

Agenda Item: 620-2069 – Attachment D (ASME VIII Div 2 2025 vs 2017 Comparison)

ASME VIII Div 2 – 2025	ASME VIII Div 2 - 2017
3.11 MATERIAL TOUGHNESS REQUIREMENTS 3.11.1 GENERAL 3.11.1.1 Charpy V-notch impact tests shall be made for materials used for shells, heads, nozzles, and other pressure-containing parts, as well as for the structural members essential to structural integrity of the vessel, unless exempted by the rules of 3.11. (a) Toughness requirements for materials listed in Table 3-A.1 (carbon and low alloy steel materials except bolting materials) are given in 3.11.2. (b) Toughness requirements for materials listed in Table 3-A.2 (quenched and tempered steels with enhanced tensile properties) are given in 3.11.3. (c) Toughness requirements for materials listed in Table 3-A.3 (high alloy steels except bolting materials) are given in 3.11.4. (d) Toughness requirements for materials listed in Tables 3-A.4 through 3-A.7 (nonferrous alloys) are given in 3.11.5. (e) Toughness requirements for all bolting materials are given in 3.11.6.	3.11 MATERIAL TOUGHNESS REQUIREMENTS 3.11.1 GENERAL 3.11.1.1 Charpy V-notch impact tests shall be made for materials used for shells, heads, nozzles, and other pressure-containing parts, as well as for the structural members essential to structural integrity of the vessel, unless exempted by the rules of 3.11. (a) Toughness requirements for materials listed in Table 3-A.1 (carbon and low alloy steel materials except bolting materials) are given in 3.11.2. (b) Toughness requirements for materials listed in Table 3-A.2 (quenched and tempered steels with enhanced tensile properties) are given in 3.11.3. (c) Toughness requirements for materials listed in Table 3-A.3 (high alloy steels except bolting materials) are given in 3.11.4. (d) Toughness requirements for materials listed in Table 3-A.4 through 3-A.7 (nonferrous alloys) are given in 3.11.5. (e) Toughness requirements for all bolting materials are given in 3.11.6.
Compare Materials per API 620 Table 4.1, Section 4.3, Section 4.4 to ASME <u>ASME VIII Div 2 Table 3-A.1 that are matching API 620 Table 4.1</u> Plates A36 A283 D A285 C A516 55/60/65/70 A537 CL 1/2 A662 B/C A737 B A841 CL 1/2 A/B Pipe A106 A333 A524 Forgings/Castings A105 A181 A350 Structural Shapes A36 <u>Not Listed in ASME VIII Div 2 Table 3-A.1</u> Plates – A20, A131 B, A283 C, A573 58/65/70, A633 C/D, G40.21 38W/44W/50W, ISO 630, EN 10025 Pipe – A53, A134, A139, A671, API 5L Forging/Casting – A27 Structural Shapes – A131, A633 A, A992	Compare Materials per API 620 Table 4.1, Section 4.3, Section 4.4 to ASME <u>ASME VIII Div 2 Table 3-A.1 that are matching API 620 Table 4.1</u> Plates A36 A283 D A285 C A516 55/60/65/70 A537 CL 1/2 A662 B/C A737 B A841 CL 1/2 A/B Pipe A106 A333 A524 Forgings/Castings A105 A181 A350 Structural Shapes A36 <u>Not Listed in ASME VIII Div 2 Table 3-A.1</u> Plates – A20, A131 B, A283 C, A573 58/65/70, A633 C/D, G40.21 38W/44W/50W, ISO 630, EN 10025 Pipe – A53, A134, A139, A671, API 5L Forging/Casting – A27 Structural Shapes – A131, A633 A, A992

Compare Materials per API 620 Annex R Table R-1,-2, and -3 (-60F to -20F) <u>ASME VIII Div 2 Table 3-A.1 that are matching API 620 Annex R Tables</u> Plates A516 55/60/65/70 A662 B/C A537 CL1/2 A841 CL1/2 A/B A737 B A36 Pipe A333 A106 A420 Forgings A350 A105 Structural members A36 <u>Not Listed in ASME Div 2 Table 3-A.1</u> Plates – A131 B, A573 58, A633 C/D, G40.21 38W/44W/50W, ISO 630, EN 10025, EN 10028 P275 Pipe – A671 CI 22 Forgings – none Structural members – A992, A131 D/E, A633 A, G40.21 38WT/44WT/50WT, ISO 630, EN 10025	Compare Materials per API 620 Annex R Table R-1,-2, and -3 (-60F to -20F) <u>ASME VIII Div 2 Table 3-A.1 that are matching API 620 Annex R Tables</u> Plates A516 55/60/65/70 A662 B/C A537 CL1/2 A841 CL1/2 A/B A737 B A36 Pipe A333 A106 A420 Forgings A350 A105 Structural members A36 <u>Not Listed in ASME Div 2 Table 3-A.1</u> Plates – A131 B, A573 58, A633 C/D, G40.21 38W/44W/50W, ISO 630, EN 10025, EN 10028 P275 Pipe – A671 CI 22 Forgings – none Structural members – A992, A131 D/E, A633 A, G40.21 38WT/44WT/50WT, ISO 630, EN 10025
NOTE – material lists between ASME 2017 and ASME 2025 are the same. No changes were found in comparing to the 2025 version. Only the materials found in ASME Table 3-A.1 can benefit with the low stress/low temperature provisions for lower DMTs. For materials in API 620 that are not listed in ASME, these low stress/low temperature provisions do not apply.	

(25) **3.11.2.5 Exemption From Impact Testing Based on Design Stress Values.**

(a) A colder MDMT for a component than that derived from 3.11.2.2 or 3.11.2.3 may be determined in accordance with the procedure outlined below.

Step 1. For the welded part under consideration, determine the nominal thickness of the part, t_n , and the required governing thickness of the part, t_g , using 3.11.2.3(b).

