TECHNOLOGICAL PACKAGES
STEELMAKING TECHNOLOGIES
MORE is a worldwide leading manufacturer of process technology packages related to chemical energy and auxiliary equipment for the steel making industry.

MORE has developed an international reputation for quality products since the company was established in 1984. Special equipment and manufacturing techniques are employed to ensure that maximum strength and durability are built into every item we produce.

MORE makes a wide range of products which are suitable for all kinds of EAF applications. The in-house manufacturing facility gives us the flexibility to supply our products quickly, custom work can be manufactured to your particular requirements by our specialists.

All products are built and tested in our modern workshop using specially designed heavy duty, automated equipment, made to our own demanding specifications. Uniformity of quality control is achieved through an integral automatic checking system supplemented by our quality control program.

MORE is ISO 9001 certified ensuring all products are manufactured according to strict international standards, and OHSAS 18001 Occupational Health and Safety management certification.
Since 1984, technological research and development has been the backbone of MORE and the building block for the future development of advanced products and services.

For us, it is vital to meet evolving customer demands with high performance solutions. Highly skilled engineers are constantly working to study new products. This makes us forerunners in the exploration and industrial application of new technological solutions. MORE manufactures and assembles all equipment which is then subjected to trial tests prior to delivery. This ensures that thorough checks are carried out on both working sequences and functionality.
OUR EXTENSIVE WORKSHOP FACILITY, STAFFED BY OUR OWN EXPERIENCED ENGINEERS, WILL WORK WITH YOU TO ASSESS THE MOST COST EFFECTIVE SOLUTION WITHOUT LOSING PERFORMANCE

ANALYSIS FOR REDUCTION OF TRANSFORMATION COSTS

FEASIBLE INSTALLATION STUDIES

HEAT AND MASS BALANCE CALCULATION

TAILOR MADE INSTALLATION MEET THE EXACT REQUIREMENTS OF OUR CUSTOMER

TO ENSURE QUALITY, RELIABILITY AND SAFE EQUIPMENT; MANUFACTURING AND ASSEMBLY IS ENTIRELY CARRIED OUT IN MORE’S WORKSHOP
BEFORE DELIVERY, THE EQUIPMENT IS ASSEMBLED AND TESTED IN-HOUSE TO CHECK THE WORKING SEQUENCES AND FUNCTIONALITY TO ENSURE EASY ON-SITE INSTALLATION AND START-UP.

OUR TEAM INCLUDES EXPERIENCED AUTOMATION AND MECHANICAL ENGINEERS AS WELL AS HIGHLY SKILLED PROCESS SPECIALISTS SUPPORTING OUR CUSTOMERS ALONG THE ENTIRE CHAIN FROM ERECTION TO START-UP AND FINAL ACCEPTANCE OF THE SUPPLIED EQUIPMENT.
PROCESS ANALYSIS - TECHNICAL AND PROCESS ENGINEERS ARE AVAILABLE FOR IMPROVEMENTS, PROBLEM SOLVING, TRAINING AND TECHNICAL ADVICE
Our leadership in this field is the result of constant research for innovation and improvement, making us the ideal partner for the most important international steelmakers.

Since 1984, technological research & development are intended as a mission, to be accomplished by way of innovative equipment that must be continuously improved.

The technical department makes use of up-to-date software such as CAD/ CAE/CAM, Finite Element Method and Computational Fluids Dynamic (CFD) to perform its tasks without compromise.

In order to ensure that our customers get the best solutions, we continuously work to improve our processes and invest in research and development. Many of our projects include developing tailor made installation meets the exact requirements of our customers.
Chemical Energy Package

Fast metallic charge melting requires appropriate capability to manage the chemical energy in the most efficient way, according to the rapidly changing conditions within the furnace environment. The melting power and the metallurgical processes can be managed only by specialized equipment and careful process control to attain high productivity performances at minimum energy consumption. Sinergy between electrical arc power schedule and correct chemical action can lead to consistent savings in consumptions and time.

Melting material in an Electric Arc Furnace requires a number of process functions to be fulfilled:

- Heat and melt down the metallic charge.
- Oxidize silicon, phosphorus, chromium and carbon.
- Correct the slag chemistry and control the iron oxide production.
- Foam the slag.
- Limit the carbon monoxide output and control the combustion within the furnace.
- Protect the refractory lining from corrosive wearing.

