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	CLIENT OR USER:				ALL				FOLHA 1 de 23	
	JOB OR PROJECT:				ALL				-	
	AREA OR UNIT:				GENERAL				-	
SBS/PROJINV/QB	TITLE:				<b>COMPLEMENTARY QUALITY REQUIREMENT FOR VALVES</b>				PUBLIC	
EI										
<b>INDEX OF REVISIONS</b>										
<b>REV.</b>	<b>DESCRIPTION AND/OR ALTERED SHEETS</b>									
0	Original Issue									
A	General Review									
B	Included items 3.1.2, 3.1.3 e 4.2.1.1. Revised items 4.1 and 4.2.1									
C	Excluded item 6.11 and revision of following after items numbers Revised items 1 and 4.3 Included items 5.5, 5.5.1 to 5.5.7 Revised Annex 1, 2, 3 and 4									
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CHECK	UQZ5	UQZ5	CTMV	CTMV						
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## 1. PURPOSE

This Technical Specification sets out the minimum quality requirements in the supply of valves (with or without actuator) for installation in PETROBRAS' industrial and exploration and production units. It defines parameters for an inspection based on components inspection. It applies to the following types of valves:

### 1.1 Industrial Valves

Angle Globe Valve (VAN), Butterfly Valve (VBO), Diaphragm Valve (VDI), Ball Valve (VES), Gate Valve (VGA), Globe Valve (VGL), Plug Valve (VMA) and Check Valve (VRE).

### 1.2 Control Valves

### 1.3 Spring loaded or pilot operated safety and/ or relief valves

This requirements are complementary to ET-0000.00-0000-972-1AL-001 – Quality of Materials General Requirements. In case of disagree, this complementray requirement shall prevail.

1.4 This document is not applicable for body / bonnet manufacture in bronze alloy, brass alloy (ASTM B61 or ASTM B62) or cast iron.

## 2. REFERENCES

- ET-0000.00-0000-972-1AL-001 –Quality of Materials General Requirements
- ABNT NBR 15827 – Industrial Valves for installations of exploration, production, refining and transport of petrol products – Requirements for design and prototype test

2.1 The documents applicable to the project are not limited to those listed in this Complementary Quality Requirement. The other listed documents in the contract shall be observe. In case of conflict between contractual requirements, the most stringent criterion shall prevail.


## 3. DEFINITIONS

The definitions adopted in this document are present in ET-0000.00-0000-972-1AL-001 and ABNT NBR 16278

### 3.1 Terminology

#### 3.1.1 Batch

It is consider a batch the set of units belonging to the same run and the same set-up of product machining to be inspected to verify compliance with the acceptance requirements.

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### 3.1.2 Valve Rejection Index – IRV

Percentage of rejected valves during the manufacturing inspection process. This index consider the critical non conformity average in a priod of four months related with quantity of inspected valves.

### 3.1.3 Critical Non Conformity

Follow the critical non conformity for valves:

- a) Dimensional verification, including thickness.
- b) Positive material identification
- c) Hardness
- d) Body integrity test
- e) Seat leak test
- f) Functional acceptance test

## 4. MINIMUM MANUFACTURING INSPECTION ACTIVITIES

In addition to ET-0000.00-0000-972-1AL-001 the following activities shall be witnessed by the Responsible for the Inspection, taking into account the applicability for each type of valve.

### 4.1 Initial Inspection

- a) Visual and dimensional inspection of critical components after machining.
- b) Verification of certificate of flow capacity for safety and / or relief valves.
- c) Verification of all technical documentation (product conformity report listing tests, inspections carried out, raw material certificates, records generated by the supplier in response to manufacturing).


### 4.2 Intermediate inspection

- a) Inspeção visual e dimensional dos componentes críticos após a usinagem.
- b) Measurement of wall thickness.
- c) Positive material identification
- d) Hardness measurement of the FJA channels and hardened regions.
- e) Verification of roughness of the components that require this control.

**4.2.1** The supplier who fully complies with items 8.3.1.a to 8.3.1.d of ET-0000.00-0000-972-1AL-001 is dismiss from the witness of intermediate inspection by the responsible for the Inspection.

**4.2.2** If the IQF is less than 97,0% in the last 3 auditing foreseen in the ET-0000.00-0000-972-1AL-001 item 8.3.1a, manufacturer is dismiss of witness intermediate inspection by responsible for the inspection, as follow:

**4.2.2.1** IRV (Valve Rejection Index) average less than 1% (one percent) in a period of four months.

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**4.2.2.2** Valve with API Monogram or certify according NBR 15827.

### **4.3 Final Inspection**

- a) Electrical continuity test.
- b) Body and bonnet (or cover) integrity test.
- c) Seat tightness test.
- d) Cavity relief test.
- e) Functional test with pressure.
- f) Studs / stud bolts torque.
- g) Drive torque.
- h) Verification of markings.
- i) Identification and traceability.
- j) Paint inspection when required PETROBRAS standard.
- k) Visual and dimensional final inspection (assembled valve).
- l) Data Book final verification.

**4.3.1** In cases where the supplier is dismissed from the witness of intermediate inspection by the responsible for the Inspection according to item 4.2.1, the activities of measuring wall thickness, PMI (where accessible), hardness measurement of the FJA channels and hardened regions, roughness verification of components requiring this control (where accessible) shall be performed during the final inspection..

### **4.4 Other inspection activities**

The other inspection and testing activities required under the contractual documentation shall be included in the ITP. The participation of the responsible for the inspection shall be define through hold points during the ITP analysis and approval.

## **5. INSPECTION PLANNING**


### **5.1 Industrial valve manufacturing inspection**

In order to inspect the manufacturing of industrial valves, at least the checks applicable to the critical components set forth in item 7 shall be perform, in accordance with items 5 and 6 of this requirement.

#### **5.1.1 Before valve assembly**

**5.1.1.1** Analysis of 100% of supplier manufacturing records (visual, dimensional, body thickness and cover / bonnet, PMI, non-destructive testing, hardness testing, critical components referred in the ITP, welding documentation, non-conformity reports), as well as other applicable records in compliance with the constructive standards.

