

Details for Installation of Instruments to the Process

Standardization

This Standard replaces and cancels its previous revision.

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the sections, subsections and enumerates thereof.

Technical Requirement: A provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by imperative nature.

Recommended Practice: A provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by verbs of a nonmandatory nature. It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the section, subsection and enumerate to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

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CONTEC

Comissão de Normalização
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SC - 10

Instrumentation and Industrial
Automation

Introduction

PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting specialized of Technical Collaborators from Company and its Subsidiaries), are commented by Company Units and its Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of technicians from the same specialty, representing the various Company Units and its Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the Company Units and its Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS Technical Standard [N-1](#). For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.

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Foreword

This Standard is the English version (issued in 07/2013) of PETROBRAS N-2791 REV. A 09/2014. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

1 Scope

1.1 This Standard unifies the installation detail of process instruments to be used in instrumentation processes for PETROBRAS.

1.2 This Standard does not address installation details concerning level and temperature measuring instruments.

1.3 Annex A shows matrix for the selection of installation details which allows the selection of details of installation according with the assembly, connection with the process, tap orientation, and others.

1.4 Annex B shows drawings with typical installations defined according to the installation needs set forth in Annex A.

1.5 This Standard applies to procedures started as of their issuance date, also to existing facilities and equipment subject to maintenance or overhaul.

1.6 This Standard contains Technical Requirements and Recommended Practices.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

PETROBRAS [N-42](#) - Projeto de Sistema de Aquecimento Externo de Tubulação, Equipamento e Instrumentação com Vapor;

PETROBRAS [N-57](#) - Mechanical Design of Industrial Piping;

PETROBRAS [N-75](#) - Abbreviations for Industrial Designs;

PETROBRAS [N-76](#) - Piping Materials for Refining and Transportation Plants;

PETROBRAS [N-1882](#) - Criteria for Development Instrumentation Designs;

PETROBRAS [N-1883](#) - Presentation of Instrumentation/Automation Design;

PETROBRAS [N-1931](#) - Instrumentation Piping Material;

PETROBRAS [N-2833](#) - Forms and Lists for Instrumentation Designs;

API [RP 551](#) - Process Measurement Instrumentation.

NOTE For documents referred in this Standard and for which only the Portuguese version is available, the PETROBRAS department that uses this Standard should be consulted for any information required for the specific application.

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1

connection to the instrument's process

connection of the instrument which shall be connected to the impulse line

3.2

by-pass

physical installation allowing the isolation of the instrument without interruption of the process, always closed in normal operation

3.3

drain

a valve-isolated line, allowing fluid to run off, installed in lower points of piping or equipment

3.4

impulse line

line section interconnecting the root valve to the instrument's process connection

3.5

purge or flushing

continuous or eventual impulse taps flushing system by fluid injection

3.6

impulse tap

equipment or process line derivation point where the root valve is to be installed

3.7

root valve

block valve that isolate the impulse tap from the impulse line

3.8

vent

a valve-isolated line, allowing fluids to run off, installed in higher points of piping or equipment

4 General Conditions

Details of instrument installation (typical details) defined in the Standard embrace the most general cases for pressure and flow rate measuring instruments. Those details consider, for the design purpose, the root valve as the scope limit between piping and instrumentation. In instrumentation designs where impulse line needs welding services, materials and components shall be defined and supplied by the instrumentation discipline and submitted to piping discipline for execution of welding services. For root valves supplied with welded fitting (ES x DE), see 5.3. Any situation not described in this Standard shall require specific solutions or adjustments in existing details and shall be submitted to PETROBRAS.

4.1 Documentation

4.1.1 Details of installation shown in this Standard, executed as design's documents, shall be presented according to the standard form defined on PETROBRAS [N-2833](#) or according to standards defined on design automation tools in use by PETROBRAS.

4.1.2 Besides the abbreviations found in PETROBRAS [N-75](#), the following apply:

- a) INST - Instrumentation;
- b) TUB - Piping.

