

## SHELL & TUBE INSPECTION REPORT

LSD: 07-27-051-19W5M

Date: JUNE 07, 2014

SAP Equipment ID: 66036274

SHELL & TUBE STATIC DATA									
Plant		Ansell Gas Plant		Op Unit			System		
Prov. Insp. #		A0194704		CRN			F-1711.2		
Equipment Description		Condi Stabilizer Reboiler					Serial #		
Manufacturer		Ellett Copper and Brass Co					Vessel Class		
Internal Access:		YES		Description: 16" channel flange			Year Built		
							1984		
SHELL SIDE DATA									
MAWP		PSI		@		°F		MDMT	
CODE :				Sweet				PWHT :	
Diameter		16"		Length		(T/T) in		OAL 186 in	
Shell Mat'l				Thickness		in		Corr Allowance	
Nozzle Mat'l				Thickness		mm / in		Corr Allowance	
Internal Coating:		YES — NO		Internal Clad :		YES — NO		Capacity	
Manway :		yes – 16"		Inspection Port :		NO		Saddle	
Nozzle Rating		lb ANSI		Painted :		YES		Insulated	
								Yes	
Operating Pressure		kPa / PSI		Operating Temperature		°C / °F			
TUBE/CHANNEL SIDE DATA									
MAWP		PSI		@		°F		MDMT	
CODE :				Sweet				PWHT :	
Diameter		16"		Length		(T/T) mm/in		OAL 16 in channel.	
Shell Mat'l				Thickness		in		Corr Allowance	
Nozzle Mat'l				Thickness		mm / in		Corr Allowance	
Internal Coating:		YES — NO		Internal Clad :		YES — NO		Capacity	
Manway :		YES – 16"		Inspection Port :		NO		Skirt — Legs — Saddle	
Nozzle Rating		lb ANSI		Painted :		YES		Insulated	
								Not at time of inspection	
Operating Pressure		kPa / PSI		Operating Temperature		°C / °F			
SHELL SIDE PSV STATIC DATA									
Serial No.	Location	Set Pressure	Capacity SCFM / Lbs/Hr / GPM	Manufacturer	Model / Type	Service Date / Company			
C27216A10	Off stabilizer tower	485psi	3199scfm	Farris	286FA12-120/55M	Sept-2011, Wizard. Tag PSV-1003			
SHELL SIDE PSV DETAILS									
Type (Thread/Flange)		ANSI Rating			Size (in)				
PRD Inlet	Flanged				1.5"				
PRD Outlet	Flanged				2"				
Tube side PSV STATIC DATA									
Serial No.	Location	Set Pressure	Capacity SCFM / Lbs/Hr / GPM	Manufacturer	Model / Type	Service Date / Company			
575327-32-KE	Tube side piping	180psi	24usgpm	Farris	27CA23-M20	3-Nov-11. Wizard. PSV-1004			
Tube side PSV DETAILS									
Type (Thread/Flange)		ANSI Rating			Size (in)				
PRD Inlet	Flanged								
PRD Outlet	Flanged								
NDE Equipment records									
Procedure#	Description	Manufacturer	Model#	Serial#	Due Date				

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### INSPECTION SUMMARY

Exchanger in plant 1 inlet building. A visual external and internal inspection was conducted on exchanger during plant turnaround.

**External:**

Dataplate was not located. Either it is missing or under insulation. A# was found stamped in shell to channel flange (shell side). Shell side and piping is insulated, preventing visual access to shell surface. Cladding and banding in good condition, no damage noted. Exposed nozzles show signs of heat caused paint deterioration. No corrosion noted on exposed surfaces. Channel bonnet was found to be in fair condition. Extensive paint caused paint deterioration and surface rusting / very light corrosion noted, however no significant wall loss was measured. Vessel saddle support anchor bolts are securely attached to structural beams, which are in good condition. Building skid is grounded but no direct ground connection to exchanger found. No visual access to support to shell connections. All associated piping appears well supported and in acceptable condition. Tube side PSV (off tube side piping) service is up to date. PSV inlet and outlet isolation valves are carsealed open. Shell side PSV was found to be off the stabilizer tower. UT corrosion survey performed by Streamline Inspection June 2014.

