PETROBRAS	SPECIFICATION	Nº I-ET-3000.00-1000-972-1AL-004	
	CLIENT: E&P		Sheet **1** of **16**
	PROJECT: ALL		-
	AREA: GENERAL		-
SBS	TITLE:: **COMPLEMENTARY QUALITY REQUIREMENTS FOR SUBSEA UMBILICALS AND ANCILLARY EQUIPMENTS**		PUBLIC
			DPU

INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR ALTERED SHEETS
0	Original Issue
A	Number of this spec; index; altered items 1; 2; 4; 5; 6; 7; 8; 9; 10; 11 e 12; item 4 (Equipment Categorization) excluded.
B	Items 2; 5; 9 e 12.
C	Section 2 NOTE 3; item 9.3.2 d) g).
D	Altered items 6.1 and 12. Removed item 6.5
E	Removed item 5.3

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	18/02/2019	29/03/2019	25/04/2019	29/05/2019	12/11/2019				
PROJECT	SBS/PROJINV/QB/DPU	SBS/PROJINV/QB/DPU	DPU	DPU	DPU				
EXECUTION	EM1E	EM1E/CSM5/CQJ4	CSM5	RNIU	RNIU				
VERIFICATION	CSM5/RNIU/CQJ4	MFJ8/RNIU/MF3G/EIBH	RNIU	A50O	A50O				
APPROVAL	UTJ6	UTJ6	UTJ6	UTJ6	UTJ6				

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1. PURPOSE

1.1. This document establishes the minimum quality requirements that shall be considered and observed by the Supplier during the entire Subsea Umbilical and Ancillary equipment manufacturing process and shall be considered as a complementary document to I-ET-0000.00-0000-972-1AL-001 – Quality of Materials General Requirements.

1.2. This Quality Requirement applies to the following families of subsea Umbilical and their ancillary equipment:

a) Subsea Umbilical TPU (Thermoplastic Hose Umbilical) and Electro/Optical [ESTR];
b) Subsea Umbilical STU (Steel Tube Umbilical) [ESTR].

NOTE 1: All components assembled in Umbilical at the factory and/or during installation are ancillary equipment.

NOTE 2: In case of conflict with I-ET-0000.00-0000-972-1AL-001, this Complementary Requirement shall prevail.

2. REFERENCES

2.1. I-ET-0000.00-0000-972-1AL-001– Quality of Material General Requirements;
2.2. ET-3000.00-1500-251-PAZ-001 – Fixadores em Aço de Alta Resistência para Utilização Submarina;
2.3. ET-3000.00-1500-251-PAZ-002 – Rastreabilidade de Fixadores em Aço de Alta Resistência para Utilização Submarina;
2.4. ET-3000.00-1500-29B-PMU-001 – Fixadores de ligas resistentes à corrosão para utilização em umbilicais submarinos;
2.5. ET-3418.00-1243-721-PPC-002 – Cabo Elétrico Submarino de Potência de 13,8 kV;
2.6. ET-3000.00-1500-941-PMU-003 – Padronização de Acessórios para Kit Pull-In;
2.7. ET-3000.00-1516-940-PPC-001 – Projeto de Proteção Catódica para Equipamentos Submarinos;
2.8. ET-3000.00-1500-29B-PZ9-001 – Engates Rápidos para Umbilicais Submarinos de Controle;
2.9. I-ET-3000.00-1500-29B-PAZ-005 – Metallic tubes for Subsea Umbilical;
2.10. I-ET-3000.00-1500-29B-PAZ-006 – Qualification for Power, Control and Injection Umbilical;
2.11. I-ET-3000.00-1500-29B-PAZ-003 – 3/8” & ½” ID Hydraulic Hoses;
2.12. I-ET-3000.00-1500-29B-PAZ-004 – ½” ID Hoses for Chemical Injection;
2.13. I-ET-3500.00-1500-896-PAZ-001 – Electrical Cable (3 x 2,5mm² Pairs);
2.14. I-ET-3500.00-1500-896-PAZ-010 – Electrical Cable Element Type: 1 Pair @ 2.5mm²;
2.15. I-ET-3500.00-1500-896-PAZ-002 – Electrical Cable with Four (4) Pairs x 4,0mm²;
2.16. I-ET-3010.00-1500-960-PPC-011 – General Bend Stiffener Requirements;

