

Inspection Procedure For: Heat Medium Boiler (Sweet Service)

Company: Signalta
Facility / Field: Forestburg Gas Plant
Production Area: Stettler
LSD: 13/14/042/16 W4M
Maximo Data Collection No: 0

Boiler Design Information

Equipment No: _____ Equipment Status: In Service
Name: Heat Medium Boiler
Provincial Registration No: A0200407 NB No: _____ Tag No: B-201
CRN Number: C-9883.21
Serial Number: 3671
Year Built: 1984 Manufacturer: Saskatoon Boiler
Tube Access: N/A
Corrosion Allowance: 0
Capacity: 7380.766 ft³
Size: 12 ft 16 in (OAL) Orientation: Horizontal
Manway: No Access: _____
Scaffold Required: External: No Internal: No

Shell Side			Tube Side		
Design Press:	1034 kPa	150 psig	Design Press:	N/S kPa	N/S psig
Design Temp:	-18/204 °C	0/399 °F	Design Temp:	N/S °C	N/S °F
Materials:			Materials:		
Shell:	SA-516-70	Thickness: 0.50 in	Tubes:	Thickness:	
Shell:		Thickness:	Diameter:	Length:	
Tubesheet:		Thickness:			
Heat Treated:	No		Heat Treated:	No	
Radiography:			Radiography:		
Internals:	Tubes, Fire Tube, Attachments		Internals:	None	
Insulation:	Yes		Insulation:	Refractory (Doors)	

Operating Conditions

Shell Side			Tube Side		
Pressure:	724 kPa	105 psig	Pressure:	N/S kPa	N/S psig
Temperature:	145 °C	293 °F	Temperature:	N/S °C	N/S °F
Flow Rate:	N/S		Flow Rate:	N/S	
Description			Description		
PSV Location:	Top of shell		PSV Location:		
PSV No:	N/S	Model: 151/5	PSV No:		Model:
Size:	N/S	Capacity: N/S	Size:		Capacity:
Last Serviced In:	2005		Last Serviced In:		
Set Pressure:	1034 kPa	150 psig	Set Pressure:	kPa	psig
Serial No:	DA01835		Serial No:		
Manufacturer:	Consolidated		Manufacturer:		
Serviced By:	Barber		Serviced By:		
CRN:	N/S	Set Date: 2005	CRN:		Set Date:
Description			Description		
PSV Location:	Top of Shell		PSV Location:		
PSV No:	N/S	Model: 151/J	PSV No:		Model:
Size:	N/S	Capacity: N/S	Size:		Capacity:
Last Serviced In:	N/S		Last Serviced In:		
Set Pressure:	1034 kPa	150 psig	Set Pressure:	kPa	psig
Serial No:	DA02036		Serial No:		
Manufacturer:	Consolidated		Manufacturer:		
Serviced By:	N/S		Serviced By:		
CRN:	OG553052	Set Date: N/S	CRN:		Set Date:

Fluid Services (To be Verified by Operations)	
Shell Side	Tube Side
Glycol	
Comments:	Comments:

Potential Damage Mechanisms
<p>Corrosion: Crevice/Under Deposit, CUI, High temperature, Microbiological, pH, Suspended solids, Velocity</p> <p>Fabrication Defects: Nothing unusual expected</p> <p>Mechanical Effects: Cavitation (thinning), Corrosion Fatigue (surface connected cracking), Creep and Stress Rupture (microfissure / microvoid formation, subsurface cracking, surface connected cracking, metallurgical changes, dimensional changes), Erosion (thinning), Thermal fatigue (surface connected cracking)</p> <p>Metallurgical & Environmental Effects: Hardening (metallurgical and material property changes), Quenching, Reheat Cracking (surface connected cracking, Carburization Strain aging, Softening due to over aging</p>

Potential Damage Type & Location
<p>Fabrication Defects:</p> <p>High Stress Areas: Subject to low ph, sediment in or around nozzles, Cracking in the HAZ of attachment welds of the Firetube</p>

