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	PROJECT:	ALL		-
	AREA:	GENERAL		-
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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR ALTERED SHEETS
0	Original Issue
A	Items 1, 2 and 6
B	Items 6.12.1, 10.3.1, 10.4.1, 13.1 and 14.4
C	Item 10.3.1 c) f); Section 3 NOTE 2

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DATE	08/01/2019	20/03/2019	22/04/2019	29/05/2019				
PROJECT	DPU	DPU	DPU	DPU				
EXECUTION	CSM5 EM1E RNIU UQY9	UQY9	CSM5	RNIU				
VERIFICATION	CSMB UPK1	CSMB UPK1	RNIU	A500				
APPROVAL	UTJ6	UTJ6	UTJ6	UTJ6				


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THIS FORMULARY BELONGS TO PETROBRAS N-381 REV. L.

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1. PURPOSE

This document establishes the minimum quality requirements that shall be considered and fulfilled by the Supplier during the entire manufacturing process of equipment for well construction and it shall be considered as a complementary document to I-ET-3000.00-1000-972-1AL-001 – Quality of Material General Requirement.

NOTE: In case of conflict, this Complementary Requirement shall prevail.

2. SCOPE

2.1. This document shall apply to the following corporate families of material:

- a) Downhole Safety Valve (DHSV);
- b) Production Packer;
- c) Integral Chemical Injection Mandrel;
- d) Side Pocket Mandrel;
- e) Conventional or integral Mandrel;
- f) Intelligent Completion System;
- g) Subsurface Inflow Control Valve;
- h) Sand Control Screens;
- i) Hydraulic Formation Isolation Valve - ISO 28781;
- j) Conventional Completion System;
- k) Gas Lift Valve.

3. REFERENCES

3.1. ABNT NBR 16137 - Nondestructive testing - Material Identification by spot test, X-ray fluorescence spectrometry and optical emission spectrometry

3.2. ISO/IEC 17025 - General requirements for the competence of testing and calibration laboratories

3.3. API RP 578 - Guidelines for a Material Verification Program (MVP) for New and Existing Assets


3.4. ASTM A1038 – Standard Test Method for Portable Hardness Testing by the Ultrasonic Contact Impedance Method

3.5. ASTM A751 – Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

3.6. ASTM E10 – Standard Test Method for Brinell Hardness of Metallic Materials

3.7. ASTM E18 – Standard Test Methods for Rockwell Hardness of Metallic Materials

3.8. ASTM E110 – Standard Test Method for Rockwell and Brinell Hardness of Metallic Materials by Portable Hardness Testers

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- 3.9.** ASTM E322, Test method for analysis of low-alloy steels and cast irons by wavelength dispersive X-ray fluorescence spectrometry
- 3.10.** ASTM E572, Test method for analysis of stainless and alloy steels by wavelength dispersive X-ray fluorescence spectrometry
- 3.11.** I-ET-0000.00-0000-972-1AL-001 - Quality of Material General Requirement
- 3.12.** NAS 1638 - Cleanliness requirements of parts used in hydraulic system
- 3.13.** PETROBRAS NI-133 - Welding
- 3.14.** PETROBRAS NI-2301 - Preparation of Welding Technical Documentation
- 3.15.** PG-3ED-00126-C - Procedimento de Flushing
- 3.16.** SAE AS 4059 - Aerospace Fluid Power – Contamination Classification for Hydraulic Fluids

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: PETROBRAS NI-133 e NI-2301 are guidelines, and may be followed by Supplier, according to its convenience, when project specifications do not provide details about welding process.

4. DEFINITIONS, TERMINOLOGIES AND ACRONYMS

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

5. EQUIPMENT CATEGORIZATION


The equipment shall be classified according to the design standard (e.g. PSL, Project Validation and Quality Level) and other contractual documents. This classification shall be included in the Inspection and Test Plan.

6. MINIMUM MANUFACTURING INSPECTION ACTIVITIES

In addition to the minimum manufacturing inspection activities set out in I-ET-0000.00-0000-972-1AL-001, the following activities shall be considered by the Inspection Body. Other inspection and testing activities required in the contractual documentation shall be included in the ITP.

