

INTRODUCTION TO METAMAG INC.



30 YEARS SERVING THE MAGNESIUM INDUSTRY

INTRODUCTION TO METAMAG INC.

Established in 1979 as a privately owned company, Metamag Inc. is now celebrating its 25th year in business and in becoming a worldwide leader in the development, engineering, and manufacturing of *Magnesium Melting and Transfer Equipment*.

More than 250 Metamag® Preheaters, Furnaces, and Control Packages have been sold in sizes ranging from 100 lbs. per hour melting capacity hot chamber systems, to 3,000 lbs. per hour melting capacity cold chamber systems.

Our equipment produces high quality parts for the automotive, computer, electronic, power tool, and recreational industries.

Our newly renovated web-site www.metamag.com is where you can find information on all our manufactured products now including *New Products, In-Stock Items, and Equipment Upgrades*.

PARTNERSHIPS, CO-OPERATIONS, & DEVELOPMENT EFFORTS

- **16 years development work Meridian**
- **8 year co-operation Dow Magnesium**
- **Inter-metallic separation study Dow**
- **Re-cycling Development Dow**
- **Re-cycling system setup at Metal Works**
- **Develop test recycling Meridian**
- **Recycling trial Die Makers Inc.**
- **MP4000 pump testing Die Makers Inc.**
- **Bailing pump development Noranda**
- **12 ft. long pump testing Northwest Alloys**
- **Anticipative logic MPI**
- **MP6000 Pump trial SPX Contech**
- **Set-up first recycling system Taiwan (1998)**
- **Develop to furnace melting system**
- **Develop In-line Re-melting Georg Fischer (Austria)**
- **Manufacture largess DCM production system 600 kW 1,200 kg/h**

