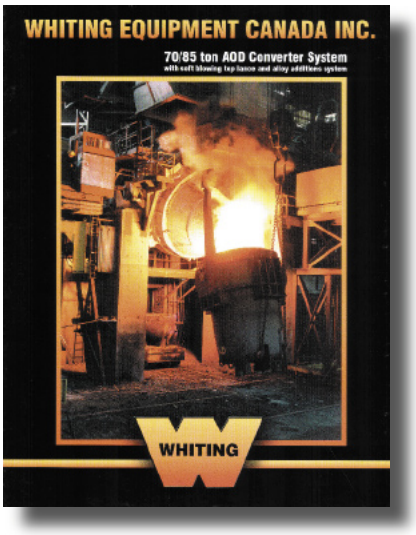
# Whiting Equipment Canada Inc.
## 70/85 ton AOD Converter System



On August 9,1998, a 70/85 nominal ton AOD converter system poured its first heat at Atlas Specialty Steels, Wetland, Ontario, Canada. The system is based upon Praxairs Argon Oxygen Decarburization (AOD) process for the production of high quality stainless steel, superior castings, low alloy or specialty steels.

This turnkey project carried out by Whiting Equipment Canada Inc. proves the high degree of flexibility of the process and its success in meeting the high quality standards set out by Atlas Specialty Steels.

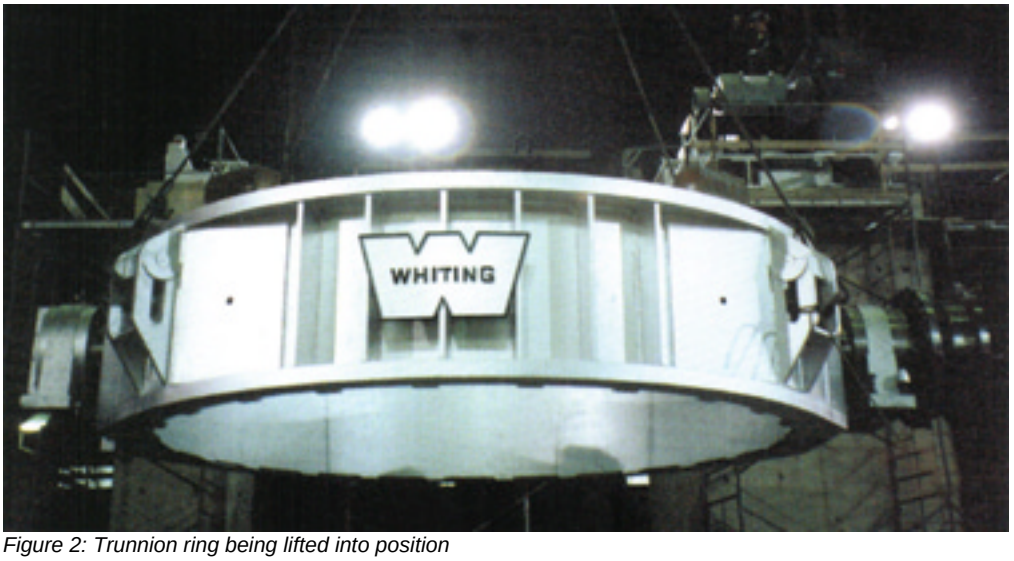



*Figure 2: Trunnion ring being lifted into position*

## Technical Specifications of the Installation

### Converter

**Number of Vessels Supplied:**
• three (3) – *Figure 1*

**Nominal Capacity:**
• 70 tons

**Capacity Range:**
• 55 tons to 85 tons

**Inner Diameter:**
• 14’-0”

**Vessel Height (including cover):**
• 20’-4 $^{3}/_{8}$”

**Vessel Weight Excluding Lining:**
• 75,900 lbs.

**Tilting Drive:**
• two (2) 52.5 hp dc mill motors,
• two (2) nitrogen driven backup motors

**Rational Speed:**
• zero to 1 rpm variable

**Number of Tuyeres:**
• five (5)

**Trunnion Bearing Center Distance:**
• 19’-7 $^{1}/_{2}$” – *Figure 2*

*Figure 1: AOD vessel bottom section under construction in Whiting’s Welland fabrication shop*

