induction atos
innovative heating systems

INDUCTIVE HEATING SYSTEMS

Innovative heating solutions
for medium power applications


atos
GROUP

ATOS GROUP

We are a Group operating in more than 80 countries, with 9 production sites in Italy, China, USA and India with over 750 professionals who share the same passion for innovation, technology and creativity

We are specialists, 100% dedicated to electrohydraulics, in a constant search of innovative solutions for any application, from the industrial ones with our high-performance axis controls, to the explosion-proof line for hazardous locations and the stainless steel one for corrosive environments and fluids

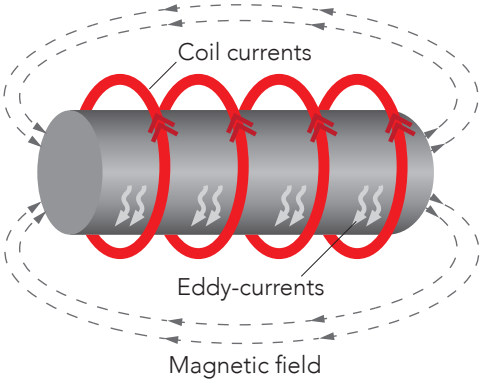
ATOS INDUCTION

Atos Induction is the Atos Group company specialized in medium power inductive heating systems.

The range of patented products is the result of intensive research and development activities on providing industrial heating solutions designed to increase productivity and energy efficiency, reducing operating and maintenance costs.

TECHNOLOGY

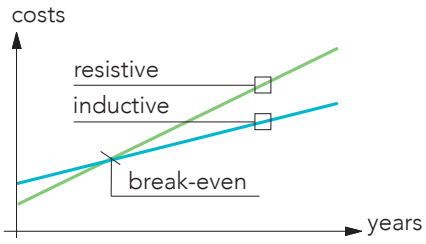
The production of heat with inductive technology is based on the application of a variable magnetic field to a ferromagnetic material, which generates eddy-currents on the surface of the material to be heated.



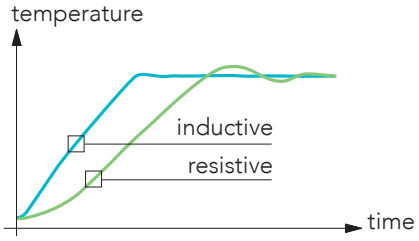
BENEFITS OF INDUCTIVE HEATING

Atos Induction has exploited this physical phenomenon to create innovative heating solutions, offering numerous advantages over traditional resistive systems:

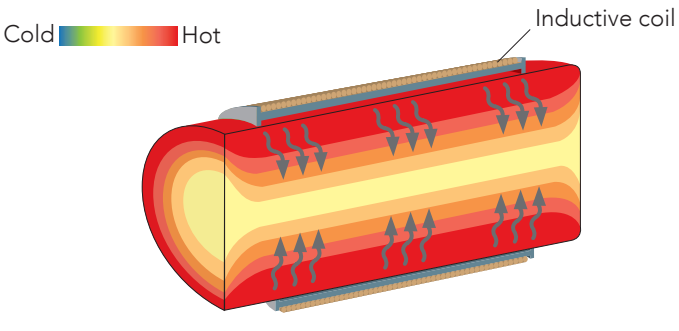
- **Energy savings** up to 25% with estimated return on investment in less than 2 years
- **Minimal heat dissipation** towards the external environment, guaranteed by an optimal insulation of the heating elements
- **Faster heating** due to high specific power and more efficient heat transfer to the material
- **Maximum heating uniformity** achieved by generating heat directly inside the material
- **High precision of temperature control**, thanks to the low thermal inertia of the inductive system
- **Long operating life** and reduced thermal stresses of the heating elements



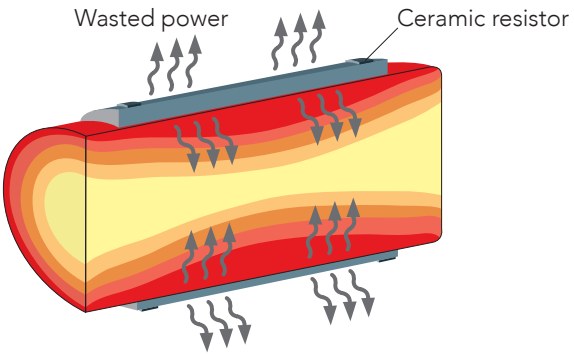
Return on investment



Heating performance comparison



Heat generated by induction



Heat transmitted by conduction

PRODUCT RANGE

CHC COILS & EPG GENERATORS

PLASTICIZING SYSTEMS

CHC coils, powered by **EPG generators**, are designed to heat plasticizing barrels of extruders, injection molding and blow molding machines.

These solutions increase performance, in terms of speed and precision of thermoregulation, minimizing energy consumption.

CHC

EPG

ECT

MHB

MHB BLANKETS & ECT TROLLEYS

MOLDS PRE-HEATING

MHB blankets, powered by **ECT control trolleys**, are the ideal solution to quickly and safely preheat the molds of metal and rubber presses.

Preheating operations can be carried out directly on the machine, without the need to move the molds.

FIH UNITS

FLUIDS HEATING

The innovative **FIH fluid heaters** exploit magnetic induction to heat ferromagnetic elements positioned inside the system, in direct contact with the fluid.

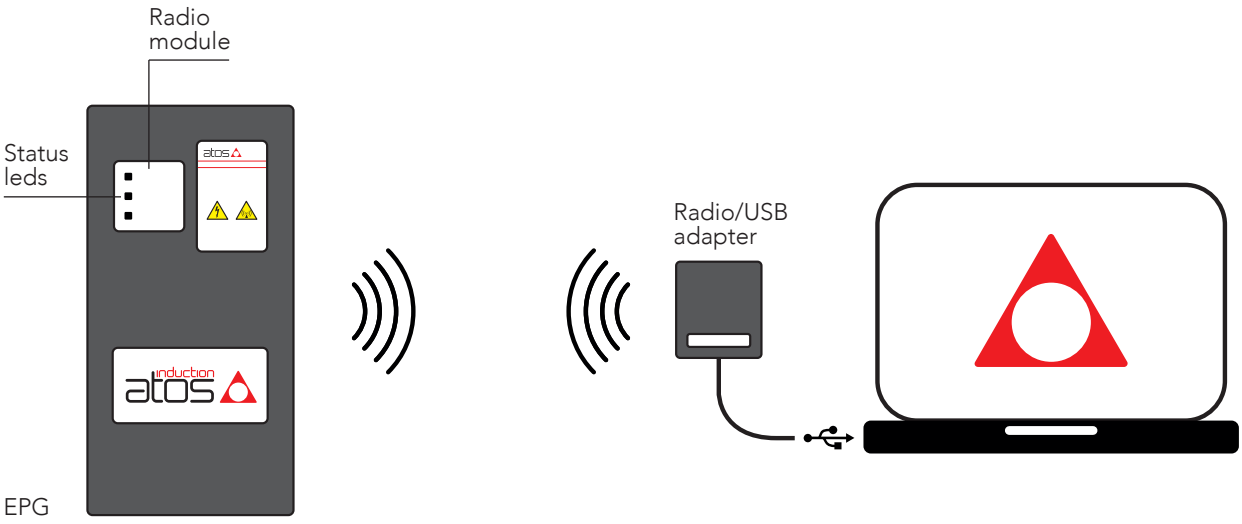
These systems allow precise, fast, and homogeneous fluid temperature control in any hydraulic system.

FIH

EPG GENERATORS

EPG power electronic generators supply the coil with an amplitude and frequency modulated current according to the characteristics of the ferromagnetic material to be heated, in order to optimize the performance of inductive heating.

- **Plug & play solution**, designed for an easy integration in common industrial electrical panel
- **Maximum efficiency** in every working condition thanks to the self-adaptive control of the current
- **Power output up to 15 kW** for each coil
- Full compatibility with **timed or thermoregulated control logic**
- **Real-time diagnostics** of the operating status
- **Dedicated software** that allows to remotely monitor functional parameters and system alarms



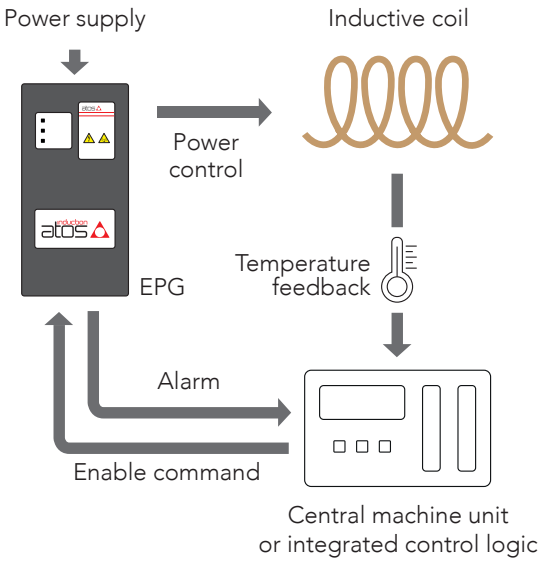
The wireless communication between **EPG** generators and PC is performed by special radio modules, up to 150 meters in open field.

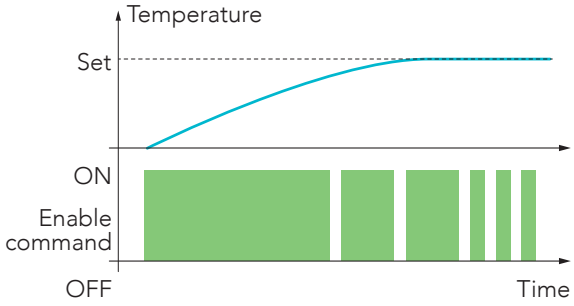
CONTROL LOGICS

The Atos Induction systems allow easy integration in both new and existing machines, using the same control logic of traditional resistive systems.

THERMOREGULATED

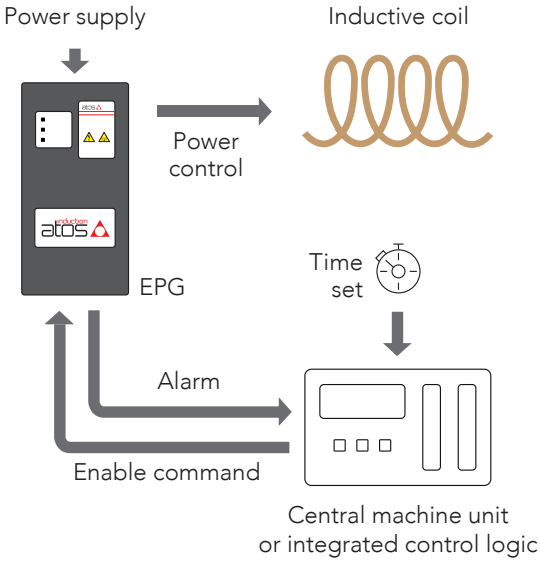
In plasticizing systems, temperature feedback is processed by the machine's electronic control unit by enabling/disabling the heating control in order to maintain a precise and repeatable working temperature. In mold and fluid heating solutions this control is directly integrated in the supplied system.

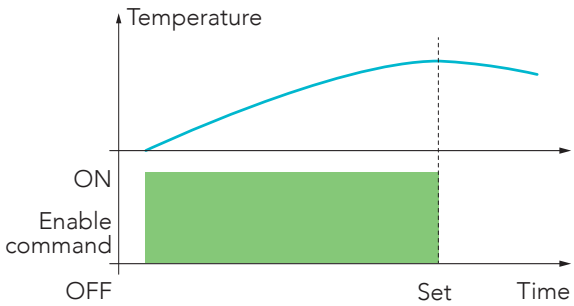




TIMED

This control is obtained by enabling the generator for a pre-set time interval and is suitable for applications where a precise thermoregulation is not required. The temperature reached at the end of the cycle is estimated by the user according to the heating time.

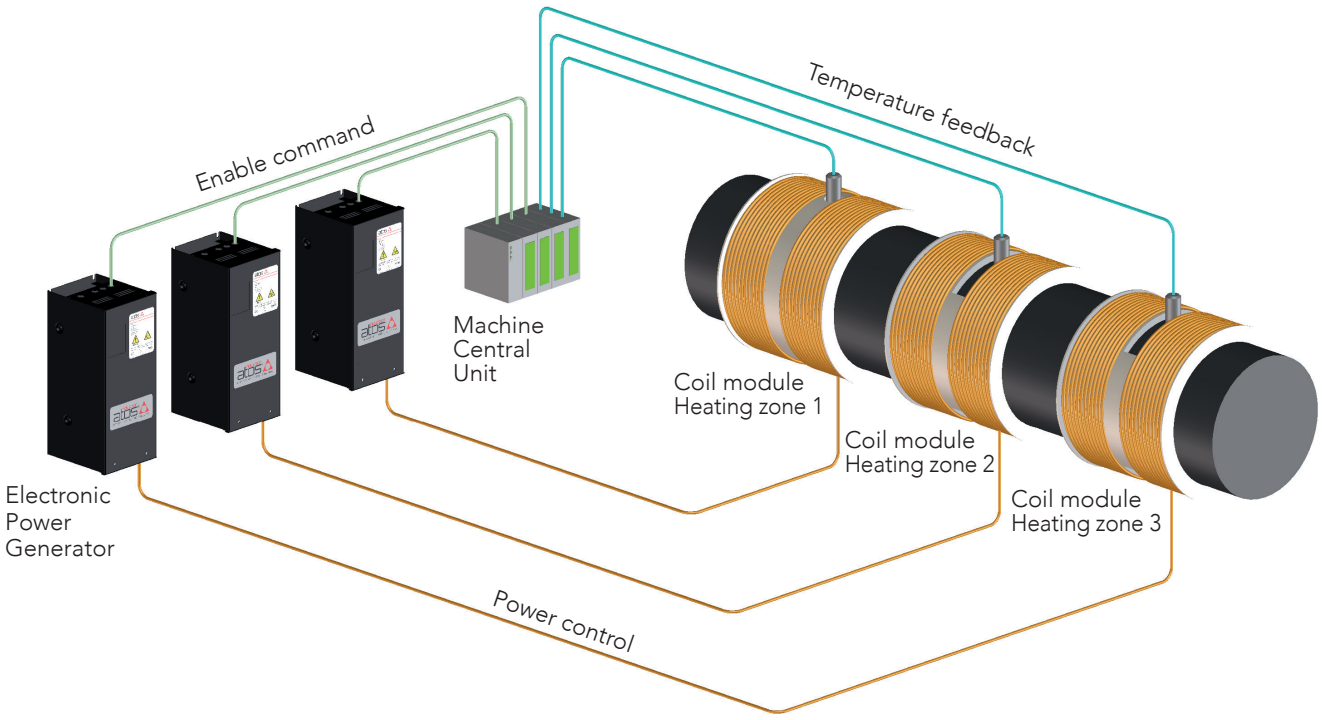




CHC COILS & EPG GENERATORS

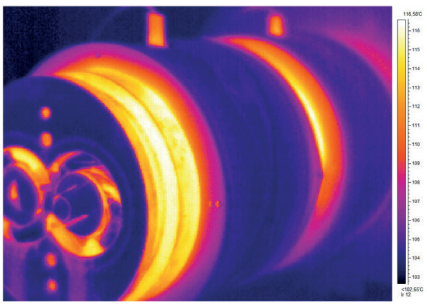
CHC coils are designed to maximize the heating performance of plasticizing barrels, especially extruders, injection molding and blow molding machines.

Plasticizing heating systems consist of one or more coils, depending on the number of barrels zones to be heated. Each coil is powered by an **EPG electronic power generator**.
The thermoregulation logic is managed by the machine central unit, using the temperature feedback of the single zone to enable or disable the relevant **EPG** generator.



Main advantages over traditional resistive heating systems:

- **High energy saving** and less heat dissipation - efficiency over 90%
- **Uniform heat distribution** and reduce coil surface temperature
- **Fast heating** up to 250 °C
- **High precision in temperature regulation**, thanks to instantaneous start/stop of heat transfer to the barrel
- **Immediate integration** with the control logics adopted for resistive systems
- **Low maintenance** and long service life



CHC COILS

CHC coils are available in different combinations of diameters and lengths, depending on the size of the element to be heated and the power required.

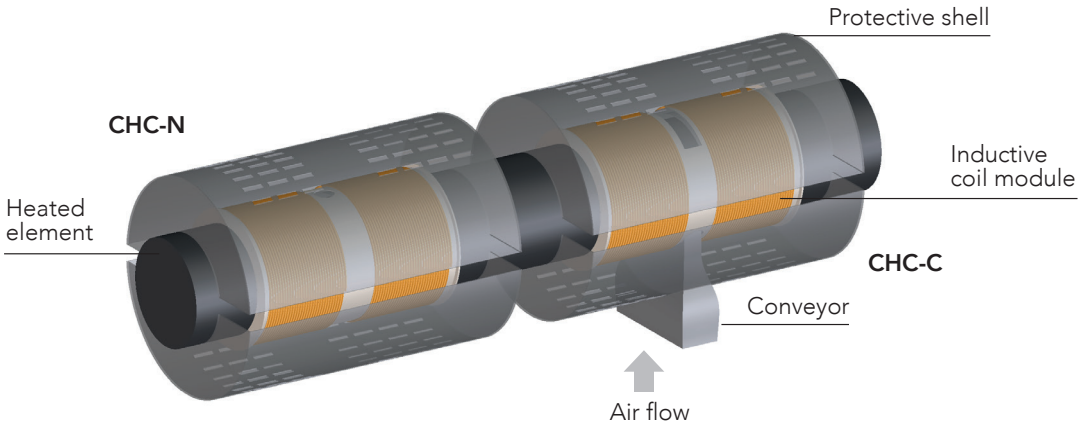
The modular construction technology of the coils allows an easy installation both on new machines and for the retrofit of existing machines.

Standard coils are available with diameters from 80 mm to 400 mm, larger diameters on request.

CHC-N EXECUTION

CHC-N uncooled coils are designed for temperature sensor installation and are suitable for those zones of the plasticizing barrel that do not require cooling.

The coil is wound on highly insulating materials to minimize heat loss from the barrel to the environment.



CHC-C EXECUTION

CHC-C cooled coils are provided with openings for airflow and temperature sensor installation.

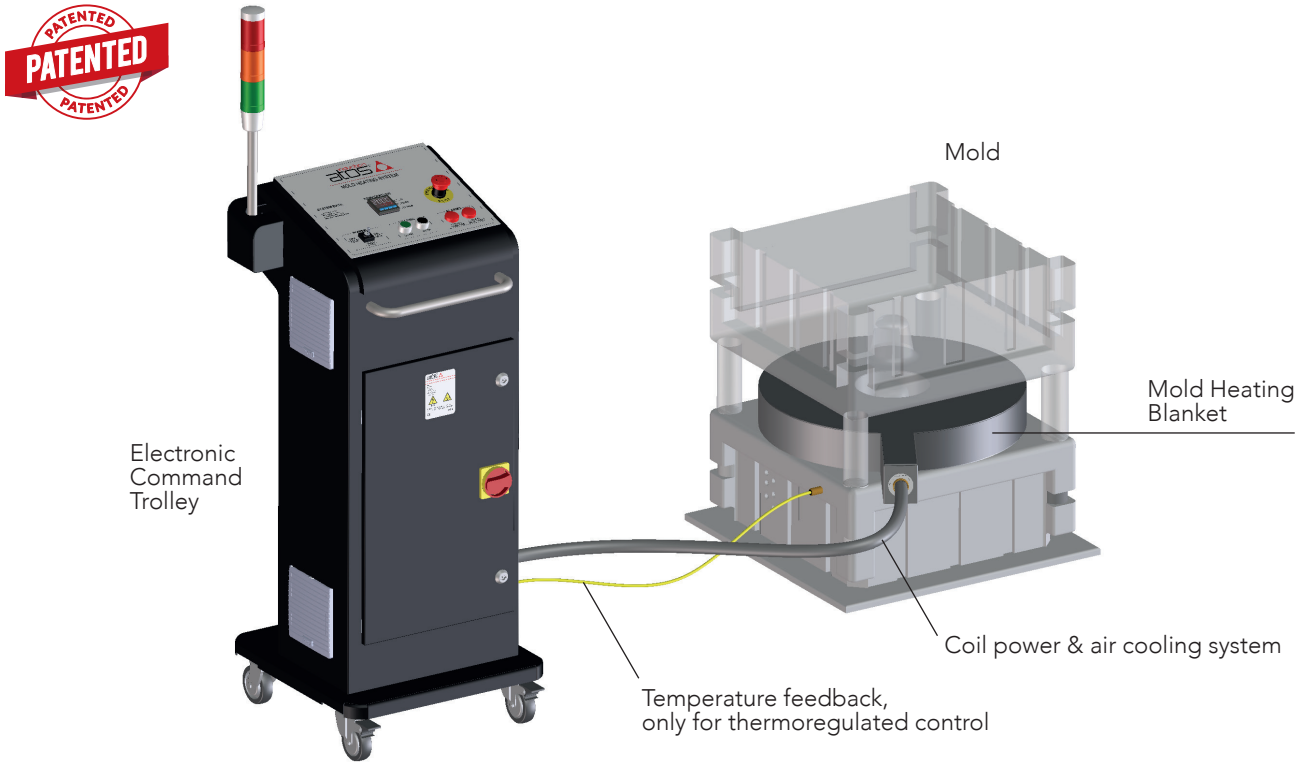
The special internal structure allows cooling air to be conveyed directly onto the plasticizing barrel, guaranteeing faster cooling than resistive systems.

MHB BLANKETS & ECT TROLLEYS

The system is composed by a **heating blanket MHB** and an **electronic control trolley ECT** which integrates the control logic and the **EPG** power generator.

The **MHB** blankets are covered with a high temperature resistant fabric, and a flat coil is installed inside protected by a semi-rigid shell, in order to easily fit the surface of the mold and heat it up to **300°C**.

The standard dimensions of the **MHB** blankets are from 400 mm up to 800 mm diameter, other dimensions are available on request.



The **ECT** control trolley is a plug & play system, designed to allow an easy connection with the heating blanket. It does not require any specific knowledge from the user, as it automatically recognizes the connected blanket.

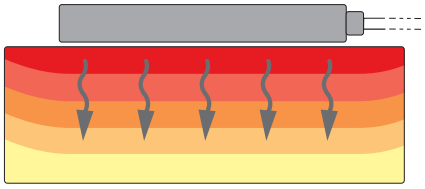
Simply select the blanket to be used according to the size of the mold and connect it to the trolley.

MOLDS PRE-HEATING

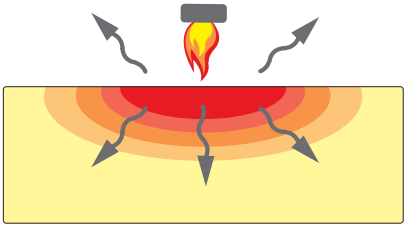
BENEFITS

The most common molds preheating methods require continuous supervision of specialised personnel, in addition they have several safety disadvantages:

- **Induction furnaces** require the risky handling of heavy & hot molds from the furnaces. Besides, induction furnaces are bulky and very expensive.
- **Open flame burners** present enormous dangers related to the use of combustible gases in indoor environments.



Inductive blanket

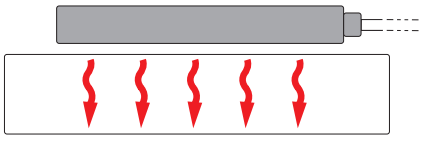


Open flames

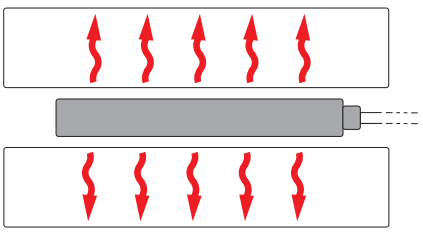
The solution proposed by Atos Induction overcomes all these disadvantages through the safe use of inductive heating blankets, which allow easy installation.

Simply place the blanket in contact with the surface of the mold and start heating it.

MHB blankets are available in two versions to heat a half-shell at a time or two halves simultaneously.



