Appendix A

General Guide for Materials Selection

SCOPE

This guide covers:

1. Materials and corrosion allowance (CA) for process equipment,
2. Materials for low-temperature services,
3. Materials for wear and abrasion resistance.

EQUIPMENT DESIGN LIFE

Materials selection is based on the following approximate design lives:

1. Large vessels and columns	25 years
2. Small vessels (volume less than 2.2 m^3 (78 ft^3)	10 years
3. Exchanger shells and channels	15 years
4. Air coolers	15 years
5. Furnace tubes and supports	10 years
6. Piping, critical, and 100 mm (4 in.) or larger	15 years
7. Pumps and valves	10 years

CRITERIA FOR MATERIALS SELECTION

1. Materials selection should be based on most severe operating conditions.
2. Process flow diagrams, stream analyses, contaminant levels, upset conditions, safety, reliability, and environmental conditions during shutdowns and start-ups should be evaluated in selecting materials.
3. All materials for process equipment and piping should be identifiable and conform, where necessary, to the requirements of the ASTM or other national standard specifications. Table A-l contains typical ASTM standard specifications for different product forms in frequent use.
4. When welding is involved, the low carbon grade SS (UNS S30403 and S31603) are preferred to the regular grades (UNS S30400 and S31600) except for use at operating temperatures higher than 425°C (800°F) and when intergranular stress corrosion or intergranular corrosion is not a problem during operation or downtime. Note: It is common practice for 300 series SS to be made so that it meets both the regular and low carbon grade requirement; thus, it will be stamped, e.g., 304/304L (UNS S30400/S30403).

TABLE A-1
Typical ASTM Specifications for Materials

Material (UNS No. as applicable)	Plate	Pipe	Tubing	Forgings & Fittings	Bars	Castings
Cast Iron						A48, A126 A278
Carbon Steel	A285, A515 A516, A537 A737	A53, A106 A671, A672 A691	A214, A179 A192, A210	A105, A181 A266, A234	A29, A575 A576, A663 A675	A216
Carbon-1/2 Mo	A204	A335	A161, A209	A182, A234		A217
1 Cr-1/2 Mo, 1-1/4 Cr-1/2 Mo, & 2-1/4 Cr-1 Mo	A387	A335	A199 A200 A213	A182 A336 A234	A29 A739	A217
5Cr-1/2 Mo	A387	A335	A199, A200 A213	A182, A234		A217
12Cr, CA15	A240		A268	A182	A479	A217
Austenitic Stainless 304, 304L, 316, 316L, 321, 347, 310, CF3, CF3M, CF8, CF8C, CF8M	A240	A312 A358	A213 A249 A271	A182 A336 A403	A479	A351 A744
HK40(J94204) & HP modified						A297
Duplex 2205 SS (S32205)	A240	A790	A789	A182, A815	A276	
6 MoSS (N08367)	B688	B675	B676			
Alloy 800 (N08800)	B409	B407	B163, B407	B366, B564	B408	
Alloy 825 (N08825)	B424	B423	B163, B704	B366	B425	
904L (N08904)	B625	B673, B677	B674, B677		B649	
Alloy 20 (N08020)	B463	B464, B474	B468	B462	B472	A351
Copper (C10200)	B152	B42	B75, B111			
Admiralty Brass (C44300)			B111			
Naval Brass (C46500)	B171				B124	
70-30 Cu-Ni	B171	B467, B608	B111, B395			
Titanium Gr.2 (R50400)	B265	B337	B338	B381	B348	B367
Alloy 400 (N04400)	B127	B165	B163, B165	B564	B164	A494
Alloy 625 (N06625)	B443	B444	B444, B704	B446		
Alloy C276 (N010276)	B575	B622	B622, B626	B574		A494
Ni Resist TP2 (F41002)						A436
Aluminum	B209	B241	B234	B247	B211	

General Guidelines for Materials Selection and Corrosion Allowances

1. Materials typically used for the following environments are contained in Tables A-2 through A-17. It is important to note that the materials listed are typical and that there can be exceptions.

- General - hydrocarbon with low sulfur contents, non-corrosive steam and water
- Hydrocarbon plus sulfur greater than 1 wt%
- Hydrocarbon plus sulfur greater than 0.2 wt% plus naphthenic acid
- Hydrocarbon plus sulfur between 0.2 wt% and 1.0 wt%
- Hydrocarbon plus hydrogen
- Hydrocarbon plus hydrogen and hydrogen sulfide
- Sour water and desalter water
- Carbonate
- Low pressure wet carbon dioxide
- High pressure wet carbon dioxide
- Amine
- Acid gas
- Liquid sulfur
- Untreated, aerated water
- Caustic
- Valve trim

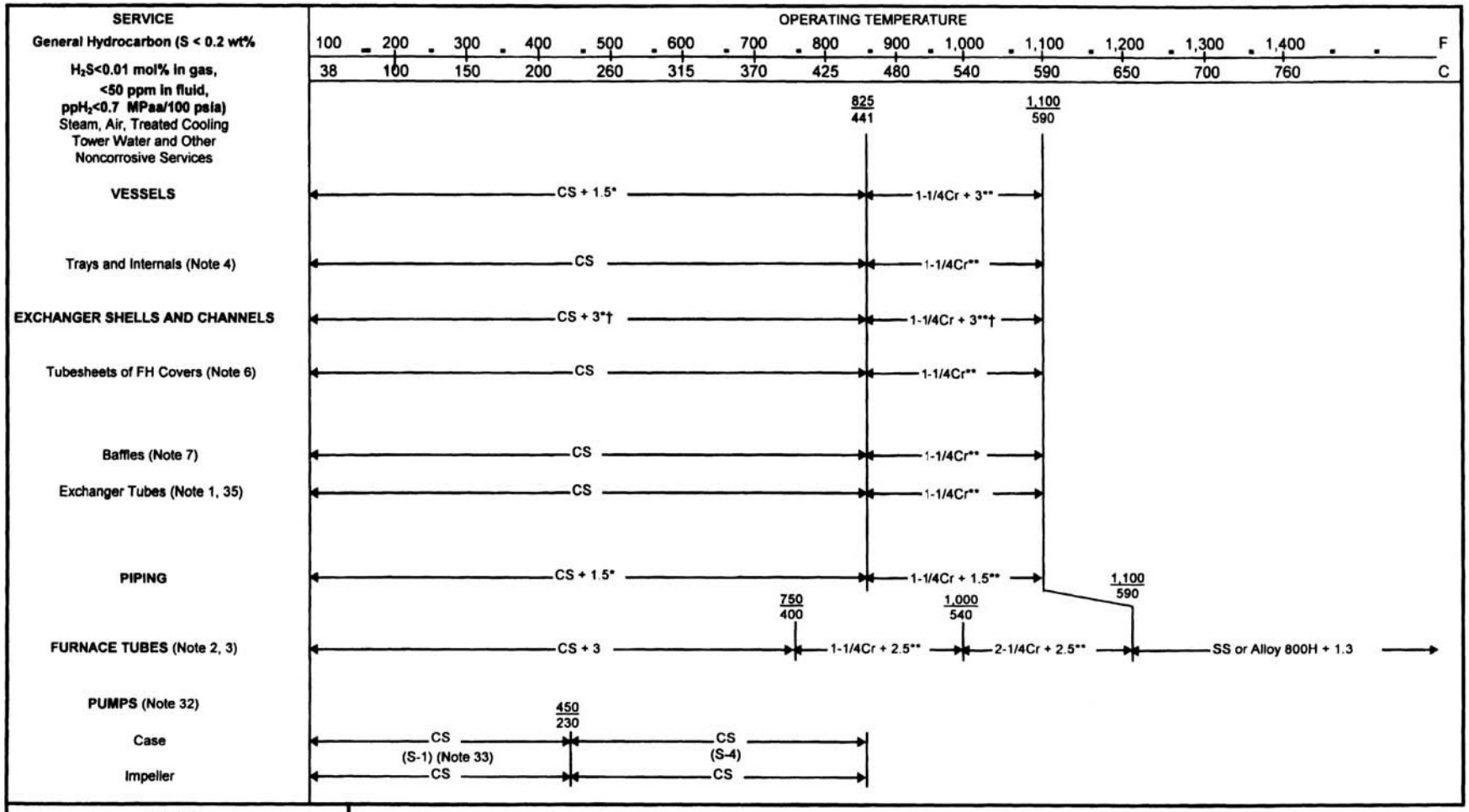
2. The following legend has been used for materials designations:

CI	= cast iron	12 Cr	= Types 405, 410, 410S, CA15 (UNS S40500, S41,000, S41008, J9II59)
CS	= carbon steel		
1 Cr	= 1 Cr-1/2 Mo	18-8	= Types 304, 316, 321, 347, CF8, CF8M, CF8C (UNS S30400, S31600, S32100, S34700, J92600, J92900, J92710)
1-1/4 Cr	= 1-1/4 Cr-1/2 Mo		
5 Cr	= 5 Cr-1/2 Mo		
9 Cr	= 9 Cr-1 Mo	SS	= stainless steel

3. The numerals after a material designation indicate the minimum nominal corrosion allowances in millimeters (mm) as follows:

- 1.3 mm (0.050 in.) for SS furnace tubes unless otherwise specified
- 1.5 mm (0.063 in.) for piping unless otherwise specified
- 2.5 mm (0.100 in.) for 1 Cr - 5 Cr furnace tubes and typical minimum thickness for clad
- 3.0 mm (0.125 in.) for carbon steel furnace tubes, for TEMA Class R heat exchangers, and for sour water piping with hydrogen sulfide partial pressures less than 0.07 MPaa (10 psia)
- 4.5 mm (0.188 in.) for sour water vessels and heat exchangers with hydrogen sulfide partial pressures less than 0.07 MPaa (10 psia)
- 6 mm (0.250 in.) for vessels and heat exchangers with hydrogen sulfide partial pressures greater than 0.07 MPaa (10 psia) or carbon dioxide partial pressures less than 0.03 MPaa (4 psia)

