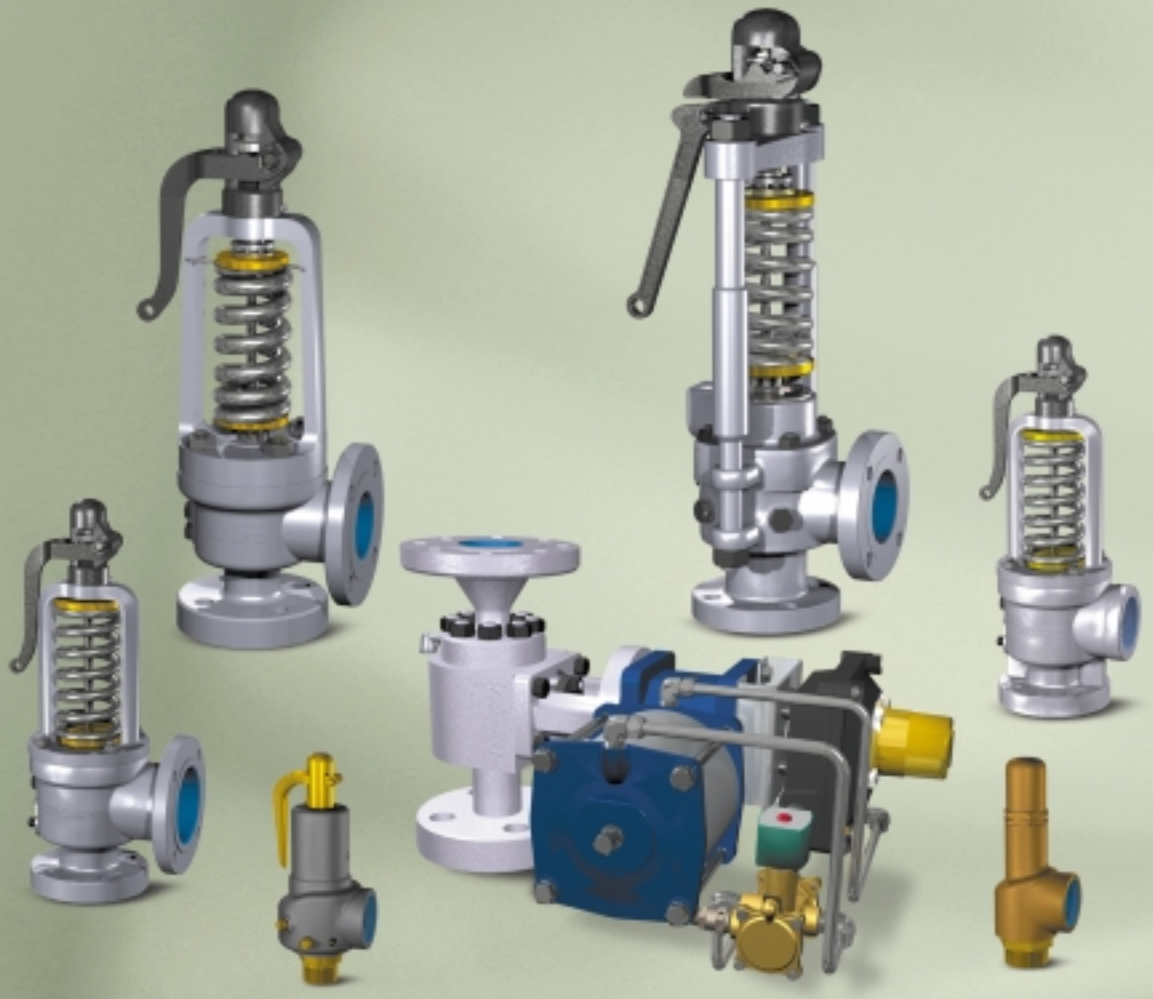
Codes & Standards

Safety Valves



Consolidated®

ASME Section I Boiler and Pressure Vessel Code for Fired Vessels

	Conditions	Requirements			
		Single Valve	Multiple Valves	Superheater	Reheater
SIZING	Number of valves	Boilers less than 500 sq. ft. heating surface and generates less than 4000#/hr. (PG-67.1)	When only two valves are used, capacity of smaller shall not be less than 50% of the larger. (PG-71.1)	At least one valve shall be installed on the superheater outlet.	At least one or more valves to relieve maximum reheater steam flow. There shall be at least one valve on the reheater outlet such that the relieving capacity shall not be less than 15% of the required total.
SIZING	Required Capacity		The complement of spring loaded valves must relieve 100% of boiler steaming capacity. (PG-67.2)	The superheater valve capacity may be included in the complement of valve capacities provided the aggregate capacity of the drum valves is at least 75% of the boiler steaming capacity. (PG-68.1 & PG-68.2)	Credit for reheater valves cannot be taken in determining required capacity for drum and superheater valves. (PG-68.4)
SIZING	Set pressure	At least one valve must be set at or below the design pressure.	Any additional valves cannot be set in excess of 3% above design pressure. Set pressure range for saturated steam valves shall not exceed 10% of the highest valve set pressure.	The low set superheater valve shall be the first to open and the last to close.	At least one reheater outlet valve shall be the first of the reheater valves to open and the last of the reheater valves to close.
SIZING	Blowdown	For valves set above 100 psig, blowdown shall be between 2% and 4%. For valves set at or below 100 psig, blowdown shall be between 2 and 4 psi.	After blowing down, all valves shall close at a pressure not lower than 96% of their set pressure, except that all drum valves installed on a single boiler may be set to reseat at a pressure not lower than 96% of the set pressure of the lowest set drum valve.	The superheater valve should be set to be the last valve to close.	At least one of the reheater outlet valves should be the last to close.