Single stage execution



Double stage execution

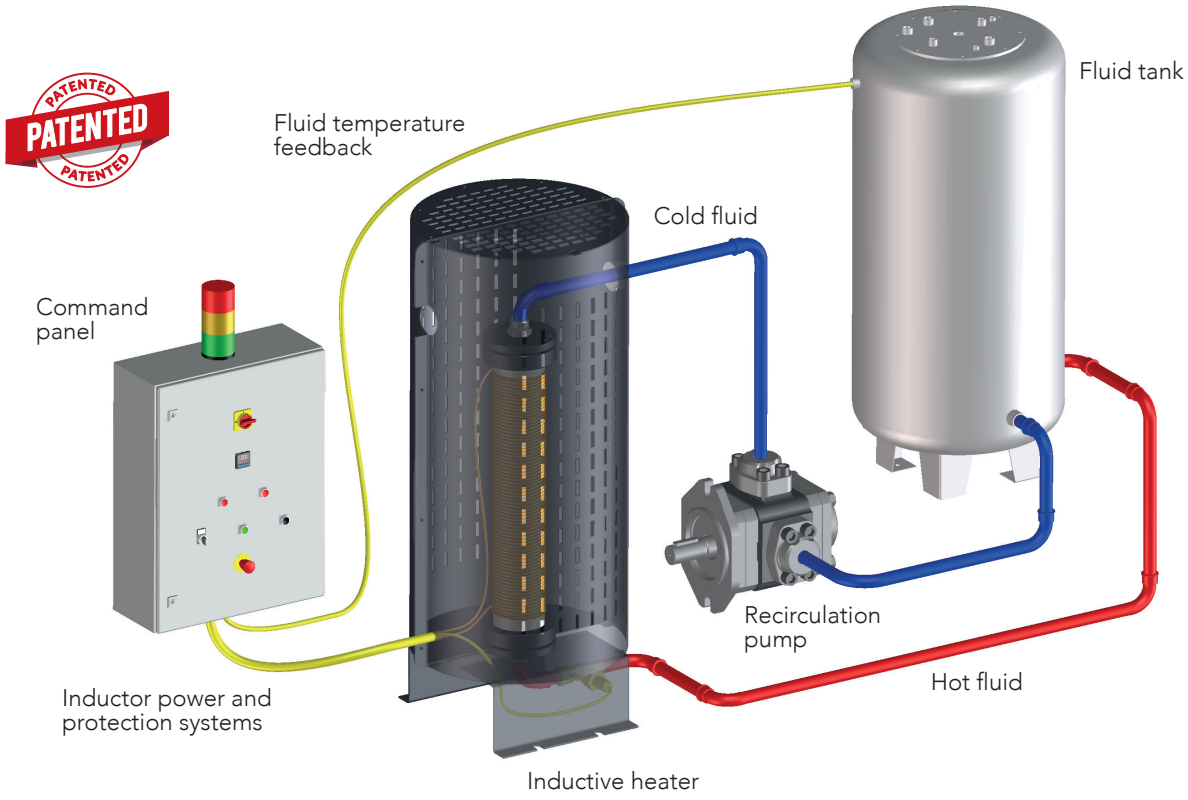
Main advantages over traditional systems:

- **Reduced heating time**, thanks to induction high efficiency
- **Automatic timed or thermoregulated control** of heating processes, without the need of an operator supervision
- **Easy to use**, simply place the blanket in contact with the mold
- **Maximum safety** during heating operations, eliminating the use of combustible gases and open flames

FIH UNITS

FIH hydraulic fluid induction heaters are innovative systems for rapid and precise heating of mineral and synthetic oils in industrial processes; for example, preheating of oil in hydraulic machines and systems.

The heater consists of an inductor, which exploits magnetic induction to heat internal ferromagnetic elements in direct contact with the fluid, and a control panel, which integrates the control logic and the **EPG** generator.



The main advantages over traditional systems are:

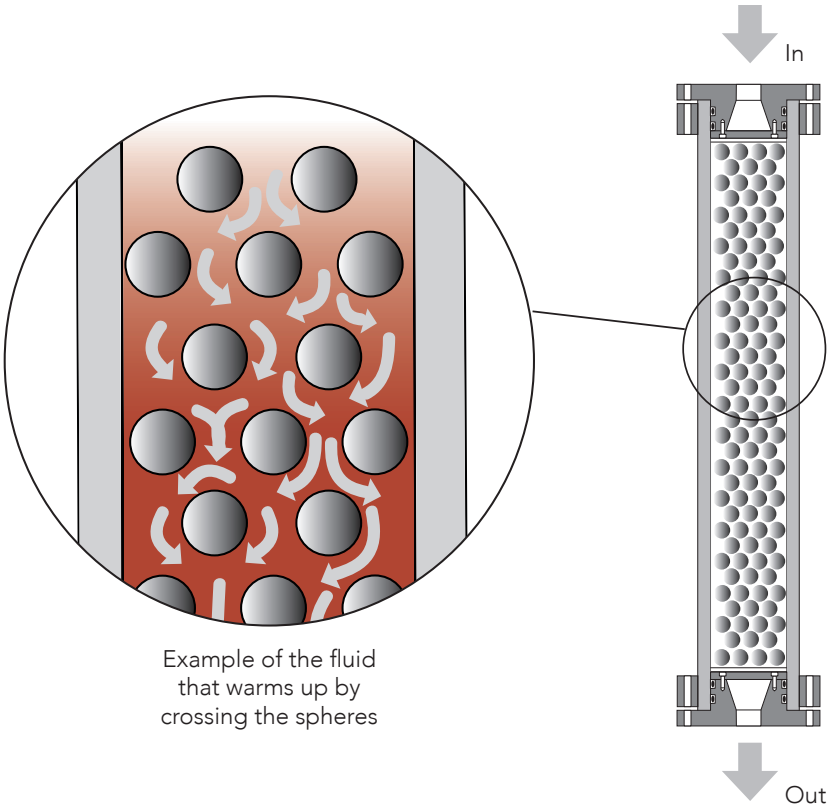
- **Reduced energy consumption** and more efficient heat transmission
- **Reduced heating time** due to high heat exchanged per unit volume
- **Uniform heat distribution** within the fluid up to 60°C, avoiding dangerous localized overheating
- Possible **integration in off-line filtration circuits**
- **High reliability** and long life service

FUNCTIONAL DESCRIPTION

The cylindrical inductor is filled with ferromagnetic spheres in direct contact with the fluid.

When the inductor is powered, the magnetic field heats the spheres by the induction effect.

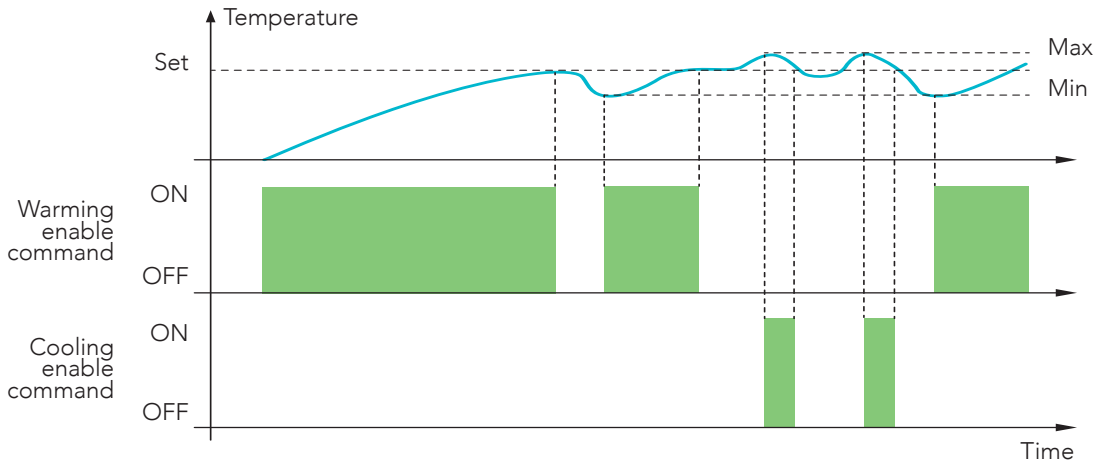
The fluid is therefore heated by flowing through the hot spheres, obtaining a uniform heat distribution.



Example of the fluid that warms up by crossing the spheres

The control logic, integrated in the control panel, performs a closed-loop control of the fluid temperature, modulating the command to the **EPG** generator that powers the inductor.

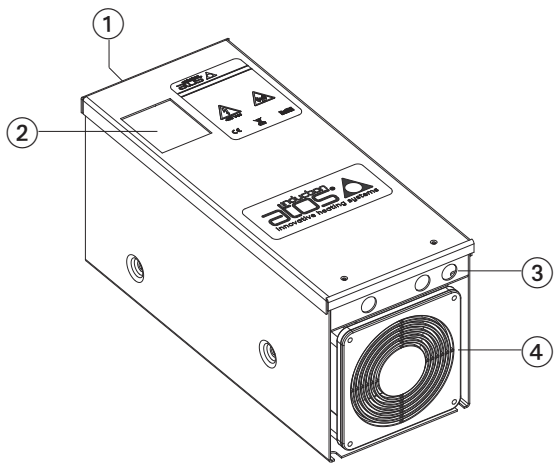
A dedicated digital output is also available for the activation of an external cooling system, in order to have a complete control of the fluid temperature.



TECHNICAL TABLES

Electronic power generators

for induction heating elements



① Power supply cables inlet
② Internal LEDs for diagnostics
③ Connection cable inlet for heating element and signals
④ Cooling fan

EPG-L

EPG

Electronic power generators designed to supply the Atos Induction inductive heating elements. They allow heating and temperature control of plasticising barrels, molds, and fluids more rapidly and efficiently than conventional systems, such as electric resistors or open-flame burners. It is possible to perform heating cycles according to commonly used control logic:

- Time control for rapid heating based on a predefined time
- Thermoregulated control for precise closed-loop temperature control

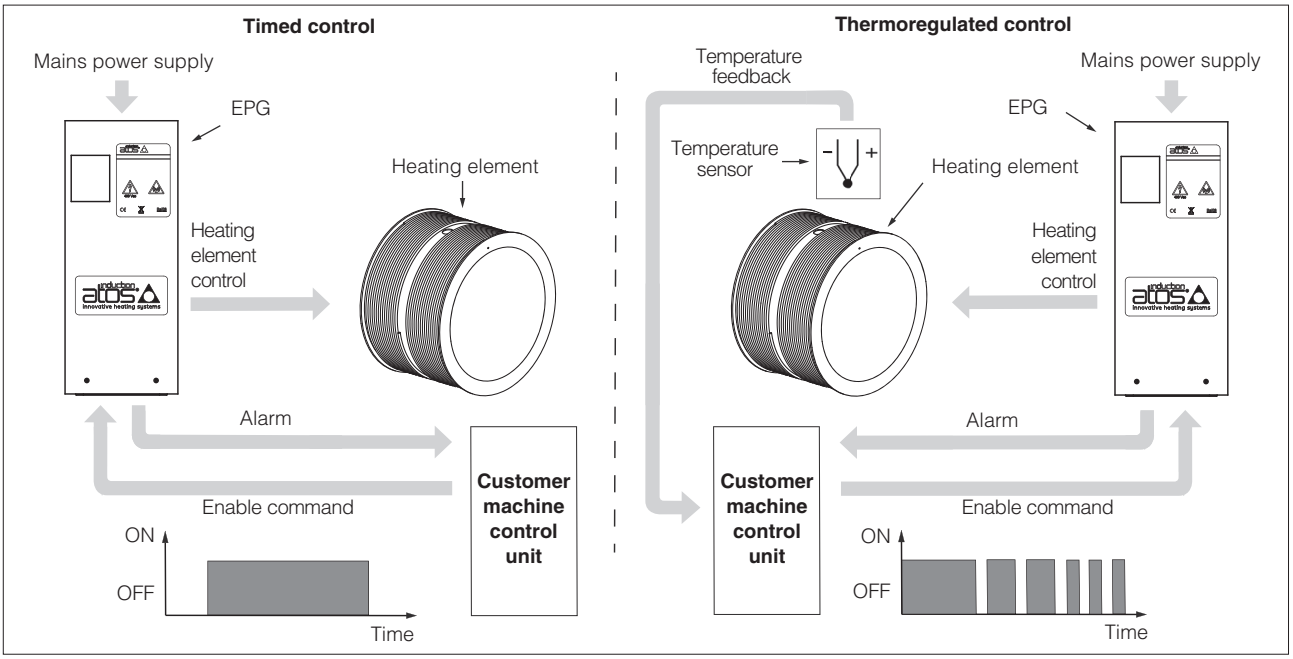
EPG generators must be interfaced with the customer machine control unit (for enable and alarm signals) and installed inside electrical cabinets.
In addition, generators can be equipped with ECD-TS transceiver for data transmission to a PC.

1 MODEL CODE

EPG	-	L	/	T400VAC	-	P	-	*	/	*
Electronic power generator		**Size (1)** **L** = 6 kW **M** = 10 kW **H** = 15 kW		**Power supply (2)** **T400VAC** for 380-400VAC - 50/60Hz three-phase **T460VAC** for 440-460VAC - 50/60Hz three-phase		**Transceiver option** **P** = Prepared for the installation of the transceiver **(3)** **T** = Transceiver installed **(4)**		Series number		Setting (factory setup code)

(1) To be selected according to the heating element to be connected
(2) For different supply voltages, please contact Atos Induction's technical department
(3) The generator is ready for any subsequent installation of the ECD-TS transceiver (not included with the generator) by the customer
(4) The ECD-TS transceiver is already installed inside the generator
Note: For data transmission to PC are required the ECD-RV radio/USB converter and the ECD-SW software (not included). See section 7.2

2 FUNCTIONAL EXAMPLE



3 FUNCTIONAL DESCRIPTION

EPG electronic power generators are designed to supply Atos Induction heating elements with amplitude and frequency modulated currents. They generate magnetic fields capable of heating elements composed of ferromagnetic materials (e.g., plasticising barrels, moulds, etc.).

The system automatically detects the electrical resonance frequency, characteristic of the magnetic coupling between the heating element and the element to be heated, modulating the output current around this value to reduce electrical transmission losses and increase process efficiency.

The generators are designed to receive an ON/OFF command from the customer machine control unit. The command is used to enable or disable the heating element power supply, and can be actuated via dry contact (relay) or 0 - 30 VDC voltage signal; see section 4.2. This allows the execution of the temperature control logics commonly used:

a) Timed control

The machine control unit triggers the enable command of the EPG generator for a predefined time (by means of the control unit's internal timer) necessary to reach the desired temperature. In this condition, the generator provides constant power for the entire set time interval, and at its end the control unit turns OFF the enable command to stop the heating process. The heating time is defined by the user according to the application requirements.

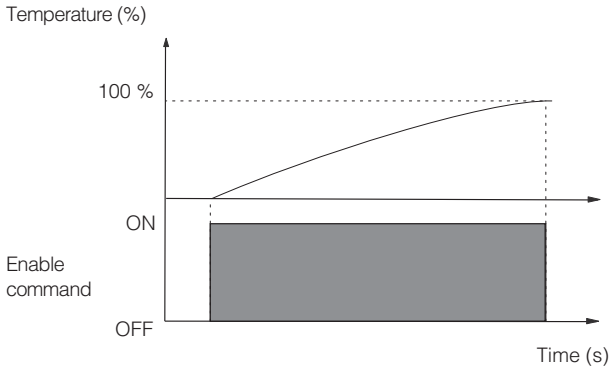
b) Thermoregulated control

Through ON/OFF modulation of the enable signal, the machine control unit precisely regulates the temperature in closed-loop control.

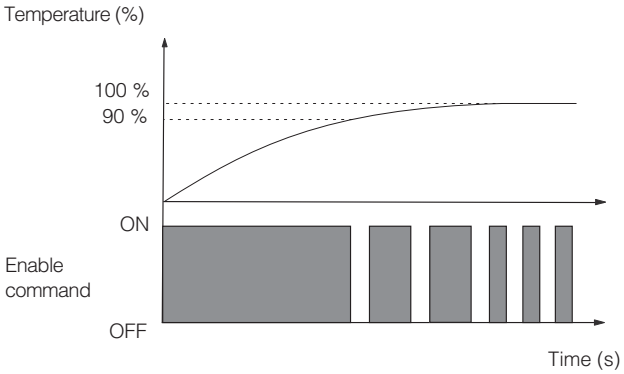
This control logic requires the installation of a sensor (thermocouple type K or similar) to measure the real temperature of the heated zone. The sensor output signal is sent to the machine control unit that compares the value with the set reference temperature. Normally, at the beginning of the heating cycle, the enable command is maintained active until approximately 90% of the desired temperature is reached. Subsequently, the machine unit, through the continuous ON/OFF switching of the enabling command, allows to reach the desired temperature. This control logic guarantees high precision in temperature achievement and maintenance, eliminating possible thermal drifts.

The following diagrams show the timed and thermoregulated control logics.

Timed control



Thermoregulated control



4 POWER SUPPLY AND CONTROL SPECIFICATIONS

4.1 Power supply

The EPG power generator is available in two executions:
Code T400VAC: suitable for mains power supply 3x400 ±10% VAC 50 or 60 Hz.
Code T460VAC: suitable for mains power supply 3x460 ±10% VAC 50 or 60 Hz.
See installation prescriptions in section 9.

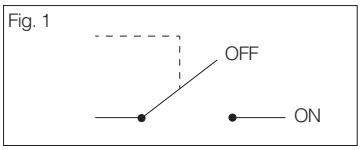
4.2 Heating enable command

The enable command is an ON/OFF signal provided by the machine control unit to start or stop the power supply to the heating elements. This command can be a dry contact (a) or a 0-30 VDC voltage command (b).

a) Generator enabling via dry contact - see fig. 1

It is a voltage free ON/OFF signal, normally provided by a relay included in the machine control, or installed by the user.
With CLOSED relay (ON), the generator supplies the heating element.
With OPEN relay (OFF), the generator does not supply the heating element.
The contact is electrically isolated.

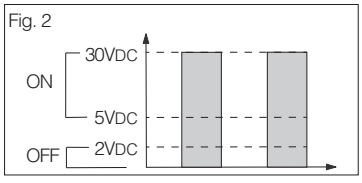
Fig. 1



b) Generator enabling via voltage command - see fig. 2

This is a voltage input in the range 0-30 VDC.
With command input > 5 VDC, up to 30 VDC max (ON), the generator supplies the heating element.
With command input from 0 VDC to 2 VDC (OFF), the generator does not supply the heating element.
For inputs from 2 VDC to 5 VDC the operating state of the generator cannot be defined.
For correct operation, the polarity of the cables must be observed as indicated in the section 8. The contact is protected from the reversed polarity and electrically isolated.

Fig. 2



⚠ The two commands (volt-free or voltage) must not be used at the same time.

5 MAIN CHARACTERISTICS

Model			EPG-L		EPG-M		EPG-H	
Power supply			3x400 ±10% VAC or 3x460 ±10% VAC					
Max power		[kW]	6 ±15%		10 ±15%		15 ±15%	
Frequency		[Hz]	50 - 60					
Max absorbed current (±5%)		[A]	T400VAC	T460VAC	T400VAC	T460VAC	T400VAC	T460VAC
			9,1	7,9	15,2	13,2	22,8	19,8
Power factor (cos ϕ)			0,95					
Efficiency			98,60%					
Output	Peak voltage	[V]	1200					
	Peak current	[A]	55		85		95	
	Frequency	[kHz]	7 - 12		5 - 11		4 - 10	
Enable command	Volt-free	Open	Heating OFF					
		Closed	Heating ON					
	Voltage		0VDC ÷ 2VDC heating OFF					
			5VDC ÷ 30VDC heating ON					
Alarm contact		Open	Generator not powered or generator in alarm condition					
		Closed	Normal functioning, see section 7.1 for details					
IP protection degree [CEI EN 605229]			IP 10					
Compliance			EC Declaration of Conformity valid in accordance with the directives: EMC 2014/30/UE (EN 61000-6-2; EN 61000-6-4); Low Voltage 2014/35/UE (EN 60519-1; EN 60519-3); RoHS 2011/65/UE; REACH (CE n° 1907/2006)					

6 INSTALLATION REQUIREMENTS

Assembly position		Vertical with fan down (recommended) or horizontal		
Electrical cabinet requirements		Electric cabinet minimum protection IP54, with forced ventilation		
Heat dissipated by each generator [W]		EPG-L	EPG-M	EPG-H
		90	150	180
Electrical protections		Following protections must be provided by the customer: - Residual current circuit breaker for protection against leakage currents - Fuses for protection against overloads and short circuits See section 9 for details		
Recommended fuses (for T400VAC and T460VAC)	Fuse type	gG 500V 10x38 120kA		
	Current	10A	25A	25A
Ambient temperature range		0°C ÷ +40°C		
Ambient humidity range		30% ÷ 60%		

7 DIAGNOSTICS

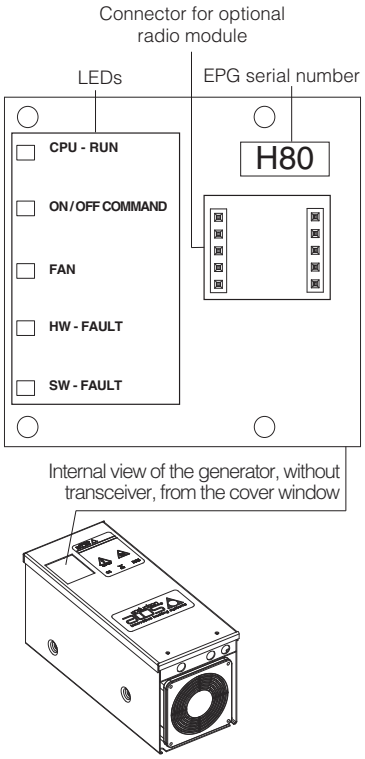
The EPG generator is provided with internal diagnostics permitting the real time monitoring of generator and heating element status. Eventual failures are immediately identified by means of diagnostic LEDs and an alarm switch.

LED	LED COLOUR	STATUS
CPU - RUN	Green	LED ON - Generator powered
ON / OFF	Green	LED ON - Heating element powered
FAN	Yellow	LED ON - Cooling fan working
HW-FAULT **(1)**	Red	LED ON - Hardware fault
SW-FAULT **(2)**	Red	LED ON - Software fault

In case of a HW or SW fault, the power supply to the heating element is immediately interrupted.

(1) The HW-FAULT LED indicates serious faults that cannot be solved by the user. In these cases contact Atos Induction technical service. In the event of HW alarm, the HW-FAULT LED and the SW-FAULT LED light up simultaneously while the CPU-RUN LED starts flashing.

(2) The SW-FAULT LED indicates minor faults which can be reset sending a new enable command to the generator. In the event of SW alarm, the SW-FAULT LED lights up and the CPU-RUN LED starts flashing. If the alarm persists after repeated enable commands, contact Atos Induction Technical Service.



7.1 Alarm switch

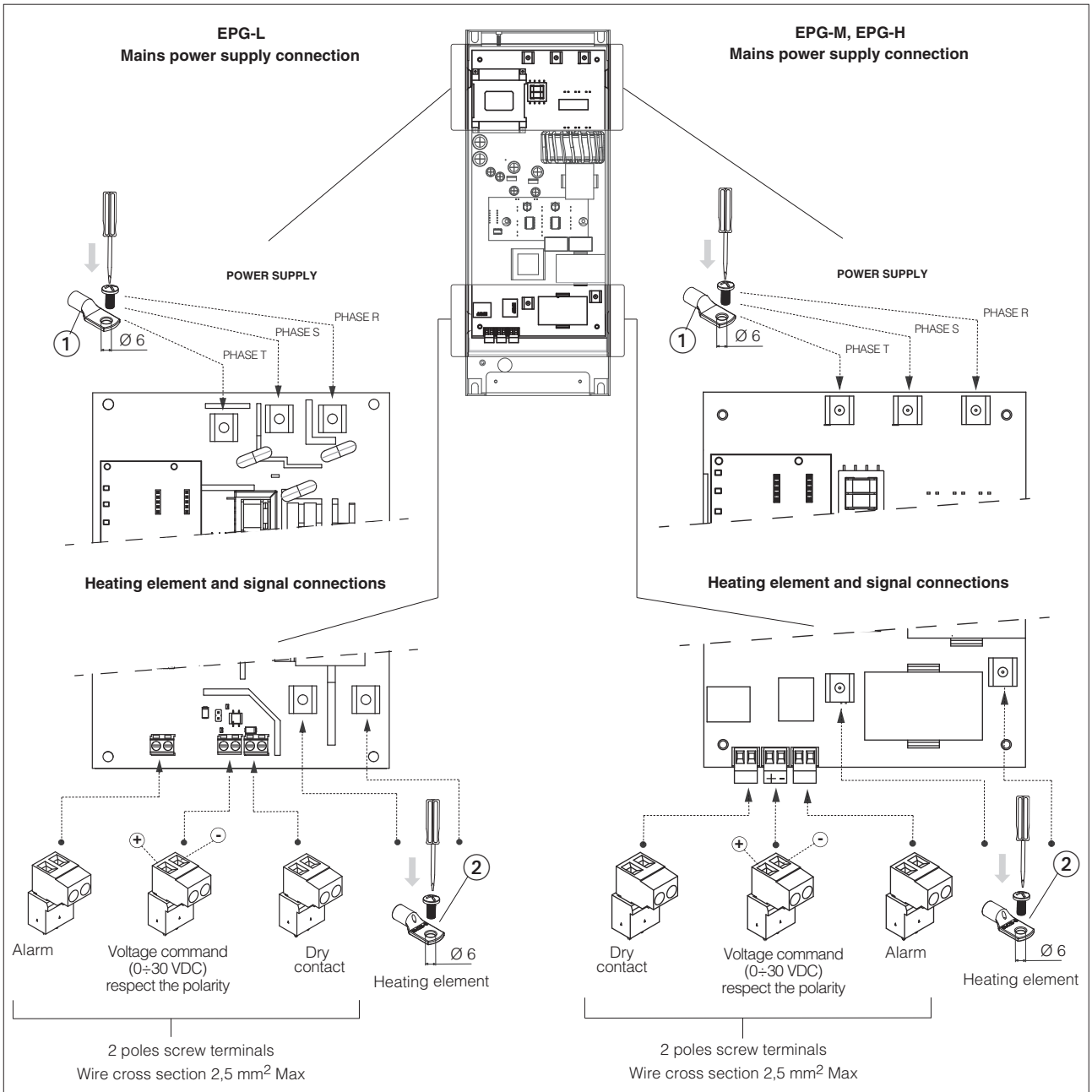
It is a voltage free ON/OFF contact, provided by a generator internal relay, used to monitor eventual failures.
The CLOSED contact indicates the normal generator functioning.
The OPEN contact indicates the generator alarm condition.
If the generator is not powered, the alarm contact is OPEN.
When the generator is powered the contact is CLOSED, on start-up the contact closes after 5 seconds from the moment when the generator is powered.
If a failure of the generator or heating element is detected, the contact opens.

