

# ANSI Classes & Body Material Selection

## ANSI CLASSES

It is important that the valve specifier understands ANSI Class ratings and pressure ratings; and they must clearly designate the appropriate standard class, special class, or intermediate class rating when specifying valves.

When Valtek designates a valve pressure class according to ANSI B16.34, the following standard designations are generally used: Class 150, 300, 600, 900, 1500 or 2500. These designations apply to valves with flanged, butt weld, "Grayloc", socket weld, or NPT threaded end connections.

In addition to the above mentioned classes and end configurations, ANSI B16.34 designates a standard Class 4500 for butt welding end valves. Butt welding end valves may also be upgraded to Special Class 150, 300, 600, 900, 1500, 2500, and 4500. Special Class ratings are available when certain non-destructive examination requirements are met for butt welding end valves. Properly applied Grayloc-style end connections are also suitable for many high pressure applications. Therefore Valtek offers Special Class and standard Class 4500 valves with Grayloc and butt weld end connections.

ANSI B16.34 also permits standard and Special Class 400 ratings with appropriate end connections. Although available by special request, Valtek does not offer the Class 400 rating as a standard option.

ANSI B16.34 also permits the use of intermediate ratings for butt weld end valves. For example: A customer requires a WCB body material for service at 300°F and 6500 psi. ANSI B16.34 provides a method for determining an intermediate rating for this valve (a butt weld end valve) so that it would not be necessary to require a

Class 4500 valve rating (with greater size, weight and cost). This method is described in detail in Annex F of ANSI B16.34-1981. Using this example, the method in Annex F would allow the valve specifier to use an intermediate rating of Class 3300. Although designing to intermediate ratings increases engineering time and adds pattern time when castings are required, it minimizes weight, size and material costs for some applications.

The intermediate rating method can also be used to establish pressure classes greater than Class 4500. However, the valve specifier must be careful not to interpret a 6600 psi pressure rating as a Class 6600 which has a maximum working pressure of 13,200 psi.

## BODY MATERIALS

The control valve user normally specifies the body material, which is often the same material as the pipe. The most common choices of body material are carbon steel, chrome-molybdenum steel and stainless steel.

Carbon steel is the most commonly used material for bodies. It handles most non-corrosive liquids and gases up to 800 degrees Fahrenheit for continuous service, or to 1000 degrees Fahrenheit for occasional service. (See ANSI B16.34 for specific temperatures and pressures.) Carbon steel can be used for most condensate and steam services.

Chrome-moly steel is used for higher temperatures and pressures than carbon steel, including such services as high pressure steam or flashing condensate which requires corrosion and erosion resistance. Chrome-moly is stronger than carbon steel and, in some cases, is as strong as stainless steel. It costs less than stainless steel, but is not as corrosion resistant.

Stainless steel is specified for high temperature services (1000 degrees Fahrenheit and up) or in corrosive applications. It is more corrosion resistant than either carbon steel or chrome-moly.

Special alloys—such as Hastelloy B and C, Monel, nickel and titanium—are also available. Consideration should be given to the types of material that have been used successfully in the past for similar applications.

Valtek is cautious about choosing materials for the user. Except in the most basic applications, the control valve user should specify the body materials.

Because of the lack of actual correct fluid data, Valtek does not recommend body material or guarantee corrosive resistance or fluid compatibility. Valtek has no control over fluid composition.

Once the body material has been chosen, check the pressure/temperature tables in ANSI B16.34 (found at the end of this section) to determine the application limits for the selected material.

The valve body can be cast, forged, wrought or fabricated. Castings are usually the first choice in standard sizes and ratings. Forgings are used for smaller sized Mark Two valve bodies. (Generally these valves have high pressure ratings—1500, 2500 and 4500 for those special materials not available in castings.) Barstock bodies are recommended when delivery is critical and a casting or forging is not available. Fabricated bodies are a convenient way to manufacture large angle valves.

Bonnets are generally manufactured from barstock of the same material as the body. The exception is smaller (6-inch or less) low pressure chrome-moly valves, where a stainless steel bonnet is normally standard. The basic rule is to specify the general type of bonnet material only, not the ASTM (American Society of Testing Materials) specification number, because Valtek's standard material varies according to valve size and pressure rating.

Material specification is based upon the ASTM specifications listed in ANSI B16.34 for standard service valves, and ASME (American Society of Mechanical Engineers) specifications. ASME codes are preceded by the letter "S," such as SA216-WCB.

