Barrier Plans

Plan 53A vs 53B vs 53C

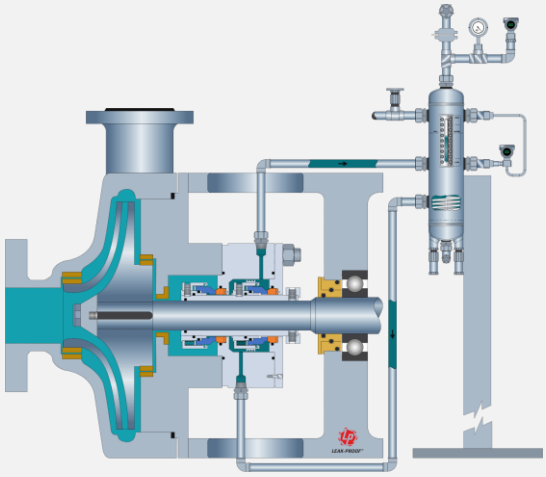
Variants of API Plan 53

Why do variants of Plan 53 exist?

API Plan 53 is the most commonly used **Barrier Plan** for dual mechanical seals, and it comes in **3** variants: **Plan 53A**, **53B**, and **53C**. But the real question is: ***which variant fits your application best?***

All three variants share the same goal: to maintain a **pressurized barrier fluid** between the **inboard** and **outboard** seals. However, the way this pressure is **generated**, **maintained**, and **isolated** from the external pressure source differs significantly. To understand the need for these variants, it's essential to first understand the limitation of each.

a)



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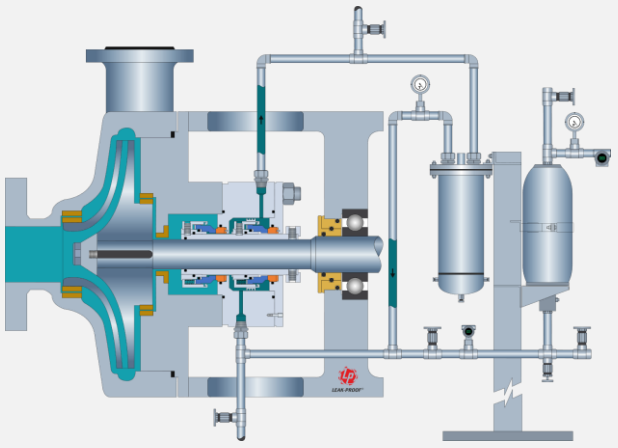

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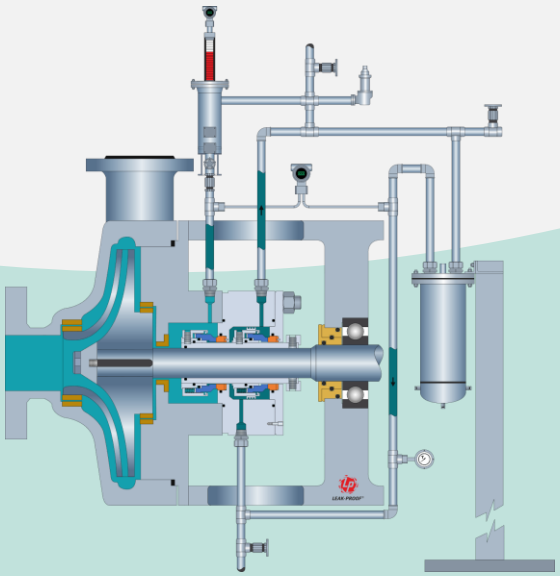

Image 1: a) Plan 53A, b) Plan 53B, c) Plan 53C

Limitation of Plan 53A & How Plan 53B solves it:

Plan 53A is essentially the **pressurized version of Plan 52.** Instead of using an unpressurized reservoir, Plan 53A uses a **nitrogen-pressurized** reservoir to create pressure on the barrier fluid. However, when the required

barrier pressure exceeds **10 bar (150 psi)**, there is a risk of **nitrogen absorption** into the barrier fluid, which can disrupt fluid stability and circulation.

