SAFE WORK PRACTICE: HYDROSTATIC TESTING PRESSURE PIPING SYSTEM

DOCUMENT NO.: SC-RPS-SWP-0800-002

REVISION: Z1
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1.0 PURPOSE

This specification defines the technical requirements for performing the hydrostatic testing of a pressure piping system to assess the installed structural integrity of the piping for acceptability and to reveal the occurrence of faults or defects of an assembled piping system. Additionally, the purpose of testing is to validate piping system, ensuring that the system is able to sustain an acceptable level of over-pressure slightly greater than its design pressure without leakage.

2.0 SCOPE

This specification defines the general technical requirements for performing the hydrostatic testing of piping system defined as pressure-retaining components by the relevant ASME Codes of construction and legislative regulations.

This hydrostatic testing procedure is applicable to projects or scope of work undertaken by Sancon Commissioning only. This Recommended Practice shall be mainly applied on pressure piping systems constructed/ repaired/ altered in accordance with ASME B31.1, ASME B31.3. and ASME B39.1

The following are excluded from the requirements of this procedure:

a. Any pack unit previously tested by the Manufacturer in accordance with the applicable codes and standards.

b. Atmospheric sewers and drains.

c. Plumbing systems, which are tested in accordance with the applicable plumbing codes.

d. Lines and systems open to the atmosphere provided it is Category “D” fluid. The definition of category D fluid service for piping as per categorized in ASME B31 are as below;

Fluid is not flammable, not toxic or otherwise harmful to human tissues. Harmful means exposure that can harm skin, eyes or mucous membranes that irreversible damage may result unless immediate action is taken.

Design Gauge pressure is below 150 psi (1,035 kPa)

Design Temperature is between -20F to 366F (-29C to 186C)

An example of Category D fluid might be utility water in a plant or low-pressure steam condensate.

e. Boiler external piping under the jurisdiction of ASME B31.1.

No deviation from the requirements stated in the present specification shall be permitted unless prior written approval has been obtained from COMPANY.
3.0 STANDARDS, REGULATIONS & CODES

Work shall perform in accordance with the latest revision of all applicable Codes, Standards, Specifications, and Regulations listed below:

American Society of Mechanical Engineers (ASME)

- ASME B31.1 Power Piping
- ASME B31.3 Process Piping

Canadian Standards Association (CSA)

- CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code

Regulations

- Province of Alberta, Safety Codes Act (SCA)
- The Pressure Equipment Safety Authority (ABSA)
- Province of British Columbia, Safety Standards Act (SSA)
- Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation

4.0 GENERAL

The concept behind hydrostatic testing is to strain the pipe, fittings and associated apparatus. Hydrostatic testing provides the normal level of assurance for leak integrity and the absence of flaws.

*Pressure testing is mandatory for Piping designation under ASME codes B31.1 and B31.3*

Piping systems previously passed pressure testing by manufacturer or shop test are excluded from this process.

These include mechanical assembled/ modified piping and tubing instrumentation system be subjected to hydrostatic leak test to ensure the system integrity and maintain safety standards before initial operation.

The standard pressure tests as per ASME are outlined in table below based on new construction of pressure vessels and piping systems:

<table>
<thead>
<tr>
<th>System</th>
<th>Code</th>
<th>Hydrostatic</th>
<th>Pneumatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler</td>
<td>power ASME Section I</td>
<td>1.5 × MAWP</td>
<td>Not permitted</td>
</tr>
<tr>
<td>Boiler – heating</td>
<td>ASME Section IV</td>
<td>1.5 × MAWP</td>
<td>Not permitted</td>
</tr>
<tr>
<td>Pressure vessel</td>
<td>ASME Section VIII- Div 1</td>
<td>1.3 × MAWP</td>
<td>1.1 × MAWP</td>
</tr>
<tr>
<td>Pressure vessel</td>
<td>ASME Section VIII- Div 2</td>
<td>1.43 × MAWP</td>
<td>1.15 × MAWP</td>
</tr>
<tr>
<td>Power piping</td>
<td>ASME Section B31.1</td>
<td>1.5 × design pressure</td>
<td>1.2 × design pressure</td>
</tr>
</tbody>
</table>
A hydrostatic test is performed by using water or water glycol mixture as the test medium, whereas a pneumatic test uses air, nitrogen, or any non-flammable and nontoxic gas.

