

Type Testing of Rising Stem Valves Equipped with Graphite Packing for Fugitive Emissions

1 Scope

This standard specifies the requirements and acceptance criteria (100 ppmv) for fugitive emission type testing of rising and rising-rotating stem valves equipped with packing previously tested in accordance with API 622. ~~The type testing requirements contained herein are based upon elements of EPA Method 21.~~

Valves larger than NPS 42 or valves greater than class 1500 are outside the scope of this standard.

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 (including any amendments) applies.

API Standard 600, *Steel Gate Valves – Flanged and Butt-welding Ends, Bolted Bonnets*

API Standard 602, *Steel Gate, Globe and Check Valves for Sizes DN 100 and Smaller for the Petroleum and Natural Gas Industries*

API Standard 603, *Corrosion-resistant, Bolted Bonnet Gate Valves—Flanged and Butt-welding Ends*

API Standard 622, *Type Testing of Process Valve Packing for Fugitive Emissions*

API Standard 623, *Steel Globe Valves—Flanged and Butt-welding Ends, Bolted Bonnets*

ASME B16.34¹, *Valves—Flanged, Threaded, and Welding End*

EPA Method 21², *Determination of Volatile Organic Compound Leaks*

3 Terms and Definitions

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

3.1

ambient temperature

Temperature that is between 15 °C to 40 °C (59 °F to 104 °F).

3.2

auxiliary connection

Drain(s), vent(s), or sealant injection port(s).

3.3

bolting torque

The amount of twisting or turning effort (expressed as N-m, ft-lb, or in.-lb) required to tighten a threaded fastener.

¹ ASME International, 3 Park Avenue, New York, New York 10016-5990, www.asme.org.

² U.S. Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Avenue, Washington, DC 20460, www.epa.gov.

3.4

dynamic leak measurement

Measurement of leakage taken while the stem is traveling through an opening and closing cycle.

3.5

EPA Method 21

A leak check method established by the United States Environmental Protection Agency (EPA) for performing emissions measurements on equipment such as valves, pumps, and flanges.

3.6

emissions

Gaseous leak given off by a piece of equipment used in reference to volatile organic compounds (VOCs) and expressed in parts per million volumetric (ppmv or ppm) for methane.

3.7

leakage

Measurable amount of test medium escaping from the valve pressure boundary.

3.8

manufacturing facility

Location of final assembly, inspection, and testing of the valve selected for evaluation.

3.9

mechanical cycle

A motion of the stem that moves a valve obturator open and close 90% of the full travel without backseating/seating the valve.

3.10

obturator

Part of a valve, such as a wedge, disc, or plug, which is positioned in the flow stream to permit or prevent flow.

3.11

packing set types

3.11.1

braided packing type

Packing rings that have an interlaced construction in which yarns/filaments are woven to a round, square or lattice weave pattern. Can also be die formed into shape.

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3.11.2

combo-set packing type

Combination of die formed packing type and braided packing type.

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3.11.3

die formed packing type

Rings produced from graphite material that is axially compressed in molds to an increased density and to the desired shape.

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3.12

packing stress

Packing compressive load divided by the packing cross sectional area based upon the stem and bore dimensions.

General Use

Classification: General Use

3.13

purchaser

A person, group, company, agency, corporation, or designated representative responsible for valve acceptance.

3.14

qualification facility

A testing entity capable of type testing valves for fugitive emissions in accordance with this standard.

3.15

rising stem valve

Valve in which the movement of the stem is in an axial direction with no rotation.

3.16

rising-rotating stem valve

Valve in which the movement of the stem is in an axial direction with rotation.

3.17

running torque

The amount of torque required to move a valve stem through the packing.

3.18

static leak measurement

Measurement of leakage taken when the stem is not moving.

3.19

stem

Metal rod that connects the obturator of a valve to a handwheel, handle, or actuator.

3.20

thermal cycle

A change in temperature from ambient temperature, to elevated and/or lower temperature(s), and back to ambient temperature.

3.21

third party

A person, group, company, agency, corporation, or designated representative independent from the manufacturer responsible for valve certification.

3.22

type testing

A test conducted to assess the performance of a specific valve design at prescribed temperatures and pressures.

4 Valve Selection and Test Preparation

4.1 Packing that meets the requirements of API 622 third edition (or later) shall be installed in the valve to be tested. 3/16" packing and smaller shall be qualified using the 1/8" cross section packing per API 622 latest edition.

4.2 The test valve shall be completely assembled and ready for testing. The test valve shall be randomly selected from manufacturer or distributor stock where such stock is available. For valves not in stock, the manufacturer shall certify that the test valve was not modified in any way to meet type test requirements and is a typical representation of the manufacturer's stock product. Valve selection shall be approved by the purchaser.

