INDUCTION EQUIPMENT FOR HEAT-TREATMENT OF STEEL WIRES

APPLICAZIONI TERMOELETTRONICHE S.r.l.

CHARACTERISTICS

- **APPLICATION**

  The equipment is designed for the in-line heating of steel wires used in the production of springs for automotive suspensions and valves

- **MATERIAL TO BE HEATED**

  High carbon steel : 55SiCrV, 55CrSiA, 55CrV, 55CrS,

  $60Si_2Mn$, 65Mn and similar

- **DIMENSION OF WIRES**

  Cylindrical wires: Ø 6 ÷ 18 mm

- **HEAT-TREATMENT TEMPERATURES**

  Hardening section: 950 ÷ 1000°C

  Tempering section: 400 ÷ 600 °C

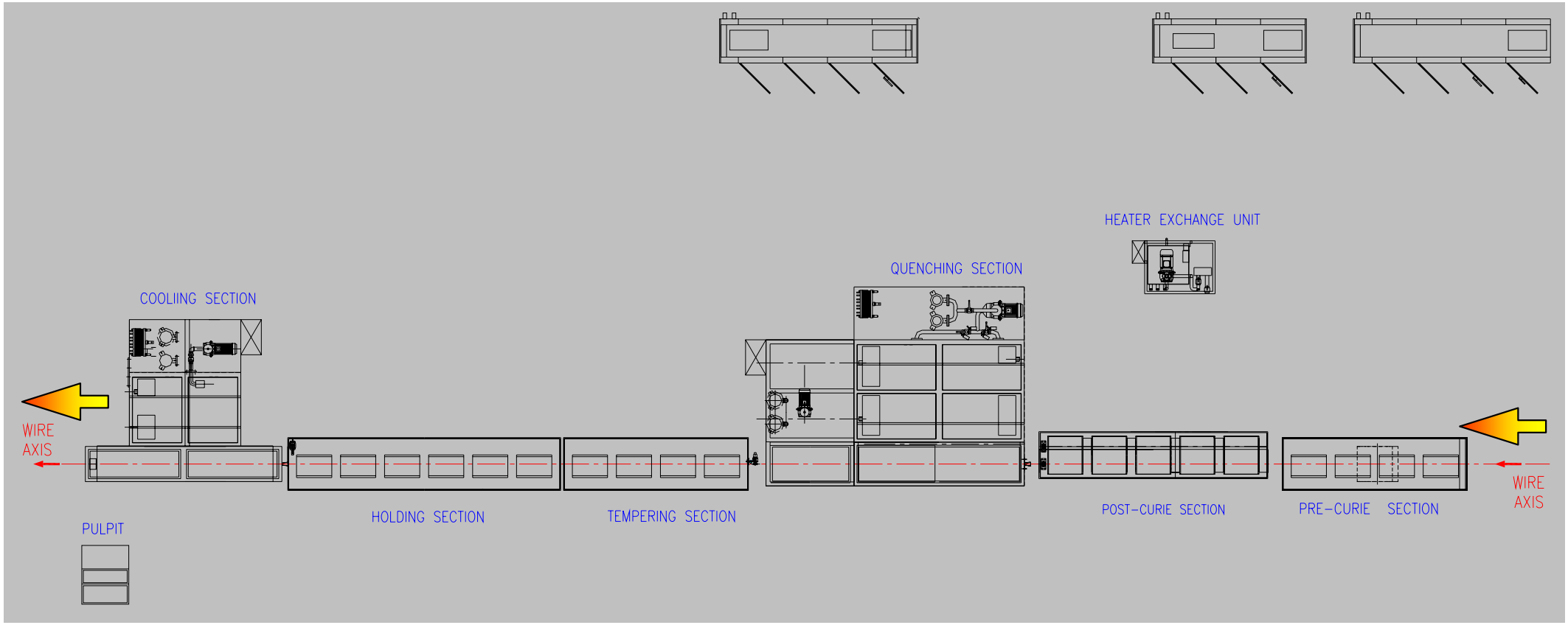
- **HOURLY PRODUCTION**

  wire Ø 6 ÷ 12 mm : 860 ÷ 2000 kg/h

  wire Ø 13 ÷ 18 mm: 1880 ÷ 2100 kg/h

LAYOUT

PARTIAL LAYOUT SKETCH FOR WIRE - DELIVERY ATE's -

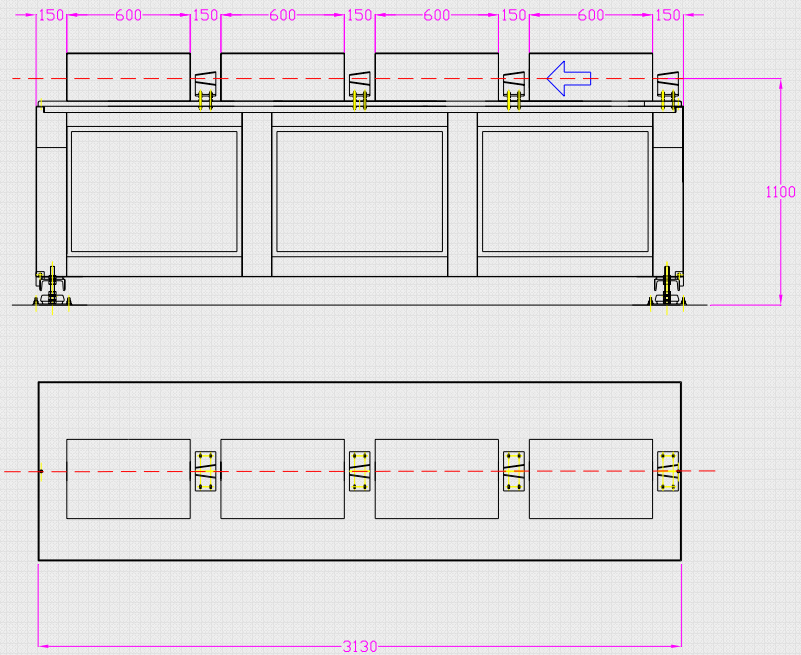


Operating direction

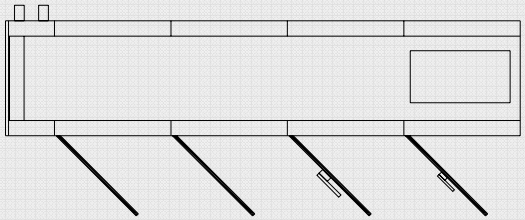
PRE-CURIE FURNACE

PRE-CURIE SECTION [redacted] (heating to about 700-750 °C)

FURNACE



CABINET

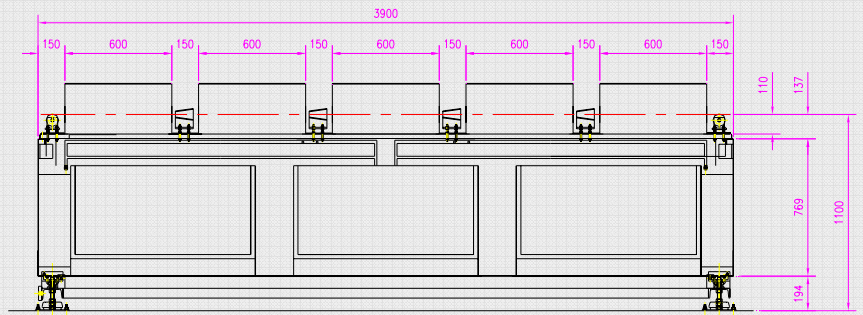


POST-CURIE FURNACE

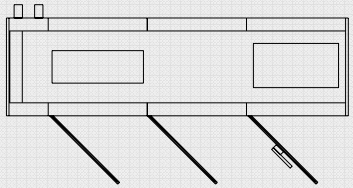
POST-CURIE SECTION (heating to about 950-1000 °C)

[redacted]

