
 <b>PETROBRAS</b>	<b>TECHNICAL SPECIFICATION</b>		N°: <b>I-ET-3010.00-1210-888-P4X-003</b>
	CLIENT:		SHEET: 1 of 12
	JOB:		
	AREA:		
	TITLE: <b>SESDVS CONTROL RACK</b>		ESUP
			INTERNAL
MICROSOFT WORD / MICROSOFT 365 V.2402 / I-ET-3010.00-1210-888-P4X-001_B.DOCX			

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DATE	AUG/21/20	OCT/07/22	MAR/05/24			
EXECUTION	U44D	U44D	DVOP			
CHECK	U5D6	U5D6	CTTD			
APPROVAL	U49R	CDC1	CDC1			

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## 1 INTRODUCTION

### 1.1 Objective

- 1.1.1 This technical specification describes the minimum requirements and basic characteristics of the SESDVs Control Rack for the UNIT (FPSO).
- 1.1.2 SESDVs Control Rack shall be supplied in the quantity indicated in Equipment List of the Project.
- 1.1.3 This rack shall be modular and shall hold the commands for 4 (four) Subsea Emergency Shutdown Valves.

### 1.2 Definitions

- 1.2.1 Refer to I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS

### 1.3 Abbreviations, Acronyms and Initialisms


A&C	Automation & Control
CSS	Control and Safety System
DCV	Direction Control Valve
DOU	Diário Oficial da União (Official Gazette of the Federal Government)
FAT	Factory Acceptance Test
FPSO	Floating Production Storage and Offloading Unit
HPU	Hydraulic Power Unit
NPT	National Pipe Thread
NR	Norma Regulamentadora (Regulatory Standards)
PCS	Process Control System
PSD	Process Shutdown System
SAT	Site Acceptance Test
SESDV	Subsea Emergency Shutdown Valve
SIT	Site Integration Test

## 2 REFERENCE DOCUMENTS, CODES AND STANDARDS

### 2.1 Internal References

#### 2.1.1 Project Documents

I-ET-3010.00-1200-800-P4X-013	GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS
I-ET-3010.00-5140-700-P4X-003	ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS
I-DE-3010.00-1210-888-P4X-006	SESDVS CONTROL RACK - FUNCTIONAL DIAGRAM
I-DE-3010.00-1210-888-P4X-005	SESDVS CONTROL RACK – LAYOUT

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2.1.2 Titles below and respective document codes may vary according to each project, see DOCUMENT LIST

- AUTOMATION AND CONTROL ARCHITECTURE
- AUTOMATION AND CONTROL SYSTEM FUNCTIONS
- FIELD INSTRUMENTATION
- GENERAL ARRANGEMENT
- INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS
- EQUIPMENT LIST
- SPECIAL MONITORING SYSTEMS
- HYDRAULIC POWER UNIT FOR SUBSEA

**2.2 External References**

2.2.1 International Codes, Recommended Practices and Standards

**API - AMERICAN PETROLEUM INSTITUTE**

- API RP 14B DESIGN, INSTALLATION, OPERATION, TEST AND REDRESS OF SUBSURFACE SAFETY VALVE SYSTEMS
- API RP 14C ANALYSIS, DESIGN, INSTALLATION AND TESTING OF SAFETY SYSTEMS FOR OFFSHORE PRODUCTION FACILITIES

**IEC - INTERNATIONAL ELECTROTECHNICAL COMMISSION**


- IEC 60079 EXPLOSIVE ATMOSPHERES – ALL PARTS
- IEC 60529 DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP CODE)
- IEC 60533 ELECTRICAL AND ELECTRONIC INSTALLATIONS IN SHIPS - ELECTROMAGNETIC COMPATIBILITY (EMC) – SHIPS WITH A METALLIC HULL
- IEC 61000 ELECTROMAGNETIC COMPATIBILITY (EMC) SERIES - ALL PARTS
- IEC 61892 MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS – ALL PARTS
- IEC 62381 AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY – FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT), AND SITE INTEGRATION TEST (SIT)

**INMETRO - INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL**

- PORTARIA Nº 115 (21 / MARÇO / 2022) REQUISITOS DE AVALIAÇÃO DA CONFORMIDADE PARA EQUIPAMENTOS ELÉTRICOS PARA ATMOSFERAS EXPLOSIVAS - CONSOLIDADO.

