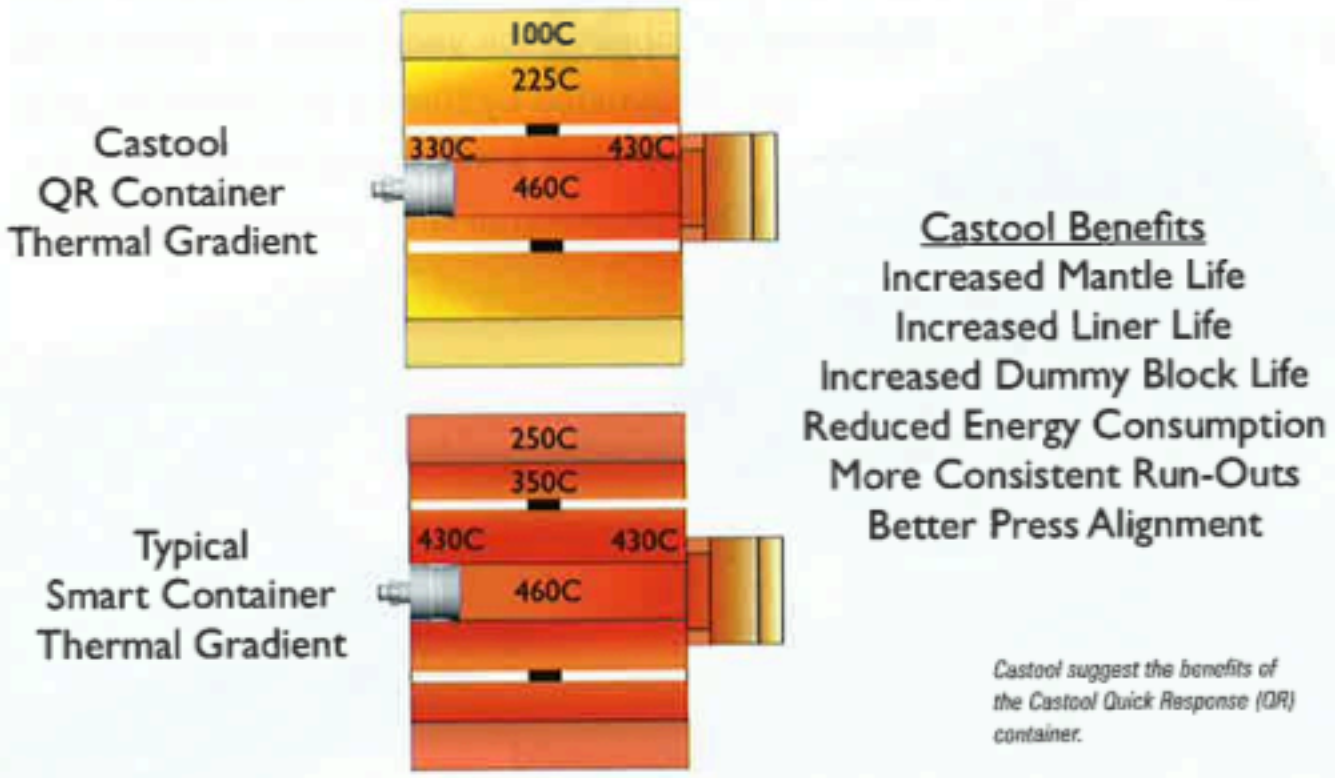
Quick response container manages the die

Aside from holding the billet during the push, the main purpose of the quick response container is to manage the temperature of the die during extrusion, writes Paul Robbins of Castool Tooling Systems.



Castool suggest the benefits of the Castool Quick Response (QR) container.

The thermal mass of the container is so much greater than that of the die, so that as soon as the die is clamped onto the container liner, the face of the die assumes the temperature of the exit end of the container until the run is completed.

With a quick response container, the focus of its thermal control system is on the liner, not the mantle. The temperature is measured and managed in several control zones, vertical as well as horizontal. Heat is added when and where it is required. Cartridge heaters are positioned close to the liner. Double acting thermocouples are located between the heaters and the liner. They monitor temperatures at the entry and exit of the liner, both top and bottom, and the temperature of the heaters. The time taken to respond to a demand for heat is in direct proportion to the distance between the temperature sensors and the heat source. With a quick response container, the response to a demand for heat is therefore almost immediate. Think of smoothing ripples instead of waves. The liner is heated when and where necessary, and a relatively consistent billet temperature is maintained as the alloy enters the die.

Existing problem

With conventional containers, heat loss from the bottom of the mantle rises inside the container housing, and increases the temperature at the top. At the liner exit, this temperature increase is typically 50-100 °C, which is reflected in the die. Experience has shown that, since flow stress reduces as temperature increases, for every 5C° of vertical temperature variance, the run-out length from the top aperture of a multi-hole die will exceed that of the bottom by approximately 1 per cent. This presents a serious problem for pullers, retaining shape consistently with multi-hole dies, and cutting to length. It also makes it difficult to maintain required tolerances on profiles with a high vertical component.

Heat loss compensated

When a die is placed in the press and located in the die slide, it immediately begins to lose heat - some by convection to the surrounding air, but mostly by conduction down into the mass of steel in the die slide which acts as a heat sink. The die therefore develops a temperature gradient where it is hotter at the top than the bottom. Contact between a conventional container and the die does little to overcome this thermal gradient. A quick response container, however, can be controlled to create a hotter lower zone which not only compensates for heat loss from the container, but when in contact with the die, overcomes the top-to-bottom temperature differential. It also helps equalise alloy flow through the die and therefore produces extrusions with improved dimensional accuracy and consistency. Breakthrough pressures can also be reduced.

The quick response container, because heating elements and control thermocouples are located close to the liner, allows the outside of the mantle to be cooler than the liner, and for the container housing to be even cooler. This lets heat dissipate from the middle of the liner, and also, without using auxiliary cooling or air, makes it possible to keep the liner 30C° below the billet temperature. This is intended to retard the flow of billet skin into the die and thus reduce scrap. The technology of the quick response container by Castool reflects an advance in our understanding of the important role the container can play in better controlling temperatures entering the die, and within the die itself.

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