4.2 Materials

4.2.1 Materials used shall follow specifications foreseen in the project.

4.2.2 For material specifications in the areas of Upstream (where applicable), Downstream, Gas and Energy shall be applied PETROBRAS [N-1931](#) and [N-76](#). PETROBRAS [N-1931](#) concentrates standards from PETROBRAS [N-76](#), according to types of material and product, aiming at reducing the types and specifications of materials.

4.2.3 The complete description of materials presented in the process installation details shall follow the descriptions defined by standards and documents mentioned in 4.2.2 and 4.2.3 and in systems in use at PETROBRAS.

4.2.4 In the installation details of Annex B, only one item of each type of material is indicated. The final quantities shall be determined during the executing of Executive Project's final document.

4.3 Inspection and Tests

Impulse lines and respective components shall be submitted to the same procedures of inspection, tests, examination and others applied to the source equipment or piping. Special cases shall be clearly indicated in the specific sheet of the installation detail. For further details about these inspections and tests, see PETROBRAS [N-858](#).

4.4 Assembly

4.4.1 Instruments directly inserted on the line or equipment were not considered in the scope of this Standard, since they do not have installation material besides joints and bolts, which follow the specifications applicable and usually are quantified by the piping discipline. When the piping discipline does not quantify these materials, a detail shall be created, allowing their quantification and specification.

4.4.2 The instrumentation discipline shall verify the position of the instruments directly inserted in the line, as well as the determination of the impulse tap by the piping discipline, considering the operation and maintenance requirements for the instrument.

4.4.3 The limit of instrumentation and piping discipline's accountability presented in the installation details drawing refers to the material specification and quantification. In defining the construction limit, specific activities performed by each discipline shall be considered.

4.4.4 It is recommended that activities related to instrumentation involving welding services be executed and inspected by the piping discipline. **[Recommended Practice]**

4.4.5 Instruments shall be installed in a way that they are accessible from the floor, platforms or ladders, assuring permanent access. For this purpose, impulse lines shall have the least possible length.

4.4.6 The maximum length to the impulse lines shall be 1 m for the applications which need short answer time, to comply with greater accuracy class and uncertainty measuring level such as: anti-surge control, custody transfer etc.

4.4.7 It is recommended that the maximum impulse lines length be 6 m for all application not mentioned in 4.4.6. **[Recommended Practice]**

4.4.8 The instruments, when assembled over the floor or platform shall be between 1,45 m and 1,55 m high, on a 2" tubular support type column or wall. When functional requirements require different height or assembly, these shall be submitted to PETROBRAS approval.

4.4.9 The instruments shall be installed in locations with adequate temperature, according to its specifications. Avoid installation near heat sources which could change the normal conditions of operation.

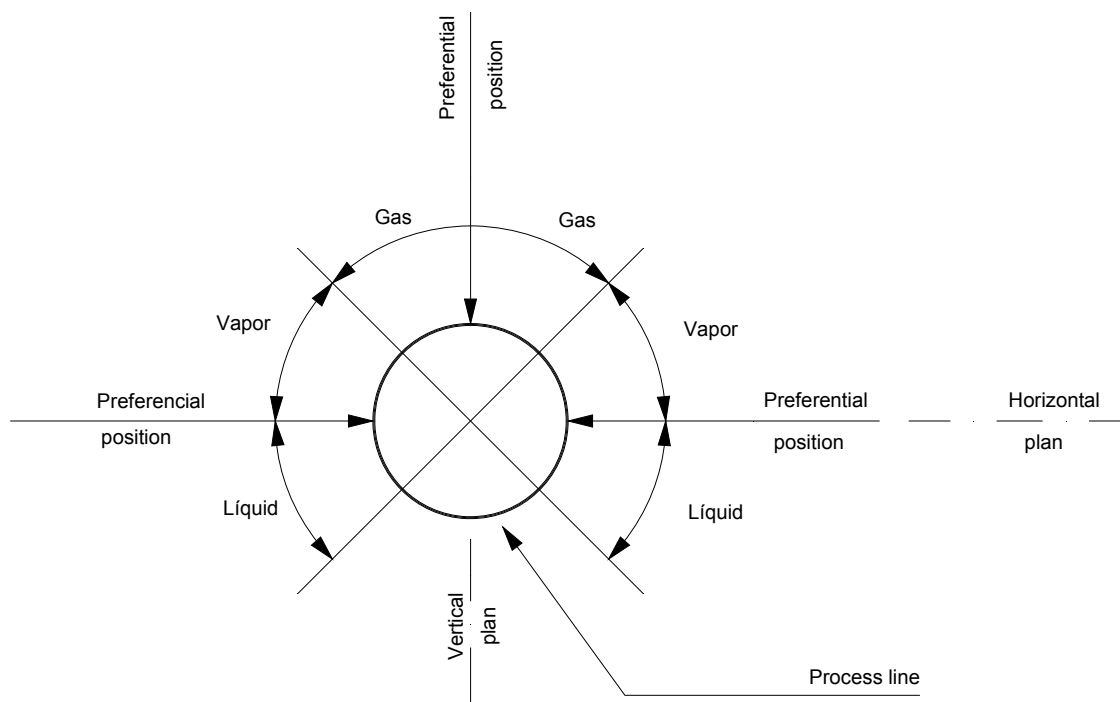
4.4.10 Instruments with local indication shall be installed with their display facing the regular access paths.