6.1. DHSV – Downhole Safety Valve

6.1.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

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- a) PMI of finished components, before assembly;
- b) Drift testing;
- c) Identification (individual traceability) of the components assembled on each valve, including identifying their position of assemblage;
- d) Measurement of the surface roughness on sealing areas of the piston with the dynamic seals;
- e) Dimensional examination of the Flapper and Flapper seat;
- f) Load test of the primary closure springs - Alternatively to the Hold Point at load test, the Supplier may perform the test at an accredited laboratory in accordance with ISO 17025, and submit the result in the data book;
- g) All normative tests and other tests required in PETROBRAS technical specifications.

6.1.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Points**, at least, the following steps:

- a) Nondestructive testing;
- b) Assemblage of valves;
- c) Dimensional examination of the dynamic seals;
- d) Dimensional examination of critical components.

6.1.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.1.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.


6.2. Production Packer

6.2.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

- a) PMI of finished components, before assembly;
- b) Verification of test results of pins and/or shear rings;
- c) Drift testing;
- d) Check of metallic coating of wedges;
- e) Hardness measurement of the sealing rubbers.

6.2.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Points**, at least, the following steps:

- a) Nondestructive testing;
- b) Assemblage of packer;

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c) Dimensional examination of critical components.

6.2.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.2.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

6.2.3. The ITP shall detail the components reporting the classification (Type I or Type II, according to API 11D1). The ITP shall report the quality grade Q1, Q2 or Q3 of the quality control according to Design and Validation.

6.3. Integral Chemical Injection Mandrel

6.3.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

- a) PMI of finished components, before assembly;
- b) Drift testing.

6.3.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Point**, at least, the following step:

- a) Nondestructive testing;

6.3.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.


6.3.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

6.4. Side Pocket Mandrel

6.4.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

- a) PMI of finished components, before assembly;
- b) Drift testing.

6.4.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Point**, at least, the following step:

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a) Nondestructive testing.

6.4.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.4.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

6.5. Conventional or Integral Mandrel

6.5.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

- a) PMI of finished components, before assembly;
- b) Drift testing.

6.5.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Point**, at least, the following step:

a) Nondestructive testing.

6.5.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.5.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

6.6. Intelligent Completação Sistema

6.6.1. The minimum activities of the Inspection Body for each component of the Intelligent Completion System shall be performed as defined in this section 6, in addition to I-ET-0000.00-0000-972-1AL-001 – Quality of Material General Requirement.

6.6.2. Components of the Intelligent Completion System not mentioned in this document, only the I-ET-0000.00-0000-972-1AL-001 – Quality of Material General Requirement is applicable.

6.7. Subsurface Inflow Control Valve (ICV)

6.7.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

- a) PMI of finished components, before assembly;
- b) Drift testing.

6.7.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Point**, at least, the following step:

- a) Nondestructive testing.

6.7.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.7.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

6.8. Sand Control Screens

6.8.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:


- a) PMI of finished components, before assembly;
- b) Drift testing.

6.8.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Point**, at least, the following step:

- a) Nondestructive testing.

6.8.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.8.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

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6.9. Hydraulic Formation Isolation Valves - ISO 28781

6.9.1. For each Purchase Order, the Inspection Body shall assign as **Hold Points**, at least, the following steps:

- a) PMI of finished components, before assembly;
- b) Drift testing.

6.9.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Points**, at least, the following steps:

- a) Nondestructive testing;
- b) Assemblage of the valve.

6.9.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.9.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

6.10. Conventional Completion System

6.10.1. The manufacture of each component of the Conventional Completion System described in the contractual technical documentation shall be accompanied by the inspection body as defined in this document, in addition to I-ET-0000.00-0000-972-1AL-001– Quality of Material General Requirements.

6.10.2. Components of the Conventional Completion System not mentioned in this document, only the I-ET-0000.00-0000-972-1AL-001 – Quality of Material General Requirement is applicable.


6.11. Gas Lift Valve (GLV)

6.11.1. For each Purchase Order, the Inspection Body shall assign as **Hold Point**, at least, the following step:

- a) PMI of finished components, before assembly.

6.11.2. For each Purchase Order, the Inspection Body shall assign as **Monitoring Points**, at least, the following steps:

- a) Nondestructive testing;

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b) Assemblage of the valve.

6.11.2.1. Each step shall be monitored by the Inspection Body at least once a week, considering the period of execution the respective step.