**ISO – INTERNATIONAL STANDARD ORGANIZATION**

- ISO 4406 HYDRAULIC FLUID POWER - FLUIDS - METHOD FOR CODING THE LEVEL OF CONTAMINATION BY SOLID PARTICLES
- ISO 13628-6 PETROLEUM AND NATURAL GAS INDUSTRIES – DESIGN AND OPERATION OF SUBSEA PRODUCTION SYSTEMS – PART 6: SUBSEA PRODUCTION CONTROL SYSTEMS
- ISO 16889 HYDRAULIC FLUID POWER - FILTERS - MULTI-PASS METHOD FOR EVALUATING FILTRATION PERFORMANCE OF A FILTER ELEMENT

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2.2.2 Classification Society

2.2.2.1 The detailed design shall be submitted to Classification Society for approval.

2.2.2.2 The Unified Requirements (URs) and Unified Interpretations (UIs) of IACS, applicable and in force in the detailing design, shall be observed and their requirements implemented.

2.2.2.3 The design and installation shall be updated following requirements, comments of Classification Society as well as URs and UIs mentioned in item 2.2.2.2.

2.2.3 Certification

2.2.3.1 To prove compliance with area classification, Certificates of Conformity in accordance with PORTARIA INMETRO N° 115, de 21/março/2022, and its annexes, shall be supplied.

2.3 Brazilian Codes and Standards

2.3.1 All Regulatory Standards (Normas Regulamentadoras-NRs) in force, published in the Diário Oficial da União (DOU), shall be followed.

2.3.2 Order of Precedence

2.3.2.1 Regarding to minimize conflicts among project documents, except where specific codes and regulations are more stringent, the order of precedence of technical documents shall otherwise be:

- This Specification;
- Project Documents listed on item 2.1.1 and 2.1.2 above;
- Codes and Standards.

3 OPERATIONAL CONDITIONS

3.1 The SESDVs Control Rack shall be installed in open area, for SESDVs Control Rack operating and environmental conditions refer to INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS.

3.2 The SESDVs Control Rack and all its components shall be appropriate for Zone 2, Group IIA, T3 classified areas according to IEC-60079 standard, even if installed in non-classified zone.

3.3 The rack shall use a water bases hydraulic fluid with 3 (three) µm absolute filtering.


3.4 The signals to solenoid are 24 Vdc +10% - 15%.

3.5 The hydraulic power for the SESDVs with direct control will be provided by the Hydraulic Power Unit for Subsea System, see technical specification HYDRAULIC POWER UNIT FOR SUBSEA, through pressure regulator valves at the following level of pressure:

- LOW PRESSURE LEVEL: for operation of the SESDVs, with pressure adjustable from 9,308 kPa (1,350 psi) to 20,684 kPa (3,000 psi).

3.6 Operation Hydraulic Fluid

3.6.1 The SESDVs Control Rack hydraulic fluid shall be MacDermid Oceanic HW 525P,

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MacDermid Oceanic HW 443 or Castrol Transaqua DW (choice to be later taken by PETROBRAS). Such fluids shall not be indiscriminately mixed, it being accepted only the migration of use from one to the other, with a minimum 12 (twelve) month waiting period for a new migration mixture.

**3.7 Preservation Hydraulic Fluid until Pre-Operation phase**

3.7.1 In case PETROBRAS specifies MacDermid Oceanic HW 525P fluid, the Rack hydraulic circuit shall be filled with MacDermid Oceanic HW 443 hydraulic fluid from manufacturing until just before pre-operation phase in Brazil, aiming at internal protection against corrosion from the vapor phase of the fluid during possible long weather storage period. In such cases, the MacDermid Oceanic HW 443 fluid shall be substituted by MacDermid Oceanic HW 525P during the final phase of commissioning and pre-operation in Brazil.