Plan 53B was developed to overcome this limitation. Plan 53B uses a **bladder accumulator** charged with nitrogen. This design completely separates the nitrogen from the barrier fluid, **eliminating the risk** of absorption and making the system suitable for higher-pressure applications with better stability and reliability.

Limitation of Plan 53B & How Plan 53C Solves It:

While Plan 53B solves the nitrogen absorption issue of 53A by isolating the gas from the barrier fluid, it still depends on a pre-charged **bladder accumulator** to maintain system pressure. This setup works well only when seal chamber pressure remains relatively **stable**. In applications with significant or unpredictable **pressure fluctuations**, Plan 53B **cannot adapt** in real time—leading to risks of under-pressurization or over-pressurization.

To address this challenge, Plan 53C was introduced. Plan 53C uses a **piston accumulator**, connected to the seal chamber. The piston accumulator senses process fluid pressure in the seal chamber and ensures that the barrier fluid pressure is continuously **adjusted** and **maintained** above the varying seal chamber pressure. This makes Plan 53C ideal for applications with fluctuating seal chamber pressure.

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Table 1: API Plan 53A, 53B & 53C Comparison			
Parameter	**Plan 53A**	**Plan 53B**	**Plan 53C**
Fluid Pressurization	Pressurized Reservoir	Bladder Accumulator	Piston Accumulator
Barrier Fluid Pressure	Up to 10 bar (150 psi)	Above 10 bar (150 psi)	Adjustable (maintains pressure margin)
Nitrogen Interaction	Direct contact with barrier fluid	Completely isolated by bladder membrane	Completely isolated by piston seal
Pressure Regulation	No	No	Active regulation
Cooling Mechanism	Integrated cooling coils in reservoir	External heat exchanger	External heat exchanger
Fluid Recirculation	Thermosyphon + Pumping Ring	Pumping Ring	Pumping Ring
Complexity Level	Low	Medium	High
Cost	Low	Medium	High
Key Advantage	Low cost and simplicity	Isolation from nitrogen allows higher pressure use	Real-time pressure regulation for fluctuating pressure conditions
Key Limitation	Risk of gas absorption in higher pressure	Cannot respond to fluctuating seal pressures in real time	High cost and complexity in control and setup

Barrier Plans

Plan 53A vs 53B vs 53C

Variants of API Plan 53

Step-by-step Selection Guide

1. **Select Plan 53A, Where;**

Application: Process fluid is highly toxic, hazardous, or flammable, requiring zero leakage to the atmosphere.

Or

Application: Process fluid contains suspended solids, contaminants, polymerizing or solidifying tendencies, or poor lubricity, where product dilution is acceptable.

And

Pressure: Application has stable seal chamber pressure and barrier pressure requirement is **10 bar (150 psi)** or less.

