

API 5CRA Sales Checklist- Group 2 Duplex Austenitic/Ferritic and Super Duplex Austenitic/Ferritic

Chemistry Requirements (Wt %)- Chemical analysis should have one report per cast PLUS 2 samples per cast for non-remelted alloys, 1 product chemistry per remelted ingot for remelted alloys													
S31803 (22CR)	C	Cr	Ni	Fe	Mn	Si	Mo	Cu	P	S	W	N	PREN
Minimum		21.0	4.5				2.5					0.08	35
Maximum	0.03	23.0	6.5	Bal	2.00	1.00	3.5		0.03	0.02		0.20	40
S31260 (25CR)	C	Cr	Ni	Fe	Mn	Si	Mo	Cu	P	S	W	N	PREN
Minimum		24.0	5.5				2.5	0.2			0.10	0.10	37.5
Maximum	0.03	26.0	7.5	Bal	1.00	0.75	3.5	0.8	0.03	0.03	0.50	0.30	40
S32750 (2507)	C	Cr	Ni	Fe	Mn	Si	Mo	Cu	P	S	W	N	PREN
Minimum		24.0	6.0				3.0					0.24	40
Maximum	0.03	26.0	8.0	Bal	1.20	0.80	4.0		0.035	0.02		0.32	45
S32760 (25CRS)	C	Cr	Ni	Fe	Mn	Si	Mo	Cu	P	S	W	N	PREN
Minimum		24.0	6.0				3.0	0.5			0.50	0.20	40
Maximum	0.03	26.0	8.0	Bal	1.00	1.00	4.0	1.0	0.03	0.01	1.00	0.30	45
S39274 (25CRW)	C	Cr	Ni	Fe	Mn	Si	Mo	Cu	P	S	W	N	PREN
Minimum		24.0	6.0				2.5	0.2			1.50	0.24	40
Maximum	0.03	26.0	8.0	Bal	1.00	0.80	3.5	0.8	0.03	0.02	2.50	0.32	45
Tensile Properties- Tensile strength shall be at least 10ksi greater than the specified minimum yield, if that is not met then there shall be a greater than 5ksi difference between yield and tensile, SA indicates solution annealed, all others cold worked, *NOTE- PSL-2 not applicable- tensiles to be performed once per heat													
Alloy	Grade	Min Yield	Max Yield	Min Tensile	Min Elongation	Temperature and Offset							
22CR (SA)	65	65	90	90	25%	Room Temperature at .2% Offset							
25CR (SA)	75	75	100	90	25%	Room Temperature at .2% Offset							
Super Duplex (SA)	80	80	105	110	20%	Room Temperature at .2% Offset							
Super Duplex (SA)	90	90	105	115	20%	Room Temperature at .2% Offset							
All	110	110	140	125	11% Duplex 12% Super	Room Temperature at .2% Offset							
All	125	125	150	130	10%	Room Temperature at .2% Offset							
All *	140	140	160	145	9%	Room Temperature at .2% Offset							
PIPE- Charpy Impacts- both ends of two lengths from each ingot or continuous cast strand performed transverse (C-L) at 14F													
Max critical wall thickness				Min ft-lbs	Sub-Size Specimen Reduction Factor								
65 -75 - 80/90	110	125	140		Specimen Size	Dimensions	Reduction Factor						
1.653-1.377-1.264-1.077	0.805	0.657	0.542	20	Full-Size	10mm x 10mm	1.00						
	0.864	0.710	0.589	21	3/4 Size	10mm x 7.5mm	0.80						
	0.924	0.763	0.636	22	1/2 Size	10mm x 5mm	0.55						
	0.984	0.815	0.683	23	For wall thicknesses not shown, contact Quality for calculation. If product dimension doesn't allow for CVN then flattening tests should be performed. If the application of the material is neither pipe or coupling stock, use the requirements for coupling stock.								
	1.044	0.868	0.730	24									
		0.921	0.777	25									
		0.973	0.824	26									
		1.026	0.871	27									
			0.918	28									
			0.965	29									
			1.012	30									

