PETROBRAS	TECHNICAL SPECIFICATION	Nº:	I-ET-0000.00-0000-140-P56-001
	CLIENT: E&P	SHEET:	1 of 38
	JOB: GENERAL	CC:	
	AREA: GENERAL	PROJECT:	
DP&T	TITLE: CONICAL RECEPTACLE SPECIFICATION	NP-1	SUB / ES

INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL
A	Revised where highlighted.

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	06/07/2020	11/03/2021							
PROJECT	SUB/ES	SUB/ES							
EXECUTION	QM63	QM63							
CHECK	TS8H	TS8H							
APPROVAL	BERL	BERL							

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1 INTRODUCTION

1.1 PURPOSE OF DOCUMENT

This specification captures the minimum functional and technical requirements for the design, fabrication, assembly, inspection, and testing of Conical Receptacles (open porch Receptacles) for the structural connection (hang-off) of Rigid Risers to a Floating Production Unit (FPU).

This document is applicable to Semi-sub, SPM FPSO, FLNG, Spar and TLP Production Systems.

1.2 SYSTEM DESCRIPTION

The Receptacle to be supplied by SUPPLIER will consist of the slotted Conical Receptacle in which the Flexible joint or TSJ with adapter bushing will be installed.

The typical configurarion of the assembly of the conical receptacle onto hull structure is illustrated in Figure 1. This approach allows the SUPPLIER to construct and inspect the weldment tolerances, and the hull contractor to weld the box structure to the hull porch.

Also shown in this figure side holes for welding access.

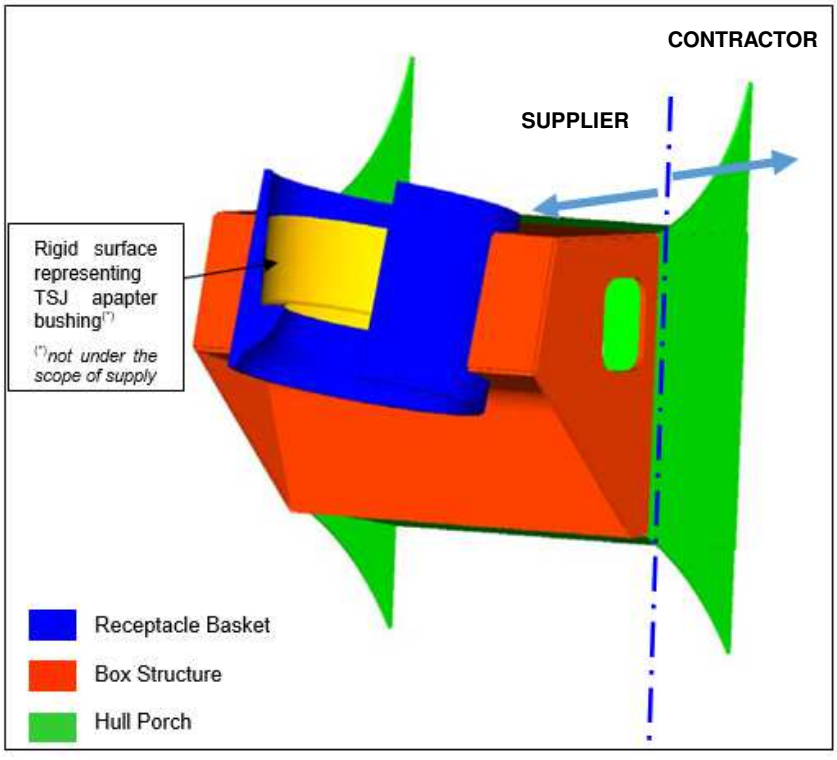

Figure 1 – Typical Conical Receptacle System - Structural Parts.

Other typical features required for the receptacle assembly, an upper guide funnel, front bumper pipes (neoprene coated guide bars) and handling padeyes, are shown in Figure 2.

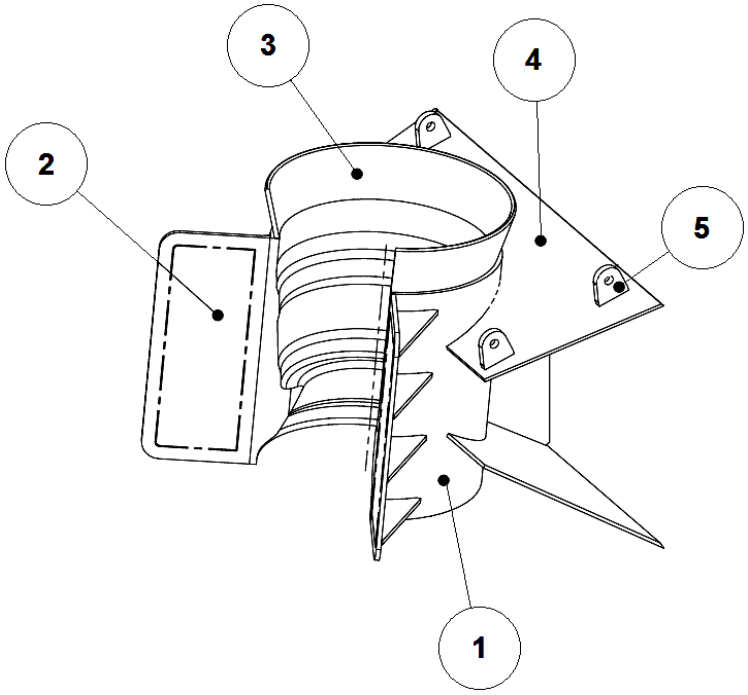

Figure 2 – Typical Conical Receptacle Set:
①Receptacle Basket, ②Guide Plate or Bar, ③Guide Funnel, ④Box Structure (steel plates), and ⑤Lifting eyes/ Installation Auxiliary Lugs.

It is worth noting that steel grab handles for ROV (see ref. [24]) may be required around the basket (welded as appropriate) in order to reduce diving operations related to maintenance (see sec. 8.5).

2 DEFINITIONS

For the purpose of this Specification the following definitions shall apply.

2.1 ORGANIZATIONS

PETROBRAS	PETRÓLEO BRASILEIRO S.A. – PETROBRAS
SUPPLIER	The Manufacturer, or Vendor, that constructs the Conical Receptacles and accessories for the Project, under a Purchase Order through FPU Hull Contract.
SUB–SUPPLIERS	The Party supplying materials or services to the Receptacle SUPPLIER.
CONTRACTOR	The Main Contractor in charge of detailed engineering, supply and construction phase of the FPU Hull.
PARTIES	The companies directly involved in the Receptacle design and fabrication, with power to propose modification over design and manufacturing aspects. By definition they are: PETROBRAS, CONTRACTOR and SUPPLIER.

2.2 GENERAL DEFINITIONS

May	Is used where alternatives are equally acceptable.
Shall	Indicates a mandatory requirement.
Should	Indicates a recommendation. Alternative solutions having the same functionality and quality are acceptable.
Work	All work to be performed by the SUPPLIER under the Purchase Order, including all duties and obligations undertaken by the SUPPLIER.

