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ADVANCED ADHESIVES REPORT

YOUR CORRUGATING NEWSLETTER FROM HARPERLOVE

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Soak Testing

by Wayne Porell

One of the best and easiest tools for corrugator diagnostics is soak testing. It is straightforward to perform and provides a lot of insight about potential issues with the corrugator. It is the box plant equivalent of going to the doctor and getting an x-ray.

Soak Tank

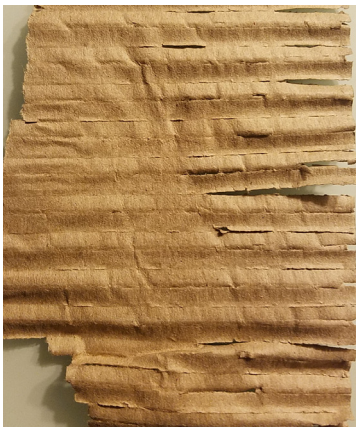
To begin, the soak tank should be filled with heated water at 95°F to 100°F so the combined board will soak apart within a reasonable amount of time—approximately 10 minutes. In cold water, the board can take 24 hours or more to completely soak apart. It is important that the board soak apart without being disturbed. If you pull the board apart prematurely, you might alter the glue lines and get an inaccurate reading. You will know the board has separated on its own when the medium begins protruding from the lead and trailing edges of the combined board.

After the board has separated, spray the liners and medium with an iodine solution. Iodine will react with starch and turn a dark blue-black color which will make the presence of the starch-based adhesive very easy to identify.

Medium

When doing a soak test, I usually start by looking at the medium. The glue lines on the medium will tell you a lot about what is really happening in your machine. The first thing to look for is whether the starch is applied directly on top of the flute tips. If it is, then the glue roll speeds are correct relative to the paper speeds. If the starch lines are off-center and tending to the front or the back of the flute tips, then your glue roll speeds need to be adjusted. Incorrect glue roll speeds can also lead to lower pin test results.

The glue lines on the medium will also tell you if the starch application is even and consistent across the web. If the glue line width on the operator side differs from the width on the drive side, the glue roll and the metering roll are likely out of parallel.



Fractured Medium

There are several reliable ways to measure glue lines. A plastic glue line measuring gauge is quick and easy to use. Glass magnifiers with calibrated reticles will provide more accurate measurements and a better view of the glue lines. These are better to use when you want precise measurements or if you want to clearly see whether the glue lines are symmetric about the flute tips.

It's also important to look at the edges of the medium for fractured flutes. Excessive loading on the corrugator roll can fracture the medium, and this can result in an edge bonding problem at the doublebacker. Many machine operators set the corrugator roll loading at its highest setting to prevent blow out issues while running at high speeds. In addition to fracturing the medium, excessive pressure will cause premature corrugator roll wear and will lead to the rolls having to be replaced more frequently than necessary.

Liners

The widths of the glue lines on the liners will show how well the starch is transferring from the medium to the liners. Most machines will provide at best 85% - 90% starch transfer from the medium to the liner at the doublebacker (e.g., 0.070" on the medium versus 0.060" on the liner). Transferring less than 85% can be caused by a lack of pressure due to issues with the hold down device in the hot plates or the top belt being too tight. When the top belt is too tight, it works

against the hold down devices (shoes, ballast rolls, air bags etc.). Another potential cause of inadequate starch transfer is high liner or medium temperatures entering the machine prior to the bonding process. The paper temperatures can be checked with an IR pyrometer.
The glue lines should also be consistent across the web without any voids or spotty application. Spotty application is usually caused by a dirty or worn glue roll, insufficient tension on the liners entering the machine, or an out-of-parallel issue.

Conclusion

Although straightforward and easy to perform, soak tests and glue line analyses are excellent diagnostic tools and can provide a lot of insight about the mechanical condition and operational settings of the corrugator.

Troubleshooting a Diaphragm Pump

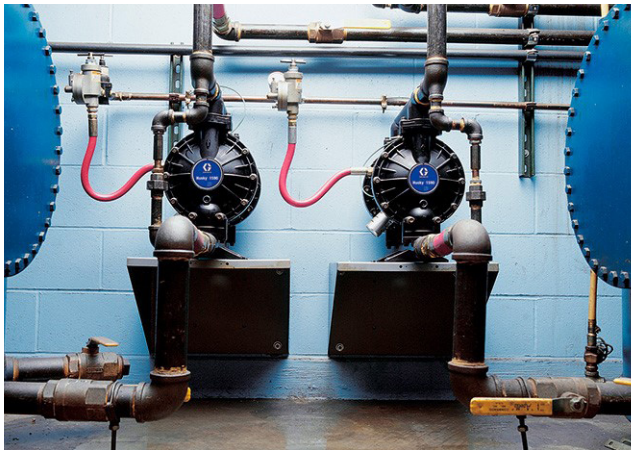
by Michael Sandlin

Follow these six easy steps to address common installation and operation problems.

