MSS SP-121-2006

Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves

Standard Practice
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This MSS Standard Practice was developed under the consensus of the MSS Technical Committee 308 and the MSS Coordinating Committee. The content of this Standard Practice is the result of the efforts of competent and concerned volunteers to provide an effective, clear, and non-exclusive specification that will benefit the industry as a whole. This MSS Standard Practice is intended as a basis for common practice by the manufacturer, the user, and the general public. The existence of an MSS Standard Practice does not in itself preclude the manufacture, sale, or use of products not conforming to the Standard Practice. Mandatory conformance is established only by reference in a code, specification, sales contract, or public law, as applicable.

Unless otherwise specifically noted in this MSS SP, any standard referred to herein is identified by the date of issue that was applicable to the referenced standard(s) at the date of issue of this MSS SP. (See Annex A.)

U.S. customary units in the Standard Practice are the standard; the metric units are for reference only.

In this Standard Practice all notes, annexes, tables, and figures are construed to be essential to the understanding of the message of the standard, and are considered part of the text unless noted as "supplemental". All appendices appearing in this document are construed as "supplemental". Supplemental" information does not include mandatory requirements.

Originally Approved March, 1997

FOREWORD

This Standard Practice was developed by a cooperative effort of representatives of valve and packing manufacturers. This Standard Practice is intended primarily to be an aid for verification of the performance of valve stem packing materials and material combinations at selected pressure and temperature conditions. It is based on packing systems to be used in rising stem steel valves that generally use flexible graphite packing systems in accordance with MSS SP-120.

While MSS SP-120 addresses only flexible graphite packing systems, it does not preclude use of specified system design features for other types of packing systems. This Standard Practice references MSS SP-120 design features and packing systems qualified in accordance with this Standard Practice and may be considered by manufacturers and users for application in rising stem steel valves that otherwise comply with MSS SP-120.

This Standard Practice shall not be construed to be effective in qualifying packings for all types of services expected of ASME B16.34 or equivalent valves. Special service applications such as low fugitive emissions control or toxic fluid may require additional or different qualification testing or leakage measurement methods that are outside the scope of this Standard Practice.

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ANNEX

QUALIFICATION TESTING METHODS FOR STEM PACKING FOR RISING STEM STEEL VALVES

1. SCOPE

1.1 This Standard Practice provides procedures and guidelines for testing and evaluation of valve stem packing materials and material combinations. This testing provides qualification by verifying the adequacy of specific packing material combinations for service within defined limits of size, pressure, temperature, and cyclic duty. Such specific combinations generally represent products of individual manufacturers, although generic qualification of raw materials may be demonstrable in certain cases.

1.2 It is intended that this Standard Practice apply to qualification of stem packings for Class 150 through 4500 ASME B16.34 or equivalent steel or special alloy valves (including intermediate classes and Standard, Special, and Limited Class ratings) with rotating/rising and non-rotating/rising stems, as traditionally used in globe and gate valves. Other valve stem types (e.g. quarter-turn) may involve additional considerations not within the scope of this Standard Practice.

1.2.1 The requirements herein apply to qualification of traditional compression packings. Rod seal elements such as "O" rings, "V" rings, and similar proprietary seals are not within the scope.

1.2.2 Stem packings may be prequalified by experience or by test programs conducted prior to publication of this Standard Practice if a qualification report is prepared based on documented evidence.

1.3 This Standard Practice is intended to provide experimental qualification of packing materials and materials combinations for service with water, steam, and other common liquids, vapors, and gases. Some of the procedures identified in detail use water and steam as test fluids, but air or nitrogen may also be used with appropriate modifications in testing and data acquisition methods.

General Note: More chemically aggressive line fluids may damage packings and degrade sealing performance. Packings qualified in accordance with this Standard Practice may not be satisfactory for applications with such fluids.

1.4 Environmental pollution regulations (e.g. fugitive emissions) or limitations on leakage of hazardous or toxic fluids may require additional or different qualification tests that are outside the scope of this Standard Practice.

1.5 This Standard Practice is not intended to apply to packings for valves developed for and predominantly used in instrument piping systems.

