Recommended Practice for the Repair and Remanufacture of Pipeline Valves

API RECOMMENDED PRACTICE 6DR
SECOND EDITION, MAY 2012

AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

Contents

Recommended Practice for the Repair and Remanufacture of Pipeline Valves

1 Scope

This recommended practice provides guidelines for the repair and remanufacture of steel ball, check, gate, and plug valves normally used in pipeline applications, as defined by API 6D.

This recommended practice covers repair or remanufacturing of end user's (owner's) valves for continued service in the owner's production applications. It does not cover repair or remanufacture of used or surplus valves intended for resale.

Repaired or remanufactured valves may not meet API 6D and/or the OEM original product definition (OPD) for new valves.

The owner is responsible for the correct application of valves repaired or remanufactured per this document.

Field repair is outside the scope of this document.

2 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. For undated references, the latest edition of the document referred to applies. Referenced standards may be either the applicable edition shown herein or the latest revision, provided the reconditioner can show that the latest edition meets or exceeds requirements of the specific edition listed. When the latest edition is specified, it may be used on issue, and shall become mandatory six months from the date of the revision.

API Specification 6D, *Specification for Pipeline Valves*

ASME Boiler and Pressure Vessel Code, Section V [1] *Non-Destructive Evaluation*

ASME Boiler and Pressure Vessel Code, Section IX, *Welding and Brazing Qualifications*

ASNT SNT-TC-1A [2], *Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing*

ISO 9712 [3]*, Non-destructive Testing — Qualification and Certification of Personnel*

NACE MR0175/ISO 15156 [4], *Materials for Use in H_2S-containing Environments in Oil and Gas Production*

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1 ASME International, 3 Park Avenue, New York, New York 10016-5990, www.asme.org.
2 American Society for Nondestructive Testing, Inc., 1711 Arlington Lane, P.O. Box 28518, Columbus, Ohio 43228-0518, www.asnt.org.
3 International standard Organization, Case postale 56, CH-1211 Geneva 20, www.iso.org.
4 NACE International (formerly the National Association of the Corrosion Engineers), 1440 South Creek Drive, P.O. Box 218340, Houston, Texas 77218-8340, www.nace.org.

3 Terms, Definitions, and Abbreviations

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

3.1 Terms and Definitions

3.1.1
end user, owner
The entity that holds title to or applies the valve to a particular process.

3.1.2
original product definition
Complete definition of the requirements for the original assembled equipment, single equipment unit, or component part, including specified limits and tolerances, health, safety and environmental requirements, limitations of use, owner specific requirements, design acceptance criteria, materials of construction, materials processing requirements and physical properties, physical dimensions, and requirements for manufacturing process controls, inspection, assembly and testing, marking, handling, storage, maintenance, and records requirements.

3.1.3
recondition
Repair and/or remanufacture.

3.1.4
remanufacture
Activities involving disassembly, reassembly, and testing with or without replacement of parts. Machining, welding, heat-treating, other manufacturing operations, or replacement of bodies may be employed.

3.1.5
repair
Activities involving disassembly, reassembly, and testing with or without replacement of parts. Repair does not include machining, welding, and heat-treating, other manufacturing operations, or replacement of bodies. Buffing, polishing, deburring, and other minimal removal processes are not considered machining and may be employed in repair processes.

3.2 Abbreviations

BOM	Bill-of-material
MSDS	Material safety data sheet
NDE	Nondestructive examination
NORM	Naturally occurring radioactive material
OEM	Original equipment manufacturer
OPD	Original product definition
PQR	Procedure qualification record
SAE	Society of Automotive Engineers
WPS	Weld procedures specification
WQR	Welder qualification record

4 Preparation for Shipment to the Reconditioner

The owner shall complete the following activities before sending the equipment to the reconditioner:

a) All pressure shall be removed from valve cavities and accompanying actuators, tanks, etc.

b) Hazardous materials shall be removed and cleaned from the valve and accompanying equipment.

c) Copy of the material safety data sheet (MSDS) to be provided for the valve service media.

d) Valves should be checked for NORM in accordance with the applicable local regulations (region/state/country/province).

