METAMAG INCELL RE-MELT TECHNOLOGY

28 YEARS SERVING THE MAGNESIUM INDUSTRY

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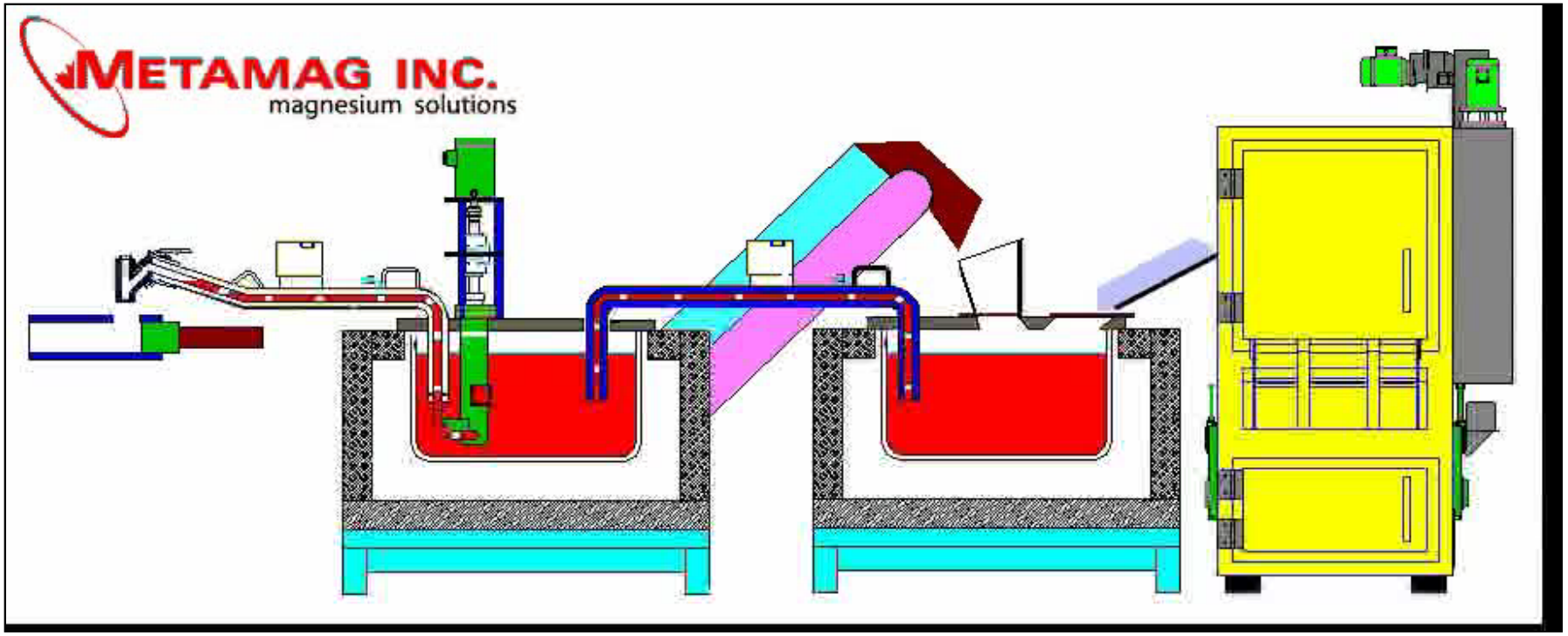

Double Furnace Re-Melt System

Double click on animation to start

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The Management of Die Cast Scrap

Magnesium die casting by nature produces a high percentage of scrap metal, typically 40-60% of the total shot weight. The relationship between the quantity of die cast scrap and recycled, and the volume of primary metal purchased is dependent upon one or more of the following factors:

- **Scrap to part ratio for a single shot**

This is dependent on die design and DCM capability.

- **Metal loss during the melting cycle**

Melt loss is affected by improper melt practice such as melt temperature swings and ingots not preheated at all or not enough, causing excessive alloy separation, poorly fitted crucible lids, and improper settings on cover gases.

- **Production efficiency in percentage of rejected parts**

Is affected by the whole die cast process. example extreme bath temperature swings

Quality of scrap

Is affected by the condition of the cast furnace this will determine if re-alloying is necessary and to what extent.

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Efficiency of the recycling operation vs incell re-melting

Melt loss plays an important role in re-cycling it can be as high as 20% if not handled properly. Metal chemistry also can be a cause of major concern in ingot quality. The volume of recycled metal re-entering the system would be 35% to 45% of parts cast. This then highlights that efficient use of scrap is critical to the overall cost of the die cast operation.

The parts manufacturer has three options in terms of managing this quantity of die cast scrap:

Sell the scrap onto the open market (The disadvantage is that the material is down-graded.)

Recycle the scrap externally

The disadvantages: higher inventories must be kept, higher charges are applied with set melt loss, and tolling charges are affected by outside sources.

Recycle in-house with a re-melt InCell System

The most cost effective solution available to date. Lower inventory can be kept and somewhat stabilizes costs, and the scrap generated by die-casting gets used in a closed loop.

