TESTING REQUIREMENTS FOR ONE TIME ACCEPTANCE (VALIDATION) TEST FOR PR2 GATE VALVES & HYDRAULIC ACTUATORS as per API 6A

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1.0 SCOPE

This procedure covers the testing requirements for Validation Test of PR2 rated Gate Valves as per API 6A.

The scope of testing shall include:

a) Review of all Quality Records for the Valve inclusive of:
- MTC
- Physical Test Certificates
- Heat Treatment Reports
- Welding Records
- NDT Records
- Dimensional Inspection Reports

b) Witness of the PR2 Test.
c) Review of test Reports.

2.0 REFERECNCE STANDARD

The testing of the Valve is carried out as per requirements mentioned under clause F.2.3 in Annexure F of API 6A.

3.0 TEST EQUIPMENT

4.0 DESIGN VALIDATION PROCEDURE

4.1 Valve Body Hydrostatic Test at Room Temperature: (F.2.2.2.3.1)

Test Medium – Water **Test Temperature** – Room Temperature **Initial Valve Position** – Half Closed

4.1.1 Apply pressure to the valve equal to the rated working pressure and hold till a period of 3mins.
4.1.2 Bleed the pressure to zero.
4.1.2 Pressurize the valve again and hold for a secondary period of 15mins.

Acceptance Criteria (F.1.6.3) – No visible leakage during the specified hold period. The pressure change observed on the pressure measuring device during the hold period shall be less than 5% of the test pressure or 500 PSI, whichever is less.

4.2 Valve Seat Hydrostatic Test at Room Temperature: (F.2.2.2.3.2)

Test Medium – Water **Test Temperature** – Room Temperature **Initial Valve Position** –Closed

4.1.1 Apply pressure to the valve equal to the rated working pressure and hold till a period of 3mins.
4.1.2 Bleed the pressure to zero.
4.1.2 Pressurize the valve again and hold for a secondary period of 15mins.

Valve seat hydrostatic test is performed for both the sides of the valve.

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Acceptance Criteria (F.1.6.3) – No visible leakage during the specified hold period. The pressure change observed on the pressure measuring device during the hold period shall be less than 5% of the test pressure or 500 PSI, whichever is less.

4.3 Force or Torque Measurement: (F.2.3.3.1)

The break away and running torques shall be measured. The values of Torque measured using a Torque wrench shall be as follows:

1) <= _____Nm at atmospheric pressure
2) <=_____Nm at working pressure

4.4 Dynamic Test at Room Temperature: (F.2.3.3.2)

Test Medium – Water Test Temperature – Room Temperature Initial Valve Position - Closed

4.4.1 Fill the downstream end of the valve with the test medium at 1% or less of test pressure.
4.4.2 Apply pressure equal to rated working pressure against upstream side of the gate. **All subsequent seat tests will be done in the same direction.**
4.4.3 Open the valve fully starting against the full differential pressure. Pressure shall be maintained at minimum of 50% of the initial test pressure after the initial partial opening. The opening stroke may be interrupted to adjust the pressure within the above limits.
4.4.4 Close the valve fully while pressure is maintained within the limits of preceding step.
4.4.5 Bleed the downstream pressure to 1% or less of test pressure after the valve is fully closed.
4.4.6 Repeat the above steps until a minimum of **160 open-and-close** have been carried out.

Acceptance Criteria (F.1.6.3) – No visible leakage during the specified hold period. The pressure change observed on the pressure measuring device during the hold period shall be less than 5% of the test pressure or 500 PSI, whichever is less.

4.5 Dynamic Test at Maximum rated Temperature: (F.2.3.3.3)

Test Medium – Nitrogen Gas Test Temperature –Max for the Temp Class Initial Valve Position - Closed

4.5.1 Setup the valve in the right position and start the heating process. When the temperature reaches the value of test temperature hold and let the temperature stabilize. (Variation less than 5°C per hour shall be considered to be a stabilized condition)
4.5.2 Fill the downstream end of the valve with the test medium at 1% or less of test pressure.
4.5.3 Apply pressure equal to rated working pressure against upstream side of the gate.
4.5.4 Open the valve fully starting against the full differential pressure. Pressure shall be maintained at minimum of 50% of the initial test pressure after the initial partial opening. The opening stroke may be interrupted to adjust the pressure within the above limits.
4.5.5 Close the valve fully while pressure is maintained within the limits of preceding step.
4.5.6 Bleed the downstream pressure to 1% or less of test pressure after the valve is fully closed.
4.5.7 Repeat the above steps until a minimum of **20 open-and-close** have been carried out.

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

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4.6 Gas Body test at Maximum rated Temperature: (F.2.3.3.4)

Test Medium – Nitrogen Gas Test Temperature –Max for the Temp Class Initial Valve Position – Partially Closed

4.6.1 Apply pressure to the valve equal to the rated working pressure and hold till a period of 60 mins.
4.6.2 Bleed the pressure to zero.