CUSTOMER LIST

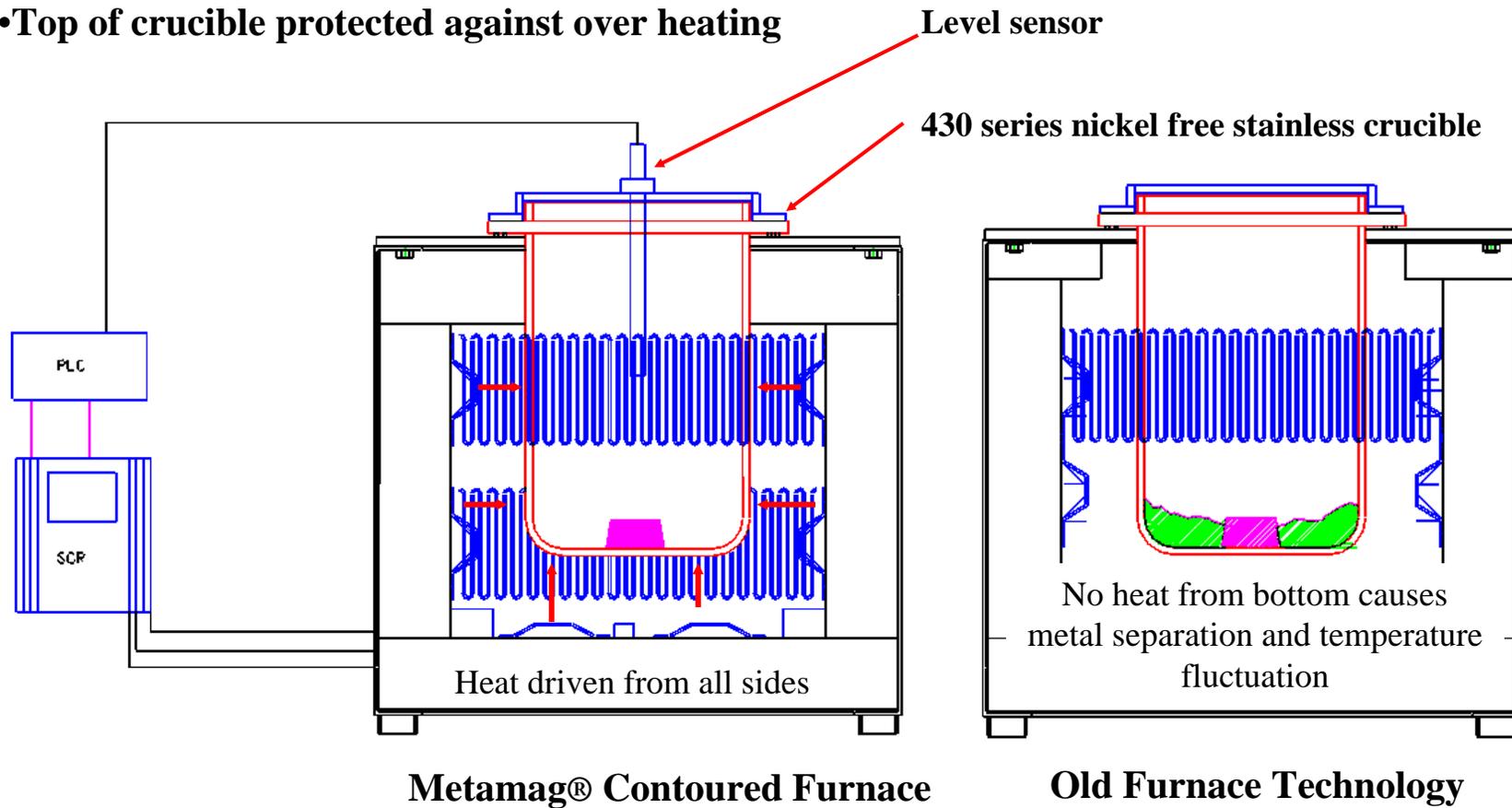
- **Black & Decker**
- **Chicago White Metal**
- **Daimler, Germany**
- **Delphi Interiors**
- **Exco Engineering**
- **Gatetech Taiwan**
- **Georg Fisher, Austria**
- **Intermet**
- **K.S. Centoco**
- **Magnesium Aluminum Products**
- **Meridian China**
- **Meridian Products Ltd.**
- **Meridian UK**
- **KIPT of Indiana**
- **Aisin of Japan**
- **Meridian Products of America**
- **Meridian Products of Italy**
- **Neaton Auto Products**
- **Noranda**
- **North West Alloys**
- **Northern Die Cast**
- **Pechiney**
- **SPX Contech**
- **Techmire**
- **T.J. U.S.A.**
- **Trimag of Canada**
- **Red Oak Die Casting**
- **Euromag Poland**
- **WBK of Korea**

MANUFACTURING AND TECHNOLOGY CENTER



METAMAG® CONTOURED FURNACES, ENABLING TECHNOLOGY

- Metamag® contoured element system
- Anticipative logic
- 430 series stainless crucibles
- Top of crucible protected against over heating



METAMAG® CONTOURED FURNACES, ENABLING TECHNOLOGY

Metamag® Contoured Element System

- Contoured elements drive the heat in the crucible more evenly
- More heat from the bottom of crucible where ingot rests after it is charged
- Superior heat transfer

Anticipative Logic

Anticipative PLC Logic monitors molten bath level. Before preheated ingot is charged, the SCR applies more power to the system, allowing the bath to be pre-warmed by 5 to 8 degrees before ingot is charged. Colder ingot dissipates in the bath reducing overall bath temperature back down to its production set point.

410 Series Stainless Crucibles

- Crucible is a one-piece construction, stainless and nickel free
- Casted shape means no welds
- Reduced iron oxide contamination
- Longer lasting

Top of Crucible is Protected Against Over Heating

Metamag® furnaces are designed with thick insulated covers that reduce over heating and improve cover gas effectiveness.