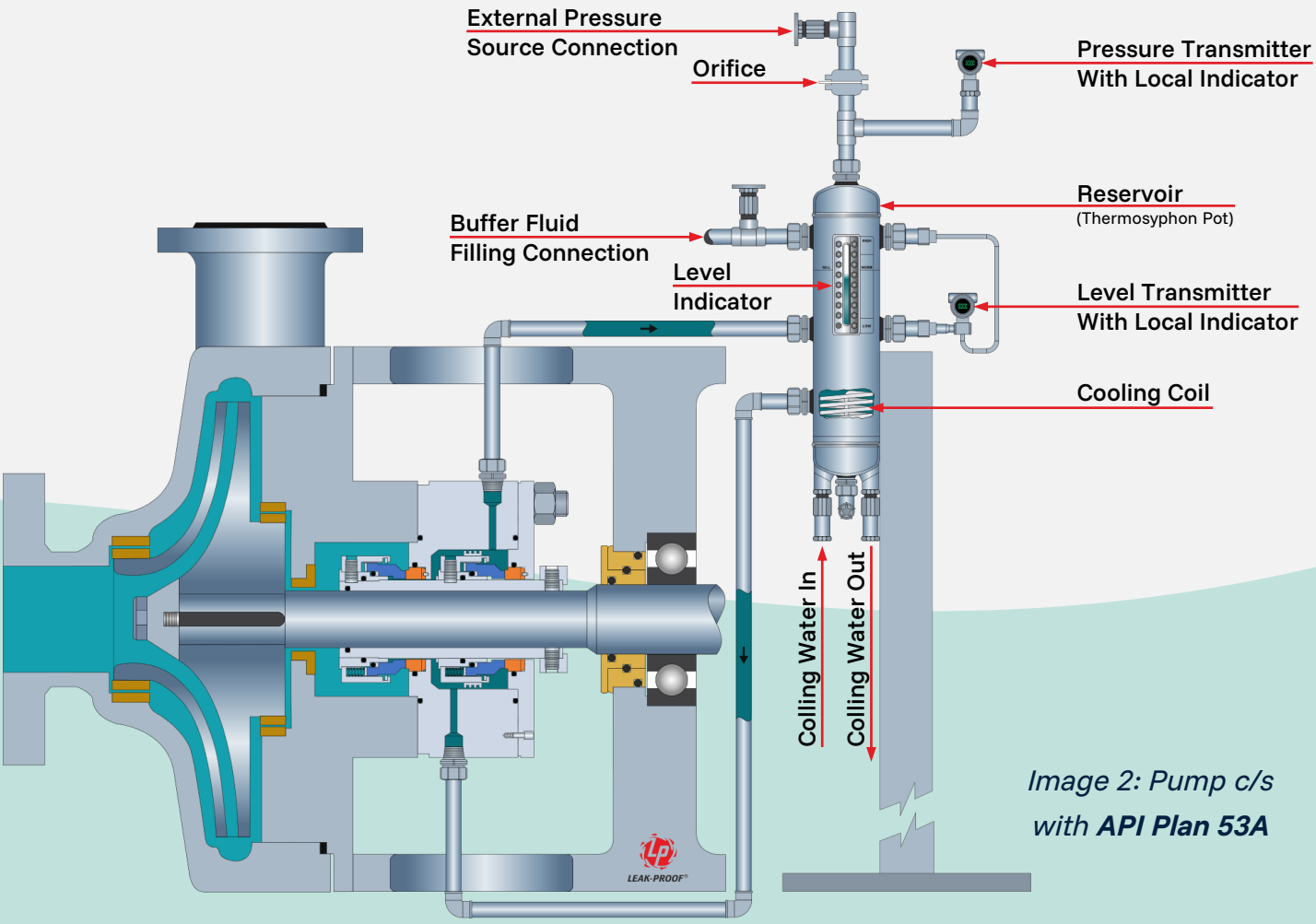

*Image 2: Pump c/s with **API Plan 53A***

2. Select Plan 53B, Where;

Application: Same as Plan 53A.

But

Pressure: Application has stable seal chamber pressure, and the required barrier pressure is **above 10 bar (150 psi)**, where Plan 53A becomes unsuitable due to risk of nitrogen absorption into barrier fluid.

Or

Pressure: Application has stable seal chamber pressure and barrier pressure requirement is **10 bar (150 psi)** or less, but a reliable nitrogen source at the required pressure is **not available** at the installation site.

