Dual Seal Integral Pumping Devices that Increase Pump Reliability and Safety

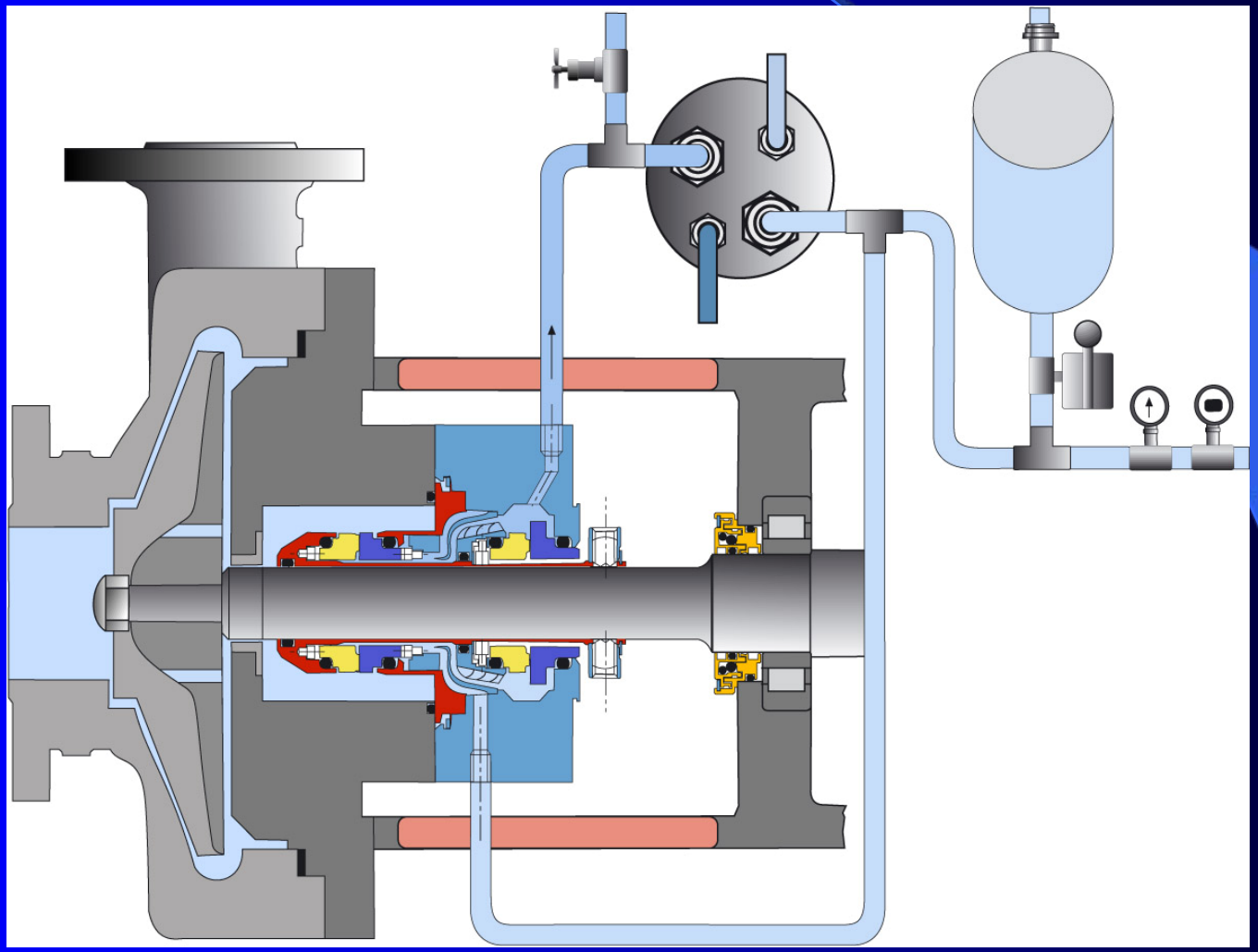
Alan Roddis[1],MDip
Chris Carmody[1], PhD
Heinz P. Bloch, P.E.[2]

[1] AESSEAL plc, Rotherham, England
[2] Consulting Engineer, West Moines, Iowa

What's the Problem?

- Legislation and environmental issues of concern to modern industry
- Clear indications that the adverse consequences of leakage and/or emissions no longer accepted by society.
- In particular, such leakage is no longer tolerated for toxic, flammable, carcinogenic and explosive liquids.
- Prohibited liquids include some that were, until recently, exempt from governmental rulings and similar regulatory protocols.
- In response, users now often opt to prevent leakage of pumped fluids to atmosphere by installing dual mechanical seals. In dual seals, the cavity is filled with a neutral liquid; *the liquid tends to heat up (Fig. 1).*

