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PROPER SCREW WEAR EVALUATION

By: Randy Conner, President of Concor Tool & Machine

The first step to optimizing through put, increasing screw life and saving money.

Proper inspection and wear evaluation of a plasticizing screw can be of great benefit. Most people will measure the wear of the flight tops to determine if there is sufficient wear to adversely affect screw performance. If so, they will either have the screw rebuilt or replaced, however, there is much more to consider. It is correct to look for flight top wear, but where are the tops worn most? What kind of wear is evident? Is the surface of the flights tops uniform all the way down the flighted length? Is there a burr of the corners of the flight tops? If so, is the burr all the way down the flight tops or on just a few of them? Is the burr the same all the way around the circumference of the flight? Is there damage on the body of the screw? Is there erosion on the face or body of the screw? Let's examine some of these conditions and see what they reveal. With proper machine inspection and screw wear evaluation, adjustments can be made to eliminate or reduce some of this wear, increase screw life and produce more parts of better quality.

First, let's take a look at flight top wear. Regardless of whether it's an aluminum or titanium screw, we all know the tops are going to eventually wear, but are the flight tops worn evenly down the entire flighted length? Years ago, flight tops would often wear more towards the discharge end of the screw. These days, however, with all the different engineered resins that are run; we see more wear of the flight tops back in the feed and transition sections of the screw. If this is the case, it may be time to make a change or two. The first place to look is the heat profile you have been running. You will likely see this area run with much less wear if you wet the material out sooner by running a reverse profile. You may also want to examine your screw profile. The feed section of your screw may be too short, causing the flight tops to be forced into the barrel wall by the non-wetted out material leaving the feed section and going up the transition section. This side loading is what can create burrs on the flight tops.

If you have galling or burrs on the flight tops for most of the flighted length, you may want to look at your purging, start up, or shut down methods. When everything is operating properly the melted resin acts as a lubricant between the barrel ID and the flight tops. Running the machine with no material along the flighted length of the screw will allow metal to metal contact of the barrel wall and the flight tops. This contact can cause the flight tops to get hot and expand reducing clearance. This reduction in clearance may in turn cause galling of the flight tops and even the barrel wall. Whenever you need to run the machine void of material, you should always use the lowest possible screw RPM.

If you have a burr on the flight tops or galling that isn't totally around the circumference of the screw, there are two things to consider. First, the screw may be bent. A bent screw will contact the barrel wall of the high side of the bend, thus wearing or galling the tops on one side only. Second, and probably more often the culprit, the screw could have been manufactured improperly or poorly rebuilt. Before the flight tops are ground to final size, either in the manufacturing or rebuilding process, the screw should be straightened to the body diameter. This will insure that the screw body and flights tops are on the centerline. If

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you have a depth micrometer, you can check for this by measuring the height of the flights all the way around their circumference of the screw. That measurement should be the same within .002 of an inch all the way around the screw. Be sure you check the flights in the feed section and metering sections of the screw as well. In the transition section, the body diameter increases with every revolution, so you cannot easily check body run out here.

Another important evaluation is the condition of the surface of the screw. Is it extremely smooth and polished looking, as if it were new? If so, this would indicate that the surface of the screw is compatible with the material you are running and how you are running it. However, if the screw has root erosion or if it is pitted in the flow path, some adjustments may be in order. Pitting often results from a reaction of the material the screw is manufactured from or coated with to the material in process. A nitrided screw surface, for example, can negatively react to material that may be somewhat acidic. This may result in specks, splay, etc. in your product. The best solution in this case may be to reduce screw RPM or anything you can do to minimize the time material sets dormant in the barrel. When material isn't moving in the barrel, it has more time to affect the metals it encompasses. The more you keep the material moving in the barrel, the fewer problems you will encounter.

In the case of root erosion, you may need to elevate your rear temperatures or again, adjust your RPM's. You could also have the screw chrome plated, but this adjustment will require removal of the screw and out of shop time. Root erosion is most often seen with chrome-plated screws, as the plating is usually a .001 or .002 of an inch thick. It also can appear on nitrided screws. It is almost never seen on solid tool steel screws. Increasing your temperatures in the zones on front of the eroded area can often reduce or alleviate this issue. This area is typically at the end of the feed zone and into the transition section of the screw. Again, wetting the material out before this eroded area will make the material more lubricious and less abrasive. Reducing RPM's if possible will also help. Another option would be to strip the chrome from the screw and have the screw ion nitrided. Nitriding is a much deeper process and usually a better choice of surface treatment in an abrasive environment; however, this will require some out of house time for the screw. We recommend solid tool steel screws whenever possible. They may cost more money initially, but the pay back is many times over that of a surface-coated screw.

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