

STANDARD OIL COMPANY OF CALIFORNIA
ENGINEERING DEPARTMENT - SAN FRANCISCO
SPECIFICATION NO. EG-2350-A
FEBRUARY 2, 1971
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CONTROL VALVE CONSTRUCTION

SECTION A

TECHNICAL REQUIREMENTS

1.0 SCOPE

This Specification covers Company's minimum requirements for the design, fabrication and inspection of all valves used for control, except gate valves.

Air-operated diaphragm actuators, piston actuators and control valve positioning devices are also covered by this Specification.

Electric-operated control valves shall meet the requirements of this Specification insofar as they are applicable.

2.0 BODY

2.1 Valve bodies and bonnets shall conform to the following material specifications, as applicable:

Carbon Steel	Castings	ASTM-A216, Gr WCB
	Forgings	ASTM-A105, Gr II
Carbon $\frac{1}{2}$ Mo	Castings	ASTM-A217, Gr WC1
	Forgings	ASTM-A182, Gr F1
1 $\frac{1}{4}$ Cr $\frac{1}{2}$ Mo	Castings	ASTM-A217, Gr WC6
	Forgings	ASTM-A182, Gr F11
5 Cr $\frac{1}{2}$ Mo	Castings	ASTM-A217, Gr C5
	Forgings	ASTM-A182, Gr F5
9 Cr-1 Mo	Castings	ASTM-A217, Gr C12 (9 Chrome)
	Forgings	ASTM-A182, Gr F9
Hastelloy B of C	Castings	ASTM-A494
304 SS	Castings	ASTM-A351, Gr CF8
	Forgings	ASTM-A182, Gr 304
Monel	(Manufacturer's Standard)	
316 SS	Castings	ASTM-A351, Gr CF8M
	Forgings	ASTM-A182, Gr F316
347 SS	Castings	ASTM-A351, Gr CF8C
	Forgings	ASTM-A182, Gr 347

Acceptable material substitutes are:

- (a) 316 SS in place of 304 SS or 9 Cr or 9 Cr-1 Mo.
- (b) 5 Cr in place of 1 $\frac{1}{4}$ or 2 $\frac{1}{4}$ Cr (on flanged valves only).

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2.2 Body bolting and packing-flange studs shall conform to the following specifications:

ASTM-A193 - Alloy Steel Bolting for High Temperature Service.
ASTM-A194 - Carbon and Alloy Steel Nuts and Bolts for High Pressure and High Temperature Service.

Except that studs and nuts for Austenitic Stainless Steel and Nickel Alloy Valves shall be of the same nominal chemistry as the valve body.

2.3 All flanged connections and pressure-temperature ratings shall conform to ANSI B16.5, except as follows:

- (a) Flanged valves, 4 inch size and smaller shall have rating at least 300 lb for steel bodies and 250 lb for iron bodies.
- (b) Flange facings for "raised" and "flat faced" flanges shall be "smooth - 250 AARH maximum" in accordance with MSS-SP-6. A 250 RMS smooth finish is an acceptable alternate as judged by comparison with Visual Standards such as "General Electric Standard Roughness Specimens."
- (c) "Flangeless" type bodies such as wafer-butterfly, ball, etc., shall have body rating and facing that meets pipe specification. These valves shall be furnished with thru bolt-studs and nuts.
- (d) Threaded-end valves shall have internally tapered threads in accordance with ANSI B2.1 and minimum body rating of 600 lb in steel or 250 lb in iron.

Threaded valves shall be allowed only in body sizes $1\frac{1}{2}$ inch and less.

- (e) "Welded-on" flanges and similar fabricated body constructions are only acceptable by prior agreement with COMPANY.

2.4 End Connections shall be 1-inch minimum except when the line size is smaller. Odd body sizes, such as $1\frac{1}{4}$, $2\frac{1}{2}$ and 5-inch shall not be used.

