



FORGING
WITH INDUCTION
HEATING EQUIPMENT

 **INDUSTRY 4.0**
READY

HEATING

SAET IS YOUR PARTNER FOR INDUCTION FORGING SOLUTIONS

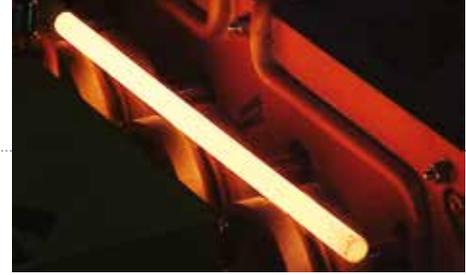
SAET TOGETHER WITH THE AJAXTOCCO MAGNETHERMIC GROUP OF COMPANIES IS A LEADING SUPPLIER OF INDUCTION HEATING AND FORGING EQUIPMENT

SAET strength derives from a heritage of excellence, the continuous strain of innovation, product solutions that include application review, process development and tooling, commissioning services to complete a full turnkey manufacturing solution. Not least, complete customer services and support networks that benefit from the resources of a global corporation.

Through close collaboration and personal attention, our group is dedicated to sharing our customers' passion and focus on their business goals.

We don't just sell equipment, we provide the right solution, furthermore we optimize your floor plan and streamline your energy consumption.

By applying our years of experience and knowledge of best practices, our customers are empowered to compete more effectively.



INDUCTION FORGING TECHNOLOGY & EQUIPMENT

INDUCTION HEATING IS EFFICIENT, EASILY CONTROLLED, USES NO ENERGY WHEN NOT HEATING, AND PUTS THE HEAT WHERE YOU WANT IT, WHEN YOU WANT IT

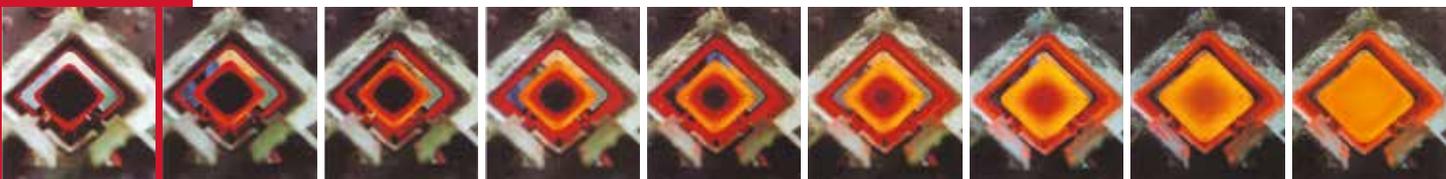
No idle time, no massive refractories to heat, and close coupling enable you to use energy in the best possible way.

Equally important is the manufacturers experience and know-how in providing the right equipment to match your overall objectives.

Our group of companies have experience that spans over 50 years and covers the heating of all metals in all shapes and sizes utilizing a wide range of advanced solid state power supplies ranging from 50 Hz to 450 kHz. The photo sequence below shows the heating process.

However, there are other determining factors which set induction heating apart from other heating methods.

Factors such as energy efficiency, labor costs, quality, automation, maintenance, scale losses, cleaning and scrap losses are some of the advantages of induction heating.



INDUCTION HEATING SYSTEMS

POWER FORGE
Featuring PowerBlock Technology

The PowerForge design integrates the entire induction system, including the water cooling system, onto a common base for a quick, efficient installation that conserves floor space. Whether you need 200 or 5000 kg per hour, heating billets or bar ends, we have over 50 years of experience to provide systems which meet your requirements for maximum efficiency.

The PowerForge is a simple and robust system for standard massive productions. A single power generator delivers the required power to the coils set in a continuous way.

