The Importance of Filtration in Compressed Air Systems

Maximizing productivity and minimizing downtime starts with understanding the need to protect a system's valves and valve positioners with filters.

Introduction

Considered by manufacturers to be the fourth utility alongside electricity, natural gas and water, compressed air is a universal and essential element of today's industrial processes. All manufacturing facilities use compressed air extensively for a variety of applications, but the most common use—and perhaps the most important—is to automate the operation of pneumatic actuators, which rely on clean and dry compressed air as a safe power source.

These actuators open and close valves that control and regulate the flow of crucial gases and fluids throughout a manufacturing process. Depending on the size of a given plant, there can be hundreds of valves in operation throughout a process.

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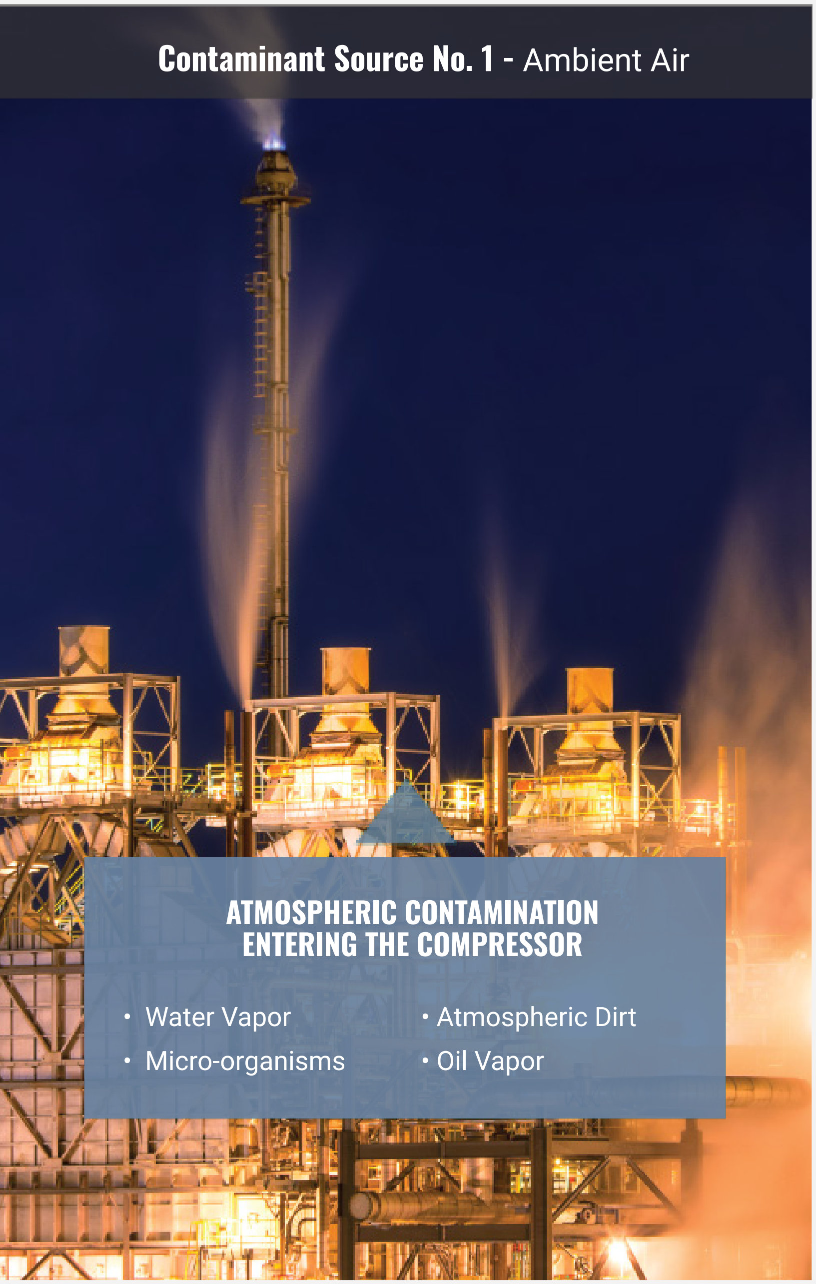
Other common components include valve positioners, which translate a pneumatic signal to a valve position and supply the valve actuator with the required air pressure to move the valve to the correct position. All valve manufacturers now use digitally controlled valve positioners for better control.

Contaminants that are inherently present in plant environments—such as particulates, aerosol particles, oil vapor and water vapor—can significantly damage valve and valve positioner assemblies to the point where they freeze and break, causing lengthy periods of system downtime. Digital valve positioners are more susceptible to moisture and particulate because they have much smaller orifices compared to their analog predecessors.

Contaminant Source No. 1 - Ambient Air



ATMOSPHERIC CONTAMINATION ENTERING THE COMPRESSOR

- Water Vapor
- Micro-organisms
- Atmospheric Dirt
- Oil Vapor

Contaminant Source No. 2 - The Air Compressor

CONTAMINATION INTRODUCED BY THE COMPRESSOR

- Water Aerosols
- Condensed Liquid Water
- Liquid Oil
- Oil Aerosols

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The Challenge

The combination of harmful contaminants present in most manufacturing environments and the high cost of crucial process downtime makes it clear that plants should place a high priority on protecting the valves and valve positioners in their compressed air systems. That protection comes from the implementation of filters designed to prevent process equipment and delicate instruments from being damaged by the dirt, water and oil that is usually found in compressed air.