2.5 Face-to-face dimensions shall conform to ANSI B16.10 (equal to ISA RP 4.1.1F) wherever practical.

2.6 Globe valves shall have a bolted-bonnet with confined gasket. Gasket material shall be the manufacturers standard providing it meets the requirements specified on the purchase specification sheet attached to the Agreement to which this Specification applies.

2.7(a) Extension-bonnets shall be provided where specified. Where possible valves in these services shall be provided with packing and

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lubricant designed to withstand the process fluid temperature, without consideration of the possible radiation losses due to an extension bonnet.

2.7(b) Bellows-seal type bonnets shall be provided where specified. As a precaution against bellows failure, the bonnet shall be provided with "back-up" packing to seal the valve stem and bonnet, and a plugged pressure test connection.

2.8 Lubricators and isolating valves shall be furnished with all valves requiring stem lubrication.

One year's supply of lubricant shall be furnished with each lubricator.

2.9 Direction of flow shall be cast or stamped on the valve body.

3.0 TRIM

3.1 Globe valves having "cage" type trim shall meet the following minimum requirements:

- (a) Controlled compression type gaskets used as a pressure seal between adjoining portions of the trim, or body and trim, shall not be subject to inner valve seat loading and unloading.
- (b) Cage and plug shall be hard stainless steel as a standard. Coefficients of thermal expansion for cage and plug shall be similar, so that required clearances are maintained over the range of operating temperatures.
- (c) Reduced trim for two nominal sizes smaller than valve body size shall be available as a standard option.
- (d) Valve stem shall be threaded and pinned to the valve plug. It shall be hardened stainless steel as standard, having a finish of 8 micro inches RMS or less.
- (e) Flow characteristic shall be obtained by means of "shaped cage ports" rather than a "shaped plug with rectangular ports."

3.2 Globe valves having conventional plug and seat rings shall meet the following minimum requirements:

- (a) Double seated valves shall be top and bottom guided.
- (b) Single seated valves shall be top and bottom guided; or top guided only, providing the guide post has sufficient diameter to provide lateral stability to the valve plug.

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- (c) Plug and seat rings shall be hard stainless steel as standard.
- (d) Hardened guide material shall be 350 BHN minimum, with a differential hardness not less than 125 BHN between sliding metal surfaces.
- (e) Valve stem shall be threaded and pinned to the valve plug. It shall be hardened stainless steel as standard having a finish of 8 micro inches or less.

The plug shall be reversible in the field by removal of the pin and valve stem.
- (f) Bonnet and bottom flange, where supplied, shall be interchangeable so as to permit reversal of the valve action without additional parts or alterations.

3.3 Ball control valves shall meet the following minimum requirements:

- (a) The ball plug shall rotate through 90° and its surface shall be wiped clean by the shearing action of a seal ring, to prevent accumulation of solids and damage to the ball surface.
- (b) The ball shall be designed to control flow in either direction. The seal ring shall provide reasonable shut-off when pressure is applied to the body in the reverse direction.
- (c) Ball shaft shall be 17-4PH hardened stainless steel as a standard. The ball plug shall be 316 SS with a polished chromium-plated surface as standard. Other trim parts shall be hardened SS unless specified otherwise.
- (d) Spline type connection shall be provided between ball plug, shaft and actuator. Shear pins or keys are not acceptable.
- (e) Ball plug position shall be indicated by an engraved marking or mechanical indicator connected to the ball shaft.

3.4 Butterfly control valves shall meet the following minimum requirements:

- (a) Heavy duty flangeless 'wafer' construction shall be standard.
- (b) Shaft shall be 17-4PH hardened stainless steel with plain stainless steel inboard bushings and bronze outboard sleeve bearings. Provision shall be made for bearing lubrication.

In cases where the pressure drop across the vane is high, where extension bonnets are supplied, or for valves that have special tight shut-off features such as elastomer lining, outboard bearings shall be of the precision roller type.

