# Three-in-One Injector for EAF

## Supersonic carbon injection, oxygen lancing, and burner in a single injector

*Linde's Three-in-One Injector offers supersonic carbon injection without need for changes in the carbon conveying system.*

### Challenge

Carbon injection is a critical step in the steelmaking process and in the operation of Electric Arc Furnaces (EAF). Carbon injection requires precise control to ensure the desired carbon content is achieved and helps foam the slag and reduce iron oxide (FeO) generated during oxygen refining. Currently, carbon is injected at low velocities from lances placed adjacent to fixed oxygen injectors on the wall of the furnace. Due to low momentum, an estimated 40% to 60% of the injected carbon is lost directly to the off-gas system, increasing cost, emissions, and limiting chemical energy use in the EAF due to heat load limitations in the fume system.

### The Linde Approach

Linde has developed the Three-in-One Injector to be used as an oxygen lance, a carbon injector and an oxyfuel burner. This innovative Three-in-One Injector has the capability to replace existing fixed-wall oxygen injectors. It entrains carbon into the primary oxygen stream and accelerates it to supersonic velocities, generating a coherent jet of fluidized carbon in oxygen that is able to traverse the distance from the wall of the furnace to the bath/slag interface.

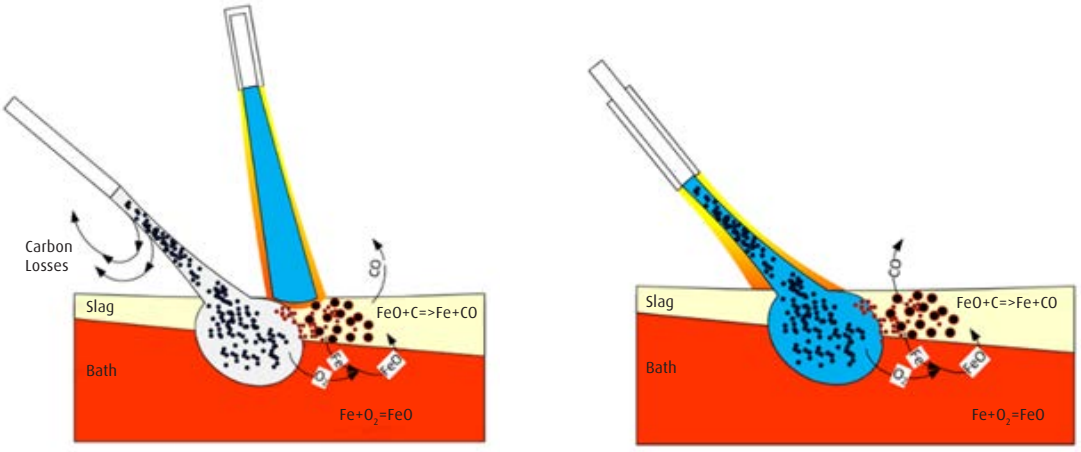
The injector can accomplish supersonic carbon injection without the need to modify the existing carbon conveying system. The system works with existing infrastructure, and requires no updates to carbon, oxygen, or fuel system.

### Benefits at a Glance

By delivering the carbon at high momentum, it has the advantages of:

- → Increasing carbon utilization
- → Reducing electrode consumption
- → Reducing power consumption
- → Allowing the use of lighter carbon material (e.g. petcoke, biocarbon, and lower cost coals)

**Conventional Carbon Injection** **3-in-1 Carbon Injection**




*By fluidizing the carbon/oxygen stream, the high momentum jet delivers the carbon where it is needed, minimizing losses to the freeboard.*

## Features

Linde's Three-in-One Injector was designed with the harsh EAF environment in mind. Its key design features allow it to operate for extended periods of time with no wearing or maintenance concerns. These features include:

- Its modular design allows the inner carbon conveying assembly to be replaced in-situ; the inner nozzle can be changed between heats without removing the entire injector
- Works seamlessly with existing carbon conveying system
- No additional compressed air lines, pressure, controls, or equipment required
- Works with existing available oxygen and natural gas systems
- No skid upgrades, additional controls, or any additional equipment required

## Partnership Model

Over the years, Linde has gained vast experience in EAF oxygen injection. The introduction of the Three-in-One Injector design leverages decades of COJET® supersonic injection know-how which revolutionized the EAF process. This new option is supported by Linde's technical expertise, working in close collaboration with the customer at every step, to maximize their return on investment.

## Contact us

For more information about this or other technologies for the steelmaking industry, call Linde at **1-844-44LINDE**, or visit our website at **www.lindeus.com/metal**.

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