4.3 Body-bonnet and gland bolting torque shall be verified to be in accordance with published manufacturer's installation specifications.

4.4 All pre-test activities to the valve shall be documented on the Fugitive Emissions Test Report in Annex A.

5 Safety Considerations for Type Testing

Caution/Warning—Methane used during testing is a pressurized flammable gas which requires that appropriate safety measures be taken.

5.1 The valve may be partially or fully depressurized between thermal cycles, such as during a non-active testing period (i.e., overnight) or during thermal transients.

5.2 Testing of valves is potentially hazardous and it is essential that the safety of personnel be given prime consideration. Given the nature of this test, hazardous release of pressurized, combustible gas could occur. The qualification facility shall be designed to ensure that all the test conditions are conducted in a safe and protected environment.

The measures stated in paragraph 5.3 to 5.6 are noted for consideration in providing a safe testing environment. The qualification facility shall be responsible to assess the potential hazards resulting from the testing requirements and conditions, to ensure that proper safety precautions are implemented and to comply with all applicable safety regulations and laws.

5.3 All equipment shall have appropriate certification that verifies its suitability to withstand the minimum and maximum pressures and temperatures in the testing environment.

5.4 Hoses or pipes used for inlet and outlet supply of methane shall be suitable for maximum pressures and temperatures. Where hoses are used, appropriately designed restraints shall be used to prevent hose detachment from the test rig in the event that a blow-out occurs.

5.5 All testing shall be in accordance with local and national codes, regulations, and safety standards and shall be equipped with pressure relief devices as required.

5.6 Purge the partially open valve to eliminate air in the valve cavity prior to starting the testing. __

6 Type Testing

6.1 Test Fluid

The test fluid used shall be dry methane gas, 97% minimum purity, ~~subjected to a temperature range from ambient to 260 °C (500°F) and pressures from 0 kPag to 4,137 kPag (0psig to 600 psig).~~

6.2 Qualification Facility

The manufacturer shall either engage an independent qualification facility to perform the tests or a third party to witness and certify tests done in its own facility.

6.3 Test Set up

6.3.1 The stem orientation for NPS ~~2620~~ or larger test valve shall be horizontal. ~~Reference paragraph 14.1.3.~~

The stem orientation for all other test valves shall be vertical.

6.3.2 The valve shall be heated using an internal heat source or an external heat source such as electric heating blanket, coils, or other suitable equipment or an appropriate internal heat source.

6.3.3 The test valve may be equipped with a method of actuation capable of mechanically cycling the valve. The method of actuation should not impose additional side loads on the stem or packing. Running torque values shall be recorded on the first and last cycle of testing. For qualification of manual operated valves, the method of actuation employed shall utilize the existing manual valve stem, yoke, and yoke nut /stem bushing assembly.

6.4 Test Profile

~~6.4.16.4.1 When the initial purge is with other than the test fluid, a final purge shall be performed with the test fluid.~~

6.4.2 Valves shall be subjected to a total of 310 mechanical cycles and 3 thermal cycles per Figure 1. Mechanical cycling shall begin with the valve at ambient temperature. An optional low temperature test at $-29\text{ }^{\circ}\text{C}$ ($-20\text{ }^{\circ}\text{F}$) may be performed if requested by the purchaser (see Figure 1).

6.4.23 The elevated test temperature shall be $260\text{ }^{\circ}\text{C} \pm 14\text{ }^{\circ}\text{C}$ ($500\text{ }^{\circ}\text{F}$) ~~$\pm 5\text{ percent}$~~ , $\pm 25\text{ }^{\circ}\text{F}$ at TC-1.

6.4.34 The test pressure shall be the lower of 41.4 barg (600 psig) or the maximum allowable pressure at $260\text{ }^{\circ}\text{C} \pm 14\text{ }^{\circ}\text{C}$ ($500\text{ }^{\circ}\text{F} \pm 25\text{ }^{\circ}\text{F}$) per ASME B16.34 for the applicable material group and shall be held to ~~± 1~~ 5% of the target pressure during each thermal cycle. There may be variability in pressure during the thermal transitions.