A mixture of glycol-water shall be used where the ambient temperature may reach less than 0°C (32°F) during testing or prior to dry-out.

4.1 Preliminary Statements

The new installed/repaired/altered pressure piping system shall be hydrostatically tested as soon as practicable after completion of construction or installation works. The minimum holding time for hydrostatic pressure test as per ASME B31.3 is 10 minutes or greater without interruption.

The battery limits of the test shall be from flange to flange, and include all piping components. The piping may be tested as separated sections, provided the sections are isolated from each other’s, but the test shall never be performed against closed valve.

The test pressure of temporary items shall be designed by the same code as the pipe and shall be tested separately prior to being used.

Temporary fittings and assemblies hydrotests can be less than 24hrs based on smaller volume and scope. Pressure shall be held long enough to determine integrity and no signs of lost pressure.

4.2 Safety

During the hydrostatic test, no work shall be performed on or near the piping system, especially at both ends of the pipe.

For the piping in test, a restricted access area shall be materialized with warning tape and safety warning signs. The pressure shall be reduced to a safe level before any work is permitted on the piping section under test or associated connections.

5.0 EXECUTION

Pressure test shall be performed in jurisdiction with an applicable codes and standards of Hydrostatic Testing of piping Designed for Internal Pressure (ASME B31.3), with the exception of an underground pressure piping in water service and employing non-welded girth joints.

Hydrostatic pressure testing requires adopting an appropriate combination of method, pressure, time duration and length of test section. The test parameters and test details usually are determined with due consideration for the following:

• Pipe material
• Pipe diameter and working pressure rating
• Length of test section
• Duration of the test
• Magnitude of the test pressure and planned rate of pressurization
• Presence of air in the pipe
• Potential movement of pipe thrust restraints
• Limiting pressure for thrust and anchor supports
• Accuracy of test equipment
• Ambient temperature changes during testing (stability of the temperature)
• Presence of small leaks in hydro-test equipment or connections used
• Potential for leaks in the pipe

5.1 Test Pressure Selection

The hydrostatic pressure test is a leak test intended to validate the integrity of the pipe. The test pressure is never less than the designed operating pressure. The maximum hydrostatic test pressure is based on the piping component with the lowest design pressure rating.

The ASME Code for Pressure Pipe, in B31.3, requires the hydro-test as follows:

\[
\text{Hydro-Test Pressure} = \text{Design Pressure} \times 1.5 \times \left( \frac{\text{Stress Value of the metal at test temperature}}{\text{Stress Value of the metal at design temperature}} \right)
\]

The test pressure for hydrostatic test shall not be less than 1.5 times the design pressure of the new piping system multiplied by the highest value of the ratio of allowable stress at test temperature to allowable stress at design temperature (the Rr ratio).

When all piping components are mechanical assembly, the Rr ratio must be calculated for each component that has the different material or design temperature within the piping system, with the exception of bolting and pipe supports. Component with pressure rating e.g., flanges, the Rr ratio shall be the ratio of pressure rating at test temperature to pressure rating at design temperature.

5.2 Minimum Test Temperature

As per ASME B31.3 the hydrostatic leak test for new piping systems, the minimum test temperature for hydrostatic testing shall not be performed at metal temperature below 1°C (34 °F) or below the minimum design metal temperature (MDMT) specified in the applicable piping materials line class.

The MDMT may depend on the material thickness e.g., ASTM A53 grade B piping system. If applicable the minimum temperature is considered at a certain thickness value. For instance, the wall thickness of A106 grade B pipe that is less or equal to 12.5 mm (0.5 inches) required the minimum test temperature more than its MDMT at – 29 °C (-20 °F).
5.3 Selection of Test Section Lengths

The pipe length for testing shall be either the whole piping system, or a section of the entire line capable of being isolated, dependent upon the length and diameter, the availability of water, the disposability of the water, and the spacing between sectioning valves or blind flanged ends. Based upon elevations and distance, the pipe shall be divided into test sections such that:

1. The hydrostatic test pressure at any point in the test section is (i) not less than the design pressure, and, (ii) not more than 25% to 50% above the design pressure rating of any piping component; and

2. Water is available for the test together with facilities for its disposal, in accordance with regulatory requirements, after test.

