Sensors and actuators used:
- Valve: CV580
- Temperature: list in the tables 2, 3 and 4
- Heater: list in the tables 2, 3 and 4

The user chooses:
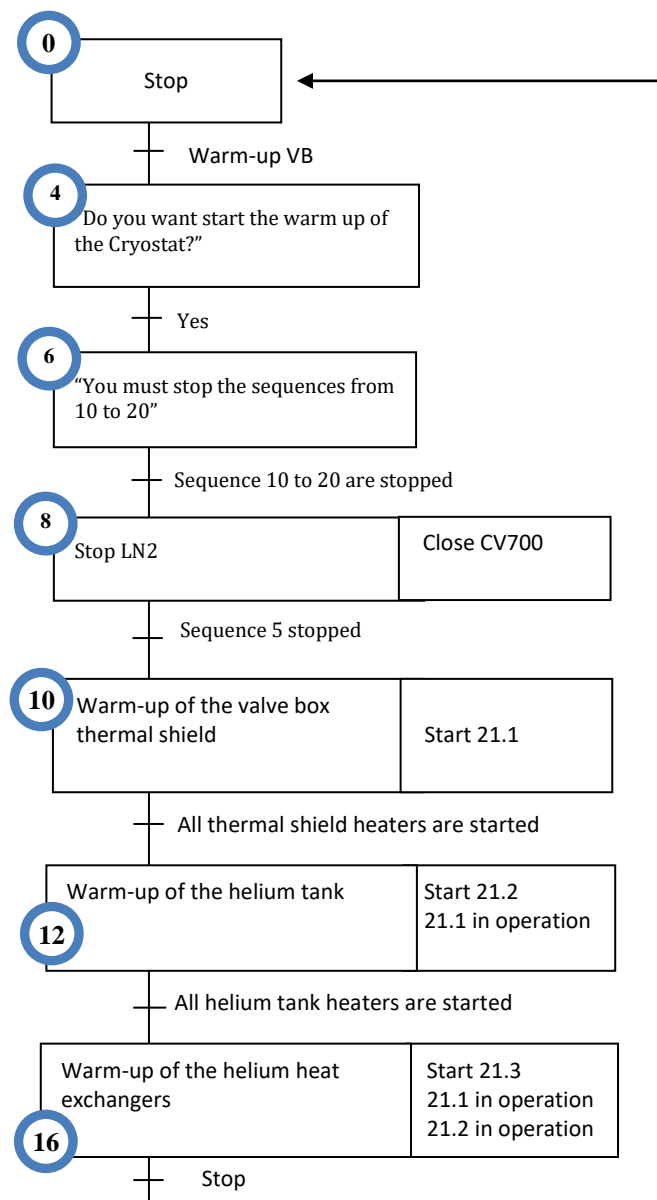- Temperature setpoint: list in the tables 2, 3 and 4

Initial conditions:
- Sequences from 1 to 3 stopped
- Sequences 5 and 9 stopped
- Sequence 8 in operation

