



**Wolf Creek – Pressurizer
Alloy 600/82/182 Location Summary**

NSD-EPRI-06-43

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Wolf Creek - Pressurizer - Alloy 600/82/182 Location Summary

The following summarizes the review of the design and fabrication information of the surge, spray, safety, and relief nozzles of the Wolf Creek pressurizer. For each location (Figure 1) the following information will be provided:

- A sketch (not to scale) of the location with material identification
- A table detailing the weld location/material and if post-weld heat treatment (PWHT) was performed at the location.
- A table detailing all readily available fabrication repairs at each identified location.

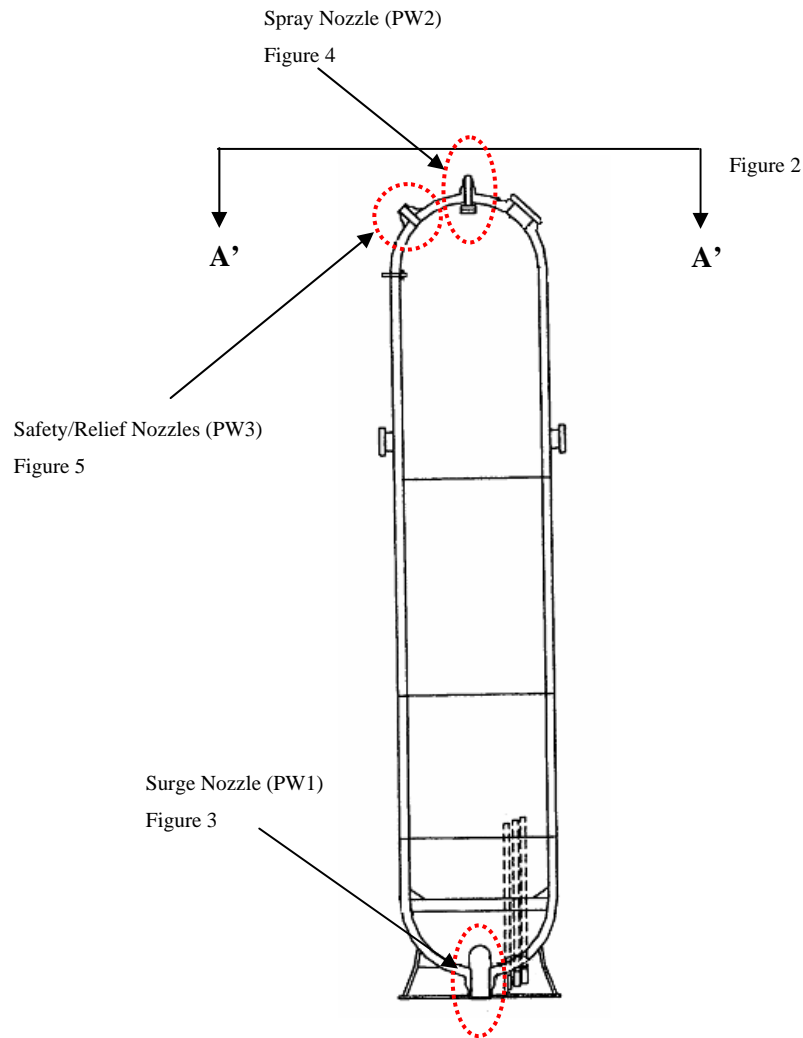


Figure 1 - Pressurizer Sketch

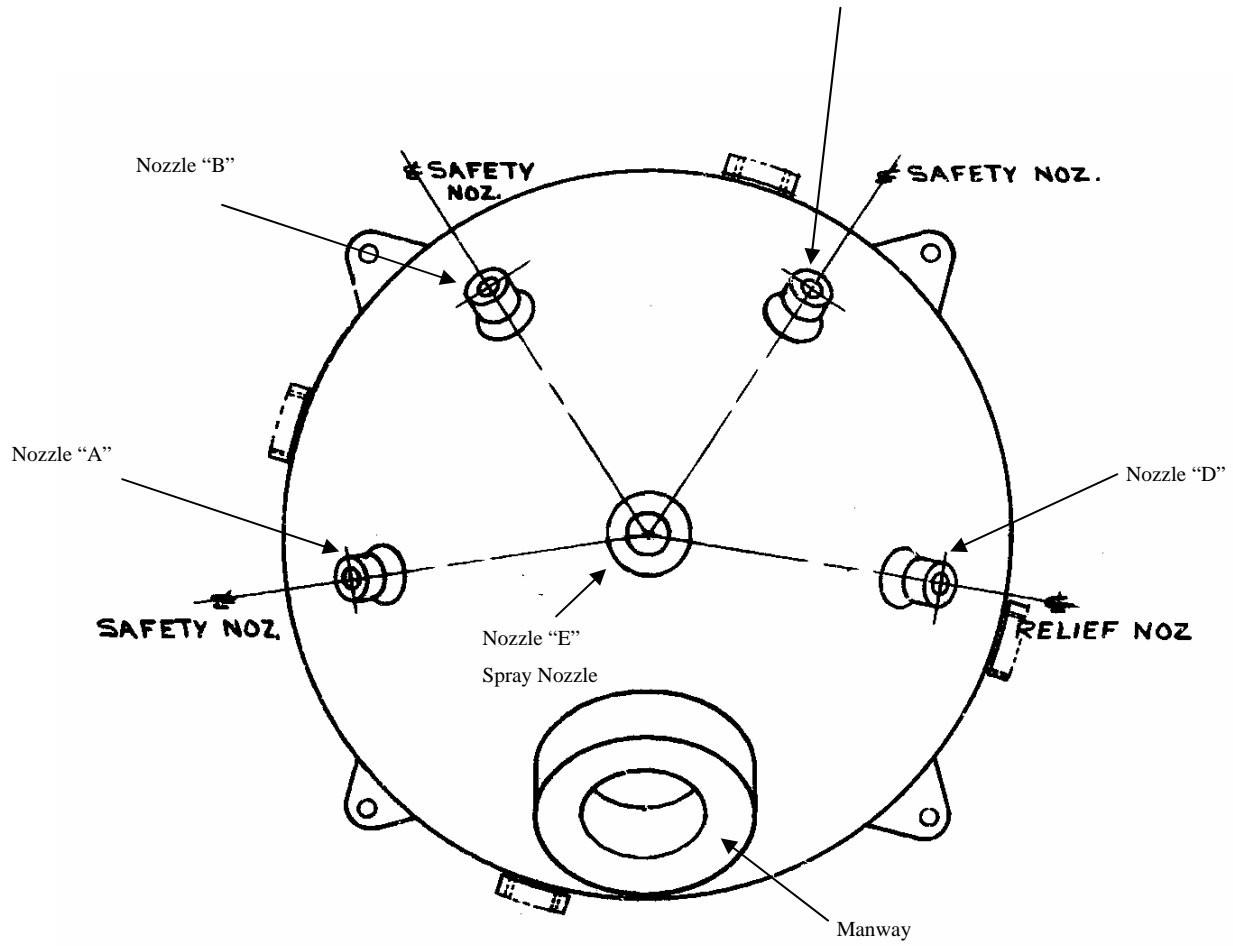


Figure 2- Pressurizer Upper Head Sketch (View A'-A')