FEATURES & BENEFITS

- MINIMAL FLOOR SPACE REQUIREMENT
- TURN-KEY OPERATION
- BUILT-IN HEAT STATION
- BUILT-IN POWER SUPPLY
- BUILT-IN PINCH ROLL DRIVE
- BUILT-IN EXIT CONVEYOR
- QUICK CHANGE COIL(S)

OPTIONS

- FORGEVIEW OR FORGEVIEW PLUS TECHNOLOGY
- COIL SHUTTLE
- COOLING WATER RECIRCULATING SYSTEMS
- LOADERS / FEEDERS
- PROSOLV SOFTWARE
- COIL CASSETTES
- REPLACEMENT LINERS
- WEAR RAILS

INDUFORGE
1500 kW- compact
Inductor Automatic Changeover



PowerForge induction forge heater - 2,000 kW system

POWERFORGE TECHNICAL SPECIFICATIONS

- POWER RANGE: 300 - 2400 kW
- FREQUENCY RANGE: 500 Hz - 30 kHz
- INPUT LINE VOLTAGE: 3 phase, 400 - 650 Vac



Two PowerForge 800 kW Systems



FORGING



INDUCTION HEATING SYSTEMS DYNA ZONE

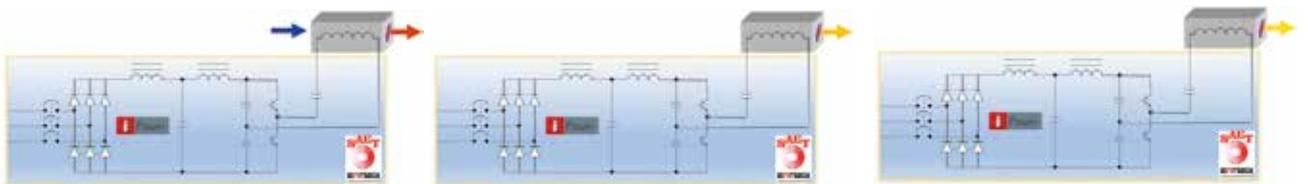
If you need an extremely flexible and efficient line, our DynaZone technology is the solution. DynaZone is a modular system for variable production rates: half bridge voltage fed inverter, series or parallel (LLC) load, 6 or 12 pulse rectifier bridge and modular structure are the main feature of SAET DynaZone. The power can be tuned and controlled independently for each heating section, changing the heating profile according to the production needs.

OPTIONS

- FORGEVIEW OR FORGEVIEW PLUS TECHNOLOGY
- COIL SHUTTLE
- COOLING WATER RECIRCULATING SYSTEMS
- LOADERS / FEEDERS
- COIL CASSETTES
- REPLACEMENT LINERS
- WEAR RAILS

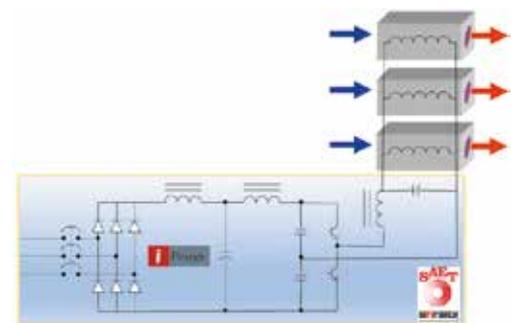
DYNAZONE TECHNICAL SPECIFICATIONS

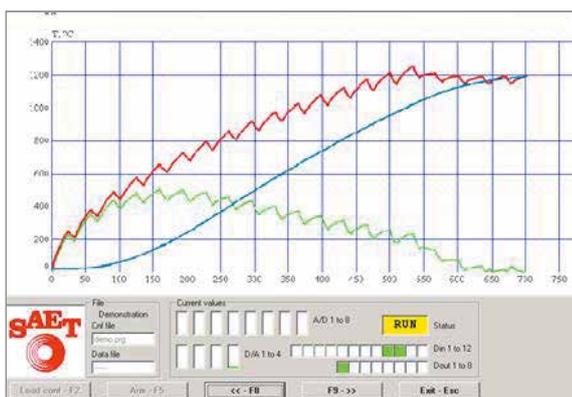
- POWER RANGE: 300 - 5000 kW
- FREQUENCY RANGE: 500 Hz - 3 kHz
- INPUT LINE VOLTAGE: 3 phase, 400 - 650 Vac



FEATURES & BENEFITS

- EASILY EXPANDABLE
- IGBT POWERBLOCK TECHNOLOGY
- MINIMAL FLOOR SPACE REQUIREMENT
- TURN-KEY OPERATION
- BUILT-IN HEAT STATION
- BUILT-IN POWER SUPPLY
- BUILT-IN PINCH ROLL DRIVE
- BUILT-IN EXIT CONVEYOR
- QUICK CHANGE COIL(S)





HMI

FORGEVIEW AND FORGEVIEW PLUS

Control and monitoring of our systems is provided through our "FORGE VIEW" control packages, which monitor and control the power supply, billet feeding system and temperature of the billets. Standard controls are PLC based, offering basic power and system monitoring. When process requirements dictate more precise control and monitoring, PC based controls can be supplied with capability to monitor and/or upgrade operating parameters via the internet, utilizing our ForgeView and ForgeView Plus technology, allowing the user to change production requirements as needed.