2.17. I-ET-3000.00-1500-29B-PAZ-001 – Technical Specification for Subsea Umbilical Systems;
2.18. PETROBRAS NI-133 – Welding;
2.19. PETROBRAS NI-2301 – Preparation of the Welding Technical Documentation;
2.20. ANSI/API SPECIFICATION 17E – Specification for Subsea Umbilical;
2.21. API Spec. 9A – Specification for wire rope;
2.22. ASTM D3359 – Standard test for measuring adhesion by tape test;
2.23. ASME Section V – Nondestructive examination;
2.24. ASME Section IX – Welding qualification;
2.25. ISO 13628-5 – Petroleum and natural gas industries – Design and operation of subsea production system. Subsea Umbilical;
2.26. ISO 3834-1 – Quality requirements for fusion welding of metallic materials – Past 1: Criteria for the selection of the appropriate level of quality requirements;
2.27. ISO 3834-2 – Quality requirements for fusion welding of metallic materials – Part 2: Comprehensive quality requirements;
2.28. ISO 3834-5 – Quality requirements for fusion welding of metallic materials – Part 5: Documents with which it is necessary to conform to claim conformity to the quality requirements of ISO 3834-2, ISO 3834-3 or ISO 3834-4;
2.29. NAS 1638 – Cleanliness requirements of parts used in hydraulic system;
2.30. ISO 15609-1 – Specification and qualification of welding procedures for metallic materials – Welding procedure specification – Part 1: Arc welding;
2.31. ISO 15608 – Guidelines for a metallic materials grouping system (ISO/TR 15608:2017);
2.32. ISO 15607 – Specification and qualification of welding procedures for metallic materials – General Rules;
2.33. ISO 15614-1 – Specification and qualification of welding procedures for metallic materials – Welding procedure test – Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys;
2.34. SAE J517 – Hydraulic Hose;
2.35. Procedimento de Flushing – PG-3ED-00126-C.

NOTE 1: The documents applicable to the project are not limited to those listed in this Complementary Quality Requirement. All technical documents related to the contract shall be observed and fulfilled.

NOTE 2: The edition/revision of the documents applicable to the PROJECT will be that defined in the contractual documentation, if not specified, the current edition/revision on the date of signature of the contract applies.

NOTE 3: PETROBRAS NI-133 e NI-2301 are guidelines, that may be followed by Supplier according when project specifications do not provide details about welding process.

3. DEFINITIONS, TERMINOLOGIES AND ACRONYMS

3.1. The definitions and acronyms adopted in this document are in accordance with I-ET-0000.00-0000-972-1AL-001and ABNT NBR 16278.

3.2. When preparing the Inspection and Test Plan (ITP), the acronyms defined in I-ET-0000.00-0000-972-1AL-001shall be used.

4. MINIMUM MANUFACTURING INSPECTION ACTIVITIES

In addition to the statements set forth in I-I-ET-0000.00-0000-972-1AL-001, the activities listed below shall be performed and recorded by the Responsible for the Manufacturing Inspection (RIF).

NOTE: In order to ensure the compliance of the material with the contractual requirements, other activities, besides those listed below, may be accompanied by RIF and shall be recorded.

4.1. Visual inspection, final dimensional check and technical documentation review - for all Umbilical and ancillary equipment.

4.2. Inspections during manufacturing for all Umbilical and their critical components, as detailed in the following items.