**Internal:**

Exchanger bonnet was removed and tube bundle pulled and cleaned for internal inspection. Shell side was found to be in fair condition. Several minor wear areas were noted on shell where tube bundle baffle plates are in contact with shell. These were located at approx. 83" and 56" in from shell flange. Wall loss was not measureable due to no access and vessel being insulated. Wall loss does not appear significant and is not a concern at this time. No other areas of corrosion or damage noted on shell, shell side nozzles or shell flange face. No visible corrosion or defects on shell or nozzle welds was observed. No visual access to far shell and head was possible due to distance from shell opening. Channel bonnet was found to be in fair condition. No corrosion or erosion noted on head, shell or nozzles. The partition plate was found to be securely attached with no deformation noted. Channel and channel nozzle flange faces were found to be in acceptable condition with no corrosion or damage noted. Tube bundle was found to be in fair condition. Tubes near return bends are being held in place by insulation straps. These tubes were found to be bent out of place at previous inspection. Some external pitting noted on one tube. This tube and one other have been historically plugged. Some bowing of the tubes was noted. A hard scale was found on tubes externally. No significant corrosion noted under scaling on tubes still in service. No fretting damage noted at or near where tubes pass through baffle plates. Eddy current was performed on tubes by FGG. Wall loss (approx. 0.030%) was noted on several tubes – see FGG report for details. As a result of the Eddy Current test, it was decided to plug 5 tubes.

Exchanger was found to be in fair condition and fit for continued service.

### RECOMMENDATIONS

Review UT survey report.

It appears the tube bundle is reaching the end of it serviceable life span. Consider replacing tube bundle at next outage.

### NONCONFORMANCES / INSPECTION DEFICIENCIES

Tube bundle wall loss noted during FGG Eddy Current inspections – See FGG report for details.

### INSPECTION PLANNING

Inspection Strategy	Availability	Inspection Interval
Inspection Date	Date of Last Inspect	Date of Next Inspect
June 07, 2014		

### REPORT CERTIFICATION


**SHELL & TUBE INSPECTION REPORT**

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The signatures below certify that inspections/tests have been completed in accordance with the identified inspection strategy and that the specified equipment is considered fit for service until the date of next inspection.

Inspected by	<u>Ed Tymensen</u>		Date	<u>June 07, 2014</u>
Company	<u>Streamline Inspection</u>	PESL # <u>000711</u>	API #	<u>27479</u>
Reviewed and Approved by	_____	_____	Date	_____
	_____	PESL # _____	API #	_____
Criticality Assessment Rerun	_____	Inspection Planning Rerun	_____	_____
Assessed Next Inspection Date	_____			

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### DETAILED INSPECTION VISUAL EXTERNAL