The ForgeView Plus System is an intelligent HMI terminal that provides the operator direct access to the induction heater's controls. With a few key strokes, the unit automatically sets up all the operating parameters for a given part.

> PART SELECTION

ForgeView Plus provides precise and rapid setup for various production operations. Once a proper operating condition has been established for a specific part, it can be saved for later recall.

> INCREMENTAL TEMPERATURE CONTROL

The ForgeView Plus System incorporates Incremental temperature Control (ITC). Final billet temperature is continually monitored and this information is used to reset the power supply output before the final billet temperature reaches either the over or under limit.

> PRODUCTION SUMMARY

The production summary screen provides a current and accumulated status for the number of billets which have been processed through the heater which includes number of rejects for under temperature conditions or the number of rejects for over temperature conditions which are not reusable and should be accounted for under a quality control program.

> MAINTENANCE SCHEDULE

Periodic maintenance schedules are established within the induction heater control system which alerts the maintenance personnel when miscellaneous actions are required based on production time or other criteria.

CONNECTIVITY - INDUSTRY 4.0

Our forging system is designed to improve the connectivity and computational power of SAET frequency converters, which is linked to. It is compliant with Industry 4.0 trends, with the following features:

- Fieldbus connection makes available the generator parameters and fault messages to PLC, NC and HMI.

- User-friendly web interface shows the generator status in real time, through Ethernet connection.
- Alarm log and basic statistics can be used for predictive maintenance or remote diagnostics.



The system can be installed on new SAET frequency converters or existing ones equipped with GINCO card. Connectivity infrastructure may be PROFINET fieldbus or wired LAN, according to the desired functions.



FORGING

STEEL HEATING

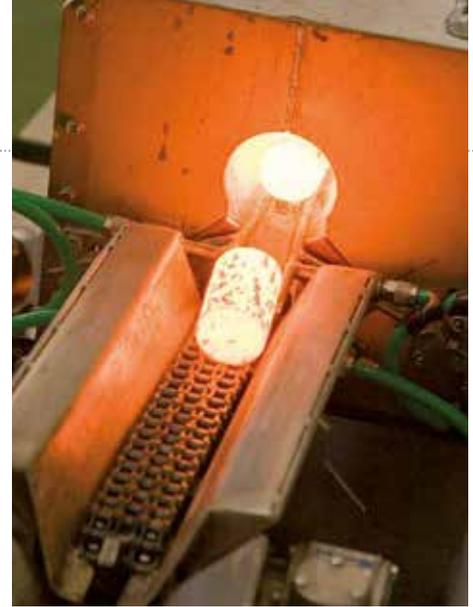
Metal forging and hot forming are excellent induction heating applications.

Billets can be transported through the inductor via a pneumatic or hydraulic pusher, pinch roller drive, tractor drive, or walking beam.

Non-contact pyrometers are used to measure the billet temperature.

When compared to conventional furnaces, induction heating machines for forging offer significant process and quality advantages:

- Much shorter heating times, minimizing scaling and oxidation
- Easy and accurate temperature control. Parts at temperatures outside specifications can be detected and removed
- No time lost waiting for the furnace to ramp up to the required temperature
- Automated induction heating machines require minimal manual labor
- Greater thermal efficiency - heat is generated in the part itself and does not need to be heated in a large chamber.
- Better working conditions compared with a fuel furnace.



Experience and know-how play an important role in recommending the right equipment to handle your heating requirements in a dependable and economical way.

Properly designed induction heating equipment offers many advantages. The difference in equipment is in its reliability and the way it is applied to solve a heating problem.

Whether your forging system demands an incremental feed, a continuous feed, or a propulsion system that keep billets separated, our group has modern, proven units in the field plus the technology to select and furnish the best equipment for the forger's needs.

