Best Practices for Effective Polymer Drying

>> AUTHOR

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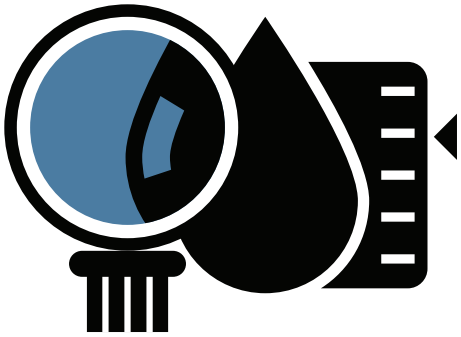
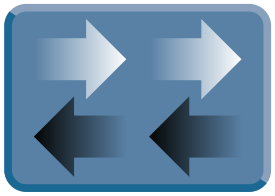
Mark has been designing and installing dryer systems for over 40 years and has worked at Novatec, a leading dryer equipment supplier for the plastics industry, for 25 years. Mark is a well-known and well-respected resin drying expert. Throughout his career, Mark has visited thousands of plastics plants offering solutions for drying challenges and has authored many technical drying and moisture-related articles

Mark Haynie is the leading expert in drying plastic resins. Mark is fondly referred to as the 'Drying Doc'. With more than 40 years of experience in dryer and desiccant design for plastics and industrial applications, he has helped many processors improve their drying performance. Below he outlines practical advice to achieve the best drying results.

MONITOR DEW POINT.

The dew point produced by a dryer is not directly tied to the dryness of the resin, but rather the dryness of the air produced by the dryer. However, knowing the dew point can tell you that the dryer is likely operating up to its specifications. The dryer you select should have continuous monitoring of the dew point.



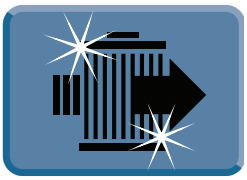


MONITOR AIR FLOW.

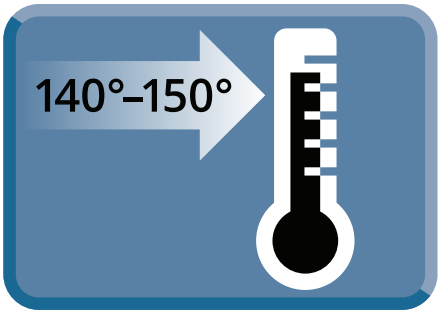
Proper air flow is critical to the drying process. It is both the vehicle that provides the low dew point air for drying resin and it carries the heat from the process heater to the resin. The best practice is to have a continuous monitor – typically a pressure drop device which gives a warning when air flow is reduced.

It's never a convenient time to shut down the dryer to clean and/or change the filters, but operation of the dryer with clogged filters or without filters, even for a short period, will hamper dryer performance and can allow plastic dust to get into the heater which can destroy the desiccant or even cause a fire.

KEEP AIR FILTERS CLEAN.



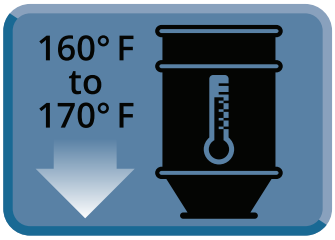
There are filters in both the process and regeneration air streams. The filters should be cleaned or replaced frequently. Check the filters at a minimum of every two weeks and even more often for dusty materials. Always have an extra set of clean filters ready for changing. It's never a convenient time to shut down the dryer to clean and/or change the filters, but operation of the dryer with clogged filters or without filters, even for a short period, will hamper dryer performance and can allow plastic dust to get into the heater which can destroy the desiccant or even cause a fire.



MONITOR THE RETURN AIR TEMPERATURE TO THE DESICCANT.

Molecular sieve desiccant dries the process air best at low temperatures. When the temperature of the air returning to the desiccant bed exceeds 140-150° F the dryer will not achieve a -40° F/C dew point. If the return air temperature is exceeding this level, then there is too much process air or too high a processing temperature. A thermocouple or temperature indicator, at this point will let you know this. In some modern systems, this temperature is fed back into the controls so that a VFD (variable frequency drive) can change the air flow rate automatically. Maintaining a return air temperature of 140-150° F also minimizes energy usage.

