Washington Public Power Supply System
P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

Docket No. 50-508

September 21, 1982
G03-82-963

Mr. Frank J. Miraglia, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Dear Mr. Miraglia:

Subject: NUCLEAR PROJECT NO. 3
FORMAL NRC APPROVAL OF ASME CODE CASE N-249-2

Reference: Letter G03-82-760, GD Bouchey to FJ Miraglia, dated July 30, 1982, "WNP-3 Response to NRC Questions on Pipe Clamps"

This letter requests formal NRC approval of ASME Code Case N-249, "Additional Materials for Subsection NF Class 1, 2, 3 and MC Component Supports Fabricated Without Welding, Section III, Division 1" (copy attached). Approval is requested to cover strap and rivet materials used in the ITT-Grinnell Figure 215 Stiff Clamps. The subject Code Case was approved by the ASME Council on June 17, 1982. Due to its recent approval, N-249-2 is not currently listed in Regulatory Guide 1.85. Details relative to application of this Code Case were presented to the NRC staff in Bethesda on June 18, 1982 and as further discussed in the referenced letter.

Your expeditious response will be appreciated.

Very truly yours,

GD Bouchey

G. D. BOUCHEY, Manager
Nuclear Safety and Licensing

GDB/rch
Attachment

cc: JA Adams NESCO
WG Albert NRC 761
D Smithpeter BPA 762
LL Wheeler NRC
Ebasco - Elma

B001

Meeting of March 12, 1982
Approved by Council, June 17, 1982

This Case shall expire on June 17, 1985
unless previously annulled or reaffirmed.

Case N-249-2
Additional Materials for Subsection NF Class 1, 2, 3, and MC Component Supports Fabricated without Welding Section III, Division 1

Inquiry: What materials, in addition to those listed in Tables I-11.0, I-12.0, and I-13.0 of Appendix I of Section III, Division 1, may be used for Class 1, 2, 3, or MC component supports constructed to the requirements of Subsection NF when the items are fabricated without welding?

Reply: It is the opinion of the Committee that the additional materials, design stress intensity and allowable stress values, the yield strength, and the ultimate tensile strength values,[1] listed in Tables 1, 2, 3, 4, and 5 of this Code Case may be used in the construction of Class 1, 2, 3, and MC component supports fabricated without welding for Section III, Division 1, in addition to those listed in Table NF-2121 (a) - 1.

The following additional requirements shall apply:

(1) The requirements of Subsection NF shall be met except as modified by this Case.

(2) Repair welding is not permitted on carbon and low alloy steels containing more than 0.35% carbon, nor on precipitation hardened or age-hardened steels, nor on the free machining steels permitted in (3) below, unless permitted by the material specification. Weld repairs of base material shall be made on annealed material and such repaired material shall be reheat treated in accordance with the material specification.

(3) When the Nominal Composition column references AISI grades, only materials meeting the chemical composition requirements of the specific AISI grades listed shall be used, with the exception that 0.60% maximum silicon is permitted for castings. Free machining modifications of the specific AISI grades listed may be used at the same design stress intensities, allowable stresses and yield strengths of the reference grades but their use is limited to 400°F (200°C) maximum temperature.

(4) When the ASTM specification referenced in Tables 1 through 4 does not specify minimum tensile and yield strengths, the values listed under the appropriate columns shall be met by the material.

(5) The maximum measured ultimate tensile strength (UTS) of the component support material should not exceed 170 ksi (117 MPa) in view of the susceptibility of high-strength materials to brittleness and stress corrosion cracking. Certain applications may exist where a UTS value of up to 190 ksi (131 MPa) could be considered acceptable for a material and, under this condition, the Design Specification should specify impact testing for the material. For these cases, it should be demonstrated by the owner that (1) the impact test results for the material meet Code requirements and (2) the material is not subject to stress corrosion cracking by virtue of the fact that (a) a corrosive environment is not present and (b) the component that contains the material has essentially no residual stresses or assembly stresses, and it does not experience frequent sustained loads in service.

[1] The tabulated values of tensile strength and yield strength are those which the Committee believes are suitable for use in design calculations required by Section III, Division 1. At the temperatures above room temperature, the values of tensile strength tend toward an average or expected value which may be as much as 10% above the tensile strength trend curves adjusted to the minimum specified room temperature tensile strength. At temperatures above room temperature, the yield strength values correspond to the yield strength trend curve adjusted to the minimum specified room temperature yield strength. Neither the tensile strength nor the yield strength values correspond exactly to either "average" or "minimum," as these terms are applied to a statistical treatment of a homogeneous set of data.

Neither the ASME or ASTM Material Specifications nor the rules of Section III, Division 1, require elevated temperature testing for tensile or yield strengths of production material for use in Code components. It is not intended that results of such tests, if performed, be compared with these tabulated tensile and yield strength values for ASME Code acceptance/rejection purposes for materials. If some elevated temperature test results on production material appear lower than the tabulated values by a large amount (more than the typical variability of material suggesting the possibility of some error), further investigation by retest or other means should be considered.

(6) Materials in Tables 1 through 4 whose nominal composition is referenced as an AISI composition may be accepted as satisfying the requirements of the ASTM specification provided the chemical requirements of the AISI specification are within the specified range of the designated ASTM specification, and certification of the material shall be in accordance with the requirements of NCA-3867.4(e) or (f). The term "each piece of stock material" in NCA-3867.4(e) may be taken to refer to that portion of the material of the same heat and lot which has traceability established by the Manufacturer through his program. Where Certificates of Compliance are acceptable under Subsection NF, testing of each piece is not required.

(7) The material shall be furnished with the requirements of NF-2600.

(8) This Case and revision number shall be listed on the applicable documentation accompanying shipment.