2. DEFINITIONS

2.1 See MSS SP-96 for definitions of common terms used in this Standard Practice.

2.2 ***Detectable Leakage*** For the purposes of this Standard Practice, detectable leakage of a packing assembly is defined as follows:

2.2.1 ***Standard criteria***

(1) Visible leakage of liquid water which results in breaking away of droplets to form a dripping action or a steady stream

(2) Leakage of saturated or superheated steam that is visible as condensed vapor or detectable as condensation in a cold trap, on a mirror, or with a similar device

(3) Leakage of air or nitrogen sufficient to produce continuous bubbling in a liquid leak detector solution applied in the packing gland area

2.2.2 ***Alternate criteria*** At the discretion of the test sponsor, more conservative (lower) allowable leakage rate criteria may be selected. If this is done, leakage shall be measured quantitatively (e.g., in ml/hr as liquid or condensed vapor or as an air or nitrogen volume at standard atmospheric conditions). The alternate “detectable leakage” definition and the method of measurement shall be described in the Qualification Report.

2.2.3 ***Static vs. dynamic leakage*** When observed, detectable leakage shall be further identified as static if the stem is stationary and dynamic if the stem is moving.

2.3 ***Maximum Qualified Packing Pressure*** The maximum pressure rating for a packing material or material combination at room temperature [50 to 100^0F (10 to 38^0C)] conditions based on tests in accordance with this Standard Practice. See Section 4.1.3.

2.4 ***Maximum Qualified Packing Temperature*** The maximum continuous temperature (expressed as a mean temperature of the packing chamber) for a packing material or material combination based on tests in accordance with this Standard Practice. See Section 4.1.4.

2.5 ***Qualification Report*** A concise report documenting results of tests conducted in accordance with this Standard Practice. See Section 5.

3. TEST FIXTURES

3.1 ***Performance Test Fixtures***(1) may be valves or mockups of valves including stems and packing assemblies as described in MSS SP-120. Stem and pressure boundary materials shall be representative of those used in construction of valves used for pressures and temperatures corresponding to specified test conditions.

3.1.1 Test Fixtures shall be representative of a specific valve pressure class number and designation in accordance with ASME B16.34 (e.g., Standard Class 1500). Successful testing of a packing material or material combination at conditions corresponding to a given pressure class shall qualify that material or combination for that and all lower class numbers.

Example: Successful performance at Standard Class 1500 conditions qualifies a packing material or material combination for Standard Class 150 through 1500 service and any other applications with the same or lower pressure ratings.

3.1.2 Test fixtures shall provide a valve stem travel length representative of the maximum expected travel in valves having the same stem diameter used in the test fixture. Successful testing of a packing material or material combination in a fixture with a given stem diameter shall qualify that material or material combination for use with stem diameters from half through twice the diameter tested; this qualification applies to any stem travel not exceeding that tested (expressed as a multiple of stem diameter).

Note: Tests with a stem travel length of at least four times the stem diameter qualify a packing material or material combination for use with any longer travel.

Examples:

a) Testing of a 1.0 inch (25.4 mm) diameter stem with a 1.0 inch (25.4 mm) travel qualifies a packing material or material combination for use with a 0.5 inch (12.7 mm) diameter stem with up to 0.5 inch (12.7 mm) travel or a 2.0 inch (50.8 mm) diameter stem with up to 2.0 inch (50.8 mm) travel.

b) Testing of a 3.0 inch (76.2 mm) diameter stem with a 12.0 (4.0 x 3.0) inch (305 mm) travel qualifies a packing material or material combination for use with a 1.5 inch (38.1 mm) diameter stem or a 6.0 inch (152 mm) diameter stem with any stem travel.

Note: Upward or downward extrapolation in size is valid for specific packing combinations only when the same material and construction is used over the full qualified size range. For example; the qualification is not valid where different braiding methods (e.g., square braid instead of lattice braid) or core materials are used in packings smaller or larger than the size tested.

Supplementary Information:
(1) While not required by this Standard Practice, it is recommended that test fixtures be designed to permit non-destructive removal of packing assemblies after test to allow examination of individual packing rings.

3.1.3 Test fixtures shall provide stem motion representing either rotating/rising or non-rotating/rising (linear) valve stem motion. Successful tests of a packing material or material combination with a rotating/rising stem shall qualify that material or material combination for application with either the same or non-rotating/rising stem motion. Qualification based on tests of fixtures with linear stem travel shall apply only to applications with non-rotating/rising stems.

