TECHNICAL SPECIFICATION

CLIENT: -
PROJECT: -
AREA: -

DP&T/SUP

TITLE: REQUIREMENTS FOR PIG LAUNCHER AND RECEIVER DESIGN

REV.

DESCRIPTION AND/OR REVISED SHEETS

0

ORIGINAL ISSUE

INDEX OF REVISIONS

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THIS FORM IS PART OF PETROBRAS N-381 REV. L
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1 SCOPE

1.1 This specification establishes the technical requirements for Pig Launcher, Pig Receiver and Pig Launcher/Receiver for PETROBRAS offshore facilities.

1.2 This technical specification establishes complementary requirements to be met on design, material acquisition, manufacturing, construction and assembling for Pig Launcher, Pig Receiver and Pig Launcher/Receiver in PETROBRAS units.

1.3 The physical limits of this specification are shown on: Figure 5, Figure 6 and Figure 7.

1.4 This technical specification is based on the following normative/codes: ASME BPVC Sec. VIII Division 1 and 2, ASME B31.4, ASME B31.8, ABNT NBR 12712, ABNT NBR 15280-1, DNV OS F101 and ABNT NBR16381.

2 TERMS AND DEFINITIONS

For the effects of this specification, the following terms and definitions are applied.

2.1 Automatic Launcher: device that allows the automatic launching of pigs into a pipeline, provided with specific piping arrangements, in accordance with the service or manufacturer.

2.2 Converging "Y": fitting connecting two pipelines to a third one and which allows the passage of pigs through the point of intersection among the pipelines.

2.3 Explosive Decompression: increase in volume presented by plastic materials when rapidly exposed to atmospheric pressure after a long period of contact with high pressure vapor liquids or pressurized gases. The expansion occurs by the vaporization of the liquid or decompression of the gas absorbed by these materials.

2.4 Foam Pig: pig manufactured of polyurethane foam, with the capability of passing through severe obstructions in the pipeline.

2.5 Full Bore Valve: valve that permits an unobstructed passage, and with the same inside diameter along its entire length.

2.6 Internal Tray (Basket): removable cylindrical device used in receiver traps to keep the foam pig retained in the major barrel to facilitate its removal.

2.7 Launcher Trap (Launcher): device that allows the launching of pigs.

2.8 Launcher/Receiver Trap (Launcher/Receiver): device that allows both pig launching and pig receiving.

2.9 Major Barrel: portion of the pig barrel that has the greatest diameter, from where the pig is inserted or removed.

2.10 Minor Barrel: portion of the pig barrel that has the smallest diameter.

2.11 Pig Diverter: fitting connecting a pipeline to other pipelines and which allows the selective passage of pigs, allowing them to be directed to the selected pipeline.

2.12 Pig Trap: device connected to the ends of a pipeline or sections of pipeline for launching or receiving a pig, composed of: major barrel, minor barrel, quick opening closure, kicker branch, bypass branch and other branches for instruments, drains, vents, etc.
2.13 Processed Gas: natural gas treated after heavier components removal process. This gas is composed basically of methane.

2.14 Shared Launcher: device intended to launch pigs in pipelines connected by means of a pig diverter or a similar fitting.

2.15 Receiver Trap (Receiver): device that allows the receiving of pigs.

2.16 Shared Receiver Device intended to receive pigs from pipelines connected through a converging “Y” or similar fittings.

2.17 Through Conduit Valve: full bore valve with an unobstructed and continuous cylindrical opening.

3 NORMATIVE REFERENCES

3.1 International Standards:

3.1.1 ASME Boiler and Pressure Vessel Code - Section VIII - Division 1

3.1.2 ASME Boiler and Pressure Vessel Code - Section VIII - Division 2 - Alternative Rules for Design & Fabrication of Pressure Vessels;

3.1.3 ASME B16.9 – Factory-Made Wrought Buttwelding Fittings, (maximum slope angle according item 4.5.4)

3.1.4 ASME B16 47 – Large Diameter Steel Flanges;

3.1.5 ASME B31.3 – Process Piping;

3.1.6 ASME B31.4 – Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids;

3.1.7 ASME B31.8 – Gas Transmission and Distribution Piping Systems;


3.1.9 MSS SP-44 – Steel Pipeline Flanges;

3.1.10 MSS SP-75 – Specification for High-Test, Wrought, Butt-Welding Fittings.

3.1.11 NACE SP-0286 – Electrical Isolation of Cathodically Protected Pipelines.

3.2 Brazilian Standards

3.2.1 ABNT NBR 12712 - Projeto de sistemas de transmissão e distribuição de gás combustível;

3.2.2 ABNT NBR 15280-1 – Dutos Terrestres – Parte I: Projeto;

3.2.3 ABNT NBR 15280-2 – Dutos Terrestres – Parte II: Construção e Montagem;

3.2.4 ABNT NBR 15827 - Válvulas industriais para instalações de exploração, produção, refino e ABNT ABNT transporte de produtos de petróleo — Requisitos de projeto e ensaio de protótipo;

