

INDUCTION
MELTING / HEATING / HOLDING
SYSTEMS



ENG

THYRISTOR & *IGBT* TECHNOLOGIES



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5M with the importance given to the quality and determination to achieve the challenge, 4 Continents, 35 Countries

5M Induction Systems, established in 2002, is a multi-partner international organization. With its headquarters and production site in Istanbul, 5M operates in a wide geography with its extensive sales and service network throughout the world. Our main products and services related to induction melting systems, related sectors and areas:

- 25 kg - 30 ton capacity foundries, special solutions and more
- Steel, stainless, ductile iron, pig iron, brass, copper, aluminum, iron and nonferrous alloys
- Induction heating systems
- Induction holding systems
- Movable pot induction melting systems for nonferrous metals.
- Mini-melting systems for laboratories and precious metals.
- Dual frequency or variable frequency induction melting systems.
- Induction melting systems for steel mills with a capacity of 400.000 tons/year
- Billet production facilities (Continuous casting machine)

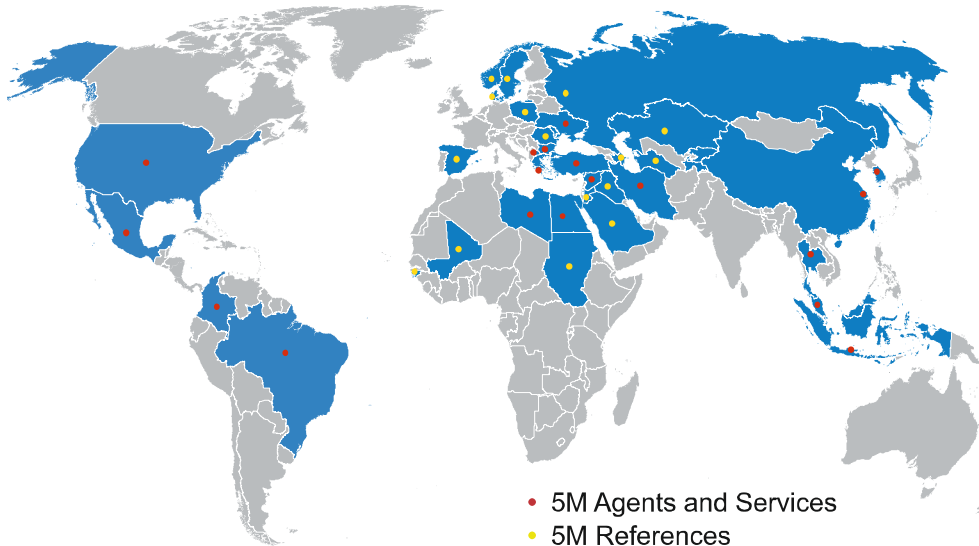
Our successful experience in induction melting systems and our ability to meet your needs makes us a valuable supplier and service center for you. We realize your projects with mutual cooperation and trust in accordance with your demands.



5M PMI 100KW 1X150KG Precious Metal
IGBT Controlled Melting System /Sivas, Turkey

5M World References

- | | |
|---------------|----------------|
| • TURKIYE | • AZERBAIJAN |
| • BRAZIL | • IRAQ |
| • BULGARIA | • KAZAKHSTAN |
| • COLOMBIA | • K.S.A |
| • EGYPT | • MACEDONIA |
| • IRAN | • HUNGARY |
| • GREECE | • NORWAY |
| • LIBYA | • POLAND |
| • MALAYSIA | • ROMANIA |
| • SOUTH KOREA | • RUSSIA |
| • SYRIA | • SPAIN |
| • THAILAND | • SWEDEN |
| • UKRAIN | • SUDAN |
| • INDONESIA | • JORDAN |
| • SERBIA | • DENMARK |
| • MEXICO | • TURKMENISTAN |
| • U.S.A | • GAMBIA |
| | • MALI |
| | • NAKHCHIVAN |



- 5M Agents and Services
- 5M References

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5M PMI 225kW 2x150KG + 1x350KG
IGBT Controlled Melting System / Leon, Mexico