Step 2. Determine the applicable material toughness curve to be used in Figure 3.9 for welded parts not subject to PWHT or Figure 3.10 for welded parts subject to PWHT. See 3.11.2.2(b) for materials having a specified minimum yield strength greater than 450 MPa (65 ksi).

Step 3. Determine the MDMT from Figure 3.9 for welded parts not subject to PWHT or Figure 3.10 for welded parts subject to PWHT based on the applicable toughness curve and the governing thickness, t_g . For materials having a specified minimum yield strength greater than 450 MPa (65 ksi), the MDMT shall be determined by impact testing per 3.11.2.2(b).

Step 4. Based on the design loading conditions at the MDMT, determine the stress ratio, R_{ts} , using one of the equations below. For pressure vessel attachments that are exposed to tensile stresses from internal pressure (e.g., nozzle reinforcement pads, horizontal vessel saddle attachments, and stiffening rings), the coincident ratio shall be that of the shell or head to which each component is attached. Note that this ratio can be computed in terms of required design thickness and nominal thickness, applied stress and allowable design stress, or applied pressure and maximum allowable working pressure based on the design rules in this Division or ASME/ANSI pressure-temperature ratings.

$$R_{ts} = \frac{t_g E^*}{t_n - CA} \quad (\text{Thickness Basis}) \quad (3.1)$$

$$R_{ts} = \frac{S^* E^*}{SE} \quad (\text{Stress Basis}) \quad (3.2)$$

$$R_{ts} = \frac{P_g}{P_{rating}} \quad (\text{Pressure-Temperature Rating Basis}) \quad (3.3)$$

Step 5. Determine the final value of the MDMT and evaluate results.

(a) If the computed value of the R_{ts} ratio from Step 4 is less than or equal to 0.24, then set the MDMT to -104°C (-155°F).

(b) If the computed value of the R_{ts} ratio from Step 4 is greater than 0.24, then determine the temperature reduction, T_R . If the specified minimum yield strength is less than or equal to 450 MPa (65 ksi), then determine T_R from Figure 3.14 for parts not subject to PWHT or Figure 3.15 for parts subject to PWHT based on the R_{ts} ratio from Step 4. If the specified minimum yield strength is greater than 450 MPa (65 ksi) for parts subject to PWHT, then determine the temperature reduction, T_R from eq. (3.4). The final computed value of the MDMT is determined using eq. (3.5). The reduction in the MDMT given by eq. (3.5) shall not exceed 55°C (100°F). Impact testing is not required if the specified MDMT is warmer than the computed MDMT. However, if the specified MDMT is colder than -48°C (-55°F), impact testing is required.

$$T_R = \frac{\left(\frac{-27.20656 - 76.98828R_{ts} + 103.0922R_{ts}^2 + 7.433649(10)^{-3}S_y}{1 - 1.986738R_{ts} - 1.758474(10)^{-2}S_y + 6.479033(10)^{-5}S_y^2} \right)}{(\text{°F, ksi})} \quad (3.4)$$

$$\text{MDMT} = \text{MDMT}_{\text{STEP3}} - T_R \quad (3.5)$$

(b) The procedure in 3.11.2.5(a) above is repeated for each welded part, and the warmest MDMT of all welded parts is the MDMT for the vessel.

(c) For a flange attached by welding, the procedure in 3.11.2.5(a) above can be used by determining the temperature reduction as determined for the neck or shell to which the flange is attached. The bolt-up condition need not be considered when determining the temperature reduction for flanges.

(d) For components not stressed in general primary membrane tensile stress such as flat heads, covers, tubesheets, and flanges, the MDMT shall not be colder than the MDMT derived from 3.11.2.3, 3.11.2.4(a), or the impact test temperature less the allowable temperature reduction as determined in 3.11.2.5(a). The ratio used in 3.11.2.5(a) shall be the ratio of the maximum design pressure at the MDMT to the maximum allowable pressure (MAP) of the component at the MDMT.

(e) Longitudinal tensile stress in the vessel due to net-section bending that results in general primary membrane tensile stress (e.g., due to wind or earthquake in a vertical vessel, at mid-span and in the plane of the saddles of a saddle-supported horizontal vessel) shall be considered when calculating the R_{ts} ratio in (a), Step 4.

(17) **3.11.2.5 Exemption From Impact Testing Based on Design Stress Values.**

(a) A colder MDMT for a component than that derived from 3.11.2.2 or 3.11.2.3 may be determined in accordance with the procedure outlined below.

Step 1. For the welded part under consideration, determine the nominal thickness of the part, t_n , and the required governing thickness of the part, t_g , using 3.11.2.3(b).

Step 2. Determine the applicable material toughness curve to be used in Figure 3.7 for parts not subject to PWHT or Figure 3.8 for parts subject to PWHT. See 3.11.2.2(b) for materials having a specified minimum yield strength greater than 450 MPa (65 ksi).

Step 3. Determine the MDMT from Figure 3.7 for parts not subject to PWHT or Figure 3.8 for parts subject to PWHT based on the applicable toughness curve and the governing thickness, t_g . For materials having a specified minimum yield strength greater than 450 MPa (65 ksi), the MDMT shall be determined by impact testing per 3.11.2.2(b).

Step 4. Based on the design loading conditions at the MDMT, determine the stress ratio, R_{ts} , using one of the equations shown below. Note that this ratio can be computed in terms of required design thickness and nominal thickness, applied stress and allowable design stress, or applied pressure and maximum allowable working pressure based on the design rules in this Division or ASME/ANSI pressure-temperature ratings.

$$R_{ts} = \frac{t_g E^*}{t_n - CA} \quad (\text{Thickness Basis}) \quad (3.1)$$

$$R_{ts} = \frac{S^* E^*}{SE} \quad (\text{Stress Basis}) \quad (3.2)$$

$$R_{ts} = \frac{P_g}{P_{rating}} \quad (\text{Pressure-Temperature Rating Basis}) \quad (3.3)$$

Step 5. Determine the final value of the MDMT and evaluate results.