### Motorized Operator’s Platform

**Function:**
• a chemistry, temperature samples and preheating platform

**Drive Systems:**
• 5 hp dc

**Dimensions (approximate):**
• 27’-0” high x 16’-0” long

### Oxygen Lance

**Function:**
• rapid decarburization

**Cooling:**
• water

**Movement:**
• horizontal 21’-0”; vertical 9’-0”

**Hoist Drive:**
• 20 hp

### Motorized Fume Hood

**Function:**
• capture process fumes

**Cooling:**
• refractory lined, air cooled

**Drive:**
• 10 hp

**Movement:**
• horizontal 21’-0”

**Capture Mode:**
• an accelerator stack projected to the canopy roof

### Preheaters

**Function:**
• preheat AOD vessel and ladle linings

**Quantity:**
• three (3)

**Capacity:**
• one (1) vertical ladle preheater, 7 x $10^{6}$ Btu/h,
• one (1) horizontal AOD operating vessel preheater, 10 x $10^{6}$ Btu/h,
• one (1) vertical AOD standby vessel preheater, 10 x $10^{6}$ Btu/h.

### Valve Rack and Gas Control System

**Function:**
• perform process gas control

**Supplier:**
• Praxair “IRS” (Intelligent Refining System)

### Transfer Cars

**Function:**
• move process slag pots and ladles

**Quantity:**
• two (2)

**Capacity:**
• ladle transfer car – 160 tons, 10 hp dc, 35 ft/min
• slag pot car – 50 tons, 5 hp dc, 30 ft/min

### Immersion Sampler

**Function:**
• remote robotic temp./chem. samples at ladle post treatment station

**Quantity:**
• one (1)

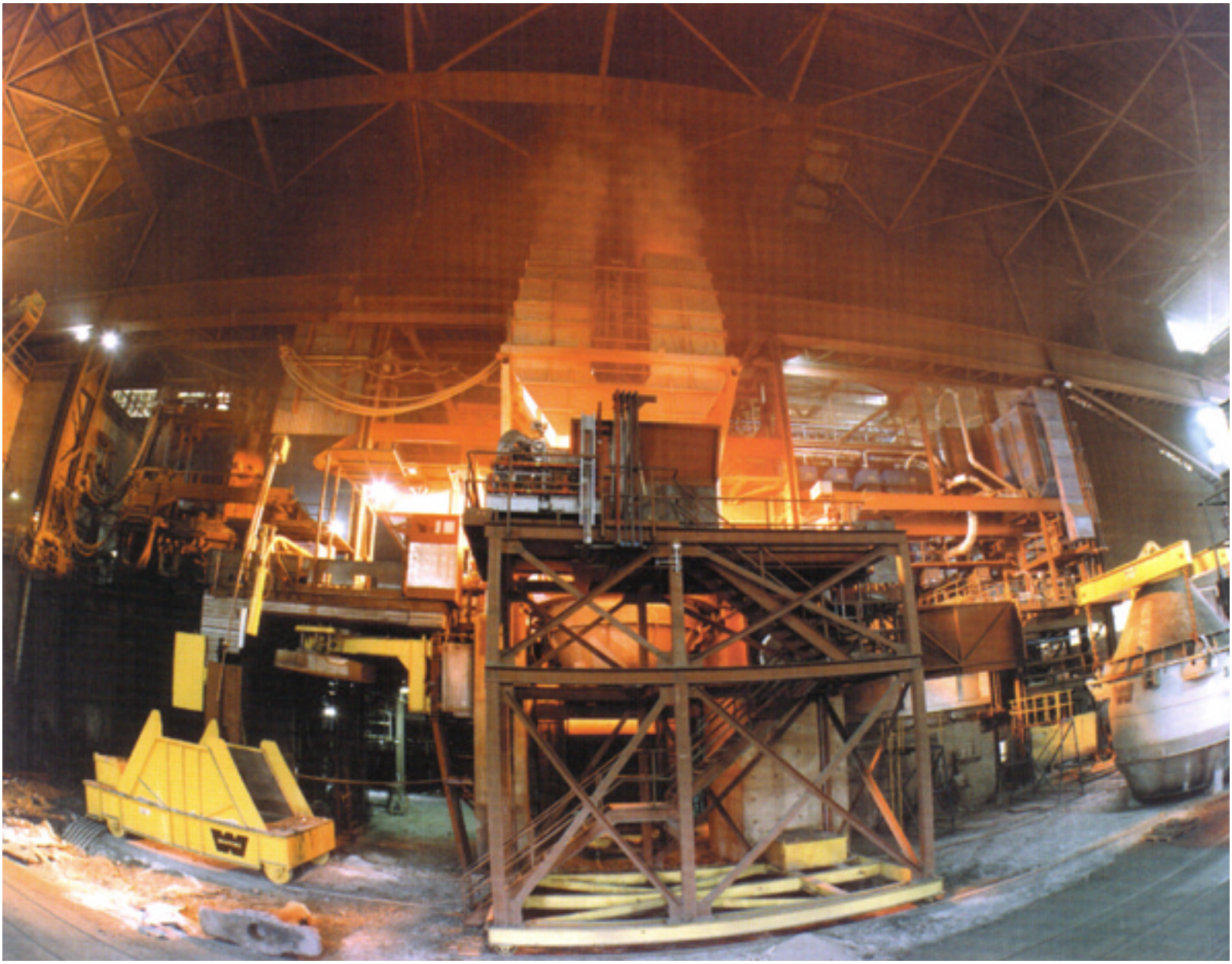


*Figure 3: Overall Installation*

## Alloy Additions System

**Function:**

- delivery of accurately weight alloy additions to the AD vessel while operating, using full automation

**Bin Quantity:**

- twenty-two (22), one (1) operating floor hand additions weight hopper

**Overall Dimensions (approximate):**

- 39'-0" high x 26'-9" wide x 80'-0" long

## Miscellaneous Auxiliary Equipment

- Ladle post treatment station
- Melt shop building expansion
- 5 ton jib service crane
- Installation of a 50 ton service crane
- Cooling water system
- AOD vessel bricking platforms
- Vessel lifting beams
- Training and commissioning programs

## System Description

The AOD plant had to be integrated into the existing melt shop, downstream of two (2) operating electric arc furnaces, a VAD all originally supplied by Whiting and a VOD. Pits were not allowed. All equipment had to be built on a mezzanine basis, 24 feet above the plant operating floor. This accounts for the unusual elevation of the tapper's platform necessary to reach the vessel mouth area and the high piers needed to support the vessel.

