

Using FTA to Reduce Capital Cost of Safety

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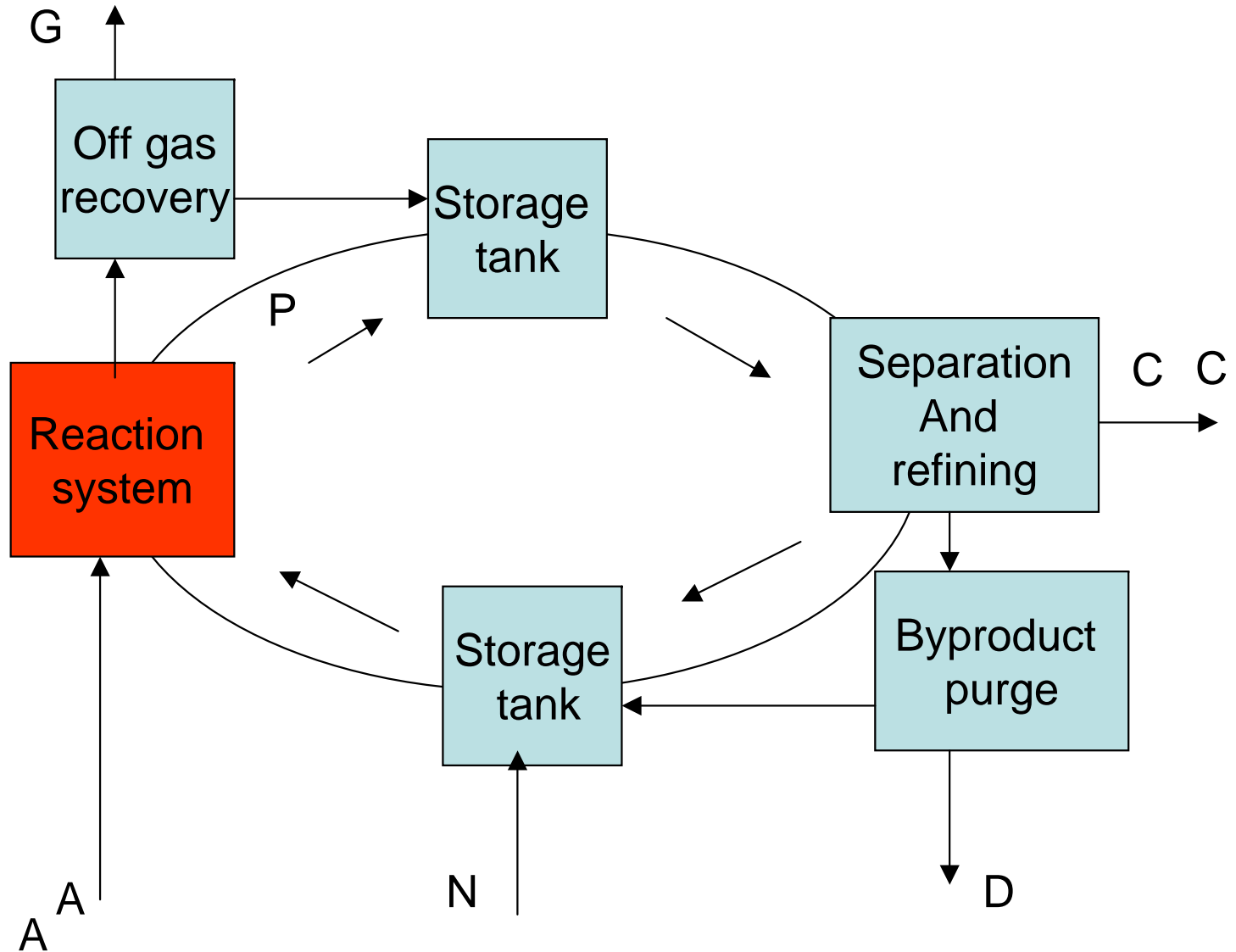
WZAKY TECH SERV

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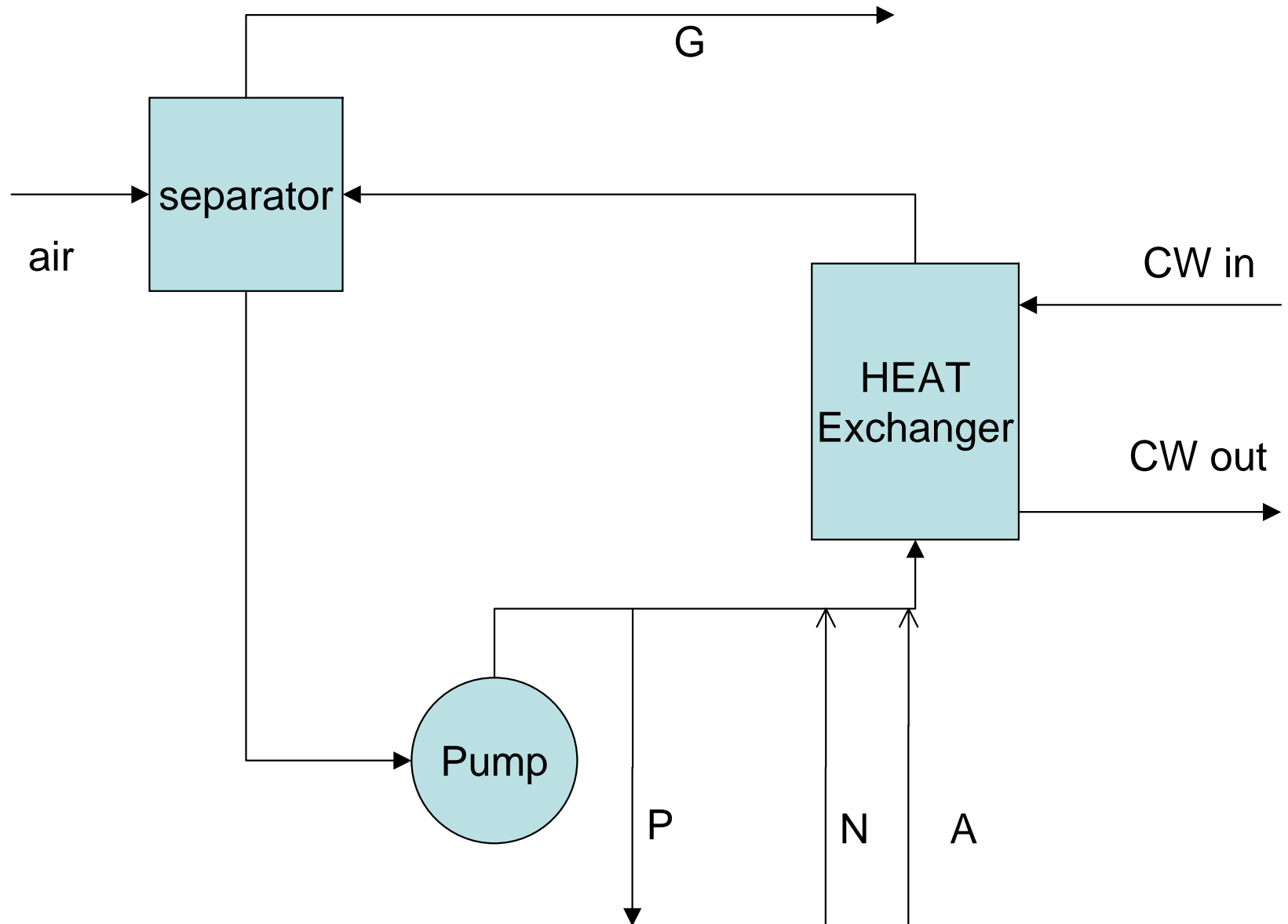
Summary

- FTA was used effectively to determine the weaknesses of the existing system and propose appreciable improvements in Process Safety with lower capital cost by taking a holistic view of process and taking credit of prior improvements to the process and instrumentation