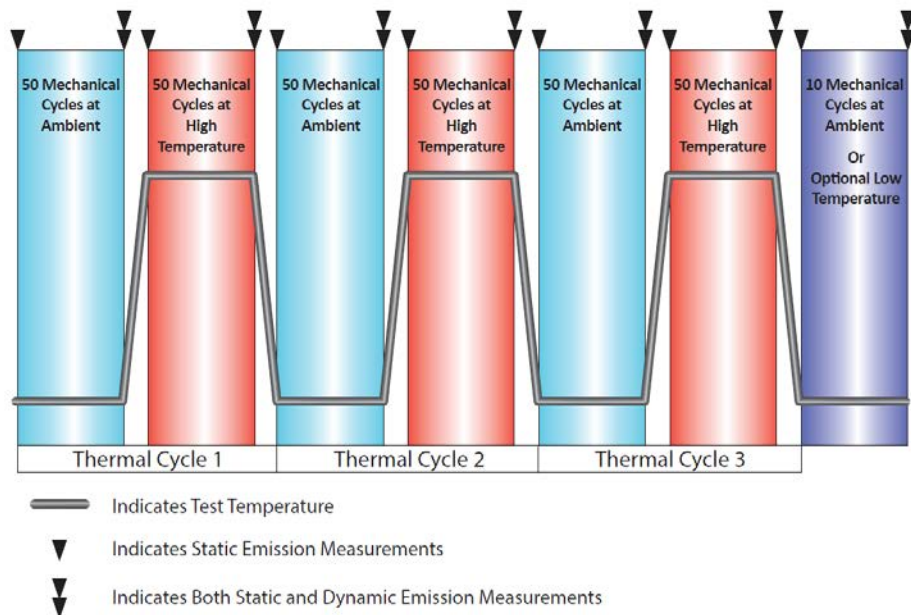


Figure 1—Valve Cycling

6.5 Leak Measurement

6.5.1 Static and dynamic stem leakage measurements shall be taken. See Figure 1.

6.5.2 Leak/Leakage measurements shall be conducted/performed in still air. Shielding-potential The stem seal and body/bonnet joint leak paths from environmental impacts shall be enclosed in foil or other nonpermeable material with a foil the leak probe inserted into the enclosure shall be employed. For the stem seal, the enclosure shall contain both the ID and OD of the packing leak path. If flow is choked, a small opening opposite the probe shall be made so the sampling rate is not affected. The enclosure may be removed during the high temperature testing. The foil enclosure shall include the stem outside diameter and packing outside diameter.

6.5.3 Leak measurements of the body-bonnet connection shall be taken at the same time as stem leakage measurement. Any leak measurement that exceeds the allowable per Section 7 during the test constitutes failure of the valve. Leakage from end connections or test apparatus shall be corrected prior to continuing the test.

6.5.4 Any leakage shall be recorded after a time delay of twice the response time of the instrument. For each measurement, a minimum of 10 readings shall be taken over a one-minute duration. The average reading shall be calculated and recorded. If any reading is more than 50 percent greater than the average, except for when the average leakage rates are less than 10 ppmv, the readings shall be repeated.

6.6 Packing Adjustment

Packing adjustment during type testing is not permitted

6.7 Temperature Monitoring

6.7.1 The valve shall be equipped with thermocouples for monitoring the temperature during testing. The temperature shall be monitored and recorded at two locations (see Figure 2).

a) TC-1—~~affixed at the external body adjacent~~ to the stuffing box. ~~The~~This thermocouple ~~affixed to the stuffing box~~ shall control the test temperature.

b) TC-2—at the external body adjacent to the flow path shall be a reference measurement.

6.7.2 ~~The~~At time of measurement in elevated temperature cycle, the temperature at TC-2 shall be equal to or greater than the temperature at TC-1, unless both temperatures are above 260 °C (500 °F). For cold testing option, the temperature at TC-2 shall be less than or equal to TC-1.

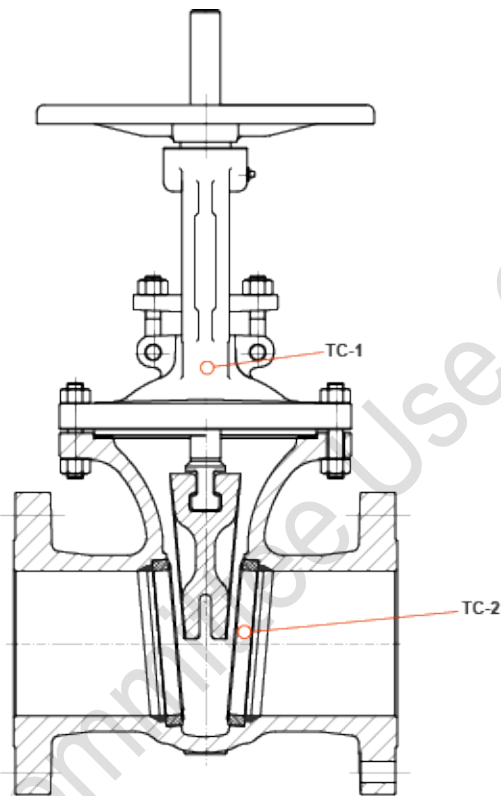


Figure 2—Temperature Locations

7 Acceptance Criteria

The Fugitive Emissions Test Report in Annex A shall indicate “pass” when ~~the measured~~ leakage throughout the test does not exceed 100 ppmv.

