

Steel grades according to American standards

Mechanical properties

Standards	Grades	Yield strength R _e	Tensile strength R _m	Ratio R _e /R _m	Minimum elongation A		Notch impact test ³⁾	
					min. 200 mm [8 in.]	min. 50 mm [2 in.]	ASTM A673, standard position longitudinal, flange	
		MPa [ksi]	MPa [ksi]		%	%	Temperature °C (°F)	Energy average J [ft-lbf]
A36-14	Grade 36*	≥250 [36]	400-550 ²⁾ [58-80]		20 ¹⁾	21 ²⁾		
A572-15	Grade 42*	≥290 [42]	≥415 [60]		20 ¹⁾	24 ^{1)2b)}		
	Grade 50	≥345 [50]	≥450 [65]		18 ¹⁾	21 ^{1)2b)}		
	Grade 55*	≥380 [55]	≥485 [70]		17 ¹⁾	20 ^{1)2b)}		
	Grade 60*	≥415 [60]	≥520 [75]		16 ¹⁾	18 ^{1)2b)}		
	Grade 65*	≥450 [65]	≥550 [80]		15 ¹⁾	17 ^{1)2b)}		
A588-15	Grade B ^{*6)}	≥345 [50]	≥485 [70]		18 ¹⁾	21 ^{1)2a)}		
A709-13	Grade 36*	≥250 [36]	400-550 [58-80]		20 ¹⁾	21 ¹⁾²⁾		5)
	Grade 50	≥345 [50]	≥450 [65]		18 ¹⁾	21 ¹⁾²⁾		5)
	Grade 50S	345-450 [50-65]	≥450 [65]	≤0,85	18 ¹⁾	21 ¹⁾		5)
A913-15	Grade 50	≥345 ⁴⁾ [50]	≥450 [65]		18	21	21 [70]	≥54 [40]
	Grade 65	≥450 [65]	≥550 [80]		15	17	21 [70]	≥54 [40]
	Grade 70	≥485 [70]	≥620 [90]		14	16	21 [70]	≥54 [40]
A992-11(15)	Grade 50	345-450 [50-65]	≥450 [65]	≤0,85	18 ¹⁾	21 ¹⁾		

- 1) See elongation requirement adjustments under the "Tension Tests" section of standard A6 / A6M.
- 2) For shapes with flange thickness >75 mm (3 in): A min. 19% on 2 in. (50 mm), Gr.36 exempted of R_m max.
- 2a) For shapes with flange thickness >75 mm (3 in): A min. 18% on 2 in. (50 mm)
- 2b) For shapes over 634 Kg/m (426 lbs/ft): A min. 19% on 2 in. (50 mm)
- 3) Upon agreement: supplementary requirement S30 of ASTM A 6/A 6M: "CVN test, alternate core location" = min. ave energy 27J n [20 ft-lbf] at 21 °C [70°F], applicable to flange thickness ≥ 38.1 mm [1.5 in.], (formerly AISC Sup.2 for shapes of size groups 4 and 5 of A6)
- 4) Upon agreement: supplementary requirement S75 of ASTM A 913/A913M: Re/R_m max. 0.85 and Re max. 450 MPa [65 ksi], applicable to Grade 50
- 5) Supplementary requirement upon agreement: notch impact test according to A709
- 6) Available for a nominal thickness up to ≤40 mm. For series W 14 x 16 and W 36 x 16.5 up to ≤70 mm.

* Available upon agreement.

Chemical composition

Standards	Grades	Ladle analysis												
		C max. %	Mn %	S max. %	P max. %	Si %	Cu %	Ni %	Cr %	Mo max. %	Nb max. %	V %	CE ¹⁾ max. %	Other elements
A36-14	Grade 36*	0,26	³⁾	0,05	0,04	≤ 0,40 ³⁾	⁷⁾							
A572-15	Grade 42*	0,21	≤ 1,35 ²⁾	0,05	0,04	≤ 0,40 ³⁾	⁷⁾				²⁾	²⁾		²⁾
	Grade 50	0,23	≤ 1,35 ²⁾	0,05	0,04	≤ 0,40 ³⁾	⁷⁾				²⁾	²⁾		²⁾
	Grade 55*	0,25	≤ 1,35 ²⁾	0,05	0,04	≤ 0,40 ³⁾	⁷⁾				²⁾	²⁾		²⁾
	Grade 60*	0,26	≤ 1,35 ²⁾	0,05	0,04	≤ 0,40	⁷⁾				²⁾	²⁾		²⁾
	Grade 65*	0,23 ⁴⁾	≤ 1,65	0,05	0,04	≤ 0,40	⁷⁾				²⁾	²⁾		²⁾
A588-15	Grade B*	0,20 ²⁾	0,75-1,35 ²⁾	0,05	0,04	0,15-0,50	0,20-0,40	≤ 0,5	0,40-0,70			0,01-0,10		²⁾
A709-13	Grade 36*	0,26	³⁾	0,05	0,04	≤ 0,40 ³⁾	⁷⁾				²⁾	²⁾		²⁾
	Grade 50	0,23	≤ 1,35 ²⁾	0,05	0,04	≤ 0,40 ³⁾		²⁾			²⁾	²⁾		²⁾
	Grade 50S	0,23	0,50-1,60 ²⁾	0,045	0,035	≤ 0,40	≤ 0,60	≤ 0,45	≤ 0,35	0,15	0,05 ⁵⁾	≤ 0,15 ⁵⁾	0,45 ⁶⁾	²⁾⁵⁾
A913-15	Grade 50	0,12	≤ 1,60	0,030	0,030	≤ 0,40	≤ 0,45	≤ 0,25	≤ 0,25	0,07	0,05	≤ 0,06	0,38	
	Grade 65	0,12	≤ 1,60	0,030 ⁴⁾	0,030	≤ 0,40	≤ 0,35	≤ 0,25	≤ 0,25	0,07	0,05	≤ 0,08	0,43	
	Grade 70	0,12	≤ 1,60	0,030 ⁴⁾	0,030	≤ 0,40	≤ 0,45	≤ 0,25	≤ 0,25	0,07	0,05	≤ 0,09	0,45	
A992-11(15)	Grade 50	0,23	0,50-1,60 ²⁾	0,045	0,035	≤ 0,40	≤ 0,60	≤ 0,45	≤ 0,35	0,15	0,05 ⁵⁾	≤ 0,15 ⁵⁾	0,45 ⁶⁾	⁵⁾

1) $CE = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15$.

2) See specific limitations in the standard.

3) For shapes with flange thickness over 75 mm (3 in.): Si min. 0.15% to 0,4%, (Mn 0.85- 1.35% for A709 and A36)

4) Upon agreement: supplementary requirement S77 of ASTM A 913/A913M: Sulphur max. 0.010%, applicable to Grade 65 and Grade 70.

5) $Nb + V \leq 0.15\%$, ($N \leq 0.015\%$ for A992 and grade 50S of A709).

6) Max CE = 0.47% for shapes with flange thicknesses over 2 in. (50 mm).

7) When copper steel is specified, $Cu \geq 0.20$.

* Available upon agreement.