**EXHIBIT IV**

**DIRECTIVES FOR PRODUCT FABRICATION**

**FPSO PETROBRAS 91 (P-91)**

**\*\*\*\*\*\*\*\*\*\*\*\*Revision Control\*\*\*\*\*\*\*\*\*\*\*\*\***

**Rev 0: Bid original version**

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# GENERAL

* 1. The requirements described in this Exhibit are applicable to the personnel and facilities of Seller yards, all Modules Yards, Hull shipyard and Subcontractor Sites.
	2. Specific requirements related to activities to be carried out onboard the Unit, both onshore and offshore, are also herein provided. The Seller workforce and its Subcontractors shall be aware about 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. Seller shall deliver to Buyer all required documents on this Exhibit as per Exhibit III – Directives for Product Development.

# PRODUCT FABRICATION EXECUTION PLAN

* 1. Within 60 (sixty) days after the Agreement Effective Date, or other date agreed with Buyer, Seller shall submit the product fabrication execution plan (first version) for Buyer approval. The plan shall be a detailed breakdown of Seller´s technical proposal.
	2. The plan shall present Site locations, applicable logistics, scope assigned to Subcontractors and all Sites organization charts.
	3. The plan shall include the strategy of building/converting the Hull and fabricating the Modules, as well as the Integration activities.
	4. In case of Hull conversion, the plan shall include the technical documentation (plans, reports of the latest structural inspections, etc.) approved by Classification Society regarding the vessel purchased for the project.
	5. Each construction yard shall have its own execution plan containing, at least, the information below:
		1. The scope assigned to the construction Site.
		2. Track records of previous relevant/completed projects, current projects and corporate structure.
		3. Site logistic plan, containing layout map, department division, means of access, escape routes and main internal routes.
		4. Histogram including direct and indirect manpower.
		5. List of site facilities to attend the workforce, such as means of transportation, restaurants, dress rooms, WCs, ambulatories, offices, etc.
		6. Planned gross processing quantities at Site versus Site’s current capacities for all disciplines, such as, steel structures, piping, erection, storage, painting and testing, indicating that the Site has enough process capability.
		7. Site facilities for storage and preservation for mechanical, electrical and electronics equipment, consumables and any other kind of material that requires specific preservation conditions such as temperature and humidity control, in accordance with Vendor requirement. Special materials like membranes for sulphate removal and carbon dioxide separation membranes shall be stored according to manufacturer’s instructions, with temperature and moisture controlled indoor facilities. Appropriate handling and store of filters shall be guaranteed. Special attention for lube oil filters and turbine intake air filters due to its large volume and weakness.
		8. Suitable and safe facilities for critical activities such as mechanical and chemical piping cleaning, x-ray inspection (if applicable), pressure testing, hydro blasting and painting.
		9. Means to segregate piping material (i.e. flange, nipples, weldolets, etc.) and welding consumables, that have similar visual aspect but different applications such as inconel, stainless steel and duplex family, to avoid misusage of non-compatible materials leading to unnecessary repair works.
		10. Transport and lifting strategy for heavy/special items, as Hull blocks, Equipment skids and Modules.
		11. The list of long lead delivery time Equipment or materials, which delay may impact the Project Schedule due to lack of correct construction sequence.
		12. All necessary documents evidencing that all Subcontracted shipyards or Sites are cleared for operation as per local authorities’ requirements.
	6. Seller shall make available for review of Buyer all contracts with third-party yards, including overseas. All contracts shall meet the requirements of local regulation. Documents shall be presented omitting prices.
	7. For piping and structure disciplines, Seller shall use, and make available for Buyer consultation, a computational tool that allows the team to control and register materials, welding, non-destructive tests and hydrostatic tests traceability. It is Seller's responsibility to compile all the data and information from different Subcontractors and compile it into a single and consolidated database.
	8. Seller shall update the execution plan and submit it to Buyer whenever any major modification either on construction strategies or yards/Sites facilities is applied.
	9. If Buyer finds any inconsistency in the presented execution plan, Buyer will inform Seller that shall correct the plan and resubmit it within a period to be agreed between the parties.

# PERSONNEL REQUIREMENTS

* 1. Seller shall ensure that all Subcontractors’ and Vendors’ employees are aware and follow its Health, Safety and Environmental System (HSE) and are trained and certified according to local authorities requirements (i.e. confined space, working at height, electrical activities, etc.).
	2. Seller shall officially designate the following coordinators at the beginning of the Agreement. They shall be responsible for temporary and definitive installations and for all activities related to these regulations as well as the Agreement requirements. They shall remain engaged throughout the whole timeframe of the Agreement and are responsible for these activities in all Seller Sites.
		1. 1 (one) NR-10 qualified professional;
		2. 1 (one) NR-13 qualified professional.
		3. 1 (one) NR-17 human factors/ergonomics qualified professional with 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) and in accordance with International Association of Oil & Gas Producers IOGP Report 454 - Human Factors Engineering in Projects.