3.2.5 ABNT NBR 16381 – Dutos terrestres e submarinos – Câmara de Pig.

3.3 Brazilian Legislation

3.3.1 NR - Normas Regulamentadoras Brasileiras.

3.3.2 ANP RTDT – Regulamento Técnico de Dutos Terrestres

3.3.3 ANP SGSO – Regulamento técnico do sistema de Gerenciamento da Segurança Operacional das instalações marítimas de perfuração e produção de petróleo e gás natural.
3.3.4 SGSS – Regulamento técnico do sistema de Gerenciamento da Segurança Operacional de sistemas submarinos

4  GENERAL REQUIREMENTS

4.1  CONTRACTOR scope and responsibility:

4.1.1  Design documents shall be provided by CONTRACTOR/VENDOR

4.1.2  CONTRACTOR shall provide to PETROBRAS at least the following equipment documents:

4.1.2.1  Design Calculation Reports

4.1.2.2  Equipment datasheet (launcher trap, receiver trap, launcher/receiver trap), including closure datasheet.

4.1.2.3  Datasheet for: Valves, electrical insulation joints and instruments.

4.1.2.4  Equipment material requisition (launcher trap, receiver trap, launcher/receiver trap), including closure material requisition;

4.1.2.5  Material Requisition for: valves, electrical insulation joints and instruments;

4.1.2.6  Installation drawing and layout;

4.2  General Arrangement:

Launcher trap, receiver trap, and launcher/receiver trap arrangements shall be according Figure 5, Figure 6 and Figure 7; considering the following notes:

NOTE:
1) all drawing dimensions in millimeters;
2) dimensions are shown on Table 3 and Table 4;
3) components descriptions are listed in Table 5;
4) all types of branches shall be according the piping specification current document for this project;
5) For inclined or vertical Launchers drain (item 7) shall be installed as close as possible to valve (item 5);
6) For launcher/receiver trap Pig passage indicators shall be capable of detecting the passage of foam pigs, located at the following position: at the top of the pipe or side surface; within the limit of dimension $L_2$;
7) the branches shall not be assembled on the bottom of the pipe or on any downward position;

4.3  Equipment Dimensions

The pig launcher trap, receiver trap and launcher/receiver trap dimensions shall be according as Table 3 and Table 4. Dimensions $L_1$ and $L_2$ shall be observed, considering a ±3 mm variation as a manufacturer allowance.

NOTE:
1) Dimensions in millimeters, for dimensions in inches are used parenthesis.
2) Dimension ØA corresponds to the nominal diameter of the pipeline. For pipelines with variable nominal diameter consider as ØA the larger nominal diameter of the pipeline.
3) For installations with shared launchers or receivers, adopt as ØA the larger nominal diameter of the pipes interconnected to these installations.

4.4  Requirements for traps design:

4.4.1  It is recommended that the elevation of the bottom of the barrel be 1 m (one meter) above the operation floor. [Recommended Practice]
Note: The access area between the bottom of the barrel and the operation floor shall be sufficient for the installation of the fittings for drainage connections or basin and other accessories.

4.4.2 The sizing of wall thicknesses for pig launcher, receiver and launcher/receiver shall be in accordance with pipeline design code.

4.4.3 The provision of supports for attaching load handling equipment is recommended, to allow pig introduction or removal inside the barrel. [Recommended Practice]

4.4.4 The installation of launchers e receivers parallel to the floor (no slope) is recommended. For installations with space restrictions, the arrangement of superposed or vertical launchers, receivers and launchers-receivers is allowed. [Recommended Practice]

4.4.5 The inside diameter of the barrel of launchers, receivers, and launchers/receivers shall be at least 89 mm (3 1/2") larger than the inside diameter of the pipeline.

4.4.6 Launchers for pipelines designed for intelligent pig passage with nominal diameter of 200 mm (8") and larger shall have a flanged outlet with nominal diameter of 50 mm (2") to help loading the pig into the barrel, using a pulling cable (see item 18 of Table 5 and Figure 6 and Figure 7 of ANNEX). This outlet shall be installed horizontal (3h or 9h positions), inclined at 45° and without interference with the trap block valve.

4.4.7 For “piggable” systems, the inside diameter of pipes and fittings located between the barrel reduction and pipeline derivation shall not be smaller than the smallest pipeline inside diameter;

4.4.8 If the inside diameter of pipes and fittings located between the barrel reduction and main pipe derivation are different, shall be provided a conical diameter transition, maximum inclination 1:4 (30 degrees of the pipe wall).

4.4.9 A sampling outlet with nominal diameter of 25 mm (1") shall be installed on the drain branch, next to the closure according to Figure 8.

4.4.10 Flanged connection shall be used for pig launchers and receivers. Clamp connection (e.g.: Grayloc) is prohibited.

4.4.11 If inner diameter variation occurs, the transition region shall have a slope of 1:5 ratio.

4.4.12 If the pipeline have two consecutive derivations (or branches), the minimum distance between them shall be observed in order to avoid the pig stuck in to the pipe, as show in Figure 9. The minimum distance recommended between them is three times the nominal diameter of the main pipe.

