

Channel Induction Furnaces for holding and melting ferrous alloys



CHANNEL INDUCTION

Jet-Flow™ Channel Induction

Advanced Solid State Control ("CFC" Channel Furnace Controller)



Ajax TOCCO Solid State Control Systems eliminate the high maintenance items present in most other control systems that use electro-mechanical contactors.

With Ajax TOCCO's Solid State Controller, there is no need for tap changers, contactors, or phase balancing equipment.

Ajax TOCCO's Solid State Control is available on new equipment and is ideal for retrofitting all makes and models of existing equipment.

The single phase solid state controller provides:

- Infinite control from zero to maximum
- Instantaneous response time to power lever adjustments
- No in rush current (soft start)
- No moving parts to wear out
- Automatic control of power and temperature
- Eliminates tapped transformers and saturable reactors
- No mechanical switching devices
- High reliability and low maintenance
- Easily interfaced to main frame computer systems
- Built-in diagnostics and safety devices

Four 30-ton Ajax TOCCO furnaces, each powered by a 2000 kW Jet-Flow™ inductor are used to produce 160 tons of gray and ductile iron per day. For one customer "off peak" melting saves over \$35.00 per ton and Jet-Flow inductors enable them to melt plant generated chips and borings.



Ajax TOCCO Magnethermic® Corporation

The Global Force in Induction Technology

CHANNEL INDUCTION

Furnaces for Ferrous Alloys

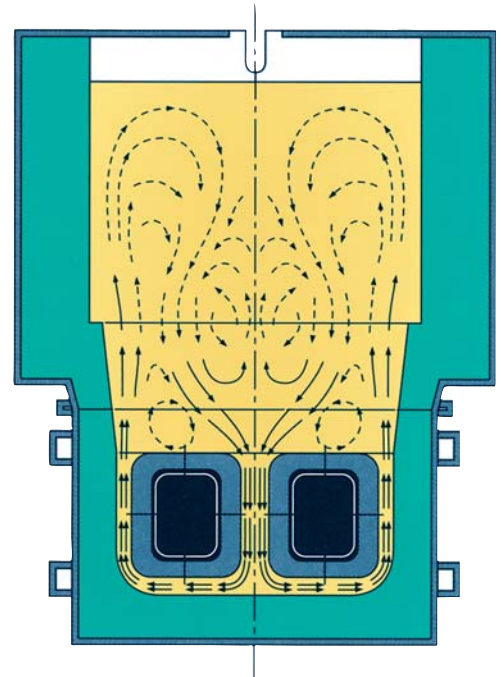
Inductors

The heart of a channel furnace is the inductor. For optimum performance, the inductor must be extremely reliable and predictable. Ajax TOCCO places a great deal of emphasis on inductor design.

Ajax TOCCO pioneered the development of high power inductor designs that are used throughout the industry today. The premier design uses the patented Ajax TOCCO high power Jet-Flow™ inductor technology. The Jet-Flow principle leads all inductor designs in field performance and reliability.

In the Jet-Flow inductor, metal flows downward into the center channel, divides evenly into the bottom channel, and flows in high velocity streams upward from both outer channels. This strong circulation insures maximum temperature uniformity and alloy chemistry in the furnace main hearth.

Metal flows at the rate of up to 1200 tons per hour. Due to the high metal flow, the temperature differential between the furnace bath and the inductor channels is very low. This insures maximum inductor life. Metal velocity is precisely controlled, prevents hot spots, and allows the Jet-Flow inductor to be operated continuously at rated power. Jet-Flow technology allows Ajax TOCCO to build 6000 kW inductors – the highest operating power level in the industry.



Four channel furnaces, plus all melt shop functions are controlled with this Ajax TOCCO computerized melt system.



Channel Induction Furnace Advantages for Melting and Holding



Ninety-ton vertical nose-tilt channel furnace for iron.

Primary melting is done here with four 30 ton, 2000 kW Jet-Flow furnaces for iron.

Ajax TOCCO was responsible for the complete melt shop, from overhead cranes to metal handling.



Let's Explore the Reasons Why

Ajax TOCCO channel furnaces are available to fit most ferrous alloy foundry needs with proven records that are economically hard to beat, from initial cost through the costs of operating and maintenance. Let's explore the reasons why Ajax TOCCO channel furnaces for ferrous alloys give the foundryman flexibility and continuous melting capabilities with maximum efficiency.

Efficiency...

Channel furnaces have electrical efficiencies over **92%**, with overall efficiencies in excess of **80%**... higher than any other type of melting equipment.

Flexibility...

By design, they can be used as melters, holders, provide off-peak melting, and have the advantage of holding large volumes of metal required for large or continuous casting. There is always a reserve of metal to eliminate scheduling problems.