# YARDS’S FACILITIES

* 1. Seller shall submit to Buyer, up to 120 (one hundred and twenty) days after Agreement Effective Date, or other date agreed with Buyer, the Subcontractor yards where the construction activities of Modules will take place, before starting these construction activities, as well as the shipyard to be contracted for the Hull construction (if applicable).
	2. 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.
	3. Seller shall submit to Buyer a recent bathymetric survey for each yard, in order to demonstrate that depths of the maneuvering, mooring and channel areas are compatible to the construction, inclining test and commissioning requirements.
	4. Pipe shop shall have segregated fabrication lines for each of the following pipe materials: carbon steel, stainless steel, duplex and super-duplex, copper-nickel alloy, fiber reinforced plastic, inconel, etc.
	5. Seller shall not use any Unit facilities, such as compressed air, electrical power, cranes, hoists, pumps, etc., for the execution of contracted scope onshore, unless agreed and authorized by Buyer. Seller shall mobilize its own or hired proper equipment/utilities before Unit commissioning.

# EXECUTION METHOD

* 1. **GENERAL EXECUTION METHOD**
		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 shall constantly review the methods being applied and propose new ones throughout the Unit construction, assembly and commissioning process, for example: lifts, elevated work platforms, cranes for small materials, Hull cutouts for access, automated welding processes, etc.
		2. Seller shall submit to Buyer, not later than120 (one hundred and twenty) days from Agreement Effective Date or other date agreed with Buyer, all procedures related to construction, such as, but not limited to, welding procedure specifications, inspection test plans, equipment run test procedures, surface preparation and painting procedure, etc.
		3. Seller shall present assessments related to critical path, controls (rundown curves, etc.), deadlines and allocated manpower, as well as interact with Buyer, including acquisition, construction, planning and “Quality Assurance” (QA)/“Quality Control” (QC), to smooth the Unit execution process and achievement of project Milestones.
		4. All stainless steel, duplex and super-duplex items, as tubing, tube, fittings and cable trays, shall be protected against construction activities contamination by applying a special preservation coating (i.e. varnish, etc.).
		5. External pickling and passivation of stainless-steel, duplex and super-duplex items (boxes, trays, tubing, piping, etc.) shall be performed close to the end of the construction activities at Integration Yard, before Sail Away.
		6. Direct contact is not allowed between carbon steel supports and any item/ pipe/ equipment of stainless alloy, copper-nickel or inconel. A wear pad/washer made of PTFE/bakelite shall be inserted between support and the item/pipe/equipment to avoid galvanic corrosion.
		7. Seller shall comply with all applicable requirements of brazilian regulations. Special attention is required for NR-10, NR-12, NR-13, NR-17 and NR-37.
		8. Seller shall prepare and submit to Buyer a plan with the construction activities, criteria and tests necessary to inspect and approve the Mechanical Completion for:
		+ the Hull, by areas, compartments and tanks;
		+ each Module, prior to placement on board;
		+ the integrated Unit;
		+ each system or subsystem before starting Pre-Commissioning and commissioning services.
		1. Seller and Buyer shall hold regular construction progress meetings at a location and timing to be mutually agreed. On such meetings shall be discussed all matters regarding the progress and execution of the Scope of Supply and Project Schedule.
		2. Seller shall control the activities and schedule of construction works through a computerized management system according to Exhibit XVI - Computational Tools and Integrated Management System.
		3. Seller shall implement 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 Exhibit XVI - Computational Tools and Integrated Management System.
		4. Quality reports as for Non-Destructive Testing (NDT), dimensional, material certificates and receiving inspection, shall be made available to Buyer no later than 4 (four) days after the conclusion of the correspondent activities (welding, assembly, material receiving, etc.).
		5. 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 Agreement if the Buyer and the Seller mutually agree that this will not directly interfere with the works of the Seller or its subcontractors. During the entire term of this Agreement, 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, always provided that these activities do not interfere with activities by Subcontractor. Such mobilizations and works will be subject to local and yards regulation and at Buyer's costs.
		6. Buyer shall take measures to avoid interference, damages or delay caused by such activities with those under Seller’s responsibility.
		7. The permission hereby granted shall not be an excuse for the Seller to justify breaking clauses or conditions of this Agreement, 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.
	2. **STRUCTURE**
		1. In case of Hull conversion, Seller shall clean and completely remove oil residues/films from all tanks, pipes and bilge wells from the ship, and obtain the “Free for Fire” certificate, through an authorized chemistry, before allowing any hot work on board.
		2. In case of Hull conversion, Seller shall submit to Buyer for comments the detailed plan for the structural repairs, meeting the criteria defined in the General Technical Description (GTD), including thickness measurement, close-up inspection, structural reassessment reports and definition of the scope of steel renewal and structural repairs (cracks, pitting, etc.).
		3. The Unit lightweight and center of gravity are to be determined before Sail Away to final location. An inclining test shall be carried out, as close as possible to unit completion, to determine accurately the lightweight and position of center of gravity. The inclining test procedure is to be submitted for Classification Society review prior to the test, which is to be witnessed by the class surveyor and Buyer Representative.
