ROGERS MACHINERY COMPANY, INC.

COMPRESSORS, PUMPS, BLOWERS,
VACUUM SYSTEMS & ENERGY AUDITS

How to Select a Dryer for Your Air Compressor

This Compressed Air Dryer Buying Guide will help you select the right air dryer for your air compressor and specific application requirements.

Are you responsible for your compressed air systems at your facility? Rogers Machinery's Compressed Air Dryer Buying Guide will help you select the best air dryer for your air compressor, your environment and your specific application requirements.

Understand Your Need for Dry Compressed Air

Air compressors have the ability to turn atmospheric air into a powerful compressed air. One part of a compressed air system that is often overlooked is the need for clean, *dry* compressed air. Along with compressed air filters , a compressed air dryer is a critical component to ensure that the air used in your final application is clean and free of moisture.

The simple reason compressed air dryers exist as part of a compressed air system is that all atmospheric air contains some amount of water. As air is compressed, the

concentration of water increases, resulting in condensation. If 7 cubic feet of air is compressed to 1 cubic foot of air, the compressed air still contains the same amount of water as the original ambient air.

Condensation has the potential to create problems in processes that use compressed air. Downstream issues caused by moisture in compressed air can range from fisheyes in paint to clogged media blaster nozzles. Wet air adds to plant operating expenses through the cost of:

- repair parts
- repair labor
- product damage
- production downtime

To protect valuable tools, machinery, and compressed air piping from water and rust, you need clean, treated air, and that usually means selecting a compressed air dryer. The right kind of compressed air dryer depends on:

- the specifications of the air compressor
- the plant environment
- the end application for compressed air

How to Select a Dryer for your Compressed Air System: First Steps

To choose an air-drying system for an air compressor, start with an analysis of the air compressor, plant environment, and applications. The best solution will depend on a few key factors:

- **Dew point.** The dew point is the moment when the air reaches a temperature that leads to condensation and moisture saturation. It varies with temperature and pressure but is a key rating to consider when selecting an air dryer.
- The compressed air temperature required by your application will affect the dew point. The ambient air temperature will affect the type of air dryer most that is best suited for conditions.

- **Compressed air use.** Keep in mind how often you will use the compressed air and how that flow will fluctuate. This can help determine whether a cycling or non-cycling dryer is appropriate.
- The location of the air compressor can determine what type of compressor is a best fit. If the compressor is outdoors in fluctuating temperatures, or indoors in a cramped area, the best air dryer will need to accommodate those conditions.
- **Air compressor specifications.** Generally, dryers are rated to pair with a compressor system with certain pressure (psig) and flow (scfm) ratings. Actual air pressure and flow will vary from factory rated pressure and flow.
- Moisture tolerance levels of the machines and processes that use compressed air determine how dry the air needs to be, and at what temperature and pressure.

Some moisture is always present in a compressed air system, regardless of the degree of drying. Air that may be considered dry for one application may not be dry enough for another. ISO 8573-1 establishes the standard for air quality classes for pollutants. For moisture content, the standards are:

Air Quality Classes encompassing pollutants have been established in an International Standard ISO 8573-1. For moisutre content, these are as follows:		
Class	Maximum Pressure	Dew Point
1	-70	-100
2	-40	-40
3	-20	-4
4	3	38
5	7	45
6	-10	50
7	Not specified	

Choosing the right type of air dryer for your needs is generally the next step.

Types of Compressed Air Dryers

To understand what air-drying system is best for your situation, start with an overview of the main types of dryers.

The two main categories of dryers are refrigerated air dryers and desiccant air dryers. The main difference between these two types is the drying agent inside the machine.

Refrigerated Dryers

Refrigerated compressed air dryers use a small refrigerator to cool compressed air to 37° Fahrenheit. Any condensate that forms is removed by a condensate trap, and then all the water is removed. The dry air is then re-heated to room temperature and will not form any water as long as it stays above 37° Fahrenheit.

Refrigerated dryers advantages:

- are the lower cost option in terms of set-up, operation and maintenance
- are resistant to airborne oil particles

Refrigerated dyers disadvantages:

- They have minimal dew point capacity. As a result, water in the air lines will condense more easily, and they have a maximum ambient temperature of about 100°F to 120°F.
- Refrigerated dryers are not resistant to freezing temperatures unless low-ambient-temperature controls are installed.

What is the difference between a non-cycling and cycling refrigerated dryer?

Refrigerated dryers are split into two subcategories: cycling and non-cycling.

A **cycling dryer** uses a thermal mass or frequency controller to turn the dryer on based on compressed air coming into the dryer. The dryer then cools a secondary cooling fluid, then shuts off while the cooled fluid does the work of drying the air.

A strong example of a cycling air dryer is Pneumatic Products' ESM series. As the manufacturer notes, "Compressed air load profiles in most manufacturing facilities fluctuate. The ESM Series provides cost-effective energy savings by matching electrical power consumed in direct proportion to incoming air demand. Linear load matching is achieved from 0 to 100%."

A **non-cycling dryer** runs all the time, regardless of the compressed air flow coming into the dryer.

Deltech's HG series is a non-cycling refrigerated dryer solution "that offers the right combination of technology and simplicity to keep your air system at a dry, 38°F (+3°C) pressure dew point."

How to Pick the Right Refrigerated Air Compressor Dryer

Cycling dryers can by ideal for applications that have fluctuating air demand, because with minimal additional cost, they can offer maximum energy savings.