TABLE 1

Design Stress Intensity Values, S_m, for Ferrous Steels and Copper Alloys for Class 1 Plate and Shell Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Design Stress Intensity, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
Carbon Steels																	
AISI 1015, 1018, 1020	Bar	A108-79	1015CW 1018CW 1020CW	–	4	40	60	20.0	20.0	20.0	20.0	–	–	–	–	–	–
AISI 1045	Bar	A108-79	1045CW	–	–	100	120	40.0	40.0	40.0	40.0	–	–	–	–	–	–
AISI 1050	Bar	A108-79	1050CW	–	–	125	140	46.7	46.7	46.7	46.7	–	–	–	–	–	–
AISI 1117	Bar	A108-79	1117	–	–	60	70	23.3	23.3	23.3	23.3	–	–	–	–	–	–
AISI 1144	Bar	A108-79	1144	–	–	100	115	38.3	38.3	38.3	38.3	–	–	–	–	–	–
AISI 1214	Bar	A108-79	1214	–	–	55	65	21.7	21.7	21.7	21.7	–	–	–	–	–	–
AISI 1015	Tube	A513-80	1015CW	–	4	55	65	21.7	21.7	21.7	21.7	–	–	–	–	–	–
AISI 1020	Tube	A513-80	1020CW	–	4	60	70	23.3	23.3	23.3	23.3	–	–	–	–	–	–
AISI 1025, 1026	Tube	A513-80	1025CW 1026CW	–	5	65	75	25.0	25.0	25.0	25.0	–	–	–	–	–	–
AISI 1018, 1020, 1022	Tube	A519-80	1018CW 1020CW 1022CW	– – –	– 4 –	60	70	23.3	23.3	23.3	23.3	–	–	–	–	–	–
AISI 1025, 1026	Tube	A519-80	1025CW 1026CW	– –	3,5 –	65	75	25.0	25.0	25.0	25.0	–	–	–	–	–	–
Low Alloy Steels																	
AISI 4130, 4140, 4320, 4340	Casting	A148-80	105-85 120-95 150-125	– – –	32 33 –	85 95 125	105 120 150	35.0 40.0 50.0	35.0 40.0 50.0	35.0 40.0 50.0	35.0 40.0 50.0	35.0 40.0 50.0	35.0 40.0 50.0	35.0 40.0 50.0	35.0 40.0 50.0	–	–
AISI 4140, 4142	Tube	A519-80	4140SR 4142SR	– –	– –	100	120	40.0	40.0	40.0	40.0	–	–	–	–	–	–
5Ni-Cr-Mo-V	Forging	A579-77	12a	–	–	140	150	50.0	49.5	48.0	47.0	47.0	47.0	46.0	44.0	–	–
AISI 4140, 4340	Forging	A688-79a	–	K	6, 13	75	100	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	–	–
					6, 9, 11, 12	80	105	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	–	–
				L	6, 13	85	110	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	–	–
					6, 9, 12	95	115	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	–	–
					6, 9, 11	105	125	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	–	–
				M	6, 13	110	135	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	–	–
					6, 9, 12	115	140	46.7	46.7	46.7	46.7	46.7	46.7	46.7	46.7	–	–
					6, 9, 11	120	145	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	–	–
AISI 4340	Forging	A668-79a	–	N	6, 13	130	160	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	–	–
					6, 9, 12	135	165	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	–	–
					6, 9, 11	140	170	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	–	–

*Notes follow Table 5.

TABLE 1 (Continued)

Design Stress Intensity Values, S_{DY}, for Ferrous Steels and Copper Alloys for Class 1 Plate and Shell Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Design Stress Intensity, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
High Alloy Steels																	
Precipitation Hardened Steels																	
26Ni-15Cr-2Ti	Bar	A453-80	660	A, B	31	85	130	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	–	–
Copper and Copper Alloys																	
Alum. Bronze	Bar	SB-150	642	–	7	45	90	30.0	25.8	24.0	23.7	–	–	–	–	–	–
					8	45	85	28.3	25.8	24.0	23.7	–	–	–	–	–	–
					2	42	80	26.7	24.0	22.4	22.1	–	–	–	–	–	–
					10	35	75	23.3	20.0	18.7	18.5	–	–	–	–	–	–

TABLE 2

Allowable Stress Values, S, for Ferrous Steel and Copper Alloys for Classes 2, 3, and MC Plate and Shell Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes[a]	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Allowable Stress Values psi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
Carbon Steels																	
AISI 1015, 1018, 1020	Bar	A108-79	1015CW 1018CW 1020CW	–	4	40	60	15.0	15.0	15.0	15.0	–	–	–	–	–	–
AISI 1045	Bar	A108-79	1045CW	–	–	100	120	30.0	30.0	30.0	30.0	–	–	–	–	–	–
AISI 1050	Bar	A108-79	1050CW	–	–	125	140	35.0	35.0	35.0	35.0	–	–	–	–	–	–
AISI 1117	Bar	A108-79	1117	–	–	60	70	17.5	17.5	17.5	17.5	–	–	–	–	–	–
AISI 1144	Bar	A108-79	1144	–	–	100	115	28.8	28.8	28.8	28.8	–	–	–	–	–	–
AISI 1214	Bar	A108-79	1214	–	–	55	65	16.3	16.3	16.3	16.3	–	–	–	–	–	–
AISI 1015	Tube	A513-80	1015CW	–	4	55	65	16.3	16.3	16.3	16.3	–	–	–	–	–	–
AISI 1020	Tube	A513-80	1020CW	–	4	60	70	17.5	17.5	17.5	17.5	–	–	–	–	–	–
AISI 1025, 1026	Tube	A513-80	1025CW 1026CW	–	5	65	75	18.8	18.8	18.8	18.8	–	–	–	–	–	–
AISI 1018, 1020 1022	Tube	A519-80	1018CW 1020CW 1022CW	–	4	60	70	17.5	17.5	17.5	17.5	–	–	–	–	–	–
AISI 1025, 1026	Tube	A519-80	1025CW 1026CW	–	3, 5	65	75	18.8	18.8	18.8	18.8	–	–	–	–	–	–
Low Alloy Steels																	
AISI 4130, 4140, 4320, 4340	Casting	A148-80	105-85 120-95 150-125	– – –	32 33 –	85 95 125	105 120 150	26.3 30.0 37.5	26.3 30.0 37.5	26.3 30.0 37.5	26.3 30.0 37.5	26.3 30.0 37.5	26.3 30.0 37.5	26.3 30.0 37.5	26.3 30.0 37.5	– – –	– – –
AISI 4140	Tube	A519-80	4140SR	–	–	100	120	30.0	30.0	30.0	30.0	–	–	–	–	–	–
AISI 4142	Tube	A519-80	4142SR	–	–												
5Ni-Cr-Mo-V	Forging	A579-77	1/2a	–	–	140	150	37.5	37.1	36.0	35.1	35.1	35.1	34.5	33.0	–	–
AISI 4140, 4340	Forging	A668-79a	–	K	6, 13	75	100	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	–	–
					6, 9, 11, 12	80	105	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	–	–
				L	6, 13	85	110	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	–	–
					6, 9, 12	95	115	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	–	–
					6, 9, 11	105	125	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	–	–
				M	6, 13	110	135	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	–	–
					6, 9, 12	115	140	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	–	–
					6, 9, 11	120	145	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3	–	–
AISI 4340	Forging	A668-79a	–	N	6, 13	130	160	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	–	–
					6, 9, 12	135	165	41.3	41.3	41.3	41.3	41.3	41.3	41.3	41.3	–	–
					6, 9, 11	140	170	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5	–	–