6.11.2.2. The above activities must be performed and recorded by the Supplier for 100% of the items.

GENERAL NOTE: Critical component shall be defined by Supplier and PETROBRAS according to I-ET-0000.00-0000-972-1AL-001.

6.12. Other Equipment or Component

The equipment listed below shall be treated as operational from the point of view of quality (do not require the contracting of manufacturing inspection), even if they are part of a Critical or Strategic.

- a) Mule Shoe;
- b) Mule Shoe for Gravel Pack;
- c) Bull plug;
- d) Mule Shoe Guide for Gravel Pack.

7. INSPECTION PLANNING


7.1. Pre Manufacturing Meeting – PMM

7.1.1. This meeting may include more than one purchase order (PC), since that they have the same equipment, requirements and contractual technical specification.

7.1.2. This meeting may be waived by PETROBRAS if the new purchase order has the same equipment, requirements and specifications of other PMM previously performed. In this case, the Supplier shall formalize the necessity to guarantee the same conditions set out in previous PMM.

7.2. Planning of Inspection Events at Supplier Facilities

7.2.1. In addition to I-ET-0000.00-0000-972-1AL-001, the Supplier shall prepare an initial planning prior to the start of the manufacture of the product, from placing the purchase order to its delivery. This planning shall be focused on the inspection and tests view pointed out in the ITP.

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7.2.2. This planning shall be submitted to the Inspection Body contracted prior to the beginning of manufacture, including inspection activities at sub-suppliers' facilities.

7.3. Planning of Inspection Events at Subsupplier Facilities

7.3.1. The Sub-suppliers of materials, components and inputs for the manufacture of the equipment shall be duly approved by the Supplier's evaluation methodology according to its Quality Management System.

7.3.2. The Supplier shall select and evaluate Sub-suppliers in accordance with the requirements of Standard NBR ISO 9001, I-ET-0000.00-0000-972-1AL-001, this Complementary Requirement and other contractual documents, where and when applicable, in order to ensure compliance with all criteria established for the supply, with the methodology for periodic revaluations, aiming a continuous improvement in this process.


7.3.3. The qualification criteria and the frequency for requalification of these Sub-suppliers shall be submitted and validated by the Inspection Body.

7.3.4. The Supplier shall establish and reproduce in the Sub-suppliers deemed critical, the same practices and requirements established by PETROBRAS, such as PMM, preparation of PIT, treatment of nonconformities, elaboration of quality indicators, with the participation of the Inspection Body.

7.3.5. The manufacturing inspection at Sub-Suppliers is the responsibility of the Contracted Inspection Body. Inspection activities shall be witnessed by the Manufacturing Inspector, observing their respective modality of performance. 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.

8. INSPECTION AND TEST PLAN

8.1. The ITP shall comply with the requirements established by ISO 9001, I-ET-0000.00-0000-972-1AL-001 (item 8.1) and this Complementary Requirement. In addition, the Supplier shall submit to the Inspection Body an ITP for each equipment, main components and accessories to be provided, prior to the start manufacturing, ensuring the compatibility of the materials with the design requirements, procedures and contractual documentation.

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8.2. In order to ensure the compliance of the material with the contractual conditions, the Inspection Body should define, at the time of the approval of the ITP, for each Purchase Order, the extent of its participation in the follow-up of the inspections and tests to be carried out at the factory premises (such as HP, WP, RD, M), including at least the inspection activities defined by the Quality of Material General Requirements and this Complementary Requirements.

8.3. The ITP shall include inspection by the Supplier, at Sub-supplier, according to the technical requirements and acceptance criteria established in the project and in the contractual documentation.

8.4. When designating critical items, the Supplier shall take in account at least:

- a) Exposure to the production fluid (well pressure - pressure containing);
- b) Exposure to stresses that result in high levels of tensile, such as fasteners, springs and components and lifting devices;
- c) Relevant aspects of project or the manufacturing process, such as: pioneering project, domain of characteristics, operations or complexity of the manufacturing process and volumetric NDT throughout the manufacturing;
- d) Sealing components (seals, rings, gaskets, o-rings etc.);
- e) Items defined in the contractual documents;
- f) Control system equipment: sensors, electrical and hydraulic connectors, electronic components etc.

