



IRANIAN PETROLEUM STANDARD

IPS

MATERIAL STANDARD

FOR

CONTROL VALVES

FIRST EDITION

AUGUST 2003

FOREWORD

This Standard is intended to be used within and for Iranian Ministry of Petroleum (N.I.O.C, N.I.G.C, N.P.C., N.I.O.R.D.C. and other affiliate organizations and companies) and has been prepared on the basis of the recognized standards, scientific publications, technical documents, accumulated knowledge and experiences in petroleum industries at national and international levels.

Iranian Petroleum Standards are prepared by Iranian Petroleum Standards Organization reviewed and amended by the relevant technical standard committees to incorporate acceptable comments made by oil, gas and petrochemical experts.

Standards are finally approved by the "Standards High Council" of Iranian Ministry of Petroleum.

Iranian Petroleum Standards (IPS) are subject to amendment withdrawal, if required, thus the latest edition of IPS shall be applicable.

Any comment or recommendation submitted to the "Iranian Petroleum Standards Organization" will be evaluated in the relevant technical committee and will be considered in the next revision, upon approval.

GENERAL DEFINITIONS:

Throughout this Standard the following definitions shall apply.

"COMPANY" : Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company etc.

"PURCHASER" : Means the "Company" Where this standard is part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract documents.

"VENDOR" and **"SUPPLIER"** : Refers to firm or person who will supply and/or fabricate the equipment or material.

"WILL" : Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

"MAY" : Is used where a provision is completely discretionary.

"SHOULD" : Is used where a provision is advisory only.

"SHALL" : Is used where a provision is mandatory.

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1. SCOPE

This standard represents the minimum requirements for control valve material and their accessories material, which are used in oil, gas and petrochemical industries. In any case, material of control valves shall be selected as specified in data sheet.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

ISA (INSTRUMENT SOCIETY OF AMERICA)

- | | |
|-------------------|---|
| S75.03 ANSI / ISA | "Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies (ANSI Class 125, 150, 300, 600)" 1985 |
| S75.04 ANSI / ISA | "Face-to-Face Dimensions for Flangeless and Control Valve Bodies (ANSI Class 150, 300 and 600)" 1985 |
| S75.05 ANSI / ISA | "Control Valves Terminology" 1986 |

API (AMERICAN PETROLEUM INSTITUTE)

- | | |
|--------|---|
| RP-550 | "Process Instrumentation and Control Section 6-Control Valve and Accessories"1985 |
|--------|---|

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

- | | |
|---------|---|
| B-16.5 | "Pipe Flanges and Flanged Rating for Class 150, 300, 400, 600, 900, 1500 and 2500" 1988 |
| B-16.34 | "Steel Valve Flanged Butt welding End" 1981 |

BSI (BRITISH STANDARDS INSTITUTION)

- | | |
|---------|-------------------------|
| BS-5155 | "Butterfly Valves" 1988 |
|---------|-------------------------|

NACE (NATIONAL ASSOCIATION FOR CORROSION ENGINEERS)

- | | |
|----------|--|
| MR-01-75 | "Material Recommendation in Corrosive Atmosphere" 1975 |
|----------|--|

IPS (IRANIAN PETROLEUM STANDARDS)

- | | |
|--------------------------------|---|
| IPS-G-SF-900 | "Noise and Vibration Control System" |
| IPS-M-PI-110/2 | "Pressure-Temperature Rating of Globe Control Valves" |
| IPS-M-PI-110/5 | "Pressure-Temperature Rating of Butterfly Valves" |

3. UNITS

This Standard is based on International System of Units (SI), except Celsius is used for temperature and Barg for pressure.

4. DESIGN REQUIREMENTS OF CONTROL VALVE MATERIAL

4.1 The following description represents the minimum requirements for control valve body material to be used in Iranian petroleum industries. The suppliers material selection for control valves shall be approved by the purchaser before order placement.

4.2 Control valve material shall be selected by taking into account such factors as pressure, temperature, fluid being handled, cavitations or any other requirements.

