SQ22 – Cryostat warm-up

Sensors and actuators used:
- Temperature: list in the tables from 5 to 7
- Heater: list in the tables from 5 to 7 and current leads heaters for magnet insert
- Level: LI670, LI680
- Valve: CV581

The user chooses:
- Temperature setpoint: list in the tables from 5 to 7
- Level: LI670mini, LI680mini
- Flow: FT581limit, FT583limit

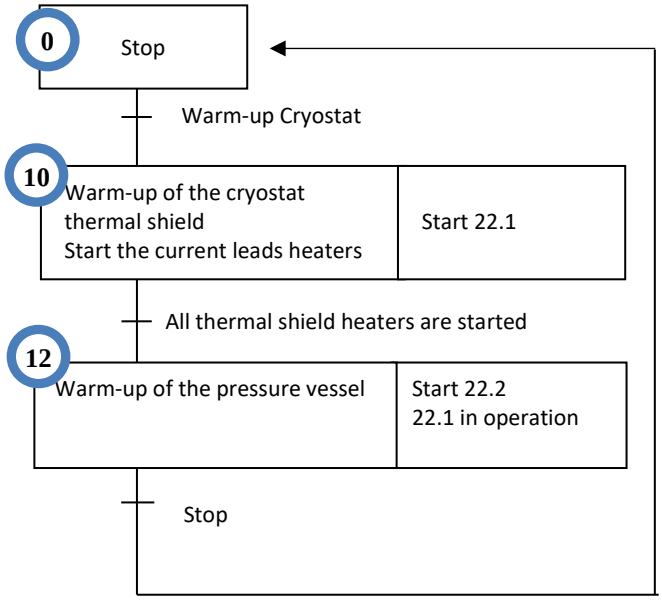
Initial conditions:
- Sequences from 1 to 3 stopped
- Sequences 6 and 7 stopped
- Sequences from 10 to 20 stopped
- Sequence 8 in operation

This sequence drives the electrical heaters implicated in the warm-up of the cryostat. Each set of heaters has its own cycle. To limit the current draw when starting the heater, the sequences work this way: each set of heaters starts its cycle 10 seconds after the previous. The sequential starting of heaters may take several minutes. The cycles of heater control run in parallel until the user decides to stop the warm-up. The cycles then all stop at the same time.

The sequences used to warm-up the thermal shield and the helium circuits are very similar, but for the pressure vessel warm-up, the program checks the helium level. As long as the cryostat contains liquid helium, the heating is intermittent and allows evaporating the liquid stored in the cryostat. The heating operates in continuous mode when the cryostat is empty (Liquid helium level<5%).

The sequence 22 can start only when the cryostat thermal shield cooling (sequence 6) and the cryostat helium cooling sequences are stopped.

The sequences 22.1 and 22.2 are started one after the other as described below:



22-1: Warm up of the cryostat thermal shield

The sequence used for the warm-up of the cryostat thermal shield is similar to the valve box thermal shield sequence 21-1.