Valves containing NORM may require special handling and cleaning procedures.

5 Control of Equipment

The valve shall be identified by the owner name/location or other appropriate identifier.

Each valve shall be assigned a unique identification number [5]. This number shall be traceable back to the pertinent instructions and or information provided by the owner.

A visual inspection shall be conducted to determine if the valve can be reconditioned. If valve cannot be reconditioned, notify the owner for disposition instructions.

Disposition may include one or more of the following:

a) Salvage useable parts.

b) Scrap in accordance with the owner's instructions.

c) Return to the owner.

6 Disassembly and Cleaning of Valves

Valves to be reconditioned shall be completely disassembled. Packing, gaskets, and non-metallic parts shall be removed and disposed of in accordance with the owner's instructions or appropriate safety procedures.

The Original Equipment Manufacturer (OEM) tag shall not be removed. Damaged tags which cannot be properly attached shall be retained in the reconditioned valve document file. Tags from previous reconditioning shall be removed and the tag(s) or information from the tag(s) placed in the reconditioned valve document file. Tags may be electronically scanned or the information recorded and kept in the reconditioning document files.

The new identifier number shall be stamped on body, bonnet, cover, closure member, seats (if removed), stem and any other major components, using low stress stencils. If stamping is not practical, parts may be tagged or electro etched, except that all stems and closure elements for valves 2 in. and larger valves shall be marked by stamping. Finished surfaces that may be damaged shall be protected. Identification numbers marked on parts shall remain on the parts throughout the reconditioning process. Smaller parts may be placed in a container labeled with the unique identification number.

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[5] May be alpha-numeric.

Marking/labeling shall be of a type and material that resists damage, fading, or loss for a period of time consistent with the expected storage period.

Valve parts shall be cleaned; Methods include, but are not limited to steam, chemical, sand/bead, or shot blasting. Finished surfaces that may be damaged shall be protected.

7 Evaluation of Components

All components shall be inspected and evaluated in accordance with documented procedures. This shall consist of the following, as a minimum:

— Visual and dimensional inspection as to suitability for reuse.

— Verification of API 6D specified flange and end-to-end dimensions.

— Evaluation as to valve fitness and function.

Annex A provides minimum requirements for evaluation of components.

8 Repair/Remanufacture/Replacement of Valve Parts

8.1 Control of Manufacturing Operations

Repair and remanufacture operations shall be performed in accordance with documented procedures.

8.2 Inspection of Valve Parts

Valve parts shall be inspected to determine their acceptability for re-use and/or extent of required repair. Inspection shall be performed per documented procedures not less stringent than the OEM or owner's requirements.

Equipment for measuring dimensions shall be controlled and calibrated in accordance with the reconditioner's methods specified in documented procedures which shall be consistent with nationally or internationally recognized standards.

8.3 Replacement Parts and Material

Source of replacement parts shall be one or more of the following.

a) Suitable replacement parts from the OEM.

b) Parts obtained from similar valves from the same valve manufacturer.

c) The material must be identified, and critical dimensions verified to be the same as the original component.

d) Manufactured or repaired component parts, from the recondition facility. These parts shall be made from materials equivalent to the original. Where the material cannot be determined or it is desirable to substitute a material different from the original, the part design shall be supported by the OEM's design file or the reconditioner's design file which is not less stringent than the OPD.

Replacement parts shall be made from materials that are procured to written specifications. Specifications for metallic parts shall, as a minimum, specify requirements for chemistry, heat treatment, mechanical properties, testing, and dimensions. Materials for replacement valve parts exposed to sour service shall comply with NACE MR0175/ISO 15156.