3.1.4 Test fixtures shall incorporate stem and packing chamber dimensions consistent with Table 1 of MSS SP-120. Diametrical clearances (stem to packing gland, packing gland to bonnet, and stem to bonnet) shall be controlled closely to ensure conservatism in demonstrating resistance of packing materials to extrusion. Actual dimensions shall be documented in the Qualification Report and shall limit the qualification of the packing material or material combination tested (e.g. closer clearances in the tests shall require closer clearance in actual applications).

3.1.5 Packing gland loading shall be provided by bolts, studs, or threaded adjustment devices typical of those used on actual valves with stem diameters similar to that used in the test fixture. The condition and lubrication of threaded parts shall be recorded and described in the Qualification Reports. Suitable means shall be provided for measurement of the load applied to produce compressive stress on the packing.

Note: As an option, "live loading" features (e.g. Belleville spring stacks) may be incorporated in test fixtures for qualification of packing materials or material combinations. Details of the live loading arrangement, including spring loads and load/deflection characteristics shall be included in the Qualification Report. Results of qualification tests conducted in this manner shall apply only to packings used in valves with similar live loading features.

3.1.6 As a minimum, test fixture instrumentation shall provide for continuous or periodic measurement of:

a) Fluid pressure
b) Fluid temperature
c) Mean temperature of packing chamber (based on at least one metal temperature reading)
d) Stem temperature at a location just outboard of the gland (when stem is in innermost position)
e) Stem actuating force or torque due to packing friction
f) Fluid leakage rate, if alternate criteria are used to define "Detectable Leakage" (see Section 2.2.2).

3.2 ***Corrosion Test Fixtures*** shall be designed to contain packing material in the same way it is contained in a valve for evaluation of the tendency of the material to cause damage to valve stems under wet lay-up (stocking) conditions.

3.2.1 Figure 1 illustrates a fixture design based on dimensions given for a 1 inch (25.4 mm) diameter stem in MSS SP-120. Use of these dimensions and the procedures in this Standard Practice should give standardized results that will be comparable when performed by different laboratories. Dimensions not given in MSS SP-120 may be determined for convenience in manufacture.

3.2.2 Stem specimens shall be of corrosion resistant materials corresponding to actual alloys used for valve construction. At least one test fixture shall include a stem of martensitic stainless steel (e.g. type 410). Tests with any specific stem material qualify a packing material or material combination for use with other more cathodic stem materials (in Galvanic Series). Specific material specifications for valve stem materials used shall be identified in the Qualification Report.

Example: Successful tests with type 410 stem specimens qualify a packing for use with type 316 or Monel stems providing that stem surface finishes are equal.

4. TEST PROCEDURES

(Refer to Test Outline in Figure 2)

4.1 ***Performance Tests*** shall be conducted with water and steam, air, or nitrogen at test pressures in accordance with the pressure ratings of the corresponding ASME B16.34 class number of performance test fixtures. A minimum of three (3) performance tests shall be conducted and reported in the Qualification Report; qualified performance ratings (e.g. Maximum Qualified Packing Temperature) shall be based on the minimum values from the three tests.

4.1.1 Performance test fixtures shall be assembled with packing installed and loaded in accordance with recommendations of the test sponsor. The compressive stress on the packing in lb/in^2 (mPa) and any special procedures (e.g. stroking the stem and retightening) shall be identified in the Qualification Report.

Note: If the packing loading above is found to be unsatisfactory, it may be increased to reduce or eliminate leakage. All required increases in the compressive stress shall be documented in the Qualification Report.

4.1.2 Performance test fixtures shall be hydrostatically shell tested in accordance with MSS SP-61. Any detectable leakage during the shell test shall be noted in the Qualification Report. Minor stem leakage during shell test is permissible, but compressive stress on the packing may be increased to stop such leakage if specified by the test sponsor.

4.1.3 Normally, tests at room temperature [50 to 100^0F or (10 to 38^0C)] shall be performed at a pressure equal to the 100^0F (38^0C) standard or special class pressure rating of the test fixture. If the packing under evaluation is not intended for normal service at this elevated pressure [e.g. up to 11,250 psig (77,590 kPa) for a class 4500 fixture], the room temperature test pressure may be truncated. This must be documented in the Qualification Report. Either the full 100^0F (38^0C) pressure rating or the truncated pressure value will be the Maximum Qualified Packing Pressure (see Section 2.3) for this specific packing.