⚠ If the heating element is not properly connected or coupled with the item to be heated, the SW-FAULT LED lights up and the alarm switch opens.

7.2 Connection with PC

The ECD-TS transceiver permits the transmission of generator diagnostics information (operating status and alarms) to a computer. It is necessary to use the ECD-RV radio/USB converter and the associated ECD-SW software to establish a communication with the PC. The radio/USB converter can communicate with multiple generators equipped with transceiver, but not simultaneously. See tech. tab. AI110.

8 **CONNECTIONS** view from top without the cover

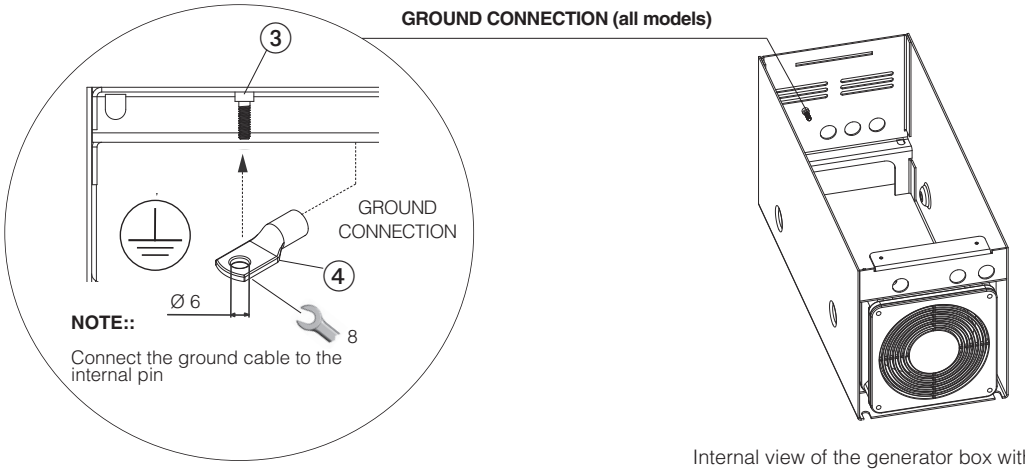


(1) Ring cable lugs not included with generator; screws included with generator

(2) Ring cable lugs included with heating element cable; screws included with generator

(3) Ground pin with two hex nuts included

(4) Ring cable lug not included with generator;



9 INSTALLATION AND ELECTRICAL PROTECTION PRESCRIPTIONS see also manual E-MAN-EPG

Connection to the power grid

Install a three-phase residual current circuit breaker (to be sized by user) at the mains junction. Install a three-phase fuse holder in series with the residual current circuit breaker, and connect the fuse holder to the generator through unipolar flame retardant cables; see section 6 for fuses type.

The operations described above must be carried out in accordance with the applicable safety and industrial systems requirements of the country of installation.

Cables shall have a minimum size of:

- 2,5 mm^2 for generator EPG-L
- 6 mm^2 for generator EPG-M
- 10 mm^2 for generator EPG-H

The power supply cables must be terminated with ring cable lugs with a 6 mm hole. They have to be connected to screw terminals located inside the generator box, see section 8.

In case of multiple generators, each generator must be individually protected with the appropriate electrical protections, see Figure 3.

Ground connection

Connect the ground cable to the dedicated pin inside the generator box.

The ground cable shall be the same size as the power cables and be headed with ring lug with a 6 mm hole; see section 8.

Heating element connection

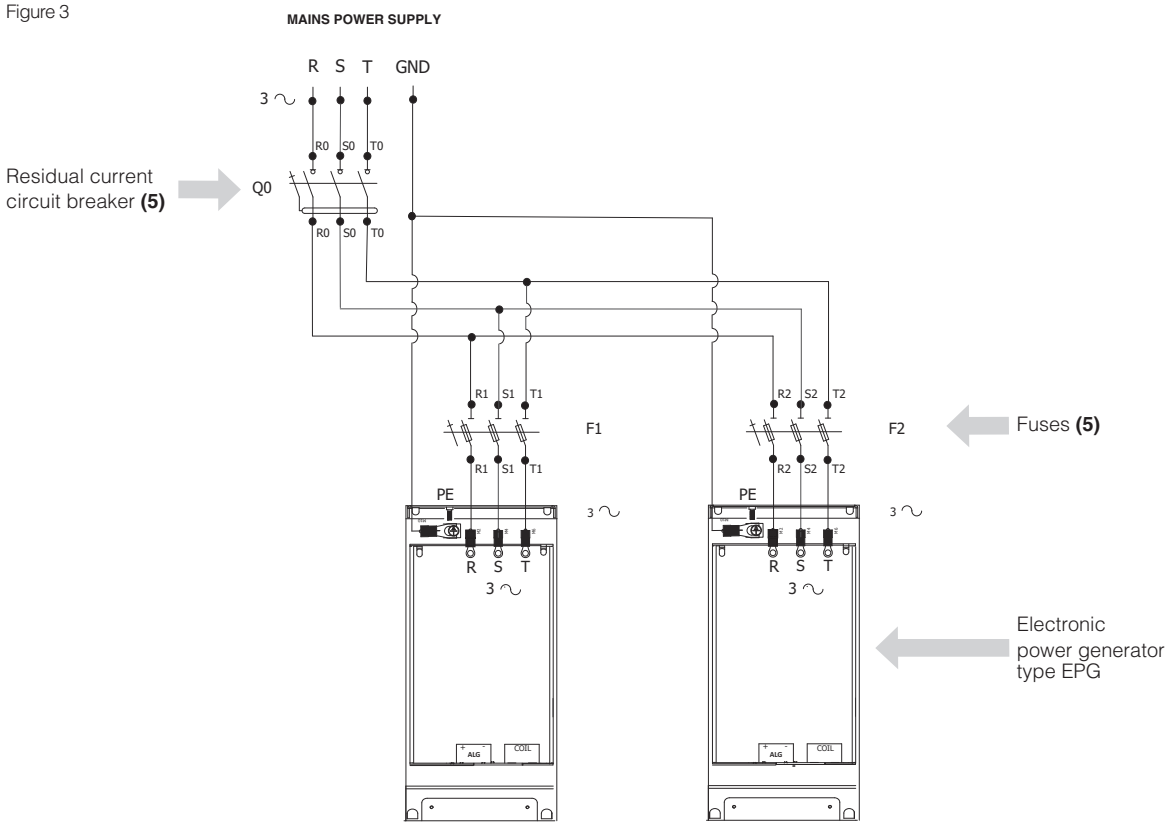
The generator can power only one heating element at a time, then it is not possible to connect several heating elements to a single generator. Use only the heating elements cables provided by Atos Induction. The cables of the single heating element must be insulated from each other and laid twisted into insulating ducts: e.g., corrugated (non-metallic) or conduits with insulation voltage of at least 1000V. If there are multiple generators inside the same electrical cabinet, their cables must be separated from each other.

The heating elements cables must be separated by three-phase power supply and signal cables.

Enable signal and Alarm connections

The enable command and alarm cables have to be connected to screw terminals located inside the generator box, see section 8.

Figure 3

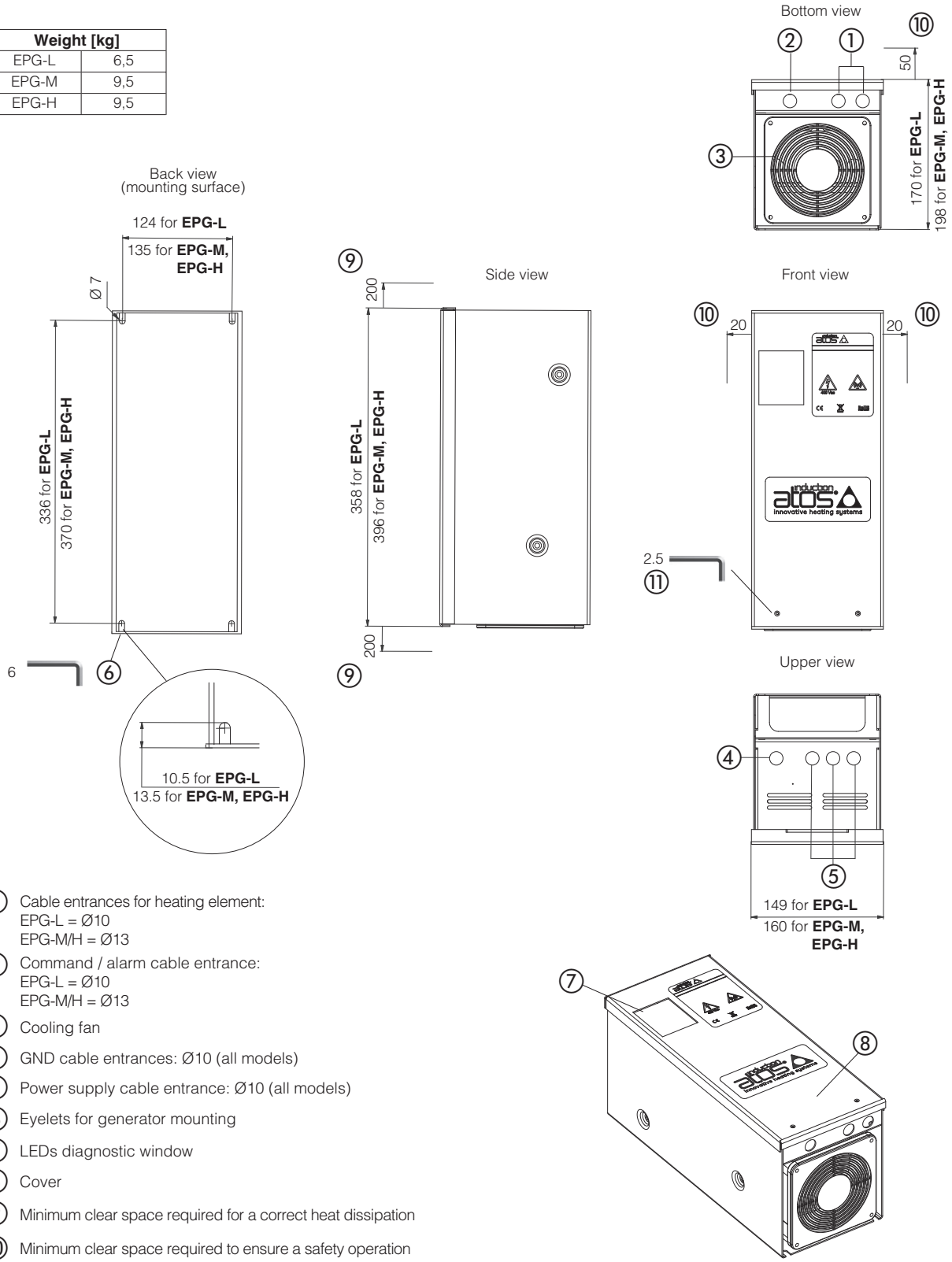


(5) Not included with EPG generator

10 INSTALLATION REQUIREMENTS AND DIMENSIONS [mm]

The generator must be installed inside an electrical panel preferably in vertical position, with the fan at the bottom to enhance heat dissipation. N°4 eyelets are located in the back side of the generator, allowing the positioning of the generator on the cabinet wall by means 4 M6 screws (not included). In the electrical cabinet, forced ventilation must be ensured to dissipate the thermal power produced during generator work, see section 6. Is required a clear space of at least 200 mm above and below the generator to allow air circulation. A clear space of at least 20 mm on both sides and at least 50 mm on the front side must be granted to ensure safety operation when removing the cover. To remove the cover, unscrew the 2 front screws using a M2.5 Allen key.

Weight [kg]	
EPG-L	6,5
EPG-M	9,5
EPG-H	9,5



① Cable entrances for heating element:
EPG-L = Ø10
EPG-M/H = Ø13

② Command / alarm cable entrance:
EPG-L = Ø10
EPG-M/H = Ø13

③ Cooling fan

④ GND cable entrances: Ø10 (all models)

⑤ Power supply cable entrance: Ø10 (all models)

⑥ Eyelets for generator mounting

⑦ LEDs diagnostic window

⑧ Cover

⑨ Minimum clear space required for a correct heat dissipation

⑩ Minimum clear space required to ensure a safety operation

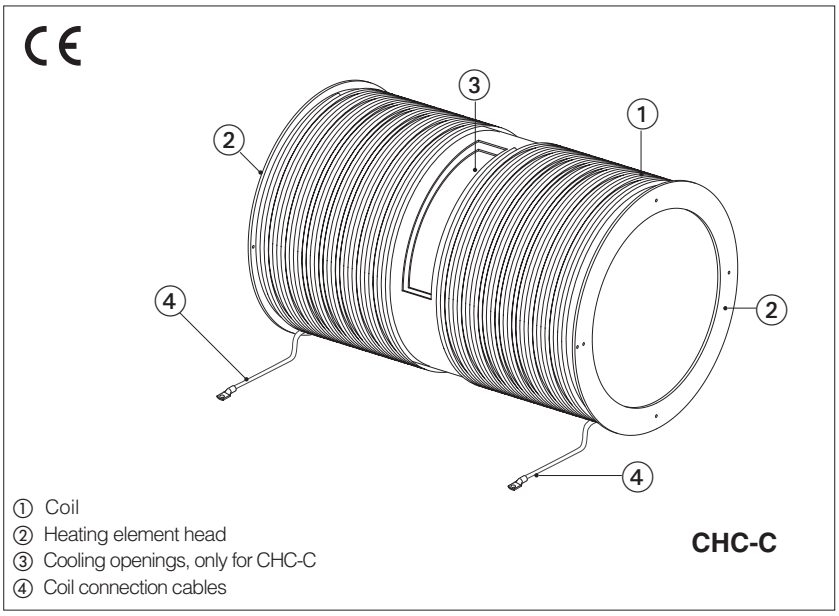
⑪ Two screws for cover fixing

11 RELATED DOCUMENTATION

AI110	Electronic communication devices	**E-MAN-EPG**	Use and instruction manual
AI220	Closed heating coils		

Closed heating coils

for plasticising barrels



① Coil
② Heating element head
③ Cooling openings, only for CHC-C
④ Coil connection cables

CHC-C

CHC

Heating coils in closed execution, designed for fast and efficient heating of plasticising barrels of extruders and injection molding machines. These consist of cylindrical inductors, powered by EPG power generators, which exploit the principle of magnetic induction to heat the ferromagnetic material. The CHC coils offer significant benefits over traditional resistive heating systems:

- Higher power density
- Fast heating: less than 30 minutes to increase the temperature of a 310 mm diameter barrel from 20°C to 200°C
- High energy savings (up to 25%)
- No thermal inertia: instantaneous start and stop of heat transmission
- Greater precision in temperature achievement and maintenance

1 MODEL CODE

CHC	-	C	-	M	-	300	/	350	-	02	*
Closed Heating Coil											Series number

Coil type
N = Not cooled
C = Predisposed for cooling

Size (1)
L = for connection to EPG-L
M = for connection to EPG-M
H = for connection to EPG-H

Barrel diameter (2)
*** = from 80 mm to 400 mm with step 10 mm

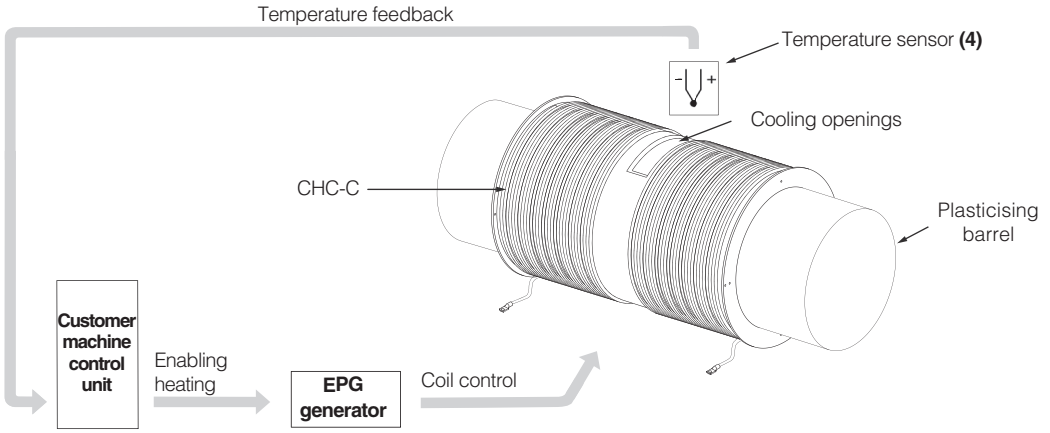
Coil length (3)
*** = from 150 mm to 700 mm with step 25 mm

Length of connection cable
02 = 2 m
05 = 5 m
10 = 10 m

(1) To be selected according to the proper EPG size; see sections 8 and 9
(2) For plasticising barrels with diameters not included in the standard dimensions, please contact Atos Induction's technical department
(3) The length of the coil should be as close as possible to the length of the zone to be heated. It is also necessary to consider the shelter encumbrance (not included), see sections 3 and 7

2 FUNCTIONAL EXAMPLE

EXAMPLE OF A CHC-C COIL WITH THERMOREGULATED CONTROL

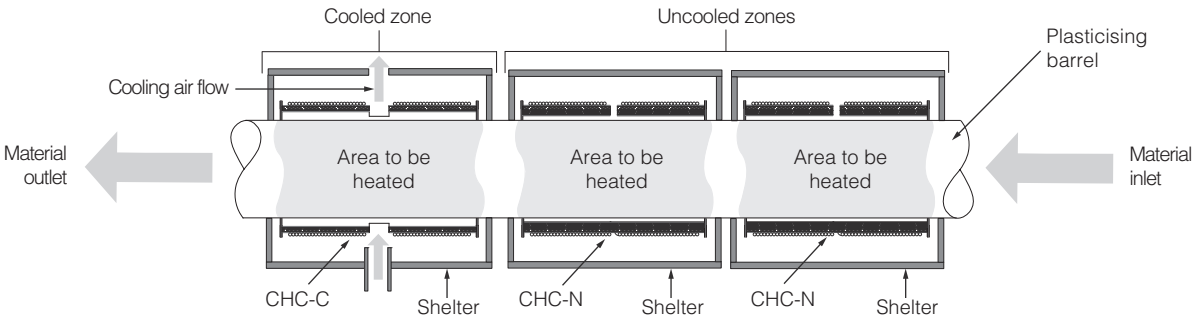


(4) It is recommended the use of K-type thermocouples or other sensors immune to electromagnetic interference

3 APPLICATION OF CHC COILS ON THE PLASTICISING CYLINDER

According to the type of process, the plasticising barrels may require heating with different powers to obtain different localised temperatures. In these conditions, it is necessary to install several CHC coils on the barrel, as many as the number of zones required. Each coil must be powered by a corresponding EPG generator (controlled by the machine control unit), which energises the coil to maintain the process temperature. In addition, some zones require forced cooling to dissipate the heat produced by the mechanical action of the plasticising screw (typical case of extruders). In these zones, should be used CHC-C coils with openings for the cooling air flow. The drawing below shows an example of a plasticising barrel equipped with CHC-C and CHC-N coils, including their own shield shelters (not included).

⚠ The length of the CHC coil should fit as closely as possible to the length of the zone to be heated, reduced by the lateral encumbrance of the shelters; see dimensioning example in section 9



4 COIL/BARREL COUPLING

The nominal power density of the coil depends on the correct magnetic coupling between the inductor and the plasticising barrel. A poor magnetic coupling, e.g., irregular barrel surfaces, can lead to a reduction in the transmissible heating power.

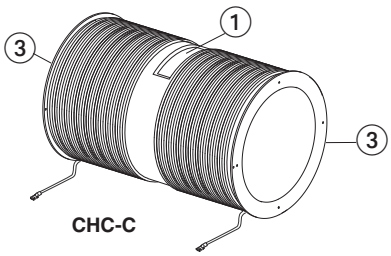
⚠ The installation of CHC coils is intended for plasticising barrels with smooth surfaces. For applications on grooved surfaces, please contact Atos Induction's technical department

5 FUNCTIONAL DESCRIPTION

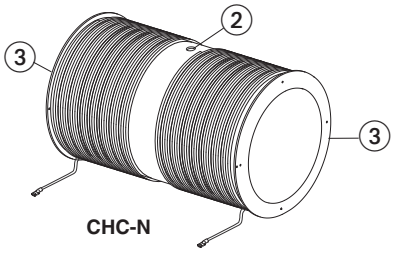
The closed heating coils are designed to be powered by EPG power generators (see tech. tab. AI100) and, by means of modulated magnetic fields, produce heating of the ferromagnetic materials on which they are placed. During the heating process, heat is generated directly inside the metal through the circulation of eddy currents (Foucault currents) induced by magnetic field. Heat transmission is not by conduction as with electrical resistors, improving efficiency and reducing dissipation losses. The structure of the inductor contains highly insulating materials that allow to maintain the heat inside the metal, further increasing efficiency. In case of significant lengths of the plasticising barrel or if different zones need to be heated up to different temperatures or powers, it is possible to install more coils on the same barrel. In such cases, each coil shall be powered by a dedicated EPG generator.

CHC-C coils are equipped with two openings that allow internal air flow for barrel cooling, and the installation of the temperature sensor.

CHC-N coils are intended for applications where cooling of the plasticising barrel is not required. They have a hole for the temperature sensor, necessary to perform the closed-loop control.



CHC-C



CHC-N

① Opening for cooling and temperature sensor, width 45 mm

② ø30 hole for temperature sensor

③ Heating element head

6 MAIN CHARACTERISTICS

Coil execution	CHC-C (Predisposed for cooling), CHC-N (Not cooled),		
Size	L	M	H
Power supply device	EPG-L	EPG-M	EPG-H
Working frequency [kHz]	7 ÷ 12	5 ÷ 11	4 ÷ 10
Power density [W/cm^2]	See section 7		
IP protection degree [CEI EN 605229]	Not applicable, avoid contact between coils and liquids		
Cable type	Litz wire – Double Kapton wrapped; U-180		
Max heating temperature of the barrel	250°C		
External working temperature	0°C ÷ +60°C		
Electromagnetic emissions [EN UNI 12198]	The use of the coils without protective shelters is comparable to a Class 1 source		

7 INSTALLATION PRESCRIPTIONS

During the heating process are produced electromagnetic fields and the barrel reach high temperatures, that could be dangerous for the health of the operators working in the close vicinity.

For this reason, the coils must be segregated inside aluminium shelters with a thickness of at least 4 mm (not included), to protect the operators from accidental contact with coils and from magnetic fields.

The shelters should consist of two half-shells covered with electrically insulating paint, to allow positioning on the plasticising barrel. The two halves of the shelter must not be in direct contact with each other, but connected by components made of electrically insulating material to prevent the generation of eddy currents on the surface of the shelters and consequent overheating phenomena. See Fig. 1.