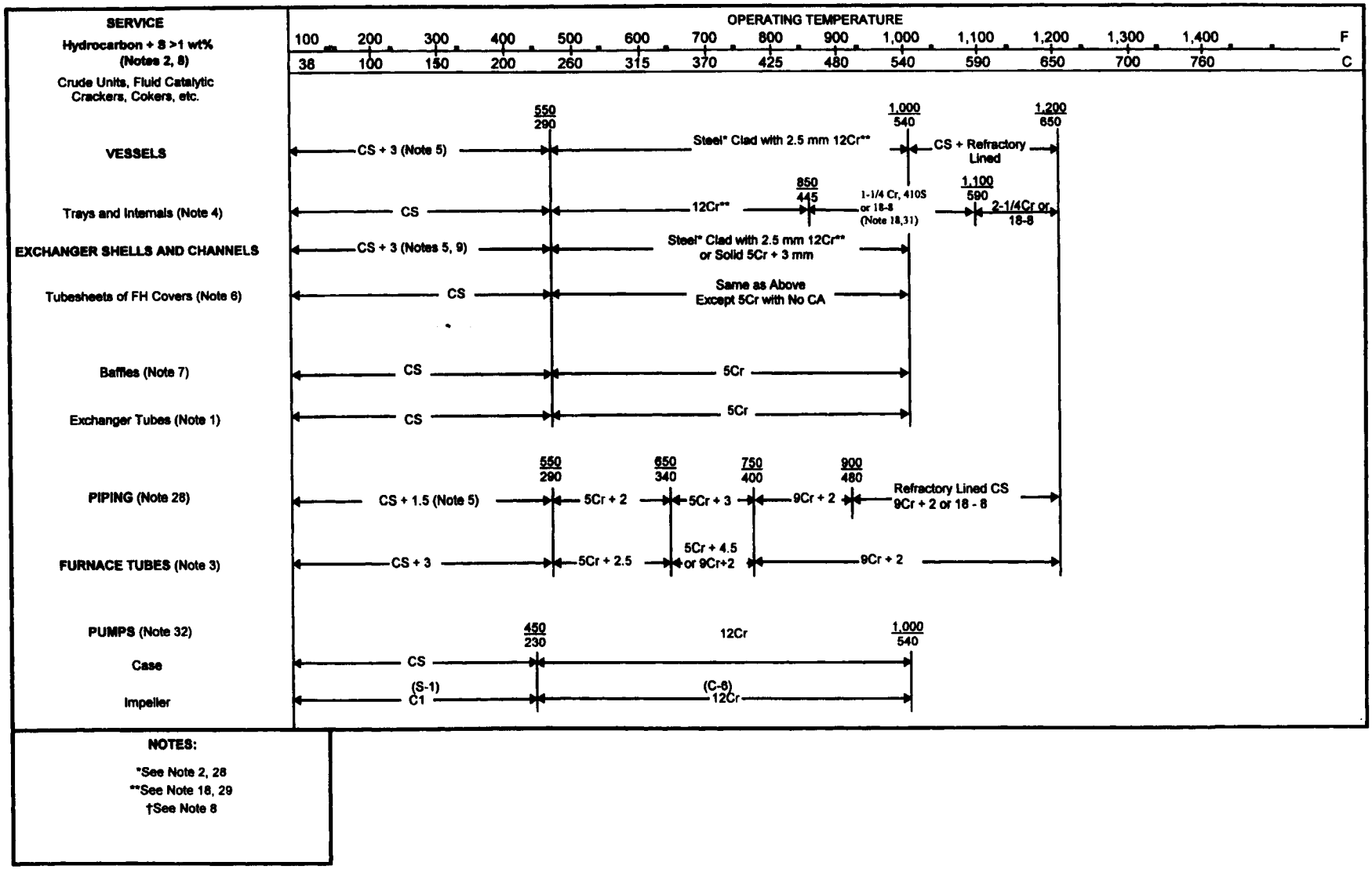
TABLE A-2



NOTES:

*See Note 2, 26
**See Note 8
†See Note 9

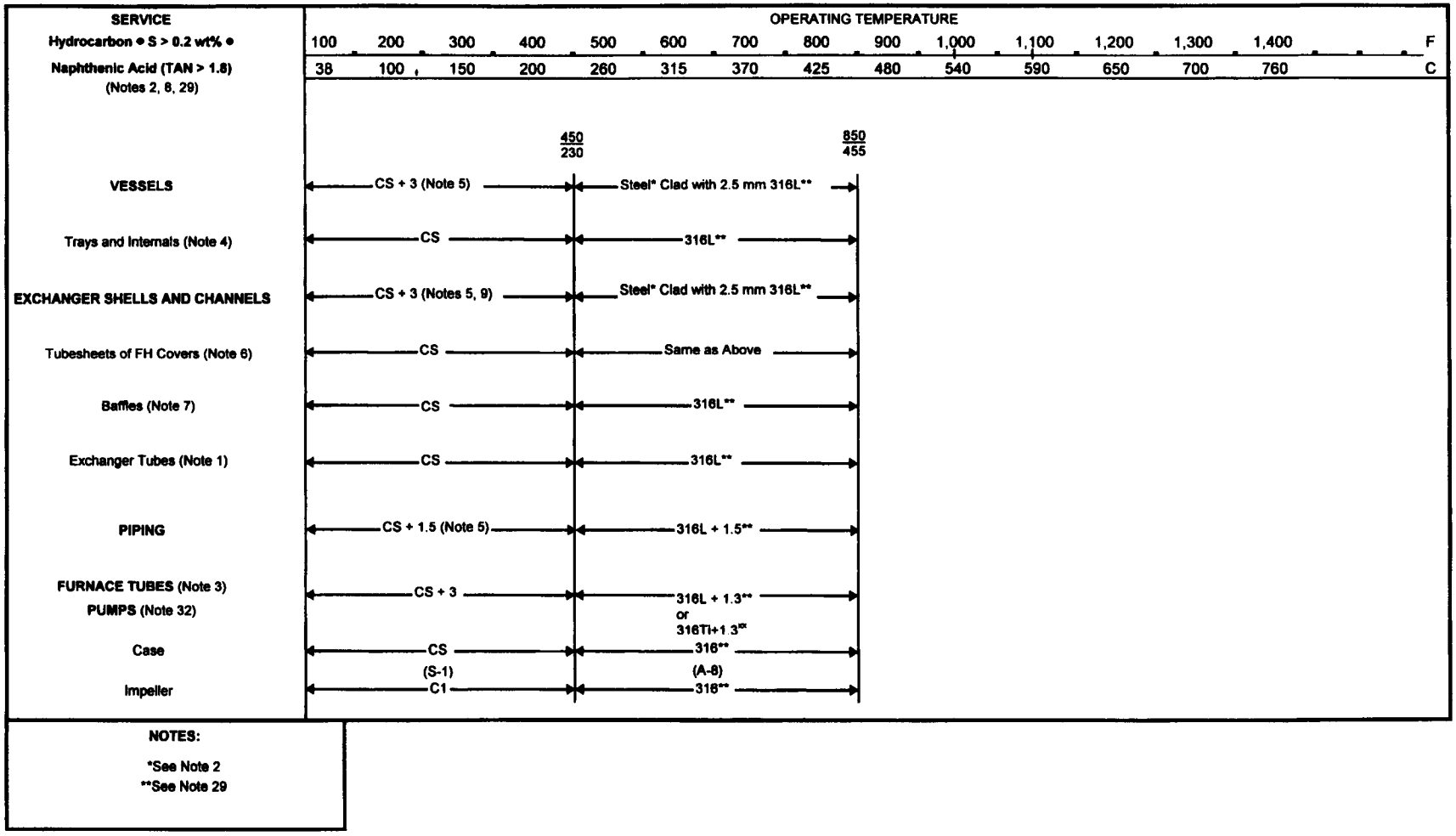
TABLE A-3



NOTES:

*See Note 2, 28
**See Note 18, 29
†See Note 8

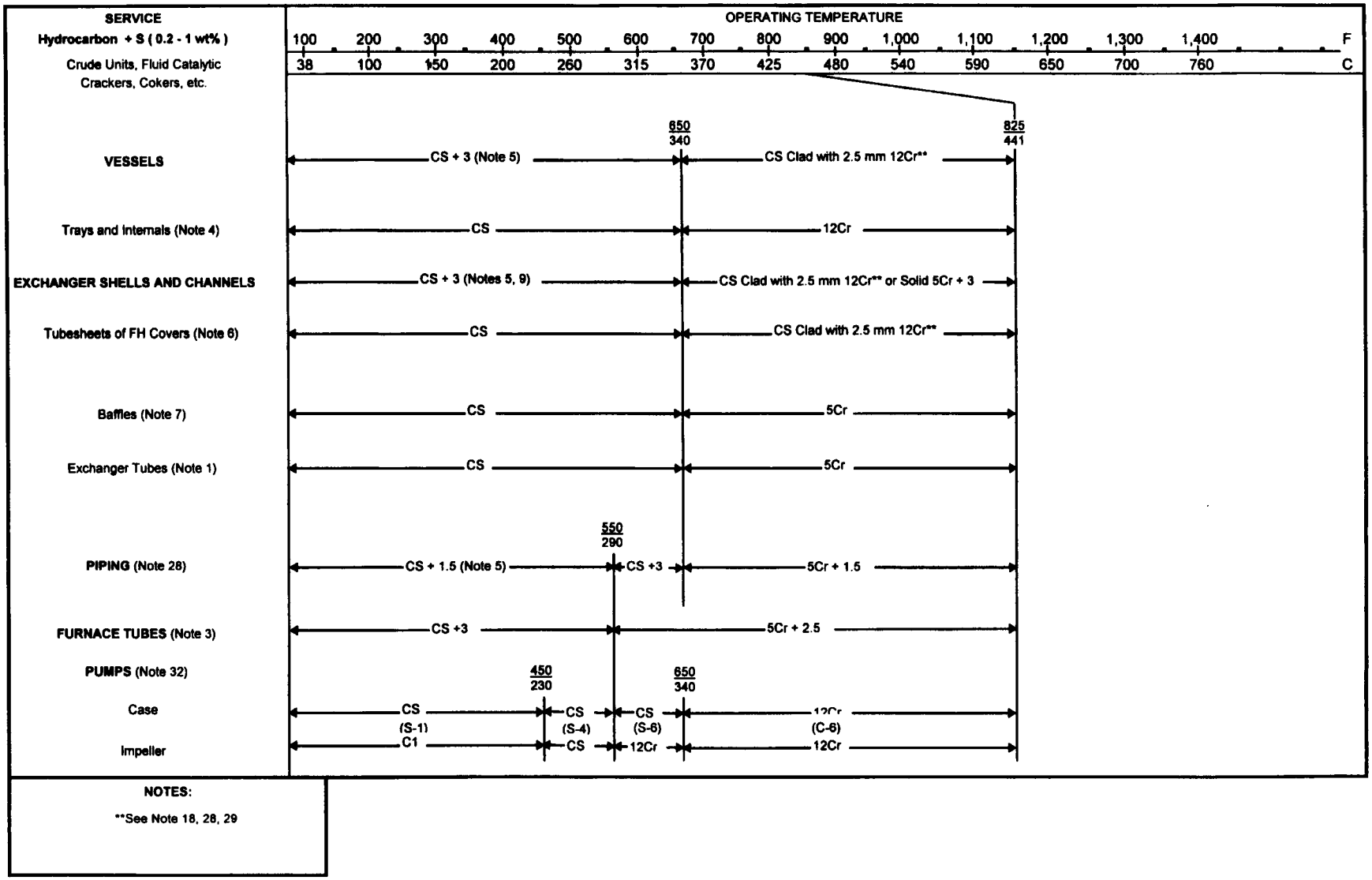
TABLE A-4



NOTES:

*See Note 2
**See Note 29

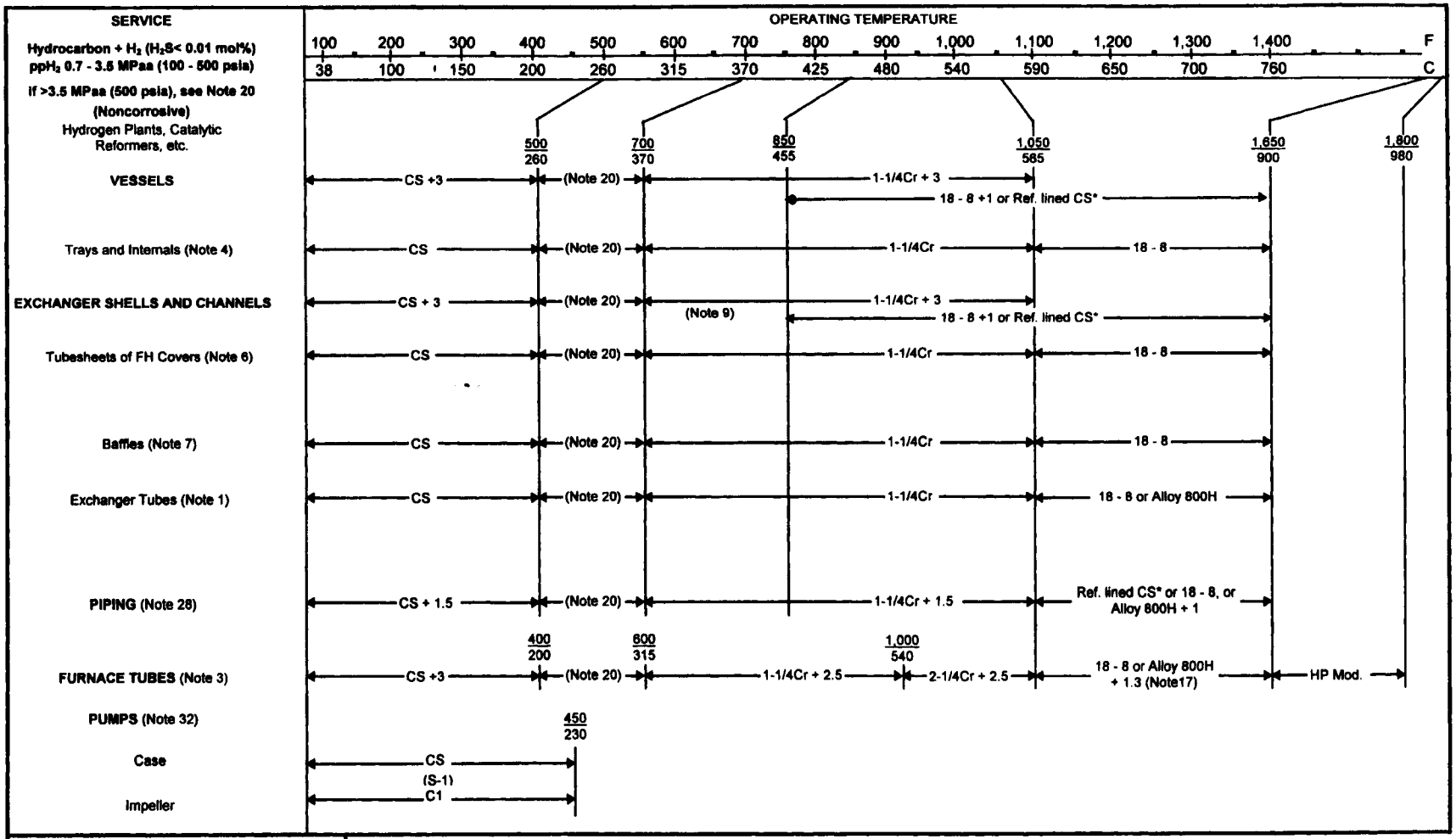
TABLE A-5



NOTES:

**See Note 18, 28, 29

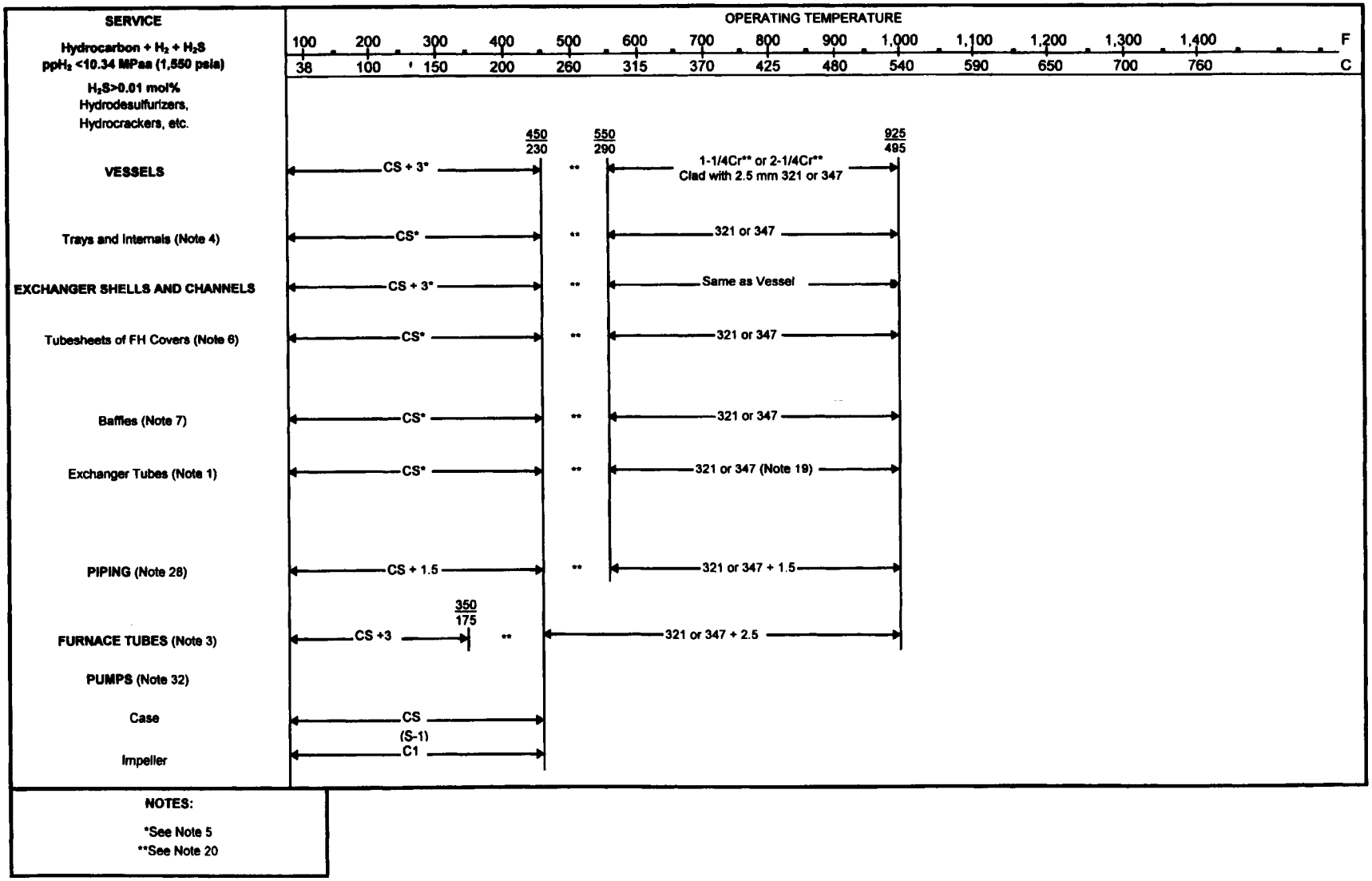
TABLE A-6



NOTES:

*See Note 15
Ref. = Refractory

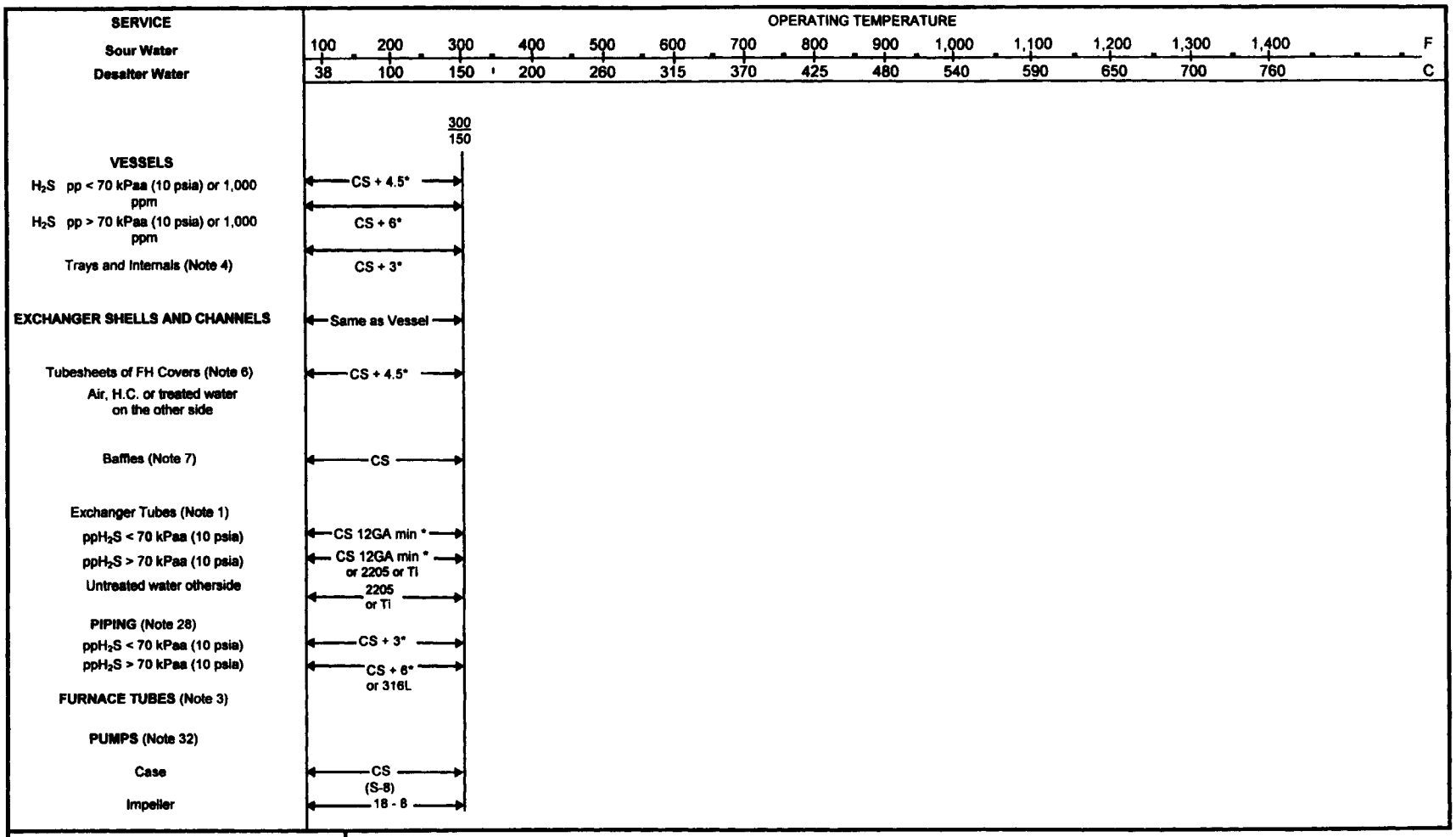
TABLE A-7



NOTES:

*See Note 5
**See Note 20

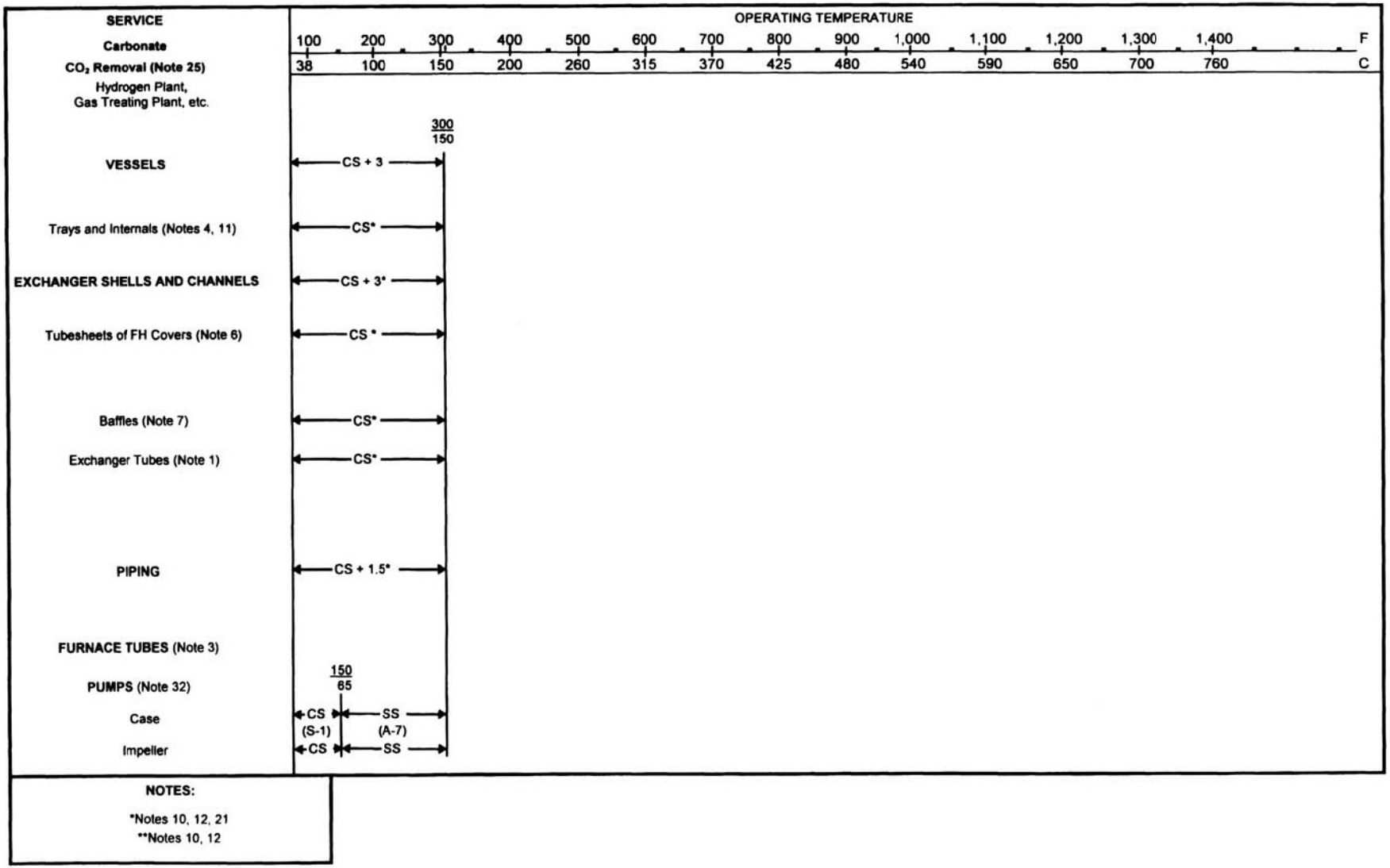
TABLE A-8



NOTES:

*See Notes 13, 24

TABLE A-9



NOTES:

*Notes 10, 12, 21

**Notes 10, 12

TABLE A-10

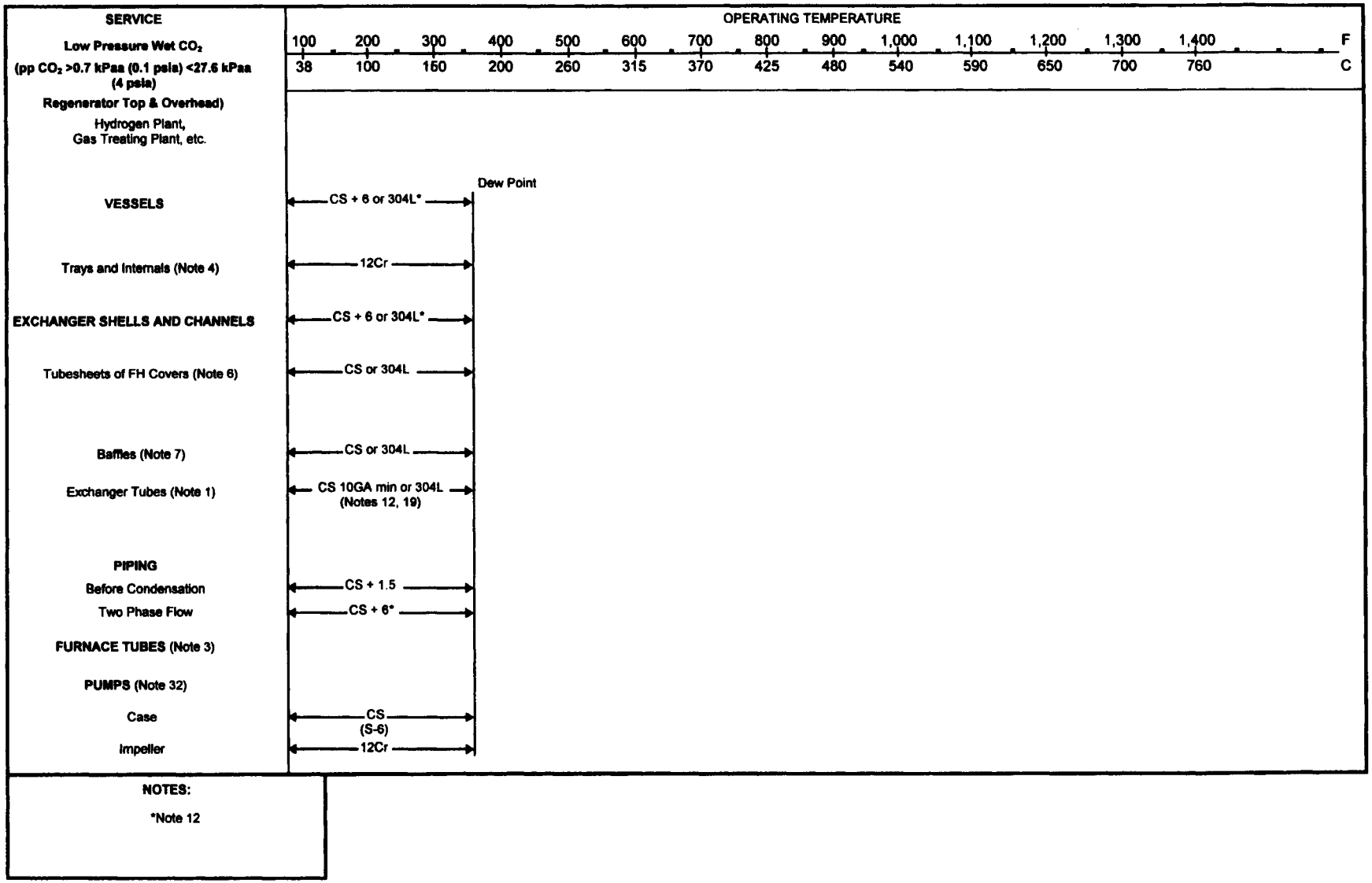

SERVICE
OPERATING TEMPERATURE
Low Pressure Wet CO_2
(pp CO_2 >0.7 kPaa (0.1 psia) <27.6 kPaa (4 psia)
Regenerator Top & Overhead)
Hydrogen Plant,
Gas Treating Plant, etc.
100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 F
38 100 150 200 260 315 370 425 480 540 590 650 700 760 C
Dew Point
VESSELS
CS + 6 or 304L*
Trays and Internals (Note 4)
12Cr
EXCHANGER SHELLS AND CHANNELS
CS + 6 or 304L*
Tubesheets of FH Covers (Note 6)
CS or 304L
Baffles (Note 7)
CS or 304L
Exchanger Tubes (Note 1)
CS 10GA min or 304L
(Notes 12, 19)
PIPING
Before Condensation
CS + 1.5
Two Phase Flow
CS + 6*
FURNACE TUBES (Note 3)
PUMPS (Note 32)
Case
CS
(S-6)
Impeller
12Cr
NOTES:
*Note 12