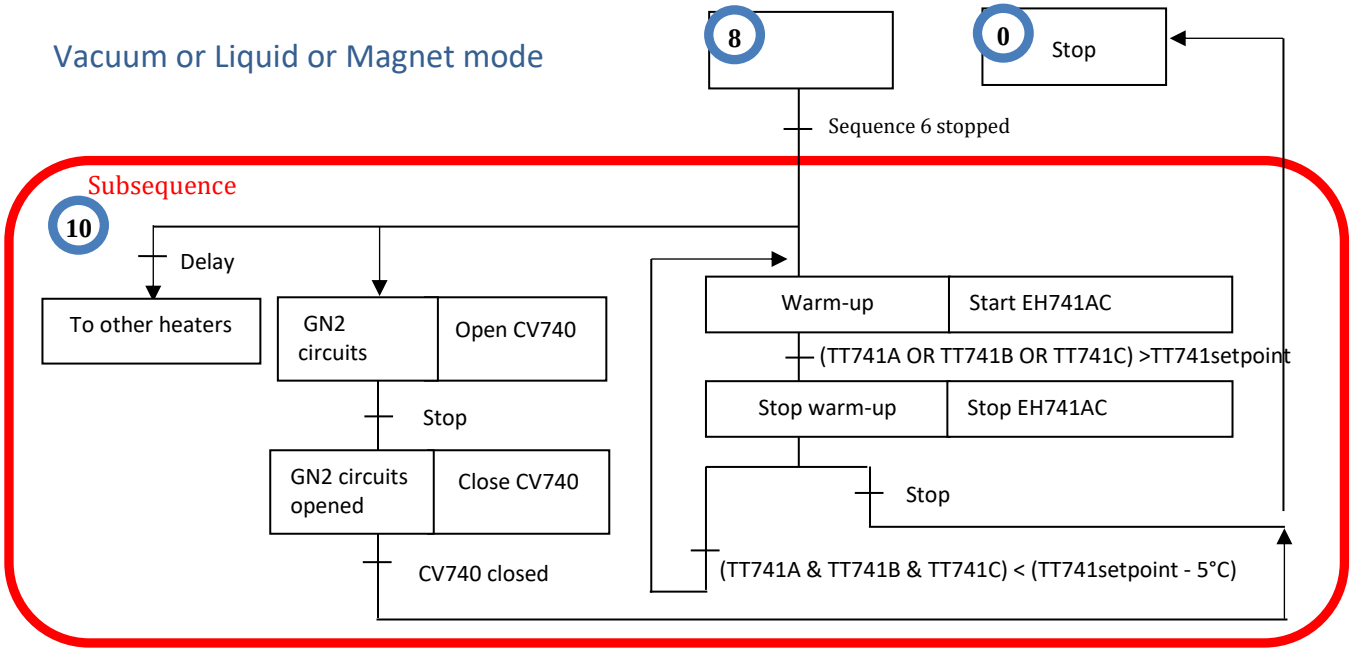


Table 5: Cryostat warm-up - Thermal shields

Heater	Thermometer	Temperature setpoint
EH741AC	TT741AC	TT741setpoint
EH742AC	TT742AC	TT742setpoint
EH743AF	TT743AF	TT743setpoint

22-2: Warm-up of the pressure vessel

This sequence 22-2 is similar to the sequence Warm up Valve Box 21-2.

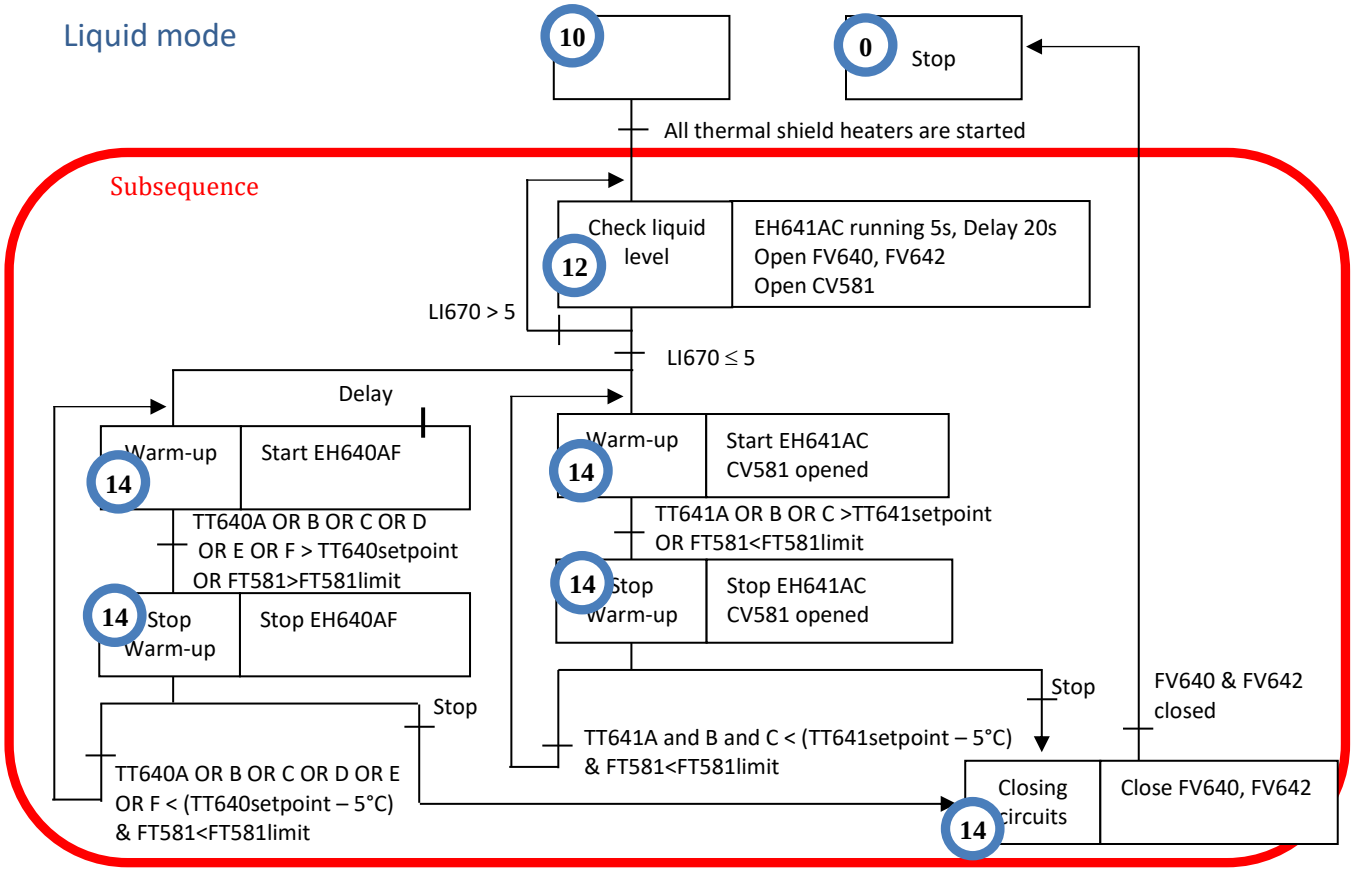


Table 6: Cryostat warm-up - Helium tank – Liquid mode

Heater	Pt thermometer	Level	Temperature setpoint	CX thermometer	Temperature threshold
EH640AF EH641AC	TT640AF TT641AC	LI670 LI670	TT640setpoint TT641setpoint	TT644 TT644	120K 120K