3.7.2 In case PETROBRAS specifies MacDermid Oceanic HW 443 or Castrol Transaqua DW fluid, the Rack shall be filled with the same hydraulic fluid from manufacturing until just before pre-operation phase in Brazil, aiming at internal protection against corrosion from the vapor phase of the fluid during possible long storage periods exposed to the elements. In such cases, only completing of the fluid is necessary at the end of the commissioning and pre-operation phase in Brazil.

**3.8 Hydraulic Fluid Cleanliness Class**

3.8.1 The SEDVs Control Rack shall be appropriate to operate with Cleanliness Class 19/17/14 according to ISO 4406 (equivalent to Class 8 of NAS1638 Standard).

**4 CONSTRUCTION REQUIREMENTS**

**4.1 General Requirements**

4.1.1 The SEDVs Control Rack structure shall be modular self-supported closed type panel and shall be able to actuate 4 (four) Subsea Emergency Shutdown Valves. For further details, see I-DE-3010.00-1210-888-P4X-006 - SEDVVS CONTROL RACK - FUNCTIONAL DIAGRAM.

4.1.2 The rack shall have 1 (one) front door and 1 (one) rear door, all with transparent polycarbonate windows to allow visualization of the state opened/closed of the directional valves. The access doors shall allow easy access to the whole extension of the rack and shall be fixed by means of continuous hinges made of AISI 316L. The doorknobs shall be reinforced.


4.1.3 The rack shall be built of AISI 316L stainless steel specification shapes and sheets.

4.1.4 The rack layout shall be in accordance with typical layout I-DE-3010.00-1210-888-P4X-005 - SEDVVS CONTROL RACK - LAYOUT.

4.1.5 All cuts and drilling operations shall be done cold.

4.1.6 All pneumatic and hydraulic lines, connections, valves and other internal accessories to the panels, shall be in accordance with I-ET-3010-1200-800-P4X-013-GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION.

4.1.7 AISI 316L stainless steel shall be used in the manufacture of the supporting skid. The panel plates shall be free of warping, wrinkling, roughness, signs of rust and corrosion, and they shall have the same minimum thickness of 3.175 mm for sides,

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ceiling, bottom, and doors, and 4.760 mm for panel front side

## 5 CONNECTIONS AND TUBING

- 5.1 All tubing, fittings and components operating with hydraulic fluid shall be in accordance with I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION.
- 5.2 The removal of any component shall be preferably executed from the front part of the rack and shall not require the removal of other circuits than the one that is being fixed.
- 5.3 The connection with the SESDVs control rack shall be made at the lower part of the rack through a bulkhead type connection, see I-DE-3010.00-1210-888-P4X-005 - SESDVs CONTROL RACK - LAYOUT, or at most in 2 (two) lines where 1 (one) is shifted related to the other at half the distance between the connections, to allow connection or disconnection of any line without interfering with the others.
- 5.4 All lines shall be adequately supported and arranged in a way to avoid damage when in operation, facilitate maintenance and minimize their respective lengths.
- 5.5 All hydraulic connections in the SESDVs Control Rack shall have a capacity to preserve their sealing for at least 30 (thirty) years of service.

## 6 RACK INLETS AND OUTLETS

### 6.1 Hydraulic Outlets

- 6.1.1 There shall be 1 (one) hydraulic fluid return outlet rated LEVEL 3000 psi (20684 kPa), for the actuation of SESDVs, in 2" (minimum) outside diameter tubing with adaptation for a union type outlet for the panel, class 6000 psi (41369 kPa). This outlet shall be connected to the drain of UH-1210001 - HYDRAULIC POWER UNIT FOR SUBSEA SYSTEMS, not to its return.
- 6.1.2 There shall be 4 (four) outlets of rated LEVEL 3000 psi (20684 kPa), for the actuation of the SESDVs, in 3/8" outside diameter tubing with adaptation for a union type outlet for the panel, class 6000 psi (41369 kPa).

