

# Process Valve Qualification Procedure

API RECOMMENDED PRACTICE 591  
THIRD EDITION, SEPTEMBER 2003



**Helping You  
Get The Job  
Done Right.<sup>SM</sup>**



# Process Valve Qualification Procedure

## Downstream Segment

API RECOMMENDED PRACTICE 591  
THIRD EDITION, SEPTEMBER 2003



**Helping You  
Get The Job  
Done Right.<sup>SM</sup>**

## SPECIAL NOTES

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

API is not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, or federal laws.

Information concerning safety and health risks and proper precautions with respect to particular materials and conditions should be obtained from the employer, the manufacturer or supplier of that material, or the material safety data sheet.

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. Sometimes a one-time extension of up to two years will be added to this review cycle. This publication will no longer be in effect five years after its publication date as an operative API standard or, where an extension has been granted, upon republication. Status of the publication can be ascertained from the API Standards department telephone (202) 682-8000. A catalog of API publications, programs and services is published annually and updated biannually by API, and available through Global Engineering Documents, 15 Inverness Way East, M/S C303B, Englewood, CO 80112-5776.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this standard or comments and questions concerning the procedures under which this standard was developed should be directed in writing to the Director of the Standards department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005. Requests for permission to reproduce or translate all or any part of the material published herein should be addressed to the Director, Business Services.

API standards are published to facilitate the broad availability of proven, sound engineering and operating practices. These standards are not intended to obviate the need for applying sound engineering judgment regarding when and where these standards should be utilized. The formulation and publication of API standards is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

*All rights reserved. No part of this work may be reproduced, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Contact the Publisher, API Publishing Services, 1220 L Street, N.W., Washington, D.C. 20005.*

Copyright © 2003 American Petroleum Institute



## FOREWORD

This recommended practice is based on the knowledge and experience of petroleum refiners, valve manufacturers, and others, and its objective is to describe practices that will result in a purchaser's receipt of valves which consistently meet API valve specifications.

Any modifications, deletions, and amplifications necessary for individual users should be made by supplementing this recommended practice rather than by rewriting it.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any federal, state, or municipal regulation with which this publication may conflict.

Suggested revisions are invited and should be submitted to API, Standards department, 1220 L Street, NW, Washington, DC 20005.

## IMPORTANT INFORMATION CONCERNING USE OF ASBESTOS OR ALTERNATIVE MATERIALS

Asbestos is specified or referenced for certain components of the equipment described in some API standards. It has been of extreme usefulness in minimizing fire hazards associated with petroleum processing. It has also been a universal sealing material, compatible with most refining fluid services.

Certain serious adverse health effects are associated with asbestos, among them the serious and often fatal diseases of lung cancer, asbestosis, and mesothelioma (a cancer of the chest and abdominal linings). The degree of exposure to asbestos varies with the product and the work practices involved.

Consult the most recent edition of the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, Occupational Safety and Health Standard for Asbestos, Tremolite, Anthophyllite, and Actinolite, 29 *Code of Federal Regulations* Section 1910.1001; the U.S. Environmental Protection Agency, National Emission Standard for Asbestos, 40 *Code of Federal Regulations* Sections 61.140 through 61.156; and the U.S. Environmental Protection Agency (EPA) rule on labeling requirements and phased banning of asbestos products (Sections 763.160-179).

There are currently in use and under development a number of substitute materials to replace asbestos in certain applications. Manufacturers and users are encouraged to develop and use effective substitute materials that can meet the specifications for, and operating requirements of, the equipment to which they would apply.

SAFETY AND HEALTH INFORMATION WITH RESPECT TO PARTICULAR PRODUCTS OR MATERIALS CAN BE OBTAINED FROM THE EMPLOYER, THE MANUFACTURER OR SUPPLIER OF THAT PRODUCT OR MATERIAL, OR THE MATERIAL SAFETY DATA SHEET.



# CONTENTS

	Page
1 SCOPE .....	1
2 REFERENCED PUBLICATIONS .....	1
3 TERMS AND DEFINITIONS .....	1
4 PURCHASER RESPONSIBILITIES .....	2
5 MANUFACTURER QUALITY ASSURANCE PROGRAM .....	2
5.1 General .....	2
5.2 Documentation .....	2
5.3 Control of Purchased Items and Services .....	2
5.4 Control of Processes .....	3
5.5 Inspection .....	3
5.6 Examination and Testing .....	3
5.7 Testing Equipment .....	3
5.8 Handling, Storage and Shipping .....	3
5.9 Corrective Actions .....	3
5.10 Audits .....	3
6 VALVE QUALIFICATION .....	3
6.1 Data to be Provided by Manufacturer .....	3
6.2 Test Facility .....	4
6.3 Selection of Valves .....	4
6.4 Required Inspection and Testing .....	4
6.5 Documentation of Examination and Test Results .....	6
7 POST QUALIFICATION .....	6
APPENDIX A SUGGESTED SELECTION QUANTITIES FOR EXAMINATION AND TEST OF VALVES MADE IN ACCORDANCE WITH API VALVE STANDARDS .....	7
APPENDIX B STRENGTH TESTS FOR STEM SHAFT-TO-CLOSURE ELEMENT CONNECTIONS .....	9
Tables	
1 Material Tests .....	6
A-1 Suggested Size and Class to be Tested for Each Type Check Valve (Single Plate, Dual Plate, Swing Type) Made in Accordance with API Std 594 .....	7
A-2 Suggested Size and Class to be Tested for Each Type Plug Valve (Lubricated, Non-lubricated, Elastomer Lined, Wedge Type) Made in Accordance with API Std 599 .....	7
A-3 Suggested Size and Class to be Tested for Steel Gate Valves Made in Accordance with API Std 600 .....	7
A-4a Suggested Size and Class to be Tested for Flanged Steel Gate Valves Made in Accordance with API Std 602 .....	7
A-4b Suggested Size and Class to be Tested for Threaded/SW Steel Gate Valves Made in Accordance with API Std 602 .....	7