Because non-cycling dryers run all the time, they use nearly the same amount of energy even when compressed air is not in use. Over time, this results in wasted energy whenever compressed air is not in use. Non-cycling dryers are good choices for:

- Environments that require simple compressed air dryer designs
- Minimal dew point swings
- Pairing with any rotary screw compressor

Desiccant Dryers (or Adsorption Dryers)

Desiccant dryers remove moisture from compressed air through a process of adsorption. Water sticks to the surface of the adsorption material (also known as a desiccant). When the desiccant beads get saturated with moisture, a process involving air, heat, or a combination of the two is employed to regenerate the desiccant and remove the water again.

Typically, this kind of desiccant dryer is designed with twin towers. The air flows through one of two towers filled with a drying agent that adsorbs any moisture and dries the wet air. At the same time, the opposing tower is offline, and the desiccant beads are regenerated with “purge air” that purges the moisture.

Desiccant beads are normally a material like silica or activated carbon, activated alumina, or another hygroscopic medium. Silica gel needs to be replaced when it is saturated, whereas activated carbon can be regenerated.

Desiccant dryers advantages have better dew point capacity than refrigerated dryers, meaning they can reach much lower dew points (as much as -100 °F). They work in any season and can be used in remote and hazardous environments. For applications that require flow rates over 100 scfm and dew points lower than -40°F/°C, a desiccant dryer is the best choice.

Desiccant air dryers are used in health care, food and beverage, and material processing. They may be best suited for conditions where the compressed air piping runs outside in environments that experience low temperatures, or for special applications that require very dry air. Common applications for desiccant air dryers include spray paint operations, laboratories, some printing processes, and certain pneumatic tools.

There are several characteristics of a desiccant dryer to be aware of:

- They tend to have higher installation costs.
- Depending on the type of dryer, the desiccant bed needs to be replaced every 3-5 years.
- They require more filtration for particulate carryover and airborne oil vapor. Therefore, a desiccant dryer needs an oil-coalescing filter before it in the air system.

- They often need purge air. Because they consume purge air, they tend to be less energy efficient than refrigerated air dryers.

What are the types of desiccant air dryers?

Desiccant dryers can be heatless, heated internal, or heated external. In general, a desiccant air dryer is designed to achieve a standard dew point of -20 °C (-25° F), -40° C/F or -70 °C (-100 °F).

- **Heatless desiccant dryers** use 16-25% purge air, and it is important to account for that when sizing an air compressor to pair with a desiccant dryer.
- **Heated desiccant dryers** require less than 10% purge air.
- **Externally heated desiccant dryers** use external purge air that is heated and introduced to the desiccant to help with drying and regeneration. The process requires between 0% and 4% purge air. To eliminate the need for purge air, a blower may be added to circulate heated air.

How to Pick the Right Desiccant Air Compressor Dryer

As noted, some designs require more purge air than others. Higher purge air requirements translate to larger compressors, increased energy consumption, and increased ongoing costs.

Heatless desiccant dryers are the most cost-effective desiccant air dryers and are also the least efficient.

An example of a heatless desiccant dryer is the ZEKS ZPB Eclipse Heatless Purge Dryer. These dryers achieve dew points from -40 °F to as low as -100 °F. According to ZEKS, “The ZPB’s simple yet thoughtful design uses dry air to regenerate the desiccant media and requires minimal maintenance.”

Heated desiccant dryers generally have a higher initial cost than heatless dryers but offer overall energy savings.

Hankison's standard HPD Series Heated Desiccant Compressed Air Dryers are designed, according to the manufacturer, to be "100% efficient at delivering full supply-side compressor capacity. Therefore, users benefit from the ability to purchase a less expensive air compressor and a 20% reduction in compressor operating costs."

Externally heated desiccant dryers are very energy efficient.

Deltech's ZP Series blower purge type regenerative compressed air dryers are both economical and reliable at drying compressed air to dew points below freezing. According to the manufacturer, ZP blowers have a design that will "improve air system efficiency by the use of a dedicated axial blower, instead of a percentage of dehydrated purge air, to regenerate the off-line desiccant tower."

Compressed Air Dryer Ratings

Each air dryer is generally rated to work with the specifications of the compressed air system in a certain environment, which makes it easier to compare models. The Compressed Air and Gas Institute (CAGI) has set standards for compressed air dryer ratings. The conditions are usually called the "three 100s" because dryers are rated at 100 psig, 100°F inlet temperature, and 100°F ambient temperature.

Obviously, dryer performance would vary if the plant compressed air system has different operating conditions. When sizing a dryer, consider all the temperatures that the compressed air system will operate at, and try to compare based on standard conditions.

Tips for Choosing Air Dryers

To specify the right dryer for a compressed air installation, keep the following information in mind:

- Avoid over-specifying. Drying the entire supply of compressed air to dew points less than -40°F can be a waste of energy. One possibility is to subdivide the compressed air supply by application, and then treat each point of use as needed for the downstream application served.
- Avoid under-specifying. Design the drying system to meet your specific needs to avoid damage caused by wet air.

Selecting the right dryer for your air compressor depends mainly on the air quality requirements for the process. In nearly all compressed air applications, dryers play a vital role by providing clean, dry air for reliable operations. Dry air helps prevent costly shutdowns, product contamination, and equipment failures. Finding the right drying system brings substantial savings over the lifetime of the equipment.

When specifying a dryer, professional assistance will ensure the most energy efficient and comprehensive solution to meet precise application needs for the system. Contact Rogers Machinery for expert selection assistance.

For more information or any questions, call us at **(503) 639-0808.**