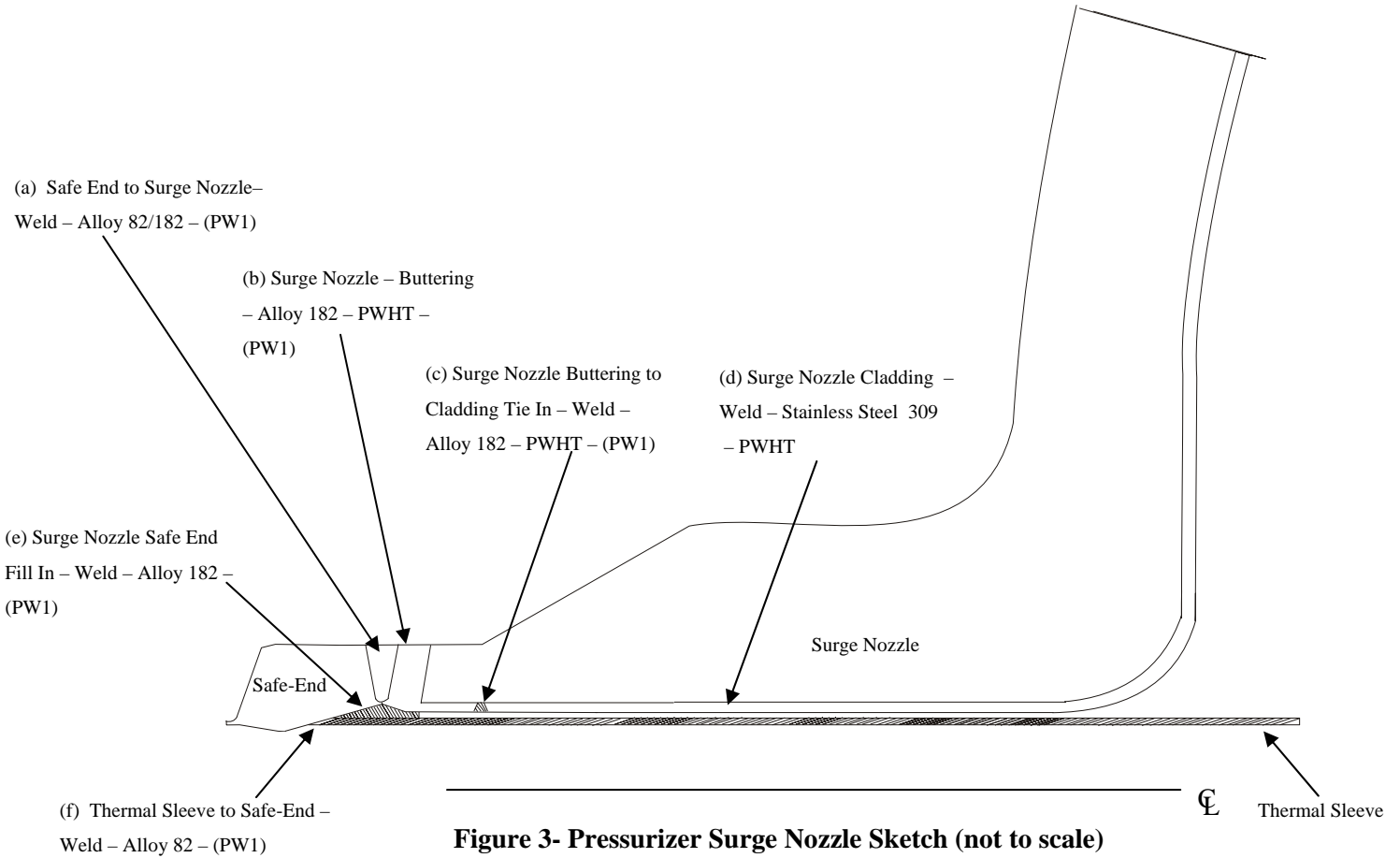


Figure 3- Pressurizer Surge Nozzle Sketch (not to scale)

Table 1- Wolf Creek Pressurizer Surge Nozzle Fabrication

Figure	ID Letter	Location Area	Location Description	Location Type (Weld, Buttering, Base Metal)	Material	Post Weld Heat Treat? (Yes, No)
3	a	Surge Nozzle	Safe End to Surge Nozzle	Weld	1 st Pass - Alloy 82 Weld - Alloy 182	No
	b			Buttering	Alloy 182	Yes
	c		Surge Nozzle Buttering to Nozzle Cladding Tie In	Weld	Alloy 182	Yes
	d		Surge Nozzle Cladding	Weld	Stainless Steel 309	Yes
	e		Surge Nozzle Safe End Fill In	Weld	Alloy 182	No
	f		SS Thermal Sleeve to Safe-End	Weld	Alloy 82 (45° of circumference affected)	No

