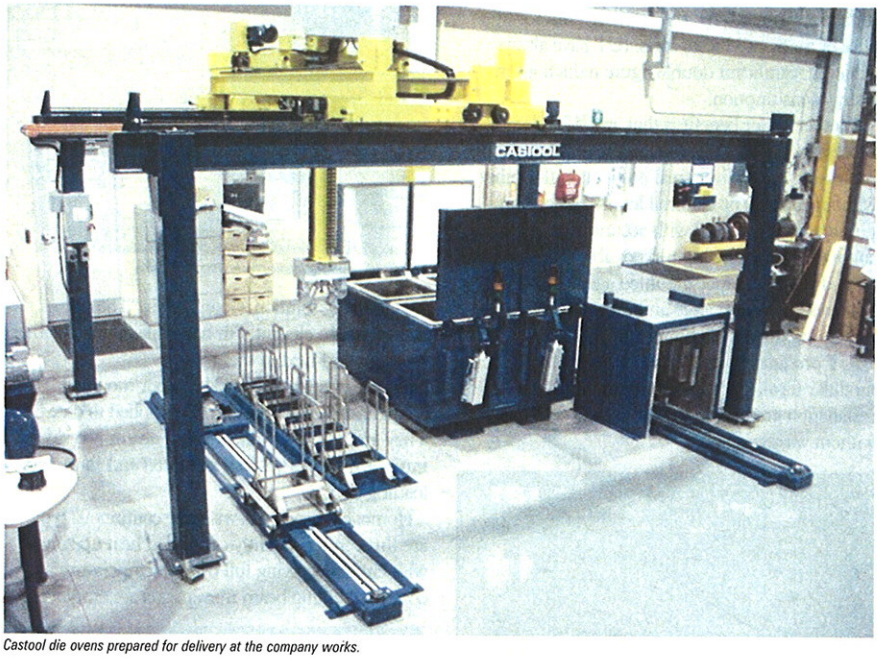
Don't rely on estimates, calculate your die heating program

Most extruders today are not yet using single cell die ovens, despite their obvious advantages. If an extruder has made a satisfactory profit for many years while using a chest oven, it is naturally hard for the extruder to become persuaded that they will benefit by the installation of several single cell die ovens.

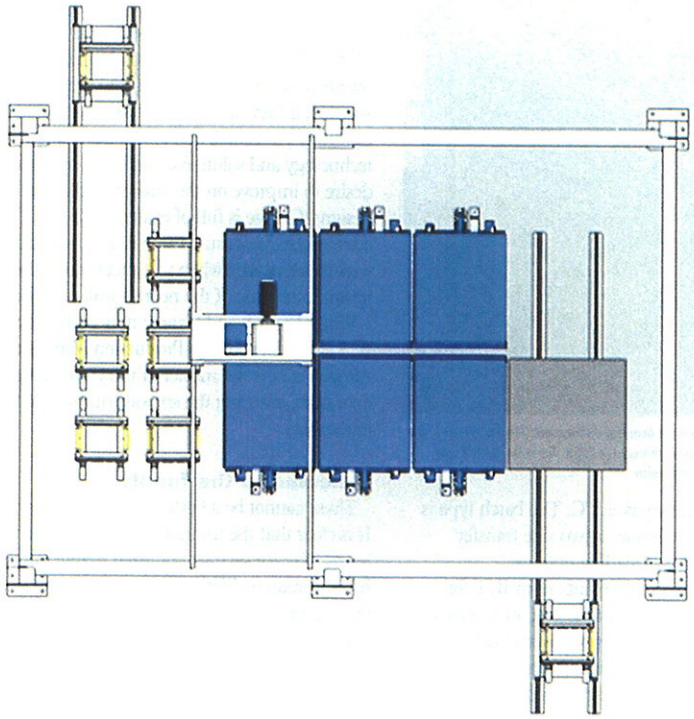
But these are no longer normal times. In today's unique economy, it is unlikely that any extruder can afford to waste the first one or two billets at the start of every run in order to bring the die completely and uniformly to operating temperature. For the extruder who saves the cost of a wasted billet on every run, coupled with their saving in energy costs, the return on the investment can be attractively short. Castool has assisted a number of extruders in obtaining government grants for energy conservation.

Extruding aluminium appears to be a simple process. It is not. A billet of an aluminium alloy is heated until it is soft, then it is pushed through a die, which determines the resulting profile. In this very brief moment of extrusion, as the alloy passes through the die, it hardens, the profile is set, and most of the added value on which the extruder depends is generated.

If the die is well designed and well made, the shape that leaves it should meet all dimensional tolerances, have a good surface finish, and be moving at a profitable speed from the first billet to the last. This can only happen, however, if three specific conditions are satisfied. First, the alloy must enter the die at or near its optimum operating temperature. Second, the die must be completely and uniformly at the optimum operating temperature of the alloy being used. Third, the temperature of the die and the exit temperature of the extrusion should remain virtually unchanged from the beginning to the end of each extrusion cycle. Varying the ram speed should not be an option because the dimensional integrity of the profile may then be compromised.



Castool die ovens prepared for delivery at the company works.


Top view of Castool six oven layout.