A-5	Suggested Size and Class to be Tested for Steel Gate Valves Made in Accordance with API Std 603. . . . .	7
A-6	Suggested Size and Class to be Tested for Each Type Ball Valve (Floating Type: End Entry, Split Body, Three Piece and Top Entry; Trunnion Type: Split body, Three Piece) Made in Accordance with API Std 608 . . . . .	8
A-7	Suggested Size and Material Type to be Tested for Butterfly Valves (Class 150, Ductile Iron, Grey Iron) Made in Accordance with API Std 609 (Category A) . . .	8
A-8	Suggested Size and Class to be Tested for Each Type of Offset Butterfly Valves Made in Accordance with API Std 609 (Category B) . . . . .	8



# Process Valve Qualification Procedure

## 1 Scope

This recommended practice provides recommendations for evaluation of a manufacturer's valve construction and quality assurance program for the purpose of determining a manufacturer's capability to provide new valves manufactured in accordance with the applicable API standards listed in Section 2.

Qualification of valves under this recommended practice is "manufacturing facility specific" and does not cover valves manufactured by other manufacturing facilities, whether owned by the same manufacturer or a third party.

## 2 Referenced Publications

The most recent editions of the following standards, codes, and specifications are cited in this recommended practice:

### API

Std 594	<i>Check Valves: Wafer, Wafer-lug and Double Flanged Type</i>
Std 598	<i>Valve Inspection and Testing</i>
Std 599	<i>Metal Plug Valves—Flanged, Threaded and Welding End</i>
Std 600	<i>Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries</i>
Std 602	<i>Compact Steel Gate Valves—Flanged, Threaded, Welding, and Extended Body Ends</i>
Std 603	<i>Corrosion-Resistant, Bolted Bonnet Gate Valves—Flanged and Butt-Welding Ends</i>
Std 608	<i>Metal Ball Valves—Flanged, Threaded, and Butt-Welding Ends</i>
Std 609	<i>Butterfly Valves: Double Flanged, Lug- and Wafer-Type</i>

### ASME<sup>1</sup>

B1.1	<i>Unified Inch Screw Threads (UN and UNR Thread Form)</i>
B16.5	<i>Pipe Flanges and Flanged Fittings</i>
B16.10	<i>Face-to-Face and End-to-End Dimensions of Valves</i>
B16.11	<i>Forged Fittings—Socket-Welding and Threaded</i>
B16.25	<i>Butt-Welding Ends</i>
B16.34	<i>Valves—Flanged, Threaded, and Welding End</i>
B18.2.2	<i>Square and Hex Nuts (Inch Series)</i>
B31.3	<i>Process Piping</i>

<sup>1</sup>American Society of Mechanical Engineers, 3 Park Avenue, New York, New York 10016-5990, [www.asme.org](http://www.asme.org).

### MSS<sup>2</sup>

SP-55	<i>Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components—Visual Method</i>
-------	---

### ISO<sup>3</sup>

ISO 9000	<i>Quality Management Systems</i>
----------	-----------------------------------

## 3 Terms and Definitions

**3.1 acceptance criteria:** Specified limits placed on the characteristics of an item, process, or service defined in codes, standards, or other requirement documents.

**3.2 audit:** A planned and documented activity performed to determine by investigation, examination, or evaluation of objective evidence the adequacy of and compliance with established procedures, instructions, drawings, and other applicable documents and the effectiveness of implementation.

**3.3 characteristic:** Any property or attribute of an item, process, or service that is distinct, describable, and measurable.

**3.4 corrective action:** A measure taken to rectify non-conformance and, where necessary, to preclude repetition of such conditions.

**3.5 manufacturer:** The entity whose name or trade mark appears on the valve.

**3.6 nonconformance:** Any item or action that does not meet the requirements of the standards listed in Section 2, or the manufacturer's specifications.

**3.7 purchaser:** A person, group, company, agency or corporation responsible for valve acceptance.

**3.8 qualified procedure:** An approved procedure that has been demonstrated to meet the specified requirements for its intended purpose.

**3.9 quality assurance:** Refers to the planned and systematic actions necessary to provide confidence that a valve is manufactured in accordance with the requirements of the referenced API standard and manufacturer's specifications.

