ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

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ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

BACKGROUND—ASME B16.34-2009

• ANSI NATIONAL STANDARD

• LIMITED CONSTRUCTION DETAILS COVERS:
  • PRESSURE BOUNDARY PART DETAILS
  • PRESSURE-TEMPERATURE RATINGS
  • MINIMUM BODY WALL THICKNESS

• SPECIFIC TO STEEL, ALLOY STEEL, NICKEL & NICKEL ALLOY VALVES

CONSTRUCTION--AN ALL-INCLUSIVE TERM COMPRISING MATERIALS, DESIGN, FABRICATION, EXAMINATION, TESTING, INSPECTION, AND CERTIFICATION REQUIRED IN THE MANUFACTURE AND INSTALLATION OF AN ITEM.
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

OTHER VALVE STANDARDS

• API-594, 599, 600, 602, 603, 608, 609
• MSS SP-42, 67, 68, 72, 81, 135
• USE B16.34 PRESSURE BOUNDARY AND PRESSURE-TEMPERATURE RATING RULES
• ADDRESS NON-PRESSURE BOUNDARY PART CONSTRUCTION RULES INCLUDING

  1. MATERIALS
  2. MIN. STEM SIZE
  3. MIN. SEAT SIZE
  4. MIN. PACKING SIZE
  5. SPECIFIC EXAMINATION/TESTING RULES
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

HISTORY OF B16.34 DEVELOPMENT BASED ON:

- ASA/USAS B16e (later designated B16.5)-Pipe Flanges, Flanged Fittings & Valves

- MSS SP-66-Pressure-Temperature Ratings for Steel Butt-Welding Valves

- MSS SP-84-Valves-Socket Welding and Threaded Ends
HISTORY OF B16.34 DEVELOPMENT:

- ASA/USAS B16e-1927-Pipe Flanges and Flanged Fittings

- ASA/USAS B16e-1939
  1. PRESSURE CLASSES 150, 300, 400, 600, 900, 1500, 2500
  2. FORGINGS-A181, A105 & A182 F1
  3. CASTINGS-A95 (FORERUNNER A216) & A151 Grade C1 (FORERUNNER OF A217)
  4. INCLUDED WELDING TECHNOLOGY/WELDING NECK FLANGES
  5. P/T RATINGS SPECIFIC TO SERVICE (WATER & STEAM/OIL) AND GASKET (RJ & OTHER)
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

HISTORY OF B16.34 DEVELOPMENT:

• ASA/USAS B16e5-1943-WWII STANDARD SUPPLEMENT TO P/T RATINGS
  1. USA WAR PRODUCTION BOARD STANDARD
  2. SIGNIFICANT IMPROVEMENT IN P/T RATINGS
  3. ADDED FLANGED AND WELDED VALVES TO SCOPE
• 1st STANDARD TO INCLUDE STEEL VALVES
• P/T RATINGS CLOSE TO B16.34 RATINGS TODAY
• REMAINED THE FLANGED & WELDED END STEEL VALVE STANDARD UP TO 1973
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

HISTORY OF B16.34 DEVELOPMENT:

• POST WW II DEVELOPMENT
  1. THE WARTIME RATINGS WERE ADOPTED
  2. STANDARD CLASS WAS ADOPTED FOR FLANGED VALVES
  3. CEILING PRESSURE INTRODUCED

• CEILING PRESSURE IMPOSED

• EXTRACTS FROM B16.5-1957

  Extracted from American Standard Steel Pipe Flanges and Flanged Fittings (ASA B16.5-1957) with the permission of the publisher, The American Society of Mechanical Engineers.
APPENDIX D

METHOD OF RATING ALLOY STEELS NOT GIVEN IN TABLES 1 TO 8 INCLUSIVE

Ratings of 150-lb pressure class flanges and flanged fittings for all alloy steels shall be taken to be the same as 150-lb pressure class ratings for carbon steel.

Ratings of 300-lb and higher pressure class flanges or flanged fittings made of alloy steels with allowable stresses given in Table P-7 of the ASME Boiler Construction Code other than those in Tables 1 to 8 inclusive may be obtained by the following procedure:

1 DEFINITION OF SYMBOLS
P = pressure ratings (psi) at desired temperature
S_c = Table P-7 allowable stress (psi) at that temperature
S_y = yield strength (psi) at that temperature
P_p = primary rating pressure (psi)

2 RATINGS
a Primary Rating Temperature. Plot allowable stresses given in ASME Boiler Construction Code, Table P-7, for the alloy steel against temperature. The temperature at which the curve intersects the 8750 psi stress line is the primary rating temperature. This temperature should be rounded to an even 25°F by adding or subtracting 12.5°F, otherwise dropping to the next lower 25°F interval.

b Pressure-Temperature Ratings:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Pressure Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 650°F</td>
<td>Ratings same as carbon steel (carbon steel ratings)</td>
</tr>
<tr>
<td>650°F to primary rating temperature</td>
<td>Ratings obtained by linear interpolation between pressure rating at 650°F and primary rating pressure at primary rating temperature</td>
</tr>
<tr>
<td>Above primary rating temperature</td>
<td>Ratings determined from formula: ( P = S_c \cdot \frac{P_p}{8750} )</td>
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</tbody>
</table>

All except:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Pressure Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 875°F</td>
<td>Except: ( P = 0.625 \cdot P_p )</td>
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</table>

2 The same ratings shall be used for cast and forged material. Where ASME Code gives different allowable stresses for the two forms of the same material, use the lower.