4.4.11 All horizontal sections of the impulse lines shall have a minimum slope of 1:10, to prevent pocket formation and aiming at helping the drainage or relief. For condensable gas lines it shall provided tap inclined upwards.

4.4.12 According to API [RP 551](#), for gaseous fluids measurements, the instrument shall be installed above the impulse tap, and for condensable liquids and vapors, the installation shall be done below the impulse tap. For dry gas, not subject to condensation, the instrument shall be installed below the impulse tap.

4.4.13 According to the fluid to be measured, the impulse taps orientation in horizontally-installed process lines shall be according with Figure 1.

4.4.1.4 For another installation details, see PETROBRAS [N-858](#).



NOTE 1 The installation details in Annex B show preferential positions. In case the piping arrangement does not allow the installation of the impulse tap in the preferential position, the details shall be adapted, including the use of other materials to allow for the installation.

NOTE 2 Whenever there is a possibility of residues being carried inside the liquid lines, the tap shall be installed in the horizontal position. Possible services where it shall be applied: vacuum residue lines, load lines for coke unit furnace and injection water lines in wells.

Figure 1 - Orientation for Impulse Taps Installation

4.5 Supporting Brackets

4.5.1 The type of bracket and place of installation shall be adequate to the mechanical solicitations, such as thermal expansion and vibration of equipment or pipes associated with it, in order to avoid damages or disturbance to the operation of the instruments.

4.5.2 The instruments shall not be mounted in guardrails, pipe racks or in other places subject to vibrations, impacts or other disturbances.

4.5.3 The spacing between supporting brackets on impulse lines shall ensure the secure harshness, stability and adequate slope for the measurement.

4.5.4 The impulse lines shall be properly supported to:

- support their own weight, including the fluid within;
- do not create undue tension on instruments;
- avoid tubing and fittings damages in applications where there are high vibration occurrences.

4.5.5 In supporting impulse lines shall be used proper brackets and materials to avoid wear by friction or by galvanic corrosion.

5 Specific Conditions

5.1 Use of Joint Fittings in the Instrument Installation (Threaded or Welded)

5.1.1 It shall be observed the piping specification regarding the possibility of using joint or flange.

5.1.2 Whenever the impulse line assembly requires the use of joints due to maintenance requirements, flanges shall be used instead.

5.2 Installation of Instruments Requiring Purge or Flushing

5.2.1 Applications requiring purge or flushing for unclog the impulse tap shall have the purge or flushing fluid inlet connection near the impulse tap, according to API [RP 551](#) Section 6. For auxiliary equipment (rotameter, pressure regulator, restriction orifice, etc) it shall be observed the criteria described on PETROBRAS [N-1882](#).

5.2.2 Equipment and accessories required for purge or flushing installation shall be mounted in a permanent way.

5.3 Use of Nipple/Fitting Welded to Root Valve

For root valve with female fitting type ES, it shall be used a nipple and a female fitting (ES X OD), allowing for the reuse of the root valve.