TABLE A-11

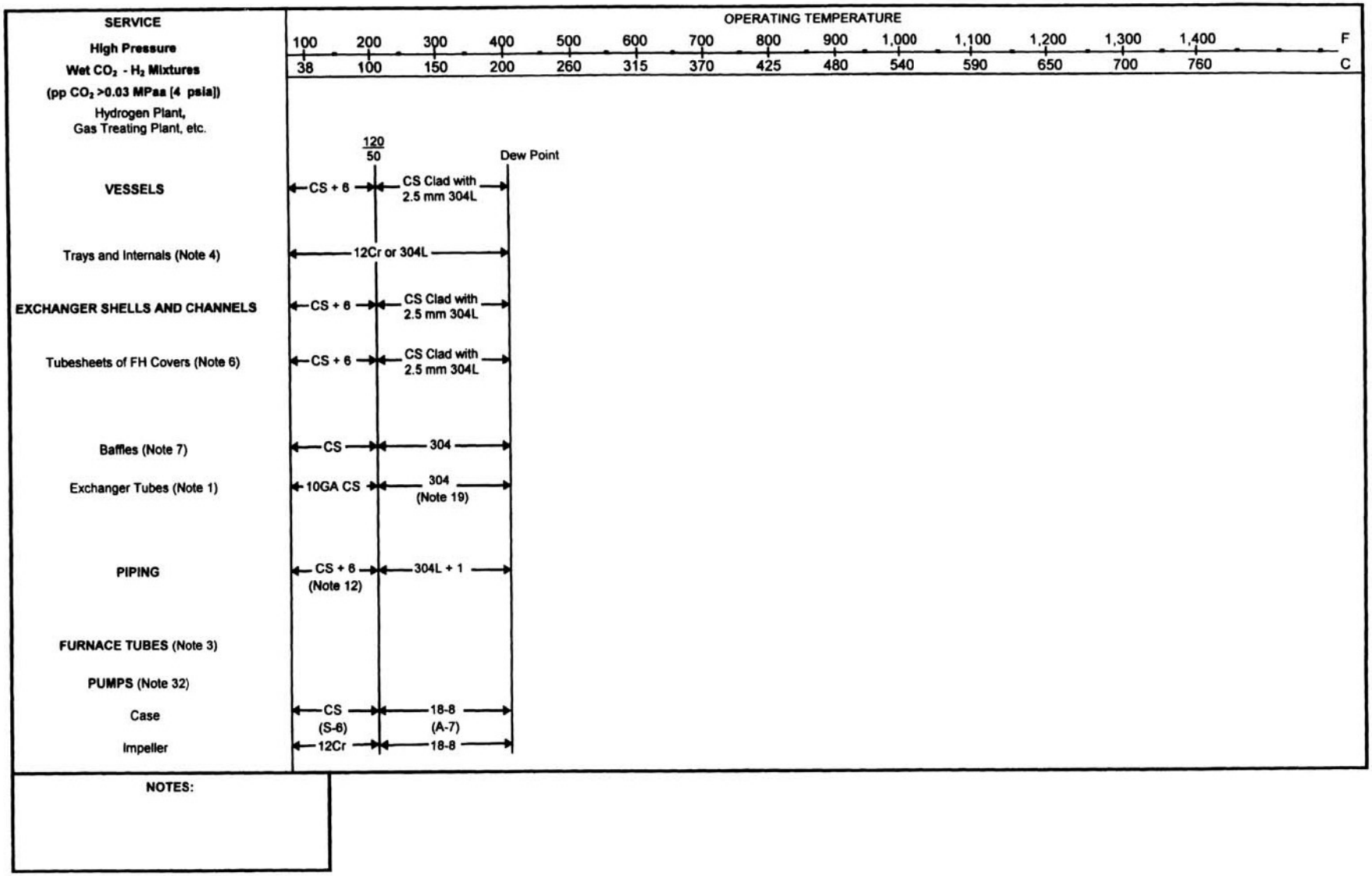
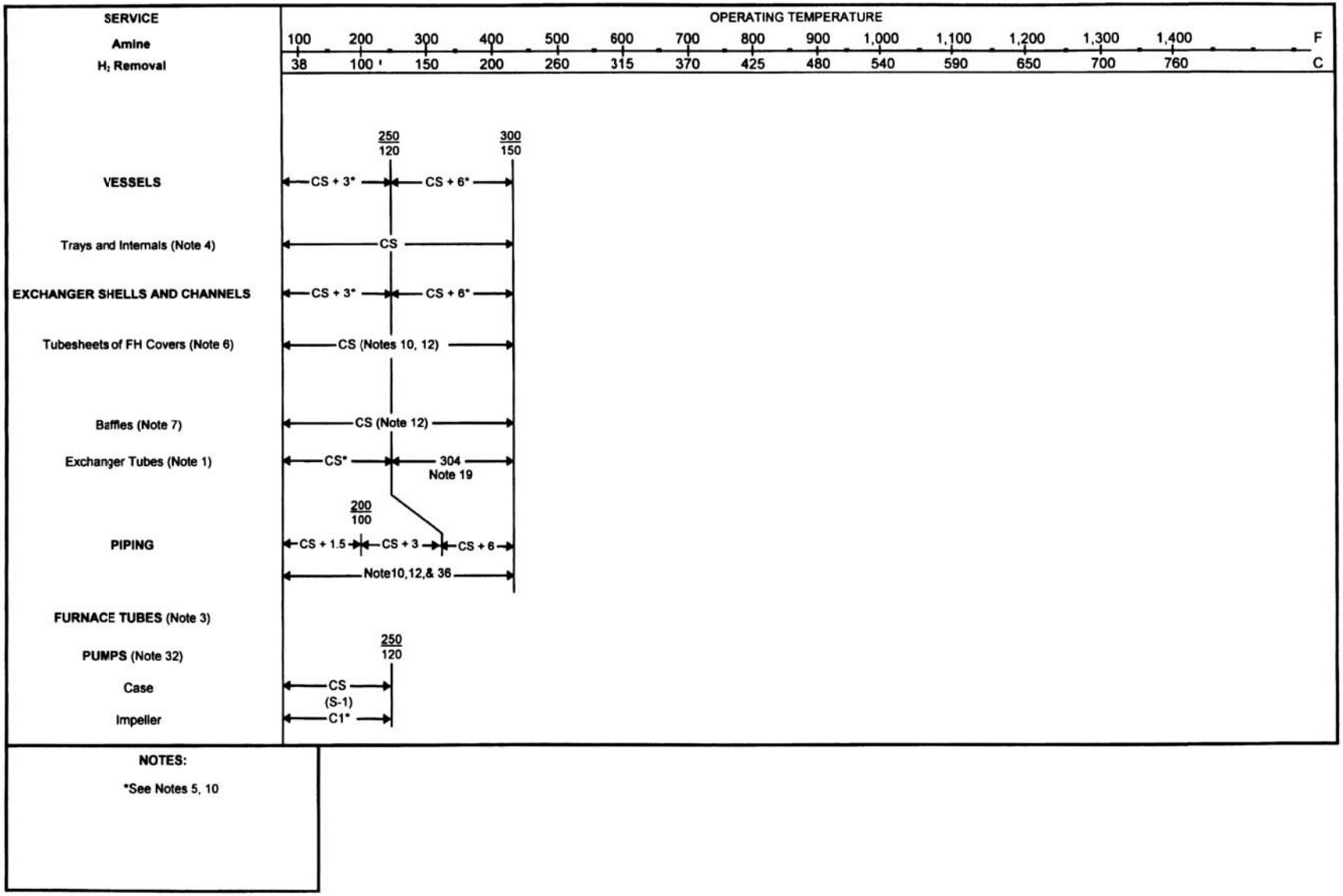

SERVICE
OPERATING TEMPERATURE
High Pressure
Wet CO_2 - H_2 Mixtures
(pp CO_2 >0.03 MPaa [4 psia])
Hydrogen Plant,
Gas Treating Plant, etc.
100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 F
38 100 150 200 260 315 370 425 480 540 590 650 700 760 C
120
50
Dew Point
VESSELS
CS + 6
CS Clad with 2.5 mm 304L
Trays and Internals (Note 4)
12Cr or 304L
EXCHANGER SHELLS AND CHANNELS
CS + 6
CS Clad with 2.5 mm 304L
Tubesheets of FH Covers (Note 6)
CS + 6
CS Clad with 2.5 mm 304L
Baffles (Note 7)
CS
304
Exchanger Tubes (Note 1)
10GA CS
304 (Note 19)
PIPING
CS + 6 (Note 12)
304L + 1
FURNACE TUBES (Note 3)
PUMPS (Note 32)
Case
CS (S-6)
18-8 (A-7)
Impeller
12Cr
18-8
NOTES:

TABLE A-12



NOTES:

*See Notes 5, 10

TABLE A-13

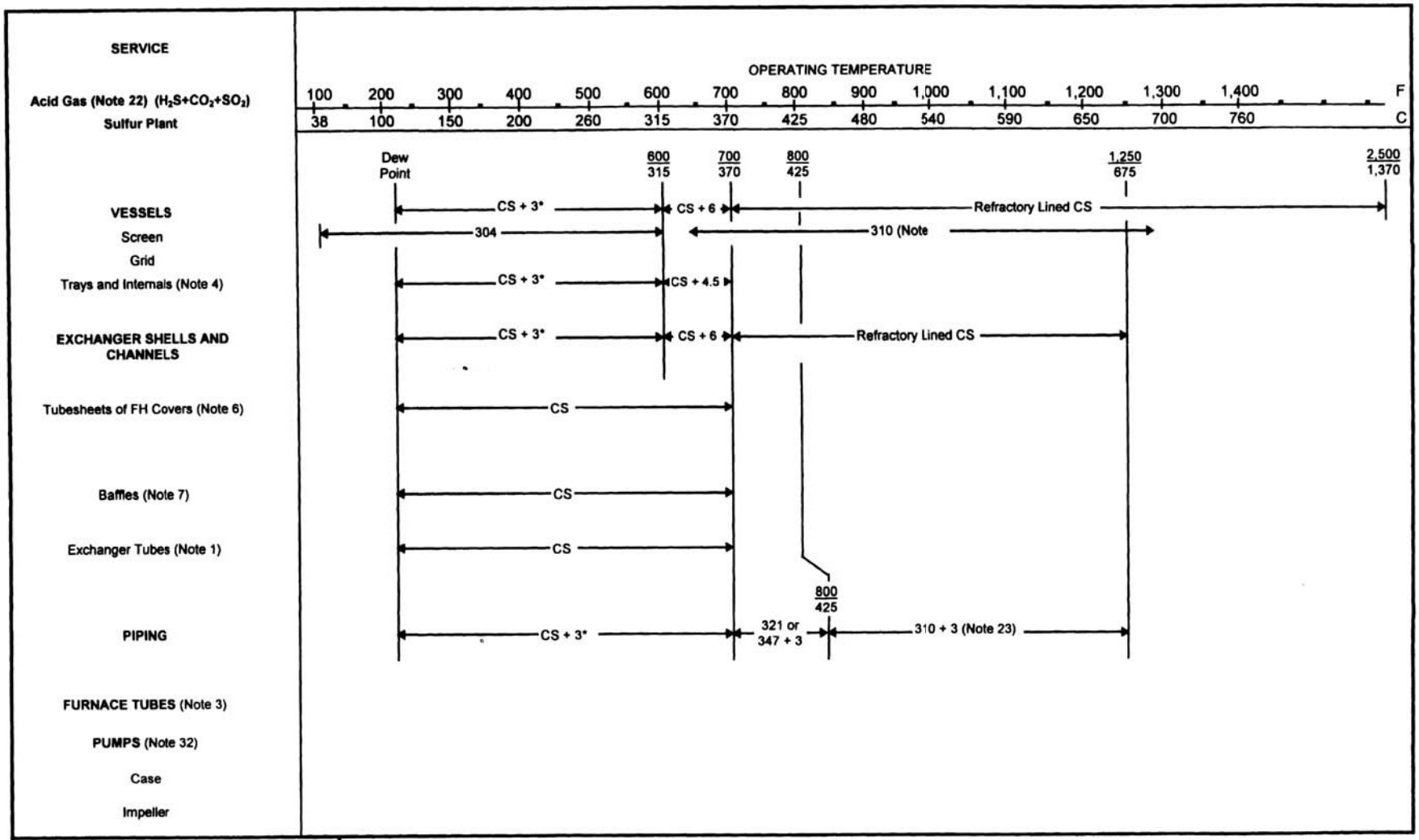

SERVICE
Acid Gas (Note 22) ($H_2S+CO_2+SO_2$)
Sulfur Plant
OPERATING TEMPERATURE
100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 F
38 100 150 200 260 315 370 425 480 540 590 650 700 760 C
Dew Point
600/315
700/370
800/425
1,250/675
2,500/1,370
VESSELS
Screen
Grid
Trays and Internals (Note 4)
EXCHANGER SHELLS AND CHANNELS
Tubesheets of FH Covers (Note 6)
Baffles (Note 7)
Exchanger Tubes (Note 1)
PIPING
FURNACE TUBES (Note 3)
PUMPS (Note 32)
Case
Impeller
CS + 3*
CS + 6
Refractory Lined CS
304
310 (Note
CS + 4.5
CS
800/425
321 or 347 + 3
310 + 3 (Note 23)
NOTES:

TABLE A-14

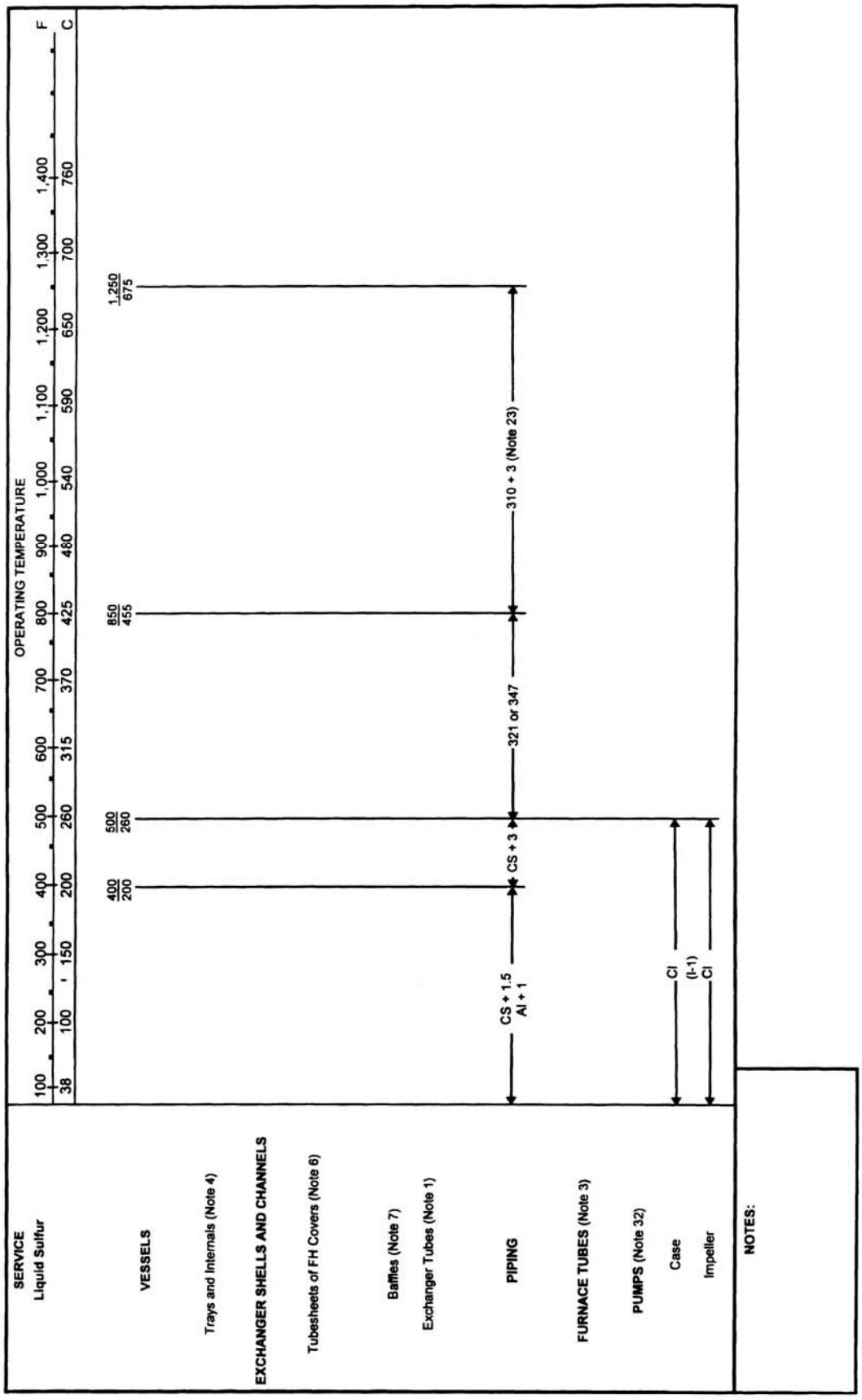
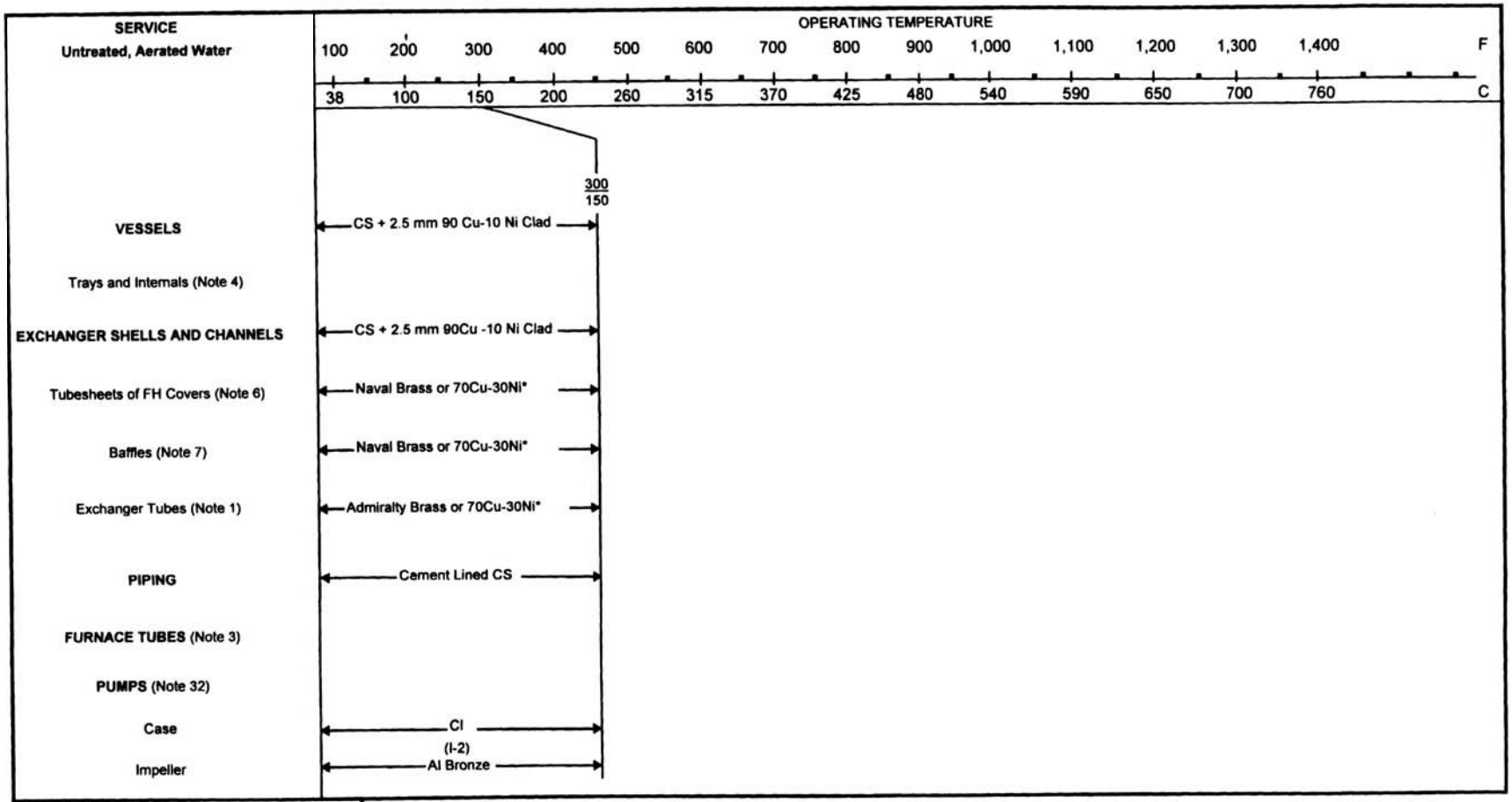