3 Calculated ratings may be rounded to nearest 5 psi.

4 This exception applies to materials with comparatively low yield strength at atmospheric and moderate temperatures, such as Type 304 austenitic stainless steel.
METHOD OF RATING ALLOY STEELS NOT GIVEN IN TABLES 1 TO 8 INCLUSIVE

EXAMPLE - TO OBTAIN RATINGS OF 300 LB ASA B16.5 FLANGES AND FLANGED FITTINGS MADE OF SA-335, OR P7 (7Cr-1/2Mo):

PRESSURE - TEMPERATURE RATINGS:

SAME AS CARBON STEEL

ALLOWABLE STRESS VS.
TEMP. PLOT TO DETERMINE PRIMARY RATING TEMPERATURE

PRIMARY RATING TEMPERATURE FROM ABOVE PLOT
### Table 7 - 1500 Pound Pressure-Temperature Ratings

*Note: These ratings are all subject to stipulations in Introductory Note 2 which form a part of this table. All pressures are in pounds per square inch gage (psig).*

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<tr>
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| PRESSURE - TEMPERATURE RATINGS |

**Hydrostatic Shell Test Pressure**: 5400 psi

5400

5400
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

• HISTORY OF B16.34 DEVELOPMENT:
  • MSS SP-66, PRESSURE-TEMPERATURE RATINGS FOR STEEL BUTT-WELDING END VALVES
    1. CEILING PRESSURE REMOVED
    2. COVER BUTT-WELDING END VALVES
    3. REQUIRED 100% NDE OF BODY BONNET PARTS

• SP-66 WAS THE SOURCE OF B16.34-73 SPECIAL CLASS B16.34 P/T RATINGS
  1. IMPROVED P/T RATINGS IN THE MID TEMPERATURE AND HIGH TEMPERATURE RANGE
  2. ALLOWED PLASTICITY FACTOR TO BE APPLIED TO PRESSURE RATING FOR TEMPERATURE ABOVE 900F
  3. DIFFERENT METHOD FOR P/T RATINGS
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

HISTORY OF B16.34 DEVELOPMENT:

• B16.5-73, STEEL PIPE FLANGES, FLANGED VALVES AND FITTINGS, LAST DOCUMENT THAT CONTAINED FLANGED VALVES IN SCOPE

• B16.34-73 STEEL BUTT-WELDING END VALVES
  1. B16.5 STANDARD CLASS
  2. MSS SP 66 SPECIAL CLASS
  3. EXPANSION OF MATERIALS TABLES

• B16.34-77 STEEL VALVES
  1. COVER CONSTRUCTION DETAILS OF ALL STEEL VALVES
  2. VALVE DETAILS WAS REMOVED FROM B16.5-77
HISTORY OF B16.34 DEVELOPMENT:

- B16.34-81, NICKEL AND NICKEL ALLOYS ADDED

- B16.34-81 MATERIAL GROUPS
  - GROUP 1: (CARBON AND STEEL ALLOYS),
  - GROUP 2: (STAINLESS STEEL ALLOYS) AND
  - GROUP 3: (NICKEL AND NICKEL ALLOYS) FINALIZED

- B16.34-81
  - TABLE 1 MATERIAL LISTING
  - EACH MATERIAL GROUP (1.1, 2.1, 3.1, ETC.) P/T TABLE EXISTS
  - FORGING, CASTING, PLATE, BAR, OR TUBULAR MATERIALS ACCEPTABLE FOR PRESSURE BOUNDARY
HISTORY OF B16.34 DEVELOPMENT:

• MSS SP-84, VALVES- SOCKET WELDING AND THREADED ENDS

• DETAILED THE REQUIREMENTS FOR SW AND THREADED VALVES

• ALLOWED FOR THE USE OF SPECIAL CLASS RATINGS + PLASTICITY FACTOR AT TEMPERATURES ABOVE 900F

• WAS THE SOURCE FOR B16.34 LIMITED CLASS VALVES

• SP-84 ADOPTED BY B16.34-88 EDITION AND ALLOWED VALVES TO BE GIVEN LIMITED CLASS RATING
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

SUMMARY OF ASME B16.34 P/T HISTORY

• ASME B16.5 SOURCE FOR B16.34 STANDARD CLASS RATING

• MSS SP-66 SOURCE FOR B16.34 SPECIAL CLASS RATING

• MSS SP-84 SOURCE FOR B16.34 LIMITED CLASS RATING
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-2009

