

# MAINTENANCE TRACKING TOOL

## Vacuum

Test of vacuum tightness on PSS

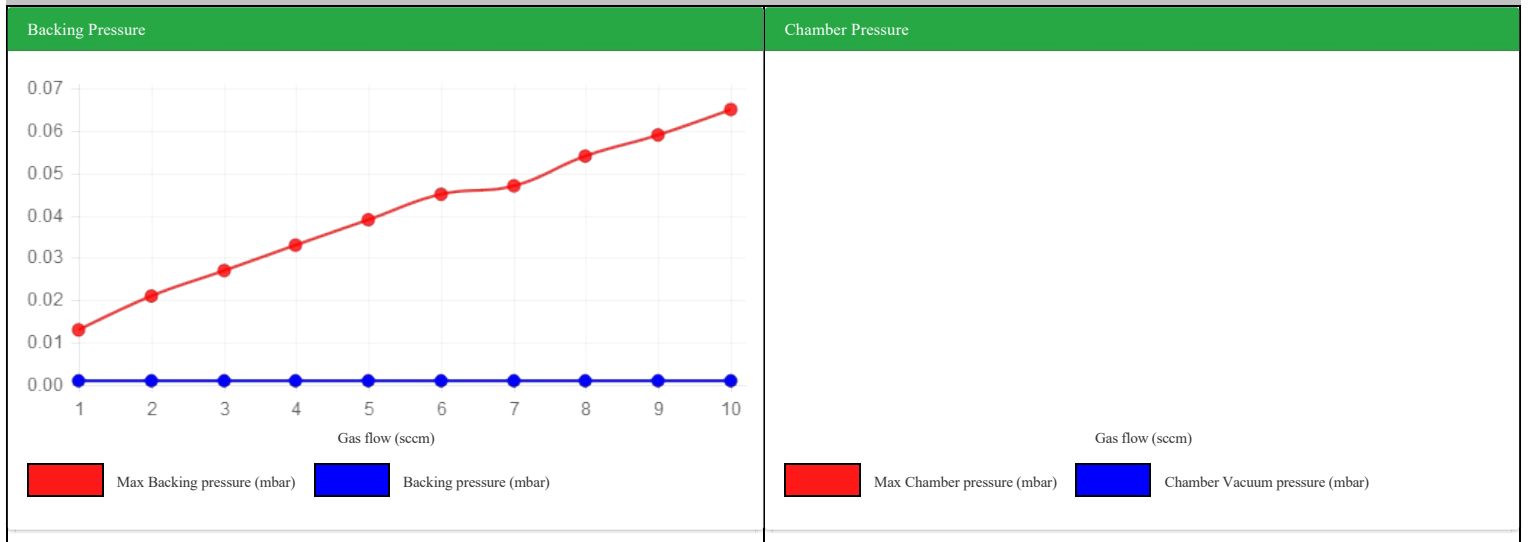
Plot vacuum pressure as function of gas flow from 1sccm to 10 sccm.

Vacuum pressure vs gas pressure should be a linear relationship.

Gas flow setting: 5,0 +/- 1 sccm

Gas flow	Chamber vacuum pressure (mbar)	Backing pressure	Max Chamber pressure (mbar)	Max Backing pressure (mbar)
1	2.0E-7	0.001	3,60E-06	1,30E-02
2	4.0E-6	0.001	6,10E-06	2,10E-02
3	4.0E-6	0.001	8,90E-06	2,70E-02
4	4.0E-6	0.001	1,10E-05	3,30E-02
5	4.0E-6	0.001	1,30E-05	3,90E-02
6	4.0E-6	0.001	1,50E-05	4,50E-02
7	4.0E-6	0.001	1,60E-05	4,70E-02
8	4.0E-6	0.001	1,80E-05	5,40E-02
9	4.0E-6	0.001	2,00E-05	5,90E-02
10	4.0E-6	0.001	2,20E-05	6,50E-02

