10 Tips on Troubleshooting Dryers

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Imagine You Are an Air Molecule . . .

Ideally, every one of us is desirous to have our process equipment run to specification all the time. Product quality should be maintained, and other than rou-tine preventative maintenance, the machine should never stop. It should start up and shut down exactly the same way each time without any problems!

Those of you who are "in the know" know -- and those of you who wish to be "in the know" will soon know -- that this is a fantasy. Those of us who are in the business of doing this are very familiar with the gremlins that occasionally creep in to thin our hair. "Plant has been running great for the last month and now all of a sudden ? is the frantic report, "and, we haven't touched a thing! I promise!"

In these instances, a little experience and a logical, methodical mind are extremely valuable. The word for it is troubleshooting, and it is aptly descriptive. Just as it never fails that what you are looking for is in the last box, when troubleshooting dryers, sometimes the most simple of fixes stares you in the face for hours before the light is switched on -- figuratively, of course!

Troubleshooting a dryer that has never operated to specification from startup is essentially more challenging than troubleshooting a dryer that is no longer operating to specification. Spending time with these systems and systematically evaluating all the parameters will enable you to draw conclusions and provide certain fixes to the problems and other enhancements. This column, however, focuses on troubleshooting a dryer that has previously operated to specification and is no longer.

Let's first get rid of the obvious. If your feeder is on fire or if your exhaust fan belts are protruding through the belt guard, get your maintenance man involved. If you are putting material in and nothing is coming out, stop the machine -- there is a serious problem. Obvious mechanical issues that can be assessed visually should be simple enough to identify. It's when there are no obvious signs that the challenge is presented.

TIP 1: Be Systematic

A logical and methodical mind is extremely valuable when troubleshooting. The systematic approach will lead you to the primary issue and may uncover other hidden retardations. You must systematically -- and I use the word again to stress the importance -- evaluate performance of each primary component and then break it down to smaller systems.

Revert back to your piping and instrumentation diagram (P&ID) or control schematic and generate a checklist of obvious functions. Look at the mechanical details and continue to develop a checklist of other inspection points. If thorough, you will only ever need to do this once.

Once you have developed your checklist, analytically inspect and confirm the operation of each item. This action removes any uncertainties and will eventually uncover the principle issue.

TIP 2: Refer to Operating Manuals

Many suppliers publish a troubleshooting guide or checklist in their manuals. These are invaluable because they often contain a comprehensive list of topics gleaned from the supplier's experience. Don't be shy, call the supplier. Even if the machine is out of warranty, vendors should provide telephonic troubleshooting assistance.

TIP 3: Use the Available Resources

Modern control systems are becoming more and more complicated. With this complication comes wonderful benefits and simplification of operation if implemented correctly. The cost of programmable logic controllers (PLCs) has reduced to the point where it is frequently economically favorable to utilize the technology. Solid-state controllers also offer additional and improved functionality.


Photo courtesy of Werner Mathis USA Inc.

Should you be fortunate to have a human-machine interface (HMI), system control and data acquisition (SCADA) system, historical trending package or distributed control system (DCS), **and** (note that this is a big and) the code has been written with troubleshooting in mind **and** (another big and) you have invested in field control and motor control input and output (I/O) loops, you should consider yourselves blessed. These tools make troubleshooting far simpler and quicker to conclude.

If you don't, all is not lost. High and low temperature alarms, motor status indicators, and pressure and motion switches often are incorporated into relay logic control panels.

TIP 4: Become Familiar with the Program or Hardwired Schematics and the Logic Thereof

Electrical spikes or other gremlins frequently blow fuses. Some instruments fail with the failure condition not alarming the system. Wires can come loose, opening a circuit that should close under an operating condition. These will have an effect on the operation, frequently manifesting in strange performance. There are numerous possibilities of control faults that cause poor operation.

Becoming familiar with the logic of the control system is paramount to successfully troubleshooting poor performance. Ladder logic or other logic diagrams will illustrate the intended operation. Reducing the time investment in first understanding and then following schematics or logic diagrams to appreciate the intended operation of each condition will absolutely prove to be beneficial. Verifying the logic will remove any uncertainty relating to the control system.

