Helium Operators Familiarization Program

Unit 324/325 – He 1 - He 2 main differences

Dec 2012 I Vincent HELOIN

Lessons learnt from He I

- Turbines T1 T2 in series
  - He I: T1 & T2 were started using bypasses
  - He II: T1 & T2 start as a train
  - ⇨shorten T1 & T2 starting time

- Loading sequence / Distribution lines
  - Containers pulling
    - He I: Through liquefier or recovery compressor
    - He II: Unit sized to perform pulling through recovery compressor
  - ⇨avoid liquefier heat exchangers clogging in case of containers contamination

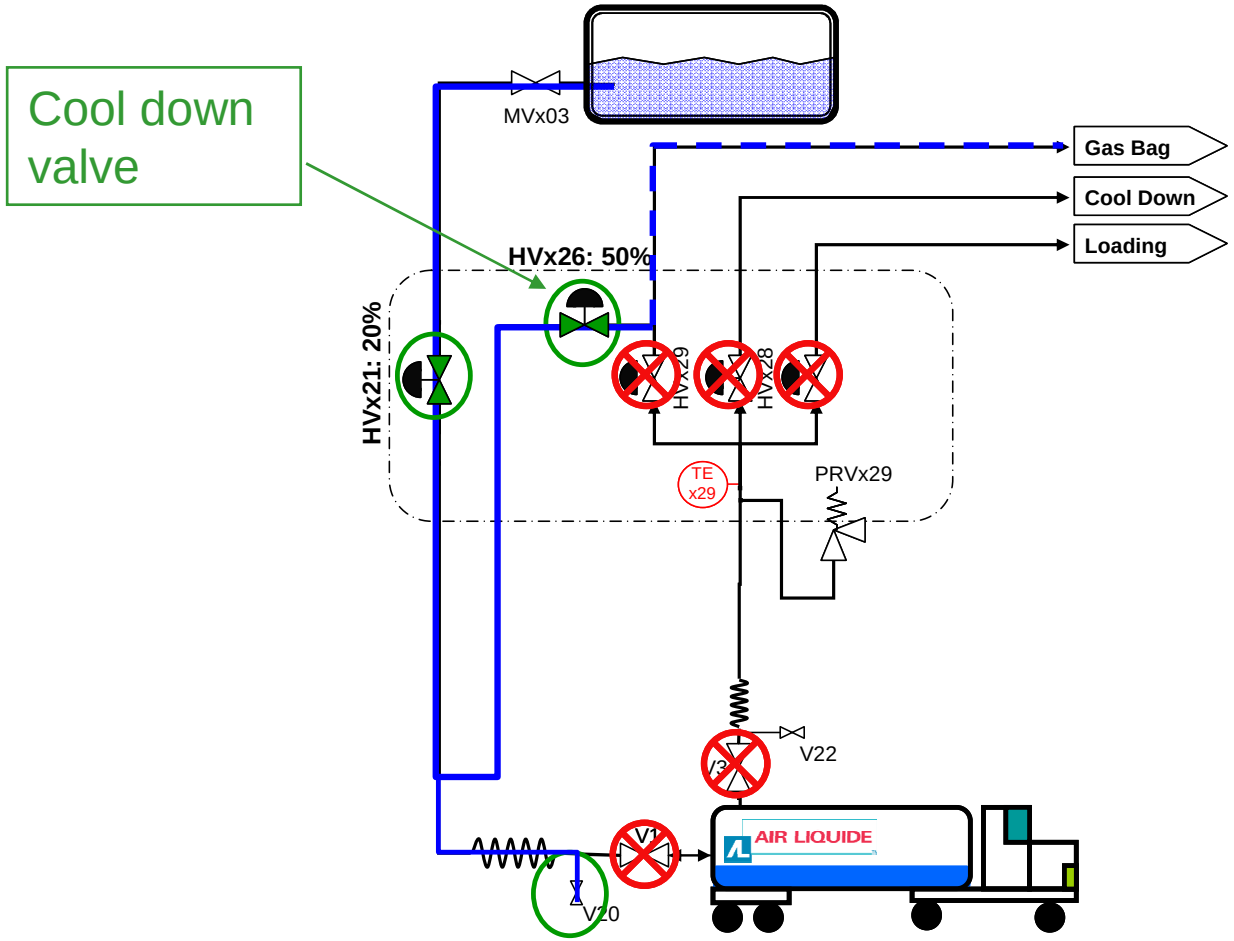
  - One LHe tank per bay
  - ⇨Sufficient storage volume