5.4 Fill-Rate Selection

Slowly fill the test section of the pipe with water at ambient temperature. Filling is ideally supplied from the lowest point such that the water's entry is submerged and under a “pool” of water inside the pipe, thus avoiding frothing, air entrainment and air being dissolved into the test water. A slow, submerged, fill velocity will prevent air entrainment and dissolving when the water stream is cascading through downward slopes along the pipe. Dissolved air can be eruptive leading to a large surge pressure event, and can disguise a possible leak. Obviously, the high point air vents should be open and monitored. After filling, allow 3-hours to 24-hours for the system to reach thermal equilibrium, and, to allow time for any dissolved air to “breathe” and exit the system vents.

The period of stabilization will depend upon the volume of water within the pipe. The recommended slow fill-rate Q, in gpm, is based on the pipe inside diameter D, in inches, and an axial filling velocity of less than 10-feet per min calculated as follows:

\[
Q_{gpm} = 0.402D^2_{\text{inches}}
\]

5.5 Field Test Preparation

Prior to carrying out any testing activities, many precautions and considerations must be addressed. All joints/fittings that required leak test shall be left uninsulated. The additional temporary supports may require for piping designed for vapor or gas to support the weight of the test liquid and must provide before filling the system.

The following step shall be carried out before testing:

- Verify that all piping system construction/ repair/ alteration are comply with codes and standards and properly documented.
• Check all piping systems for readiness and completeness.

• Isolate unrelated instruments or piping systems from the tested process piping system. This includes flanged joints at which a blank is inserted to isolate other equipment need not be tested after blank is removed.

• Ensure that the entire system can be completely drained after testing.

• Ensure that the system is preliminary purged with air at 25 psig in order to reveal major leaks before performing hydrostatic pressure test

• Ensure that vent points or high point connections are opened to eliminate bubble or air from the lines that are to receive a hydrostatic test.

• The normal location for the pressure test gauge is at grade near the pressure test pump. Readings may be made at higher points providing the gauge pressure reading and the static head [9.79 kPa/m (0.433 psi/ft) for water] between grade and the point of measurement do not exceed the maximum test pressure.

• Gauges shall be tagged with the date last calibrated, and this activity shall be recorded. Gauges shall be a minimum 100 mm (4") diameter face and shall be graduated over a range of approximately double the intended test pressure but in no case, shall the range be less than 1.5 times the test pressure nor greater than 4 times the test pressure.

• At least two gauges shall be used per test. One gauge shall be located on the test head and one on the system being tested. Gauge must read within 5% of each other.

5.6 Water Filling

The step for water filling shall ensure that all air is removed from the piping and that no air pocket is left during filling. Use of intermediate water storage tanks for feeding the pumps on large piping systems is necessary to ensure minimum flow requirements and absence of air in flow. Only certified turbine flow meters, recently calibrated by third party, are to be used during the filling operations. Most of Sancon applications will be for small temporary tie in assemblies and the main piping system will have been completed by Construction fabrication prior to commissioning.

5.7 Hydrostatic Testing Safe Work Practice

5.7.1 Test Pack

A Test Pack shall be prepared, containing as a minimum:

1) Pressure test record (see Appendix A)
2) Calibration certificates for all test equipment, to be validated prior to the start of the testing and be included in the final test report

3) Detailed description of all equipment and instrumentation under test

4) Inventory of all hydrostatic fill and test equipment

5) Inventory of spares as required

6) Isometric drawing showing all fill and discharge points and test equipment tie in points and associated piping

7) List of all measuring devices to be used (pressure gauges, dead weight tester, thermometer, turbine meters, etc.)

8) Piping identification, pipe specifications and manufacturer

9) Piping testing pressure, based on Test Data sheet

10) Pressuring procedure including location of injection points and test medium

11) Test procedures and Test Data Sheet

12) Outlining the battery limits of the pressure test

13) Theoretical pressure volume curve for hand-plot during test and temperature volume curves.

5.7.2 Hydro-testing step

The step of hydrostatic test are separated in to 3 phase.

