R10274652

PLANT ITEM MATERIAL SELECTION DATA SHEET

TLP-COND-00002 & TLP-COND-00003 (PTF)
Treated LAW Evaporator Intercondenser & Aftercondenser

ISSUED BY RPP-WTP PDC
INIT DATE 3/25/04

- Design Temperature (°F) (max/min): 250/49
- Design Pressure (psig) (Max/min): Shell side: 50/FV; Tube side: 100/FV
- Location: outcell

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on sheet 5

Materials Considered:

Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 316 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: Shell side: 0.04 inch; Tube side: N/A

Process & Operations Limitations:

- None

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EXPIRES: 12/07/05

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This bound document contains a total of 5 sheets.

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Corrosion Considerations:

a General Corrosion
Hamner (1981) lists a corrosion rate for 304 and (304L) in 2 M HNO_3 of less than 2 mpy. Davis (1994) states the corrosion rate for 304L in 12% HNO_3 will be less than about 1 mpy up to about 212°F. The amounts of halides and solids are also small so there is little concern about excessive uniform attack.

Conclusion:
At the anticipated temperatures, either 304L or 316L is expected to be sufficiently resistant to the waste solution with a probable general corrosion rate of less than 1 mpy. Because the tubes are cooled, either alloy would be satisfactory for them as well.

b Pitting Corrosion
At the expected normal operating conditions, 304L is expected to be acceptable. Because of the high design temperature, 316L is recommended.

Conclusion:
Based on the expected operating conditions of the vessel, 304L stainless steel is satisfactory, but 316L is recommended to provide additional pitting resistance should chlorides concentrate.

c End Grain Corrosion
End grain corrosion only occurs in metal with exposed end grains and in highly oxidizing acid conditions.

Conclusion:
Not applicable to this system.

d Stress Corrosion Cracking
The exact amount of chloride required to cause stress corrosion cracking is unknown. In part this is because the amount varies with temperature, metal sensitization, and the environment. But it is also unknown because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as 10 ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140°F. The "L" grades are also more resistant to cracking than the higher carbon versions.

Given the environment and the lack of heat transfer into the process stream, caustic cracking is not anticipated to be a problem.

Conclusion:
Because of the normal operating environment as well as that which can occur during off normal conditions 316L is recommended.

e Crevice Corrosion
The pitting discussion covers this area.

Conclusion:
See Pitting.

f Corrosion at Welds
Corrosion at welds is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem for this system.

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g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions on the process side are somewhat extreme for microbe growth. The use of treated process water makes infection unlikely.

Conclusion:
MIC is not considered a concern.

h Fatigue/Corrosion Fatigue
Corrosion fatigue is not expected to be a concern.

Conclusions
Not believed to be a concern.

i Vapor Phase Corrosion
The vapor phase portion of the shell will be continually washed with condensing vapors.

Conclusion:
No vapor phase corrosion is anticipated.

j Erosion
Velocities within the condenser are expected to be low.

Conclusion:
Not a concern.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
Not expected to be a concern.

Conclusion:
Not a concern.

m Galvanic Corrosion
For the environment and the proposed alloys, there is not believed to be a concern.

Conclusion:
Not a concern.

n Cavitation
None expected.

Conclusion:
Not believed to be of concern.

o Creep
The temperatures are too low to be a concern.

Conclusion:
Not applicable.

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References:

1 Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
2. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
3. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX
4. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. Agarwal, DC, *Nickel and Nickel alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
2 Danielson, MJ & SG Pitman, 2000, *Corrosion Tests of 316L and Hastelloy C-22 in Simulated Tank Waste Solutions*, PNWD-3015 (BNFL-RPT-019, Rev 0), Pacific Northwest Laboratory, Richland WA
3 Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
4. Koch, GH, 1995, *Localized Corrosion in Halides Other Than Chlorides*, MTI Pub No. 41, Materials Technology Institute of the Chemical Process Industries, Inc, St Louis, MO 63141
5. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
6. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

PLANT ITEM MATERIAL SELECTION DATA SHEET

OPERATING CONDITIONS

Materials Selection Data

Material Selection Data Sheets for The Pretreatment Facility

Component (Name/ID) TLP-COND-00002/00003

System TLP

Operations

Chemicals	Unit	Cold Startup	Normal Operation*	Standby/Idle	Cleaning	Accident
Aluminum	g/l		8.6E-07			
Chloride	g/l		4.8E-07			
Fluoride	g/l		1.1E-08			
Hydroxide	g/l		9.8E-08			
Iron	g/l		7.2E-08			
Nitrate	g/l		9.3E-07			
Nitrite	g/l		1.5E-05			
Phosphate	g/l		4.6E-07			
TOC✝	g/l		7.6E-07			
Sulfate	g/l		1.3E-07			
Undissolved solids	g/l		0.0E+00			
Particle size/hardness	µm (##)		N/A			
Other (Hg)	g/l		9.4E-11			
Carbonate	g/l		2.7E-08			
pH	-		6 TO 8			
Dose rate, α, β/γ (inside)	Rad		N/A			
Temperature	°F		212			
Velocity	fps		N/A			
Vibration			N/A			
Time of exposure	#		1.0E+02			

* Based on Contract Maximum Chemical A/D run at 60/6

- % of total; ## - use Mho scale

Remarks: Stream TLP01

Comments: Trace HNO3 Vapors During Acid Cleaning of Separator and Reboiler

[X] C3 Area

[X] Flushing

✝ List expected organic species: N/A

Use maximum of 2 significant figures

N/A Information not available or not in Process Engineering Scope.