The shelters have to guarantee at least a free space around the coil of about 250 mm, and 10 mm on both sides, see Fig. 1. In addition, they must be provided with lower and upper openings to permit natural air circulation inside.

To improve the shielding effectiveness of the shelters it is recommended to make them cylindrical.

Atos Induction's technical department is available to support customers in the shelters design.

If CHC-C coils are installed, it is necessary to implement an air conveyor (made of non-magnetic material), positioned in the shelter, to direct the inlet air flow towards the internal surface of the coil, improving the cooling of the plasticising barrel.

⚠ Do not install insulated shelters, as for resistance systems, because they could lead to excessive air temperature increase around the inductor. Do not install two or more coils under the same shelter to reduce risks of magnetic interference between coils

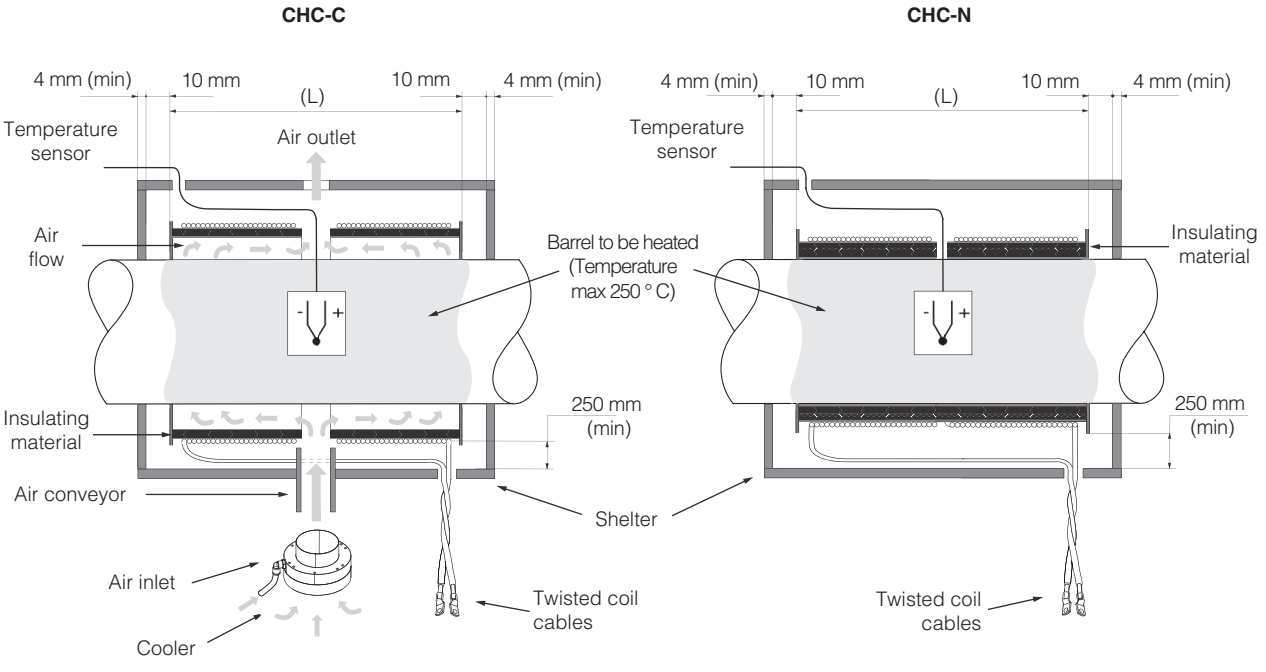
⚠ Use only the cables supplied with the coil. Due to their special design, the coil connection cables cannot be shortened or extended. When ordering, please select the required length carefully from the available lengths, see section 1

⚠ Lay the coil cables twisted inside non-metallic corrugated with at least Ø23 mm, to protect them from mechanical stress and electromagnetic interference. Coil cables must be separated from temperature sensor cables

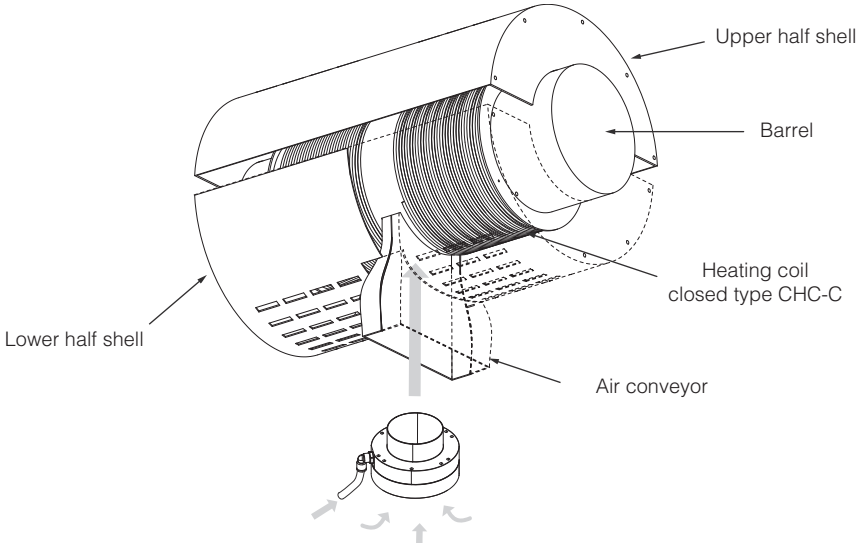
⚠ Always position the shelters after installing the coils. If the heating element must be started without shelter, e.g., for maintenance work, must be ensured a safety distance of at least 1400 mm from the operating coil, within which access to personnel is prohibited

⚠ Following the installation, the customer will have to perform fields measurements in compliance with safety regulations in force in the country of installation (e.g., in Europe EN UNI 12198)

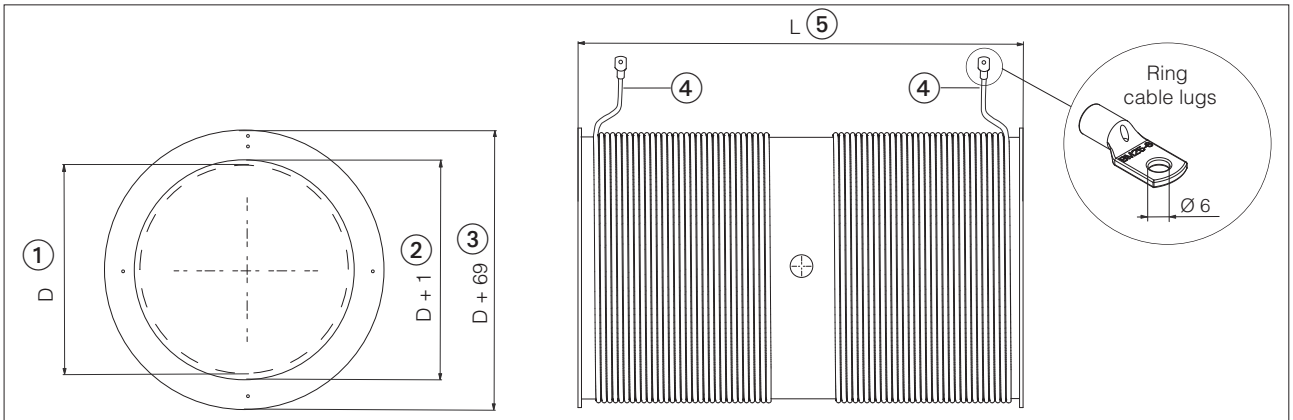
Fig.1



EXAMPLE OF SHELTERS FOR CLOSED HEATING COIL TYPE CHC-C



8 DIMENSIONS [mm]



1. Plasticising barrel external diameter
2. Internal head diameter for CHC-C and CHC-N
3. External coil diameter = D + 69 mm (for all sizes)
4. Coil connection cables
5. Coil length

For possible combinations of diameter D and length L, see the tables in section 9.

9 POWER DENSITIES [W/cm^2]

Example of coil sizing to heat a zone with length 330 mm and diameter D = 170 mm, with a specific power of at least 6,5 W/cm2.

Sizing of CHC coil length L

The useful length for the installation of the CHC coil is obtained from the total length of the area to be heated 330 mm, reduced by the lateral encumbrance of the shelters = 10 mm + 4 mm from both ends of the coil; see section 7. This results in a useful length of 302 mm. Checking the available lengths in the columns of the tables below, the closest lower dimension to the usable length 302 mm corresponds to a coil length L = 300 mm.

Sizing of CHC coil

With reference to Tables I, II and III below, the power density is obtained by crossing the column corresponding to the length of the coil L = 300 mm with the line corresponding to the diameter of the plasticising barrel D = 170 mm.
In table I (CHC-*-L + EPG-L) the power value is 3 W/cm2, which is lower than required.
In table II (CHC-*-M + EPG-M) the power value is 5 W/cm2, which is slightly lower than required.
In Table III (CHC-*-H + EPG-H) the power value is 7.5 W/cm2, which satisfies the requirement.
The coil code to be selected is therefore:
CHC-C-H-170/300-XX. in case of coil predisposed for cooling
CHC-N-H-170/300-XX, in case of coil not cooled

Tab. I - Power density performed by coupling **CHC-*-L** coils with **EPG-L** generators, divided by size

Plasticising barrel diameter = D [mm]	Coil length = L [mm]																							
	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700
80			2,9	3,4	3,5	4,7	4,2	4,8	5,5	5,1	4,8	4,5	4,2	4,0	3,8	3,6	3,5	3,3	3,2	3,1	2,9	2,8	2,7
90		3,3	3,8	4,2	4,2	5,2	4,8	5,2	4,9	4,5	4,2	4,0	3,8	3,6	3,4	3,2	3,1	3,0	2,8	2,7	2,6	2,5	2,4
100		4,0	4,4	4,7	4,7	5,6	5,1	4,7	4,4	4,1	3,8	3,6	3,4	3,2	3,1	2,9	2,8	2,7	2,5	2,4	2,4	2,3	2,2
110	4,1	4,4	4,7	5,0	4,9	5,1	4,6	4,3	4,0	3,7	3,5	3,3	3,1	2,9	2,8	2,6	2,5	2,4	2,3	2,2	2,1	2,1	2,0
120	4,4	4,7	4,9	5,1	5,1	4,6	4,2	3,9	3,6	3,4	3,2	3,0	2,8	2,7	2,5	2,4	2,3	2,2	2,1	2,0	2,0	1,9	1,8
130	4,6	4,8	5,0	5,2	4,7	4,3	3,9	3,6	3,4	3,1	2,9	2,8	2,6	2,5	2,4	2,2	2,1	2,0	2,0	1,9	1,8	1,7	1,7
140	4,7	4,9	5,1	4,9	4,4	4,0	3,6	3,4	3,1	2,9	2,7	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,6
150	4,8	4,9	5,1	4,5	4,1	3,7	3,4	3,1	2,9	2,7	2,5	2,4	2,3	2,1	2,0	1,9	1,9	1,8	1,7	1,6	1,6	1,5	1,5
160	4,8	4,9	4,8	4,2	3,8	3,5	3,2	2,9	2,7	2,5	2,4	2,2	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,5	1,5	1,4	1,4
170	4,8	4,9	4,5	4,0	3,6	3,3	3,0	2,8	2,6	2,4	2,2	2,1	2,0	1,9	1,8	1,7	1,6	1,6	1,5	1,4	1,4	1,3	
180	4,8	4,9	4,2	3,8	3,4	3,1	2,8	2,6	2,4	2,3	2,1	2,0	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,4	1,3		
190	4,7	4,6	4,0	3,6	3,2	2,9	2,7	2,5	2,3	2,1	2,0	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,3				
200	4,7	4,4	3,8	3,4	3,1	2,8	2,5	2,4	2,2	2,0	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,3					
210	4,6	4,2	3,6	3,2	2,9	2,6	2,4	2,2	2,1	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,3						
220	4,5	4,0	3,5	3,1	2,8	2,5	2,3	2,1	2,0	1,9	1,7	1,6	1,5	1,5	1,4	1,3							
230	4,4	3,8	3,3	3,0	2,7	2,4	2,2	2,0	1,9	1,8	1,7	1,6	1,5	1,4	1,3								
240	4,2	3,6	3,2	2,8	2,5	2,3	2,1	2,0	1,8	1,7	1,6	1,5	1,4	1,3									
250	4,1	3,5	3,1	2,7	2,4	2,2	2,0	1,9	1,7	1,6	1,5	1,4	1,4										
260	3,9	3,4	2,9	2,6	2,4	2,1	2,0	1,8	1,7	1,6	1,5	1,4	1,3										
270	3,8	3,2	2,8	2,5	2,3	2,1	1,9	1,7	1,6	1,5	1,4	1,3											
280	3,6	3,1	2,7	2,4	2,2	2,0	1,8	1,7	1,6	1,5	1,4												
290	3,5	3,0	2,6	2,3	2,1	1,9	1,8	1,6	1,5	1,4	1,3												
300	3,4	2,9	2,5	2,3	2,0	1,9	1,7	1,6	1,5	1,4													
310	3,3	2,8	2,5	2,2	2,0	1,8	1,6	1,5	1,4	1,3													
320	3,2	2,7	2,4	2,1	1,9	1,7	1,6	1,5	1,4														
330	3,1	2,6	2,3	2,1	1,9	1,7	1,5	1,4	1,3														
340	3,0	2,6	2,2	2,0	1,8	1,6	1,5	1,4															
350	2,9	2,5	2,2	1,9	1,7	1,6	1,5	1,3															
360	2,8	2,4	2,1	1,9	1,7	1,5	1,4	1,3															
370	2,8	2,4	2,1	1,8	1,7	1,5	1,4																
380	2,7	2,3	2,0	1,8	1,6	1,5	1,3																
390	2,6	2,2	2,0	1,7	1,6	1,4	1,3																
400	2,5	2,2	1,9	1,7	1,5	1,4																	

Note: grey cells indicate coils available on request

Tab. II - Power density performed by coupling **CHC-*-M** coils with **EPG-M**, generators, divided by size

Plasticising barrel diameter = D [mm]	Coil length = L [mm]																							
	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700
80								9,8	9,1	8,5	8,0	7,5	7,1	6,7	6,4	6,1	5,8	5,5	5,3	5,1	4,9	4,7	4,5
90							9,4	8,7	8,1	7,5	7,1	6,7	6,3	6,0	5,7	5,4	5,1	4,9	4,7	4,5	4,4	4,2	4,0
100						9,3	8,5	7,8	7,3	6,8	6,4	6,0	5,7	5,4	5,1	4,9	4,6	4,4	4,2	4,1	3,9	3,8	3,6
110					9,3	8,4	7,7	7,1	6,6	6,2	5,8	5,4	5,1	4,9	4,6	4,4	4,2	4,0	3,9	3,7	3,6	3,4	3,3
120				9,4	8,5	7,7	7,1	6,5	6,1	5,7	5,3	5,0	4,7	4,5	4,2	4,0	3,9	3,7	3,5	3,4	3,3	3,1	3,0
130			9,8	8,7	7,8	7,1	6,5	6,0	5,6	5,2	4,9	4,6	4,4	4,1	3,9	3,7	3,6	3,4	3,3	3,1	3,0	2,9	2,8
140			9,1	8,1	7,3	6,6	6,1	5,6	5,2	4,9	4,5	4,3	4,0	3,8	3,6	3,5	3,3	3,2	3,0	2,9	2,8	2,7	2,6
150		9,7	8,5	7,5	6,8	6,2	5,7	5,2	4,9	4,5	4,2	4,0	3,8	3,6	3,4	3,2	3,1	3,0	2,8	2,7	2,6	2,5	2,4
160		9,1	8,0	7,1	6,4	5,8	5,3	4,9	4,5	4,2	4,0	3,7	3,5	3,4	3,2	3,0	2,9	2,8	2,7	2,5	2,4	2,4	2,3
170	9,5	8,6	7,5	6,7	6,0	5,4	5,0	4,6	4,3	4,0	3,7	3,5	3,3	3,2	3,0	2,9	2,7	2,6	2,5	2,4	2,3	2,2	2,1
180	9,2	8,1	7,1	6,3	5,7	5,1	4,7	4,4	4,0	3,8	3,5	3,3	3,1	3,0	2,8	2,7	2,6	2,5	2,4	2,3	2,2	2,1	2,0
190	8,9	7,7	6,7	6,0	5,4	4,9	4,5	4,1	3,8	3,6	3,4	3,2	3,0	2,8	2,7	2,6	2,4	2,3	2,2	2,1	2,1	2,0	1,9
200	8,5	7,3	6,4	5,7	5,1	4,6	4,2	3,9	3,6	3,4	3,2	3,0	2,8	2,7	2,5	2,4	2,3	2,2	2,1	2,0	2,0	1,9	1,8
210	8,1	6,9	6,1	5,4	4,9	4,4	4,0	3,7	3,5	3,2	3,0	2,9	2,7	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,9	1,8	1,7
220	7,7	6,6	5,8	5,1	4,6	4,2	3,9	3,6	3,3	3,1	2,9	2,7	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,9	1,8	1,7	1,7
230	7,4	6,3	5,5	4,9	4,4	4,0	3,7	3,4	3,2	3,0	2,8	2,6	2,5	2,3	2,2	2,1	2,0	1,9	1,8	1,8	1,7	1,6	1,6
240	7,1	6,1	5,3	4,7	4,2	3,9	3,5	3,3	3,0	2,8	2,7	2,5	2,4	2,2	2,1	2,0	1,9	1,8	1,8	1,7	1,6	1,6	1,5
250	6,8	5,8	5,1	4,5	4,1	3,7	3,4	3,1	2,9	2,7	2,5	2,4	2,3	2,1	2,0	1,9	1,9	1,8	1,7	1,6	1,6	1,5	1,5
260	6,5	5,6	4,9	4,4	3,9	3,6	3,3	3,0	2,8	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,8	1,7	1,6	1,6	1,5	1,5	1,4
270	6,3	5,4	4,7	4,2	3,8	3,4	3,1	2,9	2,7	2,5	2,4	2,2	2,1	2,0	1,9	1,8	1,7	1,6	1,6	1,5	1,5	1,4	1,3
280	6,1	5,2	4,5	4,0	3,6	3,3	3,0	2,8	2,6	2,4	2,3	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,5	1,5	1,4	1,3	
290	5,9	5,0	4,4	3,9	3,5	3,2	2,9	2,7	2,5	2,3	2,2	2,1	2,0	1,8	1,8	1,7	1,6	1,5	1,5	1,4	1,4	1,3	
300	5,7	4,9	4,2	3,8	3,4	3,1	2,8	2,6	2,4	2,3	2,1	2,0	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,4	1,3		
310	5,5	4,7	4,1	3,7	3,3	3,0	2,7	2,5	2,3	2,2	2,1	1,9	1,8	1,7	1,6	1,6	1,5	1,4	1,4	1,3			
320	5,3	4,5	4,0	3,5	3,2	2,9	2,7	2,4	2,3	2,1	2,0	1,9	1,8	1,7	1,6	1,5	1,4	1,4	1,3				
330	5,1	4,4	3,9	3,4	3,1	2,8	2,6	2,4	2,2	2,1	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,3					
340	5,0	4,3	3,7	3,3	3,0	2,7	2,5	2,3	2,1	2,0	1,9	1,8	1,7	1,6	1,5	1,4	1,4	1,3					
350	4,9	4,2	3,6	3,2	2,9	2,6	2,4	2,2	2,1	1,9	1,8	1,7	1,6	1,5	1,5	1,4	1,3						
360	4,7	4,0	3,5	3,1	2,8	2,6	2,4	2,2	2,0	1,9	1,8	1,7	1,6	1,5	1,4	1,3							
370	4,6	3,9	3,4	3,1	2,8	2,5	2,3	2,1	2,0	1,8	1,7	1,6	1,5	1,4	1,4	1,3							
380	4,5	3,8	3,4	3,0	2,7	2,4	2,2	2,1	1,9	1,8	1,7	1,6	1,5	1,4	1,3								
390	4,4	3,7	3,3	2,9	2,6	2,4	2,2	2,0	1,9	1,7	1,6	1,5	1,5	1,4	1,3								
400	4,2	3,6	3,2	2,8	2,5	2,3	2,1	2,0	1,8	1,7	1,6	1,5	1,4	1,3									

Note: grey cells indicate coils available on request

Tab. III - Power density performed by coupling **CHC-*-H** coils with **EPG-H** generators, divided by size

Plasticising barrel diameter = D [mm]	Coil length = L [mm]																							
	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700
80															9,5	9,1	8,7	8,3	8,0	7,6	7,3	7,1	6,8
90												10,0	9,4	8,9	8,5	8,1	7,7	7,4	7,1	6,8	6,5	6,3	6,1
100											9,5	9,0	8,5	8,0	7,6	7,3	6,9	6,6	6,4	6,1	5,9	5,7	5,5
110									9,9	9,3	8,7	8,2	7,7	7,3	6,9	6,6	6,3	6,0	5,8	5,6	5,3	5,1	5,0
120								9,8	9,1	8,5	8,0	7,5	7,1	6,7	6,4	6,1	5,8	5,5	5,3	5,1	4,9	4,7	4,5
130							9,8	9,0	8,4	7,8	7,3	6,9	6,5	6,2	5,9	5,6	5,3	5,1	4,9	4,7	4,5	4,4	4,2
140						9,9	9,1	8,4	7,8	7,3	6,8	6,4	6,1	5,7	5,5	5,2	5,0	4,7	4,5	4,4	4,2	4,0	3,9
150						9,3	8,5	7,8	7,3	6,8	6,4	6,0	5,7	5,4	5,1	4,9	4,6	4,4	4,2	4,1	3,9	3,8	3,6
160					9,5	8,7	8,0	7,3	6,8	6,4	6,0	5,6	5,3	5,0	4,8	4,5	4,3	4,2	4,0	3,8	3,7	3,5	3,4
170				10,0	9,0	8,2	7,5	6,9	6,4	6,0	5,6	5,3	5,0	4,7	4,5	4,3	4,1	3,9	3,7	3,6	3,5	3,3	3,2
180				9,4	8,5	7,7	7,1	6,5	6,1	5,7	5,3	5,0	4,7	4,5	4,2	4,0	3,9	3,7	3,5	3,4	3,3	3,1	3,0
190				8,9	8,0	7,3	6,7	6,2	5,7	5,4	5,0	4,7	4,5	4,2	4,0	3,8	3,7	3,5	3,4	3,2	3,1	3,0	2,9
200			9,5	8,5	7,6	6,9	6,4	5,9	5,5	5,1	4,8	4,5	4,2	4,0	3,8	3,6	3,5	3,3	3,2	3,1	2,9	2,8	2,7
210			9,1	8,1	7,3	6,6	6,1	5,6	5,2	4,9	4,5	4,3	4,0	3,8	3,6	3,5	3,3	3,2	3,0	2,9	2,8	2,7	2,6
220		9,9	8,7	7,7	6,9	6,3	5,8	5,3	5,0	4,6	4,3	4,1	3,9	3,7	3,5	3,3	3,2	3,0	2,9	2,8	2,7	2,6	2,5
230		9,5	8,3	7,4	6,6	6,0	5,5	5,1	4,7	4,4	4,2	3,9	3,7	3,5	3,3	3,2	3,0	2,9	2,8	2,7	2,6	2,5	2,4
240		9,1	8,0	7,1	6,4	5,8	5,3	4,9	4,5	4,2	4,0	3,7	3,5	3,4	3,2	3,0	2,9	2,8	2,7	2,5	2,4	2,4	2,3
250		8,7	7,6	6,8	6,1	5,6	5,1	4,7	4,4	4,1	3,8	3,6	3,4	3,2	3,1	2,9	2,8	2,7	2,5	2,4	2,4	2,3	2,2
260	9,8	8,4	7,3	6,5	5,9	5,3	4,9	4,5	4,2	3,9	3,7	3,5	3,3	3,1	2,9	2,8	2,7	2,6	2,4	2,4	2,3	2,2	2,1
270	9,4	8,1	7,1	6,3	5,7	5,1	4,7	4,4	4,0	3,8	3,5	3,3	3,1	3,0	2,8	2,7	2,6	2,5	2,4	2,3	2,2	2,1	2,0
280	9,1	7,8	6,8	6,1	5,5	5,0	4,5	4,2	3,9	3,6	3,4	3,2	3,0	2,9	2,7	2,6	2,5	2,4	2,3	2,2	2,1	2,0	1,9
290	8,8	7,5	6,6	5,9	5,3	4,8	4,4	4,1	3,8	3,5	3,3	3,1	2,9	2,8	2,6	2,5	2,4	2,3	2,2	2,1	2,0	2,0	1,9
300	8,5	7,3	6,4	5,7	5,1	4,6	4,2	3,9	3,6	3,4	3,2	3,0	2,8	2,7	2,5	2,4	2,3	2,2	2,1	2,0	2,0	1,9	1,8
310	8,2	7,0	6,2	5,5	4,9	4,5	4,1	3,8	3,5	3,3	3,1	2,9	2,7	2,6	2,5	2,3	2,2	2,1	2,1	2,0	1,9	1,8	1,8
320	8,0	6,8	6,0	5,3	4,8	4,3	4,0	3,7	3,4	3,2	3,0	2,8	2,7	2,5	2,4	2,3	2,2	2,1	2,0	1,9	1,8	1,8	1,7
330	7,7	6,6	5,8	5,1	4,6	4,2	3,9	3,6	3,3	3,1	2,9	2,7	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,9	1,8	1,7	1,7
340	7,5	6,4	5,6	5,0	4,5	4,1	3,7	3,5	3,2	3,0	2,8	2,6	2,5	2,4	2,2	2,1	2,0	2,0	1,9	1,8	1,7	1,7	1,6
350	7,3	6,2	5,5	4,9	4,4	4,0	3,6	3,4	3,1	2,9	2,7	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,6
360	7,1	6,1	5,3	4,7	4,2	3,9	3,5	3,3	3,0	2,8	2,7	2,5	2,4	2,2	2,1	2,0	1,9	1,8	1,8	1,7	1,6	1,6	1,5
370	6,9	5,9	5,2	4,6	4,1	3,8	3,4	3,2	2,9	2,8	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,5	1,5
380	6,7	5,7	5,0	4,5	4,0	3,7	3,4	3,1	2,9	2,7	2,5	2,4	2,2	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,5	1,5	1,4
390	6,5	5,6	4,9	4,4	3,9	3,6	3,3	3,0	2,8	2,6	2,4	2,3	2,2	2,1	2,0	1,9	1,8	1,7	1,6	1,6	1,5	1,5	1,4
400	6,4	5,5	4,8	4,2	3,8	3,5	3,2	2,9	2,7	2,5	2,4	2,2	2,1	2,0	1,9	1,8	1,7	1,7	1,6	1,5	1,5	1,4	1,4

Note: grey cells indicate coils available on request

10 POSSIBLE COMBINATIONS OF CHC COILS WITH EPG GENERATORS

The following table summarises the possible combinations of coils according to the dimensions.