4.5 Barrel reduction for launcher, receiver and launcher/receiver:

4.5.1 Barrel reducer for pig launcher and launcher/receiver traps shall be eccentric;

4.5.2 Barrel reducer for pig receiver traps shall be concentric;

4.5.3 For pig launcher traps installed in vertical position, the barrel reducer shall be concentric.

4.5.4 The maximum slope angle of the reducers shall be 11° (see Figure 1).

NOTES:

1) Reducer fabrication shall be supplied according one of the following standardization: ASME B16.9, MSS SP-75 or another equivalent normative.

2) If the reducer is fabricated using welded plate, this weld shall have traceable quality and weld certificate shall be in the databook.

3) The pig receiving basket for launcher/receiver shall be designed considering the use of an eccentric reducer.
4.6 Pig traps access area for handling

A access area shall be provided directly behind the barrel (see Figure 2), according to the minimum area dimensions indicated in Table 1, which refer to installations for operation with intelligent pigs. For exclusive use of non-intelligent pigs, the area dimensions may be reduced as shown in the Notes of Table 1.

### Table 1 – Access area for intelligent pig traps

<table>
<thead>
<tr>
<th>Nominal Diameter ΦA [mm]</th>
<th>Access Area</th>
<th>&quot;X&quot; [mm]</th>
<th>&quot;Y&quot; [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 a 350 (4&quot; a 14&quot;)</td>
<td>L₁ +1000</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>400 a 750 (16&quot; a 30&quot;)</td>
<td>L₁ +1000</td>
<td>1400</td>
<td></td>
</tr>
<tr>
<td>800 a 1100 (32&quot; a 42&quot;)</td>
<td>L₁ +1000</td>
<td>1750</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1) The access area for launchers and receivers (for non-intelligent pig operation), shall be considered dimension "X" equal to 1500 mm for nominal diameters up to 12 inches (NPS12) and 2000 mm for nominal diameters of 14 inches (NPS14) and 16 inches (NPS16), and dimension "Y" equal to 750 mm.

2) Dimension L₁ is referring to Table 3 and Table 4 of ANNEX.
5 DESIGN REQUIREMENTS

5.1 Closure requirements for pig traps:

5.1.1 Closure shall be designed according ASME BPVC Section VIII division 1. As alternative, if the designer has all additional information required in ASME BPVC Section VIII division 2, the closure can be designed using this normative code.

5.1.2 The closure drive system shall be provided with a pressure warning device which prevents closure opening when the barrel is pressurized.

5.1.3 The closure drive system shall be quick opening/ quick closing type, provided with hinge or other mechanism capable to support the moving part during the opening and closing operation.

5.1.4 The closure drive system shall be designed considering the opening and closing operation to be performed in a maximum two minutes period by just one man with no additional than the manufacturer’s provided and specified tools.

5.1.5 Closure sealing material and closure safety system shall be designed to be resistant to the specified process fluid at both operational and design conditions (temperature, pressure, pressurization rate and depressurization).

5.1.6 The Closure locking system shall be uniformly distributed along the entire sealing regions.

5.1.7 For pipelines containing gaseous product, the sealing material specification shall be for explosive decompression resistant.

5.2 Pressure Equalization System

5.2.1 A pressure equalization line of the pig trap shall be installed, equipped with a block valve and a throttling valve.

5.2.2 The pipe nominal diameter shall be 25 mm (1 in) for pipelines with a nominal diameter up to 150 mm (6 in) and 50 mm (2 in) for the other nominal pipeline diameters.

5.2.3 The throttling valve shall be a needle type valve with ¾ inches diameter (NPS ¾). Reducers shall be used in order to the needle valve diameter coincide with the equalization line diameter.

5.2.4 Pipelines with possible scaling shall be provided with flanges to facilitate disassembly and internal cleaning. The equalization line shall be installed as close as possible to the barrel and bypass line duly supported.

5.2.5 The by-pass and main branches shall be installed horizontal (3 h or 9 h positions) or on the top of pipe (12 o’clock position). The branches cannot be located on the bottom of pipe (6 o’clock position) or in any descending position.

5.3 Drainage System

5.3.1 For offshore facilities the drainage system shall be using a closed type drainage circuit, i.e., the drainage product collected in drainage basin shall be conducted by pipe to a closed reservoir /tank.

5.3.2 A drainage basin shall be provided with a capacity equal to 1.2 times the total volume of the launcher or receiver.

5.3.3 The basin shall be positioned beneath the barrel according to Figure 3 and be covered with a removable grating. The depth of the basin shall be at least 150 mm.

5.3.4 Drains standardization shall be according the pipe specification document provided by PETROBRAS.
5.3.5 For inclined or vertical Launchers drain (item 7) shall be installed as close as possible to valve (item 5), items according Table 5.

5.3.6 Pipes with possible scaling shall be provided with flanges to facilitate disassembly and internal cleaning.

5.3.7 For drainage of high viscosity liquids shall be predicted a system in order to facilitate the fluid flow through the drain pipe, e.g. an electrical heating system.

Figure 3 – Locating of drainage basin for launchers, receivers and launchers/receivers

Notes:
1) Dimension Y according Table 1.
2) Dimension L1 according Table 3 and Table 4 of ANNEX.
3) Minimum dimension for “Z” is 1 m (one meter).