A full time research and development department is also available for test heats or laboratory work.



WARM FORGING

Warm forging is a precision forging operation carried out at a temperature range between 550 - 950 °C.

It is useful to produce components with large dimensional changes and high precision.

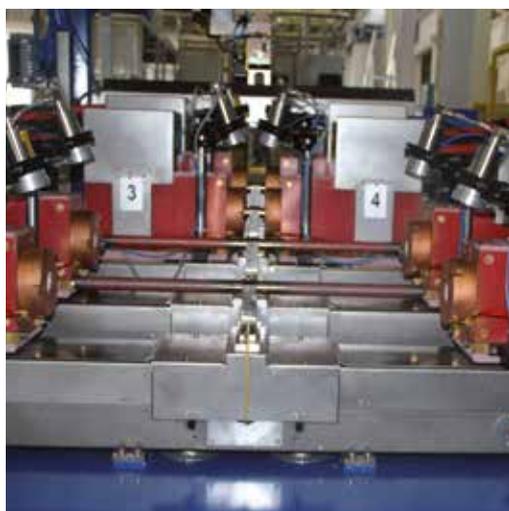
Our group has a proven experience in developing induction heating equipment prior to the first forging operation and in very demanding industry sectors as automotive.

A particular care is put in the heating parameters control and namely the temperature in terms of accuracy of measurement and possibility of tuning during the process.

The ergonomics and ease of start-up in all conditions of the induction equipment is another key design driver.

The usual configuration includes pre-heating station (when graphitiser system is necessary), followed by the heating line (single or multiple coils) and integrated with all the ancillaries devices (feeding system, extractor, pinch-roll, reject system, ...).

Most complex applications with the integration of robot cells and a very high productivity output have been also developed.



BAR HEATING

This type of induction heating machine are designed for the forging temperature of round and square billets section induction heating. Their modular conception makes the machine flexible and adaptable to the customer's needs.

Our power supply technology warrants a very high energetic performance and allows to work inside a wide range of frequencies without loss of efficiency. This heating machine consists of three sections: feeding, main equipment with generator, frame and inductor, and output section.

With a compact design, it has as main advantages:

- Smaller necessity of space.
- Compact design, transport of generator and machine in one piece.
- Absence of lost in medium frequency cables.

Within our group of companies, part of the Park Ohio organization, PMC-Colinet is specialized in the OCTG & the rail way fields. Through its 100 years of experience in those demanding markets, PMC-Colinet has designed and built several handling equipments for the tube and bar applications. PMC-Colinet covers a wide range of pipes, tubes & bars diameters from less than 0,5" to 20". All the Park Ohio companies can access this huge experience in material handling to best fit all the customers requirements.

TECHNICAL SPECIFICATIONS

- OUTPUT POWER: 50 - 5000 kW
- WORKING FREQUENCY: From 500 Hz to 30 kHz
- INPUT VOLTAGE: 3 phase, 400 - 650 Vac



FORGING



PARTIAL HEATING

In induction heating, heat can be directly generated in one specific point which is ideal for parts with localized heating requirements.

Coil designs can be optimized to heat a specific area with a desired thermal profile in a fast, efficient, and repeatable way.

Partial heating machines are designed for bar end heating in forging shops. (from screws to steering racks) The machines can be configured in both manual and automatic loading system.

TECHNICAL SPECIFICATIONS

- **POWER RANGE:** From 50 kW to 1,5 MW
- **FREQUENCY RANGE:** 500 Hz - 20 kHz
- **INPUT LINE VOLTAGE:** 3 phase, 400 - 650 Vac

SAET's experience and know-how play an important role in recommending the right equipment to handle your heating requirements. Properly designed induction heating equipment offers many advantages including cost savings through electrical efficiencies and dependability. The difference in equipment is in its reliability and the way it is applied to solve a heating problem. Whether your forging system demands an incremental feed, a continuous feed, or a propulsion system that keep billets separated, our group has modern, proven units in the field plus the technology to select and furnish the best equipment for the forger's needs. A full time research and development department is also available for test heats or laboratory work.