OK value Too low value



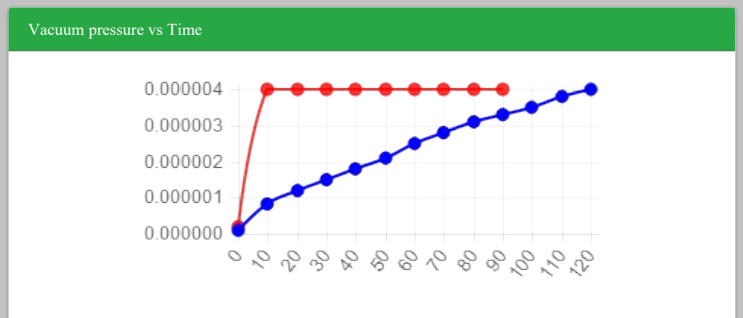
**Pass criteria:** Linear relationship between vacuum pressure and gas flow. (Blue line should be below red line)

### Vacuum leak test performed on PSS

With the vacuum system operating in pump mode with all BEV closed and without gas flow.

Set Vacuum system on VCU to Standby and observe the leak rate into the cavity (using pressure as proxy)


Time from Set Standby (sec)	Vacuum pressure (mbar)	Max leak rate
0	4.0E-8	1,80E-07
10	4.0E-8	1,00E-06
20	4.0E-8	1,50E-06
30	4.0E-8	1,90E-06
40	4.0E-8	2,30E-06
50	4.0E-8	2,70E-06
60	4.0E-8	3,00E-06
70	4.0E-8	3,30E-06
80	4.0E-8	3,60E-06
90	4.0E-8	3,90E-06
100	4.0E-8	4,20E-06
110	4.0E-8	4,60E-06
120	4.0E-8	4,90E-06



**Pass criteria:** Time to reach 1.0E-5 mbar > 10 s (Blue line should be below red line)

Vacuum	<ul style="list-style-type: none"> <li>Switch on the water cooling to the diffusion pump</li> <li>Press STANDBY on the VCU, record time</li> </ul>		
	<b>Standby time</b>		
	Actual standby start time:	10:27	
	<ul style="list-style-type: none"> <li>Verify that the green DP-lamp on the VCU lights up within 30min, re-adjust DP temp-switch as required</li> </ul>		
	<b>DP-lamp activation time</b>		
	DP -lamp activated in (min):	0	Max 30min
	<ul style="list-style-type: none"> <li>Press PUMP on the VCU and note the following values:</li> </ul>		
	<b>Pumping down</b>		
	Time before HVV opening	11	10-15 min
	Actual time for HVV opening:	0	<30s
Actual time to reach 1.0*E-5	0		
<ul style="list-style-type: none"> <li>After reaching the vacuum value of 1.0*E-5 open the IS gas flow at 10scem for 15 minutes</li> </ul>			

Vacuum	<p><b>WARNING! Diffusion pump may be very warm, verify that at least 2hrs has passed since pump shutdown.</b></p> <p><b>WARNING! Rotary and/or diffusion pump oil may be radioactive, verify activity level by performing an activity survey!</b></p> <p><b>NOTE! Verify that all cables are free from interference with the diffusion pump, interference may cause cable melting and/or electrical shortcut</b></p> <ul style="list-style-type: none"> <li>Verify the oil level and the color of the rotary pump oil, re-fill or change as required, record re-filled or changed volume</li> </ul>		
	<b>Rotary pump oil level</b>		
	Date of the last replacement of oil:	2022-11-07	
	Volume filled/changed (ml):	0	
	<b>Maintenance of the diffusion pump: to be performed every 5 years</b>		
	Last maintenance of the diffusion pump		
	<p>Ventilate the diffusion pump by removing Pirani 1</p> <p><b>NOTE! Verify that the water cooling is shut off before disconnection of the diffusion pump</b></p> <ul style="list-style-type: none"> <li>Remove the diffusion pump and drain the oil</li> <li><b>NOTE! Measure the length of the Jet assy before it is disassembled. The length is critical to pump performance.</b></li> <li>Disassemble and clean the diffusion pump</li> <li>Replace the heater</li> <li>Reassemble, reinstall and fill the diffusion pump with new oil</li> </ul>		
	<b>Diffusion pump oil replacement</b>		
	Volume filled/changed (ml):	0	
	<ul style="list-style-type: none"> <li>Verify the condition of the rotary pump oil mist filter, clean, inspect or replace as required</li> <li>Verify the condition of the rotary pump oil mist filter O-ring, clean, inspect for damage and/or deformation, replace as required</li> <li>Verify the functionality of the pirani gauges and the penning gauge, clean, inspect or replace as required</li> </ul>		