(a) If the computed value of the R_{ts} ratio from Step 4 is less than or equal to 0.3 for Class 1, or 0.24 for Class 2, then set the MDMT to -104°C (-155°F).

(b) If the computed value of the R_{ts} ratio from Step 4 is greater than 0.3 for Class 1, or 0.24 for Class 2, then determine the temperature reduction, T_R . If the specified minimum yield strength is less than or equal to 450 MPa (65 ksi), then determine T_R from Figure 3.12 for parts not subject to PWHT or Figure 3.13 for parts subject to PWHT based on the R_{ts} ratio from Step 4. If the specified minimum yield strength is greater than 450 MPa (65 ksi) for parts subject to PWHT, then determine the temperature reduction, T_R from eq. (3.4). The final computed value of the MDMT is determined using eq. (3.5). The reduction in the MDMT given by eq. (3.5) shall not exceed 55°C (100°F). Impact testing is not required if the specified MDMT is warmer than the computed MDMT. However, if the specified MDMT are colder than -48°C (-55°F), impact testing is required.

$$T_R = \frac{\left(\frac{-27.20656 - 76.98828R_{ts} + 103.0922R_{ts}^2 + 7.433649(10)^{-3}S_y}{1 - 1.986738R_{ts} - 1.758474(10)^{-2}S_y + 6.479033(10)^{-5}S_y^2} \right)}{(\text{°F, ksi})} \quad (3.4)$$

$$\text{MDMT} = \text{MDMT}_{\text{STEP3}} - T_R \quad (3.5)$$

(b) The procedure in 3.11.2.5(a) above is repeated for each welded part, and the warmest MDMT of all welded parts is the MDMT for the vessel.

(c) For a flange attached by welding, the procedure in 3.11.2.5(a) above can be used by determining the temperature reduction as determined for the neck or shell to which the flange is attached. The bolt-up condition need not be considered when determining the temperature reduction for flanges.

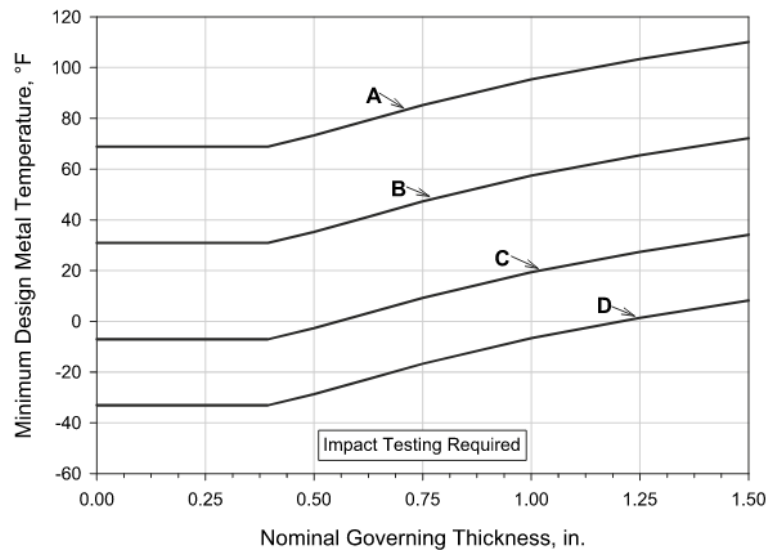
(d) For components not stressed in primary membrane tensile stress such as flat heads, covers, tubesheets, and flanges (including bolts and nuts), the MDMT shall not be colder than the MDMT derived from 3.11.2.3 or the impact test temperature less the allowable temperature reduction as determined in 3.11.2.5(a). The ratio used in 3.11.2.5(a) shall be the ratio of the maximum design pressure at the MDMT to the maximum allowable pressure (MAP) of the component at the MDMT.

NOTE – comparing ASME VIII Div 2 3.11.2.5 between 2025 and 2017 are

2017 had the Class 1 and Class 2 reference.

essentially the same rules, same equations, same figures, and same steps, overall (a couple figure numbers have changed though, but the same figure/graph). However, the change with removing Class 1 is seen in the updated text.

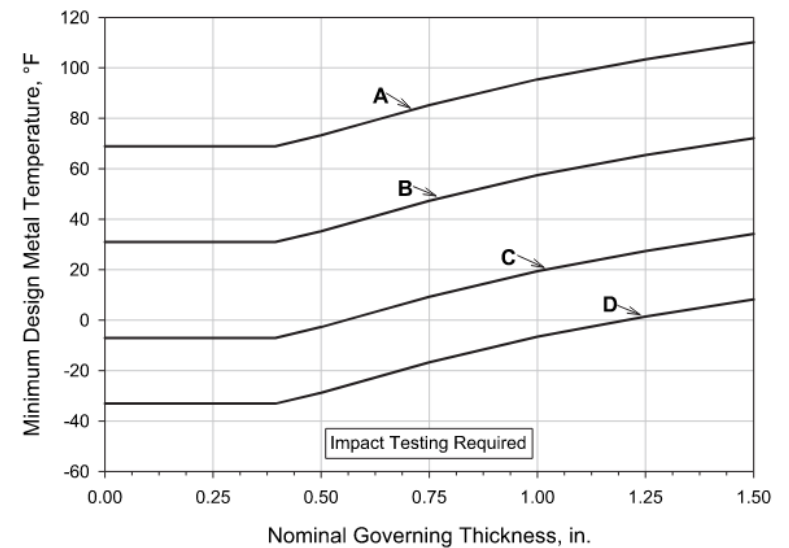
Figure 3.9
Impact Test Exemption Curves — Welded Parts Not Subject to PWHT