SPECIAL CONSIDERATIONS FOR LOW TEMPERATURE DRYING.



Drying temperatures lower than 160-170° F are difficult to achieve for most standard dryers. These processing temperatures apply to some nylons, co-polyesters, PLA and a few other resins. Although the return temperature to the dryer may only be 140-150° F, there is a temperature rise as the air passes through the blower and another rise as it goes through the desiccant. For these applications you'll need to add, typically, an extra post-dryer cooling coil in the case of desiccant drying. This is also a difficult thing for twin tower dryers to achieve. They experience a spike in temperature each time the towers switch as the partially cooled regenerated bed comes on line. Another option for these low temperature resins is the membrane-type dryer that can typically get to low temperatures without the need for water. They are limited to throughputs of about 200 lb/hr. And, yet another option is Novatec's new NITROdry technology. This oxygen-free dryer avoids degradation of nylons, PBT, PLA and TPU's that is the result of prolonged exposure to heat in the presence of oxygen.

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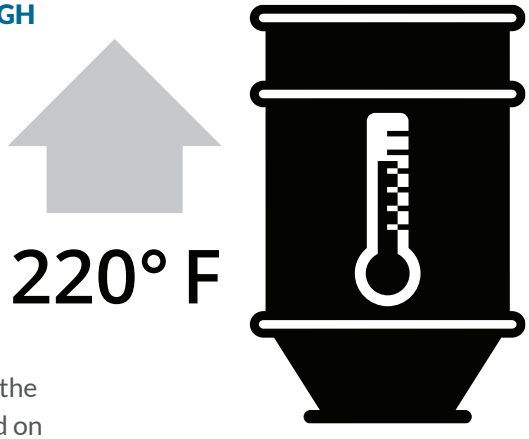
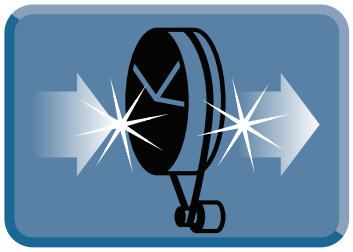
SPECIAL CONSIDERATION FOR HIGH TEMPERATURE DRYING.

When drying resins at temperatures in excess of 220° F, there should be a post hopper cooling coil with tower water. This may also have a water saver valve to limit the amount of cooling water used. Remember, over-cooling (below 130° F) the air in the cooling coil will require additional heating in the process air heater and additional load on the cooling water system.

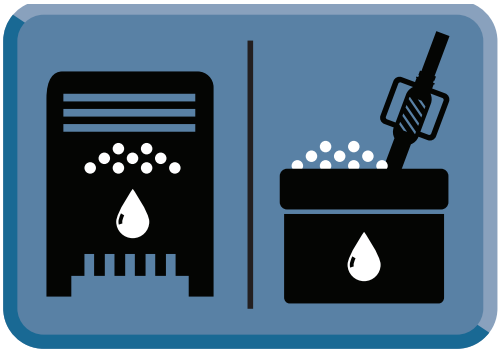




KEEP VOLATILES OUT OF YOUR DESICCANT.

Volatiles (organics) can be released from some resins during the drying process. Resins such as PET, nylons, PBT and some others can give off significant amounts of volatiles over time, which can contaminate and destroy desiccant. Even more, this contamination can lead to carbon dust that can enter the drying hopper and contaminate the resin. All systems subject to volatiles should have a well-maintained plasticizer system.

CHECK MOISTURE LEVEL IN THE RESIN.



The moisture in the resin isn't just a function of the -40° dew point from the dryer. Best practice is to use either an on-line or off-line measurement tool to verify that the resin leaving the dying hopper meets the process requirements. Many products can have flaws from under-dried resins and some, like nylon and PBT, can become brittle if over-dried. The only true way to know if you are sending properly treated resins to the process is to measure the resin moisture. Novatec's latest offerings in moisture analyzing products include the DryerGenie for pre-drying inline moisture analysis and the HT3 HydroTracer by aboni for active inline moisture-based drying with offline process verification when needed.

