and touch ups after Modules and equipment lifting, especially on decks where underdeck repairs are high time consumers for requiring scaffolding assembly.
     15. The same strategy shall be applied on Hull and Engine room Decks, where late welding works can cause high time loss repairs inside tanks. For these areas, SELLER shall have deck footprints for all outfitting, supports, penetrations, foundations, etc. not yet assembled between construction phases in order to pre-install deck double plates instead, avoiding critical paint repairs.
     16. SELLER shall preview eye lugs strategically spread inside the tanks in order to foresee anchorage points for industrial climbers in case of late painting touch ups or other small works, avoiding using of scaffolding after final painting.
     17. SELLER shall issue an interface and responsibility matrix to establish the boundaries of the scope between the Construction and Assembly (C&A) and Commissioning activities in order to ensure that all pending issues arising from the C&A phase are cleared or recorded in a punch list report prior to issuing the Mechanical Completion Certificate (MCC) to the System or Sub-system for Commissioning phase. The Punch List Report shall clearly indicate the subsystem number related to punch list item and shall integrate the pending items of all Project phases, such as engineering, procurement, construction, commissioning and operation, and shall be part of Integrated Management System as indicated in the Agreement and its Exhibits;
     18. SELLER shall present a mapping with all Welding Processes, Welding Procedures and Welding Qualifications necessary for performing all welding, inspections and destructive and non-destructive tests, including all materials provided for welders qualification;
     19. SELLER shall plan Module 15B - UTILITIES AND HULL GENERATION construction and assembly activities to be completed and the module integrated in its definitive position on the hull deck before deliver the Hull to the integration shipyard;
     20. SELLER shall consider the interface analysis and precedence network due the central pipe rack integrated on starboard side modules, considering the hook up works and the commissioning critical paths for integration phase;
  3. In reference to I-MD-3010.00-1200-94B-P4X-001 - DIRECTIVES FOR CONSTRUCTABILITY PLANNING AND EXECUTION :
     1. SELLER shall deliver the first version of Constructability Plan according to item 3.1 of I-MD-3010.00-1200-94B-P4X-001 - DIRECTIVES FOR CONSTRUCTABILITY PLANNING AND EXECUTION, 10 (ten) days after “Execution Planning” Review;
  4. SELLER shall deliver a version of Constructability Reviews Reports according to item 3.2 of I-MD-3010.00-1200-94B-P4X-001 - DIRECTIVES FOR CONSTRUCTABILITY PLANNING AND EXECUTION, 10 (ten) days after these Reviews:

- Hull;

- Topsides Modules;

- Lifting and Integration.

* + 1. - SELLER shall identify risks of delay within its supply chain that could impact the planned sequence of assembly and commissioning and present a response plan including 3D model simulations according to I-MD-3010.00-1200-94B-P4X-001 - DIRECTIVES FOR CONSTRUCTABILITY PLANNING AND EXECUTION and I-PR-3010.00-1200-94B-P4X-001 - 3D ASSEMBLY AND DISASSEMBLY SIMULATION PROCEDURE - FLEXIBILIDADE B. It shall be applied to all those equipment that cannot be handled through designed handling ways and/or may cause construction dismantling/rework or delays in post commissioning activities.
  1. SELLER shall assure that the construction is in conformance with the requirements listed in I-MD-3010.00-1200-940-P4X-033 - DIRECTIVES FOR CONSTRUCTABILITY REQUIREMENTS
  2. SELLER shall issue an Interface procedure involving all SUB-SELLERS of the Project. SELLER must submit, review, and share interface information with all stakeholders, throughout the duration of the project, in accordance with the interface management procedure.

1. PERSONNEL REQUIREMENTS
   1. SELLER shall mobilize a qualified professional (at least ten years experienced in similar Projects) who will represent the SELLER at each SELLER’s job site, being responsible for the management and all activities direction. The professional mobilization shall occur prior to activities beginning.
   2. SELLER is fully responsible for supervision, technical and administrative management of the Contract scope. The manpower to be employed at the project scope of work shall be well experienced, in enough quantity to the scope of work and well equipped with proper tools, equipment and PPE. For any and all cases the BUYER will always consider the SELLER as the sole employer.
   3. SELLER shall have a construction Supervision team including a Construction Manager at each Site.
   4. At each site where activities are being performed, SELLER will provide an engineering team, formed by professionals that have worked on the design phase approved by BUYER, who will technically support Construction and Assembly team, Commissioning team and the Handover of Systems. This team will also approve design modification on site and keep “as built” registration updated.
   5. SELLER shall, at the beginning of the Contract, officially designate the coordinators:
      1. 1 (one) NR-10 Qualified Professional;
      2. 1 (one) NR-13 Qualified Professional;
      3. SELLER shall, at the beginning of the Contract, officially designate 1 (one) NR-10 Qualified Professional, 1 (one) NR-13 Qualified Professional and 1(one) NR-17 Human Factors/Ergonomics Qualified Professional to deal with matters pertaining to Brazilian Regulatory Standards NR-10, NR-13, NR-17, ANP Resolution #43/2007 – “*SGSO – Segurança Operacional para as Instalações de Perfuração e Produção de Petróleo e Gás Natural”* (ANP Operational Safety in Oil and Natural Gas Drilling and Production Installations). They shall be responsible for temporary and definitive installations and for all activities related to these regulations as well as the Contract requirements. They shall remain engaged throughout the whole timeframe of the Contract and are responsible for these activities in all SELLER sites.
      4. 1 (one) NR-17 Human Factors/Ergonomics Qualified Professional;
      5. Training and technical qualification foreseen in *"Prática de Gestão nº 3: Qualificação, Treinamento e Desempenho Pessoal”* (Management Practice #3: Staff Qualification, Training and Performance) of ANP Resolution Number 34/2013 – “*SGSO – Segurança Operacional para as Instalações de Perfuração e Produção de Petróleo e Gás Natural”* (ANP Operational Safety in Oil and Natural Gas Drilling and Production Installations) shall be in accordance with International Association of Oil & Gas Producers IOGP Report 454 - Human Factors Engineering in Projects.
2. YARD’S FACILITIES
   1. SELLER shall submit to BUYER, for approval, the SUBCONTRACTORs Yards where the construction and assembly activities of Modules will take place, before starting construction and assembly activities, as well as the Shipyard to be contracted for the hull construction (if applicable).
   2. SELLER shall guarantee, during the whole construction period, the drainage, and the appropriated paving of the yard/shipyard, in order to avoid mud and dust.
   3. The storage areas for instrumentation, electronics components and other items so required, shall be acclimated in accordance with manufacturers technical requirements and engineering best practices.
   4. Storage areas shall have paved and levelled floor, with load capacity compatible with its use.
   5. SELLER shall submit to BUYER’s approval before starting construction and assembly activities, the following documents:

* Yards layouts and facilities, with dimensions and the maximum capacity;
* Construction and Assembly work locations;
* Transport and lifting strategy for big and/or heavy items, for example skids and modules.
  1. SELLER shall submit to BUYER a recent bathymetric survey for each yard, not older than one year, in order to demonstrate that depths of the maneuvering, mooring and channel areas are compatible to the construction and commissioning requirements.
  2. Quay utilities shall be compatible to hull and the movements plan.
  3. SELLER shall demonstrate that all utilities, such as water, power, drainage and access, are adequate for the execution of the Contract.
  4. In case of unavailability of the facilities, such as cranes, barges and dredging, during the period of service execution, SELLER shall immediately communicate BUYER, informing the conditions of other Contracts signed and a forecast of utilization of the facilities with indication of their respective periods formalized by letters of availability assigned to the Project.
  5. It is SELLER’s responsibility to provide all resources and facilities for the movement, ballast operation, inspection and cleaning of bio-incrustation of the hull, the collection and proper disposal of waste generated, even after the occupation of the Accommodations Module. SELLER shall submit to BUYER a marine bio-incrustation inspection and removal plan when the hull is concluded. The removal shall be performed as close as possible to sail away date to Brazilian waters and final location.
  6. SELLER shall not use the UNIT facilities, such as compressed air, electrical power, cranes, hoists, pumps, etc., for the execution of contracted scope onshore. SELLER shall mobilize its own or hired proper equipment/utilities before UNIT commissioning.
  7. Scaffolding and accessories shall comply with local safety recommendations, standards and legislation where the job is taking place, including offshore phase. SELLER shall have a designated engineer who will sign responsible for scaffolding design when it requires memory of calculation approval according to the applicable standards.
  8. SELLER shall provide industrial rope access technicians duly equipped and certified by Industrial Rope Access Trade Association (IRATA) to perform activities where this kind of professionals can be a time saver or where scaffolding assembly can damage finished areas, cause instruments/equipment damage or where its assembly does not prove practical before punctual works such as inspections, touch ups, tests, repairs, etc.