Table 2 - Wolf Creek Pressurizer Surge Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
1	Surge Nozzle Buttering	The surge nozzle end build up (safe end prep) was insufficient. There was not enough weld build up to clean up during machining of the outside diameter.	Alloy 182 was welded to the nozzle end until the nozzle had sufficient weld buildup to support final machining. PWHT was completed during normal cycle operations.
2	Surge Nozzle Buttering	During the Repair # 1 radiography test (RT) indications were identified: <ol style="list-style-type: none"> 1. Length 7/8 inch, Depth 9/16 inch OD. 2. Length 1 1/8 inch, Depth 1 inch OD 	<ul style="list-style-type: none"> • Indication removed • Dye Penetrate test (PT) excavations • Preheat and prepare to weld • Weld repair area using Alloy 182 • PT repaired area • Check nozzle dimensions • PWHT normal cycle.
3	Safe End to Surge Nozzle Weld	Radiography test (RT) rejection of safe end to surge nozzle weld. <ol style="list-style-type: none"> 1. Length 1 inch, Depth 13/64 to 7/16 inch – Inside Diameter (ID) 	<ul style="list-style-type: none"> • Remove indication • Dye Penetrate test (PT) excavation • Preheat and prepare to weld • Weld repair area using Alloy 82 • PT and RT repaired area • PWHT normal cycle
4	Surge Nozzle Cladding	A measurement of the surge nozzle cladding thickness was not taken during the proper operation. So three slots were cut into the surge nozzle cladding to the base metal to obtain clad thickness measurements. These slots were cut after intermediate post weld heat treat.	<ul style="list-style-type: none"> • Weld repair area using 308L stainless steel • PWHT normal cycle • PT repaired area after PWHT

Table 2 (continued) - Wolf Creek Pressurizer Surge Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
5	Surge Nozzle Cladding	This repair is a result of Repair #4. PT of the repaired areas in the surge nozzle after PWHT was not completed. This was identified by a review of the feeder travelers. The unit was sealed, purged, and on rail car for shipment when this was identified.	<ul style="list-style-type: none"> • Covers and gaskets were removed from the surge nozzle and manway. • The basket was cut from the surge nozzle. The cut was made as close to the weld clad as possible. • The thermal sleeve was then removed from the surge nozzle by grinding the connection welds. • It was then verified that the basket and thermal sleeve were removed without exposing base metal. • The surge nozzle outside diameter was then cleaned to remove paint residue. • The repair areas noted in Repair #4 were then removed via grinding. • The excavations were then inspected using dye penetrant examination (PT). • The affected areas were then weld repaired using 308L and 309L stainless steel. • Local PWHT of weld repair was then completed. • The repaired area underwent PT. • The thermal sleeve was then reinstalled using Alloy 82. The weld area was PT. • The basket was then reinstalled. • Replace all covers and gaskets. • Repaint area.