  - T6 stability
    - Process is designed to allow for higher vapour fraction downstream of JT valves
    - Gas return to liquefier is less disturbed by loading scenario
    - T6 Bypass is smaller in He II (with regard to He I)
  - ⇨increase T6 stability

Lessons learnt from He I

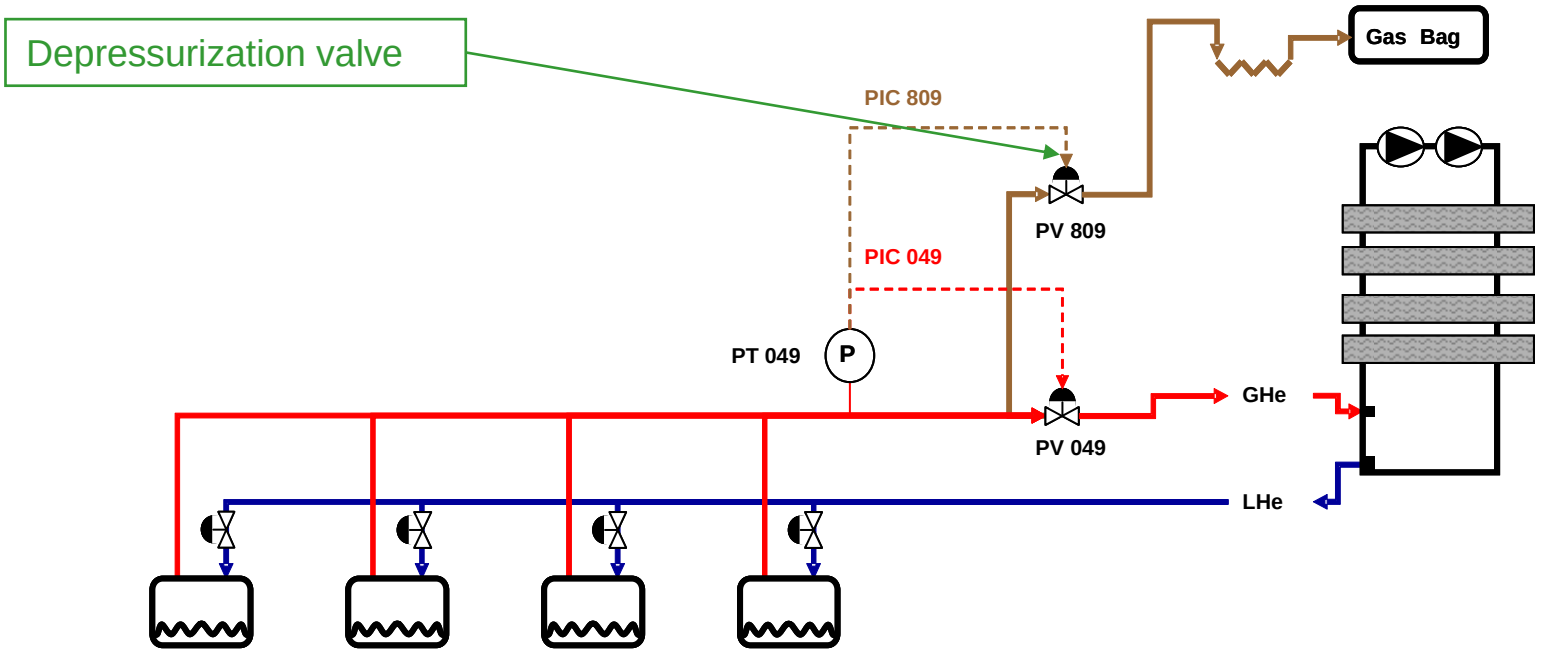
Loading line is equipped with cool down valve