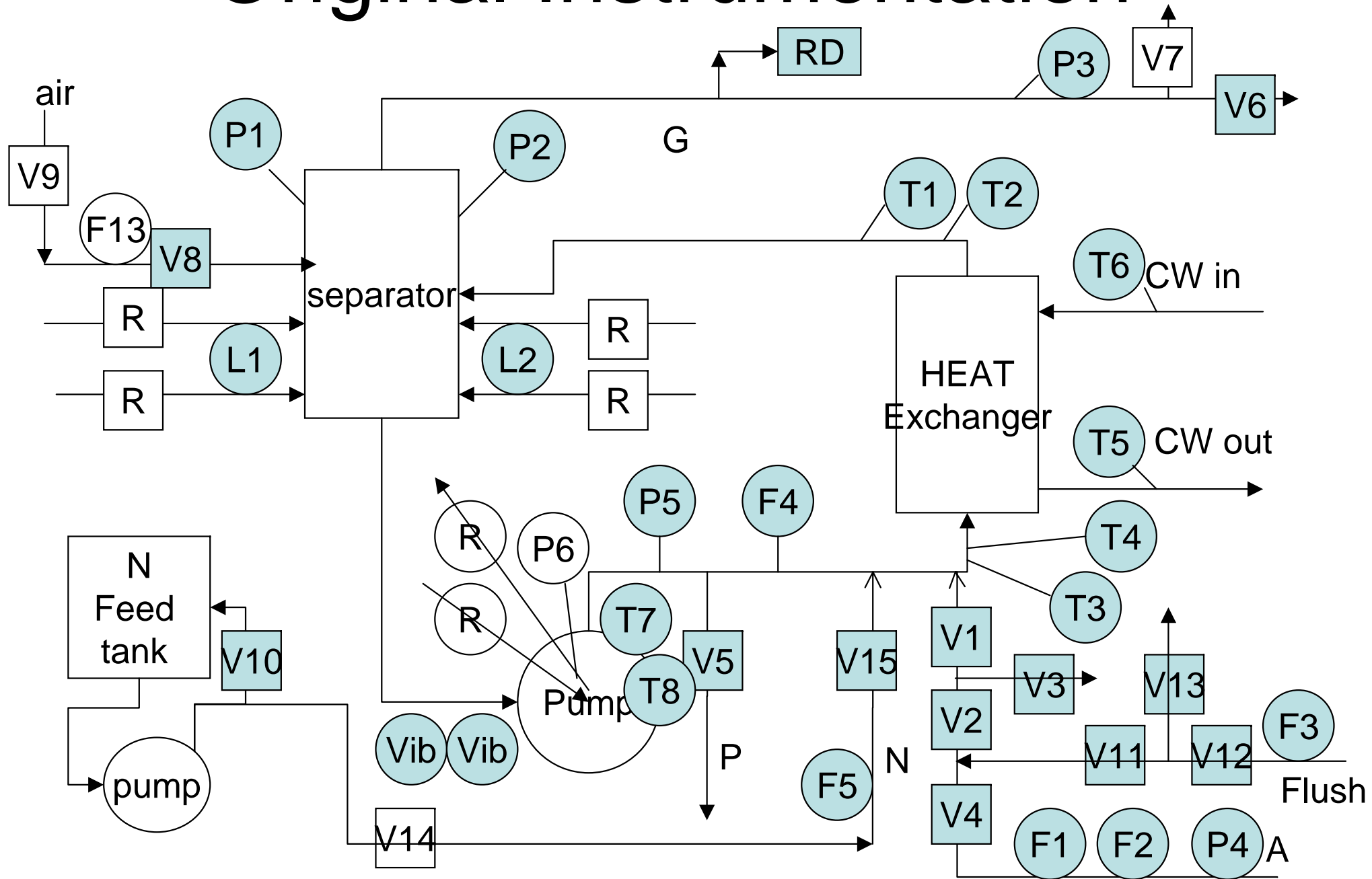
Overall process



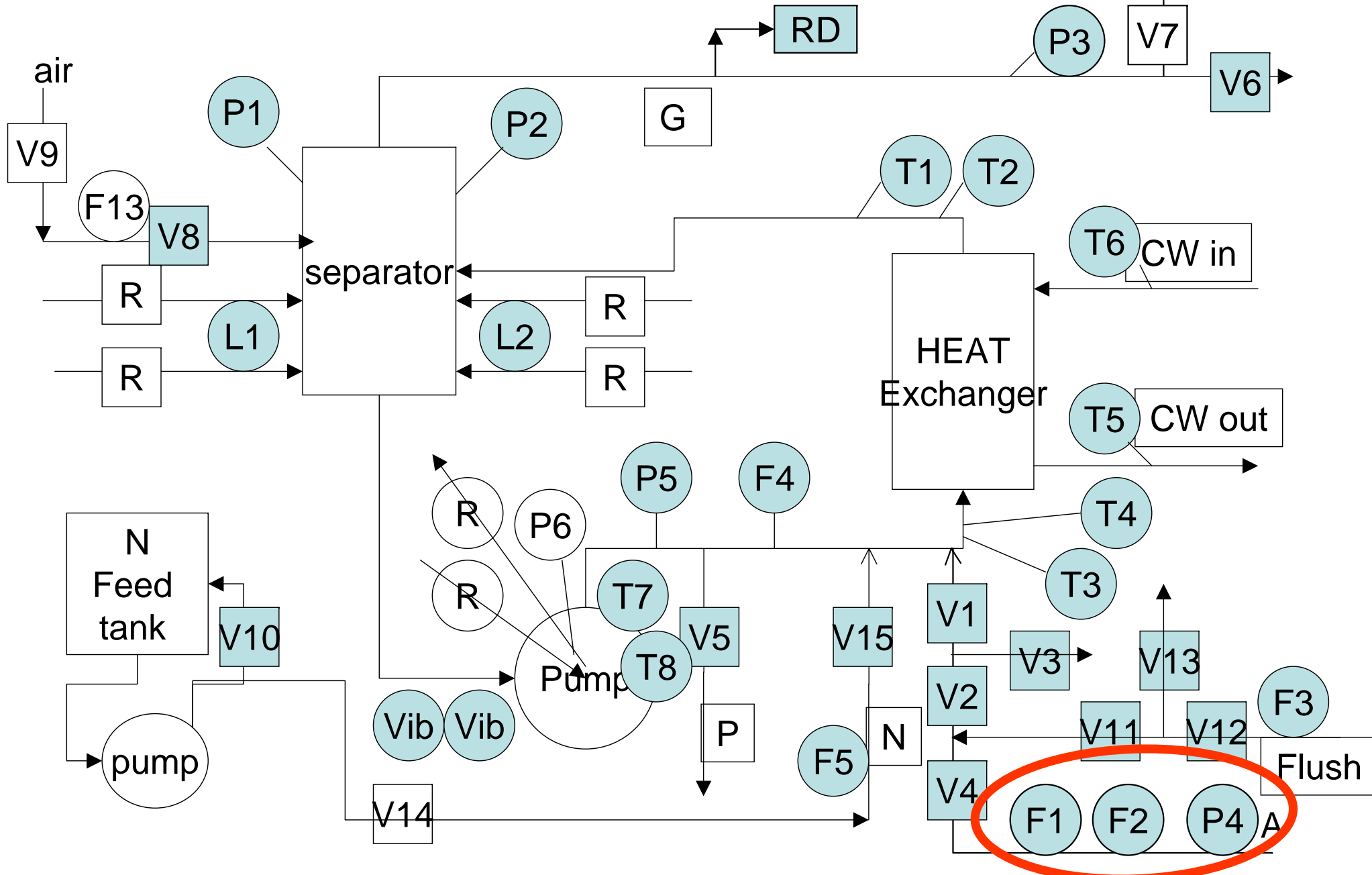
Reaction System



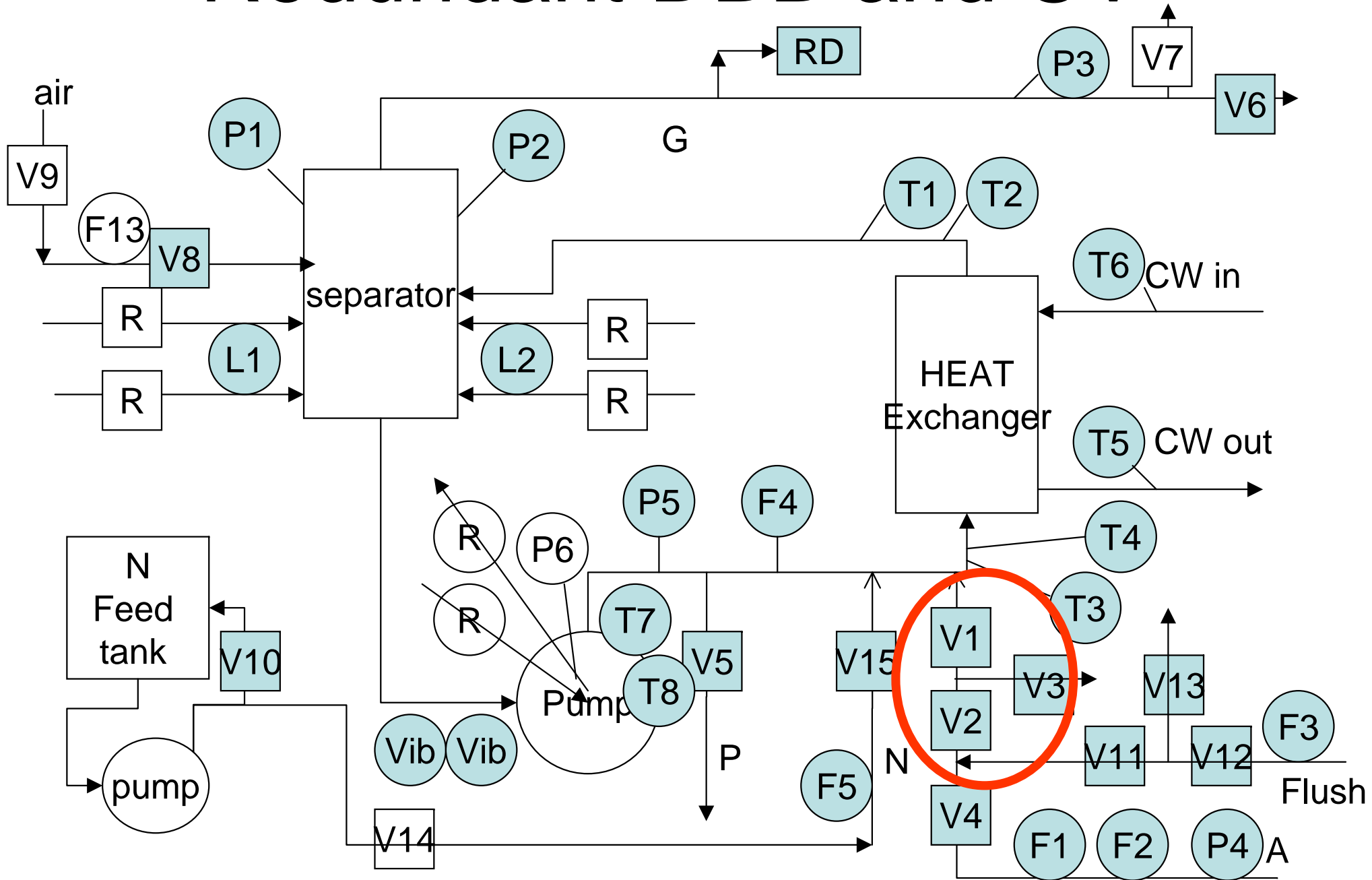
Original Instrumentation



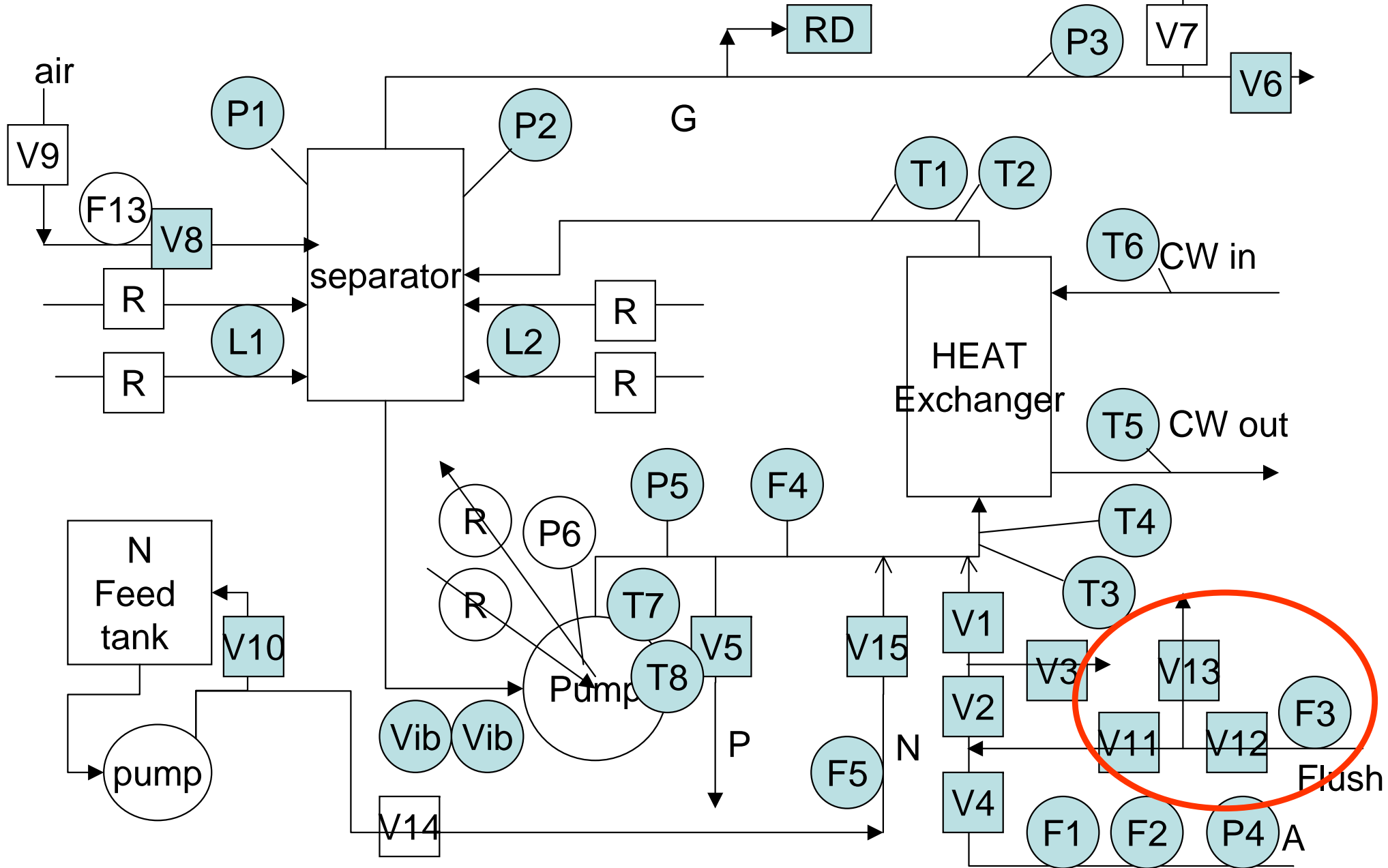
Redundant flow and pressure



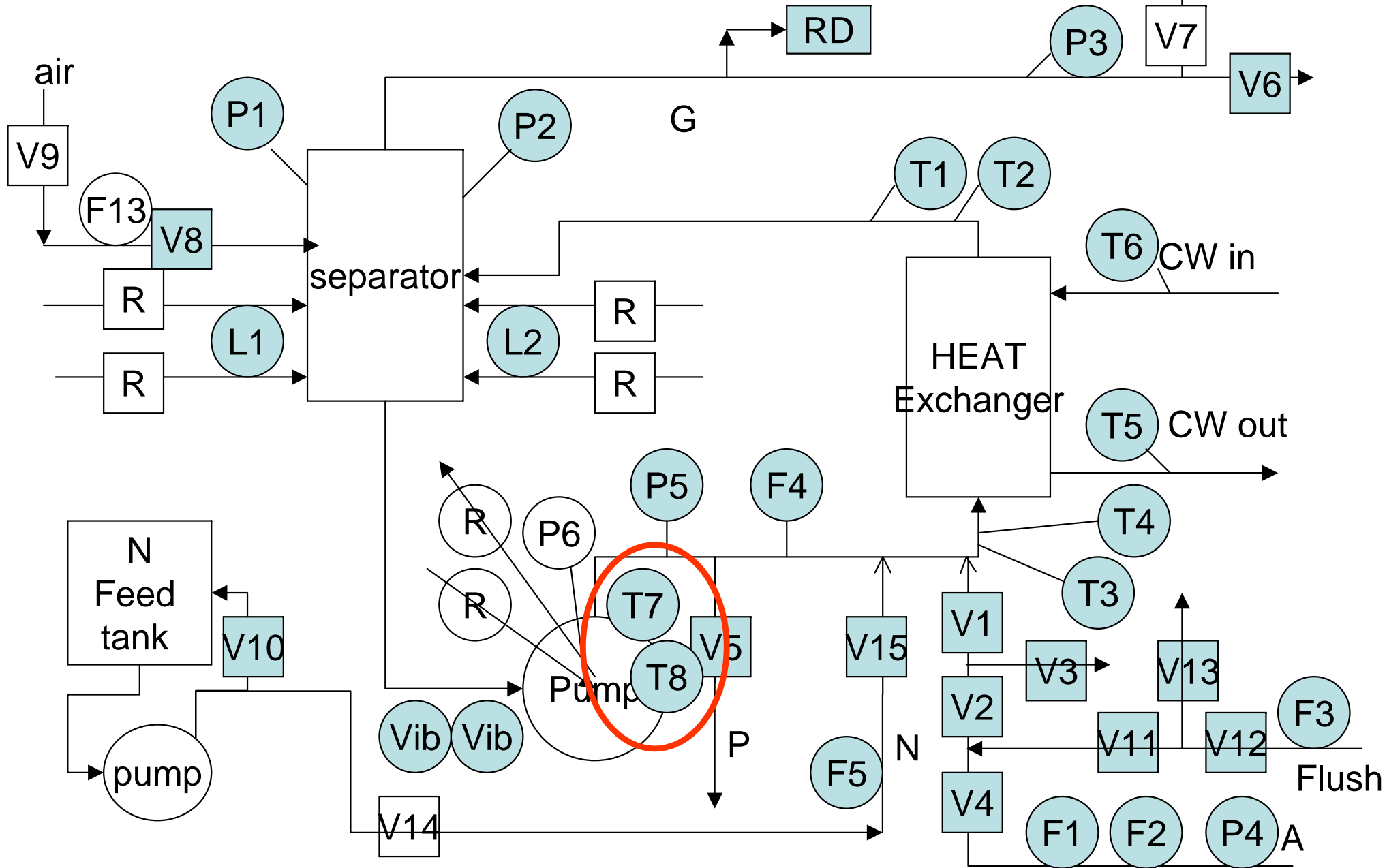
Redundant DBB and CV



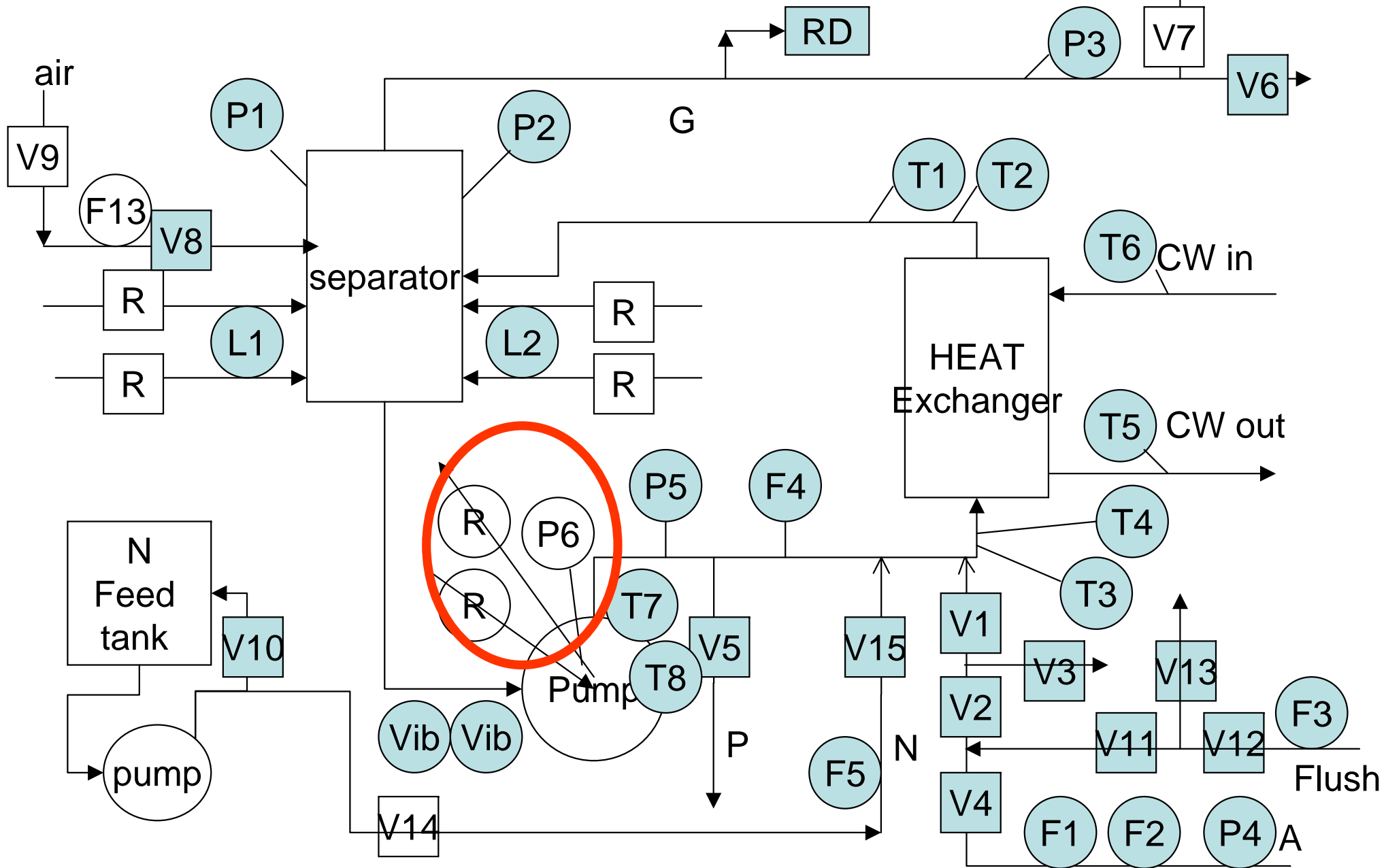
DBB and flushing medium



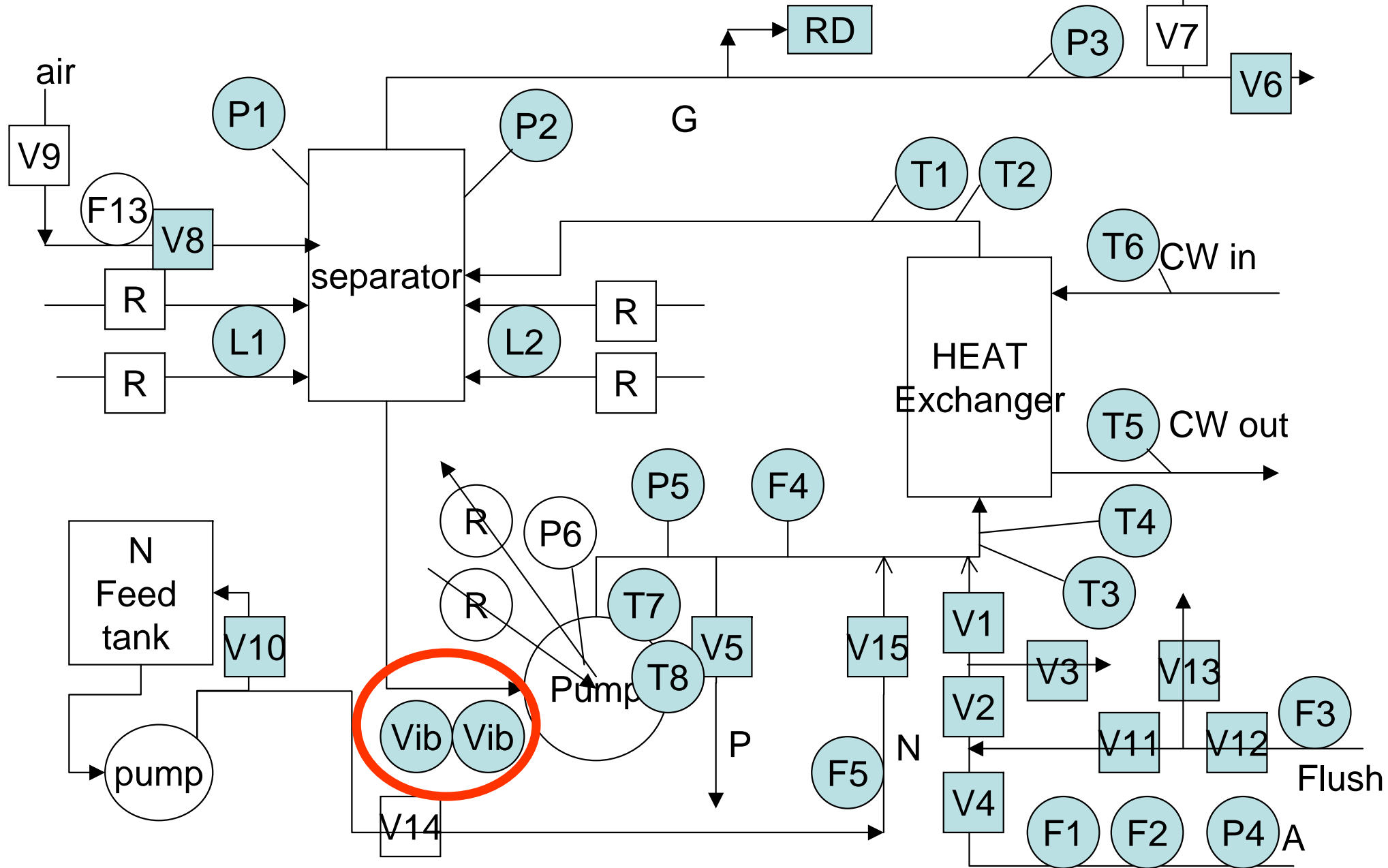