Plasticising barrel diameter = D (mm)	Coil length = L [mm]																							
	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	625	650	675	700
80			L	L	L	L	L	L M	L M	L M	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
90		L	L	L	L	L	L M	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
100		L	L	L	L	L M	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
110	L	L	L	L	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
120	L	L	L	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
130	L	L	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
140	L	L	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
150	L	L M	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
160	L	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H
170	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H
180	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H
190	L M	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H
200	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H
210	L M	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H
220	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H
230	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H
240	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H
250	L M	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H
260	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H
270	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H
280	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H
290	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H
300	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H
310	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H
320	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H
330	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H
340	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H
350	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H	H
360	L M H	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H	H	H
370	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H	H	H
380	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H	H	H	H
390	L M H	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H	H	H	H
400	L M H	L M H	L M H	L M H	L M H	L M H	M H	M H	M H	M H	M H	M H	M H	M H	H	H	H	H	H	H	H	H	H

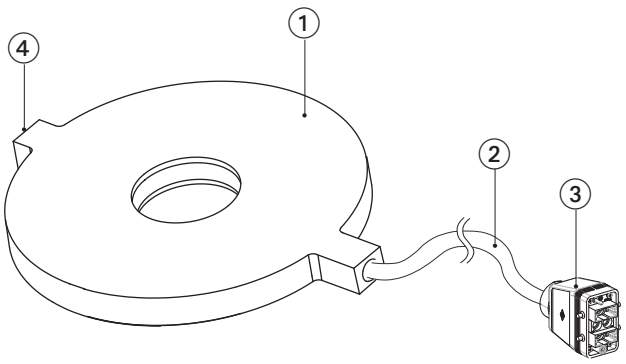
	Available on request
L	Available in combination with EPG-L
L M	Available in combination with EPG-L or EPG-M
L M H	Available in combination with EPG-L, EPG-M or EPG-H
M H	Available in combination with EPG-M or EPG-H
H	Available in combination with EPG-H

11 RELATED DOCUMENTATION

AI100 - Electronic power generators

Mold heating blankets

pre-heating of molds for metal and rubber presses



① Circular inductor covered with protective fabric
② Connection cable to ECT trolley
③ Quick connector
④ Cooling air vent

MHB-H

MHB

Heating blankets designed to preheat quickly and safely the molds. They consist of circular flat inductors, insulated and covered with heat-resistant fabric. The blankets are powered by the ECT command trolleys, and exploit the principle of magnetic induction to heat the ferromagnetic material they are in contact with. MHB blankets allows to obtain significant benefits compared to traditional open flame heating systems:

- Rapid heating
- Elimination of risks related to the use of combustible gases in production plants
- Automatic control of the heating cycle without specialized personnel

MHB blankets are available in different combinations of diameters to suit various mold geometries and sizes. Each blanket is equipped with protective sheets to safeguard the covering fabric.

1 MODEL CODE

MHB	-	H	-	02	-	150	/	500	-	05	*

Mold heating blanket

Size
H = for connection with trolley ECT-H

Type of execution
01 = single stage, half mold heating
02 = double stage, heating of both mold halves

Internal diameter (1)
*** = from 100 mm to 400 mm with step 50 mm

External diameter (2)
*** = From 400 mm to 800 mm with step 50 mm

Length of connection cable
05 = 5 m
10 = 10 m

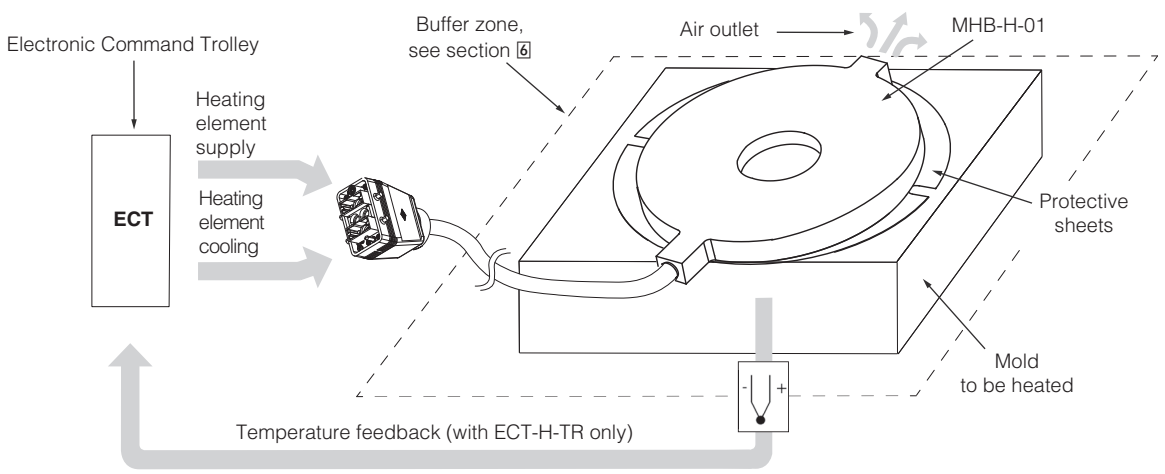
Series number

(1) The internal diameter allows to position the blanket even in the presence of central dimensions of the mold, for example centring axes. The internal diameter must be selected to be as close as possible to the dimensions of the central encumbrance. If the mold has no internal constraints, select the smallest internal diameter available (100 mm)
(2) The outer diameter of the blanket should be selected according to the surface of the mold; for example, in the case of rectangular mold, select the outer diameter of the blanket less than or equal to the length of the mold short side. See section 8 for available diameter combinations

Note: for diameters not included in the standard dimensions, contact Atos Induction's technical department

2 FUNCTIONAL EXAMPLE

EXAMPLE OF HEATING ONE HALF OF THE MOLD



3 FUNCTIONAL DESCRIPTION

Thanks to indirect heat transfer, molds can be pre-heated quickly and safely simply by placing blankets on the surfaces to be heated. The heat is generated directly inside the mold through the circulation of eddy currents, induced in the metal by appropriately modulated magnetic fields. This reduces heating times and improves process efficiency. In addition, the use of MHB blankets avoids the burning of combustible gases in production plants and their associated hazards.

4 BLANKET/MOLD COUPLING

The power transferred by the inductor depends on the magnetic coupling between the blanket and the mold. For example, particular mold geometries, presence of air gaps and irregular contacts between blanket and metal can result in poor magnetic coupling, reducing heating speed and uniformity.

⚠ The use of MHB blankets is intended for metal and rubber molds. For applications on other types of metal parts, please contact the Atos Induction technical department.

5 MAIN CHARACTERISTICS

Power supply device	ECT Electronic command trolley
Working frequency [kHz]	4 ÷ 10
Max heating temperature of the mold	300°C on the surface of the mold in direct contact with the fabric of the blanket
IP protection degree [CEI EN 605229]	Not applicable, avoid contact between blankets and liquids
Cable type	Litz wire - Double Kapton wrapped; U-180
Electromagnetic emissions [EN UNI 12198]	The use of the blankets is comparable to a Class 1 source

6 INSTALLATION PRESCRIPTIONS

The MHB blanket must be connected to the ECT command trolley through the quick connector; it contains the connections for the inductor power supply and for the cooling air passage. Forced cooling is required to prevent possible overheating of the inductor cable inside the blanket.

In case of horizontal double stage installation, the upper part of the mold has to be placed in contact with the blanket, but it must be suitably supported by holders to prevent its weight from damaging the heating element.

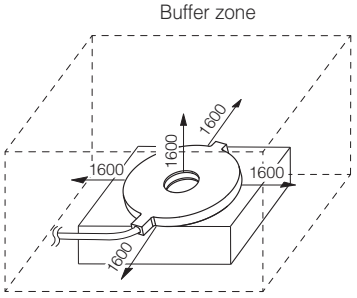
Due to the irregular surfaces and the roughness of the molding surfaces, the blankets are supplied with attached protective sheets to be placed in direct contact with the mold. Therefore, for correct use of the blanket, place the protective sheet directly on the mold and then place the MHB blanket on it.

Note: the number of protective sheets supplied upon purchase of MHBs is: one for MHB-H-01-**, two for MHB-H-02-**. It is possible to order additional spare sheets separately; see section 9

⚠ Always remove the MHB blanket from the hot mold at the end of the heating cycle

⚠ During blanket handling, it is recommended to use personal protective equipment suitable for high temperatures

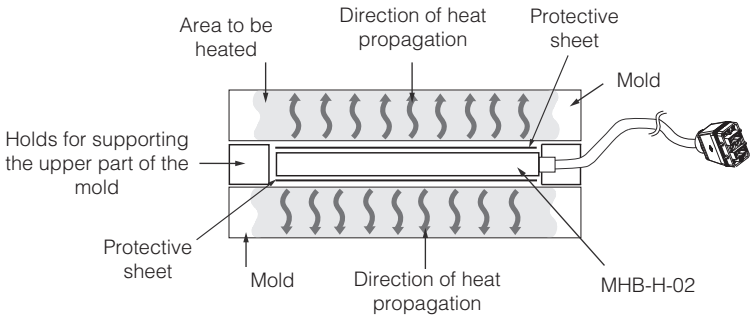
During the heating process the MHB inductor generates a high surface temperature and a surrounding electromagnetic field that could be dangerous for the health of the operators working in the immediate vicinity. For this reason, a “buffer zone” around the blanket must be circumscribed and bounded by a proper barrier (not supplied with the blanket), placed at a distance of at least 1600 mm from the heating blanket edge. This ensures the protection of operators against accidental contact with hot parts and against electromagnetic fields.
The ECT trolley must be positioned outside the safety barrier.
In single stage application, the distance of 1600 mm must also be guaranteed upwards.



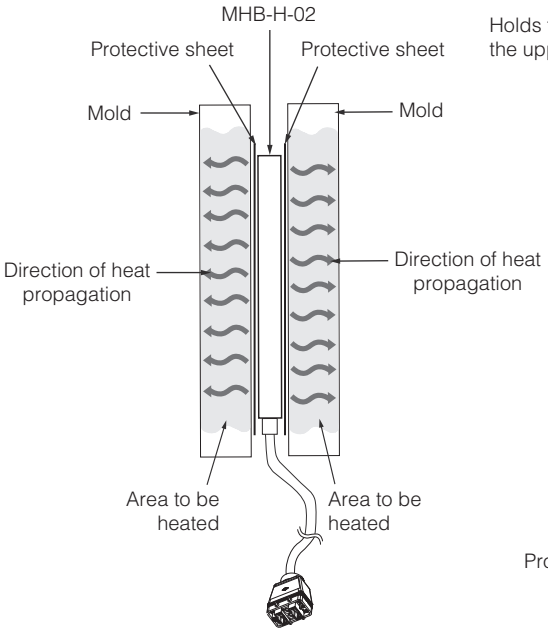
⚠ During the heating process, access to the buffer zone is severely prohibited

EXAMPLES OF MHB BLANKETS POSITIONING

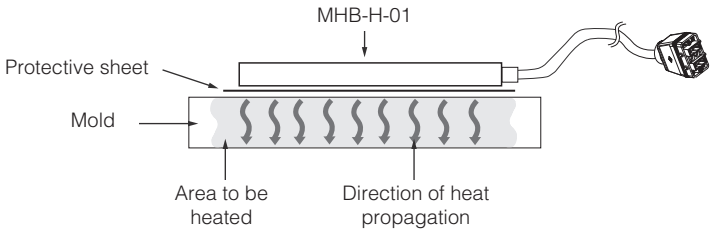
Horizontal double stage application



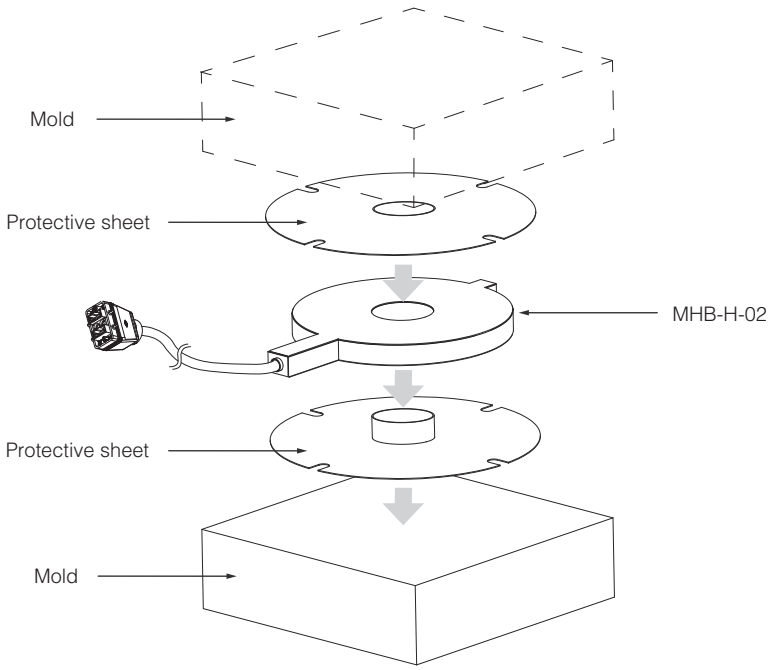
Vertical double stage application



Single stage application

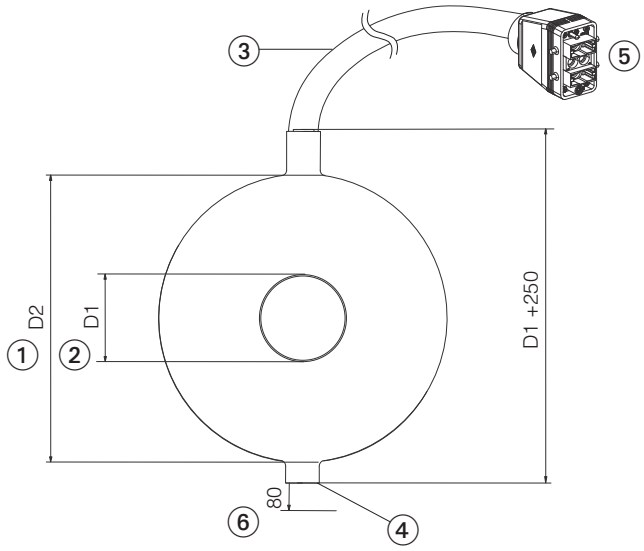


Double stage application example



7 DIMENSIONS[mm]

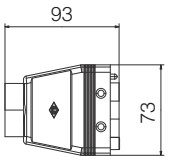
MHB blanket top view



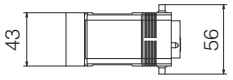
MHB blanket side view

Quick connector

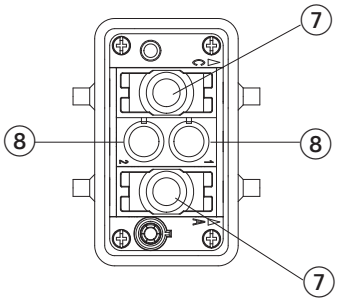
Top view



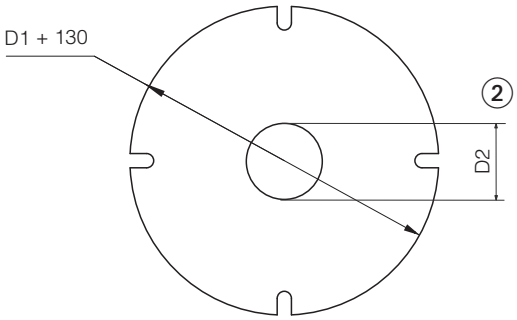
Side view



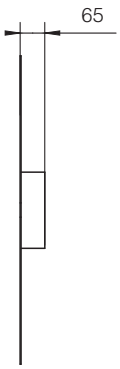
Front view



Protective sheet top view



Protective sheet side view



(1) External diameter of the blanket

(2) Internal diameter of the blanket

(3) Connection cable to ECT trolley

(4) Cooling air vent

(5) Quick connector

(6) Minimum free space required for proper cooling air dissipation

(7) Blanket power supply passage

(8) Cooling air passage

8 POSSIBLE COMBINATIONS OF DIAMETERS

The following tables show the combinations of external and internal diameters available for the different executions of MHB blankets

MHB-H-01 Single stage heating blankets

= Available blankets

= Blankets available on request

		External diameter = D2 [mm]								
		400	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**
Internal diameter = D1 [mm]	**100**									
	150									
	200									
	250									
	300									
	350									
	400									

MHB-H-02 Double stage heating blankets

= Available blankets

= Blankets available on request

		External diameter = D2 [mm]								
		400	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**
Internal diameter = D1 [mm]	**100**									
	150									
	200									
	250									
	300									
	350									
	400									

9 MODEL CODE OF PROTECTIVE SHEETS

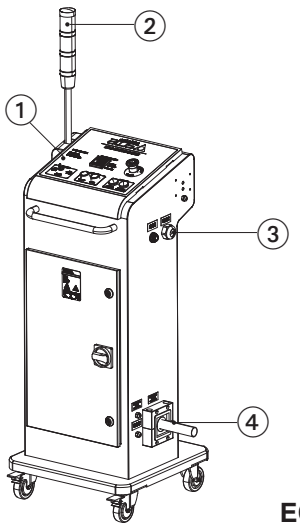
PS	-	**150**	/	**500**
Protective sheet		Internal diameter of the corresponding MHB blanket		External diameter of the corresponding MHB blanket

10 RELATED DOCUMENTATION

AI700 - Electronic command trolleys

Electronic command trolleys

for controlling the heating of molds using MHB blankets



① Control panel
② Signalling stoplight
③ Cable entrances for mains power supply and compressed air inlet
④ Wall pass for insertion of the MHB blanket fast connector

ECT

ECT
Electronic command trolleys, designed to power MHB inductive heating blankets (see tech. tab. AI 300) for metal and rubber molds preheating. They allow to regulate the molds temperature more quickly, precisely and efficiently than conventional open flame burners, significantly reducing heating times and eliminating the risks related to combustible gases in production plants. Each trolley contains an EPG power generator, for blanket power supply, and all necessary control devices.
It is possible to perform heating cycles according to the following integrated control logics:

- Timed control for rapid heating based on a predefined time
- Thermoregulated control for precise closed-loop temperature control

ECT trolleys can be equipped with ECD-TS transceiver for for data transmission to a PC (see tech. tab. AI110).

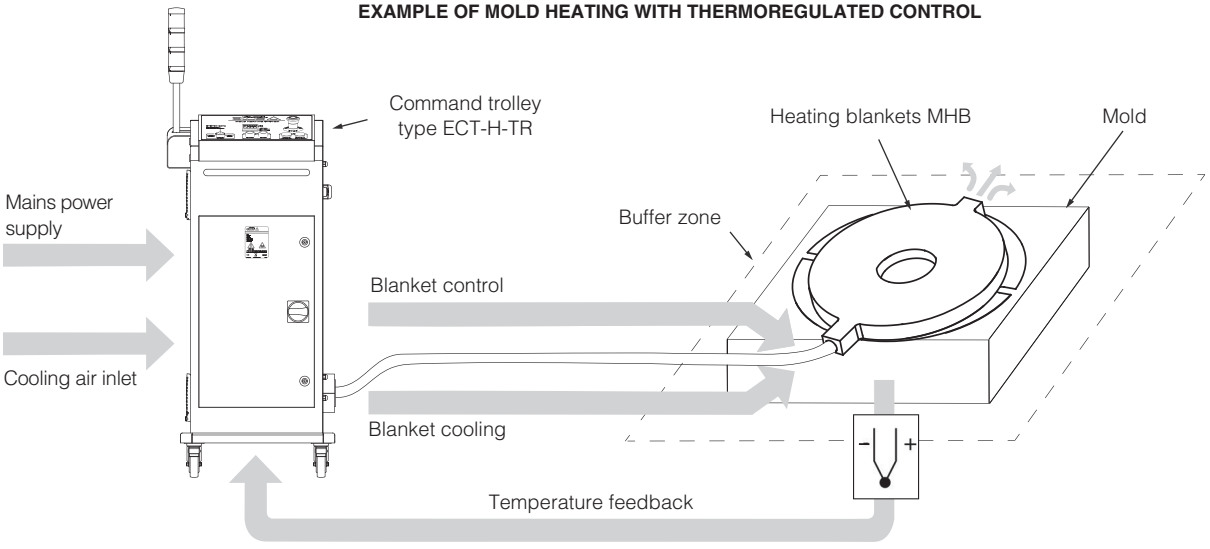
1 MODEL CODE

ECT	-	H	-	TR	-	T400VAC	-	P	*
Electronic command trolley		Size		**Temperature control logic** **TM** = Timed **TR** = Thermoregulated		**Power supply (1)** **T400VAC** for 380-400VAC - 50/60Hz three-phase **T460VAC** for 440-460VAC - 50/60Hz three-phase		**Transceiver option** **P** = Prepared for the installation of the transceiver**(2)** **T** = Transceiver installed **(3)**	Series number

(1) For different supply voltages, please contact Atos Induction's technical department
(2) The trolley is ready for any subsequent installation of the ECD-TS transceiver (not included) by the customer
(3) The ECD-TS transceiver is already installed inside the generator
Note: For data transmission to PC are required the ECD-RV radio/USB converter and the ECD-SW software (not included). See tech. tab. AI110

2 FUNCTIONAL EXAMPLE

EXAMPLE OF MOLD HEATING WITH THERMOREGULATED CONTROL



3 FUNCTIONAL DESCRIPTION

Thanks to the internal EPG generator, the control trolleys feed the MHB blankets with amplitude and frequency modulated currents, generating magnetic fields able to heating elements composed of ferromagnetic materials. The generator automatically adapts the current modulation to optimize the magnetic coupling between the heating element and the material to be heated. This functionality maximizes the thermal power transmission, as well as improving efficiency and reducing heating cycles times.

ECT trolleys integrate the following temperature control logics:

a) Timed control

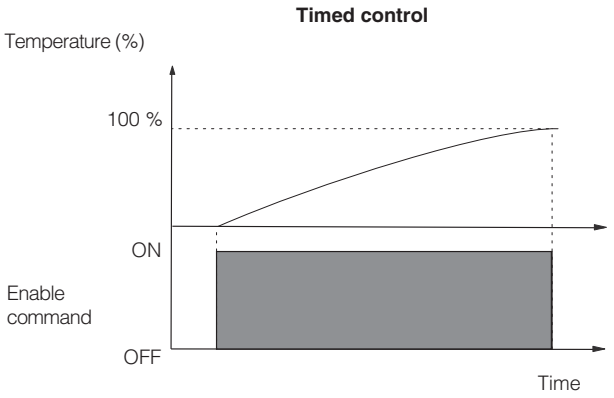
The trolley timer enables the EPG generator for a predefined time to reach the desired temperature. In this condition, the generator provides constant power for the set time interval, after which the heating process is automatically interrupted. The heating interval is defined by the user according to the application requirements.

