Air Motor Icing:

What is it and what can be done to eliminate it!

Why do air motors have an icing problem in the first place?

Air motors operate on compressed air from 20 to 180 psi and exhaust the same air at approximately 14.7 psi or atmospheric pressure. This is an extremely high percentage pressure drop that occurs in a short period of time. Exhausted air temperatures will be well below freezing at times on exit. Moisture in the air freezes and crystallizes at these low temperatures. This is the same basic principle as a household refrigerator.
Icing is a problem that is inherent to all air motors. Many factors can influence icing.

They include:

- Compressed air temperature.
- Compressed air dew point.
- Compressed air pressure.
- Compressed air volume flow rate.
- Air quality due to contaminants.
- Ambient air temperature.
- Ambient air dew point.
- Ambient air flow.
- Motor air valve material.
- Motor air valve geometry.
- Cycle rate of motor.
- Exhaust port restrictions such as a muffler.

Any one of these factors can cause icing. These factors can interact in unpredictable ways and can be temporary, which is especially true with seasonal fluctuations in relative humidity.

How do you know if you have an icing problem?

Before you try to fix an icing problem, you should be reasonably sure that icing is the problem.
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You likely have an icing problem if the following conditions exist:

- The pump has erratic pressure fluctuations.
- The air motor stops but will restart after the ice melts. This may take an extended period of time.
- The motor or muffler is heavily frosted.
- The compressed air you are using is moisture laden because little or no drying equipment is installed.

Icing can also show up in subtle ways. Icing may be the problem if you need to do air supply or fluid control adjustments to maintain a constant cycle rate. The problem may be temporary if it is a seasonal fluctuation in humidity.

What can I do if I have an icing problem?

There are several possible solutions to motor icing. The following solutions describe the less expensive methods first. Consider the more expensive changes only if the less expensive options do not work or do not meet the needs of the application.

Change the operating parameters:

- Decrease the pump air supply pressure. This will change the output rate of the fluid.
- Lower pump line restrictions.
- Change the exhaust configuration, put a muffler on the air motor to restrict the exhaust. However, this will lower the performance of the pump.
- Attach a tube to the air exhaust port and exhaust the air to a remote location.
- Install an air line heater. You may want to install an air supply heater if none of the above solutions work satisfactorily or if the problem is not temporary or seasonal. The heater should heat the air supplied to the pump to 130 F, raising the exhaust air temperature to above 32 F to eliminate the icing. Warning: only install these types of heaters in areas not prone to explosions or use an approved explosion-proof heater. The drawback to this solution is the ongoing energy cost for the electricity.
- Install an air drying system

If none of the above changes solve the problem or are feasible, you may have to lower the pressure dew point temperature with an air compressor dryer. A compressor dryer is the best long term solution.

There are three levels of solution for improving air quality:

(1) After cooler
(2) Refrigeration system air dryer
(3) Desiccant air dryer

This list is in order of expense and effectiveness. The after cooler may be enough for intermittent use, while a pump running continuously may require a desiccant air dryer.

How can I prevent motor icing?

Motor icing is likely to occur in any of the following installation examples:

- High-pressure demand.
- Long duty-cycle, especially if running continuously.
- High cycle-rate.
- High dew point most of the year.

If any of the above are true, you may want to install a larger sized pump.
Obviously, if you think you have an air motor icing problem and are seeking the best solution for you specific application, give your local Balcrank distributor a call. They will be able to assess the problem and provide you with the most cost efficient, practical solution or contact me at http://www.dsmith@balcrank.com.

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