Comments:	test
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ACU

ACU	<p><b>NOTE! If readings are out of specification, the problem could come from the power supply or a ground fault.</b></p> <ul style="list-style-type: none"> <li>Verify ACU voltages</li> </ul>	
	<b>ACU voltages</b>	

Test point	Reading	Range
GND_IO (24V):	0.00	+24 ± 1,2
GND_IO (+15V):	0.00	+15 ± 0,75
GND_IO (-15V):	0.00	-15 ± 0,75
GND (+5V):	0.00	+5 ± 0,25
Chassis (GND_IO):	0.00	< 1V

Comments:	
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### MAINTENANCE TRACKING TOOL

#### PSMC

PSMC	<ul style="list-style-type: none"> <li>Switch off the PSMC main power</li> <li>Open the PSMC back door and remove one of its side covers</li> <li>Verify that the PSMC has no water leaks, loose cables, burn marks or broken parts, verify air filter condition, adjust and/or replace as required</li> <li>Verify the PSMC resistance values, read and record</li> </ul>			
<b>PSMC resistance</b>				
<b>Resistance between negative (-) and positive (+) (<math>\Omega</math>):</b>		0.00		
<b>Resistance between positive (+) and ground (<math>\Omega</math>):</b>		0.00		
<b>Resistance between negative (-) and ground (<math>\Omega</math>):</b>		0.00		
<b>WARNING! High power and current</b>				
<ul style="list-style-type: none"> <li>Switch on the PSMC power</li> <li>Ramp up the magnet to the H- configuration value, read and record the ramping time</li> </ul>				
<b>Magnet ramping up sequence</b>				
<b>On sequence ramping speed (A/second):</b>		0.00	Typically 6A/second	
<b>On sequence ramping up time to maximum (minutes):</b>		0.00	Typically 1 minute 30s	
<b>On sequence ramping up time to configuration value (seconds):</b>		0.00	Typically 15 seconds	
<ul style="list-style-type: none"> <li>Verify PSMC output current and voltages, adjust and/or repair as required, read and record</li> <li>Verify PSMC voltage regulation stability (voltage reading during 10 seconds should not vary more than 0.1 V)</li> </ul>				
<b>PSMC H- output current and voltages</b>				
<b>Parameter</b>	<b>10%</b>	<b>50%</b>	<b>100%</b>	<b>H- config value</b>
<b>Current setting PSS (10% 50±1, 50% 250±1, 100% 499±1 A):</b>	0.00	0.00	0.00	0.00
<b>Current PSS (10% 50±1, 50% 250±1, 100% 499±1 A):</b>	0.00	0.00	0.00	0.00
<b>Voltage read PSS (10% 12±1, 50% 41±1, 100% 80±1 VDC):</b>	0.00	0.00	0.00	0.00
<b>Coil voltage (10% 7±1, 50% 40±1, 100% 80±1 VDC):</b>	0.00	0.00	0.00	0.00
<b>Thyristor firing sequence (&lt;20 peaks in 20 ms)</b>	0.00	0.00	0.00	0.00
<b>Frequency (Hz):</b>	0.00	0.00	0.00	0.00
<b>Ripple 2±0,5 (true rms) (VAC):</b>	0.00	0.00	0.00	0.00
<ul style="list-style-type: none"> <li>Ramp down the magnet, read and record, switch off the PSMC power</li> </ul>				
<b>Magnet ramping down sequence</b>				
<b>Off sequence ramping down (minutes):</b>		0.00	Typically 1 minute	
<b>NOTE! Do not forget to connect the ground wire to the side cover/s.</b>				
<ul style="list-style-type: none"> <li>Close the PSMC back door and reinstall the side cover/s, switch on the PSMC power</li> <li>Verify fan and interlock functionality, adjust, repair and/or replace as required</li> </ul>				