FURNACE



CABINET



HARDENING FURNACE

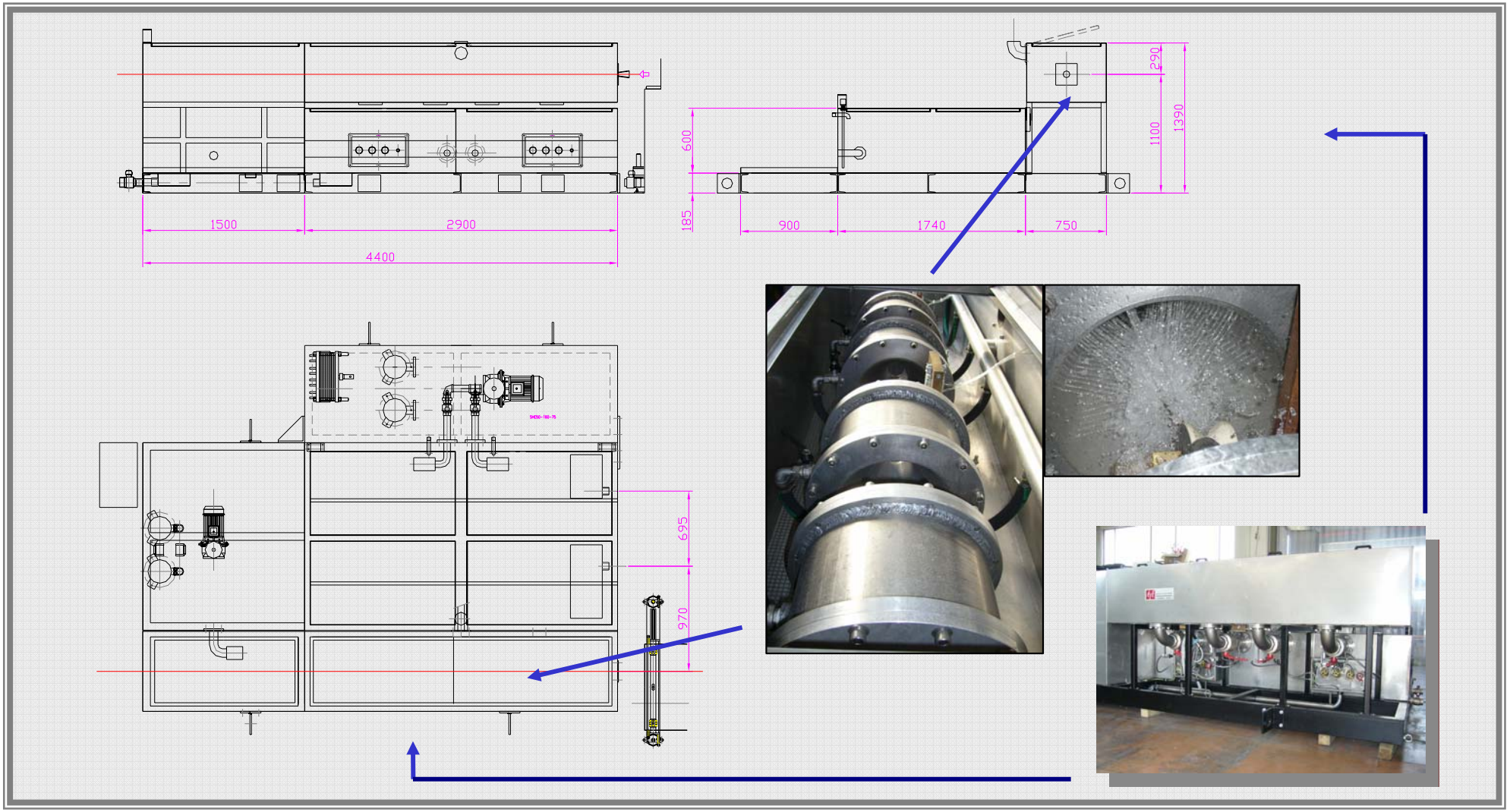
HARDENING SECTION (heating to about 950-1000 °C)

[redacted]

Heating unit:	Sturdy metal frame, bench shaped with 1 line of heating inductors mounted on a supporting table. Transversal displacement of the unit, vertical and lateral adjustment
Coils design:	Possibility of different power level in the first 2 coils and in the second 2 coils → optimal distribution of temperature across the wire section
Coils construction:	The coils are constructed with electrolitic copper tube internally water cooled, taped with H class insulating material and cast with refractory lining
Wire guiding:	The wire is guided trough the inductors by a series of cones and special rollers made by stainless steel with ceramic coating

QUENCHING DEVICE (1)

This assembly is basically composed by the following elements *(see following slide)* :



QUENCHING DEVICE (2)

This assembly is basically composed by the following elements :

