

How to Avoid Pressure Equipment Failure

If you are an engineer, operator or technician who is responsible for system performance and safety, you know that pressure instruments play a critical role in your process and industrial/OEM applications.

These instruments provide accurate, reliable pressure measurements to confirm whether systems are operating effectively and efficiently, or if adjustments are needed. This information helps protect personnel, improve process efficiency and maintain product quality.

What happens when instruments fail?

There are many causes of instrument failure, and these issues can create serious problems for your operation. The good news is, in most cases, they can be prevented.

Read this guide to learn how to recognize the early warning signs, the most common pressure instrument failures and how to address them before they happen.

While the focus of this guide is on pressure gauges, the information provided also applies to pressure switches and transducers.

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What to Look for Before Failure Happens

Regular instrument maintenance is essential for ensuring safety, process efficiency and product quality. It also makes it easier to identify issues early and apply the right solutions before they escalate. This proactive approach helps reduce costly service work, minimize unplanned downtime and lower the risk of equipment-related injuries.

Top Three Signs of Failure

Appearance	Symptom	Description
	Pointer Flutter	The pointer continually moves back and forth making the gauge hard to read.
	Unresponsiveness	The pointer does not react to pressure changes.
	Component Damage	<p>One or more of the gauge components are damaged.</p> <ul style="list-style-type: none"> ■ A dented pointer may indicate severe under- or overpressure. ■ A melted or deformed window signals extreme heat. ■ A window and dial coated in black powder that causes poor reliability can be the result of excessive pulsation or vibration that is wearing down the movement teeth.

These signs, among others, serve as indicators of underlying gauge issues. If you can recognize them and understand their causes, you will be better prepared to diagnose and resolve problems that may occur in your own instruments.

6 Common Problems & Solutions

Below are six of the most common pressure instrument problems, why they occur, how they affect your system and steps you can take to resolve them.

1 Problem: Excessive Pulsation or Vibration

In processing equipment, surges in pressure can cause pulsation of the gauge pointer and vibration leading to pointer flutter and gauge component damage.

These conditions generally fall into one of two categories:

- **High frequency and low amplitude:**
The high frequency vibration tends to cause localized wear on the gear teeth within the gauge movement.
- **Low frequency and high amplitude:**
The low frequency vibration creates broader stress on the Bourdon tube and other internal parts.

As a rule of thumb, if pulsations or vibrations cause pointer movement of five percent or more of the full-scale range, steps should be taken to reduce their effect on the instrument.

Solutions:

- **Dampen the movement or tube:** Use a liquid-filled gauge or a dry gauge with [PLUS!™ Performance](#) to reduce pulsation and vibration effects.
- **Install remotely:** Mount the gauge away from the pulsation/vibration source using a capillary between 1 and 100 feet in length.
- **Restrict process flow:** Add a pulsation dampener, throttle screw, steel needle valve or diaphragm seal to reduce pulsation before it reaches the instrument.

Real world example

A pump station experiencing pointer flutter and frequent gauge damage caused by vibration can switch to a [PLUS!™ Performance](#) gauge and relocate the instruments away from the vibration source to prevent recurring failures and extend service life.



[1279 Duragauge PLUS!™](#)

2 Problem: Operating Outside Temperature Limits

Instruments are designed for specific temperature ranges. Exposure outside those limits can cause significant damage. Refer to Figure A for typical temperature ranges for dry and liquid-filled gauges.

Typical Ranges

- **Dry gauges:** Up to 200 °F (93 °C) ambient temperature and -20 °F (-29 °C) to 250 °F (121 °C) process temperature. Beyond this, issues such as dial or window discoloration (if acrylic) and gasket hardening may occur.
- **Liquid-filled gauges:** Up to 150 °F (66 °C) ambient temperature and a similar process temperature range to dry gauges, depending on design. Higher temperatures can cause gasket and O-ring material to degrade and the fill liquid to discolor.

Extremely low or high temperatures can also impact accuracy. For instance, a standard dry gauge may respond more slowly in cold conditions. In general, accuracy shifts when ambient temperatures differ from the calibration point. For gauges calibrated at 68 °F (20 °C), expect a change of about 0.4% for every 25 °F (13.9 °C) above or below that point.

Solutions:

- **Remote mounting with capillary:** Install the instrument away from the process using a capillary rated from -300 °F to 750 °F (-184 °C to 399 °C) to reduce temperature exposure. Even a short 5-foot length is effective at reducing high temperatures or raising very low ones.
- **Direct mounting with dissipating devices:** Use an Ashcroft® [MicroTube™ siphon](#) or [finned siphon](#). This accessory handles pressures up to 5,000 psi and process temperatures up to 800 °F (427 °C). The finned siphon is rated for 3,000 psi and 700 °F (371 °C).
- **Coil or pigtail siphons for steam:** A pigtail siphon is used for vertical mounting, while a coil siphon is for horizontal mounting. Before installation, fill the loop with water to create a barrier that protects the instrument from high temperature and water hammer.