8 Supplementary High Temperature Testing

Additional high temperature testing per Annex D shall be performed when specified.

8.9 Leak Test Equipment and Calibration

8

General Use

Classification: General Use

9.1 Monitoring equipment shall be as described below capable of providing on-board a flame ionization organic vapor analyzer with an integral data logging with digital readout logger or a signal output for data collection. The equipment shall be certified as intrinsically safe for use with the test medium. Data logging may also be performed with a separate data acquisition system. fluid.

9.2 The equipment shall meet the following performance requirements in the flame ionization mode:-- using methane as the test fluid.

- a) a) Maximum variation: $\pm 2\%$ repeatability: $\pm 2\%$ 0 ppmv at 0 ppmv to 100 ppmv.
- b) b) Minimum detectable level (defined as $2 \times$ the peak noise): 300 ppb hexane.: ≤ 1.0 ppmv.
- c) c) Maximum response time to reach final value: 3 (from 0 ppmv to 100 ppmv): 15 seconds.
- d) d) Maximum recovery time to return to 10 % of initial value: 510 seconds.
- e) e) Sample flow rate at probe inlet: 0.8 to 25 $\pm 1.5 \pm 5$ l/min (0.21 to 0.40 gal/min).

9.3 The test equipment shall be inspected prior to each use to ensure against fouling of the detector probe. This shall be done per EPA Method 21 using an external calibration gas with a known methane concentration.

9.4 To increase accuracy of readings between different measuring instruments and testers, the leakage device shall be calibrated to known leak rate standards daily prior to testing. A current record of test equipment calibration shall be maintained by the qualification test facility.

9.5 A porous or sintered metal/ceramic leak standard or similar device shall be used per the following procedure (see Figure 3):--

- a) Verify the sampling flow rate: Calibration of the leakage monitoring device to be in the range of 0.5 to 1.5 l/min (0.13 to 0.40 gal/min) leak with a calibrated flow meter.
- b) Verify the flow rate of the calibrated standard leak at a regulated differential pressure. The calibrated standard leak shall be in the range of 0.025 to 0.075 ml/min (6.6×10^{-6} to 1.98×10^{-6} gal/min) of methane performed annually at a minimum. The inverted beaker technique may be used with a sufficient amount of time to collect a measurable amount of sample. The test time should also be sufficient to fill the tubing and fittings used in the calibration setup.

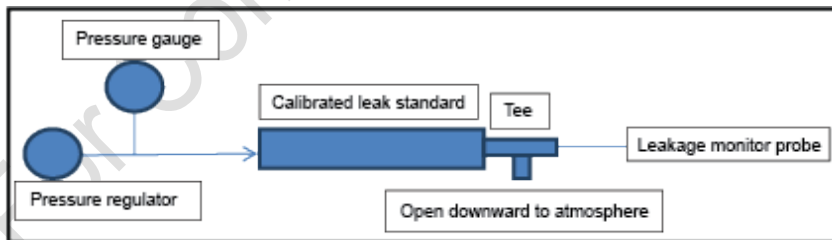


Figure 3—Calibration Setup

- c) After the flow rate is verified and it is ensured that the test gas has completely saturated the calibrated leak standard, the leakage monitor probe shall be attached to the tee fitting connected to the standard.

9.5.1 Using a nominal flow rate of 1.00 l/min (0.26 gal/min), a 0.05050 ml/min (1.32×10^{-6} gal/min) leak standard shall produce by definition a--

General Use

Classification: General Use

$0.05050 / (1.00 \text{ liter} \times 1000 \text{ ml/liter}) = 0.005\%$ $[1.32 \times 10^{-5} / 0.26 = 0.005\%]$ concentration of test gas by volume or 50.0 ppmv concentration.–

d) Therefore, the reading of the leakage monitor shall be tuned to be the verified flow rate of the leak standard in ml/min times 1000 in ppmv.
in ml/min x 1000 in ppmv.

9.5.2 Verify the sampling flow rate of the leakage monitoring device to be in the range of 0.25 to 1.5 l/min with a calibrated flow meter.

9.5.3 Verify the flow rate through the calibrated standard leak at a regulated differential pressure using 97 % minimum purity test gas. The calibrated standard leak shall be in the range of 0.050 ml/min to 0.100 ml/min of methane. The inverted beaker technique may be used with a sufficient amount of time to collect a measurable amount of sample. The test time shall be sufficient to fill the tubing and fittings used in the calibration setup.

9.5.4 After the flow rate is verified and it is ensured that the test gas has completely saturated the calibrated leak standard, the leakage monitor probe shall be attached to the tee fitting connected to the standard. After stabilization has occurred, calibrate the leakage monitoring device per the manufacturer's instructions using the calculation in 4.2.5.1. Leakage for calibration shall be between 50 ppmv and 100 ppmv. Calibration shall be performed before the start of each test and the results recorded.