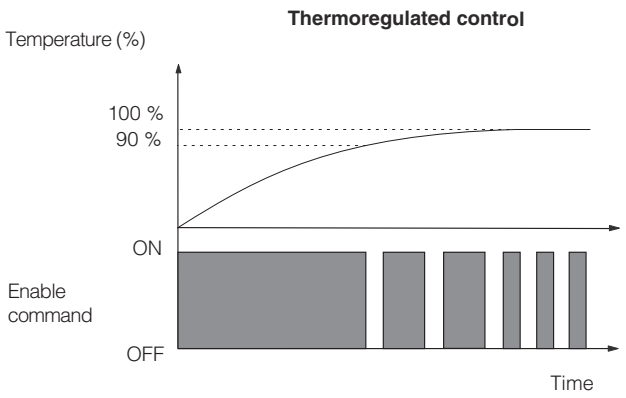
⚠ In order to safely use time control, it is necessary to verify that, at the end of the set time, the mold does not exceed the maximum temperature (300°C) permissible by the MHB blanket

b) Thermoregulated control

Through ON/OFF modulation of the enable signal, the machine control unit precisely regulates the temperature in closed-loop control. This control logic requires a temperature sensor (K-type thermocouple) to measure the effective temperature of the molds. The sensor feedback signal is sent to the thermoregulator which compares the value with the set reference temperature. At the beginning of the heating cycle, the enable command is switched ON until about 90% of the desired temperature is reached. Subsequently the thermoregulator modulates the enable command to obtain the target temperature. This control logic allows high precision in temperature achievement and maintenance, eliminating possible thermal drifts.

The following graphs show the timed and thermoregulated control logics.





4 MAIN CHARACTERISTICS

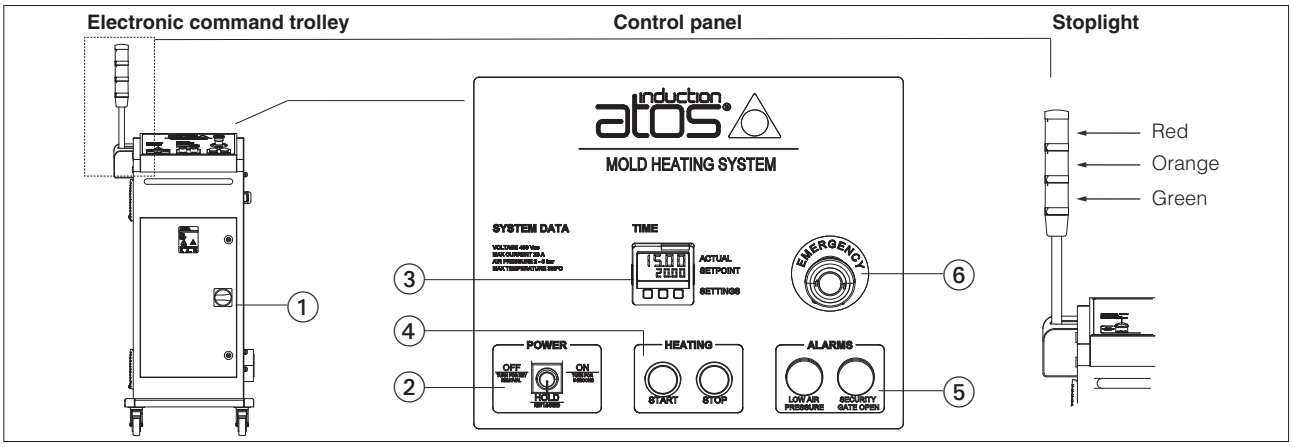
Trolley position	During the heating process the trolley must be placed in a safety zone, outside the buffer zone, at a distance of at least 1600mm from the edge of MBH Mold Heating Blanket. See section 8
Ambient temperature range	0°C ÷ +40°C
Max. mold temperature	300°C
Ambient humidity range	30% ÷ 60%
Inlet air pipe diameter	External diameter 12 mm - not included with the trolley
Inlet air pressure	2 ÷ 6 bar
IP protection degree [CEI EN 605229]	IP 42
Compliance	EC Declaration of Conformity valid in accordance with the directives: EMC 2014/30/UE (EN 61000-6-2; EN 61000-6-4); Low voltage 2014/35/UE (EN 60519-1; EN 60519-3); RoHS 2011/65/UE; REACH (CE n° 1907/2006)

5 ELECTRICAL CHARACTERISTICS

Maximum power		[kW]	15
Power supply			3x400 ±10% VAC o 3x460 ±10% VAC
Maximum power supply (±5%)	T400VAC	[A]	22,8
	T460VAC	[A]	19,8
Frequency		[Hz]	50 ÷ 60
Power factor		[cos φ]	0,95
Output	Peak voltage	[V]	1200
	Peak current	[A]	95
	Frequency	[kHz]	4 ÷ 10
Control circuit voltage			24 VDC
ECT power cable			FG16OR16 4X10 mm^2 (three-phase + ground) - not included with the system

6 CONTROL PANEL AND SIGNALLING STOPLIGHT

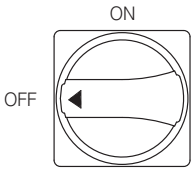
The control panel is equipped with buttons and indicator lights to control the heating process. At the top of the panel is positioned a stoplight to remotely visualise the operating status of the system.



General disconnector (1)

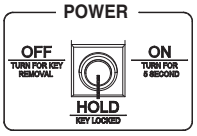
The general disconnector links the trolley to the power grid.

Turn the switch to ON to connect the control panel to the mains.
Turn the switch to OFF to disconnect the control panel from the mains.
The general disconnector must be in the OFF position to open the front door of the trolley.



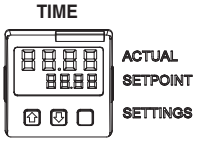
Key switch (2)

Switch ON: turn the key to the right to **ON**, hold for five seconds to enable the power supply to the generator and the thermoregulator.
Once released, the key automatically returns to position **HOLD** and cannot be removed. Orange lights up on the stoplight.
If the heating element is not correctly connected or coupled with the mold, the control panel cannot be activated, and the stoplight illuminates red.
Switch OFF: Turn the key to the left to **OFF** to shut down the control panel.
In this position, the key can be removed to prevent the activation of the panel.



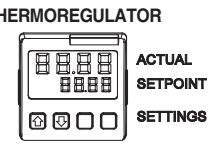
Timer (for ECT-TM) (3)

The timer allows to set the mold heating time without the use of a dedicated thermocouple.
The time is shown on the digital display. The factory preset value is 25 min.
Press the buttons ⇧⇩ to change the heating cycle time.
At the end of the set time, the heating process stops automatically.
In order not to overcome the maximum admissible temperature of 300°C, it is recommended that the first heating cycles be carried out for short intervals, gradually increasing until the desired temperature is reached. During these phases, it is necessary to monitor the temperature of the metal at the points in direct contact with the MHB blanket.



Thermoregulator (for ECT-TR) (3)

The thermoregulator controls the fluid temperature in closed loop according to the thermoregulated control logic described in section 3.
The selected temperature Tset is shown on the digital display. Press the buttons ⇧⇩ to change the temperature up to a maximum of 300°C.
The user must place a K-type thermocouple on the mold surface, in direct contact with the MHB blanket, and connect it to the trolley thermoregulator as shown in section 9. In this way the thermocouple measure one of the hottest points on the mold; it should be considered that the system will initially heat the surface in contact with the heating blanket and subsequently it will propagate uniformly over the entire mold volume.

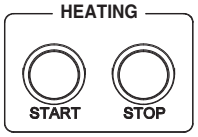


Heating (4)

The START/STOP buttons can be used to control the heating process.

START: after setting the timer (ECT-TM) or the thermoregulator (ECT-TR), press the button to power up the inductor and start the heating process. The stoplight turns green.

STOP: Press the button to de-energise the inductor and stop the heating process. The stoplight turns orange.

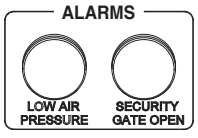


Alarms (5)

Two alarm lights, placed on the control panel, indicate non-consent to start or forced interruption of the heating cycle due to the following anomalies:

- LOW AIR PRESSURE: inlet air pressure in the cooling circuit less than 2 bar.
- SECURITY GATE OPEN: open buffer zone gate.

Both alarms are associated with red lighting on the stoplight.



⚠ If the stoplight turns red and simultaneously both warning lights are off, this means that there is an internal failure. Check all the connections and the correct positioning of the blanket on the mold. If the problem persists, contact Atos Induction technical service

⚠ In case of thermocouple breakage (for ECT-TR only), the blanket supply is automatically interrupted. The stoplight turns red, and an error message appears on the display of the thermoregulator. The heating can be restarted once the thermocouple fault has been solved

Emergency stop (6)

In the case of an emergency, press the button EMERGENCY STOP to switch off the trolley completely.

7 CONNECTION WITH PC

The ECD-TS transceiver permits the transmission of generator diagnostic information (operating status and alarms) to a computer. It is necessary to use the ECD-RV radio/USB converter and the associated ECD-SW software to establish a communication with the PC. The radio/USB converter can communicate with multiple trolleys equipped with transceiver, but not simultaneously. See tech. tab. AI110.

8 INSTALLATION PRESCRIPTIONS

Use the handle on the front of the trolley to move it. Once in position, lock the wheels with the brakes.
Note: in order to prevent damage during shipping, the trolley is delivered with the wheels separated from the chassis. Mount them before starting to use the system, using the screws provided.

The ECT trolley must always be positioned outside the buffer zone, see tech. tab. AI300 sect. 6. The buffer zone must be delimited by a physical barrier with a safety sensor.
The safety sensor ensures that the blanket is segregated during the heating process.

⚠ During the heating process, access to the buffer zone is severely prohibited; if the barrier is opened, the process is automatically interrupted

8.1 Electrical connections

To connect the cables to the trolley, open the panel front door, insert each of them through the corresponding cable gland (located on the right side of the trolley) and connect the cable ends to the appropriate terminal blocks. See section 9 for connection specifications.

Connection to the power grid

The trolley must be connected to the mains in accordance with the applicable safety and industrial systems requirements of the country of installation.

Connection of thermocouple (for ECT-H-TR only)

Make sure to place the thermocouple firmly between the MHB blanket and the surface of the mold, so that it can measure the temperature in the area of contact between fabric and metal.

⚠ Wrong positioning of the thermocouple would cause errors in the thermoregulation process and possible damage to the MHB blanket

Connection of buffer zone safety sensor

The safety sensor must be installed to detect any accidental opening of the barrier, which delimits the buffer zone, during the heating cycles.

8.2 Compressed air connection

The ECT trolley is provided with an inlet for compressed air, necessary to cool the inductor inside the MHB blanket.
Connect the air pipe to the quick coupler on the right side of the trolley.
Ensure air pressure and supply pipe specifications as indicated in section 4.

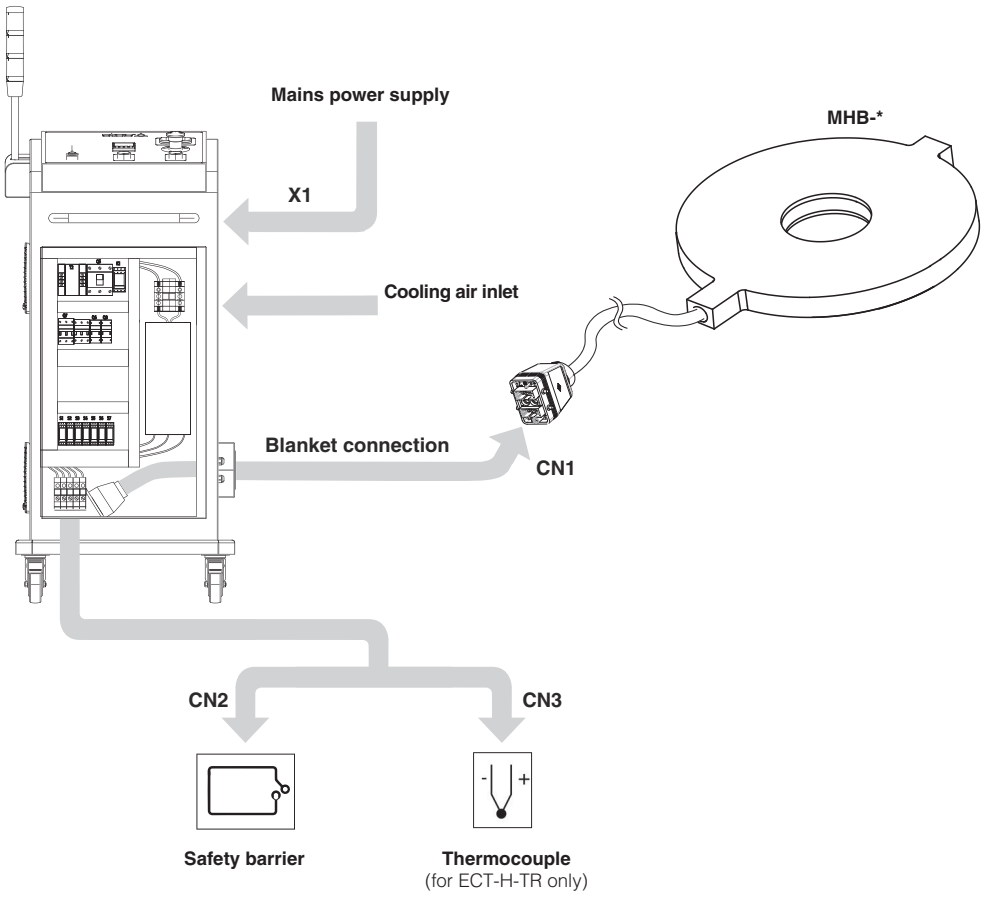
⚠ At the end of the heating cycle, the air continues to flow towards the heating element to protect the internal inductor. However, always remove the MHB blanket from the hot mold at the end of the heating process

8.3 MHB heating blanket connection

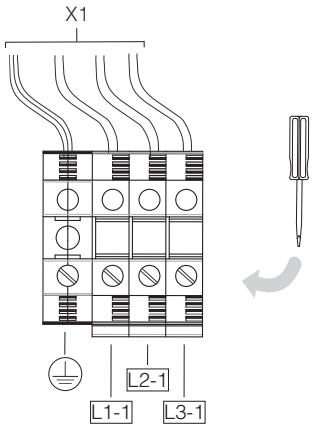
To connect the blanket, open the front door, remove the cover of the wall pass (on the right side of the trolley), insert the blanket cable through the wall pass, connect the quick connector to the corresponding interface located inside the trolley, and finally replace the wall pass cover. The connector contains the electrical connections, and the cooling air pipes.

⚠ The trolley can supply only one blanket at a time, so it is not possible to connect several inductors to a trolley

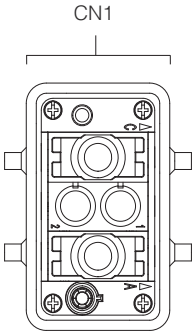
⚠ All connections must be performed exclusively by qualified personnel



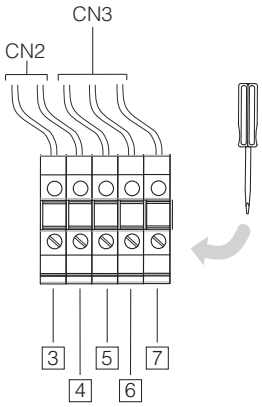
Power supply connection



Blanket connection



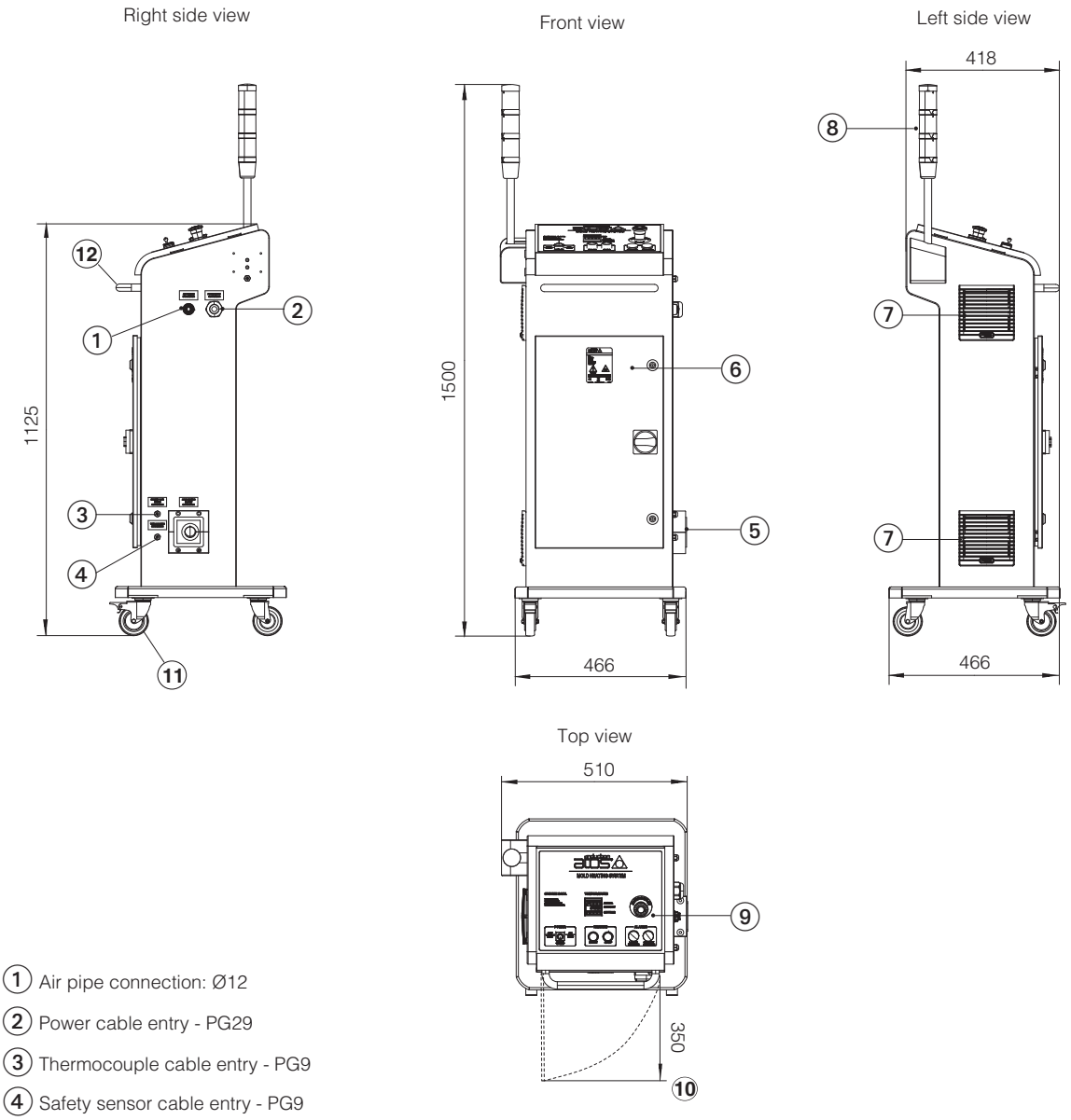
Safety sensor and thermocouple connection



TERMINAL BLOCKS	PIN	TECHNICAL SPECIFICATIONS	NOTES
X1 **(4)**	L1-1	3x400 VAC or 3x460 VAC	Mains power connection
	L2-1		
	L3-1		
	Yellow / green		Ground connection
CN1			Blanket connection
CN2 **(5)**	3	24VDC (5 A max)	Input - Safety sensor contact
	4		
CN3 **(5)**	5	Terminal Ni-Cr	Input - K type thermocouple (for ECT-H-TR only)
	6	Terminal Ni-Al	
	7 Yellow / green	Shielding terminal	

(4) Cable section: min.10 mm^2; max.16 mm^2; **(5)** Max. cable section = 2,5 mm^2

10 DIMENSIONS [mm]



1. Air pipe connection: Ø12
2. Power cable entry - PG29
3. Thermocouple cable entry - PG9
4. Safety sensor cable entry - PG9
5. MHB cables wall pass
6. Front door
7. Cooling grids
8. Light signaling device (stoplight)
9. Control panel
10. Minimum distance for front door opening
11. Swivel wheels with brakes
12. Handle for moving

11 RELATED DOCUMENTATION

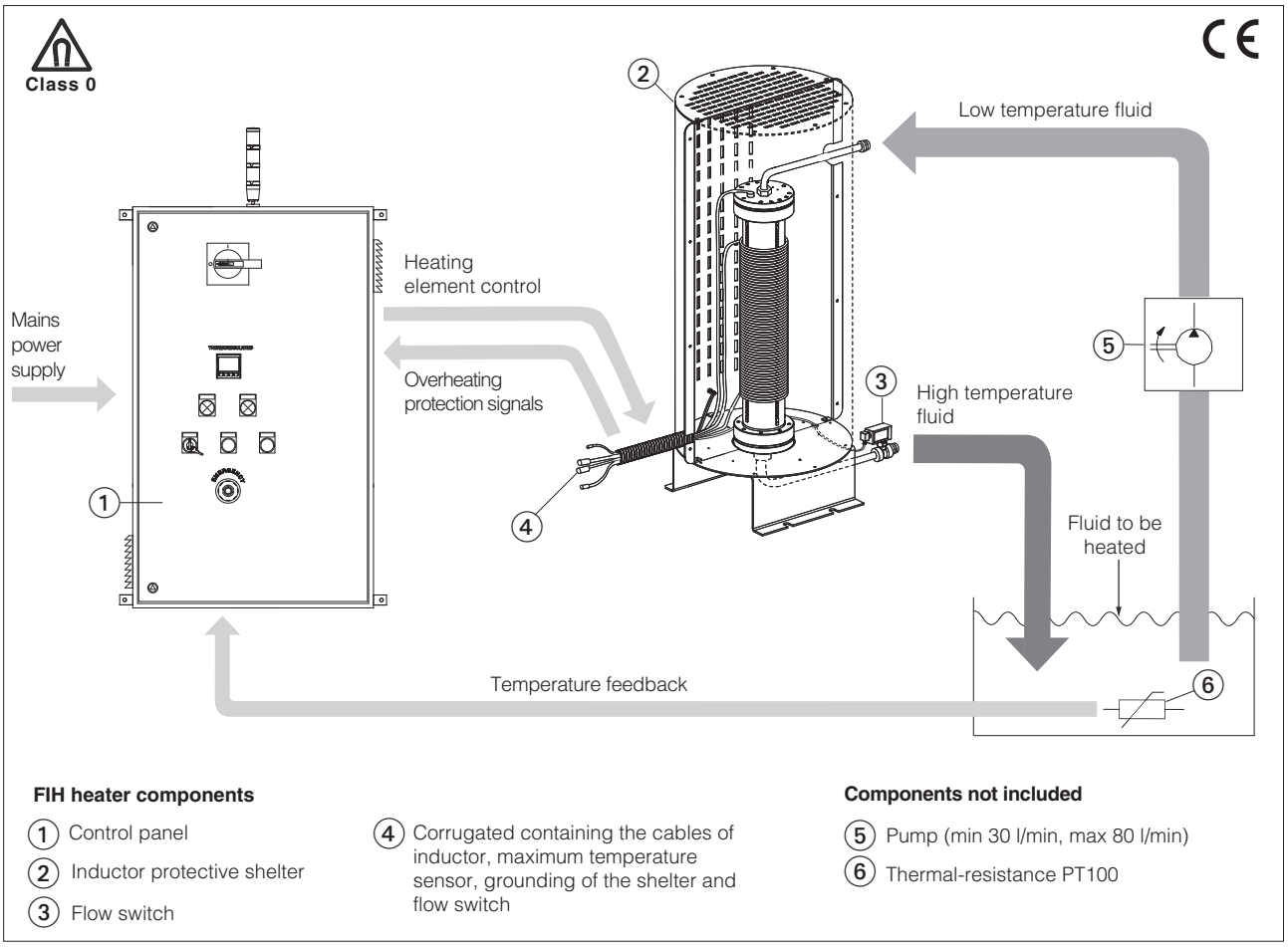
AI100	Electronic power generators
AI110	Electronic communication devices
AI300	Mold heating blankets

Induction heaters for oleohydraulic fluids

Designed for rapid and precise heating of mineral and synthetic oils in industrial processes, for example, oil preheating in hydraulic systems and machinery.

