SQ9 – Valve Box cooling and 4K tank control level

Sensors and actuators used:
- Pressure: PT600
- Flow rate: FT580
- Valve: FV601, FV602

- Control valve: CV600, CV580, CV590, CV-He-liquefier
- Level: LT600
- Temperature: TT602, TT614

The user chooses:
- Level: LT600setpoint, LT600mini, LT600Maxi
- Pressure: PT600setpoint
- Flow: FT580limit
- Valve: CV600%opening, CV580%opening, CV-He-liquefier%opening, CV590%opening
- Mode: Regulation or Intermittent
- Helium supplier: Liquefier/Stop Liquefier or Dewar/Stop Dewar

Initial conditions:
- Sequences from 1 to 3 stopped
- Sequences 5 & 8 in operation

C

A

Regulation & Liquefier & Validation

Intermittent & Liquefier & Validation

32 Preparation to regulate
- Close FV601
- CV-He-liquefier %opening
- Open CV580

41 Waiting for Level
- CV-He-liquefier %openingCV580 regulated
- PT600=PT600setpoint

CV580 fully opened

LT600 < LT600mini OR Stop

34 Regulation mode
- CV-He-liquefier %opening
- CV600 regulated
- LT600=LT600setPoint
- FT580 < FT580limit
- CV580 regulated
- PT600=PT600setpoint

42 Cool down TL L010

Regulation OR Stop

TT602 < 10K OR TT614 < 10K OR Stop

Intermittent

35 Waiting for level
- Close CV600

44 4K tank Filling
- CV-He-liquefier %opening
- CV580 regulated
- PT600=PT600setpoint
- Close FV601
- CV600 open and controlled
- FT580 < FT580limit

LT600 < LT600mini

Stop Liquefier OR Stop

Regulation

LT600 > LT600 Maxi OR Stop

36 Liquefier valve closing
- Close CV-He-liquefier
- CV580 regulated
- PT600=PT600setpoint
- CV600 regulated
- LT600=LT600setPoint

46 End of Filling
- CV-He-liquefier %opening
- CV580 regulated
- PT600=PT600setpoint
- Close CV600

CV-He-liquefier closed

Intermittent & LT600 < LT600mini

Regulation

38 Avoid closed volume
- Close CV600
- Open FV601
- CV580 regulated
- PT600=PT600setpoint

Stop Liquefier OR Stop

Liquefier valve closing
- Close CV-He-liquefier

48

CV600 closed

CV-He-liquefier closed

40 Tank 4K outgassing
- FV601 opened
- CV580 regulated
- PT600=PT600setpoint

Dewar

B

Stop

Liquefier

A

C → **0** stop

Start

4 "Have you chosen the recovery circuit for the valve Box? "

Yes

6 "Do you want operate with an extra Dewar or with the liquefier Dewar? "

Yes

7 "Have you connected the extra Dewar? " — **B**

Liquefier → **A**

Dewar

Intermittent & Dewar & Validation

13 Waiting level

LT600 value > LT600min

Regulation & Dewar & Validation

8 Preparation to regulate | Close FV601
CV590 %opening
Open CV580, Open FV602

14 Preparation to fill | Open FV602

CV580 fully opened

FV602 opened & LT600 < LT600mini OR Stop

10 Regulation mode | CV590 %opening
CV600 regulated
LT600=LT600setPoint
FT580 < FT580limit
CV580 regulated
PT600=PT600setpoint
FV602 opened

16 Cool down TL L010 | CV580 regulated
PT600=PT600setpoint
Open FV601
CV590 %opening
FV602 opened

TT602 < 10K OR TT614 < 10K OR Stop

Regulation OR Stop

18 4K tank Filling | CV590 %opening
CV580 regulated
PT600=PT600setpoint
Close FV601
CV600 open and controlled
FT580 < FT58limit
FV602 opened

Intermittent

11 Waiting for level | Close CV600

LT600 < LT600mini

Stop Dewar OR Stop

LT600 > LT600 Maxi OR Stop — Regulation

12 Dewar Isolated | Close FV602
CV580 regulated
PT600=PT600setpoint
CV600 regulated
LT600=LT600setPoint

20 End of Filling | CV590 %opening
CV580 regulated
PT600=PT600setpoint
Close CV600
FV602 opened

FV602 closed

Intermittent & LT600 < LT600mini

Stop Dewar OR Stop — Regulation

22 Dewar Isolated | Close FV602
CV580 regulated
PT600=PT600setpoint

28 Avoid closed volume | Close CV600
Open FV601
CV580 regulated
PT600=PT600setpoint

FV602 closed

24 "Do you want close the valve of the Dewar?"

No

CV600 closed

30 Tank 4K outgassing | FV601 opened
CV580 regulated
PT600=PT600setpoint

Yes

26 Dewar valve closed | Close CV590

CV590 closed

A

Liquefier

Dewar

Stop

B