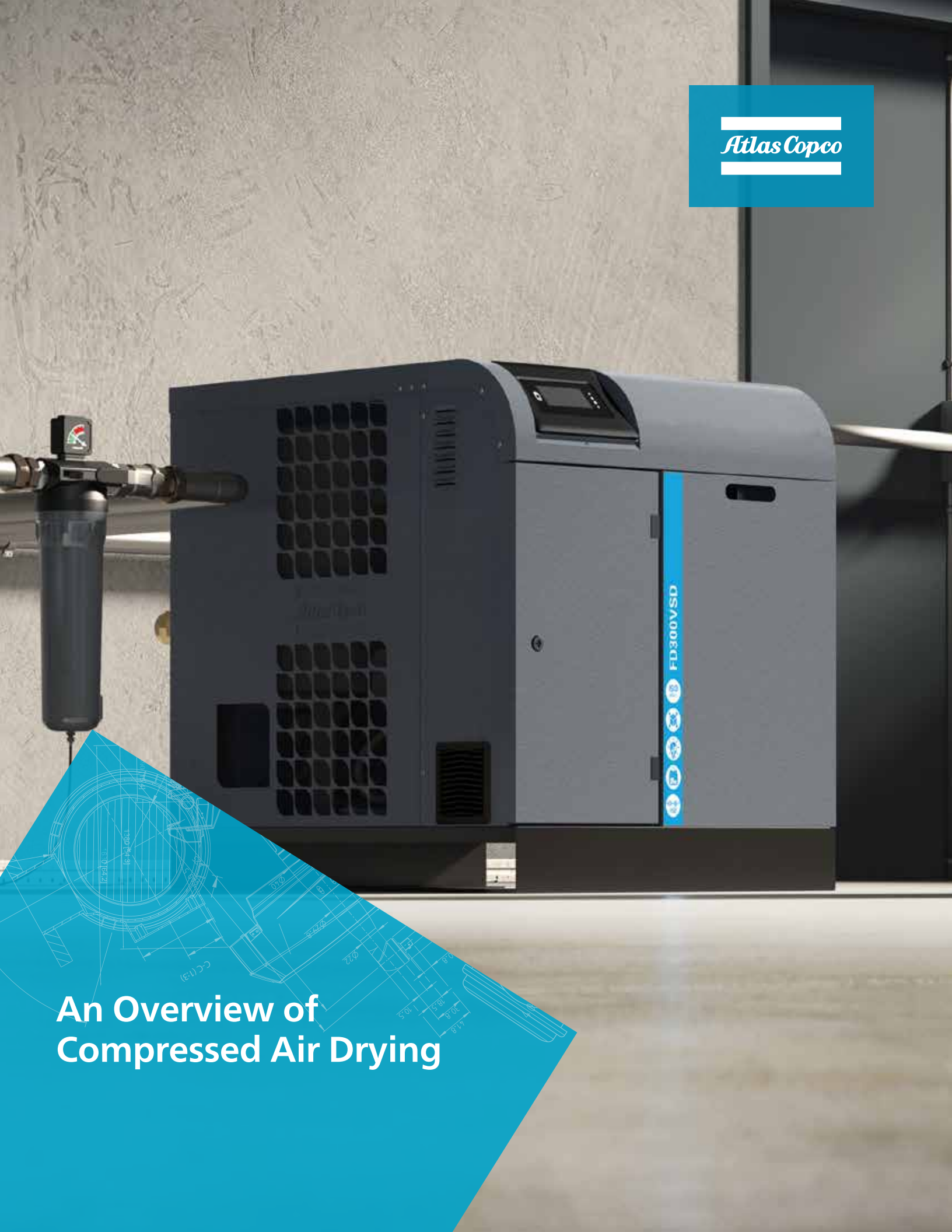
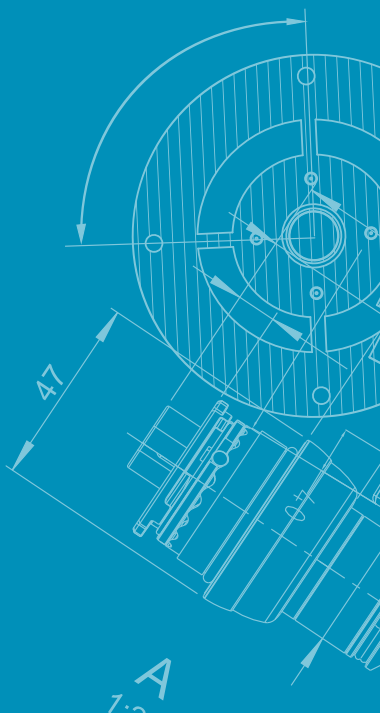


An Overview of Compressed Air Drying

How has dryer technology changed in the last five years?