8.4 Fabrication Welding

Weld procedures used for pressure or load bearing fabrication welds in pressure containing and/or pressure-controlling parts shall be qualified in accordance with ASME Section IX. Welders shall be qualified per ASME Section IX.

Weld procedures used for pressure or load bearing welds in pressure containing and/or pressure-controlling parts for low temperature materials shall also be qualified in accordance with the applicable sections of the current edition of API 6D relating to Impact Testing of welds.

Procedures for non-pressure retaining or non-load bearing welds shall be qualified per the reconditioner's requirements. Weld Procedure Specifications (WPS) shall be documented, qualified, and a copy of the Procedure Qualification Record (PQR) retained.

All weld procedures used for wetted components in valves intended for use in sour oil or gas shall also meet the requirements of NACE MR0175/ISO 15156.

8.5 Repair Welding

Repair welding is limited to repairing local defects or indications.

Weld repair shall be performed in accordance with the reconditioner's written procedures including the following as a minimum.

— Removal of the defect using a suitable means.

— Inspection of the excavated area using the same methods and criteria used to find the defect, but as a minimum magnetic particle or liquid penetrant inspection.

— Weld repair the subject area using qualified procedures and welders per 8.4.

— Grind or machine the welded surface to a finish and dimension(s) consistent with its purpose. As a minimum, surfaces shall be consistent with cleaned castings or forgings.

— Inspect the completed surface using the same methods and criteria used to find the defect but as a minimum magnetic particle or liquid penetrant inspection.

8.6 Nondestructive Examination (NDE)

NDE, where applicable, shall be performed and evaluated by ASNT SNT-TC-1A or ISO 9712 Level II certified technicians. Procedures for the NDE evaluations shall be per ASME Section V, as a minimum.

9 Reassembly

Valves shall be reassembled in accordance with documented procedures which are not less stringent than the OEM or owner's requirements and API 6D. Special processes and procedures shall be provided in written instructions. New packing, gaskets, and non-metallic parts shall be used. See A.6 for replacement bolting requirements.

Interfaces between pressure controlling parts shall be assembled free of any sealant, except where the sealant is the primary means of sealing. A lubricant with a viscosity not exceeding that of SAE 10W motor oil or equivalent may be used if necessary for assembly of pressure controlling parts.

Other parts such as threads, bearings, sliding parts, etc. may be lubricated, if necessary for assembly, using an appropriate oil or grease.

NOTE Valves specified by the owner as “critical service” valves for ethylene or other services shall not be lubricated during assembly. If minimal lubricant is required, the reconditioner shall supply details to the owner for evaluation.

10 Final Acceptance

10.1 Pressure Testing

Repaired/remanufactured valves shall be pressure tested in accordance with the requirements of API 6D, as a minimum. Supplemental tests may be performed as agreed between the owner and the reconditioner.

10.2 Notification

Should the repaired or remanufactured valve not meet API 6D or OPD, the owner shall be notified by the reconditioner of such status.

11 Equipment Marking

11.1 Nameplates

Nameplates shall be made from austenitic stainless steel or other material with equivalent or better corrosion resistance. The nameplate shall be securely affixed and so located that it is easily accessible.

The nameplate and serial number may be omitted for valves smaller than NPS 2, by agreement.

11.2 Marking

See Section 6 for additional marking information.

The following information shall be marked on an additional nameplate as indicated:

MARKING	LOCATION
Reconditioner’s name or identifier	On nameplate
Date of repair or remanufacture	On nameplate
Nominal Valve Size	On nameplate
Pressure class designation	On nameplate
Pressure rating at 100ºF (38 ºC)	On nameplate
Temperature rating	On nameplate
Body material designation (Material symbol such as ASTM, AISI, ISO, etc.)	On nameplate
Bonnet, cover plate, or tailpiece material designation (Material symbol such as ASTM, AISI, ISO, etc.)	On nameplate
Trim Identification (Symbols indicating the material of the stem and pressure controlling parts. MSS-SP-25 provides guidance for industry recognized symbols. The use of MSS-SP-25 symbols is recommended but not required)	On nameplate
Face to face or End to end dimension (Only if different from API 6D)	On nameplate
Ring Joint Groove number (if not already marked on the valve)	End flange
Reconditioner’s unique identification number	On nameplate and body