5.4 Manometers

5.4.1 Two pressure indicators shall be installed in the pig trap. First one shall be installed before reducer (near the closure) and the second one shall be installed after the reducer (between reducer and block valve). These both pressure indicators shall be capable to indicate the barrel operating pressure in the middle third of the scale range.

5.4.2 The installation of a third pressure gauge on the barrel is recommended, provided with block and drain or vent valves. This third pressure gauge of the barrel shall be a “pressure and vacuum” one with measurement scale of 760 mmHg (vacuum) - zero - 2.0 kgf/cm². [Recommended Practice]

5.4.3 The “pressure and vacuum” gauge shall be installed with overpressure protection (set at 2.2 kgf/cm²) and the assembly of pressure and vacuum gauge and protection kit shall be sealed with clean and appropriate liquid (ethylene glycol or glycerin).

5.4.4 Pressure indicator connection shall be a ½ inch NPT threaded flanged, thread plug capped.

5.5 Vents

5.5.1 Two vents shall be installed; one upstream and another downstream from the reducer, to make possible the adequate filling or depressurizing of the pig trap.

5.5.2 When the passage of an intelligent pig is expected, a branch shall be installed in the pig trap, with a block valve, for nitrogen injection, positioned upstream from the atmospheric vent block valve which is installed closest to the closure; according Figure 10. The nitrogen injection branch shall have a check valve to avoid that the product being transported by the pipeline return to the nitrogen system (see Figure 10).
5.5.3 In addition to the atmospheric vents, barrel pressure relief shall be executed first using a closed system directed to the FPSO flare.

5.5.4 In installations that require closed system vents, there shall be vents additional to the atmospheric ones.

5.6 Valves

5.6.1 Valves with a nominal diameter greater than or equal to 300 mm (12 in) should be motorized, driven by electromechanical, hydraulic or pneumatic systems.

5.6.2 The valves (items 5, 12 and 13 of Table 5) shall be trunnion mounting and full bore type according to API SPEC 6D.

5.6.3 The pig trap block valve (item 5 of Table 5) shall be “Through-Conduit” type, full bore according to API SPEC 6D.

5.6.4 For any variation between the inside diameter of the valve and the pipe, the sharp edges shall be beveled with maximum slope of 1:4 (30° with the piping wall).

5.7 Thermal Relief Valve

5.7.1 A thermal relief valve shall be installed in the barrel, preferably connected to the pipeline, for pipelines transporting products with a liquid phase (item 3 of Table 5, of ANNEX).

5.7.2 Pig traps working with a liquid phase fluid shall have a relief valve in case of increase the temperature of the fluid inside the barrel.

5.8 Pig passage indicator

5.8.1 Pig passage indicators (item 4 of Table 5) shall be installed at a minimum distance from the block valve of the trap, in accordance with dimension o L_{2} of Table 3 and Table 4 of ANNEX.

5.8.2 Pig passage indicators shall be capable of detecting the passage of foam pigs, located at the following position:

   a) at the top of the pipe or side surface;
   b) within the limit of dimension L_{2}.

5.8.3 The ultrasonic type indicators shall be installed on the 3 or 9 o’clock positions. The ultrasonic transducers of the intrusive type shall face the inside wall thickness of the pipe, so as to not damage or be damaged by the pig.

5.8.4 For pipelines conveying only liquid, the pig passage indicator shall be an active ultrasonic non-intrusive.

5.8.5 For pipelines conveying treated gas, with no presence of condensed liquid, the pig passage indicator shall be intrusive active ultrasonic type.

5.8.6 For pipelines conveying non-treated gas, with the possibility of condensing or liquid, the pig passage indicator shall be the acoustic non-intrusive type.

5.8.7 Intrusive sensors shall be installed face to face with the inner pipe wall, in order to not suffer damage during the pig passage.

5.8.8 Each facility shall be evaluated in order to define if classified area indicators are applicable.

5.8.9 For offshore facilities with control room, pig indicators shall have both local and remote indications.

5.9 Nameplate

Pig launcher, receiver and launcher/receiver shall have identification plate, written in Portuguese, made of aluminum or stainless steel AISI 316, stating at least the following characteristics:
a) Designer;
b) Manufacturer or Contractor;
c) Manufacture year or assembly year;
d) Design code
e) Design pressure; hydrostatic pressure test and, date of the hydrostatic test execution.
f) Design Temperature; maximum and minimum operation temperature;
g) Body material and corrosion allowance;
h) Fluid;
i) Capacity and dry weight and full weight
j) TAG: \text{XX-YYYY.YYZZ};

where: \text{XX} = pig trap type; e.g.: \text{LP} = Pig Launcher; \text{YYYY.YY} = facility identification; \text{ZZ} = sequential number for the installation of pig launcher or receiver.

5.10 Derivations

5.10.1 For pig launcher, pig receiver and pig launcher-receiver, the bypass and main branches shall be assembled horizontally (3 or 9 o’clock positions) or on the top of pipe (12 o’clock position). The branches cannot be located on the bottom of pipe (6 o’clock position) or in any descending position.