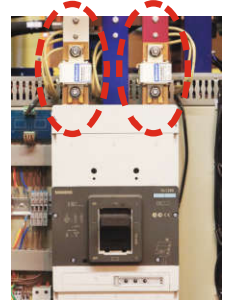
10 Ton Melting Furnace - South Korea



5M PMI 1600KW + 350KW 2X3 Tons IGBT Melting -Holding / Holding Induction Furnace - Thailand

➤ **Network protections and high-speed input fuses for maximum system protection**

- High-speed protective fuses on the transformer output for system protection
- High-speed semi-conductor protection class fuses on the converter input
- Thermic magnetic switch against current overload
- Standard Input Over Current Protection Circuits
- Standard Input Over Voltage Protection Circuits



➤ **Easier to use through next generation operator panels and Reporting System**

Specially designed for easier to use of operator, distinctly visible under foundry conditions, bright, digital and analog displays, operator panel and keypad. All necessary displays on panel such as temperature, pressure, kilowatt meter, earth leakage, volt meter, frequency...

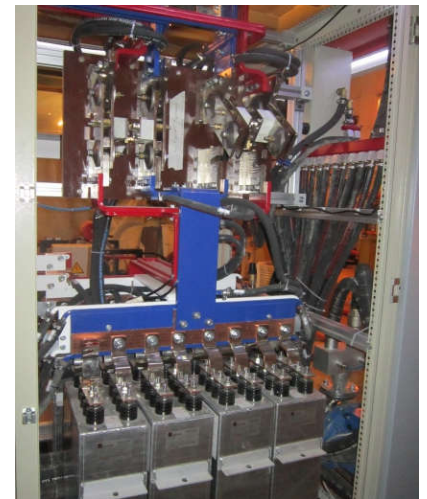
- Getting Status reports easily by record keeping facility on internal memory integrated PLC and SCADA systems.
- If required daily, weekly or monthly period reports can be printed out.
- SMS status and warning messages transmission.



➤ **Capacitor Bank and Transfer Switch**

Long life power capacitors through professional capacitor protection measures;

- Long life with installation of earthen full insulation
- Analog temperature sensor on each capacitor
- Pressure sensor on each capacitor
- Total capacitor pressure data
- Total capacitor temperature data
- Easy assembly and maintenance



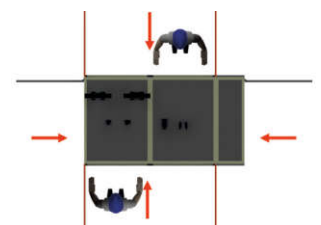
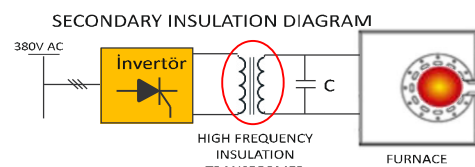
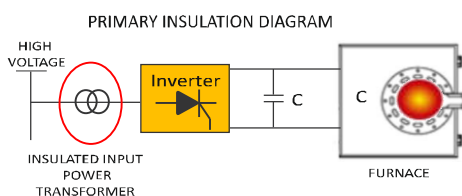
➤ **A class, water cooled energy cables**

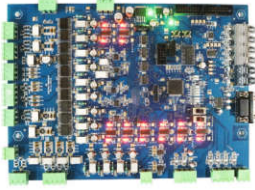
- Made from high purity copper conductor, stranded, multicore energy cable
- Free water transition, internal cooling water channel
- Mounting and maintenance facility with easy demountable connections
- High insulation class ?5000VAC
- A class carbon free insulating hose
- Steady-state operation through high pressure cooling water
- Excellent sealing under high pressure with double or triple stainless steel clamps connectors on both terminal points



➤ **Primary Or Secondary Insulation Solutions**

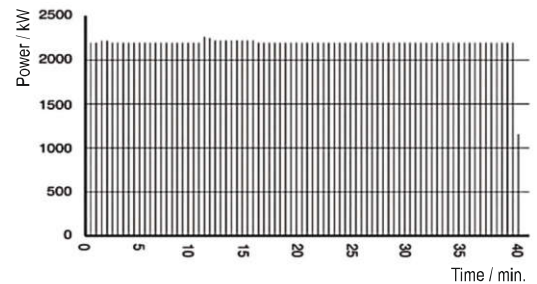
➤ **Easy service and maintenance**





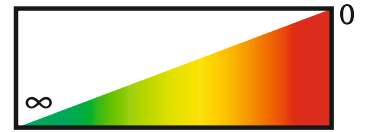
- **Single Control Board managing Overall System**
Single Digital Control Board, improved by current and new technologies, has a design providing high safety and efficiency conditions .
- All adjustments are loaded beforehand and necessary adjustments can be done through computer if required.
- No need for special setup in future or during commissioning