Precise Control...

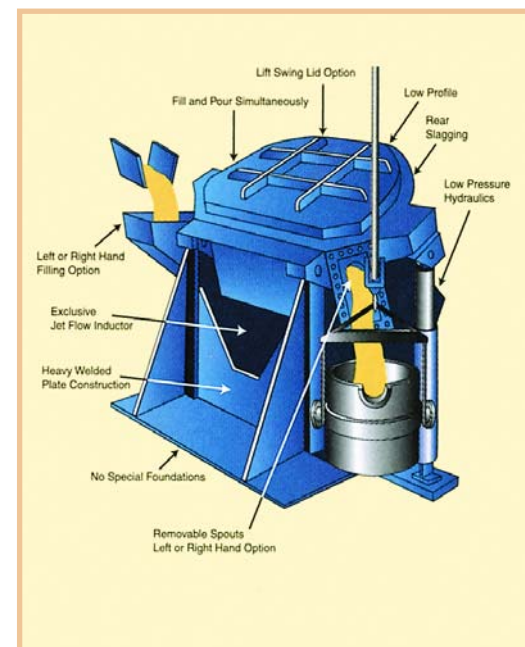
Temperature and chemistry are easily controlled. Metal can be held for long periods with minimal effect on the metal quality.

Operating Costs...

Ton for ton, kilowatt for kilowatt, Jet-Flow channel furnaces cost less to operate. Refractory costs are lower and maintenance is required less frequently. Power costs are minimized because of their greater efficiency.

Working Conditions...

Channel furnaces are clean, quiet, and cool. Workers' comfort and confidence are improved.



Channel Induction Furnaces

Vertical Tilt Melting Furnaces

Vertical channel furnaces can be used as melters, holders, provide off-peak melting, and have the advantage of holding large volumes of metal required for large or continuous casting.

The furnaces are ruggedly constructed of heavy steel sections and designed for long life under all foundry conditions.

The furnaces are hydraulically tilted and can be equipped with lift and swing lids for easy charging and slagging. Back tilting for ease of slagging is also available.

Inductor cases are equipped with a machined flange that attaches to a mating flange mounted on the furnace body for quick inductor changes. Standard furnaces are available up to 250 tons usable capacity and power ratings to 12,000 kW.

Vertiplex Furnaces

The Vertiplex channel furnace is ideal for holding or duplexing ferrous alloys where a constant supply of metal is required to meet varying production demands. The Vertiplex can pour and receive at the same time.

The compact rugged construction of the Vertiplex coupled with a low profile make it especially suited for foundries with low head room and floor space limitations. Vertiplex consists of four main assemblies: the furnace tilt frame, furnace body, furnace cover, and the Jet-Flow™ inductor. Construction utilizing heavy section steel plates and structural shapes, ruggedly reinforced to evenly distribute tilting stresses throughout the body, eliminate distortion. Tea pot style receiving and pouring spouts are bolted to mounting flanges for simplified maintenance and easy mounting and removal. The furnace can pour and receive at the same time while low pressure hydraulics provide smooth operation.

Options include a lift and swing cover, furnace platform, and back-tilting capability. Furnace sizes range from 10 tons to 250 tons usable capacity with power ratings up to 6000 kW.

Rotary Drum Furnaces

Drum-type furnaces are well suited for foundries with restricted head room and/or foundation depth limitations. As with vertical type channel furnaces described earlier, drum furnaces can be used as melters, holders, provide off-peak melting, and have the advantage of holding large volumes of metal required for large or continuous casting.

Drum furnaces are constructed of rolled heavy gauge steel plate with rigidly reinforced end plates. The ends of the drums are fitted with heavy steel rotating tires that surround the entire circumference of the furnace for added support. Furnace rotation can be accomplished either hydraulically or with chain drive systems. Hydraulic or air operated doors can be provided to facilitate charging and slagging operations.

Drum furnaces are available in sizes ranging from 20 tons to 2,200 tons with power ratings up to 36 megawatts.



Superheating Blast Furnace Iron with Channel Furnaces

Induction Melting and Superheating Saves Energy.

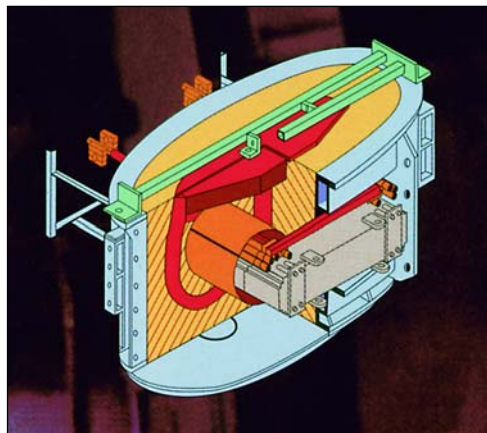
The Ajax TOCCO Magnethermic superheaters are large drum furnaces similar in appearance to conventional hot metal mixers, with multiple high power Jet-Flow™ inductors attached to the furnace body. They can be used to superheat blast furnace iron, as primary melters for cold scrap, or perform a combination of both.