BRASS FORGING

Induction heating systems are widely used even in non-ferrous material industries. For example, it is applied to brass forging for fittings and components molding. The starting material used in forging is presented in the form of rounded slabs, squares billet or bar materials. After heating up the material, the forming operation is done on different types of machines: mechanical impact presses, hydraulic extrusion presses, etc.

The automation of forging by induction heating allows:

- Competitive operational costs
- Labor saving
- High productivity
- Minimization of start and stop times
- Easy adjustment, the billet temperature and cycle time can be continuously and automatically changed.

Uniform and constant temperature, an optical pyrometer controls the temperature of each billet to obtain:

- A longer life of dies
- A considerable reduction in flash
- An optimum appearance of the part surface, higher dimension accuracy of the part material saving
- High safety
- Simple handling
- Reduced maintenance costs.

TECHNICAL INFO

TYPE OF MACHINE	4ACJ	4ACL	4ACM	4ACN	4ACQ	4ACR	4ACS	
Productivity	825	1100	1375	1650	2200	2750	3300	[kg/h]
MF power	150	200	250	300	400	500	600	[kW]
Frequency	3-10							[kHz]
Power consumption	170	220	275	329	437	545	652	[kW]
Cooling water ($\Delta T = 10^\circ C$)	126	158	198	236	312	389	464	[l/min]
Parts diameter \varnothing	15-65			40-80				[mm]

MORE THAN POWER

AN INDUCTION POWER SUPPLY IS MORE THAN A RANGE OF FREQUENCIES AND POWERS FOR APPLYING INDUCTION HEATING

The right selection of a converter makes possible a long-lasting investment performing as the first day, a reliable induction process, flexibility in the application, energy savings, low maintenance and easy operation.

A power supply must allow you to focus on your business.

> WHAT TO CONSIDER?

Versatility

- Different types of power supplies depending on the need
- Customization of systems and feature development
- Wide range of usage from for very specialized process to flexible applications.

Reliability

ROBUST DESIGN AND MATERIALS

- Latest technologies and recognized brands
- Protection against short-circuits at the output of the inverter and the inductor
- Dew point detection and protection against dew. Control of the humidity.

Energy Efficiency

SERIES COMPENSATED POWER SUPPLIES

- **Advanced digital control:** depending on the frequency the system selects the best control strategy or their combination. Mandatory for heating wide range of parts.
- **Different possibilities:**
FM (Frequency Modulation)
PWM (Pulse-Width Modulation)
PDM (Pulse Density Modulation) and FM-PWM mixed
- **Efficiency (η) $\geq 90\%$**
- **Reduced impact in the facility supply network:** load independent power factor (constant $\approx 0,95$).

PARALLEL COMPENSATED POWER SUPPLIES

- **Full digital control.** Closed loop PLL to have the inverter work always at the resonant frequency, thus maximizing the efficiency
- **Easy load adaptation,** mainly in case of low frequency and high current
- **Efficiency (η) up to 96%**
- **Reduced impact in the facility supply network:** compensated power factor and harmonics reduction according to load variation for precise temperature phases.



