



Enhancing Customer Operations in **Iron & Steelmaking**





Overview

What We Do

The Clyde Metal Technologies Division of Clyde Materials Handling (CMH) provides low energy, low maintenance, and environmentally enhanced materials handling solutions for customers in process-based manufacturing environments such as iron & steel.

CMH specialises in providing dense phase pneumatic conveying and pneumatic injection solutions that strive to reduce energy and maintenance costs, reduce the emission of dust and harmful pollutants while helping customers to improve productivity.

Significant savings in power consumption, tap-to-tap times and minimising refractory wear can be generated from the range of solutions provided by Clyde Metal Technologies. Improved control of slag FeO levels can also be generated through highly accurate, controlled and reliable feed of carbon and lime directly into the heart of electric arc furnaces (EAF).

Experience and Excellence

With more than 30 years of experience in developing and implementing customised solutions for a wide range of process industries, Clyde Materials Handling has become an internationally recognised leader in two core technologies: dense phase pneumatic conveying and pneumatic injection.

CMH has a strong heritage in providing dense phase pneumatic conveying and pneumatic injection solutions with many systems installed and all adding value to the iron & steel market. In the EAF market, the Clyde Materials Handling range of solutions are further strengthened through a partnership with Praxair Inc., a global, Fortune 300 company that supplies atmospheric, process and specialty gases, high-performance coatings, and related services and technologies to a wide diversity of customers.

Clyde has witnessed strong demand for the range of dense phase pneumatic conveying and pneumatic injection technologies as the iron & steel industry constantly seeks energy, environmental and operational improvements.

Clyde Materials Handling today employs over 150 people from locations in the UK, US, Brazil, China, South Africa and India. Its parent company, Clyde Process Solutions plc, is listed on UK's AIM stock market. CMH's expertise in developing innovative solutions is complemented by its strong capabilities in design study, testing, project management and after sales services.

Technologies

Dense Phase Pneumatic Conveying – Next Generation Conveying for the Steel Market

CMH's Dense Phase Pneumatic Conveying technology is suitable for transporting difficult, abrasive and/or friable materials, and conveying material along a pipe in plug form at very low velocities. This results in minimal wear on pipes and bends, promoting minimum maintenance and long life. Efficient use of compressed air also gives low power consumption and running costs.

CMH's range of Dense Phase Pneumatic Conveying systems have been designed to provide a simple and effective method of transferring material from a single collection point to either single or multiple reception points, and can be used throughout the iron & steelmaking industries to transfer almost all types of bulk solid materials. Systems are available for materials at temperatures up to 450°C, rates of over 300 tonnes/hour, and for distances up to 1.5 miles, all in a single pipeline.

Clyde Materials Handling's Dense Phase Pneumatic Conveying technologies provide the following benefits:

- Lower Energy
- Lower Maintenance Costs
- Lower Operational Costs
- Increased Productivity
- Increased Reliability
- Reduced Risk of Material Spillage
- Reduced System Footprint
- Flexibility to Extend Application



Pneumatic Injection – Accurate, Adaptable, Reliable Injection for Iron & Steel

Clyde Materials Handling has provided pneumatic injection solutions across many industries and has consistently improved productivity rates, system reliability, availability and performance for those clients.

The core technology utilised for the accurate, adaptable and reliable injection of material is called the Rotofeed.

The Rotofeed consists of two pressure vessels, a rotating volumetric feeder at the outlet, and valves to control the air supply, material flow and vessel pressures. The feeder, which is designed to work at high pressure with abrasive materials, is driven by a geared electric motor. Adjusting the speed of the motor via a loss-in-weight feedback loop accurately controls the rate of concentrate injection by each feeder.

Material can be injected volumetrically with accuracy of $\pm 2\%$ or gravimetrically to $\pm 0.5\%$ by weight. Containment backpressures of up to 50 barg can be accommodated by the Rotofeed, and injection distances are only limited by the available conveying pressure.

Different configurations are available for batch or continuous delivery to one or multiple injection points.

Wherever there is a need to inject powdered or granular materials into a process environment, there is a potential application for Clyde Materials Handling's pneumatic injection technology. Clyde's pneumatic injection technologies also have the capability to inject a blend of materials such as ore, coal and flux into alternative ironmaking processes, creating a consistent, homogenous mix of material direct to process. Products can be continuously dosed into process environments at smooth, easily controlled rates up to and over 150 tph, over long distances, with accuracies of $\pm 0.5\%$.

Clyde Materials Handling's Pneumatic Injection technologies provide the following benefits:



- Increased Process Control
- Increased Injection Accuracy
- Increased Productivity
- Increased Reliability
- Increased Utilization of Raw Material

CoJet® – Gas Injection Technology

Praxair's CoJet® Coherent Jet Gas Injection Technology is a state-of-the-art oxygen injection system that lowers costs and improves productivity of electric arc furnace (EAF) operations. The technology provides a safe, easily operated method for lancing/decarburization, post-combustion, and burner operation in a single, integrated system using oxygen supplied by Praxair.

A process and injector nozzle can deliver up to a 3 metre long laser-like coherent jet of oxygen at supersonic speeds into the molten bath. The fixed, wall-mounted injector nozzle retains the original diameter and velocity of the oxygen jet, delivering precise amounts of oxygen to the steel bath with less cavity formation and splash compared to traditional manipulators.

Once the oxygen jet impinges on the steel bath, the concentrated momentum of the oxygen beam dissipates in the steel as fine bubbles, providing deep penetration and effective slag-metal mixing. The nozzle also operates as a conventional sidewall burner to melt scrap and as a supplemental post-combustion oxygen source, improving furnace productivity and decreasing power consumption.

In addition, Praxair's CoJet® Gas Injection Technology:

- Allows for automatic furnace operation
- Decreases costs through lower power consumption, extended furnace life, and decreased maintenance
- Decreases refractory erosion, arc flare damage, and maintenance gunning
- Enhances slag foaming
- Speeds decarburization
- Eliminates the need for lance manipulators
- Decreases splashing and improves slag-metal stirring

The combination of Clyde Materials Handling's Rotofeed together with Praxair's CoJet® provides the iron & steel market with a powerful, highly accurate, reliable, effective and efficient injection proposition – a proposition that is unrivalled in the market.



References

Clyde Material Handling has many reference systems in the iron & steel industry covering pneumatic injection technologies. Examples of typical references on electric arc furnaces include:

Location	No. of EAF's	Normal Capacity (Tonnes)	No. of Injection Pts (Per Furnace)	Material
Argentina	2	100	2	Carbon
Brazil	2	80	2	Carbon
Brazil	2	50	1	Carbon
China	2	150	4	Carbon
China	1	80	3	Carbon
USA	1	120	2	Carbon
USA	1	120	3	Carbon
USA	1	100	2	Carbon EAF Dust FeSilicon
USA	2	80	1	Silicon Carbide
Canada	1	135	4	Carbon



Clyde Materials Handling – Enhancing Customer Operations

The latest range of Dense Phase Pneumatic Conveying and Injection solutions from Clyde Materials Handling has an 'eco' message at its core. The drive towards enhancing the range of technologies was to help producers respond to the increasing need to reduce energy, emissions, maintenance and operational costs while improving process reliability and production performance.

Clyde Materials Handling's "eco" range of solutions has been developed to: • Enhance our Customers Operations • Improve Energy Conversation and process Optimisation, and • Be ECOnomically designed to consume low volumes of air and energy, and at reasonable capital costs.



Contact Us

Clyde has global coverage, through direct offices and representatives. Please contact us if you wish to speak to a Clyde iron & steel expert or to a representative in your region.



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