4.2.1. The Responsible for the Manufacturing Inspection shall consider, at least, the following steps as **Hold Points at Supplier**, which shall be set out in the ITP:

a) Tests and assays of tubes (when applicable);
b) Whole welding process of tubes and fittings for the first section of each unifilar (when applicable);
c) Verification/identification of Umbilical marking;
d) Verification of continuity and identification of lines;
e) Factory acceptance tests - FAT;
f) Checking the flushing process in hoses and tubes;
g) Final visual inspection of assembled terminals/connectors;
h) Assembly of quick couplings and final filling of hydraulic hoses;
i) Final inspection of ancillary equipment;
j) Final Inspection of Umbilical Assembly and Ancillary equipment;
k) Conditioning and final mooring of the Umbilical and ancillary equipment;
l) Verification of manufacturing technical documentation book (Umbilical and ancillary equipment data book).

4.2.2. The Responsible for the Manufacturing Inspection shall consider, at least, the following steps as **Document Review**, which shall be set out in the ITP:

a) Tests and assays of hoses;
b) Tests and assays of electric/power cables;
c) Tests and assays of optical fiber cables;
d) Review and approval of all certificates of raw materials used in the manufacture of Umbilical and its critical components;
NOTE: Special attention must be taken regarding the expiration date of the polymers.
e) Review and approval of all manufacturing technical documentation as defined in PIT (certificates, registrations, reports, etc.);
f) Verification/approval of the treatment contained in the nonconformities issued by the Supplier.

4.2.3. The Responsible for the Manufacturing Inspection shall consider, at least, the following steps as **Monitoring Points at Supplier**, which shall be set out in the ITP:

a) Manufacturing process of thermoplastic and resistant to collapse hoses;
b) Welding process of tubes and fittings;
c) Cleaning process of hoses and tubes before Umbilical lay-up;
d) Process of lay-up the components;
e) Nondestructive examinations;
f) Intermediate processes after lay-up;
g) Armouring processes;
h) Extrusion processes;
i) Process for preparation of terminations (pressing/crimping/welding of terminals/connectors);
j) Other inspection and testing activities required in the contractual documentation shall be included in the PIT. The participation of the Responsible for the Manufacturing Inspection in these activities shall be defined when the PIT is analyzed and approved.

Each step above shall be monitored, at least, twice a week, considering the period of execution of respective step.

4.2.4. The Responsible for the Manufacturing Inspection shall consider, at least, the following steps as **Hold Points at Sub-supplier**, which shall be set out in the ITP:

a) Factory Acceptance Test – FAT for Subsea Fasteners, Armour Pot, Bend Stiffener, Hang off e API Adapter Flange;
b) Visual inspection and final dimensional check of Subsea Fasteners, Armour Pot, Bend Stiffener, Hang off, API Adapter Flange and kit Pull-in;
c) Verification of manufacturing technical documentation book (data book of hoses, cables and tubes).

NOTE 1: The steps defined in items 4.2.4 b) and c) may be carried out at the Supplier's discretion in its own factory.

NOTE 2: Critical components of Umbilical are electrical cables, power and electrical cables, optical fibers, collapse resistant hoses, thermoplastic hoses and metallic tubes.

5. MANUFACTURING AND QUALITY INSPECTOR

5.1. The Manufacturing Inspectors of the AIB shall be certified according to ABNT NBR 16278, modality IF-TF, to act directly in the inspection of manufacturing and assembly activities of the Umbilical. For the inspection of ancillary equipment, certifications in modalities IF-PP, IF-CT and IF-AT may be used, according to the characteristics of the object to be inspected.

5.2. API SIFE (Source Inspector Fixed Equipment) certification is also acceptable. Other similar certifications, issued by internationally recognized, independent entities, may be accepted, but they shall be submitted to previous approval of the PETROBRAS Quality of Material Department.

5.3. For the certification of Manufacturing Inspector abroad, the equivalence defined in I-ET-0000.00-0000-972-1AL-001 shall apply.

6. INSPECTION PLANNING

6.1. PRE INSPECTION MEETING - PIM

In addition to the item in I-ET-0000.00-0000-972-1AL-001that refers to the PIM, it shall be considered:

6.1.1. Presentation/confirmation by the Supplier regarding the pre-qualification of the Umbilical structure and Classification Society approval.

