VRU SERVICE

Service, emission and alarm check report

General Information:

Project Nr.: 25110
Company: Atlantsolia
City: Hafnarfjordur
Country: Iceland

Days of visit: 8-15/9
Year of visit: 2017

Purpose of visit: Contractual Service - 1/1 Yearly

Engineer: Henrik Kjær Hansen

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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**

Required action:

	OK	Not OK
1) Process and Vacuum Pumps	☐	☑
2) Valves and Instrumentation	☑	☐
3) Absorption System	☑	☐
4) Adsorption System	☑	☐
5) Control System	☑	☐
6) Electrical System	☑	☐
7) Emission from unit	☑	☐

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 meassurement, but no emissions was found.

Estimated maintenance cost for the next 12 month

☑	**0 - 15.000**	**EUR**
☑	**15.000 - 30.000**	**EUR**
☐	**30.000 - 60.000**	**EUR**
☐	**60.000+**	**EUR**

Luveba s.a.			Date:	Name:
Project 25110 Contractual Service - 1/1 Yearly			8-15/9 2017	Henrik Kjær Hansen
Terminal 0			**Service inspection sheet Vapour Recovery Unit**	
0 N/A	**1** OK	**2** Replaced / Fixed	**3** Up for replacement at next visit	**4** Must be repaired / cleaned

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	* m^3/h	* m^3/h
Filter temperatures (bottom/middle/top) (Obtained at end of adsorption period)	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 propperly 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	1
Safety valve replaced	2		

Safety valve must be replaced no later then: Accodingly to local regulations

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

Remarks:

All valves on VRU was replaced, execpt 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.

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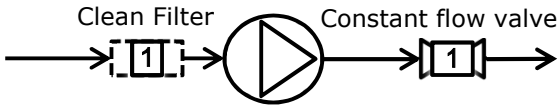
Project 25110 Contractual Service - 1/1 Yearly	8-15/9 2017	Henrik Kjær Hansen

Terminal	Service inspection sheet Vapour Recovery Unit

0

0 N/A	1 OK	2 Replaced / Fixed	3 Up for replacement at next visit	4 Must be repaired / cleaned

Absorbent Line



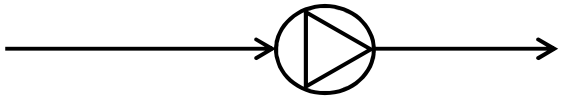
Press in 0,1 bar(g)

Flow in 3 m^3/h

Press out na / 3,0 bar(g)
at VRU / at pump

Absorbent inlet pump no. 1

Coupling if direct driven 1
Magnetic Coupling -
Oil level 2



Press in 0,2 bar(g)

Press out 2,5 bar(g)

Flow out na m^3/h

Absorbent outlet pump no. 1

Coupling if direct driven 1
Magnetic Coupling -
Oil level 2

Remarks:

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

Quality of Absorbent

Absorbent volumen _____ m^3

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.

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Terminal	Service inspection sheet Vapour Recovery Unit
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Rotary Vane Vacuum Pump no. P261

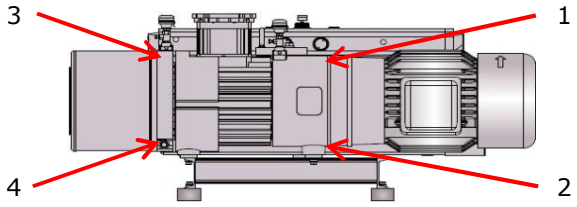
Oil quality (smell, colour)	1	Air filter	2
Oil filter	2	Exhaust filter	2
Oil level	2	Vent. valves (closed)	1
Rupture disc	1	Drained knock out pot	1
Heat element disconnected	-		

Operational observations:

Suction pressure when preheating	135-145	mbar(a)	Type of oil	VE101	
End pressure at closed valve	10-12	mbar(a)	Temperature of oil	80	°C
Suction filter size	149x83x221	mm	Operation time	16665	h
Air filter last changed	23/09-16	date	Operation time /day	1,7	h
Measured data at:	50	Hz →	9,2-9,1-9,2 A →	308	mbar(a)
				SP300	

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.

