MTS 1500

AUTOMATED MELT TREATMENT STATION

- Consistent mechanical and physical properties
- Very good levels of melt cleanliness
- Reducing emissions
- Improving performance
- Reducing treatment costs
What is the MTS 1500?

The MTS 1500 is an automated melt treatment station that:

+ Provides a platform to perform all necessary melt treatments in a single operation
+ Improves efficiency of the various treatments
+ Reduces operator involvement
+ Reduces emissions

A new perspective on performance

The MTS 1500 is based upon FDU rotary degassing technology, with the additional capability of adding a range of melt treatment products.

The addition of these treatment products uses a unique method, whereby the fluxes are fed from a dispensing unit into a vortex deliberately created by the spinning rotor. This vortex is carefully controlled to ensure a very efficient mixing of the treatment products.
The standard treatment cycle using the MTS 1500 consists of a series of stages that can be summarised as follows:

1. **Consumables introduction**
   Shaft, rotor and baffle plate are first lowered into the melt.

2. **Vortex formation**
   The baffle plate is deactivated and rotor speed is increased to a point at which a vortex is created around the shaft.

3. **Addition of treatment agents**
   The required amount of flux is then dispensed directly into the vortex and drawn down into the melt.

4. **Vortex termination and degassing**
   After the flux addition the baffle plate is activated again to terminate the vortex and initiate the degassing phase.
Consumable products

There are two types of products that are key to the performance of the MTS 1500:

**XSR and FDR rotors**

New designs of rotors that:
- create the optimum vortex for the addition of the treatment products
- are highly efficient in removing dissolved hydrogen

**COVERAL* MTS fluxes**

A range of new treatment agents has been specifically formulated for use with the MTS 1500 that:
- covers the principal foundry operations of cleaning, drossing, modification and grain refinement
- keeps smoke and fume to a minimum

<table>
<thead>
<tr>
<th>Flux</th>
<th>Application</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>COVERAL MTS 1524</td>
<td>Cleaning and drossing</td>
<td>Reduces corundum build up. Removes oxides and other non-metallic inclusions. Produces a light dry dross.</td>
</tr>
<tr>
<td>COVERAL MTS 1533</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COVERAL MTS 1560</td>
<td>Sodium free cleaning and drossing</td>
<td>Reduces corundum build up. Removes oxides and other non-metallic inclusions. Produces a light dry dross. Especially suitable for AlMg alloys.</td>
</tr>
<tr>
<td>COVERAL MTS 1565</td>
<td>Sodium and calcium free cleaning and drossing</td>
<td>Reduces corundum build up. Removes oxides and other non-metallic inclusions. Produces a light dry dross. Especially suitable for AlMg and piston alloys.</td>
</tr>
<tr>
<td>COVERAL MTS 1572</td>
<td>Sodium modifying</td>
<td>Modifying metallurgical structure to reduce shrinkage defects and increase mechanical properties.</td>
</tr>
<tr>
<td>COVERAL MTS 1576</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COVERAL MTS 1582</td>
<td>Grain refining</td>
<td>Grain refinement to improve mechanical properties.</td>
</tr>
<tr>
<td>COVERAL MTS 1540</td>
<td>Hydrogen addition</td>
<td>Introducing controlled hydrogen level.</td>
</tr>
<tr>
<td>COVERAL MTS 1591</td>
<td>Element removal</td>
<td>Removes Na, Ca, Sr, Li.</td>
</tr>
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</tbody>
</table>

For detailed information refer to the datasheets and SDS which are available on request.
Benefits of the MTS 1500

The MTS 1500 offers the foundry several benefits that can be divided into four main categories:

**Metallurgical benefits**
The highly efficient manner in which the melt treatment products are introduced gives a number of metallurgical benefits in the finished casting:

- Consistent mechanical and physical properties
- Homogeneous microstructure and composition
- Very good levels of metal cleanliness
- Controlled gas porosity

**Environmental benefits**
The MTS 1500 assists the foundry in achieving a better environmental performance by:

- Using less consumables (flux, inert gas)
- Reducing the amount of dross produced
- Reducing emissions
- Reducing treatment time and melt superheat with associated energy savings

**Health and Safety benefits**
The MTS 1500 contributes to the foundry Health & Safety improvements:

- The MTS 1500 uses less flux
- The action of the vortex draws the flux down into the melt where it is quickly mixed into the metal
- The flux used for the melt treatment is fully consumed and does not continue to react post treatment
- A safer environment through reduced operator involvement in the melt treatment process

**Economic benefits**
Of major importance to aluminium foundries is reducing process costs. From this perspective the MTS 1500 brings value to the foundry by:

- Reducing treatment costs
  - Reduced inert gas consumption
  - Reduced flux consumption
  - Reducing aluminium loss in the dross
  - Reduced labour costs
- Improving performance
  - Fast melt turn around
  - Reproducible melt quality
  - Increased reliability and decreased maintenance
The foundry
A gravity die casting foundry producing safety critical components for the automotive industry.

Foundry practice
Foundry A casts an AlSi10Mg alloy modified with sodium. The original practice was to make a manual addition of sodium modifying tablets.

Foundry requirements
Significant variability had been found in the modification process, both in the length of time the tablet was plunged into the melt and the resulting sodium content. The result was variable mechanical properties in the finished castings.