Inspection Methods
<p>DIMENSIONAL MEASUREMENTS: If Blistering, Buckling or Deformation found</p> <p>Inspections: DIMENSIONAL MEASUREMENTS (include percentage), MT, RT, SWUT, UT, VISUAL</p> <p>MPI (WFMPI): 100% of Welds (all tube sheet attachment welds, tube end seal welds, Long seams in the shell of the fire side, attachment welds), Inspect all Category "D" welds, Shear Wave if cracking found on tube to tubesheet</p> <p>UT: Pre-turnaround survey of all TML's identified on the UT drawings, Thickness readings in areas of corrosion</p> <p>VISUAL: Total Boiler and associated piping</p>

Special Equipment Needed
<p>Boiler must be clean and gas free</p> <p>110V GFI protected power supply required</p> <p>Maintenance crew required if repairs necessary</p> <p>Wire buffing of weld areas likely needed for WFMPI</p> <p>UT shearwave technician required to examine all designated areas</p>

Previous Internal/External Inspection Summary
<p>2006 - Internal - Ron Vanderwood API 510 + Stephen Droeske PESL 54</p> <p>Shell Condition</p> <ul style="list-style-type: none"> - Tubesheet faces in good condition. - Tubesheet stays and associated welds in good condition. - Tube ends and tube seal welds in good condition: No deterioration. - Tube ID's covered with typical ash deposits: no corrosion. - Tube OD's have tightly ground pitting to .003". - All castable refractory at the burner and return ends is in good condition - Ceramic fibre seal around burner can and at both end covers was replaced this turnaround. - Burner blocks, tips and air register in good condition: no distortion or high temperature degradation. - Firetube and associated welds in good condition. - MPI performed on tube seal welds, tubesheet stay welds and on firetube welds, did not detect any defects. - This boiler is in good overall condition. - 5 hand hole plugs removed. - Small amount of soft sludge on bottom of boiler shell. - Thin film of sludge on tubes. - Tube and visible stay rods are in place and in good condition. <p>Recommendations</p> <ul style="list-style-type: none"> - (0) Open the vessel for cleaning and video probe / internal visual inspection at the next scheduled turn-around. - (0) Service the PSV. Ensure that the PSV is pre-popped and the service report is forwarded to MTL Inspection Group Inc. - (0) Add this vessel and associated piping to the UT corrosion survey. - (0) Run discharge lines from PSV D52 and D51 to Pop-tank or containment bin. - (0) PSV's currently discharge to ground outside building.

2005 - External - Stephen Droeske PESL 54**Shell Condition**

- The external surface of the boiler is primer coated, insulated and cladded, all which is in good condition.
- Some minor surface rusting was noted around some of the hand holes.
- The accessible pressure retaining welds are intact and revealed no signs of deterioration or visible surface cracking.
- The internal bore (fireside) of the boiler tubes and associated seal weld, appeared to be free of surface defects.
- A light non-adhering process residue was observed along the entire length of the tube bores.
- No concerns noted at the time of this inspection.
- The boiler refractory and firebrick is still in great condition.
- No evidence of deterioration.

Vessel Support Condition

- The boiler support saddles and skid appear to be in good condition.
- There is no sign of mechanical strain noted on the skid.
- The support saddles are securely bolted to the structural skid base.

Flange / Gasket Condition

- The associated gaskets are in place and appeared to be tight.
- Pressure retaining welds were intact and showed no signs of deterioration or cracking.
- All accessible gasket sealing surfaces evaluated during this inspection are in pristine condition.

Instrumentation Condition

- The associated boiler controls and related safety devices were noted in good working order.

Piping Condition

- Inlet piping from glycol pumps are in good mechanical condition.
- The flange bolting is of the correct length and appear to be tight.

Pipe Support Condition

- The external pipe supports are in good condition and appear to be functioning properly.

Nozzle Condition

- The hand hole assemblies and the associated welds are in good condition.
- Some minor surface rust noted around the handhold plugs.
- No concerns at this time.

Recommendations

- (0) Schedule the boiler for an internal and external inspection during the next turnaround.
- (0) Service the two related PSVs during the next turnaround.
- (0) Perform Wet MT on the boiler tube to tubesheet, firetube to tubesheet welds. This would also include the related tubesheet to stay rod welds.
- (0) Add boiler to UT survey at shutdown. 6 O'clock position.