The tilt drive system is - helical gear, dual-input, single-output, double-quadruple reduction parallel shaft gear drive, connected through a gear coupling and driven by two (2) 52.5 hp dc mill motors. In addition, two (2) nitrogen motors were installed as a backup in case of power failure.

*Figure 4: AOD blowing a heat*

Provision of three (3) AOD vessels ensures that a completely bricked backup vessel will always be available while the AOD is operating and a vessel is being relined. The design of the vessel locking arrangement to the trunnion ring allows one hour or less exchange time. The vessel has a removable top cone section to ease relining. The fume hood (which has the water cooled lance installed through it) is designed to move horizontally out of the way, allowing the melt shop crane to lift the vessel vertically from the trunnion for relining and relined vessel replacement.

All alloys, fluxes, cooling scrap, etc., are automatically precalculated, weighed on weigh belt feeders and fed from the bin storage system into the mouth of the converter vessel by the automated alloy additions system. The charge is transferred via a retractable feed chute. The alloy additions system is complete with its own integrated dust control system to reduce dust generation through loading in the melt shop to a minimum.

The process gases are fed to the AOD heat through the Praxair proprietary "Intelligent Refining System" (IRS) via the five (5) vessel tuyeres and top blowing oxygen lance, all gas compositions are precalculated through custom designed programs to suit final product requirements.

The water-cooled oxygen top lance moves vertically into and out of the vessel's mouth by a hoisting mechanism situated above the fume hood. The same mechanism that moves the fume hood also moves the lance horizontally.

A new 160 ton capacity Whiting ladle transfer car was supplied to move the tapping ladle between the post treatment station and the AOD vessel thus freeing up the existing melt shop cranes for other duties.

A new 50 ton capacity Whiting slag pot transfer car was supplied to receive and remove the slag generated by the process without the use of the existing melt shop cranes.