**3.10 supplier:** An individual or organization that furnishes items in accordance with a procurement document. It is a term used to indicate any of the following: vendor, seller, contractor, subcontractor, or fabricator.

**3.11 traveler:** A process control document that accompanies the work through various manufacturing stages.

<sup>2</sup>Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 127 Park Street, N.E., Vienna, Virginia 22180, [www.mss-hq.com](http://www.mss-hq.com).

<sup>3</sup>International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, [www.iso.org](http://www.iso.org).



## 4 Purchaser Responsibilities

**4.1** It is the responsibility of the purchaser to verify the source of supply to assure that purchased valves are newly manufactured in accordance with the applicable standards.

**4.2** It is the responsibility of the purchaser to determine that the valve manufacturer can supply valves that meet the referenced API valve standards, and that the manufacturer continues to supply valves of appropriate quality. The purchaser shall also verify that the manufacturer has a working quality assurance program. The essential elements of a quality assurance program are described in Section 5.

**4.3** As part of the review and evaluation, the purchaser or his representative may survey the valve manufacturer's shops, and, as the purchaser deems appropriate, may survey the facilities of primary suppliers to the valve manufacturer, such as foundries and forge shops. The valve manufacturer shall provide access, upon request, at times that are mutually agreed. At the conclusion of a manufacturing facility survey, the purchaser or his representative shall conduct an exit interview with the facility managers for the purpose of communicating observed nonconforming activities, if any.

## 5 Manufacturer Quality Assurance Program

### 5.1 GENERAL

The manufacturer shall establish and maintain a quality assurance group that shall be responsible for establishing and maintaining a quality assurance program.

The quality assurance program shall follow the principles of an appropriate standard from the ISO 9000 series.

The quality assurance group shall be independent from the manufacturing department, and shall have the authority, access to work areas, and organizational freedom to identify quality problems; initiate solutions and verify the implementation of the solutions.

When a problem is discovered, the quality assurance group shall assure that further processing, delivery, installation, or use is controlled until proper disposition has been made of the nonconformant, deficient, or unsatisfactory condition.

### 5.2 DOCUMENTATION

#### 5.2.1 General

The organizational structure, functional responsibilities, levels of authority, and lines of communication for activities that affect quality shall be documented. The manufacturer shall establish and maintain documented procedures to control and verify the design of the product to assure that specified requirements are met.

#### 5.2.2 Design Input

Design basis, performance requirements, and codes and standards, shall be identified and documented.

#### 5.2.3 Document Control

The preparation, distribution, and modification of documents, such as drawings, specifications, and procedures that specify quality requirements or prescribe activities affecting quality shall be controlled to assure that the correct versions of the documents are employed.

### 5.3 CONTROL OF PURCHASED ITEMS AND SERVICES

#### 5.3.1 General

Purchased items and services shall be controlled by the manufacturer to assure conformance with the specified requirements. This control shall provide for the following as appropriate:

- Evaluation and selection of the source.
- Evaluation of objective evidence of quality, furnished by the supplier.
- Inspection, audit, and examination of items and services upon delivery or completion.
- Confirmation of a quality assurance program consistent with the requirement of this recommended practice.

#### 5.3.2 Receiving Inspection

The manufacturer shall use receiving inspection to verify the conformance by a supplier to the specified requirements. The manufacturer shall establish acceptance criteria for the items inspected. If the procurement documents require the supplier to furnish documentation, the receiving inspection shall be coordinated with a review of the supplier's documentation.

#### 5.3.3 Control of Supplier Nonconformances

The manufacturer shall establish and document methods for the disposition of items that do not meet the requirements of the procurement documents.

#### 5.3.4 Right of Access

At each level of procurement, the manufacturer's procurement documents shall require the supplier to provide access to his plant facilities and records for inspection or audit by the manufacturer, his designated representative, and other parties authorized by the manufacturer.



## 5.4 CONTROL OF PROCESSES

### 5.4.1 General

Processes that affect the quality of items or services shall be controlled by instructions, procedures, drawings, checklists, or travelers. Special processes that control or verify quality, such as those used in welding, heat treatment, and nondestructive examination, shall be performed by qualified personnel in accordance with the specified requirements.

### 5.4.2 Acceptance Criteria

The applicable requirements of relevant codes and standards, including acceptance criteria for the processes, shall be specified or referenced in the manufacturer's procedures or instructions.

### 5.4.3 Records

Records shall be maintained as appropriate for currently qualified personnel, processes, and the equipment for each special process.

## 5.5 INSPECTION

**5.5.1** Characteristics to be inspected and inspection methods to be employed shall be specified. Inspection shall verify that the characteristics of an item are within the specified limits in accordance with the applicable API valve standard. Identification of a rejected item shall be maintained until the item is repaired or scrapped.

**5.5.2** Inspection personnel shall have organizational independence from manufacturing and production personnel.

**5.5.3** Where necessary to verify quality, items should be inspected while in process or under construction. If it is not practical to inspect items while in process or under construction, indirect control should be provided by monitoring of the processing methods, equipment, and personnel. Inspected items shall be segregated from un-inspected items.