ID	Description	Condition	Location	NCR / IDR	Comments
V1	General Other (Please Explain)	Fair			Overall
V2	General Corrosion	n/a			Minor surface rusting, very light general corrosion on channel bonnet and exposed shell side nozzles
V3	General Leaks	n/a			None noted
V4	Vibration	n/a			Inspection done during shutdown
V5	Dissimilar Flange Rating	n/a			Similar flange ratings
V6	Ladder/Stairway	n/a			
V7	Heads	Good	Channel bonnet head		No significant corrosion or damage noted
V9	Electrical Ground	Good	Building skid		Skid ground cable present and secure. No direct ground connection to vessel found
V10	Painted Inactive Corrosion	n/a			
V11	Coating/Painting	Poor			Extensive paint deterioration on channel bonnet and exposed shell side nozzles, due to heat
V12	Expansion Joint or Bellows	n/a			
V13	Gauge/Site Glass	Good			Gauge clear and legible
V14	Shell	n/a			Insulated, no access
V15	Jacket	n/a			
V21	Support Other (Please explain)	Good	Piping		Well supported
V22	Foundation	Good	Steel skid		Skid on steel piles
V23	Anchor Bolts	Good			Tight and secure
V24	Saddle/Skirt	Good	Saddle		Saddle support to shell connection insulated
V25	Davit	n/a			
V26	Fireproofing	n/a			
V31	Connections Other (Please explain)	Good			All connections appear secure
V32	Small Branches	n/a			
V33	Nozzles	Fair			No significant corrosion or damage noted
V34	Manways	n/a			Internal access through channel flange
V35	Reinforcing Pads	n/a			
V36	Inadequate Thread Engagement	Good			Adequate thread engagement
V37	Bolting	Good			All bolting tight and secure, no corrosion of threads
V38	Flanges	Good			No leaks or surface corrosion noted
V39	Leak Clamps	n/a			
V41	Insulation Other (Please explain)	Good	Shell and piping		Insulated and clad
V42	Damage	n/a			No damage noted
V43	Penetrations	Good			All penetrations sealed
V44	Insulation Jacket	Good	Shell and piping		Tin cladding
V45	Banding	Good			
V46	Seals/Joints	Good			All penetrations sealed
V51	Relief Devices Other (Please explain)	Good			No access to shell side PSV off stab. tower
V52	Corrosion	n/a			None noted
V53	Leaks	n/a			None noted
V54	Restricted Inlet/Outlet	n/a			No restrictions
V55	Manual Operation Lever	Good	Tube side PSV inlet and outlet isolation valves		All valves to and from tube side PSV are carsealed open

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### DETAILED INSPECTION VISUAL INTERNAL

ID	Description	Condition	Location	NCR / IDR	Comments
V1	General Other (Please Explain)	Fair			Overall
V2	Corrosion (depth, length, width)	n/a			No significant corrosion noted. Light surface rusting on channel bonnet and exposed shell side nozzles
V3	Erosion	Fair	Shell		Minor shell wall loss, wear marks, where tube bundle baffles contact shell, no concern at this time – at 83" and 56" in from shell flange
V4	Distortion	n/a			No distortion noted
V5	Blisters	n/a			No blisters noted
V6	Deposits	n/a			No deposits noted
V7	Heads	Good	Channel bonnet head		No corrosion or damage noted
V8	Welds	Good			No corrosion or defects noted
V9	Nozzles	Good			No corrosion or damage noted
V10	Shell	Good	Shell		Minor shell wall loss, wear marks, where tube bundle baffles contact shell, no concern at this time – at 83" and 56" in from shell flange
V11	Gasket Surfaces	Good	Shell and channel flange faces and channel nozzle flange faces		No corrosion or damage noted
V21	Internals Other (Please explain)	Good	Channel partition plate		Securely attached, no distortion
V22	Demister	n/a			
V23	Baffle/Weir	n/a			
V24	Sparger	n/a			
V25	Thermowells	n/a			
V26	Metallic Linings	n/a			
V27	Nonmetallic Linings	n/a			
V30	Other Welded Attachments	n/a			
V31	Tubes	Fair poor	Tube bundle		Eddy current found wall loss on 5 tubes. These tubes are to be plugged. Tubes near tube return bends are being held together by insulation banding (several tubes were bent out of place at previous inspection.)
V32	Tube sheet	Good			

### DETAILED INSPECTION OTHER TECHNIQUES

ID	Location	Observation/Measurement	Acceptance Criteria	NCR / IDR	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

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**DETAILED INSPECTION TUBE INSPECTION**

Tube #	Flaw Type	Flaw Length	Location on Tube	Wall Loss	NCR / IDR	Comments

**DETAILED INSPECTION UT THICKNESS**

CML	Nom. Thk	Current Reading	Short Term Corr Rate	Long Term Corr Rate	Remaining Life	Comments



