SQ2 – Cryostat, conditioning He circuits

**Sensors and actuators used:**

- Pressure: PT581

- Valve: FV090, FV091NO, FV092, FV660, FV640, FV641, FV642, FV643, FV582, FV587, Switch Valves

- Control valve: CV581, CV582, CV583, CV680, CV650, CV651, CV652, CV653

- Purging system: vacuum pump P090

|  |  |
| --- | --- |
| **The user chooses:** | **Initial conditions:** |
| - Number of cleaning cycle: Nb cycle | - Sequences from 5 to 20 stopped |
| - Delay: tstarting, tvac1, tvac2, tp1, tp2 |  |
| - Mode: Vacuum, Liquid or Magnet |  |
| - Pressure: Pvac, PvacMax, P He, P He min |  |

PT581 < Pvac

Alarm validated

PT581< PvacMax & t > tvac1

PT581 ≥ PvacMax & t < tvac1

PT581 > P He

PT581 > P He min

& t > tp1

& N ≥ Nb cycle

PT581 > P He min

& t > tp1

& N < Nb cycle

Alarm validated

t > tvac2 & PT581 > Pvac

t > tp2 & PT581<P He

High level vacuum alarm

P090 running

Alarm validated

“Do you want to stop the conditioning?“

Flushing with

GHe

Open FV092 & FV660

Delay tp2

t > tstarting & (CV581 & CV582) opened

“Do you want to stop the conditioning?“

PT581 P He min & t < tp1

Alarm validated

Low level pressure alarm

FV660 closed

CV581&CV582 closed

Helium conditioning stopped

Close FV090, FV092

Close CV581, CV582

P090 stopped

Pump stopped

Stop P090

Open FV091NO

Open CV581, CV582

Close Switch Valves “Cryostat 4K Circuit”

Close FV582

Close FV640, FV641, FV642, FV643

Start the Pumping

Close FV091NO

Open FV090

Start the Pump P090

Open FV660

Delay tvac2

Pumping

CV581, CV582 opened

CV581, CV582 opened

FV091NO closed, P090 running

FV090 opened

Leak test at low pressure

Close FV090 & FV660 Delay tvac1

CV581, CV582 opened

FV091NO closed, P090 running

CV581, CV582 opened

FV091NO closed, P090 running

Cryostat circuits isolated

Close FV660

No

Yes

“Do you want to keep lines under vacuum?“

Yes

No

Yes

Leak test at high pressure

Close FV092 & FV660

Delay tp1

Start conditioning

Prepare for purging

Stop

Vacuum

Alarm

Close FV090

Pressure

Alarm

Close FV092

No

PT581 > P He

t > tp2 & PT581<P He

Alarm validated

Flushing

with *GHe*

Open FV092 Open FV660

Delay tp2

Close FV092

“Not possible to pressure the line”

Close FV090

FV090 closed

#### Vacuum/Liquid modes

#### Magnet mode

PT581 < Pvac

Alarm validated

PT581< PvacMax & t > tvac1

PT581 ≥ PvacMax & t < tvac1

PT581 > P He

PT581 > P He min

& t > tp1

& N ≥ Nb cycle

PT581 > P He min

& t > tp1

& N < Nb cycle

Alarm validated

t > tvac2 & PT581 > Pvac

t > tp2 & PT581<P He

High level vacuum alarm

P090 running

Alarm validated

“Do you want to stop the conditioning?“

Flushing with

GHe

Open FV092 & FV660

Delay tp2

t > tstarting & (CV581 & CV582 & CV583) opened

PT581 P He min & t < tp1

Alarm validated

Low level pressure alarm

FV660 closed

CV581&CV582&CV583 closed

Helium conditioning stopped

Close FV090, FV092

Close CV581, CV582, CV583

Close CV650, CV651, CV652, CV653

P090 stopped

Pump stopped

Stop P090

Open FV091NO

Open CV581, CV582, CV583

Close Switch Valves “Cryostat 4K circuit”

Close Switch Valves “Magnet 4K Circuit”

Close FV582, FV587

Close FV640, FV641, FV642, FV643

Open FV680, FV681

Open CV680

Open CV650, CV651, CV652, CV653

Start the Pumping

Close FV091NO

Open FV090

Start the Pump P090

Open FV660

Delay tvac2

Pumping

CV581, CV582, CV583, CV680 opened

FV680, FV681 opened

CV650, CV651, CV652, CV653 opened

CV581, CV582, CV583, CV680 opened

FV091NO closed, P090 running

FV090, FV680, FV681 opened

Leak test at low pressure

Close FV090 & FV660 Delay tvac1

CV581, CV582, CV583, CV680 opened

FV091NO closed, P090 running

FV680, FV681 opened

CV650, CV651, CV652, CV653 opened

CV581, CV582, CV583, CV680 opened

FV091NO closed, P090 running

FV680, FV681 opened

CV650, CV651, CV652, CV653 opened

Cryostat circuits isolated

Close FV660

Close CV680, FV680, FV681

Leak test at high pressure

Close FV092 & FV660

Delay tp1

No

Yes

“Do you want to keep lines under vacuum?“

Yes

“Do you want to stop the conditioning?“

No

Yes

Start conditioning

Stop

Prepare for purging

CV650, CV651, CV652, CV653 opened

Vacuum

Alarm

Close FV090

Pressure

Alarm

Close FV092

No

PT581 > P He

t > tp2 & PT581<P He

Alarm validated

Flushing

with *GHe*

Open FV092 Open FV660

Delay tp2

Close FV092

“Not possible to pressure the line”

Close FV090

FV090 closed