Dual seal with internal pumping device, covered by API Plans 53 & 54



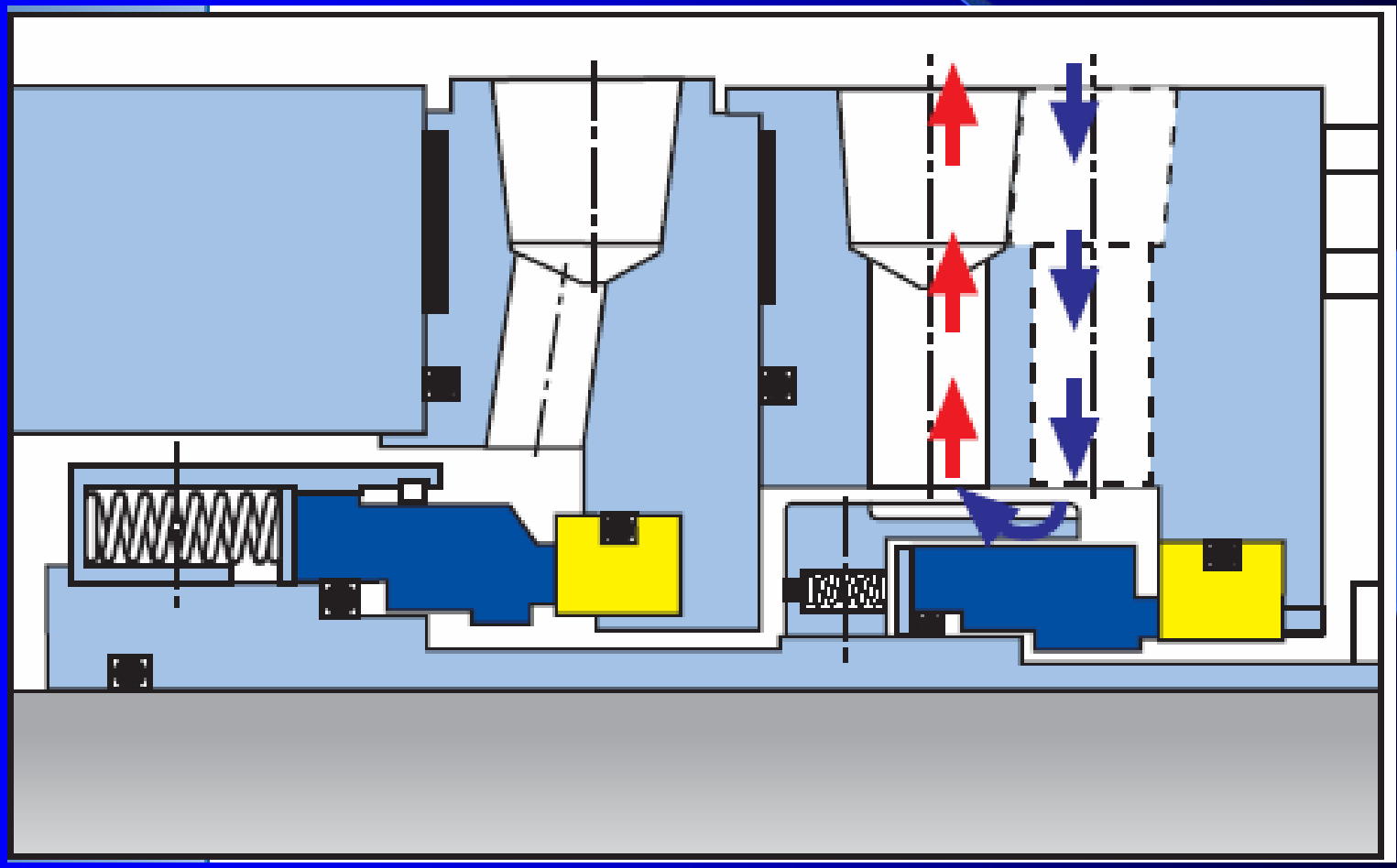
Pros and Cons of Other Options

Widely accepted *externally-pumped* API Plan 54 system is more expensive to run, consumes energy and is often impractical to install. (True also for existing plant upgrade situations.)

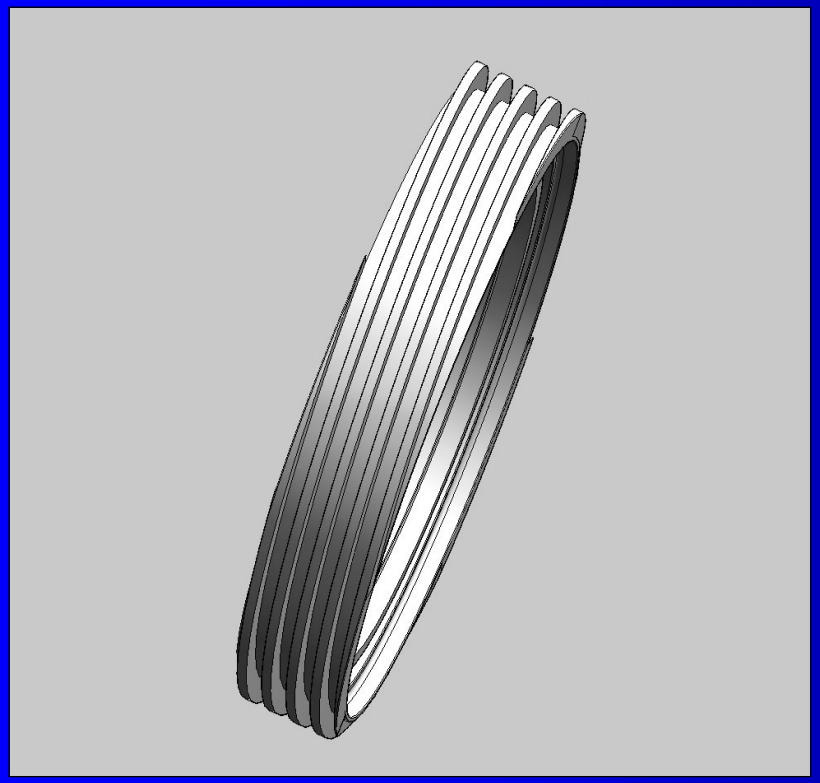
Similarly, *thermosiphon-convection systems* are somewhat unreliable and ineffective at efficiently dissipating the heat within the mechanical seal. These systems are particularly prone to miss-installation, where, for example, sags in the piping between the seal and system might prevent fluid convection flow. *The result would be seal overheating.*