OTHER	Set pressure (opening pressure) tolerance	Pressures above 15 psig, up to and including 70 psig = ±2 psi. Pressures over 70 psig, up to and including 300 psig = ±3%. Pressures over 300 psig, up to and including 1000 psig = ±10 psi. Pressures over 1000 psig = ±1%.			
OTHER	Blowdown (closing pressure) tolerance	**Minimum Blowdown** - Minimum blowdown, regardless of set pressure, is 2 psi. For pressures above 100 psig, the blowdown shall not be less than 2% of the set pressure. **Maximum Blowdown** - After blowing down, all valves set at pressures of 375 psi or greater shall close at a pressure not lower than 96% of their set pressure, except that all drum valves installed on a single boiler may be set to reseat at a pressure not lower than 96% of the set pressure of the lowest set drum valve. For pressures below 375 psi, blowdown shall not exceed that specified in the following table:			
OTHER	Tightness	A tightness test shall be conducted at the maximum expected operating pressure, but at a pressure not exceeding the reseating pressure of the valve. When testing, a valve exhibiting no visible signs of leakage shall be considered tight.			
OTHER	Recommended operating gap	Boiler Design Pressure (psig) 15 to 300 301 to 1000 1001 to 2000 2000 and above	Min. Differential as a Percent of Boiler Design Pressure 10% but not less than 7 psi 7% but not less than 30 psi 5% but not less than 70 psi Per designer's judgement		
OTHER	Nameplate Stamping	Valves shall be stamped with ASME Symbol V. Official stamped relieving capacity is at 3% accumulation or 2 psig, whichever is greater.			

Set Pressure, psi	15-66	67-250	251-374
Maximum Blowdown	4 psi	6% of set pressure	15 psi

Note: The following information has been extracted from the ASME Boiler and Pressure Vessel Code Section I (2001) to be used purely as a reference source and is not intended to be a complete reproduction of that document. Paragraphs PG-67.1, PG-67.2, PG-67.3, PG-72.1, and PG-72.2 are referenced.

