QUALITY FEED SCREWS AND BARRELS

The more you know, the better we look.

9665 N Concor Road • Hayward, WI 54843-7671 • 715-462-3756
Fax 715-462-3205 • sales@concortool.com • www.concortool.com

Screws and Barrels

There is almost no part of a molding machine that is more important than the engine that melts and injects the plastic. The screw, the barrel, and the mechanical front end of that combination can have a significant impact on the quality of the melt, the quality of the molded part, and the economics of operation. How you address the basic issues of the screw and barrel, treated, and front-end components - tips, check rings, nozzles, valves, that are discussed can be a drag on your operation or can make it successful.

THE HARDWARE

Since many screws and barrels are purchased as replacement parts, the first place your supplier will want to start is understanding what you presently have installed in your machine. Whose machine is it? What model, serial number, and year manufactured? What is its clamp force and rated shot size in GP polystyrene? What about stroke, maximum screw rpm, and maximum injection pressure?

What is the screw diameter and L/D? What type of screw design is it - metering, mixing, general purpose, barrier? Single-stage or two-stage? What condition is the screw in? The barrel? Is the problem abrasive wear, adhesive wear, or corrosive wear (see below)?

Maybe you are looking at an upsizing or downsizing project - replacing the screw and barrel to achieve better processing conditions. Do you need to upsize because you can now mount a mold or a large part in a smaller press? Do you need to downsize to avoid excessive residence time for the material in a small part that needs to run in a larger press? Your supplier will want to know the details of that particular part - material, shot volume (including the sprue and runner), and cycle time.

PROCESS CONDITIONS

Your supplier will also want to know the exact nature of any problems, and what the conditions are for that problem. Do you have an ex-

UNDERSTANDING WEAR

There are three basic types of wear that occur on screws and barrels. Understanding which type is occurring on your equipment will help you apply the right corrective measures, either for an existing barrel or screw or when ordering new or replacement components.

• **ABRASIVE WEAR.** Just like it sounds, abrasive wear is surface damage caused by fillers such as talc, calcium carbonate, glass fibers, and even titanium dioxide pigments (used in white plastics). These hard particles scrape off a little metal from a screw or barrel with every contact. Glass fibers particularly abrade the root of the screw at the leading edge, usually in the transition or compression area where the fibers have been exposed by some melting and the partially melted pellets are squeezed against the screw and barrel. Hard-surfacing materials applied to the screw and barrel can help slow this wear.

• **ADHESIVE WEAR**. This is basically galling, caused by metal-to-metal contact. Certain metals can "weld" to each other when excessive frictional heating takes place, pulling apart on further rotation of the screw. Proper clearance and alignment, compatible materials, and proper hardness can prevent this type of wear.

• **CORROSIVE WEAR.** Chemical attack on the screw and barrel surfaces usually results when a resin is overheated and a corrosive chemical is released. The most common occurrence is the hydrochloric acid that is released when PVC degrades. Other resins that may release corrosive chemicals are ABS, polycarbonate, cellulosics, polysulfones, fiber sizing agents, and flame-retardant materials. The best preventive measure for this problem is to avoid overheating; don't let the machine sit idle for long periods of time at operating temperature. Corrosion-resistant screw and materials should be specified.

9665 N Concor Road • Hayward, WI 54843-7671 • 715-462-3756
Fax 715-462-3205 • sales@concortool.com • www.concortool.com

isting screw recovery time problem? What melt temperatures are you running? How does that compare to the material supplier's recommended setting? How does the barrel temperature set-point differ from the actual in front, center, and rear zones?

Are you looking to improve your existing cycle time? Are you experiencing melt decompression? What is the normal screw rpm? What about backpressure? What is the screw motor hydraulic pressure?

THE MATERIAL

What are the materials you want to run in this machine? It's important to know what additives or reinforcements are in the resin, particularly flame retardants, glass fibers, or minerals. Outgassing of volatiles is a major cause of corrosive wear on screws and barrels. Is the material difficult to melt? What is the percentage of scrap that is being reused? Can you calculate the actual residence time for the material?

MIXING ISSUES

How important is the mixing function to your operation? While we don't have room to cover the subject here thoroughly, screw designs generally favor either distributive mixing or dispersive mixing. (Distributive mixing is basically the process of dividing one component into another. Dispersing mixing is the process of reducing the size of the small component to improve its distribution with in the major component. Generally, distributive mixing is preferred, because dispersive mixing involves high shear and a resulting temperature increase.) Understanding how screw design affects mixing is basic to this choice. If you are using strictly precolored material, and are not mixing scrap back in, melting the plastic is your primary goal, not mixing it. But if you are metering color or additive concentrates at the machine, or have a high percentage of scrap reuse, the mixing function of the screw will be essential to good part quality. Additive or color concentrates that have a large particle size require more mixing than those with small particle sizes. High concentration levels within the color concentrate mean that fewer pellets are required, the thus mixing is more difficult. When additives are fed near the throat, it usually means that there is less dispersion of the additive when it enters the barrel.

Finally, the resin type makes a difference as well. Crystalline resins are more difficult to mix than amorphous ones, because they melt with less ease. Inorganic additives such as talc or calcium carbonate can agglomerate under pressure, requiring substantial shear to be broken down again. - *Suzy Witzler*

From IMM Almanac - April 2000

FACTORS AFFECTING WEAR

- **Screw, barrel, and drive alignment.**
- **Straightness of screw and barrel.**
- **Screw design.**
- **Uniformity of barrel heating.**
- **Material being processed.**
- **Abrasive fillers, reinforcing agents, pigments.**
- **Screw surface materials.**
- **Barrel liner materials.**
- **Combination of screw surface and barrel wear.**
- **Improper support of the barrel.**
- **Excessive loads on barrel discharge end.**
- **Corrosion.**
- **Excessive backpressure on recovery.**
- **High screw rpm.**