

MAY 2016

06

MORE HIGHLIGHTS

NEWS FROM THE STEELMAKING WORLD

O ZERO MEN AROUND



TECHNOLOGICAL PACKAGES SUITE
TO REMOVE HUMAN OPERATION
AROUND THE EAF

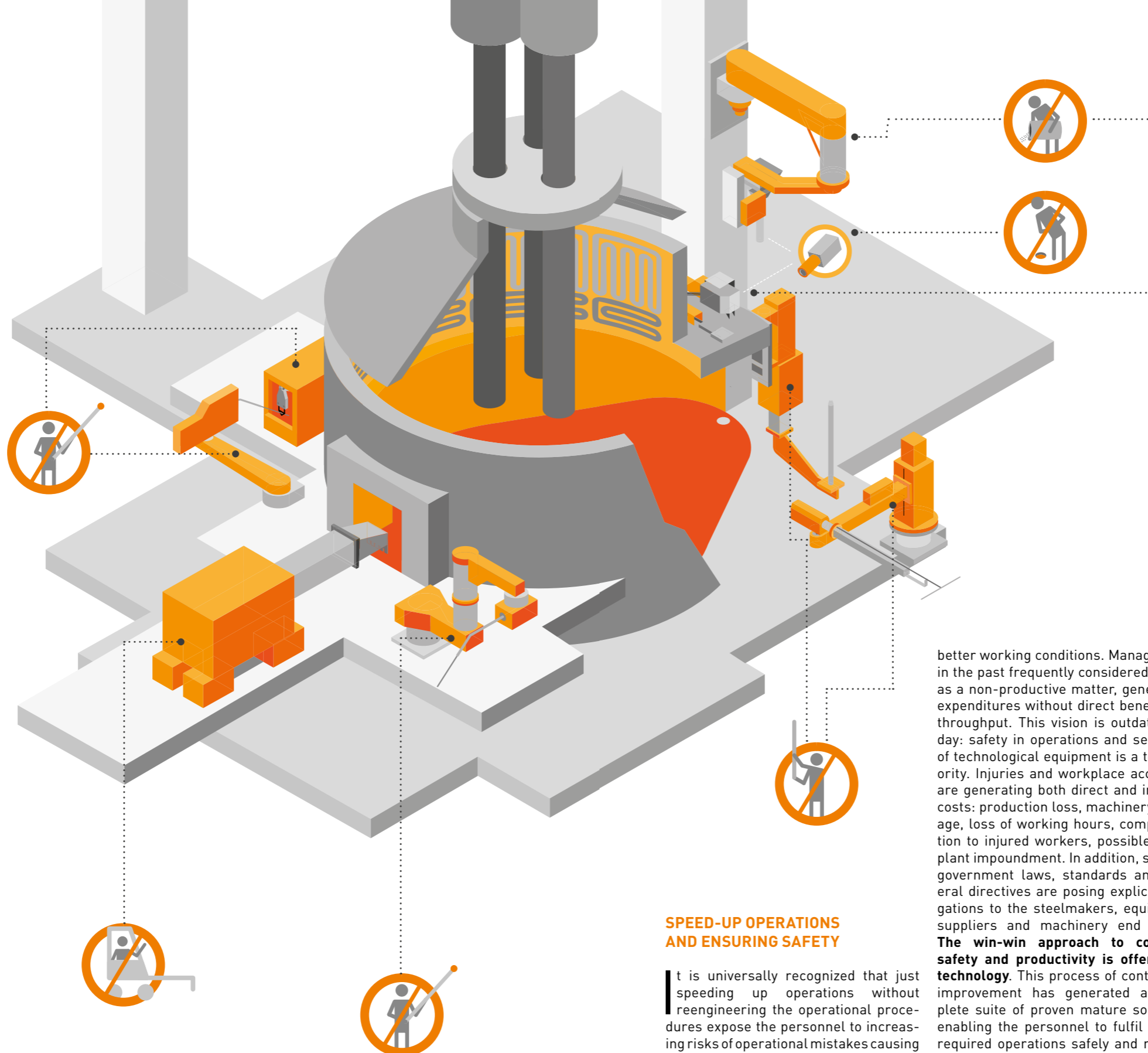
ZERO MEN AROUND

TECHNOLOGICAL PACKAGES SUITE TO REMOVE HUMAN OPERATION AROUND THE EAF

The steel melting process in an Electric Arc Furnace is a complex set of tasks, coping with highly dangerous hazards as fire, explosions, uncontrolled reactions, hot metal projections and gas or dust emissions. Melt shops are dangerous working areas for operators, recording statistics with a high frequency of injuries. In the past years, without dedicated safety equipment, there wasn't a real attitude to the risk prevention. Regardless all the best personal protective equipment, training and careful operating practices adopted, the exposure to risk is very serious, and **statistics report that severe injuries and fatalities are still happening**. Among them, a few are connected with operations in the melting cycle, mainly exposing operators to heating injuries, oxygen back flashes or blasts.

AUTOMATIC CONTROL OF THE EAF AND TRANSFORMATION COST IMPROVEMENT

Zero men around technological packages eliminate the manned activities on the melting floor, with the aim to prevent accidents and keep furnace operators safe. **The suite extends the automatic control of the EAF melting process to all the operations from charging phase to tapping**. Plus, the integration of the most frequent operations by automated specialized tools **effectively minimizes pow-**



er-off times, enhancing reliability and improving the transformation costs. The modern meltshops produces more in shorter tap-to-tap times. Operations involved in the melting process require some tasks that, in most cases, are still

performed manually. Steel sampling, sill clearing, tap hole cleaning and ebt sanding are recurrent operations that require skilled personnel and coordination to be fulfilled.