- (c) Butterfly valves shall normally be installed with the shaft in the horizontal plane. Thrust bearings designed to support the weight of shaft and vane shall be provided where the shaft is not so mounted.
- (d) Shaft shall have spline or keyway connection with actuator that will allow valve action to be easily changed.
- (e) Vane position shall be indicated by an engraved mark on the end of the shaft.
- (f) Vane shall be carbon steel unless specified otherwise.
- (g) Vane shall be pinned to the shaft so that excessive vane torque will shear the pins before rupture of vane or shaft.

4.0 PACKING AND LUBRICATION

4.1 Recommended stem or shaft packing and lubricants are as follows:

<u>Service</u>	<u>Packing</u>	<u>Lubricant</u>
Air	Garlock 256 or John Crane 6AM	Rockwell 234
Ammonia	Garlock 144, Raybestos Manhattan 122S	Rockwell 421 or 147
Asphalt & Tars	Garlock 256 or 144	Rockwell 555
Aromatic Solvents (as benzene, toluene, etc.) to 600F	Garlock 256 or 144	Rockwell 755
Chlorine Liquid and Chlorine Gas	John Crane C-98	Rockwell 188
Hydrocarbon Liquids to 600F. LPG, fuel & lube oil, crude distillates	Garlock 256 or 144 John Crane 6AM	Rockwell 555

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Service	Packing	Lubricant
Gasoline, Kerosene, mineral oil, naphthas	Garlock 256 or 144	Rockwell 357
Hydrocarbon gas	Garlock 256	Rockwell 555 or 386
Hydrochloric Acid and Hydrochloric Acid - Hydrocarbon Mixtures	John Crane C-98	Rockwell 921
Hydrofluoric Acid 50 to 100%	John Crane 704	Rockwell 799
Nitric Acid (0 to 80%) to 140F	John Crane 704	Rockwell 921
Phenol	John Crane 704	Rockwell 921
Phosphoric Acid (70-100%) to 250F	John Crane 704	Rockwell 921
Salt Water	Garlock 256	Rockwell 234
Sodium Hydroxide to 425F	John Crane 704 or C-98	Rockwell 421, 147 or 921
Steam (Superheated) -Limits 1200°F/2000PSI	John Crane 177-AI	
Steam to 125 psig	Garlock 145	Rockwell 234
Steam between 125 to 600 psig	Garlock 256	Rockwell 921
Sulfuric Acid (75% to fuming) 40 to 100F	John Crane 704	Rockwell 921
Water - Fresh, Cooling Tower	Garlock 256	Rockwell 234
Hydrogen	Raybestos Manhattan 122S	Rockwell 555

Brief description of packing materials follow:

- John Crane 6AM:
- Braided asbestos with monel wire insert. Asbestos core with dry graphite lubricant. Maximum temperature: 850°F

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| John Crane 177-A1 | - Closely braided asbestos with inconel wire insert.
Long fibre asbestos core with flake graphite lubricant
Max. temperature: 1200°F
Max. pressure : 2000 PSI |
| John Crane C-98 | - Braided asbestos yarn impregnated with teflon
Temperature: -100°F to + 600°F |
| John Crane 704 | - Pure Teflon braid, no lubricant within the packing.
Temperature: -100°F to + 500°F |
| Garlock 256 | - Long fibre asbestos yarn with copper wire insert.
Impregnated throughout with petroleum lubricant.
Graphite coated surface.
Maximum Temperature: 700 F |
| Garlock 144 | - Woven asbestos cloth wrapped over a rubber core.
Cloth is impregnated with rubber (except outside
surface) and a glycerol lubricant. Graphite coated
surface.
Max. temperature: 600°F |
| Raybestos Manhattan 122S | - Asbestos cloth wrapped over a rubber core. Cloth is
lubricated, and surface coated with flake graphite.
Max. temperature: 600°F |

NOTE: The above packing numbers are for Coiled Packing. Preformed-Ring packing is preferred when installed at factory.

