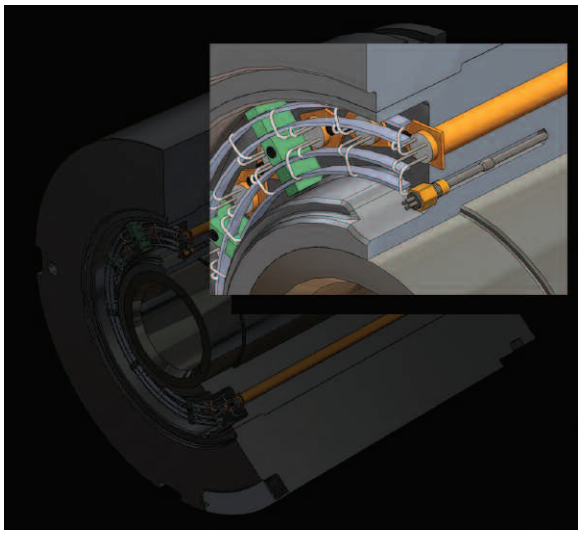
CASTOOL
TOOLING SYSTEMS

QR CONTAINERS

Product

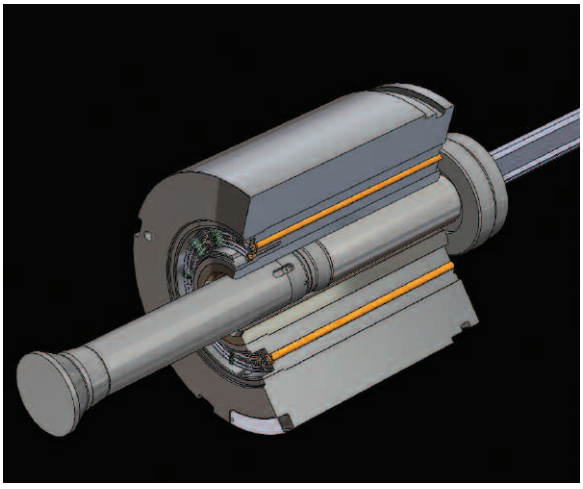
The introduction of the Castool Quick Response or QR Container is one of the most significant and beneficial innovations in light metal extrusion since Castool pioneered the use of the fixed dummy block, followed by the single cell die oven, a number of years ago. The QR Container reflects new knowledge of the extrusion process gained during its development, combined with the most basic laws of physics. The logic of the design of this Castool temperature controlled container is unassailable.



Operation

The temperature of the billet should be closely controlled from the time it is heated until it passes through a uniformly heated die. This is best done by immediately correcting any variations in the temperature of the container liner as soon as they occur. Think of ripples instead of waves. The reduction in energy required is obvious.

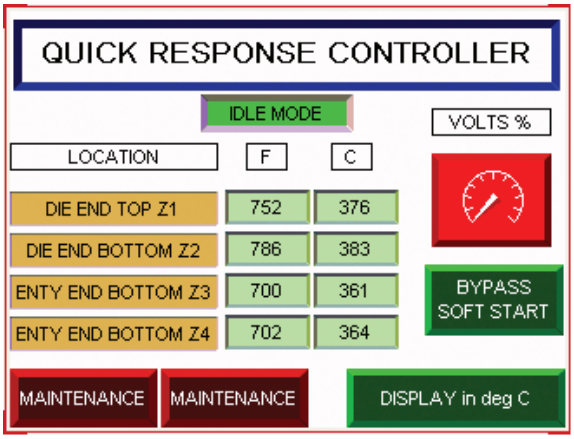
The time taken to respond to a demand for heat is in direct proportion to the distance between the temperature sensor and the heat source. In the Castool QR Container, typically with four temperature control zones, vertical as well as horizontal, cartridge heaters are located close to the liner. Their purpose is to heat the liner, not the mantle, and thus to maintain a consistent billet temperature as the alloy enters the die. Specially designed double thermocouples are used to monitor the temperature of both liner and mantle simultaneously.



Quick Response

The heating elements are positioned close to the temperature sensors. The quick response that results ensures that the liner temperature will remain fairly constant. The risk of overheating, tempering, and softening the mantle is also practically eliminated. Also, since the demand for heat is so quickly satisfied, the cost of operation is minimized.

The viscosity of the alloy being extruded is extremely temperature-sensitive. The die designer must, however, assume that the die will remain completely and uniformly at optimum operating temperature at all times during extrusion. For this to happen, the temperature of the exit end of the container liner must be very closely controlled during the extrusion process, because the temperature of the die very quickly reflects that of the container.



The thermal mass of the container is much greater than that of the die stack. Accordingly, as soon as the die is firmly sealed to the end of the liner, heat transfer by conduction begins, and continues rapidly until a thermal equilibrium is reached.

Unequal Runouts

Especially with large containers, unless closely controlled, heat lost from the bottom of the container mantle rises inside the housing, and considerably increases the temperature at the top. With conventional containers,

the vertical temperature difference at the liner exit is typically 150-200ºF (85-110ºC).

