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## **TUYERE STOCK TECHNOLOGIES** WIND-DISTRIBUTION SYSTEM FOR THE BLAST FURNACE



# BLAST FURNACE TUYERE STOCKS

## RELIABLE WIND DISTRIBUTION

### THE CHALLENGE

Blast Furnace wind-distribution equipment is process-critical, and its performance directly influences the availability and productivity of the furnace. The tuyere stock assembly must satisfy a number of key functions:

- Minimize energy loss from the hot blast entering the process
- Mechanically compensate for differential vertical and radial expansions of the blast furnace shell and bustle main, plus possible rotational movement that can occur

At the same time, the hot blast temperature loss must be minimized to reduce the blast furnace fuel rate and CO<sub>2</sub> emissions.

The tuyere stock system must remain leak tight and sufficiently cool to avoid weakening the steel construction. Maintenance routines and changes should be readily undertaken without excessive set-up requirements. Supplementary fuel injection into the furnace via the tuyere assembly should also be incorporated in many modern operations.

### OUR SOLUTIONS

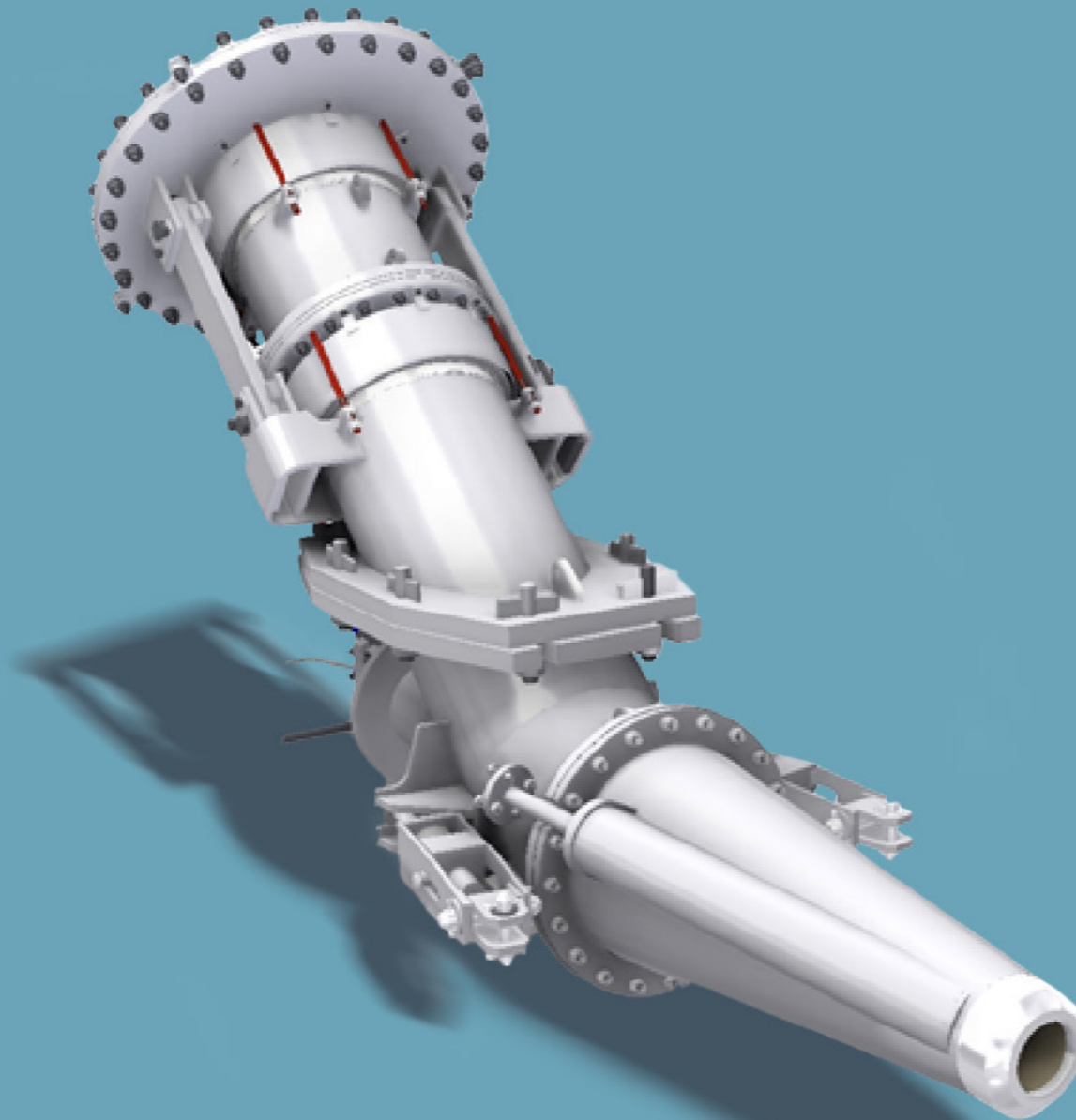
- Energy saving lining to provide minimized heat losses, providing fuel and CO<sub>2</sub> emission reductions
- Designed in accordance with the current Pressure Equipment Directive requirements
- Three true spherical joints – Two in the downleg and one at the connection between the blowpipe and the tuyere itself
  - Horizontal flange connections between downleg/elbow
- Quick-release cotter bolts for easy changing of blowpipe assembly
- Peep sight and ball valve to allow furnace raceway viewing. See also 'Tuyere Optics' later for automated viewing options
- Twin, spring-loaded blowpipe tie rods, seated into the tuyere via a stainless steel spherical nose (with additional water cooling as necessary)
- Multi-lance fuel injection ports as required





