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DRYER PERFORMANCE

**Let's take a look at various types of dryers
and answer some common questions about dryer performance.**

Why do people buy dryers?

There are several different answers to this question, just as there are several different types of dryers. Dryers are used to remove moisture from compressed air so that tools, instruments, and machinery will work properly. If water is not removed from compressed air, you can have frozen outdoor air lines and corrosion in valves, instruments, and tools. It is less expensive to buy a dryer than to live with the problems caused by wet air.

What type of dryer should I buy, or how dry does my air have to be?

There are several different applications for dryers; process air, plant air, instrument air, and frequently each application requires a different dewpoint. Typically, for most plant and instrument air applications, moisture is not a problem as long as it does not condense into liquid. This means that we should select a dryer that will deliver a dewpoint 18°F below the lowest ambient temperature the air will encounter. In fact, the Instrument Society of America's standard for instrument air states that the "dewpoint shall be 18°F below the lowest recorded ambient in a

given month". Moisture in a vapor form usually is harmless, provided that it does not come in contact with lower temperatures and then condense. Many customers mistakenly assume that because they have an instrument air application, they need a -40°F dewpoint. The only time a -40°F dewpoint is required, is if the compressed air will be in contact with ambient temperatures below -20°F. If the application is for process air and the air comes in contact with a specific product, then a customer may really need a -40°F dewpoint. The point to remember is that for most applications, a dewpoint 18°F below ambient is acceptable and any further drying is unnecessary. Over-specifying a required dewpoint only results in unnecessary expense, not added protection.

What is the dewpoint of different dryers?

There are 3 basic types of dryers; Deliquescent, Refrigerant, and Regenerative. The Deliquescent dryer typically delivers a dewpoint 20° to 40°F below the inlet air temperature. Refrigerant dryers can deliver either a +35°F or +50°F dewpoint. Most Regenerative dryers deliver a -40°F dewpoint.

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What are the different types of Regenerative dryers?

There are really two basic types of Regenerative dryers; Heatless and Heat Reactivated. There are several types of Heat Reactivated dryers; Exhaust Purge, Blower Purge, Closed System, Split Stream, and Heat-of-Compression.

How does a Regenerative Dryer operate?

A regenerative dryer consists of two towers filled with a regenerable type desiccant and valves that allow air to be switched back and forth between the two towers. While one tower is on-stream drying the air, the other tower is being regenerated. The difference between regenerative dryers is the method used to regenerate the desiccant.

What determines outlet dewpoint?

The desiccant in a regenerative type of dryer typically provides a dewpoint that varies from 0°F to -100°F. All dryer manufacturers purchase desiccant; none manufacture their own, so we are all using the same basic material.

Do all Regenerative dryers deliver a -40°F dewpoint?

The Heat-of-Compression dryer delivers a varying dewpoint based on several different factors. The outlet dewpoints from a Heat-of-Compression dryer can be as low as -100 °F or above 0 °F, depending on the following variables:

1. Ambient air temperature and relative humidity
2. Number of stages of compression and final discharge pressure
3. Temperature of interstage cooling
4. Efficiency of interstage separators
5. Compressor discharge air temperature
6. Aftercooler discharge air temperature

The dewpoint out of a Heat-of-Compression dryer will vary with the season, providing the lowest dewpoint during the winter months when it is really needed. Even during the hot summer months, the dewpoint can be as low as -20 °F, which is acceptable for most applications because it does what the dryer was purchased to do, prevent moisture from condensing into liquid water. A dryer does not have to give a -40°F dewpoint in order to keep moisture from condensing; a dewpoint 18°F below ambient is all that is required.

How can I determine the dewpoint from a Heat-of-Compression dryer?

We have formulated a chart that shows the lowest attainable dewpoints with varying conditions. This chart can be used to determine both summer and winter dewpoints. For example, take the following conditions:

- Ambient air temperature 80°F, 100% Relative Humidity
- 2-Stage Compressor with 100°F temperature intercooling and a 300°F discharge temperature
- 100 PSIG discharge pressure
- 100°F Aftercooler discharge air temperature

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Even with these tough summertime conditions, the outlet dewpoint from a Heat-of-Compression dryer can be as low as -13°F. Since the ambient is +80°F, this dewpoint should be more than adequate for 90% of all regenerative dryer applications.