In this white paper, we address the primary obstacles manufacturing plants face in their efforts to increase productivity and uptime, which can be directly related to the functionality of the valves and valve positioners that keep fluids flowing through their processes. Most if not all of these obstacles can be mitigated or eliminated with a general awareness and understanding of compressed air filtration, as well as establishing and adhering to a preventive maintenance program.

1. Many plants don't know they need filters.

This is the most basic—and most common—challenge that manufacturers must overcome in order to reduce valve and valve positioner failure. Plant Maintenance often isn't aware of the need for filters in their systems that can protect these costly components from damage or failure. For example, if a digital valve positioner is fouled with water or particulate and it must be serviced, the repair cost can easily approach $1000 in parts alone. When you factor in the cost of service labor, lost man-hours in the plant and compromises in production caused by an out-of-service control valve, it's easy to see how quickly and significantly the overall costs can add up. Or is it?

2. Many plants cannot quantify the consequences of valve failure.

Maintenance managers, reliability engineers and equipment operators understand the importance of valves and valve positioners. They don't always realize how filters help minimize the need to replace those components. They also remember the general headache of experiencing system downtime, but they don't always know the specifics related to the shutdown, such as:

- Actual filter cost.
- Labor hours required to solve the problem.
- The cost of not being able to operate a specific piece of equipment or process.
- The length of time between valve, solenoid and other component failures.
- The quantity of a particular type of valve purchased within the past year.

3. Many plants don't know about maintenance schedules.

Manufacturing plants are often unaware of the filter element life for their filters. Generally, the elements are changed on a reactive approach and not based on the recommended service interval for the type of filter element they have.

4. Many plants rely on substandard filters or outdated technology.

Using low-quality filters to protect high-quality valves and valve positioners is a common practice in some manufacturing facilities. This is another byproduct of the "any filter will do" approach to compressed air system maintenance. Unfortunately, inexpensive filter elements do not fit properly, allowing for "blow by" or increased pressure drop. In addition, most inexpensive filter elements do not have a microfibre construction that is resistant to liquids, resulting in filter non-function due to a saturated filter element.

International ISO Standards

Class	Solid			Water Maximum		Oil Maximum	
	Maximum Particle Size (micron)	Maximum Concentration ppm (mg/m$_3$)		Pressure Dewpoint oF (oC)		Concentration ppm (mg/m$_3$)	
1	0.1	.08	(0.1)	-94	(-70)	.008	(0.01)
2	1	.8	(1)	-40	(-40)	.08	(0.1)
3	5	4.2	(5)	-4	(-20)	.83	(1)
4	15	6.7	(8)	37	(+3)	4.2	(5)
5	40	8.3	(10)	45	(+7)	21	(25)
6	-	-	-	50	(+10)	-	-

The Solution

It is imperative that today's manufacturing plants understand the importance of compressed air filtration and recognize the substantial value of adopting a predictive approach to system maintenance. The same filter/regulator solutions that have been utilized since the early 1970s are no longer sufficient to protect vital valves and valve positioners that have been continually improved over the same time period.

Coalescing compressed air filters are available that eliminate moisture, aerosols and particulate from compressed air at a very high efficiency of up to 99.99% for 0.01 micron particles and droplets (in accordance with ISO8573-1 standards for instrument-quality air). Compare that to a traditional filter with a micron rating of 40 that merely act as a screen to remove large particles from the line but not water droplets or aerosols. Not only does that micron rating fall significantly short of ISO standards, but it leaves costly valves and valve positioners vulnerable to failure by allowing excessive amounts of contaminants to reach them.

Modern, high-quality coalescing filters also feature automatic dump drains that allow the filter to continue removing liquids for an unlimited time without loss of efficiency or flow capacity. Older filter technologies are equipped with a petcock-style drain that requires operators to physically unscrew the drain to remove any water. Not only is this an inefficient process, but over time, the filter housing will fill with water and overflow into the valve, causing damage.

Finally, modern compressed air filter housings are constructed of aluminum or stainless steel. This ensures greater reliability and long-term performance than cheaper, antiquated counterparts, which are housed in polycarbonate or lower-grade aluminum and therefore not as durable in harsh environments. These housings also provide a virtually foolproof filter element connection during installation, eliminating the risk of "blow by" conditions for an incorrectly installed filter element.

Conclusion

It is impossible to overstate the importance of valves and valve positioners to modern manufacturing processes. Keeping those components operating at optimum levels is the key to maximizing productivity and uptime—and it comes as a result of having the most effective, highest-quality filtration in place in every possible instance.

Using substandard filters before valve and valve positioner assemblies in compressed air equipment—or worse, using no filters whatsoever—cannot be considered a viable option when profitability and ISO compliance are at stake.

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