

Furnace tending machines provide solutions and cost savings

The pressures of increasing energy costs, the growing prices of raw materials and scrap, and the global economy are pushing primary and secondary aluminium producers to seek innovative solutions to improve productivity and cut operating costs.



1 A dedicated furnace tending machine.

For over twelve years T.T. Tomorrow Technology has been studying, designing and manufacturing customised solutions to increase melting furnace productivity and efficiency. One proven solution for reducing the costs associated with the melting of aluminium is to use dedicated furnace tending machines instead of the usual fork-lifts and front loaders (fig 1). Standard forklifts and front loaders are not designed and manufactured to operate as charging vehicles in front of aluminium melting furnaces. Running costs and maintenance are very high when compared with other solutions and their level of safety is very low.

These are the main points where T.T. has directed its efforts to achieve optimum loading of aluminium melting furnaces:

- To reduce the charging time
- To save energy
- To preserve the refractory lining
- To improve the management of the scrap
- To improve the operator safety
- To have a better environmental impact
- Increased productivity
- Reduction of damage to the refractory lining of the furnaces
- Loading of up to 20 m³ of scrap in few seconds, thus providing the metal immediate immersion without metal splashes



2 Thesetwo pictures are typical of the method used in many cast houses to load the aluminium melting furnaces.



3 Charging boxes loaded with scrap ready for furnace.

- Consequent reduction of gas usage
- Increased operator safety

Continuous operations

A short description of a charging operation by means of a dedicated vehicle and a rail mounted machine follows:

- a) A certain number of charging boxes can be loaded in the scrap area by standard grab crane and front loader. This is done far away from the melting furnaces while the furnace door is closed and the previous melt cycle is still running,
- b) Both the furnace charging vehicles and the rail mounted charging machines are equipped with their own weighing system on board to check and record the quantity of scrap that should be also monitored by the different typology. These data are collected and sent via radio and or bluetooth to the local computer in the cast house office,
- c) As soon as the furnace is ready to receive a new charge the operator and / or the rail charging machine starts the new operation with the following sequence:
 - 1 The charging vehicle or machine moves to the front of the furnace
 - 2 The furnace door is automatically opened
 - 3 The charging box is entering into the furnace





4 T.T. Tomorrow Technology Furnace Charging Vehicles have their own weighing system on board each vehicle.

4 The scrap is lightly discharged either into the molten metal directly or left for a few minutes on the dry hearth of the furnaces

5 The charging box comes out and the furnace door is automatically closed.

This sequence is repeated continuously 24 hours per day and, due to the precision of the operation and the rapidity of its execution, furnace productivity can be increased by up to 20 per cent depending on the current charging method.

Another important benefit coming from the use of dedicated tending machines is the energy savings. Dedicated charging systems and vehicles need approximately 3 to 5 minutes to load 20 tonnes of solid scrap while the same quantity of material charged by forklift and or front loader may need up to 30 minutes. Particular importance has to be given to the prolonged life of the refractory lining.

The precision of the charging operation and the speed of execution may extend the lining campaign by 4-5 times. Several aluminium companies have confirmed this data. While charging and tending, forklifts and front loaders continuously smash into the furnace doorsill. A dedicated charging system does

not touch the furnace lining while tending at all. A quicker charging operation also limits the temperature loss inside the furnaces.

T.T. has monitored temperature savings of more than 50°C when compared to a forklift charging operation. This operation took approximately 30 minutes and during this time the lining of the furnace walls went from red to black and created shrinkages and later many lining dilations. These deformations of the refractory lining impact negatively on its lifetime and the only way to prevent them is quick opening and closing of the furnace door.

Tailoring to suit

A fully automated scrap management systems and furnace charging machine of 10 tons capacity at Sapa Finspang (Sweden) is illustrated. Previously this process was carried out either by fork-lift trucks or modified mechanical shovels, with the following problems:

- Long performance times
- Considerable damage to the furnace refractory lining
- Poor visibility for the operator



5 A fully automated scrap management system and furnace charging machine of 10 tons capacity at Sapa Finspang (Sweden). The picture shows the furnace door open and the charging box is automatically rammed into the furnace to discharge the aluminium scrap for melting. After discharge of the scrap the system will return to the loading bay to await the loading of more scrap. Notice the rails for the furnace charging machine to travel on, can be seen on the works floor.

- High heat exposure for vehicles not suited to this purpose
- High heat exposure for the vehicle operator, who also risks metal splashes
- Considerable difficulty in controlling the dross to be removed
- Considerable difficulty in cleaning the furnace bottom.

The use of dedicated furnace tending machines demonstrates many advantages:

- De-drossing times reduced by 80 per cent
- No damage to the refractory lining
- Excellent visibility for the operator thanks to the lifting driving cab
- A high level of safety for operator and vehicle, with the cab's case-hardened safety glass protected by a metal grid
- Precise control of the dross to be removed
- Automatic control of the cleaning tool pressure on the refractory lining surface.

These solutions are more flexible and effective than standard equipment not properly designed for subsidiary operations to the melting phases.



6 Furnace tending vehicles built by T.T Tomorrow Technology (this picture shows a telescope length reach of 9.5 metres) are much more efficient than the standard forklift and dumpers truck for skimming and cleaning operations.

T.T. believes that the use of dedicated furnace tending machines is the right way to increase the melting capacity and the quality of the product. The cast house environment will be enhanced and the work safety of the operators increased greatly, along with the operating noise level being reduced.

The message to aluminium companies that are willing to improve the subsidiary operations of the melting phases is to invest in dedicated vehicles and equipment. You need tailored solutions to best support and reach your optimum efficiency. The return on investment in such technology will have a very short payback period, normally within a year.

I have spent the last 25 years of my life working in supporting the aluminium industry, with a special focus on the melting operations. I would like to say to you that we have to look forward with a special regard to the new generations, therefore it is very important to invest in dedicated vehicles and equipment, consider the safety of the operators as well as preserving the valuable environment for all our futures.

Reader Reply No.

Author: Giovanni Magarotto, Founder and Managing Director, T.T. TOMORROW TECHNOLOGY (Italy).