This sequence drives the electrical heaters implicated in the warm-up of the valve box. 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 helium tank warm-up, the program checks the helium level. As long as the helium tank contains liquid helium, the heating is intermittent and allows evaporating the liquid stored in the tank. The heating operates in continuous mode when the helium tank is empty (LT600<5%).
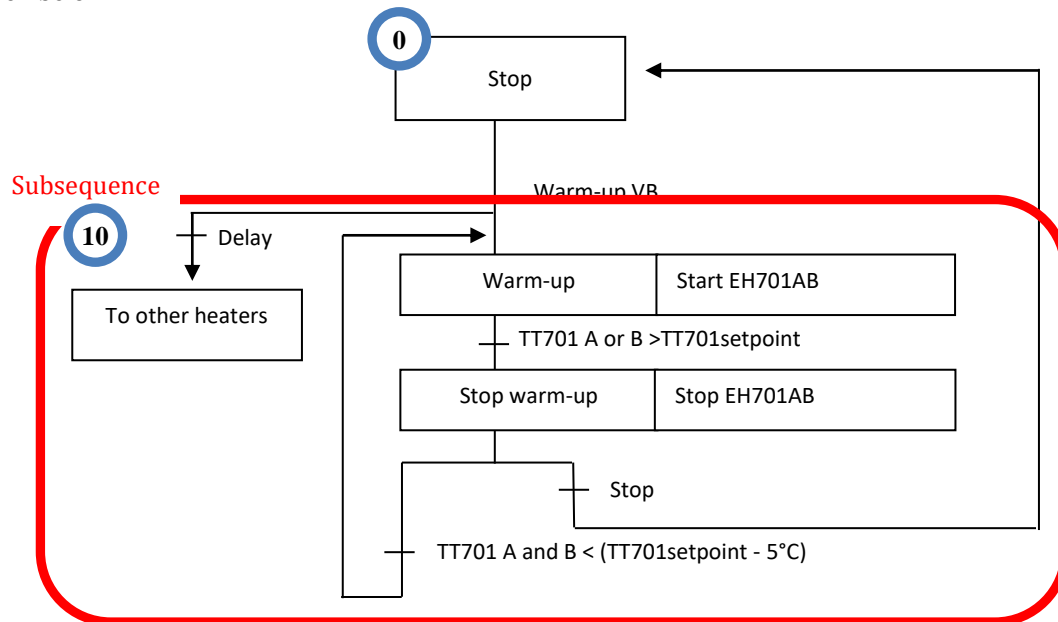
The sequence 21 can start only when the valve box thermal shield cooling (sequence 5) and the valve box helium cooling sequences are stopped (sequence 9 to 20).

The sequences 21.1, 21.2 and 21.3 are started one after the other as described below:

21.1: Warm-up of the valve box thermal shield

The cycle 21-1 used for the control of the electrical heaters glue on the thermal shield heaters (EH701AB) is given below:
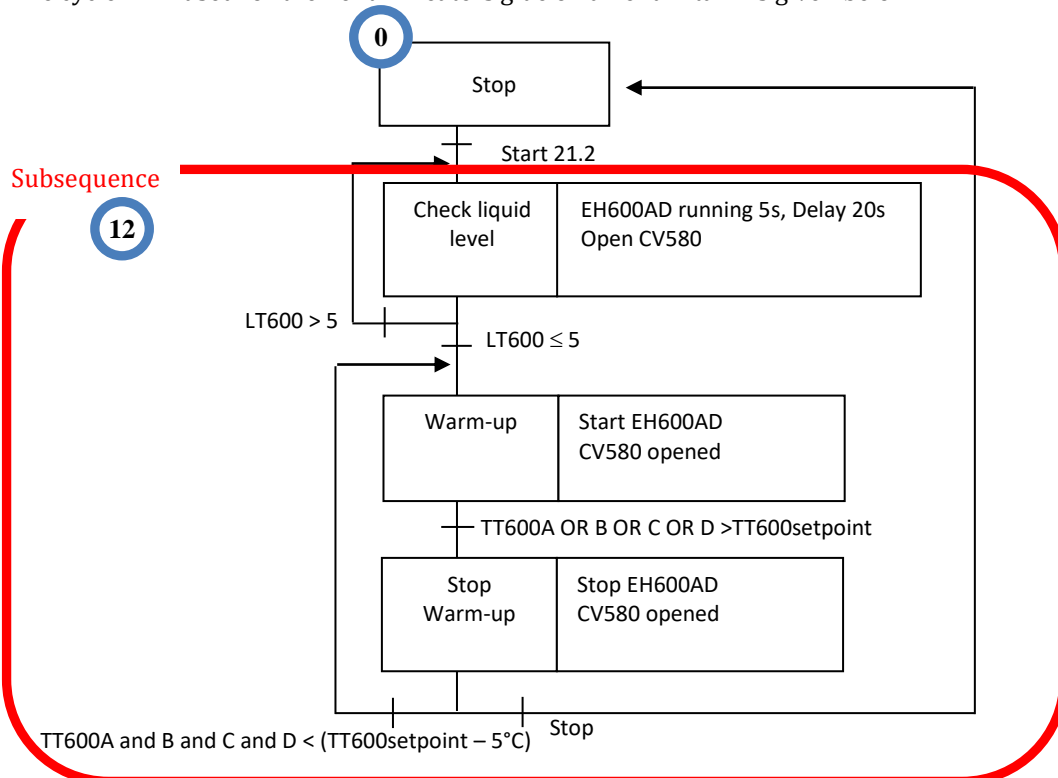

The table 2 gives the list of heaters implicated in the warm-up of the thermal shields.