		4. After the inclining test, Seller shall prepare a report and submit to Classification Society for review and approval. Seller shall revise theoretical trim and stability curves and provide a revised Classification Society approved trim and stability booklet. Seller shall prepare a revised loading manual and update the loading computer software using this data with the appropriate Classification Society approvals until the Unit Substantial Completion.
		5. Seller shall carry out structural tests to verify the structural adequacy and tightness of tanks construction according to Classification Society requirements.
	3. **PIPING**
		1. Seller shall prepare and submit to Buyer 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). Any finding, such as scale, mug and oxides, shall be removed and the lines properly dried.
		2. Hydraulic piping systems and hydraulic tubing systems for mechanical equipment lubrication and/or hydraulic systems of gas air compressors, turbines, turbo generators, hydraulic valves, subsea systems, winches and pumps and others, shall be cleaning by flushing using appropriated meshes, oil and temporary fluids, as appropriated auxiliary equipment as and not limited to off-line pumps, filters, hoses, and vacuum dehydration system. Only trained personal shall be in charge to plan and perform those flushing activities. The flushing of hydraulic systems shall contemplate successive modulations of the valves so that their reservoirs are also effectively cleaned, avoiding possible contamination. Seller shall inform the specific cleanliness acceptance criteria as required by the equipment Vendor and / or applicable international standard. Storage tanks for these systems will only be filled-up after Operation Contract personnel / Vendor cleaning approval.
		3. Seller shall carry out and complete piping cleaning before closing the pipeline.
		4. Seller shall inform and agree with Buyer which lines will be internally inspected by means of borescope.
		5. Seller shall perform the proper parallelism, gap, clearance, alignment, etc. of all piping flange connections.
		6. Special care shall be taken when handling FRP piping and its accessories. 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.
		7. 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. All flanges, gaskets, bolts, nuts and other accessories for the implementation of this plan will be provided by Seller.
		8. Seller shall supply, install and remove all spectacle blinds and blind flanges required by the isolation plan.
		9. For automatic deluge piping systems installation, Seller shall issue an installation dimensional report containing 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 updated in accordance with the design specification and tests. Seller shall correct any difference between field results and design.
		10. Seller shall apply a specific procedure for 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. Each bolted flange shall be physically identified with the conditions of materials and tightness/torque, to control and avoid leaks after assembly. The flange management procedure shall be submitted to BUYER for review.
			1. The bolted joint management procedure shall comply with ASME PCC-1 – Guidelines for Pressure Boundary Bolted Flange Joint Assembly latest revision.
			2. SELLER shall include in the procedure at least the following content: qualification personnel involved in bolted joint assembly, classification of flanged joints, bolted joint assembly procedures, joint assembly records, definitions of bolted joint TAGs, implementation and features of bolted joint management system and method for preservation (see Appendix I – Requirements for Bolted Joints Assembly and Management as a good practice to the flange management procedure).
		11. 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.
		12. Accommodation HVAC condensate drain lines shall be installed with sufficient slope, especially if running to the fore, to deal with the Unit operation trim, and avoid water leak within the accommodation area due to condensate return.
		13. Seller shall supply to complete the commissioning for both onshore and offshore phase, as well as for starting up the systems, spare gaskets and joints for piping systems considering all types of joints specifications of the Unit and the different materials and pressure classes in enough quantity.
	4. **PRESSURE VESSEL AND STATIC EQUIPMENT**
		1. Seller shall strictly follow Vendor requirements for static equipment installation.
		2. Seller shall keep the equipment properly preserved and protected in order to avoid water, dirty or debris entrance.
		3. Seller shall plan carry out all at once the NR-13 and SPIE ("Serviço Próprio de Inspeção de Equipamentos" ) requirements as defined on this Exhibit.
		4. All pressure vessels by the definition on NR-13 shall have an initial safety inspection after their installation at the definitive location and prior to startup. A report of the initial safety inspection shall be issued and provided by Seller. Such report shall be signed by the NR-13 qualified professional.
	5. **MECHANICAL EQUIPMENT**
		1. Loose items belonging to mechanical equipment, as turbines and compressors, delivered and lifted separately, shall be assembled and aligned by Seller with Vendor representative’s approval.
		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 shall 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. Reports shall be issued and submitted to Buyer.
		5. Seller shall carry out the scope in compliance with NR-12 requirements.
		6. Seller shall check the alignment and leveling of all mechanical equipment (i.e. compressors, generators, turbines, winches, pumps and others) of the Unit during the Integration and commissioning phases. Any reading out of maker tolerance shall be corrected before starting-up of the equipment.
	6. **ELECTRICAL, INSTRUMENTATION, TELECOM AND AUTOMATION**
		1. Metallic structures, equipment, modules, cables and accessories shall be grounded properly, applying solutions based on engineering good practices according to the requirements of applicable standards, including the need for equipotential bonding.