SPEED-UP OPERATIONS AND ENSURING SAFETY

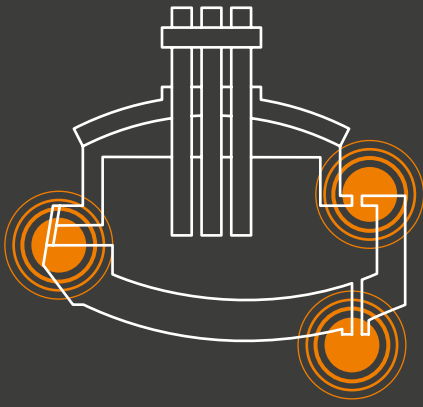
It is universally recognized that just speeding up operations without reengineering the operational procedures expose the personnel to increasing risks of operational mistakes causing injuries. At the same time, safety operating procedures and space confinement are often posing limitations and interferences with the process, slowing it down. In real life, safety prescriptions are very often unwelcome by the personnel, considered as useless complications more than contributions towards

better working conditions. Management in the past frequently considered safety as a non-productive matter, generating expenditures without direct benefits on throughput. This vision is outdated today: safety in operations and selection of technological equipment is a top priority. Injuries and workplace accidents are generating both direct and indirect costs: production loss, machinery damage, loss of working hours, compensation to injured workers, possible fines, plant impoundment. In addition, specific government laws, standards and federal directives are posing explicit obligations to the steelmakers, equipment suppliers and machinery end users. **The win-win approach to combine safety and productivity is offered by technology.** This process of continuous improvement has generated a complete suite of proven mature solutions enabling the personnel to fulfil all the required operations safely and reliably from the control room. Eliminating all the manned exhausting recurring operations that were required in the past, **immediate benefits in terms of productivity throughput are obtained.** At the same time, part of the personnel, free from the previous demanding duties, can be dedicated to different activities.

