

Hydrostatic Testing of Control Valves

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FOREWORD

Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining without delay the proper product for his particular need. Existence of a

Standard does not in any respect preclude any member or non-member from manufacturing or selling products not conforming with the standard.

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Hydrostatic Testing of Control Valves

1. SCOPE AND PURPOSE

1.1 This standard applies to ferrous, including stainless steel, Control Valves.

1.2 The purpose of this procedure is to establish guidelines and definitions for the Control Valve industry and their customers by describing a standard hydrostatic test for Control Valves.

1.3 The purpose of the hydrostatic test is to prove the structural integrity and liquid tightness of the valve.

2. DEFINITIONS

2.1 Control Valve. A Control Valve is a valve with a pneumatic, hydraulic, electric (excluding solenoids) or any other externally powered actuator that automatically fully or partially opens or closes the valve to a position dictated by a signal transmitted from a controlling instrument.

2.2 Test Fixtures. Test Fixtures are devices designed to close off the pipe connections of the Control Valve to allow pressurization for hydrostatic testing.

3. REFERENCES

In the preparation of this SAMA Standard of Process Measurement and Control Hydrostatic Testing of Control Valves, many standards and publications sponsored by technical organizations such as ASME, IEEE and ISA were studied by the committee. Source documents used from the many reviewed are as follows:

3.1 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Standard Practice SP-61, 1961 Edition, Hydrostatic Testing of Steel Valves.

Copies of the Standard Practice referred to above may be purchased from the Manufacturers Standardization Society of the Valve and Fittings Industry, 1815 North Fort Myer Drive, Arlington, Virginia 22209.

3.2 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, 1968 Edition, Unfired Pressure Vessels.

Copies of the ASME Boiler and Pressure Vessel Code referred to above may be purchased from the American Society of Mechanical Engineers, 345 East 47th Street, New York, N. Y. 10017.

3.3 American National Standards Institute, Inc. (ANSI) Standard B16.5-1968, Steel Pipe Flanges and Flanged Fittings.

3.4 American National Standards Institute, Inc. (ANSI) Standard B16.1-1967, Cast Iron Pipe Flanges and Flanged Fittings.

Copies of the ANSI Publications referred to above may be purchased from the American National Standards Institute, Inc. 1430 Broadway, New York, N. Y. 10018.

3.5 American Society for Testing and Materials (ASTM)

A 105 Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service

A 126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A 181 Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for General Service

A 182 Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service

A 216 Carbon -- Steel Castings Suitable for Fusion Welding for High Temperature Service

A 217 Alloy Steel Castings for Pressure Containing Parts Suitable for High Temperature Service

A 335 Seamless Ferritic Alloy Steel Pipe for High Temperature Service

A 350 Forged or Rolled Carbon and Alloy Steel Flanges, Forged Fittings, and Valves and Parts for Low Temperature Service

- A 351 Ferritic and Austenitic Steel Castings for High Temperature Service
- A 352 Ferritic Steel Castings for Pressure Containing Parts Suitable for Low Temperature Service
- A 395 Cast Ductile Iron for Pressure Containing Parts for Use at Elevated Temperatures
- A 445 Ferritic Ductile Iron Castings for Valves, Flanges, Pipe Fittings, and other Piping Components

Copies of the ASTM Publications referred to above may be purchased from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

4. TEST FIXTURES

4.1 Test Fixtures include, but are not limited to, plugs with tie-bars and tie-rods, hydraulic presses, and plugs or flanges attached to the pipe connections; bosses or lugs on the valve, expandable rubber plugs, etc. When end plugs are used, the seal point shall be as close to the end of the valve as practical.

5. PREPARATION OF CONTROL VALVE FOR HYDROSTATIC TESTING

5.1 The Control Valve assembly, with or without actuator, must be complete before hydrostatic testing, except as permitted per paragraph 5.3.

5.2 Tightening torques applied to the bolts and nuts shall be as intended for use.

5.3 All cavities pressurized in service shall be simultaneously subjected to the hydrostatic test pressure. Components such as bellows, diaphragms, backseats, stem packing, etc., which may be damaged by the hydrostatic test pressure may be removed.

5.4 Welded-on nipples or expanders shall be considered as parts of the valve body assembly and, therefore, should be included in the hydrostatic test. If it is not practical to hydrostatically test the valve in accordance with this standard, the test procedures may be agreed upon by the vendor and customer. (e.g., a typical instance is a valve assembled with

fittings of lower pressure rating where it is apparent that the assembly cannot be tested at the valve pressure rating.)

