



LIQUID HYDROGEN BULK STORAGE INTRODUCTION

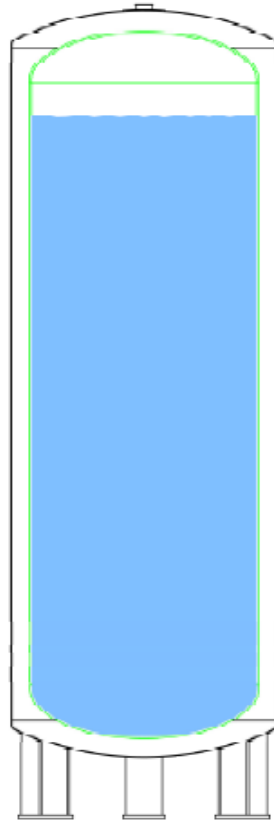
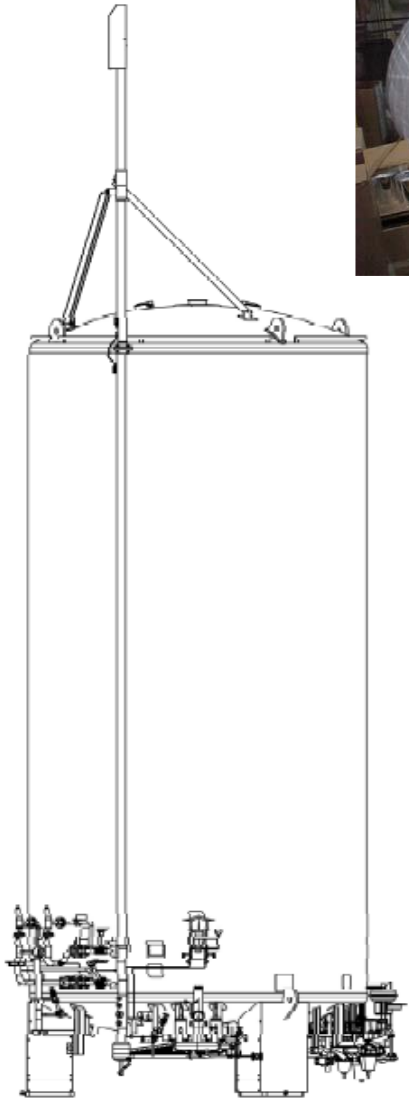
IAN NEESER

Cooler By Design.

Hydrogen Fluid Properties

Property	Air	Oxygen	Nitrogen	Argon	Hydrogen
Molecular Weight	29.0	32.0	28.0	39.9	2.0
Gas Density @ STP (kg/m ³)	1.20	1.33	1.16	1.65	0.083
Liquid Density (kg/m ³)	877	1141	806	1395	70.8
STP/Cryo Liq. Volume Ratio	718	845	682	827	833
Atm Boiling Point (°C/°F)	-212/-349	-183/-298	-196/-321	-186/-303	-253/-423
Cryo Gas Density (kg/m ³)	4.49	4.47	4.61	5.77	1.34

Tank Outline/Boil-off Mitigation

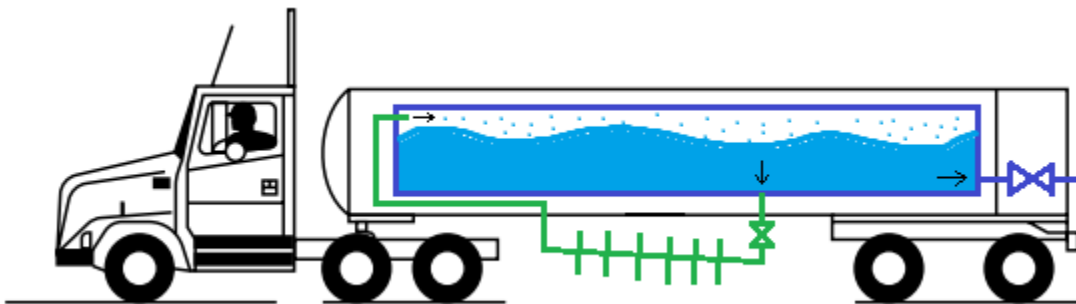


- Double-walled tank
- Stainless steel inner / carbon steel outer
 - Exceptional ductility @ low temp
- H₂ embrittlement mitigation
 - Material Selection
 - Welding
 - Forming
- 9,000-18,000 gallons typical (34-68 m³)
 - 4,950-9,900 lbs (2,250-4,490 kg)
 - Over 100k gallons
- Heat Leak Mitigation
 - Thermally optimized inner vessel support system
 - Evacuated annular space
 - Radiation Shielding