Magnet mode

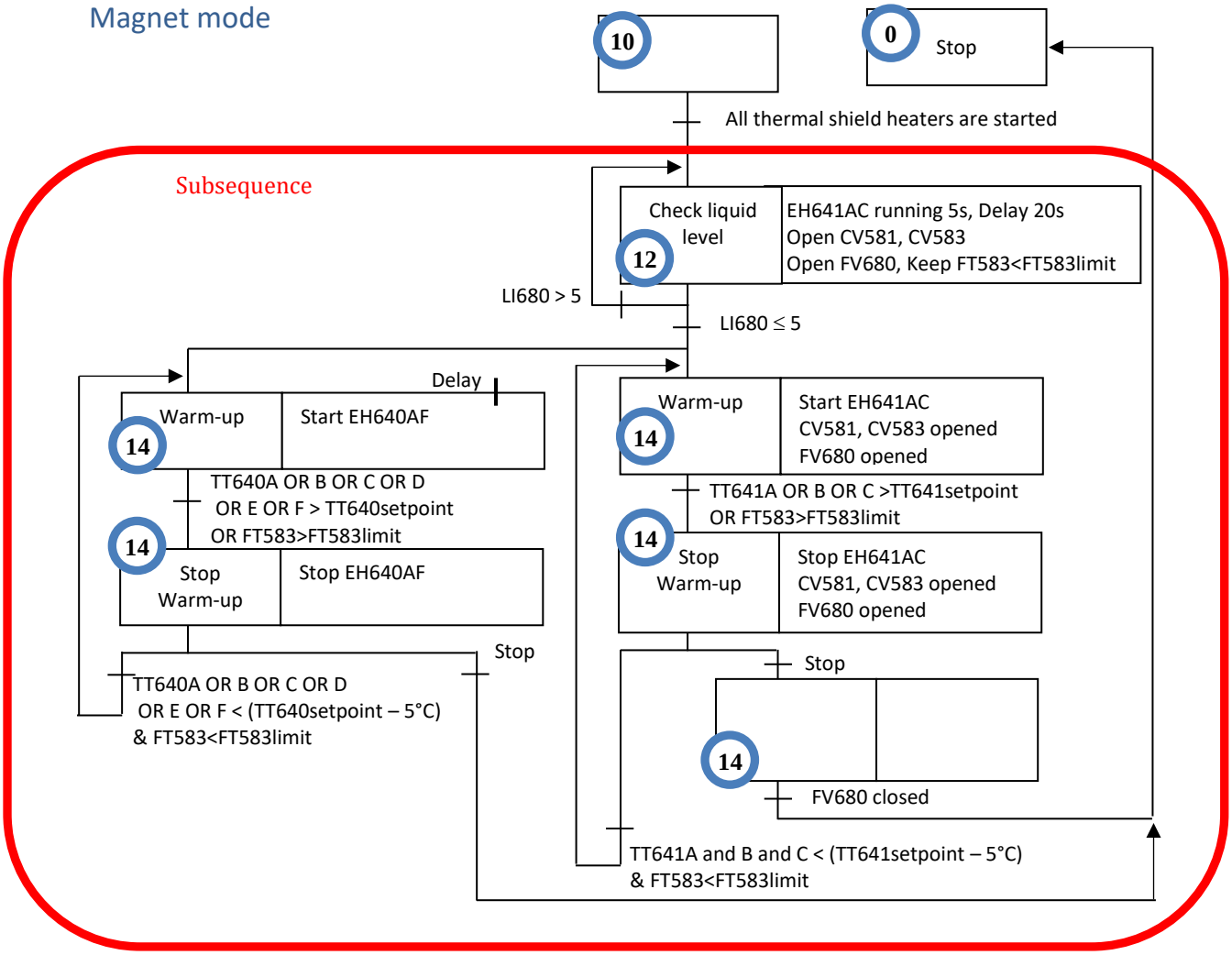


Table 7: Cryostat warm-up - Helium tank – Magnet mode

Heater	Thermometer	Level	Temperature setpoint
EH640AF EH641AC	TT640AF TT641AC	LI680 LI680	TT640setpoint TT641setpoint

Step 12: Turn off EH641AC when FT583 >= FT583 limit.