



Helium Operators Familiarization Program Unit 324/325 – Vacuum Principle

Dec 2012 | Vincent HELOIN



Course Agenda

■ Vacuum Circuits

■ Simplified PFD

■ Vacuum Automatic Sequence

■ Upper and Lower Deck vacuum integrity check

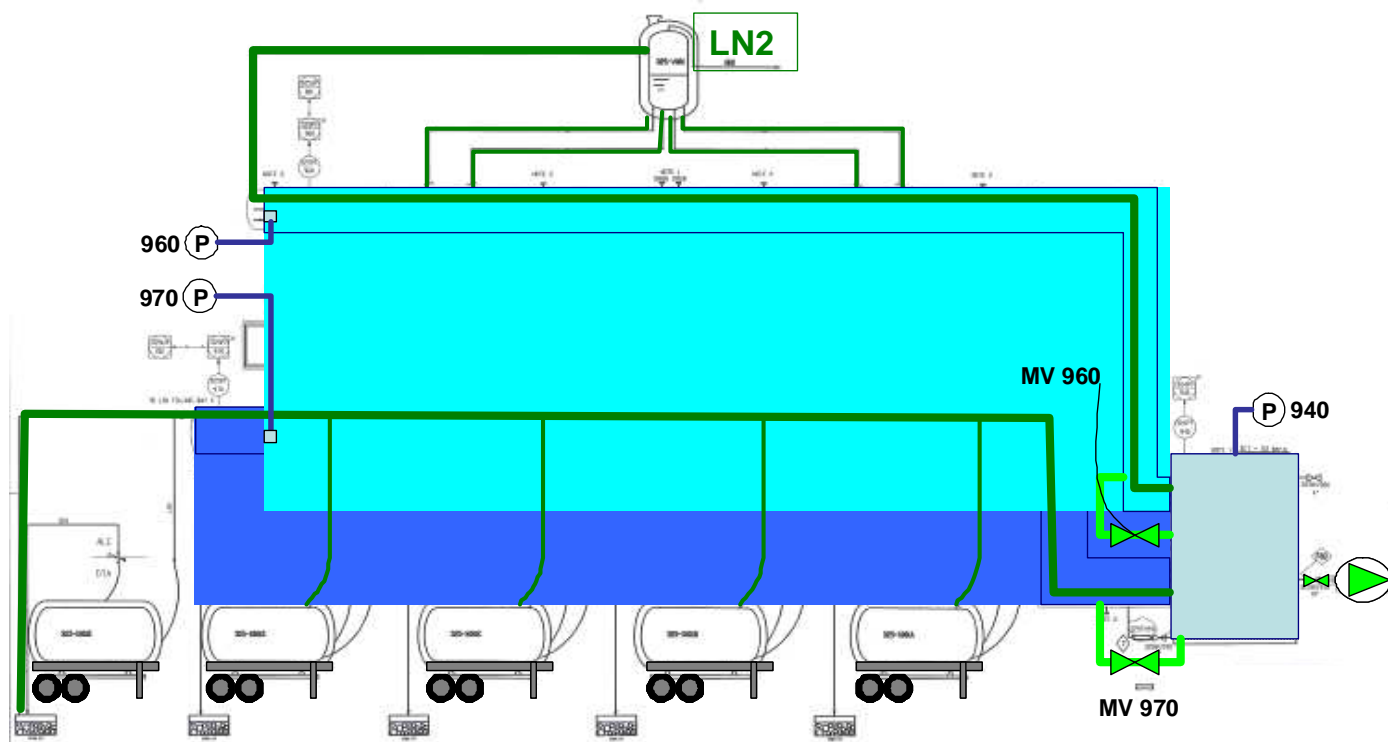
■ Vacuum Pumps

Vacuum Circuits

The following volume share a a common vacuum: (DYBAMIC VACUUM: 324 P 001 & 2)

- **LIQUEFIER** Vacuum directly connected to 324 P 001 & 2
- **UPPER** Vacuum Line (to Dewars) connected to LIQUEFIER Vacuum via 325 MV 960: 325 PT 960
- **LOWER** Vacuum Line (to Trailers) connected to LIQUEFIER Vacuum via 325 MV 970: 325 PT 970

Note: LN2 is used for shielding the He Cryogenic Lines. This further improves vacuum insulation.