5.3.1 The nipple's length shall be within 100 mm up to 150 mm range, and shall follow the piping material specification according to PETROBRAS [N-76](#) or material specification applicable.

5.3.2 Nipple specification shall be according to PETROBRAS [N-76](#).

5.4 Use of Sealing

5.4.1 Sealing shall be used whenever there is the need to avoid, near the instrument, the presence of:

- a) liquids subject to freezing or solidification;
- b) corrosive fluids;
- c) viscous fluids;
- d) fluids with phase change near the instrument;
- e) toxic liquids;
- f) condensable vapors.

5.4.2 If there is a need to use sealing in impulse taps for instruments, the mounting shall have a tee, used for sealing closure and assembly. The use of sealing pot or condensable pot shall be restricted to specific cases and submitted for PETROBRAS approval.

5.4.3 The distance from the process tap to the sealing tee shall be minimized.

5.4.4 The sealing fluid and the impulse line to be filled shall be indicated in the installation details. Use the following liquids for sealing:

- a) bi-distilled glycerin - for hydrocarbon purposes;
- b) water - for steam applications.

NOTE The use of another fluids shall be submitted to PETROBRAS approval.

5.4.5 A needle valve is recommended to fill the impulse lines from the bottom. **[Recommended Practice]**

5.5 Use of Remote Seal with Capillary

A drain or vent shall be used after the root valve for instrument release.

5.6 Use of Valves for Vent and Drain

5.6.1 Vent valves for gases and vapours and drain valve for liquids shall be included in all installation details. These shall be needle valves, in order to allow for their gradual opening. When a manifold block that allow for venting and drainage is used, it shall not used additional valves for these purposes.

5.6.2 All drains or vents of impulse taps shall be directed to a safe local defined in the design, including those coming from the 5-way manifold. Exceptions to this item shall be submitted for PETROBRAS approval.

5.6.3 For applications where the process fluid require line and impulse tap cleaning, the installation of devices (vents/drains) shall be planned to allow for the cleaning without the need to disassemble the lines and valves.

5.6.4 Specifically for piping and equipment containing toxic fluid, the drains and vents for impulse taps shall be directed to a safe place or to flare. Exceptions to this item shall be submitted for PETROBRAS approval.

5.6.5 The use of a ball valve (fast opening and full bore) instead of a needle valve (outflow regulation and reduced bore) in the impulse line drain for instruments is allowed only for non-critical applications, such as non-corrosive fluids, non-toxic fluids, non-flammable liquids and for pressure lower than 1 kgf/cm².

5.6.6 All vent or drain ends shall be provided of plugs, caps or similar gradual opening devices. Plugs and caps with threaded fittings or Output Diameter (DE) can be replaced by vent-screw.

NOTE When using vent-screw, this cannot have any device for manual actuation. The vent-screw shall have a limiter lock in order to avoid the ejection of the shut plug. The actuation shall be made by means of a spanner. The vent-screw opening shall be gradual until exposing more than 1 thread.

5.7 5-Way Manifold

5.7.1 A 5-way manifold shall be used in differential pressure transmitters installation.

5.7.2 Draining, venting or impulse tap filling with sealing fluid near the instrument shall be done by means of a 5-way manifold.

5.8 Impulse Line Blocking

5.8.1 The root valve shall be considered as the main blocking device, and the manifold as the instrumentation block.

5.8.2 The use of other blocking device with a valve near the instrument on the impulse line shall be limited to critical applications and when the root valve is in a hard-to-access place.

5.8.3 It is recommended that all process block valve has a stainless plate with the TAG of the instrument connected to it. **[Recommended Practice]**

5.9 Construction of Impulse Lines with Tubing

5.9.1 If the impulse line's length is bigger than the maximum manufactured length of the material used (6 m) in the assembly, the following option shall be considered for the connection:

- compression joint;
- orbital welding;
- socket welding for tubing.