- 4.2 Stuffing box shall have a bolted packing flange and for valves requiring stem lubrication, a Lantern Ring shall be provided. Lantern Ring material must be compatible with the process fluid and shall not cause scoring of valve stem.

5.0 ACTUATORS

- 5.1 Actuators shall be designed to move the valve over its full stroke and be sized for the maximum pressure drop and line pressure shown on the purchase specification sheet attached to the Agreement to which this Specification applies.
- 5.2 In the opening direction, a travel limit stop shall be engaged before the valve plug reaches its travel limit. The "stop" shall be designed to absorb any force transmitted to it. In the closing direction, the valve plug shall seal before the actuator reaches its travel limit.
- 5.3 Actuator characteristic shall be linear, at least over the working portion of its range.

Actuator performance shall be as follows:

- (a) Stem position error shall not exceed $\pm 5\%$ of rated travel.
- (b) Hysteresis shall not exceed 5% of rated travel.
- 5.4 Valve stem position shall be indicated on a graduated scale with the words "OPEN" and "CLOSED" at the stem travel limits. The indicating pointer shall be directly connected to the stem.
- 5.5 Spring and diaphragm actuators shall be of the enclosed spring type. They shall preferably be direct acting and designed to stroke nominally 3 to 15 PSIG when in operation. Other ranges are only acceptable by prior agreement with the Company.
- 5.6 Actuators shall have a positive action on failure of the operating medium, unless otherwise specified. This may be obtained by use of springs or auxiliary volume tanks used in conjunction with relays. Mechanical "fail-safe" devices are not acceptable.
- 5.7 Actuator size shall not be less than the manufacturers standard size for a given valve.
- 5.8 Handwheels, when specified, shall be of the side mounted type except for butterfly or ball valves which shall have shaft mounted handwheels.

Handwheels shall preferably not require use of a clutch or gear shift and shall be continuously connected type capable of moving the valve in either direction. The neutral position of travel shall be clearly marked.

Without exception, handwheel operation shall be "clockwise rotation closes valve" and, "counterclockwise rotation opens valve."

6.0 ACCESSORIES

- 6.1 Pneumatic positioners, relays, transducers, etc. furnished with control valve shall be mounted and connected by the supplier using size 3/8 inch stainless steel or PVC coated copper tubing. Tubing fittings are to be compression type, stainless steel for stainless steel tubing and brass for PVC coated copper tubing.
- 6.2 Pneumatic valve positioners shall have full by-pass assembly except for split range pneumatic positioners, or where spring/diaphragm range is other than 3-15 PSIG. Each positioner shall be supplied complete with supply, input and output air gauges.
- 6.3 Electro-pneumatic positioners, transducers, and valves provided with pneumatic relays or solenoid valves shall be provided with an output air gauge to measure diaphragm pressure.
- 6.4 Each control valve shall be furnished with a permanently attached, corrosion resistant nameplate bearing the following information:
 - (a) Manufacturer's name, model number and serial number
 - (b) Body and trim size
 - (c) Body and trim materials
 - (d) Trim type
 - (e) Body and flange rating
 - (f) Valve action on air failure
 - (g) Bench setting and operating range
 - (h) Tag number and Purchase Order number

In addition, each valve shall have a tag indicating the packing material and lubricant.

7.0 INSPECTION AND TESTING

- 7.1 Valve body shall pass a hydrostatic pressure test after assembly at the manufacturers works. Test pressure for steel bodies shall be according to ANSI B16.5. Test pressure for cast iron, brass or bronze bodies shall be two times the nominal body rating.

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- 7.2 Where specified, castings that require radiograph testing shall meet ASTM Standard No. E-71, Class 2 for castings up 2 inches in thickness or ASTM Standard No. E-186-67 for heavy walls 2 to 4 inches in thickness.
- 7.3 Where specified, castings that require dry powder magnetic particle inspection shall meet ASTM Standard E-109-03.
- 7.4 Where specified, castings that require dye penetrant inspection shall meet ASTM Standard E-165.