2.3 TECHNICAL DEFINITIONS

Adapter Bushing	Forged ring with tapered ID for mating with a Tapered Stress Joint (TSJ).
(Receptacle) Basket	Conical casting or forging that docks the Rigid Riser Flexible Joint (FXJ), or the TSJ w/ adapter bushing.
(Receptacle) Box Structure	Weldment structure that supports the appropriate Receptacle Basket, manufactured to be welded to hull porch structure at location with specific azimuth and hang off angles.
(Conical) Receptacle	Integrated structure comprising the appropriate Receptacle Basket assembled on its Box Structure at specific azimuth and hang-off angles, to be welded to the corresponding location on hull porch.
CS Rules	Classification Society Rules.
(Material) Requisition	A formal written request for supply of equipment or materials.
Mockup	Dummy insert that sets in basket or adapter bushing and replicates azimuth, departure angle, and top flange position of the FXJ or TSJ.
Project	Scope of activities performed by the PARTIES to design and construct the FPU.
Riser Top Joint	Refers to the two kinds of devices which may be used at the top end of the rigid riser, to enable its interfacing with the FPU hull and piping: the Flexible Joint and the Tapered Stress Joint.

2.4 ABBREVIATIONS

ABS	American Bureau of Shipping
AISC	American Institute of Steel Construction
ALS	Accidental Limit State
API	American Petroleum Institute
ASCII	American Standard Code for Information Interchange
ASME	American Society of Mechanical engineers
ASTM	American Society for Testing and Materials
AUT	Automatic Ultrasonic Test
AWS	American Welding Society
CJP	Complete Joint Penetration
CoG	Centre of Gravity
CTOD	Crack Tip Opening Displacement Test
CVN	Charpy V–Notch
DBM	Design Basis and Methodology
DC	Direct Current
DNV	Det Norske Veritas
DPI	Dye Penetrant Inspection
EDM	Electrical Discharge Machine
FAT	Factory Acceptance Test
FE	Finite Element
FEA	Finite Elements Analysis
FPSO	Floating Production, Storage and Offloading
FPU	Floating Production Unit. In general meaning herein this specification, it is understood as the larger structure where the hang–off system in attached.
FXJ	Flexible joint
GA	General Assembly (Drawing)
HAZ	Heat–Affected Zone
HIC	Hydrogen Induced Crack
ITP	Inspection and Test Plan
LC(s)	Load Case(s)
MPS	Manufacturing Procedure Specification
MT	Magnetic Particle Testing
MTR	Material Test Report
NCR	Nonconformity Report
NDT(NDE)	Non-destructive Testing (Non-destructive Examination)

OD	Outer Diameter
P/N	Part Number
PEP	Project Execution Plan
PQR	Welding Procedure Qualification Records
PWHT	Post Weld Heat Treatment
QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
QHSE	Quality Health, Safety and Environment
QMS	Quality Management System
QTS	Qualification Test Sample
Ra	Arithmetic Average Value of a Filtered Surface Roughness Profile
ROV	Remotely Operated Vehicle for Underwater Activities
RP	Recommended Practice
Rt	Maximum Height of the Roughness Profile (Range)
SCF	Stress Concentration Factor
SCR	Steel Catenary Riser
SEI	Syndicat de l'Emballage Industriel (Industrial Packaging Union)
SI	Système International (International System of Units)
S/N	Serial Number
SLWR	Steel Lazy Wave Riser
SPM	Spread-moored
Std	Standard Deviation
TLP	Tension Leg Platform
TSA	Thermal Sprayed Aluminum
TSJ	Tapered Stress Joint
ULS	Ultimate Limit State
UT	Ultrasonic testing
UV	Ultraviolet Ray
WPQ	Welder Performance Qualification.
WPQT	Welding Procedure Qualification Test
WPS	WPS Welding Procedure Specification
WT	Wall Thickness

3 REFERENCES

All equipment supplied under the scope of this specification shall be designed and manufactured in conformance to the latest editions of the rules, codes, standards, and PETROBRAS' documents listed herein, as well as Flag Administration and Brazilian Statutory Administration regulations The list is not exhaustive and the responsibility of obtaining and utilising the correct codes, standards, and recommended practices lies with CONTRACTOR and SUPPLIER.

Within this list, the following order of precedence should apply:

- Project Specifications
- Other PETROBRAS Technical Documents
- Industry Standards

3.1 PROJECT SPECIFICATIONS

Ref. n°	Document number	Title
[1]	--- (1)	Project Technical Specification for Hull Structural Requirements
[2]	--- (1) (2)	Project Material Requisition / Data Basis
[3]	--- (1) (2)	Project Coating Assessment Specification

(1) Project reference number to be informed within a Project Document List, to be released during BID phase.

(2) These Project documents or equivalent are under CONTRACTOR´S responsibility.

3.2 RULES

Ref. n°	Document number	Title
[4]	--- (2)(3)	CS Rules(3)

(2) Classification Society selected by CONTRACTOR.

(3) Related to Hull Design.

3.3 CODES AND STANDARDS

3.3.1 DNV

Ref. n°	Document number	Title
[5]	DNVGL–OS–C401	Fabrication and Testing of Offshore Structures
[6]	DNVGL-RP-B401	Cathodic Protection Design

3.3.2 API

Ref. n°	Document number	Title
[7]	API RP 2X	Recommended Practice for Ultrasonic and Magnetic Examination of Offshore Structural Fabrication and Guidelines for Qualification of Ultrasonic Technicians
[8]	API RP 2RD	Design of Risers for Floating Production Systems (FPSs) and Tension-Leg Platforms (TLPs)
[9]	API RP 2A-WSD	Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design
[10]	API SPEC 6A	Specification for Wellhead and Christmas Tree Equipment

3.3.3 ASME

Ref. n°	Document number	Title
[11]	ASME Section VIII, Division 1	ASME Boiler & Pressure Vessel Code
[12]	ASME Section VIII, Division 2	ASME Boiler & Pressure Vessel Code

3.3.4 ASTM

Ref. n°	Document number	Title
[13]	ASTM A388M	Standard Practice for Ultrasonic Examination of Steel Forgings
[14]	ASTM A703M	Standard Specification for Steel Castings, General Requirements, for Pressure-Containing Parts
[15]	ASTM A707M	Standard Specification for Forged Carbon and Alloy Steel Flanges for Low-Temperature Service
[16]	ASTM A788	Standard Specification for Steel Forgings, General
[17]	ASTM E1290	Standard Test Method for Crack Tip Opening Displacement (CTOD) Fracture Toughness Measurement
[18]	ASTM E709	Standard Guide for Magnetic Particle Testing
[19]	ASTM B499	Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
[20]	ASTM E797	Standard Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method

3.3.5 AWS

Ref. n°	Document number	Title
[21]	A4.3	Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding
[22]	D1.1/D1.1M	Structural Welding Code - Steel

3.3.6 ISO

Ref. n°	Document number	Title
[23]	ISO 13628-7	Design and Operation of Subsea Production Systems – Completion / workover riser systems
[24]	ISO 13628-8	Petroleum and natural gas industries - Design and operation of subsea production systems – Part 8: Remotely Operated Vehicle (ROV) interfaces on subsea production systems