Metamag® Stirring Tool

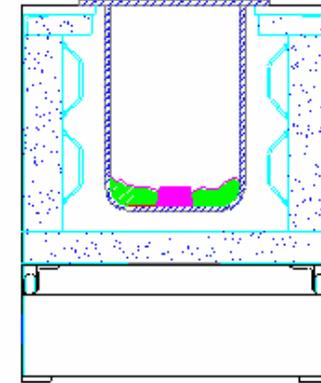
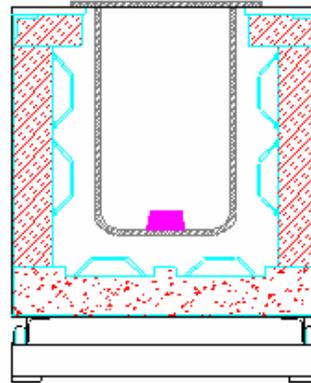
Metamag® furnaces are manufactured with extra length in the furnace box and crucible. This allows for our stirring tool to fit, leaving room for ingot charging and access for bath cleaning.

Stirring Tool Benefits:

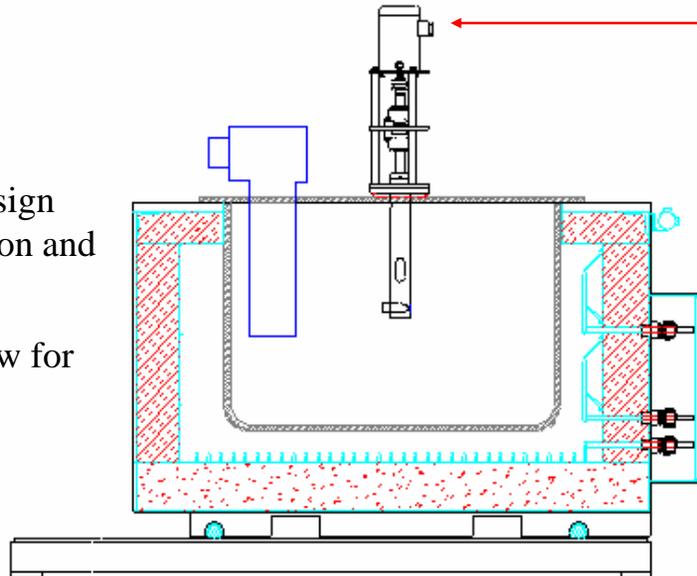
- Increase gooseneck life by stabilizing temperature, which in turn prevents gooseneck distortion that occurs when bath temperature is allowed to fluctuate
- Stabilizes the melt bath, and helps dissipate the colder ingot when charged
- Prevents sludge and dross build-up around gooseneck and at the bottom of the crucible

METAMAG® HOT CHAMBER FURNACE DESIGN

- Contoured element system
- Anticipative heating logic like our Cold Chamber furnaces
- 430 series SS crucible
- Top of crucible is protected against over-heating with more insulation

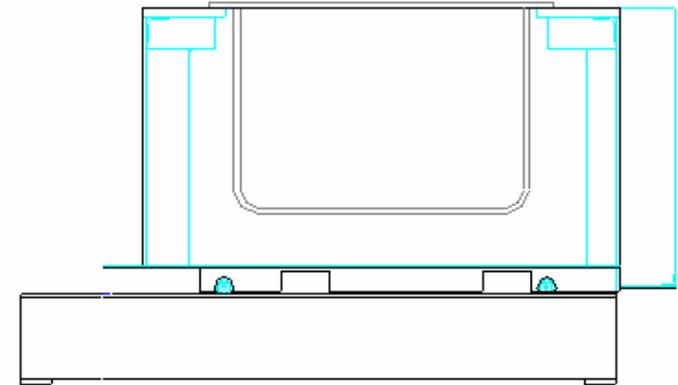


- Deeper furnace box design allows for more insulation and bottom elements
- Longer crucible to allow for stirring tool
- More cleaning access



METAMAG FURNACE DESIGN

Stirring tool keeps bath and gooseneck temperature stable for longer life



OLD FURNACE DESIGN

METAMAG® CONTOURED FURNACES, ENABLING TECHNOLOGY

Benefits:

-  **Stabilize die cast process**
-  **Reduce inter-metallic separation**
-  **Casted parts maintain alloy specification**
-  **Increased good part yield**
-  **Increased utilization time**