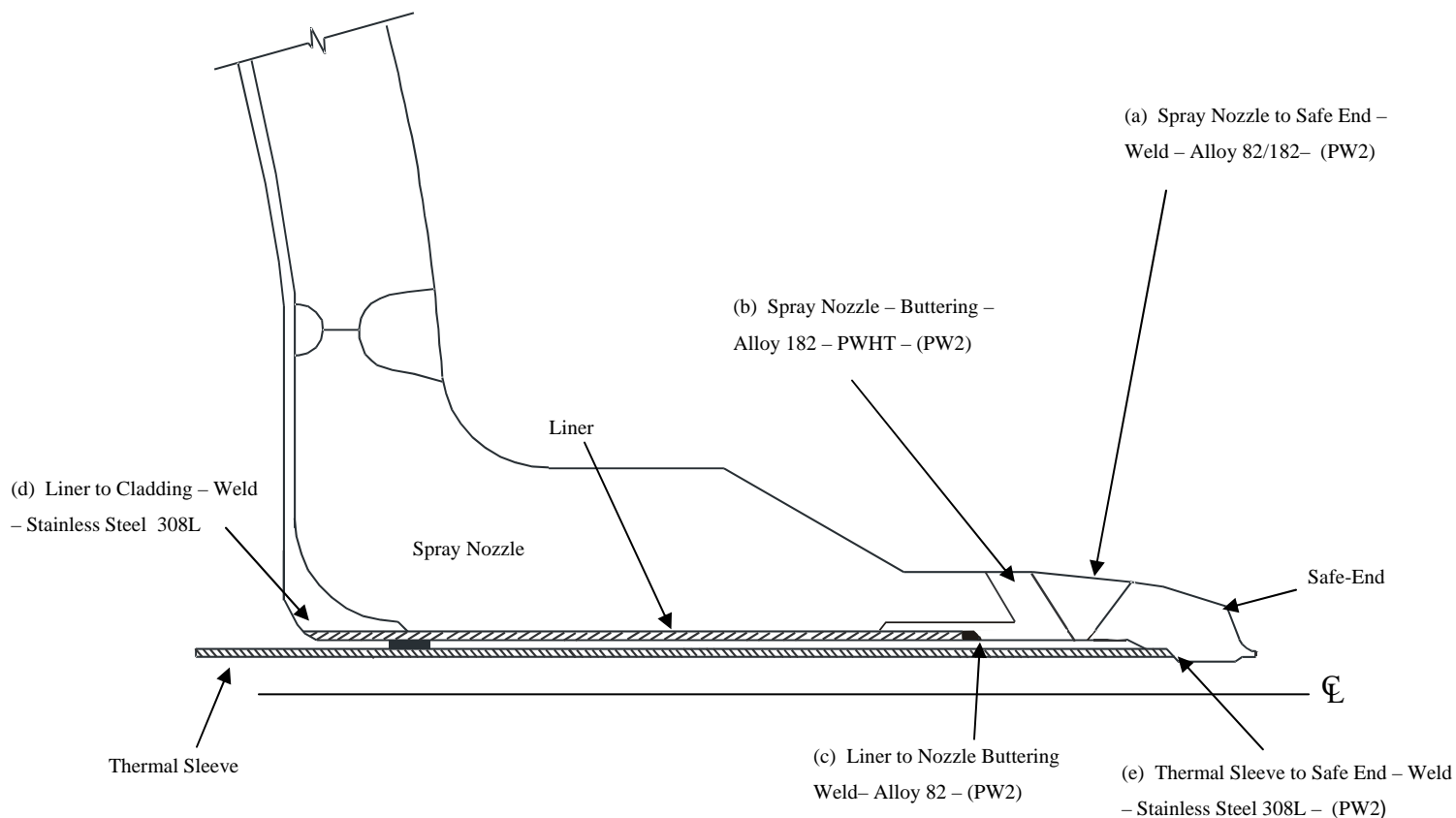


Figure 4 - Pressurizer Spray Nozzle Sketch (not to scale)

Table 3 – Wolf Creek Pressurizer Spray Nozzle Fabrication

Figure	ID Letter	Location Area	Location Description	Location Type (Weld, Buttering, Base Metal)	Material	Post Weld Heat Treat? (Yes, No)
4	a	Spray Nozzle	Spray Nozzle to Safe-End	Weld	1 st Pass – Alloy 82 Weld – Alloy 182	No
	b			Buttering	Alloy 182	Yes
	c		SS Liner to Nozzle Buttering	Weld	Alloy 82	No
	d		SS Liner to Nozzle Cladding	Weld	Stainless Steel 308L	No
	e		SS Thermal Sleeve to Safe-End	Weld	Stainless Steel 308L (45° of circumference affected)	No

