SIGNATURE CONTROL		
DEVELOPED	**REVISED**	**AUTHORIZED**
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SIGNATURE	SIGNATURE	SIGNATURE
Quality Control Inspector POSITION	Quality Control Manager POSITION	General Manager POSITION

CHANGE CONTROL		
CHANGE DESCRIPTION	**REVIEW**	**DATE**
Unification of the inspection sections and acceptance criteria of PH.	04	18.08.23
The translation of this procedure PCC-11 is included in the IMS, the English version is integrated with the same control data as the Spanish document. Modification of associated formats for handling the English/Spanish version.	03	08.03.23
Integration of the reference documents, definitions, and responsibilities section.	02	13.08.22
safety and drying section integration with PCC-1/F-03 Drying Report format.	01	13.06.22
Creation and issuance of procedure.	00	07.02.22

OBJECTIVE OF THE PROCEDURE

To establish the technical guidelines necessary to perform the examination and evaluation of piping, valves, and Pressure Vessels (PSVs), using the Pressure Change Measurement (PCM) technique to ensure reliability during normal operation.

SCOPE OF THE PROCEDURE

This procedure covers the technique for determining the leak rate of a component or closed system at a specified pressure or vacuum; as well as the methods of performing filling, pressure testing, test fluid evacuation and final inspection to piping lines and RSPs, whether stainless steel or carbon steel.

REFERENCE DOCUMENTS

- International Standard for Quality Management Systems ISO 9001:2015
- International Standard for Environmental Management Systems ISO 14001:2015
- ASME BPVC – Section V, Nondestructive examination.
- ASME BPVC – Section VIII, Pressure Vessels
- ASME B31.3 Process Piping.
- ASME B31.4 Pipeline Transportation Systems for Liquids and Slurries

- ASME B31.8 Gas Transmission and Distribution Piping Systems
- ASME B16.5 Pipe Flanges and Flanged Fittings
- ASME B16.34 Valves – Flanged, Threaded, and Welding End
- NOM-020-STPS-2011 Pressure vessels, cryogenic vessels, and steam generators or boilers - Operation - Safety conditions.
- NRF-150-PEMEX 2011 Hydrostatic testing of pipes and equipment.
- ASTM-E-1003 Standard Practice for Hydrostatic Leak Testing
- API STD 1104 Welding of pipelines and related facilities
- API RP 1110 Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide.
- API 6D Specification for Pipeline Valves
- ASNT SNT-TC-1A Recommended Practice No. SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing. 2016 / 2020 Edition.
- ISO 9712:2021 Non-destructive testing — Qualification and certification of NDT personnel.
- ISO 11484:2019 Steel products — Employer's qualification system for non-destructive testing (NDT) personnel.
- NMX-B-482-CANACERO-2016 "Steel industry-training-qualification and certification of personnel in non-destructive testing
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DEFINITIONS

Hydrostatic test (PH). Pressure test performed on pipes and equipment to assess mechanical integrity, tightness level and to verify that they are in optimal operating conditions.

MCP. Measurement of Pressure Changes. A technique used to evaluate PH results.

Test Fluid. Fluid used to conduct PH.

Pressure gauge. Instrument for pressure measurement, where data will be obtained for acceptance or rejection of the test. The calibration of this instrument must be carried out with a certified and traceable standard.

Pressure and Temperature Recorder (Thermomanograph). An instrument for measuring and recording continuously on a graph with a scale according to the magnitude of the internal pressure of pipes, equipment, or process sections under test.

Test Pressure (PPH). This is the internal pressure designated to perform the hydrostatic test. This PPH is determined at X times the PD according to the applicable building code.

Test temperature. It is the temperature in the test medium used at normal PH conditions.

Design Pressure (PD). It is the pressure at the most severe pressure and temperature conditions simultaneously expected during service.

Design Temperature (TD). It is the temperature used to design piping and equipment to the most severe conditions expected during service operation.

Piping component. A mechanical element for assembling or joining pipe to form a system of piping and/or service or process equipment, to hermetically contain the pressure and fluid within. It can be

pipe, tubing, fittings, flanges, gaskets, studs, valves, expansion joints, flexible joints, traps, filters, in-line instruments, and separators.

Spool. It is the union of pipes with fittings which are joined by welding, to determine the isometric configuration required for on-site assembly according to the APC drawings of the project.

Test circuit. A set of spools/equipment joined by flanged and/or threaded joints that constitute the object of test.

RSP. Vessel subject to pressure.

