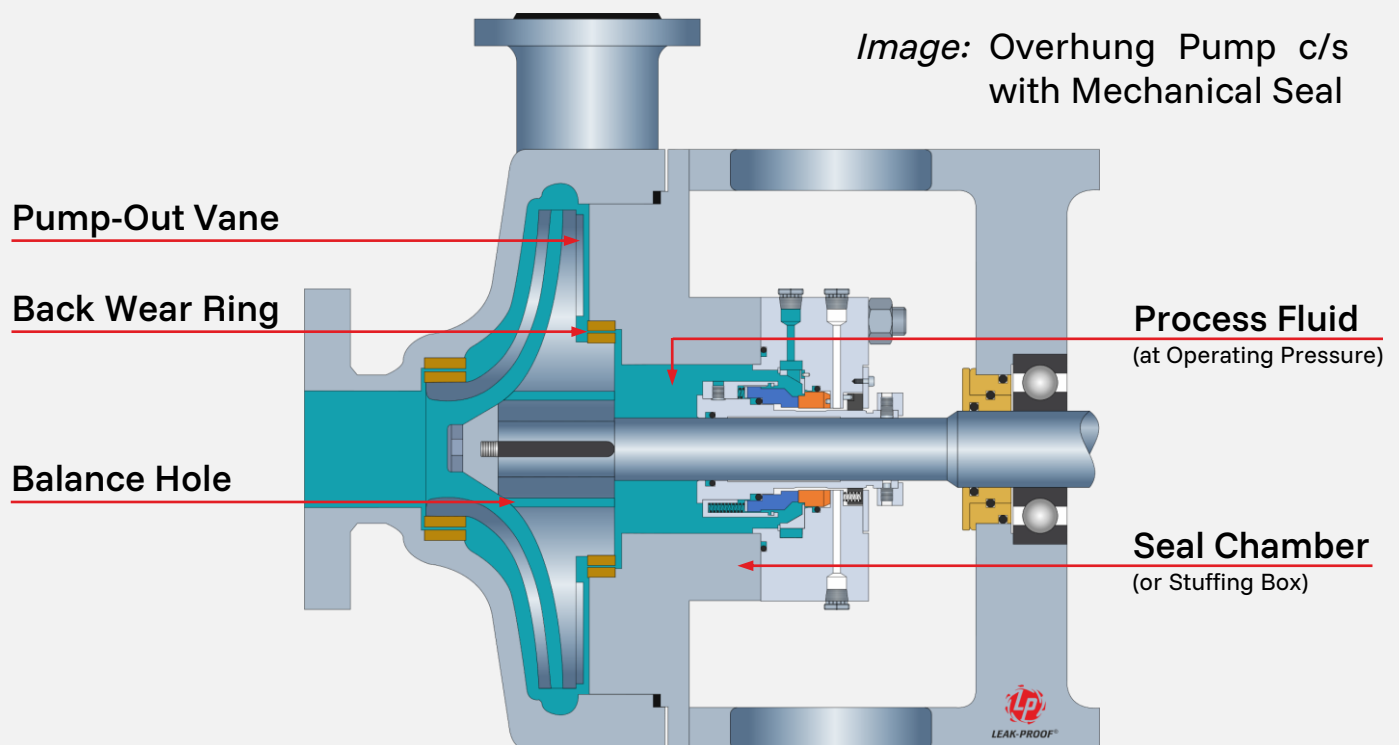


What is Seal Chamber Pressure?

Seal chamber pressure, often referred to as **Seal Operating Pressure**, is the pressure **inside the Seal Chamber or Stuffing Box** where the mechanical seal is installed. It is the **actual pressure of the seal chamber fluid (process fluid)** acting on the seal faces **during pump operation**.