These systems allow significant advantages over traditional resistive heating systems:

- Reduced energy consumption and more efficient heat transmission
- Reduced heating time due to high heat exchanged per unit volume
- Uniform heat distribution within the fluid up to 60°C, avoiding dangerous localized overheating
- Compatibility with fluids of various viscosities [10 ÷ 500 mm^2/s]
- Possible integration in off-line filtration circuits
- High reliability and long life service



FIH heater components

1. Control panel
2. Inductor protective shelter
3. Flow switch
4. Corrugated containing the cables of inductor, maximum temperature sensor, grounding of the shelter and flow switch

Components not included

5. Pump (min 30 l/min, max 80 l/min)
6. Thermal-resistance PT100

1 MODEL CODE

FIH	-	H	-	T400VAC	/	60	-	10	-	80	05	*

FIH — Induction heater for oleohydraulic fluids

H — Nominal power
H = 15 kW

T400VAC — Power supply (1)
T400VAC for 380-400VAC - 50/60Hz three-phase
T460VAC for 440-460VAC - 50/60Hz three-phase

60 — Maximum fluid outlet temperature (2)
60 = 60°C

10 — Maximum pressure
10 = 10 bar

80 — Maximum flow rate
80 = 80 l/min

05 — Length of inductor connection cable
05 = 5 m
10 = 10 m

***** — Series number

(1) For different supply voltages, please contact Atos Induction's technical department

(2) For higher temperatures, please contact Atos Induction's technical department

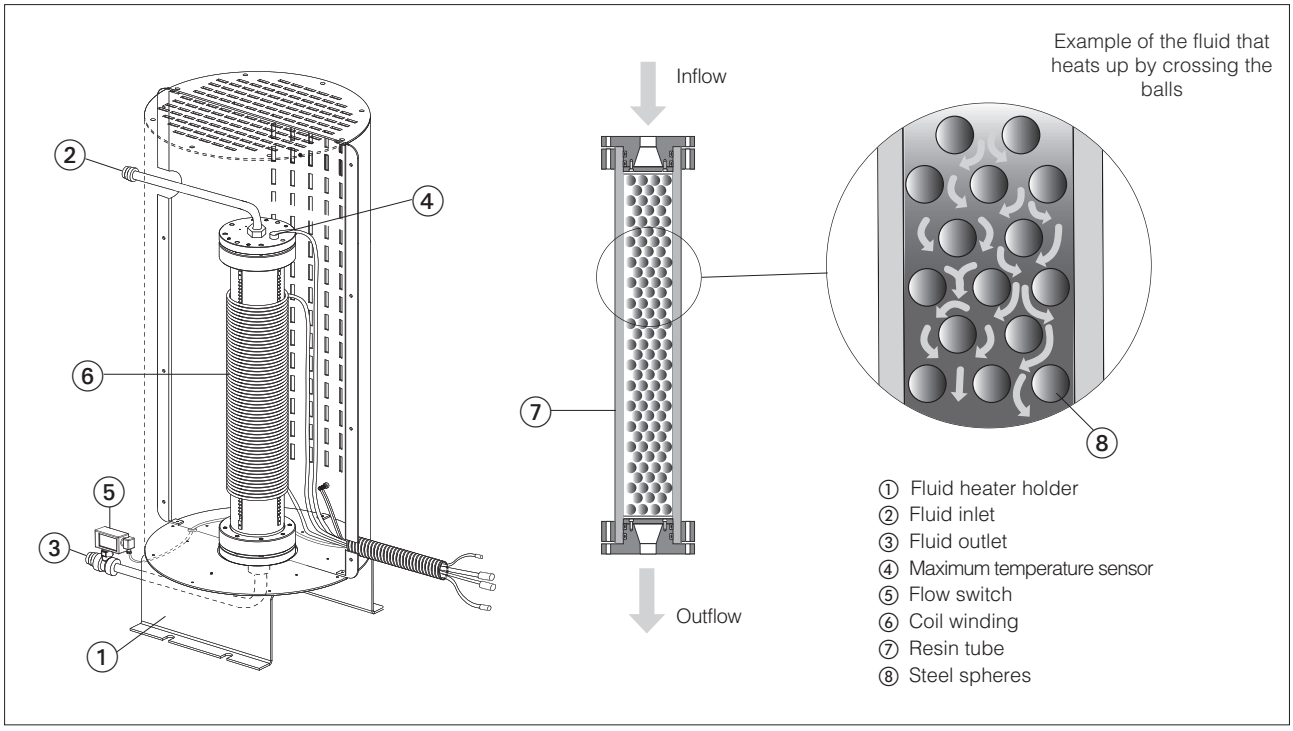
2 FUNCTIONAL DESCRIPTION

The fluid heater is designed to heat mineral and synthetic oils (not water-based fluids) through the electromagnetic induction principle. The FIH system consists of an inductor, supplied pre-assembled for connection to the hydraulic circuit, and a control panel.

2.1 Inductor

The inductor is composed of a coil wound on a resin tube; at the ends of the tube there are the hydraulic inlet and outlet connections for the fluid passage. Inside the tube there are a series of steel spheres, of uniform diameter, in direct contact with the fluid. When the inductor is powered, the magnetic field generated by the coil penetrates inside the cylinder and heats the steel spheres because of the magnetic induction. The fluid is heated by direct contact with the sphere surfaces, obtaining a uniform distribution of the temperature inside, and avoiding localized overheating as in common resistance heaters. The inductor is equipped with two pre-installed safety systems: a maximum temperature sensor mounted on the upper head, which measures the inductor temperature, and a flow switch located on the outlet pipe, which enables heating only in the presence of fluid flow rate and avoids spheres overheating.
During the heating process the inductor generates an electromagnetic field that could be dangerous for the health of the operators in the close vicinity. The heating element is supplied with a protective shelter which reduces field emissions below human safety limits (Class 0 - UNI EN 12198). The shield is made up of two half-shells, placed on the inductor support.

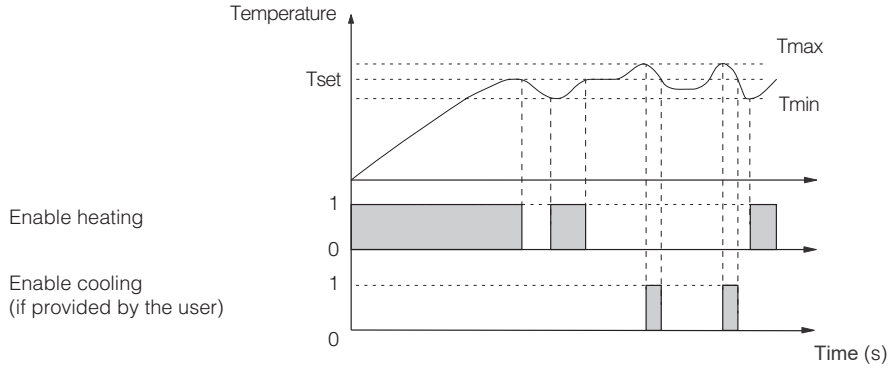
⚠ It is forbidden to remove the shield when the heater is running. If the heater must be started up without shelter or with open shelter, e.g., for maintenance work, it is necessary to ensure a buffer zone around the inductor, with a radius of 1400 mm, inside which access by operators is prohibited. To remove the shelter, see the user and maintenance manual



2.2 Control panel

The control panel powers the inductor and manages the control logic of the heating cycle and the system diagnostics. The control panel contains the EPG power generator (see table AI100), the thermoregulator and terminal blocks for the connection of the system components. The fluid temperature is precisely regulated in closed-loop control by ON/OFF modulation of the enabling signal sent to the internal EPG generator.

The following diagram shows the logic of the FIH thermoregulated control.



When the heater is started, the fluid temperature increases until it reaches the selected value Tset; once the set point is reached, without external heat sources, the heater control maintains the fluid temperature between the values Tmin and Tset. The temperature Tmin is the value below which the thermoregulator starts heating the oil; Tmin is automatically set 2°C under the selected Tset and cannot be changed.

The control panel provides a contact to automatically activate a fluid cooling system, if provided by the customer. The temperature Tmax represents the value whereby the thermoregulator enables the oil cooling, until it returns to the temperature Tset. Tmax is automatically set 0,5°C above the selected Tset and is not modifiable.

3 MAIN CHARACTERISTICS

Inductor position	Vertical
Electrical panel position	Wall mounting. The panel must be positioned so that anyone can easily reach all the controls
Ambient temperature range (for electrical panel)	0°C ÷ +40°C
Ambient humidity range (for electrical panel)	30% ÷ 60%
IP protection degree [CEI EN 605229]	Control panel: IP54
	Inductor: not applicable, avoid contact between the external surface of the tube and liquids
Electromagnetic emissions [EN UNI 12198]	Class 0
Compliance	EC Declaration of Conformity valid in accordance with the directives: EMC 2014/30/UE (EN 61000-6-2; EN 61000-6-4); Low voltage 2014/35/UE (EN 60519-1; EN 60519-3); RoHS 2011/65/UE; REACH (CE n° 1907/2006)

4 ELECTRICAL CHARACTERISTICS

Nominal power	[kW]	15 ±15%
Power supply		3x400 ±10% VAC o 3x460 ±10% VAC
Input current (±5%)	T400VAC [A]	22,8
	T460VAC [A]	19,8
Frequency	[Hz]	50 ÷ 60
Power factor (cos φ)		0,95
Electrical protections		The control panel contains all the necessary protection devices
Control panel power cable		FG16OR16 4X10 mm^2 (three-phase + ground) - not included
External cooling system control		24 VDC - 2 A

5 HYDRAULIC CHARACTERISTICS

Max fluid heating temperature	[°C]	60
Max inlet fluid pressure	[bar]	10
Flow rate	[l/min]	min 30, max 80
Fluid pressure drop inlet / outlet	[bar]	2 (with 80 l/min flow rate and 500 mm^2/s fluid viscosity)
Admissible viscosity	[mm^2/s]	10 ÷ 500
Hydraulic connections inlet / outlet		G1”
Fluid filtration degree		ISO 4406 class 20/18/15

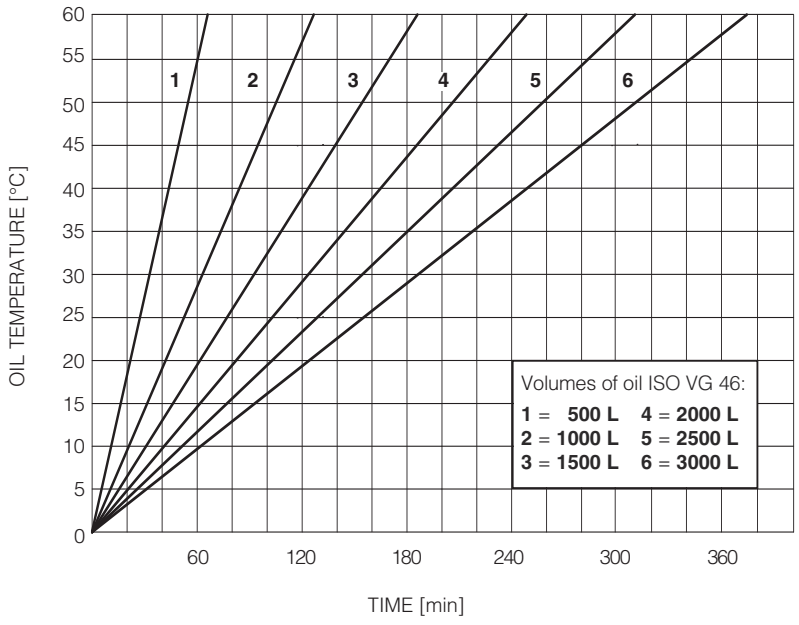
The FIH heater is designed to operate with the following fluids type:

HYDRAULIC FLUID	CLASSIFICATIONS	REFERENCE STANDARD
Mineral and synthetic oils	HL, HLP, HLPD, HVLP, HVLPD, HFDU, HFDR	DIN 51524; ISO 12922

For fluids not included in the table, consult the Atos Induction technical department.

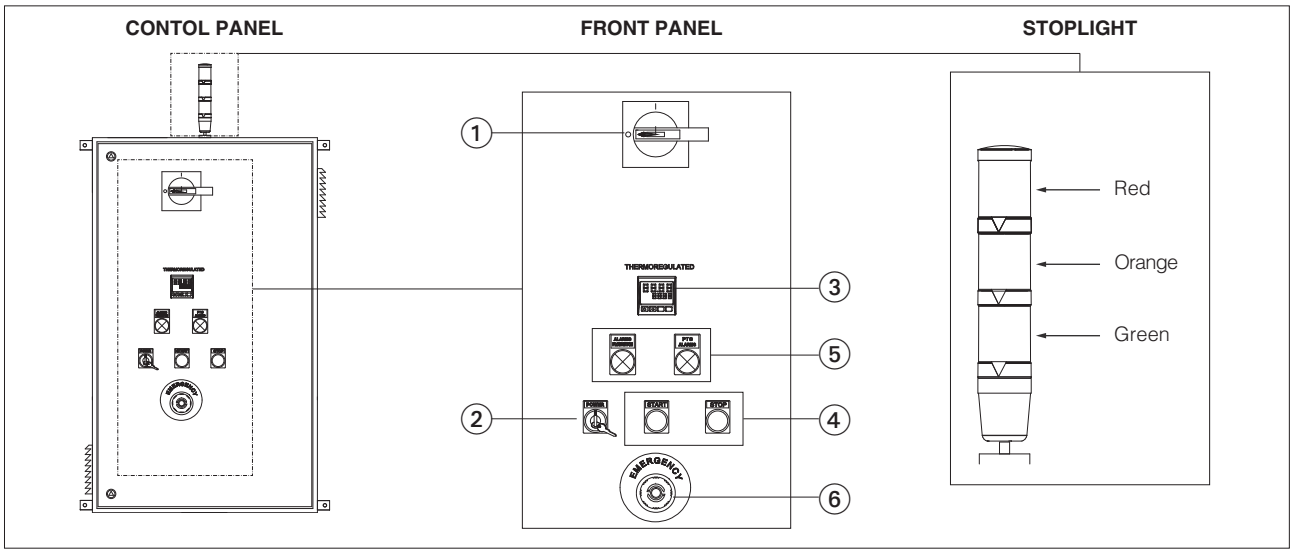
⚠ Water-based fluids are not permitted because they may damage the heater

The chart below shows the time required to heat different volumes of ISO VG 46 oil.



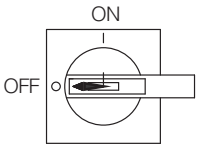
6 CONTROL PANEL AND SIGNALLING STOPLIGHT

The front control panel is equipped with buttons and indicator lights to manage the heating process. At the top of the panel there is a stoplight for remotely visualise of the operating status of the system.



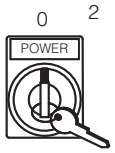
General disconnector (1)

The general disconnector links the control panel to the power grid and enables the control circuit 24 VDC of the panel.
Turn the switch to ON to connect the control panel to the mains.
Turn the switch to OFF to disconnect the control panel from the mains.
The general disconnector must be in the OFF position to open the front door of the cabinet.



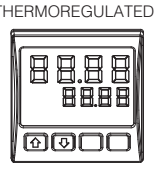
Key switch (2)

It allows to activate the panel internal power supplies and to prepare the heater to be started.
Switch ON: turn the key to the right to **2**, hold for five seconds to enable the power supply to the generator and the thermoregulator.
Once released, the key automatically returns to position **0** and cannot be removed. Orange lights up on the stoplight.
If the heating element is not correctly connected to its terminals, the control panel cannot be activated, and the stoplight illuminates red.
Switch OFF: turn the key to the left to **1** to shut down the control panel. In this position, the key can be removed to prevent the activation of the panel.



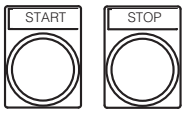
Thermoregulator (3)

The thermoregulator controls the fluid temperature in closed loop according to the thermoregulated control logic described in section 2.2.
The selected temperature Tset is shown on the digital display. Press the buttons ⇧⇩ to change the temperature up to 60°C maximum.
The user must place a PT100 thermo-resistor in the fluid tank and connect it to the control panel, as shown in section 8.



Heating (4)

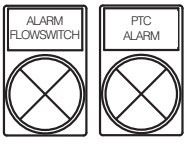
The START/STOP buttons can be used to control the heating process.
START: after setting the thermoregulator, press the button to power up the inductor and start heating the fluid. The stoplight turns green.
STOP: press the button to de-energise the inductor and stop the heating process. The stoplight turns orange.



Alarms (5)

In order to prevent possible overheating, the heater is equipped with protection systems that interrupt or do not allow the heater start up in the presence of a malfunction:

- Flow switch (supplied with the system): ensures to operates only in presence of fluid flow through the inductor
- Maximum temperature sensor (supplied with the system): monitors that the inlet head temperature does not exceed the safeguard value +70°C. The heating cycle cannot be reactivated until the temperature returns within the safety threshold



Two alarm lights corresponding to the sensors are positioned on the control panel:

ALARM FLOW SWITCH: absence of fluid flow. The stoplight lights red.

PTC ALARM: inductor inlet head temperature greater than 70°C. The stoplight lights red.

Note: In case of anomaly the inductor power supply is always interrupted

⚠ If the stoplight turns red and simultaneously both warning lights are off, this means that there is an internal failure. Check the connections of mains power supply and coil. If the problem persists, contact Atos Induction technical service

⚠ In case of thermo-resistor breakage, the inductor supply and the fluid heating are interrupted. The stoplight turns red, and an error message appears on the display of the thermoregulator. The heating can be restarted once the thermo-resistor fault has been solved

Emergency stop (6)

In the case of an emergency, press the button EMERGENCY STOP to switch off the heater completely.

Enabling cooling: The control panel provides a 24 VDC - 2 A source to automatically enable any customer cooling system. See section 2.2 for cooling enable logic.

7 INSTALLATION PRESCRIPTIONS

The inductor can be connected to a dedicated hydraulic circuit or, if present, it is possible to exploit the off-line filtration circuit, checking the flow and pressure characteristics.
In addition to the heating process, the FIH system can also manage the customer's cooling system to allow total control of the fluid temperature.

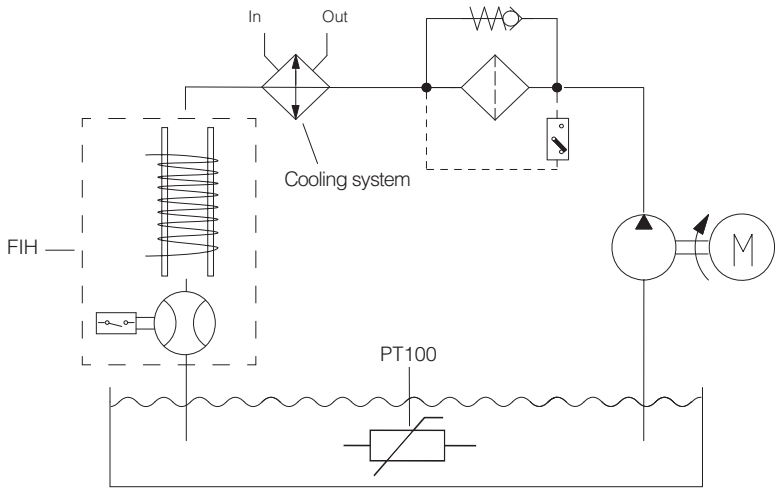
7.1 Requirements and equipment

- Admissible fluid flow rate from 30 l/min to 80 l/min.

⚠ **Warning**: an insufficient flow could overheat the oil and damage the inductor. It is forbidden to power the inductor without fluid flow; these data must be considered to select a compatible pump

- Maximum inlet pressure 10 bar
- The thermoregulated process requires the installation of a temperature sensor in the fluid tank; to this end, it is necessary to connect a PT100 thermo-resistance (not included) to the control panel, see section 8

The following example shows the integration of the FIH heater into a typical off-line circuit.



7.2 Electrical connections

To connect the cables to the control panel, open the panel front door, insert each of them through the corresponding cable gland (located on the bottom side of the panel) and connect the cable ends to the appropriate terminal blocks. See section 8 for connection specifications.

Connection to the power grid

The control panel must be connected to the mains in accordance with the applicable safety and industrial systems country requirements.

Connection of the corrugated containing the cables of inductor, maximum temperature sensor, grounding of the shelter and flow switch

The cables of inductor, maximum temperature sensor, grounding of the shelter and flow switch are supplied pre-laid together in a corrugated tube. To connect the components, clamp the corrugated pipe to the fitting (located at the bottom of the panel) and connect the cable ends to the corresponding terminals.

Note: the inductor protective shelter needs to be connected to ground in order to perform shielding function correctly

⚠ The control panel can supply only one inductor at a time, so it is not possible to connect several inductors to a panel

⚠ Use only the cables supplied with the heater. Due to their special design, the inductor connection cables cannot be shortened or extended. Please select the required length carefully from the available lengths, see section 1

Connection of PT100 thermo-resistor

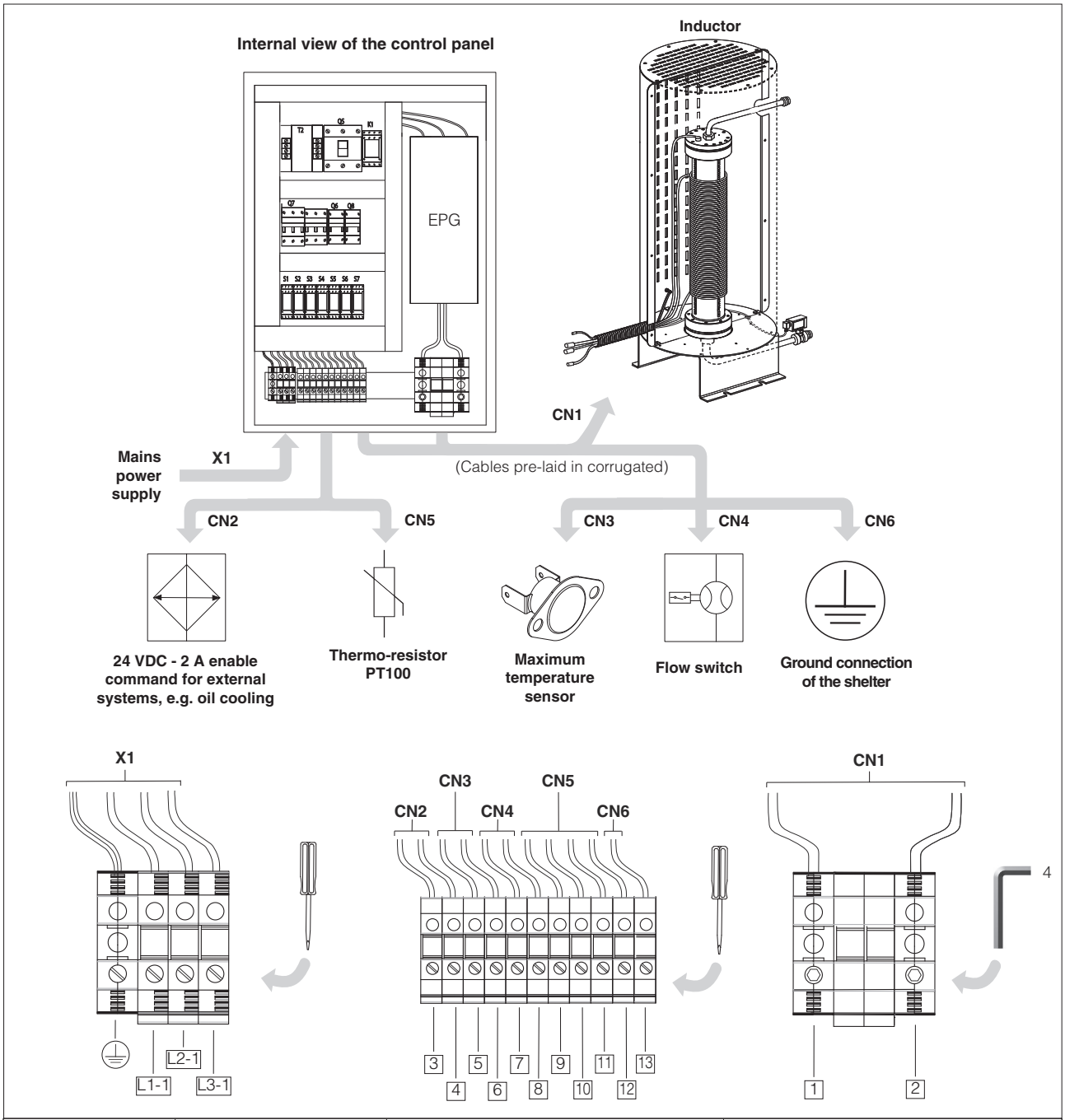
The thermo-resistor is necessary to monitor the temperature of the fluid tank and to perform temperature control. For correct temperature measurement, use only 2- or 3-wire PT100 sensors. It is advisable to choose shielded sensors to reduce possible interference.