5.5 The valve shall not be painted before hydrostatic testing. If hydrostatic tests in the presence of purchaser's representative are specified, painted valves from stock may be retested without removal of the paint.

6. TEST PROCEDURE

6.1 After filling the valve with a suitable liquid such as water, safety solvents, light petroleum distillate, etc., and venting all air, the valve shall be pressurized in accordance with Table 1 listed on page 5. (Reference: ANSI B16.1, B16.5, and MSS SP-61.)

6.2 For service conditions above the 2500 lb. ANSI rating the hydrostatic test pressure shall be calculated by the following formula:

$$\text{Hydrostatic testing pressure} = 1.5 \times \text{design pressure} \times \frac{\text{allowable stress at room temperature}}{\text{allowable stress at design temperature}}$$

The allowable stresses refer to the body and bonnet material and shall be taken from Section VIII of the ASME Boiler Code.

6.3 The minimum duration of test pressure before start of inspection shall be in accordance with Table 2 on Page 5. (From MSS SP-61 except that every 1/4 inch of wall thickness requires at least 1 minute.)

6.4 The temperature of the test liquid shall not exceed 125 F.

7. ACCEPTANCE STANDARDS

7.1 Any weeping or leakage through the metal or past static seals shall be cause for rejection.

7.2 Distortion due to hydrostatic testing which impairs functional operation of the valve shall be cause for rejection. It shall be the manufacturer's responsibility to determine whether this distortion impairs the operation.

Table 1

TEST PRESSURES IN PSIG

ANSI STANDARD RATING	CARBON & LOW ALLOY STEELS, SS 347, 321, 316, 310	CAST IRON	SS 304	SS 304L SS 316L	CAST NODULAR (DUCTILE) IRON
125 lb (sizes 1-12")	-	250	-	-	
125 lb (sizes 14-24")	-	200	-	-	
250 lb (sizes 1-12")	-	500	-	-	
250 lb (sizes 14-24")	-	400	-	-	
150 lb	425	-	425	425	440
300 lb	1100	-	925	775	1150
400 lb	1450	-	1250	1025	1540
600 lb	2175	-	1875	1550	2000
900 lb	3250	-	2775	2325	
1500 lb	5400	-	4650	3850	
2500 lb	9000	-	7725	6425	

Table 2

DURATION OF HYDROSTATIC TEST

Time in minutes, minimum

VALVE SIZE	125 & 150 LB	250 & 300 LB	400 LB	600 LB	900 LB	1500 LB	2500 LB & ABOVE
2" & Smaller	1	1	1	1	2	2	3
2-1/2"	2	2	2	2	2	4	4
3"	2	2	2	2	3	4	4
3-1/2"	2	2	2	2	3	4	5
4"	2	2	2	3	4	5	5
5"	2	2	3	3	4	5	6
6"	2	2	3	3	5	6	7
8"	2	3	3	4	5	8	9
10"	3	3	4	5	6	9	11
12"	3	4	4	5	7	11	13
14"	3	4	5	6	8	11	--
16"	3	4	5	6	9	13	--
18"	3	4	5	7	9	14	--
20"	3	5	6	7	10	16	--
24"	4	5	6	8	12	18	--

Table 3

APPLICABLE ASTM SPECIFICATIONS

(Use Latest Revision)

	FORGINGS	CASTINGS
Carbon Steel	A 105 Grade I " Grade II A 181 Grade I " Grade II A 350 Grade LFI	A 216 Grade WCB A 352 Grade LCB
Low Alloy Steel	A 182 Grade F1 " Grade F5a " Grade F9 " Grade F11 " Grade F12 " Grade F22 A 335 Grade P2 " Grade P3b " Grade P5b " Grade P21 A 350 Grade LF3 " Grade LF4	A 217 Grade WC1 " Grade WC4 " Grade WC5 " Grade WC6 " Grade WC9 " Grade C5 " Grade C12 A 352 Grade LC1 " Grade LC2 " Grade LC3
High Alloy Steel (SS)	A 182 Grade F304 " Grade 304L " Grade F310 " Grade F347 " Grade F321 " Grade F316 " Grade 316L	A 351 Grade CF8 " Grade CF8C " Grade CF8M
Cast Iron		A 126 Class A " Class B " Class C
Cast Nodular (Ductile) Iron		A 395 A 445