RECURRING OPERATIONS AND RECURRING RISKS

Operations at the slag door area are prone to sudden reactions that are occurring rarely, but are highly unpredictable. In some meltshops the practice to switch the electrical power off prior to approach to the furnace floor is compulsory by the Company safety rules. In few countries, law already prescribes it. Switching the electrical power off is of course consuming time and interrupts melting but, above all, it suppresses the foaming slag process and takes time to rebuild again. In most meltshops **the practice to allow the personnel to operate at the slag door with the power on is still a diffused habit.** At the occurrence of a boil reaction or a sudden blast, any workers close to the furnace are exposed to severe injuries, regardless the safety equipment they are wearing. The tapping operations may be regarded as the most critical of the overall furnace cycle. In less than 3 minutes, more than 100 tons of liquid steel at a temperature higher than 1630 C° (2966 F°) are transferred into the ladle by a stream as fast as 5 m/s (16.4 ft/s). Normally, when the flap at the EBT swings away, the stream is free-opening and the tapping operations can immediately start. Sometimes the stream is not opening spontaneously. In this cases, the tap hole requires oxygen lancing to be cleared from any clogging. In such an unlikely event, **a skilled operator is required to approach to the EBT area from the bottom** with a bent pipe to lance the tap hole and clear it by oxygen from few meters distance. At the sump area, after tapping operations, the tap hole needs to be inspected, eventually cleared from slag residuals and filled in with sand. **This operation requires to the helper to walk to the EBT balcony to perform the required actions.** In case of incomplete melting, residuals and skulls may fall in the area, obstructing the tap hole sleeves. The efforts to remove the obstructions can be sometimes very difficult to fix and time consuming.

- All these operations entail:
- unpredictable time losses,
 - exhausting man labor in hazardous conditions [restricted space, heat, dust, hot sparks projections, operating with oxygen]
 - posing high risk of injuries,
 - resulting in higher production costs.



DESIGN CONCEPT

A skilled engineer, approaching for the first time to the EAF process, may guess why the required technologies to perform these functions have not been native since the origins of the modern electric arc furnace. At a deeper insight, he will realize that simply adding equipment to fulfil individual actions will not work in the meltshop environment. Neighborhoods of an electric arc furnace are a tough environment for any mechatronic application to survive. Dust, heat loads, flames, electromagnetic effects, falling loads, pose any equipment in great difficulty.

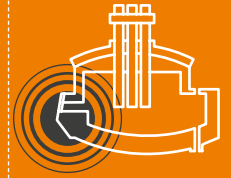
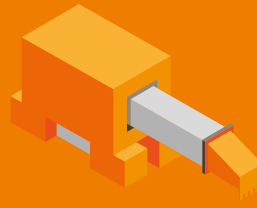
Moreover, the space for the equipment to fit is most of the time very restricted, limiting the degrees of freedom for the possible design solutions.

The tasks described above, which would be easy for a skilled person to fulfil, are not easy to perform by machines.

Therefore, the equipment functionality, i.e. the capacity to fulfil the required task in a practical, user-friendly manner, is guiding our design concept. Beyond the technological package functionality, in our experience reliability of the equipment is a mandatory key-stone, a top priority.

MOTANK

SLAG DOOR CLEANING



Maintaining the slag door's sill clear from scrap or skulls build up is very important for efficient steelmaking process. By performing all the operations during the arc melting is not only beneficial for the production throughput, but it is also improving the effectiveness of the cleaning action and the metallurgical process.

MOTANK is a remote controlled ram, specifically designed to operate at the slag door. The cart moves independently on rails, that can be laying in axis with the door or eventually sideways to best fit in almost all the layouts, even in case of EAFs encapsulated in a doghouse. The ram is actuated by a hydraulic cylinder equipped on-board. The pulling force is designed to easily clear the scrap and skulls in all the situations. It can be also tilted downwards to better fulfil the clearing action.



