Anti-Slosh Inflatable Component Case Study

Erik Jeroen Eenkhoorn
PhD candidate University of Twente
Hengelo (O), The Netherlands

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Laplace building, ground floor, salle Renaudeau.

Erik Jeroen Eenkhoorn (10-Aug-1957)

- University of Twente, Mechanical Engineer 1980 & MBA 1985
- Shell E&P; project manager 1982 -1997, with postings in
- Brunei, Singapore, Netherlands, Nigeria and Sri Lanka
- “Accede”, the “Cairbag” company, based in the Netherlands
- Founder and Director since 1997; research and development of
- Slosh mitigating products; “bags” in tanks
- University of Twente, Enschede, The Netherlands
- PhD Candidate Liquid semi-dynamics
- Thesis: ”Liquid slosh mitigation and products thereto”.
- Father of Daan (16) and Fern (11)

Frans Fisher Case Study

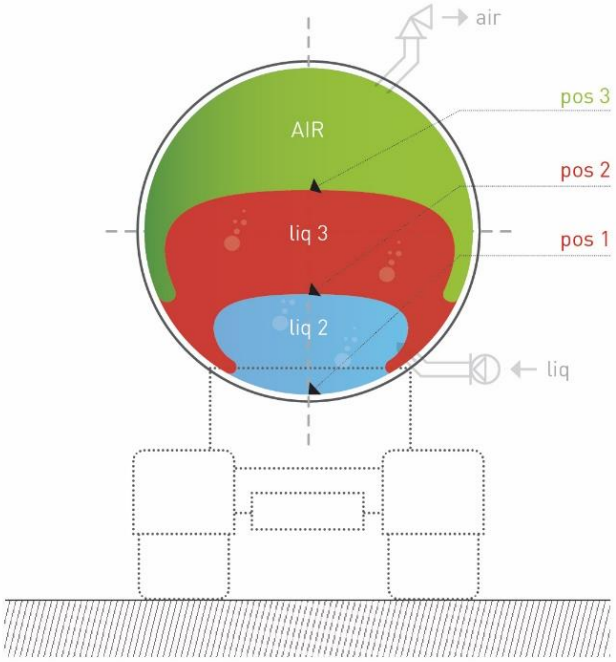
A 20’ ADR tank container of 22,6 cubic meter volume on chassis trailer for the transportation of produced water and oil substances.

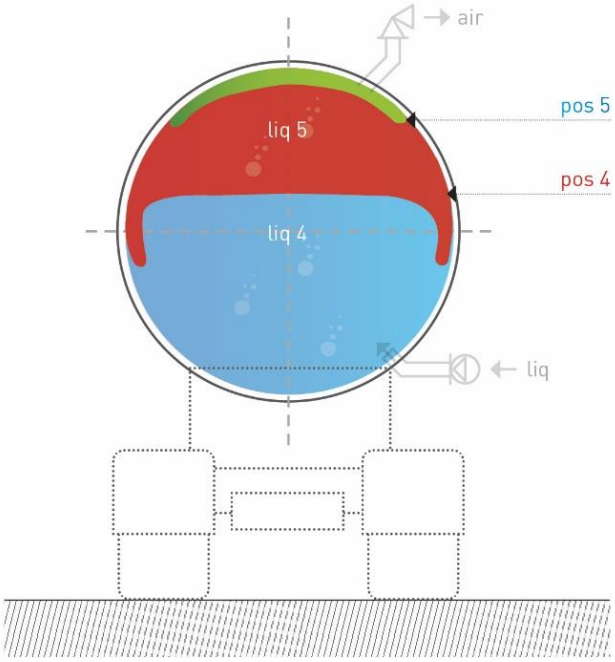
Frans Fisher Case Study

Target of slosh mitigating product:
Elimination of emissions.