➤ Continuous constant full power melting



➤ Early Alert System (Furnace Metal Leakage Detector)

It is a PLC controlled safety application that protects the system against any earth leakage and thus provides full protection.



Earth Leakage Sensitivity

➤ High efficiency coil conductor

- Low-efficiency round and oval section conductors are not used
- Material conductivity of electrolytic copper profile is selected as 58.
- Power losses is quite low
- It provides 1800°C heat resistance with a special lining material
- Coil windings are protected by special heat-resistant materials.
- Total system efficiency increases with special design and measures.

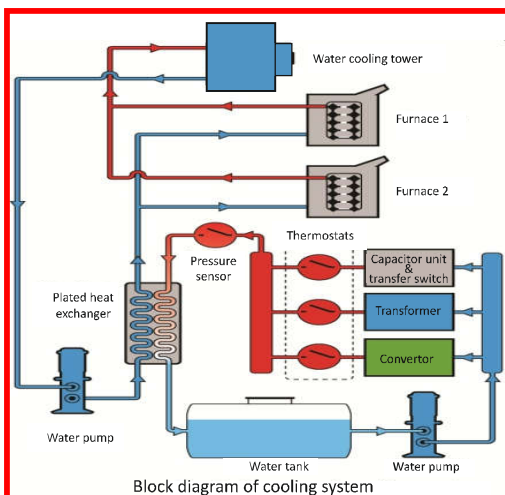


- **Full safety for all systems;** Operation temperature of all components on system, especially thyristor and capacitors is not more than max. 60°C. Thus, defects caused by high temperature are prevented and total system quality is increased.
- **International standard spare parts;**
 - Electronic components can be supplied by readily available global producers
 - Manufacturers, brands and product codes of all power electronic components are international standard.
- 5M products do not include hidden brands and international codes data of power electronic components such as power thyristors, capacitors, resistors etc.