4.1.4 In addition to the room temperature tests, maximum temperature tests shall be conducted with saturated or superheated steam, air, or nitrogen. The pressure/temperature combination shall correspond to one given in ASME B16.34 for the class number of the performance test fixture. The packing chamber temperature shall be substantially equal to the Maximum Qualified Packing Temperature (see Section 2.4) that is intended for the packing material or material combination.

<u>Example</u>: A packing material combination is to be tested in a large Special Class 2500 ASTM A 217-WC9 performance test fixture, and a Maximum Qualified Packing Temperature of 700^0F (371^0C) is to be established. Assume that it is found that the mean temperature of the packing chamber in the test fixture is 350^0F (194^0C) less than the line fluid temperature. This requires a steam temperature[(a)] of 1050^0F (565^0C), and Table 2-1.10B of ASME B16.34 requires a test pressure of 1820 psig (12,550kPa).

4.1.5 The performance test program shall include a combination of "wear aging", "thermal aging", and "thermal equilibrium" tests to evaluate the sealing performance, service life, and stem friction of specific packing materials and material combinations.

(a) The relationship between packing temperature and fluid temperature may vary widely among various valve sizes and types. A packing material or material combination qualified in accordance with this Standard Practice may be suitable for lower or higher fluid temperatures when used in some valve types than in others. The valve manufacturer or user should consider the expected packing chamber temperature for each valve type and fluid temperature when selecting packings.

4.1.5.1 ***Room temperature testing*** shall be exclusively "wear aging", involving stem cycling to simulate valve opening and closing at a rate that avoids excessive frictional heating of the packing or test fixture. Stem speed shall be 4 to 18 inches/minute (either as rotating/rising or as non-rotating/rising motion). A dwell time of approximately 10 to 15 seconds shall be provided at each end of the stem stroke to permit checking for static leakage.

Standard cycle tests shall include 1000 full-stroke cycles. Visual inspections (or instrumented readings with equivalent or better sensitivity) for leakage (static or dynamic) shall be conducted and recorded at intervals not to exceed 100 cycles. If there is detectable leakage (see Section 2.2), the test shall be interrupted and the packing gland retightened to produce the same compressive stress as initially applied in Section 4.1.1 (or greater if necessary to stop leakage). The Qualification Report shall indicate the number of cycles at which tightening was necessary and the packing gland load required. The test shall be terminated if leakage cannot be stopped or if it recurs within 100 cycles of the last tightening.

Frictional force or torque measurements shall be recorded under test pressure at the beginning of the tests, before and after any retightening, or at intervals not to exceed 250 cycles. Record both static "breakaway" and "running" values if there is a significant difference. Measurements shall be corrected by calculation if necessary to account for effects of unbalanced pressure loads.

At least once within the first 10 cycles of the room temperature testing, cycling shall be stopped (with the test fixture under pressure) for an extended dwell period of approximately 48 hours. Frictional force or torque measurements shall be recorded immediately before and after the dwell. If a significant (over 50%) increase in readings is recorded, this shall be repeated with a 7-day dwell period under pressure.

A special test with higher numbers of cycles may be required for some valve applications. Extended cycle tests (over 1000 cycles) shall be identified in the Qualification Report.

4.1.5.2 ***Tests at the Maximum Qualified Packing Temperature*** shall be conducted on a new packing set, assembled and shell tested in accordance with Sections 4.1.1 and 4.1.2.

Testing shall include "thermal aging" of any packing materials or material combinations containing organic or unstable sealants, lubricants, cores, or binder (e.g. materials included to facilitate manufacture of braided packing rings). Such materials shall be subjected to a minimum of 4 hours exposure to the Maximum Qualified Packing Temperature prior to commencing other high temperature tests. This testing shall be conducted with the assembled packing set in the performance test fixture prior to cycle testing. The method of thermal aging shall be identified in the Qualification Test Report. Packing shall not be retightened after thermal aging unless required to stop detectable leakage.

A minimum of three thermal equilibrium tests shall be conducted with steam, air, or nitrogen in the test fixture and with the Maximum Qualified Packing Temperature and the pressure defined in Section 4.1.4.

Tests shall be conducted to simulate:

(1) closing a valve with a cool extended stem and

(2) opening a valve with a hot internal stem to evaluate effects of "thermal taper" (stem diameter difference due to temperature).