Heater	Thermometer	Temperature setpoint
EH701AB	TT701AB	TT701setpoint
EH702AB	TT702AB	TT702setpoint
EH703AC	TT703AC	TT703setpoint

21.2: Warm-up of the helium tank

The cycle 21-2 used for the helium heaters glue on a helium tank is given below:
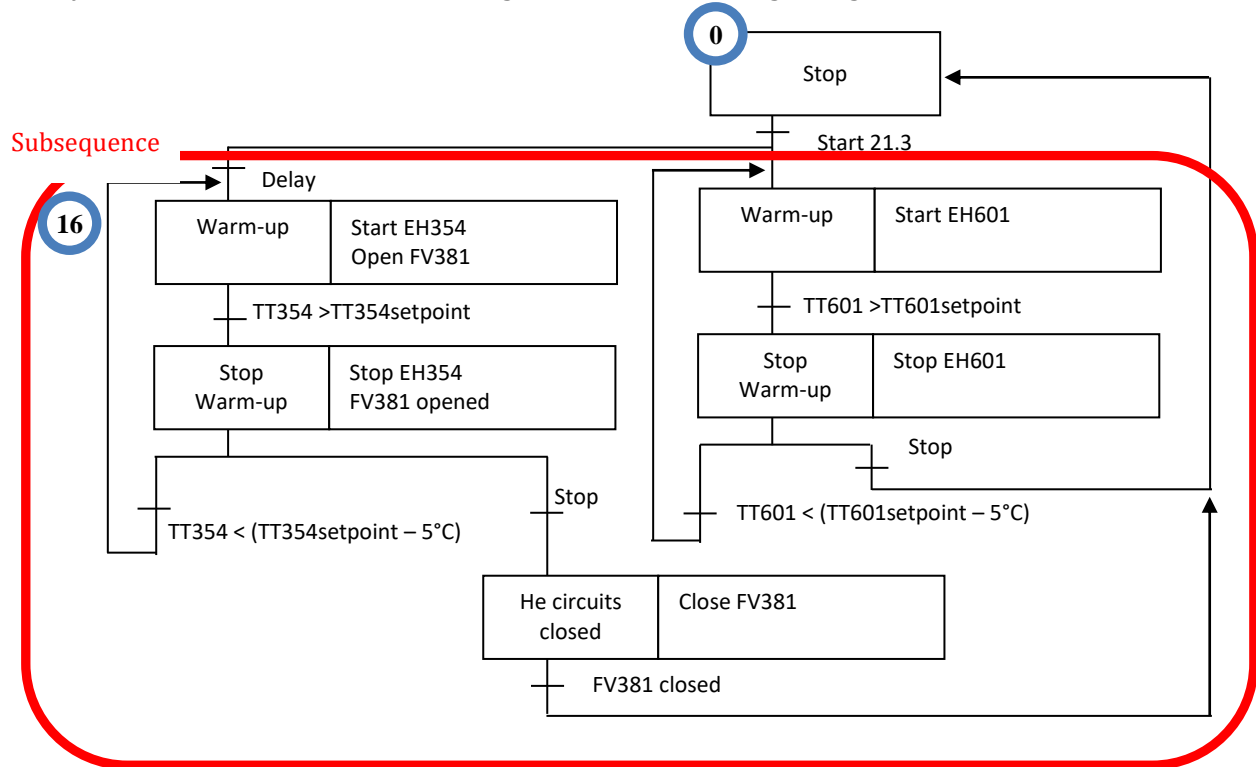

The table 3 gives the list of heaters implicated in the warm-up of the helium tanks.

Heater	Pt thermometer	Level	Temperature setpoint	CX thermometer	Temperature threshold
EH600AD	TT600AD	LT600	TT600setpoint	TT603	30K

21-3: Warm-up of the helium heat exchangers

The cycle 21-3 used for the helium heaters glue on the heat exchangers is given below:

The table 4 gives the list of heaters implicated in the warm-up of the heat exchangers.

Heater	Pt thermometer	Level	Temperature setpoint	CX thermometer	Temperature threshold
EH601	TT601		TT601setpoint	TT606	30K
EH354	TT354		TT354setpoint	TT355	50K