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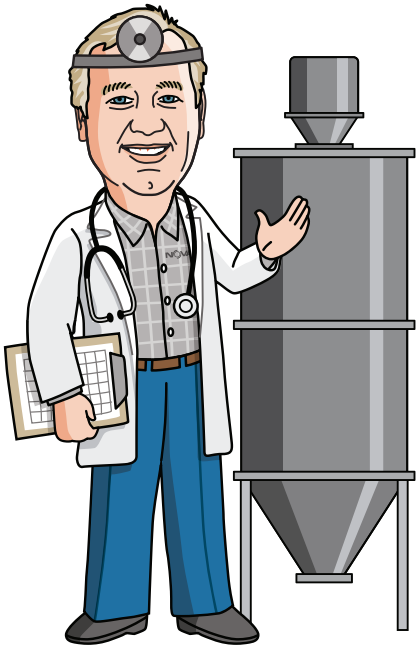
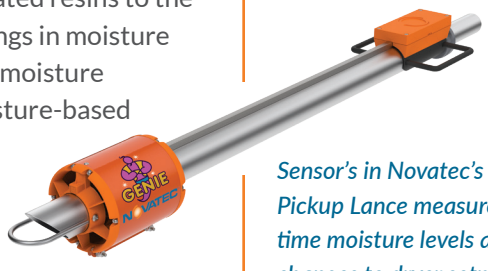
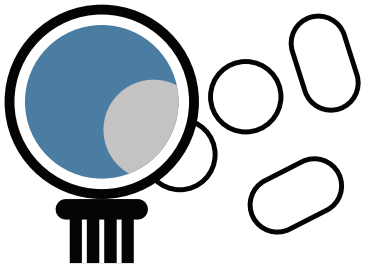


Mark "Drying Doc" Haynie



Sensor's in Novatec's Drying Genie Pickup Lance measure initial and real-time moisture levels and communicate changes to dryer setpoints.

Leaks anywhere in a closed loop system are bad. Air leaks can lead to a significant increase in energy bills when more moisture must be removed from the desiccant.



INSPECT YOUR DESICCANT.

The desiccant types that are typically used in plastics industry dryers are molecular sieve beads, Silica Gel beads and Pure Crystalline Molecular Sieve. The molecular beads are typically used in twin bed dryers and produce -40°dew point drying air when functioning properly. They have a base of about 30% clay so they are not as efficient as the pure crystalline desiccant and should be replaced on 2-year intervals. You can check it in the following ways – if it is discolored – replace it. If you gather a handful and squeeze it, you should feel it warming up quickly. If it does not – replace it. Silica gel does not produce -40°dew point air so it is typically used to provide a blanket of desiccated air in the tops of silos. Pure crystalline molecular sieve is typically used in desiccant wheel dryers. It produces consistent -40°dew point air for several years.

INSTALL A RETURN AIR HOPPER SCREEN.

At a minimum, there should be a screen in the return air (at the hopper) to ensure that resin pellets don't leave the drying hopper.

CHECK FOR LEAKS.

Leaks anywhere in a closed loop system are bad. Inspect the system regularly to determine if you have any issues. Leaks generally allow ambient air, with a high moisture level, to enter the "closed loop". Air leaks can lead to a significant increase in energy bills when more moisture must be removed from the desiccant.

DON'T IGNORE WARNINGS OR ALARMS.

Most dryer controls have a warning or alarm system to alert the operator when something is going wrong in the system. Some controls give very simple warnings while others will tell the operator exactly what is going wrong and even offer instructions for a "fix". In either case, the warning is an indication that some correctional action is necessary or greater consequences will follow. Simply acknowledging the warning and turning it off is not the correct procedure.

Following these simple tips will help keep your production line running more smoothly, with fewer emergencies – and in turn increase productivity and profits.

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