5.10.2 Next item is referring about pig guide bars installed in pipe branches in order to avoid pig passage:

5.10.2.1 The branches with diameter equal or larger to half pipeline nominal diameter shall be provided with guide bars according to \text{Figure 11 of ANNEX}.

5.10.2.2 For pipelines with variable diameters the nominal diameter is considered the smaller diameter of the pipeline.

5.11 Flanges

5.11.1 Flanges shall be designed according the following standardization ASME B16.5, ASME B16.47 and ASME BPVC section VIII, Division1 as informed in \text{Table 2}.

5.11.2 Flange and pipe inside diameters shall be the same

5.11.3 Flange materials shall have better, or at least the same, mechanical resistance of the pipe.

\textbf{Table 2 – Flange design code}

<table>
<thead>
<tr>
<th>NPS</th>
<th>CARBON STEEL FLANGES</th>
<th>\text{ASME B16.5 CODE}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRESSURE CLASSES</td>
<td>ASME B16.1 CODE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>1&quot; a 12&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14&quot; a 24&quot;</td>
<td>Flange ASME B16.5 Class 150</td>
<td>Flange ASME B16.5 Class 300</td>
</tr>
<tr>
<td>26&quot; a 36&quot;</td>
<td>Flange ASME B16.47 - Serie A</td>
<td>Flange ASME B16.47 - Serie A</td>
</tr>
</tbody>
</table>

Notes:

1) If the use of flanges of high strength is necessary, the standard MSS SP-44 may be used;
2) Overlapped flanges or rolled plate flanges will not be accepted.
3) Clamp type connections (e.g.: grayloc) are not accepted.

5.12 Pig foam receiving basket

5.12.1 The receiving basket dimensions describe in \text{Figure 12} shall be used for receiving foam pigs.
5.12.2 The receiving basket shall be installed in the receiver trap before the foam pig is placed in the launcher trap.

5.13 Lifting system

Supplier shall provide the pig trap with pad eyes (lifting lugs) devices according Figure 4.

![Figure 4 – Lifting lugs position](image)

6 FABRICATION AND SUPPLY REQUIREMENTS

6.1 Minimum requirements for packing and transportation:

6.1.1 The flanged ends shall be blanked off with wood or plastic protective covers for the protection of the faces of the flanges.

6.1.2 The flanged ends shall be blanked off with wood or plastic protective covers for the protection of the faces of the flanges.

6.1.3 Closure detailed operation, maintenance and inspection plan shall be supplied by VENDOR.

6.1.4 Contact surfaces of flanges shall be protected against corrosion by applying non water-soluble anti-corrosion grease or removable vinyl resin varnish.

6.1.5 The flanges shall be stored indoors, on shelves or wooden pallets, separated by diameter, wall thickness, pressure class and other characteristics. The flanges with a nominal diameter above 150 mm (6 in) shall be stored and handled only on wooden pallets.

6.1.6 Welding neck flanges bevels shall be protected by removable vinyl resin varnish.

6.1.7 Closure’s sealing ring shall be protected with Vaseline. The spare ring shall be stored in a plastic package.

6.2 Minimum requirements for manufacture documentation

A data book containing at least the following documents shall be provided by the manufacturer:

a) detailed drawing of the pig trap;

b) pig trap mechanical calculation report;

c) list of materials, containing a complete specification of all materials used in the manufacture of the pig trap, such as: pipes, plates, fittings and gaskets;

d) materials certificates;

e) weld maps;

f) weld procedure specification (WPS) and weld procedure qualification record (WPQR);

g) spreadsheet containing the identification of the welded joints, with their respective required procedures and testing.
h) procedures for nondestructive testing, stress relieving (when applicable), for hydrostatic tests and painting or coating;
i) visual and dimensional inspection and weld size reports;
j) reports for the nondestructive testing executed on the welded joints;
k) post weld heat treatment report, when applicable;
l) hydrostatic test report;
m) painting or coating report;
n) quick opening closure operating manual.
o) Spare parts list

6.3 Documentation for PETROBRAS Approval

Manufacturer shall provide for PETROBRAS approval the following documentation drawings:
a) General drawing
b) Fabrication drawing containing: list of materials, constructive details and identification plate.
c) Valves drawings (for block valve, throttling valve and thermal relief valve).
d) Basket drawing, (for foam pig receive).

6.4 Minimum requirements for quick opening closure supply

6.4.1 Closure shall be designed according ASME BPVC section VIII, as informed in item 5.1.1;
6.4.2 Closure’s quick opening/closing system shall be tested, considering item 5.1.4 requirements;
6.4.3 Hydrostatic and leak tests shall be performed;
6.4.4 VENDOR shall provide the minimum number of operations for seal system change;
6.4.5 Closure opening criteria: clockwise, 180 degrees.
6.4.6 Closure and major barrel are connected; therefore closure dimensions shall be matching the major barrel diameter.
6.4.7 Safety system for closure operation;
6.4.8 Supports, fixing and installation plan,
6.4.9 Weld procedure specification (WPS) and weld procedure qualification record (WPQR);
6.4.10 The type of finishing and coating used at sealing areas shall be specified; e.g.: Inconel 625 overlay at sealing ring contact area;
6.4.11 VENDOR shall provide the maintenance plan, including spare part list and reference codes (part numbers). Spare parts shall be provided considering one operation per month for two years, including preventive and corrective maintenances;