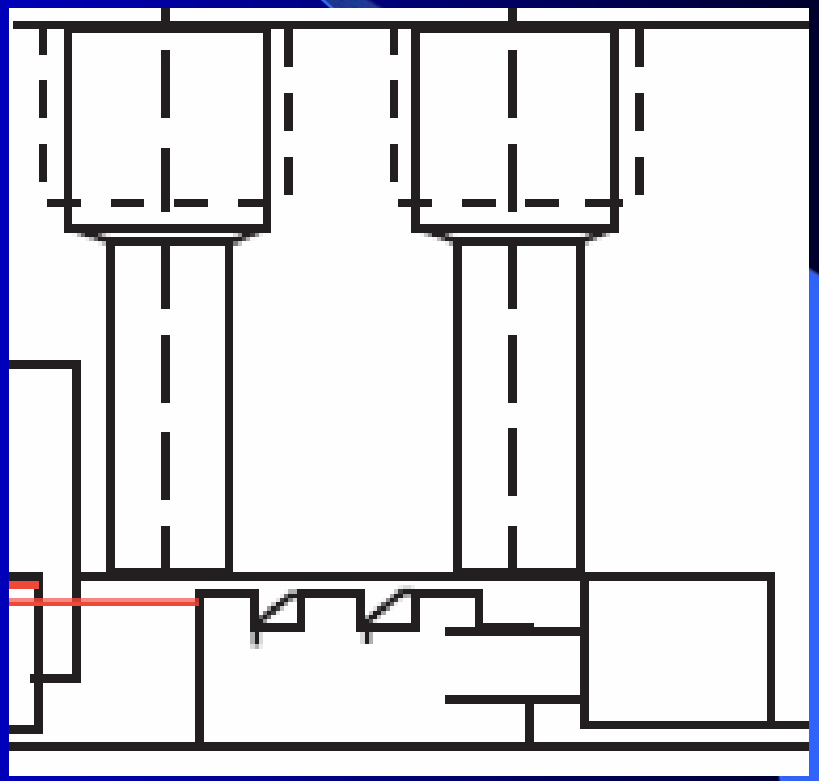
Consider Your Plan 52/53 Options:

(1) Bi-directional parallel slot configurations



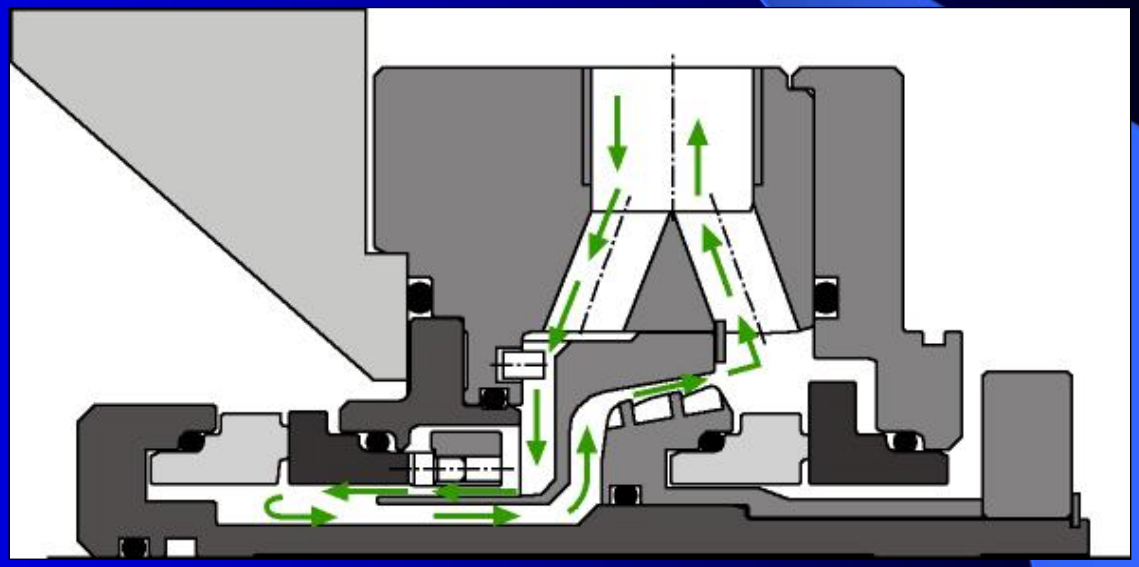
Unidirectional helical screw devices: (2) must maintain close clearances