Achievements
Using the MTS 1500 both the amount of flux added and the resultant sodium concentration were much more reproducible resulting in improved consistency of casting properties.

The high efficiency of the MTS 1500 has also given significant cost savings in terms of reduced temperature loss due to shorter treatment cycles, a reduction in both absolute dross levels, and the metal content of this dross.

<table>
<thead>
<tr>
<th>Foundry A</th>
<th>Manual tablet plunging + FDU</th>
<th>MTS 1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total melt to be treated</td>
<td>20,000 t/year</td>
<td></td>
</tr>
<tr>
<td>Crucible</td>
<td>BU 400 with 380 kg of AlSi10Mg</td>
<td></td>
</tr>
<tr>
<td>Product used</td>
<td>SIMODAL 77</td>
<td>COVERAL MTS 1576</td>
</tr>
<tr>
<td>Amount of product</td>
<td>800 g (0.21%)</td>
<td>700 g (0.18%)</td>
</tr>
<tr>
<td>Total treatment time</td>
<td>15 minutes</td>
<td>8 minutes</td>
</tr>
<tr>
<td>Variation in sodium content</td>
<td>+/- 12%</td>
<td>+/- 5%</td>
</tr>
<tr>
<td>Aluminium content in dross</td>
<td>~ 75%</td>
<td>~ 55%</td>
</tr>
<tr>
<td>Total savings per year</td>
<td>€ 55,000</td>
<td></td>
</tr>
</tbody>
</table>
Case study B

The foundry
Foundry B produces a range of castings in both high pressure and low pressure.

Foundry practice
Foundry B melts centrally and then transfers metal to the casting furnaces using a transfer ladle. Melt treatment was carried out in the transfer ladle using a rotary degassing unit with a manual addition of flux.

Foundry requirements
The foundry wanted to expand its activity by a factor of four and needed a second machine to increase melt treatment capacity. The metal content in dross is high, to reduce the melt loss and save energy, an MTS machine is required.

Achievements
The high efficiency of the MTS 1500 has given significant cost savings in terms of reduced treatment costs and a reduction in metal loss in the dross. More consistent process due to fully automised device and about 60 tons less aluminium loss per year.

<table>
<thead>
<tr>
<th>Foundry B</th>
<th>FDU with manual granulate addition</th>
<th>MTS 1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production capacity</td>
<td></td>
<td>20,000 tons per year</td>
</tr>
<tr>
<td>Number of ladles to degas</td>
<td>65 - 70 ladles with 800 kg AlSi7Mg per day</td>
<td></td>
</tr>
<tr>
<td>Treatment temperature</td>
<td></td>
<td>730 - 760 °C</td>
</tr>
<tr>
<td>Granulate and addition rate</td>
<td>COVERAL GR 2410 (0,05 %)</td>
<td>COVERAL MTS 1524 (0,03 %)</td>
</tr>
<tr>
<td>Amount of granulate per treatment</td>
<td>400 g +/- 20 g</td>
<td>240 g +/- 10 g</td>
</tr>
<tr>
<td>Annual granulate consumption</td>
<td>6,000 kg</td>
<td>3,600 kg</td>
</tr>
</tbody>
</table>

![Graph showing amount of dross and aluminium loss per year](image)
Case study C

The foundry
A European wheel foundry produces aluminium wheels in low-pressure die casting.

Foundry practice
Foundry C uses AlSi7Mg alloy, molten in a tower smelter and treated in an INSURAL* transfer ladle. The original practice was a manual addition of TiBor rods followed by a FDU rotary degassing treatment.

Foundry requirements
The foundry wants to do all necessary treatment steps in a single operation to reduce operator involvement in TiBor rods addition. Moreover they recognised the high metal content in dross and asked for a reduction in aluminium loss.

Achievements
The titanium-boron based COVERAL MTS 1582 grain refiner has been introduced and is applied through a MTS 1500 device. An amount of 250 g COVERAL MTS 1582 grain refiner is added into a carefully controlled vortex during each MTS treatment.

It results in an excellent grain refining effect at lower addition rates compared to TiBor rods; the grain refining level is more constant now due to the automated process.

The resulting dross is low in metal and the foundry reports reduced effort in cleaning the LPDC furnaces.

<table>
<thead>
<tr>
<th>Treatment parameters</th>
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<tbody>
<tr>
<td>Ladle</td>
</tr>
<tr>
<td>INSURAL ATL 600 with 500 kg of AlSi7Mg</td>
</tr>
<tr>
<td>Temperature</td>
</tr>
<tr>
<td>730 - 760 °C</td>
</tr>
<tr>
<td>Addition rate</td>
</tr>
<tr>
<td>250 g COVERAL MTS 1582 (0.05 % of the melt weight)</td>
</tr>
<tr>
<td>Treatment time</td>
</tr>
<tr>
<td>6 minutes</td>
</tr>
<tr>
<td>Inert gas flow</td>
</tr>
<tr>
<td>20 l/min N₂</td>
</tr>
<tr>
<td>Rotor speed</td>
</tr>
<tr>
<td>450 rpm for MTS FDR 190.70</td>
</tr>
</tbody>
</table>

Very dry dross obtained without any additional drossing flux

Microstructure before and after grain refining

Thermal analysis curve

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