Steelmakers can profit from the appropriate management of all these actions only if their furnace is equipped with an efficient and reliable chemical package. The most important figures required to such equipment are:

- Specialized mechanical design completed by a dedicated assembly on the furnace layout.
- Fast and precise regulation according to the melting program and the process control.
- Flexibility, reliability and consistency.
- Equipment stiffness and maintainability.
The LINDARC™ off-gas analysis technology, with lasers installed on the fix duct, just after the secondary gap, uses the technique of “Tunable Diode Laser Absorption Spectroscopy” (TDLAS) to obtain exact data of various gas species in the EAF off-gas system in real time. The LINDARC™ is used to further optimize the EAF melting process, controlling fuel and oxygen post combustion by Q-MELT.

**FEATURES**

- CO, CO₂, H₂O AND OFF-GAS TEMPERATURE MEASUREMENT
- FAST RESPONSE TIME (LESS THAN 2 SECONDS)
- DYNAMIC WATER LEAK DETECTION

**MEASURED ELEMENTS**

<table>
<thead>
<tr>
<th>Element</th>
<th>Measurement</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>0 ÷ 50%</td>
<td>In temperature range 400° ÷ 1600° C</td>
</tr>
<tr>
<td></td>
<td>0 ÷ 100%</td>
<td>In temperature range 1000° ÷ 1600° C</td>
</tr>
<tr>
<td>OFF-GAS temp.</td>
<td>400° ÷ 1600° C</td>
<td>[752 °F ÷ 2912 °F]</td>
</tr>
<tr>
<td>CO₂</td>
<td>0 ÷ 100%</td>
<td>In temperature range 400° ÷ 1600° C</td>
</tr>
<tr>
<td>H₂O</td>
<td>0 ÷ 50%</td>
<td>In temperature range 600° ÷ 1600° C</td>
</tr>
</tbody>
</table>

Image: Industrial setting with LINDARC™ technology applied.
SATETY

- Real-time signal of H₂O will prevent explosions generated by water leaks.
- Real-time signal of CO will prevent explosions in the dust settling chamber or bag house.
- Possible set-up of gap / dumpers position.
- Real-time signal of CO will prevent excessive release of CO in the atmosphere.

SAVINGS

- Maximum yield of oxygen requirements.
- Low maintenance cost (no filters, no driers installed).
- Reduced electric energy requirements as CO is combusted in the EAF shell.

OPTIMIZATION

- High accuracy of CO, CO₂ and O₂ measured values.
- Fine tuning of burners settings (best ratio of CH₄ and O₂).
- High yield of CO combustion due to precise O₂ injection.
- High system functionality thanks to minimized maintenance design.
- Fast response time with real-time availability of measurement results (<2 sec.).
- All readings made on the real off-gas volume (no sampling, drying or filtering needed).
- Dynamic closed-loop control of burner and injection system by Q-MELT.
Data taken from the **LINDARC™** is transferred to an adaptive EAF process control the **Q-MELT**. **Q-MELT** purpose is to reach complete automatic control in each stage of the EAF melting process. It can adjust the electric power input, optimize the combustion process within the furnace shell, control slag steel metallurgy and every other operation needed during the EAF melting cycle.
• It implements a statistical approach to identify process deviations.
• It dynamically adjusts the oxygen injection to hit the final carbon % and steel temperature without over-oxidizing the heat.
• It integrates several process models to track the %C, temperature and O₂ content in the steel bath.
• It performs synchronization, normalization and qualitative analysis of all collected process data.
• It provides personalized reports and analysis tools for the main process parameters.

• It adjusts the electrical set-points dynamically to keep the EAF running in a stable manner.
• It keeps the highest active power until the end of the heat without creating severe stress to the panels.
• It integrates a dynamic foamy slag control that monitors slag conditions and adjusts electric arc and carbon/lime injection set-points.

**FEATURES**

**DWLD - DYNAMIC WATER LEAKS DETECTOR**

The LINDARC™ includes a DWLD software to prevent any dangerous explosions generated by accidental water leaks that may occur during operations. Using a specific algorithm, it is possible to calculate an expected water baseline level for every on-going heat. Any accidental water leakage that may occur will increase the water content above the dynamically/self-calculating baseline water level and it will generate a warning message for the operators.
The MODULE TECHNOLOGY: state-of-the-art chemical energy package for electric arc furnaces, combines a variety of fixed injectors and related control devices [i.e.: valve stands, carbon/fluxes dispensers, automation system and Human Machine Interface]. Injectors add chemical energy by exothermic reactions, post-combustion control and foaming slag optimization to improve the overall EAF performances and to reduce transformation costs.
BENEFITS

- Increased oxygen efficiency and carbon recovery.
- Increased metallic yield.
- Increased productivity.
- Improved foaming slag conditioning.
- Improved metallurgical process control.
- Improved overall operating efficiency.
- Improved process gas emission.
- Reduced fuel usage.
- Reduced electrical energy usage.
- Reduced power-on time.
- Reduced conversion costs.
**M-ONE** is an advanced side-wall injector which integrates three functions in a single unit: burner, supersonic oxygen and high-efficiency carbon injection.