NOTE 1: This meeting may include more than one Purchase Order (PC), as long as they have the same contractual technical designs/structures, requirements and specifications.

NOTE 2: If a new purchase order refers to structures, requirements and specifications that have already been evaluated and discussed in past PIM (previously held and related to the

same contract), it is at the Supplier's discretion to hold a new PIM. If so, Supplier shall report that the same definitions discussed and validated in the previous PIM are valid for said purchase order.

6.2. PLANNING OF INSPECTION EVENTS AT SUPPLIER'S FACILITIES

6.2.1. In addition to I-ET-0000.00-0000-972-1AL-001, the Supplier shall prepare, prior to start of manufacturing, a manufacturing plan to realize the product, from placing the purchase order up to its delivery. This planning shall be focused on the inspection and tests pointed out in the ITP of Umbilical and its Ancillary equipment.

6.2.2. This planning shall be submitted for the acknowledgement and comments of the AIB prior to start manufacturing, also including the inspection activities at Sub-suppliers.

6.3. PLANNING AND INSPECTION EVENTS AT SUB-SUPPLIER'S FACILITIES

6.3.1. The Sub-suppliers of materials, components and consumables for the manufacture of the equipment shall be duly approved considering the supplier evaluation methodology, according to its Quality Management System.

6.3.2. The Supplier shall select and evaluate the Sub-suppliers in accordance with the requirements of ABNT NBR ISO 9001, of the Quality of Material General Requirement, of this complementary requirement and other contractual documents, where and when applicable, to ensure compliance with all requirements and criteria established for the supply, with periodic revaluations methodology, aiming the continuous improvement in this process.

6.3.3. The qualification criteria and the frequency of requalification of these Sub-suppliers shall be submitted for comments by the Responsible for the Manufacturing Inspection.

6.3.4. The Supplier shall establish and reproduce in its Sub-contractors considered critical, the following good practices: PIM, PIT preparation, nonconformity treatment, quality indicator development, with the acknowledgement of the Responsible for the Manufacturing Inspection.

6.3.5. It is the responsibility of the Supplier/Responsible for the Manufacturing Inspection to inspect the manufacture of critical components and ancillary equipment in its Sub-suppliers, as established in section 4 of this document. These inspection activities shall be performed by the Manufacturing Inspector, observing their respective modality of certification. These inspectors shall be certified by the SNQC (National System of Qualification and Certification) and according to I-ET-0000.00-0000-970-PSQ-001.

7. INSPECTION AND TEST PLAN

7.1. The ITP shall follow the requirements of ISO 9001, I-ET-0000.00-0000-972-1AL-001 and this Complementary Requirement. In addition, the Supplier shall submit to the Responsible for the Manufacturing Inspection, prior to the start of manufacturing, an ITP for each Umbilical, main components and ancillary equipment to be supplied, ensuring the compatibility of the materials with the project requirements, procedures and contractual documentation.

7.2. In order to ensure the conformity of the material in accordance with the contractual conditions, the Responsible for the Manufacturing Inspection shall define, upon the approval of the ITP, for each Purchase Order, the extent of their participation in the inspections and tests to be carried out at the Supplier's facilities (such as, for instance, HP, WP, RD or M), covering, at least, the inspection activities set out in I-ET-0000.00-0000-972-1AL-001and in this Complementary Requirement (section 4).

7.3. The Sub-suppliers' ITP shall be in accordance with the technical requirements and acceptance criteria set out in the project and in the contractual documentation, including, along the manufacturing process, the level of participation of the Supplier inspection and the Responsible for the Manufacturing Inspection.