SERVICE
Liquid Sulfur
OPERATING TEMPERATURE
100 200 300 400 500 600 700 800 900 1,000 1,100 1,200 1,300 1,400 F
38 100 150 200 260 315 370 425 480 540 590 650 700 760 C
VESSELS
400/200
500/260
850/455
1,250/675
Trays and Internals (Note 4)
EXCHANGER SHELLS AND CHANNELS
Tubesheets of FH Covers (Note 6)
Baffles (Note 7)
Exchanger Tubes (Note 1)
PIPING
CS + 1.5
Al + 1
CS + 3
321 or 347
310 + 3 (Note 23)
FURNACE TUBES (Note 3)
PUMPS (Note 32)
Case
Cl
(I-1)
Impeller
Cl
NOTES:

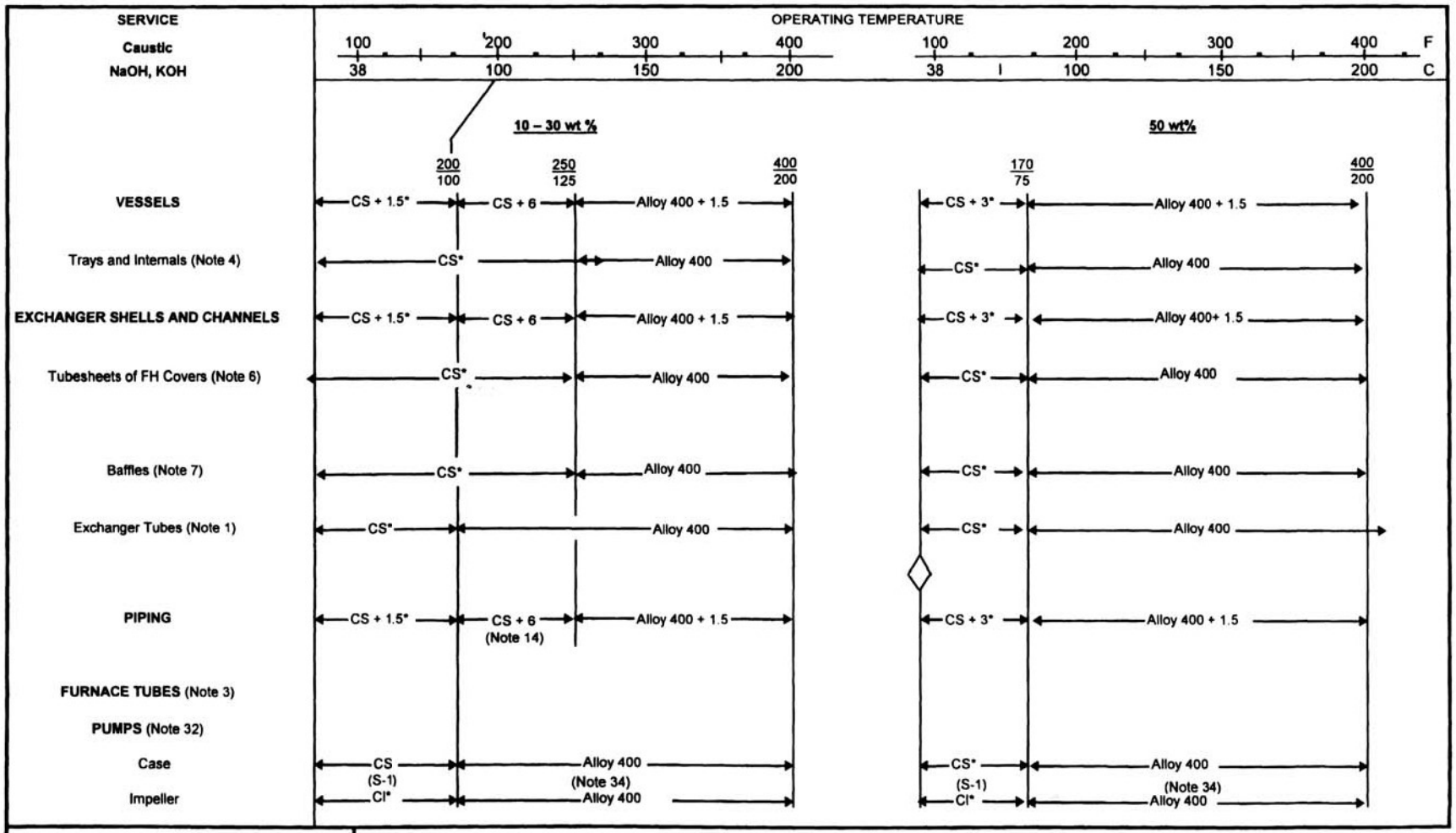
TABLE A-15



NOTES:

*See Note 27

TABLE A-16



NOTES:

*See Note 10

Table A-17 – Valve Trim

Environment	Valve Trim Material (Note 16)
1. General Service	
a) Treated Water	
b) Steam Δp <1.03 MPag (150 psig) in multiphase flow	12 Cr
< 3.4 MPag (500 psig) in single phase flow	12 Cr
Δp >1.03 MPag (150 psig) in multiphase flow or	
>3.4 MPag (500 psig) in single phase flow	Stellite 6™ (UNS R30006)
2. Hydrocarbon, Carbonate, Wet CO_2, Acid Gas, Liquid Sulfur	
a) Carbon and low alloy steel piping	12 Cr
b) 321 or 347 (UNS S32100 or S34700) piping	18-8
3. Sour Water, Desalter Water	18-8 or 12 Cr (HRC 22 max.)
4. Amine	
a) <100°C (200°F)	12 Cr
b) >100°C (200°F)	18-8
5. Untreated Water <100°C (200°F)	Bronze
6. Caustic	
a) 10-30 wt%, <100°C (200°F)	12 Cr
b) 10-30 wt%, >100°C (200°F), 50 wt% all temperatures	Alloy 400 (UNSN04400)

Notes for Tables A-2 through A-17

1. The thickness of exchanger tubes should be that specified in the Exchanger Design Criteria. Where a gauge is specified, the thickness must be checked for adequacy with regard to pressure. Alternatively, a corrosion allowance of 0.25 mm (0.01 in.) to 1.5 mm (0.06 in.) can be specified.

2. Above 400°C (750°F), use silicon-killed (not aluminum-killed) carbon steel. Above 440°C (825°F), use 1 Cr-1/2 Mo or 1-1/4 Cr-1/2 Mo.

3. Materials selection for furnace tubes in non-hydrogen containing hydrocarbon plus sulfur services is based on the assumption that the metal temperature is 50°C (100°F) higher than the internal fluid temperature. To avoid excessive oxidation the outside skin temperatures should not exceed 530°C (1,000°F) for carbon steel, 650°C (1,200°F) for 1-1/4 Cr to 9 Cr and 930°C (1,700°F) for 18-8 SS. When austenitic SS is specified for temperatures above 530°C (1,000°F), "H" grades should be used, and cold forming should be prohibited where creep strength governs the allowable stress unless it is followed by solution annealing. Cold forming of carbon steel furnace and boiler tubes, e.g., cold bends, should be prohibited unless followed by stress relief.

4. Corrosion allowance (CA) for trays and internals:

	Removable	Welded In
Carbon steel	1 mm (1/32 in.)	Vessel CA x 1.5
Corrosion-resistant alloys in carbon steel vessel	none	1.5 mm (1/16 in.)
Corrosion-resistant alloys in alloy vessel	none	Vessel CA

5. Use only silicon-killed steels for temperatures above 232°C (450°F). For areas where sour water collects, see Table A-8.

6. Where not covered by TEMA and the material specified for both sides is the same, corrosion allowance should be 0.75 x the sum of the corrosion allowances for each side up to 6 mm (1/4 in.) maximum. Where not covered by TEMA and alloy requirements for two sides are different and solid alloy tube sheet is used, use corrosion allowance for higher alloy side as the total corrosion allowance. Where cladding is required on the tubeside, the minimum thickness of cladding should be 10 mm (3/8 in.) so that at least one of the grooves for rolling will be in the cladding.

7. Baffles should be 6 mm (1/4 in.) minimum thickness; no other corrosion allowance need be used.

8. Where 1-1/4 Cr-1/2 Mo is specified, 1 Cr-1/2 Mo also may be used. Do not use 1 Cr-1/2 Mo in hydrogen service if hydrogen partial pressure is greater than 0.7 MPaa (100 psia) above 480°C (900°F). Do not use 1 Cr-1/2 Mo in general service above 530°C (1,000°F).

9. A corrosion allowance of 3 mm (1/8 in.) should be used on carbon steel and low alloy steel exchangers since it is standard for TEMA Class R.

10. Stress relieve carbon and chrome steel welds and cold bends in amine service regardless of service temperature. For all concentrations of carbonate solutions and in concentrations of caustic up to 30%, stress relieve for service temperatures above 60°C (140°F). For 30% to 50% caustic, the service temperature where stress relief is required decreases from 60°C (140°F) to 48°C (118°F). Welded tubing does not require heat treatment in addition to that required by the ASTM specifications. Rolled tube-to-tube sheet joints do not require stress relief.

11. Use 12 Cr for valve trays and valves. Sieve trays and stationary bubble cap trays may be made of carbon steel.

12. For control valves and other areas of high turbulence (velocity >2.5 m/s [8ft/s]) e.g., downstream of control valves, the rich carbonate inlet of a carbonate regenerator, reboiler tubesheets, baffles, etc., use 304 SS (UNS S30400) plus 1 mm (1/32 in.) corrosion allowance. Do not use miters; long-radius elbows are preferred. Piping specifications usually contain other limitations on miters.

13. Hardness of completed carbon and low-alloy steel welds should not exceed 200 Brinell. Valve trim should be 18 Cr-8 Ni SS and meet NACE Standard MR0175. For piping, if the ammonium bisulfide concentration exceeds 4% or the product of the mol% H_2S and the mol% NH_3 exceeds 0.05, use materials recommended for ppH_2S >70 kPaa (10 psia).