## 5.6 EXAMINATION AND TESTING

**5.6.1** Examination and testing requirements and acceptance criteria shall be based on requirements specified in applicable design documents.

**5.6.2** Test procedures shall include or reference test objectives and provisions for assuring that the prerequisites for the given test have been met, that adequate instrumentation is available and used, and that necessary monitoring is performed.

**5.6.3** Tested items shall be segregated from untested items. Identification of a rejected item shall be maintained until the item is repaired or scrapped.

## 5.7 TESTING EQUIPMENT

Testing equipment and measuring devices shall be of the appropriate type, range, accuracy, and tolerance. Testing equipment shall be calibrated at the prescribed intervals or before use.

## 5.8 HANDLING, STORAGE AND SHIPPING

The handling, storage, and shipping of items shall be conducted in accordance with established procedures or specified instructions.

## 5.9 CORRECTIVE ACTIONS

Documented procedures shall be established and maintained for implementing corrective and preventive actions. Statistical techniques may be used to verify the acceptability of process capability and product characteristics.

Corrective action includes:

- Identifying, investigating, and documenting the cause of repetitive nonconformances related to product, process, and/or quality system, and recording the results.
- Determining and implementing corrective action needed to eliminate cause of nonconformances.
- Using appropriate sources of information (e.g., processes, work operations, audit results, quality records, etc.) to detect, analyze and eliminate potential causes of nonconformances.

## 5.10 AUDITS

The manufacturer's quality assurance group shall perform periodic audits to verify compliance with the quality assurance program. The audit results shall be documented and shall be reviewed by the responsible manufacturing management.

## 6 Valve Qualification

### 6.1 DATA TO BE PROVIDED BY MANUFACTURER

**6.1.1** General assembly drawings of one valve size of each design for each pressure class shall be available to the test facility. These drawings shall show the construction, including stem-to-wedge, disk, ball, or plug connection; guides; bearings; stem seals; body joint, seat details and seal. They shall also include descriptions of the construction materials for all of the parts, including fasteners. The manufacturer shall also identify the trim and sealing materials used.

**6.1.2** If welding, including casting repair, was used in the manufacture of the valves being evaluated, the applicable qualification and procedure documents shall, upon request, be available for evaluation.

**6.1.3** The manufacturer shall make available a tabulation of the sources from which castings and forgings used for bodies, bonnets, covers, and closure elements (e.g., wedges, disks or



balls) were obtained and the sources from which completed valves were obtained.

**6.1.4** The manufacturer shall provide the recommended closure torques or rim-pull handle forces required to adequately seat the valve for all sizes of valves being evaluated.

**6.1.5** As part of the test program, the manufacturer shall provide written certification, signed by an officer of the manufacturing company, which states that the manufacturer's production valves, regardless of size, pressure class, or materials of construction, are equivalent to the valves involved in the qualification and comply with the applicable product standards.

**6.1.6** The manufacturer shall identify the name and location of the facility where the valves undergo final assembly and testing for inclusion in the final report required by 6.5.

## 6.2 TEST FACILITY

The manufacturer shall engage an independent testing laboratory, to perform the inspections, examinations, and tests described in this section. The facilities used shall be mutually agreeable to the purchaser and the manufacturer. The laboratory staff responsible for testing shall include a degreed, or licensed metallurgical engineer or mechanical engineer.

The laboratory, or combination of laboratories, shall be equipped to perform, or supervise the performance of, nondestructive examination, physical tests, and chemical analyses on materials. The laboratory staff shall be familiar with the applicable API standards and with the codes, standards, and specifications referenced in those standards. The laboratory's proposed program shall cover the following:

- a. Qualifications of the personnel performing the inspections and tests.
- b. Test details and format used to present the results of the tests.
- c. Number, sizes, and types of valves examined (see Appendix A).
- d. Source of the test valves and test valves selection method.

## 6.3 SELECTION OF VALVES

**6.3.1** In order to ensure that the test valves were not made specifically for the tests, a random sampling feature shall be incorporated into the program. The laboratory personnel shall select the test valves randomly from the manufacturer's or distributor's stock. Alternatively, the purchaser may choose to select the valves to be tested.

**6.3.2** It is expected that the manufacturer shall have sufficient stock from which a random sampling of their valve products may be selected. Reduced sample lot may be agreed upon by the purchaser and manufacturer. Selected valves shall be clearly identified. Once testing commences, testing

shall be limited to the randomly selected sample lot with no substitutions.

## 6.4 REQUIRED INSPECTION AND TESTING

**6.4.1** All of the pressure tests specified in API Std 598, including the optional closure tests, shall be made on each valve. Seating surfaces shall be dry or coated only with very light oil no heavier than kerosene. For seat tests, valves shall be tightened to the closure torque recommended by the manufacturer.

The torque is to be applied by a calibrated torque wrench either directly or through a gear operator to the center of the stem/shaft. If the torque recommended by the manufacturer should prove to be inadequate, the torque may be increased incrementally, to a maximum of 1.25 times the recommended value, until the seat leakage is within allowable limits. The required closure torques shall be measured and reported. During seat tests, external forces that affect seat leakage shall not be applied to the valve ends.