Redundant dead head temperature



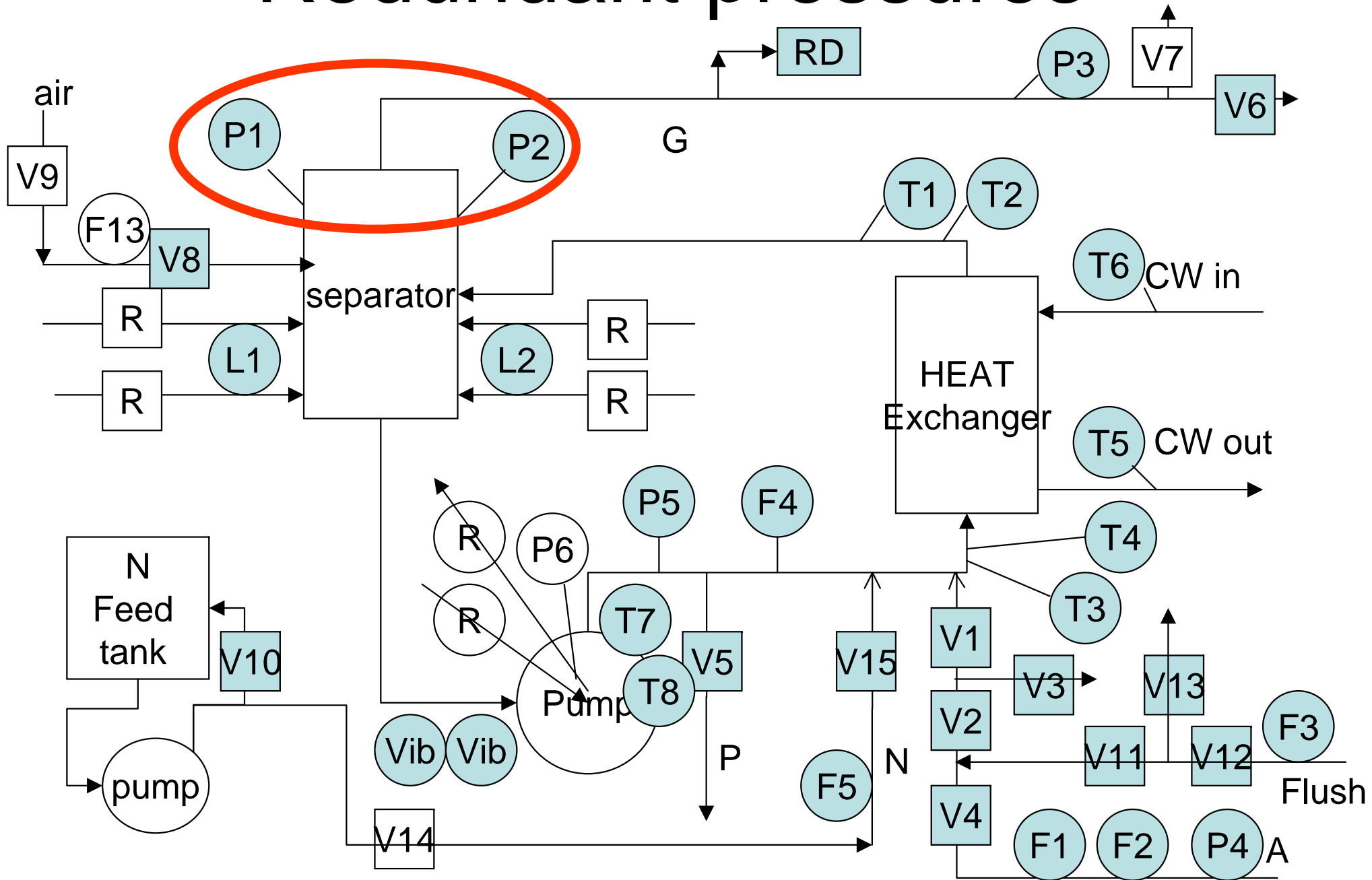
Seal flow in/out and pressure



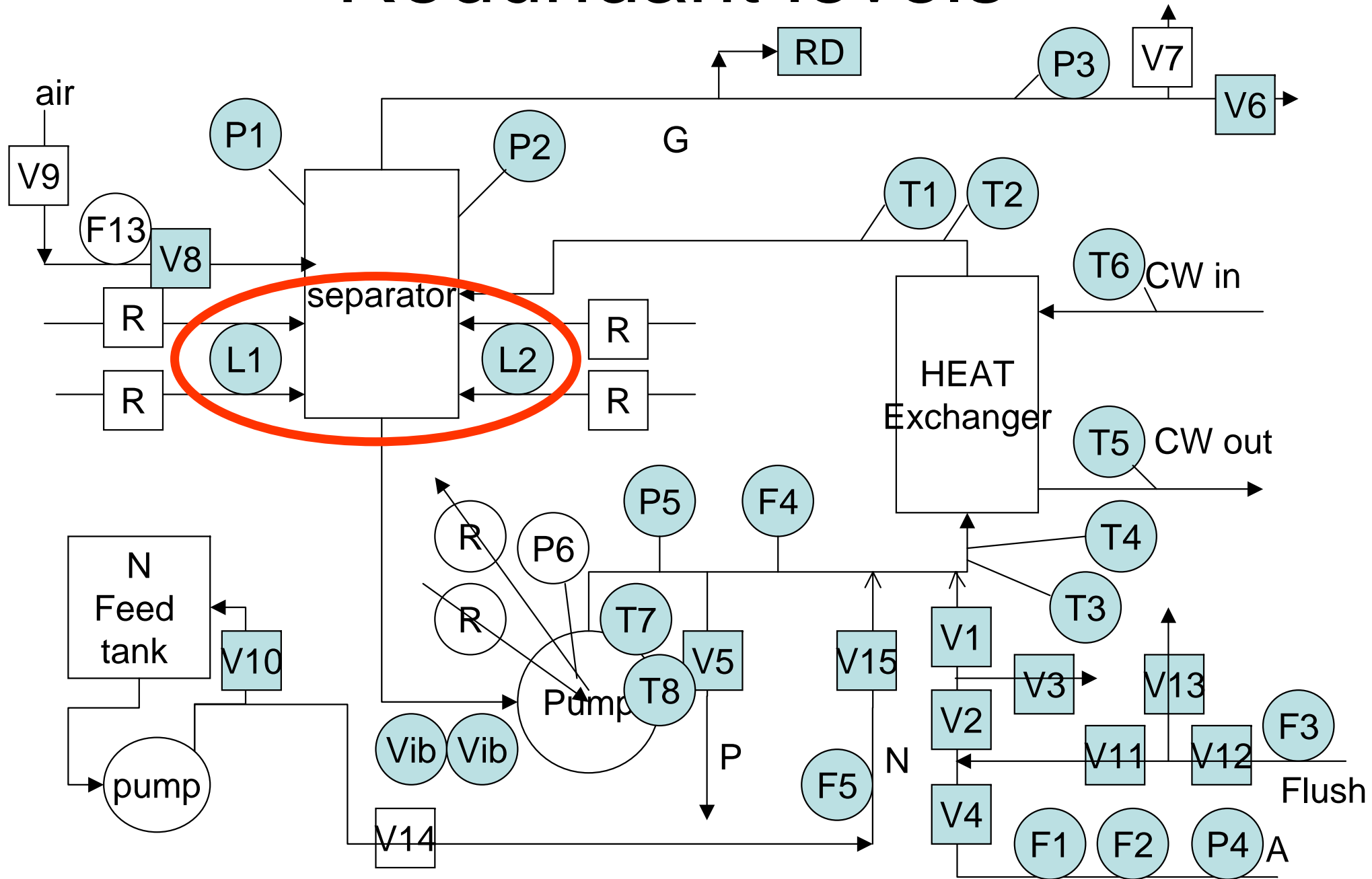
Redundant vibration detection



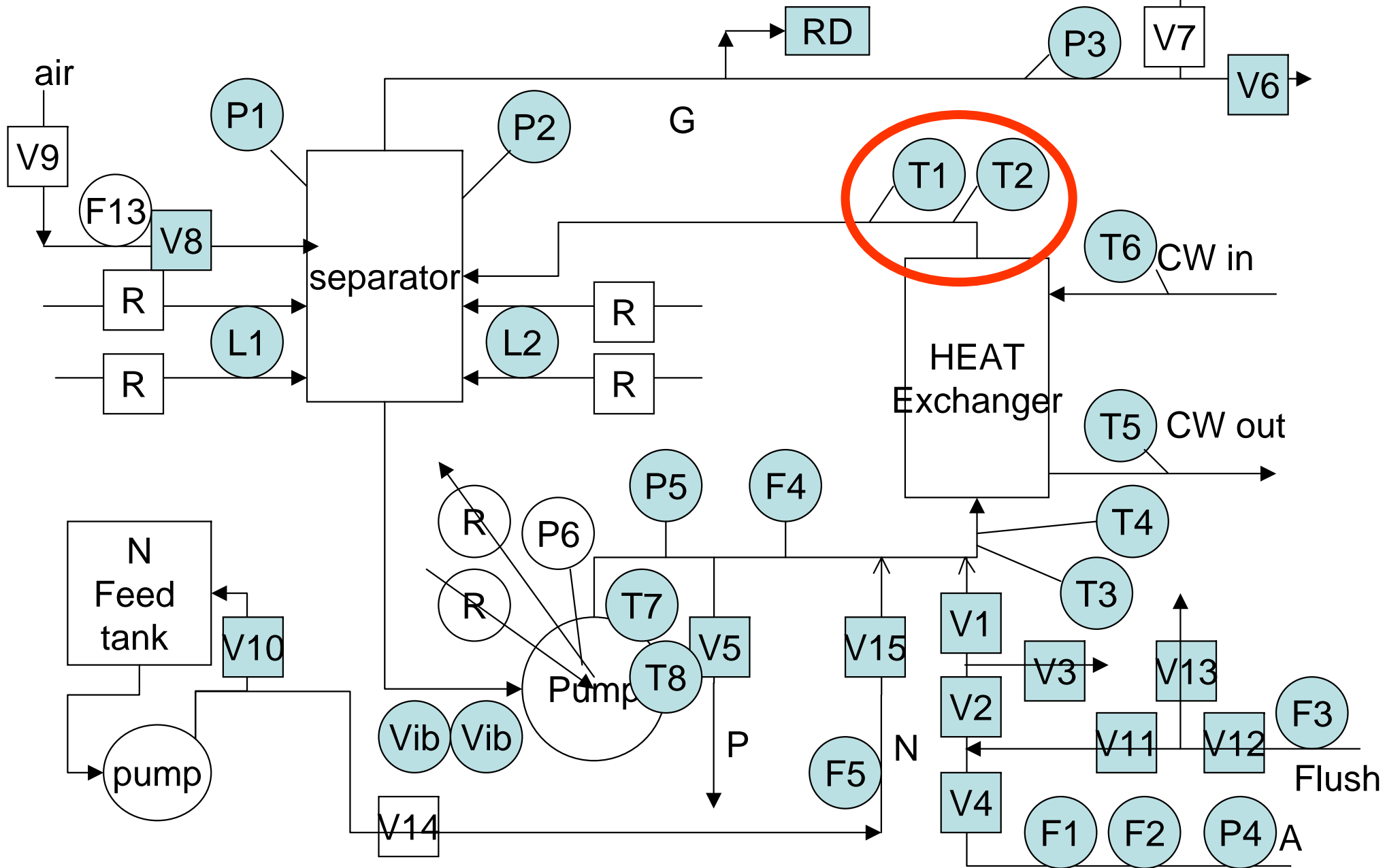
Redundant pressures



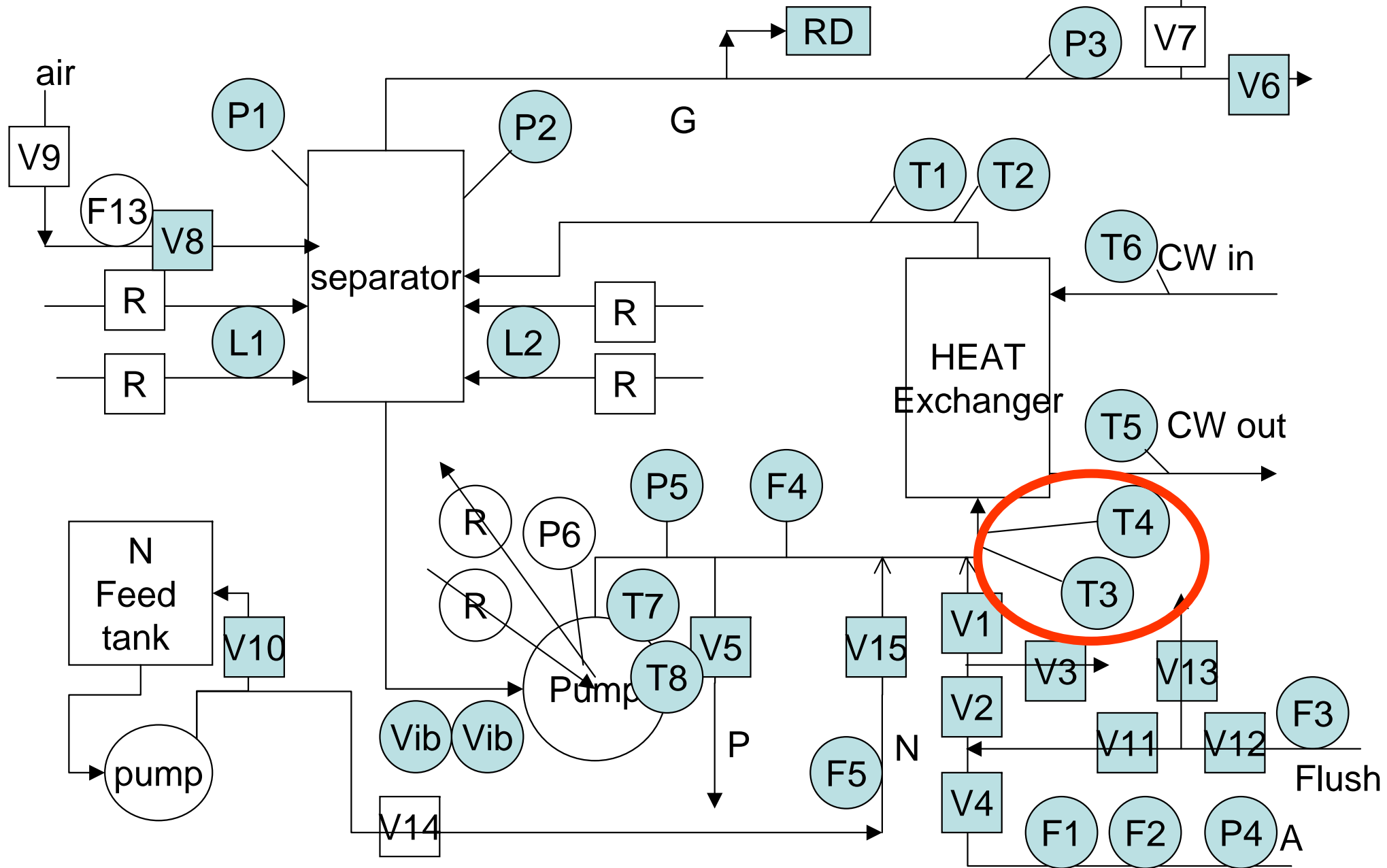
Redundant levels



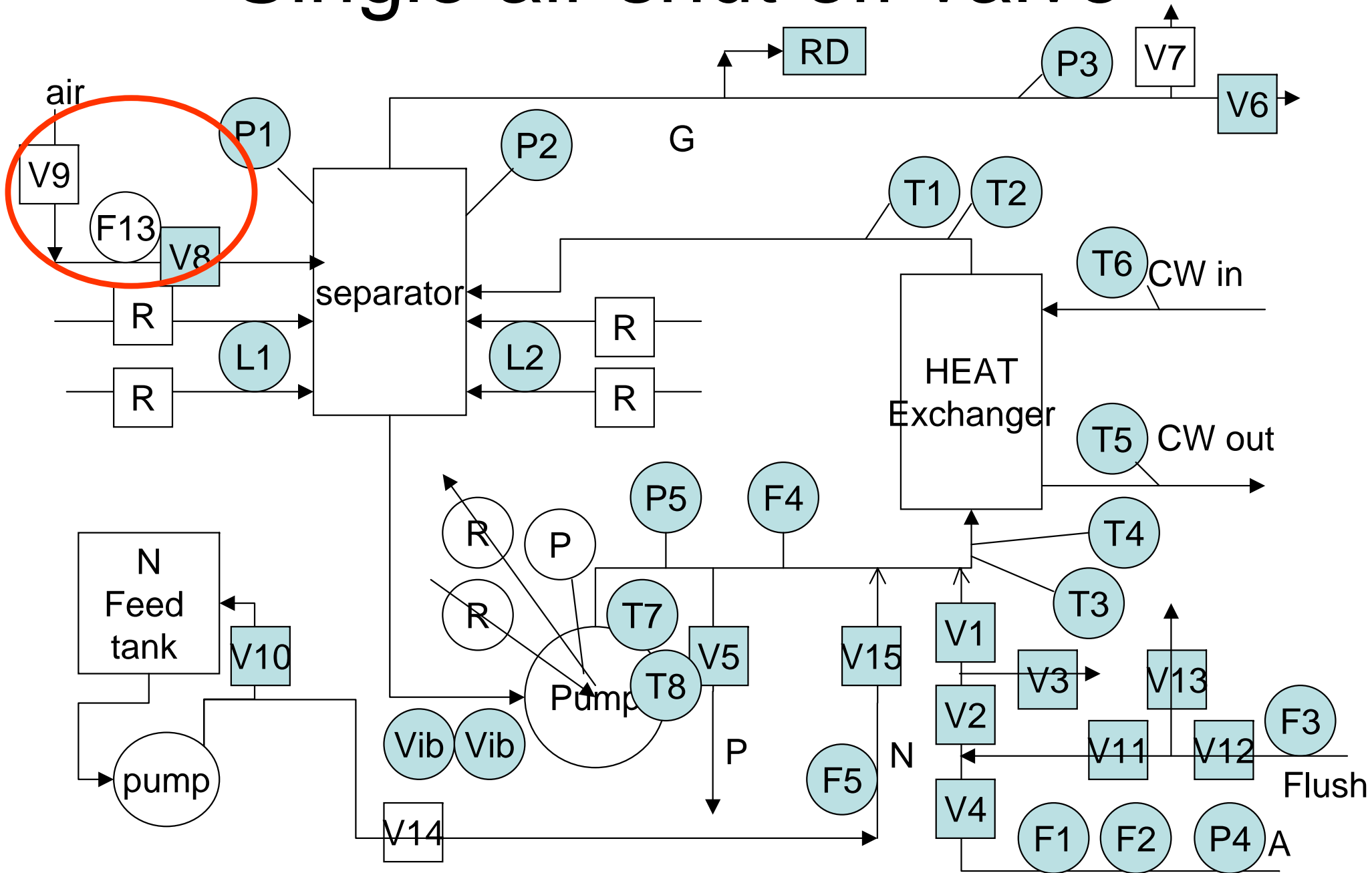
Redundant exit temperatures



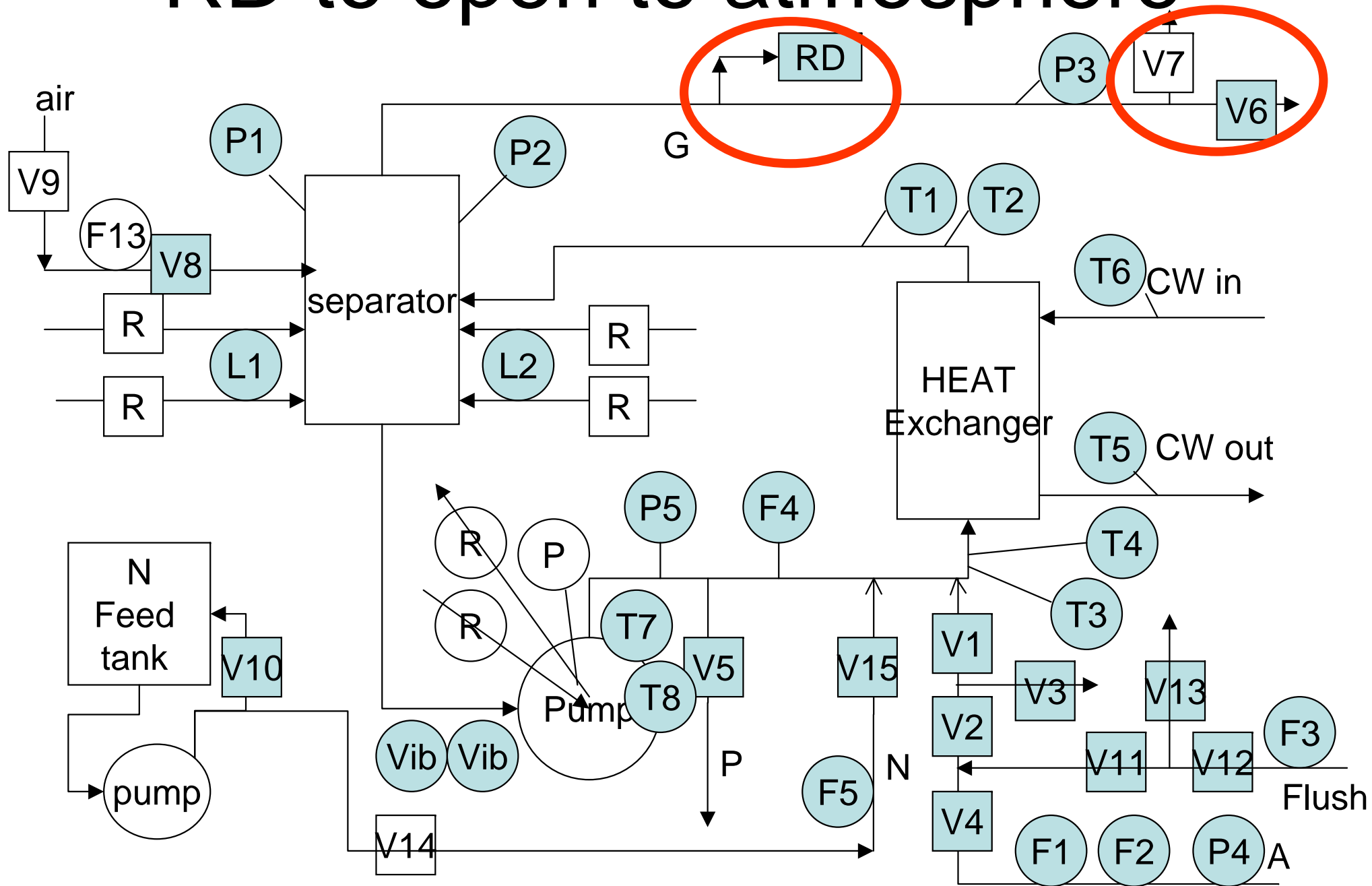