TABLE 2 (Continued)

Allowable Stress Values, *S*, for Ferrous Steel and Copper Alloys for Classes 2, 3, and MC Plate and Shell Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Allowable Stress Values ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
High Alloy Steels																	
Precipitation Hardened Steels																	
26Ni-15Cr-2Ti	Bar	A453-80	660	A	31	85	130	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.0	—	—
Copper and Copper Alloys																	
Alum. Bronze	Bar	SB-150	642	—	7	45	90	22.5	22.3	22.0	21.2	—	—	—	—	—	—
					8	45	85	21.3	21.1	20.8	20.0	—	—	—	—	—	—
					2	42	80	20.0	19.9	19.6	18.9	—	—	—	—	—	—
					10	35	75	18.8	18.6	18.4	17.7	—	—	—	—	—	—

*Notes follow Table 5.

TABLE 3

Yield Strength Values, S_y, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Yield Strength Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
Carbon Steels																	
AISI 1015, 1018, 1020	Bar	A108-79	1015CW 1018CW 1020CW	–	– 4 –	40	60	40.0	36.5	35.4	34.2	–	–	–	–	–	–
AISI 1045	Bar	A108-79	1045CW	–	–	100	120	100.0	91.2	88.4	85.6	–	–	–	–	–	–
AISI 1050	Bar	A108-79	1050CW	–	–	125	140	125.0	114.0	110.5	107.0	–	–	–	–	–	–
AISI 1117	Bar	A108-79	1117	–	–	60	70	60.0	54.7	53.0	51.4	–	–	–	–	–	–
AISI 1144	Bar	A108-79	1144	–	–	100	115	100.0	91.2	88.4	85.6	–	–	–	–	–	–
AISI 1214	Bar	A108-79	1214	–	–	55	65	55.0	50.2	48.6	47.1	–	–	–	–	–	–
	Wire	A228-77	C	–	14	250	270	250.0	220.5	202.5	187.5	–	–	–	–	–	–
AISI 1038, 1541	Bar, Bolt	A325-80a	1	–	1	81	105	81.0	73.9	71.6	69.3	–	–	–	–	–	–
AISI 1015	Tube	A513-80	1015CW	–	4	55	65	55.0	50.2	48.6	47.1	–	–	–	–	–	–
AISI 1020	Tube	A513-80	1020CW	–	4	60	70	60.0	54.7	53.0	51.4	–	–	–	–	–	–
AISI 1025, 1026	Tube	A513-80	1025CW 1026CW	–	5	65	75	65.0	59.3	57.5	55.6	–	–	–	–	–	–
AISI 1018, 1020, 1022	Tube	A519-80	1018CW 1020CW 1022CW	– – –	– 4 –	60		60.0	54.7	53.0	51.4	–	–	–	–	–	–
AISI 1025, 1026	Tube	A519-80	1025CW 1026CW	–	3, 5	65	75	65.0	59.3	57.5	55.6	–	–	–	–	–	–
AISI 1035, 1040	Forging	A521-76		CC	11 12, 13	50 55	85 90	50.0 55.0	45.6 50.2	44.3 48.6	42.9 47.1	40.4 44.5	37.0 40.7	36.3 39.9	36.0 39.6	–	–
AISI 1035	Forging	A668-79a	–	B C D	6 6 6	30 33 37.5	60 66 75	30.0 33.0 37.5	27.3 30.1 34.2	26.6 29.2 33.2	25.7 28.3 32.1	24.5 26.5 30.3	22.2 24.4 27.7	21.8 24.1 27.2	21.6 23.8 27.0	–	–
AISI 1035, 1040, 1045	Forging	A668-79a	–	F	6,12,13 6, 9, 11	50 55	85 90	50.0 55.0	45.6 50.2	44.3 48.6	42.9 47.1	40.4 44.5	37.0 40.7	36.3 39.9	36.0 39.6	–	–
Low Alloy Steels																	
AISI 4130, 4140, 4320, 4340	Casting	A148-80	105-85 120-95 150-125	–	32 33 –	85 95 125	105 120 150	85.0 95.0 125.0	82.5 92.1 121.1	79.2 88.5 116.5	74.8 83.5 110.0	71.0 79.3 104.3	70.5 78.9 103.9	70.5 78.9 103.9	70.5 78.9 103.9	–	–
AISI 4150	Bar	A322-80	4150	–	–	100	115	100.0	93.5	90.2	87.8	85.1	81.4	78.9	76.0	–	–
AISI 4130, 4140, 4145, 4320, 4340, 8260	Bar	A434-76	–	BB	24 25 26 12 27	90 80 75 75 65	110 105 100 95 90	90.0 80.0 75.0 75.0 65.0	84.1 74.8 70.1 70.1 60.7	81.3 72.3 67.7 67.7 58.6	79.0 70.3 65.8 65.8 57.1	76.6 68.1 63.8 63.8 55.3	73.3 65.1 61.0 61.0 52.9	71.0 63.1 59.1 59.1 51.2	68.4 60.0 57.0 57.0 49.4	–	–