2002 - External - Les Martel PESL 170**Shell Condition**

- The external surface of the boiler is primer coated, insulated and cladded, all which is in good condition.
- Some minor surface rusting was noted around some of the hand plugs.
- The accessible pressure retaining welds are intact and revealed no signs of deterioration or visible surface cracking.
- The internal bore (fireside) of the boiler tubes and associated seal weld, appeared to be free of surface defects.
- A light non-adhering process residue was observed along the entire length of the tube bores.
- No concerns noted at the time of this inspection.
- The boiler refractory and firebrick is still in great condition.
- No evidence of deterioration.

Vessel Support Condition

- The boiler support saddles and skid appear to be in good condition.
- There is no sign of mechanical strain noted on the skid.
- The support saddles are securely bolted to the structural skid base.

Flange / Gasket Condition

- The associated gaskets are in place and appeared to be tight.
- Pressure retaining welds were intact and showed no signs of deterioration or cracking.
- All accessible gasket sealing surfaces evaluated during this inspection are in pristine condition.

Instrumentation Condition

- The associated boiler controls and related safety devices were noted in good working order.

Piping Condition

- The flange bolting is of the correct length and appear to be tight.

Pipe Support Condition

- The external pipe supports are in good condition and appear to be functioning properly

Nozzle Condition

2002 - External - Les Martel PESL 170**Nozzle Condition**

- The hand hole assemblies and the associated welds are in good condition.
- Some minor surface rust noted around the handhold plugs.
- No concerns at this time.

Additional Comments

- Note: Always inform ABSA of any Boiler inspections.

Recommendations

- (0) Schedule the boiler for an internal and external inspection during the next turnaround.
- (0) Service the two related PSVs during the next turnaround.
- (0) Perform Wet MT on the boiler tube to tubesheet, firetube to tubesheet welds. This would also include the related tubesheet to stay rod welds.

2000 - External/Internal - Les Martel PESL 170**External Shell Condition**

- The external surface of the boiler is primer coated, insulated and cladded, all which is in good condition.
- Some minor surface rusting was noted around some of the hand plugs.
- The accessible pressure retaining welds are intact and revealed no signs of deterioration or visible surface cracking.
- The internal bore (fireside) of the boiler tubes and associated seal weld, appeared to be free of surface defects.
- A light non-adhering process residue was observed along the entire length of the tube bores.
- No concerns noted at the time of this inspection.

Vessel Support Condition

- The boiler support saddles and skid appear to be in good condition.
- There is no sign of mechanical strain noted on the skid.
- The support saddles are securely bolted to the structural skid base.

Flange / Gasket Condition

- The associated gaskets are in place and appeared to be tight.
- Pressure retaining welds were intact and showed no signs of deterioration or cracking.
- All accessible gasket sealing surfaces evaluated during this inspection are in pristine condition.

External Instrumentation Condition

- The associated boiler controls and related safety devices were noted in good working order.

External Piping Condition

- The flange bolting is of the correct length and appear to be tight.

Pipe Support Condition

- The external pipe supports are in good condition and appear to be functioning properly.

External Nozzle Condition

- The hand hole assemblies and the associated welds are in good condition.
- Some minor surface rust noted around the handhold plugs.
- No concerns at this time.

Internal Shell Condition

- The shell (glycol side) internal inspection of the tubes, stay rods and firetube stiffener ring were noted in good condition.
- The internal shell area is coated with a thin uniform passive layer.
- There is no evidence of any active corrosion.
- The refractory located on the boiler end removable doors appeared to be in good condition.
- Some hairline shrinkage cracks were observed.
- No concerns at this time.

Firetube / Burner Condition

- The firetube appeared to be in good condition with no evidence of corrosion or distortion noted at the time of this inspection.

Additional Comments

- Note: Always inform ABSA of any Boiler inspections.