		2. Gas sensors shall not be installed with height less than 2 meters from the reference deck to avoid the sensibilization by human presence.
		3. Instruments shall not be mounted with their electrical connections in upwards position.
		4. Orifice plates, both spare and the initial plates, shall not be assembled in line until the conclusion of pipe cleaning.
		5. Equipment/instruments for local reading shall be installed in an easily accessible location to allow proper reading and maintenance from the operator.
		6. During construction and commissioning phases, Seller shall take special care against dust, temperature, humidity and contamination in instrumentation, automation and electrical items.
		7. The tubing systems shall be installed by personnel who have been certified by fitting manufacturer approved product training program or equivalent industry training program including hands-on practice.
		8. Seller shall standardize, for the entire Unit, the manufacturer of the tubing fittings to avoid mixing components from different manufacturers during assembly phase. Deviation to this requirement shall be agreed with Buyer.
		9. Seller shall perform field inspection and issue a final report for all electrical equipment installed in hazardous areas in compliance with IEC 60079. All reports shall be individual by equipment.
		10. 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.
	7. **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 shall submit 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.
		3. 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.
		4. Special attention shall be made to welding processes and procedures, whenever possible, in order to anticipate the qualification, including all special steels to be used in the project, meeting the requirements of international technical standards and technical specifications, avoiding possible impact to the fabrication of structures and piping schedule.
	8. **ANTICORROSIVE PROTECTION**
		1. Seller shall submit to Buyer a painting plan describing the surface preparation and coating specification to reach the requirements for the Unit design life, considering a minimum of maintenance and repair, in accordance with the General Technical Description (GTD).
		2. In case of Hull conversion, Seller shall present the procedure, in accordance with the General Technical Description (GTD), for removing organic matter, such as films of oil and grease and soluble ionic materials, such as chlorides, ferrous salt and sulfates that remain on the tank substrate.
		3. All painting works shall be inspected by Seller’s quality control representative and paint manufacturer supervisor, hired by Seller. The inspectors shall have the right to reject any or all work, material, or equipment, which does not comply with Buyer/paint manufacturer technical specification, including safety aspects.
		4. Buyer, Seller and the paint manufacturer shall sign a corrosion protection performance warranty before Unit Substantial Completion, as defined by the Agreement.
		5. The draft warranty shall be issued by Seller (or paint manufacturer), discussed and agreed by the three parties Buyer, Seller and the paint manufacturer prior to commencement of works.
		6. Seller shall issue a coating maintenance plan with painting recommendations for future maintenance planning needs, in accordance with the coating warranty aiming to keep the integrity and maintain the overall appearance of the Unit. The maintenance plan shall consider predictive, preventive and corrective actions.
		7. Seller shall made available to Buyer all painting reports approved by paint manufacturer supervisor or qualified professional and Classification Society where applicable.
	9. **QUALITY**
		1. Seller shall consider the definitions and extension of traceability as applied to materials/disciplines, as presented in Exhibit VII – Directives for Quality Assurance System.
		2. Seller shall use laser scanning as means to identify and correct modelling deviations to guarantee the “as built” condition of the 3D model.
		3. 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 the coordinates (x, y & z) and the angle cone of vision for each sensor, as installed. Seller shall correct any difference between the design drawing data and the final location.
		4. Buyer, at its sole discretion, may define its participation on any inspection and/or test as witness. In case Buyer decides to be “Witness point” in any inspection or test, it shall inform Seller 24 hours in advance.
		5. When removing any temporary attachment welded to structure or pipe, the surface shall be grinded smooth and tested by NDT either dye penetrant or magnetic particle. Removal of temporary welded attachments by means of hammering is not allowed.
	10. **MANAGEMENT OF HULL’S BIOFOULING**
		1. The management of the Unit's Hull biofouling shall be carried out in accordance with the conditions described in the General Technical Description (GTD) and Exhibit I – Scope of Supply.
	11. **AUGMENTED INSPECTION**
		1. To allow remote inspections and remote technical assistance to be carried out, on constructions and manufacturers 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 remote inspection of Buyer’s team (one in Hull construction/conversion Site, one in main topside Modules construction Site, and two 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.
			4. Seller shall provide the license for the software that interfaces with the smart glass and make ten (10) of these licenses available to Buyer.
			5. Software should allow the remote specialist to be able to control the smart glasses camera, zooming, taking photos, starting recordings, etc.
			6. The smart glasses shall be safe to use in the field, in such a way that it does not compromise the workers’ movement, does not compromise the line of sight and does not impair their hearing capabilities. In addition, smart glasses shall be lightweight and operationally hands-free.
			7. The camera of the smart glasses shall have minimum of 12 MP.
		3. The 360º PICTURES
			1. Seller shall deliver 360° pictures after:

- The Mechanical Completion of each Topsides Modules;

- The Hull mega blocks erection completion or conversion completion;

- The Mechanical Completion of Hull;

- The Mechanical Completion of FPSO (before Sail Away).

* + - 1. Seller shall provide, whenever requested by Buyer, 360° photos of a particular area of its interest.
			2. The pictures shall be taken every two (2) months, covering all areas, and it shall be delivered together with a plan indicating the location from which photos were taken.
			3. The 360° pictures shall have at least 4K resolution
			4. Buyer will provide the license for a commercial software and Seller shall have to upload the 360° pictures and the respective floor plan document. The necessary settings such as making the indication of where photos were captured in the floor plan document and other necessary adjustments in the software are Seller’s responsibility.
		1. DRONE
			1. When necessary and if in line with local rules and regulations, to support some inspections, Buyer can request to Seller to provide drone inspection service.
			2. Inspection results shall be delivered to Buyer in digital media with all images and videos recorded during the inspection, since take-off until landing, or just certain parts highlighted by Buyer representative.
			3. Images shall be delivered to Buyer in \*.jpg extension file and shall have at least 12 MP resolution.
			4. Videos shall be delivered to Buyer in \*.mp4 extension file and shall have at least Full HD resolution (1080p).
	1. **THERMAL INSULATION AND PASSIVE FIRE PROTECTION**
		1. All materials applied to passive fire protection obligatorily shall be certified by manufacture with properly time resistance, according to the defined on “Fire Propagation and Smoke Dispersion Analysis”, “Explosion Analysis” and “Gas Dispersion Analysis”.
		2. 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.
		3. All surfaces, which are to be insulated, shall be cleaned free of all dirt and grease, etc., and shall be perfectly dry before application of the insulation.
		4. In no cases shall insulation be applied to pipe or equipment, which is primed only and does not have a full paint coat applied in accordance with the painting specification.
		5. Care shall be taken that insulation does not interfere with the operation or visibility of instruments such as gauge glasses, sight ports, level indicators etc., or the operation of mechanical or electrical equipment.
		6. All insulation junctions, seams, terminations, and penetrations shall be sealed with sealant to make them weatherproof and prevent the ingress of water.
		7. 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.
	2. **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 Agreement Effective Date as a reference to the rules.
		3. SPIE certification under NR13 regulation shall be mandatory during the Unit operation phase under Operation Contract. In order to support such certification, Seller shall carry-out all necessary tests and inspections gathering all necessary documents and reports during the construction phase to support Operation Contract Team on its SPIE certification.
		4. Seller shall issue and submit to Buyer the list of all piping, equipment and safety relief devices categorized as SPIE and NR13.
		5. NR13 and SPIE requirements also includes the safety devices calibration and the supply of car seals and warning plates for LO/LC valves.
		6. THICKNESS MEASUREMENT ON PIPING AND EQUIPMENT
			1. Seller shall carry-out, where required, the thickness measurement for all piping and equipment categorized as SPIE and NR13 during the Unit construction phase.
			2. For piping and equipment with thermal insulation or PFP, inspection windows shall be installed to allow the measurement of thickness during the Unit’s lifetime.
			3. Seller shall measure the piping thickness with piping at its final position on the Modules and Hull. As a reference, recent Petrobras Unit’s had about five thousand (5000) thickness measurement points.
		7. INITIAL SAFETY INSPECTION
			1. Seller is responsible for the initial safety inspection of all equipment and piping under NR-13 and SPIE control.
			2. Initial safety inspection of NR-13 equipment category I e II shall 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.
		8. Safety devices, manly pressure safety valves, connected to NR-13 equipment category I and II shall 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.
		9. NR-13 AND SPIE DOCUMENTATION
		10. The transferring to Buyer of all NR13 and SPIE data books shall be done in accordance with Exhibit VII (Directives for Quality Assurance System).
	3. **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 requirements, as well as the definitions in the General Technical Description.
		2. Seller shall issue an ergonomic evaluation report containing evidence of implementation of recommendations of the ergonomic work analysis. This ergonomic evaluation report shall have his final version issued at the end of construction phase.