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- Vacuum Circuits

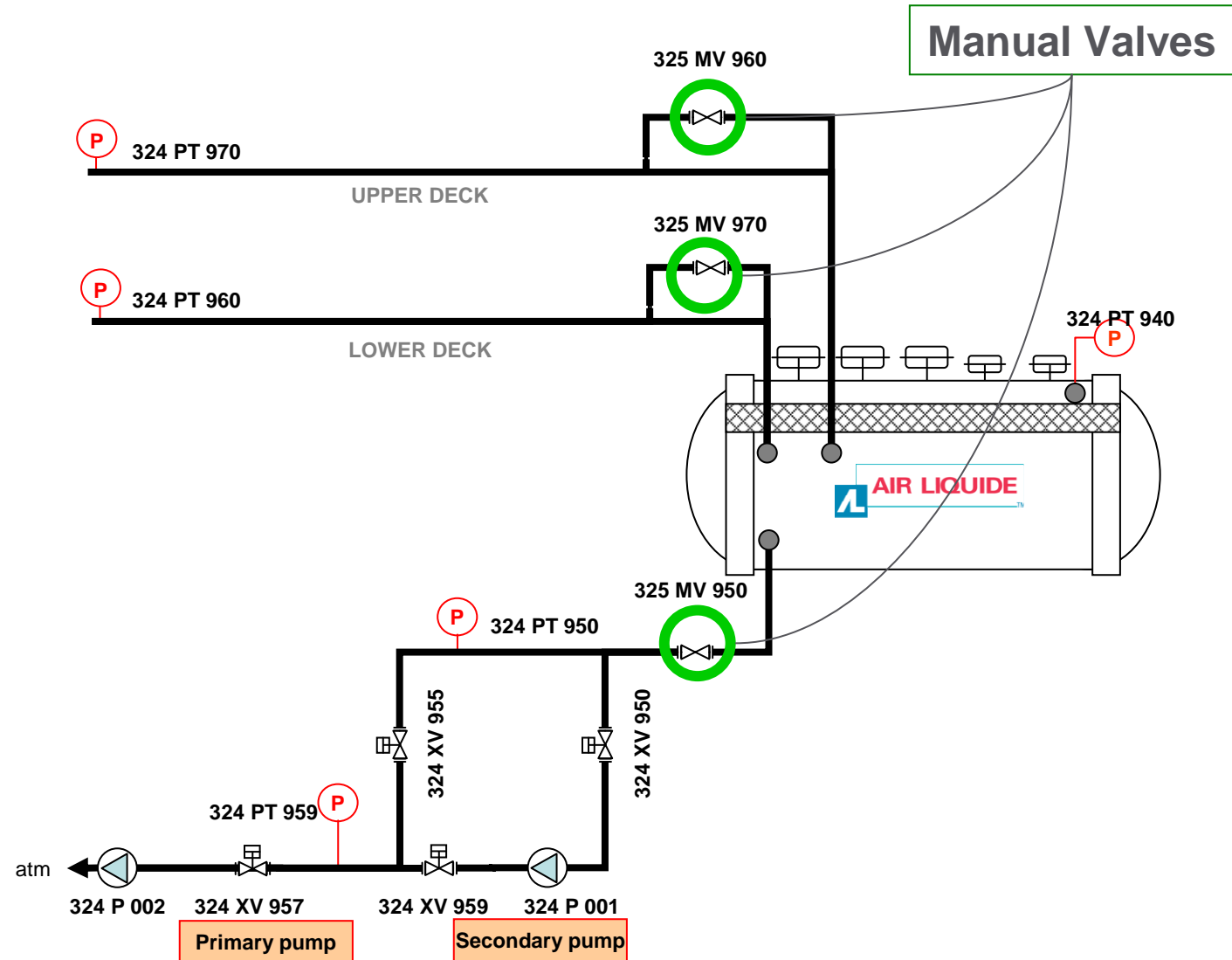
- **Simplified PFD**

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VACUUM: Simplified PFD