Recommendations

- (0) Schedule the boiler for an internal and external inspection during the next turnaround.
- (0) Service the two related PSVs during the next turnaround.
- (0) Perform Wet MT on the boiler tube to tubesheet, firetube to tubesheet welds. This would also include the related tubesheet to stay rod welds.

1998 - External/Internal - Unknown**External Shell Condition**

- The external insulation is in good condition.
- The tube ID's are in good condition.

External Instrumentation Condition

- The pressure gauge is in good condition.

Previous Internal/External Inspection Summary

(continued)

1998 - External/Internal - Unknown

External Nozzle Condition

- The hand holes are in good condition.

Demister / Filter Condition

- The refractory is good at both ends.

Firetube / Burner Condition

- The firetube is in good condition.

Recommendations

- (0) Service PSVs within 24 months.
- (0) Next internal in 24 months.

1997 - External/Internal - Unknown

External Shell Condition

- The insulation appears to be in good condition.

Vessel Support Condition

- The foundation is in good condition.

External Instrumentation Condition

- The pressure gauge is in good condition.

Internal Shell Condition

- Inspection performed by looking through end doors.
- Water not removed.
- The tubes have a very thin tight scale.
- The refractory has some minor cracking but is in good condition with the exception of the rope type insulation used in the door seals.

Internal Piping Condition

- The internal piping, bolting and pipe supports are in good condition.

Recommendations

- (0) Replace rope type insulation in door seals.
- (0) Clean and inspect complete internal at next turnaround.

Previous UT Thickness Survey Summary

- The Boiler and associated Piping are not on the current UT corrosion survey.

Pre-Inspection

- SD Confirm Boiler contents and process function
- SD Determine pressure and temperature operating conditions since last inspection
- SD Obtain all tools required for Boiler inspection
- SD Pre-Job Planning, Safety Meetings, Safety and Health Hazard Analysis, Emergency Response
- SD Review all available permanent and progressive records
- SD Safety procedures and precautions reviewed
- SD Special Equipment Needed: 110V-GFI, Grinding, Power, Power buffing, Safety watch / personnel

Visual Internal

- Check condition of the face / throat of all manways, flanges, nozzles and blinds opened for inspection. Check nozzles for obstructions
- Take samples of scale/sludge if found and note the location in the Boiler from where it came, then submit for analysis as necessary
- Note any manufacturing discontinuities (scabs, slivers, rolled in inclusions, roller marks, arc strikes, etc.)
- Inspect vapour zone areas of Boiler for areas of condensation and possible vapour zone corrosion
- Note any areas not accessible for internal inspection
- Inspect the shell (either for bulging or collapsing), and heads for deformation
- Check condition of all gasket surfaces and threaded connections
- Inspect all accessible areas of the shell, head and channel surfaces for signs of blistering, pitting, erosion, etching or general corrosion loss
- Inspect all accessible weld areas (circumferential, longitudinal, nozzle and attachment) for any signs of preferential attack of HAZ or cracking
- Inspect accessible areas where flow changes take place (inlets, outlets etc) for potential corrosion or erosion
- Inspect accessible stagnant areas (shell, low flow areas) for under deposit corrosion
- Inspect areas opposite inlet streams for corrosion and erosion
- Inspect and note condition of all accessible internals (heating coils, fire tubes, etc.)
- Inspect the stack for corrosion and scale build-up
- Inspect the burner assembly for alignment and weld integrity
- Inspect areas of liquid gas interface for areas of potential H₂S or CO₂ damage due to gas breakout

Visual External

- SD Check to ensure the nameplate is legible and attached to the Boiler
- SD Inspect stairways, platforms, ladders and walkways
- SD Check for evidence of leaks on flanges, welds, relief valves, heads, headers, tubes, etc.
- SD Check for corrosion around heads of nuts, bolts and bracket connections
- SD Examine external condition of Boiler and its' support structure. Note condition of external coating or paint
- SD Inspect structural steel supports for corrosion, distortion and cracking
- SD The area of contact between any anchor bolts and any concrete and steel should be scraped and closely examined for corrosion
- SD Check the static ground wire to ensure it is properly attached
- SD Auxiliary equipment such as gauges are inspected for damage
- SD Verify that the external UT survey TML'S are in the appropriate places
- SD Check associated PSVs for set pressure, capacity, servicing date and correct installation
- SD Inspect the foundation and supports for settling, spalling and cracking
- SD Ensure the anchor bolts on the sliding saddle are loose and allow the Boiler to move
- SD If the Boiler is insulated inspect the general condition of the cladding and check lower points under insulation for damage. If there is evidence of problems have the insulation removed for further investigation

Inspection Notes

2009 - Internal

- The internal surface was not evaluated at this time.