Curve	Material Assignment
A	(a) All carbon and all low alloy steel plates, structural shapes, and bars not listed in Curves B, C, and D below (b) SA-216 Grades WCB and WCC if normalized and tempered or water-quenched and tempered; SA-217 Grade WC6 if normalized and tempered or water-quenched and tempered (c) A/SA-105 forged flanges supplied in the as-forged condition
B	(a) SA-216 Grades WCA if normalized and tempered or water-quenched and tempered; Grades WCB and WCC for thicknesses not exceeding 50 mm (2 in.) if produced to a fine grain practice and water-quenched and tempered (b) SA-217 Grade WC9 if normalized and tempered (c) SA-285 Grades A and B (d) SA-299 (e) SA-414 Grade A (f) SA-515 Grades 60 (g) SA-516 Grades 65 and 70 if not normalized (h) SA-662 Grade B if not normalized (i) SA/EN 10028-2 Grade P355GH as-rolled (j) Except for cast steels, all materials of Curve A if produced to fine grain practice and normalized which are not listed for Curve C and D below (k) Pipe, fittings, forgings; A/SA-105 forged flanges that are produced to fine grain practice and normalized, normalized and tempered, or quenched and tempered after forging; and tubing not listed for Curves C and D below (l) Parts permitted from 3.2.8 shall be included in Curve B even when fabricated from plate that otherwise would be assigned to a different curve.
C	(a) SA-182 Grades F21 and F22 if normalized and tempered (b) SA-302 Grades C and D (c) SA-336 Grades F21 and F22 if normalized and tempered, or liquid quenched and tempered (d) SA-387 Grades 21 and 22 if normalized and tempered, or liquid quenched and tempered

(17)

Figure 3.7
Impact Test Exemption Curves — Parts Not Subject to PWHT

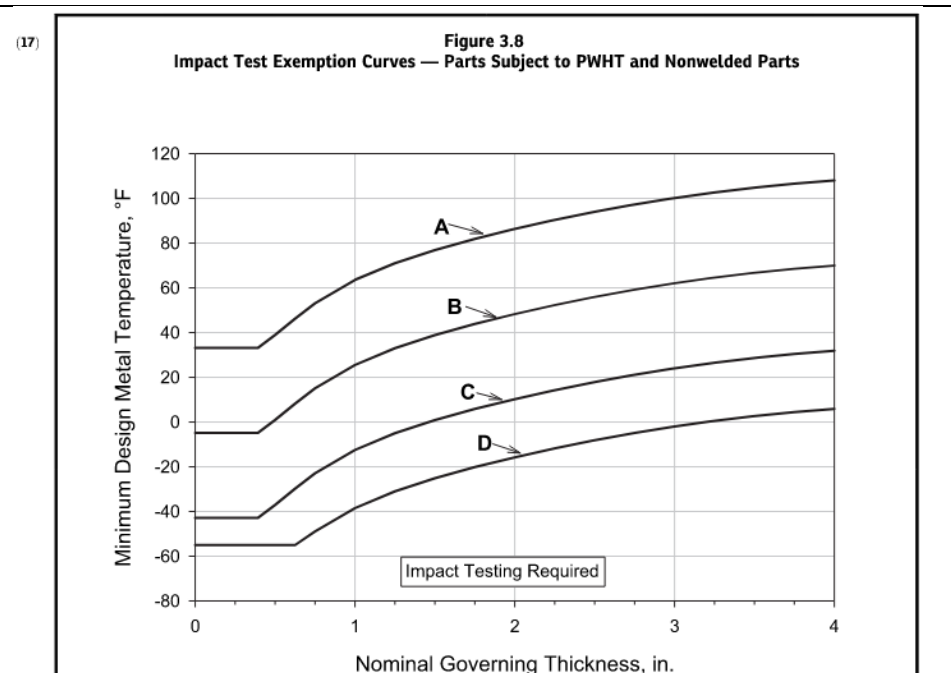
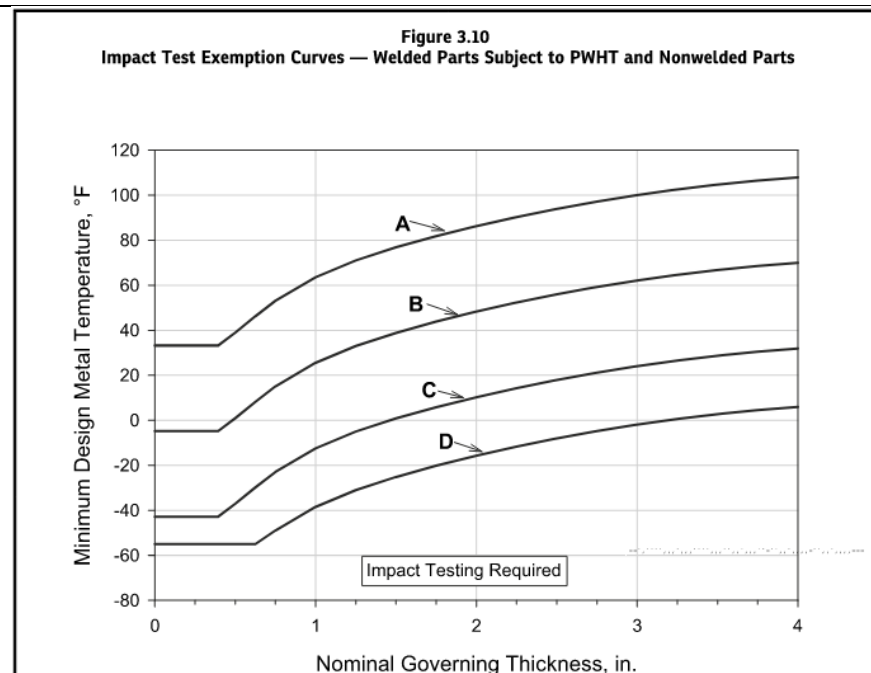