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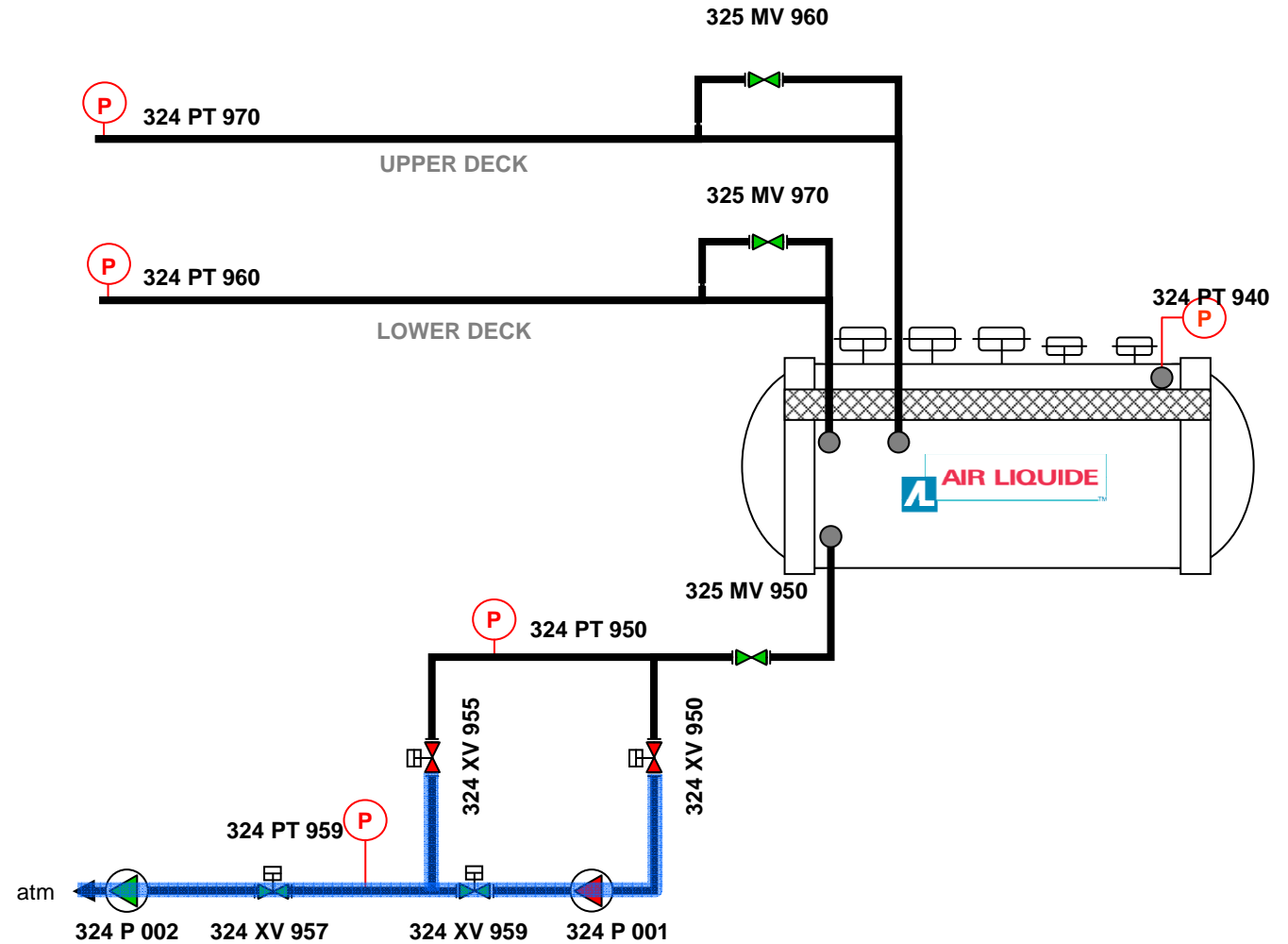
- Vacuum Pumps

VACUUM: Sequence – Step 1

⚠ No differential pressure on valves before opening.