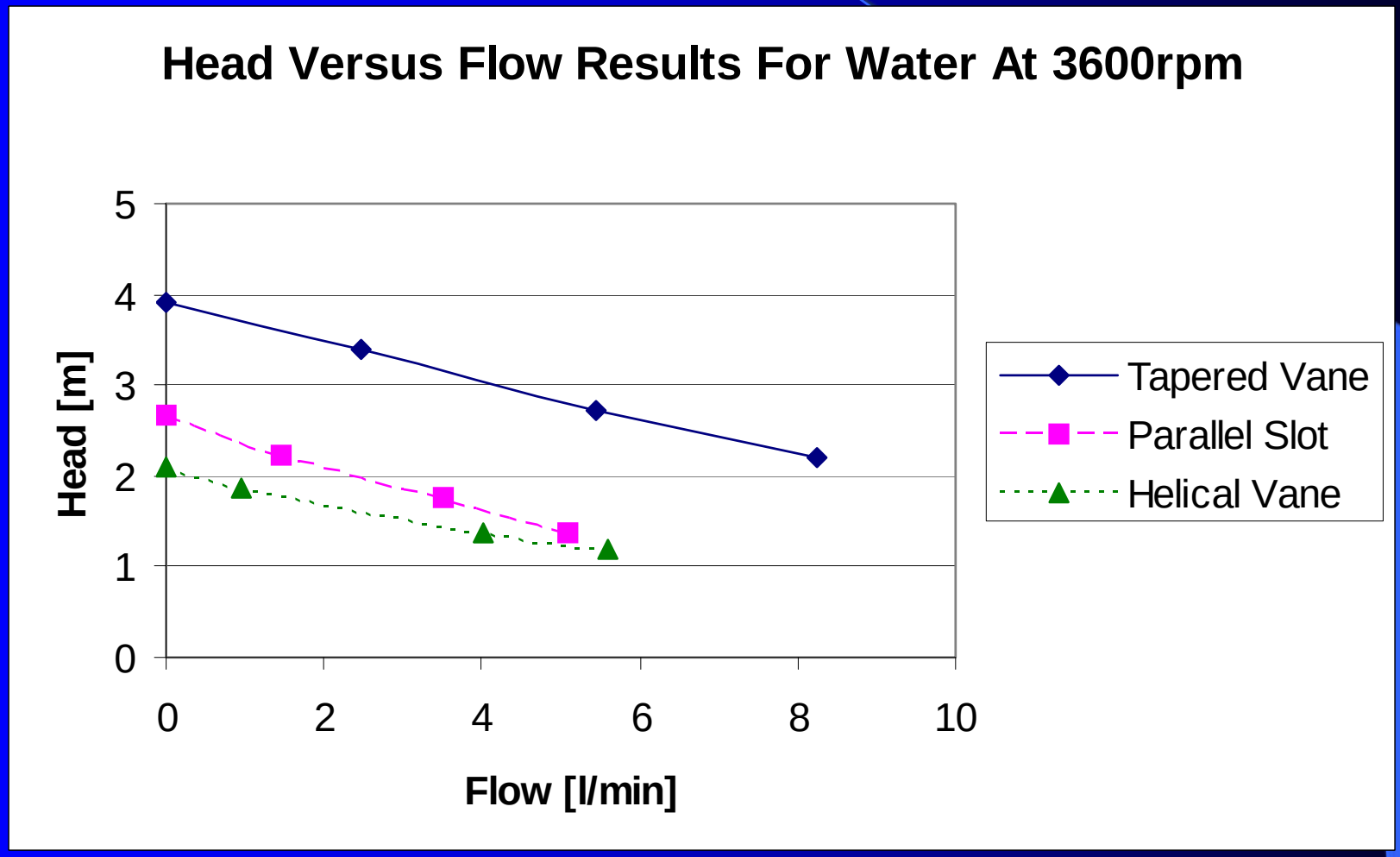


(3) A tapered vane pumping ring

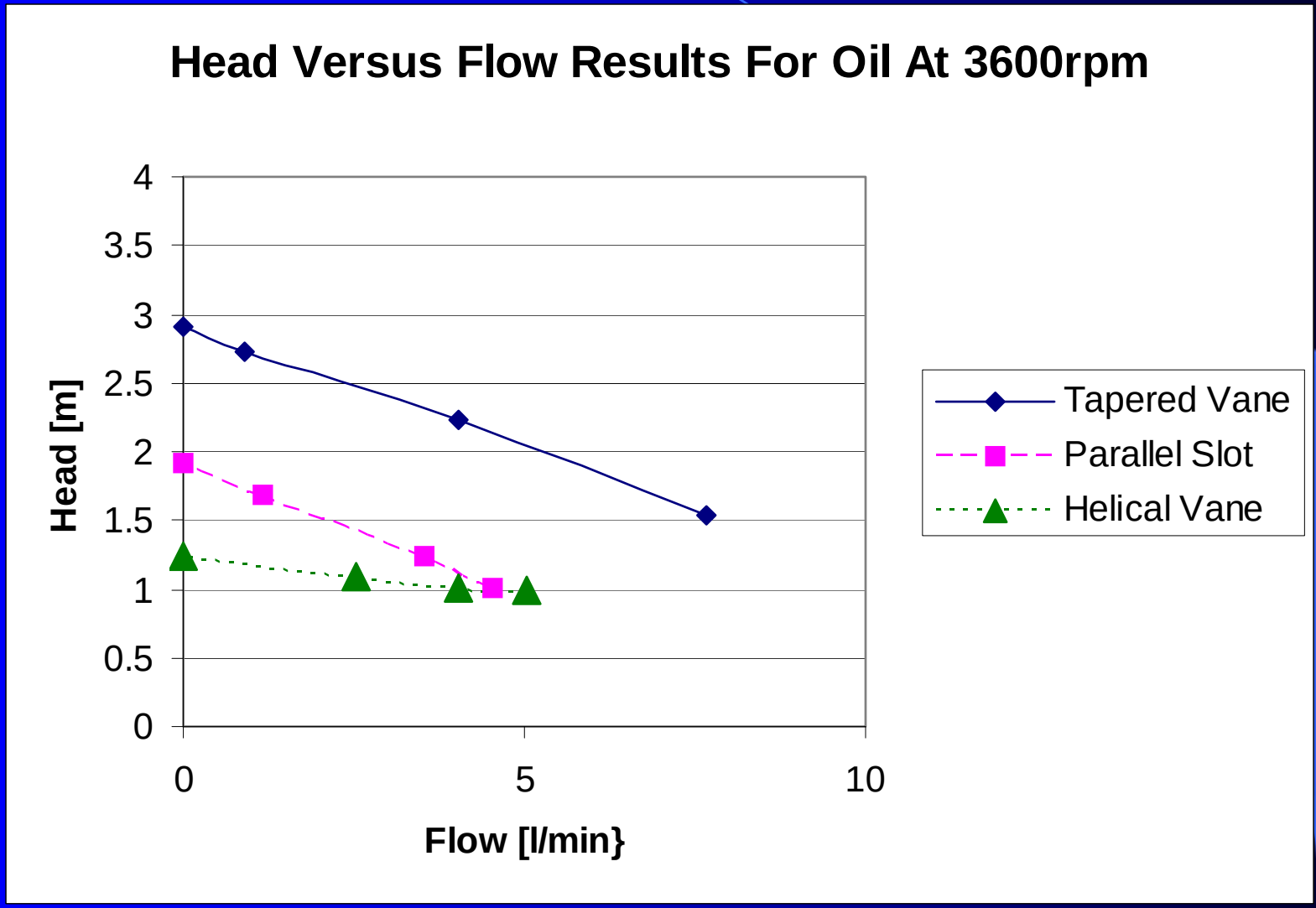
This one has wide-open clearances!