9. PERSONNEL AND PROCEDURES QUALIFICATION


9.1. Qualification of Personnel

9.1.1. For execution of inspection related to manufacturing, welding, non-destructive testing, the Supplier shall follow the definitions in I-ET-0000.00-0000-972-1AL-001.

9.2. Qualification of Procedures

9.2.1. Non-destructive testing, welding, testing and repair procedures
The supplier shall qualify the following procedures for non-destructive testing, welding, testing and repair prior to the respective activity.

- a) Radiography Testing;
- b) Ultrasonic Testing;
- c) Dye Penetrant Testing;
- d) Magnetic Particle Testing;
- e) Visual Testing;

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- f) Hardness Testing;
- g) Welding;
- h) Pickling and Passivation;
- i) Repairs.

9.3. Other Required Procedures

9.3.1. Procedures shall be qualified according to the contractual premises and/or technical requirements of the Supplier. The qualification process for these procedures shall be witnessed and approved by the Inspection Body.

10. EXECUTION OF MANUFACTURING INSPECTION

The following items shall be considered in addition to those set out in I-ET-0000.00-0000-972-1AL-001.

10.1. Minimum Activities to Start Manufacturing

10.1.1. To start manufacturing, the following conditions shall be met:

- a) Pre-manufacturing meeting (PMM);
- b) Definition of the Inspection Body.


10.2. Technical Documentation of Manufacture - Data Book

10.2.1. The Supplier shall keep available for review by the Inspection Body, all quality records and inspections performed as required in the Inspection and Test Plans (ITP). All these records shall be in the Date Book.

10.3. Welding Process

10.3.1. The following documents shall be available for review by the responsible for the manufacturing inspection, when applicable, before carrying out the inspection and tests activity according to ITP.

- a) certification or training/qualification evidence of welding inspectors;
- b) procedure of storage and handling of welding consumables approved by certified welding inspector;
- c) WPS, PQR and welding plans approved by certified welding inspector or FBTS welding engineer. The NDT shall according to ITP;
- d) Qualification Records of welders and/or welding operators, including tack welders, according to PETROBRAS NI-2301;
- e) Quality certificate of welding consumables;

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- f) Performance control criteria of welders and/or welding operators according to PETROBRAS NI-133, when required in contract.

10.4. Inspection and Testing Activities


10.4.1. During the manufacturing process and when applicable, all documentation necessary for the performance of the inspection event shall be available for verification by the Inspection Body. In addition to the procedures and records of the activity in progress, all evidences of personnel certification, qualification and certification of procedures, as well as approval of documents by PETROBRAS (when applicable) shall be available for verification by the Inspection Body. For instance:

- a) Certification of manufacturing inspectors;
- b) Certification of NDT inspectors;
- c) Qualification and adequacy of the inspection procedure of nondestructive tests by level 3 inspector in the respective technique;
- d) Welding procedure;
- e) PMI procedure;
- f) Factory acceptance testing procedure (FAT);
- g) Testing/assays procedure of component;
- h) Internal and/or external coating application procedure;
- i) Repair procedure;
- j) Certificate of calibration of instruments to be used for inspection and factory testing;
- k) Packing, shipping, transport and storage procedure;
- l) Indication of devices/equipment, including required accuracy, during the verification of critical dimensions, operation and performance testing.

10.5. Testing Procedures

10.5.1. The test procedures shall be prepared based on the design standards and complementary requirements (RM, ET, FD etc.) set out in the contract. Test procedures shall contain, at least, the following information:

- a) Purpose;
- b) Applicable standards;
- c) Personnel qualification;
- d) Tests description;
- e) Acceptance criteria;
- f) Conditions for performance (area, devices and accessories, safety, etc.);
- g) Test fluid;
- h) Chloride content (for materials susceptible to chloride corrosion);

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- i) Use of corrosion inhibitors (if applicable);
- j) Filters;
- k) Conditions and adequacy of the panel, lighting, resolution and calibration of manometers, transducers, displays, registers and software.

10.6. Testing Requirements

10.6.1. Supplier shall have systems and instruments to monitoring and recording the factory acceptance, performance, functional, integrity and sealing tests (hydrostatic or gas), compatible with the normative, project and contractual requirements.