**5.1.1.2** Inspection of critical components by comparing them with the registers generated by the manufacturer:

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a) in 100% of the batch: visual inspection of the critical components mentioned in the ITP, measurement of wall thickness (body, cover / bonnet), dimensional face-to-face, dimensional drilling circle, grooves, verification of guide clearances and wear travel for gate valves, identification and traceability. For bipartite or tripartite valves, the face-to-face dimension shall be performed according to item 5.1.2.6.

b) Verification by batch sampling: dimensional of critical dimensions (except body wall thickness, cover / bonnet and other dimensions referred to in 5.1.1.2.1), roughness, PMI and hardness test.

### **5.1.2 After valve assembly**

**5.1.2.1** Hydrostatic test of body integrity and cover /bonnet using the final studs, bolts, studs bolts, nuts and gaskets. The supplier shall submit the original certificate of integrity of the body and cover / bonnet approved by a qualified professional.

#### **5.1.2.2** Seats tightness test.

a) For ball valves, perform cavity relief test, meeting regulatory and supplementary requirements, when applicable.

b) For check valves, perform low pressure test, if foreseen in constructive contractual standard.

**5.1.2.3** Pneumatic seat tightness test for valves whose operating fluid is gas, except for check valves.

**5.1.2.4** Verification, by sampling, of the following torques, following the sequence below:

a) Tightening of the studs, bolts, studs bolts and nuts in the junction cover - body and cover/ bonnet –body.

b) Tightening of the gaskets, screws, studs bolts and gasket nuts.

c) Actuation and / or closing.


#### **5.1.2.5** Visual final inspection

**5.1.2.6** Dimensional final inspection contemplating at least the interference dimensions in the field assembly. For ball-type, face-to-face valves shall be checked at this stage

**5.1.2.7** Painting inspection (only when specified in PETROBRAS standard).

**5.1.2.8** Verification of the nameplate and analysis of the records generated in this stage of manufacture.

### **5.2 Manufacturing inspection of forged valves up to 2”**

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**5.2.1** For forged valve inspections up to and including 2", all valves in the batch shall be assemble. A valve from each batch shall be select by responsible for the inspection to be dismantled, in order to verify the entire internal part. In this sample, dimensional inspection of the critical dimensions, measurement of wall thickness, alloy recognition test (where applicable) and hardness test (where applicable) as recommended in the Inspection and Testing Plan shall be carried out. If the inspection does not present non-conformities, the valve and any batch pertinent to that sample shall be considered approved in relation to critical internal ratings, alloy recognition and hardness, and it is not necessary to disassemble the other valves of this batch.

For all the rest of the batch presented assembled, at least the following checks shall be carry out:

**5.2.1.1** Analysis of 100% of the records generated by the supplier during manufacturing (visual, dimensional, body thickness and cover / bonnet, PMI, non-destructive tests, hardness test, raw material origin certificates critical components referred in the ITP, welding documentation, non-conformity reports), as well as other applicable records in compliance with the design codes.

**5.2.2** Verification in 100% of the batch: visual inspection of the critical components mentioned in the ITP and accessible with the assemble valve, wall thickness measurement (body, cover / bonnet), dimensional face to face, identification and traceability.

**5.2.3** Verification by batch sampling: dimensional verification of critical dimensions (except body wall thickness, cover / bonnet and other dimensions referred to in 5.2.2), alloy recognition test (where accessible) and hardness test (where applicable and accessible).

**5.2.4** Pressure test in 100% of the batch, according to the contractual specification and sequence below:

**5.2.4.1** Hydrostatic test of the body and cover / bonnet with the assembled valve and with the use of studs, bolts, studs bolts, nuts and gaskets. The supplier shall submit the original body and cover / bonnet integrity pre-approved certificate.


**5.2.4.2** Seats tightness test.

**5.2.4.3** Pneumatic seat sealing test for valves whose operating fluid is gas, except check valves.

**5.2.5** Verification, by sampling, of the following torques, following the sequence below:

**5.2.5.1** Tightening of the studs, bolts, studs bolts and nuts in the junction cover -body and cover/ bonnet –body.

**5.2.5.2** Tightening of stud, bolts, nuts of gland flange (gland packing).

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**5.2.5.3** Actuation and / or closing.

**5.2.6** Visual final inspection

**5.2.7** Dimensional final inspection contemplating at least the interference dimensions in the field assembly. For ball valve, face-to-face dimension shall be check at this stage.

**5.2.8** Painting Inspection (only when specified in PETROBRAS standard).

**5.2.9** Verification of the nameplate, analysis of the records generated in this stage of manufacture.

### **5.3 Manufacturing Inspection of control valves**

For manufacturing inspection of control valves, at least the checks applicable to the components defined as critical in item 7 shall be carry out in accordance with items 5 and 6 of this requirement.

#### **5.3.1 Before valve assembly**

**5.3.1.1** Analysis of 100% of the records generated by the supplier during manufacturing (visual, dimensional, body thickness and cover / bonnet, PMI, non-destructive tests, hardness test, raw materials origin certificates critical components referred to in the ITP, welding documentation, reports of nonconformities, required functional blocks, test reports of the electric actuator motor, as well as other applicable registers in compliance with the design standards.

**5.3.1.2** Inspection of critical components by comparing them with the records generated by the manufacturer:

a) In 100% of the batch: visual inspection of the critical components mentioned in the ITP, measurement of wall thickness (body, cover / bonnet), dimensional face-to-face, dimensional drilling circle, grooving, identification and traceability. For bipartite or tripartite valves, the face-to-face dimension shall be perform according to item 5.3.2.7.

b) Batch sampling verification: dimensional dimension of the critical dimensions (except body wall thickness, cover / bonnet and other dimensions referred to in 5.3.1.2.a, alloy recognition test and hardness test.


#### **5.3.2 After valve assembly**

**5.3.2.1** 1 Hydrostatic test of body integrity and body and cover / bonnet using the final studs, screws, studs bolts, nuts and gasket. The supplier shall submit the original body and cover / bonnet integrity pre-approved certificate.