TIP 5: Have the Right Tools

This goes without saying. To troubleshoot a dryer, the right tools include instruments such as a multimeter, manometer, ammeter and thermometer. Other nice-to-have instruments include a tachometer, anemometer (vaned or hot wire), micro-manometer, pitot tube and infrared thermometer.

Let's not forget the safety equipment, including a flashlight and heat-resistant gloves. Basic hand tools also are needed.

Learn how to use the instruments effectively. (This will be a topic of a future column.)

TIP 6: Understand How the Operator Can Help You and Hurt You

The best intentions can have opposite effects. I cannot overstate enough the value of a talented operator nor emphasize that operators typically know more about the idiosyncrasies of the equipment than anyone else! That being said, verify your setpoints. Check your valve and damper positions. Validate that all control and mechanical variables are as commissioned.

Whenever a variable is changed, the entire system may need to be rebalanced. Upping the throughput rate may require changing of various setpoints and mechanical adjustments. This is a biggie -- lots of time is spent troubleshooting issues related to unauthorized changes to

operating parameters.

TIP 7: Don't Overlook Feed Changes and Contamination

Everyone is emphatic that nothing in the feed stream has changed even though the performance has changed dramatically. So much can change! For example, in a classifying preprocess, they increased the screen size opening because they didn't have the correct spare screen. What will this do? Well, reducing the surface area will do lots and can even increase the moisture content!

Once again, validate the feed material. Size, moisture, temperature, characteristics, etc., need to be confirmed to be in accordance with the feed specification.

TIP 8: Conceptualize the Operation of the System

Visually conceptualizing the operation of the system is very helpful in troubleshooting transient conditions. As crazy as it sounds, you need to imagine that you are a part of the system and observe what is happening. For example, if you imagine you are an air molecule starting from the ambient pool of air, your first action would be to be induced into the system. Can you get into the burner? Is the inlet filter clogged making it hard work? Are you mixing with the hot gases? Is there buildup in the combustion chamber? Do you feel hot enough? Are you moving fast enough? Can you sneak by the heat source into the drying chamber without being heated? Can you miss the product and escape? Questions such as these can intuitively lead you to areas that require further investigation. The tools described in tip five above will allow you to measure such things as temperature and airflow and permit observation of buildup and confirmation of short-circuiting.

Pretend you are a feed particle. Once again, visualize your path through the machine. Can you enter the dryer easily? Are you leaving some of your friends behind? Are a whole lot of your friends having a get together in the dryer (buildup)? Are some of your friends getting cremated (burning)? Are you able to escape to the atmosphere (emissions)? Are you being successfully trapped?

As the machine itself, ask yourself questions about vibration, balance, catching and/or pinching, general wear, valves, bearings, fan wear, insulation breakdown, etc. These all can have unexpected effects on the system performance. For example, if you carry over abrasive fines through your exhaust fan, the impeller will wear. It may take years, but eventually the performance will suffer to the extent that operation is problematic. Another example is insulation breakdown on one side of the unit. This would cause a hot spot and a point of heat loss on that side. It may be sufficient to cause your product moisture to vary from one side of the machine to the other.

TIP 9: Confirm Electrical Components

This is a surreptitious issue. You would think that electrics are either off or on. This is true when you have single phase but not always when you have three-phase power.

Losing a phase may result in dramatically reduced performance but not a fault of the system. This is quite common with electric elements and motors, especially if they are over designed. Check all three fuses on fused systems carefully.

Motors also may continue to function if one of the windings has failed. The component may seem to operate but with dramatically reduced performance. Checking for rotation of a fan may not tell you that there is a problem because most people presume a fan is functioning if it is turning. But, when variable frequency drives (VFDs) are being utilized, they will operate at lower power requirements on two phases without any problems. Some of the newer drives, fortunately, have phase loss alarms or indicators.

TIP 10: Keep Records

Of all the tips presented here, this is by far the most valuable tip, and one that is least often followed. Rest assured that the problem you just solved will occur again at some time in the future. Think of how nice it would be if the operator could reference a "lessons learned" database, identify that the issue has occurred before and resolve it as part of his normal duties.

Document all troubleshooting activity. Publish the findings. Circulate the information and maintain it in a logical and searchable format that is easily accessible. Promote its use. Use the information as a training aid for your continuing education programs and new hire training. The data is invaluable!