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COUPLING STOCK- Charpy Impacts- both ends of each length of coupling stock performed transverse (C-L) at 14F							
Max critical wall thickness				Min ft-lbs	Sub-Size Specimen Reduction Factor		
65 - 75 - 80/90	110	125	140		Specimen Size	Dimensions	Reduction Factor
1.077- .927- .863	0.542	0.478	0.421	20	Full-Size	10mm x 10mm	1.00
NA- .993- .926	0.589	0.521	0.462	21	3/4 Size	10mm x 7.5mm	0.80
NA- .1059- .988	0.636	0.565	0.504	22	1/2 Size	10mm x 5mm	0.55
NA - NA- 1.051	0.683	0.609	0.545	23	For wall thicknesses not shown, contact Quality for calculation. If product dimension doesn't allow for CVN then flattening tests should be performed. If the application of the material is neither pipe or coupling stock, use the requirements for coupling stock.		
	0.73	0.653	0.586	24			
	0.777	0.697	0.627	25			
	0.824	0.741	0.668	26			
	0.871	0.785	0.709	27			
	0.918	0.828	0.75	28			
	0.965	0.872	0.791	29			
	1.012	0.916	0.833	30			
		0.96	0.874	31			
		1.004	0.915	32			
			0.956	33			
			0.997	34			
			1.038	35			

Hardness HRC - Single Quad Performed on OD, Mid-wall, and ID														
Grade	PSL-1 Max Avg. HRC					PSL-2 Max Avg. HRC					Hardness Variation Allowances			
	65/75	80/90	110	125	140	65/75	80	90	110	125	Wall Thickness in inches	Allowable Hardness Variation		
22CR	26	NA	36	37	38	26/NA	NA	NA	36	36	≥	<	Pilgered	All Others
25CR	26	NA	36	37	38	NA/26	NA	NA	36	36	-	0.354	3	3
2507	NA	28/30	36	37	38	NA	28	30	36	36	0.354	0.50	4	3
25CRS	NA	28/30	36	37	38	NA	28	30	36	36	0.50	0.75	5	4
25CRW	NA	28/30	36	37	38	NA	28	30	36	36	0.75	1.00	6	5
											1.00	-	6	6

Microstructure and Ultrasonic Testing	
Microstructure	The microstructure shall have grain boundaries with no continuous precipitates. Inter-metallic phases, nitrides and carbides shall not exceed 1.0 % in total. The sigma phase shall not exceed 0.5%. Examination shall be on a longitudinal section after final heat treatment. Microstructure to be ferritic-austenitic. For duplex, ferrite should be in range of 40-60%. For super duplex- 35-55% and reported.
Ultrasonic Testing	All product shall be inspected by ultrasonic testing and for the detection of longitudinal and transverse imperfections on the outside and inside surfaces to acceptance level L2 by ultrasonic testing in accordance with ISO 9303 or ASTM E213 (longitudinal) and ISO 9305 or ASTM E213 (transverse). And laminar imperfections with an area not greater than 260 mm ² (0.4 in ²) when outlined on the outside surface by ultrasonic testing in accordance with ISO 10124.

Special Instructions/Definitions
Refer to API 5CRA C.15 for dimensions and masses and C.17 for tolerances.
To convert Mpa to ksi, Mpa*.145=ksi
To convert joules to ft-lbs., Joules*.7376=ft-lbs.
Melting – This family of alloys is typically melted in an Electric Arc Furnace (EAF) then further refined by Argon Oxygen Decarburization (AOD) or Vacuum Oxygen Decarburization (VOD). At the mill or customer's discretion, an additional refining process such as Electro-slag Remelting may be employed. As an alternative to EAF + AOD or VOD, Vacuum Induction Melting is permissible however not typically cost effective.
Casing - pipe intended to line the walls of a drilled well
Coupling stock - seamless thick-wall tubular product used for the manufacture of coupling blanks
Pipe- plain-end casing, tubing, and pup joints as group
Tubing - pipe placed in a well to produce or inject fluids