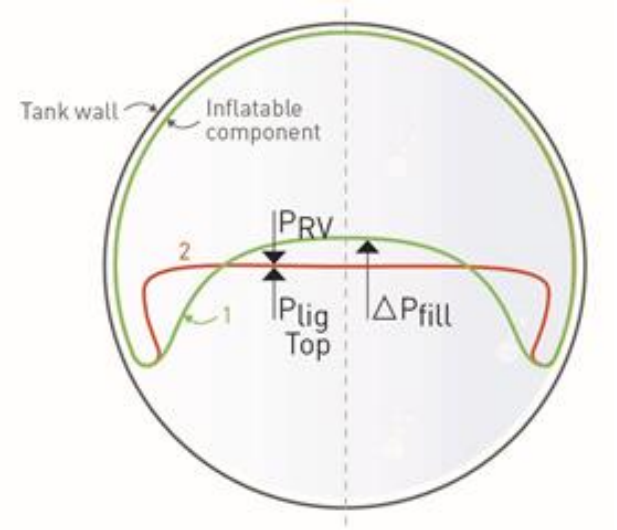
This requires:
Variable volume inflatable component
with a main chamber and air channels
A matching dual pneumatic system

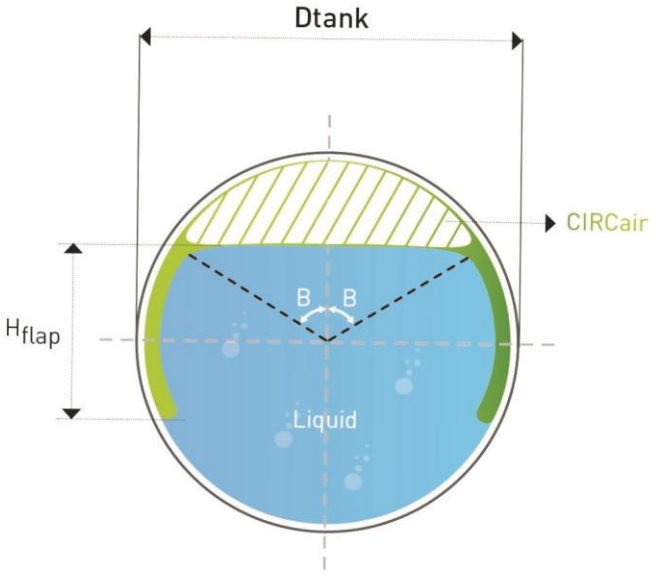
Load securing during liquid fill process





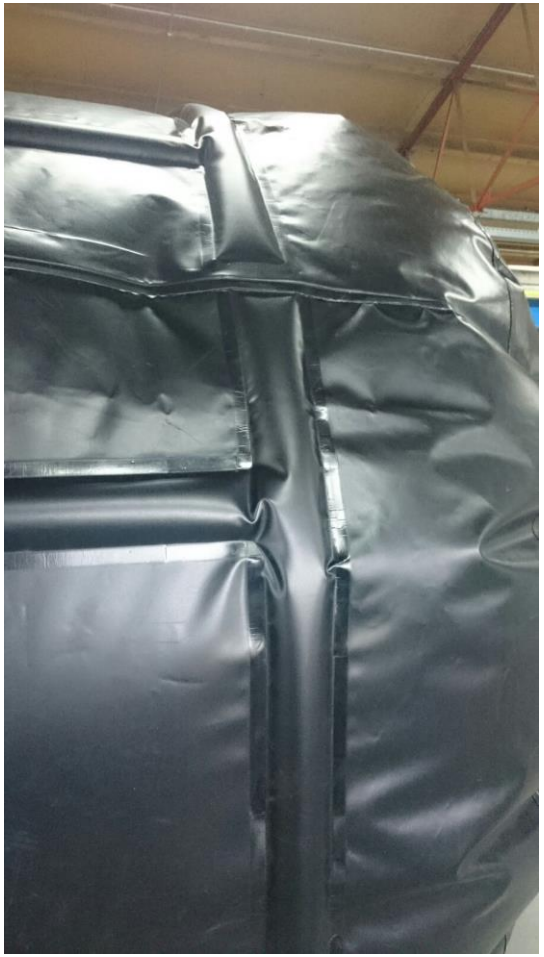
Load securing during liquid fill process