MORE THAN 40
MACHINES AT
WORK IN THE
WORLD



HEAVY
DUTY
DESIGN

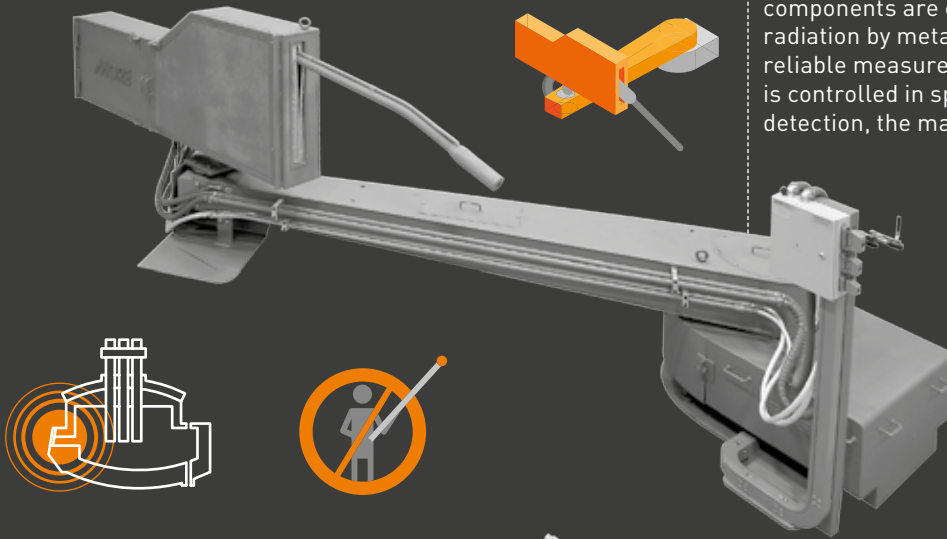


10 TONS
PUSHING
FORCE

CATFIS

AUTOMATIC TEMPERATURE AND SAMPLING MANIPULATOR

The manipulator has a swinging movement around two axes of rotation in order to approach from the parking to the measuring position. The lance is water cooled, in order to guarantee a long life and a proper protection for the cabling and the measuring lance sensor. All the mechanical components are carefully shielded from heat and slag radiation by metallic protections. In order to perform a reliable measurement, the lance insertion movement is controlled in speed and position. In case of collision detection, the manipulator retracts the lance.



MORE THAN 200 MACHINES AT WORK IN THE WORLD



ANTI COLLISION SYSTEM

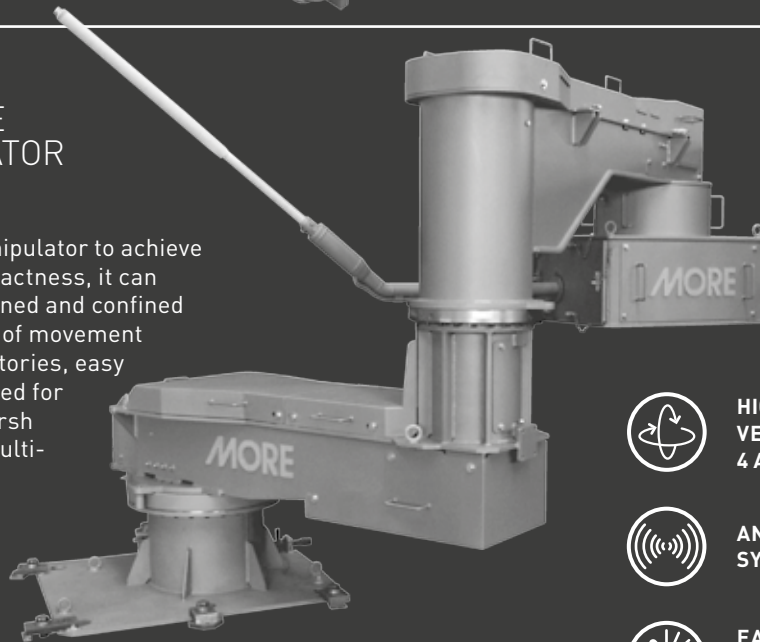


EASILY EQUIPMENT INSTALLATION / DISINSTALLATION

CATFIS 2.1

AUTOMATIC TEMPERATURE AND SAMPLING MANIPULATOR

A multiple axis manipulator to achieve flexibility and compactness, it can be fitted in constrained and confined areas, total control of movement and adapting trajectories, easy maintenance, tailored for the steelmaking harsh environment and multi-tasking operations.