TABLE 3 (Continued)

Yield Strength Values, S_y, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes[a]	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Yield Strength Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed 100	200	300	400	500	600	650	700	750	800
Low Alloy Steels (Cont'd)																	
AISI 4130, 4140, 4145, 4320, 4340	Bar	A434-76	–	BC	24	110	130	110.0	102.9	99.4	96.6	93.6	89.5	86.8	83.6	–	–
					25	105	125	105.0	98.1	94.8	92.2	89.4	85.5	82.9	79.8	–	–
					26	95	115	95.0	88.5	85.4	83.0	80.6	77.0	74.6	72.0	–	–
					12	85	110	85.0	79.5	76.8	74.6	72.4	69.1	67.0	64.6	–	–
					27	80	105	80.0	74.8	72.3	70.3	68.1	65.1	63.1	60.9	–	–
AISI 4130, 4140, 4145, 4320, 4340	Bar	A434-76	–	BD	24	130	155	130.0	121.5	117.2	114.1	110.7	105.7	102.5	98.8	–	–
					25	120	150	120.0	112.1	108.4	105.2	102.1	97.6	94.6	91.1	–	–
					26	110	140	110.0	102.9	99.4	96.6	93.6	89.5	86.8	83.6	–	–
					12	105	135	105.0	98.1	94.8	92.2	89.4	85.5	82.9	79.8	–	–
					27	100	130	100.0	93.5	90.2	87.8	85.1	81.4	78.9	76.0	–	–
3Ni-Cr-Mo-V	Forging	A471-77	–	2		21	85	105	85.0	80.1	77.5	75.8	74.6	73.3	72.2	71.2	–	–
				3		21	95	110	95.0	89.5	86.6	84.7	83.4	81.9	80.7	79.6	–	–
				4		21	105	120	105.0	99.0	95.8	93.7	92.1	90.6	89.2	88.0	–	–
				5		21	115	130	115.0	103.4	104.9	102.6	100.9	99.2	97.7	96.4	–	–
				6		21	125	140	125.0	117.8	114.0	111.5	109.7	107.8	106.2	104.8	–	–
				7		21	135	150	135.0	127.1	123.0	120.3	118.3	116.2	114.8	113.1	–	–
				8		21	145	160	145.0	136.6	132.2	129.3	127.1	124.9	123.2	121.8	–	–
				9		21	155	170	155.0	146.0	141.2	138.1	136.0	133.5	131.8	130.0	–	–
AISI 4140, 4142	Tube	A519-80	4140SR	–	–	–	100	120	100.0	93.5	90.2	87.8	–	–	–	–	–	–
	Tube	A519-80	4142SR															
5Ni-Cr-Mo-V	Forging	A579-77	12a	–	–	–	140	150	140.0	138.6	134.0	129.5	127.7	126.3	123.5	117.6	–	–
AISI 4140, 4340	Forging	A668-79a	K	–	6,13,20	75	100	75.0	70.1	67.7	65.8	63.8	61.0	59.0	57.0	–	–
					6,9,11,12,20	80	105	80.0	74.8	72.3	70.3	68.1	65.1	63.1	60.9	–	–
AISI 4135, 4140, 4335, 4340	Forging	A668-79a	L	–	6,13,20	85	110	85.0	79.5	76.8	74.6	72.4	69.1	67.0	64.6	–	–
					6,9,12,28	95	115	95.0	88.5	85.4	83.0	80.6	77.0	74.6	72.0	–	–
					6,9,11,28	105	125	105.0	98.1	94.8	92.2	89.4	85.5	82.9	79.8	–	–
AISI 4140, 4340, 4135, 4335	Forging	A668-79a	M	–	6,13,20	110	135	110.0	102.9	99.4	96.6	93.6	89.5	86.8	83.6	–	–
					6,9,12,20	115	140	115.0	107.5	103.8	101.0	98.0	93.6	90.7	87.5	–	–
					6,9,11,20	120	145	120.0	112.1	108.4	105.2	102.1	97.6	91.6	91.1	–	–
AISI 4340	Forging	A668-79a	N	–	6,13,20	130	160	130.0	121.5	117.2	114.1	110.7	105.7	102.5	98.8	–	–
					6,9,12,20	135	165	135.0	126.1	121.9	118.5	115.0	109.9	106.5	102.7	–	–
					6,9,11,20	140	170	140.0	131.0	126.3	123.0	119.1	114.0	110.4	106.3	–	–

TABLE 3 (Continued)