**5.3.2.2** Seat leakage test with water or air as per test standard.

**5.3.2.3** Functional test comprising:



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- a) Linearity.
- b) Repeatability.
- c) Position of pneumatic and electric failure.
- d) Leakage test from the positioner control.
- e) Indication and transmission of position.
- f) Verification of the characteristics of the positioner through the hand held.

**5.3.2.4** Other specific tests, when applicable and requested in contract:

- a) *Partial stroke* test.
- b) Number of acutations.
- c) Opening / Closing time.
- d) Test of applied voltage and insulation resistance.

**5.3.2.5** Verification, by sampling, of the following torques, following the sequence below:

- a) Tightening of the studs, bolts, studs bolts and nuts in the junction cover - body and cover/ bonnet –body.
- b) Tightening of stud, bolts, nuts of gland flange (gland packing)..

**5.3.2.6** Visual final inspection

**5.3.2.7** Dimensional final inspection contemplating at least the interference dimensions in the field assembly. For ball valve, face-to-face dimension shall be check at this stage.


**5.3.2.8** Painting Inspection (only when specified in PETROBRAS standard).

**5.3.2.9** Verification of the nameplate, analysis of the records generated in this stage of manufacture.

**5.4 Safety valve and / or spring relief or pilot operated manufacturing inspections**

For safety valve and / or spring relief or pilot operated manufacturing inspection, at least the checks applicable to critical defined components set forth in item 7 shall be perform in accordance with items 5 and 6 of this requirement.

**5.4.1 Before valve assembly**

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**5.4.1.1** Analysis of 100% of the records generated by the supplier in order to fabrication (visual, dimensional, body thickness and cover / bonnet, alloy recognition test, nondestructive tests, hardness test, raw material origin certificates of critical components referred to in ITP, welding documentation, non-conformity reports) , as well as other applicable registries in compliance with the design standards.

**5.4.1.2** Inspection of critical components by comparing them with the records generated by the manufacturer:

- a) In 100% of the batch: visual inspection of the critical components quoted in the ITP, measurement of wall thickness (body, cover/ bonnet), dimensional face-to-face, dimensional drilling circle, grooving, identification and traceability.
- b) Batch sampling: verification of critical dimensions (except body wall thickness, cover /bonnet), spring load test, alloy recognition test and hardness test.

**5.4.1.3** Hydrostatic test to check integrity of primary parts, secondary parts and nozzle in 100% of the batch according to the contractual specification.

**5.4.1.4** The supplier shall submit the certificate of body and cover / bonnet hydrostatic test.

#### **5.4.2 After valve assembly**

**5.4.2.1** Hydrostatic test of body integrity of cover /bonnet using the final studs, screws, studs bolts, nuts and gaskets. The supplier shall submit the certificate of body and cover / bonnet hydrostatic test.

**5.4.2.2** Seat sealing test.

**5.4.2.3** Adjustment pressure test.

**5.4.2.4** Functional test of the lever (when applicable).

**5.4.2.5** Bellow integrity test (when applicable).


**5.4.2.6** Sampling verification of tightening of the studs, bolts, studs bolts and nuts in the junction cover -body and cover/ bonnet –body.

**5.4.2.7** Final visual inspection.

**5.4.2.8** Dimensional final inspection contemplating at least the interference dimensions in the field assembly.

**5.4.2.9** Painting Inspection (only when specified in PETROBRAS standard).

**5.4.2.10** Verification of the nameplate and selflock security seal, analysis of the records generated in this stage of manufacture.

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## 5.5 Dispensation of Hiring the AIB for a Family of Material

**5.5.1** The Supplier may be waived of hiring an AIB, as required by item 8.3.1 of Quality Materials General Requirements, if the following criteria are fully met:

**5.5.2** IRV (Valve Rejection Index) average in a period of four months less than 1% (one percent).

**5.5.3** Absence of untreated COD.

**5.5.4** Absence of IR-NCR or CRM (Material Rejection) reporting High or Severe Nonconformities in the last 12 months.

**5.5.5** Own a Manufacturing Inspector, with Supervision attribution in its Quality Control staff, certified according to ABNT NBR 16278 or API SI in the modalities and levels applicable to the scope of the inspection. Other similar certifications, issued by independent entities, internationally recognized, shall be previously submitted to PETROBRAS Quality of Materials Department.

**5.5.6** Valve with API Monogram or NBR 15827 certification. If, in a particular situation, do not exist API Monogram, API Q1 will be considered.

**5.5.7** When supplier complete the third PETROBRAS quality audit, IRV will not be anymore considered for dispensation of hiring the AIB for a family of material

## 6. REQUIREMENTS FOR QUALITY GUIDELINES

Quality Guidelines (DQ) are the supplemental adaptations that shall be implement in the Supplier Quality System to meet the contractual requirements for valve supply.

### 6.1 Project

#### 6.1.1 Critical Components


Engineering department shall present to manufacturing inspection responsible (RIF) a list of critical components submitted to pressure. Critical component influence performance, maintenance, safety and product life.

#### 6.1.2 Critical Dimensions

The critical dimensions of the components defined in item 6.5.1 shall be present to manufacturing inspection responsible (RIF) including at least the dimensions standardized in the valve construction standard and the manufacturer's design

#### 6.1.3 AISI/SAE X ASTM Materials

When specified in the Contract, the AISI / SAE material term shall be consider as TYPE and shall be certify accordingly to ASTM regardless of the manufacturing process.

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**Note:** For materials submitted to the hardening thermal treatment to obtain the hardness differential (AISI 410), consider as a certificate requirement only chemical analysis and hardness, since in the hardening treatment the mechanical characteristics of the material are changed.

#### **6.1.4 NACE International – Standard Material Requirements**

When specified in the Contract, the supplier shall define criteria for hardness control, as required by NACE MR0175 / ISO 15156, "Petroleum and natural gas industries - Material for use in H<sub>2</sub>S-containing environments in oil and gas production" (upstream condition) or requirements NACE MR0103 / ISO 17945 "Materials resistant to sulfide stress cracking in corrosive petroleum refining environments" (downstream condition).