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.7 Gas Seat test at Maximum rated Temperature: (F.2.3.3.5)

Test Medium – Nitrogen Gas Test Temperature –Max for the Temp Class Initial Valve Position - Closed

4.7.1 The upstream side of the valve shall be maintained at the rated Working Pressure.
4.7.2 Hold for 60 mins.
4.7.3 Check for leaks from the downstream side

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.8 Low pressure Seat test at Maximum rated Temperature: (F.2.3.3.6)

Test Medium – Nitrogen Gas Test Temperature –Max for the Temp Class Initial Valve Position - Closed

4.8.1 The upstream side of the valve shall be maintained between 5%-10% of the rated working pressure.
4.8.2 Hold for 60 mins.
4.8.3 Check for leaks from the downstream side

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.9 Dynamic Test at Minimum rated Temperature: (F.2.3.3.7)

Test Medium – Nitrogen Gas Test Temperature –Min for the Temp Class Initial Valve Position - Closed

4.9.1 Setup the valve in the right position and start the heating process. When the temperature reaches the value of test temperature hold and let the temperature stabilize. (Variation less than 5°C per hour shall be considered to be a stabilized condition)
4.9.2 Fill the downstream end of the valve with the test medium at 1% or less of test pressure.
4.9.3 Apply pressure equal to rated working pressure against upstream side of the gate.
4.9.4 Open the valve fully starting against the full differential pressure. Pressure shall be maintained at minimum of 50% of the initial test pressure after the initial partial opening. The opening stroke may be interrupted to adjust the pressure within the above limits.
4.9.5 Close the valve fully while pressure is maintained within the limits of preceding step.

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4.9.6 Bleed the downstream pressure to 1% or less of test pressure after the valve is fully closed.
4.9.7 Repeat the above steps until a minimum of **20 open-and-close** have been carried out.

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.10 Gas Body test at Minimum rated Temperature: (F.2.3.3.8)

Test Medium – Nitrogen Gas Test Temperature –Min for the Temp Class Initial Valve Position – Partially Closed

4.10.1 Apply pressure to the valve equal to the rated working pressure and hold till a period of 60 mins.
4.10.2 Bleed the pressure to zero.

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.11 Gas Seat test at Minimum Rated Temperature: (F.2.3.3.9)

Test Medium – Nitrogen Gas Test Temperature –Min for the Temp Class Initial Valve Position - Closed

4.7.1 The upstream side of the valve shall be maintained at the rated Working Pressure.
4.7.2 Hold for 60 mins.
4.7.3 Check for leaks from the downstream side

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.12 Low pressure Seat test at Min rated Temperature: (F.2.3.3.10)

Test Medium – Nitrogen Gas Test Temperature –Min for the Temp Class Initial Valve Position - Closed

4.12.1 The upstream side of the valve shall be maintained between 5%-10% of the rated working pressure.
4.12.2 Hold for 60 mins.
4.12.3 Check for leaks from the downstream side

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.13 Body pressure/temperature cycles (F2.3.3.11)

Test Medium – Nitrogen Gas Test Temperature –Cyclic Initial Valve Position – Partially Open

4.13.1 The temperature shall be raised to the room temperature.
4.13.2 Temperature shall be raised to the maximum while maintaining the pressure between 50%-100% of the rated working pressure.
4.13.3 Hold for 60 mins at maximum rated working pressure.

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4.13.4 Temperature shall be reduced to the minimum while maintaining the pressure between 50%-100% of the rated working pressure.
4.13.5 Hold for 60 mins at maximum rated working pressure.
4.13.6 Temperature shall be raised to room temperature while maintaining the pressure between 50%-100% of the rated working pressure.
4.13.7 Release pressure and raise the temperature to the maximum.
4.13.8 Pressure shall be raised to the rated working pressure and shall be held for 60mins. Release pressure after the hold period.
4.13.9 Temperature shall be reduced to the minimum temperature.
4.13.10 Pressure shall be raised to the rated working pressure and shall be held for 60mins. Release pressure after the hold period.
4.13.11 Temperature shall be raised to the room temperature.
4.13.12 Pressure shall be raised to the rated working pressure and shall be held for 60 mins. Release the pressure after hold period.

Acceptance Criteria (F.1.6.3) – The gas test at high temperature shall be acceptable if the pressure change in the pressure-measuring device is less than 5 % of the test pressure or 3,45 MPa (500 psi), whichever is less.

4.14 Body pressure holding test at room temperature (F2.3.3.12)

Test Medium – Nitrogen Gas Test Temperature – Room temp Initial Valve Position – Partially Open

4.14.1 Apply pressure to the valve equal to the rated working pressure and hold till a period of 60 mins and then release pressure.

Acceptance Criteria (F.1.6.3) – The gas test at room temperature shall be acceptable if no sustained bubbles are observed. If leakage is observed, the rate shall be less than 30cm3/hour/25.4mm of nominal bore size.