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Project 25110	Contractual Service - 1/1 Yearly		8-15/9 2017	Henrik Kjær Hansen

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Electric / Measuring Equipment

	Test reference	1. Reading	Reading after cal.	Unit
Check / Cal. of HC-analyzer	na			gC_4H_{10}/Nm^3
Check / Cal. of CO-analyzer	na			ppm

Inspection of SCADA PC	2	Calibration of HC analyzer ONLY with HART	-
Inspection modem (eWON, Secomea, K56)	1	Inspection of I/O station	1
Inspection in low voltage switch board	1	Inspection of pneumatic station	1
Inspection in high voltage switch board	1	Inspection of PLC backup battery	-

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)	1
Temperature Indicators (TI)	1
Temperature Transmitters (TT)	1
Flow Indicators (FI)	3
Flow Transmitter / Switch (FT / FS)	3

YEARLY

Inspection / calibration of modulating valves

Input / Output	PCV-221	LCV-314
4 mA (0%)	0	100
8 mA (25%)	25	75
12 mA (50%)	50	50
16 mA (75%)	75	25
20 mA (100%)	100	0

Check pressure transmitter value at end of desorption 2

Sensor	mbar(a)	
PT221	36/36	☑
PT211	34	☑
PT231	40	☑
		☐
		☐

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

Remarks:

Alarm for PLC-HMI has been removed as this was for Fix32 SCADA solution.

Data Back-up

☑ PLC Version: _____
☑ SCADA Version: _____
☑ 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.

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0			8-15/9	Henrik Kjær Hansen
Project	25110	Contractual Service - 1/1 Yearly	2017	

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 casused 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 of at the low level mark in the middle of the oil glas.
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 theese 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 feed back from connecting vapour return hose.
The VRU can handle vapours from both diesel and gasoline loading - only hydro carbons are adsorbed in beds.

Installed auxillary 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 intstalled 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 recieve 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.

Follwing 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.

Luveba s.a.			Date:	Name:
Project 0	25110	Contractual Service - 1/1 Yearly	8-15/9 2017	Henrik Kjær Hansen

Engineer's Timesheet

Day	Date	Leave Base	Arrive Site	Depart Site	Arrive Base	Travel Time	Hours Worked	Over Time	Milage
Mon	11/9		09:15	18:00		00:00	08:45	0	
Tues	12/9		08:30	18:00		00:00	09:30	0	
Wed	13/9		08:30	18:00		00:00	09:30	0	
Thur	14/9		08:30	18:15		00:00	09:45	0	
Fri	15/9		08:30	16:30		00:00	08:00	0	
						00:00	00:00	0	
Fri	8/9		08:45	16:30		00:00	07:45	0	

Remarks:

Consumed spare parts / material

Qty	Material Description / Type	Price pr. pcs:	Total in EUR
1	pc. Auxillary contact for Heat Tracing		0
2	hour for updating electrical documentation		0
	Some wire 0,75 mm2 and 2,5 mm2 for instaling auxillary contract		0
			0
			0
			0
			0
			0
			0
			0
			0
			0
			0
All lines in total [EUR]			0

Remarks:

Luveba s.a.			Date:	Name:
0 Project	25110	Contractual Service - 1/1 Yearly	8-15/9 2017	Henrik Kjær Hansen

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/Hm^3)
Certficate 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.

1 Hour Period	Average outlet concentration [g.HC/Nm^3]
dd.mm.yy at hh:mm - hh:mm	0.00

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.