Air-operated double-diaphragm pumps (AODD) are preferred in transfer applications because their simple design makes them easy to operate and cost-effective to repair. To achieve top performance, end users must install and operate these pumps correctly. In a matter of minutes, common issues can be corrected with the right information.
Here are six quick steps that can help you fix common problems during installation and operation.

1. Check the inlet air line size and pressure.

Installing an air line that is too small is the most common mistake users make when installing an AODD pump. Using too small of an air line will starve the pump of the fuel—



Chemical Transfer with air-operated double-diaphragm pumps (Images and graphics courtesy of Graco Inc.)

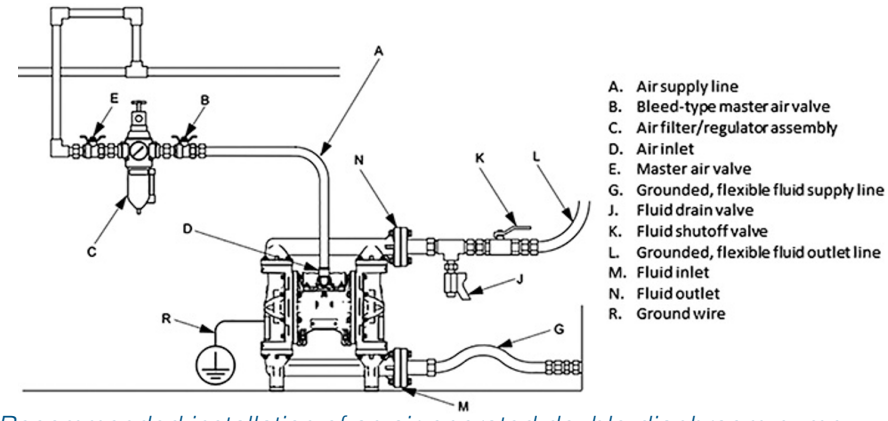
compressed air—it needs to operate at peak performance. Upgrading to a larger air line is an easy fix that takes a few minutes. Double-diaphragm pumps come in all shapes and sizes, based on the application and fluid requirements. Larger AODD pumps (1-inch and greater) require more compressed air and larger air lines than smaller pumps to operate at full capacity.
The appropriate air line size for a pump is located in the manufacturer's installation and operation manual. As a general guideline for AODD inlet air line sizes, match the air line hose size to the air inlet port size on the air valve.

Inlet air pressure also plays a key role in getting the most out of a pump. Diaphragm pumps operate on a 1-to-1 ratio, meaning the pressure of the inlet air feeding the pump is directly related to the fluid pressure at the pump's outlet. For example, if the target outlet pressure of a 1-inch, 50-gallon-per-minute (gpm) pump is 100 pounds per square inch (psi), the inlet air pressure entering the pump's air valve must be greater than or equal to 100 psi. System backpressure and fluid viscosity will impact the outlet fluid pressure. Too little backpressure may cause the pump to run inefficiently because the ball checks may not check as quickly. Too much backpressure can cause the pump to stall if the fluid pressure overcomes the air pressure to the pump.
To control the performance (flow and pressure) of an AODD pump, install an air regulator assembly to control the incoming air pressure. Installing the correct air line size with an air regulator will solve the most common AODD pump installation problem.

2. Inspect for muffler icing and restrictions.

Diaphragm pumps can generate high decibels at full speed, a main reason mufflers are recommended during installation. The AODD air motor requires compressed air to operate. As the compressed air enters the air valve and channels through the pump center section to exhaust through the muffler, rapid temperature changes occur. At the muffler exhaust, air temperature is below freezing and can cause icing-related issues that are common in humid environments.
Erratic pump operation, inlet air with high levels of moisture or visible frost on the outside of the muffler are indications of an icing-related issue that is decreasing pump efficiency. Here are suggested solutions to eliminate these issues:

- Decrease the air pressure to the pump.
- Increase the pump size to operate at lower speeds (i.e. lower air pressure).
- Exhaust air to a remote location using an exhaust port tube.
- Add an air line filter with a water catcher and



A. Air supply line
B. Bleed-type master air valve
C. Air filter/regulator assembly
D. Air inlet
E. Master air valve
G. Grounded, flexible fluid supply line
J. Fluid drain valve
K. Fluid shutoff valve
L. Grounded, flexible fluid outlet line
M. Fluid inlet
N. Fluid outlet
R. Ground wire

Recommended installation of an air-operated double-diaphragm pump

drain to collect condensation.
- Install an air line heater to raise the exhaust air temperature above freezing.
- Adjust the pressure dew point temperature with an air compressor dryer.

Solutions to icing can range in difficulty depending on the application and environment, but reducing the air pressure to the pump is one of the quickest and most effective ways to reduce icing.

3. Inspect sealing surfaces for leakage.

A wise maintenance technician once said, "There are two types of pumps—those that leak and those that are going to leak."
Leakage is a common problem in all pump types. A few simple fixes can ensure the fluid stays in an AODD pump. First, pumps, especially plastic pumps, must be torqued to the manufacturer's recommended rating. Materials relax over time—often referred to as cold flowing—which can cause sealing surfaces to loosen and create leak paths. Refer to the pump manual for torque values, and follow the bolting patterns to reduce the threat of leakage.
Reuse of polytetrafluoroethylene (PTFE) O-rings is another cause of leakage at sealing surfaces. A downfall of PTFE is resilience. Once a PTFE O-ring has been compressed, it is not capable of regenerating its original shape. Replace all pump PTFE O-rings when servicing an AODD pump.
After properly torquing the pump according to manufacturer recommendations and ensuring all sealing O-rings have been replaced after service, the AODD pump should be leak-free. Save significant rebuild time later on by ensuring the PTFE O-rings are replaced when the pump is rebuilt.

4. Ensure proper tubing and piping size.

Pump inlet and outlet fluid port diameters vary based on the flow rate required. Inlet and outlet hose sizes must match the pump's size. A primary concern is the risk of cavitation, which can increase repairs and maintenance costs. Changing tubing and piping size after installation is relatively fast. Knowing the correct size at installation eliminates the time and effort required to make a modification later.
For example, if a 1-inch pump has a half-inch inlet hose connected, the pump will not be able to operate at full capacity without the risk of cavitation. This risk increases dramatically as the desired fluid viscosity rises. In this example, the 1-inch pump should have a 1-inch inlet and outlet hose attached to prevent cavitation.
It is also recommended that an AODD pump be installed with a flexible inlet/outlet connection rather than being hard plumbed. As pump speed increases, vibration increases, which elevates the risk of loosening a hard plumb connection, creating the potential for leakage.

5. Slow the pump down to prime.

AODD pumps are popular when self-priming is required. Creating a low-pressure zone—less than the atmospheric pressure of 14.7 psi—inside the fluid bowls is how the AODD pump draws fluid. If air pressure supplied to the pump is too high, the pump will change over too quickly and there will not be enough time for the fluid to be drawn into the pump.
To solve this priming issue in a matter of seconds, slow down the pump by using the air regulator to decrease the air pressure entering the air valve. Once the pump speed has been reduced and the fluid has had enough time to enter the pump, increase the air pressure and operate the pump at a faster speed.

6. Clear any fluid line restrictions.

Certain restrictions create backpressure that may negatively affect the pump and potentially create cavitation that will increase maintenance. Take a minute to inspect the pump and connected piping to ensure there are no visible restrictions. Look for the following at both the pump's inlet and outlet:

- closed or partially closed valves
- clogs or kinks in the line
- too much hose or length of distance

Listen carefully to the pump as it operates. Listen for erratic operation, which may be caused by an inlet hose that is too small or a problem related to icing. Hearing what sounds like gravel running through the pump or seeing flashing around the manifold elbows indicates cavitation and the need to correct the inlet or outlet tubing size or reduce the pump speed. Also, be sure to keep an eye out for kinks in the inlet and outlet lines or any valves that could be closed or restricted.
Spending a few minutes up front to ensure proper installation will save a tremendous amount of time correcting problems later. Following these steps can help end users spend less time trying to figure out problems with their AODD pumps and more time pumping.

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HARPERLOVE

11101 Westlake Drive
P.O. Box 410408
Charlotte, NC 28241-0408

704.588.1350 • www.harperlove.com
email: salestech@harperlove.com

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