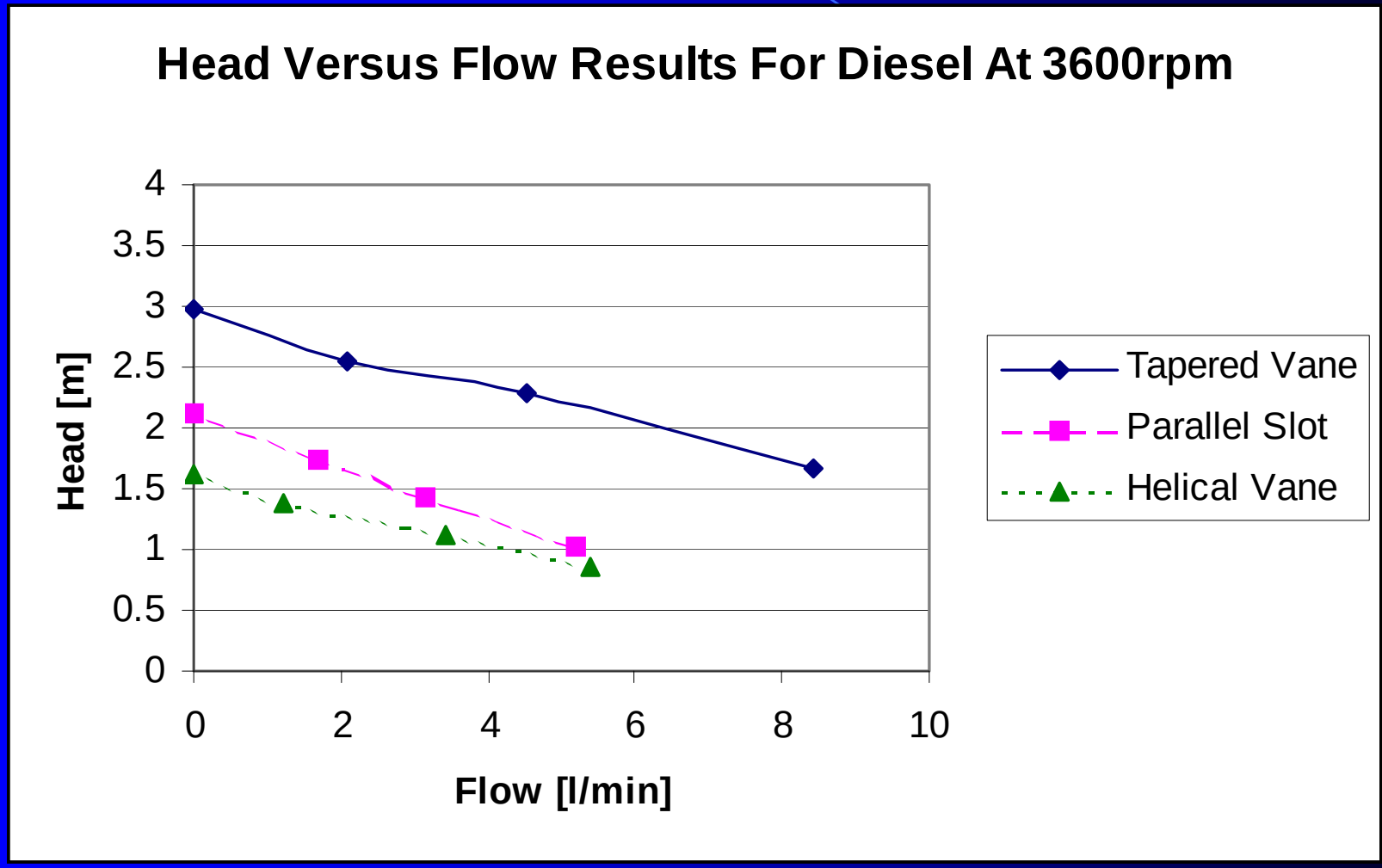
H_2O Test Plot for 3 Devices



Test Plot (Lube Oil) for 3 Devices



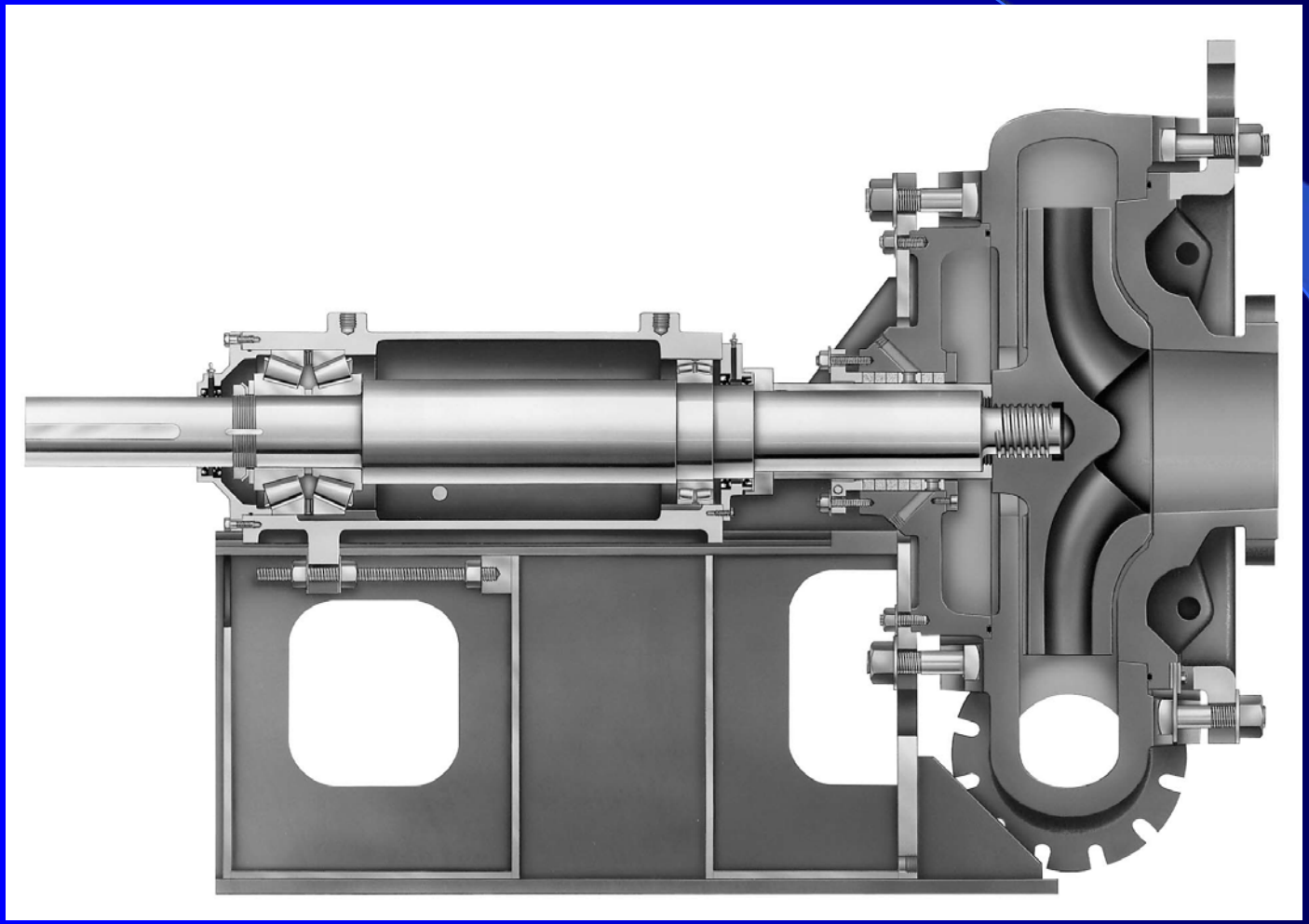
Test Plot (Diesel Fuel) for 3 Devices



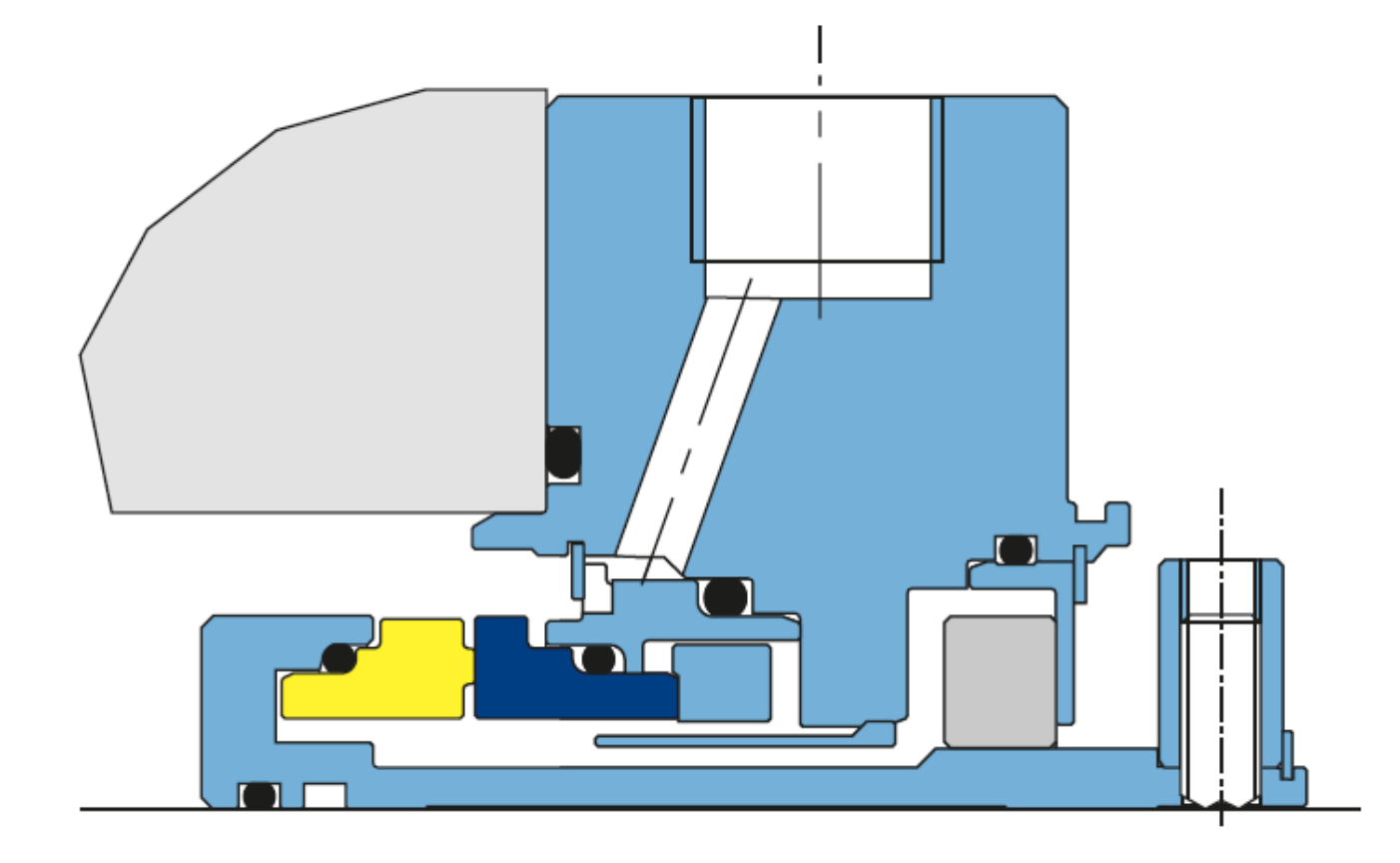
And when the science checks out and the testing is successful, a good seal manufacturer will find an interested user. (A fall-back position is needed—just for the relatively unlikely event that something will go wrong.) And so…….