**OXYGENJET** is dedicated supersonic oxygen for lancing. It is mostly used as a supplementary injection point, especially to clean the scrap and the skulls at the sump area, in order to assume EBT free-opening.
The POST COMBUSTOR is a dedicated tool to manage the post combustion within the EAF shell by injecting low speed oxygen during every melting phase.

The L-ONE is a side-wall injector specifically designed to inject grain sized slag formers with a speed up to penetrate the thick slag layer.
All **MORE** injectors work as highly efficient oxyfuel burners for heating and assisting melting of scrap after each scrap bucket charge.

The flame makes use of the innovative **MIXED SWIRLED TECHNOLOGY (MSF)**.

A specific research project has been performed to improve combustion and heat transfer efficiency to the scrap surface. The particular burner tip design dramatically improves the mixing of reactants and prevents the generation of a cold flame.

**EXTREMELY HIGH FLAME TEMPERATURE**

**IMPROVED HEAT EXCHANGE WITH SCRAP PILE**

**OPTIMUM MIXING OF GASSES AND COMBUSTION**

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Stable and hot flame close to the injector tip.

**TRADITIONAL AXIAL DIFFUSION FLAME**

Blue colored flame due to the poor mixing of oxygen and natural gas.
The **FLASH STOP** system has been developed to prevent accidental damages due to oxygen and fuel backfiring in the copper front face, injector tip and water cooled panels caused by the presence of a thick piece of heavy scrap in front of the injector tip.

The system is made up of temperature sensors continuously detect the variance of the copper temperature. In case of backfiring, the temperature on the front panel will rapidly increase over the alarm threshold. Then, the automation system will automatically reduce the burner power or switch-off the injector. As soon as the temperature returns to its normal value, the system will turn on the injector again.
Copper Bulged Blocks are made from cold rolled copper slabs that guarantee exceptionally high thermal conductivity avoiding all the usual problems related to cast copper parts (i.e. embedded impurities or cavities). Copper and steel welding is done by MORE’s highly qualified welders.

- More than 70% extended lifetime compared to traditional cast items.
- No embedded impurities nor cavities caused by casting technology.
- Exceptionally high thermal conductivity.
- Copper faces are designed for simple on site replacement (steel to steel welding on the sides and top and easy unbolting for changing of the front face) by the maintenance team.
- Low warehouse.
- Robust and sturdy to resist heavy mechanical impacts.
- Tailor made design.
The MOCA pneumatic injection system has been conceived to satisfy the carbon metallurgical demand for steelmaking processes with precise flow control and transport air optimization. A precise and efficient carbon injection in the EAF is the cornerstone for improvement of metallurgical processes and reduction of conversion costs.

The integration of the pneumatic carbon injection system into the Q-MELT automation, allows a dynamic foaming slag control that monitors slag conditions and adjust automatically the carbon injection set-points.

- Dispenser encased in a self-standing steel frame for easy handling.
- Automatic anti-clogging system.
- Independent pneumatic cabinet for transported air requirements.
- Optimized consumption of transported air.
- Low operating and maintenance costs.
- Accurate tolerance of set point (± 5%).
- Fast carbon flow rate stabilization (< 30 sec).

MANUFACTURING STANDARDS

- PED 2014/68/UE pressure equipment directive.
- ATEX 2014/34/UE.
- ASME code rules, section VIII, division I.

Other standards are available upon request.
The MOLI pneumatic injection system has been conceived to satisfy the flux metallurgical demand for steelmaking processes with precise flow control and transport air optimization. Lime injection is a valid well-proven improvement compared to lime charged through the roof or into the scrap bucket. Additionally, injection of powdered reactants generates a much cleaner shop environment. Therefore, dusty and maintenance demanding belt conveyor systems can be abandoned.

Thanks to the Q-MELT automation, the dynamic regulation of the correct feeding rate of lime and dololime enables a complete control of slag conditions throughout the process. Proper slag management improves slag foamability and dramatically changes the heat input efficiency and the refractory lifetime.