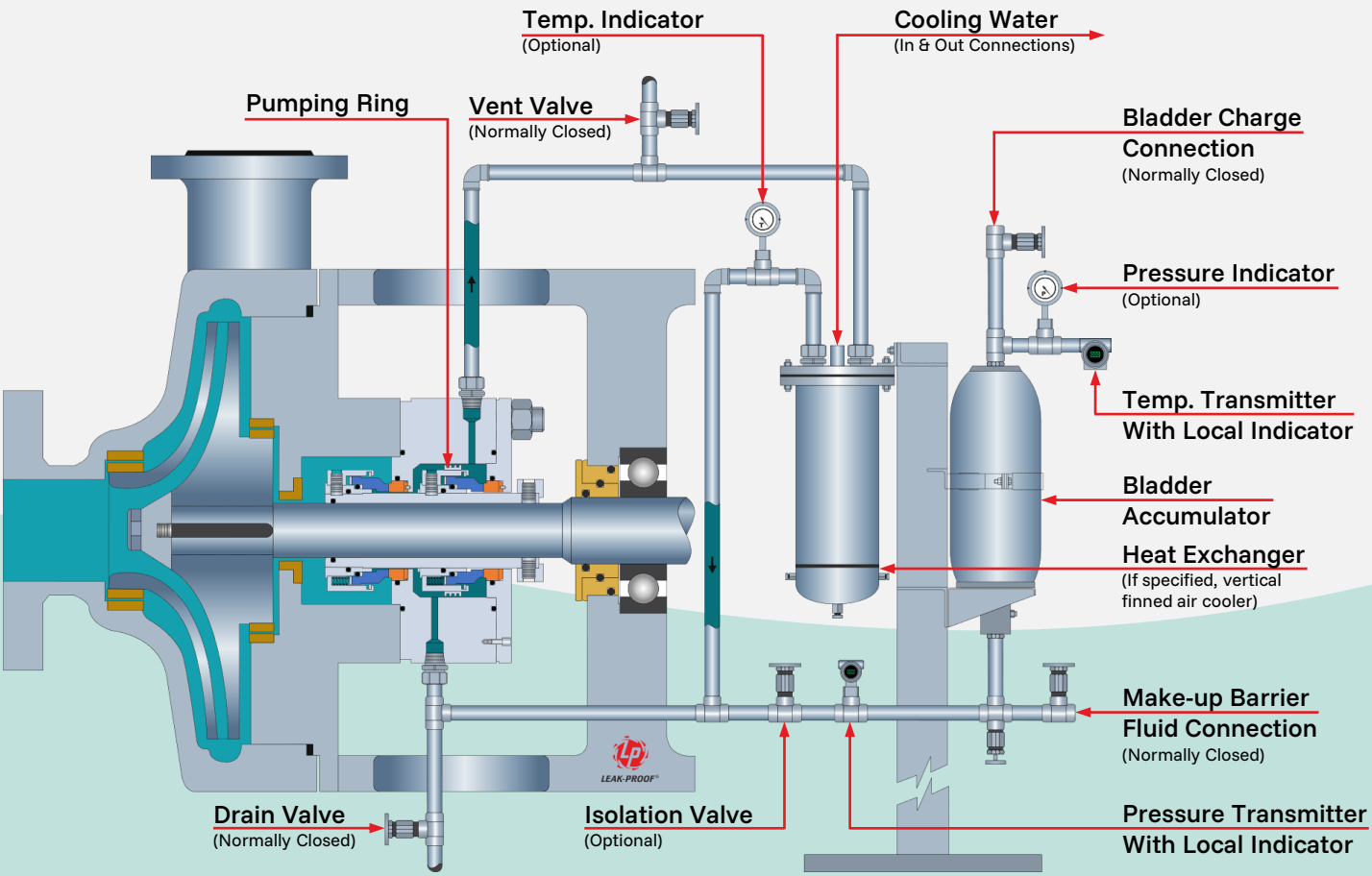

*Image 3: Pump c/s with **API Plan 53B***

3. Select Plan 53C, Where;

Application: Same as Plan 53A.

But

Pressure: Application has **variable** or **fluctuating** seal chamber pressure, where neither Plan 53A nor Plan 53B can maintain a consistent **pressure margin**.