1. METHOD OF EXECUTION
   1. **GENERAL METHOD OF EXECUTION**
      1. SELLER is responsible for the methods to be employed in construction, assembly, equipment installation, modules lifting and testing activities. In case these methods are not proven to be the best for schedule, quality and HSE sake, SELLER shall promptly adopt all necessary corrections. These methods or procedures aim to increase productivity and reduce employees’ exposure to risks. The SELLER must constantly review the methods being applied and propose new ones throughout the unit's construction, assembly and commissioning process, for example: lifts, elevated work platforms (cherry pickers), cranes for small materials, hull cutouts for access, automated welding processes, etc.
      2. SELLER shall issue the Modules construction and assembly procedures and submit them to BUYER approval, no later than 90 (ninety) days from Agreement Effective Date. In these documents, the SELLER shall inform the methods and procedures that will use to increase productivity and reduce risks to employees.

SELLER shall issue a Master Schedule List with all C&A documents, plans and procedures, including from subcontracts, until 30 (thirty) days from Agreement Effective Date.

* + 1. SELLER shall submit to BUYER all shop drawings documents in electronic file, including fabrication details and shop drawing, with suitable place to filing and handling or permit the access of these information by EDMS system.
    2. The dimensional control of the main structural components and/or assembly shall be carried out by means of laser scanner and executed by qualified professional. Equipment and structures shall undergo topographic checking for positioning, elevations, alignments, and verticalization as defined on the detailed engineering documents, Vendor procedures and recommendations and best engineering practices.
    3. SELLER shall monitor the gaps between the multi-column support, the process module plant supports, the hull structures and the topside modules using topographic and dimensional reports during their fabrication and installation. SELLER shall implement dimensional control and level settlement monitor and correction of soil and bases used for construction of any subassembly parts as modules, structures and skids.
    4. SELLER shall present Rigging Plans for handling equipment and structures heavier than 10 (ten) metric tons or for those which require spreader bars, transportation, rigging and handling, approved by SELLER HSE. These plans shall be submitted by SELLER to BUYER for information. Special care shall be taken to large size equipment, which need heavy duty cranes for transportation and handling.
    5. SELLER shall issue an Occurrence Report (RO) for each site, in order to record service progress and remarks relatives to fabrication, construction, assembly, erection, commissioning, integration and offshore phases and labor employed by function. The RO shall be a written communication procedure between SELLER and BUYER, according to SECTION 3.3.7 of CONTRACT and Exhibit XVI - COMPUTATIONAL TOOLS AND INTEGRATED MANAGEMENT SYSTEM.
    6. Quality Reports as for Non-Destructive Testing (NDT), dimensional, material certificates and receiving inspection, shall be presented no later than 4 (four) days after the conclusion of the correspondent activities (welding, assembly, material receiving, etc.). The inspection shall be considered as concluded only after the report issued and approval.
    7. SELLER shall allow, whenever required by BUYER, the execution of activities in its Yards, by third parties, during the execution of the scope related to this Contract, without SELLER’s intervention and without extra cost to BUYER or its SUBSCONTRACTORs. During the entire term of this Contract, BUYER has the right to mobilize at SELLER’s Sites, either itself or through others, companies to perform works related to UNIT, such as inspection, additional testing, installation of BUYER equipment, vendors support and complementary works in general.
    8. BUYER shall take measures to avoid interference, damages or delay caused by such activities with those under SELLER’s responsibility.
    9. The permission hereby granted shall not be an excuse for the SELLER to justify breaking clauses or conditions of this Contract, especially in relation to time schedules and prices, except in case the SELLER proves and BUYER accepts, that the third parties were responsible for the delay and/or costs increase.
    10. All Modules related to this Contract to be incorporated to the UNIT must be weighted prior to assembling and their center of gravity coordinates are to be confirmed, for materials and equipment out of Modules. SELLER shall follow standard market practices for weight control and provisions of the Weight Control procedure created by SELLER.
    11. Data obtained shall be tabulated for the weight and center of gravity control, based on technical specifications of the Exhibit II – BASIC ENGINEERING DESIGN of this Contract and the Classification Society’s rules.
    12. The theoretical result from determination of the UNIT weight and center of gravity after integration shall be confirmed by an inclining test experiment, as per the Classification Society Rules, executed by SELLER.
  1. **MECHANICAL EQUIPMENT**
     1. SELLER shall submit specific assembly procedures for BUYER approval, for all mechanical equipment of the UNIT comprising guidelines for lifting, handling, assembly, preservation, alignment and leveling during all construction and Commissioning Phase, even if the mechanical equipment installation is before lifting campaign. These procedures shall be presented at least 90 days before equipment factory inspection acceptance.
     2. SELLER shall strictly follow vendor requirements for Mechanical Equipment installation. In case installation requirements are not provided by VENDOR, SELLER shall follow API RP 686 Recommended Practice for Machinery Installation and Installation Design.
     3. SELLER shall keep proper preservation of equipment flanges in order to avoid damage as well as water, dirty or debris contamination during storage, pre-assembly and assembly phases until final completion.
     4. SELLER must perform the proper concentricity, gap, parallelism and tension of pipe flanges and nozzles of all mechanical equipment of the UNIT and application of bolting torque, satisfying all API standards (example: API RP 686 - RECOMMENDED PRACTICE FOR MACHINERY INSTALLATION AND INSTALLATION DESIGN) as well Vendor procedures and recommendations. Dimension report, alignment reports and piping special supports adjusting (examples: spring supports and tie-rods) shall be approved by Vendor before and after module lifting and prior to running the equipment.
     5. SELLER shall carry out the scope in compliance with NR-12 Requirements according to I-ET-3010.00-1200-970-P4X-012 COMPLIANCE WITH NR-12 REQUIREMENTS and NR-12 requirements.
  2. **STRUCTURE** 
     1. SELLER must guarantee the adequate construction techniques in order to ensure requested design alignment and Classification Society’s requirements. All structures shall be categorized by application importance and consequence of an eventual failure. The structural analyses, as well as the structural inspections, tests and construction works, shall comply with the provisions of Classification Society’s Rules, Flag Administration and Brazilian Authorities. Structures shall be inspected and approved by Classification Society Surveyor, according to Exhibit III – DIRECTIVES FOR PRODUCT DEVELOPMENT.
     2. SELLER shall construct and assembly the metallic structure complying with the Technical Specifications.
     3. For Lower Hull Structure, Structural Tanks and Side Structures like seawater caissons regions, fenders, diving stations, mooring balconies, helideck structure, crane pedestal, flare tower foundation, lifeboat platforms and rescue boat davit foundations, monorails, among others:

I-ET-3010.2E-1351-140-P4X-001 HULL STRUCTURAL REQUIREMENTS

I-ET-3010.00-1200-510-P4X-001 METALLIC TANKS DESIGN FOR TOPSIDE

* + 1. For Topside structures, pipe racks, module’s structure, stools and ministools, special supports, topside supports, flare tower structure, monorails, among others:

I-ET-3010.2D-1400-140-P4X-001 TOPSIDES STRUCTURAL REQUIREMENTS

* + 1. Riser Balcony and Pull in Systems
    2. The riser system will be a coupled system, with flexible risers and umbilical connected to the FPSO through bell-mouths and rigid risers connected to the FPSO through underwater receptacles.
    3. SELLER shall also manage the construction interface and perform dimensional control of alignments, minimum spacing, angles and rotations, limiting the acceptable deviations between the parts, according to technical requirements, including the applicable load tests.
    4. SELLER shall fabricate machined mock-ups to enable proper fit-up test at shipyard in order to guarantee the correct dimensioning of spool pieces connecting the FPSO piping and flexible risers top connector flanges. Mock-up drawings shall be submitted for comments. These mock-ups shall be fabricated including blind flanges at the top end with the same specification and material of the risers top flanges in order to be used as positive isolation during FPSO operation and enable fit-up and N2/He leak tests of the FPSO piping. Such tests shall be performed at the shipyard before final sail-away.
    5. SELLER shall fabricate machined mock-ups to enable proper fit-up test at shipyard in order to guarantee the correct dimensioning of spool pieces connecting the FPSO piping and rigid risers connector flanges at the Lower Riser Balcony level. The final mock-up drawings shall be submitted for comments. These mock-ups shall be fabricated including blind flanges at the top end with the same specification of the risers top flanges in order to enable fit-up and N2/He leak tests of the FPSO piping. Such tests shall be performed at the shipyard before final sail-away.
    6. SELLER shall apply visual identification of all tools and equipment necessary to pull in and pull out of flexible and rigid risers, including wells, slot, functions, diameters and positions.
  1. **PRESSURE VESSELS AND STATIC EQUIPMENT**
     1. SELLER shall submit specific assembly procedures for BUYER approval, for all static equipment of the UNIT comprising guidelines for lifting, handling, assembly, preservation, alignment and leveling during all construction and Commissioning Phase, even if the vessels and static equipment installation is before lifting campaign. These procedures shall be presented at least 90 days before equipment factory inspection acceptance.
     2. SELLER shall strictly follow vendor requirements for static equipment installation.
     3. SELLER shall keep the equipment properly preserved and protected in order to avoid water, dirty or debris entrance.
     4. SELLER shall carry out the scope in compliance with NR-13 and SPIE Requirements according to I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS.
     5. After approval by the NR-13/SPIE Team, SELLER must close the equipment and guarantee its protection against entry of dirt. SELLER shall also guarantee the application of correct gasket and bolts, as well as the execution of final torque.
     6. SELLER shall plan carry out all at once the NR-13 and SPIE Requirements as defined on item 5.12 of this Exhibit.
     7. SELLER shall comply with the requirements:

DR-ENGP-M-I-1.3 SAFETY ENGINEERING GUIDELINE

I-LI-3010.2D-1200-940-P4X-002 EQUIPMENT LIST

I-ET-3010.2D-1200-500-P4X-001 MATERIAL SPECIFICATION FOR PRESSURE VESSELS AND TANKS

I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTSPIPING / TUBING

* 1. **PIPING INTEGRATED TEAM:**
     1. SELLER managers and piping coordinator team shall interact with BUYERs, formed by specialist of all sections, to strategically breakdown the process of fabrication, assembly, test and commissioning of the piping systems of the UNIT.
     2. The SELLER must present in the meetings, carry out analyzes, study the critical path, controls (rundown curves, etc.), deadlines, allocate manpower and interact with the BUYER, including Procurement, C&A, Planning and Quality Assurance (QA) / Quality Control (QC) control, to permit the harmony of the process, for all hold points and to achieve project milestones.
     3. For each site of modules, hull and integration, there must be a dedicated PIPING team.
     4. SELLER shall verify final alignment of mechanical equipment before connecting the piping. The following activities on piping have to be completed: pressure tests, washing and air flushing and permanent support installation (fixed, sliding and elastic supports). While those operations are carried out, piping has to remain always disconnected and isolated from the mechanical equipment. Piping has to be connected to permanent supports and tension free. Piping residual tension cannot be transferred to equipment flange whatsoever.
     5. SELLER shall provide a Dummy Spool or similar device, at the connection between topside piping and subsea risers:
* On interfaces of the flexible risers with I-tube;
* On interfaces of the rigids risers with receptacles.
  + 1. SELLER shall also provide and install blind flange on theses interfaces points, according to the Isolation Plan (Plano de Raqueteamento).
    2. During Offshore phase, SELLER shall carry out all piping dismantling and reinstatement to permit the pull in handling works offshore, for the first seven wells (oil production, gas injection, exportation and/or water injection well).
    3. SELLER shall submit and implement a “First Oil” and Gas exportation Isolation Plan (Plano de Raqueteamento) to present to Brazilian Agency for Petroleum, Natural Gas and Biofuels (ANP), to permit a safety start-up of the UNIT First Oil. This plan shall consider positive isolation, with spectacle blind and blind flanges, to isolate the interface between the systems necessary to the first oil and all other systems of the UNIT. All flanges, gaskets, bolts, nuts and other accessories for the implementation of this plan will be provided by SELLER.
    4. SELLER shall supply, install and remove all spectacle blinds and blind flanges required by the Isolation Plan, including onshore and offshore workers and other resources necessary, for example: scaffolder, tools, materials, etc.
    5. For each specification of material that requires chemical cleaning or pickling, SELLER shall manufacture a specimen and perform a preliminary test to check the effectiveness of the cleaning process proposed, prior to execution of the cleaning process on field.
    6. SELLER shall submit for BUYER’s approval a piping fabrication and installation execution plan for all equipment and modules interconnection spools aiming to avoid misalignments and rework during installation. This plan shall be presented to BUYER at least 90 days before site piping spool fabrication start.
    7. SELLER shall comply with vendor requirements for engineering and construction in piping/tubing systems for hydraulic driven pumps. Vendor shall perform a field inspection survey and SELLER shall properly correct all deviation reported by the Vendor.
    8. The Pipe Shop shall have segregated fabrication areas for each kind of material: carbon steel, stainless steel, duplex and super duplex, Copper-Nickel alloy (CUNI), Fiber Reinforced Plastic (FRP), Inconel etc. All materials, accessories and consumables shall be identified by color code according to their specification.
    9. The Pipe Shop for Duplex and Super Duplex shall be enclosed and segregated in order to avoid material contamination including a monitoring system.
    10. SELLER shall utilize Pipe Shops for piping fabrication equipped with all the required machinery, which shall be covered and protected. All safety environment aspects shall comply with Federal, State and Local rules and Exhibit IX – DIRECTIVES FOR HEALTH, SAFETY AND ENVIRONMENT of this Contract.
    11. SELLER shall submit for BUYER’s approval a piping cleaning plan considering all piping systems of the UNIT, according Exhibit VIII – DIRECTIVES FOR COMMISSIONING PROCESS. The systems shall be cleaned with appropriated method, considering chemical and mechanical methods (i.e. flushing, chemical cleaning, oil flushing, retro-jetting, foam pig, blow out and others). After cleaning of each piping system, SELLER shall execute the internal inspection of all piping systems, using the borescope, videoscope and issue an evidence report including documentation and video / photo record when requested by BUYER. Any finding, such as scale, mug and oxides, shall be removed and the lines properly dried before BUYER approval.
    12. SELLER shall carry out the cleaning works, during the construction module phase and avoid transferring these activities to the Integration Phase, carrying out the preservation properly. For each pipe folder, SELLER shall present to BUYER a certificate of pipe cleanliness, evidencing that the lines have been properly cleaned.
    13. Hydraulic piping systems and hydraulic tubing systems for mechanical equipment lubrication and/or hydraulic systems of gas air compressors, turbines, turbo generators, hydraulic valves, winches and pumps and others, shall be cleaning by flushing using appropriated meshes, oil and temporary fluids. SELLER shall fill the systems and storage tanks with the definitive oil only after BUYER and Vendor approval. For each pipe folder, SELLER shall present to BUYER a certificate of pipe cleanliness, evidencing that the lines have been properly cleaned. The flushing of hydraulic systems must contemplate successive modulations of the valves so that their reservoirs are also effectively cleaned, avoiding possible contamination.
    14. For Automatic Deluge piping systems installation SELLER shall issue an installation dimensional report content the field inspection data, but not limited to, piping as built, sprinklers specifications, sprinklers arrangements and locations, comprising at minimum flow. All results recorded in the Installation Report shall be in accordance with the design specification. SELLER shall correct any difference between field results and design.
    15. SELLER shall apply a specific procedure, approved by BUYER, the Flange Management Procedure, to control the tightness of bolted flange joint assembly, including the inspection of surfaces of flanges, type of gasket, bolts and nuts. This procedure shall be presented do BUYER at least 90 days before piping assembly activity start. Each bolted flange shall be physical identified with the conditions of materials and tightness/torque, to control and avoid leaks after the assembly. SELLER shall provide, in sufficient number, pneumatic torque machines and accessories for assembly and test of all piping spools. SELLER shall issue a report regarding Flange Management activities.
    16. SELLER shall supply spare gaskets and joints spares for piping systems, considering all types of joints specifications of the UNIT and the different materials and pressure classes, in sufficient quantity to complete the commissioning on and offshore and start up the systems. SELLER shall present to BUYER before the offshore phase a list of replacement gaskets indicating the technical specification and quantity for BUYER.
    17. SELLER shall contract Technical Support from Vendors to supervise engineering design, construction and assembly in FRP piping systems, including, but not limited to, piping arrangement, support location, spool arrangement, method of assembly and test procedure.
    18. SELLER shall plan carry out all at once the NR-13 and SPIE Requirements as defined on item 5.12 of this Exhibit.
    19. SELLER shall comply with the following Technical Specifications:

I-ET-3010.2D-1200-200-P4X-001 PIPING SPECIFICATION FOR TOPSIDE

I-ET-3010.2E-1200-200-P4X-001 PIPING SPECIFICATION FOR HULL

I-ET-3010.00-1200-251-P4X-001 REQUIREMENTS FOR BOLT MATERIALS

I-ET-3010.00-1200-200-P4X-116 BOLTED JOINTS MANAGEMENT

I-ET-3010.00-1200-200-P4X-115 REQUIREMENTS FOR PIPING FABRICATION AND COMISSIONING

I-ET-3010.00-1200-200-P4X-003 DESIGN CONSTRUCTION AND ASSEMBLY FOR FRP PIPING

I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTSI-ET-3010.00-1200-800-P4X-015 - REQUIREMENTS FOR TUBING AND FITTING (ALIGNED TO IOGP-JIP33 S-716)

* 1. **ELECTRICAL, INSTRUMENTATION, TELECOM AND AUTOMATION**
     1. SELLER shall supply and install insulating matting for all electric equipment workplaces according design specification. Including temporary insulation in the panel accesses during the testing and commissioning phase.
     2. Metallic structures, equipment, modules, cables and accessories shall be grounded properly, applying solutions based on engineering good practices according to the requirements of applicable norms, BUYER technical specification and Classification Society, using the reference I-DE-3010.00-5140-700-P4X-003 GROUNDING INSTALLATION TYPICAL DETAILS.
     3. SELLER shall provide necessary support to clear NR-10 punch lists items recorded by Quality Assurance (QA) / Quality Control (QC) with a team dedicated to this activity, in order to guarantee construction design, compliance, performance and integrity of Electrical & Instrumentation (E&I) assets, according to IEC-60079. This punch list shall be issued based on all applicable requirements of International Electrotechnical Commission (IEC) and its implementation is mandatory to operate and energize E&I systems on classified/hazardous areas.
     4. SELLER shall mobilize a team of electrical inspectors qualified to perform inspections in compliance with IEC 60079. The minimum scope of work executed by the electrical inspector’s team is:
* Perform inspection on manufactures to avoid transferring carryover of nonconforming items to constructions sites;
* Perform inspection after receiving, in order to release material to application;
* Perform inspection on field in order to release installation mechanical completion or subsystem to commissioning;
* Issue final report for all electrical equipment installed in hazardous areas in compliance with IEC 60079. Reports shall be individual by equipment, presented in groups by Subsystem;
* Monitor, guide, training and inspect the workers during construction, assembly, and commissioning. Electrical, instrument and telecom employees shall be trained about the explosion proof equipment's handling, instructing about bolts, cable entry devices and blanking element types, not allowed modifications, care to avoid damages at sealing faces, and others;
* To monitor repairs executed in certified equipment.
  + 1. For Fire and Gas Systems SELLER shall perform a field inspection and issue a Final Installation Report for each Fire and Gas Detector. The report shall include x, y and z coordinates, angle cone of vision for each sensor, as built. SELLER shall correct the design to reflect the fire and gas detector installation as built. The Final Installation Report must be issued 15 days prior to Sail Away.
    2. For Fire and Gas sensors installed with height less than 2 meters from the reference deck, SELLER shall provide a warning painting at the floor, to avoid the sensibilization by human presence.
    3. SELLER shall comply with the following Technical Specifications:

I-ET-3010.2D-1200-800-P4X-001 INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS

I-ET-3010.2D-1200-800-P4X-005 FIELD INSTRUMENTATION

I-ET-3010.00-1200-813-P4X-001 GERAL CRITERIA FOR FLOW METERING SYSTEMS

I-ET-3010.00-5140-700-P4X-002 SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS

NR-10 SEGURANÇA EM INSTALAÇÕES E SERVIÇOS EM ELETRICIDADE

* 1. **WELDING**
     1. Welding activities shall comply with all required qualifications of specialized workers, assembly and welding procedures and welding inspection following the guidelines of the applicable standards, BUYER technical specification and Classification Society requirements.
     2. SELLER must have materials, consumables, equipment and manpower, with the required qualification and in an adequate quantity. Whenever is possible, SELLER shall implement productive and automated processes to increase productivity to the welding process and improving quality of the weld.
     3. SELLER shall anticipate the qualification of welding processes and procedures, including all special steels to be used in the project, meeting the requirements of international technical standards and technical specifications. The qualification of manpower shall be planned so as not to impact the fabrication of structures and piping schedule. According to the mapping presented on Execution Plan.
     4. SELLER shall present a mapping with all Welding Processes, Welding Procedures and Welding Qualifications necessary for conducting all welding and all destructive and non-destructive inspections, including all materials provided for in the project. These procedures shall be presented to BUYER according to Exhibit VII – DIRECTIVES FOR QUALITY ASSURANCE SYSTEM.
     5. SELLER shall implement a management system of materials, welding inspections and material identification (PMI–Positive Material Identification and/or Chemical Spot Testing) of all piping welds and materials (pipes and accessories) for low, medium and high alloy steels and non-ferrous materials during the piping welds in the pipe shop and on board of the UNIT. This process also shall be presented to BUYER at least 90 days before first welding occur.
     6. SELLER shall comply with the following Technical Specifications:

I-ET-3010.00-1200-955-P4X-001 WELDING

I-ET-3010.00-1200-200-P4X-115 REQUIREMENTS FOR PIPING FABRICATION ASSEMBLY INSPECTION AND COMMISSIONING

* 1. **ANTICORROSIVE PROTECTION**
     1. SELLER shall comply with the painting requirements, including temporary painting, definitive painting, hot dip galvanizing, coatings and colors, for preparation of surfaces and painting of structures, equipment, piping, valves and instrumentation.
     2. SELLER shall provide paint inspectors, certified according Exhibit VII – DIRECTIVES FOR QUALITY ASSURANCE SYSTEM, in proper quantity for the paint activities at each jobsite where the activities will be performed. The paint inspectors shall keep inspection records to compose the paint book and the UNIT Maintenance Plain. SELLER shall also keep at each main sites at least one Paint Manufacturer inspector to follow all phases of painting works.
     3. SELLER shall hold a kick-off meeting with the participation of the main suppliers and manufacturers of equipment and materials to present the contractual requirements for painting and corrosion protection as well as the inspection plan, that shall be applied to guarantee the painting quality.
     4. SELLER shall submit a detailed work plan for painting at least 90 days before first activity of painting start, including at least the following items: paint system selection, surface preparation, painting application, specific schedule for paint to be monthly updated, personnel resources, equipment, quality control requirements and definition of painting areas blocks for control, approval and guarantee. Regular meetings shall be held weekly to monitor the activities of painting, where will be discussed the physical progress and quality of work.
     5. SELLER shall standardize the colors and piping markers to be used in the project, based on the technical specification, ensure uniformity in the application of colors and identifications throughout the UNIT, including modules, skids and goods purchased from third parties.
     6. SELLER shall present in the Painting Plan, methods, equipment and processes that increase productivity, guaranteeing the quality of the painting in places with large areas to be painted, for example tanks, ship´s side, main deck and floor.
     7. Holiday detector shall be applied on 100% of bottom plate surface in way of cargo and ballast tanks. Holiday test to be carried out only after finishing all tank internal activities as piping works, outfitting, instrumentation installation and scaffolding removal.
     8. Related to Painting/Coating works performed under this CONTRACT the warranty period is defined on ET-3010.00-1200-956-P4X-002 and shall follow this Exhibit IV and Scope of Supply Work guidelines. The “Warranty Period” commences at Handover date.
     9. Assignment and Enforcement of Subcontractor and Vendor Warranties. Related to Painting/Coating works performed by Subcontractors and Vendors, the warranty conditions shall follow Exhibit V and Scope of Supply Work guidelines.
     10. The conditions mentioned in item 17.3.4 of the contract (repair by BUYER) apply to Painting/Coating Works and Exhibit V and Scope of Supply Work requirements shall also be followed.
     11. Paint inspectors, applicators painters, blasters and hydroblasters shall be qualified and certified according to I-ET-3010.00-1200-956-P4X-002 - GENERAL PAINTING.
     12. The painting of the external and internal metallic surfaces of the entire UNIT (steel structure, piping, valves, equipment) shall fall within SELLER’s Scope of Supply, in accordance with I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING. Coating Warranty requirements must also be followed.
         1. The Painting Procedures shall be submitted to BUYER for approval. See item 5.8.4.
         2. The above-mentioned documents are included in the Exhibit II – BASIC ENGINEERING DESIGN
     13. SELLER shall comply with the following Technical Specifications:

I-ET-3010.00-1200-956-P4X-002 GENERAL PAINTING

I-ET-3010.00-1200-956-P4X-001 QUALIFICATION TESTS FOR PAINT SYSTEMS

I-ET-3010.00-5400-947-P4X-008 ESCAPE ROUTE

I-ET-3010.00-1000-950-P4X-001 MARINE BIOFOULING

I-ET-3010.00-1200-956-P4X-003 THERMAL SPRAY COATING APPLICATION OF ALUMINUM

DR-ENGP-I-1.15 COLOR CODING

* 1. **THERMAL INSULATION AND PASSIVE FIRE PROTECTION**
     1. SELLER shall guarantee before applying thermal insulation on equipment and piping, the adequate quality and complete finalization of the painting scheme or thermal spray aluminum.
     2. SELLER shall supply and apply passive fire protection and cryogenic passive protection on all surfaces, valves and equipment defined in the project, in accordance with the technical specification.
     3. All materials applied to passive fire protection, obligatorily shall be certified by manufacture with properly time resistance according defined on Fire Propagation and Smoke Dispersion Analysis, Explosion Analysis and Gas Dispersion Analysis.
     4. The cryogenic passive protection materials applied shall be compatible with the fire protection and certified by manufacture with properly time resistance. SELLER shall certify the proper application and issue reports ensuring the application on all surfaces required, as well as on flanged valves, wafers valves, actuators of valves, flanges and piping supports and equipment.
     5. SELLER shall comply with the following Technical Specifications:

DR-ENGP-M-I-1.3 SAFETY ENGINEERING GUIDELINE

I-ET-3010.00-1200-431-P4X-001 THERMAL INSULATION FOR MARITIME INSTALLATIONS

I-ET-3010.00-5400-433-P4X-001 PASSIVE FIRE PROTECTION

I-ET-3010.00-5420-300-P4X-001 FIRE PROTECTION FOR MACHINERY HOODS

I-ET-3010.00-5400-433-P4X-001 PASSIVE FIRE PROTECTION SYSTEM

I-ET-3010.2D-1400-190-P4X-001 TOPSIDE ARCHITECTURE MATERIALS AND EQUIPMENT SPECIFICATION

I-ET-3010.2E-1350-190-P4X-001 ACCOMMODATION ARCHITECTURE MATERIALS AND EQUIPMENT SPECIFICATION

I-RL-3010.2D-5400-98G-P4X-004 EXPLOSION STUDY

I-RL-3010.2D-5400-98G-P4X-001 GAS DISPERSION ANALYSIS

I-RL-3010.2D-5400-98G-P4X-002 FIRE PROPAGATION AND SMOKE DISPERSION ANALYSIS.

* + 1. SELLER shall guarantee that any alterations of surroundings that affect Passive Fire Protection (PFP) insulation after installation is fully repaired prior to mechanical protection of PFP is installed.
  1. **ARCHITECTURE**
     1. SELLER shall guarantee the correct application of each material foreseen in the project, the adequate quality and complete finalization of compartments, carry out inspection and issue a report by compartment, including check of furniture, antiskid, passive protection, thermal and acoustic insulation, nameplates, notices, frames, doors, painting and safety plan.
     2. After conclusion of activities on industrial compartments, engine room and working rooms, localized on Hull, Accommodations and Topside Modules, places must be cleaned and temporary protection installed before permit the habitation by BUYER.
     3. SELLER shall internally clean the water pipes that serve the accommodations and ensure they do not have any leaks. The pipes that serve the kitchen, refectory and clinic must be cleaned again 20 days before habitability date. In order to guarantee the water quality and potability.
     4. All tools, laboratory and workshops equipment shall be installed, tested and organized comprising its certificates, including calibration, before UNIT Sail away.
     5. Clearance of punch list items from the construction and assembly phase shall meet the precedence network to permit the mobilization of the BUYER’s team in the accommodations, according to requirements of EXHIBIT X – FACILITIES FOR OWNER’S REPRESENTATIVES, to proper following of the commissioning during the integration phase.
     6. SELLER shall comply with the following Technical Specifications:

I-ET-3000.00-8222-941-PJN-001 LABORATORY - EQUIPMENT

I-ET-3010.2D-1400-190-P4X-001 TOPSIDE ARCHITECTURE MATERIALS AND EQUIPMENT SPECIFICATION

I-ET-3010.2E-1200-695-P4X-001 – WORKSHOP EQUIPMENT AND TOOL LIST

I-ET-3010.2E-1350-190-P4X-001 ACCOMMODATION ARCHITECTURE MATERIALS AND EQUIPMENT SPECIFICATION

All Exhibit II Architecture documents.