We are now ready for Case I: A slurry pump seal retrofit

Some good old slurry pumps deserve upgrading

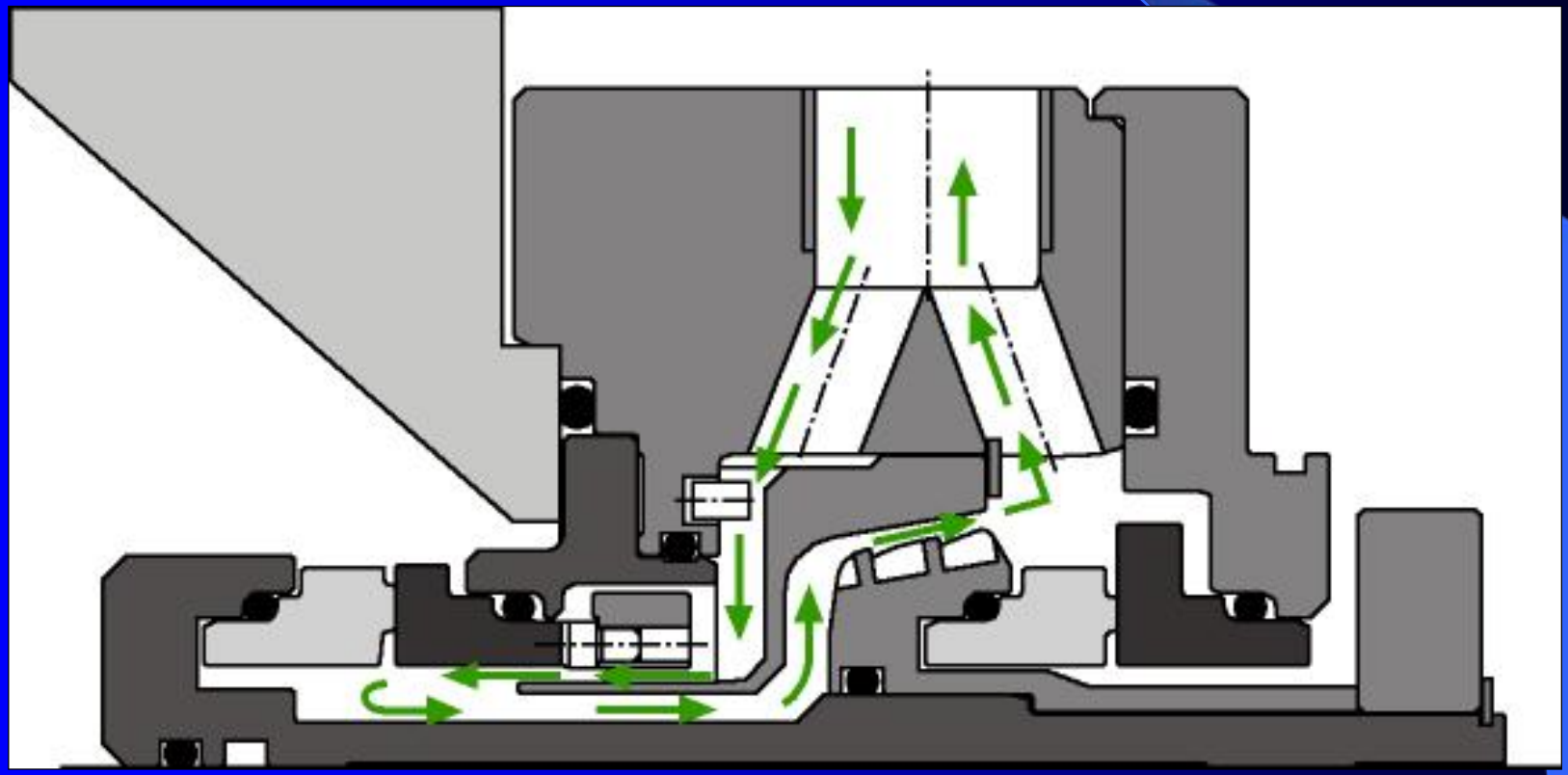


Mechanical seal used before upgrading



A slurry pump site

Barrier fluid flow with tapered vane ring

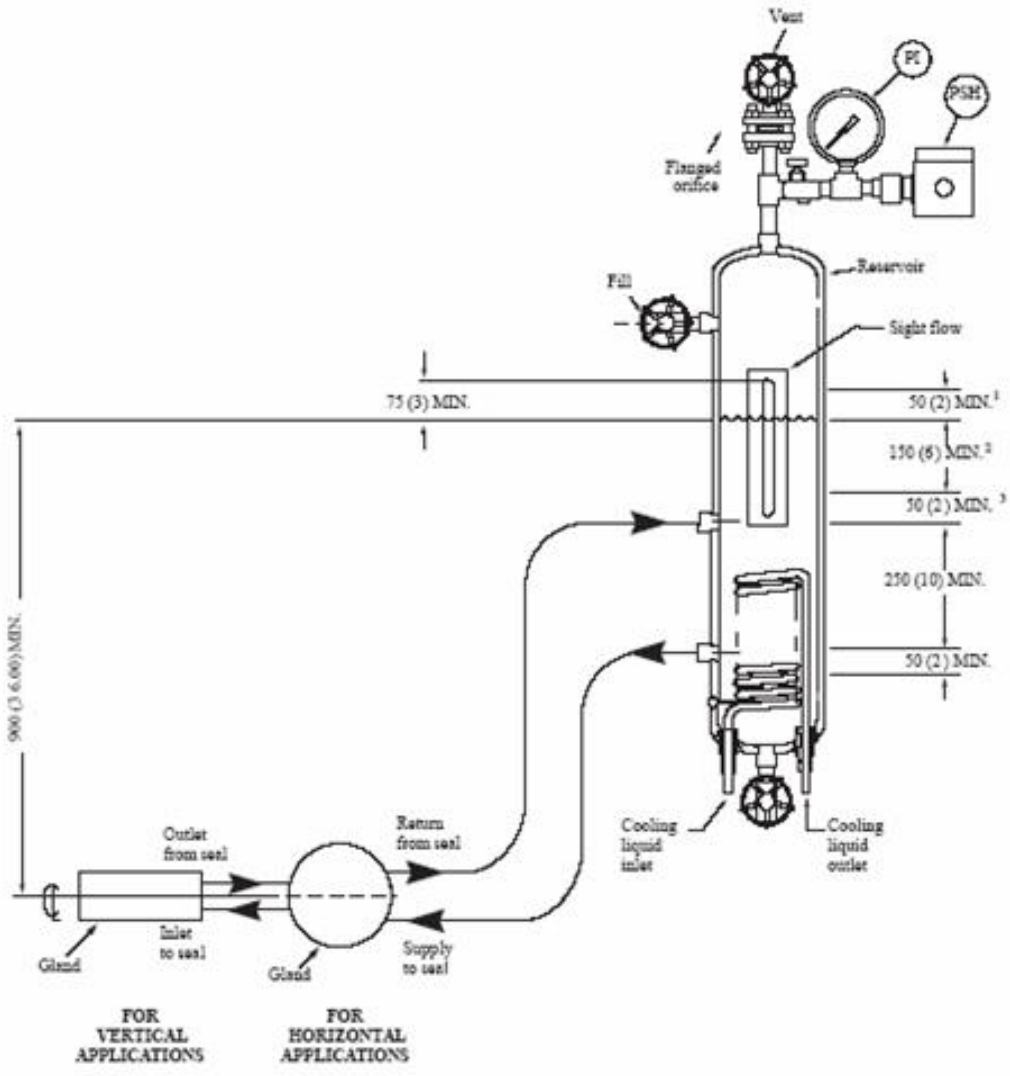


Case II: Pump (left) vs. Reservoir (right)

Pumping device performance criteria

- Energy requirement as low as reasonable
- Initial cost
- Footprint
- Maintenance cost
- Flow rate produced
- Head produced
- Selection is a compromise ----------
- Next slide represents an optimized layout

A reservoir & pip[ing layout per API-682 (below) would have required costly redesign in our Case II example



Lessons Learned

- Cost and energy savings made feasible by using API Plan 53 instead of some external plans
- Must insist on 1.5 mm clearance (API-682, Section 8.6.2.3)---it makes sense
- Be aware of the fact that some manufacturers gain efficiency only by disregarding this important API recommendation—they use risky “tight” clearances
- Tight clearances increase galling risk
- Ascertain thorough testing backs up mfr’s claims

Questions