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### PHOTOS



LSD sign



A# stamped in shell flange



Exchanger overview



Nozzle paint deterioration due to heat, no significant corrosion



Saddle supports bolted to beams



Shell side internal

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**PHOTOS**



Shell side internal



Shell nozzle internal



Tube side piping internal



Shell flange face



Channel bonnet



Channel nozzle flange face



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**PHOTOS**



Tube bundle



Tube bundle return bends – bundle tubes have insulation banding holding it together



Tube bundle



Tubes – scaly buildup



Tube sheet – 5 tubes marked for plugging after Eddy Current testing



Tube sheet – 5 tubes marked for plugging after Eddy Current testing



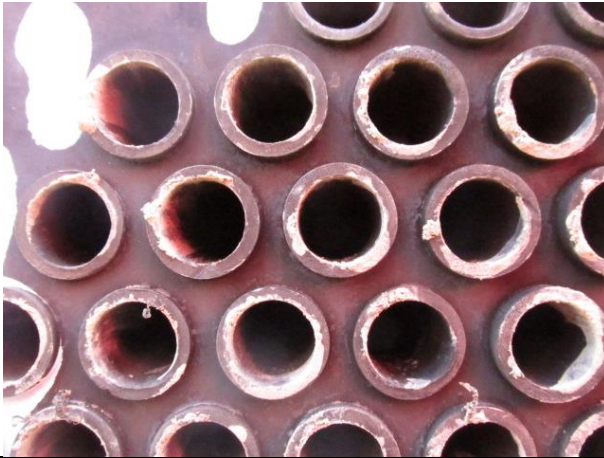
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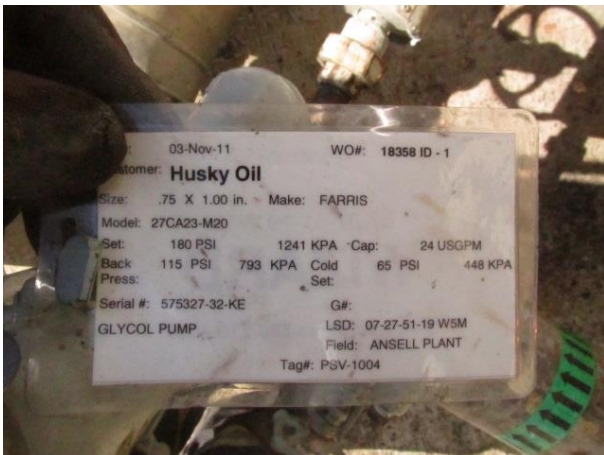
### PHOTOS



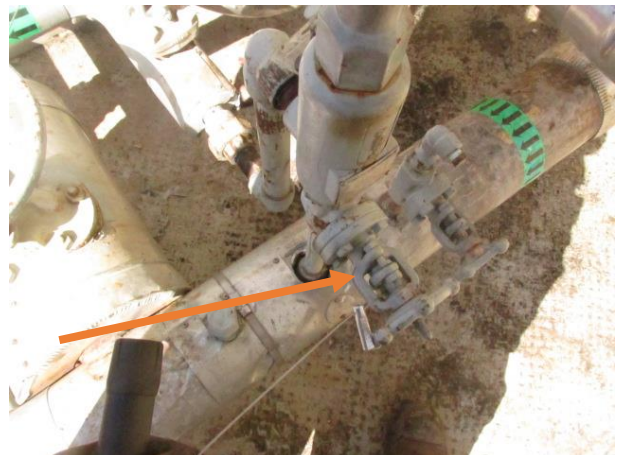
Tube internal



Tube side PSV



Tube side PSV service



PSV inlet isolation valve carsealed open



Tube side PSV outlet isolation valve carsealed open



Shell side PSV – off stabilizer tower