Connection of external cooling device (if present)

Verify that the cooling system can be properly driven through the 24 VDC - 2 A source provided by the control panel.

⚠ All connections must be performed exclusively by qualified personnel

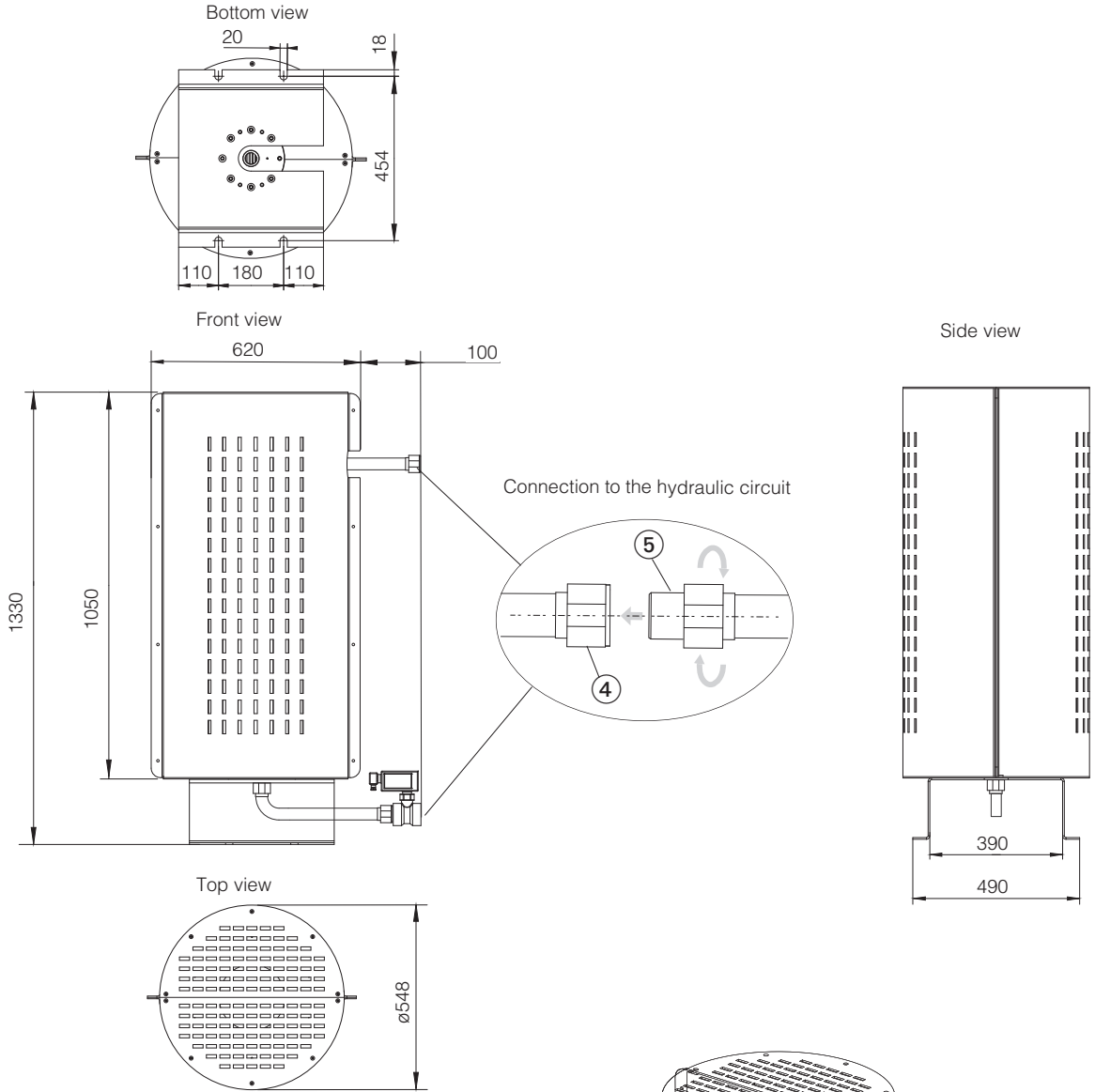
8 ELECTRIC CONNECTIONS

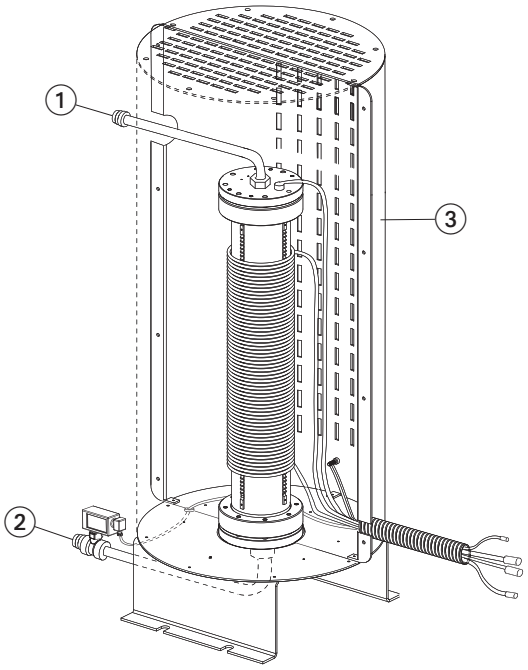


TERMINAL BLOCKS	PIN	TECHNICAL SPECIFICATIONS			NOTE
X1 **(3)**	L1-1	3x400 VAC or 3x460 VAC			Mains power connection
	L2-1				
	L3-1				
	Yellow / green				Ground connection
CN1	1				Inductor connection
	2				
CN2 **(4)**	3		0 VDC	Cooling down OFF	Output - enable command for external systems
	4		24 VDC (2 A)	Cooling down ON	
CN3	5	24 VDC (5 A max)	Open	Excessive temperature	Input - maximum temperature sensor
	6		Closed	Adequate temperature	
CN4 **(4)**	7	24 VDC (5 A max)	Open	Insufficient flow rate	Input - flow switch connection
	8		Closed	Adequate flow	
CN5 **(4)**	9	Red			Input - thermo-resistor PT100 **(5)**
	10	White			
	11	Red			
	12	Shield (optional)			
CN6 **(3)**	13	Yellow / green			Ground connection of the shelter

(3) Cable section: min.10 mm^2; max.16 mm^2; **(4)** Max. cable section 2,5 mm^2
(5) Ready for three-wire PT100 sensor + shield cable (optional). For connection of two-wire sensors, jumper terminals 9 and 10

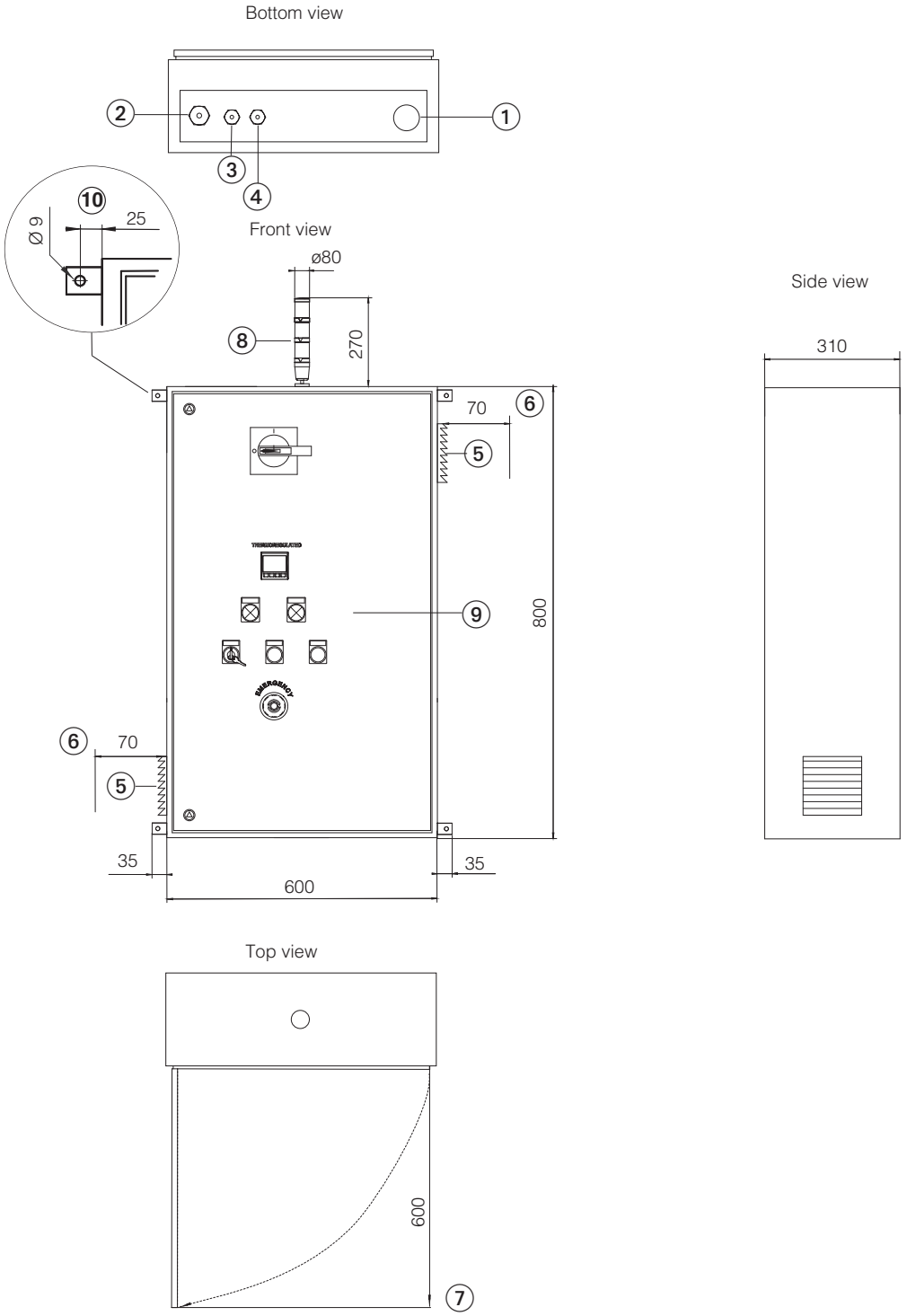
9 INDUCTOR DIMENSIONS [mm]





1. Fluid inlet connection
2. Fluid outlet connection
3. Shelter
4. G1" female connection (included)
5. G1" male connection (not included)

10 CONTROL PANEL DIMENSIONS [mm]



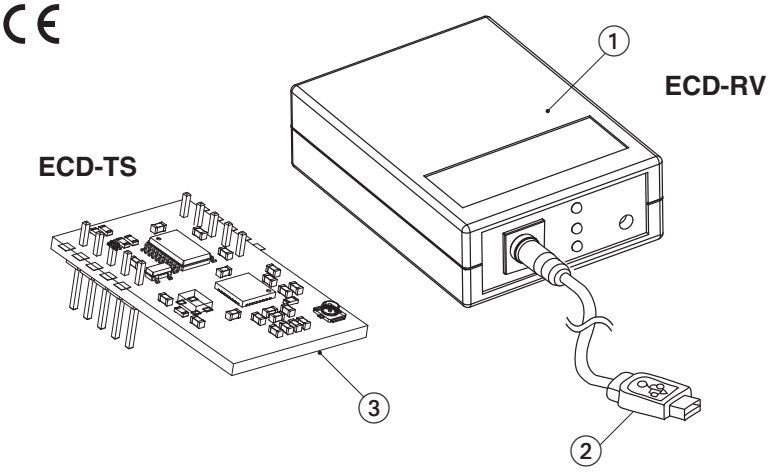
1. Cable entry for heating element, maximum temperature sensor, grounding of the shelter and flow switch. The cables are supplied laid inside a plastic corrugation
2. Power cable entry - PG29
3. PT100 cable entry - PG9
4. Cooling system cable entry - PG9
5. Cooling fans
6. Minimum distance for correct heat dissipation
7. Minimum distance for front door opening
8. Light signalling device (stoplight)
9. Front panel
10. Wall fixing brackets (n° 4)

11 RELATED DOCUMENTATION

AI100	Electronic power generators

Electronic communication devices

for EPG Electronic Power Generators



① Radio/USB converter
② PC connection cable, supplied with Radio/USB converter: L=1 m
③ Transceiver - to be installed inside EPG power generator

ECD

Electronic communication devices designed to monitor the operating parameters of EPG generators of Atos Induction heating systems.

They allow the wireless transmission of the diagnostic information form EPG power generator to a PC, such as the operating status of the system and any alarms.

The system consists of an ECD-TS transceiver module, which can be preinstalled in the EPG generator or subsequently installed by the user (see tech. tab. AI100), and a USB/radio converter ECD-RV to be connected to the PC through USB port; see section 2.

The communication between the devices is managed by ECD-SW software, to be installed on the PC. The software is supplied together with the ECD-RV radio/USB converter.

1 MODEL CODE

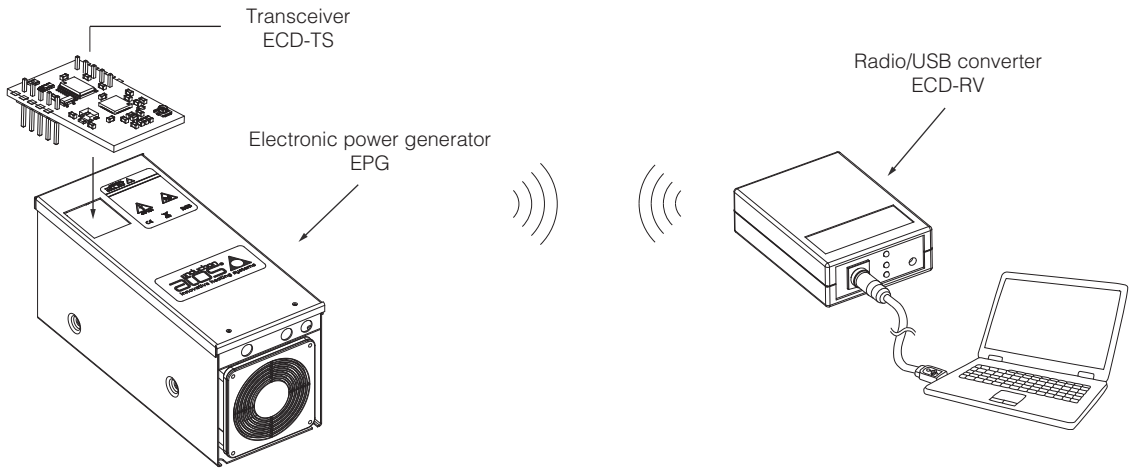
ECD	-	RV	*
Electronic communication device		**Type of device** **RV** = Radio/USB converter **TS** = Transceiver **SW** = Software	Series number

2 COMPONENTS DESCRIPTION

The ECD system includes the following devices:

- ECD-TS: the transceiver can be preinstalled in the EPG generator or ordered separately for later installation by the user. See the E-MAN-ECD manual "ECD Radio Modules for Electronic Power Generators" for the installation procedure of the ECT-TS module.
- ECD-RV: Radio/USB converter to be connected to PC or laptops via USB port A type. The radio module dialogues with the ECD-TS counterpart module installed in the power generator. The radio/USB converter can communicate with several EPG generators equipped with an ECD-TS transceiver; however, simultaneous communications are not possible, the communication can be established with one device at time.
- ECD-SW: software developed by Atos Induction to manage communication between ECD-TS and ECD-RV modules and to display process data.

3 FUNCTIONAL EXAMPLE



4 **FUNCTIONAL DESCRIPTION** - see E-MAN-ECD manual for a detailed description of the functions and use of the software

Through the ECD-SW software it is possible to monitor, in real time, the operating parameters of the power generator.
In order to establish the communication with the generator follow the next steps:

1) Connect the ECD-RV radio converter to the PC's USB port by the cable supplied with the module. Once connected, the converter is immediately ready and does not require external power sources.

2) Start the ECD-SW software, previously installed on the PC.

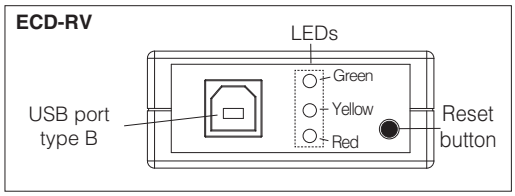
3) Power the EPG generator to connect with.

4) On the main screen of the software (HOME), insert the generator's serial number in the software box "Device Serial Num." (1). The serial number is shown on the generator's internal board and is visible through the window on the cover, see section 7 of tech. table AI100. The serial number consists of a letter and a number (for example M77).

5) Click on the software box "Connect" (2): if the connection is successful, in the box "Power Set" will appear the value of the maximum output power set on the generator. Otherwise, no number will be displayed in the box. This connection operation is necessary every time the software is started. If a new generator is to be connected, (the previous one must be disconnected using the "Disconnect" box) enter the new serial code, and press the "Connect" box again.

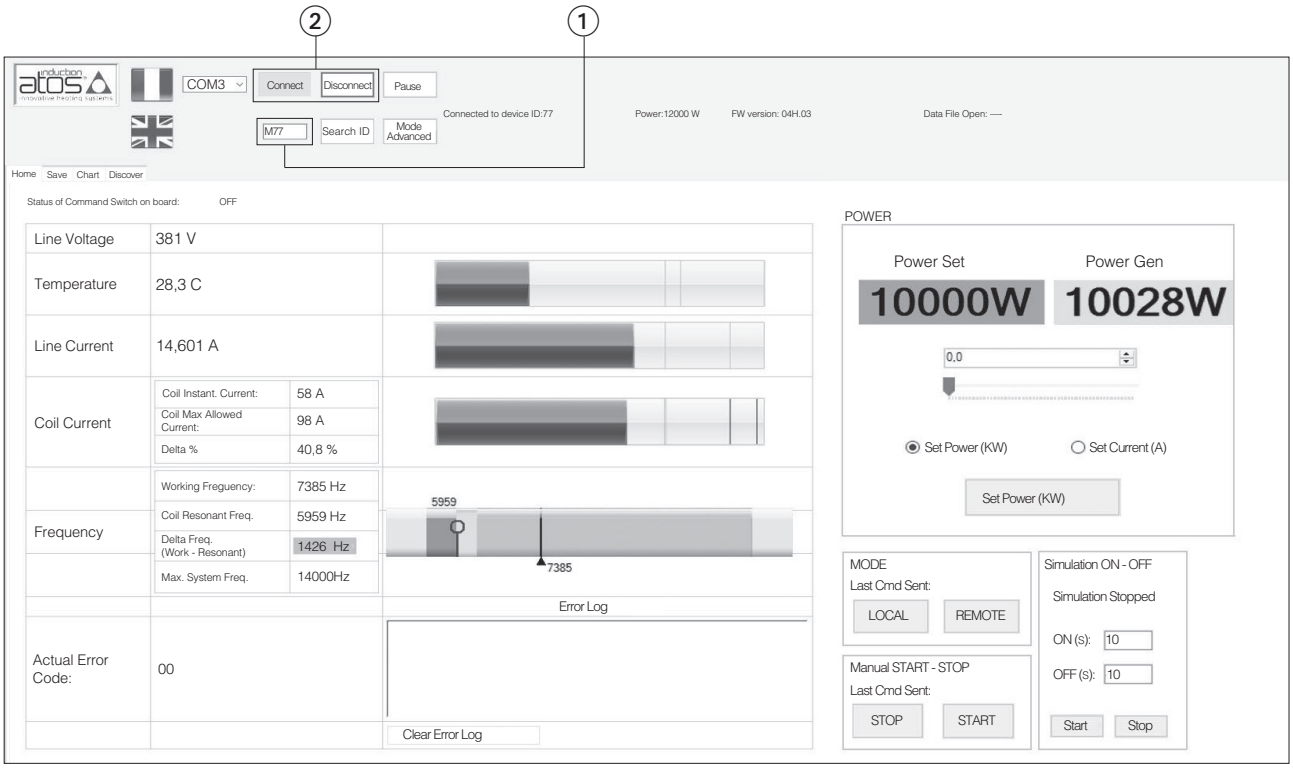
The operating status of ECD-RV is represented by three LEDs on the converter front panel:
- Green LED ON: unit powered
- Yellow and Red LEDs flashing: data transfer to and from the module

In case of communication problems, it is possible to restart the ECD-RV converter. To reboot the radio module, press the reset button positioned on the front of the converter (using a little screwdriver), hold for a second and release it; repeat the steps from point **4)**.



The main page (HOME) shows the main information of the induction process. This essential tool allows you to check the correct system functioning, facilitating remote assistance in case of faults.

Below is shown the page (HOME) with the main parameters; to view the English version click on the British flag at the top left.



- Line Voltage: line voltage measured at generator input
- Temperature: internal generator temperature
- Line current: current absorbed by the generator
- Coil current: instantaneous current supplied to the heating element, maximum current allowed and margin between the two values
- Frequency: working frequency, resonance electric frequency and difference between the two values
- Actual Error Code: any system errors are listed here; for a description of the error codes see the E-MAN-EPG generator user manual
- Power Set: maximum output power set on the generator
- Power Gen: instantaneous power supplied to the heating element

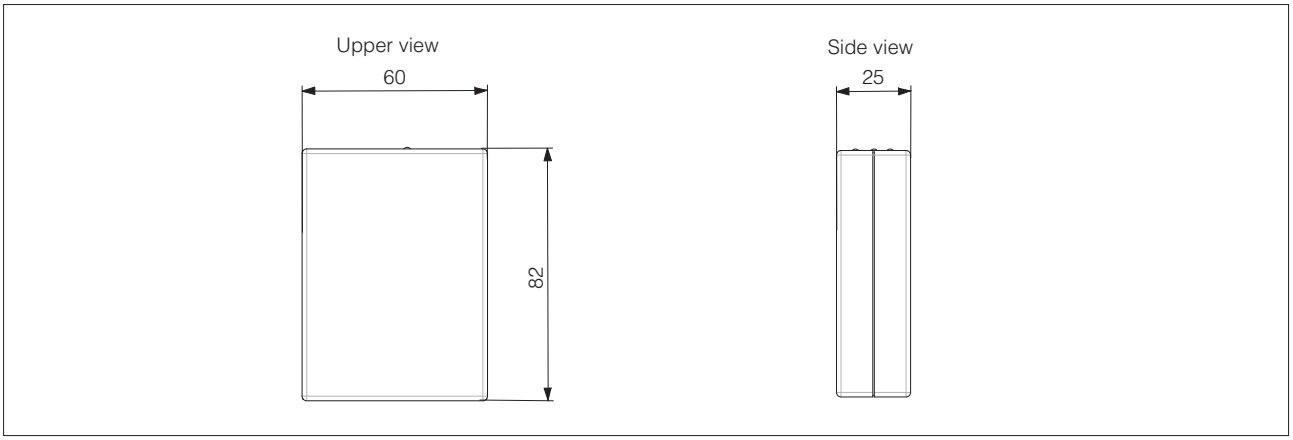
5 MAINS CHARACTERISTICS

Transmission frequency	868 MHz
Transmission power	10 mW
Radio range	up to 150 m in open field
Compliance	EC Declaration of Conformity valid in accordance with the directives: 2004/108/CEE (EN 301 489-03; EN 301 489-01; EN 55022 + A1 ; EN 61000-4-1 ; IEC 61000 – 4-3); 1999/05/CE (R&TTE); ETS 300.220-2; ETS 300.220-1

6 MINIMUM SYSTEM REQUIREMENTS

Operating System	Window 7, 8, 10
USB port	1.1; A type
Processor	32 bit (x86)
RAM	1 Gb

7 DIMENSIONS OF ECD-RV [mm]



8 RELATED DOCUMENTATION

AI100	Electronic power generators	**E-MAN-ECD**	Radio Modules for Electronic Power Generator User Manual
AI700	Electronic command trolleys		


induction
atos
innovative heating systems

induction atos
innovative heating systems

Atos Induction
via alla Piana, 57 - 21018 Sesto Calende - Italy
phone +39 0331 918384 - info@atosinduction.com
www.atosinduction.com

atos GROUP

www.atos.com