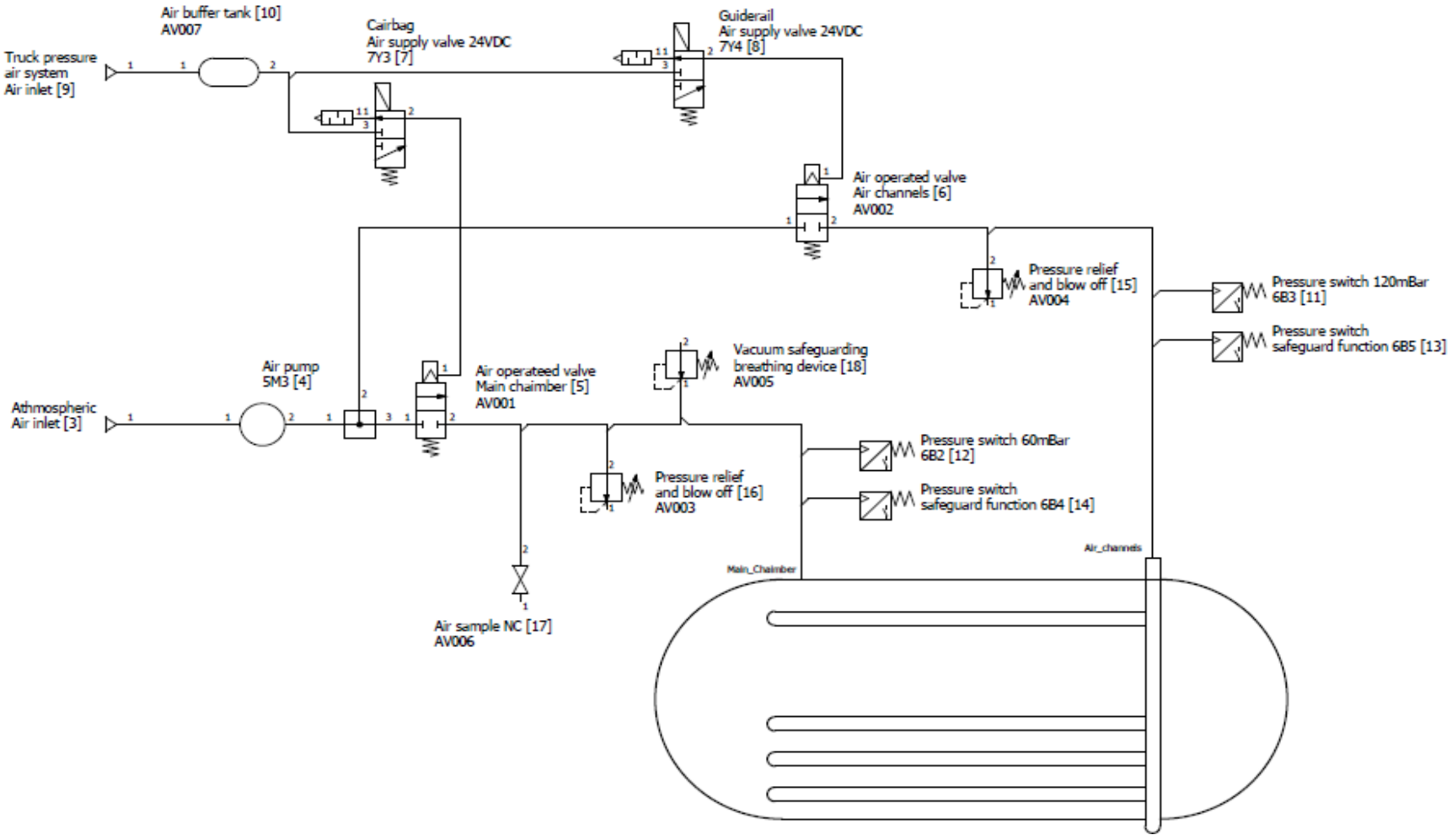


The inflatable component

Main chamber (98% of tank volume)
And air channels (remaining 2%)