Because of their size, superheaters are constructed of multiple heavy duty steel ring sections and end caps that are assembled on site. As with conventional drum furnaces, steel tires add to the structural integrity. Rotation is accomplished with hydraulic cylinders or chain drive systems, while hydraulically operated charge/slag doors facilitate operation. The superheater can receive and pour metal simultaneously.

Ajax TOCCO has supplied superheaters with capacities up to 2200 metric tons and power levels of 36 megawatts to steel making facilities worldwide. Our testing at these installations has confirmed overall efficiencies in excess of 85%.

Superheater technology has proven benefits that can be applied to the steel making industry, including the following:

- Steel scrap melting utilizes excess scrap and increases hot metal production.
- Provides the ability of increasing the temperature of molten metal for transported iron in the steel making process.
- A more continuous flow of superheated metal to the BOF of QBOP is provided, in many cases eliminating the need for alloy addition to raise temperature.
- Surplus electrical energy is more effectively used.
- High metal circulation results in an homogeneous bath, both in temperature and chemistry.



CROSS SECTION OF JET-FLOW INDUCTOR



Note: Retrofitting of existing unpowered or fuel-fired hot metal mixers with Ajax TOCCO high power Jet-Flow inductors is also possible.

Melting, Holding, Duplexing and Pouring

Metal Velocity and Temperature Rise

When power is applied to the inductor, temperature rises in the inductor channel, and is then transferred to the upper hearth. Depending on the power level, this temperature can rise very quickly and create a large differential between the metal in the channel and the metal in the main hearth. This difference can be as much as 500°F with traditional single loop and other inductor designs. The temperature differential increases chemical reactions between the melt and the refractory, and subjects the refractory to thermal shock, thus causing poor performance and shortened inductor life.

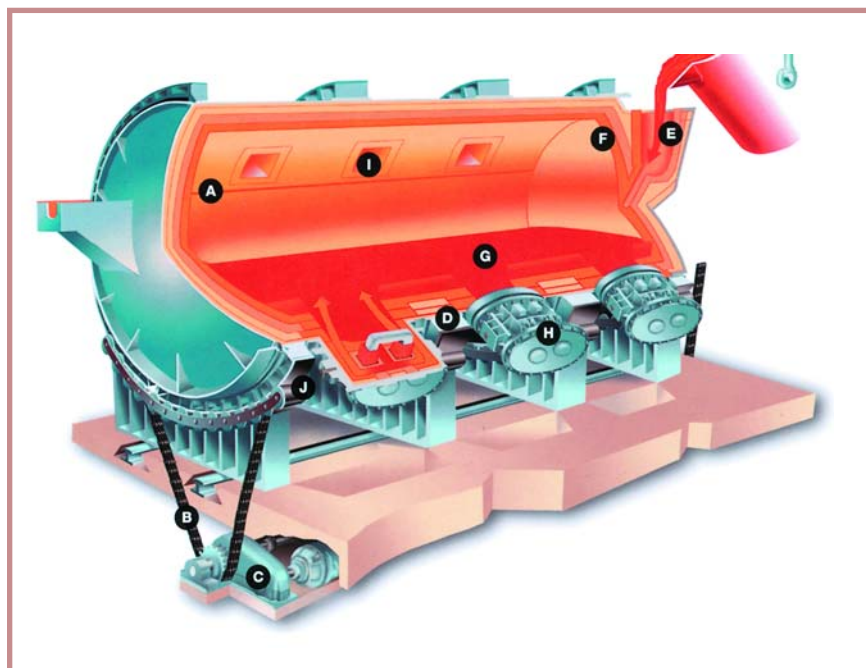
These problems are eliminated with the Ajax TOCCO Jet-Flow inductor. With Jet-Flow™, temperature differential is less than 70°F even for the highest rated inductor. As a result, Jet-Flow inductors are not subjected to extreme thermal cycling. With increased metal velocity, the temperature in the channels remain relatively constant and results in significantly increased refractory life. For example, in a 1500 kW Jet-Flow inductor operating at full power, metal uniformly flows in a jet-like action at the rate of 380 tons per hour. Stirring in the upper bath becomes more pronounced. Because of this increased stirring, metal chemistry and temperature are more homogeneous. Overall, Ajax TOCCO provides more efficient melting and improved metal quality.