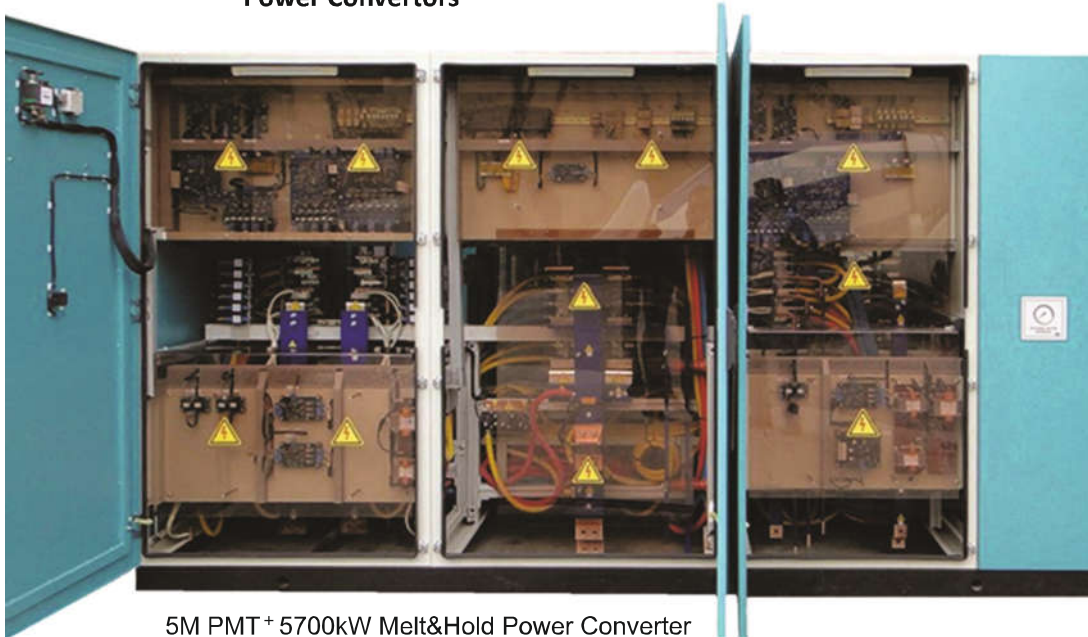


➤ Closed Circuit Water Cooling System

- Closed circuit deionized pure water cools converter, capacitors, thyristors, busbars, reactors etc.
- There is a pressure and sensitive temperature control on all lines.
- PLC warns operator in case of a problem in the cooling system and provides necessary treatment facility
- Demineralized water conductivity control constantly and warning operator.



High Safety
and Efficiency
with
Enhanced
Parallel
Resonance
Technology



5M PMT + 5700kW Melt&Hold Power Converter
Single power panel for Melt&Melt or dual power output ; Melt&Hold/Process (see, pg. 12)

ADVANTAGES OF THRISTOR (SCR) CONTROLLED MELTING SYSTEMS

- High efficiency at full power
- High $\cos \phi = \%98$
- Bath temperature control with optic sensor
- Industrial energy analysis process
- Provides single or double furnaces to work with double frequency
- Remote troubleshooting and program update with modem

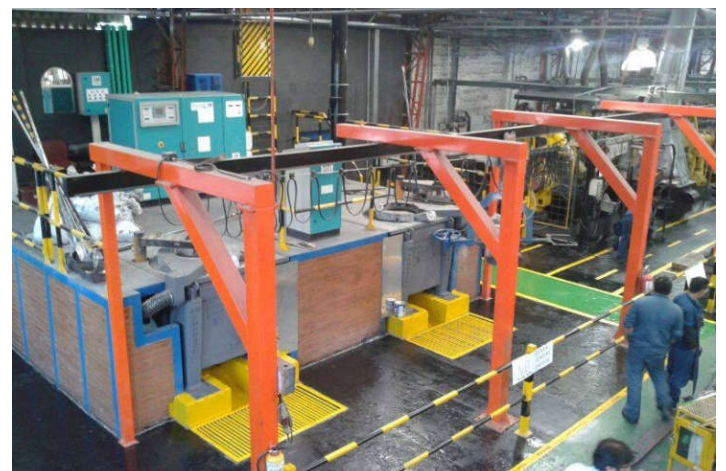
Melting solutions for special alloys



5M PMT 1250kW + 250kW 2 x 2000KG
Melt & Hold Induction Systems - Egypt



5M PMI 400kW 2x500KG
IGBT Controlled Melting System - Sweden



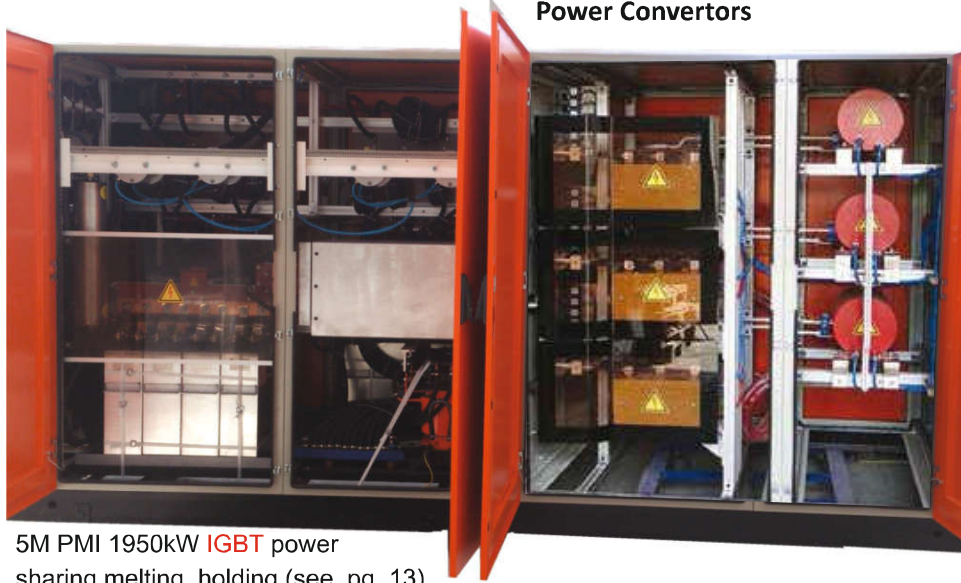
5M PM 2x250kW 2x500KG 300Hz/600Hz
Double frequency bronze melting system, Bogota, Colombia