**Phase I: Preliminary Phase**

The step of the preliminary phase of hydro test is as follow:

a) Fill and vent and purge the pipe system of trapped air to less than 4% trapped air by volume. The pipe shall be full of water, but not positively pressurized (other than the natural hydrostatic head) for 60 minutes prior to the start of the re-bound hydro-test. Rebound test described below.

b) Once the pressure has been raised to 1000 kPa, a leak check shall be performed for all values and fittings. If leak is found, the system must be depressurized prior to fixing leaks.

c) Start test timer at T=0. The pressure shall be increased gradually up to the hydrostatic test pressure. When the hydro static test pressure is obtained, it shall be maintained during the time required by the contract or until the Authorized Inspector witnesses the hydrostatic test.
d) Hold the test pressure for 30 minutes by repetitively injecting small volumes of make-up water into the test section to sustain, but not exceed, the exposed joints and connections for visible leaks during this period.

e) At T = 30 minutes, valve-off and isolate and record the confined specified test pressure (STP) as P30. Allow the test pressure to decay for an additional 60 minutes, until the timer is T = 90 minutes.

f) Measure and record the residual test pressure as P90 at T = 90 minutes.

If P90 > 70% of STP, this phase has passed and proceed to next step.
If P90 is < 70% of STP, then the test has failed, either because of a leak or because of excessive trapped air dissolving into the water.

**Phase II: Measurement of Residual Air Content**

If any trapped air or dissolved air content is “low” compared to the water volume filling the pipe system, then the pressure drop should be fairly linear upon a quick release of a partial volume of water from the pipeline. If the dissolved air or trapped air content is “high”, then, even though a small volume of test water is quickly released, the test pressure will not drop much because the air will expand to fill the space.

Residual air content shall be determined using the P/V plot during pressurization and at Company option, by drain test method. In this phase, the P90 test pressure is reduced, per the instructions below, by bleeding out a small volume of pressurized test water, and, the volume of water that is bled out is measured by a calibrated meter or by measuring receptacles (gallons, buckets, barrels).

The measurement of residual air content is performed as follows:

1. Quickly (<5 minutes) and safely bleed out water from the pipeline so as to reduce the pressure by 5%. Accurately measure and record the pressure drop as $\Delta P$.

2. Accurately and safely measure and record the water volume bled out as $\Delta V$.

3. This volume, $V_{\text{drain}}$ is compared to the theoretical calculated volume, $\Delta V$ when no air is present:

$$\Delta V = \left[ \frac{1 - \frac{v^2 r}{E s} + A}{2} \right] V\Delta P \text{ for restrained piping}$$

$$\Delta V = \left[ \frac{5 - \frac{4v r}{2E s} + A}{2} \right] V\Delta P \text{ for unrestrained piping}$$
For piping systems containing sections with pipes of differing diameter and thickness,

\[ \Delta V = \sum \Delta V_k \text{ with } \Delta V_k = \left[ 2 \frac{1 - \nu^2 r_k}{E s_k} + A \right] V_k \Delta P \text{ or } \Delta V_k = \left[ 2 \frac{5 - 4 \nu r_k}{2E s_k} + A \right] V_k \Delta P \]

for restrained or unrestrained section respectively.

Where:

- \( s \) = Wall thickness
- \( sk \) = Wall thickness of section \( k \)
- \( r \) = Internal pipe radius (same unit as \( s \))
- \( rk \) = Internal pipe radius of pipe in section \( k \) (same unit as \( s \))
- \( V \) = Internal volume of line
- \( \Delta V \) = Calculated volume (same unit as \( V \))
- \( \Delta V_k \) = Calculated volume for section \( k \) (same unit as \( V \))
- \( \Delta P \) = Pressure drop during drain test
- \( V \) = Poisson ratio for the wall material
- \( E \) = Young modulus for the wall material
- \( A = 1/K \) with \( K \) = bulk modulus (in same unit as \( \Delta P \)) of the test medium

An approximate value of the air volume (\( V_{\text{air}} \)) at atmospheric pressure (\( P_0 \)) may be obtained by remarking that \( V_{\text{drain}} - \Delta V \) is the increase in volume of the air due to the drop in pressure \( \Delta P \) during the drain test at absolute pressure \( P \).