4.15 Gas Seat test at Room Temperature: (F.2.3.3.13)

Test Medium – Nitrogen Gas Test Temperature –Room temp Initial Valve Position - Closed

4.15.1 The upstream side of the valve shall be maintained at the rated Working Pressure.
4.15.2 Hold for 15 mins.
4.15.3 Check for leaks from the downstream side

Acceptance Criteria (F.1.6.3) – The gas test at room temperature shall be acceptable if no sustained bubbles are observed. If leakage is observed, the rate shall be less than 30cm3/hour/25.4mm of nominal bore size.

4.16 Body low-pressure holding test: (F.2.3.3.14)

Test Medium – Nitrogen Gas Test Temperature –Room temp Initial Valve Position – Partially open

4.16.1 Apply pressure equal to rated working pressure and hold for 60 mins. Release pressure after hold period.

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Acceptance Criteria (F.1.6.3) – The gas test at room temperature shall be acceptable if no sustained bubbles are observed. If leakage is observed, the rate shall be less than 30cm3/hour/25.4mm of nominal bore size.

4.17 Low pressure Seat test at Room Temperature: (F.2.3.3.15)

Test Medium – Nitrogen Gas Test Temperature –Room Initial Valve Position - Closed

4.17.1 The upstream side of the valve shall be maintained between 5%-10% of the rated working pressure.
4.17.2 Hold for 60 mins.
4.17.3 Check for leaks from the downstream side

Acceptance Criteria (F.1.6.3) – The gas test at room temperature shall be acceptable if no sustained bubbles are observed. If leakage is observed, the rate shall be less than 30cm3/hour/25.4mm of nominal bore size.

4.18 Force or Torque Measurement: (F.2.3.3.16)

The break away and running torques shall be measured. The values of Torque measured using a Torque wrench shall be as follows:

1) <= _____Nm at atmospheric pressure
2) <=_____Nm at working pressure

5.0 Following the tests in Clause 4, the valve shall be disassembled and checked visually for any damages.

6.0 Design Validation procedure for PR-2 actuators (*Applicable for Hydraulic Actuators)*

6.1 Pre-Inspection Instructions (F.2.5)

6.1.1 Testing medium for hydraulic actuators shall be a suitable hydraulic fluid.
6.1.2 The actuator shall be tested either on a valve/choke or on a fixture that simulates the opening/closing dynamic force profile of a valve/choke.

6.2 Actuator Seal test at room temperature (F.2.5a)

6.2.1 Pressure-test the actuator seals in two steps by applying a pressure of 20 % and of 100 % of the rated working pressure to the actuator.
6.2.2 The minimum hold period for each test pressure shall be 3 min at each test pressure for hydraulic actuators.
6.2.3 Repeat this actuator seal test a minimum of three times.

6.3 Dynamic open/close pressure cycling test at room temperature (F.2.5b)

6.3.1 Test the actuator for proper operation by cycling the actuator an equivalent of 160 open-close-open valve cycles.
6.3.2 The pressure applied shall be equal to the rated working pressure of the actuator.

6.4 Dynamic open/close pressure cycling test at maximum rated actuator temperature (F.2.5c)

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6.4.1 Test the actuator for proper operation by cycling the actuator an equivalent of 20 open-close-open valve cycles at the maximum rated temperature of the actuator.
6.4.2 The pressure applied shall be equal to the rated working pressure of the actuator.

6.5 Dynamic open/close pressure cycling test at minimum rated actuator temperature (F.2.5d)

6.5.1 Test the actuator for proper operation by cycling the actuator an equivalent of 20 open-close-open valve cycles, at minimum rated temperature of the actuator.
6.5.2 The pressure applied shall be equal to the rated working pressure of the actuator.

6.6 Pressure/Temperature Cycles (F.2.5e)

6.6.1 Raise the temperature to room temperature.
6.6.2 Apply the test pressure at room temperature and maintain at 50 % to 100 % of test pressure while raising temperature to the maximum.
6.6.3 Hold for a period of 60mins minimum at test pressure.
6.6.4 Reduce the temperature to the minimum while maintaining 50 % to 100 % of test pressure.
6.6.5 Hold for a minimum period of 60mins at test pressure
6.6.6 Raise the temperature to room temperature while maintaining 50 % to 100 % of test pressure.
6.6.7 Release the pressure, then raise the temperature to the maximum.
6.6.8 Apply the test pressure, hold for a minimum period of 1 h, and then release the pressure.
6.6.9 Reduce the temperature to the minimum.
6.6.10 Apply the test pressure, hold for a minimum period of 1 h, and then release the pressure.
6.6.11 Raise the temperature to room temperature.
6.6.12 Apply the test pressure, hold for a minimum period of 1 h, and then release the pressure.
6.6.13 Apply 5 % to 10 % of the test pressure, hold for a minimum period of 1 h, and then release the pressure.

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