API 5CRA Sales Checklist- Group 3 (Austenitic) and Group 4 (Nickel) Alloys

Chemistry Requirements (Wt %)-Chemical analysis should have one report per cast PLUS 2 samples per cast for non-remelted alloys, 1 product chemistry per remelted ingot for remelted alloys																	
N08825 (825)	C	Cr	Ni	Fe	Mn	Si	Mo	Co	Cu	P	S	Ti	Nb+Ta	V	W	N	Al
Minimum		19.5	38.0				2.5		1.5			0.6					
Maximum	0.05	23.5	46.0	Bal	1.00	0.50	3.5		3.0	0.03	0.03	1.20					0.2
N06985 (G3)	C	Cr	Ni	Fe	Mn	Si	Mo	Co	Cu	P	S	Ti	Nb+Ta	V	W	N	Al
Minimum		21.0		18.0			6.0		1.5								
Maximum	0.015	23.5	Bal	21.0	1.00	1.00	8.0	5.0	2.5	0.04	0.03		0.50		1.5		
N06255 (2550)	C	Cr	Ni	Fe	Mn	Si	Mo	Co	Cu	P	S	Ti	Nb+Ta	V	W	N	Al
Minimum		23.0	47.0				6.0										
Maximum	0.03	26.0	52.0	Bal	1.00	1.00	9.0		1.2	0.03	0.03	0.69			3.0		
N10276 (C276)	C	Cr	Ni	Fe	Mn	Si	Mo	Co	Cu	P	S	Ti	Nb+Ta	V	W	N	Al
Minimum		14.5		4.0			15.0								3.0		
Maximum	0.02	16.5	Bal	7.0	1.00	0.08	17.0	2.5		0.03	0.03			0.35	4.5		
N08028 (28CR)	C	Cr	Ni	Fe	Mn	Si	Mo	Co	Cu	P	S	Ti	Nb+Ta	V	W	N	Al
Minimum		26.0	29.5				3.0		0.6								
Maximum	0.03	28.0	32.5	Bal	2.50	1.00	4.0		1.4	0.03	0.03						
N08535 (2535)	C	Cr	Ni	Fe	Mn	Si	Mo	Co	Cu	P	S	Ti	Nb+Ta	V	W	N	Al
Minimum		24.0	29.0				2.5	Ni+Co=29.5									
Maximum	0.03	27.0	36.5	Bal	1.00	0.50	4.0		1.5	0.03	0.03						

Tensile Properties- Note*: no 140 ksi yield grades are applicable for PSL-2 except for C276- additionally the tensile strength shall be at least 10ksi greater than the specified minimum yield, if that is not met then there shall be a greater than 5ksi difference between yield and tensile- tensiles to be performed once per heat

Alloy	Grade	Min Yield	Max Yield	Min Tensile	Min Elongation	Temperature and Offset
All	110	110	140	115	11%	Room Temperature at .2% Offset
All	125	125	150	130	10%	Room Temperature at .2% Offset
All*	140	140	160	145	9%	Room Temperature at .2% Offset

PIPE- Charpy Impacts- both ends of two lengths from each ingot or continuous cast strand performed transverse (C-L) at 14F

	Max critical wall thickness			Min ft-lbs	Sub-Size Specimen Reduction Factor		
	110	125	140		Specimen Size	Dimensions	Reduction Factor
	0.805	0.657	0.542	20	Full-Size	10mm x 10mm	1.00
	0.864	0.710	0.589	21	3/4 Size	10mm x 7.5mm	0.80
	0.924	0.763	0.636	22	1/2 Size	10mm x 5mm	0.55
	0.984	0.815	0.683	23	For wall thicknesses not shown, contact Quality for calculation. If product dimension doesn't allow for CVN then flattening tests should be performed. If the application of the material is neither pipe or coupling stock, use the requirements for coupling stock.		
	1.044	0.868	0.730	24			
		0.921	0.777	25			
		0.973	0.824	26			
		1.026	0.871	27			
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	110	125	140	110	125	140	Wall Thickness in inches		Allowable Hardness Variation							
825	35	37	38	33	35	N/A	≥	<	Pilgered	All Others						
G-3	35	37	38	35	37	N/A	-	0.354	3	3						
2550	35	37	38	35	37	N/A	0.354	0.50	4	3						
C276	35	37	38	35	37	38	0.50	0.75	5	4						
28CR	35	37	38	33	35	N/A	0.75	1.00	6	5						
2535	35	37	38	33	35	N/A	1.00	-	6	6						
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