Curve	Material Assignment
A	(a) All carbon and all low alloy steel plates, structural shapes, and bars not listed in Curves B, C, and D below. (b) SA-216 Grades WCB and WCC if normalized and tempered or water-quenched and tempered; SA-217 Grade WC6 if normalized and tempered or water-quenched and tempered
B	(a) SA-216 Grades WCA if normalized and tempered or water-quenched and tempered; Grades WCB and WCC for thicknesses not exceeding 50 mm (2 in.) if produced to a fine grain practice and water-quenched and tempered (b) SA-217 Grade WC9 if normalized and tempered (c) SA-285 Grades A and B (d) SA-299 (e) SA-414 Grade A (f) SA-515 Grades 60 (g) SA-516 Grades 65 and 70 if not normalized (h) SA-662 Grade B if not normalized (i) SA/EN 10028-2 Grade P355GH as-rolled (j) Except for cast steels, all materials of Curve A if produced to fine grain practice and normalized which are not listed for Curve C and D below; (k) Pipe, fittings, forgings, and tubing not listed for Curves C and D below; (l) Parts permitted from 3.2.8 shall be included in Curve B even when fabricated from plate that otherwise would be assigned to a different curve.
C	(a) SA-182 Grades F21 and F22 if normalized and tempered. (b) SA-302 Grades C and D (c) SA-336 Grades F21 and F22 if normalized and tempered, or liquid quenched and tempered. (d) SA-387 Grades 21 and 22 if normalized and tempered, or liquid quenched and tempered.

Curve	Material Assignment
	(e) SA-516 Grades 55 and 60 if not normalized (f) SA-533 Types B and C, Class 1 (g) SA-662 Grade A (h) SA/EN 10028-2 Grade 10CrMo9-10 if normalized and tempered (i) All materials listed in (a) through (i) and in (k) for Curve B if produced to fine grain practice and normalized, normalized and tempered, or liquid quenched and tempered as permitted in the material specification, and not listed for Curve D below
D	(a) SA-203 (b) SA-299 if normalized (c) SA-508 Class 1 (d) SA-516 if normalized (e) SA-524 Classes 1 and 2 (f) SA-537 Classes 1, 2, and 3 (g) SA-612 if normalized; except that the increased Cb limit in the footnote of Table 1 of SA-20 is not permitted (h) SA-662 if normalized (i) SA-738 Grade A (j) SA-738 Grade A with Cb and V deliberately added in accordance with the provisions of the material specification, not colder than -29°C (-20°F) (k) SA-738 Grade B not colder than -29°C (-20°F) (l) SA/EN 10028-2 Grade P355GH if normalized [See General Note (d)(3)]
GENERAL NOTES: (a) Castings not listed as Curve A and B shall be impact tested. (b) For bolting see 3.11.6. (c) When a class or grade is not shown in a material assignment, all classes and grades are indicated. (d) The following apply to all material assignments: (1) Cooling rates faster than those obtained in air, followed by tempering, as permitted by the material specification, are considered equivalent to normalizing and tempering heat treatments. (2) Fine grain practice is defined as the procedures necessary to obtain a fine austenitic grain size as described in SA-20. (3) Normalized rolling condition is not considered as being equivalent to normalizing. (e) Data of Figures 3.9 and 3.9M are shown in Table 3.15.	

Figure 3.7 Impact Test Exemption Curves — Parts Not Subject to PWHT (Cont'd)	
Curve	Material Assignment
	(e) SA-516 Grades 55 and 60 if not normalized (f) SA-533 Types B and C, Class 1 (g) SA-662 Grade A (h) SA/EN 10028-2 Grade 10CrMo9-10 if normalized and tempered (i) All materials listed in (a) through (h) and in (j) for Curve B if produced to fine grain practice and normalized, normalized and tempered, or liquid quenched and tempered as permitted in the material specification, and not listed for Curve D below
D	(a) SA-203 (b) SA-299 if normalized (c) SA-508 Class 1 (d) SA-516 if normalized (e) SA-524 Classes 1 and 2 (f) SA-537 Classes 1, 2, and 3 (g) SA-612 if normalized; except that the increased Cb limit in the footnote of Table 1 of SA-20 is not permitted (h) SA-662 if normalized (i) SA-738 Grade A (j) SA-738 Grade A with Cb and V deliberately added in accordance with the provisions of the material specification, not colder than -29°C (-20°F) (k) SA-738 Grade B not colder than -29°C (-20°F) (l) SA/EN 10028-2 Grade P355GH if normalized [See General Note (d)(3)]
GENERAL NOTES: (a) Castings not listed as Curve A and B shall be impact tested. (b) For bolting see 3.11.6. (c) When a class or grade is not shown in a material assignment, all classes and grades are indicated. (d) The following apply to all material assignments: (1) Cooling rates faster than those obtained in air, followed by tempering, as permitted by the material specification, are considered equivalent to normalizing and tempering heat treatments. (2) Fine grain practice is defined as the procedures necessary to obtain a fine austenitic grain size as described in SA-20. (3) Normalized rolling condition is not considered as being equivalent to normalizing. (e) Data of Figures 3.7 and 3.7M are shown in Table 3.14.	

NOTE: The graph portion between the 2025 and 2017 versions are the same. Only minor editorial change under “Curve / Assignment” Notes is under Curve A (c) and B (k), where A105 vs A105 normalized is added in the 2025 version.



Curve	Material Assignment
A	(a) All carbon and all low alloy steel plates, structural shapes, and bars not listed in Curves B, C, and D below (b) SA-216 Grades WCB and WCC if normalized and tempered or water-quenched and tempered; SA-217 Grade WC6 if normalized and tempered or water-quenched and tempered (c) A/SA-105 forged flanges supplied in the as-forged condition
B	(a) SA-216 Grades WCA if normalized and tempered or water-quenched and tempered; Grades WCB and WCC for thicknesses not exceeding 50 mm (2 in.) if produced to a fine grain practice and water-quenched and tempered (b) SA-217 Grade WC9 if normalized and tempered (c) SA-285 Grades A and B (d) SA-299 (e) SA-414 Grade A (f) SA-515 Grades 60 (g) SA-516 Grades 65 and 70 if not normalized (h) SA-662 Grade B if not normalized (i) SA/EN 10028-2 Grade P355GH as-rolled (j) Except for cast steels, all materials of Curve A if produced to fine grain practice and normalized which are not listed for Curve C and D below (k) Pipe, fittings, forgings; A/SA-105 forged flanges that are produced to fine grain practice and normalized, normalized and tempered, or quenched and tempered after forging; and tubing not listed for Curves C and D below (l) Parts permitted from 3.2.8 shall be included in Curve B even when fabricated from plate that otherwise would be assigned to a different curve.
C	(a) SA-182 Grades F21 and F22 if normalized and tempered (b) SA-302 Grades C and D (c) SA-336 Grades F21 and F22 if normalized and tempered, or liquid quenched and tempered