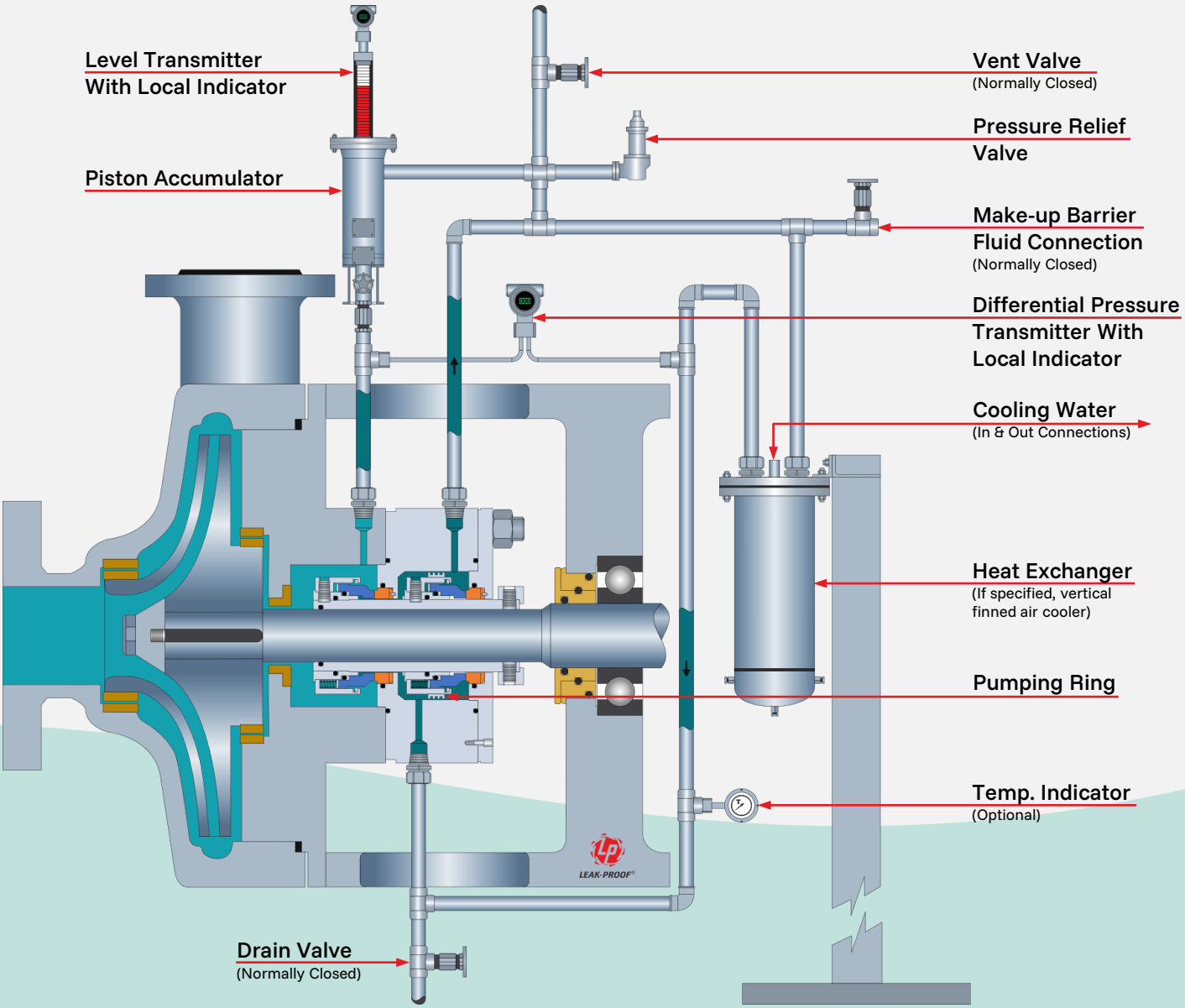

*Image 4: Pump c/s with **API Plan 53C***