# VRU SERVICE

## Service, emission and alarm check report

### General Information:
- **Project Nr.:** 25110
- **Company:** Atlantsolia
- **City:** Hafnarfjörður
- **Country:** Iceland
- **Days of visit:** 8-15/9
- **Year of visit:** 2017
- **Purpose of visit:** Contractual Service - 1/1 Yearly

### Required action:

<table>
<thead>
<tr>
<th></th>
<th>OK</th>
<th>Not OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Process and Vacuum Pumps</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>2) Valves and Instrumentation</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3) Absorption System</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4) Adsorption System</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5) Control System</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>6) Electrical System</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>7) Emission from unit</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

### Summary of required actions:
1) Vacuum pump is still using a bit too much oil.
2) All ON/OFF valves replaced on unit.
3) Absorbent pumps rotating units replaced.
4) Carbon should be tested before next year.
5) Control system OK - New SCADA PC installed.
6) Electrical installation ok.
7) Not much loading on site during measurement, but no emissions was found.

### Recommendations and predictions
- **2** Years to carbon change
- **1** Years to pump/motor change/overhaul
- **N/A** Years to Glycol/Oil change/refilling
- **5** Years to SCADA/PLC system revamp
- **N/A** = Not Applicable

### Recommendation for additional services
- Training
- Additional service visit
- Manuals
- Hotline
- Onsite Survey
- Quotation for recommended spares

### Estimated maintenance cost for the next 12 month

<table>
<thead>
<tr>
<th></th>
<th>0 - 15.000</th>
<th>15.000 - 30.000</th>
<th>30.000 - 60.000</th>
<th>60.000+</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>EUR</td>
<td>EUR</td>
<td>EUR</td>
<td>EUR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Service inspection sheet

#### Vapour Recovery Unit

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Service inspection sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 N/A</td>
<td>1 OK</td>
</tr>
</tbody>
</table>

#### Inspection Of Operation

- **Filter no.**
  - V110
  - V130

- **Opening of purge air**
  - 130 mbar(a)
  - 130 mbar(a)

- **Time of equalization fase 1 (850mbar)**
  - 22 sec.
  - 21 sec.

- **The equalization fase 1 started at:**
  - 37 mbar(a)
  - 56 mbar(a)

- **Balancing Step (only valid for 3 bed)**
  - na mbar(a)
  - na mbar(a)

- **Purge air flow**
  - * m³/h
  - * m³/h

- **Filter temperatures (bottom/middle/top)**
  - 17/7 °C
  - 23/11 °C

- **Lowest final pressure**
  - 34 mbar(a)
  - 40 mbar(a)

- **Pressure increase after 10 min.**
  - 0 mbar(a)
  - 0 mbar(a)

- **Drain**
  - 0 liter
  - 0 liter

#### Remarks:

- Wasn't able to adjust purge air properly with new flow meter, will bring new hand valve when returning later this year. Adjusted flow on end pressure instead - was running very good.

#### Valves

- **Inspection of modulating valves**
  - 1
  - By-pass valves (vacuum pump) 2

- **Inspection of on / off valves**
  - 2
  - Drain evacuation fan

- **Non return valves**
  - 1
  - Automatic drip tee, drain valve

- **Visual inspection of safety valves**
  - 2
  - Manual drip tee, drain valve

- **Safety valve replaced**
  - 2

- **Safety valve must be replaced no later then:**
  - Accordingly to local regulations

- **Safety valve to be overhauled / calibrated by Luveba?**
  - Yes
  - No

#### Remarks:

- All valves on VRU was replaced, except ball valves at tank and bypass valve, flange connection was incorrect. Old safety valve could be overhauled and used for easy replacement at a later point.
Luveba s.a.  

