

# Reduce Shutdowns and Fulfill Production Goals

## Compressor Health Monitoring



# Keep compressors from causing unplanned downtime

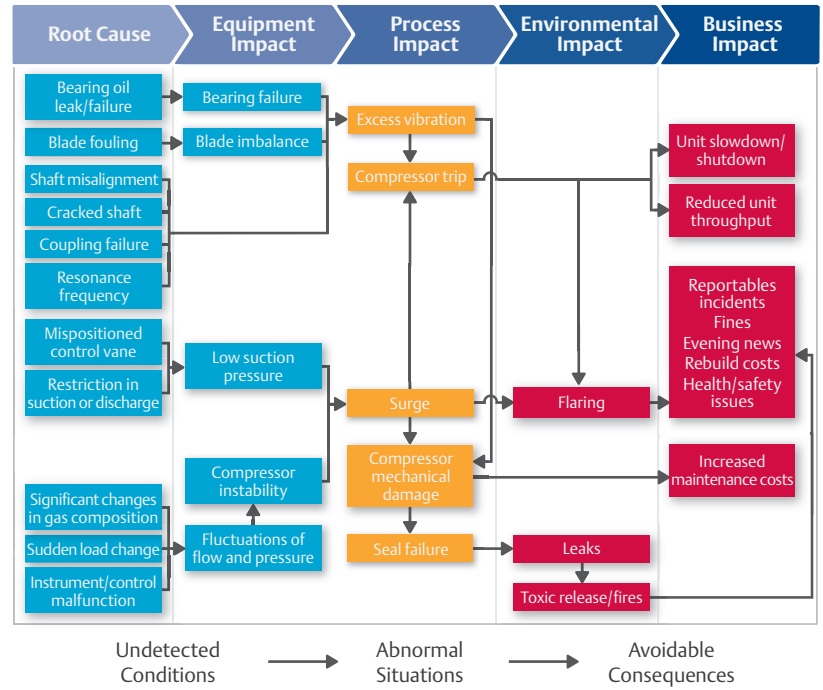
Cost has long been the main barrier to installing automated monitoring on essential (non-critical) compressors. This continues to be the case despite the many times a compressor failure caused missed production targets and repairs led to costs that outweighed the expense of automated monitoring.

Compressor failure accounts for 0.6 percent of all lost production. Many essential compressors go unmonitored, but the fact that power consumption alone represents 65 percent of compressed air costs in plants shows that there are opportunities for savings from automation.

A seemingly insignificant essential compressor failure can become a costly environmental incident. Hydrocarbon vapor releases or an unforeseen leak not only cost your staff time with paperwork and meetings, but it could also put you on the evening news.

What often plays out in plants is that the pressure of emergencies can overwhelm even the most skilled operator—assuming they aren't already overextended amid short staffing—and then cause more damage, compelling operations to ask “why couldn't this have been prevented before we even had to go fix it?”

## Anatomy of Compressor Failure



## Common Threats to Compressor Health



### HIGH VIBRATION

Increasing vibration indicates blade, bearing, shaft, or coupling issues that can lead to compressor failure and a potential unit shutdown. This reduces throughput, increases maintenance costs, and generates environmental issues. Root causes include blade fouling, lubrication and coupling failure, shaft misalignment, or operating near resonance frequency.



### FLUCTUATIONS IN GAS FLOW

Fluctuations in gas flow and pressure result in instability that can lead to surge, causing mechanical damage and/or compressor trip. Root causes include instrumentation malfunction and sudden changes in gas composition and compressor load.



### SURGE

Surge occurs when flow in the compressor is too low in relation to its speed. Sudden changes in composition, flow, or suction pressure can trigger surge, which, if uncontrolled, could cause catastrophic consequences.



