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# THERMOSIPHON ON DETECTOR COMMISSIONING AT LOW PRESSURE

This document describes planning of the low-pressure test of the Thermosiphon with ATLAS detector.

## TRACEABILITY

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## **Introduction:**

The Thermosiphon is capable of achieving lower vapor pressure than the compressor cooling plant. The low vapor pressure allows to decrease the evaporation temperature in the detector.

## **Goals:**

The goal will be to test the low pressure operation of the Thermosiphon and to evaluate the temperatures of the SCT detector at low evaporation pressures.

## **Main risks and concerns for the tests were:**

The backpressure regulators of the PIXEL detector will maintain nominal (flat) evaporation pressures of the PIXEL therefore the PIXEL temperatures will not be affected. There is a risk of stopping the cooling in case of malfunction.

## Test plans

The test will take one day. The Thermosiphon will be running on dummy load prior to the actual test with nominal vapor pressure set-point matching the compressor plant. The detector cooling will be than swapped from compressor plant to Thermosiphon and the vapor pressure will be slowly and steadily lowered.

Morning

Noon

Afternoon

Thermosiphon running on dummy load

Detector cooled by compressor plant

SWAP

Detector cooled by Thermosiphon at nominal vapor pressure

SCT BPR set to 1.0 bar

Steady ramp-down of the vapor pressure

Stable operation at low pressure

Steady ramp-up of the vapor pressure BPR to nominal set-point

SWAP back

## Initial vapor pressures

At the beginning the Thermosiphon will match the nominal vapor pressures in the same manner as during the first commissioning.

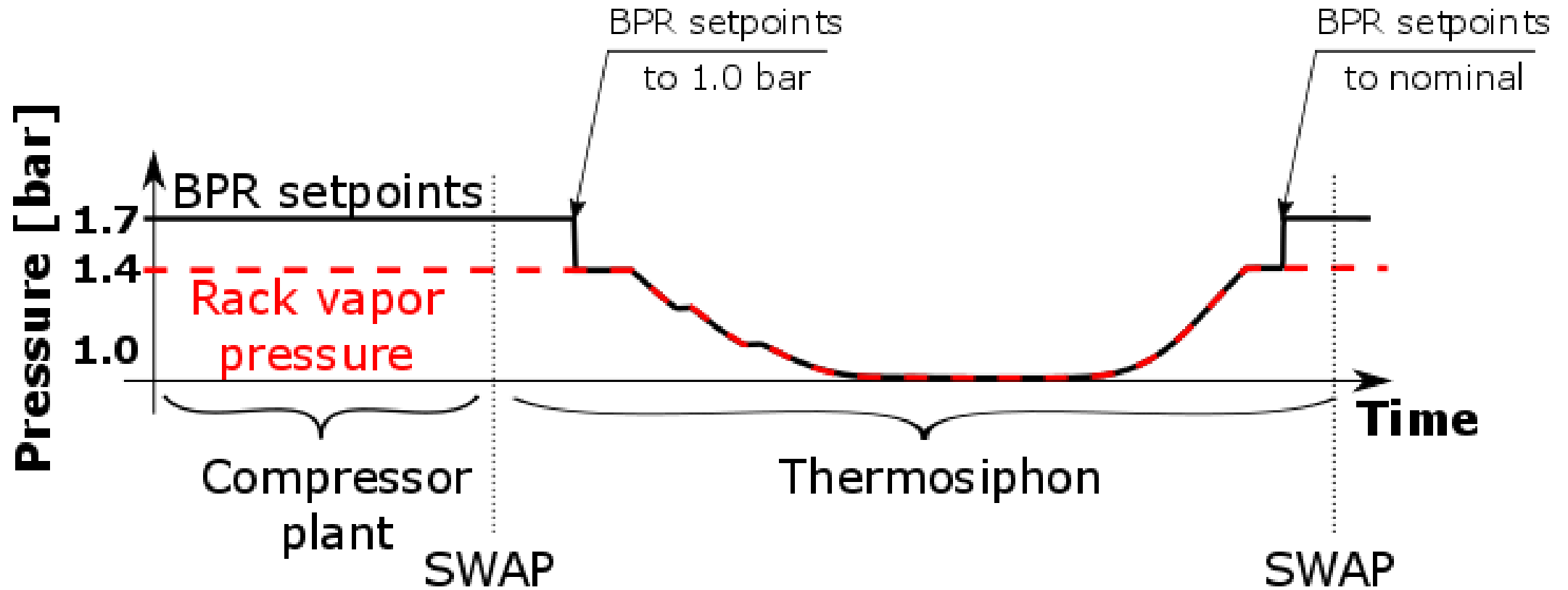
Rack:	Q1	Q2	Q3	Q4
<b>Compressor plant nominal values(SCT+PIXEL)</b>				
<b>Vapour pressure [bar<sub>a</sub>]</b>	1.44	1.43	1.44	1.44

This corresponds to Thermosiphon condenser temperature of -35°C.

Bear in mind that the back-pressure regulators are set higher:

- Minimal SCT BPR setting is ~1.64 bara
- Minimal Pixel BPR setting is ~1.71 bara

## Vapor pressure in racks during the test





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## Ramp-down

The ramp-down speed will be  $\sim 0.6$  bar/hour, this corresponds to  $\sim 10$  °C/hour

## Final vapor pressure

The ramp will be stopped when  $1.0 \text{ bar}_a$  is achieved in the distribution racks. This corresponds to vapor pressure decreased by  $0.4 \text{ bar}$  at the racks ( $\Delta T = 8^\circ\text{C}$ ).

## SCT BPR set-points

After the ramp-down the SCT backpressure set-points can be decreased as low as  $1.0 \text{ bar}$ . The evaporation temperature should decrease to  $-25^\circ\text{C}$  as a result.

	Nominal	During test
BPR setpoint	$1.7 \text{ bar}_a$	$1.0 \text{ bar}_a$
Actual evaporation temperature	$\sim -15^\circ\text{C}$	$\sim -25^\circ\text{C}$



## Summary

The test will take one day:

- 1) The settings of the PIXEL backpressure regulators will not be changed and the PIXEL temperatures will not be affected.
- 2) The cooling will be swapped to Thermosiphon at the morning
- 3) The SCT back-pressure regulator will be set to 1.0 bar and the evaporation pressure will be decreased.
- 4) The vapor pressure will be ramped-up back to nominal value
- 5) The cooling will be swapped back to compressor plant.