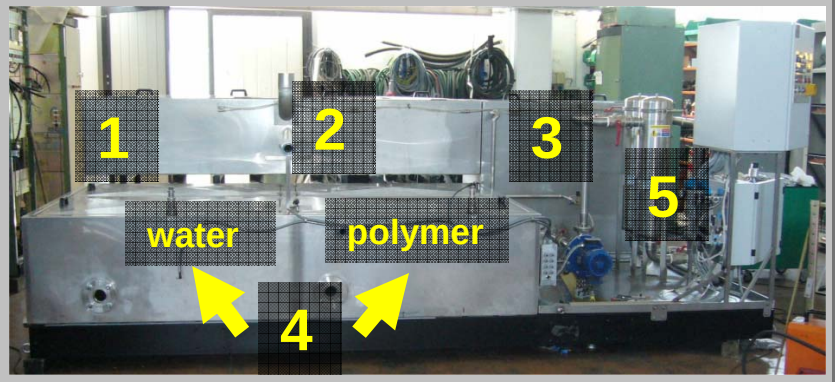
1 Entering section
- The wire is cooled by spraying water from quenching shells → quick temperature drop

2 Following section
- The wire is cooled by overflow in troubled water → smooth temperature drop

3 Exit section
- Air drying unit

4 Quenching tank
- The water is collected in a stainless steel tank with inside bulkheads for the sedimentation of the steel scrapes

5 Conditioning unit
- To keep constant the temperature of the quenching water. The group is composed by: water-water heat exchanger, high pressure pump, recirculating pump, automatically-cleaning filter,water flow, and temperature transducers, heating resistances



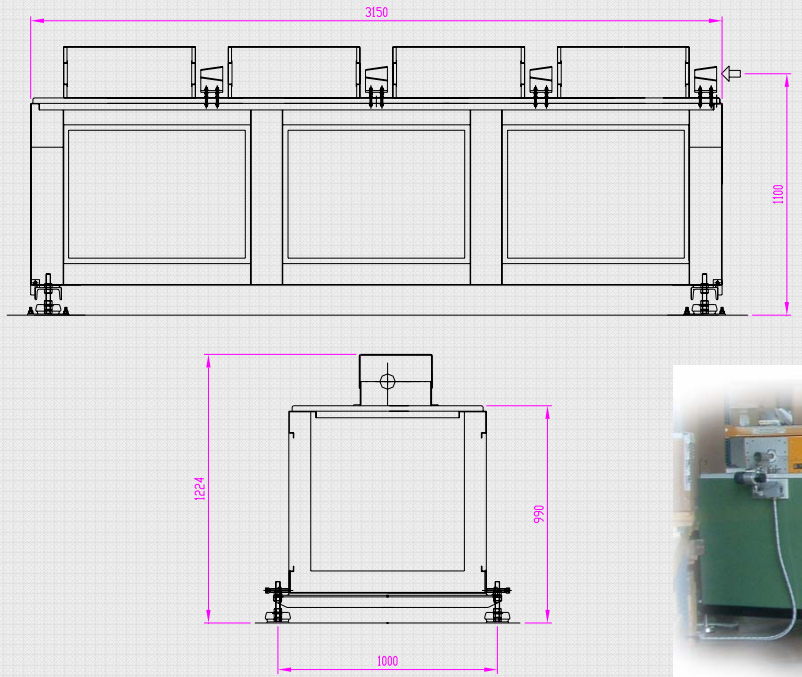
Quenching medium
- Designed water or water + polymer according to the steel grade and quality

TEMPERING FURNACE

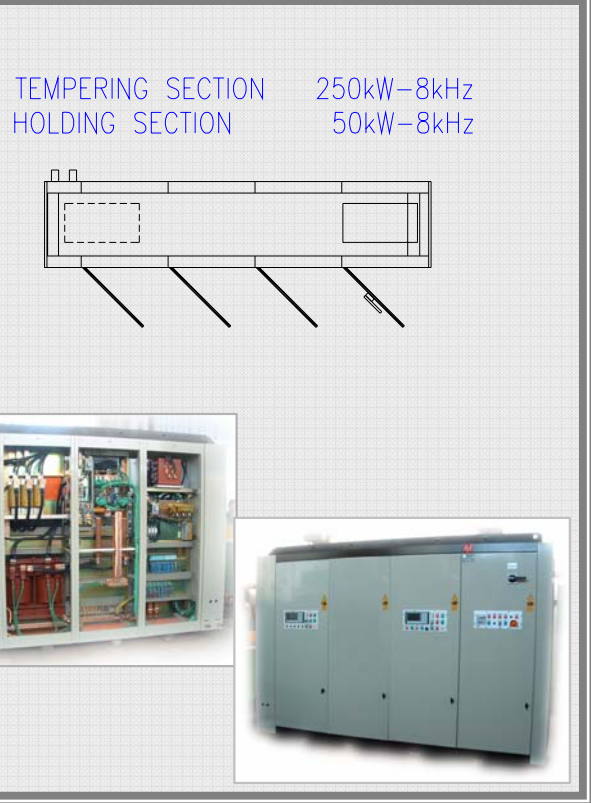
TEMPERING SECTION (heating max 600 °C)