ADVANTAGES OF MODULAR DESIGN *IGBT* TECHNOLOGIES

25kW - 5.000kW
IGBT Controlled
Modular Design
Power Convertors

5M
INDUCTION

- Compensation-free in every operating condition, so there is no installation and maintenance costs of compensation.
- Upgradable converter power with parallel module technology
- Simple replaceable power modules in case of trouble and service requirement.
- 5M parallel module **IGBT** technology provides opportunity to continue at low power with other modules as faulty module easily unmounts in case of trouble in one of modules.



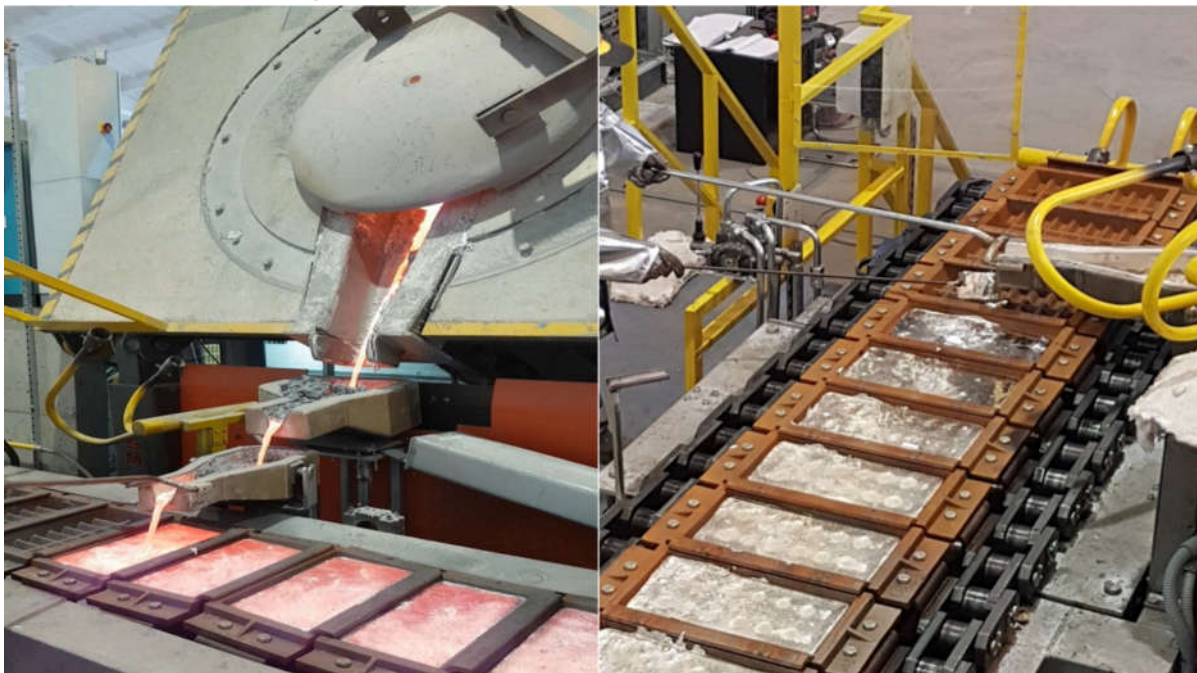
Copper Melting



5M PMI-1 **IGBT** 225kW 500kg Copper Melting System - Spain

- No compensation panel
- Better than $\cos \phi \geq 98\%$ at low power
- Better than $\cos \phi \geq 99\%$ at full power
- Energy efficiency with high power factor
- Industrial energy analysis
- Excellent coil protection system
- Operation in local languages
- Short message (SMS) warning system
- Problemless automatic sintering
- Automatic crucible preheating