Yield Strength Values, S_y, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Yield Strength Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed 100	200	300	400	500	600	650	700	750	800
High Alloy Steels																	
Martensitic Stainless Steels																	
17Cr	Bar	A276-79a	440C	–	22, 28	210	275	210.0	210.0	190.0	180.0	–	–	–	–	–	–
13Cr	Bar	A582-80	416	–	19,22,29	275	185	275.0	–	–	–	–	–	–	–	–	–
13Cr-Se	Bar	A582-80	416Se	–	23	40	70	40.0	38.1	36.9	35.7	–	–	–	–	–	–
Precipitation Hardened Steels																	
26Ni-15Cr-2Ti	Bar	A453-80	660	A	31	85	130	85.0	82.5	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
17Cr-4Ni-4Cu	Bar, Forg. / Plate, Sheet / Strip	SA-564 / A693-79	630	H1150	–	105	135	105.0	97.1	93.0	89.8	87.0	84.7	83.6	–	–	–
				H1100	–	115	140	115.0	106.3	101.9	98.3	95.2	92.8	91.5	–	–	–
				H1075	–	125	145	125.0	115.6	110.7	106.9	103.5	100.9	99.5	–	–	–
19Cr-19Mo-W	Plate, Sheet	A457-71	651	–	–	90	125	90.0	–	–	–	–	–	–	–	–	–
15Cr-5Ni-3Cu	Bar, Forg.	A564-80a	XM12 (H1025)	–	–	145	155	145.0	136.0	130.7	125.8	121.7	117.2	115.2	112.9	–	–
15Cr-5Ni-3Cu	Bar, Forg.	A564-80a	XM12 (H1075)	–	–	125	145	125.0	117.1	112.6	108.3	104.8	101.0	99.5	97.2	–	–
13Cr-8Ni-2Mo	Bar, Forg.	A564-80a	XM13	–	30	165	175	165.0	154.6	148.5	143.0	138.1	133.8	131.1	128.4	–	–
50Ni-17Cr-Mo-Cb	Plate, Sheet	B670-78		–	16	150	180	150.0	–	–	–	–	–	–	–	–	–
Stainless Steels																	
AISI 302, 304, 316, 317	Wire	A580-80a	B	–	14	100	125	100.0	83.3	75.0	69.0	–	–	–	–	–	–
17Cr-4Ni-6Mn	Plate, Sheet	A412-80	201	–	17	110	150	110.0	–	–	–	–	–	–	–	–	–
20Cr-6Ni-8Mn	Sheet, Strip	A240-80b	XM17	–	–	60	100	60.0	–	–	–	–	–	–	–	–	–
20Cr-6Ni-8Mn	Plate	A240-80b	XM17	–	–	50	90	50.0	–	–	–	–	–	–	–	–	–
18Cr-8Ni	Bar	A582-80	303	–	18, 23	30	75	30.0	25.0	22.5	20.7	19.4	18.2	17.9	17.7	17.3	16.0
18Cr-8Ni-Se	Bar	A582-80	303Se	–	23												
Copper and Copper Alloys																	
Cu-Zn-Pb	Bar	B16-81	360	–	7, 8	25	55	25.0	–	–	–	–	–	–	–	–	–
Cu-Zn-Pb	Forging	B124-81	377	–	2	20	50	20.0	–	–	–	–	–	–	–	–	–
					–	18	50	18.0	16.3	14.9	14.2	–	–	–	–	–	–
Alum. Bronze	Bar	SB-150	642	–	7	45	90	45.0	38.7	36.0	35.6	–	–	–	–	–	–
					8	45	85	45.0	38.7	36.0	35.6	–	–	–	–	–	–
					2	42	80	42.0	36.1	33.6	33.2	–	–	–	–	–	–
					10	35	75	35.0	30.1	28.0	27.7	–	–	–	–	–	–

*Notes follow Table 5.

TABLE 4

Yield Strength Values, S_y, for Bolting Materials for Classes 1, 2, 3, and MC Supports

Nominal Composition	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Yield Strength Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
							100	200	300	400	500	600	650	700	750	800
Carbon Steels																
C-Mn	SA-36	–	–	34	36	58	36.0	32.8	31.9	30.8	29.1	26.6	26.1	25.9	–	–
AISI 1038, 1541	A-325	1	–	1	81	105	81.0	73.9	71.6	69.3	–	–	–	–	–	–
AISI 1045	A108-79	1045CW	–	–	100	120	100.0	91.2	88.4	85.6	–	–	–	–	–	–
AISI 1050	A108-79	1050CW	–	–	125	140	125.0	114.0	110.5	107.0	–	–	–	–	–	–
AISI 1141	A108-79	1141	–	37	81	105	81.0	73.9	71.6	69.3	–	–	–	–	–	–
AISI 1144	A108-79	1144	–	38												
AISI 1214	A108-79	1214	–	37												
AISI 1144	A108-79	1144	–	37	105	125	105.0	95.8	92.8	89.8	–	–	–	–	–	–
	SA-194	2H	–	36	–	–	–	–	–	–	–	–	–	–	–	–
	A307-80	A	–	42	36	60	36.0	32.8	31.9	30.8	29.1	26.6	26.1	25.9	–	–
	SA-449	–	–	39, 42	92	120	92.0	83.9	81.3	78.8	–	–	–	–	–	–
				40, 42	81	105	81.0	73.9	71.6	69.3	–	–	–	–	–	–
				41, 42	58	90	58.0	52.9	51.3	49.7	–	–	–	–	–	–
AISI 1035, 1040, 1541	A574-80	1035 1040 1541	–	–	135	170	135.0	123.1	119.3	115.6	–	–	–	–	–	–
Low Alloy Steels																
AISI 4037, 4137, 4140	SA-320	L7A L7B	–	–	105	125	105.0	98.0	94.1	91.5	–	–	–	–	–	–
AISI 4135, 4140, 4340	A490-80a	–	–	42	130	150	130.0	121.5	117.2	114.1	110.7	105.7	102.5	98.8	–	–
AISI 4137, 4140, 4340, 4037, 4042	A574-80	–	–	35	135	170	135.0	126.2	121.7	118.5	115.0	109.8	106.4	102.6	–	–
Precipitation Hardened Steels																
26Ni-15Cr-2Ti	A453-80	660	A	31	85	130	85.0	82.5	81.0	81.0	81.0	81.0	81.0	81.0	81.0	81.0
13Cr-8Ni-2Mo	A564-80a	XM-13	–	30	165	175	165.0	154.6	148.5	143.0	138.1	133.3	131.1	128.4	–	–
Austenitic Stainless Steel																
18Cr-8Ni-S	SA-320	B8F	1	–	30	75	30.0	25.0	22.5	20.7	–	–	–	–	–	–
18Cr-8Ni-Se		B8FA	1A													

*Notes follow Table 5.