[redacted]

FURNACE



CABINET

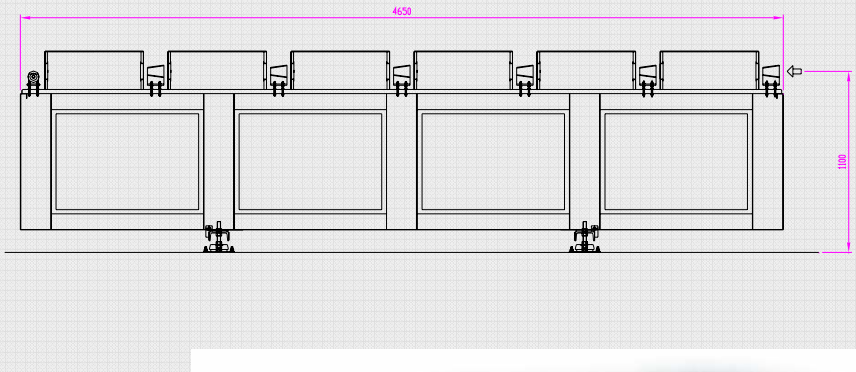


HOLDING FURNACE

HOLDING SECTION (heating max 600 °C)

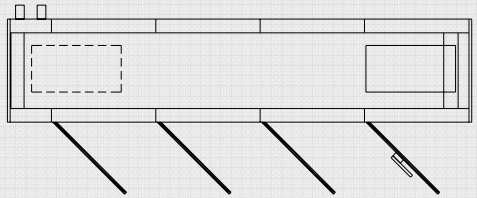
[redacted]