The tables in this section are from ANSI B16.34 and B16.24 (bronze). They determine the valve body's pressure rating, such as Class 150, 300, 600, etc. The design or maximum pressure and temperatures (as given by the control valve user) should be used. Pressure and temperature values may be extrapolated between the lines.

The "special class" tables allow higher pressure and temperature values for weld-end valves with some non-destructive examination of critical areas of the body and bonnet.

Table 5-II provides the applicable ASTM codes for Valtek's common body materials.

**Table 5-I: Valve Body Material Temperature Limits (°F)**

Material	Lower	Upper
Cast Iron	-20	410
Ductile Iron	-20	650
*Carbon Steel (Grade WCB)	-20	1000
Carbon Steel (Grade LCB)	-50	650
Carbon Moly (Grade WC1)	-20	850
1-1/4 Cr - 1/2 Mo (Grade WC6)	-20	1000
2-1/4 Cr - 1 Mo (Grade WC9)	-20	1050
5 Cr - 1/2 Mo (Grade C5)	-20	1100
9 Cr - 1 Mo (Grade C12)	-20	1100
Type 304 (Grade CF 8)	-425	1500
Type 347 (Grade CF8C)	-425	1500
Type 316 (Grade CF8M)	-425	1500
3-1/2 Ni (Grade LC3)	-150	650
Aluminum	-325	400
Bronze	-325	550
Inconel 600	-325	1200
Monel 400	-325	900
Hastelloy B	-325	700
Hastelloy C	-325	1000
Titanium		600
Nickel	-325	500
Alloy 20	-50	300

\* The carbon phase of carbon steel may be converted to graphite upon long exposure to temperatures above 775° F. (Check applicable codes for maximum temperature rating of various materials.)

**TABLE 5-II: Material Standards**

Body Type	Material	Body Standard	Bonnet Standard	
Castings	Stainless Steel	A351-CF8M	A479-316	
	Carbon Steel	A216-WCB	A675-70	
	Chrome-moly	A217-WC6	A479-316	
		A217-WC9	A479-316	
		A217-C5	A479-316	
Forgings	Stainless Steel	A743-CF8M	A479-316	
	Carbon Steel	A105	A675-70	
	Chrome-moly	A182-F11	A479-316	
		A182-F22	A479-316	
		A182-F5a	A479-316	
Bar	Stainless Steel	A182-F316	A479-316	
		A479-316	A479-316	
	Carbon Steel	A675-70	A675-70	
		Chrome-moly	See Forgings	See Forgings

**Table 5-III: Valve Body (Pressure Containment) Materials**

General Classification	Applicable ASTM Material Specification		
	Forgings	Castings	Bar
Cast Iron		A126	
Ductile Iron		A395	
Carbon Steel	A105	A216 Grade WCB*	A675-70**
Carbon Steel (low temp)	A350 Gr LF1 & LF2	A352 Grade LCB	
Carbon 1/2 Moly	A182 Grade F1	A217 Grade WC1	
1-1/4 Chrome - 1/2 Moly	A182 Grade F11	A217 Grade WC6	
2-1/4 Chrome - 1 Moly	A182 Grade F22	A217 Grade WC9*	
5 Chrome - 1/2 Moly	A182 Grade F5a	A217 Grade C5*	
9 Chrome - 1 Moly	A182 Grade F9	A217 Grade C12	
Type 304	A182 Grade F304	A351 Grade CF8*	A479-304**
Type 304L	A182-F304L	A351 Grade CF3	A479-304L
Type 347	A182 Grade F347	A351 Grade CF8C	A479-347
Type 316	A182 Grade F316	A351 Grade CF8M*	A479-316**
Type 316L	A182 Grade F316L	A351 Grade CF3M	A479-316L
3-1/2 Nickel	A350 Grade LF3	A352 Grade LC3	
Aluminum	B247	B26	
Bronze		B61	
		B62	
		B148-C952*	
Inconel 600	B166	A743-CY40	
Monel 400		A494-M30C	
Hastelloy B2		A494-N-7M-1*	
		A494-N-12M-V	
Hastelloy C		A494-CW-6M*	
		A494-CW-12M-W	
Titanium	B381	B367	
		B367 Gr. 3*	B348 Gr. 4
Nickel		A494-CZ-100	
Alloy 20	B462	A351-CN-7M*	B473

\* Valtek standard for cast bodies

\*\* Valtek standard for Mark Two bodies