3.3.7 NORSOK

Ref. n°	Document number	Title
[25]	NORSOK N-004	Design of Steel Structures

3.4 PETROBRAS TECHNICAL DOCUMENTS

3.4.1 GENERAL SPECIFICATIONS

Ref. n°	Document number	Title
[26]	I-ET-0000.00-0000-970-PSQ-001	Procedure and Personnel Qualification and Certification
[27]	I-ET-3010.00-1200-956-P4X-003	Thermal Spray Coating Application of Aluminium
[28]	I-ET-3010.00-1200-956-P4X-002	General Painting
[29]	I-ET-3010.00-5267-750-P4X-001	Cathodic Protection
[30]	I-ET-3010.00-5267-750-P4X-002	Galvanic Anodes

3.4.2 STANDARD DRAWINGS FOR COMPONENTS AND ACCESSORIES

[31]	I-DE-0000.00-0000-140-P9U-001(3)	Conical Receptacle "Type A"– Basket Profile Dimensions
[32]	I-DE-0000.00-0000-140-P9U-002(3)	Conical Receptacle "Type B"– Basket Profile Dimensions
[33]	I-DE-0000.00-0000-140-P9U-003(3)	Conical Receptacle "Type C"– Basket Profile Dimensions
[34]	I-DE-0000.00-0000-140-P56-001	Riser Top Connector Mock–up Geometry Reference

(3) Project selected Receptacle type(s) to be informed during BID phase.

4 SCOPE OF WORK

The SUPPLIER'S scope of work shall include, but not necessarily be limited to Conical Receptacles comprising of the following:

- Detail design of the Basket, Box Structure (including the interface with hull structure) and Mockup.
- Material requirements
- Welding and testing requirements (inclusive of welding procedure, procedure qualifications, and welding consumables)
- Tolerances and dimensional control
- Required NDE
- Structural and fatigue analysis of the receptacle
- Protective coatings
- Documentation.

5 SCOPE OF SUPPLY

This specification has to be considered in conjunction with other contract documents describing the FPSO hull, interfacing equipment or more details regarding riser balcony structures and facilities. These documents will give input to this specification with regard to scope of supply, hull related structures, construction requirements etc.

Table 5.1 describes the scope breakdown for the Conical Receptacle assembly and mockup tool.

Table 5.1 – Scope Breakdown

Material Description	Application
Conical Receptacle	Permanent Equipment
Receptacle Basket	Permanent Equipment
Box Structure	Permanent Equipment
Guide Plates/ Bars (neoprene coated)	Permanent Equipment
Upper Guide Funnel	Permanent Equipment
Lifting eyes/ Installation Auxiliary Lugs	Permanent Equipment
Mockup for Fit-up test on Receptacle, and FPU spool adjustment (NOTE 1)	Construction Accessories

NOTE 1: The Mockup to be used by CONTRACTOR for Fit-up tests on the yard shall be provided with a blind flange with the same specification as the Riser top interface flange (including N_2 test port if specified), able to whitstand a leak test for the topside hard pipe, with the same pressure of the riser hydrostatic test.

6 CONFLICT OF INFORMATION AND DOCUMENT APPROVAL

In the event of any conflict between this specification or any other specifications and associated Requisitions, or with any of the applicable codes and regulations arise, written clarification shall be sought from PETROBRAS before proceeding with the Work. SUPPLIER shall provide PETROBRAS with a written request of clarification. PETROBRAS' decision shall be final regarding interpretation of requirements.

All deviations to this specification and other referenced specifications or attachments listed in this specification shall be made in writing and shall require written approval by PETROBRAS prior to the execution of the work.

7 GENERAL REQUIREMENTS

7.1 MATERIAL SELECTION

All equipment and material manufactured and/or supplied under this Specification shall be new, of proven design, and in accordance with sound engineering fabrication and manufacturing practice. It is preferred to use existing designs or modifications that have already been qualified and accepted.

SUPPLIER shall be responsible for the selection of the materials. All materials shall be suitable for the intended service, described within Project documentation. The selected materials shall be in accordance with the relevant applicable codes, standards and specifications and be able to meet the requirements defined for the Project.

The origin of all materials used in the manufacture shall be clearly identified. SUPPLIER shall submit any required material manufacturing process details, tests, examinations, inspections, and acceptance criteria for review by PETROBRAS.

The selection of the materials is a responsibility of SUPPLIER and shall be made in accordance with the:

- Relevant codes listed in this document and related Project specifications;
- Results of both the structural and the fatigue analysis;
- Maintenance-free requirement during the required service life, as per Project Specifications;

7.2 SUPPLIER'S RESPONSIBILITY

SUPPLIER shall furnish all labor, consumables, tools, equipment and materials other than those explicitly identified as supplied by PETROBRAS required to manufacture, test and deliver. SUPPLIER shall perform all operations required for design, manufacture, inspection, testing and handling.

Nothing contained in this specification or omitted from it shall be construed as relieving the SUPPLIER of the obligation to supply the Conical Receptacles in accordance with the requirements outlined herein and in the Project documentation, said to be capable of functioning properly in a riser system for the entire design period specified by PETROBRAS for the Project, without need for replacement of any of its parts.

SUPPLIER shall develop a written Manufacturing Plan/Procedure, including a Quality Control/ Quality Assurance Plan (QAP), which shall be submitted to PETROBRAS for review prior to commencement of material procurement and manufacturing.

A pre-production meeting shall be held between PARTIES representatives, plus any third party inspection personnel involved. The purpose of the meeting is to ensure that all parties involved fully understand job requirements and resolve any outstanding issues prior to the beginning of the manufacturing.

PETROBRAS furnished Drawings and Specifications shall be checked by SUPPLIER immediately upon receipt, and SUPPLIER shall promptly notify PETROBRAS of any discrepancies therein.

For any requirement in question by SUPPLIER, it shall be SUPPLIER's responsibility to:

Obtain clarification from PETROBRAS, which shall be final and binding;

Review and resolve conflicts with PETROBRAS prior to initiation or continuation of Work.

SUPPLIER shall allow PETROBRAS and third party representatives, under SUPPLIER premises, reasonable access to all areas concerned with design, manufacture, inspection and testing during all times while Work is being performed for the Project.

SUPPLIER shall provide all reasonable facilities to PETROBRAS' inspectors, without extra charge, to satisfy the inspector that product is being manufactured in accordance with PETROBRAS's specifications. Such facilities shall include, but not limited to, office equipment and telecommunication equipment. All inspection shall be made at the place of manufacture prior to shipment. If any inspection or testing reveals details not in accordance with PETROBRAS' Specification, then SUPPLIER may demonstrate to PETROBRAS that the product still satisfies the design requirement. If SUPPLIER is unable to demonstrate this to PETROBRAS' satisfaction, then the manufacturing and/or testing procedure shall be repeated until compliance is demonstrated. All such remedial work shall be performed at SUPPLIER's cost.

- Equipment used for the manufacture shall be of proven design and in good operating condition.
- Methods employed shall be in accordance with prudent engineering, fabrication and construction practice.

All costs including taxes are to the SUPPLIER account in undertaking the responsibilities.

Deviations from this Specification are not permitted. All proposed changes or modifications to this Specification shall be submitted in writing for PETROBRAS approval. Approved changes shall be incorporated into a revised, approved Project (purchase) specification. Disclaimers are not permitted.

7.3 UNITS OF MEASUREMENT

All data shall be reported in primarily SI units. Customary US units may also be reported for reference only.

8 FUNCTIONAL REQUIREMENTS

8.1 RULES AND REGULATIONS

Generally Class approval is not required for the Receptacles, but may change due to specific Project requirements. In that case, this will be identified in BID documents.