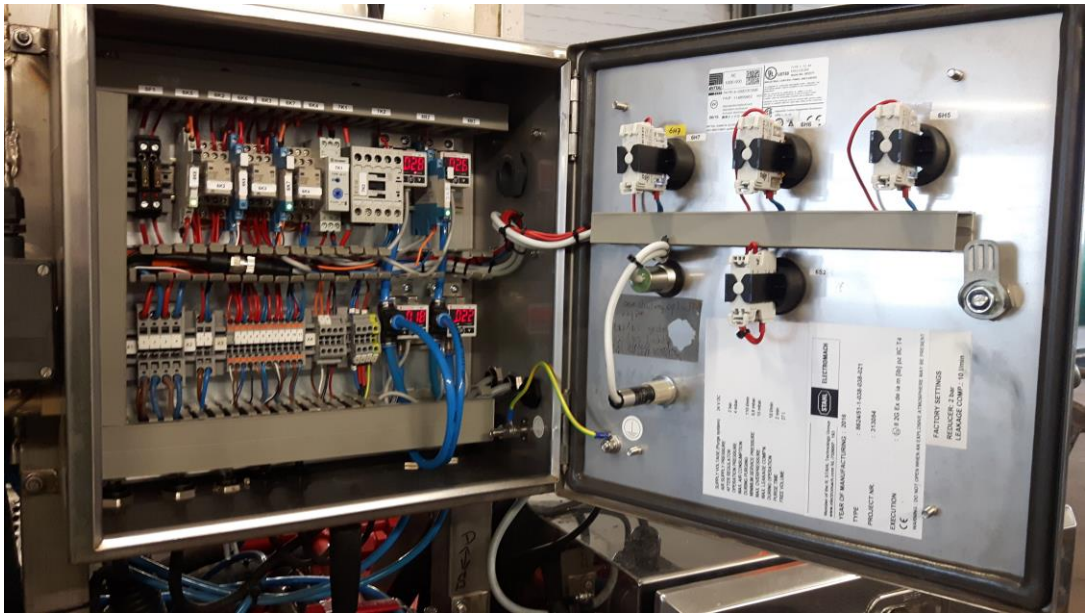


Pneumatic schematic



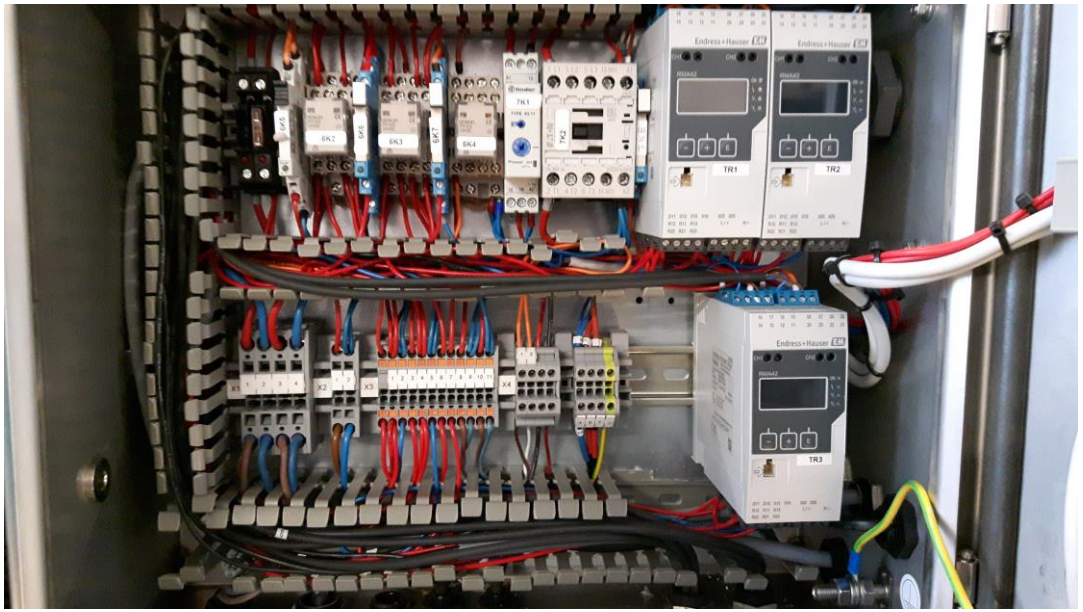
Pneumatic pressure metering and control

Pneumatic pressure sensors in control cabinet (below). Pneumatic hoses from tank wall to cabinet.