Figure 3.10
Impact Test Exemption Curves — Welded Parts Subject to PWHT and Nonwelded Parts (Cont'd)

Curve	Material Assignment
	(d) SA-387 Grades 21 and 22 if normalized and tempered, or liquid quenched and tempered (e) SA-516 Grades 55 and 60 if not normalized (f) SA-533 Types B and C, Class 1 (g) SA-662 Grade A (h) SA/EN 10028-2 Grade 10CrMo9-10 if normalized and tempered (i) All materials listed in (a) through (i) and in (k) for Curve B if produced to fine grain practice and normalized, normalized and tempered, or liquid quenched and tempered as permitted in the material specification, and not listed for Curve D below
D	(a) SA-203 (b) SA-299 if normalized (c) SA-508 Class 1 (d) SA-516 if normalized (e) SA-524 Classes 1 and 2 (f) SA-537 Classes 1, 2, and 3 (g) SA-612 if normalized; except that the increased Cb limit in the footnote of Table 1 of SA-20 is not permitted (h) SA-662 if normalized (i) SA-738 Grade A (j) SA-738 Grade A with Cb and V deliberately added in accordance with the provisions of the material specification, not colder than -29°C (-20°F) (k) SA-738 Grade B not colder than -29°C (-20°F) (l) SA/EN 10028-2 Grade P355GH if normalized [See General Note (d)(3)]

GENERAL NOTES:

- Castings not listed as Curve A and B shall be impact tested.
- For bolting see 3.11.6.
- When a class or grade is not shown in a material assignment, all classes and grades are indicated.
- The following apply to all material assignments:
 - Cooling rates faster than those obtained in air, followed by tempering, as permitted by the material specification, are considered equivalent to normalizing and tempering heat treatments.
 - Fine grain practice is defined as the procedures necessary to obtain a fine austenitic grain size as described in SA-20.
 - Normalized rolling condition is not considered as being equivalent to normalizing.
- Data of Figures 3.10 and 3.10M are shown in Table 3.16.

Curve	Material Assignment
A	(a) All carbon and all low alloy steel plates, structural shapes, and bars not listed in Curves B, C, and D below. (b) SA-216 Grades WCB and WCC if normalized and tempered or water-quenched and tempered; SA-217 Grade WC6 if normalized and tempered or water-quenched and tempered
B	(a) SA-216 Grades WCA if normalized and tempered or water-quenched and tempered; Grades WCB and WCC for thicknesses not exceeding 50 mm (2 in.) if produced to a fine grain practice and water-quenched and tempered (b) SA-217 Grade WC9 if normalized and tempered (c) SA-285 Grades A and B (d) SA-299 (e) SA-414 Grade A (f) SA-515 Grades 60 (g) SA-516 Grades 65 and 70 if not normalized (h) SA-662 Grade B if not normalized (i) SA/EN 10028-2 Grade P355GH as-rolled (j) Except for cast steels, all materials of Curve A if produced to fine grain practice and normalized which are not listed for Curve C and D below; (k) Pipe, fittings, forgings, and tubing not listed for Curves C and D below; (l) Parts permitted from 3.2.8 shall be included in Curve B even when fabricated from plate that otherwise would be assigned to a different curve.
C	(a) SA-182 Grades F21 and F22 if normalized and tempered. (b) SA-302 Grades C and D (c) SA-336 Grades F21 and F22 if normalized and tempered, or liquid quenched and tempered. (d) SA-387 Grades 21 and 22 if normalized and tempered, or liquid quenched and tempered. (e) SA-516 Grades 55 and 60 if not normalized

Figure 3.8
Impact Test Exemption Curves — Parts Subject to PWHT and Nonwelded Parts (Cont'd)

Curve	Material Assignment
	(f) SA-533 Types B and C, Class 1 (g) SA-662 Grade A (h) SA/EN 10028-2 Grade 10CrMo9-10 if normalized and tempered (i) All materials listed in (a) through (h) and in (j) for Curve B if produced to fine grain practice and normalized, normalized and tempered, or liquid quenched and tempered as permitted in the material specification, and not listed for Curve D below
D	(a) SA-203 (b) SA-299 if normalized (c) SA-508 Class 1 (d) SA-516 if normalized (e) SA-524 Classes 1 and 2 (f) SA-537 Classes 1, 2, and 3 (g) SA-612 if normalized; except that the increased Cb limit in the footnote of Table 1 of SA-20 is not permitted (h) SA-662 if normalized (i) SA-738 Grade A (j) SA-738 Grade A with Cb and V deliberately added in accordance with the provisions of the material specification, not colder than -29°C (-20°F) (k) SA-738 Grade B not colder than -29°C (-20°F) (l) SA/EN 10028-2 Grade P355GH if normalized [See General Note (d)(3)]

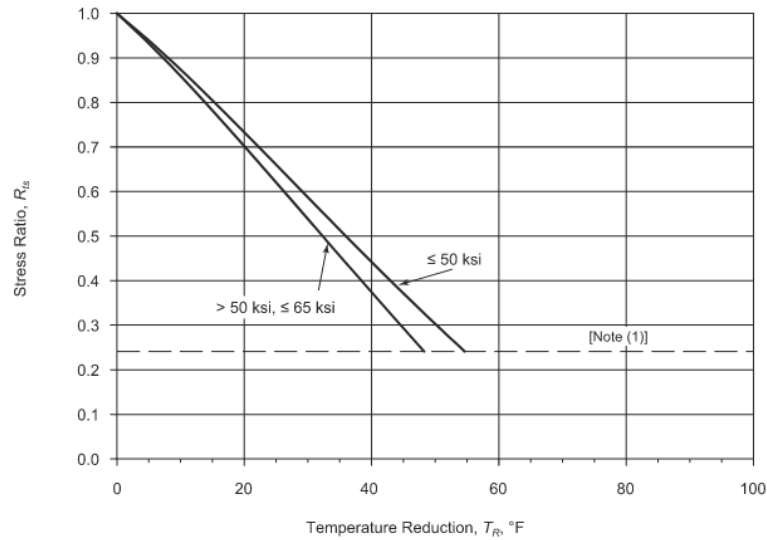
GENERAL NOTES:

- Castings not listed as Curve A and B shall be impact tested.
- For bolting see 3.11.6.
- When a class or grade is not shown in a material assignment, all classes and grades are indicated.
- The following apply to all material assignments:
 - Cooling rates faster than those obtained in air, followed by tempering, as permitted by the material specification, are considered equivalent to normalizing and tempering heat treatments.
 - Fine grain practice is defined as the procedures necessary to obtain a fine austenitic grain size as described in SA-20.
 - Normalized rolling condition is not considered as being equivalent to normalizing.
- Data of Figures 3.8 and 3.8M are shown in Table 3.15.

NOTE: Graph portion between the 2025 and 2017 versions are the same.

Under the Curve/Assignment notes, Curve A (c) was added to include the A105 forgings. Curve B (k) was revised to include A105 normalized as well.

Figure 3.14
Reduction in the MDMT Without Impact Testing — Parts Not Subject to PWHT



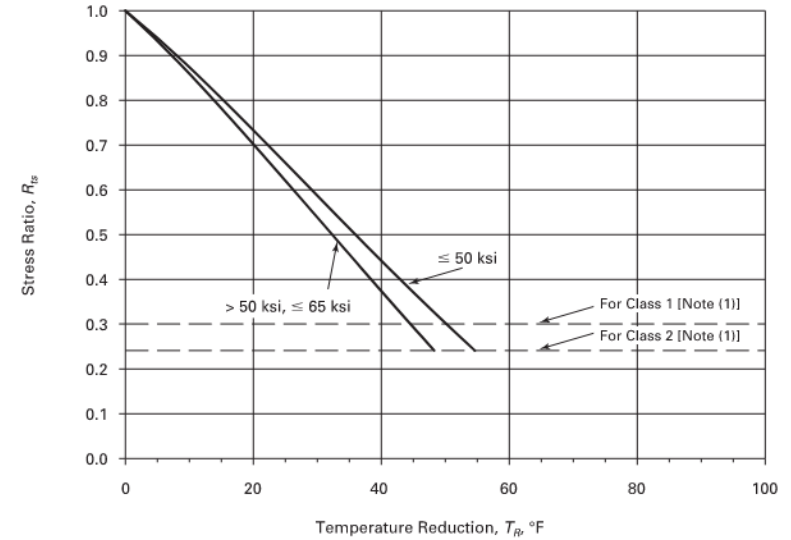
GENERAL NOTES:

- (a) Interpolation between yield strength values is permitted.
- (b) The reduction in MDMT shall not exceed 55°C (100°F), except as permitted by 3.11.2.5(a), Step 5(b).
- (c) Data of Figures 3.14 and 3.14M are shown in Table 3.17.

NOTE:

- (1) See 3.11.2.5(a), Step 5(a) when R_{ts} is less than or equal to 0.24.

Figure 3.12
Reduction in the MDMT Without Impact Testing — Parts Not Subject to PWHT



GENERAL NOTES:

- (a) Interpolation between yield strength values is permitted.
- (b) The reduction in MDMT shall not exceed 55°C (100°F), except as permitted by 3.11.2.5(a), Step 5(b).
- (c) Data of Figures 3.12 and 3.12M are shown in Table 3.16.

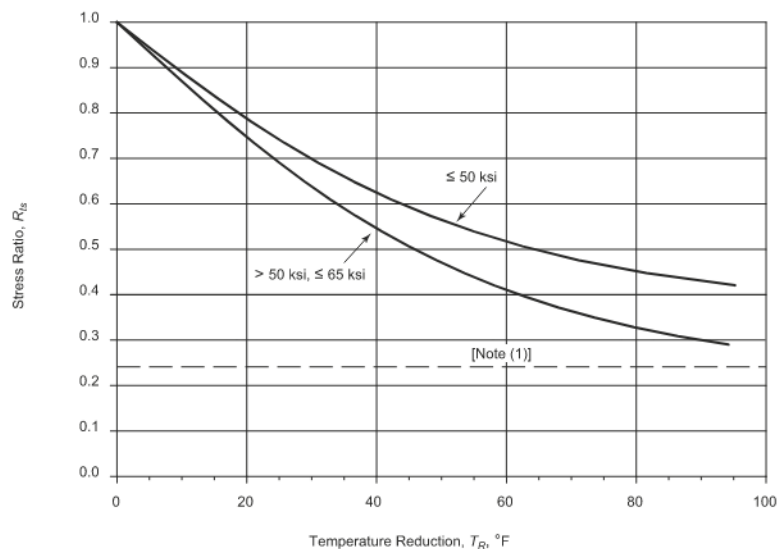
NOTE:

- (1) See 3.11.2.5(a), Step 5(a) when R_{ts} is less than or equal to 0.3 for Class 1, or 0.24 for Class 2.

Overall figure is the same lines, General notes are the same.
No more Class 1 or Class 2. Figure numbers and Table numbers updated. Note 1 changed.