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910 Post-test Inspection

910.1 Valve shall be disassembled and components including stem, packing, stem nut, gland follower, and stuffing box shall be inspected and the condition documented. If Annex D testing is required, then disassembly shall be performed after this testing is completed.

910.2 Sealing components shall be photographed in accordance with 4011.2.

4011 Recording and Documentation

4011.1 As a minimum, test results shall be provided as defined by the Fugitive Emissions Test Report provided in Annex A. In addition, photographic evidence shall be recorded as defined in 4011.2.

4011.1.1 Leak measurements shall be recorded at established intervals as detailed in 6.85.

4011.1.2 Leakage rate units of measurement for methane shall be [ppmv].

4011.2 Photographic evidence shall be documented as indicated in 4011.2.1 through 4011.2.3.

4011.2.1 Valve marking and tagging.

4011.2.2 Pre- and post-test valve external stuffing box area.

4011.2.3 Post-disassembly valve components:

- a) stem packing area,
- b) stem threads,
- c) stem nut,
- d) stem bushing,

General Use

Classification: General Use

- e) packing gland follower,
- f) stuffing box interior,
- g) packing rings and spacers.

4011.3 The test certificate or report that proves compliance with API 622 third edition (or later) shall be attached to the API 624 test report. Test reports shall be in accordance with the API 622 packing sizes for qualification.

4011.4 All completed test reports are considered to be confidential and proprietary and shall not be copied or distributed without prior approval from the manufacturer.

4412 Valves Qualified

All valves of the same design standard as the test valve may be deemed to have been type tested, subject to the following additional limitations.

4412.1 The valve stem sealing system design is of the same arrangement, shape, ~~and~~ packing set type qualified to API 622 and applied packing stress as the tested valve.

4412.2 The motion of the stem is identical. Rising stem motion is not identical to rising-rotating stem motion.

4412.3 Successful testing of a bolted bonnet valve will also qualify a welded bonnet valve of similar design, but a welded bonnet will not qualify a bolted bonnet design.

4412.4 API 602 Valves Qualification Extension:

4412.4.1 Within the qualification extension of size ranges listed in 4412.4.2 to 4412.4.4:

- Pressure classes up to and including class 800 may be qualified by testing class 800 test valves.
- Class 1500 valves may only be qualified by testing class 1500 test valves.

4412.4.2 ~~An NPN~~ NPS ¾ test valve ~~may be used to qualify~~ qualifies all valves NPS 1 and smaller.

4412.4.3 ~~An NPS 1 ½~~ test valve ~~may be used to qualify~~ qualifies all valves NPS 1 ¼ through NPS 2 ½.

4412.4.4 ~~An NPS 3~~ test valve ~~may be used to qualify~~ qualifies all valves NPS 3 through NPS 4

4412.5 API 603 Valves Qualification Extension:

4412.5.1 Within the qualification extension of size ranges listed in 4412.5.2 to 4412.5.4:

- Qualification may be extended to one pressure class lower of the test valve pressure class.

4412.5.2 ~~An NPS ¾~~ test valve ~~may be used to qualify~~ qualifies all valves NPS 1 and smaller.

4412.5.3 ~~An NPS 1 ½~~ test valve ~~may be used to qualify~~ qualifies all valves NPS 1 ¼ through NPS 2 ½.

4412.5.4 ~~An NPS 4~~ test valve ~~may be used to qualify~~ qualifies all valves NPS 2 through NPS 6

11.6.12.6 Valves not otherwise specified:

11.6.12.6.1 For valves larger than NPS 24, any test valve larger than NPS 24 in either Class 150 or 300 shall qualify the range of valves from NPS 26 through NPS 42 for both Class 150 and 300.

11.6.12.6.2 Within the qualification of extension size ranges listed in 11.6.12.6.3 to 11.6.12.6.4:

- Qualification may be extended to one pressure class lower of the test valve pressure class

11.6.12.6.3 An NPS 4 test valve ~~may be used to qualify~~ qualifies all valves NPS 2 through NPS 6.

11.6.12.6.4 For test valves larger than NPS 4, the test valve may be used to qualify valves two nominal size smaller to one nominal size larger.

11.6.12.6.5 An NPS 20 test valve ~~may be used to qualify~~ qualifies all valves NPS ~~48~~ 16 through NPS 24

11.6.12.7 Annex B provides a list of valves that may be tested to qualify to this standard.

12.13 Valve Marking

Valves qualified by this standard shall be clearly and permanently marked as "API 624". Valves qualified per Annex D shall be marked as "API 624HT".

13.14 Valves Previously Qualified to this Standard

13.14.1 Retest Exemption

13.14.1.1 No retest is required if live loading is added to the packing gland bolts of a previously qualified non-live-loaded valve.