Figure A. Gauge temperature range comparison chart

Gauge Type	Ambient Range	Process Range	Common Issues
Dry Gauge	Up to 200 °F (93 °C)	-20 °F (-29 °C) to 250 °F (121 °C)	Discoloration, gasket hardening, slow response in cold conditions
Liquid-Filled	Up to 150 °F (66 °C)	-20 °F (-29 °C) to 250 °F (121 °C)	Gasket or O-ring degradation, fill discoloration, accuracy drift

3 Problem: Sudden Pressure Spikes

Pressure spikes can result from water hammer, rapid valve actuation, equipment malfunction or process fluid freezing. These sudden surges can dent pointers, rupture Bourdon tubes or break movement gears.



Solutions:

- **Integrate an internal stop** or overload stop to increase proof pressure by about 20%.
- **Install a pressure limiting valve (PLV)** such as the Ashcroft® [PL02](#), to automatically shut off flow at the full-scale range and reset once pressure drops.
- **Select a gauge with higher overpressure capability.** For example, the Ashcroft® [T6500 with the XRA option](#) allows overpressure up to 400% of range.
- **Choose a new, properly rated gauge** that accommodates the maximum operating pressure. For optimal readability, the gauge pointer should normally operate at 12:00 on the dial face. If the normal operating pressure of the gauge is 50 psi, choose a full-scale range that is twice the operating range or 0/100 psi.

Real world example

In a water treatment facility, you can prevent repeated gauge damage caused by pressure surges during pump start-ups by installing pressure limiting valves to keep spikes from exceeding the gauge's proof pressure.

4 Problem: Clogging from Particulates and Slurries

Instruments used in dirty processes are prone to buildup that can obstruct flow and reduce accuracy. Processes involving particulates, slurries and sludge, for example, are highly susceptible to clogging. When process material becomes stuck on the instrument's inner surfaces, it can reduce the efficiency of the process.

Solutions:

- **Isolate the instrument** from process media using a diaphragm seal or isolation ring.
- **Add a flushing connection** or valve to clear buildup when needed.
- **Use a full-flow** isolation ring for heavy sludge or slurries to eliminate clogging.

Real world example

In chemical processes containing heavy slurries, frequent gauge blockages can occur. Installing diaphragm seals with flushing ports allow operators to clear buildup and maintain accurate pressure readings.



5 Problem: Corrosion from Incompatible Materials

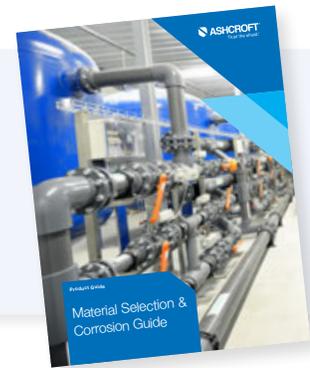
If the wetted parts are not compatible with the process media, corrosion can occur, leading to accuracy loss and possible safety hazards. In severe process conditions, the instrument can fail causing media to escape into the environment and risk operator injury.

Solutions:

- **Verify wetted part material compatibility** for composition, concentration and temperature.
- **Use a diaphragm seal or isolation ring** constructed from corrosion-resistant materials if wetted parts are not compatible.
- **Refer to the Ashcroft [Material Selector & Corrosion Guide](#)** for assistance.

Real world example

In food and beverage cleaning systems, strong sanitizing agents can corrode gauges built with incompatible alloys. Choosing compatible materials helps prevent corrosion-related failures and ensures consistent pressure measurement.



6 Problem: Improper Installation and Use

Instruments are delicate pieces of equipment. Incorrect installation or handling can cause serious instrument damage leading to measurement error or component failure.

Solutions:

- **Use an open-ended wrench** for installing NPT connections. Do not tighten using the gauge case.
- **Do not use the instrument as a step** or support after it is installed.
- **Inspect regularly** for leaks, wear or calibration drift.

Real world example

At a manufacturing plant, gauges often fail after being overtightened during installation. Training maintenance teams to use open-ended wrenches and avoid torquing the gauge case can eliminate recurring damage.