HIGH MOVEMENT VERSATILITY WITH 4 AXES



ANTI COLLISION SYSTEM

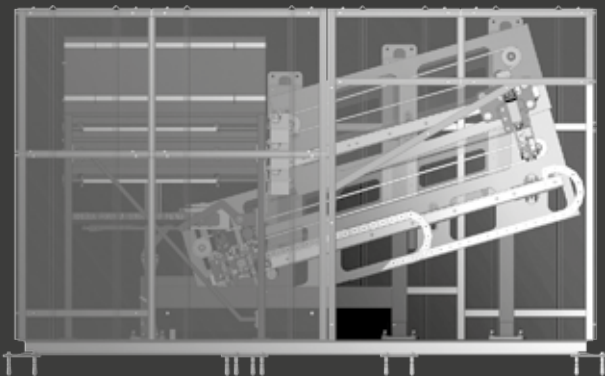


EASILY EQUIPMENT INSTALLATION / DISINSTALLATION

ACS

AUTOMATIC CARTRIDGE SYSTEM

ACS equipment is designed to change automatically the probes for CATFIS and CATFIS 2.1 manipulators eliminating manual operations. It is a "stand alone" piece of equipment that can be installed on the fix platform on the same side of the manipulators, with up to three different cartridge types compartments.



USE OF STANDARD SENSORS CARDBOARD



IT CAN BE INSTALLED ON EXISTING CATFIS AND CATFIS 2.1

EBT EYE

TAP HOLE INSPECTION CAMERA



Clear and high-resolution imaging in highly variable illuminated conditions. This integrated package adopt the highest standard of digital cameras, tailored with a proprietary vision firmware to enhance the dynamic response and resolution of the imaging in all the EAF operating conditions.



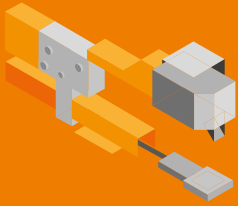
AUTOMATIC CONTROL OF IMAGE



HEAVY DUTY DESIGN

EBT SAND

TAP HOLE INSPECTION AND SAND FILLING



The on-board solution to inspect and sand fill is a compact all-in-one design equipment assembled on a sliding guide. A local small bin is delivered with the proper amount of sand by a small stationary dispenser, located close to the furnace to be charged by big-bags. The EBT EYE is mounted parallel to the feeding chute in order to check in real time the correct feeding of the material and tap hole status.