13.14.1.2 No retest is required when using the same stem sealing system design as described in paragraph 11.12.1 as used in the previously qualified valve, provided the packing ~~is qualified to meet~~ meets API 622 3rd edition 3, or API 622 later edition ~~2 meeting allowable leakage requirements.~~

14.1.3 Valves NPS 20 or larger ~~qualified prior to the release of API 622 this edition 3 para 4.4.4 of the standard tested with no adjustment the stem in a vertical position do not need to be requalified.~~

13.2.14.2 Partial Retest Qualification

14.2.1 Partial ~~retest qualification~~ per Annex C is required if ~~any the following conditions apply:~~

13.2.1.1 A change in stem sealing system design as defined in paragraph 11.12.1 is used from the one tested in the previously qualified valve, provided the packing ~~is qualified to meet~~ meets API 622 3rd edition 3 or API 622 later edition ~~2 meeting allowable leakage requirements of API 622 edition 3 para 4.4.4 without gland adjustment.~~

13.2.2 For 14.2.2 Gasket joint changes of the following type requires partial qualification as follows:

14.2.2.1 Any change from one gasketed joint design type to another, of the generic types listed below, shall require partial requalification.

General Use

Classification: General Use

- i. bolted bonnet joint not using ring joint or pressure seal gasket (i.e. - flat faced, raised face, tongue and groove, spigot and recess, round, oval, oblong short or long)
- ii. bolted bonnet ring joint
- iii. pressure seal (pressure assisted)

14.2.2.2 Partial qualification, valves to be tested:

For the purposes of partial qualification of a range of valve sizes and classes that exceeds the range covered by a single valve as per Section 12, a total of two (2) valves per valve design type shall be tested. Of the two valves:

- i. in the range qualified, one valve shall be of the smallest NPS, or one size up, and one shall be of the largest NPS or one size down.
- ii. in the range qualified, one valve shall be of the lowest pressure class, and one shall be of the highest pressure class.

14.2.2.3 For the purposes of partial qualification of a gasketed joint, it is permitted to omit mechanical cycling and only perform thermal cycling of the test valve.

14.3 High Temperature Test

14.3.1 For valves previously qualified to API 624 testing up to 500F, test per Annex D.

14.4 Full Retest

14.4.1 A full retest is required for any other changes not covered in paragraphs 14.1 and 14.2.

4415 Manufacturing Location Change

If the location of the valve manufacturing facility is different than what is listed on the API 624 certificate, the purchaser may request partial (per Annex C) or full requalification.

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Annex A
(normative)

Fugitive Emissions Test Report

API Std 624 E2 Fugitive Emissions Testing Report Number: _____		
Valve Stem Type (check one): () Rising () Rising-Rotating		Manufacturer & Location: Valve Size, Class, & Type: API/ASME Design Standard(s):
Packing Description: Manufacturer: Model/Type: Gland follower exposed length: Stuffing box depth: Live loading: Yes ____ No ____	Number of rings: OD: ID: Stack height: Gland follower insertion depth: Spacer: Yes ____ No ____ Spacer material: API 622 Report/Certification Number: _____	Body material: Stem material: Body-bonnet gasket material:
Qualification Facility: Technician: Witness: Start Date: Completion Date:	Valve Selection (check one): () Manufacturer () Distributor () Purchaser Selected by:	Date Selected:

General Use

Classification: General Use

Gland nut recommended torque: <u>(Base Test):</u> <u>Gland nut recommended torque (High Temp. Test):</u> Body-bonnet bolting recommended torque:		Body-bonnet connection: Type:		<input type="checkbox"/> Bolted <input type="checkbox"/> Welded <input type="checkbox"/> Pressure Seal <input type="checkbox"/> Other _____		
Pre-test Preparations & Adjustments (see Section 4.3):						
Notes:						
API 624 Testing Data – <u>Base Test</u>						
Test Segment	Cycle	Temperature@ TC1	Temperature @ TC2	Static Leak Measurement	Dynamic Leak Measurement	Bonnet Leak Measurement
Ambient Temperature 0 to 50 cycles P = _____ T = _____	0					
	50					
Elevated Temperature 51 to 100 cycles P = _____ T = _____	51					
	100					
Ambient Temperature 101 to 150 cycles P = _____ T = _____	101					
	150					
Elevated Temperature 151 to 200 cycles P = _____ T = _____	151					
	200					
Ambient Temperature 201 to 250 cycles P = _____ T = _____	201					
	250					
Elevated Temperature 251 to 300 cycles P = _____ T = _____	251					
	300					
Ambient (or Low) Temperature 301 to 310 cycles P = _____ T = _____	301					
	310					