Nota : 325 MV950 & 960 are normally open, except when performing integrity check

- Open 325 MV950
- Start Sequence
 - 324 XV 959 open
 - 324 XV 959 open
 - 324 P 002 Starts



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VACUUM: Sequence – Step 2

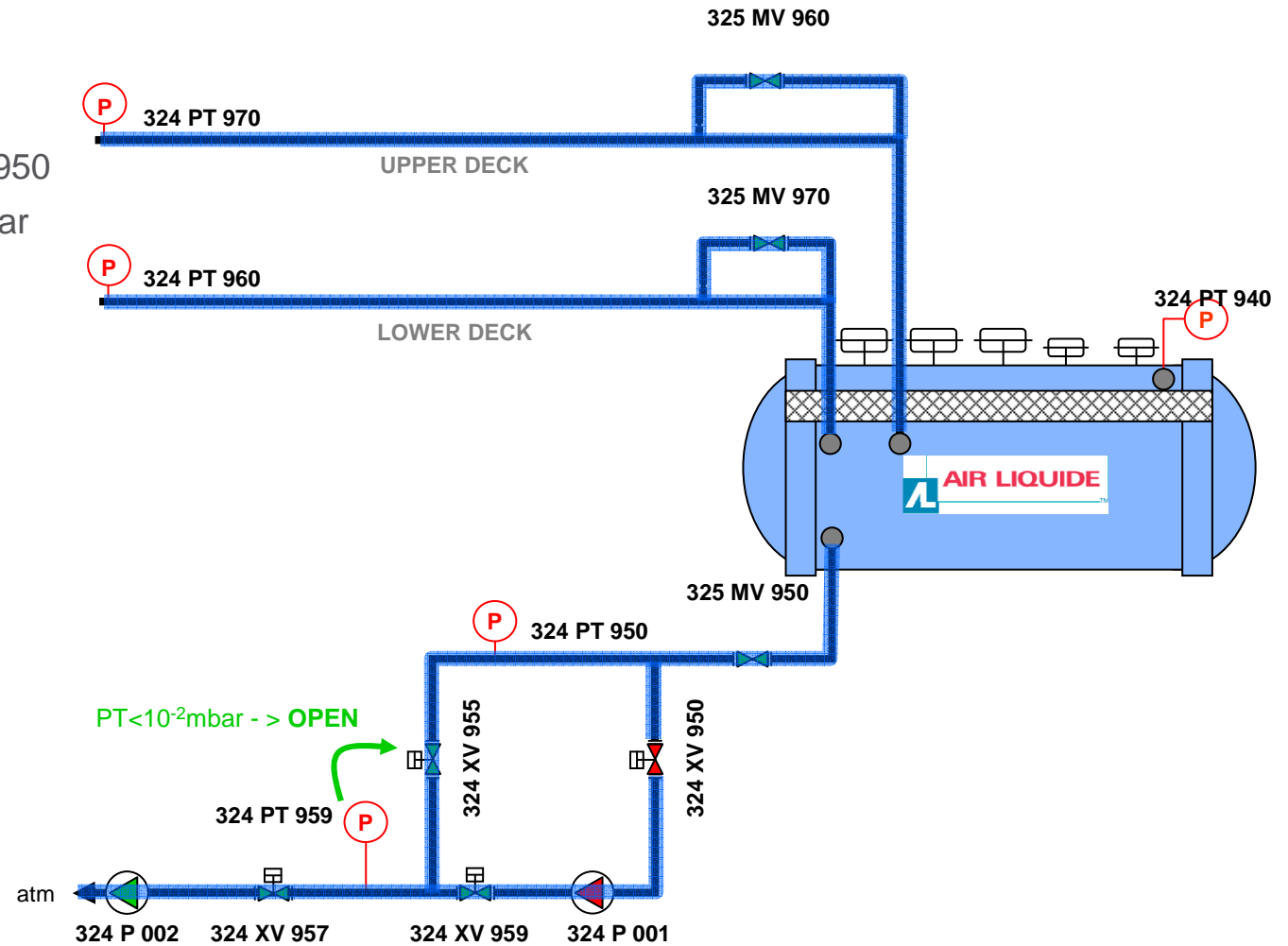
⚠ No differential pressure on valves before opening.