Hence

\[ \frac{V_{\text{drain}}}{\Delta P_1} - \frac{V_{95}}{\Delta P_2} = V_{\text{air}} \frac{P_0}{P^2} \]

With

- \( V_{\text{drain}} \) = Drain test volume at pressure \( P \)
- \( \Delta P_1 \) = Pressure drop (approx. 0.5 bar) for drain test at low pressure
- \( V_{95} \) = Drain test volume at 95% of test pressure
- \( \Delta P_2 \) = Pressure drop for drain test at 95% of test pressure

Test for air entrapment is considered as successful when the volume of entrapped air does not exceed 0.2% of the whole volume of the tested line. The test has failed, and the cause must be corrected. Upon correction, the whole processes are to be repeated until passing.

**Phase III: Final Phase**

After the pressure was dropped about 5%, and while the above residual air content calculations are being made, the pressure internal to the pipe should stabilize and remain constant within +/-
5% of the Phase III reduced test pressure. Because the pipe molecules have been “stretched” during the preliminary “expansion” phase, upon lowering the water test pressure, the molecules will elastically work to revert to their original length, and hence should compress the final test volume of water causing the final Phase III test pressure to “rebound” and rise slightly. If the plot of re-bound pressure versus time shows a continuous falling of pressure, the pipe is leaking, and the test fails. Ordinarily, the Phase III re-bound test time is 30-minutes. The test shall not be acceptable when there is a failure of any piping component, or any measurable or visible leakage. The test shall be acceptable when the Phase III reduced pressure rebounds or remains static for 30-minutes. If the hydro-test fails, the cause should be corrected, and a full procedure re-test conducted after a suitable “rest and relaxation” period, prior to the re-test.

5.7.3 De-Pressurizing and draining the test section

After the hydro-test has been successfully completed, the elevated pressure within the test section is to be safely reduced in accordance with the test plan. When the test section is ready to be drained, the air vents specified shall be opened and the water drained from low points, at a flow-rate in accordance with the test plan. The hydro-test water shall be re-used, treated, or drained to an approved water-way, after-which all connections shall be closed or otherwise re-instated. Remove all temporary blinds, supports, test connections.

The treated water may have to be removed from the piping as part of the pre-commissioning activities. This shall be performed with no harm to the surrounding environment, and comply with the local regulations. In particular, there may be a requirement to treat or segregate the test water.

5.7.4 Completion Pressure Test Report

The pressure test report should include full details of all work associated with the hydro-test, including the planning documentation, safety training, pre-test meeting minutes, the hydro-test-plan, the hydro-test documentation, any leak corrective actions, the certified test results, and the sign-offs for acceptance.

Upon successful completion of the hydrostatic test, the following records shall be provided for each piping:

• Piping test section length versus elevation chart showing heights of air vent valves, gage locations, filling and drain points, pressure rating of the pipe and pressure rating of all fittings and appurtenances included in the test.
• Notations of leakage, failure, or rupture of any thrust blocking, pipe, fitting, joint, connection, etc.
• Location and nature of any leaks that were repaired.
• Test Water temperature and ambient temperature.
• Plot of test pressure variation by test time duration for each phase.
• The plot of the pressure decay graph & its interpretation; explanation of variances.
• All calculations for Phase I, Phase II, and Phase III.
• Verification of visible inspection of any exposed pipeline components.
• Date and times of the hydro-testing; gage and instrument calibration records.
SANCON COMMISSIONING
HYDROSTATIC TESTING FOR PRESSURE PIPING SYSTEM

- Reference Standards used as guidelines for the hydro-testing.
- Signature acceptance of hydro-test results

Remarks: The following elements are identified as contributing factors to variation in the pressure test results, and should be considered when interpreting the test data:

- Length of the test section
- Diameter of the pipe
- Measurable temperature changes
- The range of the test pressure imposed on the test section
- The rate of pressurization
- The presence of some air in the pipeline
- Relative movement or slippage of mechanical fittings
- The stiffness and compaction of the soil around the pipe to resist pipe expansion
- The accuracy of the testing apparatus.
APPENDIX A: PRESSURE TEST RECORD