TABLE 5

Ultimate Tensile Stress Values, S_u, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports Class 1 Plate and Shell Type Component Supports, and for Bolting Materials for Classes 1, 2, 3, and MC Components

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Ultimate Tensile Stress Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
Carbon Steels																	
AISI 1015,	Bar	A108-79	1015CW	–	–	40	60	60.0	60.0	60.0	60.0	–	–	–	–	–	–
1018,	Bar	A108-79	1018CW														
1020	Bar	A108-79	1020CW														
AISI 1045	Bar	A108-79	1045CW	–	–	100	120	120.0	120.0	120.0	120.0	–	–	–	–	–	–
AISI 1050	Bar	A108-79	1050CW	–	–	125	140	140.0	140.0	140.0	140.0	–	–	–	–	–	–
AISI 1117	Bar	A108-79	1117	–	–	60	70	70.0	70.0	70.0	70.0	–	–	–	–	–	–
AISI 1144	Bar	A108-79	1144	–	–	100	115	115.0	115.0	115.0	115.0	–	–	–	–	–	–
AISI 1214	Bar	A108-79	1214	–	–	55	65	65.0	65.0	65.0	65.0	–	–	–	–	–	–
	Wire	A228-77	C	–	–	250	270	270.0	270.0	270.0	270.0	–	–	–	–	–	–
AISI 1015	Tube	A513-80	1015CW	–	–	55	65	65.0	65.0	65.0	65.0	–	–	–	–	–	–
AISI 1020	Tube	A513-80	1020CW	–	–	60	70	70.0	70.0	70.0	70.0	–	–	–	–	–	–
AISI 1025, 1026	Tube	A513-80	1025CW 1026CW	–	–	65	75	75.0	75.0	75.0	75.0	–	–	–	–	–	–
AISI 1018, 1020, 1022	Tube	A519-80	1018CW 1020CW 1022CW	–	–	60	70	70.0	70.0	70.0	70.0	–	–	–	–	–	–
AISI 1025, 1026	Tube	A519-80	1025CW 1026CW	– –	– –	65	75	75.0	75.0	75.0	75.0	–	–	–	–	–	–
AISI 1035, 1040	Forging	A521-76		CG	–	50 55	85 90	85.0 90.0	85.0 90.0	85.0 90.0	85.0 90.0	– –	– –	– –	– –	– –	– –
AISI 1035	Forging	A668-79a	–	B C D	– – –	30 33 37.5	60 66 75	60.0 66.0 75.0	60.0 66.0 75.0	60.0 66.0 75.0	60.0 66.0 75.0	– – –	– – –	– – –	– – –	– – –	– – –
AISI 1035, 1040, 1045	Forging	A668-79a	–	F	–	50 55	85 90	85.0 90.0	85.0 90.0	85.0 90.0	85.0 90.0	– –	– –	– –	– –	– –	– –
Low Alloy Steels																	
AISI 4130, 4140, 4330, 4340	Casting	A148-80	105-85 120-95 150-125	– – –	– – –	85 95 125	105 120 150	105.0 120.0 150.0	105.0 120.0 150.0	105.0 120.0 150.0	105.0 120.0 150.0	105.0 120.0 150.0	105.0 120.0 150.0	105.0 120.0 150.0	105.0 120.0 150.0	– –	– –
9Cr-1Mo	Casting	SA-217	C12	–	–	60	90	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	–	–
AISI 4150	Bar	A322-80	4150	–	–	100	115	115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	–	–
AISI 4320, 4130, 4140, 4145, 4320 4340, 8620	Bar	A434-76	–	BB	–	90 80 75 75 65	110 105 100 95 90	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	110.0 105.0 100.0 95.0 90.0	– – – – –	– – – – –

TABLE 6 (Continued)

Ultimate Tensile Stress Values, S_u, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports
Class 1 Plate and Shell Type Component Supports, and for Bolting Materials for Classes 1, 2, 3, and MC Components

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes[3]	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Ultimate Tensile Strength Values, ksi (multiply by 1000 to obtain psi) for metal temperature, °F, not to exceed 100	200	300	400	500	600	650	700	750	800
Low Alloy Steels (Cont'd)																	
AISI 4130, 4140, 4145, 4320, 4340	Bar	A434-76	–	BC	–	110	130	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	–	–
						105	125	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	–	–
						95	115	115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	–	–
						85	110	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	–	–
						80	105	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	–	–
AISI 4130, 4140, 4145, 4320, 4340	Bar	A434-76	–	BD	–	130	155	155.0	155.0	155.0	155.0	155.0	155.0	155.0	155.0	–	–
						120	150	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	–	–
						110	140	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	–	–
						105	135	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	–	–
						100	130	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	–	–
3Ni-Cr-Mo-V	Forging	A471-77	–	2	–	85	105	105.0	105.0	105.0	104.0	103.3	101.9	100.4	98.8	–	–
				3	–	95	110	110.0	110.0	110.0	108.9	108.1	106.7	105.1	103.5	–	–
				4	–	105	120	120.0	120.0	120.0	118.8	118.0	116.4	114.7	112.9	–	–
				5	–	115	130	130.0	130.0	130.0	128.7	127.8	126.1	124.3	122.3	–	–
				6	–	125	140	140.0	140.0	140.0	138.5	137.7	135.8	133.8	131.7	–	–
				7	–	135	150	150.0	150.0	150.0	148.5	147.5	145.5	143.4	141.1	–	–
				8	–	145	160	160.0	160.0	160.0	158.4	157.3	155.2	152.9	150.5	–	–
				9	–	155	170	170.0	170.0	170.0	168.3	167.2	164.9	162.5	159.9	–	–
AISI 4140, 4142	Tube	A519-80	4140SR	–	–	100	120	120.0	120.0	120.0	120.0	–	–	–	–	–	–
5Ni-Cr-Mo-V	Forging	A579-77	12a	–	–	140	150	150.0	149.5	144.0	141.0	141.0	141.0	138.0	132.0	–	–
AISI 4140, 4340	Forging	A668-79a	K	–	–	75	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	–	–
						80	105	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	–	–
AISI 4140, 4340	Forging	A668-79a	L	–	–	105	125	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	–	–
						95	115	115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	–	–
AISI 4330, 4340	Forging	A668-79a	M	–	–	120	145	145.0	145.0	145.0	145.0	145.0	145.0	145.0	145.0	–	–
						115	140	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0	–	–
						110	135	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	–	–
AISI 4340	Forging	A668-79a	N	–	–	140	170	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	–	–
						135	165	165.0	165.0	165.0	165.0	165.0	165.0	165.0	165.0	–	–
						130	160	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	–	–
Stainless Steels																	
AISI 302, 304, 316, 317	Wire	A580-80a	B	–	–	100	125	125.0	118.3	110.0	103.7	–	–	–	–	–	–
17Cr-4Ni-6Mn	Plate, Sheet	A-412-80	201	–	–	110	150	150.0	–	–	–	–	–	–	–	–	–
20Cr-6Ni-8Mn-Mo	Strip, Sheet, Plate	A240-80b	XM17	–	–	60	100	100.0	–	–	–	–	–	–	–	–	–
		A240-80b	XM17	–	–	60	100	100.0	–	–	–	–	–	–	–	–	–
18Cr-8Ni 18Cr-8Ni-Se	Bar	A582-80	303 303Se	–	–	30	75	75.0	71.0	66.0	64.4	63.5	63.5	63.5	63.5	63.1	62.7