- Dispenser encased in a self-standing steel frame for easy handling.
- Automatic anti-clogging system.
- Independent pneumatic cabinet for transported air requirements.
- Optimized consumption of transported air.
- Low operating and maintenance costs.

MANUFACTURING STANDARDS

- PED 2014/68/UE pressure equipment directive.
- ASME code rules, section VIII, division I.
Other standards are available upon request.
The **SMARTEC** is an advanced cooling electrode system to regulate air/water flow through the electrode cooling rings dynamically. It consists of a valve stand and a set of optimized electrode cooling rings controlled by a dedicated proprietary automation software.

This dynamic control during every melting phase, significantly increases the efficiency and effectiveness of electrode cooling compared to the standard practice to use a fixed amount of cooling water; therefore, reduction of electrode and electrical energy consumption, without affecting the arc stability, can be achieved.

- Dynamic adjustment of the water cooling flow according to the requirements of the melting profile.
- Increased availability of the cooling rings due to a design that prevents clogging and deformation.
- Electrode-consumption reduction up to 15%.
- Reduction of OPEX.
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 power-off times, enhancing reliability and improving the transformation costs.
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.

**FEATURES**

- More than 200 machines at work in the world
- Anti collision system
- Easily equipment installation / disinstallation
CATFIS 2.1

SAMPLING AND MEASURING LANCE MANIPULATOR OPERATED THROUGH THE SLAG DOOR

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 multitasking operations.

FEATURES

- HIGH MOVEMENT VERSATILITY WITH 4 AXES
- ANTI COLLISION SYSTEM
- EASILY EQUIPMENT INSTALLATION / DISINSTALLATION
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.

FEATURES

- USE OF STANDARD SENSORS CARDBOARD
- EASILY EQUIPMENT INSTALLATION / DISINSTALLATION
The MODIVE is a multiple axis manipulator designed to measure temperature, carbon/oxygen contents and take samples for steel chemical analysis automatically.

The manipulator is a “stand alone” piece of equipment that can be easily installed nearby the electric arc furnace EBT area or in the ladle furnace, trimming stations and vacuum degassing.
**MOTANK**

**REMOTE CONTROLLED RAM FOR SLAG DOOR CLEANING**

**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.

**FEATURES**

- **MORE THAN 40 MACHINES AT WORK IN THE WORLD**
- **HEAVY DUTY DESIGN**
- **10 TONS PUSHING FORCE**
EBT SAND

TAP HOLE INSPECTION AND SAND FILLING

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

FEATURES

- MULTIFUNCTION SYSTEM: SAND FILLING, SLAG BREAKING AND REMOTE VISUAL INSPECTION
- PRECISE CONTROL OF SAND FILLING
- HEAVY DUTY DESIGN
- AUTOMATIC CONTROL OF IMAGE

EBT AFTER TAPPING

EBT POST SANDING
Specifically developed for off-board installation in case of reduced space availability on sump area or frequent shell change practice to inspect and sand fill.

The inspection camera is mounted parallel to the feeding pipe in order to check in real time the correct feeding of the material and tap hole status.

**FEATURES**

- **MULTIFUNCTION SYSTEM:** SAND FILLING, SLAG BREAKING AND REMOTE VISUAL INSPECTION
- **SYSTEM INSTALLED OUTSIDE THE EBT**
- **PRECISE CONTROL OF SAND FILLING**
- **AUTOMATIC CONTROL OF IMAGE**

**AUTOSAND**

**TAP HOLE INSPECTION AND SAND FILLING**
Unmelted 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 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.

**FEATURES**

- **EAF ON BOARD INSTALLATION**
- **HEAVY DUTY DESIGN**
- **5 TONS PUSHING FORCE**
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. It saves on long delays that usually are accumulating in several meltshops due to the time required for the operators to get repaired at the occurrence of the non-free opening.
We strive at guaranteeing the best operational standards in all the stages of its organization (from designing, to construction, to sales), since 1997 the company has been certified to satisfy quality assurance requirements of ISO 9001.

MORE products meet our rigorous internal standards as well as the internationally recognized certifications you’ve come to expect from the line of products we build such as ASME, PED, ATEX and others. All welding processes in MORE are made by certified welders from IIS (Italian Institute of Welding) and according to UNI EN ISO 3834-2 in order to keep track of all welding processes used during MORE manufacturing stages.

All equipment is designed, manufactured and tested in-house prior to delivery to check the working sequences and functionality.
WHERE WE ARE
INNOVATION IN STEELMAKING