Service inspection sheet  
Vapour Recovery Unit

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Service inspection sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>25110</td>
</tr>
<tr>
<td>Name:</td>
<td>Henrik Kjær Hansen</td>
</tr>
<tr>
<td>Date:</td>
<td>8-15/9 2017</td>
</tr>
</tbody>
</table>

**Terminal**

**Absorbent Line**

- Press in: 0,1 bar(g)
- Flow in: 3 m³/h
- Coupling if direct driven: Magnetic Coupling
- Oil level: 1
- Press in: 0,2 bar(g)
- Coupling if direct driven: Magnetic Coupling
- Oil level: 2

**Remarks:**

Both pumps had the complete rotating unit replaced, was assembled and alligned.

**Quality of Absorbent**

- Absorbent volumen: ________ m³
- Last import of absorbent: ________ date
- Due time to absorbent change: ________ date

Expected optimal operating time with the current absorbent level amount: 0 Days

**Remarks:**

To ensure full capacity on the VRU, the absorbent shouldn’t be used more than 4 times through the VRU - this is also to ensure no changes in vapour pressure of the product used.
<table>
<thead>
<tr>
<th>Oil quality (smell, colour)</th>
<th></th>
<th>Air filter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil filter</td>
<td>2</td>
<td>Exhaust filter</td>
<td>2</td>
</tr>
<tr>
<td>Oil level</td>
<td>2</td>
<td>Vent. valves (closed)</td>
<td>1</td>
</tr>
<tr>
<td>Rupture disc</td>
<td>1</td>
<td>Drained knock out pot</td>
<td>1</td>
</tr>
<tr>
<td>Heat element disconnected</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Operational observations:**

- Suction pressure when preheating: 135-145 mbar(a)
- End pressure at closed valve: 10-12 mbar(a)
- Suction filter size: 149x83x221 mm
- Air filter last changed: 23/09-16
- Measured data at: 50 Hz
- Type of oil: VE101
- Temperature of oil: 80 °C
- Operation time: 16665 h
- Operation time /day: 1,7 h
- Measured data at: 9,2-9,1-9,2 A
- Measured data at: 308 mbar(a)

**Vibrations measurement:**

- Measuring point no. 1 DE: mm/s
- Measuring point no. 2 DE: mm/s
- Measuring point no. 3 NDE: mm/s
- Measuring point no. 4 NDE: mm/s

**Remarks:**

Pump is using oil, found and fixed leak at level switch, but still oil level is dropping too fast. Heat trace on pump was installed in 2016 by CS - installed auxillary relay in panel so that the tracing is OFF when pump in ON, cleaned up in the installation in electrical panel.
**Luveba s.a.**

**Project** 25110  |  **Contractual Service - 1/1 Yearly**

**Date:** 8-15/9 2017  |  **Name:** Henrik Kjær Hansen

**Terminal**

<table>
<thead>
<tr>
<th>0</th>
<th>N/A</th>
<th>1</th>
<th>OK</th>
<th>2</th>
<th>Replaced / Fixed</th>
<th>3</th>
<th>Up for replacement at next visit</th>
<th>4</th>
<th>Must be repaired / cleaned</th>
</tr>
</thead>
</table>

**Electric / Measuring Equipment**

<table>
<thead>
<tr>
<th>Check / Cal. of HC-analyzer</th>
<th>Test reference</th>
<th>1. Reading</th>
<th>Reading after cal.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check / Cal. of CO-analyzer</td>
<td>na</td>
<td>na</td>
<td></td>
<td>$gC_{H_2}/Nm^3$</td>
</tr>
</tbody>
</table>

- Inspection of SCADA PC: 2
- Inspection modem (eWON, Secomea, K56): 1
- Inspection in low voltage switch board: 1
- Inspection in high voltage switch board: 1

**Remarks:**

New SCADA installed and tested - PI and FIS was ordered wrong and will be replaced when returning later this year.

**Vapour Header System**

| Non return valve (also on loading rack) | 1 |
| Overpressure / Vacuum relief valve | 1 |
| Flame arrester | 3 |

**Remarks:**

Flame arrester should be removed and checked at next maintenance.