Redundant inlet temperatures



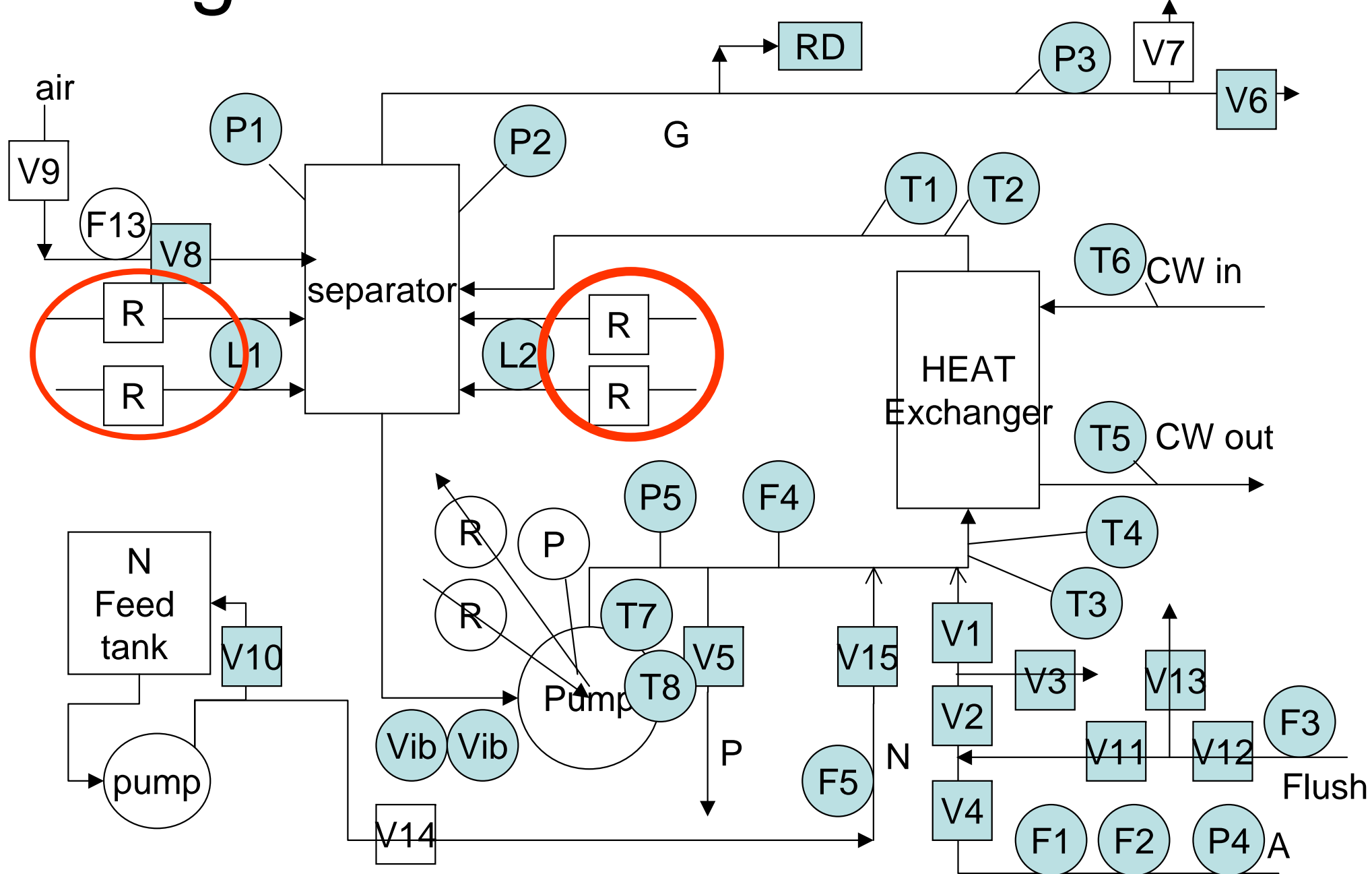
Single air shut off valve



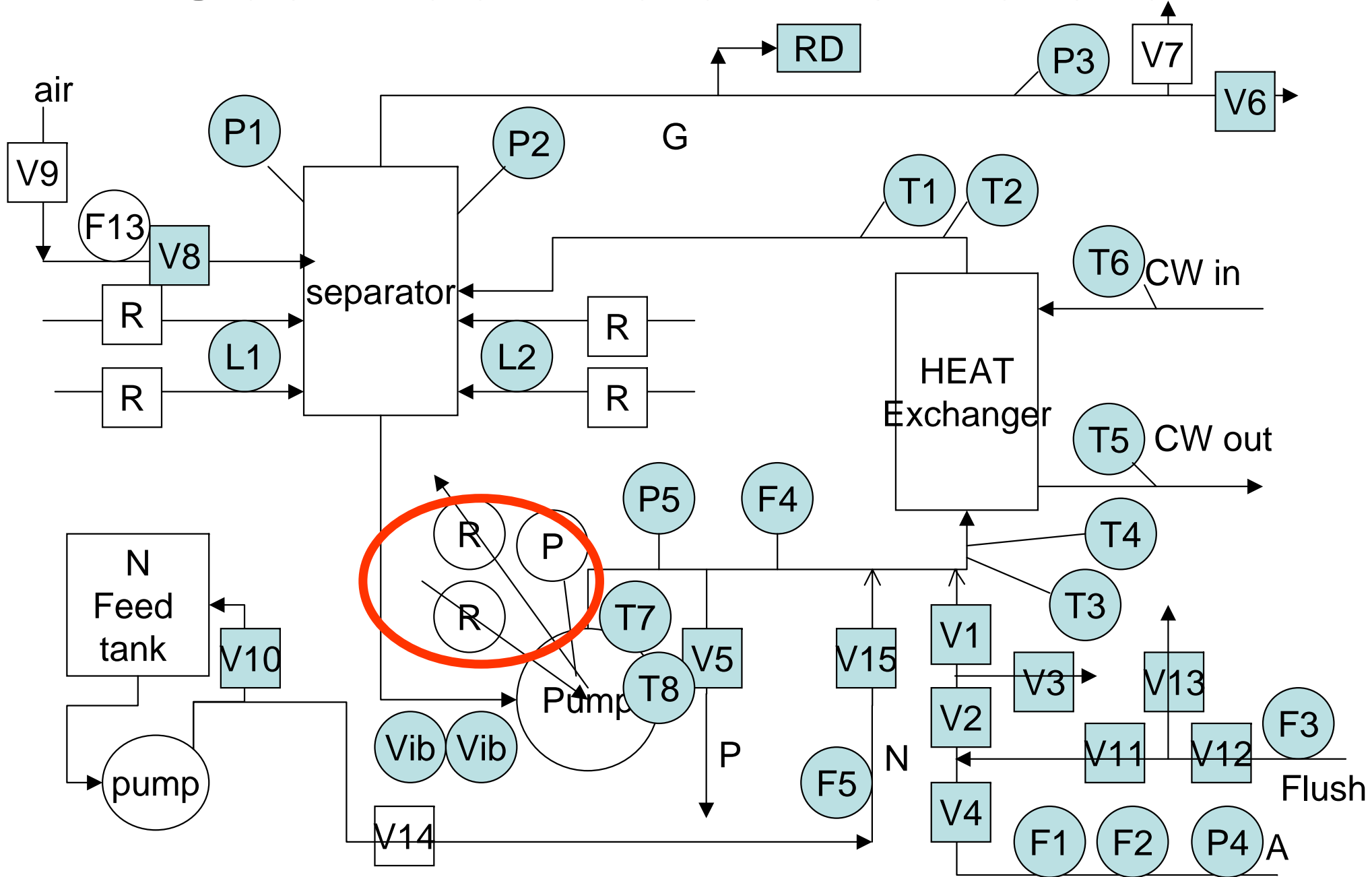
RD to open to atmosphere



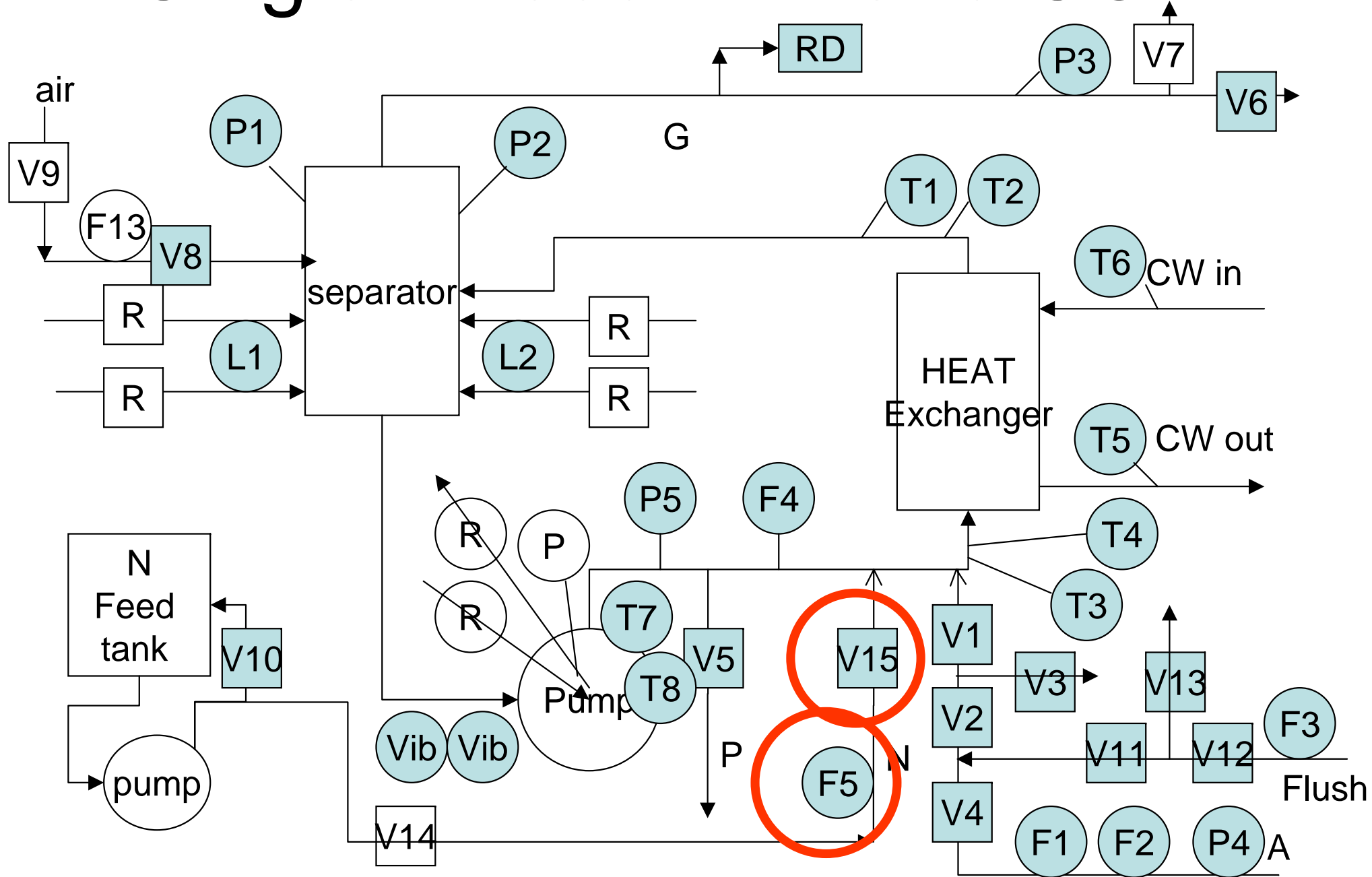
Purge level with field rotameters



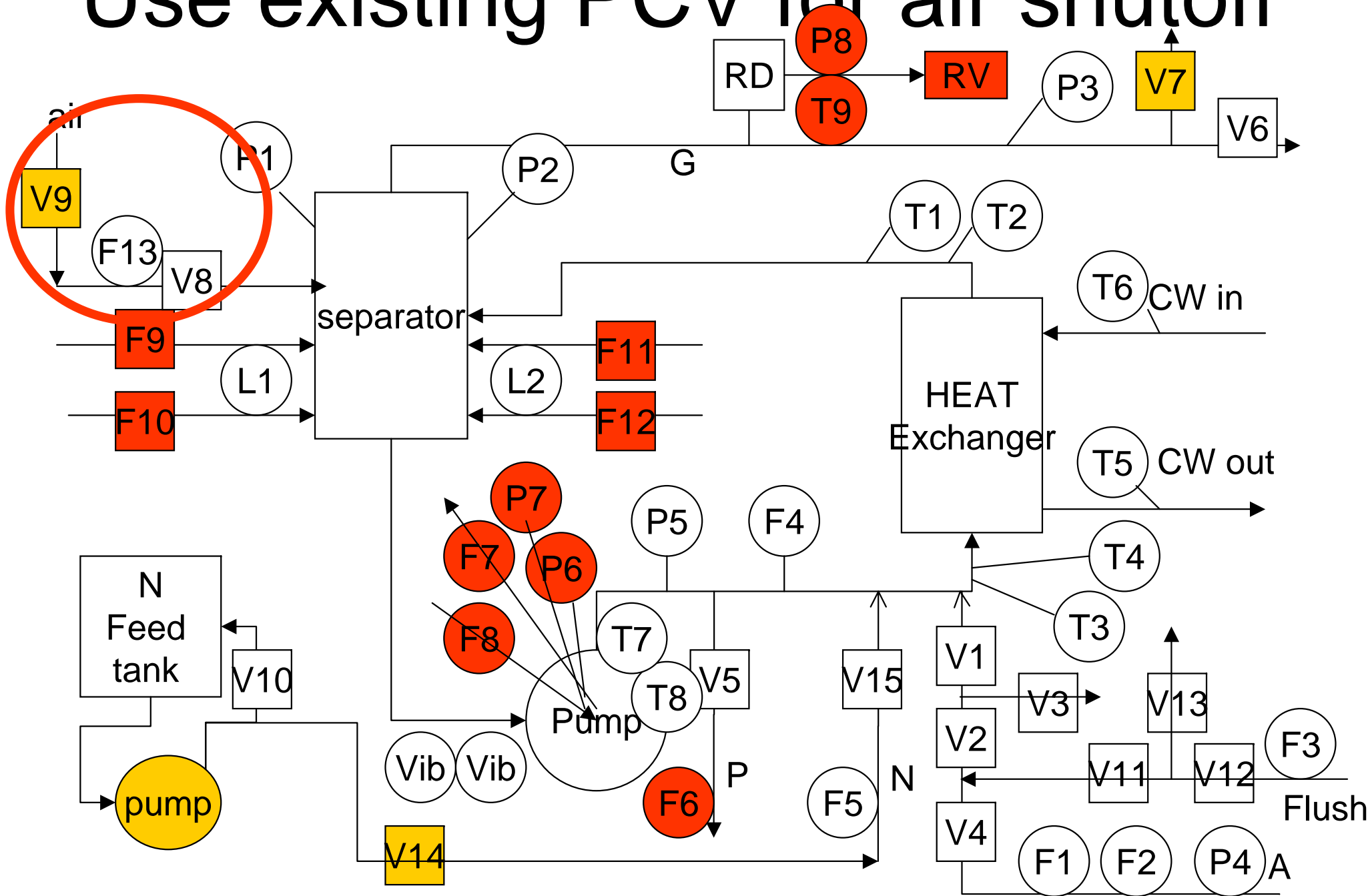
Seal flush field rotameters



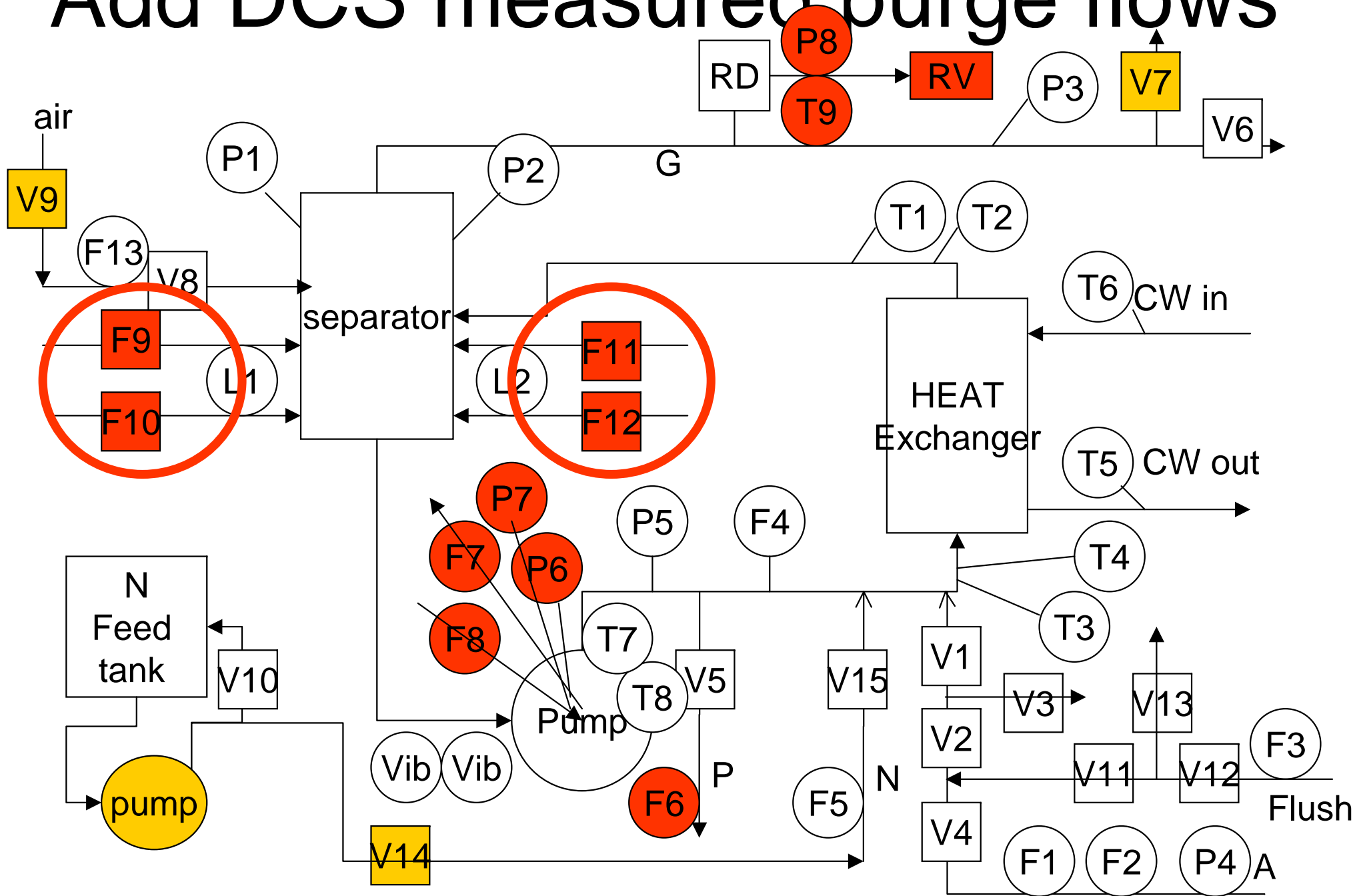
Single N feed flow and SOV



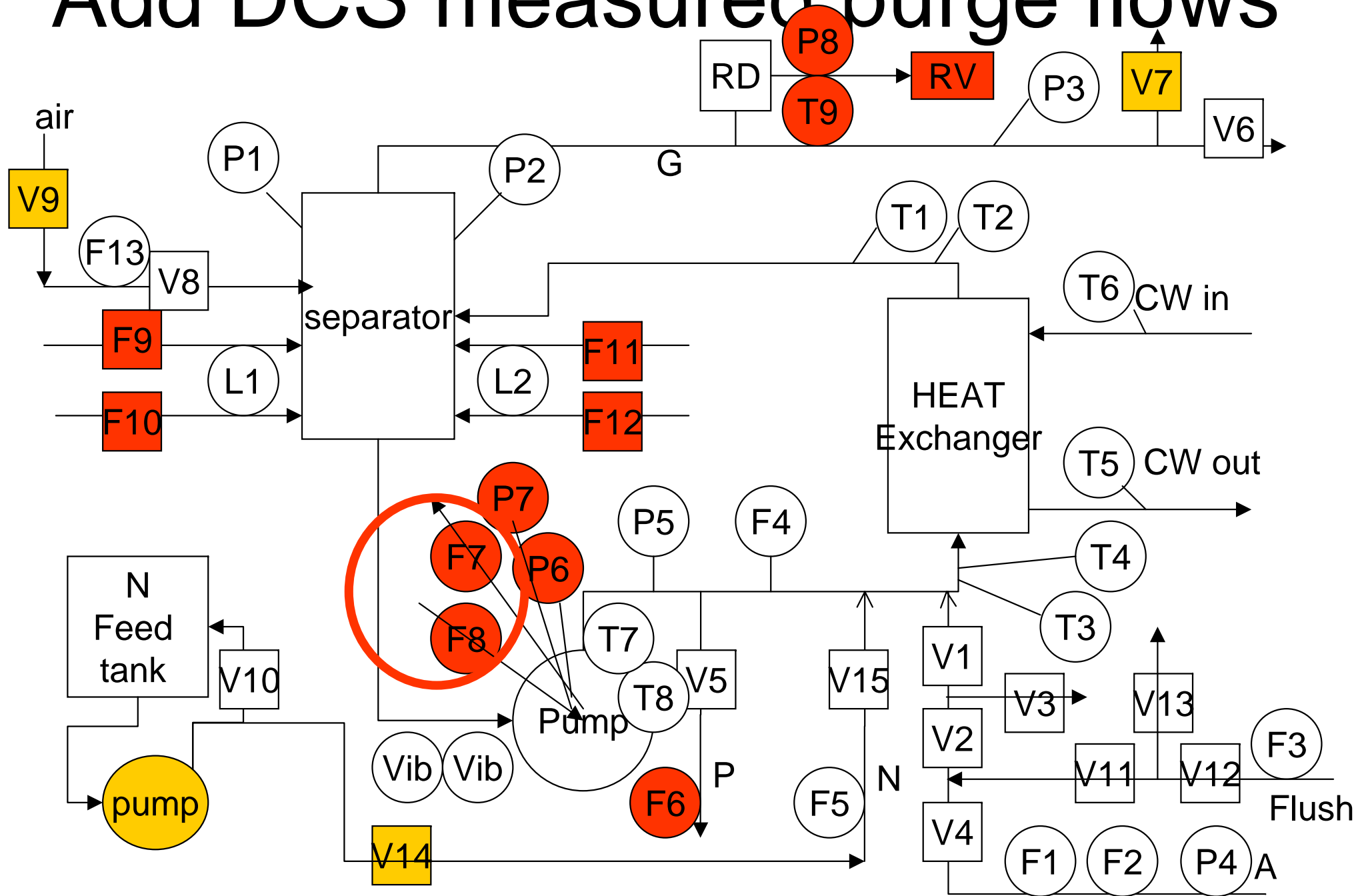