- ⇨reduce the amount of warm gas sent to container



Lessons learnt from He I

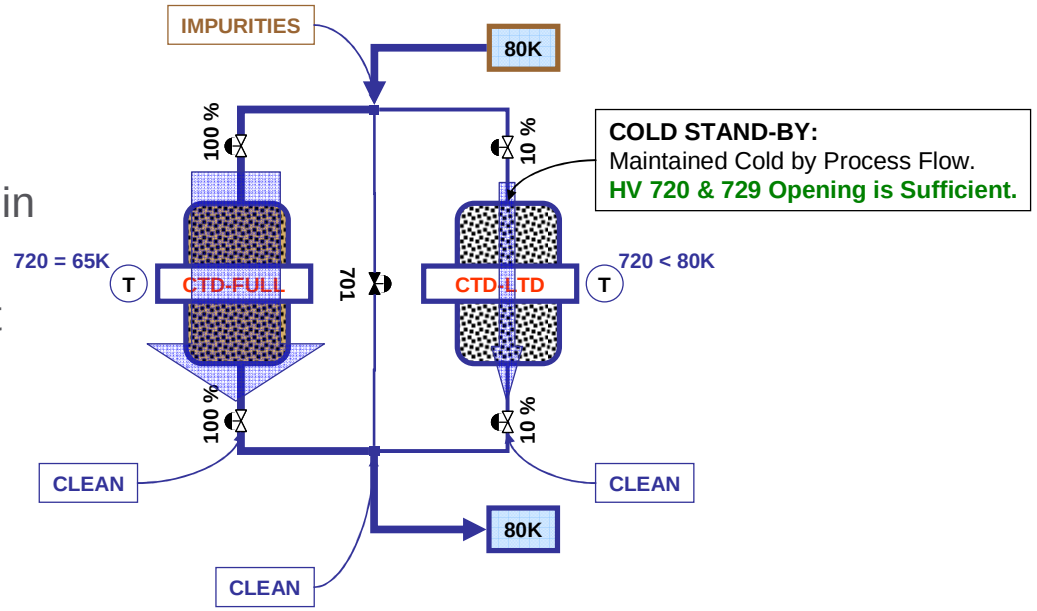
- Depressurization of storage tanks to gasbag
  - He I: In case of liquefier stop, storage tanks are isolated. Cold Ghe is vented to atmosphere before liquefier start
  - He II: GHe from storage tanks is depressurized to gas bag
  - ⇨LHe tanks are kept @ low pressure, restart time is shortened



Lessons learnt from He I

- T1 T2 stopped
  - He I: In case of T1 &T2 stop, liquefier is tripped
  - He II: In case of T1 &T2 stop, no trip is induced. Production is reduced.
  - ⇨Time to get back to production is reduced

- Adsorbers sequence
  - Cool down
    - He I: clean adsorber is kept in warm stand by
    - He II: clean adsorber is kept in cold stand by
  - ⇨Time to get back to production is reduced