Prior to initiating stem motion, the fluid temperature, packing temperature, and the stem temperature, shall be stabilized. The packing area shall be monitored closely to observe any detectable leakage before, during, and immediately after stem travel. Any transient leakage shall be described in the Qualification Report. Retightening of the packing is not necessary if the leakage rate is not hazardous (in the judgment of the test laboratory or facility) and if it stops within one minute, but it may be tightened if specified by the test sponsor.

Wear aging test at the Maximum Qualified Packing Temperature shall include 1000 full-stroke cycles, conducted during thermal equilibrium tests (following stabilized tests described above). Cycling procedures and stem force or torque measurements shall be as required for room temperature tests in Section 4.1.5.1, except that extended dwell tests are not required. If there is detectable leakage, retightening and reporting shall be as described for room temperature tests. The test shall be terminated if leakage cannot be stopped or if it reoccurs within 100 cycles of the last tightening. Extended cycling tests (over 1000 cycles) shall be identified in the Qualification Report if performed.

After each thermal equilibrium test, the performance test fixture shall be depressurized and cooled until the packing and stem temperatures are below 200^0F (93^0C). Static packing leakage shall be monitored during cooldown.

Prior to resumption of high temperature testing, the performance test fixture shall be retested statically at below 200^0F (93^0C) at the Maximum Qualified Packing Pressure. Record any observations of detectable leakage and gland loading required to arrest the leakage (if any). The test shall be terminated if leakage cannot be stopped.

4.1.6 After each performance test, the test fixture shall be carefully examined for evidence of packing extrusion. The fixture shall then be dissembled and examined. Any test fixture damage that might have influenced packing performance (e.g. stem scoring) shall be recorded. The physical condition of the packing assembly shall be recorded. In particular, note evidence of extrusion of end ring material into clearances around the stem and gland.

4.2 ***Corrosion Tests*** shall be conducted using a fixture as illustrated in Figure 1 to evaluate tendencies of packing materials or material combinations to promote valve stem pitting. A minimum of three (3) packing/valve stem specimens (in addition to the control set below) shall be tested and described in the Qualification Report.

4.2.1 Corrosion test fixtures shall be cleaned (oil free) and assembled with packing installed in the same arrangement as used in performance tests, but with the packing loose.

A “Control” test fixture shall be included in each corrosion test batch. It shall be provided with a martensitic stainless steel stem (e.g. type 410) and uninhibited flexible graphite packing.

The test fluid shall be a 0.1% solution of anhydrous sodium sulfate (Na_2SO_4) in distilled water to produce a moderate acceleration of any possible galvanic corrosion. The fixture shall be charged with the test fluid and pressurized just enough to produce a distinct leakage.

Fixtures shall be placed immediately in a 100% humidity environment and maintained at temperature between 70 and 100^0F for a period of 1000 hours. The fixtures shall be mounted with the stems horizontal.

4.2.2 Test fixtures shall be disassembled carefully after the 1000 hour exposure and observed for evidence of deposits on stems. Findings shall be identified in the Qualification Report. Loose coatings shall be removed, and the stems shall be examined with magnification to identify any evidence of pitting[a] or other damage. In particular, note where pitting occurs (e.g. adjacent to bottom packing ring, center rings, or top ring). The report shall include a comparison of the number and relative sizes of any pits observed.

(a) Dimensional measurement of pits is not required. Due to difficulty in evaluating effects of stem damage, there are no pass/fail criteria for corrosion tests; however, it should be noted that serious stem pitting can contribute to accelerated packing wear in service.

Photographs, with low magnification if required, shall be taken of all stem specimens that exhibit damage. The Qualification Report shall provide a comparison (including photographs) of the observations for the packing material or material combination being qualified with similar observation made of the stem in the "Control" test fixture.

4.2.3 The packing chamber portions of test fixtures shall be examined for evidence of general or galvanic corrosion, and the Qualification Report shall contain a comparison of observations of all fixtures (including the "Control"). This report will be for information only.[(a)]

5. QUALIFICATION REPORT

5.1 A Qualification Report shall be prepared for each packing material or material combination and stem size tested in accordance with this Standard Practice. A brief abstract (1 or 2 pages) at the beginning of the report shall contain test result highlights in a simple format as shown in Figure 3. The balance of the report shall show clearly:

a) A full description of the packing material or material combination tested, including nominal dimensions and specific materials (not just brand name).

b) The test fluid media used (water and steam, air, or nitrogen).

c) The ASME B16.34 class number and designation (Standard, Special, or Limited) that was the basis for performance tests.