(25)

Figure 3.15
Reduction in the MDMT Without Impact Testing — Parts Subject to PWHT and Nonwelded Parts



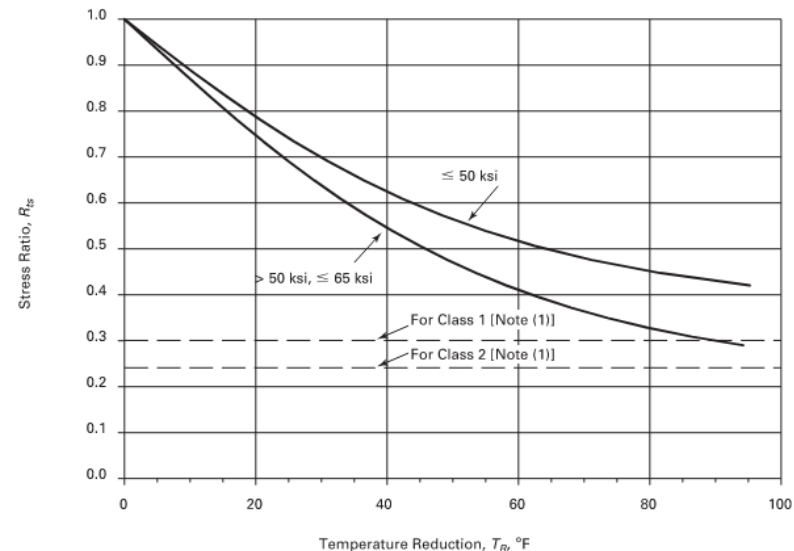
GENERAL NOTES:

- (a) Interpolation between yield strength values is permitted.
- (b) The reduction in MDMT shall not exceed 55°C (100°F), except as permitted by 3.11.2.5(a), Step 5(b).
- (c) Data of Figures 3.15 and 3.15M are shown in Table 3.18.

NOTE:

- (1) See 3.11.2.5(a), Step 5(a) when R_{ts} is less than or equal to 0.24.

Figure 3.13
Reduction in the MDMT Without Impact Testing — Parts Subject to PWHT and Nonwelded Parts



GENERAL NOTES:

- (a) Interpolation between yield strength values is permitted.
- (b) The reduction in MDMT shall not exceed 55°C (100°F), except as permitted by 3.11.2.5(a), Step 5(b),.....
- (c) Data of Figures 3.13 and 3.13M are shown in Table 3.17.

NOTE:

- (1) See 3.11.2.5(a), Step 5(a) when R_{ts} is less than or equal to 0.3 for Class 1, or 0.24 for Class 2.

Overall figure is the same lines, General notes are the same.
No more Class 1 or Class 2. Figure numbers and Table numbers updated. Note 1 changed.

3.11.6 BOLTING MATERIALS

3.11.6.1 Bolting Materials for Use With Flanges Designed to 4.16.

(a) Impact tests are not required for bolting materials listed in Tables 3.5, 3.6, 3.7, and 3.8 when used at MDMTs equal to or warmer than those shown in these Tables.

(b) Bolting materials produced and impact tested in accordance with the requirements of the specifications in (1) through (4) are exempt from impact testing by the rules of this Division at MDMTs not more than 3°C (5°F) colder than the test temperature required by the specification.

(1) SA-320

(2) SA-437

(3) SA-508 Grade 5 Class 2

(4) SA-540, except for materials produced under Table 2, note 4 in this specification

(c) Bolting materials to be used for colder temperatures than those shown in Tables 3.5 and 3.6 shall be impact tested. When impact testing is performed

(1) for materials listed in Table 3.5, Charpy V-notch acceptance criteria in accordance with 3.11.2.1(b) shall be applied

(2) for materials listed in Table 3.6, Charpy V-notch acceptance criteria in accordance with 3.11.4.1(b) shall be applied

3.11.6.2 Bolting Materials for Use With Flanges Designed to Part 5 of This Division. Impact testing is required for the ferrous bolting materials listed in Table 3-A.11 for use with flanges designed in accordance with Part 5 of this Division. The average for three Charpy V-notch impact specimens shall be at least 41 J (30 ft-lb), with the minimum value for any individual specimen not less than 34 J (25 ft-lb).

3.11.6 BOLTING MATERIALS

3.11.6.1 Bolting Materials for Use With Flanges Designed to 4.16.

(a) Impact tests are not required for bolting materials listed in Tables 3.4, 3.5, 3.6, and 3.7 when used at MDMTs equal to or warmer than those shown in these Tables.

(b) Bolting materials to be used for colder temperatures than those shown in Tables 3.4 through 3.7 shall conform to SA-320, except that the toughness criterion shall be Charpy V-notch with acceptance criteria in accordance with 3.11.2 or 3.11.4, as applicable.

3.11.6.2 Bolting Materials for Use With Flanges Designed to Part 5 of This Division. Impact testing is required for the ferrous bolting materials listed in Table 3-A.11 for use with flanges designed in accordance with Part 5 of this Division. The average for three Charpy V-notch impact specimens shall be at least 41 J (30 ft-lb), with the minimum value for any individual specimen not less than 34 J (25 ft-lb).

ASME VIII Div 2 3.11.6.1, Tables 3.4, 3.5, 3.6, and 3.7 Bolting A320 L7 A193 CL1/2 B8/B8M A193 B7 Bolting Not Listed – A307, A276 Type 304/304L/316/316L ASME VIII Div 2 3.11.6.2, Table 3-A.11 Bolting A320 L7 A193 CL1/2 B8/B8M A193 B7 Bolting Not listed – none	
NOTE: In the 2025 version, 3.11.6.1 (b) was moved to (c) and new content was put in for (b) to cover specific bolting materials that could be exempted from impact testing with DMT up to 5 deg F colder than the test temperature for that material spec. Otherwise, no changes to the list of bolting materials in terms of technical review. The bolting materials in ASME include both bolt materials and nut materials. The API 620 Section 4 and Annex R only include bolt materials and does not specify corresponding nut materials. Nut Materials in ASME are A194 2/2H/2HM/4/7/7M/16	
Conclusion: Overall, no technical changes to affect the use of low stress/low temperature provisions per the ASME BPVC VIII-2 between 2025 and 2017 versions. The removal of Class 1 is addressed in how API 620 would use the 620 allowable stress and limit the Rts to be the greater of 0.33 or actual/allowable stress.	