* 1. **ERGONOMIC REQUIREMENTS**
     1. SELLER shall guarantee the correct application of technical specifications that are part of the project. SELLER shall comply with NR-17 Ergonomics.
     2. The SELLER shall issue the reports described in technical specifications by qualified professional as described in Descriptive Memorandum.
     3. SELLLER shall issue list of valves, as described in Technical Specification, and revise it until the list is final. First issue shall be 30 days before 60% Design Review Event.
     4. The SELLER shall issue an Ergonomic Evaluation Report containing evidence of implementation of recommendations of the Ergonomic Work Analysis. This Ergonomic Evaluation Report must have his final version issued at the end of Construction and Assembly phase.
     5. Seller shall comply with the following Technical Specifications:

I-ET-3000.00-5400-947-P4X-012 - HUMAN FACTORS ENGINEERING (HFE)

I-ET-3010.2D-1400-196-P4X-001 – ERGONOMIC REQUIREMENTS FOR TOPSIDE

I-ET-3010.2E-1350-196-P4X-002 – ERGONOMIC REQUIREMENTS FOR HULL

I-MD-3010.2D-1200-940-P4X-008 - DESCRIPTIVE MEMORANDUM - ERGONOMICS

* 1. **SAFETY REQUIREMENTS**
     1. SELLER shall ensure the correct execution of the requirements and safety systems provided, as well as the quality and completion required. SELLER must carry out inspections and issue reports, including verification of the quality and functionality of the safety components and systems.
     2. The SELLER shall issue an Installation Report containing the field inspection data with evidence of closure of the recommendations provided for in the Risk Studies. SELLER must carry out inspections systematically and the Final Installation Report must be issued 15 days prior to Sail Away.
     3. The SELLER shall issue an Installation Report containing the field inspection data with evidence of full implementation of the Safety Plan. SELLER must carry out inspections systematically and the Final Installation Report must be issued 15 days prior to Sail Away.
     4. SELLER shall comply with the following Technical Specifications:

DR-ENGP-M-I-1.3 – SAFETY ENGINEERING GUIDELINE

I-MD-3010.2D-1200-947-P4X-003 – DESCRIPTIVE MEMORANDUM – SAFETY

I-ET-3000.00-5400-947-P4X-001 – MANAGEMENT OF CHANGE OF SAFETY STUDIES

I-ET-3000.00-1300-98A-P4X-002 - SHIP COLLISION STUDY

I-ET-3000.00-1300-98A-P4X-003 – DROPPED OBJECTS AND SWINGING LOADS STUDY

I-ET-3000.00-5400-98G-P4X-001 – EXPLOSION STUDY

I-ET-3000.00-5400-98G-P4X-002 – GAS DISPERSION STUDY

I-ET-3000.00-5400-98G-P4X-003 – FIRE PROPAGATION AND SMOKE DISPERSION STUDY

I-ET-3000.00-5400-98V-P4X-001 – PRELIMINARY HAZARDS ANALYSIS (PHA)

I-ET-3000.00-5400-98X-P4X-001 – HAZARD AND OPERABILITY STUDY - HAZOP

I-RL-3010.2D-5400-98V-P4X-002 – PRELIMINARY HAZARD ANALYSIS.

I-RL-3010.2E-5400-98V-P4X-001 – PRELIMINARY HAZARD ANALYSIS - HULL

I-RL-3010.2D-5400-98X-P4X-001 – HAZARD AND OPERABILITY STUDY -

HAZOP.

I-RL-3010.2E-5400-98X-P4X-001 – HAZARD AND OPERABILITY STUDY - HAZOP - HULL

I-RL-3010.2D-1300-98A-P4X-003 – DROPPED OBJECT STUDY.

I-RL-3010.2D-5400-98G-P4X-001 – GAS DISPERSION ANALYSIS.

I-RL-3010.2D-5400-98G-P4X-002 – FIRE PROPAGATION AND SMOKE DISPERSION ANALYSIS.

I-RL-3010.2D-5400-947-P4X-001 – CLOSED OUT REPORT

* 1. **NR13 and SPIE REQUIREMENTS**
     1. NR13 is a mandatory Brazilian Regulation that shall be strictly followed by SELLER in all phases of the project including design, fabrication, erection and commissioning. SELLER shall apply all necessary resources to comply with NR13 rules.
     2. SELLER shall use NR13 latest revision published by Brazilian Labour Administration Authority by the time of Contract Effective Date as a reference to the rules.
     3. SPIE is a certification to be obtained by BUYER. SELLER shall provide all information, support, inspections, documents and reports to support BUYER on SPIE Certification.
     4. NR-13 and SPIE requirements also includes the safety devices calibration and the supply of car seals and warning plates for LO/LC valves.
     5. The technical specification I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS is the reference for SELLER’s scope and responsibilities.
     6. All tests and inspections required by NR-13 and SPIE for all phases of the project shall be notified to BUYER representative to witness. Therefore, SELLER shall have an inspection plan that allows BUYER to be noticed at least 5 working days in advance for the test/inspection.
     7. The I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS present the detailed guidelines to select the equipment, piping, and safety devices under BUYER's SPIE control. Equipment and piping subjected to NR-13 requirements sufficiently fulfill the SPIE requirements and no more inspections and documentation are required.
     8. THICKNESS MEASUREMENT on PIPING and EQUIPMENT
     9. SELLER shall perform thickness measurement for all carbon steel equipment/piping without internal coating, under the NR13/SPIE control. The points shall be chosen according to I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS. As a reference, recent PETROBRAS UNITS had about five thousand (5000) thickness measurement points.
     10. For piping and equipment with thermal insulation, inspection windows shall be installed to allow the measurement of thickness during the UNIT’s lifetime.
     11. SELLER shall measure the piping thickness with piping at its final position on the Modules and Hull.
     12. Initial Safety Inspection
     13. SELLER is responsible for the Initial Safety Inspection of all equipment and piping under NR-13 and SPIE control.
     14. Initial Safety Inspection of NR-13 Equipment Category I e II must be carried out at integration phase, after lifting and hook-up of Modules, in order to ensure compliance with the date for oil production. The Initial Safety Inspection, comprising internal and external examinations, shall be done no earlier than 12 months of the Unit's sail away.
     15. Safety devices, manly pressure safety valves, connected to NR-13 Equipment Category I and II must be recalibrated no earlier than 12 months of the Unit's sail away, preferably not before carrying out the internal examination of their respective equipment.
     16. NR-13 and SPIE DOCUMENTATION
     17. SELLER shall delivery, in hard copy, the NR-13 Dossier for each equipment and piping system. Digital copy, with digital signatures, can be used if previously approved by BUYER. The minimum content shall be according to I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS.
     18. The delivery of the necessary documentation for the completion of SPIE Data Books must occur mainly before Sail Away and the final pending issues must be completed within 3 months after the Handover.
     19. LOCKING DEVICES and WARNING PLATES
     20. SELLER shall provide valves locking devices (car seals) and warning plates as per quantities defined in Exhibit I and specifications described in I-ET-3010.00-1200-970-P4X-013 COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS.
     21. SELLER shall deliver these warning plates and locking devices to BUYER for installation by BUYER (Operating Team) at least three months before Sail Away.
  2. **LIFTING CAMPAIGN**
     1. SELLER is responsible for all lifting campaign, including appropriate facilities and engineering works, cranes, barges and dredging (if necessary), with certified materials and equipment compatible with load to be hoisted and certificates and using qualified personnel for the inspections and operations. The Marine Warranty Survey (MWS) shall approve all items, according to Exhibit I – SCOPE OF SUPPLY.
     2. The 3D model shall be used to dynamically simulate the module lifting operations in order to avoid clashes, to facilitate the lifting campaign study, guaranteeing that no clashes (including dynamic clashes) will occur during the entire operation.
     3. Dismantling and reinstatement, field corrections for dimensional adjustments, in order to correct the clashing, is within SELLER’s scope of supply.
     4. SELLER shall comply with I-ET-3000.00-1300-960-P4X-001 - WEIGHT CONTROL PROCEDURES
  3. **LEAK TESTINGS**
     1. SELLER shall carry out the leak test of all piping systems of the UNIT in comply with this item and with Exhibit VIII - DIRECTIVES FOR COMMISSIONING PROCESS.
     2. SELLER shall issue the Leak Test procedure and submit it to BUYER approval, at least 90 days before first leak test execution.
     3. Prior to start the leak test, all system shall have definitive items installed (such as gaskets, bolts, supports, guides, piping cells, connectors) and all instruments and valves, which requires intervention of piping and equipment, shall be calibrated.
  4. **(NOT APPLICABLE)**
  5. **PIPING AND INSTRUMENTATIONS DIAGRAMS MARKUPS**
     1. Engineering team shall release P&IDs comprising markups delimiting the test package, considering all hazards and operation criteria, including pressure vessels and mechanical equipment. Leak tests plan shall also cover process piping within Skids limits (internally).
     2. The test package must be also reports, checklists and professional’s signature.
  6. **PRE-LEAK TEST AND LEAK TEST**
     1. Prior to conclude the module construction phase, during pre-commissioning, hydrocarbons systems shall be submitted to Pre-Leak test, to ensure flanged joint and tubing are properly assembly.
     2. Prior to conclude the UNIT integration phase, during commissioning, hydrocarbons systems shall be submitted to Leak Test. The test fluid shall be N2 + Helium and detect method shall be by spectrometer.
     3. It’s obligatory carry out two steps of leakage tests, on module construction and on integration after lifting and hook-ups, to ensure free leakage and compliance with legal requirements. For Utilities and Hull Hydrocarbons systems, it is acceptable to perform only the leak test.
     4. For all other no hydrocarbons systems (e.g. utilities), the test fluid may be water or air, respecting the phase of the operating fluid. Using the same pressure criteria.
     5. Test package and reports shall be issue for Leak Test.
     6. All flanges and threaded connections and all tubing, piping and instruments accessories, instruments and all other items shall be completely installed and shall be inspected during leak tests, even heighted, using facilities, scaffolds and/or IRATA. An appropriated team shall be mobilized to clear the leaks, comprising mechanic fitters to perform tightness and torque, scaffold fitters, pipe fitters, instruments assembler, IRATA and supervisors, among others, in each work shift.
  7. **ON SHORE N2 FINAL PRESSURIZATION**
     1. Prior to sail away of UNIT, all topside hydrocarbons systems shall be pressurized with nitrogen. In case of pressure drop during voyage, SELLER shall provide all support and all piping accessory for repressurize the systems with BUYER's Nitrogen Unit prior to introduce hydrocarbons in the process plant during the offshore startup operations.
     2. The working pressure shall be applied.
     3. Safety temporary indications and protections like labels, warnings plates, locks, lock identification cards, strips shall be included at all pressurized systems, and any unadvertised and/or no unauthorized activity shall occur at such pressurized system. All lock accessories and their indications must be represented on a lock map issued by the SELLER.
     4. SELLER shall comply with the following Technical Specification:

I-ET-3010.00-1200-200-P4X-115 REQUIREMENTS FOR PIPING FABRICATION AND COMMISSIONING

I-MD-3010.2D-1200-970-P4X-001 DESCRIPTIVE MEMORANDUM – COMMISSIONING

NR-37 SEGURANÇA E SAÚDE EM PLATAFORMAS DE PETRÓLEO

* 1. **AUGMENTED INSPECTION**
     1. To allow remote inspections and remote technical support to be carried out, on constructions and manufactures sites, SELLER shall use Smart Glasses, 360° pictures and Drones. This service will be requested to reduce time and increase safety in specifics inspections.
     2. SMART GLASSES
        1. SELLER shall have at least four (4) Smart Glasses available to be used by its employees, when request by Buyer, to enable some remote inspection of the BUYER’s team (1 in Hull Shipyard, 1 main modules shipyard, 2 to be defined with BUYER).
        2. The Smart Glasses shall be able to carry out video conferencing and be possible to make appointments through augmented reality. The appointments shall be possible to be performed both by those who wear the glasses and by those who are remote viewing the inspection.
        3. The Smart Glasses shall be able to usage of a subset of the 3D models to aid inspections, viewing the surrounding location in the installation in 3D, through augmented reality.
     3. THE 360° PICTURES
        + 1. SELLER shall deliver 360° pictures after:

- The mechanical completion of each Topsides Modules;

- The Hull mega blocks;

- The mechanical completion of Hull;

- The mechanical completion of FPSO (before Sail Away).

* + - 1. The pictures shall be taken every two (2) meters, covering all areas, and it shall be delivered together with a plan indicating the location from which photos were taken.
      2. SELLER shall provide, when request by BUYER, 360° photos of a particular area of its interest.
    1. DRONE
       1. When necessary, to support some inspections and/or register, BUYER can request to SELLER to provide a Drone Inspection Service. The Inspection results shall be delivered to BUYER in digital media.
       2. The specifications of digital equipment shall comply with the requirements of I-ET-3010.00-5510-760-PPT-001 OWNER TELECOMMUNICATIONS SYSTEMS REQUIREMENTS AT CONSTRUCTION SITE

1. ACTIVITIES ON BOARD THE UNIT ON/OFFSHORE PHASE
   1. SELLER shall comply with the following requirements during execution of activities onshore:
      1. To submit to BUYER, previously to be taken aboard, a list of all facilities, equipment, tools, special tools and materials to be used, the list shall include, at least, self-contained air conditioning, dry and oil free air compressor unit, nitrogen unit for leak tests, temporary power generation for commissioning, fans and exhaust fans for confined spaces and torque machines for classified area.
      2. To ensure that its employees are aware according to the requirements Exhibit IX – DIRECTIVES FOR HEALTH, SAFETY AND ENVIRONMENT as well as to conduct activities strictly observing the recommendations provided in other applicable safety rules and standards.
      3. To keep the work areas permanently clean and clear, constantly removing and/or saving tools, surplus materials and wastes.
      4. To implement a Facilities Security Requirements and access control according to Exhibit X – FACILITIES FOR OWNER’S REPRESENTATIVES.
   2. During this phase, the SELLER shall mobilize companies or professionals specialized in offshore commissioning, additionally, shall provide offices and workshops in Brazil, in order to speed up the support on shore.
   3. SELLER shall comply with the following requirements during execution of offshore activities:
      1. All SELLERs and SUBCONTRACTORs employees that will work on board the UNIT, shall attend a training program on HSE before their boarding on the UNIT (i.e. BST – Basic Safety Training, HUET – Helicopter Underwater Escape Training, Confined Spaces, Hazardous Areas, NRs – Brazilian Regulatory Standards), according to Exhibit IX – DIRECTIVES FOR HEALTH, SAFETY AND ENVIRONMENT;
      2. SELLER shall bear the costs related to all the Offshore HSE training for its personnel as the ones mentioned above. This HSE training shall be provided by an accredited Agency;
      3. To supply uniforms and Personnel Protection Equipment in adequate quantity to all workers employed by itself or its SUBCONTRACTORS that are sent on board to carry out activities at the UNIT. These uniforms shall be identified with SELLER’s logo, name and blood type according to Exhibit IX – DIRECTIVES FOR HEALTH, SAFETY AND ENVIRONMENT;
      4. To use tools, equipment, etc., compatible with classification of hazardous areas where ~~services~~ activities are to be carried out. Special attention is to be paid in relation to equipment, panels, provisional lighting fixtures and electrical cables, during oil and gas systems start-up and functioning. For all works, BUYER shall issue Work Permit.
      5. All offshore materials, including tools, equipment and consumables shall be packed in offshore lifted certificated containers adequate for transportation on deck of tugboats, provided with valid certified slings and having weights compatible to hoisting conditions.
      6. A Material Cargo Packing List shall be issued for each package, as per the model to be supplied by BUYER, containing at least weight, dimensions, price and invoice number, on which all items to be taken aboard shall be listed. For such, SELLER shall notify the BUYER, giving a reasonable time for Transport Requisition, RT (“Requisição de Transporte”) issued by BUYER in order to carry out the preparation and shipment of such material, according to Exhibit I – Scope of Supply
      7. Special cargo shipments (i.e. inflammables, hazardous etc.) shall follow BUYER and local legal requirements;
      8. Shipment of materials by SELLER from the UNIT to its yard or BUYER base shall only be approved by BUYER supervisor on board.
      9. All foreign personnel shall have work visa provided previously according to local legislation.
      10. SELLER is responsible for the custody, control and preservation of materials that remain on board during the offshore phase, from sail away up to the Final Completion.
      11. SELLER is responsible for all materials, tools, equipment, containers, etc., of its property or of its SUBCONTRACTORs, on board the UNIT.
      12. SELLER shall provide Positive Pressure Enclosure for Hot Work in hazardous areas where activities are to be carried out, after starting the oil production, and comply with Exhibit IX - Directives for HSE.
      13. SELLER shall reimburse BUYER, at updated costs, for losses or damages inflicted to materials and equipment belonging to BUYER and that are trusted to the SELLER.
      14. To keep the work areas permanently clean and clear, constantly removing surplus materials and wastes.
      15. It is the seller's responsibility to manage the interface between its sub-sellers, in order to avoid design problems, material/equipment supply, construction and assembly, commissioning, clash, scope gaps, etc.
      16. SELLER shall mobilize a Nitrogen Generation Unit (NGU) during all offshore phase (until the completion of the commissioning of the CO2 compressor), including operators, spares and maintenance.
          1. Nitrogen Generation Unit (NGU) characteristics: Equipment composed of 3 operational modules: Primary Compressor, Membrane and Booster Compressor.