Nota : 325 MV950 & 960 are normally open (except to perform vacuum tests)

→ 324 PT 959 < 324 PT 950

→ 324 PT 959 < 10⁻² mbar

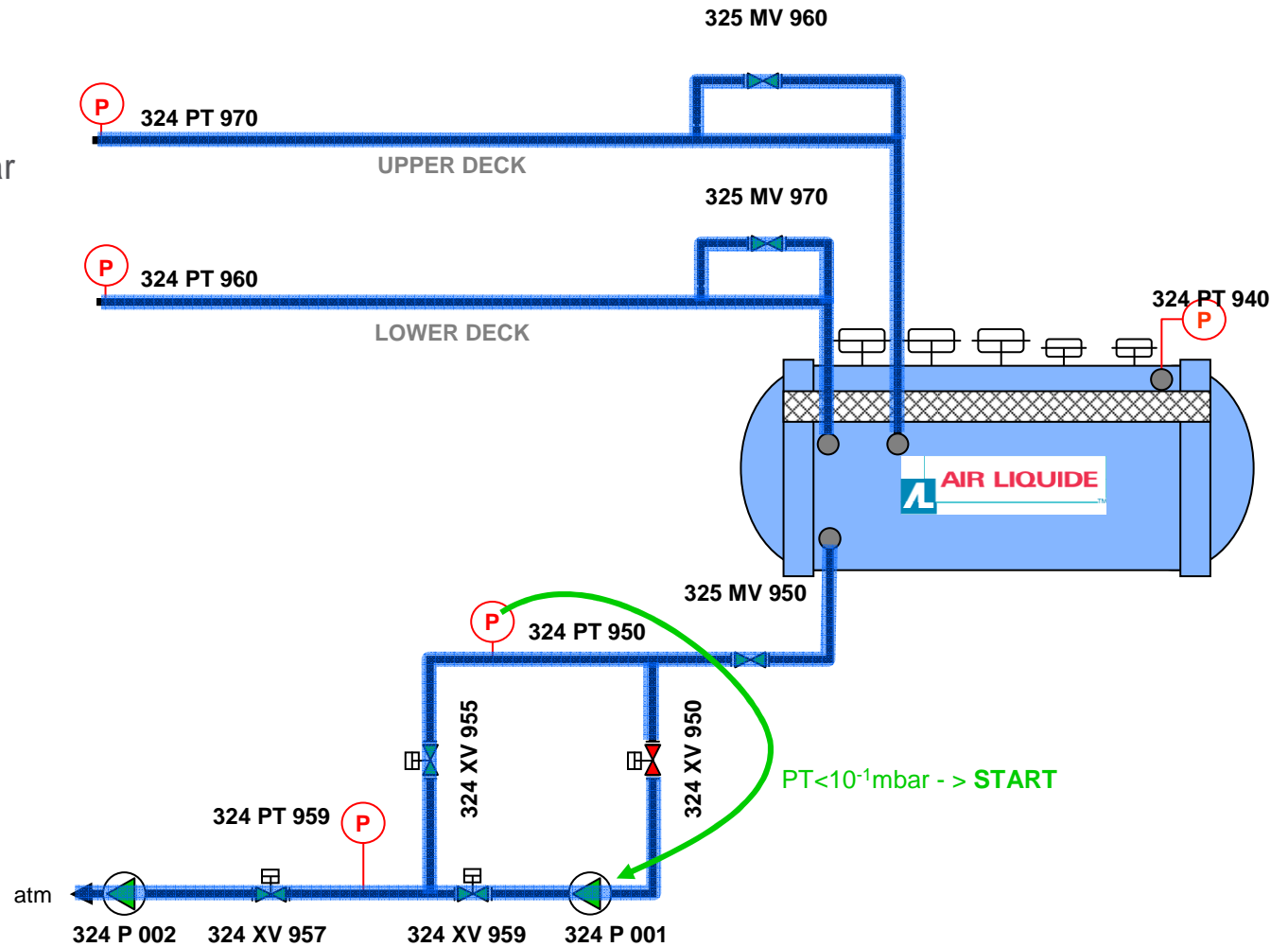
- 324 XV 955 open



VACUUM: Sequence – Step 3

