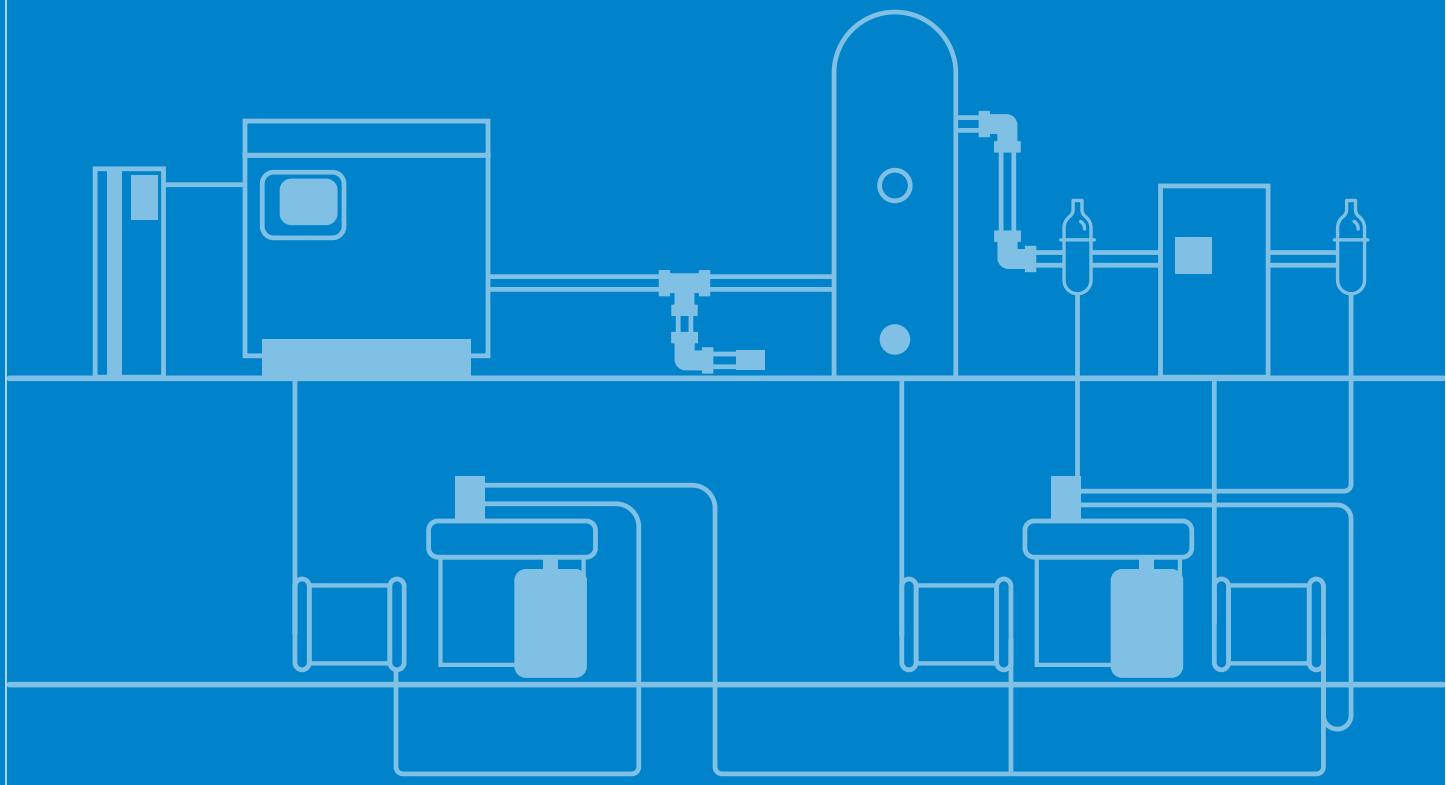
WHITE PAPER

RESPONSIBLE CONDENSATE MANAGEMENT

Approaches for separating and disposing of oil from compressor condensate.

Air System Products
Filtration Group®

PART 3



Managing compressor condensate plays an important role in the proper functioning and reliability of any facility. Because condensate is an absolute, there must be a system in place to manage and dispose of condensate properly and safely.

Understanding the environmental factors that affect the amount of condensate aids in the proper selection of condensate drains and oil/water separators. Facility managers must know the volume and composition of the condensate that they generate and the steps to be taken to implement an effective management system.

This paper is the final of a three-part series. The first installment addressed the hidden costs of compressed air, including lost air due to leaks and standard practices. The second installment looked at condensate drains and the important, yet often overlooked, role they play in a properly functioning system.

In this final segment, we present how to manage the condensate for proper and responsible disposal of contaminants from the compressed air system. We rely on the foundation of information provided in the previous installments for a comprehensive package of the proper management of system condensate.

The Ethics of Condensate Disposal

Understanding the nature and makeup of your compressed air system's condensate will determine the proper disposal methods and practices. You will also need to understand your local and state regulations for disposal of your plant effluents. By knowing these two important pieces of information, you can build a plan to responsibly dispose of your system condensate.