The steel used for welding to the riser porch or hull structure shall comply with class requirements. (see ref. [1])

Fabricated plate structures shall be verified using yielding, fatigue, and buckling criteria according to CS Rules.

8.2 HEALTH, SAFETY AND ENVIRONMENT

The Receptacle shall be fitted with welded on lifting lugs for handling during shipping and for positioning the SCR receptacle on the hull porch for welding to the hull.

The design and fabrication of the Receptacles shall provide a robust structure equivalent to hull porch that in no case can result in a riser dropping to the sea floor.

8.3 PERFORMANCE

The Receptacles shall be designed to fit the riser sizes defined in Project documentation.

The required azimuth angles shall be defined on drawings.

The Receptacles shall be inspected and verified to be within +/- 1 degree of the target angles. The inspection method will typically utilize coordinate measuring machine (CMM) technology and the procedure shall be submitted for review and approval.

8.4 CONSTRUCTION, COMMISSIONING AND INSTALLATION

The Receptacles are welded to the hull porch structure. At least one mockup for each riser size is to be provided that simulates the height and flange configuration the Riser Top Joint. The mockup also provides for verification of the final azimuth angle and departure angle provided by the receptacle in an unloaded condition.

The mockups are also used to perform piping fit up for construction of the jumper piping from the hull piping to the Receptacles. This jumper is typically connected by diver after riser installation and shall incorporate suitable subsea swivel flanges for both ends.

Project mockup tool drawings shall be in accordance with PETROBRAS document ref. [34] and shall be detailed by CONTRACTOR or SUPPLIER.

Project schedule for hull fabrication needs to take into consideration the hull fabrication sequence to make sure the mockups are available when needed by the construction yard.

8.5 OPERATION AND MAINTENANCE

The Receptacles are intended to be designed and manufactured for full project life. The only maintenance required is cleaning of the box structure to hull porch for the verification of cathodic protection potentials.

The Receptacles allocated for future risers will require cleaning prior to riser installation. Hull piping will also have to be fit up using the appropriate mockup tool.

9 SYSTEM DESIGN GUIDELINES

9.1 MECHANICAL

The intent is to have all Conical Receptacles similar minimizing differences between the different locations. Each assembly however, requires a specific azimuth and departure angle. Receptacles may be different sizes depending on the riser sizes intended, however the number of different sizes should be minimized, typically one (1) or two (2).

The Basket/Receptacle shall be welded with full penetration welds to the Box/Porch Structures. The box (receptacle side) and porch (hull side) structures are constructed from Z direction quality material where loaded through thickness. SUPPLIER and CONTRACTOR shall specify the weld dimensions and profile requirements to suit their design and analysis of the complete structure.

The Receptacle shall be complete with lifting points for positioning and welding to the hull. Weld preps in general shall be biased to the inside of the porch structure in consideration to provide the best wind protection for the largest portion of the weld.

The Receptacle shall be designed to minimize the shipping costs. If necessary the design may incorporate plates or components to be welded in by the CONTRACTOR.

9.2 MATERIALS

9.2.1 Castings

CONTRACTOR/SUPPLIER shall specify the material requirements for the basket. The casting requirements shall be documented in a written specification complete with chemistry, material properties, toughness testing, test coupon locations, inspection requirements, repair provisions, and NDE requirements. Where the engineering design considers varying criticality based on location in the casting, these areas shall be identified on drawings or material specifications. PETROBRAS will review and approve casting specifications.

SUPPLIER shall clearly define the methodology for quality control of the castings to insure all castings provide the required material properties.

As a minimum Castings shall comply with [14].

9.2.2 Forgings

SUPPLIER may elect to use forged material for the basket in lieu of castings. The material shall be selected to have good weldability, strength, and toughness when welded to steel plate (e.g. EH36 type). The forgings shall be forged to a near net shape, rough machined, heat treated, and final machined. The SUPPLIER shall document a written specification complete with chemistry, material properties, toughness testing, test coupon locations, inspection requirements, and NDE requirements. The forging supplier shall provide a MPS detailing the material, forging processing with reduction ratios, heat treatment with times and temperature ranges, location of material sampling locations, and inspections. Test material for mechanical tests shall be representative of the production part and be from a portion of the actual forging such as the “cut-out” area or a prolongation. The forging reduction ratio shall not be less than 3.5:1. An alloy such as ASTM A707 L5 having good weldability and high toughness should be selected. Forgings shall be UT inspected after heat treatment and MT inspected after final machining. Consideration shall be given to the effects of weld distortion, to ensure the final profile after completion of all welding is acceptable.

9.3 CORROSION PROTECTION

9.3.1 Coatings

The Basket internals shall be coated with thermal sprayed aluminum (TSA) and seal coat following PETROBRAS Specification ref. [27] and SUPPLIER’s recommended procedure. Typically the TSA coating system shall consist of:

- Anchor pattern 62 -100µ
- TSA thickness, 175 – 350 µ, with average thickness 250µ
- Seal coat, 12 – 50µ

The Box Structure with the exception of the hull connection weld bevels shall be painted with marine epoxy coating as per PETROBRAS Specification ref. [28] and Project documentation. Top coat color shall be specified by PETROBRAS.

The CONTRACTOR will touch up the coating at the interface to the hull structure.

9.3.2 Corrosion Allowance

The design of the plate structure shall include 3.75 mm of corrosion allowance per side exposed to seawater.

9.3.3 Cathodic Protection

Internal anodes within Box Structure shall be provided, in accordance with the requirements of DNV doc. ref. [6], and Petrobras Specifications ref. [29] and ref. [30].

Exterior of the Receptacles are under influence of Hull cathodic protection.

9.4 STRUCTURE

9.4.1 Design Criteria

CONTRACTOR shall specify with SUPPLIER the fabrication method to integrate the receptacle to the hull structure.

SUPPLIER shall consider fabrication tolerances in the design of the Receptacle.

The ultimate strength capacity and fatigue life of structural components shall be assessed using a rational, justifiable, engineering approach, with consistent design methodology and evaluation criteria.

The evaluation criteria of main structural components (plate box structure and receptacle basket) shall be primarily based on API RP 2A-WSD [9] and API RP 2RD [8], where appropriate. Other design codes or methodology previously validated by SUPPLIER may be accepted after PETROBRAS approval.

Static and cyclic design loads shall be provided by CONTRACTOR. The Design Report shall include sufficient documentation of all analyses to permit an independent assessment.

CONTRACTOR and SUPPLIER shall document that the complete hull structure (hull porch integrated with Receptacles) will not fail at the loads provided: capacity shall be documented to at least meet the survival design load. The overall design philosophy for the receptacle and hull structure is that failure of the hull shall not occur before the riser pipe yields. *((...) deleted)*

SUPPLIER and CONTRACTOR shall assure that installed tolerance of the Receptacle Basket assembled on the hull (sum of location tolerances) will not exceed 1 degree. So, assuming half of this tolerance for the hull structures, that means a tolerance of 0.5 deg for Receptacle fabrication. CONTRACTOR/SUPPLIER designed mockups will be used for final inspection of the Receptacle position. Position of the Receptacle has to be confirmed in stages during the welding sequence in order to minimize distortion in the event corrective measures have to be undertaken.