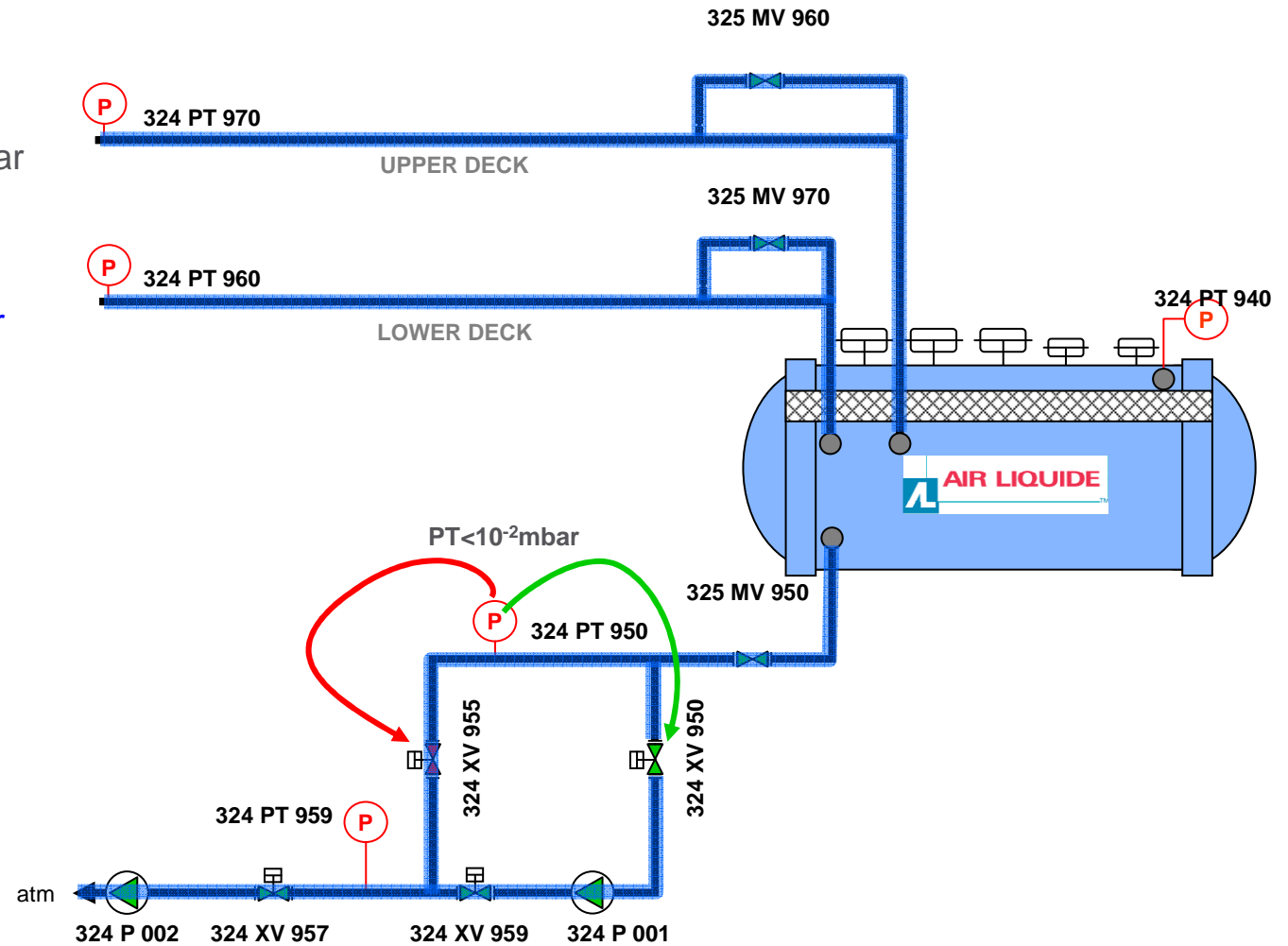
→ 324 PT 950 < 10⁻¹ mbar

- 324 P 001 Starts



VACUUM: Sequence – Step 4

- 324 PT 950 < 10^{-2} mbar
- 324 XV 950 Opens
- 324 XV 955 Close
- 324 PT 950 < 10^{-3} mbar
- NOMINAL STEP