ASME Section VIII Pressure Vessel Code for Unfired Vessels

Sizing Condition	Single valve on vessel other than unfired steam boilers	Multiple Valves On Vessel Other Than Unfired Steam Boilers	Fire and/or External Heat Protection of Vessels Other Than Unfired Steam Boilers	Fire and/or external heat protection of vessels having no permanent supply connection and used for non-refrigerated liquefied compressed gases
ASME P.V. CODE SEC. VIII (REF)	UG - 125(c), UG - 134(a), UG - 134(e)	UG - 125(c)(1), UG - 133(a), UG - 134(e)	UG - 125(c)(2), UG - 133(b), UG - 134(e)	UG - 125(c)(3), UG - 134(e)(2)
Sizing	The single valve shall prevent vessel pressure from rising more than 10% above the maximum allowable working pressure.	The aggregate capacity of multiple valves connected to any vessel or system of vessels for the release of liquid, air, steam or other vapor shall be sufficient to relieve the maximum capacity that can be generated or supplied to the attached equipment without permitting a rise in vessel pressure to more than 16% above the maximum allowable working pressure.	Supplemental valves for the protection from unexpected sources of external heat shall be capable or preventing vessel pressure from rising more than 21% above the maximum allowable working pressure.	Valves shall be sized to prevent the pressure from rising more than 20% above the maximum allowable working pressure of the vessel.
Set Point (Note: The pressure setting of each valve shall include the effects of static head and constant back pressure.)	Single valve shall be set to relieve at a pressure not to exceed the maximum allowable working pressure of the vessel.	One valve is to be set at or below the maximum allowable working pressure, the balance of valves may be set at higher pressures up to but not to exceed 105% of the maximum allowable working pressure.	Valves used to provide protection against excessive pressure caused by exposure to fire or other sources of external heat shall be set to operate at a pressure not in excess of 110% of the maximum allowable working pressure (Note: if a single valve is used to protect a vessel and to provide fire/external heat protection, it shall not be set at a pressure over the maximum allowable working pressure).	Valve set pressure must not exceed the maximum allowable working pressure of the vessel.
Set Point Tolerance	The set pressure tolerance, (plus or minus), of pressure relief valves shall not exceed 2 psi (13.6kPa) for pressures up to and including 70 psi (483 kPa) and 3% for pressures above 70 psi (483 kPa).			The set pressure tolerance of pressure relief valves shall be within -0%, +10%
Blowdown	Valves designed and capacity tested in accordance with Code Section VIII are capable of being set for 7% Blowdown. Section VIII does not require a specific blowdown setting by the valve manufacturer. (The user should specify the required blowdown that will permit reclosing of valve above the normal operating pressure.)			
Tightness UG - 136(d)(2)	Code requires a tightness test be conducted at the maximum expected operating pressure. This maximum pressure is not to exceed the resealing pressure of the valve. Then testing with either water or steam, a valve exhibiting no visible signs of leakage shall be considered adequately tight. Leakage tests conducted with air shall be in accordance with industry standards.			
Recommended Operating Gap (Appendix UA358 c)	Set pressures to 70 psi (483 kPa) - Minimum operating gap 5 psi. Set pressures from 71 psi to 1000 psi (over 483 kPa to 8000 kPa) - Minimum operating differential of 10% Set pressures above 1000 psi (8000 kPa) - Minimum operating differential of 7%.			

Note: The following information has been extracted from the ASME Boiler and Pressure Vessel Code Section I (1998) to be used purely as a reference source and is not intended to be a complete reproduction of that document.

Bronze Flanges ANSI B16.24 Class 150

Nominal pipe size	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	3-1/2"	3-7/8"	4-1/4"	4-5/8"	5"	6"	7"	7-1/2"	8-1/2"	9"	10"	11"	13-1/2"
Flange thickness	5/16"	11/32"	3/8"	13/32"	7/16"	1/2"	9/16"	5/8"	11/16"	11/16"	3/4"	13/16"	15/16"
Raised face diameter	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolt circle diameter	2-3/8"	2-3/4"	3-1/8"	3-1/2"	3-7/8"	4-3/4"	5-1/2"	6"	7"	7-1/2"	8-1/2"	9-1/2"	11-3/4"
Number of bolts	4"	4"	4"	4"	4"	4"	4"	4"	8"	8"	8"	8"	8"
Size of bolts	1/2"	1/2"	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"	3/4"