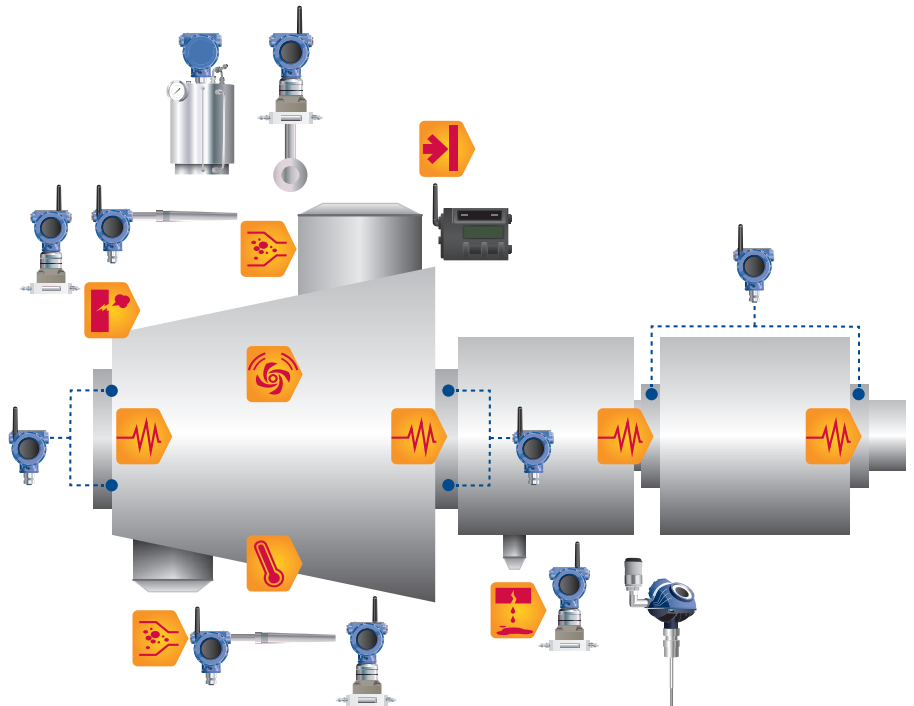
### RESTRICTIONS

Restrictions on the compressor's suction or discharge lead to low suction pressure which can result in compressor surge. Root causes include a plugged suction filter, control valve issues, or a poorly positioned control vane.



### TEMPERATURE RISK

Temperature spikes can result in damaged compressor internals and seal failure.



### HYDROCARBON VAPOR RELEASES

Process gas seal failure can be caused by excessive vibration resulting in possible flaring, toxic releases, and fires leading to reportable incidents and fines.



### LUBE OIL LEAK/FAILURE

Inadequate lubrication can result in bearing failure, which causes excessive vibration and leads to mechanical damage of the compressor.

## What if a compressor didn't fail unexpectedly and didn't mean lost production and sudden, costly repairs?

With the proper insight that comes with automated monitoring, you can reduce unplanned slowdowns and shutdowns, along with the lost production and frustrations that accompany dealing with the unexpected.

### Reduce Unplanned Shutdowns

Automated and trendable asset health data will allow your reliability engineer to run root-cause and failure analysis. If compressor failure is approaching, there may be time to perform life-extending repairs. If repairs aren't enough, operations can at least anticipate production changes and prepare a timely and effective response.

### Increase Asset Reliability

Increasing asset reliability does not have to be an unachievable goal. With early warnings and algorithms that detect when a compressor operates outside of required operating parameters, your maintenance staff will know when a compressor is not operating the way it should be. Your operator can then make preventive adjustments before the asset falls prey to a "bad actor" and becomes an unreliable piece of equipment that keeps you from required production.

### Mitigate Safety and Environmental Risk

Imagine that your operators had sufficient warning prior to abnormal operation or imminent failure of a compressor. An operator could then perform a controlled shutdown or switch to a backup compressor, if available. A controlled shutdown reduces your plant's exposure to environmental and safety risks, and takes the control and puts it into your operator's hands. An effective controlled shutdown starts with timely and accurate information, which Emerson's automated monitoring provides.

## Protecting your profit

Industry experts suggest that compressor failure and shutdowns are responsible for 0.6 percent of production capacity loss. Care to get that back?

### INPUT

Refinery capacity in barrels per day	250,000
Refinery net margin per barrel refined	\$5
Refinery total annual maintenance spend, excluding turnarounds	\$50,000,000
% of refinery total annual maintenance attributable to compressors	8%
% anticipated reduction in lost production with diagnostics	30%
% anticipated reduction in compressor maintenance cost with diagnostics <sup>1</sup>	30%

### OPERATIONAL BENEFITS

a. Refinery capacity in barrels per day	250,000
b. Refinery net margin per barrel defined	\$5
c. Production capacity lost due to compressor failures <sup>2</sup>	0.6%
d. Reduction in lost production with compressor monitoring	30%
e. Operating time in days per year	365

**Annual Net Profit Improvement (=a x b x c x d x e) \$821,250**

### MAINTENANCE BENEFITS

f. Annual maintenance budget	\$50,000,000
g. Refinery total annual maintenance attributable to compressors	8%
h. Reduction in average cost to repair if compressors didn't fail unexpectedly	30%