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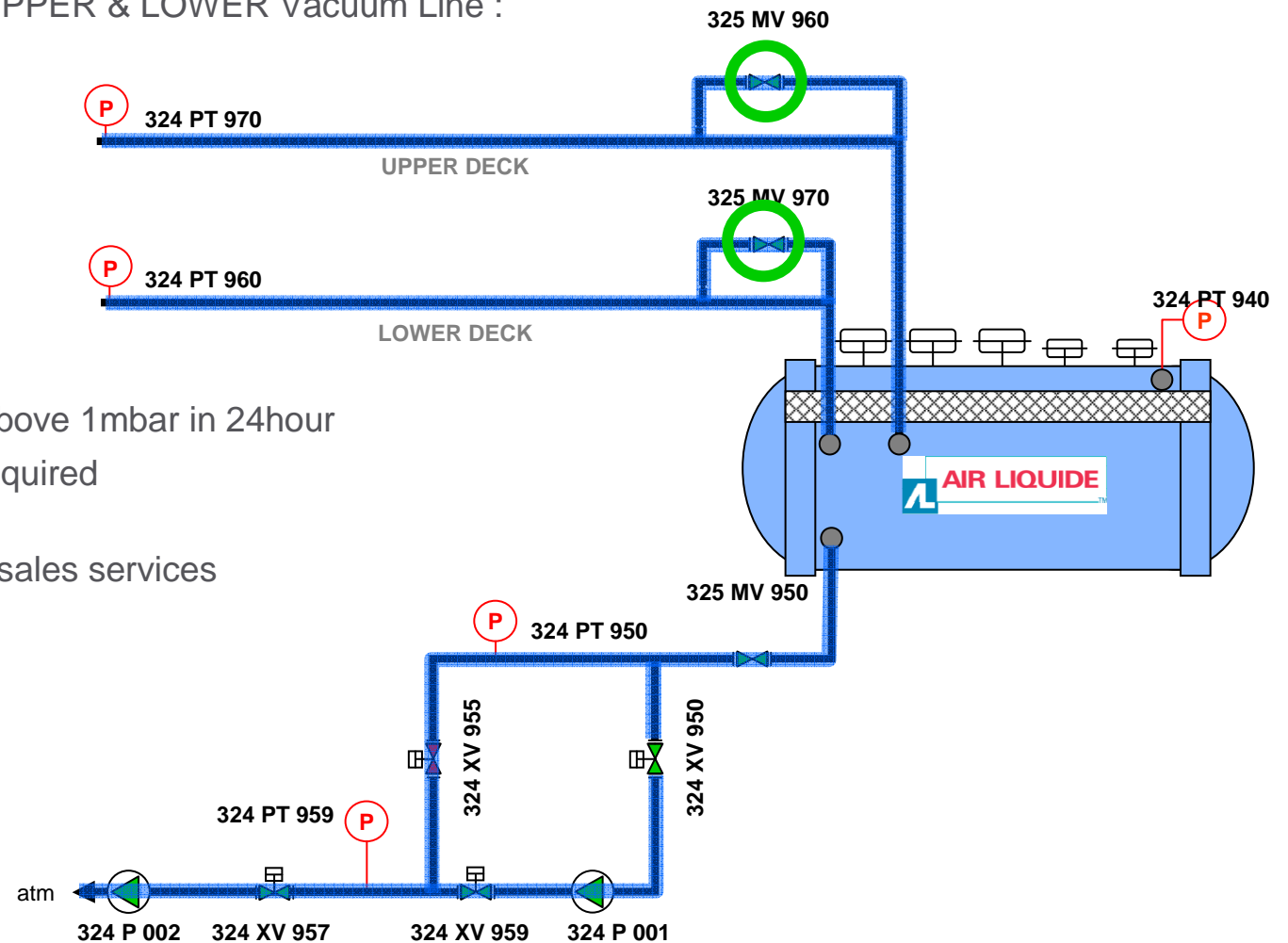
VACUUM: Integrity Check of Upper and Lower Deck

To Check the Integrity of the UPPER & LOWER Vacuum Line :

- Close 325 MV 960 (or 970)
- Check 325 PT 960 (or 970)
- Open 325 MV 960 (or 970)

-> If Pressure has increased above 1mbar in 24hour
Leak Search and repair is required