Aluminum Melting



5M PMT 1500Kw 2x9000kg. Furnace (3 ton net aluminium) Melting System - Poland

Box Type Melting Furnace

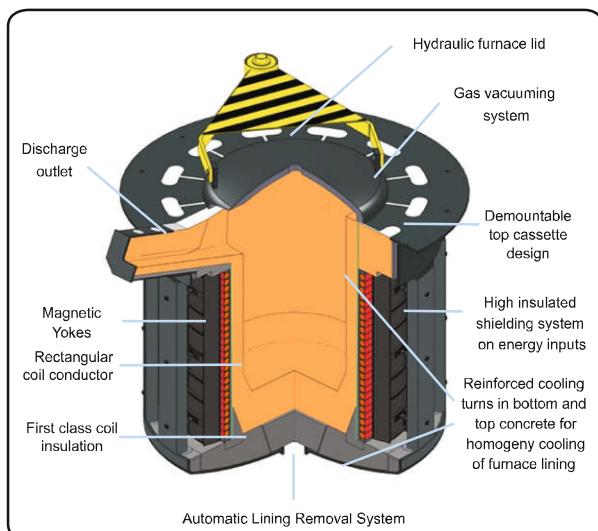
Capacity ranges from 50KG – 3.000KG



5M Box construction furnace,
(1000KG) Hydraulic furnace cover
Fixed exhaust ring



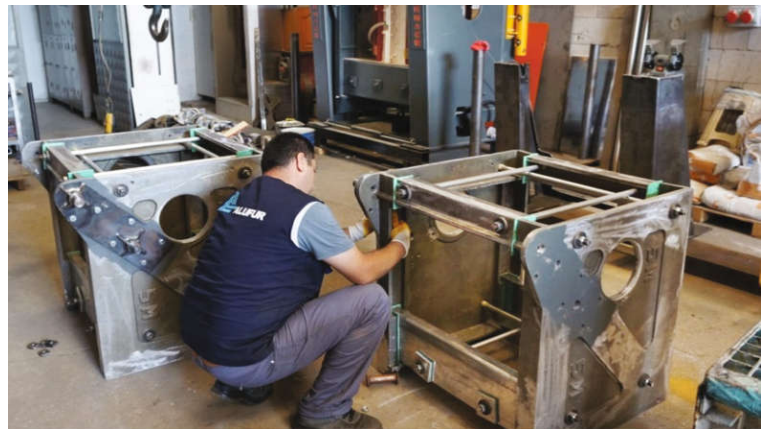
Crucible furnaces for non-ferrous smelting solutions



Special furnace design

CORELESS INDUCTION MELTING FURNACES

- Left and right plates of furnace which made of high alloy cast aluminium allow the magnetic field to act metal in furnace without any loss
- Maximum heat gain provides by hydraulic furnace cover which is reinforced with fire concrete
- Gas suction is provided with smoke chamber fixed to furnace mouth
- Front and back covers of furnace are openable for easy intervention and maintenance
- Main body was reinforced with steel construction
- It is economical with the advantage of easy installation and commissioning
- It is compatible for environmental requirements with fixed exhaust furnace cover system
- Service and maintenance is easy and take up less space with compact structure
- It has safety valve to prevent falling the furnace
- Hydraulic controlled furnace cover



5M BOX construction furnace manufacturing plant



1500kW 2x3000kg melting furnace at the time of casting – Norway

Steel Construction Furnaces

Capacity ranges from 500KG – 30.000KG



- High efficiency is provided with special desing
- Long lasting quality materials and workmanship
- High temperature resistant coil insulation tabs
- Suitable design to fast and safe loading / unloading
- water-cooled magnetic shunts designed by 5m to prevent the dispersion of induction current
- Maximum efficiency in intensive working conditions
- Easy of service and maintenance with disassembled top cassette
- Minimum sound level in heavy working environment
- Coil which is wrapped with water cooled magnetic shunts, is long life
- Long life lining with water cooled primer spirals which is to complement upper and lower spirals
- Special cover design to prevent heat losses in molten metal
- It has safety valve to prevent falling the furnace

5M design coreless induction melting furnace with all accessories safety back and side barriers back tilting, capture hood and easy lining removal system



5M Steel construction furnace at production time (12 ton)



Ready to install induction coil (15 Ton)



5M Steel construction furnace at production time (15 ton)

5M IGBT Controlled Mini Melting Systems

From 1 kg to 30 kg
IGBT controlled
melting
systems suitable
working laboratory
conditions together
with valuable and
specific metal
casting processes.



