

Title:	API 620 Annex S, addition of UNS S31655		Agenda Item # 620-2085
Date:	5/7/2026		
Contact:	Name:	John Grocki	Claes Tigerstrand
	Company:	Advantage Resources Consulting, L.L.C.	Outokumpu Oy
	Phone:	860-985-8430	+46 70 08 812 35
	E-mail:	arc_jmg@yahoo.com	claes.tigerstrand@outokumpu.com
Purpose:	Addition of duplex stainless steel UNS S31655 to relevant paragraphs of API 650 Annex S.		
Source:	C. Tigerstrand, RATIONALE AND SUPPORTING DATA FOR INCLUSION OF AUSTENITIC STAINLESS STEEL UNS S31655 (316plus) IN API 650 AND API 620 ANNEX S.		
Revision:	Rev. 2 in Red. Original API 620 Text in Black.		
Impact:	Alloy no and specifications to be included in the text of paragraphs: S.1.1 and S.4.4.3. Alloy no and values to be included in tables: S.1a, S.1b, S.2a, S.2b, S.3a, S.3b, S.5a and S.5b.		
Rationale:	The nitrogen alloyed austenitic stainless steel S31655 is developed using a leaner alloying concept than regular 316L and 316LN. Despite its leaner chemistry it provides similar (or higher) corrosion resistance compared to type 316 in most environments. The relatively high nitrogen content gives higher mechanical strength than 316L. This grade can potentially provide more cost-effective solutions than 316L, particularly for larger tanks, where its higher strength can be fully utilized.		
Current Document:	API 620 12th Edition Addendum 4, Annex S.		
Proposed Document:	S.1.1 This Annex covers materials, design, fabrication, erection, and testing requirements for vertical, cylindrical, aboveground, closed- and open-top, welded, austenitic stainless steel storage tanks constructed of material grades 201-1, 201LN, 304, 304L, 316, 316L, S31655 , 317, and 317L. This Annex does not cover stainless steel clad plate or strip lined construction. S.4.4.3 Warm forming at 540 °C (1000 °F) to 650 °C (1200 °F) may cause intergranular carbide precipitation in 304, 316, and 317 grades of stainless steel. Unless stainless steel in this sensitized condition is acceptable for the service of the equipment, it will be necessary		

to use 304L, 316L, S31655 or 317L grades or to solution anneal and quench after forming. Warm forming shall be performed only with agreement of the Purchaser.

Table S.1a

Table S.1a—ASTM Materials for Stainless Steel Components (SI)

Plates and Structural Members (Note 1)	Piping and Tubing—Seamless or Welded (Note 2)	Forgings (Notes 2, 3)	Bolting and Bars (Notes 4, 5)
A240M S31655	A312M S31655 A358M S31655		

Table S.1b

Table S.1b—ASTM Materials for Stainless Steel Components (USC)

Plates and Structural Members (Note 1)	Piping and Tubing—Seamless or Welded (Note 2)	Forgings (Notes 2, 3)	Bolting and Bars (Notes 4, 5)
A240 S31655	A312 S31655		
A554 S31655	A358 S31655		
A554 Type 201			
A554 Type 304			
A554 Type 304L			
A554 Type 316			
A554 Type 316L			
A554 Type 317			
A554 Type 317L			

Table S-2—Maximum Allowable Stress Values for Simple Tension

Material Type	Min Yield		Min Tensile		Allowable Stress for Design Temperature Not Exceeding (S_{TS})					
					40 °C	100 °F	90 °C	200 °F	120 °C	250 °F
	MPa	lbf/in. ²	MPa	lbf/in. ²	MPa	lbf/in. ²	MPa	lbf/in. ²	MPa	lbf/in. ²
304	205	30,000	515	75,000	155	22,500	129	18,750	122	17,800
304L	170	25,000	485	70,000	129	18,750	110	16,050	104	15,200
316	205	30,000	515	75,000	155	22,500	133	19,350	126	18,400
316L	170	25,000	485	70,000	129	18,750	109	15,825	103	15,000
317	205	30,000	515	75,000	155	22,500	134	19,425	127	18,500
317L	205	30,000	515	75,000	155	22,500	134	19,425	127	18,500
S31655	310	45,000	635	92,000	210	30,400	188	26,900	174	24,900

NOTE 1 S_{TS} may be interpolated between temperatures.

NOTE 2 The design stress corresponds to the lesser of 0.33 of the minimum tensile strength or 0.75 of the minimum yield strength.

NOTE 3 For dual certified materials (e.g. ASTM A182M/A182 Type 304L/304), use the allowable stress of the grade specified by the purchaser.

Table S-3—Allowable Stresses for Plate Ring Flanges

Material Type	Allowable Stress for Design Temperatures Not Exceeding					
	40 °C	100 °F	90 °C	200 °F	120 °C	250 °F
	MPa	lbf/in. ²	MPa	lbf/in. ²	MPa	lbf/in. ²
304	140	20,000	115	16,700	108	15,800
304L	117	16,700	99	14,300	93	13,500
316	140	20,000	119	17,200	112	16,300
316L	117	16,700	97	14,100	92	13,300
S31655	191	27,600	167	23,900	155	22,100
NOTE 1 Allowable stresses may be interpolated between temperatures.						
NOTE 2 The allowable stresses are based on a lower level of permanent strain.						
NOTE 3 The design stress shall be the lesser of 0.3 of the minimum tensile strength, or ² /3 of the minimum yield strength.						
NOTE 4 For dual certified materials (e.g. ASTM A182M/A 182 Type 304L/304), use the allowable stress of the grade specified by the purchaser.						

Table S-4—Yield Strength Values

Material Type	Yield Strength for Design Temperature Not Exceeding					
	40 °C	100 °F	90 °C	200 °F	120 °C	250 °F
	MPa	lbf/in. ²	MPa	lbf/in. ²	MPa	lbf/in. ²
304	205	30,000	170	25,000	163	23,700
304L	170	25,000	148	21,400	140	20,300
316	205	30,000	178	25,800	170	24,500
316L	170	25,000	145	21,100	138	20,000
317	205	30,000	179	25,900	170	24,700
317L	205	30,000	179	25,900	170	24,700
S31655	310	45,000	250	35,900	232	33,200