# TUYERE STOCK SOLUTIONS

## DELIVERING RELIABILITY AND ENERGY EFFICIENCY



### UNIQUE FEATURES

- Twin, multi-ply, multi-corrugation stainless steel bellow unit down legs to ensure 100% pressure tight sealing for the spherical joints whilst allowing the required articulation
- External tie-bar restraint held in high-temperature spherical plain bearings - the assembled length of the downleg is set in cold condition and the design ensures that growth during heating increases the units gas tightness

### ENERGY SAVING TECHNOLOGY

Heat loss from the tuyere stock has a direct and negative impact on hot blast temperature. Our energy efficient tuyere stocks are designed to:

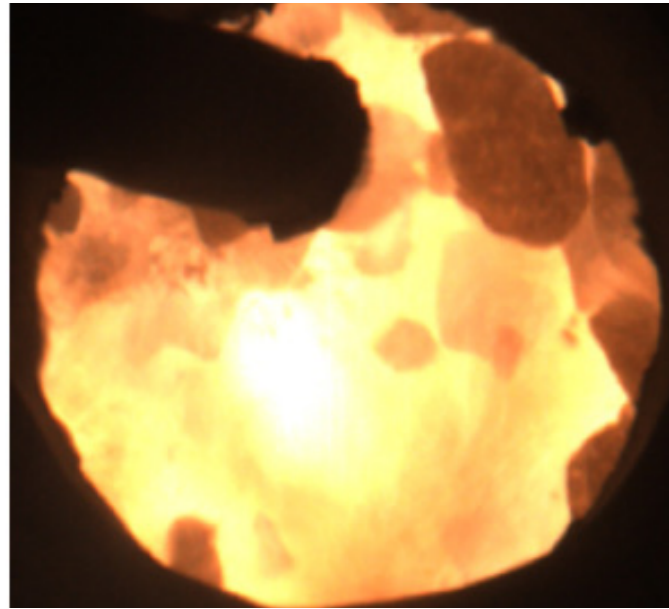
- Improve tuyere platform environment
- Reduce energy loss resulting in a fuel saving: for example 30kW/tuyere heat loss reduction can provide 0.6 kg/tHM coke saving and 2 kg CO<sub>2</sub>/tHM (dependent upon operational characteristics)

### TUYERE STOCK BENEFITS

- Reliable transfer of hot blast to the tuyeres
- Energy efficient design reduces thermal loss, lowering shell temperatures and increasing hot blast temperature
- Suitable for back-draughting temperatures
- Compensates for the differential expansion of the blast furnace shell and bustle main
- Unique external tie-bar design controlling the length during thermal expansion
- Increasing gas tightness in the hot condition
- Freedom of movement at elevated temperatures, reducing the potential for 'hot spots'
- "Quick-drop" elbow and blowpipe for tuyere maintenance access
- Suitable for multiple fuel lances
- Blast flow measurement
- Supplied "ready to install"

# TUYERE OPTICS SOLUTIONS

## BLOCKAGE PREVENTION



Tuyere optics

### TUYERE OPTICS

Continuous remote monitoring gives the operator increased confidence to run at higher pulverized coal injection (PCI) rates, reducing hot metal cost.