#### **6.1.5 INMETRO Administrative Rule 179 of May 18, 2010**

When defined in the Contract, electrical components for classified area shall comply with INMETRO Administrative rule 179 - Requirements and criteria for the compliance assessment program on electrical and electronic equipment for explosive atmospheres.

#### **6.2 Welding Process**

The supplier shall submit a welding plan to be applied to the valve design (coating and welding), with the relevant specifications, such as: WPS, PQR, WPQ/WOPQ and welding operator, according to ASME IX, N-133 and N -2301, with the appropriate approval of a level II SNQC (National Qualification and Certification System) welding inspector. For repairs coming from NCR, in addition to the above specifications, a Repair Execution Instruction shall be developed that includes at least method of defect removal, applicable NDT, Material Specification requirements, cavity mapping and defect location. The plan shall be submit to the responsible for the inspection. Tracking records shall be issue for any welding activity. The supplier shall have chemical reagents that allow the detection of repairs and make it available for responsible for the inspection use. Points for locking not provided for in construction regulations shall only be accept if specified in contract and with specific welding plan.


#### **6.2.1 Procedure for Welding Repairs**

**6.2.1.1** When it is necessary welding repairs, supplier shall issue NCR, attaching heat treatment records after repair (when applicable). Welding procedures shall be submit to manufacture inspection responsible approval. The material quality certificate shall include the traceability of the repair documentation.

#### **6.3 Coatings**

##### **6.3.1 Fasteners coating**

When ordered under Contract, fasteners shall be zinc / nickel plated to ASTM B 841, class 1, type B / E, grade 5 to 8 with stress relief and dehydrogenation.

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### 6.3.2 Dehydrogenation

Zinc / Nickel coated studs, screws, studs bolts and nuts that need to be treat with dehydrogenation heat treatment shall comply with ASTM B 849 and ASTM B 850. The heat treatment chart and other relevant documentation shall be provide.

### 6.4 Non-Metallic Sealing Rings and Seals

The project shall define the weight of the resilient component and / or composite (reinforced) material with other elements (fiberglass or carbon) in order to enable, at the receiving inspection, the compaction check of the component, besides verification of the hardness, as well as other items provided for in the standard.

### 6.5 Elastomers

The valve design shall specify a material that meets at least the requirements specified in the construction standards, which shall be verify by the fluid compatibility tests and approval by the elastomer manufacturer, as well as the storage, control service life and receipt inspection, except when specify in the contract. Documents shall be submit to the responsible for the inspection.

### 6.6 Non-Destructive Testing

#### 6.6.1 Penetrant Liquid Test

**6.6.1.1** When specify in contract, manufacturer shall perform penetrant liquid testing in accordance with PETROBRAS N-1596 on the external and internal machined parts (where accessible) of casting and micro casting (lost wax casting) valve bodies and casings. Acceptance criteria are pursuant ASME B16.34.


**6.6.1.2** When specify in contract, manufacturer shall perform penetrant liquid test according to the PETROBRAS standard N-1596 on all internal and external surfaces of cast and micro casting (lost wax casting) valve bodies and castings only when requested in PC (Purchase Request) or Purchase Order. Acceptance criteria are pursuant to ASME B16.34.

**6.6.1.3** When specify in contract, manufacturer shall perform penetrating liquid testing in accordance with PETROBRAS N-1596 standards for weld beads, weld beads between nipple and body, areas for sealing and against component sealing, with and without coating (e.g. 410 and Stellite). The acceptance criteria are pursuant to ASME VIII, division 1, appendix 8.

**6.6.1.4** When the sealing rings are seal by welding, the manufacturer shall perform penetrant liquid testing. The acceptance criteria shall be pursuant to ASME VIII, division 1, appendix 8.

**Note:** this item does not apply:

a) Bronze alloy, brass alloy and cast iron valves.

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b) Rolled internals components.

c) Forged (wrought) internals components.

### **6.6.2 Magnetic Particle and Ultrasound Test**

**6.6.2.1** When specify in contract, for castings Cr - Mo (Chromo - Molybdenum) or Cr - Mo - V (Chromo - Molybdenum - Vanadium) the manufacturer shall carry out and present the test certificate for magnetic particles according to PETROBRAS N-1598 standard in the body , cover / bonnet and shutter, internal and external side. Acceptance criteria are pursuant to ASME B16.34.

**6.6.2.2** For the materials referred to in 6.10.2.1, the manufacturer shall perform ultrasonic testing in the areas stressed by solidification and present a location map only when requested in PC (Purchase Request) or Purchase Order. Acceptance criteria are pursuant to ASME B16.34.

### **6.6.3 Test for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels**

When specify in contract, manufacturer shall perform the test on the body and bonnet components and present the certificate for verification of susceptibility to intergranular attack in accordance with ASTM A 262 Practice A or Practice E.

### **6.6.4 Positive Material Identification**

When specify in contract, supplier shall perform the alloy recognition test for material identification in the alloys provided for in N-1591 plus duplex and super duplex materials.

The supplier shall submit a chemical reagent "kit", with expiration date and certified standards that enable to carry out the alloy recognition test (PMI) or Positive Material Identification (PMI) by means of X-ray fluorescence


For the use of equipment not provided for hereinbefore, the supplier shall previously submit a procedure for evaluation by the responsible for the inspection.

### **6.6.5 Wall Thickness Measurement**

The supplier shall have a digital measuring device and the measurement shall be done by the ultrasonic method and performed in the regions of conforming subject to reduction of thickness in the bodies, cover and valve bonnets. For materials with a high index of sonic attenuation, the use of other measuring methods shall be permitted provided that it has been previously approved by the responsible for the inspection.

### **6.6.6 Radiography**

When requested in standard or Contract, the supplier shall perform X-ray testing on body junction top welds and valve flanges of non-integral construction.

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## 6.7 Process Control

### 6.7.1 Sampling Inspection

When sampling inspection is applicable, the criterion shall be adopted according to ABNT NBR 5426, inspection level II, "simple" sampling plan, normal inspection and EQS of 2.5%.