7.4. In compliance with and complementing API SPEC 17E standard, the specifications and the contractual requirements, the activities listed below shall be included in the ITP of the Umbilical and its critical components, including their respective records, where and when applicable, depending on the structure, specifications and contractual requirements:

a) Review of certificates and traceability of raw material;
b) Verification of steps in the process of hoses manufacturing;
c) Verification of steps in the process of tubes manufacturing;
d) Verification of steps in the process of electric/power cables manufacturing;
e) Verification of steps in the process of optical fiber cables manufacturing;
f) Verification of steps in the process of ancillary equipment and components manufacturing;
g) Verification of the extrusion process on hoses/tubes;
h) Verification of the extrusion process on electric/power cables and optical fibers;
i) Assays/tests on hoses prior to Umbilical lay-up;
j) Assays/tests on tubes before Umbilical lay-up;
k) Assays/tests on electrical cables/power before Umbilical lay-up;
l) Assays/tests on fiber optic cables prior to Umbilical lay-up;
m) Verification of the cleaning process of hoses and tubes before Umbilical lay-up;
n) Verification of welding process of tubes;
o) Verification of lay-up process of components;

p) Verification of nondestructive testing;
q) Verifications of the extrusion process of the cover over the lay-up;
r) Verification of the internal armour/reinforcement process;
s) Verification of the extrusion process on internal armour/reinforcement;
t) Verification of the process of the tensile armour;
u) Verification of the extrusion process over tensile armour;
v) Verification/identification of marking and final dimensional check of Umbilical;
w) Verification in the process of preparing the terminations (crimping/swaging/welding of terminals/connectors);
x) Verification of continuity and identification of lines;
y) Factory acceptance test - FAT;
z) Final check of Umbilical;
aa) Verification of flushing process in hoses and tubes;
bb) Visual inspection of terminals/connectors;
cc) Assembly of quick couplings and final filling of hydraulic hoses;
dd) Final inspection of ancillary equipment;
ee) Final inspection of assembly of ancillary equipment;
ff) Packaging and final inspection of the Umbilical and ancillary equipment;
gg) Review of the manufacturing technical documentation (Umbilical data book and ancillary equipment).

8. PERSONNEL AND PROCEDURES QUALIFICATION

8.1. PERSONNEL QUALIFICATION

For inspections of welding, nondestructive, dimensional control and painting, the Supplier shall comply with I-ET-0000.00-0000-972-1AL-001, with the additional requirements below:

8.1.1. Nondestructive Testing

Nondestructive testing activities shall preferably be carried out by inspectors certified according to ISO 9712.

8.1.1.1. The execution of Nondestructive testing not required by Standard or by contractual technical specification, i.e., for additional quality control, at the Supplier's exclusive discretion, it is admitted the certification according to the Recommended Practice SNT-TC-1A in substitution of ABNT NBR ISO 9712.

8.1.2. Dimensional Control Inspector

Unless otherwise specified, professionals without certification may be used; however, these shall have training and proven qualification in metrology to carry out the dimensional inspections during the Umbilical and Ancillary equipment manufacturing process.

8.1.3. Welding Inspector

Unless otherwise specified, professionals without certification may be used; however, these shall have training and proven qualification to carry out the welding inspections during the Umbilical and Ancillary equipment manufacturing process.

8.1.4. Painting and Coating Inspectors

Unless otherwise specified, professionals without certification may be used; however, these shall have training and proven qualification to perform painting and coating inspections during the Umbilical and Ancillary equipment manufacturing process.

8.2. PROCEDURES QUALIFICATION

8.2.1. Nondestructive testing, Welding, Testing, and Repairs Procedures

The Supplier shall qualify the following procedures before the beginning of the respective activity:

a) Radiography;
b) Ultrasonic;
c) Dye penetrating;
d) Magnetic particles;
e) Visual;
f) Hardness;
g) Welding;
h) Pickling and Passivation;
i) Repair.

NOTE: All repair procedures permitted by the contract specifications shall be qualified according to the characteristics of the defects observed and shall also be analyzed and validated by the Responsible for the Manufacturing Inspection at the time of inspection.

8.2.2. Other Required Procedures

They shall be qualified according to the contractual premises and/or technical requirements of the Supplier. The qualification of these procedures shall be witnessed and validated by the Responsible for the Manufacturing Inspection, pursuant to the contract.