* **Primary compressor** has the purpose of capturing ambient air through an input filter and compresses it to approx. 350psi and 1500scfm. Compressed air passes through a series of filters for removing moisture and oil vapors. The supply air is then reheated in order to obtain the best vibration parameter molecular for gas separation.

Uma imagem contendo prateleira, nível, trem, ônibus

Descrição gerada automaticamente

Only illustrative

|  |  |
| --- | --- |
| Equipment flow required | until 1800 scfm |
| Maximum Pressure | 500 psig |
| Classification | Atex, DNV, Zona II |
| Maximum flow rate | Max. 1800 scfm |
| Environmental conditions project performance | SPE Standard Conditions 60ºF, Dry air, Sea level |
| Diesel consumption (suggestion) | 120 l/h |
| Operating Temperature | 125ºF |
| Compressed air for motor start | 120 psi |

* **Membrane Module**, the supply air passes through a treatment plant to remove impurities and moisture in addition to an air temperature increase system that assists in the gas separation process. Dry, clean air enters a bank of separation membranes, where oxygen, CO2, steam remaining water and part of nitrogen permeate through the hollow synthetic fiber walls, being ventilated safely from back to the atmosphere. The rest of the nitrogen leaves the membranes and passes through the flowmeter and oxygen analyzer before getting to the Booster module.

Uma imagem contendo no interior, cozinha, geladeira, grande

Descrição gerada automaticamente

Only illustrative

|  |  |
| --- | --- |
| Classification | Atex, DNV, Zona II |
| Environmental conditions project performance | SPE Standard Conditions 60ºF, Dry air, Sea level |
| Nitrogen Purity | 95% to 99% |
| Nitrogen Delivery @ 95%: | 750 scfm |
| Operating Temperature | 115ºF |
| Electric Power supply (suggestion) | 2Ø220V – 60Hz – 20A |

* **Compressor Booster Module**, the purified nitrogen gas enters with a pressure of 300 to 350 psi and after going through 4 stages the pressure can be raised up to 5000 psi.

Trem de brinquedo

Descrição gerada automaticamente com confiança média

Only illustrative

|  |  |
| --- | --- |
| Equipment flow required | until 750 scfm |
| Maximum Pressure | 5000 psig |
| Classification | Atex, DNV, Zona II |
| Product flow rate | Max. 750 scfm |
| Environmental conditions project performance | SPE Standard Conditions 60ºF, Dry air, Sea level |
| Diesel consumption (suggestion) | 120 l/h |
| Operating Temperature | 125ºF |
| Compressed air for motor start | 120 psi |

1. INSPECTION AND AUDITING

* 1. Due the dimension of the project and the risk and hazards implicated in their development, the following auditing and inspection are done during the work execution or to release the UNIT to sail away, as listed below but not being restrict to these:

External Audits:

Brazilian Institute of Environment and Renewable Natural Resources (IBAMA – Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis);

Petroleum Brazilian Regulation Agency (ANP - Agência Nacional do Petróleo, Gás Natural e Biocombustíveis);

Brazilian Navy (Marinha do Brasil) to check compliance with NORMAM (Normas da Autoridade Marítima do Brasil) rules and regulations;

Brazilian Health Surveillance Agency (ANVISA - Agência Nacional de Vigilância Sanitária)

Internal Audits/Inspections:

Compliance and Regulatory Advice Inspection (APIR): inspection to check compliance with the Regulatory Norms (NR) from Ministry of Labor and Employment;

Process and Operational Safety Management (SGSO – Sistema de Gerenciamento da Segurança Operacional): internal audit according to ANP requirements for SGSO;

PHA (Preliminary Hazard Analysis) and Hazard and Operability Study (HAZOP) performed as defined in Exhibit III - DIRECTIVES FOR PRODUCT DEVELOPMENT).

* 1. All nonconformity and/or pending items lists verified on any of these audits based on Agreement and Exhibits requirements, specifications, laws in force, legal requirements, and technical codes shall be timely solved by SELLER, before sail away of the UNIT.

1. MODULE AND COMPARTMENT COMPLETION CERTIFICATE
   1. For module Completion: SELLER shall provide a control with scope of work of all disciplines, schedule for each module and issue a completion certificate called as Module Completion Certificate (ModCC). This certificate shall have all disciplines signatures complying with the completion of each Module. Check list to ensure the readiness of the Modules, including the following items, but not limited to, related to design documents and field inspection, shall be applied:

Painting;

Insulation;

Fire protection materials;

Maintenance and operations facilities;

Outfitting installations;

Arrangement of lighting fixtures.

Clashes;

Drainage system;

Safety plan devices and arrangements;

Equipment preservation;

Fire & Gas detection system;

Fire & Gas fighting system;

* 1. For Compartment Completion: SELLER shall provide a control with all HULL areas, compartments and tanks including scope of supply of all disciplines and schedule for each area and issue a completion certificate called as Area Completion Certificate (ACC). This certificate shall have all disciplines signatures complying with the completion of each area. Check list to ensure the readiness of the areas, including the following items, but not limited to, related to design documents and field inspection shall be applied:
* Painting;
* Insulation;
* Fire protection materials (Passive protection, MCTs, etc.);
* Furnishings;
* Maintenance and operations facilities, including handling;
* Outfitting installations;
* Arrangement of lighting fixtures;
* Ventilation and Air Conditioning systems;
* Clashes;
* Drainage system;
* Safety plan devices and arrangements;
* Equipment preservation;
* Fire & Gas detection system;
* Fire & Gas fighting system;
* Equipment installation and preservation;

1. CONSTRUCTION AND ASSEMBLY DATA-BOOK
   1. SELLER shall issue construction and assembly data-books, to be delivered to BUYER, until Sail-Away date.

Main structure of the fabrication, construction and assembly data books shall be:

Part I – General Records

Part II – Piping

Part III – Pipeline

Part IV – Static Equipment

Part V – Rotating Equipment

Part VI - Instrumentation

Part VII – Electric

Part VIII – Society Requirements

Part IX – Naval

Part X – IMO Requirements

Part XI – Corrosive Protection

Part XII – Structures

Part XIII – Health, Safety and Environment

Part XIV – Valves

Part XV – Cathodic Protection