Dryers are getting smaller, improving space utilization. Better controllers are improving system management. Advanced connectivity is enabling remote monitoring and service. Perhaps the most significant change is the continued development of refrigerant dryers with Variable Speed Drive (VSD). In most industrial operations, compressed air demand fluctuates, but a traditional air compressor has just one speed: full capacity. If less air is needed, a lot of energy is consumed and wasted. VSD technology, both in air compressors and dryers, saves energy by automatically adjusting the motor speed to match air demand. In dryer technology, this also ensures a consistent stable dew point while saving energy. Another breakthrough has been the development of a completely new type of desiccant and we will discuss this later in the article.



How do you choose a compressed air dryer?

Essentially, the right size dryer should dry air at whatever rate your compressor produces air to meet your process requirements. Like everything when it comes to compressed air, there are calculation tools available to accurately calculate the correct dryer and guesswork or simply replacing what was there is likely not the best option. Ultimately there are six major things to calculate to accurately choose the correct dryer:

1. Maximum air flow in standard cubic feet per minute (scfm).
2. Desired pressure dew point.
3. Inlet air pressure.
4. Inlet air temperature.
5. Ambient air temperature (and water temperature if condenser is water-cooled).
6. Installation environment of the dryer.

Desiccant dryers can provide an ultra-low dew point, typically around -40°C /-40°F. Having air at a reliable, predictable dew point can be important for demanding applications in industries such as pharmaceuticals and food processing. Refrigerant dryers typically achieve a dew point of about 3°C / 37°F, but they cost less to buy, operate and maintain than desiccant dryers.

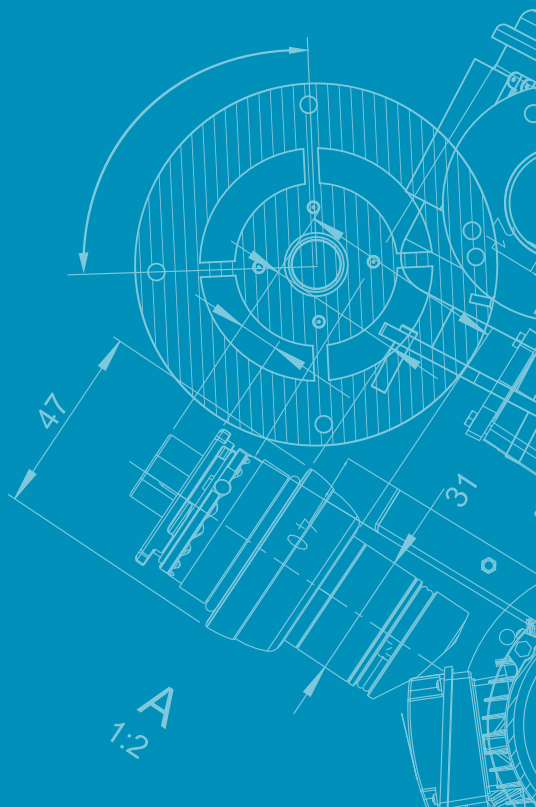
Refrigerant Dryers

What is a refrigerant dryer?

A refrigerant dryer is a crucial air system component for operations that require dry compressed air. Compressed air passes through an air to refrigerant heat exchanger to reduce the compressed air temperature typically to 3°C / 37°F. This causes the water vapor that was in the air to condense into liquid, which is trapped and removed.

How does a refrigerant VSD dryer work?

A refrigerant air dryer has a compressor of its own that compresses the refrigerant gas to liquid form. Conventional refrigerant air dryers typically employ a piston compressor operating at one fixed speed. In terms of energy efficiency, this results in the same "on or off" shortcoming present in a fixed speed air compressor. In contrast, a VSD refrigerant air dryer uses a scroll compressor with one spiral element orbiting around a second, fixed element. It's compact and quiet, and the inverter that drives the scroll element can vary speed to match demand, saving energy.



Desiccant Dryers

What is desiccant?

Open a box containing new electronics, medicines, or clothing, and often you find a small mesh packet with words such as "Desiccant, Do Not Eat." Inside those packets are hygroscopic beads (typically silica or activated alumina) that attract moisture, protecting the merchandise during shipment and storage. Desiccant also has industrial uses, notably removing moisture from a compressed air stream. Water vapor is exchanged from the moist compressed air into the desiccant, drying the air and causing the desiccant to gradually be saturated with adsorbed water. The desiccant must be regenerated (the collected moisture is purged) to regain its drying capacity.

How does a desiccant dryer work?