# 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:
		1. 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)
	+ 1. Internal Audits/Inspections - Buyer will schedule the following internal audits and pre-check for external audits, prior to Sail Away:
* Brazilian regulations inspection (NR-10, NR-12, NR-13, NR-17 and NR-37;
* Health requirements inspection;
* Pre-check on ANVISA inspection;
* Pre-Inspection metering system requirements;
* Pre-check inspection for IBAMA requirements;
* PAG SMS audit (prior to ANP official audit);
* Buyer logistics (SCA) helideck audit ~~(~~verification in order to release helideck for Buyer helicopters operations);
* Buyer (LOEP) audit (verification of bunkering stations, fenders and cranes check in order to release Buyer supply boats operations);
* Meteocean inspection;
* Telecom inspection;
* MODA flexible riser monitoring system;
* Riser Hybrid Monitoring System (RHMS) rigid riser monitoring system - verification on the RHMS cabinets infrastructure, including power and communication cables, from E-house to wet mate connectors;
* Positioning System (POS) - verification on the infrastructure if system is fully functional to enable FPSO Handover to Buyer positioning boats prior to offshore mooring hook-up operation;
* Laboratory facilties inspection - verification on the infrastructure, equipment, etc;
* Subsea Production Control System (SPCS) - verification of the subsea SPCS cabinets infrastructure, including power and communication cables and all other information needed;
* Cybersecurity requirements implementation according to ISA/IEC 62443.
	1. Dates shall be agreed by both parties for each audit or inspection carried-out, intended to be performed at shipyard. All recommendation/ outstanding points raised at Buyer inspections will be categorized as critical (Note1) or non-critical.

Note 1 - Critical outstanding item is any condition, under Buyer sole discretion, that may impose a risk for sail away, mooring and pull-in hook-up operations, First Oil Start-up, Gas Injection, Flare-out and Reservoir Water Injection..

* 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.

# CONSTRUCTION AND ASSEMBLY DATA-BOOKS

* 1. Seller shall issue construction data books according to Exhibit VIl (Directives for Quality Assurance System).

# COATING WARRANTY

* 1. **OBJECTIVE**
		1. The aim of this item is to establish the minimum requirements to be followed by SELLER regarding the provision of the COATING WARRANTY for the UNIT. The coating systems shall have a durability (as per ISO 12944-1 definition) of 25 years with minimum maintenance repair, during the UNIT lifetime.
		2. Coating system shall be suitable for the specified uses and the applicable environmental corrosivity.
		3. The methodology of coating system qualification based on performance requirements shall be issued for BUYER approval. This methodology shall consider the requirements of IOGP S-715.
		4. The COATING WARRANTY shall cover a period as state at Table 01.

Table 01 – Warranty Period

|  |  |
| --- | --- |
| **Area or coating type** | **Warranty period (years)** |
| Atmospheric exposure (main deck, topside, weatherdecks, etc) | 5 |
| Internal coating (tanks, compartments, etc), external hull, multi-polymeric matrix coating, Thermal Spray Aluminum | 10 |
| Passive fire protection / Cryogenic passive protection | 10 |

\*Period begins immediately after "Substantial Completion" milestone.