9. EXECUTION OF MANUFACTURING INSPECTION

The following items shall be considered in addition to those defined in I-ET-0000.00-0000-972-1AL-001:

9.1. MINIMUM ACTIVITIES TO START MANUFACTURING

To start manufacturing, the following conditions must be met:

a) Unifilar e Cross Section approved by the Supplier's engineering department according to the contract;
b) ITP approval by RIF;
c) Holding PIM.

9.2. MANUFACTURING TECHNICAL DOCUMENTATION - DATA BOOK

The Supplier shall keep available for review by the Responsible for the Manufacturing Inspection all quality records and inspections performed as required in the Inspection and Test Plan (ITP):

a) Certificates of raw materials or components;
b) Report of incoming inspection of materials and equipment, with guarantee of traceability of materials/equipment;
c) Nondestructive testing reports according to ITP and drawings;
d) Nonconformity Reports containing the respective analysis of the manufacturer, corrections and corrective actions;
e) Technical queries between PETROBRAS and the Supplier;
f) Report of dimensional control examinations;
g) Report of destructive tests;
h) Welding records;
i) Certificates of welding consumables (if applicable);
j) Record of stress relief heat treatment (if applicable);
k) Test records of component (hoses, electric cables, power cables, fiber optic cables and metal tubes);
l) Records of assembly of terminations/connections and ancillary equipment;
m) Umbilical factory acceptance test report;
n) Inspection reports of the coating/painting, detailing the preparation of the surface, each layer applied, as well as results regarding the thickness and adhesion and mapping of the retouched regions;
o) Record of repair of armour and sheath;
p) Final report of identification and length;
q) Photographic record of mooring, preservation and packaging;
r) Flushing report;
s) Certificates of conformity;
t) Material Release Notice (CLM).

NOTE: Other examinations, assays, inspections and tests required in the documentation shall be included in this list of Quality Records.

9.3. WELDING PROCESS

9.3.1. The welding process of the metallic tubes and the armour/reinforcement shall follow the conditions defined in ISO, ASME, PETROBRAS technical specifications and the welding specifications of the Supplier.

9.3.2. The following documents shall be available for verification by the Responsible for the Manufacturing Inspection, when applicable or required in the project, prior to performing the inspection and test activity according to ITP:

a) Qualification and training of welding inspectors for TPU Umbilical;
b) Certification of welding inspectors for STU Umbilical;
c) Welding consumables storage and handling procedure approved by certified welding inspector or FBTS welding engineer;
d) EPS, RQPS and welding plans approved by certified welding inspector or FBTS welding engineer;
e) Qualification records of welders and/or welding operators, including tack welders, according to PETROBRAS N-2301;
f) Certificate of quality of welding consumables;
g) Criteria for performance control of welders and/or welding operators according to PETROBRAS N-133, when required.

9.4. INSPECTION AND TESTING ACTIVITIES

9.4.1. During the manufacturing process, the following documents shall be available for verification before carrying out the respective inspection and test activity, according to the ITP:

a) Certification or record of training/qualification of NDT inspectors;
b) Certification or record of training/qualification of paint/coating inspectors;
c) Certification or record of training/qualification of welding inspectors;
d) Certification or record of training/qualification of dimensional control inspectors;
e) Qualification and adequacy of the inspection procedure by nondestructive testing by level 3 inspector in the relevant technique;
f) Qualification and adequacy of the painting procedure to the project by paint inspector;
g) Dimensional control procedure qualified by the product engineering area of the Supplier or by a dimensional control inspector;
h) Procedure for identification, transfer and control of traceability of materials;
i) Nonconformity report control procedure (NCR) as defined in the Supplier's Quality Management System;
j) Drawings release for manufacturing;
k) Welding procedure;
l) PMI procedure (where applicable);

m) Factory acceptance testing procedure (FAT);
n) Procedure for assay/testing of component;
o) Procedure for assembly of terminations/connectors and ancillary equipment;
p) Procedure for application of internal and/or external coating;
q) Procedure for pickling and passivation (where applicable);
r) Procedure for cleaning and preservation the Umbilical;
s) Repair procedure (where applicable);
t) Certificate of calibration of the instruments to be used in the inspection and in the factory tests;
u) Procedures for packing, mooring, shipping, transport and storage;
v) Indication of the devices/instruments, including the required accuracy, to obtain the quality, during verification of critical dimensions, function and performance tests.