7 CONSTRUCTION AND ASSEMBLY REQUIREMENTS

7.1 Welding and Finishing
7.1.1 Pig trap inside surface shall not have irregularities and not contain deposits; otherwise this could damage or restrict pig passage.
7.1.2 During the welding process, the root pass shall be executed in order to reduce penetration excess.
7.1.3 For large diameters is acceptable to grind the welding internal reinforcement
7.1.4 100% full visual and penetrant test in all welds.
7.1.5 100% full radiographic or ultrasonic examination in all circumferential welds.
7.2 Hydrostatic Test
7.2.1 Pig traps shall be hydrostatically tested according the previously defined design code.

7.2.2 Hydrostatic test shall be performed with industrial water added corrosion inhibitor. The maximum chlorines content shall be 25 ppm.

7.2.3 The minimum test pressure and test duration shall be according equipment design code.

7.3 Preservation

7.3.1 Pig trap shall be completely dried after hydrostatic test;

7.3.2 All mechanisms and hinges shall be lubricated according to manufacturer’s procedure;

7.3.3 Pig trap internal surfaces shall be protected against corrosion by applying non water-soluble anti-corrosion grease or removable vinyl resin varnish.

7.4 Pipe Bending

Pipe bending shall be according the following normative code:

- a) Pipelines: ASME B31.4 code
- b) Gas Pipelines: ASME B31.8 code and ABNT NBR 12712

8 SAFETY REQUIREMENTS

8.1 Valve operation

8.1.1 Pig trap shall be provided with a safety interlock system (e.g.: key interlock), for valves and closure operation.
9 ANNEX

Figure 5 – Pig Launcher Trap Schematic Drawing
Figure 6 - Pig ReceiverTrap Schematic Drawing
Figure 7 - Pig Launcher/Receiver Trap Schematic Drawing
### Table 3 – Dimensions for non-intelligent pig trap

<table>
<thead>
<tr>
<th>Nominal Diameter ΦA</th>
<th>Dimensions for: Figure 5, Figure 6 and Figure 7</th>
<th>Φ Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L₁ – Launcher</td>
<td>L₂</td>
</tr>
<tr>
<td>80 (3)</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>100 (4)</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>150 (6)</td>
<td>1100</td>
<td>1100</td>
</tr>
<tr>
<td>200 (8)</td>
<td>1350</td>
<td>1350</td>
</tr>
<tr>
<td>250 (10)</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>300 (12)</td>
<td>1800</td>
<td>1800</td>
</tr>
<tr>
<td>350 (14)</td>
<td>1800</td>
<td>1800</td>
</tr>
<tr>
<td>400 (16)</td>
<td>2000</td>
<td>2000</td>
</tr>
</tbody>
</table>

### Table 4 – Dimensions for intelligent pig traps.

<table>
<thead>
<tr>
<th>Nominal Diameter ΦA</th>
<th>Dimensions for: Figure 5, Figure 6 and Figure 7</th>
<th>Φ Drain</th>
<th>Φ Equalization Line</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L₁ – Launcher</td>
<td>L₂</td>
<td>L₁ – Receiver</td>
</tr>
<tr>
<td>100 (4)</td>
<td>2350</td>
<td>2400</td>
<td>2350</td>
</tr>
<tr>
<td>150 (6)</td>
<td>2000</td>
<td>1950</td>
<td>2000</td>
</tr>
<tr>
<td>200 (8)</td>
<td>3050</td>
<td>3000</td>
<td>3050</td>
</tr>
<tr>
<td>250 (10)</td>
<td>2900</td>
<td>2750</td>
<td>2900</td>
</tr>
<tr>
<td>300 (12)</td>
<td>3600</td>
<td>3400</td>
<td>3600</td>
</tr>
<tr>
<td>350 (14)</td>
<td>3700</td>
<td>3450</td>
<td>3700</td>
</tr>
<tr>
<td>400 (16)</td>
<td>3300</td>
<td>3050</td>
<td>3300</td>
</tr>
<tr>
<td>450 (18)</td>
<td>3600</td>
<td>3250</td>
<td>3600</td>
</tr>
<tr>
<td>500 (20)</td>
<td>2000</td>
<td>1650</td>
<td>3000</td>
</tr>
<tr>
<td>550 (22)</td>
<td>2100</td>
<td>1650</td>
<td>3350</td>
</tr>
<tr>
<td>600 (24)</td>
<td>3200</td>
<td>1550</td>
<td>4100</td>
</tr>
<tr>
<td>650 (26)</td>
<td>3600</td>
<td>2950</td>
<td>4500</td>
</tr>
<tr>
<td>700 (28)</td>
<td>3100</td>
<td>2450</td>
<td>4900</td>
</tr>
<tr>
<td>750 (30)</td>
<td>3200</td>
<td>2370</td>
<td>4850</td>
</tr>
<tr>
<td>800 (32)</td>
<td>3200</td>
<td>2370</td>
<td>4850</td>
</tr>
<tr>
<td>850 (34)</td>
<td>3100</td>
<td>2300</td>
<td>4300</td>
</tr>
<tr>
<td>900 (36)</td>
<td>3200</td>
<td>2370</td>
<td>4850</td>
</tr>
<tr>
<td>950 (38)</td>
<td>3200</td>
<td>2370</td>
<td>4850</td>
</tr>
<tr>
<td>1000 (40)</td>
<td>4200</td>
<td>3250</td>
<td>5150</td>
</tr>
<tr>
<td>1050 (42)</td>
<td>4200</td>
<td>3250</td>
<td>5450</td>
</tr>
</tbody>
</table>
Table 5 – Listed items in Figure 5, Figure 6 and Figure 7