FURNACE



CABINET

TEMPERING SECTION 250kW–8kHz
HOLDING SECTION 50kW–8kHz

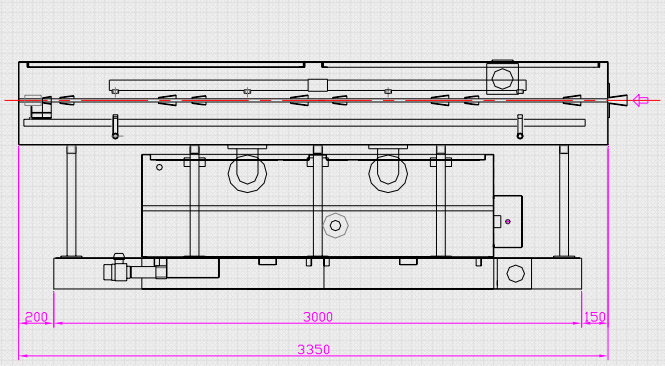


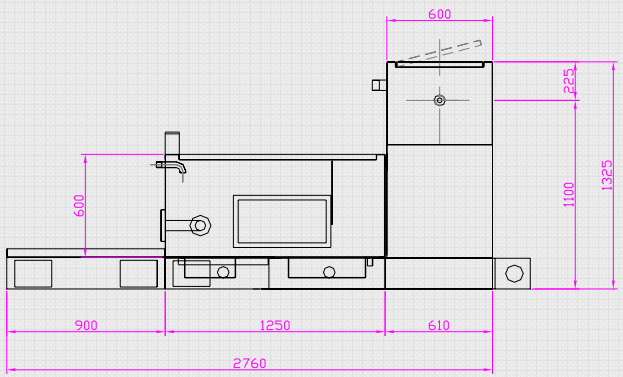
TEMPERING–HOLDING SPECIFICATIONS

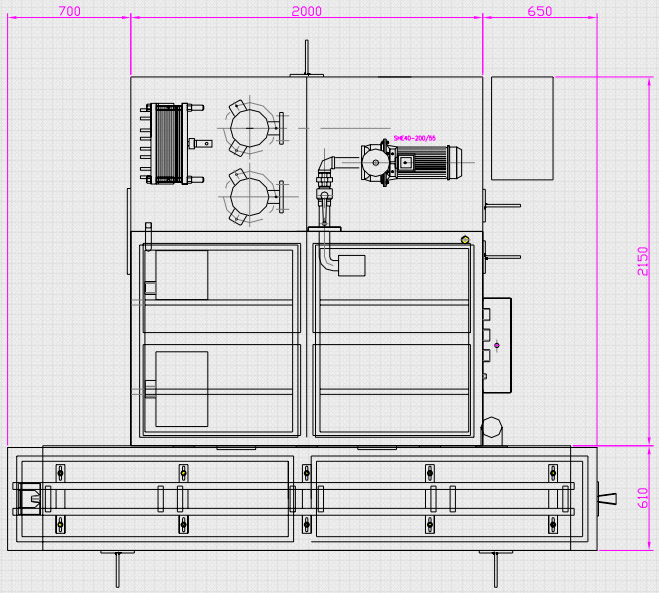
	TEMPERING	-	HOLDING
Frequency converter type	PFC-250		IFC-30
Rated power	250 Kw		30 Kw
Rated frequency	8 kHz		6 kHz
Range of working frequency	6-8 kHz		6-8 kHz
Supply connection power	400 kVA		
Supply voltage (±10%)	3x400 V		
Supply frequency services voltage	50 Hz		
Ausiliary services voltage	110 Vac		
Electronic circuits voltage	24 Vdc		

COOLING UNIT (1)

This assembly is basically composed by the following elements:







COOLING UNIT (2)

This assembly is basically composed by the following elements :

1 Sections :

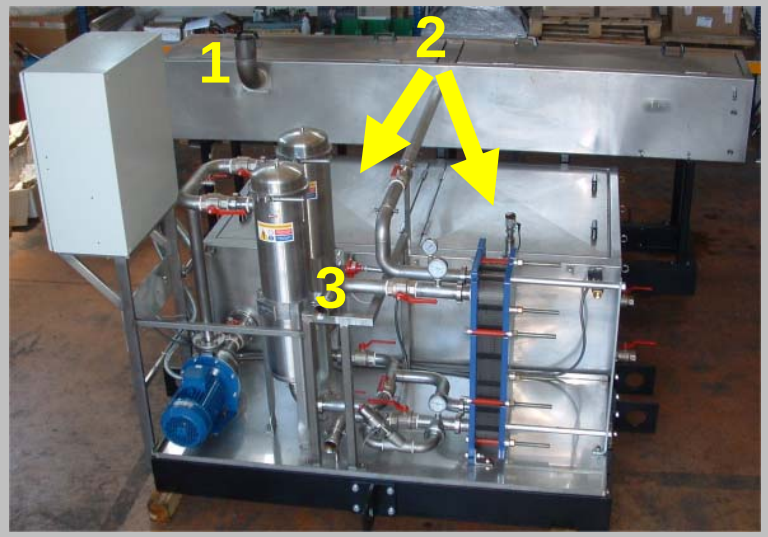
•The wire is cooled by overflow in troubled water → smooth temperature drop

2 Cooling tank:

• The water is collected in a stainless steel tank with inside bulkheads for the sedimentation of the steel scrapes

3 Conditioning unit:

• To keep constant the temperature of the cooling water. The group is composed by: water-water heat exchanger, high pressure pump, recirculating pump, automatically-cleaning filter and temperature transducers, heating resistances



CONTROL AND SUPERVISOR UNIT

All important parameter of the hardening, quenching, tempering and cooling process (wire temperatures, converter output power, etc.) will be controlled and displayed on the control unit.

The PC performs the “MASTER” function of the system and is connected with several “SLAVE” microprocessored units as:

- Digital regulator of the frequency converters
- Several logic input cards
- Unit of input and elaboration of logic and analog signals

ATE'S KNOW HOW

[redacted]:
Tempering furnace at 680 °C (four de restauration) for profiled wires, 3 ton/h – 450 kW, 4-6 kHz

ATE'S KNOW HOW

Hardening and Tempering line for steel wires [redacted] mechanical equipment by GCR Milano, wire diam. from 6 to 14mm, 2 ton/h, Pre-Curie section 300 kW/8kHz, Post-Curie section 210kW/50kHz, Tempering 200 kW/8kHz

ATE'S KNOW HOW

Hardening and Tempering line for profiled wires [redacted]
2 ton/h, Pre-Curie section 400kW/ 8kHz, Post-Curie section 400kW/ 200kHz,
Tempering 400kW/ 8kHz

ATE'S KNOW HOW

Hardening and Tempering line for profiled wires [redacted]
1,5 ton/h, Hardening section : Pre-Curie section 300kW/ 8kHz, Post-Curie section 300kW/ 200kHz, Tempering section : 200kW/ 8kHz