12 Preparation for Shipment and Short Term Storage

12.1 All pressure shall be relieved and all test fluids shall be purged from the valve.

12.2 Moving parts [6] shall be lubricated with a lubricant suitable to the design and function of the part, as applicable, only after successful completion of all pressure and functional testing.

NOTE Valves specified by the owner as “critical service” valves for ethylene or other services shall not be lubricated during assembly. If minimal lubricant is required, the reconditioner shall supply details to the owner for evaluation.

12.3 All non-corrosion resistant valves, shall be externally primed or painted in accordance with the reconditioner’s procedures or owner’s procedures. No corrosion resistant valves shall be painted unless specified otherwise by the owner. The seal surfaces of flange faces, weld bevel ends and exposed stems shall not be painted.

12.4 Bare metal surfaces shall be protected with a rust preventative that provides protection at temperatures up to at least 50 °C (122 °F).

12.5 Valves shall be prepared for shipment to prevent damage to internal and external components and allow for safe transport to the owner’s designated location. Valve flanges and weld ends shall be blanked off to protect the gasket surfaces, weld preparations and valve internals during shipment and storage. Protective covers shall be made of suitable materials such as wood, wood fiber, plastic, or metal. They shall be securely attached to the valve by such means as bolting, steel straps, steel clips, or suitable friction locking devices. The design of the covers shall prevent the valve from being installed unless the covers are removed.

12.6 Plug, ball, and gate valves shall be shipped in the fully open position, unless fitted with a “fail close” actuator.

12.7 Check valves shall be shipped with the disc supported or secured during transit. A warning label shall be attached to the protective cover with instructions to remove, prior to installation to assure the materials from inside the valve that secured or supports the disc.

12.8 Valves provided without an operating mechanism shall have significant annular spaces closed. Exposed stems shall be protected from damage during transport.

13 Documentation

13.1 General Documentation

Documentation shall be legible, retrievable, and reproducible. The following general documentation shall be maintained by the reconditioner:

— weld procedure specifications (WPS);

— weld procedure qualification records (PQR);

— welder qualification records (WQR);

— NDE personnel qualification records;

— NDE inspection records;

— records of test equipment calibration;

— records of measuring equipment calibration.

6 Bearings, operators, certain types of seat, etc.

This documentation need not be traceable to a specific reconditioned valve unless agreed between the reconditioner and the owner.

13.2 Documentation for 2 in. (DN 50) and Larger Valves

The following documentation shall be retained by the reconditioner for a minimum of ten (10) years following the date of repair/remanufacture.

— unique identification or serial number for tracing to the valve reconditioner's bill-of-material (BOM) or work order file;

— pressure test results;

— material test reports for all replacement parts by agreement;

— hardness tests, as applicable.

Annex A
(informative)

Minimum Requirements for Evaluation and Reconditioning of Parts

A.1 Bodies, Bonnets, Closures, End pieces, Tailpieces and Covers

Body, bonnet, closures, end pieces, tailpiece, and covers shall be visually inspected. NDE may be employed to investigate the extent of visual defects. Injurious defects such as cracks or excessive metal loss shall be brought to the attention of the owner for disposition instructions (see Section 5).

Localized pitting or areas of localized corrosion that do not significantly affect the pressure retaining capability of the part are generally acceptable. Significant pitting or areas of metal loss corrosion that significantly affects the pressure retaining capability of the part shall be brought to the owner's attention for disposition instructions.

All tapped holes shall be visually inspected for missing or incomplete threads, defective thread profile, torn or ruptured surfaces and cracks. Defects shall be removed/repaired using appropriate methods.