PIP. Inspection and Testing Plan.

DTI. Piping and Instrumentation Diagram.

RESPONSIBILITIES

Customer:

- Witness the test and evaluate together with the Test Inspector that the PH result is within the acceptable evaluation criteria

Quality Control Inspector (Level II ASNT):

- Implement this procedure in conjunction with the Construction Supervisor.
- Monitor strict compliance with the established parameters.
- Evaluate together with the Client that the results obtained are within the acceptable evaluation criteria.
- Carry out the reports established in this procedure.
- Make announcements when applicable.
- It must be endorsed by an ASNT level III or when specified in the client's document must be ISO 97122, or ISO11484, ACCP or another standard similar to ISO 9712.

Construction Supervisor:

- Inform the QC inspector of the start of the process.
- Set the limits of the test circuit.
- Assemble the circuit and operate it under the instructions of the Quality Control Inspector.
- Provide the input information.
- Perform corrective actions when required.
- Promote the proper use of tools and equipment.
- Properly carry out activities for the proper management of waste.

Safety Supervisor:

- Verify the requirements of Industrial Safety at work to prevent risks to workers and the environment,
- Deliver the Occupational Safety Analysis and have it at the place where the work is carried out.
- Train staff in safety and environmental standards.
- Monitor that activities are carried out in accordance with safety regulations.

Responsible	Activity	Records
Engineering Area	**1. GENERAL** This test method describes the techniques for determining the leak rate of a closed component or system at a specific pressure or vacuum. Pressure Hold, Absolute Pressure, Pressure Maintenance, Pressure Loss, Pressure Drop, Pressure Increase, and Vacuum Retention are examples of techniques that can be used as long as pressure change testing is specified as a means of determining leak rates. The tests specify a maximum allowable change in pressure per unit of time, percentage of volume, or change in mass **A. TEAM** The following equipment and instruments are required for each test circuit. ● Pressure & Temperature Logger (pressure range 1.5 to 4 times PPH) ● Pressure gauges (instrument range of 1.5 to 4 times the PPH value, accuracy within +/- 1% of the span) ● Pressure pump. ● Arrangement of test fluid injection valves. ● Graphs for pressure and temperature logger (can be quadratic or percentage) ● Different colored pens for recorder ● 100 lumens lamp (minimum) ● Magnifying glass (if required) ● Mirror (if required) All indicator and logger type meters used must be calibrated and recalibrated at least once a year. All meters used shall provide accurate results within the accuracy indicated by the manufacturer and shall be recalibrated at any time when there is reason to believe that they are incorrect. **B. INPUT INFORMATION** The following input information should be provided by engineering prior to initiating PH. ● Piping and Instrumentation Diagram with the test circuit delimited. ● General Mechanical Arrangement with the test circuit delimited. ● Isometric pipes with the test circuit delimited. ● Records of NDT tests performed on the components of the piping circuit (Visual Inspection, X-rays, Penetrating Liquids, Scintigraphy, etc.). ● Calibration certificates, valid for no more than one year, of the equipment and instruments to be used during the PH. **C. TEST PRESSURE** Components to be tested above atmospheric pressure shall not be tested at a pressure greater than 25 % of the design pressure.	

In the event that the input information does not provide the PPH, it can be determined according to the recommendations of the applicable building code.

1) ASME B31.3

- The test pressure should not be less than 1.5 PD.
- When the design temperature is greater than the test temperature, the minimum test pressure at the point under consideration should be calculated according to the following equation:

$$PPH = 1.5\ (P)(ST/S)$$

Where:
P = Internal Design Pressure
PPH = Minimum Test Pressure
S = Allowable stress at the design temperature of the component for the predominant piping material.
ST = Allowable Stress at Component Test Temperature for Predominant Piping Material

2) ASME B31.4

- The test pressure shall be at least 1.25 times the design internal pressure.

3) ASME B31.8

- The test pressure shall be at least 1.25 times the maximum permissible operating pressure.
- The offshore platform pipeline must be tested to a minimum of 1.5 times the maximum allowable operating pressure.