Factors Affecting Seal Chamber Pressure

Pump Type

- 1. Overhung Pump:** The seal chamber is typically located behind the impeller (on the high-pressure side), making it exposed to **near-discharge pressure** when pressure-balancing features are **absent** in the impeller design—such as back wear ring, balance holes, or pump-out vanes. However, when such features are incorporated, they help reduce the seal chamber pressure accordingly.

- 2. Between-Bearing Pump (Single, Double or Multistage Stage):** These pump designs incorporate **two seal chambers**. One is located on the suction side and is subjected to **suction pressure**. The second can be at the suction, discharge, or an intermediate stage (suction or discharge side of that stage)—depending on the pump layout—and is typically exposed to a **comparatively higher pressure**. These pumps generally include pressure balancing feature (e.g., balance line from higher-pressure seal chamber to the suction), which help maintain more **moderate pressures on both sides**.

Impeller Design

- 1. Closed or Semi-Open Impellers:** These impellers typically generate higher pressure behind the **back shroud** unless that pressure is mitigated by design features such as **balance holes, back wear ring or pump-out vanes**.
- 2. Open Impellers:** These designs may result in **lower seal chamber pressure compared** to closed or semi-open impellers due to the **absence** of a back shroud.

Seal Chamber Pressure Estimation

Seal chamber pressure value is generally provided by the pump OEM. However, if the value is unavailable, it can be estimated either through direct measurement or analytically (provided accurate suction and discharge pressure values are available). While the **best practice is to measure** the seal chamber pressure **directly**, the following analytical model provides a **rough estimation** based on field practices.

$$P_{Seal\ Chamber} = P_{Suction} + k (P_{Discharge} - P_{Suction})$$

Value of k for Overhung Pumps:

- 0.15** Closed or Semi-Open Impeller with Back Wear Ring & Balance Holes
- 0.95** Closed or Semi-Open Impeller without Back Wear Ring, Pump-out Vanes & Balance Holes
- 0.50** All other cases

Value of k for Between Bearing Pumps:

- 0.00** Seal Chamber at Suction side
- 0.10** Seal Chamber with Balance Line
- 0.50** Seal Chamber at Intermediate Stage without Balance Line
- 0.95** Seal Chamber at Discharge Stage without Balance Line

Importance of Seal Chamber Pressure in Plan Selection

Seal chamber pressure is a critical parameter in the design of seal support systems. Its value must be clearly established during the selection and configuration of an API Plan. Without this information, the chosen plan may not function as intended, making the system speculative and prone to failure.

Seal chamber pressure is important for the following reasons:

- 1. Flow Generation:** In flush plans, whether using process fluid (e.g., **Plan 11** and its **derivatives**) or externally supplied fluid (e.g., **Plan 32**), the flush fluid pressure must be **higher** than the seal chamber pressure to generate the **required flow rate** for effective cooling and lubrication. If differential pressure is too low or absent, circulation will not occur, risking seal overheating and ineffective flushing.

API 682 recommends maintaining a minimum differential pressure of **1.7 bar (25 psi)** for flush plans incorporating a cyclone separator (e.g., **Plan 31** and **Plan 41**). For flush plans without a cyclone separator, a minimum differential pressure of **0.5 bar (7 psi)** is recommended (Leak-Proof® Engineering recommendation).

2. **Defines Pressure Target:** Essential for the selection and configuration of API Plans in double mechanical seals, where maintaining proper pressure differentials between seal chamber and buffer/barrier fluid is critical.
 - A. **Buffer Plans (e.g., Plan 52):** Buffer fluid pressure must be lower than seal chamber pressure.
 - B. **Barrier Plan (e.g., Plan 53A/B/C):** Barrier fluid pressure must be at least **1.4 bar (20 psi)** higher than the seal chamber pressure.

Without knowing seal chamber pressure, it's impossible to correctly set and maintain these pressure levels.

Therefore, seal chamber pressure must be determined in advance to:

1. Ensure effective circulation of the flush fluid.
2. Maintain the correct pressure of the buffer/barrier fluid.