9.4.2 Fatigue Life

Based on the fatigue loading histograms for each receptacle type, the receptacle shall be checked for fatigue life according to Project Specification ref. [1] and CS Rules. The calculated life shall exceed the specified design life with a factor of 10, assuming without the capability for inspection or repair.

The structure is to be considered a fatigue sensitive component and designed accordingly. Material toughness, welding procedures, and inspection criteria shall be selected to insure meeting the required fatigue life.

For yard completed welds such as Box Structure to Hull porch structure, CONTRACTOR/SUPPLIER shall specify if weld profiling is required or recommended.

All welds that require grinding to meet the required life shall be clearly detailed on SUPLIER´s drawings. The root and crown surfaces shall merge smoothly with the adjoining base metal without the undercut exceeding 0.5mm (0.02 in). Final grinding marks shall be transverse to the weld axis.

10 DESIGN REQUIREMENTS

10.1 GENERAL

The design adopted by SUPPLIER based on the requirements set in this document and relevant specifications shall conform to certain general design requirements stated in this section. As a minimum, the Receptacle shall meet the function as outlined herein.

SUPPLIER shall fully demonstrate the adequacy and the reliability of the Receptacles by proven methods of design. The conservatism of calculation methodology employed shall also be clearly demonstrated, and no doubt of the adequacy for the Project specific service conditions shall remain. Internationally accepted computational tools (software) shall be used to obtain accurate results that support the acceptance of the Receptacles.

Design methodology reports and analysis results reports shall be submitted by SUPPLIER and approved by PETROBRAS before start of fabrication. Design revision cycles, including proprietary documents when necessary, can be requested by PETROBRAS under SUPPLIER premises, as per Section 7.2.

The design requirements applicable to the Receptacle shall include, but not be limited to the following:

- The Receptacle shall allow for easy access for hook-up and Riser Top Joint maintenance and removal.
- The Receptacle design shall be configured to be welded into the FPU hull porches during hull fabrication.
- The Receptacles shall be designed to support the full range of loads imposed by the risers throughout the design life without replacement.

- The Receptacle shall transfer all loads and moments transferred by the Riser Top Joint at their maximum design limits in any direction, without gross yielding, buckling or failing during the required service life, as per Project Specifications, considering allowable stress limits as per section 9.4.1.
- The Receptacle shall incorporate any features needed for handling during incorporation into FPU hull.
- The Receptacle configuration and materials shall be optimized to meet prudent engineering standards and practices. The fabrication of the Receptacles shall be subject to the scrutiny, inspection, verification, qualification, and documentation in accordance with PETROBRAS and industry standards.
- SUPPLIER shall use an industry recognized FEA package for the analysis of the Receptacle, as per Project Specification ref. [1].
- Offshore installation aids (guides) shall be designed and welded to the Receptacle to facilitate the installation of the Riser Top Joint during offshore installation.

The Receptacle Basket internal profile and overall length shall be in accordance with the Project selected standard Receptacle types, among the available as per ref. [31] to ref. [33].

10.2 FAILURE MODES

It shall be shown by SUPPLIER that the Receptacles have the required structural safety against all predicted failure modes. As a minimum, the components shall be designed against the following possible failure modes, as appropriate:

- Plastic collapse;
- Buckling;
- Fatigue failure (high and low cycle);
- Brittle fracture;
- Excessive deflections;
- Corrosion and wear;
- Excessive strain;
- Accumulated plastic strains;
- Functionality;
- Hydrogen induced stress cracking;
- Other types of environmental assisted cracking;

10.3 LOADS AND LOAD CONDITIONS

As a minimum, the following loading parameters/conditions shall be considered and documented by SUPPLIER when designing the Receptacle:

- External loads (e.g. extreme operating and survival loads from global riser analysis, platform spool reactions, installation loads);
- Cyclic (fatigue) loading, observing the reference system for loading.

10.3.1 Loading Cases

Table 10.1 indicates the minimum set of design cases to be considered in the structural design of the Receptacles, for each Rigid Riser and Riser top Joint types for the Project. The responsabilities about the emission of the final data set for Receptacle design is presented

Table 10.1 – Design Loading Case Matrix for Receptacle Design

Design Case	Load Condition (w/ related design factors)	Description	Environmental Return Period (yr)
1	Operating 1	Max. operating conditions	**10**
2	Extreme 1	Extreme environmental condition, intact mooring system	**100**
3	Extreme 2	Extreme environmental condition, one mooring line broken	**100**
4	Extreme 3	Extreme environmental condition, loss of buoyancy modules	**100**
5	Extreme 4	FPU heeling due to damaged hull (flooding on compartments)	**1**
6	Survival 1	FPU heeling due to failure in ballast distribution (up to ±25° static)	**1**
7	Temporary	Riser installation (pull-in), intact hull, intact mooring system	**-**
8	Fatigue	Fatigue conditions (wave w/ assoc.annual current distribution)	**-**

At least the load cases with the maximum angle/ moment and the maximum tension values shall be analysed (with the respectives associated tension and angle values).

Additional load case(s) other than those cases listed in Table 6.1 may be included, to account for any specifities of a given Project. Any Project extra load case condition will also be clearly defined within Project documentation.

The installed angle tolerance of the Receptacle at the FPU shall be considered as an additional permanent deflection of the Riser Top Joint.

10.4 FINITE ELEMENT ANALYSIS

Finite element analysis shall be used to establish structural, buckling, and fatigue performance of the Receptacles.

Care shall be exercised in the finite element analysis to ensure that appropriate element types, mesh refinement, element aspect ratio/distortion and boundary conditions are used.

Applied boundary conditions shall be clearly indicated in model sketches and/or in finite element plots.

Mesh sensitivity analysis shall be performed to ensure that accurate results are predicted. Mesh density convergence checks shall be presented in the reports.

The sensitivity of the calculation model and the parameters utilized in the model shall be examined.

10.4.1 FEA methods to evaluate plastic collapse capacity

There are different ways of estimating the plastic collapse capacity of a component using FEA:

- elastic analysis;
- limit analysis;
- elastic-plastic analysis.

The criteria used to determine limit or plastic loads assume defect-free, tough and ductile material behavior. Fracture mechanics should be considered if the above conditions are not fulfilled.

10.4.2 Elastic analysis

The principle used in some design codes when verifying a component by linear elastic FEA is that critical sections shall be identified and verified by linearizing the stresses across the sections. Stresses are in general decomposed into membrane, bending and peak stresses as well as categorized as primary or secondary stresses. Several FEA programs include modules that perform stress linearization which may be used by SUPPLIER.

For the FE models where the analysis is nonlinear because contact behavior is essential to simulate the interaction between different components, the method of code compliance check for linear elastic FEA may be used provided that the material model is linear elastic. In such cases, the code compliance check must be carried out at critical load steps in the non-linear analysis.

Primary average shear and average bearing stresses shall be calculated and compared to allowable limits. In case where the selected code does not address the shear primary average shear and average bearing stress checks, PETROBRAS shall be consulted on which methodology to be used.