4) ASME BPVC – VIII

New RSPs

$$PPH = 1.3\ [PD\ (STP/STD)]$$

Where:
PPH = Hydrostatic Test Pressure
PD = Design Pressure
STP = Permissible Stress at Test Temperature
STD= Allowable Stress at Design Temperature

RSP With Usage

$$PPH = 1.3\ [PO\ (STP/STO)]$$

Where:
PPH = Hydrostatic Test Pressure
PO = Operating Pressure
STP = Permissible Stress at Test Temperature
STO= Allowable Stress at Operating Temperature

Current regulations

a) Valves

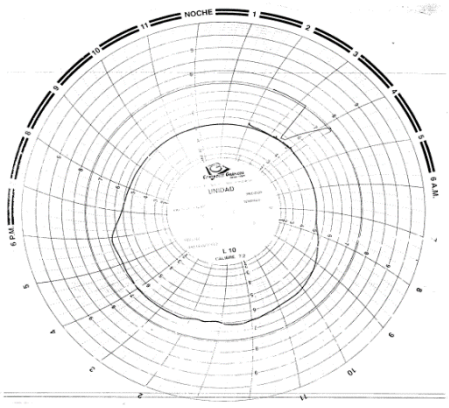
Each valve must be tested at a pressure of not less than 1.5 times the ASME class pressure at 38°C, rounded to the next 1 bar (25 psig) increment.

D. TRIAL DURATION

	1) Pipelines & RSP The duration of the test must be determined by the Inspection and Testing Plan, if it is not indicated, it must adhere to what is indicated in **ASME Sect**. **VIII**, **UG-99 STANDARD HYDROSTATIC TEST, ASME Sect. V, Article 10, ASME B31.3.** **2) Valves** The duration of each valve test stage must be at least 5 minutes. **E. TEST TEMPERATURE** To avoid brittle fractures, the test pressure should not be applied until the metal and the test medium are at the same temperature, with a difference of approximately +/- 3°C. The test medium must be at a temperature equal to or higher than the ambient temperature or droplets will form on the outside of the circuit. The minimum temperature of the test medium shall be approximately 17°C in accordance with ASME Sect. VIII. **F. TEST FLUID** The test fluid to be used should normally be water. If medium other than water is used, the boiling point of the medium should be 93°C or higher. When the test circuit contains carbon steel parts, a corrosion inhibitor should be used, the viscosity of which is no greater than that of water at a temperature not exceeding 50°C. If the test circuit contains parts made of stainless steel, nickel, or chromium, the test medium or any additive used must have a sulfur, halogen, and chloride content of less than 30 ppm each. **G. HYDROSTATIC TEST INSPECTION AND ACCEPTANCE** The areas of the surface to be tested should be free of oil, grease, paint, or other contaminants that may mask a leak. If liquids are used to clean the component or if a hydrostatic or hydropneumatic test is performed prior to the leak test, the component must be dry prior to the leak. **1.- PIPES AND RSP** **1.** The personnel to execute the PH must have basic personal protective equipment. **2.** Verify that the tools, equipment and consumables necessary for the execution of the PH are in optimal condition. **3.** Cordon off the work area, access to personnel other than those who are carrying out the PH will not be allowed.	
Quality Control Inspector		

Operational Staff / Quality Control Inspector	**4.** Assemble and connect the system to be hydrostatically tested (mechanical shaft, pressure gauges, pressure and temperature logger, pressurized water injection pump and test circuit). **5.** One or more pressure gauges must be connected to the system. If more than one gauge is used, one must be a Pressure and Temperature Logger. Pressure gauges and the Pressure and Temperature Logger must be easily visible to personnel running the PH throughout the pressurization and testing cycle.	
Operational Staff	**6.** Fill the container or object to be tested with water, until it overflows at the top, purging as much air as possible. **7.** Perform Visual Inspection prior to pressure application to visualize gross flow losses.	
Operational Staff	**8.** Once the filling is finished (packed container or test circuit), the graph is placed on the pressure and temperature recorder. NOTE: Make sure that the time of the pressure and temperature logger coincides with the start time of the PH. **9.** The hydrostatic test begins by increasing the pressure in a controlled manner, until the first third of the PPH is reached.	
Quality Control Inspector	**10.** Performs visual inspection of the system to detect possible leaks, the pressure is maintained until the test pressure stabilizes in a time span of no less than 5 min. **11.** Increase the pressure in a controlled manner, to one-second of the PPH. **12.** Perform the visual inspection of the system again to detect possible leaks, the pressure is maintained until the test pressure stabilizes in a time span of no less than 5 min.	
Quality Control Inspector	**13.** Increase the pressure in a controlled manner, to the last third of the PPH and wait 5 min minutes until the pressure in the system or object stabilizes, during this time the visual inspection of the system is performed. Disconnect the pressure pump.	
Operational Staff	**14.** The duration of the test shall be as set out in section D of this procedure.	
Quality Control Inspector Operational Staff	**15.** At the end of the hydrostatic test time, the pressure is released gradually in three phases (1/3 of the PPH each) with an interval of 5 min. between them, until the atmospheric pressure is reached. Air vents must be opened during depressurization to prevent collapse of the test circuit. **16.** Remove the graph from the pressure logger. **17.** The area should be free of any dirt or debris generated during the test (tidying up and cleaning the area).	