**Annual Maintenance Cost Reduction (=f x g x h) \$1,200,000**

**TOTAL ANNUAL PROFIT IMPROVEMENT \$2,021,250**

#### Notes

- Cost avoidance of doing preventive maintenance when no problem is found
  - Calculation assumes straight time versus overtime
  - Cost avoidance of more severe damage versus just beginning to fail
- The 0.6 percent production capacity loss is based on all compressors (critical and essential); there may be as many as 20 compressors in a mid-sized refinery
  - Percent of planned capacity loss; assumes refinery can sell recovered capacity

Get Started Today at  
[EmersonProcess.com/Compressors](http://EmersonProcess.com/Compressors)



## Compressors

Emerson's integrated solutions for compressor monitoring allows your operators and engineers to detect conditions that can cause compressor failure. With that knowledge, you can prevent potentially dangerous situations. Integration means that not only will there be fewer installation headaches, but also much less confusion in using and maintaining equipment. The clarity will allow personnel to focus their attention on the key priorities of increasing efficiency, asset planning, stopping unplanned shutdowns, and reducing the risk of environmental and safety incidents.



## Request Information

Use our simple online form to select the options most important to you. An Emerson specialist will contact you shortly.



Scan this code or visit  
[EmersonProcess.com/Compressors](http://EmersonProcess.com/Compressors)

# Emerson Compressor Monitoring Products

## SOFTWARE INTERFACE



### AMS SUITE: ASSET GRAPHICS FOR OPERATIONS

Provides online graphical displays that indicate abnormal operation, including compressor instability, control vane defect, low differential pressure, high differential temperature, plugged suction filter, and overall compressor health. A pre-engineered algorithm delivers diagnostic information for alarms, process analysis, trending, historization, and key performance indicators.



## NETWORK INTERFACE



### SMART WIRELESS GATEWAY

Connects IEC 62591 (*WirelessHART*<sup>®</sup>) self-organizing networks with any host system.



## DEVICES



### CSI WIRELESS VIBRATION TRANSMITTER

Provides early warning of excessive vibration in compressors. Helps determine root cause and guides corrective action. Optional functionality can identify premature bearing wear and predict failure.



### ROSEMOUNT WIRELESS PRESSURE TRANSMITTER

Detects compressor instability conditions from a statistical analysis of discharge and suction pressure. Provides early warning of plugged suction filter and enables monitoring of lube oil pressure.



### ROSEMOUNT WIRELESS TEMPERATURE TRANSMITTER

Enables temperature measurements to monitor compressor suction and discharge temperature limits and optimize compressor performance.



### ROSEMOUNT WIRELESS DP FLOWMETER

Provides high performance flow measurements, to give valuable insight into compressor operation. Significant increases in gas flow can indicate compressor instability problems.

## ADDITIONAL OPTIONS



### ROSEMOUNT GUIDED WAVE RADAR with Smart Wireless THUM Adapter/Wireless Vibrating Fork Level Switches

Enables level measurements to monitor lube oil tank level on compressors. Guided Wave is a suitable technology for continuous level monitoring. For high/low level indications, vibrating fork switches may be more suitable.



### FISHER WIRELESS POSITION MONITOR

Indicates equipment position with a percent of span plus on/off indication. Monitors position of mechanical control vanes for mechanical defect detection.



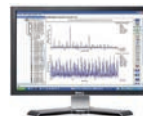
### SMART WIRELESS THUM ADAPTER

Allows devices compliant with Hart 5 (and later revisions) to wirelessly transmit measurement and diagnostic data that was previously unavailable.



### MICRO MOTION GAS SPECIFIC GRAVITY METER

Provides gas molecular weight measurement for detection of instability conditions. Responds quickly and dynamically to process changes, with self compensation for gas composition and compressibility variations, reducing fluctuations in measured gas flow.



### AMS SUITE FOR MAINTENANCE

Aids early identification of asset problems using predictive diagnostics, allowing maintenance to schedule repairs while reducing cost and downtime.

©2015 Emerson Process Management. All rights reserved.

The Emerson logo is a trademark and service mark of Emerson Electric Co. Rosemount is a mark of one of the Emerson Process Management family of companies. All other marks are the property of their respective owners.

The contents of this publication are presented for information purposes only, and while effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the designs or specifications of our products at any time without notice.

**Emerson Process Management**  
1100 W. Louis Henna Blvd.  
Building One  
Round Rock, Texas 78681-7430  
[www.EmersonProcess.com](http://www.EmersonProcess.com)