2009 - External - Stephen Droeske PESL 54

PSV Condition

- (Tag: SRL D-52) The PSV is overdue for service.
- (Tag: SRL FGP D51) There are several wrought iron fittings associated with this installation.

Shell Condition

- Insulated
- The external surface of this vessel is in good condition with no evidence of corrosion. (doors only)
- The external coating was noted in good condition with no evidence of failure.
- The external coating is dirty.
- The doors have minor surface corrosion.
- The two doors are refractory lined. The outside surface was noted in good condition

Vessel Support Condition

- The vessel is welded to saddle. The saddles are bolted to the I-beam. There is no evidence of mechanical deterioration or corrosion.
- The ground wire is visibly attached to the vessel.
- The caulking at the wall openings is sealed.

Flange / Gasket Condition

- The flange and NPT connections are in good mechanical condition with no evidence of measurable corrosion.

Insulation Condition

- The vessel, pipe cladding and insulation are in good condition. The cladding is sealed from the weather.
- The vessel and pipe cladding is sealed at the building wall interface.

Instrumentation Condition

- The associated instrumentation is in good mechanical condition.
- The instrumentation tubing is secured.

Piping Condition

- The primary piping is bolted.
- The auxiliary piping is threaded.
- The piping is in good mechanical condition with no signs of damage or deformation.
- The associated pressure welds are intact and show no signs of deterioration or visible cracking.
- The piping is insulated and protected with metal cladding. The cladding is in good condition and is sealed from the weather. The insulation is intact.
- The welded connections are not visible at this time.
- The associated piping flange bolting and gaskets are in place and tight.
- The studs are the correct length, diameter, type and grade.
- Only the flange at the shell is visible.
- The threaded piping is in place and tight with no evidence of deterioration, visible cracking or process leaks.

Pipe Support Condition

- The associated pipe support structure is in good mechanical condition with no evidence of any mechanical damage or degradation.
- The associated pipe supports are welded and bolted to the piping system.
- The pipe support clamps are tight.
- Piping attached to pumps does not have additional support.

Piping Dead Legs

- Not Applicable

Inspection Notes

(continued)

2009 - External - Stephen Droeske PESL 54

Nozzle Condition

- The nozzles are in good condition, with no mechanical damage, or measurable corrosion noted on the external surfaces.
- There are process leaks at the PSV connections, inlet/outlet flanges.
- The visible stains do not appear to be continuous leaks. Maybe spills from gasket changes.

Non-Destructive Examination (NDE)

- The vessel and associated piping is not on the current UT Corrosion Survey.
- To TML cover plates are visible.

Recommendations

Next External Inspection: 3 Years 2012
Next Internal Inspection: 3 Years 2009
Next PSV Service: 2 Years 2007
Next UT Corrosion Survey: 3 Years 2012
Next UT Creep Wave: N/S

Risk Level Recommendation

- | | | |
|---|---|---|
| 1 | 0 | Open the vessel for cleaning, video probe and internal visual inspection at the next scheduled turn-around. |
| 2 | 0 | Service the PSV. Ensure that the PSV is pre-popped and the service report is forwarded to MTL Inspection Group Inc. |
| 3 | 0 | Buff all attachment welds on tubesheets. |
| 4 | 0 | Perform B & W MPI on all attachment welds. |
| 5 | 0 | Service test the boiler prior to returning to operation. |

External: Stephen Droeske PESL 54

Date: January 12, 2009

Internal:

Date:

Reviewed By: Karen Dronyk PESL 307 *KD*

Date: April 28, 2009