MATERIAL STANDARD

FOR

CONTROL VALVES

SECOND EDITION

JANUARY 2015

FOREWORD

The Iranian Petroleum Standards (IPS) 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 is based on internationally acceptable standards and includes selections from the items 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 of each project. 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 IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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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 and National Iranian Oil Refinery And Distribution Company.

PURCHASER:

Means the “Company” where this standard is a 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.

CONTRACTOR:

Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR:

Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR:

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:

Is used where a provision is mandatory.

SHOULD:

Is used where a provision is advisory only.

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.

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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.

Note 1:

This is a revised version of the standard specification for control valves, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

Note 2:

This is a revised version of this standard, which is issued as revision (2)-2015. Revision (1)-2003 of the said standard specification is withdrawn.

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)

ANSI/ISA-75.08.01	"Face-to-Face Dimensions for Integral Flanged Globe-Style Control Valve Bodies (ANSI Classes 125, 150, 250, 300, and 600)"
ANSI/ISA 75.08.02	"Face-to-Face Dimensions for Flanged and Flangeless Rotary Control Valves (Classes 150, 300, and 600)"
ANSI/ISA 75.05.01	"Control Valves Terminology" 1986

API (AMERICAN PETROLEUM INSTITUTE)

API RP 553	"Refinery Valves and Accessories for Control and Safety Instrumented Systems"
609	"Butterfly Valves: Double-flanged, Lug- and Wafer-type"

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

ASME B16.5	"Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard"
ASME B16.10	Face to Face and End-to-End Dimensions of Valves
ASME B16.34	“Valves - Flanged, Threaded and Welding End”

BSI (BRITISH STANDARDS INSTITUTION)

BS EN 593	“Industrial valves Metallic butterfly valves”

BS EN 15714-2 "Industrial valves Actuators, Part 2: Electric actuators for industrial valves - Basic requirements"

NACE (NATIONAL ASSOCIATION FOR CORROSION ENGINEERS)

ANSI/NACE MR0175/ISO 15156-1 Petroleum and natural gas industries - Materials for use in H2S-containing environments in oil and gas production - Part 1: General principles for selection of cracking-resistant materials

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

60034-1 "Rotating Electrical Machines – Part 1: Rating and Performance"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

5210 "Industrial Valves – Multi-turn Valve Actuator Attachments"

21011 "Cryogenic Vessels - Valves for Cryogenic Service"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-IN-160 "Engineering Standard for Control Valves"

IPS-G-SF-900 "General Standard for Noise and Vibration Control System"

IPS-M-PI-110 "Material and Equipment Standard for Valves"

3. UNITS

This standard is based on international system of units (SI), as per IPS-E-GN-100 except where otherwise specified.

4. DESIGN REQUIREMENTS OF CONTROL VALVE MATERIAL

4.1 The following description represents the minimum requirements for control valve body material. 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 stainless steel with 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 extension bonnet 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 with the downstream 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 purchase order, and user's approval.

4.14 For actuators of MOVs the following items shall be considered.

4.14.1 The actuator's attachments shall be selected based on ISO 5210.

4.14.2 The actuator motors shall be of the totally enclosed non ventilated type.

4.14.3 The motors shall be separated from the lubricant-filled part of the actuator, allowing the replacing of a motor without loosing any lubricant regardless of mounting position.

4.14.4 Actuators motor shall develop full torque when power is turned on.

4.14.5 For on/off control operations the motor shall be rated for 15 minutes continuously or S2-15 minutes short time duty as a minimum according to IEC 60034-1. For sequential applications the duty type of the motor shall be S4.

4.14.6 If specified in data sheet the actuator shall be delivered with a suitable electrical / electronic device to inhibit condensation inside the actuator housing, properly connected to the power / control circuitry.

4.14.7 Each actuator shall have a rating plate marked in accordance with IEC 60034-1. The nameplate shall be securely fixed to the actuator/motor, so that they cannot be removed or scratched during shipment, installation, operation or maintenance.

4.14.8 Under all operating conditions the noise level of actuators shall not exceed 75 dB(A) at 1 m.

4.14.9 Actuators shall be protected against external corrosion by proper material selection and/or surface treatment. Standard materials and coatings may vary among electric actuator manufacturers. The purchaser must advise the manufacturer if additional special material or painting/coating is required due to service conditions.

4.14.10 The manufacturer/supplier shall demonstrate the compliance of his products to requirements mentioned in BS EN 15714-2.

4.14.11 In microprocessor based actuators, access to actuator configuration and adjustments shall be password protected.

4.15 For the design, manufacture and testing of cryogenic valves the requirements of standard ISO 21011 shall be followed as a minimum.

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 API RP 553 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 ASME 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 discs 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 50ºC 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 ANSI/NACE MR0175/ISO 15156-1.

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 EN 593.

5.18 Butterfly valves body material shall be selected based on BS EN 593, 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 discs, shafts, bushings, body and/or disc seating surfaces, internal keys and pins screws when in contact with the contained fluid shall be selected based on BS EN 593, if not specified in data sheet.

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

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 IIC 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 are recommended 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. The following materials are recommended for different related parts.

- 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

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

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, viton, Teflon and etc. Reference must be made to the specification detailed in data sheet for this selection.

9. REPAIR OF DEFECTS ON CONTROL VALVES

The user reserves the right to reject 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 by repaired as permitted by the most nearly applicable ASTM material specification listed in table 1 of ASME B16.34.

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 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 disc positioned so that the disc 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.