With regard to the context of compressed air condensate, in most areas in the United States, allowable concentrations of oil and grease in wastewater can be as low as 10 ppm. These levels of acceptable concentrations are expected to go even lower. For example, regulators in Europe are considering lowering the limit to 5 ppm. It is important to understand that prevailing limits typically apply to the total plant effluent and is not limited to the compressor.

With effective separation, untreated oil and grease are considered to be a waste stream that cannot be sewered without treatment. When applied, a properly sized oil/water separator removes contaminants in the waste stream and can even condition the waste for reuse — a step that helps to protect the environment.

Following separation, the facility is left with a small volume of spent compressor lubricant and facility managers are ethically and legally bound to properly dispose of the contaminants. Careless disposal of oil is negligent and ultimately harmful to groundwater, to the surrounding communities, to the environment and can also result in costly fines. Over time, the oil/water separator media will become saturated and require replacement. To ensure a high level of efficiency, the media must be maintained and should be serviced at least annually.

Oil/Water Separators: A Closer Look

It is important to understand that even the most efficient compressor will release at least a small amount of lubricant. Much like an automobile engine needs oil to run, a compressor requires lubricant to operate properly. Therefore, a standard and well-operating compressor will produce oily contaminate that can make its way into downstream operations and will need to be separated and removed.

While lubricants are essential to the proper operation of a compressor, they present a challenge for facility managers when it ends up in the condensate. Removing lubricating oils from condensate can be difficult due to the varying characteristics of different lubricants. Some lubricants form emulsions with water. What can appear clean to the naked eye could be condensate containing hundreds of parts per million of oil.

Not all oils separate equally, and it is important that condensate management is approached with that in mind. Because different lubricants have different properties, they can be challenging to separate. For example, some medias easily separate from water in a quick process while other medias have a specific gravity closer to water and do not readily separate, making the process more difficult. Oils with a specific gravity equal to or less than .9, can generally be separated with traditional medias.

It is important to understand the characteristics or properties of the lubricants and consider the needs of each system in case proprietary medias are required for optimization. There are many types of oil/water separators and each have different separation applications and include different elements. The systems are specifically designed for compressor condensate and to bring discharges into compliance with environmental regulations.

Every unit shares the common and necessary feature of a media chamber. However, only a select few offer diffusers and sediment and skimming chambers to help ease the demand on the media. To enhance oil/water separation, consider products that include the following components:

Diffuser

The element is designed to receive the condensate under pressure and de-energizes it for controlled processing.

Sediment Chamber

Controls the raw condensate and separates contaminants such as rust and scale that can plug downstream operations, particularly the media.

Skimming Chamber

Gravity can be used in the context of the mechanism for transporting the condensate through the separator and is highly effective in certain scenarios. Additionally, gravity will aid the removal of oil that has a relatively low specific gravity to separate and reduce the removal time — much like an oil and vinegar salad dressing.

This step can significantly reduce the load on the media by allowing lubricants with a low relative specific gravity to separate (float) and be skimmed off, thereby extending the service life. Mindful that the media has a maximum oil-holding capacity, the more oil removed by skimming, the longer the media life.

Pump Chamber

Some variants use a pump to ensure a steady and uniform flow of pretreated condensate to the media.

Media Chamber

The media is the final step which polishes the condensate to remove any remaining oil. Media adsorption efficiency is very dependent on the type of lubricant emulsification. Lubricants

that easily separate can generally rely on standard media, however if the lubricant is highly emulsified it may require engineered media. This type of proprietary media relies on much stronger mechanisms to more effectively remove the emulsified oil separators from the condensate.

Common to both gravity and pump-driven, in this final step where an adsorptive media attracts lubricants and oils while repelling water. The oily condensate flows through the media and the oil adsorbs onto the media. The resulting clean condensate can then be introduced to the wastewater stream, or even be reused in the facility.

In summary, best practice for condensate separators use multiple stages of separation. Gravity/media separation or pump/media separation are the most common multi-stage units available for compressed air systems.

BOTTOM LINE

The life of the media depends on the type and amount of lubricant present in the condensate and is influenced by:

- The age, type & condition of the compressor
- The type of lubricant used
- The amount of humidity in the ambient air

Gravity Flow vs Pump Flow Separators

The two most popular and effective methods of oil/water separation are gravity flow units and pump-driven units. These multi-stage units are based on media separation. ASP has distinguished its oil/water separators by going a step further than relying only on media separation. To help reduce the load on the media, ASP's designs include sediment and skimming chambers. ASP engineers recognized that condensate is never uniform. When dirty condensate comes in, it is not evenly distributed — it doesn't "play fair." Therefore, rust and scale, for example, can enter the unit with the potential to disrupt the effectiveness of the media.

In addition to helping prolong media life, the sediment and skimming steps also reduce costs and improve efficiencies. By reducing the load on the media, it can more effectively separate the oil and prepare and polish it for disposal or reuse.

