Oil Sealed Rotary Pumps
Understanding Gas Ballast
Rotary Vane Pump Sequence

1. Induction
   - Expansion phase
   - Low pressure

2. Isolation

3. Compression
   - Compression phase
   - High pressure

4. Exhaust
   - Boyles Law

Boyles Law
Rotary Pump Gas Loads

- Gas loads for Rotary Pumps may contain both permanent gas and **vapors**.
- Vapors can condense (liquefy) in the compression cycle and mix with the pump oil to contaminate the oil and at worst, form an **emulsion**.
- In many industrial applications the vapor is water vapor that condenses to water, but it can be other liquids too.
- This mixture of oil **and liquid contaminant** circulates through the pump and causes:
  - Reduced vacuum performance
  - Loss of lubrication and sealing
  - Possible Pump corrosion
  - Possible Pump seizure
Vapors condense on compression forming liquids that mix with the oil.
Gas ballast reduces vapor condensation

**Induction**
- Gas ballast valve open
- One way valve closed as gas in exhaust area is above atm. press.
- GAS & VAPOR

**Isolation & gas ballast**
- AIR ENTERS COMPRESSION CYCLE
- One way valve open as gas in exhaust area is below atm. press.
- GAS & VAPOR EXHAUSTED

**Compression & exhaust**
- One way valve closed as gas in exhaust area is above atm. press.
- GAS & VAPOR
• **By opening the Gas ballast valve on the rotary pump:**
  1. A small amount of air flows into the compression portion of the pump cycle.
  2. This additional air mixes with the gas/vapor being compressed.
  3. The gas/vapor mixture is now greatly diluted. There is more % of dry gas than % of vapors.
  4. There is now less tendency of vapors to condense.

• **Gas ballast benefit:**
  Vapors entering the pump tend to stay in the vapor state and exit the pump as a vapor.
  Over time Pump oil can be purged of condensate.
Effect of Gas Ballast

- Spoils ultimate vacuum
- Takes time, 2 hours or more
- Increases pump operating temperature
- Higher temperature improves vapor pumping capacity
- Oil level is reduced due to oil misting through exhaust.
- Vacuum pumps have limited capacity for vapor.
  (Consult pump manufacturer’s catalog)
Vapor pumping suggestions

- Warm pump up before pumping vapors
- Exhaust lines - Ensure exhaust condensate does not drip back into pump.
- Use inlet vapor trap for large amounts of vapor.
- Gas ballast before pump shutdown.
- Air can be used for gas ballast in most school, laboratory, and industrial applications.
- Dry nitrogen **must** be used in all semiconductor applications and others where reactive gases or vapors are present.
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End