Table 4 - Wolf Creek Pressurizer Spray Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
6	Spray Nozzle Buttering	PT indications found in lip of weld build up and along weld bond line. The indications were identified prior to PWHT.	<ul style="list-style-type: none">• Indications removed.• Areas were weld repaired using Alloy 82• PT repaired area before PWHT• PWHT normal cycle• PT repair area after PWHT

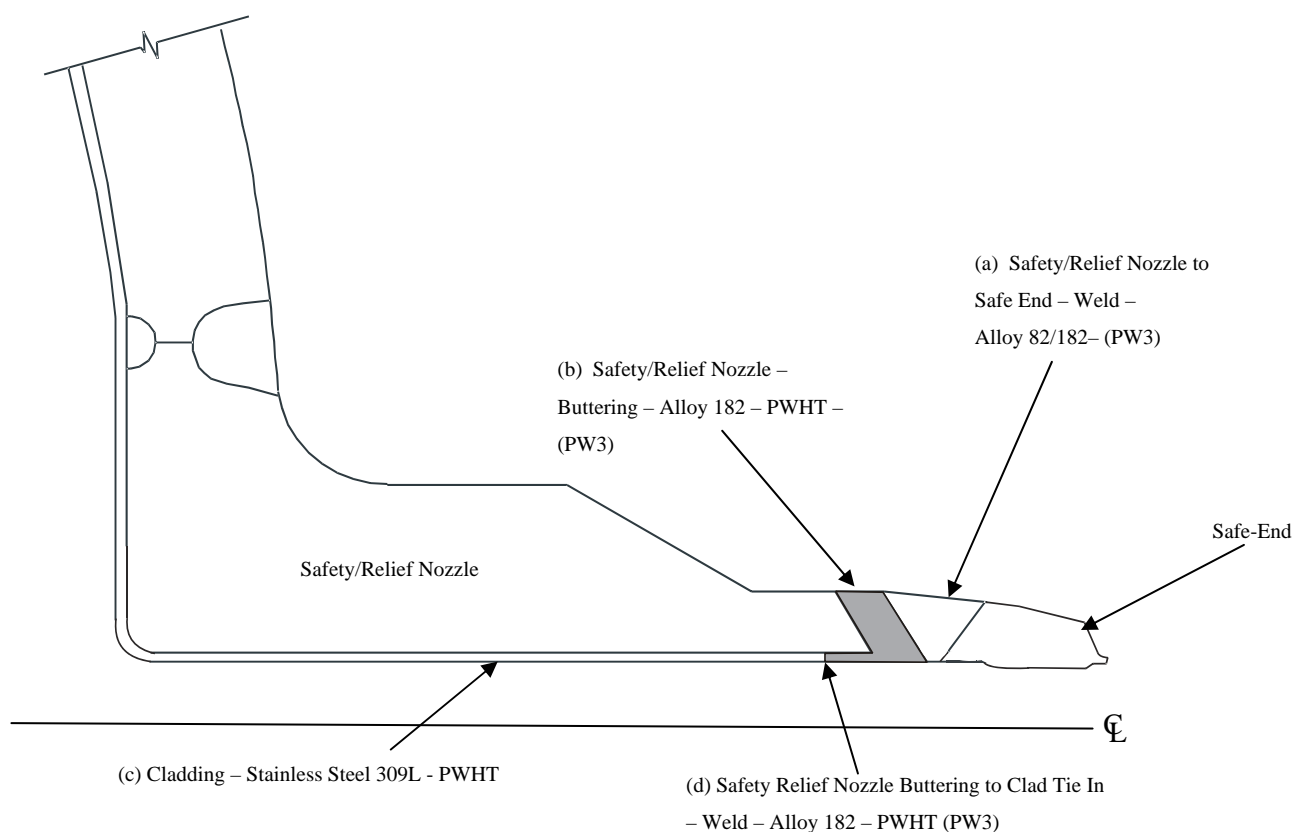


Figure 5 - Pressurizer Safety & Relief Nozzle(s) Sketch (not to scale)