In using elastic finite element analysis to calculate the Receptacles plastic collapse capacities, SUPPLIER shall be aware of the following limitations of this approach:

- For components with a complex geometry and/or complex loading, the categorization of stresses as primary or secondary in the elastic analysis requires significant knowledge and judgment on the part of the analyst. Application of elastic-plastic analysis methods is recommended for cases where the categorization process can produce ambiguous results;
- The use of elastic stress analysis and stress categorization to demonstrate structural integrity for heavy thickness components, especially around structural discontinuities, can produce non-conservative results and is not recommended;
- In cases where calculated peak stresses are above yield over a through-thickness dimension which is more than 5% of the wall thickness, linear elastic analysis can give a non-conservative result;

The structural evaluation procedures based on elastic stress analysis provide only an approximation of the protection against plastic collapse.

For the reasons listed above, the decision to perform elastic finite element analysis to calculate the the Receptacles plastic collapse capacities shall be reported and justified at the beginning of the Project, on the first revision of Design Premises document. CONTRACTOR/SUPPLIER shall also consider that, due to the aforementioned limitations of the elastic analysis technique, PETROBRAS may require additional limit analyses or elastic-plastic analyses of the Receptacle, as per sections 10.4.3 and 10.4.4 of this Technical Specification.

10.4.3 Limit analysis

Limit analysis is based on elastic-perfectly plastic material model and small deformation theory. The objective of a limit analysis is to guarantee that the relevant loading is below the load that produces overall structural instability.

The limit analysis shall be carried out following the guidelines of the respective codes selected for the verification of the Receptacle.

PETROBRAS may require the performance of limit analysis in addition to the elastic one when the presented results of elastic analysis were not conclusive.

10.4.4 Elastic-plastic analysis

Elastic-plastic analysis is generally based on material model which considers true strain hardening and large deformation theory. Some codes recommend the use of idealized stress-strain curves based on the material properties.

Elastic-plastic finite element analysis gives more realistic and accurate simulation of the stresses, strains and displacements than elastic finite element analysis and limit analysis, including local load redistribution due to yielding up to maximum load carrying capacity or resistance.

The objective of an elastic-plastic analysis is to guarantee that the relevant loading is below the load that produces overall structural instability.

The elastic-plastic analysis shall be carried out following the guidelines of the respective selected codes for the verification of the Receptacle.

PETROBRAS may require the performance of elastic-plastic analysis in addition to the elastic one when the presented results of elastic analysis were not conclusive.

10.4.5 FEA Methods to Evaluate Protection Against Local Failure

Strength verification of the Receptacle carried out by SUPPLIER shall include the evaluation of protection against local failure. This check shall be aligned with the rules and procedures of selected internationally accepted codes.

Design codes usually recommend a simplified local stress check procedure to be carried out as part of a linear elastic FEA. For some codes the protection against local failure is guaranteed by limiting the sum of the principal components at any point in the structure. For other codes the limit is imposed on the maximum principal stress component at any point in the structure.

For FEA involving plasticity, plastic collapse load analysis via the elastic-plastic method is preferable for checking local failure because it closely represents the actual structural response in comparison with a limit analysis. The local geometry of the structure shall be correctly represented in the FE-model to allow an accurate estimate of local strains that will be used in the code compliance verification.

10.4.6 FEA Methods to Evaluate Protection Against Progressive Collapse

Methods for protection against progressive collapse from repeated loading are found on internationally recognized design codes. SUPPLIER shall follow the recommended procedure of the respective selected codes for the verification of the Receptacle.

For a FE elastic analysis, the sum of primary plus secondary stresses shall be less than the respective allowable value defined on the selected code. Note that if all requirements for protection against plastic collapse are met in an elastic FE analysis with all stresses categorized as primary then the load is safe regarding progressive collapse. In the context of verification of protection against progressive collapse by means of elastic analysis, it is considered acceptable the use of stress linearization as per section 5.5.6 of ref. [12].

However, if elastic-plastic analysis results are used, then an assessment method compatible with such type of analysis shall be employed instead (e.g. see section 5.5.7 of ref. [12]).

10.4.7 FEA for Fatigue

Fatigue life evaluation of the Receptacle carried out by SUPPLIER shall include the assessment of both welds and plain material following the rules and procedures of a selected internationally accepted code.

When creating FE models for the purpose of calculating stresses for subsequent fatigue analysis, care must be taken to ensure that the mesh density and level of detail modeled are in accordance with the assumptions in the chosen S-N curve.

FE meshes for the calculation of stress ranges in plain material (e.g. forged components far from any weld) should be extra fine in areas where stresses are determined (notch stress method). The geometry of the elements should be carefully evaluated in order to avoid errors due to deformed elements. The size of the model shall be sufficiently large so that the calculated results are not significantly affected by assumptions made for boundary conditions and application of loads.

10.4.8 FEA documentation

The analysis report shall be sufficiently detailed to allow for independent verification by a third party, approved by the PARTIES, either based on review of the documentation, or using independent analyses (sensible data may be provided under a non-disclosure agreement and provisions of sec.7.2). The documentation should include at least description of:

- Purpose of the analysis;
- Failure criteria;
- Geometry model and reference to drawings used to create the model;
- Boundary conditions;
- Element types;
- Element mesh;
- Material models and properties;
- Loads and load sequence;
- Analysis approach;
- Application of safety factors;
- Mesh convergency study results;
- Analysis results;
- Sensitivity analysis;
- Discussion of results;
- Conclusions;
- Any other performed verification.

10.5 CONNECTION AND WELDING

The Receptacle shall be welded into the main structural steel of the FPU hull's porches. The material of the Receptacle shall be compatible with that of the porch material.

The as-built dimensions of the Receptacle shall be used by the CONTRACTOR to complete the connection details on the porches.

SUPPLIER shall fabricate and weld 25.4 mm thick steel guide funnels onto the top of the Receptacles. The guide funnels shall be designed to withstand a maximum horizontal load referred applied anywhere on the guide cone. Gusset plates should be used where necessary, in preference to increasing the thickness beyond 25.4 mm.

11 MANUFACTURING REQUIREMENTS

11.1 MATERIAL COMPONENTS

Copies of material specifications, results of all mechanical properties tests, and mill test certificates shall be provided to PETROBRAS.

11.2 MANUFACTURING PROCEDURES

A manufacturing Quality Control Plan shall be prepared by SUPPLIER and reviewed by PETROBRAS prior to commencing manufacture. Witness, Inspection and Hold points shall be identified in the plan along with a description of the nonconformance review process.

11.3 WELDING PROCEDURE SPECIFICATION (WPS)

All welding of structural steel shall conform to the latest editions of AWS document ref. [22], API doc. ref. [9], and Project Specification. SUPPLIER shall develop welding procedures and required welder qualifications that fully meet the applicable codes mentioned.

Prior to commencing any welding operations, SUPPLIER shall develop a WPS that will define the parameters for each proposed welding process. The WPS shall be submitted to CONTRACTOR and PETROBRAS and for approval on a timely basis. These welding procedures shall be qualified to establish that the required mechanical properties of the metal have been maintained. It will include all procedure testing including welding, NDT, sectioning and mechanical properties testing (as witness by the QA Inspector). Welding Procedure Qualification Records (PQR) shall be documented and submitted to provide traceability of the testing and qualification process.

Previously qualified WPS that meet the requirements of the applicable codes and this specification may be submitted to CONTRACTOR and PETROBRAS without necessarily repeating the qualification process.