### 6.2 Hydraulic inlets

- 6.2.1 There shall be 1 (one) inlet at pressure LEVEL 3000 psi (20684 kPa) of hydraulic fluid supply for the SESDV valves, in 2" (minimum) Outer Diameter tubing.

**NOTE:** Hydraulic inlet/outlet diameters shall be confirmed during project development.


### 6.3 Electric Inputs

- 6.3.1 There shall be 4 (four) Inlets for the actuation of the solenoid valves (see item 3.4).

### 6.4 Electric outputs

- 6.4.1 There shall be 3 (three) outlets for remote valve position (discrete signal, voltage free contact).
- 6.4.2 There shall be 1 (one) outlet analog signal for remote supply pressure monitoring.
- 6.4.3 There shall be 1 (one) outlet analog signal for remote return pressure monitoring.



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- 6.4.4 The panel rack shall be provided with, at least, 1 (one) junction box for UNIT (FPSO) interconnection. Junction Boxes shall be specified in accordance with I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION.
- 6.4.5 Junction boxes shall be supplied with terminals with non-sparking terminations, capable of withstanding vibration and environmental conditions.
- 6.4.6 The cables that conduct the signals from the transmitters to the junction box shall have electrostatic shields that shall not be connected directly to ground but rather connected to the terminals at the junction box.
- 6.4.7 All cased electric devices shall be in accordance with I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION.

## 7 INSTRUMENTATION

- 7.1 Instrumentation shall be in accordance with the document I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION.
- 7.2 All panels, instruments, materials, and equipment proper to be used in hazardous areas, shall have conformity certificates complying with "PORTARIA INMETRO N° 115, de 21/março/2022", and its annexes, and shall be approved by Classification Society.
- 7.3 All electrical and electronic devices shall be designed and constructed in a tropicalized version. Tropicalization process comprises application of reinforced protective resin Class 2 according to IEC 61086 and fungus proof according to ASTM G21 in all printed circuit boards, use of anti-rust materials and accessories and other implementations according to MANUFACTURERS' experiences and related rules, aiming to provide a robust and reliable construction.
- 7.4 **Transmitter**
  - 7.4.1 Each hydraulic supply and return header, and each hydraulic actuator supply line of SESDVs shall have a pressure transmitter. The transmitter on the actuator supply lines shall be used for indirect indication of the position of the valve.
  - 7.4.2 Pressure transmitters shall be in accordance with I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION. Also, the following additional requirements shall be met:
    - Pressure connection: ½" NPT plug;
    - Overpressure: 200% the operating range (12000 psi (55158 kPa));
    - Operating range: 0 to 4000 psi (27579 kPa);
    - Seals: appropriate for the specified hydraulic fluid;
  - 7.4.3 The transmitter shall be in accordance with I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION.

### 7.5 Directional Valves

- 7.5.1 The diagram of valves shall be in accordance with I-DE-3010.00-1210-888-P4X-006 - SESDVS CONTROL RACK - FUNCTIONAL DIAGRAM.





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7.5.2 The solenoid valves (Directional Control Valve) used for the actuation SESDVs shall be 3 (three) way, two positions, electrically actuated pilot stage with external pilot fluid supply and external drain, configured to close SESDVs in case of fail (fail-safe) and open SESDV when energized, with return spring, according to the type, model, and supplier previously qualified by PETROBRAS.