* + 1. This document presents the criteria to cover the UNIT as a whole and shall be applied on coating warranty during construction and operation phase.
	1. **GENERAL REQUIREMENTS**
		1. The COATING WARRANTY shall cover the entire scope of coating of SELLER, including vendor equipment supplied by SELLER.
		2. NA
		3. SELLER shall be liable for:
			1. Repairs, replacement and full re-coating of areas of coating failures / defects that reach the acceptance limits criteria as per item 8.5.
			2. Reimbursement of all repair costs of coating failures/defects that reach the acceptance limits criteria as per item 8.5 (Paint Failure).
		4. The Maximum Liability for all approved repairs carried out during the Coating Warranty period shall not exceed two (2) times the total invoice value of all Paint Materials supplied.
		5. SELLER’s warranty shall cover the entire coating process against any form of faulty craftsmanship.
		6. SELLER shall repair any coating failure due to faulty craftsmanship (eg. improper surface preparation, low dry film thickness, lack of stripe coat, etc.) identified on Final Coating Survey, as per item 8.6.
		7. The SELLER shall guarantee that paint supply is out of any faulty or errors in recommendation of the application. The paint manufacturer shall guarantee that the products supplied are suitable for the intended uses and are fully compliant with the product’s technical specifications.
		8. The SELLER shall warrant that the Coating System proposed by them meets or exceed the contractual requirements.
		9. The warranty terms and conditions shall be commonly agreed between BUYER and SELLER and by the PAINT MANUFACTURER. Excluded areas shall be mutually agreed and clearly recorded.
		10. Each equipment, tank, structure (as riser balcony, mooring balcony, etc.) or pipeline system shall be considered as one for evaluating the coating failures.
		11. The COATING WARRANTY shall define at least the items below:
1. Areas to be covered by COATING WARRANTY and Exceptions
2. Warranty start date
3. Cost of casual repair (m2) considering at least material and manpower
4. Evaluation criteria for coated surfaces with flaw
5. Definition of the reference areas in accordance with ISO 12944 Parts 7 and 8.
6. Coating System specifications
7. Coating Maintenance Plan
8. Warranty period
9. Rights and Responsibilities
10. Other relevant aspects related to COATING WARRANTY but not listed above
	* 1. Reference areas shall be used to establish the minimum acceptance standard. Besides being monitored in periodic inspections, it will not be used as area failure criteria for warranty purpose, in this case each individual system / area / compartment / etc. will be considered.
	1. **RIGHTS AND RESPONSIBILITIES**
		1. Every failure in the coating system must be repaired timely.
		2. When repairs are made by SELLER, he will supply labor, materials and equipment to reapply the coating system in the same manner specified in the contract or according with the maintenance plan.
		3. Any emergency repair during Operation Contract, Operation Contract Team shall document the condition of the paint systems.
		4. During Operation contract, Operation Contract Team shall be responsible to provide written reports to BUYER and PAINT MANUFACTURER of conditions related to warranty performance criteria.
		5. After termination of Operation Contract and taking delivery of the UNIT, BUYER will be responsible for monitoring the paint systems repairs during the warranty period and will provide written reports to the SELLER of conditions related to warranty performance criteria.
		6. BUYER will be responsible to notify the SELLER by written form of any necessary warranty work, after termination of Operation Contract and taking delivery of the UNIT.
		7. BUYER reserves the right to approve the date(s), materials and methods requested by the SELLER to perform warranty work if any change from maintenance plan occur.
		8. BUYER has the right to require the SELLER to make immediate emergency repairs to prevent unsafe conditions. If the SELLER fails to complete repairs, the BUYER reserves the right to complete the repairs. This does not relieve the SELLER from meeting the warranty requirements.
		9. BUYER shall document the condition of the paint systems prior to any emergency repair.
		10. BUYER will be responsible to provide scaffolding, rope access, facilities and transportation of the repair materials to the UNIT subject to coating repair, after termination of Operation Contract and taking delivery of the UNIT.
		11. After termination of Operation Contract and taking delivery of the UNIT, BUYER shall be responsible for issuing periodic paiting inspection reports (minimum one every eighteen (18) months) during the warranty period for atmospheric exposed areas (main deck, topside, weather decks, etc, except external hull).
		12. For all structural tanks (such as, cargo oil, ballast tanks, etc), compartments (such as void spaces, and cofferdams, etc) and for external hull, coating inspection shall follow Classification Society approved inspection plan.
	2. **EXCLUSIONS**
		1. Damage of fortuitous or accidental nature, such as substrate deformations, impacts, friction, leaks, run-outs, abnormal temperature rises, etc. are excluded from the Warranty coverage after acceptance termination of Operation Contract of the UNIT by BUYER.
		2. Changes in the intended use of the work, or the modification of the design parameters used as a basis for job approval, for example, operation with other fluids than the ones specified in the design are excluded from the Warranty coverage after termination of Operation Contract of UNIT by BUYER.
	3. **PAINT FAILURE**
		1. Unless otherwise stated by the CONTRACT between BUYER and SELLER, coating system failure means: Rusting, according to ISO 4628-3; Blistering, according to ISO 4628-2, (refer to Table 02); Cracking, according to ISO 4628-4, depending on the defect types b and c; Flaking, according to ISO 4628-5, depending on the defect types a and b; Wearing, loss of dry film thickness due to erosion or chalking.