1. STANDARD CLASS
2. SPECIAL CLASS
3. LIMITED CLASS
4. INTERMEDIATE CLASS—WELDING AND THREADED END VALVES ONLY—CLASS 800, CLASS 1690, CLASS 2680

ASME B16.34-2009 P/T

1. APPENDIX B-STANDARD & SPECIAL CLASS P/T METHODS
2. WALL THICKNESS EQUATION
   - TABLE 3A AND 3B, B16.34 HAS LISTING
   - EQUATIONS APPENDIX VI, B16.34 CAN BE USED
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-2009

• MINIMUM BODY WALL THICKNESS

\[ t = 1.5\left[\frac{P_c d}{2S - 1.2P_c}\right] + A \]

\( t = \) calculated thickness, in
\( P_c = \) pressure rating class designation \((150, 300, 600, \text{ etc.})\)
\( d = \) inside diameter or port opening as defined in 6.1.2
\( S = 7000 \) psi constant
\( A = \) additional allowance
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-2009

• STANDARD CLASS P/T EQUATION

\[ p_{st} = \frac{S_1 P_r}{8750} \leq p_{ca} \]

- \( p_{st} \) = Standard Class rated working pressure (psi) for the specified material at temperature \( T \)
- \( P_r \) = pressure rating class index-Class 300, 600, 1500, etc.
- \( p_{ca} \) = ceiling pressure (psi), at temperature \( T \) for Standard Class from table B-3, Standard Class, of B16.34.
- \( S_1 \) = selected stress (psi) for the specified material at temperature \( T \).

• DATA SOURCE-PART D, ASME SECTION II, MATERIALS
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-2009
SPECIAL CLASS P/T EQUATION

\[ p_{sp} = \frac{S_2 P_r}{7000} \leq p_{cb} \]

- \( p_{sp} \) = Special Class rated working pressure (psi) for the specified material at temperature \( T \)
- \( P_r \) = pressure rating class index.
- \( p_{cb} \) = ceiling pressure (psi), at temperature \( T \) for Special Class from table B-3, Special Class, of B16.34.
- \( S_2 \) = selected stress (psi) for the specified material at temperature \( T \).

- DATA SOURCE-PART D, ASME SECTION II, MATERIALS
<table>
<thead>
<tr>
<th>Region</th>
<th>Temperature</th>
<th>Standard Class MG</th>
<th>Typical Materials</th>
<th>Special Class MG</th>
<th>Typical Materials</th>
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<tbody>
<tr>
<td>Below Creep</td>
<td>≤500F</td>
<td>MG 1.2</td>
<td>A216 WCC</td>
<td>ALL TEMPS LESS THAN CREEP MG 1.2, 1.10 or 2.2</td>
<td>A216 WCC, A182 F22/A217 WC9, F316</td>
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<td>&gt;500F</td>
<td>MG 1.9 or 2.2</td>
<td>A182 F11/A216 WC6 OR F316/A351 CF8M</td>
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<td>MG 1.10 or 2.2</td>
<td>A182 F22/A217 WC9 or A182 F316/A351 CF8M</td>
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ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-2009
LIMITED CLASS P/T EQUATIONS

1. SEE APPENDIX V, B16.34
2. START WITH SPECIAL CLASS RATING
3. ABOVE 900F USE FOLLOWING EQUATION:

\[ p_{ld} = 7000 \times p_{sp}/(7000-(y-0.4)P_r) \]

\( p_{ld} \) = Limited Class rated working pressure for the specified material at a temperature \( T > 900F \)
\( P_r \) = pressure class rating index-Special Class 300, 600, 1500, etc.
\( p_{sp} \) = Special class rated working pressure for the specified material at temperature \( T \)
\( y \) = a material coefficient having values as listed below:

\( Y = 0.4 \) to \( 0.7 \) for ferritic steel from 950F to 1500F
\( Y = 0.4 \) to \( 0.7 \) for austenitic steel from 950F to 1500F
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

B16.34 LIMITED CLASS MATERIAL COEFFICIENT-\( y \)

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</tbody>
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ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-2009

- B16.34-2009 COVERS ALL TYPE OF VALVES
- METRIC AND U.S. CUSTOMARY
- LARGE LISTED MATERIAL COVERAGE-TABLE 1, FORGINGS, CASTINGS, PLATE, BAR, & TUBULAR
- FLANGED, BW, SW, THREADED. FLANGELESS, WAFER, & LUG
- PRESSURE CLASS TO 4500
- BONNET/BODY JOINTS-BOLTED, WELDED, THREADED AND WELDED
- NDE DETAILS
ASME B16.34 PRESSURE TEMPERATURE RATING HISTORY

ASME B16.34-FUTURE

- FLANGED VALVES TO NPS 50
- NEW MATERIAL ISSUES
- THREE YEAR DATE FOR PUBLICATION
- B16 CASE PROCEDURE