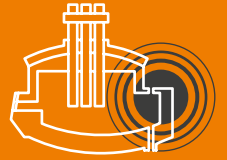
MULTIFUNCTION SYSTEM: SAND FILLING, SLAG BREAKING AND REMOTE VISUAL INSPECTION



PRECISE CONTROL OF SAND FILLING

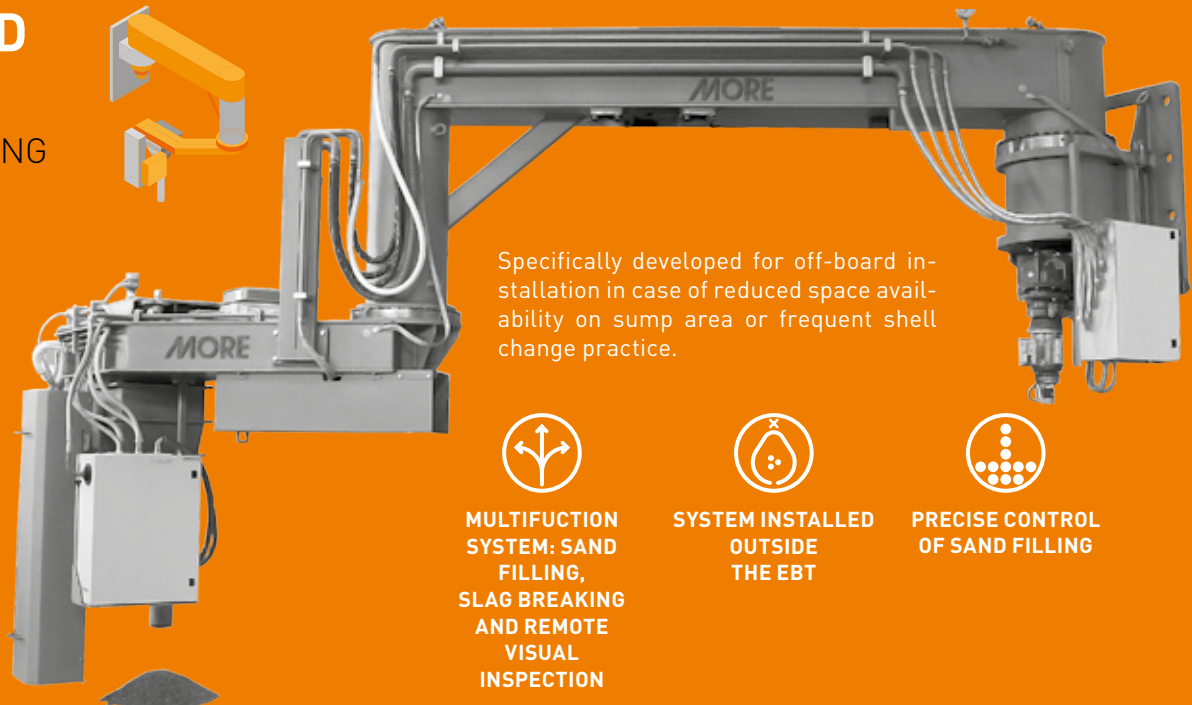
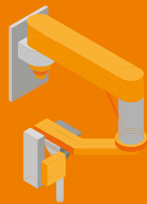


HEAVY DUTY DESIGN

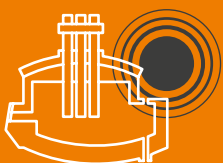


AUTO SAND

TAP HOLE INSPECTION AND SAND FILLING



Specifically developed for off-board installation in case of reduced space availability on sump area or frequent shell change practice.



MULTIFUNCTION SYSTEM: SAND FILLING, SLAG BREAKING AND REMOTE VISUAL INSPECTION



SYSTEM INSTALLED OUTSIDE THE EBT



PRECISE CONTROL OF SAND FILLING



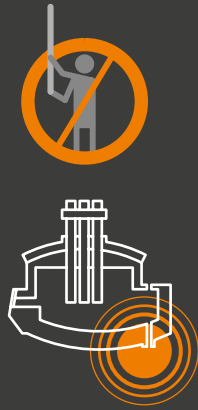
STROP

TAP HOLE
CLEANING

Unmolten scrap, skulls or heavy residuals may obstruct the tap hole after tapping. Sometimes obstructions are drilled by the operators by oxy-cutting. Moreover, lancing is non effective in case of slag skulls, concrete or graphite blocks.

These tasks, although not very frequent, normally generate long delays, sometimes hours. Production loss and cost associated, plus hazard to damage the sump panels with injuries risk for the operator represent a very serious issue.

The STROP is a hydraulically actuated equipment that inserts a sturdy rod into the tap hole that is able to lift heavy loads and free the tap hole from any kind of obstruction.