5M PMI Series
laboratory type systems
1kg - 30kg mini
melting sets

15kW - 10kg IGBT laboratory systems

- Directly input voltage "380V or 440V"
- Small place with Compact design
- Tilting system with reductor
- Cooling with city water without any specific water installation.

5M IGBT Controlled Heating System



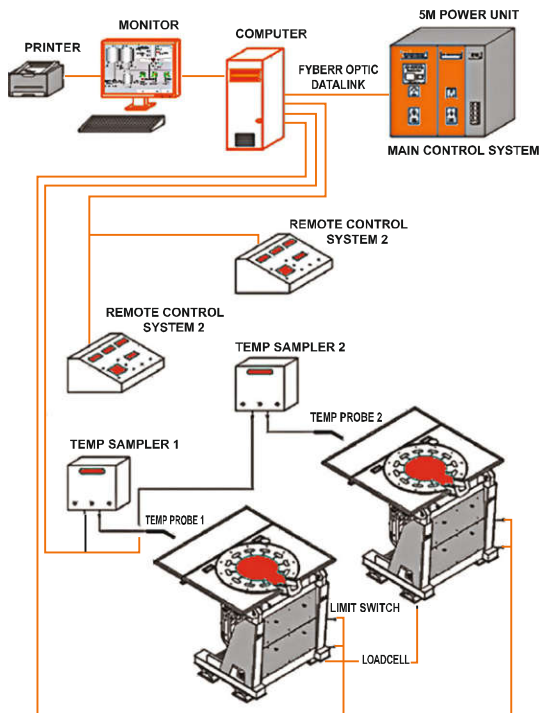
- Tunnel Heating Systems
- Pipe and joint heating
- Special heating systems for forging plants
- Variable and double frequency heating solutions
- Special heating projects for process
- Special heating solutions for copper, bronze, iron, steel, stainless steel and special alloys
- 1,2,3 or 4 headed heating solutions with variable frequencies and at the same time from single power unit



3000kW 6000kg + 4500kW 6000kg melting systems at the time of operation – South Korea

MODERN OPERATION SYSTEMS

EASY USE, CONTROL AND REMOTE



Block diagram of Scada control system

HIGH TECHNOLOGY SCADA CONTROL SYSTEM

- Graphic interface program
- Furnace power
- Metal weight
- Heat tracking system
- Calculation of energy
- Easy energy control mode,
- Instant, daily, weekly and monthly energy reports
- Heat control script;
- Calculation of consumptive power and metal weight,
- Instantaneous heat profile, casting heat target, calculation of time and casting heat according to molten metal
- Presentation of all warning and fault messages,
- Saving of event records and reporting events.



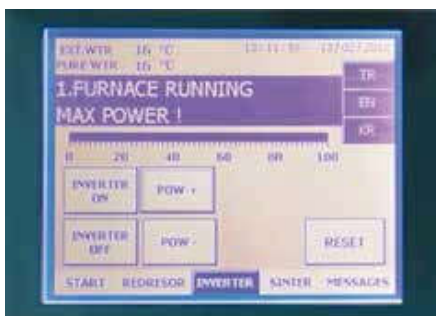
Operation Desk

DEVELOPED PLC CONTROL SYSTEM

- Modern technologies
- Instant status information of system.
- Probeless auto sintering program for fast and slow sintering process
- Automatic error logging memory
- Display error messages audible
- Remote monitoring by internal modem troubleshooting
- Easy way to operating by HMI touch screen
- Operation in local languages and different character sets. Cyrillic, Chinese, Arabic, Korean etc
- SMS through on GSM ; Short message warning system can send SMS to person in charge, Easy way to control and operation
- Crucible heating program



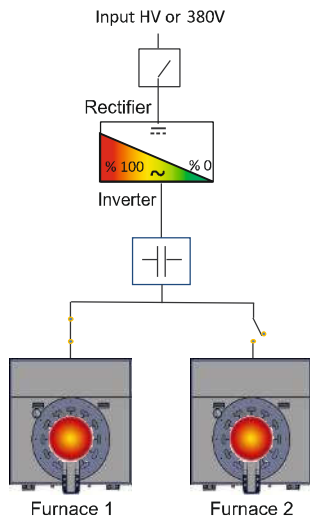
Control Cabins



PLC Information Screens



Single Melting Systems up to 10.000kW



- Modern Design
- Easy to use
- Low cost
- Standard operator panel
- New generation power electronic components

With its compact design takes a small place. With organized and systematic structure not only construction installation but also operation and maintenance costs are very economical.