Comments:	
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**MAINTENANCE TRACKING TOOL**

**RFPG**

RFPG	<p><b>WARNING! High voltage (up to +7800V DC).</b></p> <ul style="list-style-type: none"> <li>• Switch off the power to the RFPG</li> <li>• Open the TAU and verify that the grounding device is operational (completely in contact with the RF tube). Verify that no burn marks, loose cables or leaking water are present, clean, repair and/or replace as required, close the TAU</li> <li>• Open the GSPU and verify that no burn marks or loose cables are present, clean, repair and/or replace as required, close the GSPU</li> <li>• Open the DPA and verify that no burn marks, loose cables or leaking water are present, clean, repair and/or replace as required, close the DPA</li> <li>• Replace the RFPG air inlet filters, clean the front grid cover, inspect the grid of the back of the cabinet, clean if required</li> </ul> <p><b>WARNING! High voltage (up to +7800V DC). It is important to discharge components before removal of rectifier diode/s.</b></p> <ul style="list-style-type: none"> <li>• Open the TPSU, verify TPSU diode status (48 diodes), diode bridge should read 0,8-0,9V forward voltage drop from negative (-) pin to positive (+) pin. A defective diode bridge will read close to/or 0V, repair and/or replace as required</li> <li>• Verify tightness of the TPSU terminal screws TBL 1, TBL 2, TBL 3, tighten and/or replace as required, close the TPSU</li> <li>• Verify water cooling pressure, repair and/or replace as required, read and record</li> </ul>		
<b>RFPG water cooling pressure</b>			
<b>Pressure reading (bar):</b>			0.00
<ul style="list-style-type: none"> <li>• Switch on the RFPG and verify the functionality of the RFPG fans, repair and/or replace as required, reinstall all covers</li> <li>• Open the DPSU, visually verify that no components are loose or appears to be damaged, repair and/or replace as required</li> <li>• Verify the voltage output in the DPSU, adjust, repair and or replace as required, read and record. Re-install the DPSU</li> </ul>			
<b>DPSU voltage</b>			
<b>Parameter</b>	<b>Voltage</b>	<b>Ripple (peek to peek)</b>	<b>Voltage limits/ripple limit</b>
<b>+48V (V1):</b>	0.00	0.00	<b>47.5-48.5 VDC/200mV</b>
<ul style="list-style-type: none"> <li>• Verify SCU functionality for H-, adjust, repair and/or replace as required, read and record</li> </ul> <p>H-, at the PSS magnet page: switch on the water cooling and the magnet, set the magnet to the H- configured value, read and record the OFF value as displayed on the measurement module/ the PSS</p> <p>H-, at the PSS RF page: Select STANDBY, after 1 minut RF state should be: STANDBY READY, read and record the STANDBY value as displayed on the measurement module/the PSS</p> <p>Verify VAC voltage and ripple at the load phase detector board</p> <p>H-, at the PSS RF page: Select NORMAL, let the RF run for one hour, read and record the H- ( _ kV) value as displayed on the measurement module/the PSS, in case of any significant change in any value, adjust, repair and/or replace as required</p> <p>When finished, download the statistics log, the two milliseconds logs and the five seconds log. Save the log files in the backup folder in the service laptop, C:\backup\scu.</p> <p>If there are any significant change in any value, investigate the reason. Pay special attention to the analog in voltages, humidity and temperature, adjust, repair and/or replace as required</p> <p>If there are any significant change in any value, investigate the reason. Pay special attention to the analog in voltages, humidity and temperature, adjust, repair and/or replace as required</p> <p>At the PSS RF page: Select STANDBY, RF shall change state to: STANDBY READY</p>			
<b>SCU readings</b>			
<b>PSS</b>	<b>RFPG status</b>		
<b>Parameter/unit</b>	<b>Off/standby</b>	<b>H- (35kV)</b>	
		<b>0 hour</b>	<b>0.5 hour</b>
<b>DEE voltage ref (V):</b>	0.00	0.00	0.00
<b>DEE voltage read 1 (V):</b>	0.00	0.00	0.00
<b>DEE voltage read 2 (V):</b>	0.00	0.00	0.00
<b>RF fwd voltage (V rms):</b>	0.00	0.00	0.00
<b>RF reflected voltage (V rms):</b>	0.00	0.00	0.00

