# Cryomodule cool-down procedure

1. Open FV562 & FV563 (this will be done manually otherwise we need a connection to wtrvac PLC). It is the same for HNOSS.
2. **Step 4**: Setting-up the valves
   1. Set CV03 to 30 %
   2. Close CV01 (added before test of CM04 in September 2021)
   3. Open FV501 (HNOSS)
   4. Open CV5202
   5. Close CV550, Set MKS2 PID regulator off
3. **Step 6**: Filling 2K tank
   1. Control CV03:
   2. ~~Keep at constant level (sequence parameter). Do we need this mode or can achieve similar effect by setting MIN/MAX parameters for the flows?~~
   3. keep the FT552 < FT552\_MAX\_X (parameter) and FT552 > FT552\_MIN\_X (parameter). Algorithm: every 60 s adjust CV03 by 5% to fulfill the above conditions. When FT552\_MIN\_X <= FT552 <= FT552\_MAX\_X don’t change CV03

FT552\_MIN\_X / FT552\_MAX\_X is the min and max flow depending on where the GHe goes to (X=C for the compressor, X=GB for the gas bag).

Keep CV550 closed

1. **Step 8**: Filling 4K tank
   1. When LT01 reaches LT01 set-point afterwards keep CV550 at the specific value (right now it is the value set by CM PLC CM-RHtr:CV550:cSetV) or turn on the MKS2 PID regulator at the specific set-point (right now it is the value set by CM PLC CM-Ctrl:SP\_PT01-CV550:cSetV but it is prepared to use a sequence parameter – in this case CstatH-Ctrl:SQ7:cP\_CM\_SP\_MKS2 – alias CM-Ctrl:S5:cP\_SP\_PT01). Do we need here some condition for the GHe flow? Yes, for the gas bag there may be a condition to limit the flow if it lasts for more than specified time, for example >70m3/h for more than 10 min.

It must be possible to switch between the gas bag and the compressor at any time (the same sequence as at HNOSS but MKS1, MKS2, FV55\* must be in auto mode).

Green text – already implemented

## Sequence parameters:

* FT552\_MAX\_C
* FT552\_MIN\_C
* FT552\_MAX\_GB
* FT552\_MIN\_GB
* SP\_PT01 (SP\_PT550) via MKS2 (pv: CstatH-Ctrl:SQ7:cP\_CM\_SP\_MKS2 on hnoss IOC)
* CV550 PID on/off (via MKS2) via m141.0 bit on CM PLC

## Data exchange needed between different systems:

* FT550 (from HNOSS PLC to CM PLC) for the regulation of CV03
* FT552 (from HNOSS PLC to CM PLC) for the regulation of CV03
* State of the valves CV55\* and FV55\* (from HNOSS PLC to CM PLC) to see where the GHe goes to
* Request to keep open/closed the valve CV5202 is set in the PLC and available as an Epics PV CM-Ctrl:CV5202:cOpenReq to be used by the sequencer program on linde ioc.
* ~~CV550 set point from the CM PLC (set by the PLC program or from the sequence parameter) must be sent to HNOSS PLC~~ (sequence parameter residing on HNOSS PLC)
* MKS2 PID controller on/off
* PT550 set-point (MKS2) Not used now: parameter on HNOSS: CstatH-Ctrl:SQ7:P\_cP\_SP\_MKS2 (alias CM-Ctrl:S5:cP\_SP\_PT01) and CstatH-Ctrl:SQ7:P\_sP\_SP\_MKS2 (alias CM-Ctrl:S5:sP\_SP\_PT01)