Table 5- Wolf Creek Pressurizer Safety/Relief Nozzle Fabrication

Figure	ID Letter	Location Area	Location Description	Location Type (Weld, Buttering, Base Metal)	Material	Post Weld Heat Treat? (Yes, No)
5	a	Safety/Relief Nozzles	Safety/Relief Nozzle to Safe-End	Weld	1 st Pass - Alloy 82 Weld Alloy 182	No
	b			Buttering	Alloy 182	Yes
	c		Safety/Relief Nozzle Cladding	Weld	Stainless Steel 309L	Yes
	d		Safety/Relief Nozzle Buttering to Cladding Tie In	Weld	Alloy 182	Yes

Table 6 - Wolf Creek Pressurizer Safety/Relief Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
7	Nozzle "A" Buttering	After PT inspection of nozzle build up several grind outs were prevalent. The deepest grind out is 1/8 inch deep.	<ul style="list-style-type: none"> • The build up Weld repair build up using Alloy 182 • PT repaired areas. • PWHT during normal cycle. • PT repairs after PWHT.
8	Nozzle "A" Safe End to Nozzle Weld	Radiography test indications at the following areas of the safe end to nozzle weld due to operator error. <ol style="list-style-type: none"> 1. Length 1-1/4 inch, Depth 11/32 inch ID 2. Length 7/8 inch, Depth 11/32 inch ID 	<ul style="list-style-type: none"> • Indications removed • PT excavations • Weld repair area using Alloy 82 • PT and RT repaired area
9	Nozzle "B" Safe End to Nozzle Weld	Radiography test indications at the following areas of the nozzle to safe end weld due to improper cleaning of weld bead.. <ol style="list-style-type: none"> 1. Length 2-1/2 inch, Depth 1/4 to 3/4 inch ID 2. Length 1 inch, Depth 1/2 inch ID 3. Length 1-1/2 inch, Depth 1/2 inch ID 4. Length 1 inch, Depth 1/2 inch ID 5. Length 2-1/2 inch, Depth 1/4 to 3/4 inch ID 6. Length 2-1/2 inch, Depth 1/4 to 3/4 inch ID 	<ul style="list-style-type: none"> • Indications removed • PT excavations • Weld repair area using Alloy 82 • PT and RT repaired area

Table 6 (continued) - Wolf Creek Pressurizer Safety/Relief Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
10	Nozzle "B" Safe End to Nozzle Weld	Indications identified during previous Repair #9. Radiography test indications at the following areas of the nozzle to safe end weld due to improper cleaning of weld bead. <ol style="list-style-type: none"> 1. Length 1-1/2 inch, Depth 1/2 inch ID 2. Length 1-1/4 inch, Depth 1 inch ID 3. Length 3/4 inch, Depth 7/8 inch ID 4. Length 1-1/2 inch, Depth 3/8 inch ID 5. Length 1 inch, Depth 1-1/16 inch ID 6. Length 1/2 inch, Depth 1/2inch ID 	<ul style="list-style-type: none"> • Indications removed • PT excavations • Weld repair area using Alloy 82 • PT and RT repaired area
11	Nozzle "B" Safe End	The safe end ID exceeded final drawing dimensions.	<ul style="list-style-type: none"> • Using 308L stainless steel weld ID of nozzle. 1/2 inch from edge of safe end to approximately 2 inches inside of bore approximately 1/8 inch thick. • Blend taper of bore to 4:1 smooth transition • PT machined area. • Remove and weld repair PT indications with 308L stainless steel • PT area.
12	Nozzle "D" Buttering	After removing all unacceptable PT indications from the nozzle cladding and nozzle build up some areas require repair. The nozzle was not PWHT.	<ul style="list-style-type: none"> • Indications removed. • Areas were weld repaired using Alloy 82 and Alloy 182 • PT repaired area before PWHT • PWHT normal cycle • PT after PWHT
13	Nozzle "D" Buttering and Cladding	Linear indication present in the nozzle weld build up, RT rejected area. <ol style="list-style-type: none"> 1. Length 1/2 inch, Depth 7/16 inch ID 2. Length 1 inch, Depth 7/16 inch OD 	<ul style="list-style-type: none"> • Indications removed • PT excavations • Weld repair area using Alloy 82 • PT repaired area before PWHT • PT and RT area after PWHT

