Who are the Superextruders?

By Paul Robbins EXCO/Castool

Many of you have been in the aluminum extrusion industry much longer than I have, so I'm not going to tell you how to run an extrusion press. Rather, I want to tell you about a small group of very special extruders. I will tell you what makes them so special, and how you can join this exclusive group.

Because of the promotional work I do for Exco Technologies, I have had an opportunity to visit literally hundreds of extrusion plants in all parts of North America, and also in most countries of Western Europe, and even Japan.

Once you're actually in an aluminum extrusion plant, you could be in Toronto or Toledo, Birmingham, Dusseldorf, or Osaka. They're not that much different; there are no surprises. After all, extruding aluminum is a fairly straightforward process. It's not rocket science or brain surgery. We're not actually creating anything new, simply converting aluminum from one form to another.

We take a solid chunk of aluminum, heat it until it softens, then push it through a die where it takes some shape as it quickly cools and hardens. Sounds easy doesn't it? But you know and I know it isn't quite as easy as it sounds! There are many rules to be followed, most of which involve temperature.

The technology of extruding aluminum, and the machinery and tooling used has changed and improved over the years. Current technology and equipment, however, is readily available to extruders everywhere. There is little in this to give one company an advantage over another. The main difference I have seen is in the actual technical competence of the extruders themselves.

Competence of Extruders

As in any other manufacturing industry, the vast majority of aluminum extruders are experienced and competent.

The level of success of the 'average' extrusion producer depends more on business factors than on the competence of their production. Some companies are obviously better managed than others. These emphasize quality, on time delivery, and a close ongoing relationship with their customers. They know their market, their market share, and their competition. They satisfy their customers' needs and wants. Their selling price is set

Extrusion die.

by the market. Likely 80% of all the extruders I have ever visited would be included in this category.

Again, as in most other industries, at any given time there is a small percentage who are arguably incompetent. They either soon learn from their mistakes, or go out of business.

What Kind of Errors Are Made?

Extruders' most common error is that although they actually know all the rules, they think that they might be able to bend them a little to get away with something.

Consider the experience of a usually conservative extruder who has just had a quite large container relined. He is going to be late with an order for a major customer. He is in a panic to get his press up and running, so he decides to speed things up a little. This extruder is completely aware of the fact that, especially with a big container, much time and care should be spent bringing it up to operating temperature. He knows that too rapid heating may cause some massive internal stresses in the container. He is also using an internal heater. You guessed it. He didn't check all his temperatures often enough. The liner became hotter than the mantle, expanded faster and the next noise he heard was the container cracking!

This sort of disaster fortunately doesn't happen very often, but I'm sure that all of you have heard of someone who has cracked a container either through sheer carelessness or by thinking that the rules regarding temperature might be flexible. Most extruders, however, do a good competent job. They know all the rules and obey them. Their work is conservative and dependable and they take no chances.

Superextruders

There is a small group of truly outstanding operators whom I think of as the superextruders. These men are the Wayne Gretzkys, the Magic Johnsons, the Dan Marinos of our industry.

These superextruders have the same market, and sell at the same price as the average extruder. They operate the very same equipment, but more effectively. Their product is 100% quality. They have very little scrap; their downtime is minimal. Productivity is clearly much better than that of an average extruder. On every order they have time enough to make a reasonable profit.

I have met these superextruders in all parts of North America, and also in every other country I have visited. Over a period of time I have gradually realized what it is that separates these superextruders from the average extruder. I found that without exception they are all practically obsessed with temperature. They constantly monitor temperature, record temperature, control temperature. Temperature and its effect seems to be all they think about.

The superextruder is completely familiar with the effects of temperature at every point in the extrusion process. He knows all the rules. He also knows that the results are entirely predictable. He therefore takes advantage of this by running his press at close to maximum speeds all the time. He operates very close to the line quite confidently, because he knows exactly where the line is, and never crosses it. He knows just how far he can go. There are no exceptions.

The superextruder has no fear of temperature because he controls it constantly. For him, extruding aluminum is a science, not an art.

Temperature Control for Maximum Speed

Maximum productivity depends primarily on extrusion speed, assuming there is little or no unscheduled downtime.

Extrusion speed is limited by four factors. Three are fixed—one is variable.

The first factor is available press tonnage. A bigger press can push the billet at a lower temperature. The second factor is the die design. The friction of the die usually increases the temperature of the alloy passing through it by about 100°F. The third

uncontrollable factor limiting extrusion speed is the unique character of the alloy being extruded, especially the profile exit temperature at which surface deterioration such as die liners, pick-up, or tearing, will occur. This is usually about 1000°F.

If the press is not strong enough, or the die too hard to push, the billet temperature must be increased. Extrusion speed then has to be reduced to prevent the exit temperature from getting too high.

The final factor which limits speed of production is temperature—and temperature is controllable.

There are optimum temperatures for extruding aluminum, depending on the specific alloy being used. As a general rule, billet temperature would be maintained at about 800°F. Profile exit temperature should not exceed 930°F for 6063, 950°F for 6005, and 975°F for 6061.