14. Use alloy 400 (UNS N04400) valve trim for caustic service above 93°C (200°F).

15. The metal temperature should not exceed that where carbon steel starts to lose its resistance to hydrogen attack.

16. If the service temperature will exceed 480°C (900°F), check with a materials engineer.

17. Stress corrosion cracking of 300 series SS may result if solids carry-over exceeds 1 ppm.

18. Do not use type 405 SS (UNS S40500) above 343°C (650°F). When welding is anticipated, use 410S SS (UNS S41008) rather than 410 SS (UNS S41000).

19. For U-bends, heat treat the entire 18 Cr-8 Ni SS tube at 1,000°C (1,850°F) minimum after bending. Where a 1000°C (1850°F) minimum heat treating temperature is not practical, 900°C (1,650°F) may be used. Use 321 (UNS S32100) or 347 SS (UNS S34700) if only the U-bends can be heat treated.

20. To choose between carbon or alloy steels in hydrogen service, see API 941. The corrosion allowance given in the table must be applied.

21. See Table A-10 for recommended materials for the top of regenerator column and overhead system.

22. Severe corrosion may occur if lines are not kept above the dew point.

23. Welded assemblies must be heat treated at 900°C (1,650°F) for 4 hours after completion to prevent polythionic acid cracking during downtime.

24. Unless more restrictive velocities are specified, the maximum velocity should not exceed 6 m/s (20 ft/s) in mixed phase flow piping where the ammonium bisulfide concentration exceeds 4% or the product of the mol% H_2S and the mol% NH_3 exceeds 0.05. Use 2205 (UNS S32205) for tubes and 309L (UNS S30903) clad headers in mixed phase flow where the ammonium bisulfide concentration exceeds 4% and 2205 (UNS S32205) piping where the ammonium bisulfide concentration exceeds 8%. For control valves where high turbulence occurs due to a pressure drop of greater than 3.8 MPag (2,000 psig), use Stellite™ 6 (UNS R30006) valve trim and 304L (UNS S30403) piping for 10 diameters downstream of the control valve.

25. Do not use nickel or cobalt base alloys, e.g., alloy 600 (UNS N06600), alloy 400 (UNS N04400), Colmonoy™, etc.; Stellite™ (UNS R30006) may be used.

26. The 1.5 mm (1/16 in.) corrosion allowance should be used where the vessel is externally coated (painted) and either internally lined or where experience has shown that the corrosion rate is essentially nil e.g., pure hydrocarbons, dry steam, etc.

27. The choice between brass and copper nickel alloys is contingent upon ammonia content and temperature of process side. Brass should not be used when the pH due to ammonia exceeds 7.2. Copper nickel alloys should not be used if the sulfides in the water exceed 0.007 mg/L. Admiralty (UNS C44300) is usually limited to a process inlet temperature of 177°C (350°F) for cooling service. Aluminum bronze (UNS C61400) or copper nickel alloys often are used when the process inlet temperature is 177°C to 232°C (350°F to 450°F). Aluminum bronze (UNS C61400) has a somewhat higher tolerance for hydrogen sulfide than copper nickel alloys.

28. For lines and equipment handling catalyst, use refractory-lined steel or hard facing on the indicated alloy. Hard facing is not required for vertical pipe runs.

29. Use solid 5 Cr or 12 Cr clad for hydrocarbons containing over 1 wt% sulfur above 290°C (550°F) and for crude oils containing 0.1 wt% to 1.0 wt% sulfur above 340°C (650°F) unless there is operating experience or hydrogen sulfide evolution data to indicate where the break between carbon steel and alloy should be.

Regardless of the sulfur content, when hydrocarbons have a TAN above 1.5 mg of KOH/gm and the temperature is above 230°C (450°F), use 316L (UNS S31603) - except use 317L (UNS S31703) for California crude oils. For castings, use CF8M (UNS J92900) or CG8M (UNS J93000) provided the ferrite content is 8% minimum.

30. When 18 Cr-8 Ni SS is specified, any grade may be used; however, unstabilized regular carbon (0.08% carbon maximum) grades usually are not used for operating temperatures above 425°C (800°F). For temperatures above 425°C (800°F), stabilized grades should be used if there is a possibility of intergranular attack during downtime. For 321 (UNS S32100) or 347 SS (UNS S34700) in thickness in excess of 13 mm (1/2 in.), restricted chemistry (0.04% to 0.05%C, 0.015 max. P & max. S, Cr/Ni>1.6) should be used. In addition, 347 (UNS S34700) should be limited to 19 mm (3/4 in.) maximum to avoid problems associated with welding. Types 309 (UNS S30900), 310 (UNS S31000), 316 (UNS S31600), 321 (UNS S32100), and 347 (UNS S34700) should be used with caution for operating temperatures above 600°C (1100°F) because of the possibility of sigma phase embrittlement.

31. When experience shows that coking will occur above 455°C (850°F), 1-1/4 Cr-1/2 Mo can be used up to 590°C (1,100°F) and 2-1/4 Cr-1 Mo can be used up to 650°C (1,200°F). Conversely, if coking does not occur or if high velocities occur that will prevent coke lay-down, SS is required. The choice between 410S (UNS S41008) and 18-8 depends on the anticipated loading. This is because 410S will lose some room temperature ductility due to 475°C (885°F) embrittlement. Thus, 410S should be limited to parts with relatively low stress levels.

32. Designations in parenthesis, e.g. (S-1) are API 610 materials classes.

33. For water service from 120°C to 175°C (250°F to 350°F) use class S-5. For water service over 175°C (350°F) or boiler feed water over 100°C (200°F), use class C-6.

34. See note 9 in Table G-1 of API 610 (1996).

35. Experience has shown that carbon steel tubes will only give economical life if water treating and corrosion inhibitors additions are carefully controlled on a continual basis.

36. When ammonia is present in the stripper overhead system, ammonium bisulfide forms. This requires 316L for reflux piping.

Table A-18
Chemical Compositions of Some Common Stainless Steels, Special Stainless Steels and High Nickel Alloys

Alloys		Chemical Compositions, weight %																	*CPI or
UNS No	P (G)-No.	C	Mn	P	S	Si	Cr	Ni	Mo	Fe	Cu	N	Ti	Nb	Al	Co	W	V	PRE_N
304L	8 (Gr 1)	0.03	2.00	0.045	0.03	0.75	18.00	8.00		64.95		0.00							18.0
UNS S30403		max	max	max	max	max	20.00	12.00		74.00		0.10							21.6
316L	8 (Gr 1)	0.03	2.00	0.045	0.03	1.50	16.00	10.00	2.00	61.30		0.00							22.6
UNS S31603		max	max	max	max	max	18.00	14.00	3.00	72.00		0.10							29.5
2205	10H (Gr 1)	0.03	2.00	0.03	0.02	1.00	21.00	4.50	2.50	63.72		0.14							31.5
UNS S32205		max	max	max	max	max	23.00	6.50	3.50	71.86		0.20							37.8
CD-4MCu		0.04	1.00	0.03	0.04	1.00	24.50	4.75	1.75	59.89	2.75								30.3
J93370		max	max	max	max	max	26.50	6.00	2.25	66.25	3.25								33.9
SAF 2507	10H (Gr 1)	0.03	1.20	0.035	0.02	0.80	24.00	6.00	3.00	58.77	0.50	0.24							37.7
UNS S32750		max	max	max	max	max	26.00	8.00	5.00	66.76	max	0.32							47.6
Alloy 20		0.07	2.00	0.045	0.035	1.00	19.00	32.00	2.00	40.85	3.00			8XC					25.6
UNS N08020	45	max	max	max	max	max	21.00	38.00	3.00	44.00	4.00			1.00					30.9
904L		0.02	2.00	0.045	0.035	1.00	19.0	23.0	4.0	49.90	1.00								32.2
UNS N08904	45	max	max	max	max	max	23.0	28.0	5.0	42.00	2.00								39.5
6XN		0.03	2.00	0.04	0.03	1.00	20.00	23.50	6.00	41.40	0.75	0.18							42.7
UNS N08367	45	max	max	max	max	max	22.00	25.50	7.00	50.32	max	0.25							49.1
254SMO		0.015	1.00	0.03	0.01	0.80	19.50	17.50	6.00	51.43	0.50	0.18							42.2
UNS S31254	8 (Gr 4)	max	max	max	max	max	20.50	18.50	6.50	56.32	1.00	0.22							45.5
25-6Mo		0.02	2.00	0.03	0.01	0.50	19.00	24.00	6.00	41.69	0.50	0.15							41.2
UNS N08926		max	max	max	max	max	21.00	26.00	7.00	50.35	1.50	0.25							48.1
1925hMo		0.02	1.00	0.045	0.03	0.50	19.00	24.00	6.00	42.71	0.80	0.10							40.4
UNS N08925	45	max	max	max	max	max	21.00	26.00	7.00	50.10	1.50	0.20							47.3
20Mo-6		0.03	1.00	0.03	0.03	0.50	22.00	33.00	5.00	24.51	2.00								38.5
UNS N08026	45	max	max	max	max	max	26.00	37.20	6.70	38.00	4.00								48.1
Sanicro 28		0.03	2.50	0.03	0.03	1.00	26.00	30.00	3.00	29.01	0.60								35.9
UNS N08028	45	max	max	max	max	max	28.00	34.00	4.00	40.40	1.40								41.2
Alloy+A21 800		0.10	1.50		0.015	1.0	19.0	30.0		39.50	0.75		0.15		0.15				19.0
UNS N08800	45	max	max		max	max	23.0	35.0		min	max		0.60		0.60				23.0
Alloy 825		0.05	1.00		0.03	0.50	19.50	38.00	2.50	22.22	1.50				0.20				27.8
UNS N08825	45	max	max		max	max	23.50	46.00	3.50	38.50	3.00				max				35.1
Alloy 625		0.10	0.50	0.015	0.02	0.5	20.00	55.92	8.00	5.00			0.40	3.15	0.40				46.4
UNS N06625	43	max	max	max	max	max	23.00	68.85	10.00	max			max	4.15	max				56.0
C276		0.01	1.00	0.04	0.03	0.08	14.50	50.99	15.00	4.00						2.50	3.00	0.35	73.9
UNS N10276	44	max	max	max	max	max	16.50	63.50	17.00	7.00						max	4.50	max	87.5

*CPI (Critical Pitting Index) or PRE_N (Pitting Resistance Equivalent, nitrogen included) = %Cr + 3.3 x (%Mo + %W) + 16 x %N