Each valve shall be (stroke) tested operational with the stem in the horizontal position (flow in the horizontal direction) to confirm that the closure element does not hang up.

**6.4.2** The following dimensions and finishes shall be measured on each valve, as applicable, and compared with those specified in the applicable standards, and the manufacturer's requirements:

- a. Face-to-face dimension (ASME B16.10).
- b. Flange dimensions (ASME B16.5), including orientation of bolt holes.
- c. Butt-welding end dimensions (ASME B16.25).
- d. Center to top (closed and open position).
- e. Hand wheel diameter.
- f. Facing finish, including number of grooves per in., of raised-face end flanges (ASME B16.5) and bonnet-joint flanges.
- g. Type of bolting threads (ASME B1.1 and B18.2.2).
- h. Body and bonnet thickness.
- i. Stem diameter at the extremities and midpoint of the packing contact area, including minimum OD and thread major/minor diameters, surface finish, and straightness.
- j. Wedge-wear travel.
- k. Stem projection.
- l. Number and size of bonnet or cover bolts.
- m. Stuffing box dimensions and surface finish, and gland follower dimensions.
- n. Socket-weld ends and threaded ends (ASME B16.11).
- o. Gasket dimensions.
- p. Port opening (bore and seat ring inside diameters).
- q. Backseat ID and finish.
- r. Bonnet joint dimensions.
- s. Stem cylindricity and straightness.



**6.4.3** All valve parts shall be visually examined to confirm and document the following, as applicable:

- a. Markings are as specified in the applicable API valve standard.
- b. Identification plate is as specified in the applicable API valve standard.
- c. Construction is as specified in the applicable API valve standard.
- d. Hand wheel, gear operator or lever operates clockwise to close when viewed from the outboard end of the stem, and that the hand wheel, gear operator or lever is properly marked with an arrow and the word OPEN to indicate the opening direction.
- e. Hand wheel conditions, material and method of fabrication.
- f. Packing type and arrangement, size, and number of rings as well as the number of rings that could be added after the shell hydro-test.
- g. Method of attaching the seat ring to the body.
- h. Presence of lubrication on the stem nut.
- i. Nothing other than light lubricant, having a viscosity no greater than kerosene, has been used on valve sealing surface, except for valves using lubricant as their primary sealing mechanism.
- j. Type of closure element.
- k. T-head is integral (without welding or weld buildup) with the stem.
- l. A fully open gate/plug/ball completely clears the seat openings.
- m. Any disk nut on swing check valves is positively locked in place.
- n. Number, location, and size of any tapped openings in pressure-containing parts.
- o. Type and direction of the stem threads.
- p. Markings on the bolting for the body, bonnet, and cover joints are as specified in applicable ASTM specifications.
- q. Method of attachment of the hand wheel nut.
- r. Tack welding is used or is not used in securing various components.
- s. Type of end protection used in shipment.
- t. Body-to-bonnet cover gasket design and material.
- u. Blow-out proof stem design.

**6.4.4** After completion of required dimensional and visual examinations, paint and sealants shall be removed from the bodies, bonnets, and covers, and each of these valve pressure-containing component shall be visually examined to determine the following:

- a. Forgings are free from laps and seams.
- b. Surface quality of castings, including the body, bonnet, and cover, is as specified in MSS SP-55.

After completing visual examination a photograph of the disassembled valve parts, readable nameplate, and cast-in markings shall be made.

**6.4.5** Material tests listed in Table 1 shall be made on a minimum of five of the sample valves. The source of each body and bonnet (or cover) as well as each material group from each material source shall be sampled. Chemical composition and hardness shall be nondestructively determined except that small samples may be removed from the body, bonnet, or cover in a manner that will not affect the integrity of the component (e.g., areas such as bosses, ribs, and flange perimeters).

**6.4.6** Strength tests of the stem/shaft-to-closure element connection shall be performed on valves as indicated in Appendix A, in accordance with Appendix B.

The manufacturer shall make available to the laboratory conducting the strength tests a guide for sizing the required test fixtures by providing the calculated stem shaft-to-closure element failure loads for the valves to be tested.

**6.4.7** All pressure-retaining welds shall be completely radiographed in accordance with the requirements of Table 341.3.2 of ASME B31.3, using the acceptance criteria for normal fluid service conditions. Butt-welding end preparations, welds in fabricated wedges, and pressure-retaining welds that can not be radiographed shall be examined in accordance with ASME B16.34 Annex C by either the magnetic particle or the liquid penetrant method.

**6.4.8** Sections of cast valves, as identified in 8.3.1.1 of ASME B16.34 and shown in Figures 6-16, from four valves or 25% of the sample lot (whichever is larger) shall be examined by radiography. A minimum of one valve from each foundry source shall be examined. The procedure shall be in accordance with ASME B16.34, Annex B. The laboratory shall report each type of discontinuity for each film, with sketches illustrating the locations of all films.

**6.4.9** Four hand wheels out of the sample lot shall be subjected to a hammer test. Using normal force, the hammer (3 lb. [13.34 N] for valves NPS 4 and smaller, 10 lb. [44.482 N] for valves NPS 6 and larger) should strike the outer rim between the spokes at an angle perpendicular to the plane of the hand wheel, and any damage reported.