Cast Iron Flanges ANSI B16.1 Class 125

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	4-1/4"	4-5/8"	5"	6"	7"	7-1/2"	8-1/2"	9"	10"	11"	13-1/2"
Flange thickness (*)	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	15/16"	5/16"	1"	1-1/8"
Raised face diameter	-	-	-	-	-	-	-	-	-	-	-
Bolt circle diameter	3-1/8"	3-1/2"	3-7/8"	4-3/4"	5-1/2"	6"	7"	7-1/2"	8-1/2"	9-1/2"	11-3/4"
Number of bolts	4"	4"	4"	4"	4"	4"	8"	8"	8"	8"	8"
Size of bolts	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"	3/4"

Cast Iron Flanges ANSI B16.1 Class 250

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	4-7/8"	5-1/4"	6-1/8"	6-1/2"	7-1/2"	8-1/4"	9"	10"	11"	12-1/2"	15"
Flange thickness (*)	11/16"	3/4"	13/16"	7/8"	1"	1-1/8"	1-3/16"	1-1/4"	1-3/8"	1-7/16"	1-5/8"
Raised face diameter	2-11/16"	3-1/16"	3-9/16"	4-13/16"	4-5/16"	5-11/16"	6-5/16"	6-15/16"	8-5/16"	9-11/16"	11-15/16"
Bolt circle diameter	3-1/2"	3-7/8"	4-1/2"	5"	5-7/8"	6-5/8"	7-1/14"	7-7/8"	9-1/4"	10-5/8"	13"
Number of bolts	4"	4"	4"	8"	8"	8"	8"	8"	8"	12"	12"
Size of bolts	5/8"	5/8"	3/4"	5/8"	3-4"	3/4"	3/4"	3/4"	3/4"	3/4"	7/8"

Steel & Alloy Flanges ANSI B16.5 Class 150

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	4-1/4"	4-5/8"	5"	6"	7"	7-1/2"	8-1/2"	9"	10"	11"	13-1/2"
Flange thickness (*)	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	15/16"	15/16"	1"	1-1/8"
Raised face diameter	2"	2-1/2"	2-7/8"	3-5/8"	4-1/8"	5"	5-1/2"	6-3/16"	7-5/16"	8-1/2"	10-5/8"
Bolt circle diameter	3-1/8"	3-1/2"	3-7/8"	4-3/4"	5-1/2"	6"	7"	7-1/2"	8-1/2"	9-1/2"	11-3/4"
Number of bolts	4"	4"	4"	4"	4"	4"	8"	8"	8"	8"	8"
Size of bolts	1/2"	1/2"	1/2"	5/8"	5/8"	5/8"	5/8"	5/8"	3/4"	3/4"	3/4"

Steel & Alloy Flanges ANSI B16.5 Class 300

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	4-7/8"	5-1/4"	6-1/8"	6-1/2"	7-1/2"	8-1/4"	9"	10"	11"	12-1/2"	15"
Flange thickness (*)	11/16"	3/4"	13/16"	7/8"	1"	1-1/8"	1-3/16"	1-1/4"	1-3/8"	1-7/16"	1-5/8"
Raised face diameter	2"	2-1/2"	2-7/8"	3-5/8"	4-1/8"	5"	5-1/2"	6-3/16"	7-5/16"	8-1/2"	10-5/8"
Bolt circle diameter	3-1/2"	3-7/8"	4-1/2"	5"	5-7/8"	6-5/8"	7-1/4"	7-7/8"	9-1/4"	10-5/8"	13"
Number of bolts	4"	4"	4"	8"	8"	8"	8"	8"	8"	12"	12"
Size of bolts	5/8"	5/8"	3/4"	5/8"	3/4"	3/4"	3/4"	3/4"	3/4"	3/4"	7/8"

(*) ANSI flange thickness (Min.) includes 1/16" raised face.
(***) Not applicable to hubbed flanges 3/4" thru 3", Class 150. Refer to ANSI B16.5