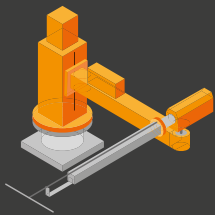
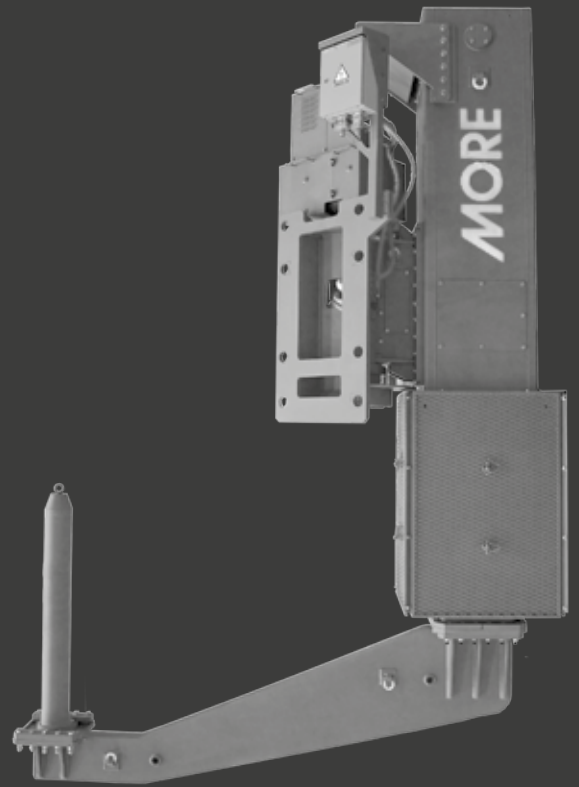
EAF ON BOARD
INSTALLATION



HEAVY DUTY
DESIGN



5 TONS
PUSHING FORCE

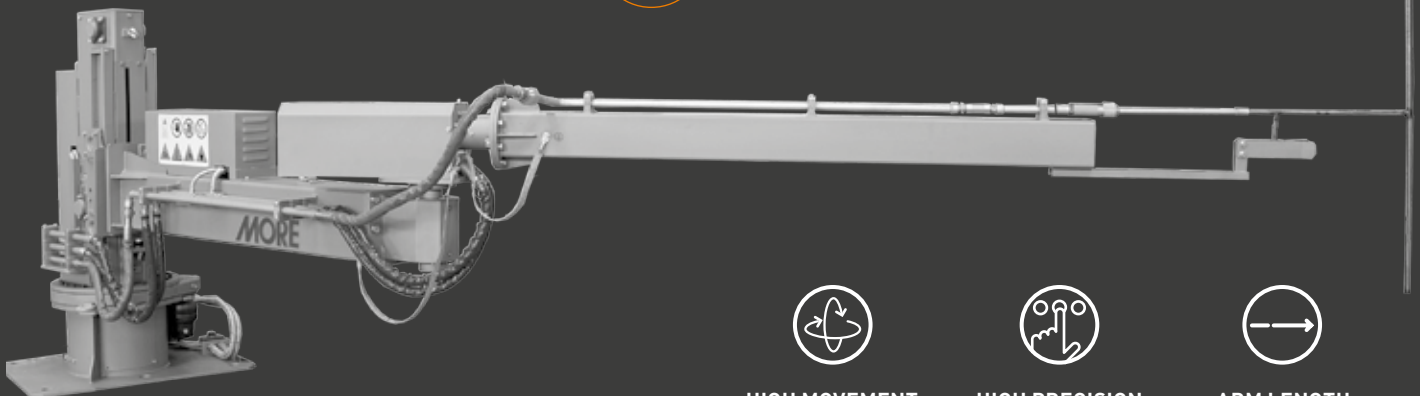


STAP

EMERGENCY
TAP HOLE OPENING



The STAP manipulator is a multi-axis equipment dedicated to open the tap hole in case of clogging by an oxygen lance. The STAP device is not used regularly at each cycle, but only when required. Nevertheless, it saves a lot of long delays that usually are accumulating in several meltshops due to the time required for operators to get prepared at the occurrence of the non-spontaneous opening.



HIGH MOVEMENT
VERSATILITY WITH
4 AXES



HIGH PRECISION
REMOTE CONTROL



ARM LENGTH
UP TO
6 METERS / 19 FT

www.zeromenaround.com

MORE

MORE S.r.l. 33013 Gemona del Friuli (UD) Italy

T +39 0432 973511 **F** + 39 0432 970676

Email: info@more-oxy.com www.more-oxy.com