11.3.1 Charpy Test Requirements

CVN testing shall be conducted for all CJP welding procedures. Testing shall be completed in accordance with AWS doc. ref. [22]. Weld metal tests shall meet or exceed the requirement for the base material.

11.3.2 Welding Procedures

Prior to commencing manufacture, it shall be demonstrated that all proposed welding procedures for each type of welding operation to be utilized during manufacture will produce properties in the heat affected zone which meet the strength requirements.

Procedures shall comply with the requirements of Petrobras Specification ref. [26].

11.3.3 Welder Performance Qualification

All welders used in riser receptacle fabrication shall be qualified in accordance with the requirements of AWS doc. ref. [22] and Petrobras Specification ref. [26] prior to being allowed to work on the project.

SUPPLIER shall maintain Welder Performance Qualification Records (WPQ) for all welders.

Previously qualified welders need not necessarily be subjected to new tests, if SUPPLIER provides documentation, which meets the satisfaction of both CONTRACTOR and PETROBRAS representatives. SUPPLIER shall make all records available for this purpose.

11.3.4 Welding Consumables

Only low hydrogen electrode consumables shall be used on riser receptacle fabrication. These electrodes shall be treated in accordance with the requirements of AWS doc. ref. [22], Section 5.3.2.1. Low hydrogen material is defined when the diffusible content that is yielded from the weld metal is less than 6ml/100g deposited metal, AWS doc. ref. [21].

11.3.5 Pre-heat requirements

If the ambient temperature is less than 4ºC (40ºF) and the relative humidity above 50%, welding will not be permitted without preheating. Minimum preheats and minimum/maximum interpass temperatures shall be in accordance with AWS doc. ref. [22], Section 3, Table 3.2.

SUPPLIER shall develop and submit to CONTRACTOR a preheat procedure that defines the methodology and equipment used for applying and checking the appropriate preheat during fabrication of the Receptacles.

Cutting torches shall not be allowed for the preheating process. Preheat temperatures above 49ºC (120ºF) should generally be performed using electrical heating mats. Rose buds are allowed providing adequate control of the heat is monitored using temperature sticks placed at several locations.

Provided that the ambient temperature is not below 4ºC (40ºF), the minimum preheat and interpass shall not be less than 14ºC (25ºF) below the temperature that has been qualified and documented in the PQR (CDR code CJ). The maximum interpass temperature shall not be more than 28ºC (50ºF) above the maximum value that has been qualified and documented in the PQR.

12 INSPECTION AND MATERIAL TESTING

12.1 WITNESS/ MONITORING POINTS AND TESTS

The manufacturing quality, Inspection and Test Plan (ITP) shall include proposals for CONTRACTOR and PETROBRAS Witness, Hold, Review and Monitor points. The ITP for SUPPLIER and its SUB-SUPPLIERS shall be submitted for CONTRACTOR and PETROBRAS review and approval prior to the start of production operations. The testing program shall include appropriate tests to assure qualification of the materials, processes, and the completed Receptacle. All testing procedures are subject to both internal and external QC oversight and verification.

12.2 MILL TEST CERTIFICATES

SUPPLIER shall furnish information copies of mill certificates for any and all primary material furnished before the material is worked. Stock plate shall bear mill heat numbers for identification.

All weldment plates shall utilize grades appropriate for the design, in conformance with Hull Project Specification ref. [1] and CS Rules.

All structural steel shall be reasonably free from mill scale and rust, and free from deformations.

Chipping or grinding shall remove all scabs and slivers. Steel that contains other defects shall not be used. No weld repairs are permitted on any steel materials.

SUPPLIER shall develop a marking procedure that employs the use of color-coding to distinguish between steel grades. This color-coding shall be applied such that plates are easily distinguished when stacked or laid flat.

SUPPLIER may make welding repairs of defects in structural steel only if they are within the limits and made according to and repaired as defined by AWS doc. ref. [26] and approved by CONTRATOR Representative. CONTRACTOR and PETROBRAS have the right to reject any steel that contains defects.

Mill Test Certificates shall be supplied for metallic materials, which include the following information:

- Steel making process;
- Yield and ultimate tensile strength and % elongation;
- Chemical analysis including carbon equivalent;
- Impact Charpy V-notch, hardness test results and percentage shear.

12.3 NDE ACCEPTANCE CRITERIA

12.3.1 General

ALL CJP welds shall be inspected by means of ultrasonic examination.

All welds and surrounding area of base metal shall pass magnetic particle inspection. Partial NDE is not allowed.

Qualification of NDE Inspectors shall be according to AWS doc. ref. [22], API doc. ref. [7] and PETROBRAS Specification ref. [26].

12.3.2 Procedures

Ultrasonic testing of welds shall conform to AWS doc. ref. [22], API doc. ref. [7] and PETROBRAS Specification ref. [26].

Magnetic Particle testing shall conform to API doc. ref. ref. [7].

12.3.3 Acceptance Criteria

The acceptance criteria for ultrasonic inspection and testing of CJP welds shall be API doc. ref. [7] Criteria Level A.

The acceptance criteria for magnetic particle inspection shall be ASME Section VIII Division 1, Appendix 6 doc. ref. [11]. Local grinding of the weld to enhance interpretation of examination results shall be carried out as determined necessary by SUPPLIER.

Radiographic testing of welds is not required by this specification. If required by CONTRACTOR or SUPPLIER, testing shall conform to AWS doc. ref. [22].

12.4 INSPECTION AND TEST REPORTS

Each test performed shall result in a test report and a quality assurance inspection report, which shall be issued to PETROBRAS within two weeks of test completion.

12.5 QUALIFICATION AND CERTIFICATION OF INSPECTORS

Personnel qualification of Weld, NDT and dimensional inspectors shall comply with ref. [26].

Personal qualification for painting operator and inspector shall comply with sections 10.2.2 and 10.2.5 of ref. [25] and PETROBRAS Specification ref. [26].

Qualification of metal spray operators shall be in conformance with PETROBRAS Specification ref. [27].

13 FACTORY ACCEPTANCE TESTS (FAT)

13.1 GENERAL

SUPPLIER shall propose, for PETROBRAS review, a Factory Acceptance Test procedure to be carried out on each manufactured Receptacle.

13.2 MINIMUM SET OF FACTORY ACCEPTANCE TESTS

13.2.1 Fit up Test

Riser Top Joint interface with Receptacle shall be verified. In place Mock-up gaps and flange elevation shall be recorded. (see ref. [34])

Frequency of test: All units

Receptacle Mock–up shall be provided by SUPPLIER.

14 QUALITY CONTROL AND REPORTING

14.1 QUALITY MANAGEMENT SYSTEM

Each element of the work shall be executed in accordance with quality management systems that comply with the requirements of CONTRACTOR and PETROBRAS project requirements.

SUB-SUPPLIER shall refer to document “Project Quality Management Plan”.

14.2 QUALITY PLAN AND QUALITY CONTROL PLAN

SUB-SUPPLIER shall produce for SUPPLIER review and approval a project quality plan and a project quality control plan:

Project quality plan	Detail the organization, responsibilities, activities, and an index of referenced and applicable procedures to complete the Work, including that of SUB-SUPPLIERS and SUPPLIER.
Project quality control plan (ITP)	Detail quality control plan and control monitoring to be employed during mobilization, acquisition and reporting phases.