d) The Maximum Qualified Packing Pressure and actual fluid temperature for room temperature qualification tests.

e) The Maximum Qualified Packing Temperature and fluid pressure and temperature used for high temperature qualification tests.

f) The stem diameter used and other stem diameters the packing material or material combination is qualified for based on the tests performed.

g) The type of stem motion used (non-rotating/rising or rotating/rising).

h) Packing chamber and stem materials (including ASTM specifications) used in performance and corrosion test fixtures.

i) Actual packing chamber and gland dimensions and clearances, including any special test fixture dimensions or clearances not in accordance with MSS SP-120.

j) Actual (measured) surface finishes of stem outside diameter in contact with packing and packing chamber bore.

k) The stem travel used and stem travels the packing material or material combination is qualified for with other qualified stem diameters.

l) If alternate criteria were used for evaluating leakage, provide definition of "detectable leakage" (see Section 2.2.2) and a description of the methods used for leakage measurement.

m) General observations on leakage in room temperature and high temperature performance tests, and specific records on when retightening of packing was required to stop leakage.

Note: If either performance test had to be curtailed due to inability to stop leakage or need for readjustment within less than 100 cycles.

(a) Accelerated tests as described in this Standard Practice may not provide a realistic appraisal of the effects of packings on packing chamber corrosion.

n) Packing friction force[a] or torque measurements (corrected for unbalanced pressure loads if necessary) from the room temperature and high temperature performance tests. Include measurements before and after extended dwell tests.

o) Note if extended cycle testing (beyond 1000 cycles) was performed, and comment on effects of additional wear aging on performance of the packing material or material combination.

p) If live loading (see Section 3.1.5) was used, describe the live loading arrangement in detail. Compare results (tightness, friction force or torque) with and without live loading if the same packing material or material combination was previously tested with conventional gland loading.

q) Observations on condition of test fixtures and packing assemblies after performance tests (see Section 4.1.6), with emphasis on degree of degradation that might influence long term sealing margins. Include comments on fixture stem or gland conditions if they might have had an effect on packing performance.

(a) Friction coefficients based on a mathematical model may be included in the report for supplementary information, but the actual forces or torques shall also be included.

r) Observations on condition of stems used in corrosion tests, noting particularly any damage that would contribute to packing wear.

s) Specifically note comparison of pitting in tests with martensitic stainless steel stems (comparing packing tested with results with the uninhibited flexible graphite control test). Include photographs as described in Section 4.2.2. Include results with other stem materials is tested.

5.2 If desired, results of performance tests of two or more stem size/travel/pressure class combinations may be combined in one Qualification Report to show a complete profile of the capabilities of a specific packing material or material combination. A combined report shall show clearly any restrictions of qualification that may be related to size, type of motion, pressure, or temperature.