### 6.7.2 Inspection Records

Supplier shall submit, before the beginning of the inspection: visual, dimensional inspection, wall thickness measurement, hardness testing, non-destructive testing, alloy recognition test, tightening torque of the studs, bolts, studs bolts and body cover joint and body-cover/bonnet, tightening torque of the studs, screws, studs bolts and nuts, valve actuation torque, hydrostatic / pneumatic tests, welding monitoring and welding documents, instrument calibration certificates, reports (as specified in PETROBRAS standard), as well as other records provided for in the Inspection and Test Plan, for all critical components set out by the manufacturer's project. All records shall provide evidence of approval of the supplier's quality control.

### 6.7.3 RTJ Groove (Ring Type Joint)

The dimensional examination for RTJ groove shall be performed with a three dimensional instrument or an appropriate ball-gage type instrument. The use of a gauge for diameter, angle and depth checks is permitted if it was previously approved by the responsible for the inspection.

### 6.7.4 Finishing and Roughness Measure

The supplier shall have a rugosimeter for verification of flange contact face finishing and machined surfaces of valve components. These instruments shall enable the execution of the test with monitoring of the responsible for the inspection. Where not accessible, other appropriate instrument can be used if it was previously approved by the responsible for the inspection.


### 6.7.5 Heat Treatment

All heat treatment processes shall be carried out through a heat treatment plan according to the standard of the material employed.

The valve manufacturer shall submit to the responsible for the inspection the heat treatment graph, it shall refer to the fusing heat treatment plan, the type of heat treatment, the thermal cycle and the traceability of the part (heat number). This graph shall be approved by the foundry production responsible.

The heat treatment plan shall contain:

- a) Requirements specified in the material standard (e.g. ASTM A 703, ASTM A 991 and other standards related to the process).

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b) Traceability of the materials treated with the respective specimens.

### 6.8 Pressure Testing

The procedure shall be submit to the manufacturing inspection responsible for analysis.

**6.8.1** The pressure test procedure shall provide that the sealing tests are perform to ensure that the valve cavity is fully filled with test fluid and pressurized. This recommendation does not apply to double block trunnion ball valve with internal pressure relief.

**6.8.2** Tests shall be monitored using two calibrate pressure gauges (02 for low pressure and 02 for high pressure).

**6.8.3** Cavity relief test: When applicable, the test shall be carry out by the manufacturer and witness by the responsible for the inspection.

**6.8.4** Pressure tests shall be in accordance with the design standard. The maximum test times are up to 1.5 times the time defined by the constructive standard, counted from the pressure stabilization.

**6.8.5** For safety valves and / or spring-type or pilot-operated relief valves, in addition to item 6.8 and its sub-items, the following items and notes are also applicable:

**6.8.6** Pilot valve pressure and adjustment tests shall be performed separately from the main valve and, after approval, shall be mounted to the main valve for the performance of the applicable functional and sealing tests.

**6.8.6.1** Bellows (Balanced Valves). Perform pneumatic bellows test after assembly.


**Nota:** The valves shall be subjected to three pressure-release tests, for checking the repeatability and accuracy of the set pressure values. The results shall be recorded in the supplier's test reports.

### 6.9 PETROBRAS Standard Painting

When the painting process is contractual, the supplier shall submit the Painting Inspection Plan in accordance with the PETROBRAS N-13 standard approved by Inspector of Painting Level II. The Painting Inspection Plan, as well as the training records of the professionals involved in the painting process, shall be submitted to the responsible for the inspection before the services start. The paint inspection record shall be submitted for contractual processes.

The supplier shall provide in the Paint Plan that the internal surfaces of the flanges of the flanges of the body and bonnet and chassis gasket are painted before the final assembly of the valve according to the contractual painting procedure or at least with the paint scheme background paint provided for in the Agreement. This procedure shall be used for valves with diameters greater than 1 ½" and for valves whose



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designs have spacing between the flanges of the flanges of the body – cover and bonnet gasket.

### **6.10 Non-conformity Treatment Control**

**6.10.1** The NCR's, with already defined provisions pertinent to Purchase Orders, shall be submitted for the knowledge and analysis of the responsible for the inspection.

**6.10.2** NCRs that have provisions with recovery practices not provided for in the project, such as welding (where heat treatment is applicable), packing, deviations of dimensions standardized by the construction regulations and other items pertinent to the process, shall be submitted to the responsible for the inspection for acknowledgement, including the subcontractors' NCRs.

### **6.11 Filing of Quality Records**

The supplier shall file the records of the Inspection and Testing activities (internal to his process and his sub-suppliers) and allow them to be traceable during the life of the product. The minimum filing time for quality records shall be five years.

### **6.12 Inspections in Distributors and Resellers**

**6.12.1** Inspections may be carried out at the premises of these suppliers as long as they have a factory structure to meet the established technical requirements and have the express authorization of the manufacturer to disassemble the valve. The manufacturer's authorization shall be approved by PETROBRAS contract manager.

**6.12.2** Inspections shall be in accordance with ITP previously approved by the responsible for the inspection.

**6.12.3** If the supplier is a representative (distributor or reseller), the integrity of the body and cover /bonnet integrity condition provided for in the contractual constructive standard is accepted provided that all the following conditions are met:


**6.12.3.1** The integrity test of these critical components has been carried out at the factory with the surface free of any type of paint.

**6.12.3.2** The integrity test of these critical components has been witnessed by the responsible for the inspection.

**6.12.3.3** The inspection has been carried out in accordance with item 6.19.2 of this Technical Specification.

## **7. INSPECTION AND TEST PLAN (ITP)**

The supplier shall prepare and forward to the responsible for the inspection the ITP for approval according to the standard of Annexes 1, 2, 3 or 4.

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The PIT shall indicate the stages throughout the valve production cycle where the checks and inspections are carried out. The ITP shall indicate the types of examinations, tests or verifications to be carried out, procedures and / or applicable instructions, acceptance criteria, issued records, including inspections performed on sub-suppliers.

### **7.1 Procedures and Instructions Indicated in the ITP**

The supplier shall have and submit the inspection procedures and instructions for all activities foreseen in the PIT. The procedures shall contain the respective acceptance criteria referring to the respective standard. They shall be submitted for review and approval by the responsible for the inspection.