**6.4.10** Each test hand wheel shall be subjected to a torque test, applying three times the torque recommended by the manufacturer for closure. In applying the torque, the center of the hand wheel is to be restrained and the force required to produce the desired torque applied to the outer rim of the hand wheel at the spoke junction, using an attachment mounted to the wrench. Any damage shall be reported.



Table 1—Material Tests

Tests	Body	Cover/ Bonnet	Seat Ring	Stem	Yoke Nut	Disk	Back Seat	RTJ Bonnet Gasket	Bonnet Bolts <sup>c</sup>
Chemical Composition	x	x	x <sup>a</sup>	x	x	x <sup>a</sup>	x	x	x
Tensile Strength	b	b	—	—	—	—	—	—	x <sup>d</sup>
Yield Strength	b	b	—	—	—	—	—	—	—
Elongation	b	b	—	—	—	—	—	—	—
Reduction of Area	b	b	—	—	—	—	—	—	—
Hardness (HB)	x	x	x	x	x	x	x	x	x

Note: RTJ = ring type joint.

<sup>a</sup>If seating surfaces are welded, chemical analysis shall be made on both metals (weld metal and base metal). If seating surfaces are applied in the form of thin plates welded to the disk, chemical analysis shall be made on the disk, the thin plates, and the attachment welds. Any welds attaching seats or seating surfaces shall be dye-penetrant examined. Neither cracks nor lack of fusion is allowed.

<sup>b</sup>These test results may be taken from mill test reports.

<sup>c</sup>Four sizes of bonnet bolts and nuts shall be tested, randomly selected from two of the largest and two of the smallest valve sizes in the sample lots from Tables A-3 and A-5.

<sup>d</sup>Bonnet bolt tensile strength shall be estimated using the measured hardness readings and the correlations (hardness to tensile strength) in ASTM A370.

## 6.5 DOCUMENTATION OF EXAMINATION AND TEST RESULTS

The test facility shall assemble all the data required by this section into a single document. The disposition of the document shall be specified by the manufacturer.

## 7 Post Qualification

**7.1** Changes to the following items shall void the qualification of valves for which this recommended practice was intended to qualify:

1. Design change that will reduce the strength or impair operability of the valve, or;
2. Location of the manufacturing facilities.

**7.2** Changes to any item listed below will not void the qualification of valves for which this recommended practice was

intended to qualify, provided that the manufacturer notifies the purchaser and complies with any additional requirements the purchaser may specify:

- a. Material grade.
- b. Ownership.
- c. Types and materials of packing and gaskets.
- d. Quality control procedures.

**7.3** Changes to the suppliers and/or location of supply of pressure-containing forgings and castings will not void the qualification provided that the manufacturer qualifies the components per 6.4.4, 6.4.5 and 6.4.8. Selection requirements for parts to be examined shall be per 6.3. Documentation of examination and test results shall be per 6.5. Any one previously provided information per 6.1.3 shall be notified of these changes.



## APPENDIX A—SUGGESTED SELECTION QUANTITIES FOR EXAMINATION AND TEST OF VALVES MADE IN ACCORDANCE WITH API VALVE STANDARDS

- For each specified valve design, the minimum suggested sample lot is provided in Tables A-1 through A-8.
- For each NPS and Class combination listed in the tables, the sample lot for each manufacturing plant location shall include at least one valve for each body and bonnet (or cover) source, and one valve for each material group (carbon steel, low chrome alloy, and stainless steel).
- For valves not covered by API standards, the minimum suggested sample lot may be established by agreement between the manufacturer and end user.

Table A-1—Suggested Size and Class to be Tested for Each Type Check Valve (Single Plate, Dual Plate, Swing Type) Made in Accordance with API Std 594

NPS	Class	Quantity (Each NPS)
4, 18	150	1
3, 12	300	1

Table A-2—Suggested Size and Class to be Tested for Each Type Plug Valve (Lubricated, Non-lubricated, Elastomer Lined, Wedge Type) Made in Accordance with API Std 599

NPS	Class	Strength Test (NPS) <sup>1</sup>	Quantity (Each NPS)
4, 8	150	8	1
3	300	3	1
3, 6	600	—	1

<sup>1</sup>See Appendix B for test details.

Table A-3—Suggested Size and Class to be Tested for Steel Gate Valves Made in Accordance with API Std 600<sup>1</sup>

NPS	Class	Strength Test (NPS) <sup>2</sup>	Quantity (Each NPS)
4, 12, 24	150	4, 12	1
3, 12	300	3, 12	1
3, 12	600	—	1

<sup>1</sup>Unless otherwise requested, all selected valves shall have flanged ends.

<sup>2</sup>See Appendix B for test details.

Table A-4a—Suggested Size and Class to be Tested for Flanged Steel Gate Valves Made in Accordance with API Std 602

NPS	Class	Strength Test (NPS) <sup>1</sup>	Quantity (Each NPS)
3/4, 1	150	3/4	3
3/4, 1	300	3/4	3
1 1/2, 2	600	1 1/2	3
1, 2	1500	—	3

<sup>1</sup>Strength test required for only one valve for each material group. See Appendix B for test details.