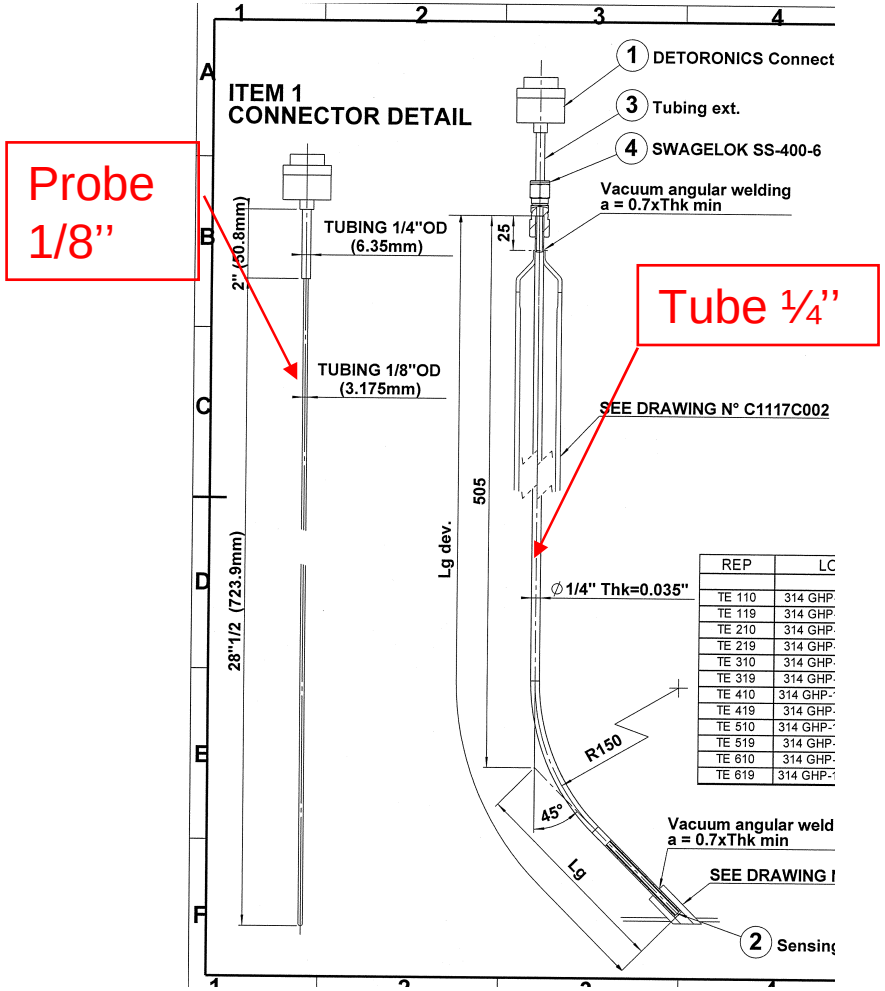
Lessons learnt from He I

- Adsorbers sequence
  - Warm-up
    - He I : electrical heater
    - He II: atmospheric heater
  - ⇨Blower inlet temperature steady, avoid overheating of pipes
  - 20K adsorption time
    - He I 50 hours
    - He II 10 days + 100% Margin
  - ⇨Regeneration loop less used, less impact on liquefier load
  - No priorization of 20K adsorber over 80K
    - He I: during a 80K regenration sequence, if a 20K regenration is ordered, the 80K regen is stopped
    - He II: no priorization of 20K over 80K. When both are requested, 80K starts first