### **7.2 ITP of Valve Accessories**

The supplier shall have a standard ITP for accessories, according to Annex 4, when they are installed in the valve. This ITP shall be approved by the responsible for the inspection. Examples of accessories are: locking valves, drain and vent valves, safety valves, relief valves, welded pressure vessels, high pressure gas tanks or any other accessory requiring sub-contractor inspection.

### **8. DATA BOOK**

Supplier shall prepare and submit to manufacturing inspection responsible analysis the valve Data Book containing at least the following items, unless otherwise specified in the contract:

**8.1** Certificate of Conformity stating:

**8.1.1** Client name (unit or end user)

**8.1.2** Number of the Purchase Request or Purchase Order.

**8.1.3** Description of all valves released and their respective serial numbers.

**8.1.4** TAG number, if applicable.

**8.1.5** Type of actuator.

**8.1.6** Integrity and leakage tests performed.


**8.1.7** Time of the tests.

**8.1.8** Tightening torque value of the studs, screws, studs bolts and nuts of the body-cover and body-cover/ bonnet gasket.

**8.1.9** Value of the tightening torque of the studs, studs bolts and nuts.

**8.1.10** Value of the drive torque and / or closing torque.

**8.1.11** Traceability table of materials containing all critical components and, at a minimum, the following information for each component: material, run, certificate number of origin, supplier.

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**8.1.12** Number of all inspection reports (visual, dimensional, test and painting) issued by the supplier during manufacture.

**8.1.13** Number of all NDT reports.

**8.1.14** Number of all welding reports and procedures, when applicable.

**8.1.15** This information shall be traceable to the records of the inspections and tests indicated in the ITP approved by the responsible for the inspection.

**8.1.16** Certificates of Conformity shall be issued in accordance with BS EN 10204, type 3.1, however, it is obligatory to comply with the provisions of items 5.1.1.1, 5.2.1, 5.3.1.1 and 5.4.1.1 of this Technical Specification, regarding the certificates of origin of raw material.

**8.1.17** The test reports referred to in 8.1.6 shall be issued individually in accordance with BS EN 10204 *type 3.1*.

**8.2** Record of non-conformities during manufacturing and corrective actions adopted.

**8.3** ITP approved by responsible for the inspection including evidence of approval.

**8.4** Reports issued by the responsible for the inspection at all stages of the inspection.

**8.5** Suitability to NR-13 (where applicable) for pressure vessels used as valve accessories.

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PC:		CLIENT: PETROLEO BRASILEIRO S/A – PETROBRAS										DESIGN #:		TAG / MODEL:																																
FD:		INDUSTRIAL VALVE (INDICATE TYPE)		DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS																															
RM:		INSPECTOR'S PERFORMANCE																																												
ET:																																														
I T E M	CRITICAL COMPONENTS	COURSE	COVER/ BONNET	PACKER	SEAT GATE (when applicable)	SEAT	KELLY	SHAFT	STUDS/ BOLTS / STUDS BOLTS / NUTS	SPYROMETALLIC GASKETS, FJA RING AND BACKING	SPRINGS	ACTUATOR	METALLIC COATINGS	PRODUCTION WELDS	REPAIR WELDS	MOUNTED VALVE	PETROBRAS STANDARD PAINTING	IDENTIFICATION PLATE	TECHNICAL DOCUMENTATION	AUDIT BOARD	CLASSIFICATION SOCIETY	PROCEDURES AND / OR TECHNICAL INSTRUCTIONS	ACCEPTANCE CRITERIA	RECORDS ISSUED BY CQ	RELATED NOTES																					
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2	Visual Inspection (after machining)	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	RD	RD					HP	RD				2, 3 and 7																					
3	Dimensional Inspection (after machining)	HP	HP	HP	HP									RD	RD					HP					3																					
4	Wall Thickness Measurement	HP	HP																	HP																										
5	Alloy Recognition Test	HP	HP	HP	HP	HP	HP			HP	HP									HP	RD				4 and 9																					
6	Penetrating liquid	RD	RD	RD										RD	RD					HP	RD																									
7	Magnetic particles	WP	WP											WP	WP					HP	RD				10																					
8	Radiography	RD	RD											RD	RD					HP	RD				5																					
9	Ultrasound	RD	RD											RD	RD					HP	RD				10																					
10	Heat treatment													RD	RD					HP	RD				3																					
11	Toughness	HP	HP											RD	RD					HP	RD				6																					
12	Electrical Continuity Testing (when applicable)															HP				HP	WP																									
13	Integrity Testing	HP	HP													HP				HP	WP				11 and 12																					
14	Seat Sealing Test															HP				HP	WP																									
15	Cavity Relief Test (when applicable)															HP				HP	WP																									
16	Functional Test with Pressure											HP				HP				HP	WP				8																					
17	Studs / Studs bolts Torque															HP				HP	WP																									
18	Breakout Torque															HP				HP	WP																									
19	Marking, Identification and Traceability											HP				HP		HP		HP	WP				7																					
20	PETROBRAS Standard Painting															HP	HP			HP					13																					
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## ANNEX 1 – ITP TEMPLATE FOR INDUSTRIAL VALVES