**Measuring Instruments**

| Pressure Indicators (PI) | 3 |
| Pressure Transmitters (PT) | 3 |
| Temperature Indicators (TI) | 3 |
| Temperature Transmitters (TT) | 3 |
| Flow Indicators (FI) | 3 |
| Flow Transmitter / Switch (FT / FS) | 3 |

**YEARLY**

**Inspection / calibration of modulating valves**

<table>
<thead>
<tr>
<th>Input / Output</th>
<th>PCV-221</th>
<th>LCV-314</th>
<th>Sensor</th>
<th>mbar(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mA (0%)</td>
<td>0</td>
<td>100</td>
<td>PT221</td>
<td>36/36</td>
</tr>
<tr>
<td>8 mA (25%)</td>
<td>25</td>
<td>75</td>
<td>PT211</td>
<td>34</td>
</tr>
<tr>
<td>12 mA (50%)</td>
<td>50</td>
<td>50</td>
<td>PT231</td>
<td>40</td>
</tr>
<tr>
<td>16 mA (75%)</td>
<td>75</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 mA (100%)</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

PCV, LCV and PT cross check was found OK.

**Alarm Check**

- Alarm check carried out
- Alarm check not carried out

Last date for alarm check: 13.09.17

**Data Back-up**

- PLC
- SCADA
- Setpoints
- Carbon test
- Backup of SCADA computer Harddrive
- Backup of SCADA and PLC program license

**Remarks:**

SCADA License handed over to customer..
All old back-up has been moved to new SCADA - some settings adjustments has been done, see findings for info.
Luveba s.a.
Project 25110 Contractual Service - 1/1 Yearly
Date: 8-15/9 2017
Name: Henrik Kjær Hansen

Findings

During the visit the following has been done / observed:
The VRU had very low running time since last visit - this is most likely due to the many low level oil alarms on the vacuum pump, that have caused the unit to stand still until it has been reset again.

The pump was leaking some oil from the level switch copper seal, this was replaced and outside leaks on the pumps was almost none existing - the oil use of the pump is more than likely internal. Normally this type of pump doesn't use much oil between maintenance, but this one uses app. 0,5-1 liter pr. month.

Have in mind that low level alarm goes off at the low level mark in the middle of the oil glass.
I could confirm that the alarm is correct, the oil level is low and is not due to the process that is making low level for a short time. It is recommended to have the pump overhauled.
Though these alarms started to come after the heat tracing of the pump was done, I couldn't find any alarming high temperatures when the unit is running.

The start signal to the VRU is only from gasoline pumps - if loading diesel with gasoline vapours in tank, the VRU will not start and therefore overload the carbon filter that is recieving vapors.
For easy use of VRU, it should start on feedback from connecting vapour return hose.
The VRU can handle vapours from both diesel and gasoline loading - only hydro carbons are adsorbed in beds.

Installed auxiliary contactor in electrical panel for heat trace, so that the heat tracing is OFF when the pump is running - this to protect the cable.

There has been several alarms from PS263 - the pressure switch should be replaced - would strongly recommend to install a pressure transmitter instead.
The alarms comes at 0,15 barg, alarm setting is 0,7 barg...

Did full service on VRU.
All on/off valves replaced, safety valve replaced, rotating units on absorbent pumps replaced, new SCADA PC installed, new purge air flow meter installed and full alarm test.

3 ball valves were ordered with wrong flange connection, flow meter for absorbent was not correct and will be changed later this year when we receive the new parts.
At same visit vacuum pump could be overhauled and pressure transmitter installed instead of PS263 is wanted.
Will also bring new hand valve for purge air and missing manometer.

Following changes was made to SCADA:
max time between regen changed from 120 minutes to 240 minutes
TT265 low temp changed from 45 to 40 degrees (pre-heat works from 40-55 degrees).
PCV221 changed from 250 mbara to 300 mbara
Adjustment of purge air - needs follow up.

The issues below needs attention / action from the costumer:
Order new PS263 or PT263 (for pressure transmitter, small changes to PLC and SCADA is needed)

Order overhaul of pump.

Have SV311 and P301 & P321 overhauled for spare parts.