The general working principle of desiccant air dryers is simple: moist air flows over hygroscopic material (desiccant) and is thereby dried. The exchange of water vapor from the moist compressed air into the desiccant causes the desiccant to gradually be saturated with adsorbed water. Therefore, the desiccant needs to be regenerated regularly to regain its drying capacity.

Is there only one type of desiccant dryer on the market?

Actually, there are *four,* each with a specific method for regenerating the desiccant.

- **Purge regenerated adsorption dryers** ("heatless-type dryers") use expanded compressed air to purge moisture from the desiccant. They are best suited for lower air flow applications.
- **Heated purge regenerated dryers** heat the expanded purge air to improve purge efficiency and reduce energy consumption by 25% compared to heatless-type dryers.
- **Blower regenerated dryers** blow heated ambient air to regenerate wet desiccant. Since no compressed air is used, energy consumption is 40% lower than for heatless-type dryers.
- **Heat of compression dryers** regenerate desiccant with the heat naturally given off by the compressor, without consuming additional energy.

Are there any new developments coming in desiccant dyers?

Yes, Atlas Copco developed and patented a revolutionary new solid desiccant called Cerades. Compared to granular desiccants, Cerades delivers higher air quality, lower energy and service costs, and health and environmental benefits. Compressed air flows straight through the Cerades structure, reducing pressure drop (up to 70%) in the dryer to save energy. It handles higher air flow that granular desiccant, so the dryer can be much smaller. Cerades is vibration resistant and can be mounted horizontally, so it works in applications that could not previously use a desiccant dryer. Cerades lasts longer than granular desiccant, doesn't decay and break down into dust like granular desiccant, and delivers longer cycle times to improve energy efficiency and process productivity.

Efficiency and System Questions

Is it best to buy an air compressor with a built-in dryer?

Generally, yes. Especially when space is limited and dry air is required, a compressor with an integrated dryer makes sense. An integrated dryer is engineered to work with the matching compressor. The whole system is packaged in a cabinet that minimizes the required footprint, reduces operating sound level, and provides savings on installation and maintenance costs.

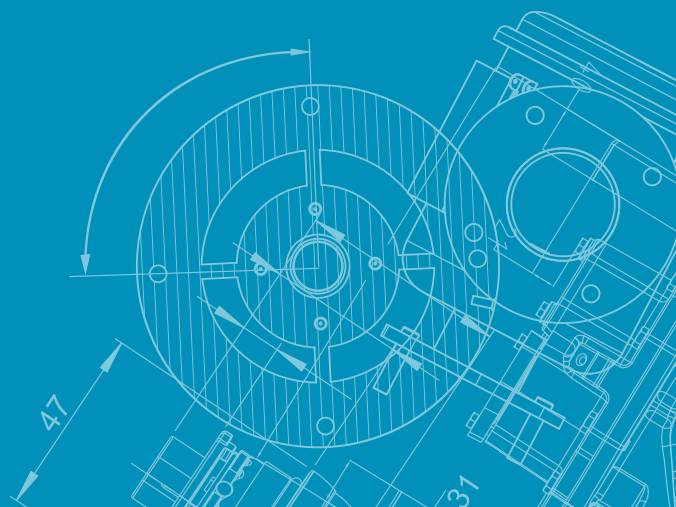
If I have a VSD compressor, should I choose a VSD dryer and, conversely, if I have a fixed speed compressor should I have a fixed speed dryer?

For processes where compressed air demand is steady, a fixed speed compressor and fixed speed dryer can provide the required air cost-effectively. For processes where the demand for compressed air varies by factors such as process, workload or shift, a VSD compressor can match the production of compressed air to demand. While a fixed speed dryer can be sized to meet the maximum output of the VSD compressor, a VSD dryer can reduce energy costs by cycling up or down automatically to meet the variable output of the compressor.

How important is dryer choice in overall system efficiency?

It can be especially important. A compressed air dryer that's not optimized for efficiency can easily add 10% to your overall energy bill, whereas an efficient compressed air dryer should only contribute around 2% maximum. The drying technology and dryer size you select should complement your compressed air flow rate and air quality requirements. For example, if your compressed air use is comparatively small, the added energy cost to purge a heatless-type dryer can be offset by the lower cost of the equipment. However, for processes with higher demand for compressed air, the investment in heated purge or blower dryers pays for itself through greater energy efficiency. New dryer technologies, such as Atlas Copco's patented Cerades solid desiccant, can further improve energy efficiency while enabling high quality air drying.

A simple compressed air study can help you calculate the current cost of your compressed air dryer, help you evaluate which technology might fit best and show what the efficiency benefits of investing in VSD technology, both for the compressor and the dryer would be.



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