MANUFACTURER LOGO		ADD PROVIDER'S NAME IN THIS FIELD											#:		REV.:											
		INSPECTION PLANS AND STANDARD EVALUATIONS													PAGE: 01 OF 01											
PC:		CLIENT: PETRÓLEO BRASILEIRO S/A – PETROBRAS											DESIGN #:		TAG / MODEL:											
FD:		CONTROL VALVE		DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS									
RM:		(INDICATE TYPE)		INSPECTOR'S PERFORMANCE																						
ET:																										
I T E M	CRITICAL COMPONENTS		COURSE	COVER/ BONNET	PACKER/ CAGE	SEAT GATE (when applicable)	SEAT	KELLY	INFERIOR SHAFT	STUDS/BOLTS /STUDS/BOLTS /NUTS	SPYROMETALL IC GASKETS, FJA RING AND PACKING	SPRINGS	ACTUATOR (ELECTRICAL OR PNEUMATIC)	METALLIC COATINGS	PRODUCTION WELDS	REPAIR WELDS	MOUNTED VALVE	PETROBRAS STANDARD PAINTING	IDENTIFICATIO N PLATE	TECHNICAL DOCUMENTATI ON	AUDIT BOARD	CLASSIFICATION SOCIETY	PROCEDURES AND / OR TECHNICAL INSTRUCTIONS	ACCEPTANCE CRITERIA	RECORDS ISSUED BY CQ	RELATED NOTES
	INSPECTIONS AND TESTS																									
1	Test Bodies for Counter-Tests		HP	HP																						1
2	Visual Inspection (after machining)		HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	RD	RD					HP	RD				2, 3 and 7
3	Dimensional Inspection (after machining)		HP	HP	HP	HP		HP	HP						RD	RD					HP	RD				3
4	Wall Thickness Measurement		HP	HP																	HP	RD				
5	Alloy Recognition Test		HP	HP	HP	HP	HP	HP			HP	HP									HP	RD				4 and 9
6	Penetrating liquid		RD	RD	RD										RD	RD					HP	RD				
7	Magnetic particles		WP	WP											WP	WP					HP	RD				10
8	Radiography		RD	RD											RD	RD					HP	RD				5
9	Ultrasound		RD	RD											RD	RD					HP	RD				10
10	Heat treatment														RD	RD					HP	RD				3
11	Toughness		HP	HP											RD	RD					HP	RD				6
12	Electrical Continuity Testing (when applicable)																HP				HP	WP				
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15	Cavity Relief Test (when applicable)																HP				HP	WP				
16	Functional Test with Pressure											HP					HP				HP	WP				8
17	Studs / Studs bolts Torque																HP				HP	WP				
18	Marking, Identification and Traceability												HP				HP			HP	HP	WP				7
19	PETROBRAS Standard Painting																HP	HP			HP	WP				13
20	Visual and dimensional final with mounted valve																HP				HP	RD				
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ANNEX 2 – ITP TEMPLATE FOR CONTROL VALVE

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		INSPECTION PLANS AND STANDARD EVALUATIONS												PAGE: 01 OF 01											
PC:		CLIENT: PETROLEO BRASILEIRO S/A – PETROBRAS											DESIGN #:	TAG / MODEL:											
FD:		SAFETY OR RELIEF VALVE		DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS	DN	CLASS										
RM:		SPRING TYPE OR PILOT OPERATED																							
ET:		INSPECTOR'S PERFORMANCE																							
I T E M	CRITICAL COMPONENTS INSPECTIONS AND TESTS	COURSE/ BASE	BONNET/CYLIN DER AND SUBCLIN	NOZZLE	KELLY	DISC	GUIDE-LINE	SPRINGS	BELLOW'S (When Applicable)	STUDS / BOLTS / STUDS BOLTS / NUTS	METALLIC GASKETS, AND PACKING	METALLIC COATINGS (When Applicable)	PRODUCTION WELDS	REPAIR WELDS	MOUNTED VALVE	PETROBRAS STANDARD PAINTING	IDENTIFICATIO N PLATE	TECHNICAL DOCUMENTATI ON	AUDIT BOARD	CLASSIFICATION SOCIETY	PROCEDURES AND / OR TECHNICAL INSTRUCTIONS	ACCEPTANCE CRITERIA	RECORDS ISSUED BY CQ	RELATED NOTES	
1																									
2	Test Bodies for Counter-Tests	HP	HP			HP																		1	
3	Visual Inspection (after machining)	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP	HP										2 and 3	
4	Dimensional Inspection (after machining)	HP	HP	HP	HP	HP		HP					HP	HP										3	
5	Wall Thickness Measurement	HP	HP						HP																
6	Alloy Recognition Test	HP	HP	HP	HP	HP	HP	HP			HP													4 and 7	
7	Solid Load Test							HP																2	
8	Penetrating liquid	RD	RD	RD									RD	RD											
9	Magnetic particles	WP	WP										WP	WP										8	
10	Radiography	RD	RD	RD									RD	RD										5	
11	Ultrasound	RD	RD																					8	
12	Heat treatment												RD											3	
13	Toughness	HP		HP									RD	RD										6	
14	Integrity Testing	HP	HP	HP																				9	
15	Seat Sealing Test														HP										
16	Opening Pressure Test "SET PRESSURE"														HP										
17	Pneumatic Test / Bellows Integrity (When Applicable)														HP										
18	Lever Functional Test (When Applicable)														HP										
19	Studs / Studs bolts Torque														HP										
20	Marking, Identification and Traceability														HP		HP								
21	PETROBRAS Standard Painting														HP	HP									
22	Visual and dimensional final with mounted valve														HP									10	
23	Packing																								
23	Data Book																								
HP – Hold Point: is the inspection event in the supplier's manufacturing cycle, in which the supplier shall notify the person responsible for the manufacturing inspection, within the contractual deadlines, for the analysis, verification or testimony of the same and without which the manufacturing process cannot continue.																					REVISIONS TRANSCRIPT				
WP – Witness Point: is the inspection event in the supplier's manufacturing cycle, in which the supplier shall notify the person responsible for the manufacturing inspection, within the contractual deadlines, for the analysis, verification or testimony of events agreed upon in the Inspection and Testing Plan, without interrupting the manufacturing process.																					REV. #:	DATE	PREPARED	VERIFIED	APPROVED
RD – Review Documents: is the inspection event in the supplier's manufacturing cycle, in which documents (procedures, records, certificates, reports, etc.) shall be generated to be presented to the inspector as a technical documentation in the final inspection.																									
RELATED NOTES (SPECIFIC)																									
1 - Test specimen: HP applicable by identification, chemical and mechanical tests according to the Complementary Quality Requirement of Valves.													7 – Gaskets and Packing: alloy recognition test is not applicable for gaskets.												
2 - Springs: present the certificate of compliance to the person responsible for the inspection, specifying the spring material.													8 - Magnetic particles and ultrasound: according to the Quality of Valves Complementary Requirement.												
3 - Welding: present to the person in charge of the inspection the repair records and visual inspection report in case of process welding.													9 - Integrity test: shall be performed on the body and cap/bonnet components.												
4 - Alloy Recognition Test: applicable only to stainless steels and alloy steels.													10 - PETROBRAS standard painting: visual inspection, thickness measurement, adhesion test and paint certificate verification.												
5 - Radiography: applicable when specified in standard, PC (Purchase Request) or Purchase Order.																									
6 - Toughness: Applicable for body and cap in FJA (RTJ) and hardened regions.																									
GENERAL NOTES																									
A) All inspection activities shall conform to the COMPLEMENTARY QUALITY REQUIREMENT OF VALVES ET-0000.00-0000-972-1AL-023 (Rev. 0). In the event of an information conflict, the Complementary Quality Requirement shall prevail;																									
B) Technical Documentation consists of: report of conformity of the product relating tests, tests and inspections carried out, certificates of raw material, records generated by the supplier in attendance to the manufacture.																									
C) Accessory used as component of the main product: certificate of conformity of the same shall be presented and inspected according to PIT ACCESSORIES STANDARD (when applicable).																									

