

Procedure 5: Firetube Repair Procedure – Cracking Non PWHT

A#	2710237	Facility	Medicine Hat West, Taber South
CRN#	H 0995.2	LSD	13-18-010-16W4
S/N	L-8-325		
MAWP	75 PSIG	Vessel Description	Treater; Repair to Spare Fire Tube 18" X .625" SA-516-70 Sour Service
Material	SA-516-70		
Shell Thickness	.375"	Scope of Work: Replacement of full miter return bend as per IRIS report details attached.	
Head Thickness	.598"		

Scope

*Anthony Paul
Jan 8/08*

1. The repair of cracks to a firetube constructed of P-I Group 1 or 2 materials.
2. Severe cracking or pitting into the firetube parent metal or through wall cracking may require the replacement of a section of the firetube.

Procedure

Weld Preparation

1. Defects identified by Wet Fluorescent Magnetic Particle Inspection shall be removed using an air arc gouger or grinder. Area shall be reinspected (including beveled surfaces of weld prep) using WFMPI to ensure all defects have been removed.
2. Area to be welded to shall be cleaned to white metal for a distance of 10 mm beyond the expected weld area.

Hydrogen Bake out and Sulfur removal: (remove this section if this firetube is not in sour service)

3. Vessels that have been exposed to sour or sulfur bearing process streams shall required the weld attachment area to undergo a "Bake Out" procedure. This procedure shall consist of heating the weld attachment area and 10 cm on each side to 315 C (600 F) and holding that temperature for a minimum of 60 minutes. Bake out should be done prior to cutting out, if cutout is done thermally. Stipulate controls methods.
4. *Bake Out* is performed by either induction coil (use thermocouples as control instrumentation) or propane torch (use temperature-sensitive crayons – upper and lower temperature to be controlled). Oxyacetylene torches are **not**

*- lind beryh :
1125 °F
for 2 hrs,*

*- bolt long ends of firetube, brace flange, brace both ends
take - measure to prevent fully cut down is even*

**Procedure
continued...**

acceptable.

5. If induction coils are used, a 250 C (482 F) four-hours heat treatment may be substituted for the normal 315 C (600 F) one-hour heat treatment.

Preheat and Welding:

Non-Post Weld Heat Treated Equipment

6. Minimum pre-heat shall be 80 C (176 F) for a 100 mm band on both sides of the weld build-up area. Temperature is to be monitored by use of temple sticks or pyrometer.



Note

The 80 C (176 F) pre-heat temperature has been selected for alignment with NB-23, Appendix B assuming the specific carbon content of the material is not known.

7. Welds shall be completed using new 2.4 mm (3/32") E 7018-1 electrodes.
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8. Maximum interpass temperature shall not exceed 230 C (450 F).

9. The Owner's Inspector, shall witness seal on the box being broken and ensure that once the box has been opened the electrodes are stored in an oven.

10. Perform repair to the procedure as outlined in the registered WPS.

11. Perform dry MPI on the root weld.

12. Fill and cap using E7018 low hydrogen electrodes. Minimize the weave (maximum 4 times electrode size and minimize heat input).

13. Ensure all fillet welds are transitioned to ensure there are no areas of undercut or stress risers.

14. Once the welds are completed the weld area shall be wrapped

with an insulating blanket and allowed to slow cool to 100 C (212 F). The cooling rate shall not exceed 260 C (500 F) / hour.

Procedure

continued...

Post Welding NDE:

- 15. Complete 100 % RT of miter butt weld joints
- 16. Perform MT 12 hours after completion of the work
- 17. No hydrotest is required.

Documentation:

- 18. Ensure Company Approved Contractor has completed QC documentation.
- 19. Sign off ABSA AB-40 and ensure one copy is submitted to ABSA and one is retained on file in the equipment inspection file.

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Section	Comments	Sign Off	Date
Scope		<i>Anthony Cook</i>	<i>Jan 8/08</i>
Procedure		<i>Anthony Cook</i>	<i>Jan 8/08</i>
Weld Preparation			
Step 1			
Step 2			
Hydrogen Bake Out and Sulphur Removal			
Step 3			
Step 4			
Step 5			
Preheat and Welding			
Step 6			
Step 7			
Step 8			
Step 9			
Step 10			
Step 11			
Step 12			
Step 13			
Step 14			
Post Welding NDE			
Step 15			
Step 16			
Step 17			
Documentation			
Step 18			

Step 19			
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Procedure

continued...

Preheat and Welding:

Non-Post Weld Heat Treated Equipment *180 C*

13. Minimum pre-heat shall be ~~80 C~~ *180 C* (176 F) for a 100 mm band on both sides of the weld attachment area.



Note

The 80 C (176 F) pre-heat temperature has been selected for alignment with NB-23, Appendix B assuming the specific carbon content of the material is not known.

14. Welds shall be completed in accordance with the contractors WPS utilizing new E 7018-1 electrodes.

interpass 260 C max
15. The PEIC, or his delegate, shall witness seal on the box being broken and ensure that once the box has been opened the electrodes are stored in an oven.

16. The PEIC, or delegate, shall approved the alignment and fit-up of the replacement head with only the tack welds in place.

17. Complete the full circumferential weld. No down hand welding shall be used.

- maintain at 220°C for 1 hr then
18. Once the welds are completed the weld area shall be wrapped with an insulating blanket and allowed to slow cool to 100 C (212 F). The cooling rate shall not exceed 260 C (500 F) / hour.

Post Welding NDE:

19. Full radiography of head to shell circ weld.

20. MT all welds 12 hours after completion of the work.

21. Hydrotest per ASME Section VIII Division I.

*- well below Martensite transformation temp
- after welding, must to convert fully from aust to mart or ferrite.*

Documentation:

22. Ensure Company Approved Contractor has completed QC documentation.

23. Sign off ABSA AB-40 and ensure one copy is submitted to ABSA and one is retained on file in the equipment inspection file.

220°C soak with temper temp some

Procedure 4: Replacement of Heads

Section	Comments	Sign Off	Date
Scope		<i>Anthony Parle</i>	<i>Oct 24/07</i>
Procedure		<i>Anthony Parle</i>	<i>Oct 24/07</i>
Cut Out			
Step 1			
Step 2			
Step 3			
Step 4			
Step 5			
Step 6			
Weld Preparation			
Step 7			
Step 8			
Step 9			
Hydrogen Bake Out and Sulphur Removal			
Step 10			
Step 11			
Step 12			
Preheat and Welding			
Step 13			
Step 14			
Step 15			
Step 16			