

Fig. 800-3 Commonly Used Materials for Components of Shell-and-Tube Heat Exchangers (1 of 2)

Components	Carbon Steel	Low Alloy Steels				High Alloy Steels			
		C-1/2Mo	1-1/4Cr-1/2Mo	2-1/4Cr-1/2Mo	5Cr-1/2Mo	12 Cr	18Cr-8Ni-3Mo	18Cr-8Ni	18Cr-8Ni Stabilized
<b>PLATES:</b> (For rolled and welded shells, shell covers, channels and nozzle necks, heads flat covers, tubesheets and baffles)	SA-285-C SA-515 and 516 (All grades)	SA-204-A SA-204-B or SA-204-C	SA-387-11 Class 1 or 2	SA-387-22 Class 1 or 2	SA-387-5 Class 1 or 2 (Tubesheets and baffles only. Use 12Cr clad for shells and channels.)	Do not use 12Cr for pressure containing parts (except tubes). Use 5Cr-1/2Mo tubesheets with 12Cr tubes.	SA-240-TP304 or SA-240-TP304L	SA-240-TP321 or SA-240-TP347	
<b>PIPE:</b> (For pipe sized shells and nozzle necks)	SA-106-B or SA-53-B	SA-335-P1	SA-335-P11	SA-335-P22	Not used	Do not use	SA-312-TP304 or SA-312-TP304L (Seamless or welded)	SA-312-TP321 or SA-312-TP347 (Seamless or welded)	
<b>FORGINGS:</b> (For body and nozzle flanges, blind flanges, couplings and forged flat covers and tubesheets)	SA-105 or SA-181 (Class 60 or 70)	SA-182-F1	SA-182-F11	SA-182-F22	SA-182-F5 or SA-182-F5a (For forged tubesheets and covers only)	Do not use	SA-182-F304 or SA-182-F304L	SA-182-F321 or SA-182-F347	
<b>TUBES:</b>	WELDED: SA-214 SEAMLESS: SA-179	SA-209-T1	SA-199-T11	SA-199-T22	SA-199-T5	SA-268-TP405 or SA-258-TP410 (Seamless or welded)	WELDED: SA-249-TP304 or SA-249-TP304L SEAMLESS: SA-213-TP304 or SA-213-TP304L	WELDED: SA-249-TP321 or SA-249-TP347 SEAMLESS: SA-213-TP321 or SA-213-TP347	

**Fig. 800-3** Commonly Used Materials for Components of Shell-and-Tube Heat Exchangers (2 of 2)

Components	Carbon Steel	Low Alloy Steels				High Alloy Steels			
		C-1/2Mo	1-1/4Cr-1/2Mo	2-1/4Cr-1/2Mo	5Cr-1/2Mo	12 Cr	18Cr-8Ni-3Mo	18Cr-8Ni	18Cr-8Ni Stabilized
<b>BOLTS:</b>	SA-193-B7	SA-193-B7 or SA-193-B16	SA-193-B7 or SA-194-B16	Caution: For hydrogen service, verify that Cr and Mo content are high enough to resist H <sub>2</sub> attack.	SA-193-B5	Do not use	SA-193-B8M	SA-193-B8	SA-193-B8T or SA-193-B8C
<b>NUTS:</b>	SA-194-2H	SA-194-2H	SA-194-2H		SA-194-3	Do not use	SA-194-8M	SA-194-8	SA-194-8T SA-194-8C