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pipeline (ØA)</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Insulating joint</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Thermal relief valve</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Pig passage indicator</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Trap block valve (full bore)</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Reducer</td>
<td>11 and 12</td>
</tr>
<tr>
<td>7</td>
<td>Drain</td>
<td>3 and 7</td>
</tr>
<tr>
<td>8</td>
<td>Pressure gauge (Manometer or Transmitter Φ3/4&quot;)</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Barrel</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Vent</td>
<td>8 and 17</td>
</tr>
<tr>
<td>11</td>
<td>Quick opening closure</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>Bypass valve</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Main valve</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Bypass line (ΦB)</td>
<td>9</td>
</tr>
<tr>
<td>15</td>
<td>Main line (inlet/outlet)</td>
<td>6</td>
</tr>
<tr>
<td>16</td>
<td>Pressure equalization line with valve</td>
<td>9, 14 and 16</td>
</tr>
<tr>
<td>17</td>
<td>Supports</td>
<td>1 and 14</td>
</tr>
<tr>
<td>18</td>
<td>Flanged outlet</td>
<td>4 and 15</td>
</tr>
</tbody>
</table>

NOTES:
1) The type, quantity, and location of supports shall be determined by the detailed design.
2) For offshore facilities insulating joint is not required. The insulating joint shall be installed on a straight section, right after the pipeline buried section and before any support.
3) Drain minimum diameter shall be according: Table 3 and Table 4. If the drain is directed to a drainage basin, it shall be predicted at least 300 mm of distance of the drain to the basin floor. The number of drain valves shall be as defined in the design.
4) Connection for pulling intelligent pig according to item 4.4.6 of this Standard.
5) Pig passage indicators shall be capable of detecting the passage of foam pigs, located at the following position: a) at the top of the pipe or side surface; b) within the limit of dimension L₂.
6) Pipeline diameter shall be according to detailed design.
7) Drainage products destination shall be predicted in drainage system detailed design. If a pipe is conveying the drained product to a drain box, it shall be predicted in the pipe design: the possibility of displacement and high pressure drops of solid residuals. The use of funnel near the drain valve shall be considered, this fixation shall be flange ended with the drain box.
8) Launchers and receivers with recommended inertization with N₂, shall have a vent with outlet according to Figure 8. The number of vents valves shall be as defined in design phase. Vents nominal diameter shall be as defined in design, and this diameter shall not be smaller than ¾ inches.
9) Pipelines with possible scaling shall be provided with flanges to facilitate disassembly and internal cleaning. The line (item 16) shall be installed as close as possible to the barrel and bypass line duly supported.
10) Thermal relief valve shall be installed in pipelines operating with process fluid in liquid phase.
11) Launcher traps and Launcher/Receiver shall have an eccentric reduction connecting major barrel to minor barrel; this reduction shall have maximum inclination equal to 1:5.
12) Receiver traps shall have a concentric reduction connecting major barrel to minor barrel. This reduction shall have maximum inclination equal to 11 degrees related to the center line.
13) Flange and connections
14) Supports for Equalization line shall be predicted in design.
15) Launchers and launchers/receivers with barrel size equal or over 8 inches (NPS8) shall be provided with a flanged end nozzle NPS2 (this requirement is just applicable if intelligent pig operation is predicted). This nozzle shall be installed inclined at 45° in order to introduce a cable into the nozzle and pull the intelligent pig into the barrel. Nozzle position shall not be coincident with barrel's block valve.
16) Equalization line maximum allowable diameter is NPS 2 (2 inches), according item 5.2.2.
17) A NPS1 (1 inch) line threaded union with drain shall be predicted. For lines with possible scaling shall be provided predicted
Figure 8 – Sampling Outlet

Figure 9 – Distance between two derivations
Figure 10 – Derivation with a block valve to atmosphere
Figure 11 – Pig guide bar in branches
Notes:
1) Guide bars shall be in accordance with the following information: (dimensions in millimeters, inches in parentheses).