General Use

Classification: General Use

Base Test: Pass () Fail ()

API 624HT Testing Data (Optional)						
Test Segment	Cycle	Temperature@ TC1	Temperature @ TC2	Static Leak Measurement	Dynamic Leak Measurement	Bonnet Leak Measurement
Ambient Temperature	0					
0-10 cycles						
P =	10					
T =						
Was gland nut adjustment required to pass HT testing? yes no						
If yes, gland nut torque value before re-adjustment						

Running Torque Value: First Cycle of Base Test: Last Cycle:

Running Torque Value: First Cycle of HT Test: Last Cycle:

High Temperature Test: Pass () Fail ()

Lab Representative Signature: Date:

Witnessed By: Date:

General Use

Classification: General Use

Annex B (informative)

Suggested Valves for Testing

Table B.1—Size and Class to be Tested for Each Gate Valve Made in Accordance with API 602

NPS	Class	<u>Standard Test</u>	<u>Partial – API 624</u>	<u>API 624HT (Optional)</u>
3/4	800	X	<u>Annex C</u>	<u>Annex C</u>
1 1/2	800	X		
3/4	1500	X		
1 1/2	1500	X		
3	800	X		
3	1500	X		

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Table B.2—Size and Class to be Tested for Each Globe Valve Made in Accordance with API 602

NPS	Class	<u>Standard Test</u>	<u>Partial – API 624</u>	<u>API 624HT (Optional)</u>
3/4	800	X	<u>Annex C</u>	<u>Annex C</u>
1 1/2	800	X		
3/4	1500	X		
1 1/2	1500	X		
3	800	X		
3	1500	X		

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General Use

Classification: General Use

Table B.3—Size and Class to be Tested for Each Gate Valve Made in Accordance with API 600

NPS	Class	Standard Test	Partial – API 624	API 624HT (Optional)
4	150	X	Annex C	Annex C
4	600	X		
4	1500	X		
12	150	X		
12	600	X		
12	1500	X		
20	150	X		
20	600	X		
30	300	X		

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Table B.4—Size and Class to be Tested for Each Gate Valve Made in Accordance with API 603

NPS	Class	Standard Test	Partial – API 624	API 624HT (Optional)
3/4	300	X	Annex C	Annex C
3/4	600	X		
1 1/2	300	X		
1 1/2	600	X		
4	300 150	X		
4	600	X		
12	300 150	X		
12.	600	X		
20	300	X		

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General Use

Classification: General Use

20	600	X		
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For Committee Use Only

Table B.5—Size and Class to be Tested for Each Globe Valve Made in Accordance with API 623

NPS	Class	Standard Test	Partial – API 624	API 624HT (Optional)
4	150	X	Annex C	Annex C
4	600	X		
4	1500	X		
12	150	X		
12	600	X		
12	1500	X		

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Annex C (normative)

Partial Re-test Valve Selection Criteria

API 600

- Minimum of three valves shall be tested
- Valves to be tested will have ~~three~~minimum of two different packing cross sectional areas
- There shall be at least one Class 150 and one Class 600 valve tested
- One valve shall be NPS 4 and one valve shall be NPS ~~20 (or the largest size manufactured less than 20 if NPS 20 is not manufactured)~~12

API 602 (Gate Valves)

- ~~There shall be an NPS ¾ and NPS 1 ½ size One valve tested~~
- ~~All manufactured type of class 800 and one of the highest class to be qualified, gate shall be tested~~
- ~~One valve of NPS ¾ and globe, one NPS 1 ½ size shall be represented tested~~

API 602 (Globe Valves)

- ~~One valve of class 800 and one of the highest class to be qualified shall be tested~~
- ~~One valve of NPS ¾ and one NPS 1 ½ size shall be tested~~

API 603

- Minimum of ~~two~~three valves shall be tested
- ~~Valves to be tested will have two different packing cross sectional areas~~
- There shall be at least one Class 150 and one Class ~~600. Class 600 may be substituted with Class 300 valve tested if this is the highest class to be qualified~~
- One valve shall be NPS 4, ~~one valve shall be NPS 12, and one valve shall be NPS 20 (or the largest size manufactured less than below NPS 20 if NPS 20 is not manufactured)~~2

API 623

- Minimum of ~~two~~three valves shall be tested
- Valves to be tested will have minimum of two different packing cross sectional areas
- There shall be at least one Class 150 and one Class 600 valve tested
- ~~One valve shall be NPS 4 and one valve shall be NPS 12~~

Annex D **(informative)**

High Temperature Testing Procedure

D.1 Valve Selection and Preparation

D.1.1 General

The high temperature test of Annex D shall be performed after completion of testing per Section 6 of this standard (i.e.: after completion of 310 mechanical cycles) or using a new test valve where the design type has been previously qualified to section 6 of this standard. Valves tested to this annex shall be per Annex B unless otherwise required by Purchaser.