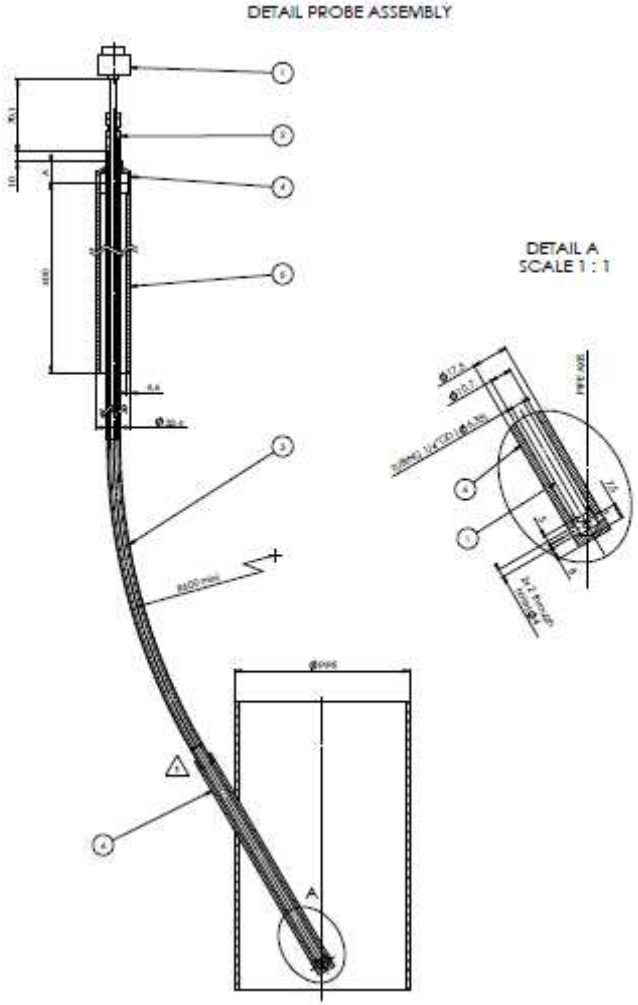
He I versus He II

- **Temperature sensors:** More robust design

He I: probe 1/8” OD, tube ¼” OD

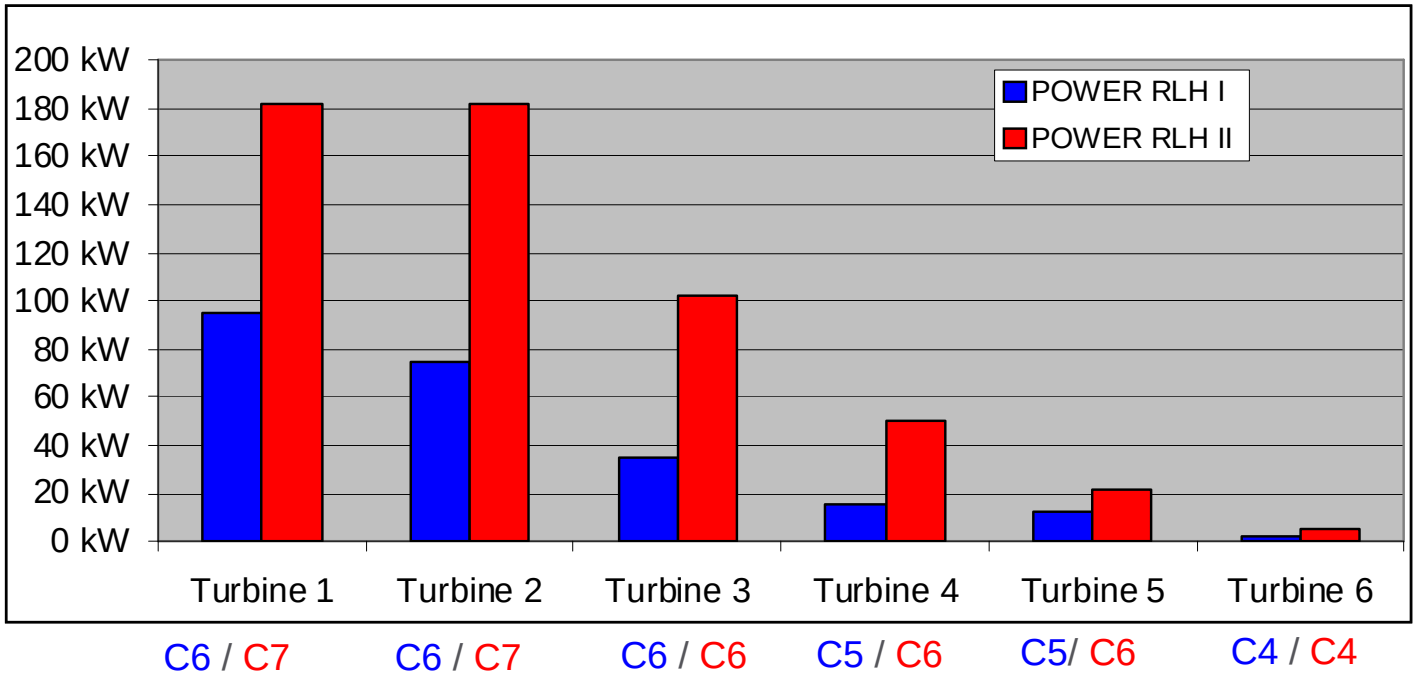


He II: probe 1/4” OD, tube 1/2” OD



He I versus He II - Turbine size and type

TURBINE	POWER RLH I	POWER RLH II	RATIO
Turbine 1	95 kW	182 kW	192%
Turbine 2	75 kW	182 kW	243%
Turbine 3	35 kW	102 kW	291%
Turbine 4	15 kW	50 kW	333%
Turbine 5	12 kW	22 kW	183%
Turbine 6	2 kW	5 kW	217%



He I versus He II

- **Adsorbents**
  - He I 80K silicagel / 20K charcoal
  - He II 80K mol sieve / 20K charcoal
- **Buffer capacity - similar**
  - He I 9,2 TPD 100 M3
  - He II 20 TPD 400 M3 X 2
- **Gas bag capacity - similar**
  - He I 9,2 TPD 560 M3
  - He II 20 TPD 1400 M3
- **Recovery comp - similar**
  - He I 9,2 TPD 10 g/s
  - He II 20 TPD ~ 20 g/s