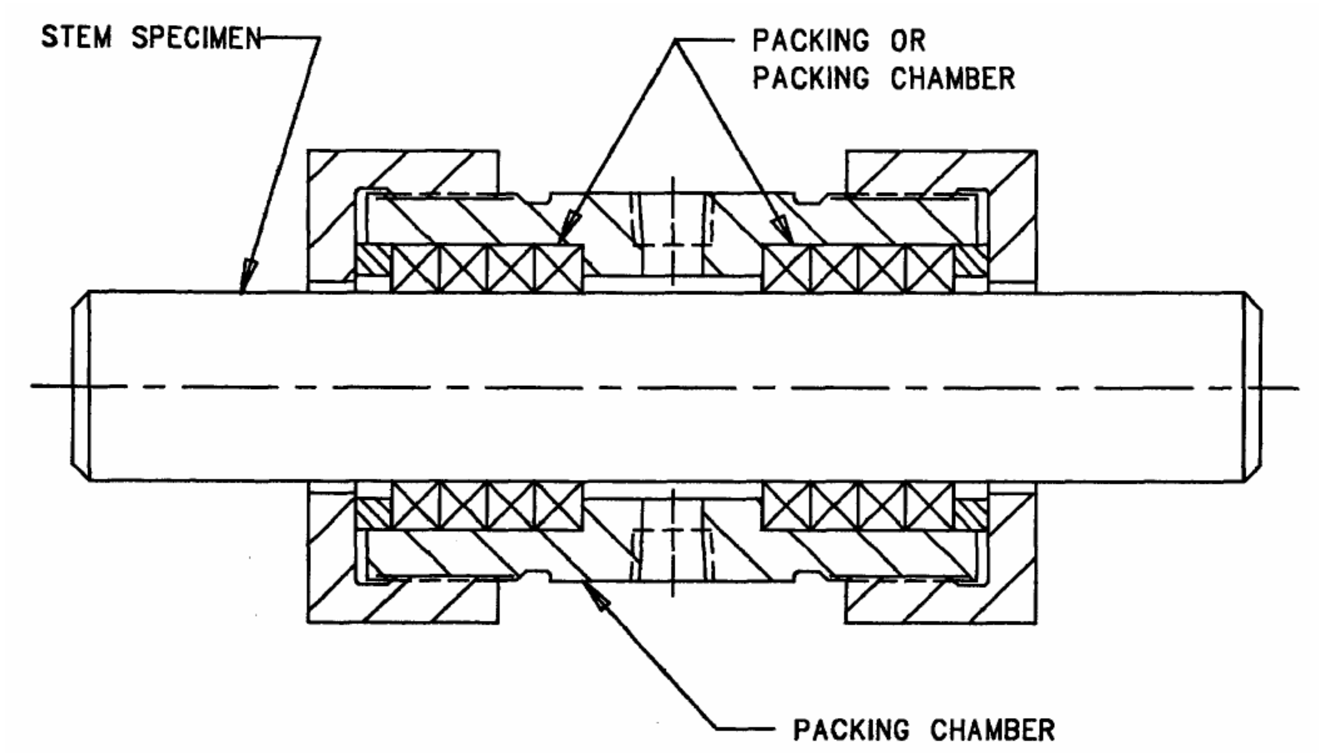

FIGURE 1 CORROSION TEST FIXTURE[(a)]

1 Inch (25.4 mm) Nominal Stem Diameter

(a) Dimensions, clearances, and surface finishes to be in accordance with Table 1 of MSS SP-120 where applicable.

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(INCLUDING CONTROL SAMPLE)
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</table>

FIGURE 2 TEST OUTLINE FOR BASIC QUALIFICATION TESTS[(a)]

(a) Extended or supplemental (e.g. live loaded) tests may be added.

Packing Brand (Manufacturer)	
Model or Style Number(s) (describe combinations where applicable)	
Packing Type (Materials)	
Packing Size (OD x ID x Length)	inches (mm)
Stem Travel	inches (mm)
Motion Type (check)	Non-Rotating/Rising
	Rotating/Rising
Stem Surface Finish	microinches
	(micrometers)
Packing Chamber Surface Finish	microinches
	(micrometers)
Performance Test Fluid Media (check)	Water and Steam
	Air
	Nitrogen
Maximum Qualified Packing Pressure	psig (kPa)
Maximum Qualified Packing Temperature	^{0}F (^{0}C)
Qualified Stem Diameter Range	Min. inches (mm)
	Max. inches (mm)
Qualified Stem Travel (Maximum)	inches (mm)
	Unlimited (check)
Qualified Motion Type (check)	Non-Rotating/Rising
	Rotating/Rising
Qualified Clearances (Reference MSS SP-120, Table 1)	
Gland/Bonnet Clearance A	inches (mm)
Stem/Gland Clearance B	inches (mm)
Stem/Bonnet Clearance C	inches (mm)
Qualified Life Cycle	cycles

FIGURE 3 QUALIFICATION REPORT ABSTRACT

ANNEX A
Referenced Standards and Applicable Dates

This Annex is an integral part of this Standard Practice and is placed after the main text for convenience.

Standard Name or Description

ASME, ANSI/ASME, ANSI, ASME/ANSI

B16.34 – 2004	Valves – Flanged, Threaded, and Welding End

MSS

SP-61-2003	Pressure Testing of Steel Valves
SP-96-2001 (R2005)	Guidelines on Terminology for Valves and Fittings
SP-105-1996 (R2005)	Instrument Valves for Code Applications
SP-120-2006	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)

Publications of the following organizations appear in the above list:

ASME — ASME International
Three Park Avenue
New York, NY 10016-5990

MSS — Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, NE
Vienna, VA 22180-4602

List of MSS Standard Practices
(Price List Available Upon Request)