4.3 Filter Regulators and Positioners or Boosters shall be factory mounted and tubbed. All connecting tubing in instrument air service shall be plastic coated copper with brass compression type fittings, unless otherwise specified.

4.4 Control valves shall have removable trims and sufficient clearance shall be allowed for access and removal.

4.5 Clearance shall be provided above and below a control valve so that the bottom flange and plug or the top-works and plug may be removed with the valve body in the pipeline.

4.6 Buttwelding valves should not be used, however, if line specification calls for buttwelding, consideration shall be given to the welding of control valves.

4.7 For flashing conditions, type, size and flashing condition of the control valve shall be specified in data sheet and/or agreed with the user.

4.8 For control valves intended for operating at high temperature, particular attention shall be paid to the clearance between plug and guide bushing to avoid valve sticking when the valve is hot.

4.9 Where cage guided control valves are specified, balanced trim should be considered for large sized valves.

4.10 For control valves on vacuum services, special provisions should be considered for prevention and detection of leakage.

4.11 Where temperature of control fluid is below zero degree Celsius a bonnet extension shall be used.

4.12 Extension bonnet or finned also shall be provided on services above 200 degree Celsius, in order to maintain the temperature of stuffing box within the limits specified in accordance with the manufacturer's recommendations.

4.13 Air operated diaphragms and springs shall be selected to optimize a bench setting range of 0.2-1 barg for the specified maximum upstream pressure of zero bar. The "Bench Setting Range" and the "In Service Stroking Range" shall be specified on the control valve data plates. Air operated control valves with an in-service stroking range other than 0.2-1 barg may be used if so dictated by availability of standard operators, and user's approval.

5. CONTROL VALVE MATERIAL SELECTION

5.1 For oxygen services, body and trim materials shall be 316 stainless steel. Body casting shall internally be completely machined to a smooth surface to remove any casting imperfections.

5.2 For material selection of body, bolts, nuts etc., the relevant piping class or any other information for the particular application shall be adhered to.

5.3 Control valve material shall be as specified in data sheets or shall be selected from ANSI-B16.5 specifications and applicable sections of the codes and standards.

5.4 Supplier shall comply with the pressure and temperature ratings of more common materials established by the ANSI-B16.5.

5.5 In case, corrosive condition would require very exotic materials, consideration may be given to a composite construction, such as internal metallic lining of the body.

5.6 For very severe erosive services the small fluid impact area inside the valve body shall be covered with a hard facing.

5.7 The minimum requirement for the body material is that the valve shall have a cast steel body, and the trim, consist of plug, seat ring and stem, shall have stainless steel 316, unless otherwise specified by the nature of process fluid being handled and/or requested through relevant data sheet.

5.8 When valves are used for chlorine service or other fluids which become corrosive when in contact with a moist atmosphere, suitable valve stem material must be chosen or other precautions taken.

For chlorine services neoprene diaphragm valves is recommended.

5.9 For extremely erosive-and corrosive services the hard facing material made of two disks of tungsten carbide material in angle pattern body can be used. This material is specially useful in oil production where severe sand erosion exists.

5.10 Hardened plug and seat rings shall be selected for the following applications:

1) Erosive service.

2) Wet gas or wet steam service with a pressure drop above 5 bars, other services when the pressure drop is above 10 bar at design condition.

5.11 Small-sized valves for erosive services shall have their plug and seat rings made for solid stellite No. 6. For economical reasons hardened stainless steel 440C may be used as trim material if this is suitable for the particular process conditions.

5.12 When tight shut off is required, a ball or plug valve, a single seated globe body valve shall be selected. The seats shall be of soft material, such as glass fiber filled PTFE, the selection shall be based on suitability for the specified process conditions. The selected material shall be suitable for temperature at least 50°C above the maximum process design conditions. The soft seat ring shall be properly clamped between metal parts.

5.13 When valves are used for sour gas services the trim and bolting material constructions shall comply with the recommendation of National Association of Corrosion Engineers (NACE) MR-01-75 latest revision.

5.14 Packing glands shall be equipped with flange style gland followers with bolted constructions.

A lubricator with steel isolating valve shall be provided where packing lubrication is required.