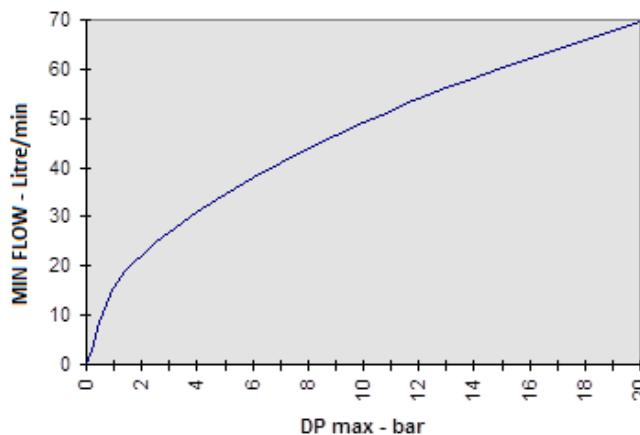
7.5.3 The manifold blocks for solenoid valves shall have integrated block valves, as well as one hydraulic supply header LEVEL 3000 psi (20684 kPa), with 6 mm internal diameter, for the SESDVs, each with 3/8" NPT socket connection. The manifold shall also have one internal return header with 10 mm internal diameter, for the same level of pressure as the above, but with 1/2" NPT female connection.


7.5.4 The valve hydraulic pilots shall be supplied by an independent header fitted with an accumulator and a flow restrictor, so that it doesn't get affected by a pressure drop at the valve main body when the SESDV is actuated.

7.5.5 Directional Valves shall have at least the following characteristics:

- Solenoid actuator with operational voltage of 24V ±25%;
- Maximum power consumption of 3.5W;
- Solenoid valves shall be equipped with suppression diodes (free wheeling diodes), installed within the solenoid casing.
- Working Pressure of 1350 psi (9308 kPa) to 3000 psi (20684 kPa). Working pressure will be defined during Detailing Engineering Design
- Shutdown pressure: 800 psi (5516 kPa) (alignment to valve return in case of pressure loss);
- Connection: adequate for assembly on manifold (6 mm accesses);
- Internal Accesses: 6 mm (minimum);
- If is not possible to determinate the exact internal passage section, the valve shall be in accordance with the minimum flow x maximum pressure drop curve below;
- Body material in AISI 316;
- Solenoids: epoxy box, temperature class F, minimum protection degree IP-56 (adequate for saline ambient) and adequate to operate on environmental conditions established on item 3 (including hazardous area classification);
- Assembly type: manifold – minimum number of 6 valves per manifold;
- Adequate to operate with a water-glycol based hydraulic fluid (as described on this document) which may contain up to 20% on volume of sea water filtered in 10 micron abs.

MIN FLOW X MAX PRESSURE DROP



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**7.5.6 Directional Valves minimum required performance during service life:**

- Maximum flow in closed position: 0.1 cm<sup>3</sup>/min;
- Maximum return flow with valve open: 0.0 cm<sup>3</sup>/min;
- Maximum flow when valve transitioning from closed to open position: 0.1 cm<sup>3</sup>/min;
- Valve Electro mechanic maximum response time: 1s;
- Maximum operation current (Transient): 1A;
- Holding current at 24Vdc: 150mA;
- Maximum Holding current: 300mA;
- Minimum operation cycles without failure or sealing alteration: 5000;
- Minimum energized hours without solenoid failure: 43800;
- Service life time: 25 years;
- Valve's construction materials shall not present potential reactivity that could lead to galvanic corrosion;
- Valve shall be capable of endure sea water contamination up to 20% on volume between 4°C and 45°C;
- Valve's construction materials shall not allow the development of bacteria on fluid.

**7.6 Pressure Gauges (Manometers)**

7.6.1 Each line to actuate the SESDVs or of the manifold mode of operation shall have a pressure gauge in accordance with I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and FIELD INSTRUMENTATION. Also, the following additional requirements shall be met:

- Connection: top ½" NPT male;
- Pulse damper: required;
- Glycerin filled: required;
- Back rupture disk: required;
- Double scale in kPa and psi: 0 – 27,600 kPa (0 – 4,000 psi) for the SESDVs valves.


**7.7 Filter**

7.7.1 One filter shall be foreseen on each of hydraulic fluid supply lines inlet, with the following characteristics, in accordance to ISO 16889:

- Body: AISI 316;
- Filtering element: AISI 316;
- Mesh: 3 µm abs (β≥200);
- Connections: 3/8" NPT socket;
- Differential pressure indicator: required;
- Operation pressure: as in item 3.5.