Cryogenic Tank Filling & Schematic

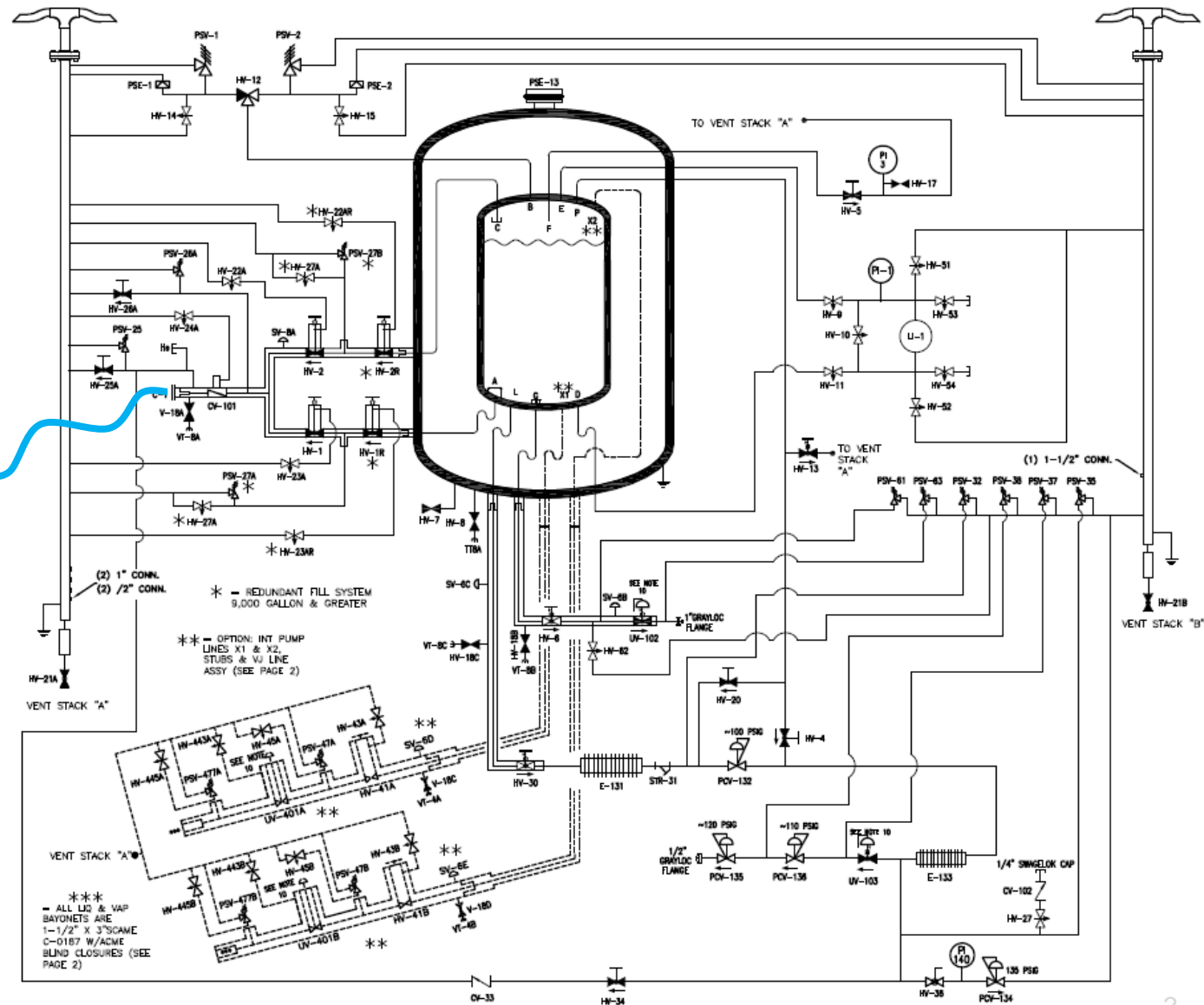
• Basic P. Transfer Offload Steps

1. Hose purge
2. Pressure ramp
3. Dispense + pressure sustain



• Cont.

4. Fill termination
5. Hose purge/emptying



Plumbing Examples



- Uninsulated pipe air liquefaction
 - Oxygen enriched (avoid dripping on asphalt)
- Freezing during nitrogen purging/hose purging



Thank you for your time.

Questions?