Visually inspect body to bonnet/tailpiece/cover flanges and seal surfaces for corrosion and overall condition. Body to bonnet gasket-sealing surfaces shall be visually inspected for corrosion, wear, cuts, or scoring. Dimensions and finish of the seal surface shall be in accordance with documented requirements not less stringent than the OEM or owner's requirements.

End connector dimensions shall conform to the applicable specification per design requirements of API 6D. Face-to-face and end-to-end dimensions shall conform to API 6D or to dimensions specified by the owner.

Stem seal preparations or stuffing boxes shall be examined for the proper condition and finish consistent with the seal design. Surface corrosion shall be removed by polishing, machining, or other suitable means. Dimensions and finishes of the reconditioned surface shall be consistent with the particular stem seal design being used and not less stringent than the OEM or owner's requirements.

A.2 Stems

Stem sealing surfaces shall be smooth and free of defects that may affect the sealability or functionality of the part. The parts shall be free of burrs or other mechanical damage that may affect the strength, function, or fitness of the part for its intended use. The dimension of the sealing area shall be inspected and evaluated with respect to documented requirements that are not less stringent than the OEM or owner's requirements.

Threaded stems shall be inspected for missing or incomplete threads, defective thread profile, torn or ruptured surfaces and cracks. The surface texture of threaded parts may be evaluated without magnification.

Rising stems shall be inspected for straightness, finish, and cylindricity. Reconditioning may be by polishing, grinding, machining, welding, mechanical straightening, plating and grinding, or other suitable means.

Stem heads or other connections shall engage properly with the mating component.

A.3 Pressure Controlling Parts (Gate, Ball, Plug, Disc, Seats, Clappers, etc.)

Pressure controlling parts shall be visually inspected for corrosion, wear, pitting, erosive wear, or other injurious defects. Defective parts shall be repaired, remanufactured, or replaced. Sealing surfaces shall have a profile (flatness, sphericity, etc.) consistent with the documented design requirements.

A.4 Bearings

Thrust Bearings—Thrust bearings shall be free of damage, excessive corrosion, or wear. Operation shall be smooth.

Sleeve Bearings—Sleeve bearings shall be free of damage, excessive corrosion, or wear. Coatings or liners shall not be torn, damaged or excessively worn. Operation must be smooth.

Bearings not meeting the above requirements shall be replaced.

A.5 Stem Nut

Visually inspect stem nut and stem housing for corrosion, galling or wear on the bearing surfaces. Internal and external threads shall be visually inspected for condition and proper engagement with the external stem threads. Defective parts shall be repaired by appropriate methods including, machining, welding, etc.

A.6 Body-to-Bonnet/Closure/End piece/Tailpiece/Cover Bolting

Unless specified otherwise by the owner, all pressure containing bolting shall be replaced. Replacement bolting shall be in accordance with API 6D.

Special or other bolting requirements are in accordance with the OEM design, owner’s engineering piping requirements or as specified on the purchase order.

A.7 Other Components

Other components shall be visually inspected and dispositioned based on documented requirements not less stringent than the OEM or owner’s requirements. Disposition may include acceptance, remanufacture, or replacement.

Bibliography

[1] ASTM A193 [7], *Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service*

[2] ASTM A194, *Specification for Carbon and Alloy Steel Nuts for Bolts in High Pressure and High Temperature Service*

[3] ASTM A320, *Specification for Alloy Steel Bolting Materials for Low Temperature Service*

[4] ISO/IEC Guide 22:1996, *General criteria for supplier's declaration of conformity*

[5] MSS-SP-25 [8], *Standard Marking System for Valves, Fittings, Flanges and Unions*

[7] ASTM International, 100 Bar Harbor Drive, West Conshohocken, Pennsylvania 19428-2959, www.astm.org.

[8] Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 127 Park Street, N.E., Vienna, Virginia 22180-4602, www.mss.hq.com.

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