DPA RF FWD voltage (V rms):	0.00	0.00	0.00
FWD power (kW):	0.00	0.00	0.00
Reflected power (kW):	0.00	0.00	0.00
Anode voltage (kV):	0.00	0.00	0.00
Anode current (A):	0.00	0.00	0.00
Grid voltage (V):	0.00	0.00	0.00
Grid current (A):	0.00	0.00	0.00
Screen voltage (V):	0.00	0.00	0.00
Screen current (mA):	0.00	0.00	0.00
Heater voltage (V rms):	0.00	0.00	0.00

<b>PSS readings</b>			
DEE voltage set (kV):	0.00		
DEE voltage read (kV):	0.00		
Delta DEE voltage set (kV):	0.00		
Delta DEE voltage read (kV):	0.00		
FWD power (kW):	0.00		
Reflected power (kW):	0.00		
Phase error (degrees):	0.00		
H- start flap I (%):	0.00		
H- start flap II (%):	0.00		
D- start flap II (%):	0.00		
D- start flap I (%):	0.00		

<b>Voltages on load phase detector board</b>			
Parameter	Recorded voltage	Ripple peak to peak	Voltage limits/ripple limit
3,3V	0.00	0.00	3,2V-3,5V/50mV
TP1 +15V (V3+):	0.00	0.00	13,5-16,5VDC/50mV
TP2 -15V (V4-):	0.00	0.00	-16,5--13,5VDC/50mV
TP3 +5V (V1+):	0.00	0.00	4,5-5,5VDC/50mV
TP4 +24V (V2+):	0.00	0.00	21,6-26,4VDC/50mV

Comments:	
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**MAINTENANCE TRACKING TOOL**

**Ion-Source**

Ion-Source	<ul style="list-style-type: none"> <li>At the PSS Ion-source page: Verify gas flow regulator functionality by selecting H-, set value and read out is to match and zero setting is to provide zero reading, read and record</li> </ul>		
<b>Gas handling</b>			
<b>Checkpoint</b>	<b>Set value</b>	<b>Reading</b>	
H2 gas pressure (bar):	0.00	0.00	<ul style="list-style-type: none"> <li>Read the value on the last stage of the supply line</li> </ul>
<ul style="list-style-type: none"> <li>Switch on the H- gas and set to your normal value verify that the flip in probe is in and switch on the Ion-source, set to 50mA</li> <li>Start the IS conditioning procedure : turn ON Ion source and leave it at a current of 20 mA for 10 minutes</li> <li>NOTE! Probe reading of 200µA should be displayed prior to 600mA on the Ion-source</li> <li>Switch on the H- gas, set to 5,0ml/minut, verify that the flip in probe is, switch on the Ion-source, set to 50mA, read and record the Ion-source current/voltage and the probe current, proceed by 50mA increase steps until 200µA on probe are displayed</li> </ul>			
<b>H- burning properties</b>			
<b>Gas 5,0ml/minut</b>	<b>DEE 1(kV)</b>	<b>DEE 2 (kV)</b>	<b>Magnet (A)</b>
0.00	0.00	0.00	0.00

Ion-source current (mA)	Ion-source voltage (V)	Flip in probe current (µA)
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00
0.00	0.00	0.00

• Repeat operation for D- with gas at 3,5ml/minut. At the PSS: Switch of the Ion-source and set RF to STANDBY

• At water manifold 1: Open the two water valves for the upper and the lower targets as per system configuration

**NOTE! Verify that all required gas supplies are adequate, that all target media is available and activated as per system configuration, and that a vial is connected to the end of the delivery line. If gas supplies and/or target media levels are becoming low and/or are empty, inform the customer.**

Comments:

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