5.15 Guide bushing shall be a corrosion resistant material. It is preferred that the guide bushing material be a minimum of 125 brinell harder than the trim, i.e., 17-4PH (Precipitation Hardened) stainless steels or better.

5.16 Stainless steel bellows seals may be considered for services with dangerous and poisoning fluids such as TEL or TML (Tetra Ethyl Lead, Tetra Methyl Lead) but should be avoided wherever possible. A purge with suitable pressure shall be used (monitored for purge) as an alternative method of sealing.

5.17 Butterfly valves material shall be as specified in data sheet for the related service conditions or shall be at manufacturers option and in accordance with the applicable standard such as BS-5155.

5.18 Butterfly valves body material shall be selected from those listed in Table 1, if not specified in data sheets.

5.19 Butterfly valves trim material shall be suitable for specified service conditions and compatible with the piping material.

5.20 Butterfly valves trim material including disks, shafts, bushings, body and/or disk seating surfaces, internal keys and pins screws when in contact with the contained fluid shall be selected from Table 1, if not specified in data sheet.

5.21 Seats in the body and on the disk may be separate or integral. Seat facings may be applied to valve bodies and/or disks as deposited metal, integral metal, mechanically retained metal, or resilient materials.

TABLE 1 - BASIC MATERIALS FOR BUTTERFLY VALVES

1 COMPONENT	2 MATERIAL	3 BS REFERENCE
Body	Cast iron	1452
Body with integral seat	Austenitic cast iron	3468
Disk	Spheroidal graphite iron	2789
Handwheel	Carbon steel	1501.151
Disk with integral seat		1503.221
Rings fitted to body or disk for sealing,		1504.161
seating, or retaining purposes		
	Stainless steel	1501: Part 3
		1503
		1504, 3100
		1504
	Gunmetal	1400
	Aluminum bronze	1400
	Rings of deposited metal or resilient + material	
Shaft	Carbon steel	970: Part 1
	Stainless steel	970: Part 4
	Aluminum bronze	2672 or 2874
	Nickel copper alloy	3076
Shaft bearings seals (when fitted)	No requirement in this Standard	
Internal fastenings	Carbon steel	
	Stainless steel	
	Phosphor bronze	2870, 2873
	Aluminum bronze	2872, 2874, 2875
	Nickel copper alloy	3076

+ When the resilient seal forms part of:

a) The body and the disk is of grey cast iron, spheroidal graphite iron or carbon steel, it is recommended that the disk should be provided with a disk facing ring deposit, on the edge, or coated all over.

b) The disk and the body is grey cast iron, spheroidal iron or carbon steel, it is recommended that the body should be provided with a facing ring, deposit on diameter in contact with the resilient seal, or coated all over.

6. ACTUATOR CONSTRUCTION MATERIALS

6.1 Materials of construction shall be manufacturer's standard for the specified environmental exposure.

6.2 The material of diaphragm housing shall be steel, unless otherwise specified. For piston type actuators aluminum housing are acceptable except for valve on depressurizing or emergency shut-off services. In special cases such as for the larger sizes of butterfly valves, consideration may be given to (long-stroke) cylinder actuators.

6.3 The enclosure housing the electrical components of a valve shall be made of iron, steel, brass, bronze, aluminum, or an alloy containing not less than 85 percent aluminum. A metal such as zinc

or magnesium or other alloys shall not be used.

6.4 Copper shall not be used for an enclosure for use in class 1 group A locations. A copper alloy shall not be used for an enclosure unless it is coated with tin nickel or other acceptable coating, or unless the copper content of the alloy is not more than 30 percent.

6.5 Construction material of actuators may be considered and selected according to the requirements. The following materials shall be considered for different parts of actuators:

Diaphragm casing	: Steel, cast iron or cast aluminum
Diaphragm	: Nitrile on nylon or nitrile on polyester
Diaphragm plate	: Cast iron, cast aluminum or steel
Actuator spring	: Alloy steel
Spring adjuster	: Steel
Spring seat	: Steel or cast iron
Actuator stem	: Steel
Travel indicator	: Stainless steel
O-Rings	: Nitrile
Seat bushing	: Brass
Stem connector	: Steel zinc plated
Yoke	: Iron or steel

7. SELF-ACTUATED REGULATORS

Construction material shall be selected according to the process requirement, and indicated as per data sheet.