Table A-4b—Suggested Size and Class to be Tested for Threaded/SW Steel Gate Valves Made in Accordance with API Std 602

NPS	Class	Strength Test (NPS) <sup>1</sup>	Quantity (Each NPS) <sup>2</sup>
1/2, 1 1/2	800	1/2	3
3/4	800	3/4	10
1	800	1	5
3/4, 2	1500	3/4	3
1, 1 1/2	1500	1	5

<sup>1</sup>Strength test required for only one valve for each material group. See appendix B for test details.

<sup>2</sup>For each NPS/Class combination, one valve shall be of socket weld construction, except that for 3/4 NPS Class 800, three valves shall be of socket weld construction. The remaining valves shall be supplied with threaded ends.

Table A-5—Suggested Size and Class to be Tested for Steel Gate Valves Made in Accordance with API Std 603<sup>1</sup>

NPS	Class	Strength Test (NPS)	Quantity (Each NPS)
4, 12, 24	150	4, 12	1
3, 12	300	3, 12	1
3, 12	600	—	1

<sup>1</sup>Unless otherwise requested, all selected valves shall have flanged ends.

Table A-6—Suggested Size and Class to be Tested for Each Type Ball Valve (Floating Type: End Entry, Split Body, Three Piece and Top Entry; Trunnion Type: Split Body, Three Piece) Made in Accordance with API Std 608<sup>1</sup>

NPS	Class	Strength Test (NPS) <sup>2</sup>	Quantity (Each NPS)
4, 8	150	4	1
3, 6	300	6	1

<sup>1</sup>Metal-seated valves are not covered by this Table.

<sup>2</sup>See appendix B for test details.

Table A-8—Suggested Size and Class to be Tested for Each Type of Offset Butterfly Valves Made in Accordance with API Std 609 (Category B)

NPS	Class	Strength Test (NPS) <sup>2</sup>	Quantity (Each NPS) <sup>1</sup>
3, 12, 24	150	12	1
4, 12	300	12	1
3, 12	600	12	1

<sup>1</sup>Selection shall include at least one flanged and one lug style design for each class.

<sup>2</sup>See Appendix B for strength test details.

Table A-7—Suggested Size and Material Type to be Tested for Butterfly Valves (Class 150, Ductile Iron, Grey Iron) Made in Accordance with API Std 609 (Category A)

NPS	Class/Material	Quantity (Each NPS)
8, 12, 24	150	1
12, 24	Ductile Iron	1
12, 24	Grey Iron	1



## APPENDIX B—STRENGTH TESTS FOR STEM SHAFT-TO-CLOSURE ELEMENT CONNECTIONS

**B.1** For steel gate valves, direct tensile loads shall be applied to wedge-stem-stem nut assemblies to determine the location of the first point of failure and the magnitude of the loads at failure. The first point of failure must occur at a location that is outside the valve pressure boundary.

**B.2** For metal plug/ball valves and category B butterfly valves, direct torsional loads shall be applied to stem-to-closure element assemblies to determine the location of the first point of failure and the magnitude of the loads at failure. The first point of failure must occur at a location that is outside the valve pressure boundary.

**B.3** If any of the tested assemblies fail to meet the requirements of the first two paragraphs, all of the valves in the sample lot shall have the strength tests for stem shaft-to-closure element connections performed, and the results reported.

**B.4** A dimensional analysis of the stem-to-closure element connection of all of the valve sizes for which approval is sought shall demonstrate that all of the connections are similarly proportioned to the tested stems and closure elements. If different product forms or different material mechanical properties are involved with untested valve sizes, additional stem-to-closure element tests shall be made to demonstrate the soundness of the other designs and/or materials.





# 2003 Publications Order Form



Effective January 1, 2003.

API Members receive a 50% discount where applicable.

The member discount does not apply to purchases made for the purpose of resale.

Available through Global Engineering Documents:

**Phone Orders: 1-800-854-7179** (Toll-free in the U.S. and Canada)  
**303-397-7956** (Local and International)

**Fax Orders: 303-397-2740**

**Online Orders: www.global.ihs.com**

**Date:** \_\_\_\_\_

☐ **API Member** (Check if Yes)

**Invoice To** (☐ Check here if same as "Ship To")

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

Department: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State/Province: \_\_\_\_\_

Zip/Postal Code: \_\_\_\_\_ Country: \_\_\_\_\_

Telephone: \_\_\_\_\_

Fax: \_\_\_\_\_

E-Mail: \_\_\_\_\_

**Ship To** (UPS will not deliver to a P.O. Box)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

Department: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State/Province: \_\_\_\_\_