METAMAG® PUMPS, ENABLING TECHNOLOGY

Metamag ® Pump Innovations

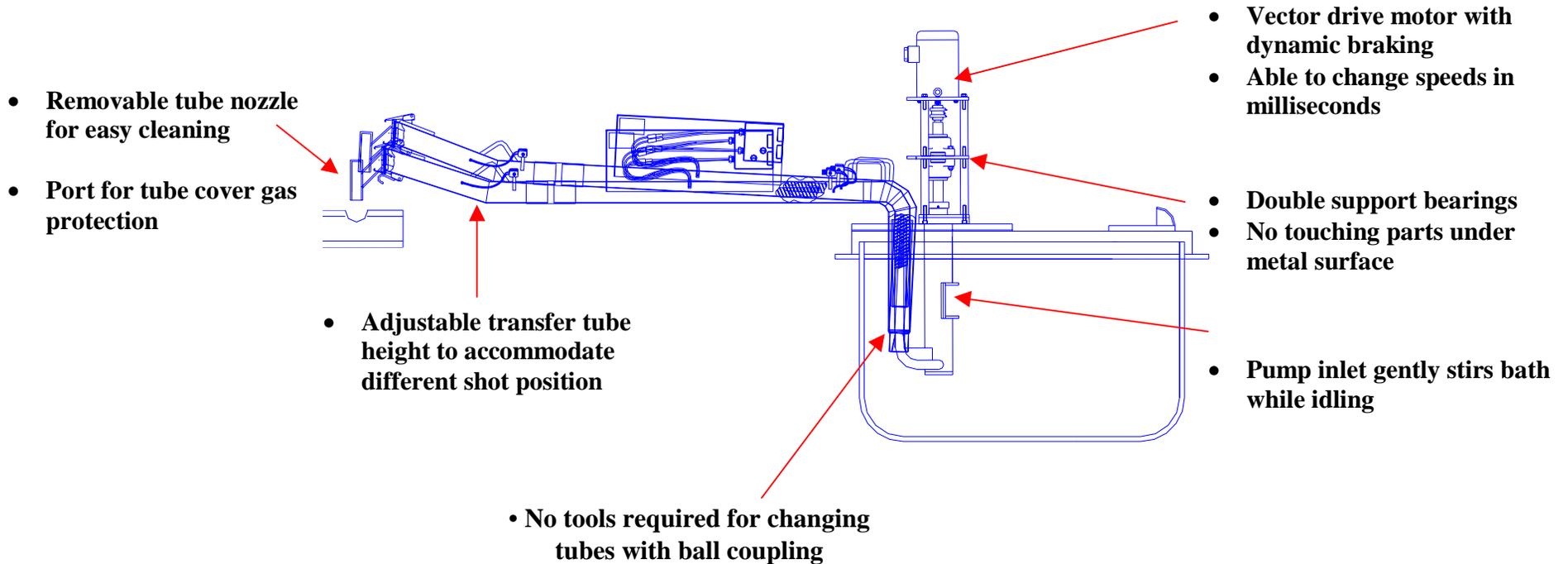
- control over pour speed and pour time
- Pump maintains head of metal ready to be transferred to DCM
- Accurate metering of shot weight
- Repeatability +/- 2% of shot weight

Example of Metamag ® Pump Settings:

<u>Part shot weight</u>	<u>Idle Speed</u>	<u>Pour Speed</u>	<u>Pour time</u>
30 lbs.	19 hertz	42 hertz	4.5 seconds

Old Technology

Siphon tubes only control over pour; is time, the speed is predetermined by fixed head of metal