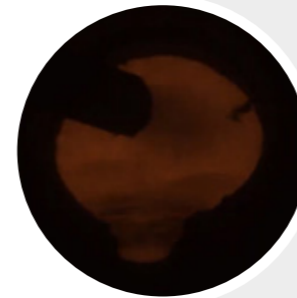
Early tuyere phenomena detection allows time for intervention as necessary and prevents unplanned maintenance stops.

Tuyere Optics gives invaluable viewing of the blowpipe, tuyere and raceway area during furnace operations and shutdown procedures. An integrated, remote, tuyere monitoring system vastly improves the safety of operator personnel (manual viewing port maintained):

- Quick release couplings to fit any modern tuyere stock eases removal in the event of furnace maintenance activities
- Visual data processed and distributed via network interface to the operator's workstation, blast furnace control room and manager's offices as required
- 24 hour, real time visual data viewing, imaging diagnostic processing and recording provides invaluable insight into the performance of the furnace and fuel injection system

### TUYERE OPTICS BENEFITS

- Improved operator safety
- UK customer ROI confirmed in under 6 months
- Manual peepsight maintained if required
- Thermo-electric cooling ensures no additional cooling medium and associated installation, supply and maintenance costs are required
- Real time continuous tuyere display in the control room where it is needed most
- Configurable short and long term storage for review of events
- Tuyere and furnace condition monitoring with alarm display and digital signal output if required for the following:
  - Tuyere status
  - Fuel injection
  - Lance and tuyere distortion/leakage

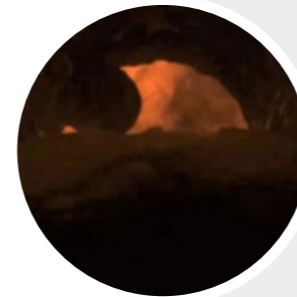


#### EVENT PHASE 1

Furnace shutdown in progress

**11:15:24**

During furnace shutdown procedures, operators monitor the camera display screen. Slag is observed entering the tuyere. Furnace operators take note and monitor the situation carefully.

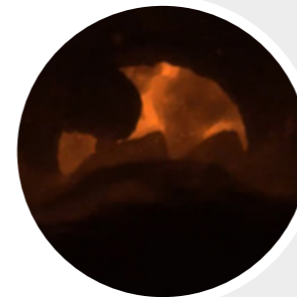


#### EVENT PHASE 2

Critical situation observed

**11:19:21**

A sudden increase in slag and coke building up is observed by the furnace operators. There is significant danger of equipment being damaged, necessitating additional furnace downtime. Immediate action is required.

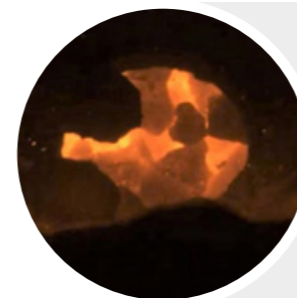


#### EVENT PHASE 3

Action taken

**11:19:26**

Snort valve close initiated to increase pressure at the tuyeres. This immediately prevents further ingress of slag and coke into the tuyere and blowpipe.

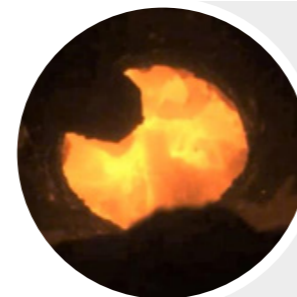


#### EVENT PHASE 4

Improvement in furnace condition observed

**11:19:36**

Increased pressure and flow of wind begin to blow slag and coke out of the tuyere and blowpipe.



#### EVENT PHASE 5

Major incident avoided

**11:19:46**

Just 20 seconds after taking action, the tuyere and blowpipe are now clear. Continuous visual monitoring provided in the control room enables the operators to identify and avert real-time, critical situations.

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