COMMISSIONING CHECKLIST

<table>
<thead>
<tr>
<th>#</th>
<th>Task</th>
<th>OK</th>
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<th>PL</th>
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<tbody>
<tr>
<td></td>
<td>Project Specification(s) Used:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Note: Test records are to be retained for 7 years</td>
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<tr>
<td></td>
<td>Reference Work Instruction 14.81 Hydrotesting</td>
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</tr>
<tr>
<td>1</td>
<td>Please select test subject: Commissioning Test &quot;jig&quot; or apparatus _____ or Permanent Equipment Installation (Inst Tubing) _____</td>
<td></td>
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<td></td>
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<tr>
<td>2</td>
<td>Record: Client __________________, Facility __________________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Record system operating pressure: ______________ kPa</td>
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<td></td>
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<tr>
<td>4</td>
<td>Record system service (product)_________________________</td>
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<tr>
<td>5</td>
<td>Confirm gross air test was conducted prior to filling with water to ensure no gross leaks</td>
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<tr>
<td></td>
<td>TEST PARAMETERS</td>
<td></td>
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<tr>
<td>6</td>
<td>Record test plan identification # __________________</td>
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<tr>
<td>7</td>
<td>Record test medium _____________________________________________</td>
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<tr>
<td>8</td>
<td>Test medium Temperature _______ celsius, Ambient Temperature ______ celsius</td>
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<tr>
<td>9</td>
<td>Calculate Test Pressure: Hydro Test Pressure = Design Pressure x 1.5 (Stress value of the metal at test temperature / Stress value of the metal at design temperature) __________ kPa</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Minimal design metal temperature MDMT __________ celsius</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>For larger volume system (&gt; 500 litres) Calculate a slow fill rate (Q) for medium. Q (gpm) = 0.402D^2 where D is the inside diameter of the pipe. __________________</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Record calibrated gauges (2) range __________ kPa to __________ kPa. Note &lt;4x, &gt;1.5x Test pressure</td>
<td></td>
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<tr>
<td>13</td>
<td>Ensure area under test is quarantine off. Ensure all safety measures as per Sancon pressure testing work instruction is in place.</td>
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<tr>
<td>14</td>
<td>Perform pressure test completing table below, confirm PASS.</td>
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<tr>
<td>15</td>
<td>Record all calibrated test equipment in the table below</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Attach all test equipment printouts/charts or logs gathered.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: Non calibrated equipment can not be used!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SANCON COMMISSIONING

**HYDROSTATIC TESTING FOR PRESSURE PIPING SYSTEM**

**REVISION: Z1**

**Page 16 of 16**

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**Project:** [Project Name]

**System:** [System Name]

**Tag:** [Tag Name]

**Template:** COM-J-101 (Rev 0.1)

**Description:** Hydrotest Pressure Test Record

**Ref Doc:** [Reference Document]

---

<table>
<thead>
<tr>
<th>Tag Type</th>
<th>System Desc</th>
<th>Phase</th>
<th>Tag Desc</th>
<th>Resp Party</th>
<th>Page</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### HYDROTEST TEST RECORDS PH 1

<table>
<thead>
<tr>
<th>Start Time</th>
<th>End time</th>
<th>Hold time (Minutes) Minimal 10 min</th>
<th>Pressure kPa</th>
<th>Test Pressure</th>
<th>Decay Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1000 kPa</td>
<td></td>
<td>n/a</td>
</tr>
</tbody>
</table>

Pass = min kPa > 70% Test Pressure

n/a

### HYDROTEST TEST RECORDS PH II

5% LESS OF TEST PRESSURE kPa - RECORD DELTA PRESSURE

DRAIN VOLUME OF WATER MEASURED (liters)

CALCULATED VOLUME OF DRAIN WATER (Ref WIN 14.81)

CALCULATED VOLUME OF AIR IN WATER (Ref WIN 14.81)

PASS OF FAIL (PASS < 0.2%)

### HYDROTEST TEST RECORDS PH III

RECORD PRESSURE kPa (SHOULD BE +/- 5% of PH II PRESSURE)

REBOUND START TIME

REBOUND FINISH TIME (+30MIN)

PASS - PH III PRESSURE REBOUNDS OR REMAINS STATIC

PASS / FAIL

---

### TEST EQUIPMENT

<table>
<thead>
<tr>
<th>Measurement Device</th>
<th>Mfg / Type</th>
<th>Model No.</th>
<th>Serial #</th>
<th>Calibration date</th>
<th>Cal Due date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device 1</td>
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<tr>
<td>Device 2</td>
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<tr>
<td>Device 3</td>
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<td>Device 4</td>
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</table>

Comments/Punch Items:

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Completed By: ___________________________ Date: ___________________________

Approved By: ___________________________ Date: ___________________________

Printed On 2018-12-03