D.1.2 Packing

The packing shall meet API 622 3rd edition or later edition requirements.

D.1.3 Valve Preparation

If this test is done as a continuation (i.e., not a new test valve) to the standard temperature test of Section 6, the gland nuts shall be removed and the studs and threads cleaned and relubricated. The manufacturer's recommended gland bolt torque procedures shall then be applied. Body or bonnet nut torque shall be retightened to recommended torque procedures.

If the test is performed on a new test valve, the packing and body/bonnet nut torques shall be tightened to the manufacturer's recommended torque procedures prior to the start. Torque values shall be recorded on test sheet.

The test torque value shall not exceed 120% of the torque value utilized per section 4.3 in this standard.

D.2 Test Setup

D.2.1 Temperature

The thermocouple positions shall be per Figure 2, as in standard temperature test. TC-1 shall be the controlling position, needing to comply with the temperatures listed in this annex. TC-2 shall be a reference, but shall be +/-50 deg. F of the TC-1 requirement at high temperature.

General Use

Classification: General Use

D.2.2 Leak Test Equipment and Calibration

Monitoring equipment shall be calibrated per Section 9.

D.2.3 Leakage Measurement Method

Reference Section 6.5.2 & 6.5.3

D.2.4 Test Media

97% minimum purity methane shall be used as the test gas at room temperature. At the elevated temperatures in this annex, 97% minimum purity nitrogen or other inert gas shall be used. See Section 5 for safety consideration.

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D.2.5 Heating and Insulation

The valve shall be heated internally or externally. Insulation may be applied to the top of the packing box chamber of the valve.

D.2.6 Other Requirements

All other setup and calibration requirements not noted above, shall be per Sections 5 through 9.

D.3 Test Procedure

1. Pressurize valve to 41.4 barg \pm 1.7 barg (600 psig \pm 25 psig) or rated pressure at 38 °C (100 °F), whichever is lower, with methane and hold for 1-hour minimum.
2. With stem static and leakage areas enclosed, measure and record stem seal and body/bonnet seal leakage over 1 minute duration.
3. If maximum static leakage exceeds 100 PPMv, perform the following steps
 - a. Measure remaining gland nut torque and record.
 - b. Retorque gland nuts per section D.1.3 in this procedure. Record Torque value.
 - c. Measure and record leakage. If maximum static leakage exceeds 100 PPMv, test fails.
4. Release pressure to atmospheric pressure.
5. Heat valve so that TC-1 is 399 °C \pm 14 °C (750 °F \pm 25 °F).
6. After temperature stabilization, pressurize valve with nitrogen or inert gas to 13.8 barg \pm 1.7 barg (200 psig \pm 25 psig) or rated pressure at 399 °C (750 °F), whichever is lower.
7. Hold pressure and temperature for 20 hours minimum. Time may be cumulative or continuous.
8. Cycle valve 5 times, ending with valve partially opened.
9. Cool valve to ambient temperature (TC-1 and TC-2 <100F) while maintaining a minimum of 7 barg (100 psig) with nitrogen or inert gas. Insulation may be removed.
10. Release pressure to atmospheric pressure.
11. Pressurize valve to 41.4 barg \pm 1.7 barg (600 psig \pm 25 psig) or rated pressure at 38 °C (100 °F), whichever is lower, with methane and hold for 1-hour minimum.
12. Enclose leak paths per D.2.3

General Use

Classification: General Use

13. Cycle valve 5 times, ending with valve partially opened.
14. With stem static, measure and record stem seal and body/bonnet seal leakage over 1 minute duration.
15. If maximum static leakage exceeds 100 PPMv, perform the following steps
 - a. Measure remaining gland nut torque and record.
 - b. Retorque gland nuts per section D.1.3 in this procedure. Record torque value.
 - c. Measure and record leakage. If maximum static leakage exceeds 100 PPMv, test fails.
16. Cycle valve 1 time and record dynamic leakage for information only. Record average and maximum leakage while stem is moving from the closed to open position. Leakage shall be recorded but is not subject to pass/fail criteria.
17. Release pressure to atmospheric pressure.
18. Record final gland nut torque.

D.4 Acceptance Criteria

The High Temperature (HT) Fugitive Emissions Test Report shall indicate "pass" when the measured leakages of the stem when static and of the body/bonnet seals are all \leq 100 PPMv. One (1) packing nut adjustment is allowed throughout the test per D.3. No tightening of the body/bonnet joint is allowed.

D.5 Valve Qualified

Valves tested per Annex C will qualify the whole range of valves previously qualified per API 624.

D.6 Valve Marking

Valves qualified by this annex shall be clearly and permanently marked as "API 624 HT" per Section 13.