Number	
SP-6-2001	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-2001	(R 05) Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System for Valves, Fittings, Flanges and Unions
SP-42-2004	Class 150 Corrosion Resistant Gate, Glove, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 01) Wrought Stainless Steel Butt-Welding Fittings
SP-44-2006	Steel Pipeline Flanges
SP-45-2003	Bypass and Drain Connections
SP-51-2003	Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings
SP-53-1999	(R 02) Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	(R 02) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-2001	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
SP-58-2002	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-60-2004	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-2003	Pressure Testing of Steel Valves
SP-65-2004	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-2002a	Butterfly Valves
SP-68-1997	(R 04) High Pressure Butterfly Valves with Offset Design
SP-69-2003	Pipe Hangers and Supports - Selection and Application (ANSI/MSS Edition)
SP-70-2006	Gray Iron Gate Valves, Flanged and Threaded Ends
SP-71-2005	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1999	Ball Valves with Flanged or Butt-welding Ends for General Service
SP-73-2003	Brazing Joints for Copper and Copper Alloy Pressure Fittings
SP-75-2004	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	(R 00) Guidelines for Pipe Support Contractual Relationships
SP-78-2005a	Gray Iron Plug Valves, Flanged and Threaded Ends
SP-79-2004	Socket-Welding Reducer Inserts
SP-80-2003	Bronze Gate, Globe, Angle and Check Valves
SP-81-2006	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
SP-83-2006	Class 3000 Steel Pipe Unions, Socket-Welding and Threaded
SP-85-2002	Gray Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-2002	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-88-1993	(R 01) Diaphragm Valves
SP-89-2003	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-2000	Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operation of Valves
SP-92-1999	MSS Valve User Guide
SP-93-1999	(R 04) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Liquid Penetrant Examination Method
SP-94-1999	(R 04) Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Ultrasonic Examination Method
SP-95-2006	Swage(d) Nipples and Bull Plugs
SP-96-2001	(R 05) Guidelines on Terminology for Valves and Fittings
SP-97-2006	Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding,Threaded and Buttwelding Ends
SP-98-2001	(R 05) Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	(R 05) Instrument Valves
SP-100-2002	Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Valves
SP-101-1989	(R 01) Part-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	(R 01) Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-104-2003	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 05) Instrument Valves for Code Applications
SP-106-2003	Cast Copper Alloy Flanges and Flanged Fittings, Class 125, 150 and 300
SP-108-2002	Resilient-Seated Cast-Iron Eccentric Plug Valves
SP-109-1997	(R 06) Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-2001	(R 05) Gray-Iron and Ductile-Iron Tapping Sleeves
SP-112-1999	(R 04) Quality Standard for Evaluation of Cast Surface Finishes -Visual and Tactile Method. This SP must be sold with a 10-surface, three dimensional Cast Surface Comparator, which is a necessary part of the Standard. Additional Comparators may be sold separately.
SP-113-2001	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-2001	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-2006	Excess Flow Valves 1 1/4 NPS and Smaller, for Fuel Gas Service
SP-116-2003	Service Line Valves and Fittings for Drinking Water Systems
SP-117-2006	Bellows Seals for Globe and Gate Valves
SP-118-2002	Compact Steel Globe & Check Valves - Flanged, Flangeless,Threaded & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-2003	Factory-Made Belled End Socket Welding Fittings
SP-120-2006	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-2006	Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP-122-2005	Plastic Industrial Ball Valves
SP-123-1998	(R 06) Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube
SP-124-2001	Fabricated Tapping Sleeves
SP-125-2000	Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves
SP-126-2000	Steel In-Line Spring-Assisted Center Guided Check Valves
SP-127-2001	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
SP-128-2006	Ductile Iron Gate Valves
SP-129-2003	Copper-Nickel Socket-Welding Fittings and Unions
SP-130-2003	Bellows Seals for Instrument Valves
SP-131-2004	Metallic Manually Operated Gas Distribution Valves
SP-132-2004	Compression Packing Systems for Instrument Valves
SP-133-2005	Excess Flow Valves for Low Pressure Fuel Gas Appliances
SP-134-2006	Valves for Cryogenic Service Including Requirements for Body/Bonnet Extensions
SP-135-2006	High Pressure Steel Knife Gate Valves

(R-YEAR) Indicates year standard reaffirmed without substantive changes

A large number of former MSS Practices have been approved by the ANSI or ANSI Standards, published by others. In order to maintain a single source of authoritative information, the MSS withdraws its Standard Practices in such cases.

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