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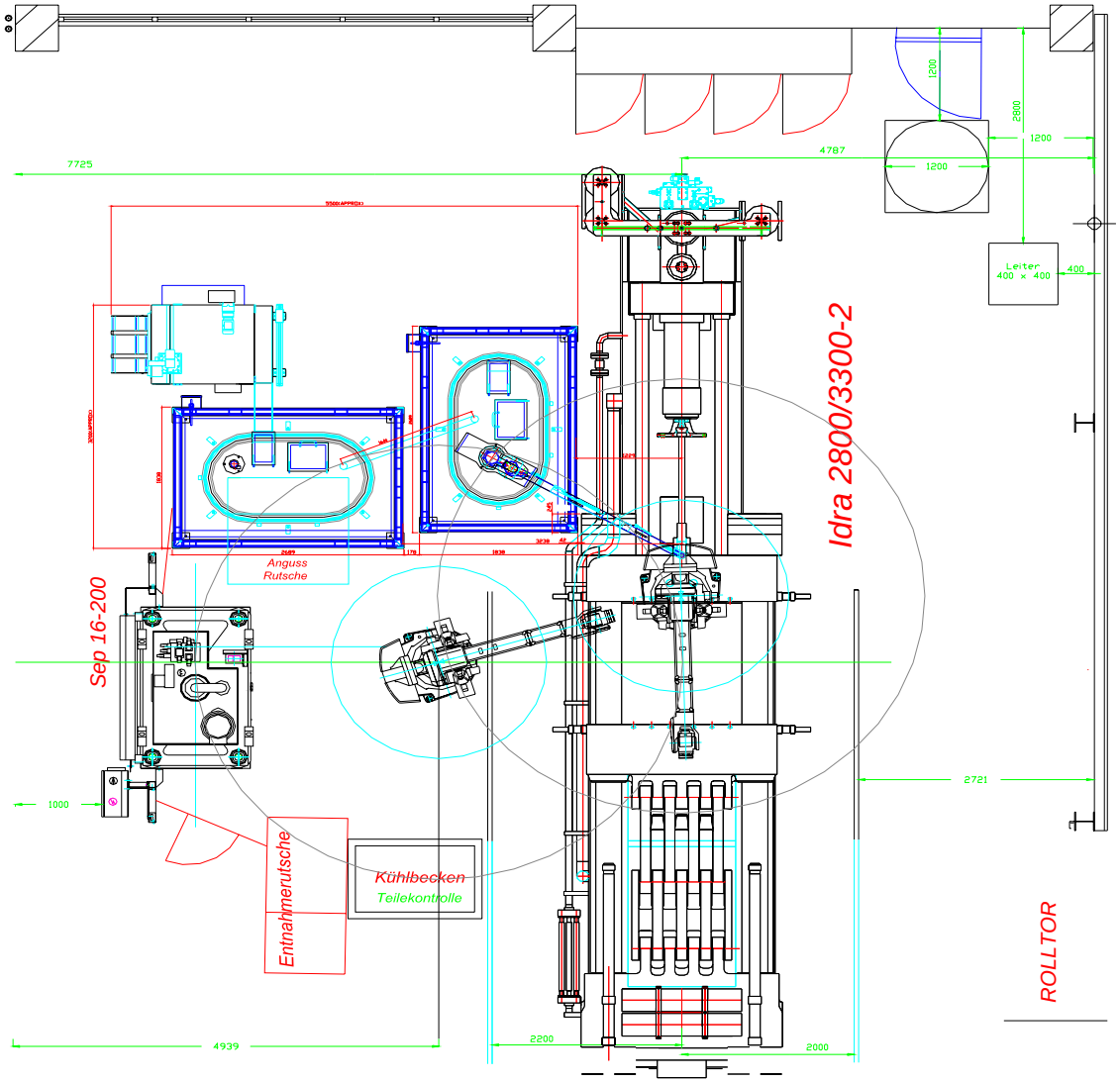

Typical inline re-melting lay-out

BENEFITS OF METAMAG INCELL RE-MELT SYSTEM

Up to 95% savings on recycling costs

Close loop process

More efficient use of energy required to preheat and melt magnesium

Minimizes the chance of contamination of scrap portion of the magnesium casted part, minimal contact with other surfaces

Simple recycling furnace cleaning

Capital expenditure reduction for recycling system can be done on a smaller scale

Minimal scrap handling needed only to gather overflow and flash

Less transport traffic

Overflow and flash can be sent to outside source for recycling with minimal cost and loss

Magnesium can be purchased from preferred vendors without tolling agreement

Inventory reduction

- **Single Furnace VS Double Furnace**
- **What Happens to Oxide Inclusions in a Magnesium Scrap Melt?**

- Oxides will rise to the top 8”(200mm) inches of the melt fairly rapidly when first melted. This is due to hydrogen formation from burning the film formation on the scrap surface. The hydrogen gas bubbles attach themselves to the surface film oxides which helps float them to the surface.
- The design of a system to In-cell Re-Melt must allow the natural separation to take place. There needs to be enough dwell time built into the process for the oxides to rise - this is why a two-furnace approach is preferred. The cast or pumping furnace does not go through a phase transformation from solid to liquid so it is easier to keep the clean alloy separate.
- Melting and holding are two different processes with two different requirements, so they should be kept separate.
- **Keeping theRight Composition**
- In order for In-Cell Re-Cycling to be successful, the alloy composition must remain within the prescribed specifications and must still meet the ASTM B94 specification for die cast ingot. If done properly the scrap to virgin ingot ratio should be 50/50. Depending on the tooling design the casted part can be up to 60% of the total shot weight; this makes it easy to keep the ratio equal. In a real time process, the scrap gets put back into the melt within minutes of being casted. This is especially good in preventing a thick oxide skin of the scrap.
- **Addition of Circulation Pump**
- The addition of Circulation Pump is more efficient in any re-melt furnace system. The Circulation Pump is located in the Melt Furnace, where it will assist the scrap to pass from solid to a liquid much faster thus minimizing inter-metallic separation. The stirring action resulting from the Circulation Pump also helps the lighter magnesium oxide to float to the surface.
- The melting and holding process require two different operating temperatures, this is impossible to do in a single furnace. There are some instances where In-Cell Re-Melting is done in a single furnace but the crucible size has to be more than double the normal size required. In a single furnace the cast temperature will be compromised in order to satisfy the required melting temperature needed to melt scrap.