TABLE 5 (Continued)

Ultimate Tensile Stress Values, S_U, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports
Class 1 Plate and Shell Type Component Supports, and for Bolting Materials for Classes 1, 2, 3, and MC Components

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes[a]	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Ultimate Tensile Stress Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
High Alloy Steels																	
Martensitic Stainless Steels																	
17Cr	Bar	A276-79a	440C	–	–	210	275	275.0	275.0	275.0	275.0	–	–	–	–	–	–
						275	285	285.0	–	–	–	–	–	–	–	–	–
13Cr	Bar	A582-80	416	–	–	40	70	70.0	–	–	–	–	–	–	–	–	–
13Cr-Se	Bar	A582-80	416Se	–	–												
Precipitation Hardened Steels																	
26Ni-15Cr-2Ti	Bar	A453-80	660	A	31	85	130	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	128.8
19Cr-9Ni-Mo-W	Plate, Sheet	A457-71	651	–	–	90	125	125.0	–	–	–	–	–	–	–	–	–
17Cr-4Ni-4Cu	Bar, Forg. / Plate, Sheet / Strip	SA-564 / A693-79	630	H1150	–	105	135	135.0	135.0	135.0	131.4	128.5	126.7	125.6	124.4	120.8	118.1
				H1100		115	140	140.0	140.0	140.0	136.3	133.2	131.4	130.3	129.1	126.3	122.4
				H1075		125	145	145.0	145.0	145.0	141.1	138.0	136.1	134.9	133.7	130.8	126.8
15Cr-5Ni-3Cu	Bar, Forg.	A564-80a	XM12 (H1025)	–	–	145	155	155.0	155.0	155.0	150.0	145.4	141.5	139.3	136.7	–	–
			XM12 (H1075)	–	–	125	145	145.0	145.0	145.0	140.4	136.1	132.4	130.3	127.9	–	–
13Cr-8Ni-2Mo	Bar, Forg.	A564-80a	XM13	–	–	165	175	175.0	175.0	175.0	174.8	169.4	164.6	161.3	156.9	–	–
50Ni-17Cr-Mo-Cb	Plate, Sheet	B670-78		–	–	150	180	180.0									
Bolting Materials																	
Carbon Steels																	
C-Mn	Bar	SA-36	–	–	34	36	58	58.0	58.0	58.0	58.0	–	–	–	–	–	–
AISI 1045	–	A108-79	1045CW	–	–	100	120	120.0	120.0	120.0	120.0	–	–	–	–	–	–
AISI 1050	–	A108-79	1050CW	–	–	125	140	140.0	140.0	140.0	140.0	–	–	–	–	–	–
AISI 1141	–	A108-79	1141	–	–	81	105	105.0	105.0	105.0	105.0	–	–	–	–	–	–
AISI 1144	–	A108-79	1144														
AISI 1214	–	A108-79	1214														
AISI 1144	–	A108-79	1144	–	–	105	125	125.0	125.0	125.0	125.0	–	–	–	–	–	–
AISI 1030, 1035, 1040, 1045, 1050	–	SA-449	–	–	–	92	120	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	–	–
	–					81	105	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	–	–
	–					58	90	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	–	–
AISI 1035, 1040, 1541	–	A574-77	1035 1040 1541	–	–	135	170	170.0	170.0	170.0	170.0						
	–	SA-194	2H	–	–	–	–	105.0	105.0	105.0	105.0	–	–	–	–	–	–
	–	A307-80	A	–	–	36	60	60.0	60.0	60.0	60.0	–	–	–	–	–	–
	–	SA-325	–	–	–	81	105	105.0	105.0	105.0	105.0	–	–	–	–	–	–
AISI 1038, 1541	Bar, Bolt	A325-80a	1	–	1	81	105	105.0	105.0	105.0	105.0	–	–	–	–	–	–
AISI 4037, 4137, 4140	–	SA-320	L7A	–	–	105	125	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	–	–
	–	SA-320	L7B														
AISI 4037, 4340	–	SA-354	BC	–	–	109	125	125.0	125.0	125.0	125.0	125.0	125.0	125.0	125.0	–	–
						99	115	115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	–	–
	–	SA-354	BD	–	–	130	150	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	–	–

TABLE 5 (Continued)

Ultimate Tensile Stress Values, S_u, for Ferrous Steels and Copper Alloys for Classes 1, 2, 3, and MC Linear Type Component Supports Class 1 Plate and Shell Type Component Supports, and for Bolting Materials for Classes 1, 2, 3, and MC Components