The issues below needs attention / action from ACS:
Quote overhaul / new vacuum pump
Quote other spares from above mentioned text.

Arrange follow up visit this year.
## Engineer's Timesheet

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Leave Base</th>
<th>Arrive Site</th>
<th>Depart Site</th>
<th>Arrive Base</th>
<th>Travel Time</th>
<th>Hours Worked</th>
<th>Over Time</th>
<th>Milage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon</td>
<td>11/9</td>
<td>09:15</td>
<td>18:00</td>
<td></td>
<td></td>
<td>00:00</td>
<td>08:45</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Tues</td>
<td>12/9</td>
<td>08:30</td>
<td>18:00</td>
<td></td>
<td></td>
<td>00:00</td>
<td>09:30</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Wed</td>
<td>13/9</td>
<td>08:30</td>
<td>18:00</td>
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<td>00:00</td>
<td>09:30</td>
<td>0</td>
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<tr>
<td>Thur</td>
<td>14/9</td>
<td>08:30</td>
<td>18:15</td>
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<td>00:00</td>
<td>09:45</td>
<td>0</td>
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<tr>
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<td>15/9</td>
<td>08:30</td>
<td>16:30</td>
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<td>00:00</td>
<td>08:00</td>
<td>0</td>
<td></td>
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<tr>
<td>Fri</td>
<td>08/9</td>
<td>08:45</td>
<td>16:30</td>
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<td></td>
<td>00:00</td>
<td>07:45</td>
<td>0</td>
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</table>

### Remarks:

#### Consumed spare parts / material

<table>
<thead>
<tr>
<th>Qty</th>
<th>Material Description / Type</th>
<th>Price pr. pcs:</th>
<th>Total in EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pc. Auxillary contact for Heat Tracing</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>hour for updating electrical documentation</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some wire 0,75 mm2 and 2,5 mm2 for instaling auxillary contract</td>
<td>0</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>0</td>
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</tbody>
</table>

All lines in total [EUR] 0

### Remarks:
**Emission test report**

**Purpose and background:**
The purpose with the service visit was to control the VRU-plants emission and monitor VRU operation for any functional problems.

**Measuring instruments:**
For measuring VRU-plants emission, we use:

- One Dräger X-am 7000 gas analyser, ranged and calibrated for 0-1.70 vol % (0-41g/Nm$^3$)
- Pressure transmitter PT221, installed in the suction line of the vacuum pump

**Calibration:**
Dräger Belgium
Calibrated the gas analyser with a certificated calibrating gas, containing 0.90% butane (21.7g.HC/Nm$^3$)
Certificate from 30.08.2017

**Explanation of the measurement:**
The red curve shows the emission from the VRU in g.HC/Nm$^3$. the scale is shown on the left side of the paper
The blue curve shows the suction pressure from the vacuum pump in mbar(a)

**Results (Luveba)**
The following HC emission value represents the mean value for the one "worst case scenario" that has been hand picked from the entire measuring period.

<table>
<thead>
<tr>
<th>1 Hour Period</th>
<th>Average outlet concentration [g.HC/Nm$^3$]</th>
</tr>
</thead>
<tbody>
<tr>
<td>dd.mm.yy at hh:mm - hh:mm</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Emission result shows that the VRU is well below the required legal / design limit of:

**35g.HC/Nm3**

The following HC emission value represents the mean value for the entire measuring period.

<table>
<thead>
<tr>
<th>24 Hour Period</th>
<th>Average outlet concentration [g.HC/Nm$^3$]</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.09.17 at 13:30 - 15:30</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Emission result shows that the VRU is well below the required legal / design limit of:

**35g.HC/Nm3**

**Remarks:**
No emissions were registrered measuring period -> 1 hour concentration = 0 g.HC/Nm3
<table>
<thead>
<tr>
<th>ID</th>
<th>Color</th>
<th>Unit</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>02</td>
<td>mBar</td>
<td>650.96</td>
<td>5.00</td>
<td>1.125.00</td>
</tr>
<tr>
<td>002</td>
<td>03</td>
<td>gHC</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>