Ashcroft Solutions in Action

Ashcroft Critical Application Solution Experts® (CASE®) help existing and prospective customers identify process challenges and recommend appropriate products and product configurations to resolve or prevent them. The following CASE studies show how our recommended solutions can improve the safety and protection of pressure instrumentation used in critical process applications.

CASE Study: Protecting a Refinery's HF Alky Unit

The customer: A refinery with a hydrofluoric acid (HF) alkylation unit, also referred to as an "HF Alky" unit. These units are used in petroleum refining operations to convert isobutane and alkenes (primarily propylene or butylene) into alkylate, which is used to make gasoline.

The problem: Hydrofluoric acid is hazardous and corrosive. If accidentally released, the acid can form a vapor cloud that causes severe reactions and possible fatalities.

The diagnosis: After visiting the plant, reviewing the application and performing on-site analysis of the gauge in use, Ashcroft recommended a gauge assembly with additional safety features for improved protection.

Solution: The gauge assembly we recommended featured the ALD (Acid Leak Detection) system. Its key benefits include:

- Tamper-proof design with the gauge welded to the seal
- Visual indication of leaking process media
- Dual containment for safety



CASE Study: Reducing Extreme Effects in Petrochemical Gauges

The customer: A refinery using pressure gauges across multiple applications.

The problem: The gauge pointer indicated 42 psi with no applied pressure.

The diagnosis: During a two-day audit, Ashcroft documented each gauge and process at the refinery plant experiencing extreme service conditions, including high temperatures, vibration, pulsation and physical damage. Of all the gauges inspected, 17% showed signs of damage such as discolored fill, overpressure, liquid fill leaks, water ingress, broken windows or loss of pressure containment.

Solution: After determining the root causes of the problems, Ashcroft:

- **Replaced most gauges with PLUS!™ Performance technology**, reducing inventory by 50% and eliminating fill leaks and discoloration.
- **Added pressure limiting valves** for overpressure protection.
- **Specified glycerin-filled gauges** for severe vibration areas and IP65 weatherproof cases to prevent moisture ingress.



Prevent Failure Before it Happens

The chart below summarizes the most common causes of pressure instrument failure, the action needed to prevent them and the solutions available to protect your operation.

Failure Causes	Action Required	Description	Solutions
 Pulsation or Vibration	Dampen, Remote Installation	Surges in pressure and mechanical vibration can cause pointer flutter and internal wear. Liquid-filled gauges or dry gauges with PLUS! ™ Performance help dampen movement and stabilize readings.	
 Temperature	Capillary Mounting, Dissipating Devices	Exposure to ambient or process temperatures outside rated limits can affect accuracy and degrade internal components. Capillary mounting and temperature dissipating devices such as siphons help reduce temperature exposure.	
 Pressure Spikes	Internal Stop, PLV, Overpressure Capability Gauge	Pressure spikes caused by water hammer, rapid valve actuation or process upsets can momentarily exceed a gauge's rated capacity. Pressure limiting valves or gauges with overpressure capability help protect internal components.	
 Clogging	Isolation, Flushing	Instruments used in processes with particulates, slurries or viscous media are prone to buildup that can obstruct flow and reduce accuracy. Diaphragm seals or isolation rings help prevent process media from entering the instrument.	
 Corrosion	Compatibility	When wetted parts are not compatible with the process media, corrosion can occur over time and lead to accuracy loss. Diaphragm seals or isolation rings with compatible materials help protect the instrument.	
 Improper Installation	Proper Tool Use, Frequent Inspection	Incorrect installation or handling can cause mechanical stress that leads to measurement error or component failure. Proper installation tools and mounting practices help protect the instrument.	

Access Resources and Get Support

You now have the insight to recognize and prevent the most common causes of instrument failure, so you can help keep your people, processes and equipment safe.

At Ashcroft, we're committed to supporting you every step of the way, from selecting the right instruments for new applications to resolving issues in existing systems. Our team is here to help you maintain reliable, accurate performance across every operation.

Next Steps

- Talk to an [Ashcroft CASE[®] expert](#) about your process challenges.
- Compare [Ashcroft[®] instrumentation and datasheets](#).
- [Check out additional helpful guides in our Resource Center](#).



Learn more about avoiding pressure equipment failure and associated Ashcroft[®] instrumentation.



Critical Application
Solution Experts[®] (CASE[®])



Resource Center for blog
articles, videos and
solution guides

Related blog articles:

- [How Do I Select the Right Pressure Gauge Range?](#)
- [How Does Temperature Affect Pressure Gauge Performance?](#)
- [How to Identify the Best Pressure Gauge Replacement](#)
- [Are Pressure Gauges Repairable?](#)
- [How To Properly Store Your Pressure Gauge](#)

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