Nominal Composition	Product Form	Specification No.	Type or Grade	Class	Notes*	Min. Yield Strength, ksi	Min. Ultimate Tensile Strength, ksi	Ultimate Tensile Stress Values, ksi (multiply by 1000 to obtain psi) for metal temperatures, °F, not to exceed									
								100	200	300	400	500	600	650	700	750	800
Bolting Materials (Cont'd)																	
AISI 4135, 4140, 4340	—	A490-80a	—	—	—	130	150	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	—	—
AISI 4140, 4340, 4037, 4137, 4042	—	A574-80	—	—	—	135	170	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	—	—
AISI 4340		SA-540	B21,B22, B23,B24	1	—	150	165	165.0	165.0	165.0	165.0	165.0	165.0	165.0	165.0	—	—
AISI 4340		SA-540	B21,B22, B23,B24	2	—	140	155	155.0	155.0	155.0	155.0	155.0	155.0	155.0	155.0	—	—
AISI 4340		SA-540	B21,B22, B23,B24	3	—	130	145	145.0	145.0	145.0	145.0	145.0	145.0	145.0	145.0	—	—
AISI 4320, 4340		SA-540	B21,B22, B23,B24	4	—	120	135	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	—	—
AISI 4320, 4340		SA-540	B21,B22, B23,B24	5	—	100	115	115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	—	—
13Cr-8Ni-2Mo		A564-30a	XM-13	—	—	105	120	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	—	—
18Cr-8Ni-S	—	SA-320	B8F	1		165	175	175.0	175.0	175.0	174.8	169.4	164.6	161.3	158.9	—	—
		SA-320	B8FA	1A		30	75	75.0	70.0	66.0	64.0	—	—	—	—	—	—
Copper and Copper Alloy																	
Cu-Zn-Pb	Bar	B16-81	360	—	—	25	55	55.0	—	—	—	—	—	—	—	—	—
						20	50	50.0	—	—	—	—	—	—	—	—	—
Cu-Zn-Pb	Forging	B124-81	377	—	—	18	50	50.0	45.5	40.0	34.0	—	—	—	—	—	—
Alum. Bronze	Bar	SB-150	642	—	—	45	90	90.0	89.4	88.1	84.9	—	—	—	—	—	—
						45	85	85.0	84.4	83.2	80.1	—	—	—	—	—	—
						42	80	80.0	79.4	78.3	75.4	—	—	—	—	—	—
80-10-10	Casting	SB-584	937	—	—	35	75	75.0	74.5	73.4	70.7	—	—	—	—	—	—
						12	30	30.0	26.8	24.8	24.5	—	—	—	—	—	—

*Notes follow Table 5.

Notes:

1. This material may be made from ASTM A 546-77.
2. Over 1 in. to 2 in. incl.
3. These materials are limited for use only for component standard supports.
4. Max. BHN 215.
5. Max. BHN 225.
6. For each forging 250 lb net weight and less, the marking requirements of A 668-79a shall be met by a suitable code or symbol identified by the Material Manufacturer in his Certificate of Compliance or Certified Material Test Report. The hardness test requirement may be performed only on the tensile test specimen.
7. ½ in. and under.
8. Over ½ in. to 1 in. incl.
9. By agreement between Purchaser and Material Manufacturer, these materials may be procured to the lower specified minimum ultimate tensile strength and minimum yield strength values given in this table.
10. Over 2 in. to 3 in. incl.
11. 4 in. and under.
12. Over 4 in. to 7 in. incl.
13. Over 7 in. to 10 in. incl.
14. This material may be used only in fully constrained applications, such as thread inserts, so that failure of the wire would not affect the function of the component support.
15. Solution heat-treated (for thickness 3/16 in. and under, tensile strength is 140 ksi, yield strength is 80 ksi).
16. Solution heat-treated and hardened (1325°F for 8 hr, furnace cooled to 1150°F, held to a total of 18 hr, air cooled).
17. Half hard.
18. Hot rolled.
19. Hot finished, heat treated.
20. E4340H may be used, with the molybdenum range increased, by agreement to 0.40% max.
21. The minimum specified yield strength shall be taken at 0.2% offset.
22. This material may be used only in fully constrained applications such as valve disc or flow restrictor balls or mechanical snubber parts such as gears so that failure of these parts does not significantly affect the function of the item. Design stresses are limited to 0.4 Sy.
23. For bar sizes under ½ in. nominal size, this material may be ordered to A 581-79.
24. 1½ in. and under.
25. Over 1½ in. to 2½ in. incl.
26. Over 2½ in. to 4 in. incl.
27. Over 7 in. to 9½ in. incl.
28. Austenitize 1850°F to 1950°F, oil quench, temper at 700°F min.
29. Austenitize 1850°F to 1950°F, oil quench, temper at 600°F min.
30. A 564 Type XM-13 shall be modified so that age hardening treatment shall be 1050°F only.
31. For gages less than ¼ in. in diameter, wire to AMS 5737 may be supplied, with or without heads. These values also apply to material that has been solution treated in a vacuum at 1650°F for 30 minutes and oil quenched and aged at 1325°F for ½ to 1½ hours and air cooled.
32. The Elongation and Reduction of Area requirements for Grade 105-85 may be specified as 14% and 30%, respectively.
33. The Elongation and Reduction of Area requirements for Grade 120-95 may be specified as 11% and 25%, respectively.
34. Threaded rods only.
35. Minimum Tempering Temperature shall be 850°F.
36. No yield or tensile strength specified. Assume to be the same as A 325-80a Type 1 bolts for nut design calculations.
37. 3 in. maximum diameter, cold drawn and tempered.
38. 10 in. maximum diameter.
39. ¾ in. to 1 in. incl.
40. Over 1 in. to 1½ in. incl.
41. Over 1½ in. to 3 in. incl.
42. Nuts may be as listed in ASTM A 563-78a, Table XI.