15 – Magnet - Cooling down

**Sensors and actuators used:**

- Pressure: PT660, PT681

- Flow rate: FT581, FT583

- Valve: FV640, FV642, FV680, FV681

- Control valve: CV601, CV602, CV581, CV583, CV680, CV644

- Level: LI680, LT682, LT683

- Temperature: TT662, TT665, TT680, TT685, TT644

- Heater: EH641 (set High T 60 K and Low T to 50 K; turned on under condition TT664 > 80 K)

|  |  |
| --- | --- |
| **The user chooses:** | **Initial conditions:** |
| - Levels: LI680Maxi, LT682setpoint, LT683setpoint | - Magnet insert selected  - Sequences from 1 to 3 stopped  - Sequences from 16 to 18 stopped  - Sequence 8 in operation |
| - Pressure: PT660Max, PT681Max, PT681setpoint, PT660setpoint |
| - Flow: FT581Max, FT581setpoint, FT583Max, FT583setpoint |
| - Control valve: CV601%opening, CV602%opening, CV581%opening, CV583%opening, CV680%opening |
| - ΔT/ΔLmagnetMax (TT665-TT662)/ΔLmagnet, dT/dt\_magnetMax (TT662), ΔLmagnet  - ΔT – T665 - Tmixed, where Tmixed  is temperature of the mixed (warm and cold) GHe |
| - Temperature: TT680setpoint, TT685Max |

The same as in step 6

Delaying transition to state 7

Time in state 5 > 3 min

Cooling Magnet with mixed (warm and cold) GHe

Same as state 6 but CV644 controlled by FIC644:

TT644 regulated by keeping the ratio (depending on TT665 + ΔT parameter) between the total flow from the insert (FTtotMagIns4K) and the warm GHe flow (FT644)

TT608 < 5K AND TT665 > 80K

TT680 < TT680setpoint OR

LT683 > LT683setpoint

TT608 > 10K OR TT665 <= 80K

Yes

“ Have you chosen the recovery circuit for the cryostat? “

Start

Stop

Cooling HX680

& HX683

Open FV681, FV640, FV641, FV642, FV680, CV680

Close CV644

CV581 regulated: FT581=FT581setpoint

PT660<PT660Max

CV601 regulated FT583=FT583setpoint

ΔT/ΔL magnet<ΔT/ΔL magnetMax

dT/dt\_magnet<dT/dt\_magnetMax

CV583 regulated PT681=PT681setpoint

EH641 on when TT664 < 80K

LI680 > LI680max

Stop

Cooling

Close FV681, CV680

CV581regulated

PT660=PT660setpoint

EH641 On when TT664 < 80K

TT685>TT685Max

LI680 > LI680max

Close CV601,

FV640, FV642 opened

FV680 opened

CV581 regulated

PT660=PT660setpoint

CV601 closed

Finished

Cooling

Stop

(FV642 & FV680) closed

CV602 regulated

LT682=LT682setPoint

FT583<FT583Max

PT681<PT681Max

CV583 regulated

PT681=PT681setpoint

CV581 regulated

PT660=PT660setpoint OR

PT661=PT660setpoint

Regulation

CV680 regulated

LT683=LT683setpoint

FT581<FT581Max

PT660<PT660Max

FV642, FV640 opened

FV680 opened

CV583 regulated

PT681=PT681setpoint

Close FV642, FV640

Close FV680

Close CV602, CV680

Stop

Cooling

CV583 regulated

PT681=PT681setpoint

CV581 regulated

PT660=PT660setpoint OR

PT661=PT660setpoint

Stop