Water Cooling

All Ajax TOCCO channel inductors for ferrous alloys are water cooled. Water-cooling has several distinct advantages over conventional cooling with air blowers. Water-cooling provides efficient, uniform cooling and eliminates the noise associated with blowers.

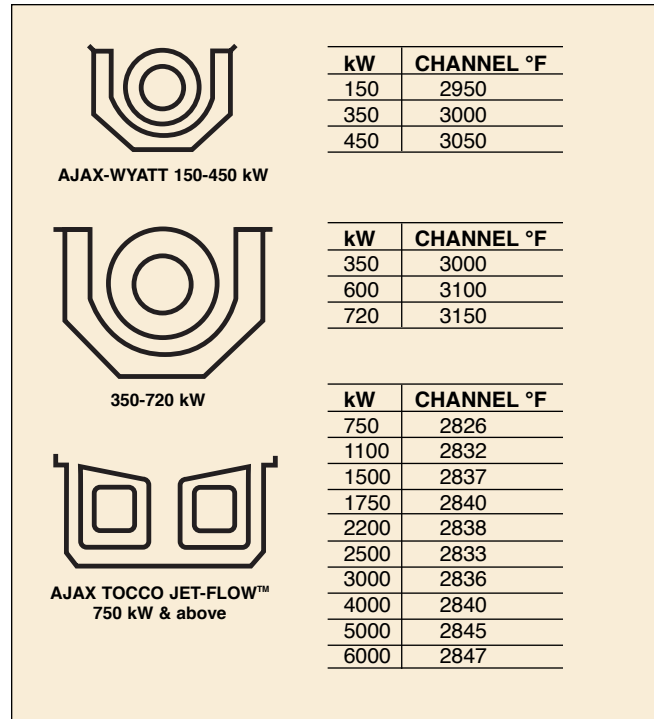
Ajax TOCCO Superheater Drum Furnace

- A. Red Line to indicate metal level.
- B. Heavy duty, triple strand drive chains on each end of furnace shell providing maximum security for rotating furnace.
- C. Electrically actuated reversible gear box chain drive for accurate pour control.
- D. Fully cylindrical, low-stressed steel shell designed for maximum refractory support.
- E. Controlled atmosphere for good refractory life achieved by submerged fill and pour spouts with close-seal access doors.
- F. High alumina pre-fired bricks with total thickness of 685mm for protracted refractory campaigns.
- G. Combined electromagnetic stirring action of six jet flow inductors ensures consistent analysis and temperature throughout the bath irrespective of metal level.
- H. Six 2.5mW Jet-Flow inductors giving total furnace electrical rating of 15mW.
- I. Three doors are provided to change scrap and remove slag.
- J. Maximum support for furnace shell is given by means of independent roller bases, which also help to ensure easy and smooth pouring.



Bath vs Channel Temperature

2800°F Bath Assumed



The above chart compares the difference between the temperature in the channel with that of the bath temperature at various kW ratings. A 2800°F bath temperature is assumed.

Ajax TOCCO is a full service company serving the world's metal casting industry.

Leader in Induction Technology

Ajax TOCCO Magnethermic, one of the oldest and most experienced manufacturers of induction melting equipment, recognizes the need to continually improve induction technology and discover better ways to utilize the induction process to serve industry. Our continued drive in induction technology and research has made us the world leader with more firsts than all other induction manufacturers combined.

Research & Development

Ajax TOCCO maintains full-time research and development teams having complete facilities for electronic and mechanical testing. Our lab features a channel furnace that is on line and operating under actual working conditions to help provide continued improvements in channel technology.

New Product Development

Through our commitment to research and development. Ajax TOCCO continually works to enhance existing technology and discover new and better methods to utilize the induction process. Ajax TOCCO works closely with their customers to develop prototype programs, feasibility studies, and often will make actual production runs.

Design Integrity

Ajax TOCCO is a leader in the development of computer control systems and designs for the induction process. Our experience enables us to provide technologically advanced systems which specifically meet our customers' present and future needs.

Technical Training

Ajax TOCCO is committed to helping its customers get the most from their investment. To achieve this, Ajax TOCCO offers extensive training programs, available to all customers. These include in-house training at Ajax TOCCO, on site schooling, web training, web troubleshooting, and a comprehensive aftermarket care program.

Worldwide Service

Ajax TOCCO customers span the world. Our customer care initiative insures that Ajax TOCCO Service Engineers worldwide are trained, experienced technicians capable of determining and handling even the most difficult of problems, many of which can be solved with telephone assistance. A Service Engineer is never more than hours away.

Convenient Repair Centers

Ajax TOCCO maintains a network of repair and service facilities strategically located throughout the U.S. A toll free telephone call will put you in touch with the Service Center and Field Engineer nearest you.

Call **1-800-547-1527**, or in Ohio, call **330-372-8511**



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