9.4.2. Hydrostatic, Intermediate and Factory Acceptance Tests (FAT)

a) Intermediate Tests on Hoses, Electric Cables, Optical Fiber Cables, Power Cables:
Components shall be tested in accordance with API 17E and additional requirements set forth in the contractual documentation.
b) Hydrostatic Testing in Metallic Tubes:
Metallic tubes shall be tested in accordance with API 17E and additional requirements set forth in the contractual documentation.
c) Factory Acceptance Test (FAT) of Umbilical:
Upon completion of Umbilical fabrication, hoses/tubes shall be subject to the factory acceptance tests in accordance with API 17E and additional requirements set forth in the contractual documentation.

10. QUALITY RECORDS

The following documents shall be issued/made available by the Supplier, reviewed and approved by the Responsible for the Manufacturing Inspection, as a minimum:

a) Certificate of raw materials or components;
b) Incoming report of materials and equipment, with guarantee of traceability of materials/equipment;
c) Nondestructive testing report provided according to ITP and drawings;
d) Nonconformities Reports of containing the respective treatment by the Supplier;
e) Technical queries between PETROBRAS and the Supplier;
f) Report of dimensional control;
g) Report of destructive tests;
h) Welding reports;
i) Certificate of welding consumables (when applicable);

j) Record of the stress relief heat treatment (when applicable);
k) Records of test/testing of components (hoses, electric cables, power cables, fiber optic cables and metal tubes);
l) Records of assembly of terminations/connectors and ancillary equipment;
m) Umbilical Factory Acceptance Test Report;
n) Inspection report of coating/paint application, detailing the surface preparation, each layer applied, as well as results on the thickness and adherence and mapping of the touched up regions;
o) Report of repair of armour and sheath;
p) Final report of identification and length;
q) Flushing report;
r) Certificate of conformity.

NOTE: Other examinations, assays, inspections and tests required in the contractual documentation shall be included in this list of Quality Records.

11. HANDLING, MOORING, PRESERVATION, STORAGE AND SHIPPING

11.1. The handling, mooring, preservation, storage and shipping requirements shall meet the API 17E and additional requirements set out in the contractual documentation, throughout all stages of the execution process, storage and transportation of the product.

11.2. When applicable, stainless steel materials, nickel alloys or titanium alloys shall be stored, handled and processed according to the Supplier's specific procedures for each type of material in order to avoid the risk of contamination.

12. MANUFACTURING QUALITY AUDIT

12.1. Periodic audits may be carried out by PETROBRAS during the manufacturing process and the Supplier shall consider, at least, the following items in addition to those defined in I-ET-0000.00-0000-972-1AL-001:

a) Homologation of the prototype;
b) Certification of inspectors (when applicable) or evidence of qualification/training;
c) Analysis and approval of ITP;
d) Holding of PIM;
e) Qualification of Sub-supplier;
f) Approval/qualification of manufacturing and inspection procedures;
g) Identification and traceability control;
h) Methodology of control and maintenance of standards and instruments of measurement and control;

i) Evidence of compliance with all the technical requirements defined in the contractual standards and technical specifications;
j) Verification of the manufacturing stages defined in the ITP, performance of the Guarantee System and quality control of the Supplier and the Responsible for the Manufacturing Inspection;
k) Evidence of assembly and testing;
l) Evidence of preservation, mooring and packaging;
m) Evidence of treatment of nonconformities;
n) Evidence of quality records and action plans.

NOTE: In the audits, the activities performed in the Sub-suppliers throughout the Umbilical manufacturing process, and their components and ancillary equipment (according to the Inspection and Test Plans - PIT) may also be verified, and these activities shall be in compliance with the Supplier/Sub-Suppliers' Quality System, ISO 9001, ISO 17020 and the INMETRO accreditation system.