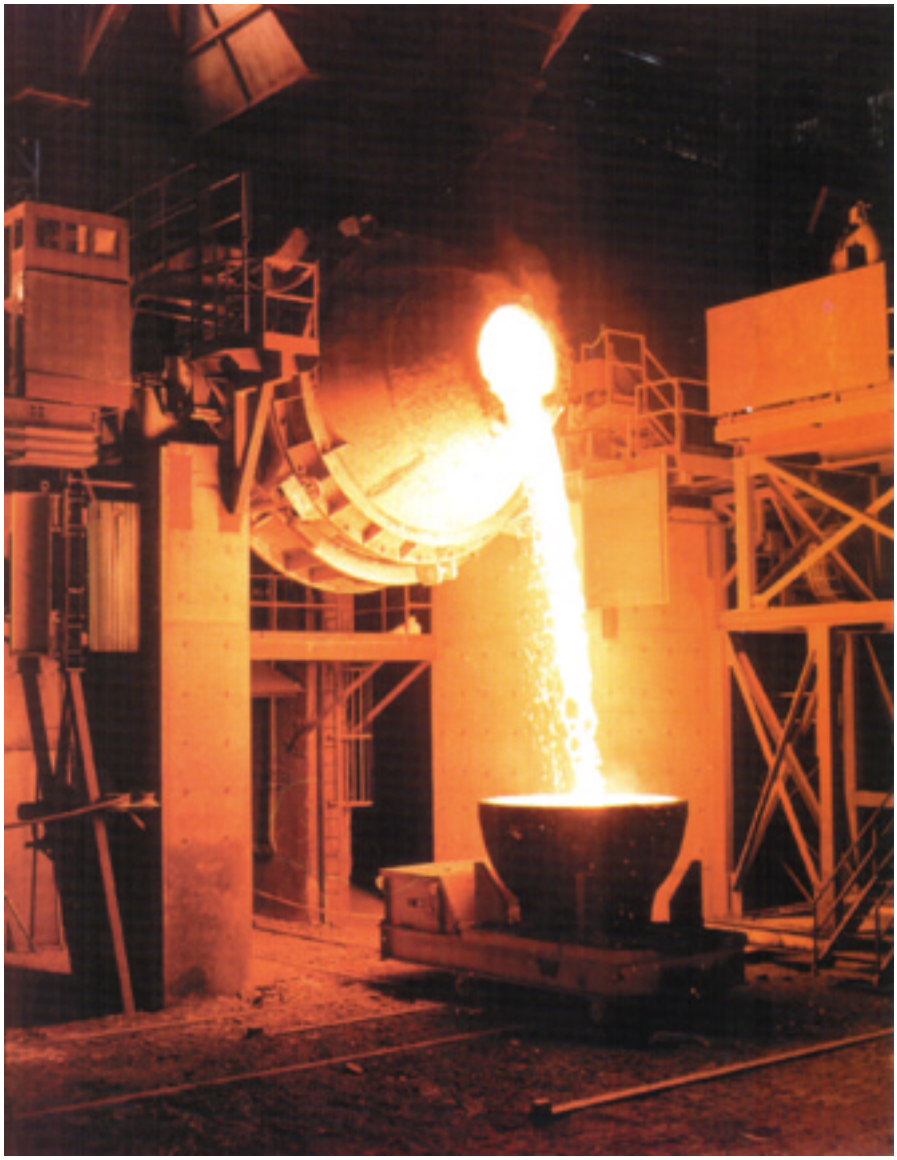


*Figure 5: AOD tapping slag*

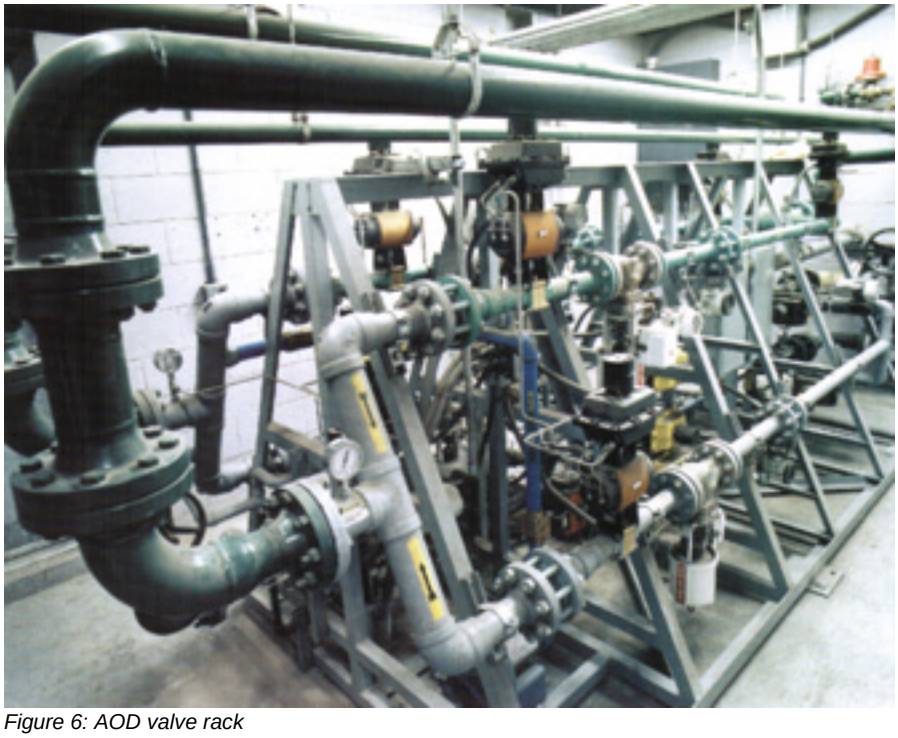


*Figure 6: AOD valve rack*

Three (3) preheaters were installed to make certain that either a ladle or AOD vessel is always ready for use. The vertical ladle preheater keeps the receiving ladle lining at the temperature required to receive the AOD tap. The vertical AOD vessel preheater ensures the standby AOD vessel lining is ready for immediate operation in the vessel trunnion ring. The horizontal AOD vessel preheater keeps the vessel lining at operating temperature during periods of downtime while the vessel is in the trunnion ring.

A new control room was constructed on the melt shop charging floor to house the control equipment for the total AOD operation and all its ancillaries. A single control console using the latest in "touch screen" industrial software and computer hardware was installed. This requires only one (1) operator to remotely monitor and control the system.

The process control is managed by an Allen-Bradley PLC-5 that interfaces with the customer's DEC mainframe and Praxair Moore APACS hardware. The man machine interface is a large operator's console complete with two (2) monitors and a printer.

This system uses touch screen technology in the graphic Windows environment, making the system exceptionally easy to use and understand. A remote operator's station was installed beside the pouring area of the AOD vessel, providing local control of the AOD and its auxiliary equipment when required.