Thermal measurements have proven that during extrusion the difference in temperature between the top and bottom of the die is approximately the same as between the top and bottom of the liner exit. Experience has also shown that for every 10ºF or 5ºC of vertical temperature variance, the runout length from the top apertures of a multi-hole die will exceed that of the bottom openings by approximately 1%. This presents a serious problem for both pullers and cutting to length. It also makes it difficult to maintain required tolerances on a profile with a high vertical component.

Unequal Runout with Conventional Containers

The problem of the vertical temperature difference which, if uncontrolled, will occur at the die end of the container liner, is further compounded by another vertical temperature difference in the die itself.

The die slide in which the die sits has enough mass to act as a heat sink and draw some heat from the lower half of the die. Simply equalizing the temperature at the top and bottom of the end of the liner will therefore not completely eliminate unequal runouts. The liner temperature must therefore be made slightly hotter at the bottom than the top to eliminate any vertical temperature variation at the die exit.

The Solution

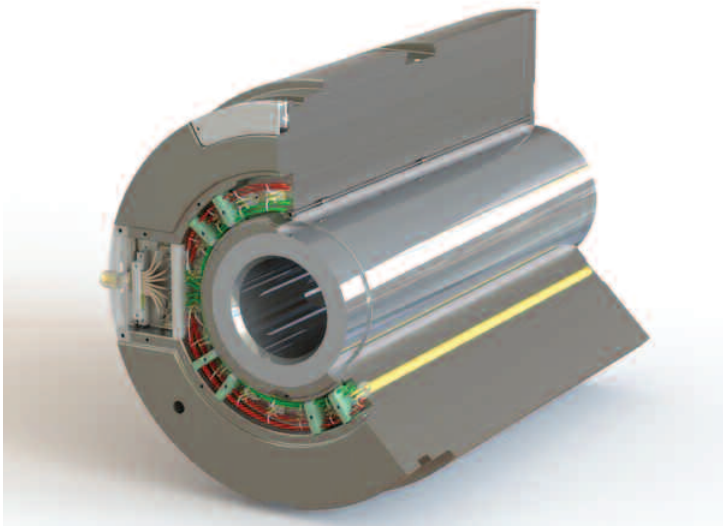
The Castool Quick Response Container solves the problem of vertical temperature variance in both the liner and the die, by utilizing 2 temperature control zones, top and bottom. The velocity of the product leaving the top or bottom of the die should therefore be the same.

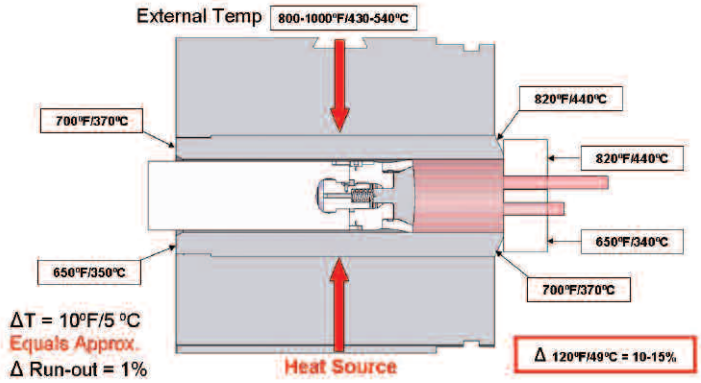
A Critical Interaction

The major technical feature of the Castool QR Container is its ability to control the temperature of the billet as it enters the die, from the start to the end of the extrusion. This can only be done, however, if the billet is steadily pushed through the container by an efficient dummy block that then immediately contracts and is withdrawn through the container without stripping a thin layer alloy from the wall of the liner. The successful interaction between these two components is critical to better extrusion. The capability of each should never be measured by itself, but only along with the other interacting component.

Reduced Operating Cost

Experience has shown that a Castool QR container, which is designed primarily to heat the liner rather than the mantle, can reduce the cost of energy used by as much as 75%.
As well, long-term savings accrue from extended mantle life.





Unequal Runout with Conventional Containers

By eliminating overheating, mantles retain their hardness. Extreme internal thermal stresses that can cause cracking are eliminated. The scrap resulting from vertical temperature difference in dies is also eliminated. Extrusions are now being produced to profile tolerances and at speeds never before possible. Extruders can now also profit from savings on the cost of material which can be made by consistently running product near the maximum tolerance when selling by weight, and near the minimum, when selling by length.

Benefits of the Castool QR Container

- **Provides uniform flow of alloy through the die**
- **Reduces cost of operation**
- **Reduces scrap**
- **Reduces downtime**
- **Increases productivity**
- **Makes isothermal extrusion attainable**
- **Increases operating life**

With the QR Container, Castool again sets a new standard of excellence in the extrusion industry. Results may vary depending on individual press characteristics and setup.

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