Gravity Flow Separators are a cost-effective method for oil/water separation, functioning by way of elevation. Condensate enters the separator at a higher elevation and the force of gravity drives the condensate through the separator. The fact that gravity flow systems don't require any external utilities and operate solely on the difference in the inlet and outlet elevations can be a deciding advantage of these units.

Oil can separate from the water differently in specific gravity and is dependent on, among other things, the actual contaminants, their sizes, and the extent of their level of emulsification. Alternatively, a pump-based system can provide a more controlled flow of condensate through the media.

BOTTOM LINE

Gravity Flow Separators are very simple in operational design and effective in many applications.

Pump Flow Separators are more capable systems that incorporate small air operated pumps. These pump-driven units are ideally suited for large systems (or large variations in the amount) of condensate while controlling the potential for biological buildup.

Pump driven separators are effective with upstream applications and will not run the risk of backing up or creating a safety and environmental concern with spills or overflows. However, there must be assurance that downstream applications and equipment are equally protected.

BOTTOM LINE

Pump-driven separators tolerate large volumes and large swings in the amount of condensate produced.

DID YOU KNOW?

In the compressed air industry, ASP is the only filtration solutions company that offers a pump-based system.

Essential Periodic Media Replacement

It is important that media is changed out routinely. Left unchecked, saturated media will permit untreated condensate downstream and may cause the unit to overflow. This is particularly the case with gravity fed systems. Even with a pump module, the pump will allow oil to bypass the media which could cause the system to exceed the local regulatory limits. Collaborating with condensate management experts will help to ensure the best-suited method with the proper media is in place and changed out as needed.

For some products, such as ASP's Posi-Zorb product line, the media module is self-contained and controls the possibility of spills or contamination during media replacement. Two features that many operational facilities prefer are its low maintenance requirement and that the condensate is well-contained. It is important to understand that no system is perfect. If the media becomes saturated, there is a risk of by-passing or overflow of untreated condensate. To avoid this, a periodic replacement of the media is imperative.

Our Obligation to the Environment

In 1970, the Clean Water Act (CWA) was enacted and established the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under the CWA, the EPA has implemented pollution control programs such as setting industrial wastewater standards. The EPA has also developed national water quality criteria recommendations for pollutants in surface waters.

Since the enactment of the CWA, a host of local, state, and federal regulations regarding contaminant disposal have been written. Plant engineers must contact their local regulatory agencies and determine the specific requirements that apply to their location. This applies to the entire plant effluent and is not limited to the compressed air system.

What more can we do? Reuse!

Facility managers and engineers are challenged to maintain optimal operations while complying with environmental regulations. Increasingly, investing in water reuse practices helps to build, support, and strengthen nearby communities.

Incorporating water reuse (a.k.a. greywater or water recycling) into local water management strategies has proven to ensure a safe, reliable, and locally controlled water supply. It is projected that by 2027, the volume of recycled water produced in the United States will have increased at a rate of 37%, from 4.8 billion gallons per day to 6.6 billion gallons per day.

In an effort to reclaim the water from compressed air condensate, proper conditions must be maintained before introducing the water to the greywater supply. Successful facilities managers should assess if the water reclaimed after an oil/water separator could be utilized in greywater applications such as use in cooling systems.

Making Informed Product Decisions

The nation's water infrastructure, built to protect public health and ensure access to clean water, continues to age. Considering the increasing demand for freshwater, infrastructures and methodologies must adapt to address clean water supply and water quality. Regulations and guidelines for proper disposal and reuse differ among regions and states and best practice methodologies can vary. It is best to contact your local recycling agencies for more information regarding the regulations for your location.

Conclusion

Managing compressed air condensate is essential in well run operations. When a compressed air system is operating effectively, essential equipment is protected, and costly downtimes can be avoided. Condensate drains are an excellent means of removing the bulk of condensate from a compressed air system.

To comply with environmental regulations, oil/water separators play an increasingly significant role in condensate to permit proper disposal or reuse. Mindful that not all oils separate equally due to differences in their physical and chemical properties, it remains imperative that the proper system and media are employed.

Facilities that manage their compressed air condensate and meet environmental regulations will be best positioned for success in an increasingly competitive industry.

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With more than 30 years of industrial experience, Bill has managed processes on individual and group levels to improve and optimize operations, including implementing engineering processes and enhancing revenue streams. Currently, he is responsible for overseeing operations at ASP, a company recognized as the best in condensate management. ASP is an integral part of Filtration Group, the world's fastest growing filtration organization. Bill holds a BSChE and an MBA from the University at Buffalo and is a senior member of ASQ.

ABOUT ASP

Air System Products (ASP) is a leading designer and manufacturer of condensate management products, including condensate drains and oil-water separators for the air and gas compressor market. Since 1981, ASP has developed efficient, reliable, and cost-effective products and systems for industries that use compressed air. ASP products exceed stringent environmental regulations that apply to condensate for a global customer base. ASP's innovation, condensate management, and service are regarded to be the best in the industry.

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