All SUB-SUPPLIERs shall address and resolve any audit reports, recommendations and / or corrective action requests issued by the CONTRACTOR to the satisfaction of the CONTRACTOR and of the PETROBRAS.

SUB-SUPPLIERs shall also refer to document “QHSE Management for Suppliers / Subcontractors”.

14.3 MOBILISATION AND CALIBRATION

All equipment used for calibration purposes will be provided with recent bench calibration.

14.4 DESIGN, PROCUREMENT AND FABRICATION PROCEDURES REPORTS AND RECORDS

The following procedures, reports and records shall be provided to PETROBRAS for review:

- QA/QC procedures, to be submitted to PETROBRAS for review prior to start of design and production work. The plans and procedures shall include, as a minimum, the following elements:
    - Manufacturing ITPs for PETROBRAS to comment (assign inspectioin points);
    - Material and Process Qualification Plan;
    - Inspection and Test Reports to be provided including all reports defined in this Specification;
    - NDT Procedures;

- FAT Procedures;
- Document Control Procedures;
- Traceability Plan;
- Nonconformance Procedure including examples of a report form to be utilized.

- Design Basis and Methodology (DBM) to be submitted to PETROBRAS for review prior to start of design and production work, as a minimum, includes the following:
  - Design Parameters;
  - Design methodology including FEA tools to be used as agreed by PETROBRAS;
  - Proposed material specifications;
  - Chemical composition and mechanical properties of steel components (yield strength, tensile strength, percent elongation, area reduction and other required properties);
  - List of Design Drawing to be provided;
  - Design calculations and reports.

The final documentation of the detailed Project shall include:

- Design Basis and Methodology;
- Design Report;
- Manufacturing Procedure Specification (MPS) to be submitted to PETROBRAS for review prior to start of design and production work, as a minimum, includes the following:
  - Procedures including process control plans;
  - Testing and Inspection Plan with monitoring points identified;
  - Factory Acceptance Testing.
- Inspection and test reports;
- As-built drawings or as-built dimensional reports;
- Inspection and test records, and procedures as defined by this Specification.

The QA/QC, DBM and MPS shall be written specifically for the PURCHASE ORDER and shall be approved by PETROBRAS prior to commencement of manufacturing operations.

SUPPLIER shall notify CONTRACTOR and PETROBRAS of any changes in these practices for their review/approval prior to implementation.

Design calculations and reports of the Receptacle shall be issued to PETROBRAS for review prior to the manufacturing.

Nonconformity reports shall be issued to PETROBRAS within the contractual deadline.

All nonconformity reports, including concession requests, shall be submitted to PETROBRAS for review.

14.5 RECEPTACLES DRAWINGS

Prior to start of manufacture, General Assembly drawings shall be supplied to PETROBRAS for review. Subsequent revisions to drawings shall also be issued to PETROBRAS for review, as they are prepared. GA drawings shall include the following as a minimum:

- Interface, overall dimensions and tolerances
- Position of CoG (in air and water);
- Total weights;
- Material identification and source part number;
- Details of handling attachments.

14.6 PROJECT MANAGEMENT

- QHSE/PEP Plans - SUPPLIER shall submit a detailed HSE Plan within two weeks of Purchase Order award, and shall submit a detailed Project Execution Plan (PEP) within four weeks of Purchase Order award, for CONTRACTOR/PETROBRAS approval. SUPPLIER's PEP shall be designed to achieve all deliveries in line with CONTRACTOR's requirements. SUPPLIER shall also submit a Manufacturing Quality Plan detailing all procurement, manufacturing, and inspection processes and activities for CONTRACTOR/PETROBRAS approval within the contractual deadlines.
- Organization and Key Personnel - SUPPLIER shall assign key engineering and service personnel to manage and control the Work from start through to final delivery. Such personnel shall not be changed without CONTRACTOR/PETROBRAS approval. Within 02 weeks of receipt of Purchase Order, SUPPLIER shall submit an organization chart defining the reporting structure and shall provide resumes of the proposed key candidates, with others on request, for CONTRACTOR/PETROBRAS approval.
- SUPPLIER shall confirm compliance with all the requirements of this document, and the referenced documents during the review of the manufacturing quality plan. Any deviation from the requirements of this document shall be highlighted and forwarded to CONTRACTOR/PETROBRAS for review and approval. In the event of any disparity of information given in this document with any referenced document or standard, written clarification shall be sought from CONTRACTOR/PETROBRAS before proceeding with design and/or fabrication of the RECEPTACLES.

14.7 TRACEABILITY AND MARKING

- Raw material traceability of components shall be established during fabrication, verified at receiving inspection, and shall be fully documented throughout the entire manufacturing process;
- Product marking;
- Supplier shall use an individual mark (P\N) for each fabricated part;
- This mark, transferred on the associated documentation, shall allow a proper traceability;
- Manufacturing operator and Inspector mark;
- On all kind of documents (Manufacturing or test router, report or ITP), the person who shall handle the task will affix his own mark and signature.

14.8 DOCUMENTATION REQUIREMENTS (DATA BOOK)

Copy of a final report for each manufactured Receptacle shall be submitted to PETROBRAS for review and approval prior to final acceptance. This report shall contain Purchase Order number, part number, dash number, serial number, actual weight, all material certifications, dimensional verification, test results and on-site verification of current visual examination compliance by site inspectors and surveyors, and shall certify that the product was manufactured and inspected in accordance with the requirements of applicable drawing(s) and this Specification.

Additional documentation shall be submitted in accordance with Requisition.

SUPPLIER shall submit a detailed description of the manufacturing process.

SUPPLIER shall document the design with drawings and calculations.

All tests and clarifications required for the design acceptance and the evaluation of the Receptacle shall be submitted.

SUPPLIER shall submit the quality control procedures for PETROBRAS review and approval.

SUPPLIER shall submit document stating all deviations to this Specification.

14.9 INSPECTION AND TEST PLAN

This section concerns the product fabricated by SUPPLIER as well as the product purchased by SUPPLIER.

At the beginning of the Project, within the contractual deadlines, the Inspection and Test Plans (ITP) for all stablished items shall be issued for PETROBRAS comments. SUPPLIER shall obtain with PETROBRAS all self assigned Inspection points (mainly Hold and Witness points) before the start of the manufactures.

The same document shall be used by the SUPPLIER and its SUB–SUPPLIER.

The ITP sums up the inspection points, applied by:

- SUB-SUPPLIER;
- SUPPLIER;
- PETROBRAS and CONTRACTOR;
- 3rd Party Inspection.

The ITP shall be submitted for PETROBRAS review. All PETROBRAS holding and witnessing points shall be confirmed prior to start of manufacturing.

The inspection points are defined hereafter:

Table 14.1 – Inspections Points and Definitions

Inspection Level	Definition
H: Hold Point	A point at wich work cannot progress beyond, until the activity has been witnessed or written approval has been given by the parties who have designated the hold point.
W: Witness Point	A point where the opportunity to witness shall be given to the parties who have designated the witness.
W1: FoaK	A Witness Point limited to the First of a Kind event.
M: Monitor Point	Activity surveillance on a random basis to verify compliance with contract specifications and procedures.
R: Review Point	Evaluation of Project generated documentation.

Contractual aspects of the inspections (including notification for inspection issual deadline and notification date revision) shall adhere to the Contractual Guidance for Quality Management.