Optimised heating program

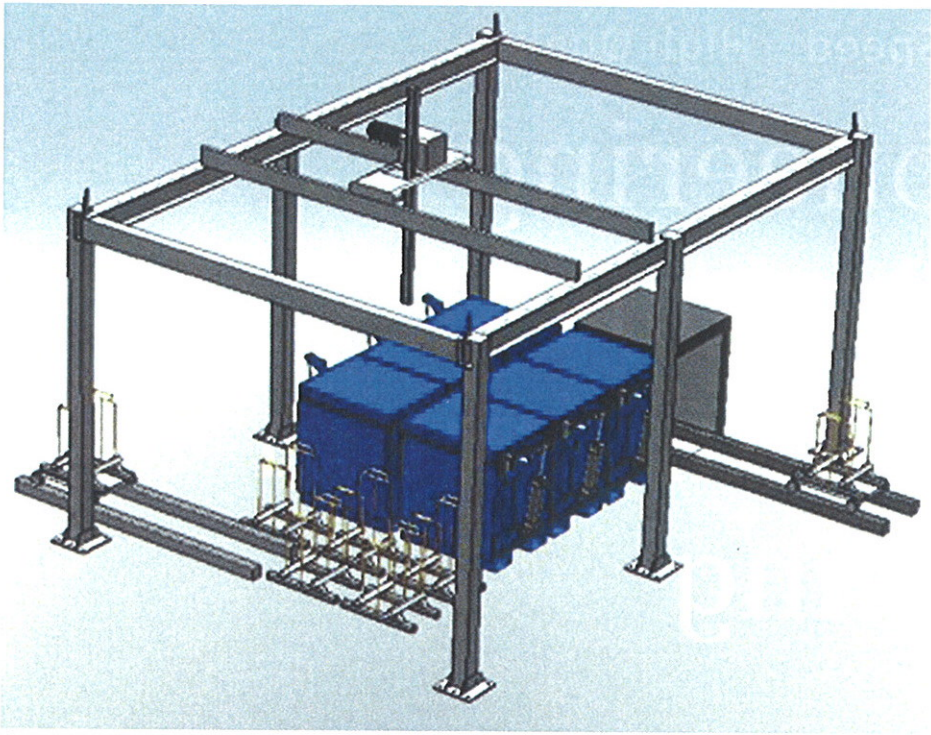
The single cell die oven using radiant energy is now accepted globally as the premium contemporary technology for safely, accuracy, and rapidly heating extrusion dies. A good single cell oven must bring the die to a uniform target temperature in a relatively brief period of time, without exceeding the annealing temperature of the Hi13 die steel, or negatively affecting the nitride layer, while using as little energy as possible, and having a small footprint.

If a die is left at temperature for a lengthy period, the bearing will oxidise. This will result in poor surface finish on the section. If the correct heating cycle, including a 'heat-head' for the die is not used, the oven will act as a soaking oven, extending time to temperature and/or delivering cold dies to the press. If more than one die is put in a single cell oven, all temperature control is lost. The single cell oven then becomes simply a small chest oven.

If a die sits for a prolonged period before being run, all accuracy is lost. Unless controlled, a heated die in shop floor ambient temperature will lose 50°C every 10 minutes. In addition breakthrough pressure will be considerably increased.

Castool pioneered the use of single cell die ovens after they first appeared in Japan in the early 1980s, and presently has well over 1,000 ovens in use globally. Current models reflect the experience gained over the years as the technology of die heating has gradually evolved.

One key to the most effective use of single cell ovens is the optimising of the heating program used for each die. It is based on the size and mass



Side and elevated view of Castool six oven layout.

of the die, thermal conductivity of the die steel, energy added by the resistance heaters, and heat lost to the environment. From the mass of knowledge now available to Castool from its large user base, the logarithm used on its controller for each die is now in fact a calculation rather than an estimate. This method is the most reliable means today to accurately and safely heat a die.

Castool is well known for the ongoing service and technical advice it provides its customers. Its large network of local representatives usually expedites this. Typically, a new die oven customer will provide Castool with a die that will then have several thermocouples installed. Its heating cycle will then be fully documented prior to delivery, or at the customer's plant after delivery. Existing single cell die ovens can also be documented for temperature and energy use.

Robotic Die Expediter (RDX)

Even the best single cell die oven cannot guarantee that the die will be uniformly at billet temperature for the first billet in every run, or that "best practices" will be followed. For this reason, Castool recently introduced the RDX. The RDX expedites the scheduling and heating of the die from the time of its arrival from the die shop, until it is installed on the press.

Although the die will be heated and moved according to a prepared formula, the press operator will continue to have complete control at all times, and will make all necessary decisions during every step in the process.

The technology of light metal extrusion has improved considerably in the past few years. Even the best extruders, however, are not yet able to make best use of the technology now available. The reason for this is that the variety of leaner alloys now being made to provide strength, physical properties and surface finish as well as increased ram speed does not nearly match the variety that would benefit extruders whose improved temperature measurement and control would now make their use possible. In the future, the extruder will have a broad spectrum of designer alloys to choose from. They can then take full advantage of the fact that the extruder has very close control of the alloy temperature from the time the billet is heated until the alloy exits the die in the desired profile.

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