Use existing PCV for air shutoff



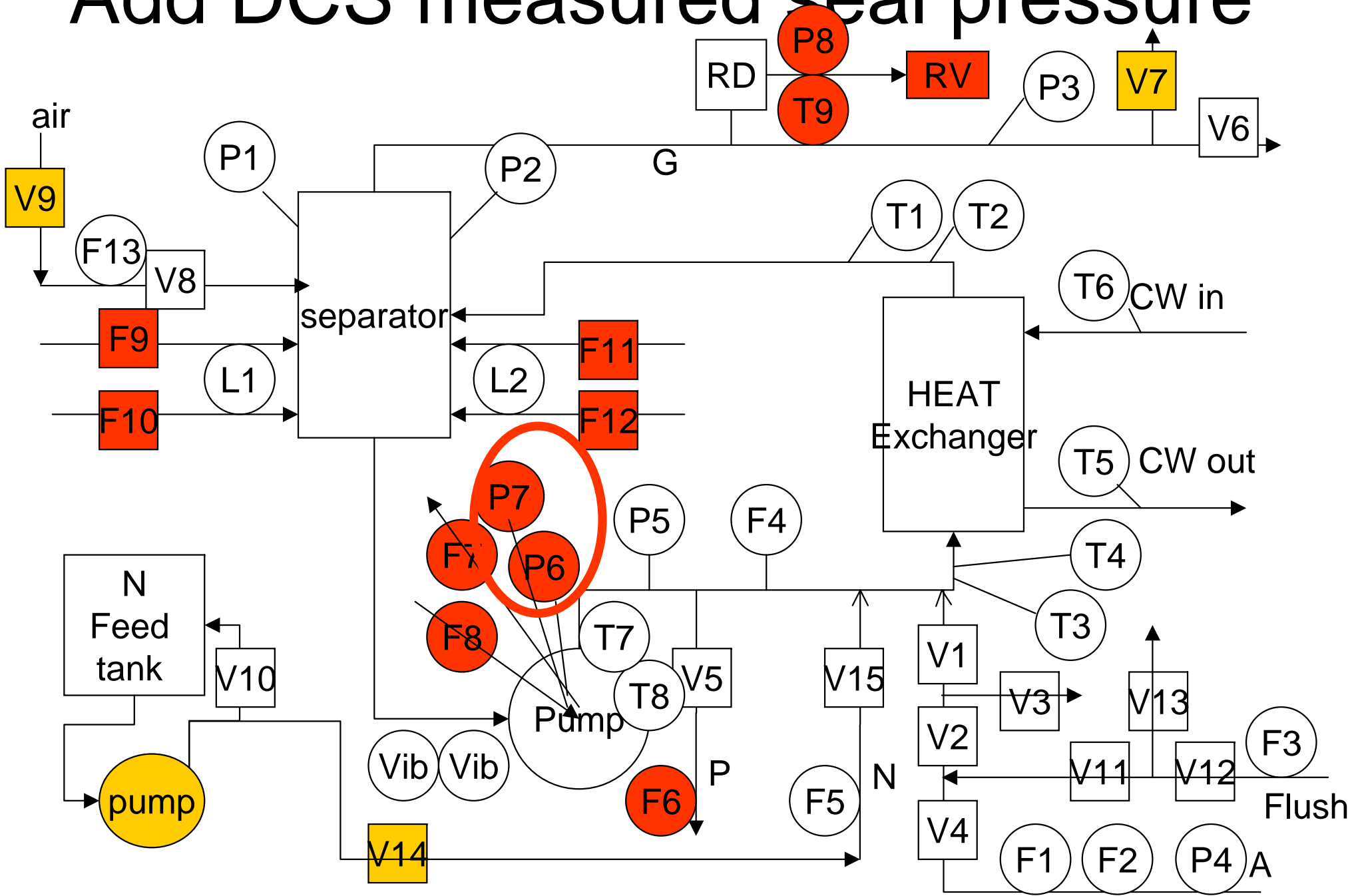
Add DCS measured purge flows



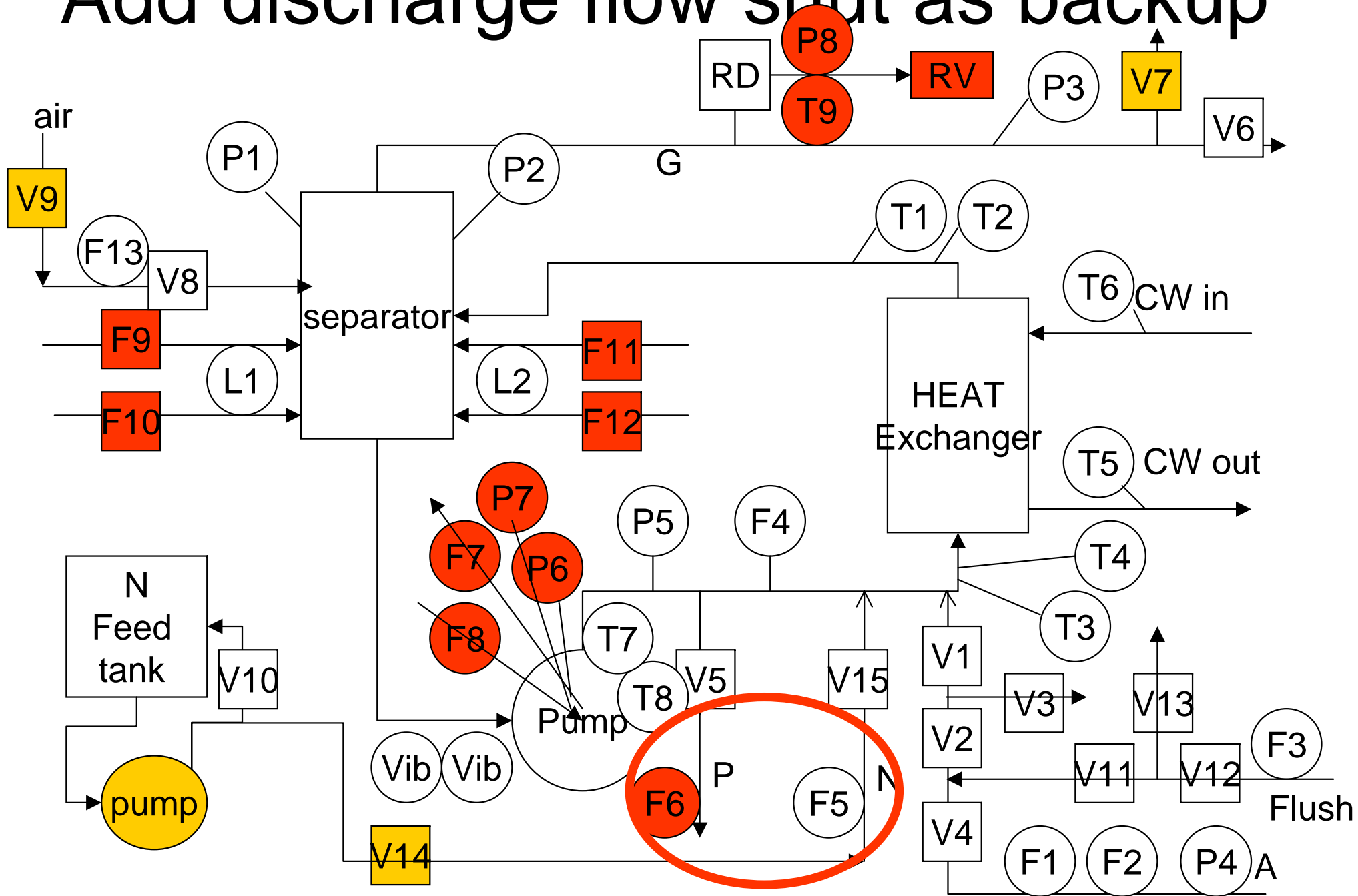
Add DCS measured purge flows



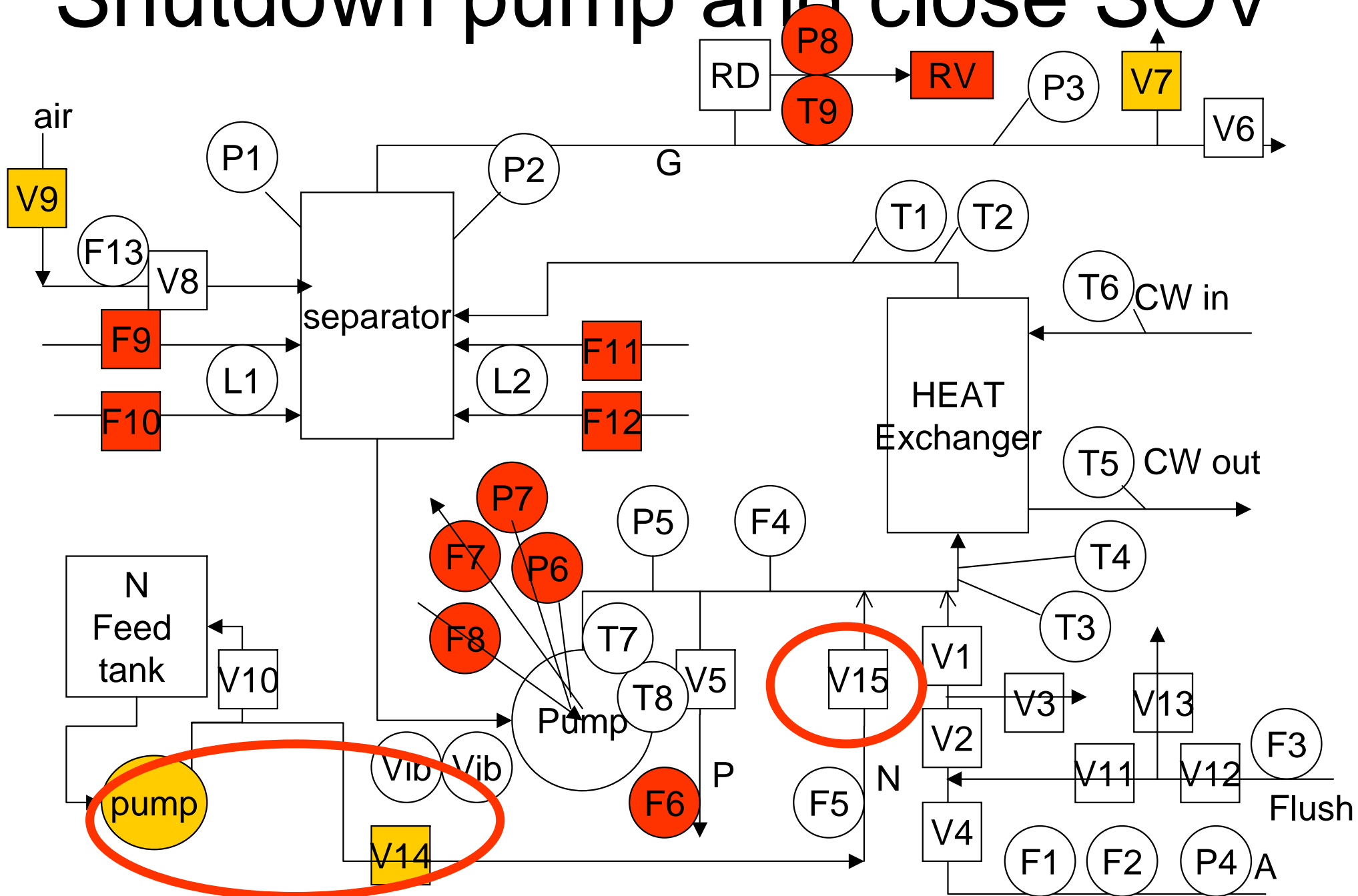
Add DCS measured seal pressure



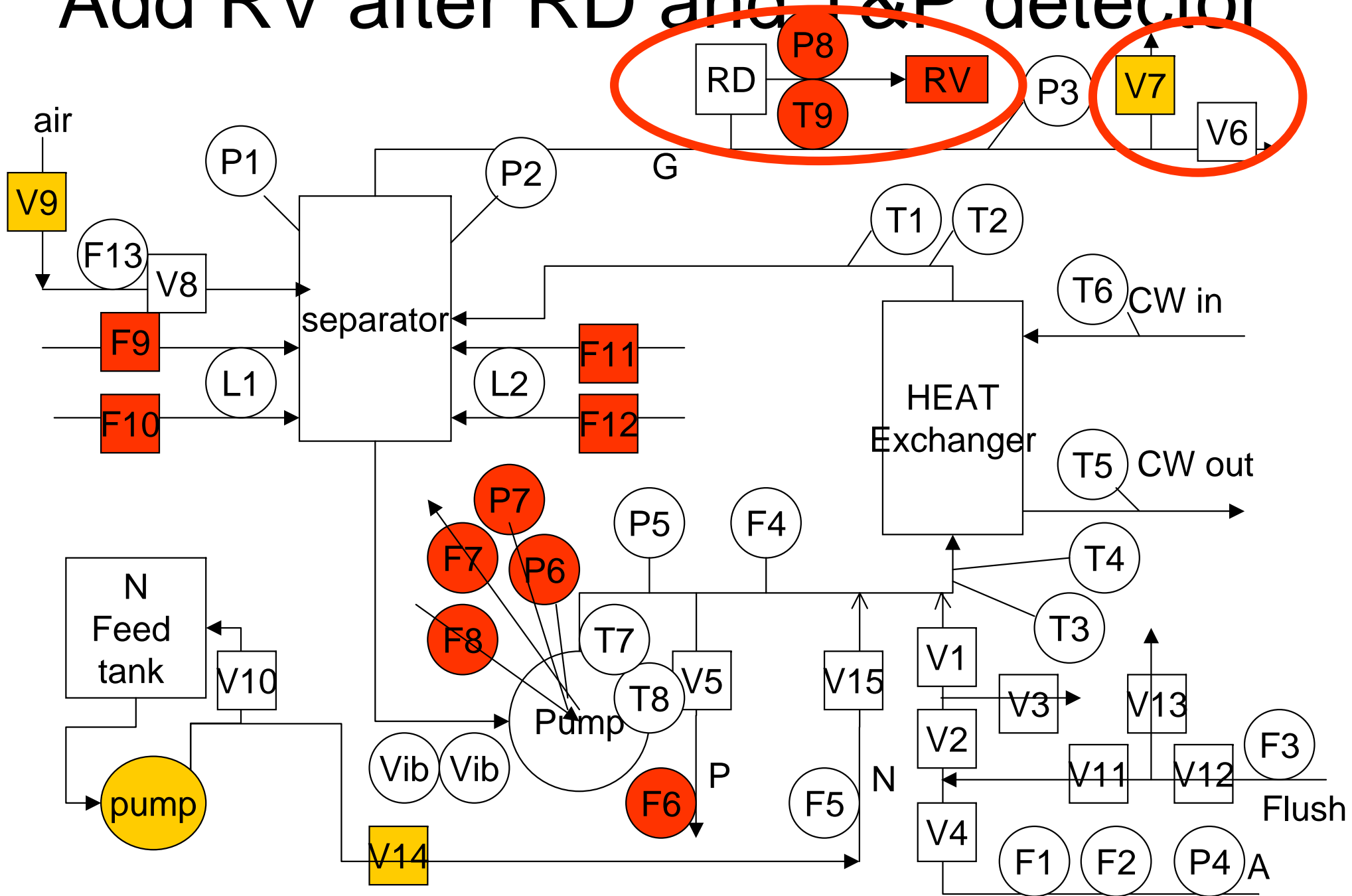
Add discharge flow shut as backup



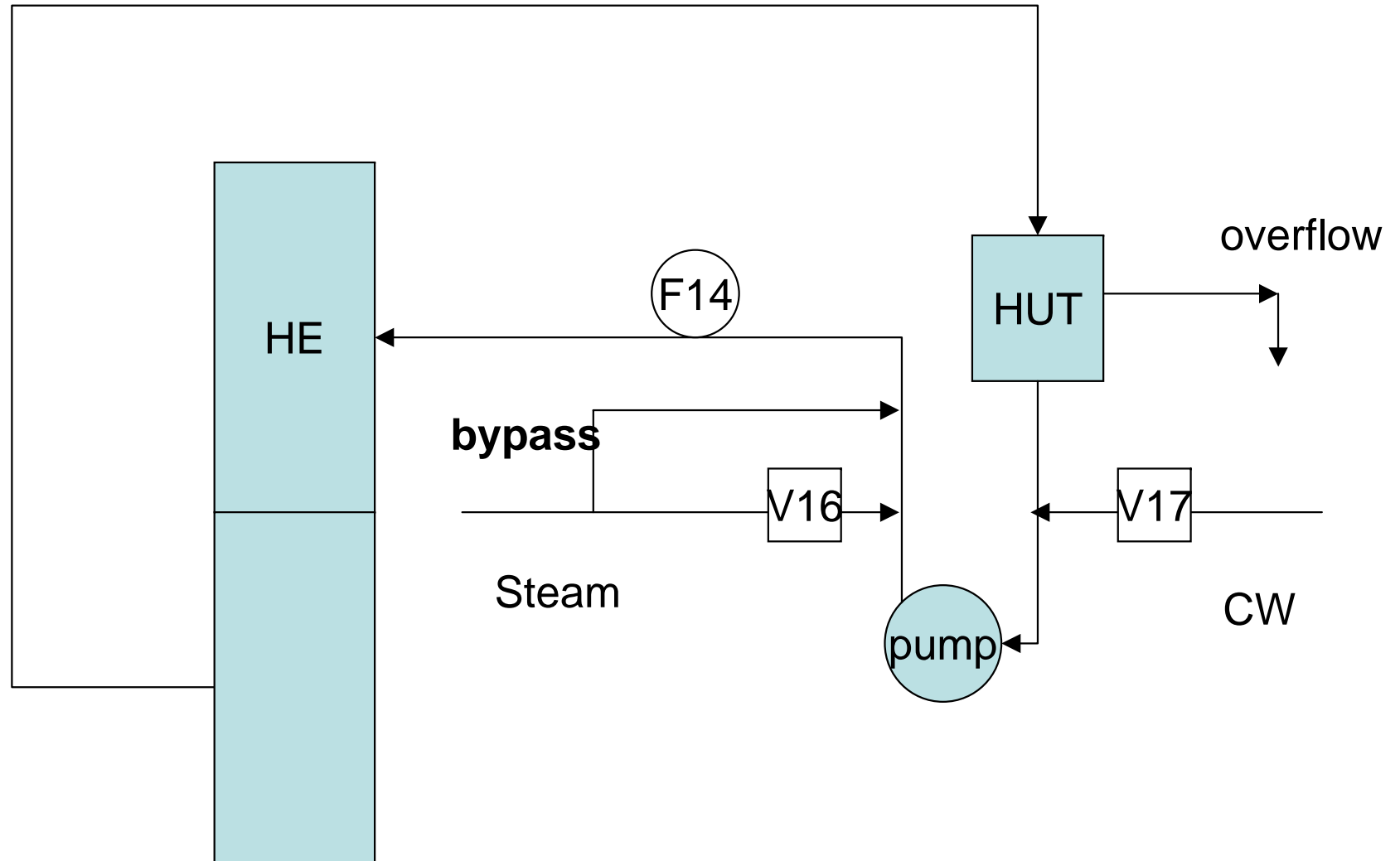
Shutdown pump and close SOV