What are the benefits of the Heat-of-Compression dryer?

Energy savings. The Heat-of-Compression dryer does not consume energy to regenerate its desiccant.

How much energy do other dryers consume?

Other regenerative dryers can consume a considerable amount of energy. For example, the Heatless dryer purges 15% of your compressor capacity which quickly amounts to a substantial amount of money. The Exhaust Purge dryer purges 7% of your compressor capacity and consumes electricity to operate an electric heater. The Blower Purge dryer requires electricity to operate the heater and blower. The attached chart illustrates the energy consumption of these dryers with the corresponding energy cost. Our calculations are ultra-conservative, and in many parts of the country, energy costs are double the figures we used.

How does the Heat-of-Compression dryer save energy?

By utilizing the normally wasted Heat-of-Compression to regenerate. All other types of regenerative dryers were de-signed to follow the compressor aftercooler, wasting the heat generated through the compression process. The Heat-of-Compression dryer uses this free source of energy, eliminating the cost of drying air.

Who developed this type of dryer?

In 1974, Henderson Engineering developed and patented the Heat-of-Compression dryer. We called it the SAHARA-PAK and it has become our most popular dryer. We have sold hundreds of SAHARA-PAK dryers to customers all over the world. It is the only air dryer ever to win an independently judged design award. In 1978, we received Chemical Processing magazine's Vaaler Award, and in 1981, we received Chemical Equipment magazine's Energy Award. No other dryer design or dryer manufacturer has won an award for a dryer design.

What are the disadvantages of the SAHARA-PAK?

The SAHARA-PAK cannot be used with a lubricated compressor. Because we use the Heat-of-Compression to regenerate the desiccant,

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the dryer must be located near the compressor. The SAHARA-PAK cannot be used for remote installations. The dewpoint out of the dryer varies with the ambient conditions, and there-ore, cannot deliver a constant year-round dewpoint. If the compressor does not supply enough heat to provide a low dewpoint, a small booster heater may be required.

What about dewpoint spike?

A dewpoint spike is a sudden rise in dewpoint that occurs during tower shift. Many regenerative dryers have dewpoint spikes; in fact, most Blower Purge dryers have dewpoint spikes as well as do most Exhaust Purge dryers. The spike from these dryers is usually higher and lasts longer than the spike from the SAHARA-PAK. Also, the spike is most noticeable right at the dryer outlet. If you measure dewpoint further downstream, you will see that the spike is dampened and only results in a minor dewpoint bump. We are not aware of any customer who has experienced any moisture problems due to a dewpoint spike; it is a phenomenon that causes concern, not damage.

Doesn't Henderson manufacture two types of SAHARA-PAK dryers?

Yes. We determined that a few of our customers could not tolerate the dewpoint spike of any dryer and to solve their problems economically, we developed a new SAHARA-PAK dryer; the HC model. You now have a choice of SAHARA-PAK dryers; the SP model that has a dewpoint spike or the HC model that includes a stripping and cooling cycle to eliminate dewpoint spikes.

Will the dewpoint be any lower with the HC?

Yes. The stripping cycle of the HC can provide dewpoints as much as 30 degrees lower than other Heat-of-Compression dryers. The dewpoint out of any Heat-of-Compression dryer is based on the variables we mentioned earlier. The cooling cycle of the HC prevents the dewpoint spike at tower shift.

What about competitive Heat-of-Compression dryers?

When we first patented the SAHARA-PAK dryer, our competitors said it couldn't work. When we won two design awards, they changed their minds and several have tried to manufacture their version of a Heat-of-Compression dryer. Some have simply modified their Split Stream dryer to use Heat-of-Compression; few have anything that competes with our SP. One manufacturer has a dryer that looks similar to our HC, but does not have the experience with Heat-of-Compression dryers that we do. We have customers who are drying over 30,000 SCFM through SAHARA-PAK dryers. If you compare the operating costs of other regenerative dryers, you will see that the Heat-of-Compression dryer is by far the most economical; making it the logical choice for large applications. If you compare manufacturers of Heat-of-Compression dryers, you will see that Henderson Engineering has more successful installations than all other competitors combined. In fact, we have more repeat customers than they have customers. We have over 25 years of experience and are the unquestioned leader in Heat-of-Compression dryer technology.