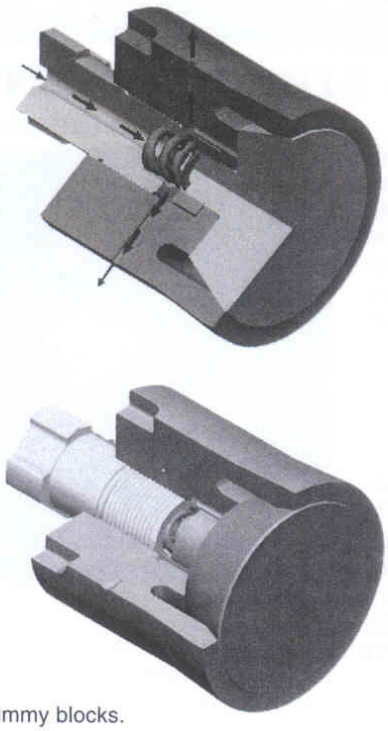
The superextruder constantly monitors and controls the temperature at every point in the extrusion process. He knows the cause and the effect of even minor temperature changes. He anticipates and prevents temperature related problems.

Temperatures to Monitor and Control

Container temperature is of course very important. Particular care must be taken during preheating. To minimize thermal stresses, and to preserve the shrink fit of the liner, it is essential that the container and liner be brought up to operating temperature together. This must be done very gradually, never more than 100°F per hour. While preheating, it is good practice to hold the container at 450°F for 8 hours, and again at 800°F for an additional 4 hours before beginning to run the press. This will ensure uniform temperature throughout the container and give any internal thermal stresses time to dissipate.

The best method of preheating is with an oven. The oven can also be used to prevent stem breakage due to thermal stress. Stems should be stress-relieved every six months. This is done by placing the stem vertically in the oven for 12 hours at 800-900°F, then allowing it to cool gradually while still in the oven.

For best results, while the press is running, the container should be 50-100°F cooler than the billet. Sometimes, however, the speed is so rapid that the container temperature raises the billet temperature. You then have the problem of trying to cool the container. As production speed climbs, heating elements controlled by thermocouples in the container tend to shut down, but container temperature



Dummy blocks.

continues to rise. If the container temperature reaches about 875°F, scrap will increase. The ideal billet temperature is specific to the alloy being extruded.

Dummy block temperature should be controlled to reduce scrap when producing profiles with a critical finish. The fixed block stays with the stem, and has much more mass than a loose dummy block. It therefore retains more heat. The goal is to reduce the back end temperature of the billet to lessen the amount of impurities extruded.

At Castool we can cool our fixed block by forcing air down the stem and through the dummy block. The air cools the mandrel or cone section of the block by about 125°F. This reduces scrap and increases productivity. Once the mandrel has closed, the cooling air can no longer travel forward. It then escapes through holes around the diameter of the block. This air then cools the container. If the container is allowed to become too hot it will affect the billet temperature and reduce productivity. The air cooled dummy block reduces container temperatures by about 75°F.

Tooling temperatures are often neglected. The superextruder doesn't ignore the temperature of any part of his press. For example, if a die that has been preheated to operating temperature is installed against a cold bolster which has twice its mass, the bolster will act as a heat sink and reduce the initial temperature of the die. This is not an ideal situation.

Die temperature is important for several reasons. A die that is operating at less then 800°F is liable to break. Also it may require extra billets to produce acceptable profiles. This can mislead the die technician into thinking that an unnecessary die correction is needed. On the other hand, a die that is overheated can lose its hardness and also oxidize. Oxidation will occur primarily on the bearing surface.

A good furnace is recommended when preheating dies. If your furnace is too small, dies may be too close together. There may not be enough room for adequate air circulation between dies. A box furnace, where each die is individually heated in its own box, is the solution.

Billet temperature depends on many factors—press power, type of alloy, difficulty of profile, die temperature, extrusion speed, and so on. A cooler billet will allow a greater temperature rise through the die, and therefore a higher extrusion speed before the limiting temperature is reached.

Profile exit temperature is always closely watched by the superextruder. It is controlled by ram speed and die friction. The temperature of the alloy will increase by about 100°F during extrusion. The amount of increase depends to a large extent on the design of the die. At Exco the die is designed with the extruder's goal of maximum productivity in mind. This will allow the profile to be extruded at the highest possible speed while still maintaining the required dimensional tolerances and surface finish.

Superextruders constantly measure, record, and control all of these temperatures and more. Temperature is their servant, not their master. They know exactly what the result of any temperature change will be. They are then able to run their presses at very close to maximum productivity all the time. The difference between the productivity of a superextruder and an average extruder is really not that great, but it is all directly reflected in profit.

Benefits for Superextruders

Superextruders run their presses faster, have less scrap, and less downtime than the average extruder. We're in a very competitive industry. The average extruder often finds that he has finished an order and just covered his costs. He hasn't had enough time to make a profit. This almost never happens to a superextruder.

The average extruder, for example, usually underestimates the real total cost of downtime. When, by the process of extrusion we convert aluminum from one form to another, we add value. This added value is really

what we are selling. All our revenue comes from added value. This revenue is only being generated while your press is running. The problem is that if a press is stopped during a working shift or is replacing scrap, virtually all the expenses in the entire company continue, even direct labor which is usually considered a variable expense and applied only during actual production. If the press is stopped for an hour or so, the operator is still paid. Of course, all fixed expenses such as sales and administration continue.

Superextruders never forget that the purpose of their company is not to make extrusions, but to make money. I was visiting a superextruder's plant recently, and a little verse on the bulletin board really sums up his attitude . . .

Count each day lost
Whose setting sun
Shows product sold for cost
And extruding done for fun.

You're not in business for fun.

Remember, if you want to join the superextruders who always have time enough to make a profit, begin by concentrating on three things . . .

First ..... Temperature!
Second ..... Temperature!
Third ..... TEMPERATURE!