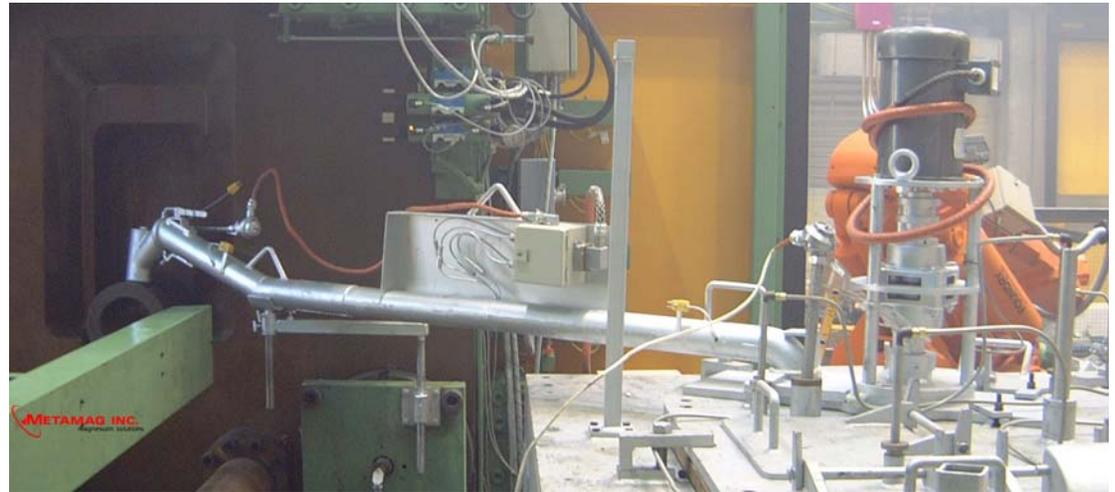
METAMAG® PUMPS, ENABLING TECHNOLOGY

Improve Conventional High Pressure Die Casting Process

- Further stabilizing melt bath temperature
- Improved metal transfer rate
- Improve cycle time
- Improve good part yield

Facilitates Re-melt Technology

- Prevents alloy separation
- Improved quality of part as well as scrap component of casted part



Underfill Process

- Full use of pump capabilities
- Underfill laminar shot sleeve fill; no air or gas entrapment
- Reduce dependency of vacuum
- Improved grain size and mechanical property
- Faster cycle time

METAMAG® ELEMENT AND THERMAL SYSTEM

Controlling thermal excursions through reduced time base

Minimizing temperature extremes results in less expansion and contraction of the heater element and extends heater life.

Dramatically increase element life

As time base cycling increases past one second, they become more damaging to the heater element. SCR's cycling at less than one second stabilizes temperature and increases heater life. Reduced time base firing extends element life. SCR's extend element life up to 20 times.

SCR's provide years of outstanding reliability

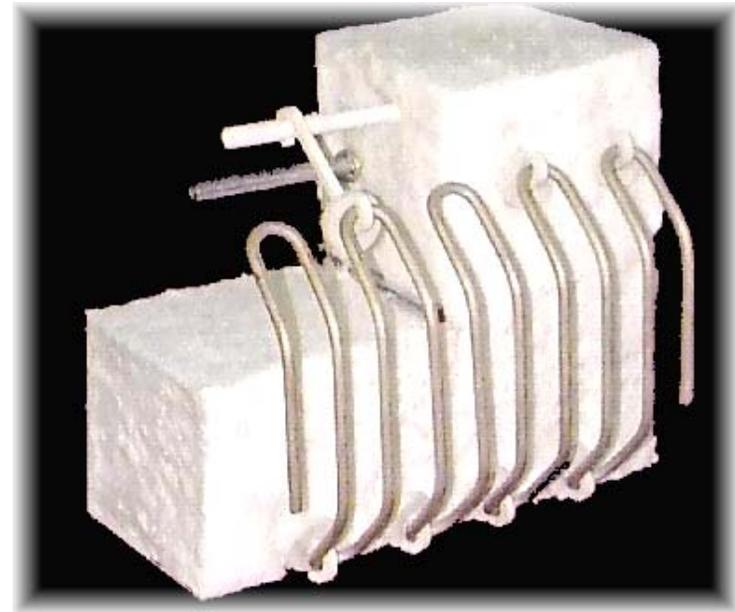
The SCR power controller is a solid state device and there are no moving parts to wear out or replace. While operating at the fastest time base, the SCR's are capable of many years of service. The SCR's virtually limitless life eliminates the maintenance time and cost in replacing mechanical contactors found in many other furnaces.