Table 02

|  |  |  |  |
| --- | --- | --- | --- |
| **Coating type or area** | **Time (months)** | **Failure criteria** | **Maximum failure per area¹** |
| **ISO 4628-3rusting** | **ISO 4628-2blistering** | **ISO 4628-4 craking** | **ISO 4628-5flaking** | **Wearingloss of thickness** |
| Topside | 0-60 | Ri1 | 1(S2) | 1(S2)b | 1(S2)a | 10% | 3% |
| Tanks, hull bwl, bootop | 0-60 | Ri1 | 1(S2) | 1(S2)b | 1(S2)a | 10% | 1% |
| 61-120 | Ri2 | 2(s2) | 1(S3)b | 1(S2)a | 10% | 3% |
| Tsa | 0-120 | Ri1 | 0 | 0 | 0 | 0 | 3% |
| Cui coating | 0-120 | Ri1 | 0 | 1(S2) | 1(S2)a | 10% | 3% |
| Note 1: Maximum failure per area: percentage of the considered area (as per area division agreed on maintenance plan) over which the warranty repairs shall be claimed. |

* 1. **FINAL COATING SURVEY**
		1. The objective of the final coating survey is to evaluate the coating condition and coating integrity of all areas of the UNIT.
		2. The final coating survey shall be held between BUYER, SELLER and COATING MANUFACTURER before Substantial Completion to issue a report on painting conditions, and to elaborate a repair/corrective be issued by SELLER.
		3. The final coating survey shall evaluate the existing condition of all items using the following ISO 4628 2 to parts 5.
		4. The Final Coating Survey shall also report an assessment of:
1. Surface contamination – grinding particle impregnation to a coating system,
2. Mechanical / fabrication damage to the coating system but where bare metal is NOT exposed.
3. Sections where the specified coating system is incomplete.
4. Surfaces where the coating system has been damaged and “Bare Metal is visible and exposed atmospheric contamination and deterioration.
5. Areas where modifications have been carried out after initial coating system has been applied and the additional steel has not received any surface preparation and mill scale is present on the substrate.
6. Areas that have been finish painted, and damaged during construction stage (Burn Damage, scratch, welding etc.)
7. Faulty craftsmanship (e.g., improper surface preparation, low dry film thickness, lack of stripe coat, etc.
	* 1. The Final Coating Survey shall be formally reported, presenting at least, the area division, the inspection.
	1. **MAINTENANCE PLAN**
		1. In order to comply with the COATING WARRANTY, a maintenance plan shall be issued by SELLER and approved by BUYER. This plan is intended to develop painting recommendations for future maintenance needs, in accordance with the Coating Warranty Document and aims to prevent the spread of corrosion and maintain the overall appearance of the UNIT. the maintenance plan shall consider predictive, preventive, and corrective actions.
		2. the maintenance plan shall cover onboard repair methods, such as surface preparation and material specification, and also shall serve as a manual for preventive practices to avoid premature failure and treat weaknesses identified during construction stage.
		3. the maintenance plan shall be elaborated by a painting inspector qualified, at least, by NACE International Coating Inspector Training and Certificate Program, level 3 or equivalent qualification by FROSIO or by ABRACO.
		4. The SELLER shall establish a maintenance plan methodology, where the coating condition (painting failure percentage) of each component or area (as per Item 8.2.10) is weighted on its critical or priority level, defined together with BUYER. The prioritization for the maintenance plan shall be based on the analysis of the coating condition and critical level combination scenario.
		5. The SELLER shall establish together with BUYER a methodology to divide the plan into blocks or areas and where a block or area is scheduled for painting the entire block or area shall be repainted except for any items that may have been specifically excluded. The Plan Methodology shall be established at the beginning of contract.
		6. The maintenance plan shall be composed by at least the following:
			1. The coating survey report, including an Inspection summary that allows the traceability of reports, areas and equipment evaluated, inspection results, coating condition classifications and maintenance priority;
			2. The items (areas or components) shall be listed. For each item the following minimum data shall be provided: substrate type, surface area, coating type, deterioration (ISO 4628), service environment, temperature, accessibility and coating thickness and strategy recommendation (touchup, remove/replace or do nothing);
			3. A pluriannual painting maintenance schedule recommendation, established in accordance with the maintenance plan methodology previously approved.
			4. Set of specifications and procedures for the maintenance of paint / coatings, including: Paint materials that shall be used during the maintenance, Surface preparation and environmental controls, Labor materials and equipment to be used on coating system and maintenance coating systems specifications.
			5. Based on data above, a minimum five-year plan must identify the surfaces to be painted each year, give the cost estimated for conducting the work, provide comprehensive specification for surface preparation and coating preparation.
	2. **WARRANTY CERTIFICATE**
		1. In accordance with item 8 a Coating Warranty shall be issued for the entire scope of SELLER.