5.9.2 All compression connections shall be accessible, in order to allow the inspection. Compression joints installation shall consider an off-set on the impulse line in order to allow the fastening tool insertion.

5.10 Tap and Impulse Line with Heating

5.10.1 The steam trace installation shall comply with PETROBRAS [N-42](#).

5.10.2 In impulse taps and lines requiring process fluid temperature conservation and using thermal isolation, with or without heating, the application of these devices shall be extended up to sealing tee, seal diaphragm or instrument.

5.10.3 The instrumentation shall check with the piping discipline the need to use heating and thermal isolation for impulse taps and lines.

5.10.4 It is recommended that the survey and specification of materials and the steam trace and thermal isolation assembly be executed and inspected by the piping discipline. **[Recommended Practice]**

5.10.5 It is recommended that the survey and specification of materials and the electric trace assembly be executed and inspected by the electricity discipline. **[Recommended Practice]**

5.11 Construction of Impulse Lines with Rigid Pipes

5.11.1 The use of rigid pipes for impulse lines shall be restricted to those cases where the tubing is not technically applicable.

5.11.2 The use of rigid pipes shall be restricted to the shortest length possible from the root valve.

5.11.3 In installations with rigid pipe, a flange shall be installed near the equipment, in order to facilitate the removal for maintenance.

Annex A - Matrix for the Selection of Installation Detail

assembly	connection to piping	tap orientation	manifold type	impulse line	connection to instrument	accessories	accessory connection	drawing
direct mount on (self-supported)	thread	Vertical on top	without manifold	simple	threaded	no accessory	NA	P-001
						Pulsation dumper Pressure snubber diaphragm seal	threaded	P-002
		horizontal	without manifold	simple	threaded	No accessory	NA	P-003
						Pulsation dumper Pressure snubber diaphragm seal	threaded	P-004
	male weld fitting	vertical on top	without manifold	simple	threaded	no accessory	NA	P-005
						Pulsation dumper Pressure snubber diaphragm seal	threaded	P-006
		horizontal	without manifold	simple	threaded	no accessory	NA	P-007
						Pulsation dumper Pressure snubber diaphragm seal	threaded	P-008
	female weld fitting	vertical on top	without manifold	simple	threaded	no accessory	NA	P-009
						Pulsation dumper Pressure snubber diaphragm seal	threaded	P-010
		horizontal	without manifold	simple	threaded	siphon	RO/ES	P-011
						no accessory	NA	P-012
	flange	vertical on top	without manifold	simple	threaded	Pulsation dumper Pressure snubber diaphragm seal	threaded	P-013
						no accessory	NA	P-014
		horizontal	without manifold	simple	threaded	Pulsation dumper Pressure snubber diaphragm seal	threaded	P-015
						siphon	RO/ES	P-016
		vertical on top	without manifold	simple	threaded	no accessory	NA	P-017
						Pulsation dumper Pressure snubber diaphragm seal	threaded	P-018

Figure A.1 - Installation for Pressure

assembly	connection to piping	tap orientation	manifold type	impulse line	connection to instrument	accessories	accessory connection	drawing
remote mount on	thread	vertical on top horizontal	threaded	simple	threaded	no accessory	NA	P-019
			— with seal		threaded	sealing tee	threaded	P-020
	male weld fitting	vertical on top horizontal	threaded	simple	threaded	no accessory	NA	P-021
			— with seal		threaded	sealing tee	welded	P-022
			flanged	simple	flanged	no accessory	NA	P-023
			— with seal		flanged	sealing tee	welded	P-024
	female weld fitting	vertical on top horizontal	threaded	simple	threaded	no accessory	NA	P-025
			— with seal		threaded	sealing tee	welded	P-026
			flanged	simple	flanged	no accessory	NA	P-027
			— with seal		flanged	sealing tee	welded	P-028
	flange	Vertical on top horizontal	threaded	simple	threaded	no accessory	NA	P-029
			— with seal		threaded	sealing tee	welded	P-030
			flanged	simple	flanged	no accessory	NA	P-031
			— with seal		flanged	sealing tee	welded	P-032

Figure A.1 - Installation for Pressure (Continued)