METAMAG® ELEMENT AND THERMAL SYSTEM

Metamag® Insulating and Heating as One

The ceramic insulation module construction is unique in two ways. The insulation module is manufactured from very high-density ceramic material for maximum heat retention and combines the element mounting system. This compact design allows us to install the proper kilowatt rated heating system to match the melt rate requirement, while minimizing the box size. This system is well liked by maintenance people for its ease and simplicity. The rugged design of the elements require only minor welding repairs if needed and there is no need to change elements.



ELEMENT

METAMAG® PREHEATERS

Primary Function for Preheating Ingots:

To insure that no moisture is entrapped in the ingots before charging into the molten magnesium bath.

Benefits:

- Stabilizes melt furnace temperature
- Helps reduce melt loss
- Automatic charging at regular intervals
- Labor savings
- Metamag® Vertical Preheater saves space with smaller footprint



- Electric or gas fired
- Radiant and convection heat source
- Fan ensures even air distribution through heat chamber
- Automatic level sensing charge ingots when needed
- Accurate bath level +/- 3 mm

HOT CHAMBER VS. COLD CHAMBER PREHEATERS

HOT CHAMBER

- Capable of small parts
- Faster cycle times
- Smaller melt bath due to “A” frame = reduced melt efficiency
- Greater temperature swings due to submerged gooseneck
- Metal bath limits 640°C due to gooseneck distortion and ring wear
- Less air entrapment during shot
- Furnace and preheater must be moved for gooseneck change
- Time consuming. Plunger gooseneck changes
- Difficult to run high temperature alloys
- Low metal bath temperature = inter-metallic separation = sludge formation in bottom of crucible
- Inter-metallic particles cause heavy wear in plunger bone and piston ring
- Perception that baffle in answer to prevention of inter-metallic’s entering bore
- Difficult to clean in front of gooseneck. More difficult in baffle used.

COLD CHAMBER

- Capable of small parts multiple cavity
- Slightly slower cycle time but more cavity = more parts
- Larger melt bath = more stable bath temperature
- No melt loss - metal runs through heated tube
- Metal temperature can be taken up to 720°C
- With proper metal temperature and transfer minimal air gas entrapment
- No moving parts, pump can be changed without tools
- Pump change 30 mins. / Tube change 15 minutes
- Capable of running high temperature alloys
- Pumping system is not affected by inter-metallic particles
- 3x melt rate - therefore 1000# 1 hr or 3000# crucible
- Easier to clean - no baffle

METAMAG® TURN KEY SYSTEM

Tight process parameters are crucial to a magnesium delivery system. At Metamag Inc., our products incorporate all of the critical functions of the delivery system into one main processor and operator interface. Besides the fact that much needed floor space is saved, we are not able to see how a system could be called “Turn Key” if each component of the melt cell has its own control panel. This latter would make communication between the equipment practically impossible, and would tend to become confusing when problems would arise.

The Metamag® Controls are located in one cabinet, which uses an operator interface with a function key pad. All data, temperature parameters, pump outputs, and cell monitoring are made simple and are in one location. The sophisticated programming increases the temperature before an ingot is charged, thus, eliminating temperature swings. The program controls the functionality of the Preheater to insure proper sequencing of all the components.

The Metamag® Transfer Pump is also controlled with the cells PLC program. This ensures proper communication between the die cast machine, furnace, and pump controls. In order to guarantee repeatability, we designed our pumps to utilize a vector drive and dynamic braking. These make the response time between pour time and pour speed almost immediate. The operator interface also provides a trouble shooting guide that pin-points the problem and provides the operator with instructions on how to fix the problem.



SUMMARY

For twenty-five years, Metamag Inc. has been manufacturing and developing a steady understanding of the handling of magnesium.

Our commitment to the magnesium industry comes through when one looks at all the equipment and processes Metamag Inc. has developed and is currently working on.

Magnesium as an alternative light metal is poised for future growth.

- Alain R. Boulet -