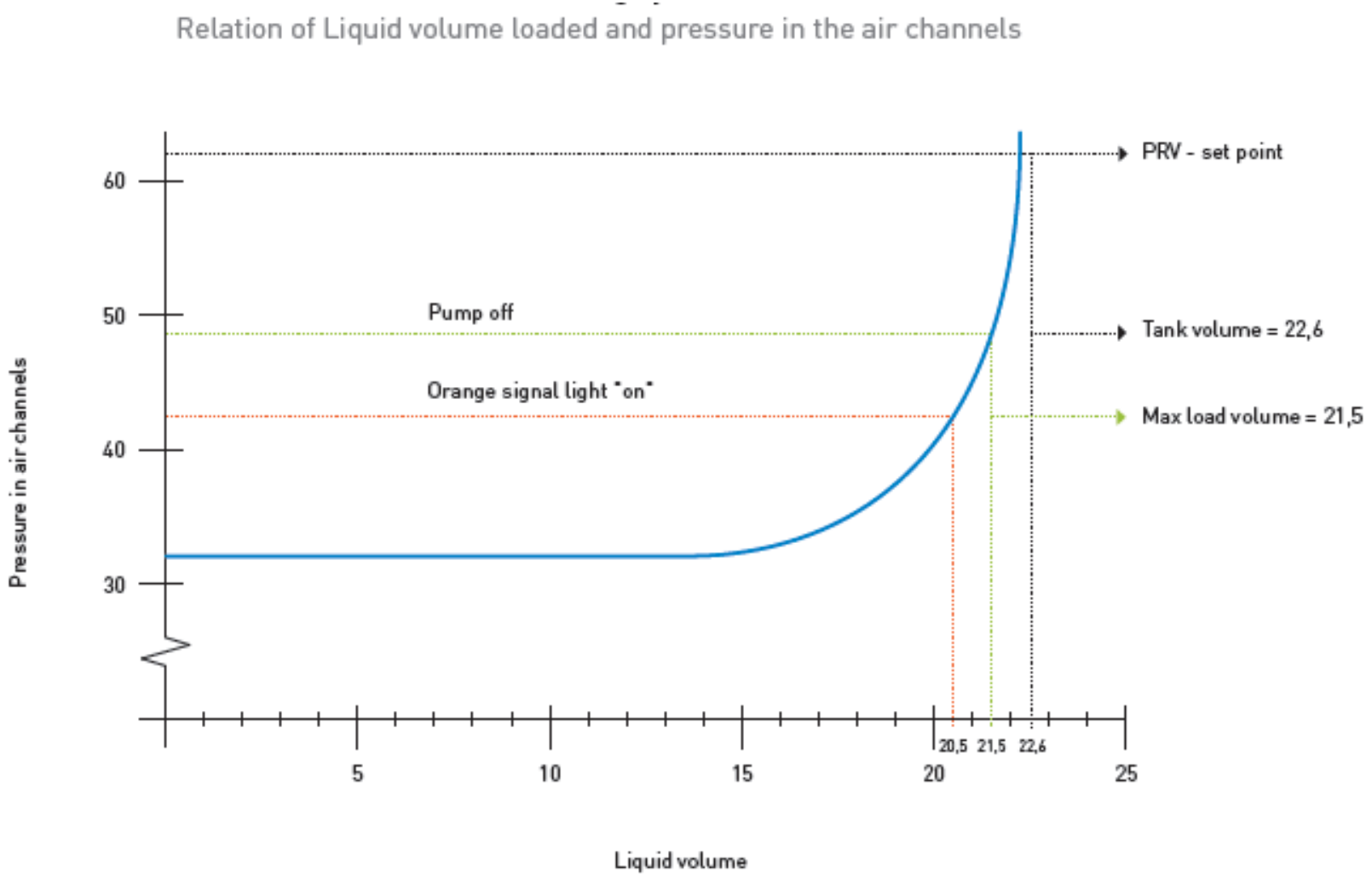


Electronic pressure metering and control

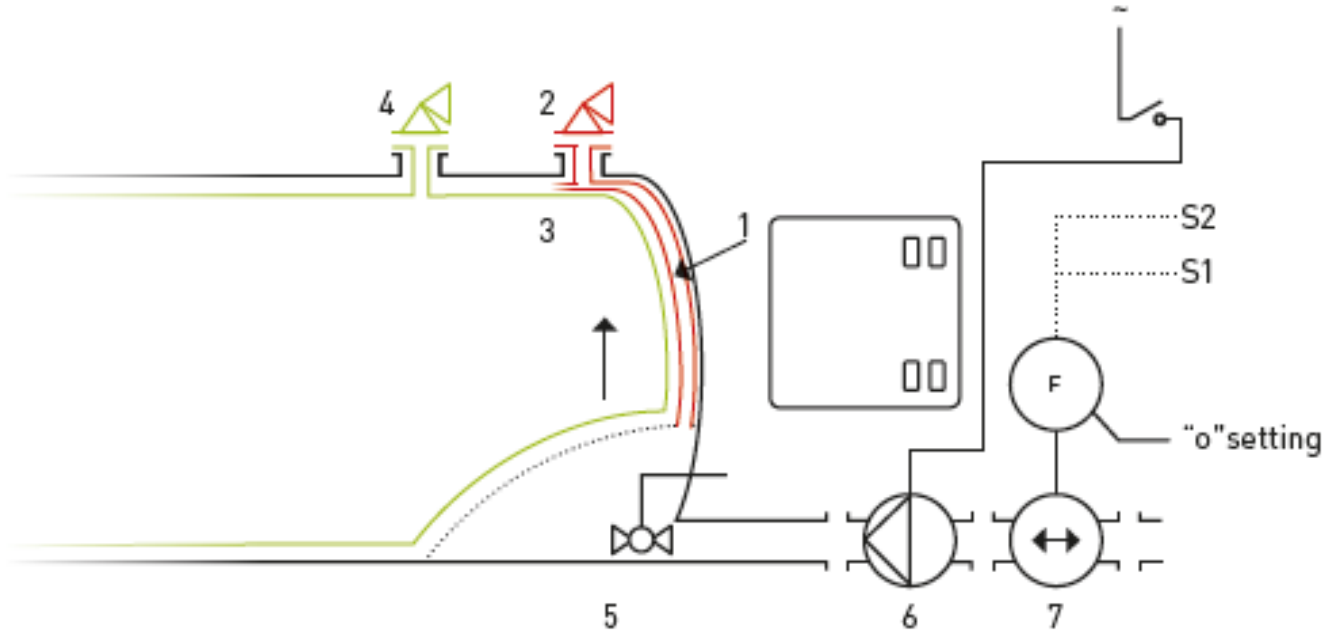
Electronic pressure sensors
(left) and control cabinet (below)



Overfill protection principle



Overpressure and Vacuum protection principle



Excess air or an over-pressure underneath the inflated component can escape via a dedicated tube or hose “3” and relief valve “2”.

ADR Legislation

Discripancy between “what is best” and what the law mandates.

Three articles relate to stability through slosh mitigation

- Article 4.3.2.2.4 Baffle plates
- Article 7.5.7.1 Securing of loads
- Article 9.5.3. Stability

How to bridge the gap?

1. Permit to apply
2. Permit to apply in mobile tanks filled with liquid ranging between 20-80% of the tank volume
3. Approval for use as alternative for baffles plates under “ADR”, or revision of ADR to slosh mitigating and stability targets

Conclusion

Slosh mitigating products,
based on variable volume inflatable components,
applied in horizontal cylinder-shaped mobile liquid tanks,
can, and generally will,
not only virtually eliminate sloshing,
but also avoid vaporisation and
thereby eliminate emissions from the tank.

Thank you for your attention.