Double containment type Ammonia Tank design features

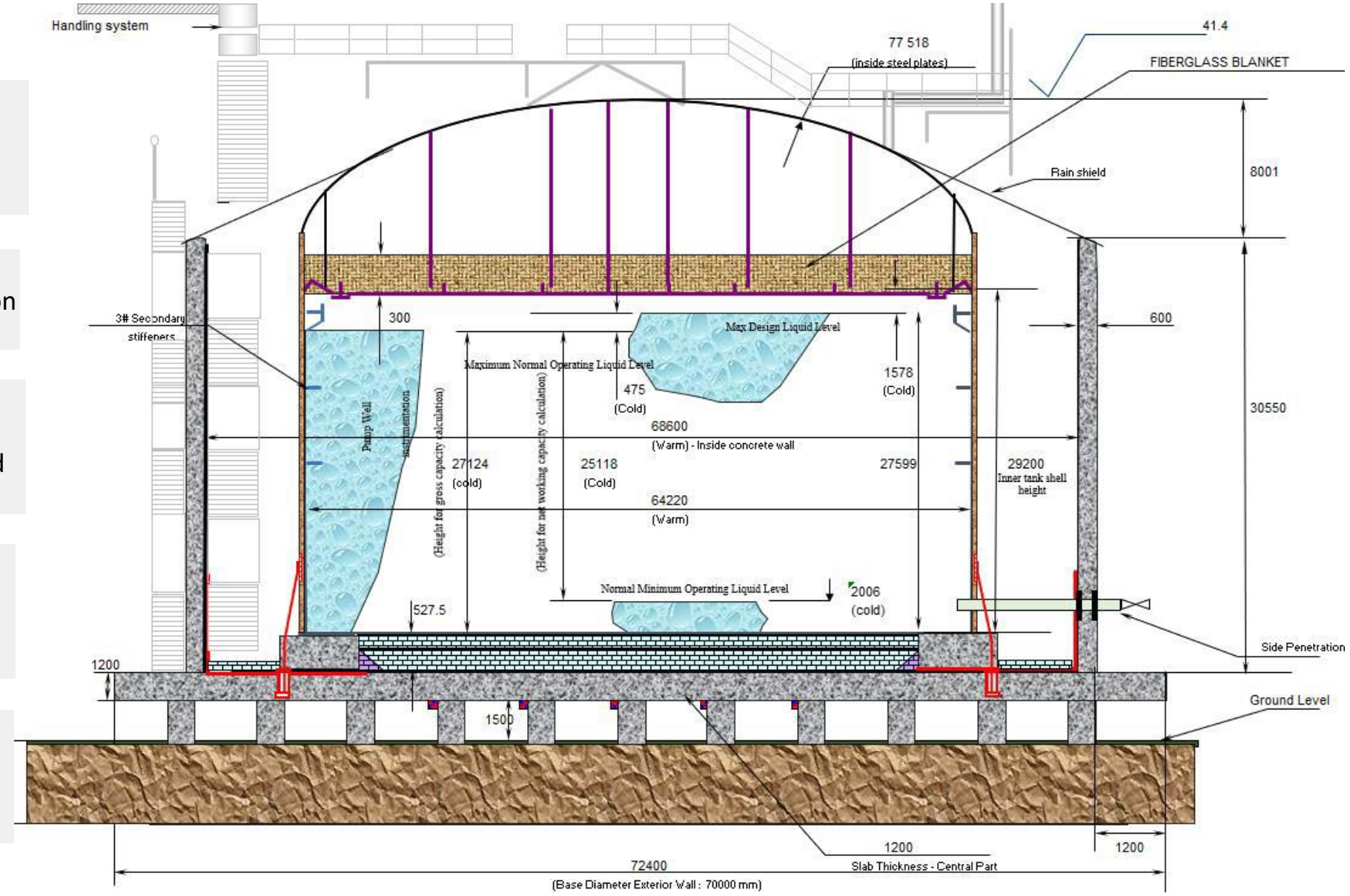
1. Annular space & outside of tank
Not exposed to Ammonia in normal service
Access for inspection O&M

2. Acoustic Emission monitoring system for warning of stress corrosion cracking

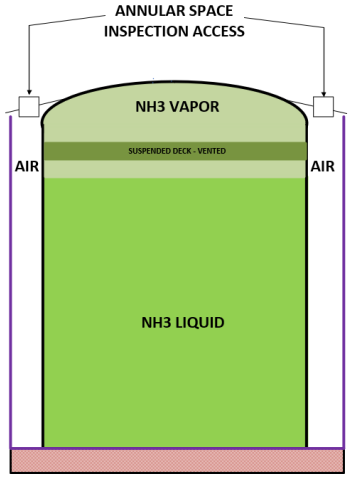
3. Outer concrete wall contains any liquid leak
Provides protection against blast and external impact

4. Elevated tank foundation
Air gap to protect against cold propagation to ground
Flood protection

5. Insulation
Outside tank shell (not roof)
Tank base and TCP - Cellular glass
Suspended deck - Fibreglass

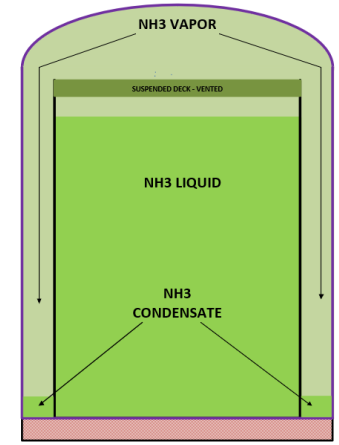


Anhydrous Ammonia Storage - Comparison of Design, and Long-Term O&M Concerns



Double Containment "Tank-in-Wall "

Double Containment		Full Containment
Liquid Tight Vapor Tight	**Inner Tank (Primary Container)**	Liquid Tight
Liquid Tight	**Outer Tank (Secondary Container)**	Liquid Tight Vapor Tight – potential for SSC
NO	**Annular Space (outside of inner tank and inside of outer tank exposed to NH_3 in normal Service**	YES Pure vapor Condensed ammonia with almost no H_2O (significantly <<2000 ppm that needed to avoid SCC)
YES	**In Service Annular Space access possible**	NO
No safety concern as Vapor released at high elevation, mainly only an odour issue at ground-level. Liquid contained Vapor released at high elevation	**Over pressure event - tanks failure**	Vapor release Liquid release at grade that will have significant downwind impact
Inner tank protected – Liquid and vapor contained Existing "wall" provides protection. Wall can be Steel or Concrete	**Impact to outer wall**	Vapor release + possible Liquid release Extra concrete/steel wall is need to ensure no **NH_3** is released
Vapor release	**Impact to roof**	Vapor release
Easy	**Operations & Maintenance (O&M)**	Complicated
On the outside of inner tank wall; easy to replace	**Insulation**	Inside pressurised container exposed to ammonia



Full Containment "Cup-in-Tank"

Only Inner Tank:
Exposed to Liquid
Exposed to Vapor

Inner Cup + Tank:
Exposed to Liquid
Exposed to Vapor + Condensed Vapor (with no water)

Full containment- NH_3 in the annular space potential undermines the integrity of the "tank" with potential domino failure of outer tank upon failure of "cup"