A post treatment station was installed next to the AOD pouring area to enable supplementary wire feed alloy additions and stirring of the heat before casting.

Molten metal is poured into the AOD vessel via the melt shop crane. The ladle transfer car or the melt shop cranes are used to receive the molten metal from the AOD vessel for final casting.


Summary

This project takes advantage of the many benefits the AOD process can provide to a steelmaker, they include:

- High metallic yields
- Flexibility in low cost raw materials selection
- Pinpoint accuracy in achieving desired aim chemistries
- Precise control of carbon to 0.01% and lower
- Rapid desulfurization to less than 0.001%
- Lead removal to less than 0.001%
- Cleaner metal, with low residual oxygen, nitrogen and hydrogen
- Increased production capacity

The Whiting AOD vessel design provides an all-welded, stress-relieved treatment vessel with heavy steel horizontal reinforcing ribs and gusset plates to retain the vessel shape after many heats. The locking arrangement provides a quick changeover and allows for expansion between the vessel and trunnion ring. Whiting has previously supplied AOD Equipment to hold different sized vessels in the same trunnion ring thereby achieving heats of various sizes at an optimum cost.

Whiting designed and manufactured more than 70% of North America's operating AODs.

Contact a Whiting Sales Engineer to find out more about our AOD equipment.


*Figure 7: Control console using "touch screen" technology*


**Whiting Equipment Canada Inc.**

www.whiting.ca

**John Bartok**
350 Alexander Street
Welland, Ontario, Canada L3B 2R3
Tel.: (+1) 905-732-7585 ext. 273
E-mail: jbartok@whiting.ca