Zip/Postal Code: \_\_\_\_\_ Country: \_\_\_\_\_

Telephone: \_\_\_\_\_

Fax: \_\_\_\_\_

E-Mail: \_\_\_\_\_

Quantity	Product Number	Title	SO★	Unit Price	Total
	<b>CX60011</b>	API 600, <i>Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries—Modified National Adoption of ISO 10434: 1998</i>		\$ 76.00	
	<b>C57801</b>	RP 578, <i>Material Verification Program for New and Existing Alloy Piping Systems</i>		\$ 89.00	
	<b>C58902</b>	Std 589, <i>Fire Test for Evaluation of Valve Stem Packing</i>		\$ 54.00	
	<b>C59807</b>	Std 598, <i>Valve Inspection and Testing</i>		\$ 50.00	
	<b>C60700</b>	Std 607, <i>Fire Test for Soft-seated Quarter-turn Valves</i>		\$ 50.00	
	<b>C62101</b>	RP 621, <i>Reconditioning of Metallic Gate, Globe, and Check Valves</i>		\$ 86.00	

☐ **Payment Enclosed**      ☐ **P.O. No.** (Enclose Copy) \_\_\_\_\_

☐ **Charge My Global Account No.** \_\_\_\_\_

☐ **VISA**    ☐ **MasterCard**    ☐ **American Express**    ☐ **Diners Club**    ☐ **Discover**

Credit Card No.: \_\_\_\_\_

Print Name (As It Appears on Card): \_\_\_\_\_

Expiration Date: \_\_\_\_\_

Signature: \_\_\_\_\_

**Subtotal**

**Applicable Sales Tax** (see below)

**Rush Shipping Fee** (see below)

**Shipping and Handling** (see below)

**Total** (in U.S. Dollars)

★ To be placed on Standing Order for future editions of this publication, place a check mark in the SO column and sign here:

**Pricing and availability subject to change without notice.**

**Mail Orders** – Payment by check or money order in U.S. dollars is required except for established accounts. State and local taxes, \$10 processing fee\*, and 5% shipping must be added. Send mail orders to: **API Publications, Global Engineering Documents, 15 Inverness Way East, M/S C303B, Englewood, CO 80112-5776, USA.**

**Purchase Orders** – Purchase orders are accepted from established accounts. Invoice will include actual freight cost, a \$10 processing fee\*, plus state and local taxes.

**Telephone Orders** – If ordering by telephone, a \$10 processing fee\* and actual freight costs will be added to the order.

**Sales Tax** – All U.S. purchases must include applicable state and local sales tax. Customers claiming tax-exempt status must provide Global with a copy of their exemption certificate.

**Shipping** (U.S. Orders) – Orders shipped within the U.S. are sent via traceable means. Most orders are shipped the same day. Subscription updates are sent by First-Class Mail. Other options, including next-day service, air service, and fax transmission are available at additional cost. Call 1-800-854-7179 for more information.

**Shipping** (International Orders) – Standard international shipping is by air express courier service. Subscription updates are sent by World Mail. Normal delivery is 3-4 days from shipping date.

**Rush Shipping Fee** – Next Day Delivery orders charge is \$20 in addition to the carrier charges. Next Day Delivery orders must be placed by 2:00 p.m. MST to ensure overnight delivery.

**Returns** – All returns must be pre-approved by calling Global's Customer Service Department at 1-800-624-3974 for information and assistance. There may be a 15% restocking fee. Special order items, electronic documents, and age-dated materials are non-returnable.

**\*Minimum Order** – There is a \$50 minimum for all orders containing hardcopy documents. The \$50 minimum applies to the order subtotal including the \$10 processing fee, excluding any applicable taxes and freight charges. If the total cost of the documents on the order plus the \$10 processing fee is less than \$50, the processing fee will be increased to bring the order amount up to the \$50 minimum. This processing fee will be applied before any applicable deposit account, quantity or member discounts have been applied. There is no minimum for orders containing only electronically delivered documents.



# There's more where this came from.

The American Petroleum Institute provides additional resources and programs to the oil and natural gas industry which are based on API® Standards. For more information, contact:

- |   |  |
|---|--|
| • API Monogram® Licensing Program                         | Phone: 202-962-4791<br>Fax: 202-682-8070 |
| • American Petroleum Institute Quality Registrar (APIQR®) | Phone: 202-962-4791<br>Fax: 202-682-8070 |
| • API Spec Q1® Registration                               | Phone: 202-962-4791<br>Fax: 202-682-8070 |
| • API Perforator Design Registration                      | Phone: 202-962-4791<br>Fax: 202-682-8070 |
| • API Training Provider Certification Program             | Phone: 202-682-8490<br>Fax: 202-682-8070 |
| • Individual Certification Programs                       | Phone: 202-682-8161<br>Fax: 202-962-4739 |
| • Engine Oil Licensing and Certification System (EOLCS)   | Phone: 202-682-8233<br>Fax: 202-962-4739 |
| • Training/Workshops                                      | Phone: 202-682-8490<br>Fax: 202-682-8070 |

Check out the API Publications, Programs, and Services Catalog online at [www.api.org](http://www.api.org).



**American Petroleum Institute**

Helping You Get The Job Done Right.®





Additional copies are available through Global Engineering Documents at (800) 854-7179 or (303) 397-7956

Information about API Publications, Programs and Services is available on the World Wide Web at: <http://www.api.org>



1220 L Street, Northwest  
Washington, D.C. 20005-4070  
202-682-8000

Product No. C59103