Steel & Alloy Flanges ANSI B16.5 Class 600

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	4-7/8"	5-1/4"	6-1/8"	6-1/2"	7-1/2"	8-1/4"	9"	10-3/4"	13"	14"	16-1/2"
Flange thickness (**)	11/16"	13/16"	7/8"	1"	1-1/8"	1-1/4"	1-3/8"	1-1/2"	1-3/4"	1-7/8"	2-3/16"
Raised face diameter	2"	2-1/2"	2-7/8"	3-5/8"	4-1/8"	5"	5-1/2"	6-3/16"	7-5/16"	8-1/2"	10-5/8"
Bolt circle diameter	3-1/2"	3-7/8"	4-1/2"	5"	5-7/8"	6-5/8"	7-1/4"	8-1/2"	10-1/2"	11-1/2"	13-3/4"
Number of bolts	4"	4"	4"	8"	8"	8"	8"	8"	8"	12"	12"
Size of bolts	5/8"	5/8"	3/4"	5/8"	3/4"	3/4"	7/8"	7/8"	1"	1"	1-1/8"

Steel & Alloy Flanges ANSI B16.5 Class 900

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	5-7/8"	6-1/4"	7"	8-1/2"	9-5/8"	9-1/2"	-	11-1/2"	13-3/4"	15"	18-1/2"
Flange thickness (**)	1-1/8"	1-1/8"	1-1/4"	1-1/2"	1-5/8"	1-1/2"	-	1-3/4"	2"	2-3/16"	2-1/2"
Raised face diameter	2"	2-1/2"	2-7/8"	3-5/8"	4-1/8"	5"	-	6-3/16"	7-5/16"	8-1/2"	10-5/8"
Bolt circle diameter	4"	4-3/8"	4-7/8"	6-1/2"	7-1/2"	7-1/2"	-	9-1/4"	11"	12-1/2"	15-1/2"
Number of bolts	4"	4"	4"	8"	8"	8"	-	8"	8"	12"	12"
Size of bolts	7/8"	7/8"	1"	7/8"	1"	7/8"	-	1-1/8"	1-1/4"	1-1/8"	1-3/8"

Steel & Alloy Flanges ANSI B16.5 Class 1500

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	5-7/8"	6-1/4"	7"	8-1/2"	9-5/8"	10-1/2"	-	12-1/4"	14-3/4"	15-1/2"	19"
Flange thickness (**)	1-1/8"	1-1/8"	1-1/4"	1-1/2"	1-5/8"	1-7/8"	-	2-1/8"	2-7/8"	3-1/4"	3-5/8"
Raised face diameter	2"	2-1/2"	2-7/8"	3-5/8"	4-1/8"	5"	-	6-3/16"	7-5/6"	8-1/2"	10-5/8"
Bolt circle diameter	4"	4-3/8"	4-7/8"	6-1/2"	7-1/2"	8"	-	9-1/2"	11-1/2"	12-1/2"	15-1/2"
Number of bolts	4"	4"	4"	8"	8"	8"	-	8"	8"	12"	12"
Size of bolts	7/8"	7/8"	1"	7/8"	1"	1-1/8"	-	1-1/4"	1-1/2"	1-3/8"	1-5/8"

Steel & Alloy Flanges ANSI B16.5 Class 2500

Nominal pipe size	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"	8"
Flange diameter	6-1/4"	7-1/4"	8"	9-1/4"	10-1/2"	12"	-	14"	16-1/2"	19"	21-3/4"
Flange thickness (**)	1-3/8"	1-1/2"	1-3/4"	2"	2-1/4"	2-5/8"	-	3"	3-5/8"	4-1/4"	5"
Raised face diameter	2"	2-1/2"	2-7/8"	3-5/8"	4-1/8"	5"	-	6-3/16"	7-5/16"	8-1/2"	10-5/8"
Bolt circle diameter	4-1/4"	5-1/8"	5-3/4"	6-3/4"	7-3/4"	9"	-	10-3/4"	12-3/4"	14-1/2"	17-1/4"
Number of bolts	4"	4"	4"	8"	8"	8"	-	8"	8"	8"	12"
Size of bolts	7/8"	1"	1-1/8"	1"	1-1/8"	1-1/4"	-	1-1/2"	1-3/4"	2"	2"

(**) ANSI flange thickness (Min.) does not include 1/4" raised face.