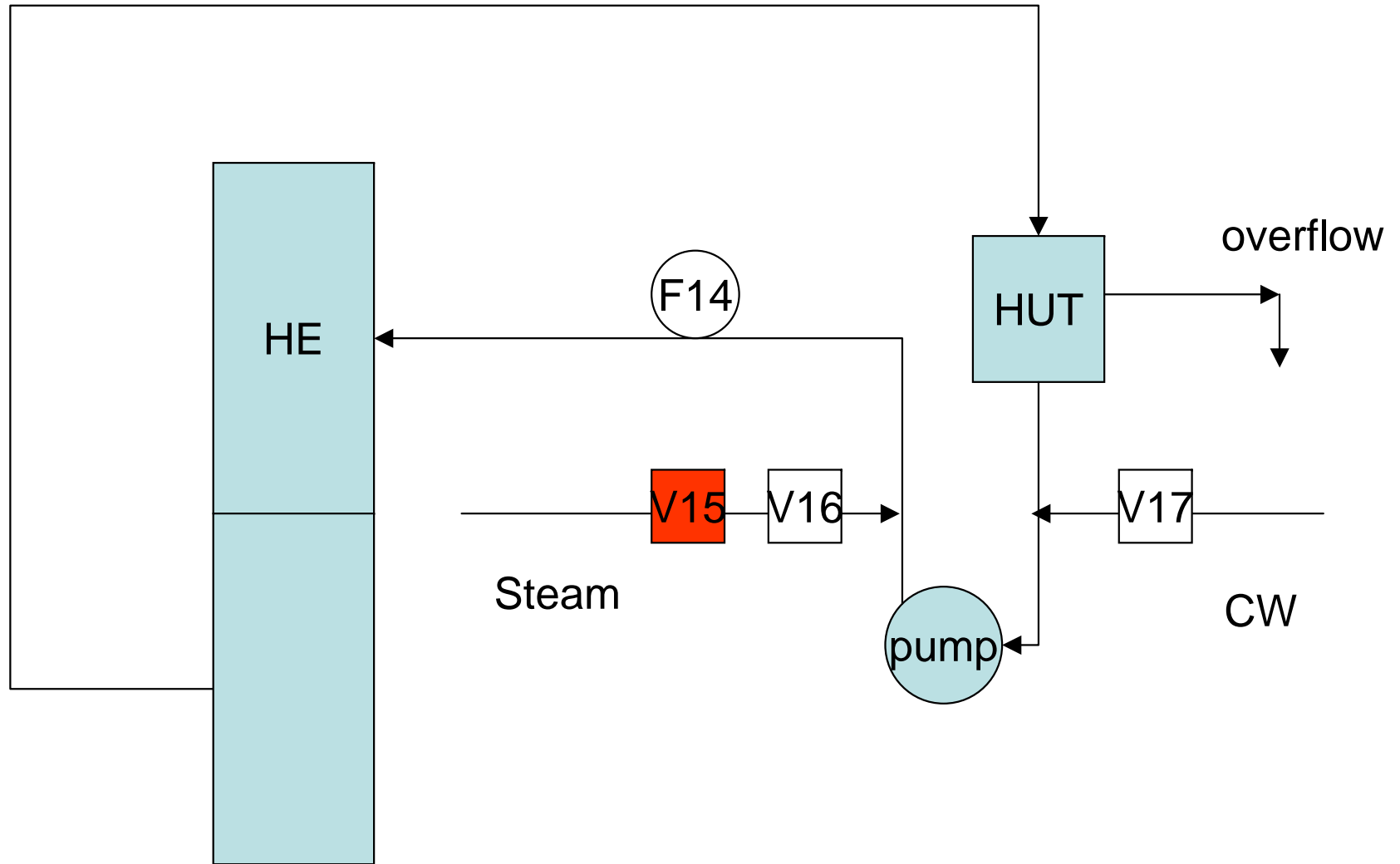
Add RV after RD and T&P detector



Tempered CW loop original



Tempered CW loop add second SOV and remove bypass



failure frequencies Before

- RD open due to high press • 40 yr
 - RD open not in anger • 115 yr
 - Large leak Pump seal • 15 yr
 - Explosion due to Free A • 50 yr
-
- Explosion due to N back flow into A
 - Runaway high Temp

failure frequencies after

- RD open due to high press • 65,000 yr
- RD open not in anger • 700,000 yr
- Large leak Pump seal • 9,000 yr
- Explosion due to Free A • 11,000 yr

- Explosion due to N back flow into A
- Runaway high Temp

failure frequencies improvement

- RD open due to high pr
 - RD open not in anger
 - Large leak Pump seal
 - Explosion due to Free A
 - Explosion due to N back flow into A
 - Runaway high Temp
- $65,000/40 = 1200$
 - $700,000/115 = 7000$
 - $9,000/15 = 600$
 - $11,000/50 = 220$

Conclusions

- Process and instrumentation improvements have focused on specific major consequences, improved reliability and reduced frequency of specific failures
- Taking a Holistic view of risks can significantly **reduce overall risk at lower cost**
- FTA can be used to define all risks combined
- FTA can quantify overall process risk improvement and satisfy outside interests