10.6.2. All hydrostatic tests shall be performed before any gas test.

10.6.3. For tests with cleaning class requirements, the fluids used must comply with Standard SAE AS 4059.

10.6.4. After testing, all connections should be sealed.

10.6.5. Integrity tests should be performed prior to painting. The pressure containing bodies or components (forged and/or rolled) may have their tests performed after the painting except in welded joints.

10.7. Requirements for Gas Testing


10.7.1. During preparation for gas testing, the Supplier shall ensure that all liquid fluid was removed from the cavity to be tested.

10.7.2. It is not allowed to remove liquids by flowing gas into the system.

10.7.3. The Supplier shall have systems in place for the visual monitoring of the gas tests, which guarantee the safety of those involved in the activities and which have a resolution capable of visualizing leaks (arising of bubbles).

10.7.4. The Supplier shall have the means to ensure the visualization of all pressurized interfaces where leaks may occur during the tests.

10.7.5. In tests involving a large volume of gas, the use of volume reducers shall be defined and detailed by the Supplier's engineering and inserted in the test procedure.

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10.8. Restriction on the use of sealing tape

10.8.1. The use of tape is not permitted as an auxiliary element for sealing threads or any other components.

11. RECORDS AND CERTIFICATIONS

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

11.1. Quality Records


11.1.1. At least, the following documents (where applicable) shall be issued/made available by the Supplier, reviewed and approved by the Inspection Body:

- 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 the ITP and drawings;
- d) Nonconformity Report 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 inspection reports;
- i) Certificate of welding consumables (if applicable);
- j) Record of stress relief heat treatment (if applicable);
- k) Factory acceptance test report;
- l) Inspection report on the application of coating/painting, detailing the preparation of the surface, each layer applied, as well as results regarding the thickness and adhesion and mapping of the touched up regions;
- m) Flushing report;
- n) Certificate of Conformity;
- o) Heat treatment records, including procedures, equipment, time and temperature graph;
- p) Drift test reports.

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

12. HANDLING, PRESERVATION, STORAGE AND SHIPPING

12.1. The handling, mooring, preservation, storage and shipping requirements shall meet the design standard and additional requirements set out in the

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contractual documentation, throughout all stages of the execution process, storage and transportation of the product.

12.2. 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.

12.3. The supplier shall prepare a preservation and storage procedure for elastomers and polymers considering the protection against the incidence of ultraviolet rays, intemperate weather etc.

13. MANUFACTURING QUALITY AUDIT


Periodic audits shall be carried out during the manufacturing process and the following aspects shall be considered in addition to those established in I-ET-0000.00-0000-972-1AL-001.

13.1. Manufacturing Process

13.1.1. The following stages of the equipment manufacturing process (according to the Inspection and Test Plan - ITP) shall be verified/confirmed through this Audit:

- a) Qualification of the prototype;
- b) Certification or evidence of qualification/training of inspectors;
- c) Analysis and approval of ITP;
- d) Records of PMM;
- e) Qualification of Sub-suppliers;
- f) Approval / qualification of manufacturing and inspection procedures;
- g) Control of Traceability and identification;
- h) Methodology of control and maintenance of calibration standards and instruments of measurement and control;
- i) Evidence of compliance with all the technical requirements set out in the contractual standards and technical specifications;
- j) Verification of the manufacturing stages defined in the ITP, the performance of the Quality Assurance and Quality Control System of the Supplier and the Inspection Body;
- k) Evidence of assemblage and testing;
- l) Evidence of preservation and packaging;
- m) Evidence of nonconformity treatment;
- n) Evidence of quality records and action plans.

NOTE: It shall also be verified in audits the inspection and testing activities performed at the Sub-suppliers throughout the manufacturing process of the

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Equipment (according to the ITP). These activities shall comply with Quality System of Supplier/Sub-supplier, ISO 9001, ISO 17020 and accreditation system.

14. COMPLEMENTARY NOTES

14.1. It is not allowed to use amended o-rings and gaskets.

14.2. The approval of the furnaces used in the processes of Heat Treatment shall meet the requirements of the respective design standards.

14.3. Hardness testing equipment using the rebound method or measurement through comparison is not permitted.

14.4. Regarding to I-ET-0000.00-0000-972-1AL-001 item 8.3.1 paragraph “b”, consider “Absence of COD” instead of “Absence of untreated COD”.