24 Hour Period	Average outlet concentration [g.HC/Nm^3]
14.09.17 at 13:30 - 15:30	0.00

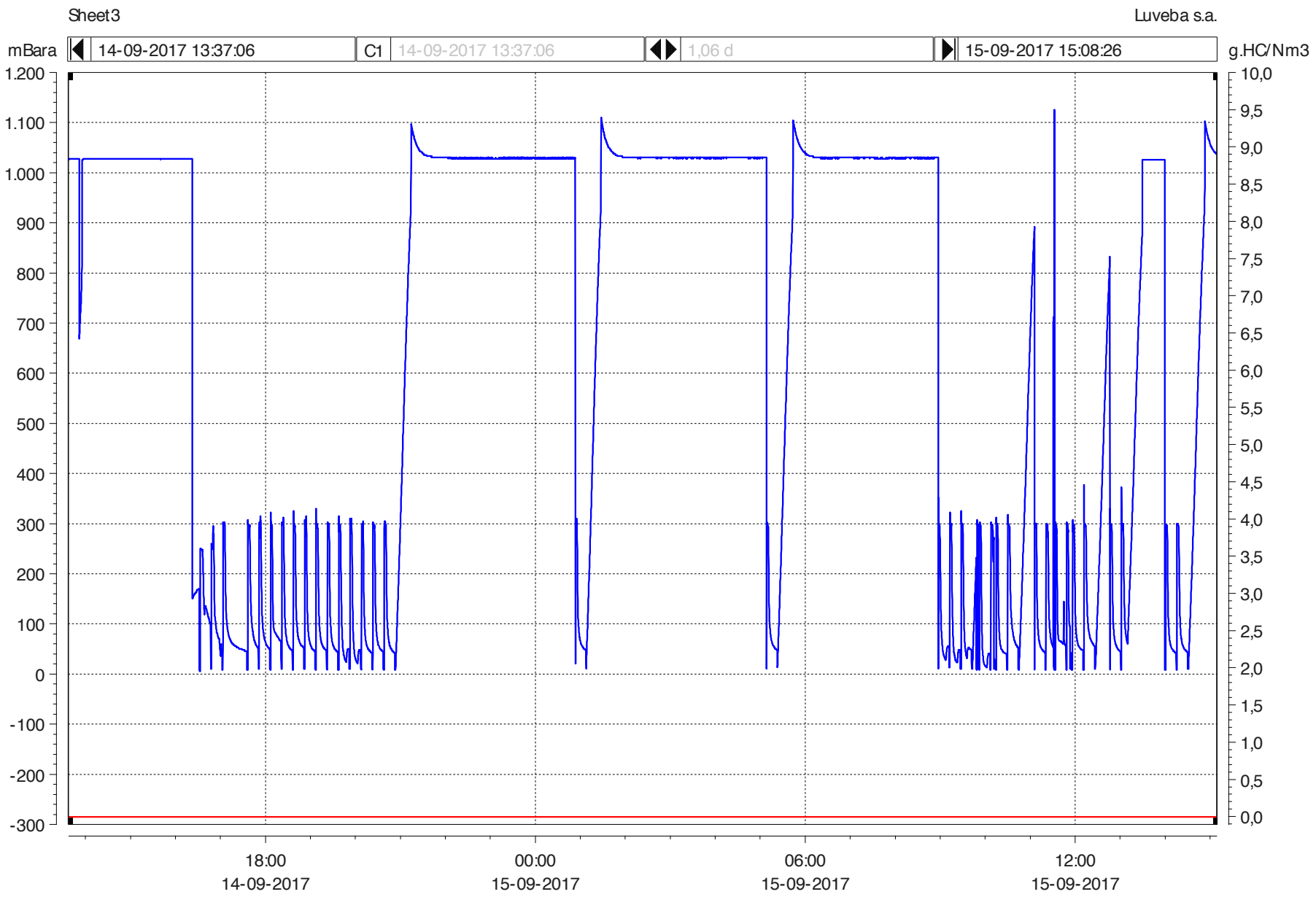
Emission result shows that the VRU is well below the required legal / design limit of:

35g.HC/Nm3

Remarks:

No emissions were registrered meassuring period -> 1 hour concentration = 0 g.HC/Nm3

	ID	Color	Unit	Average	Minimum	Maximum	
001	02		mBa	650,96	5,00	1.125,00	
002	03		g.HC	0,00	0,00	0,00	


Sheet3
Luveba s.a.
mBara
14-09-2017 13:37:06
C1
14-09-2017 13:37:06
1,06 d
15-09-2017 15:08:26
g.HC/Nm3
1.200
1.100
1.000
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
10,0
9,5
9,0
8,5
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4,5
4,0
3,5
3,0
2,5
2,0
1,5
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0,5
0,0
18:00
14-09-2017
00:00
15-09-2017
06:00
15-09-2017
12:00
15-09-2017