- Body material and spring case : Cast iron, steel or stainless steel
- Major metal internal parts : Brass or stainless steel
- Valve plug seating surfaces and diaphragm : Neoprene or stainless steel

7.1 Self-Actuated Pressure Regulator

7.1.1 Materials and temperature capabilities of the regulators must be checked to conform with process requirement. Stainless steel diaphragms and seats shall be used for higher temperatures such as steam services.

7.2 Self-Actuated Temperature Regulators

7.2.1 The material of tube system assembly consist of the sensitive bulb, capillary tubing and the bellows assembly, the indicating dial thermometer and the cap shall be specified in data sheets.

7.2.2 Packing gland for the regulators shall be Teflon v ring (or graphite asbestos for high temperature applications) packing sets with male and female adopters used as end rings, and a stainless steel compression spring. The spring loading of the packing shall maintain proper compression of the rings and also compensate for wear that occur at the seals.

8. SOLENOID VALVES

8.1 A variety of body materials are available to choose. Valve seat material shall be selected to suit the requirement. Materials available are Buna N, stainless steel discs, veton, Teflon and etc. Reference must be made to the specification detailed in data sheet for this selection.

8.2 External parts of solenoid construction in contact with fluid shall be stainless steel.

9. REPAIR OF DEFECTS ON CONTROL VALVES

The user reserves the right to reject individual valves for bad workmanship or defects.

9.1 The repair of defects in cast iron or ductile iron castings, by welding, brazing, plugging, pinning or impregnation is not permitted.

9.2 Defects in the body of carbon steel or alloy steel valve revealed by inspection or test may be repaired as permitted by the most nearly applicable ASTM material specification listed in table 1 of ANSI/B 16.34.

10 PACKING AND SHIPPING

Equipment must be carefully protected and packed to provide adequate protection during transit to destination and shall be in accordance with any special provision contained in the specification or order. Special attention must be given to protection against corrosion during transit. All bright and machined parts must be painted with a rust preventative.

Ancillary items forming an integral part of the equipment should be packed preferably in a separate container if the equipment is normally cased or crated.

Alternatively the ancillary items should be fixed securely to the equipment and adequate precaution taken to ensure that the items do not come loose in transit or be otherwise damaged.

10.1 Unless export packaging is specified in the purchase order, valves shall be shipped or packed in wooden boxes or crates, and fastened, so that prevent shifting within the package.

10.2 Threaded openings of the valves shall be plugged with suitable protective device to prevent entrance of dirt and to prevent damage to threads.

10.3 Flanged faces shall be coated with rust-ban or other suitable rust preventive substance. Flanged faces shall be protected by covers securely bolted to the flanges to prevent dirt from entering the valve interior.

10.4 Valves shipped with mounted actuators shall be packed in a manner that will prevent damage while in transit.

10.5 Butterfly valves shall be shipped with the shaft packing installed.

10.6 Butterfly valves shall be shipped with the disk positioned so that the disk edges are within the body contact faces to prevent damage during normal handling.

10.7 After the receipt of the inspection report, the control valve should be prepared for shipment either to the plant area for installation, or to storage. The valve body's air or electrical connections should be plugged to keep-out dirt. If the control valve is to be stored for any length of time it should be packed for protection against the environmental adverse effects.

Note to Users

The IPS Standards reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS publications are based on internationally acceptable standards and include selections from the options stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement or diversity of conditions of each project or work.

For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The users of IPS publications are therefore requested to send their views and comments, including any addendum prepared for particular cases to the Ministry of Petroleum, Standards and Research Organization. These comments and recommendations will be reviewed by the relevant technical committee and will be incorporated in the formal revision of the relevant IPS. The IPS publications are reviewed and revised approximately every five years.

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