-> Contact AIR LIQUIDE after sales services



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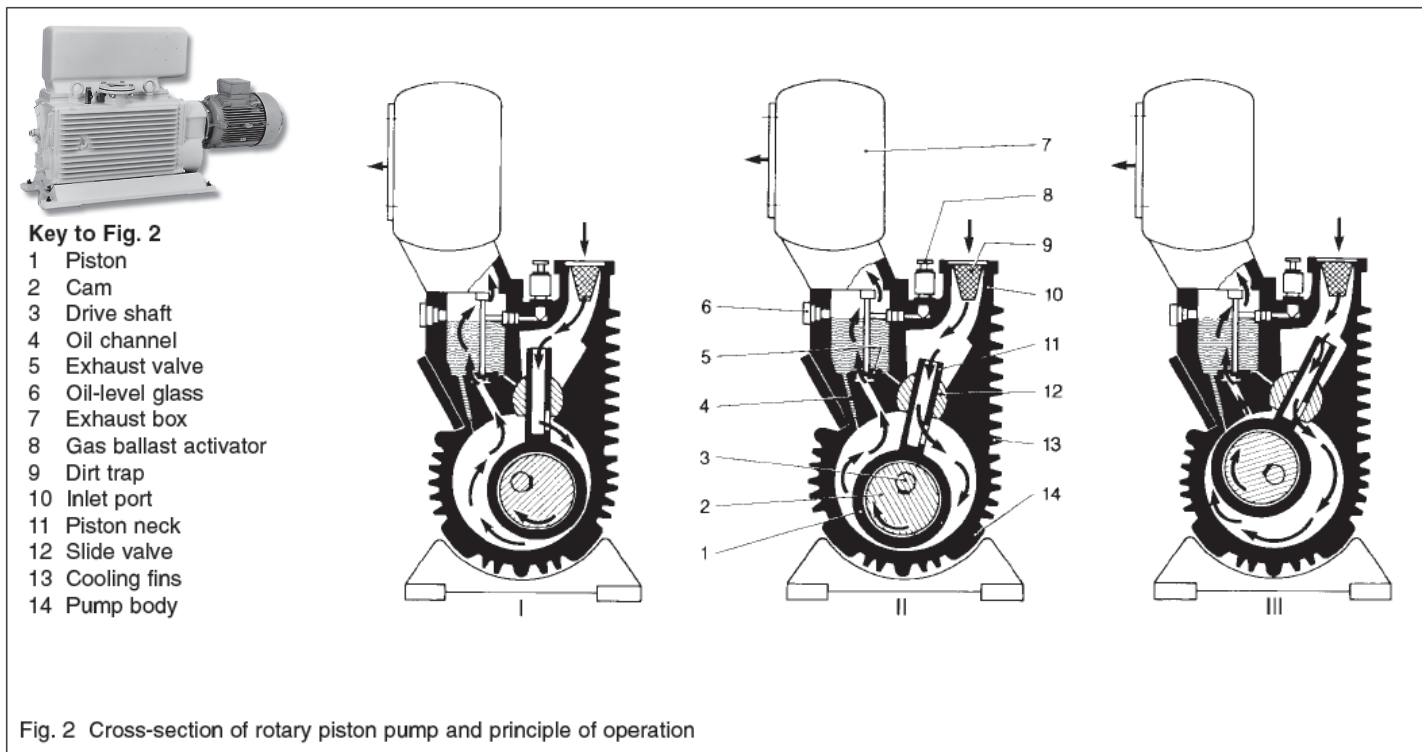
- Vacuum Circuits
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■ Vacuum Pumps

Vacuum Pumps – Primary Pump

The primary pump is a OERLIKON DK200 Rotary Piston Type with a capacity of 200m³/h

⚠ WARNING: Check oil level prior to start-up. Check oil level weekly.



Vacuum Pumps – Secondary Pump

The secondary pump is an Oerlikon DIP3000 Oil Diffusion Pump with a flow capacity of 3000 l/s.

⚠ WARNING: Check oil level prior to start-up. Check oil level weekly.

- Oil is boiled at the base of the pump.
- Oil molecules escape to produce a supersonic vapor (400-400 m/s)
- Vapour are directed towards the sides.
- Air molecules that are have diffused into the vicinity are compressed against the jets and entrained.
- The upper part of the pump wall is cooled by circulating cold water through coils wrapped around it. When the oil vapor strikes the upper pump wall, it condenses into liquid and sinks to the bottom of the pump taking the adsorbed air molecules with it.
- At the bottom, the heater reboils the oil, releasing the air molecules, producing a build up of air molecules in the lower region. A port that is attached to a mechanical pump removes these air molecules.