Cause / **Action**

Pos. No.		F-Comm.	F_OB82	F_OB86		FA-305				GA-261		GA-301	GA-321		LA+107	LA-262		LA+314	LA-314	LA+315		PA+211	PA-211	PA--211	PA---211	PA+231	PA-231	PA--231	PA---231		PA+221	PA+263		PA-901	PSD				TA+111	TA+112		TA+131	TA+132		TA+264	TA+265	TA-265
Alarm description		Alarm : Communication fail PLC-> HMI (PC)	Alarm : Failure Remote I/O Station	Alarm : PROFIBUS fail		Low flow : Absorbent inlet to Absorber Coloum				Motor not ready/fail : Vacuum pump P261		Motor not ready/fail : Absorbent inlet pump P 301	Motor not ready/fail : Absorbent outlet pump P 321		High level alarm : Vapour inlet -Drip-Tee-	Low level alarm : Oil level, Vacuum pump P261		High level alarm : Absorber V310	Low level : Absorber V310	High security level : Absorber, Pneumatic		Over-pressure alarm : Bed V110	Vacuum alarm at Equalize 2 : Bed V110	Low pressure alarm at Equalize 1 : Bed V110	Alarm : Bed V110, shift to Desorption 2 by time	Over-pressure alarm : Bed V130	Vacuum alarm at Equalize 2 : Bed V130	Low pressure alarm at Equalize 1 : Bed V130	Alarm : Bed V110, shift to Desorption 2 by time		High pressure alarm : Vacuum not obtain in suction line	High pressure alarm : Rupture disk,Vacuum pump P261		Low pressure alarm : Instrument air supply	Alarm : Process Shut-down Switch (PSD)				High temperature alarm : Bed V110 -bottom-	High temperature alarm : Bed V110 -top-		High temperature alarm : Bed V130 -bottom-	High temperature alarm : Bed V130 -top-		High temperature alarm : Flame Arrestor, Vacuum pump	High temperature alarm : Vacuum pump P261	Low temperature alarm : Vacuum pump P261
Alarm-group	USA-	A	2	2		2				2		2	2		2	2		2	2			2	2	2	A	2	2	2	A		2	2		2					1	1		1	1		1	2	2
Restart possible with alarm present						x												x	x					x				x			x														x	x
Resulting Action	**Activated device**																																														
Close : Bed V110, inlet/outlet/purge & suction valves	AV 111,112,211,214		x	x		x				x		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x	x				x	x		x	x		x	x	x
Close : Bed V130, inlet/outlet/purge & suction valves	AV 131,132,231,234		x	x		x				x		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x	x				x	x		x	x		x	x	x
Close : Bed V110, Equalizing valve AV212	AV 212																																		x						x	x		x	x		x		
Close : Bed V130, Equalizing valve AV232	AV 232																																		x						x	x		x	x		x		
Open : By-pass Valve for Vacuum pump	AV 262		x	x		x				x		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x					x	x		x	x		x	x	x
																	x																															
Close : Absorbent Supply Valve, from Storage Tank	AV 302		x	x		x				x		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x	x				x	x		x	x		x	x	x
Close : Absorbent inlet Valve to Absorber	LV 315		x	x		x				x		x	x		x	x		x	x	P		x	x	x		x	x	x			x	x		x	x				x	x		x	x		x	x	x
Close : Absorbent outlet Valve from Absorber	AV 321		x	x		x				x		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x	x				x	x		x	x		x	x	x
Close : Absorbent Return Valve, to Storage Tank	AV 322		x	x		x				x		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x	x				x	x		x	x		x	x	x
Stop : 1.Vacuum pump	P 261		x	x		x				H		x	x		x	x		x	x			x	x	x		x	x	x			x	x		x	H				x	x		x	x		x	x	x
Stop : Heating element for Vacuum pump	EE 261															x																															
Stop : Absorbent inlet pump to Absorber P301	P 301		x	x		x				x		H	x		x	x		x	x			x	x	x		x	x	x			x	x		x	H				x	x		x	x		x	x	x
Stop : Absorbent outlet pump from Absorber V310	P 321		x	x		x				x		x	H		x	x		x	x			x	x	x		x	x	x			x	x		x	H				x	x		x	x		x	x	x
Alarm only	Alarm only	x																							x			x																			
Alarm Test Certificate Date :	PLC control																																															
Testet by :	PC-screen test																																															

Note:

H: Hard wired

Alarmgroup:
A : Only alarm
P : Pneumatic interlock
1 : Alarm-group USA-1
2 : Alarm-group USA-2
3: Alarm-group USA-3

Action ! Vacuum-pump only if pump is chosen to be in operation ! else only alarm

Project : Customer :	**Vapour Recovery Unit (VRU), -type : Carbon Vacuum Adsorption(CVA) -Rotary Vane pump- Atlantsolia, Reykjavik, Island**	Reason for revision :	**Title : Safe Guarding Matrix**
			CSA Order No. : IS 25110
CSA Vapour Recovery	**Cool Sorption A/S, Smedeland 6, 2600 Glostrup, Denmark**		Constr. : KNI / Date: **07.09.05**
	Phone : +45 43 47 45	Rev. date / Drawn / Check by / Appr. by / Rev. no. : A	Drawing No. : **25110-9100** / Page: **1 á 1**