**8 IDENTIFICATION**

- 8.1 All connections and instruments shall be clearly identified.
- 8.2 The identification plates shall be made of AISI 316L with lettering in low relief fixed by stainless steel screws.
- 8.3 The rack shall be clearly and permanently identified on its front part with a 200 x 75 mm plate with the following inscriptions respectively (to be adapted according to the

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UNIT (FPSO) number and specific panel TAG):

<b>PN-1210XXX</b> <b>RACK DE CONTROLE DAS SESDVs</b> <b>P-YY</b>
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- 8.4 The manifold blocks corresponding to each well shall be equally identified with plates indicating the well number.
- 8.5 All equipment shall clearly be identified by means of a stainless steel engraved plate containing identification (tag name) and description, according to Project's EQUIPMENT LIST and containing identification according to Brazilian standard regulation NR-12 - SEGURANÇA NO TRABALHO EM MÁQUINAS E EQUIPAMENTOS. Internal components shall also be identified. Identification shall be in Brazilian Portuguese. External nameplates shall be adequate for external use.

## 9 DOCUMENTATION

- 9.1 Complete documentation of the SESDVs Control Rack, covering all devices and services, shall be supplied with the proposal, for approval, and for final acceptance.
- 9.2 There shall be supplied with the proposal, in the number of copies defined at PETROBRAS documents, at least the following technical documents:
- Technical specifications comprising: equipment, accessories, panel and materials;
  - Data-sheets and brochures for each equipment;
  - All equipment and installation data including: material list, equipment list, spare part list, power consumption, weight, panel lay-out;
  - Complete description of tests, services and other related items.
- 9.3 There shall be supplied for approval, in the number of copies defined at PETROBRAS documents, at least the following technical documents:
- Technical specifications comprising: equipment, instrument, accessories, cables, tubing and materials;
  - Data-sheets and drawings for the panel and each instrument;
  - Installation drawings including general arrangement, electrical diagrams, hydraulic diagrams, wiring diagrams, cable list, tubing list, material list, equipment list;
  - Test procedures;
  - Certificates, such as certificate of materials, instrument's calibration certificates and other related items.
  - Manifold Documentation
- 9.4 Complete SESDVs Control Rack certified documentation shall be provided by Seller.

## 10 ACCEPTANCE TESTS

- 10.1 The following tests shall be performed at MANUFACTURER installations (FAT) prior to delivery:
- Visual inspection;
  - Tightness/leakage;
  - Functional Test,/ Loop test;

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- Electric Isolation;
  - Cleanliness class of hydraulic fluid;
  - Calibration, configuration and diagnostic of each field instrument.
- 10.2 After the installation of the equipment on board, at least, the following tests shall be repeated (SAT).
- Visual inspection;
  - Tightness/leakage;
  - Functional Test;
  - Loop test;
  - Electric Isolation.
- 10.3 For Site Integration Tests (SIT) all the tests performed during FAT shall be repeated.
- 10.4 There shall also be provided all functional tests regarding operational and safety aspects, as detailed at the Tests Program approved by PETROBRAS.
- 10.5 All tests shall be according to IEC 62381.
- 10.6 SIT shall be executed with the SESDVs Control Rack interconnected with the Hydraulic Power Unit.
- 10.7 It shall be submitted to PETROBRAS, for approval, detailed FAT, SAT and SIT programs 60 (sixty) days in advance.

**11 PACKING REQUIREMENTS**

- 11.1 On completion of testing at factory all equipment shall be prepared for shipment and storage.
- 11.2 Equipment supplied loose shall be packed and crated for transport. In addition, if some rack equipment is susceptible to transport damage, shall be removed from de System Rack for separate packing and crating.
- 11.3 The packing shall be designed in order to withstand transportation by sea on a tug deck, being exposed to soaking by waves.