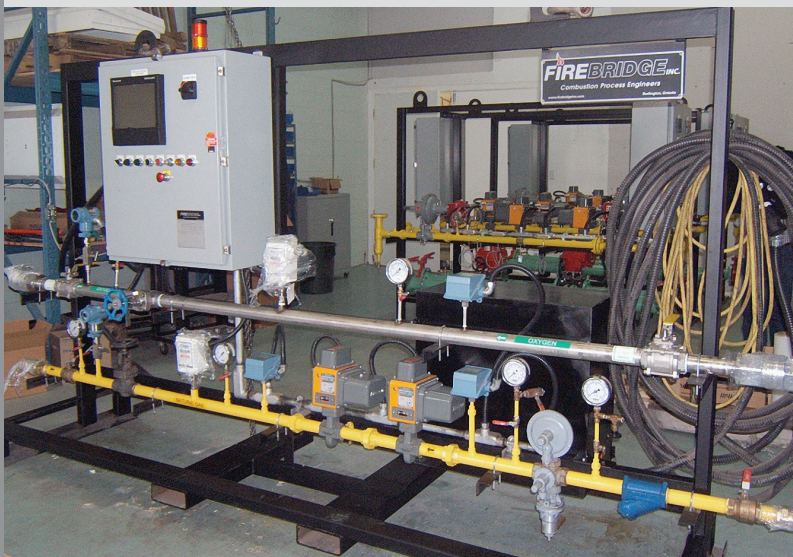


# Energy Savings and Expedited Start-Ups!

## An Economical and Effective Solution for Blast Furnace Start-ups

### Oxy-Fuel Lance Technology Improves Blast Furnace Start-up and Chilled Furnace Recovery



The start-up of a Blast Furnace following planned complete shutdowns or unplanned interruptions can be difficult and costly.

In the case where a Blast Furnace has been taken offline for upgrading, relining and repair, significant energy and manpower is required to bring the Blast Furnace up to temperature. Where an unplanned shutdown from breakdown has occurred, getting the Blast Furnace back to operating conditions using traditional methods may be extremely time consuming and nearly impossible

Firebridge Inc. has successfully designed, constructed and operated portable Oxy-Fuel Lance systems on several Blast Furnace start-ups/recoveries.

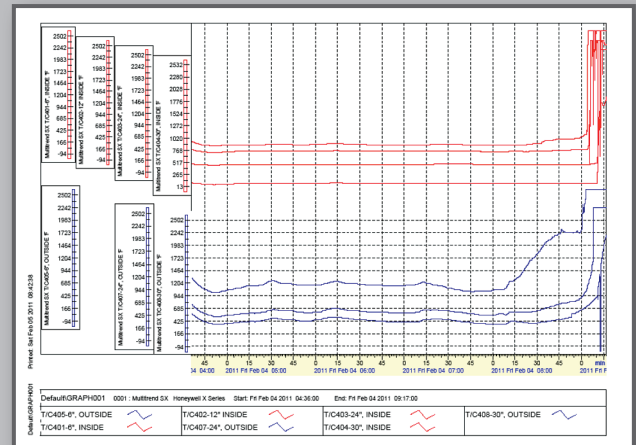
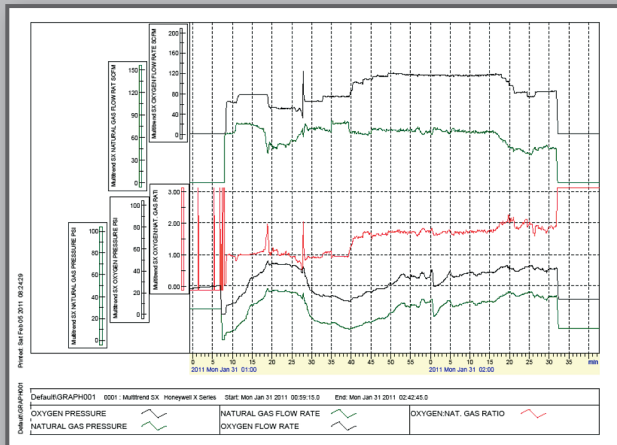
### The Technology:

- A hole is drilled into the taphole to accommodate the Oxy-Fuel lance.
- Several thermocouples mounted on the lance are used to measure the lance surface temperature at different points within the Blast Furnace.
- Accurate Oxygen and Natural gas flow rates are measured and a precise ratio of Oxygen to Natural Gas is displayed in real time to allow for manual adjustments to be made by Operators.
- Temperature indication at tuyere level and lance temperatures displayed and trended at the Oxy-Fuel valve train indicates when the Oxy-Fuel lance can be removed and molten iron can flow once again.

## Advantages:

The use of an Oxy-Fuel Lance system designed and built by Firebridge has several advantages for use during Blast Furnace start-ups:

- High heat output from an Oxygen-Natural Gas flame reduces start-up times
- There are substantial cost savings from using Oxygen-Natural Gas as a fuel source during the 24-54 hour heat-up period without having to open tuyeres.
- Portable unit can be easily set-up and operated
- Oxy-Fuel valve train has integrated safeguards in the case of a hazardous disturbance.
- High Turndown on flow rates (up to 100:1) and accurate flow measurement allows for precise fuel:oxygen ratio control



Full data recording capabilities including lance temperature at several locations, fuel:oxygen ratios, gas flow rates and pressures

## Results:

- ✓ Between 2009 and 2011, Firebridge has been involved with Blast Furnace start-ups at integrated steel plants
- ✓ Two of the three start-ups took place after lengthy shut-downs and one involved a chilled Blast Furnace; all start-ups were successfully completed using the Firebridge Oxy-Fuel Lance System.
- ✓ Significant energy savings resulted and lances were fired for between 6 and 54 hours in total.
- ✓ Lances and valve trains can be built to customer requirements and stored compactly at site.