Operational Staff Quality Control Inspector Operational Staff Operational Staff	**18.** The increase in pressure above the PPH value, during the duration of the test, attributable and proportional to temperature variations, is acceptable if it meets the following conditions: a) It is not greater than 1.5 times the pressure at 38°C of the ASME B16.5 class of flanged joints that make up the circuit. b) The Hoop Stress value of the pipe is not greater than 90% of the yield of the pipe material in accordance with ASME B36.10. **19.** The following conditions are not permitted and are grounds for refusal: a) Leaks b) Visible permanent deformations. c) Breaks In the event of one of these phenomena, the Quality Control Inspector must notify the Site Supervisor to carry out the pertinent actions, the inspector will determine if the finding is greater in order to make a statement and initiate the *Non-Conforming Output Control process (PSGI-03).* **2.- VALVES.** **1.** The valve should be blocked at both ends With the valve position partially open, it should be pressurized until the PPH value stabilizes. The body should be inspected for leaks. Once inspected, depressurize and drain the valve body. **2.** If leakage is observed on the valve stem side, the PPH should be lowered to the pressure corresponding to the ASME class at 38°C. Re-inspect for leaks. Once inspected, depressurize and drain. **3.** Lock one end and place the valve in the fully closed position. Pressurize the blocked side and wait for the pressure to stabilize. Inspect the valve seal on the unlocked side for leaks. Repeat the procedure with the other end. **4.** The acceptance criteria for the body and stem test shall be in accordance with ASME Code B16.34 **5.** The acceptance criteria for the seal test will be in accordance with the API-6D, API-598 and ISO 5208 codes. In case of not complying with the acceptance criteria, the Quality Control Inspector must notify the Site Supervisor to carry out the pertinent actions, the inspector will determine if the finding is greater to make a communication and initiate the *Non-Conforming Output Control process (PSGI-03).* **H. PIPE DRYING** 1) At the end of the PH, the construction supervisor must carry out the correct drainage of the liquid with his equipment. 2) Perform manual drying using rags	Control of Non-Compliant Outputs (PSGI-03).

Quality Control Inspector Operational Staff	3) Pipe blowing with pressurized air 4) Inspection of the cleanliness inside the pipe The Quality Control Inspector must prepare the Drying Report (PCC-11/F-03) once the activity has been corroborated and verified. **I. DOCUMENTARY RECORD** PH is considered completed when the results, records, and information obtained during the test have been reviewed, accepted, and signed by the customer representative, the Test Inspector, and the Quality Supervisor. All the data obtained from the test must be recorded in the format Pipeline Hydrostatic Test Log (PCC-11/F-01), *Valve Hydrostatic Test Log (PCC-11/F-02)* and in the graph obtained, these data must be at least: • Name of the line or spool to be tested • Means of Proof Used • Hydrostatic Test Pressure • Date and time of start and end of the test • Description of the equipment and instruments used and their calibration date • Name, signature and position of the person validating or witnessing the test • Inspected Component • Technique Used • Pressure Variation • Procedure number with current revision  **Figure 1: Pie chart for recording the Hydrostatic Test.** The Quality Control Inspector must deliver the signed documentation to the Quality Department for integration into the Quality Dossier of each project.	Drying Report (PCC-11/F-03) Pipeline Hydrostatic Test Log (PCC-11/F-01) Valve Hydrostatic Test Log (PCC-11/F-02)

FORMATS ASSOCIATED WITH THE PROCEDURE			
CODE	**REGISTRATION**	**LEVEL OF REVISION**	**RETENTION TIME**
PCC-11/F-01	*Registration of Hydrostatic Tests to Pipelines*	01	3 year at the end of the contract / Digital without expiry
PCC-11/F-02	*Registration of Hydrostatic Tests on Valves*	01	3 year from contract closure / Digital without expiry
PCC-11/F-03	Drying Report	01	3 year from contract closure / Digital without expiry
N/A	*Results Graph*	N/A	3 year from contract closure / Digital without expiry