<table>
<thead>
<tr>
<th>GUIDE BARS</th>
<th>NUMBER OF BARS</th>
<th>INTERVAL “A”</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 80 (≤ 3&quot;)</td>
<td>1</td>
<td>1/2 X Φ BRANCH</td>
</tr>
<tr>
<td>100 to 150 (4&quot; to 6&quot;)</td>
<td>2</td>
<td>1/3 X Φ BRANCH</td>
</tr>
<tr>
<td>200 to 300 (8&quot; to 12&quot;)</td>
<td>3</td>
<td>1/4 X Φ BRANCH</td>
</tr>
<tr>
<td>350 to 550 (14&quot; to 22&quot;)</td>
<td>5</td>
<td>1/6 X Φ BRANCH</td>
</tr>
<tr>
<td>600 to 750 (24&quot; to 30&quot;)</td>
<td>7</td>
<td>1/8 X Φ BRANCH</td>
</tr>
<tr>
<td>800 to 1050 (32&quot; to 42&quot;)</td>
<td>9</td>
<td>1/10 X Φ BRANCH</td>
</tr>
</tbody>
</table>

2) Transversal reinforcement bars shall be in accordance with the following information: (dimensions in millimeters, inches in parentheses).

<table>
<thead>
<tr>
<th>TRANSVERSAL REINFORCEMENT BARS</th>
<th>NUMBER OF BARS</th>
<th>INTERVAL &quot;B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 150 (≤ 6&quot;)</td>
<td>REINFORCEMENT BAR IS NOT REQUIRED</td>
<td></td>
</tr>
<tr>
<td>200 to 550 (8&quot; to 22&quot;)</td>
<td>1</td>
<td>1/2 X Φ BRANCH</td>
</tr>
<tr>
<td>600 to 750 (24&quot; to 30&quot;)</td>
<td>2</td>
<td>1/3 X Φ BRANCH</td>
</tr>
<tr>
<td>800 to 1050 (32&quot; to 42&quot;)</td>
<td>3</td>
<td>1/4 X Φ BRANCH</td>
</tr>
</tbody>
</table>

3) Bars shall be adjusted and installed on the branch connection at the pipe shop before being sent to the field for installation on pipeline;
4) The end of the guide bars which comes into contact with the pig shall be accurately adjusted to the pipeline (according to its inside diameter), in order to unobstructed passage of the pig. Sharp edges shall be eliminated in order to avoid damages in the pig.
5) Bar material shall be ASTM-A36 or equivalent.
6) Guide bars shall be welded to the reinforcement bar using a fillet weld all around.
7) All bars shall be welded to the piping by a fillet weld all around.
8) Bar dimensions shall be according to the following information: (dimensions in millimeters, inches in parentheses).

<table>
<thead>
<tr>
<th>BAR DIMENSIONS</th>
<th>BRANCH DIAMETER</th>
<th>THICKNESS</th>
<th>WIDTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guide Bar (L5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transversal Reinforcement Bar (L6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 to 150 (4&quot; to 6&quot;)</td>
<td>9.5</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>200 to 300 (8&quot; to 12&quot;)</td>
<td>9.5</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>350 to 550 (14&quot; to 22&quot;)</td>
<td>12.7</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>600 to 750 (24&quot; to 30&quot;)</td>
<td>12.7</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>800 to 1050 (32&quot; to 42&quot;)</td>
<td>12.7</td>
<td>70</td>
<td>65</td>
</tr>
</tbody>
</table>
Figure 12 - Pig receiving basket
Notes:
1) Inside diameter of receiver barrel minus 10 mm.
2) Dimensions \( L_1 \) of Table 3 and Table 4.
3) Spacers for supporting the cylindrical part and centering device, made of aluminum plates or bars with dimensions compatible with the weight of the device. The baskets shall be in aluminum plate or pipe, or other non-sparking material, with minimum thickness of 3 mm.
4) Uniformly spaced holes with diameter according to the following information:

<table>
<thead>
<tr>
<th>PIPELINE DIAMETER [mm]</th>
<th>HOLE DIAMETER [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 a 250 (4&quot; a 10&quot;)</td>
<td>19.05 (( \frac{3}{4} ))</td>
</tr>
<tr>
<td>300 a 500 (12&quot; a 20&quot;)</td>
<td>22.2 (( \frac{7}{8} ))</td>
</tr>
<tr>
<td>550 a 700 (22&quot; a 28&quot;)</td>
<td>25.4 (1&quot;)</td>
</tr>
<tr>
<td>750 a 1050 (30&quot; a 42&quot;)</td>
<td>44.45 (1 ( \frac{3}{4} ))</td>
</tr>
</tbody>
</table>

5) The 2 drilled sections length equal to 2 times the diameter \( A \) (Table 3 and Table 4), which sum of hole areas of each one shall be, at least, 2 times the inside cross section area of a by-pass each section shall be placed with its mediatrix matches the center line of one of the bypass.
6) Inside diameter of the pipeline (\( \phi A \)) of Table 3 and Table 4 plus 5 %.
7) The baskets shall be longitudinally split and articulated with hinges.
8) Inside diameter of the receiver barrel divided by 2. Provide clearance for moving the basket inside the barrel.
9) These dimensions are limited by the sum of the lengths of the pigs that may be received without opening the barrel.
10) According to dimensional \( L_1 \) (Table 3 and Table 4), the baskets shall be made in sections, in order to facilitate transportation and handling.
11) Dimensions in millimeters, unless otherwise indicated.