



## Drying Plastics

### Background:

Why is drying plastic so important? Of course, it is to get the moisture out but why does the moisture have to be taken out before processing if materials like nylon, polycarbonate, PBT, PET, and a host of others are processed without removing the water, the physical properties of the resin/part will be destroyed. During processing, there is a chemical reaction (hydrolysis) going on in the barrel making the long polymer chains shorter. Long chains – decent properties, short chains – parts will fail. Forget splay: it only takes a wee bit of water to do the damage. Splay comes about with gross amounts of water. Parts will look OK but not perform. Worse yet, if the failed part is saved there could be a lawsuit. The part can be easily analyzed to check chain size. So, a smart molder makes sure the dryer works. There will be fewer processing hassles as moisture often influences viscosity. Drying consistently and correctly provides a more robust and stable process.

### Get the Hopper Right

Take polycarbonate (PC) as an example. It is easy to say: Dry PC at 250° F (120 ° C) for 4 hours, but the details are astounding. Begin with the hopper. The majority of the industry uses the wrong angle (120°) cone at the bottom of the hopper: it should be 60° included. Ask a farmer why. It has to do with the flow through the hopper. The industry has been doing it wrong for 40 years.

### Inlet and Outlet Temperature

Next, what is the temperature of the inlet? It should be 250 ° F. Check it, and better yet, put a cheap metal thermometer on the inlet AND the outlet. Keep an eye on those temperatures. If the temperature on the outlet is below 200 ° F (96 ° C) things aren't right. There is a leak, most likely at the loading port. With all of the loading, cleaning, etc. done via that port why aren't the gaskets made like a refrigerator door – self sealing? Further, does the hot dry air delivery tube go down into the very bottom of the cone? If not, the bottom 25 to 75 lbs of resin never sees the dry air. Before starting the machine, remove the bottom granules and put them back in on top. If this bottom resin is processed "wet", the properties will be destroyed. For most resins, don't use regrind from parts molded from incorrectly dried resin. Once the long chains are broken you can't redry and put them back together again. There are some resins where regrind is OK. If dried properly, for example ABS. Also, should the air delivery and return hoses be insulated?

#### Other little issues:

1. Ever wonder why some dryers have an after cooler in the return line to the cabinet? Turns out that for the desiccant beds to work correctly the air going into them needs to be below 150 ° F. So if the dryer is running above 180 ° F an after cooler on the return line (which should not be insulated) is needed so the air temperature is cooled for the desiccants. The ideal temperature for the beds is 130 degrees F.
2. It is astounding how many regeneration heater elements don't function correctly. If they are not working properly, the desiccant won't be dried properly. Actually the wise thing to do is put an idiot light on the control panel that tells if the resistance of the elements is correct.
3. Are the filters clean? A certain amount of air forced through the system is needed. If there are lots of regrind or fines check them every day.
4. Check the desiccant often. Is it still active? A simple test can be made by putting dry desiccant into a little bit of water then watch for a temperature rise. Desiccants sinter can get contaminated or ruined by off gasses of certain resins. A general rule is to change the desiccant every 18 months.
5. Don't forget the seals. Check for leaks and crushed hoses. Do it and do it right the first time.
6. Ever get the granules melting together in the hopper? Nice 200 lb. pill. Most of the time it is not the resin's fault. It is the dryer cycling in the newly regenerated desiccant before it is cooled down properly. You can get a slug of 350 to 450 ° F air in some systems as the dryer switched desiccant beds.
7. Dew point measurements help. Run below 25 ° F to 40° F. This does not tell if the resin is dry. It just tells if the dryer has the ability to dry the resin.
8. Moisture analysis should be moisture specific. Once dry, most resins will pick up moisture in 15 – 30 minutes. So, don't allow materials to leave the hopper without a blanket of dry air.
9. Note where the dry air enters the hopper and then meets the resin. Air will only travel upward. Do not believe the arrows on most dryer drawings. Air takes the path of least resistance. The bottom of the hopper is usually blocked. So, any resin below the entry point (look for a dip tube) of the dry air must be drained and put back on top before molding. Do not process the first 20 – 40 lbs. because it is wet and will be ruined.

#### One More Tip:

First find the hot air exit port for the desiccant regeneration circuit on your dryer. Check that temperature of that hot humid air coming out during regeneration. Now go get a bright manager/owner and hold his hand over it while regeneration is on. Then ask yourself and him do you vent a dryer into your air-conditioned house during the summer? See if any ideas come to mind?