Table 6 (continued) - Wolf Creek Pressurizer Safety/Relief Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
14	Nozzle "D" Buttering	Identified after Repair #13. Radiography test indication at the following area of the nozzle buttering. Indication is due to operator error. 1. Length 1 inch, Depth 3/4 inch OD	<ul style="list-style-type: none"> • Indication removed • PT and RT excavated area. • RT failed, indication is still present. Excavated area too small. • Excavated area made wider via grinding. • RT excavated area – clear. • Weld repair area using Alloy 182 • PT and RT repaired area • PWHT buttering
15	Nozzle "D" Buttering	Following PWHT defect areas were located that were not present prior to PWHT. 1. Length 3/4 inch, Depth 3/8 to 3/4 inch ID 2. Length 2-1/4 inch, Depth 3/8 to 3/4 inch ID 3. Length 1/2 inch, Depth 3/8 to 3/4 inch ID	<ul style="list-style-type: none"> • Indication removed • PT excavations • Weld repair area using Alloy 82
16	Nozzle "D" Buttering	Identified after completion of Repair #15. Following PWHT defect areas were located that were not present prior to PWHT. 1. Length 1 inch, Depth 3/8 to 3/4 inch OD 2. Length 2-1/4 inch, Depth 3/8 to 3/4 inch OD 3. Length 1/2 inch, Depth 3/8 to 3/4 inch OD	<ul style="list-style-type: none"> • Indication removed • PT excavations • Weld repair area using Alloy 182 • PT and RT repaired area • PWHT
17	Nozzle "D" Buttering and Cladding	Occurred as a result of Repair #16. During the grinding of the RT indications noted previously the ID of the nozzle was damaged. PT of the nozzle ID revealed indications.	<ul style="list-style-type: none"> • Clad weld repaired in defected areas using Alloy 82 • Repaired areas were then cleaned up via grinding and PT inspected. • PT inspection was acceptable.
18	Nozzle "D" Safe End to Nozzle Weld	Radiography test indication at the following area of the safe end to nozzle weld. Deposited weld not properly cleaned before subsequent weld layer deposited, due to operator error. 1. Length 1-1/4 inch, Depth 1/2 inch OD	<ul style="list-style-type: none"> • Indication removed • PT excavations • Weld repair area using Alloy 82 • PT and RT repaired area

Table 6 (continued) - Wolf Creek Pressurizer Safety/Relief Nozzle Repair Information

Reference Repair #	Part Description	Defect Description	Repair Description
19	Nozzle "D" Safe End to Nozzle Weld	Radiography test indication at the following area of the safe end to nozzle weld due to operator error. Lack of fusion between weld beads 1. Length 1/2 inch, Depth 1/2 inch ID	<ul style="list-style-type: none"> • Indication removed • PT excavations • Weld repair area using Alloy 82 • PT and RT repaired area
20	Nozzle "D" Safe End	The safe end ID exceeded final drawing dimensions.	<ul style="list-style-type: none"> • Using 308L stainless steel apply weld build up to the ID of the nozzle. [1/2 inch from edge of safe end to approximately 2 inches inside of bore approximately 1/8 inch thick.] • Blend taper of bore to 4:1 smooth transition • PT machined area.
21	Nozzle "D" Safe End	PT indications found on the ID of nozzle safe end. The indications were identified after final PWHT and hydro test. 1. Length 1.88 inch, Width 2.38 inch, Depth 0.12 inch ID	<ul style="list-style-type: none"> • Indication removed • Weld repair area using Alloy 82 • PT repaired area