FORGING

AFTERMARKET AND SUPPORT SERVICES

> MAINTENANCE

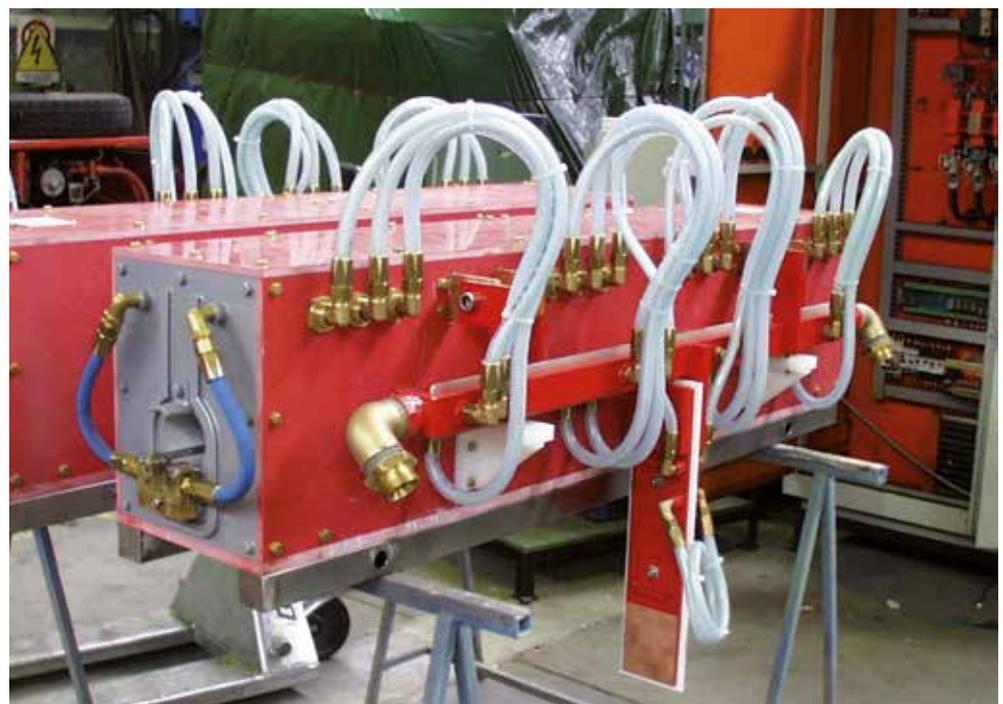
The only use of refractory in an induction system is in the coils. With the benefit of long coil life in an ATM - SAET induction system, refractory repairs and relining are greatly minimized. Die life is also extended with the drastic scale reduction.

> SPARE PARTS

Our group offer an extensive computerized inventory of factory certified replacement parts for our induction heating and melting equipment to assure quick turn around. We also offer replacement parts for all other makes of induction equipment. Our commitment to customer support means our group is available to handle emergencies any time of the day and any day of the week.

> REPAIR CENTERS

Strategically located facilities are geared to meet the repair requirements of all induction users. Our skilled workforce assures the customer's peace of mind in knowing that their job will benefit from the latest technological advances in state-of-the-art materials, components, and craftsmanship.



COMPLETE & COMPREHENSIVE SUPPORT

We have heavily invested on facilities dedicated for the sole purpose of repairing and reconditioning electronic control boards and components. Using exclusive electronic simulators that duplicate actual operating conditions we are able to pin-point problems quickly and to speed repairs. Well equipped workshop facilities provide skilled services for the repair, refurbishment and upgrade of most types of heating and melting equipment.

EUROPEAN SUPPORT

Along with providing each customer personal service, a proven process and a reliable equipment, we grant to our customers the resources of a global corporation.

A worldwide assistance is provided and specifically a strong support is offered through our European facilities:

- **FOUNDRY Service GmbH** in Hemer (Germany)
- **Ajax TOCCO Magnethermic GmbH** in Hirschhorn (Germany)
- **SAET SpA** in Leini (Italy)
- **Ajax TOCCO International** in Birmingham (UK)
- **GH** in Valencia (Spain)
- **PMC Colinet** in Le Roeulx (Belgium)

> TRAINING

Our group offer professional training by certified, experienced instructors.

Regularly scheduled schools combine classroom and hands-on training on power supply troubleshooting techniques and maintenance, safety procedures, testing, reading schematics, applications and the basics of induction.

The schools can be taught at our training facility or on-site at customer locations.

Class curriculums are customized to the customers needs and classes are held in a computer friendly training center designed specifically for this purpose.



> SERVICE

Technical assistance is available any time of the day or night using our 24 hour hot line.

Our experienced service team is strategically located to provide quick response to our customers wherever they are located.

> INSTALLATION

Installation of induction equipment performed timely and accurately is critical to the financial success of a project. Our group offer complete turn-key installation service on all equipment.

> CUSTOMER SUPPORT

Replacement power units designed to replace all makes and models. Solid State contactors designed to replace the electro-mechanical devices. Infrared imaging for locating extraordinary sources of heat in induction equipment.

Pre-packaged set of tools for equipment maintenance. MAGNE-CLEAN water system flushing service. MAGNE-FIELD electromagnetic field mapping of induction equipment.



Worldwide Service

SAET and AjaxTOCCO Magnethermic customers can benefit from the resources of a global corporation. We provide worldwide assistance through our network of regional sales and service engineers. Our experienced service team is strategically placed for quick response to customers wherever they are located.

Our commitment to customer support means that SAET and AjaxTOCCO Magnethermic are available to deal with emergencies at any location worldwide.



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