## ANNEX 3 – ITP TEMPLATE FOR SAFETY AND RELIEF VALVE

MANUFACTURER LOGO		ADD PROVIDER'S NAME IN THIS FIELD									#:	REV.:			
		INSPECTION PLANS AND STANDARD EVALUATIONS										PAGE: 01 OF 01			
PC:		CLIENT: PETROLEO BRASILEIRO S/A – PETROBRAS						DESIGN #:		TAG / MODEL:					
FD:		VALVES ACCESSORIES (PNEUMATICS, HYDRAULICS AND ELECTRICAL)													
RM:															
ET:															
I T E M	CRITICAL COMPONENTS	ELECTRICAL ACCESSORIES (Classified Area)	PNEUMATIC ACCESSORIES	VALVES – DRAIN, VENT., BLOCK	SAFETY / RELIEF VALVE	WELDED PRESSURE VASE (ASME Project Sec VIII – Div 1)	ELECTRONIC ACTUATOR (Classified Area)	ELECTRICAL ACTUATOR (Classified Area)	PNEUMATIC / HYDRAULIC ACTUATOR	HIGH PRESSURE GAS RESEVOIR (ISO 4075 PROJECT) WHEN	PROCEDURES AND / OR TECHNICAL INSTRUCTIONS	ACCEPTANCE CRITERIA	RECORDS ISSUED BY CQ		
	INSPECTIONS AND TESTS														
1	Visual Inspection	HP	HP	HP	HP	HP	HP	HP	HP	HP					
2	Dimensional Inspection	HP	HP	HP	HP	HP	HP	HP	HP	HP					
3	Wall Thickness Measurement			HP	HP	HP				HP					
4	Alloy Recognition Test			HP	HP	HP				HP					
5	Penetrating liquid			RD	RD	RD				RD					
6	Non-Destructive Rehearsals: US - RX - PM			RD	RD	RD				RD					
7	Welding Inspection			RD	RD	RD				RD					
8	Integrity Testing			HP	HP	HP				HP					
9	Pneumatic Testing			HP	HP				HP						
10	Functional Testing			HP	HP		HP	HP	HP						
11	PETROBRAS Standard Painting	HP	HP	HP	HP	HP	HP	HP	HP	HP					
12	Technical Documentation	HP	HP	HP	HP	HP	HP	HP	HP	HP					
13	Specific Related Notes	1	2	3	4	5	6	6	7	8 and 9					
<p>HP – Hold Point: is the inspection event in the supplier's manufacturing cycle, in which the supplier shall notify the person responsible for the manufacturing inspection, within the contractual deadlines, for the analysis, verification or testimony of the same and without which the manufacturing process cannot continue.</p> <p>WP – Witness Point: is the inspection event in the supplier's manufacturing cycle, in which the supplier shall notify the person responsible for the manufacturing inspection, within the contractual deadlines, for the analysis, verification or testimony of events agreed upon in the Inspection and Testing Plan, without interrupting the manufacturing process.</p> <p>RD – Review Documents: is the inspection event in the supplier's manufacturing cycle, in which documents (procedures, records, certificates, reports, etc.) shall be generated to be presented to the inspector as a technical documentation in the final inspection.</p>											<b>REVISIONS TRANSCRIPT</b>				
											REV. #:	DATE	PREPARED	VERIFIED	APPROVED
<b>RELATED NOTES (SPECIFIC)</b>															
1) With Certificate of Conformity in compliance with INMETRO Ordinance 179.															
2) With manufacturer's test certificate / guarantee.															
3) "HP" on the sub-supplier. Vendor certificate shall include dimensional inspection report of critical dimensions of critical components.															
4) "HP" in the sub-supplier according to PIT approved by PETROBRAS.															
5) "HP" at the primary equipment supplier. Data Book assembled by the manufacturer with the NR-13, with calculation bases, drawings, END's and Welding procedures (EPS, RQPS, RQS), inspection reports and raw material certificates, complemented with integrity test report.															
6) "HP" on the main mounted valve test. With INMETRO certificate.															
7) "HP" on the main mounted valve test.															
8) "HP" at the primary equipment supplier. Data Book assembled by the manufacturer, including NR-13, with calculation bases, drawings, test reports and raw material certificates. Inspection and testing as provided in the component design standard.															
9) The high-pressure gas tanks are "Gas Bottles" of the type used for the transport of gases, they are not manufactured by welding.															
<b>GENERAL NOTES</b>															
A) All inspection activities shall conform to the COMPLEMENTARY QUALITY REQUIREMENT OF VALVES ET-0000.00-0000-972-1AL-023 (Rev. 0). In the event of an information conflict, the Complementary Quality Requirement shall prevail;															
B) Technical Documentation consists of: report of conformity of the product relating tests, tests and inspections carried out, certificates of raw material, records generated by the supplier in attendance to the manufacture.															
C) The accessories shall be manufactured according to the technical specification approved by the buyer (submitted to PETROBRAS approval when foreseen in contract).															
D) The HPs at the sub-supplier shall always be effected under inspection by the Supplier Quality Control that shall issue the inspection report, ie RJ shall be issued to present to PETROBRAS for all sub-supplier inspection events.															

## ANNEX 4 – ITP TEMPLATE FOR VALVES ACCESSORIES