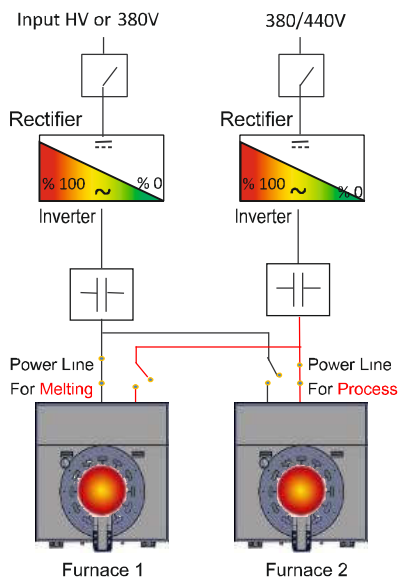


50kW- 10.000kW Thristor Controlled Power Convertors



5M PMI 175kW 2x250KG IGBT Controlled precious metal & copper Melting System - Spain

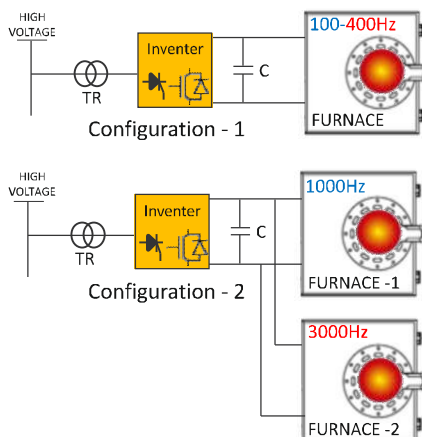
Melt&Hold Melting Systems up to 15.000kW



- Improved for foundries whose target is to have high capacity casting. It takes less place and more economic than other systems. The difference from other standard melting systems is to have capability to choose required power and holding capacity.
- While a furnace is working with full power, the other is either working with full power or just holding
- Its usage is very simple. With only a single touch one of the furnaces enters the melting mode and the other enters waiting or holding hot mode.
- There is a twin power unit technology in single converter panel having independent operation ability.
- When melting converter breaks down, holding converter supports.
- During a power cut holding converter holds molten metal in furnace hot with a suitable generator.
- In case of a problem at one of the lines, with the opportunity of joining by two different energy lines, the other system continues its operation.
- Foundation & civil work costs and operation & maintenance charges are so economic with its methodical and organized structure



Double Frequency Melting Technology for Special Melting Process



Capability to work with one furnace at 2 different frequencies , and by feeding just from single power converter capability to work with 2 or more melting furnace at different frequencies and power. Classified different from other melting Systems and designed for user's requirements. Improved specially by 5M RD Engineers for preparation of different characteristic alloys.

- Sample Configuration 1 : during melting process of existing one melting furnace, operator can choose one from 2 different melting frequencies within few seconds in any time and apply to material inside furnace. Frequency can be changed over and over again.
- Sample Configuration 2 : Designed for operation at different frequencies or power for 2 or 3 furnace melting Furnaces. For instance while furnace-1 is working at 1000Hz , Furnace-2 can continue to work at 3000Hz.

ADVANTAGES OF MODULAR DESIGN IGBT TECHNOLOGIES

- Compensation-free in every operating condition, so there is no installation and maintenance costs of compensation.
- Upgradable converter power with parallel module technology
- Simple replaceable power modules in case of trouble and service requirement.
- 5M parallel module IGBT technology provides opportunity to continue at low power with other modules as faulty module easily unmounts in case of trouble in one of modules.
- Operation with %30 higher capacity by comparison with normal systems
- New generation electronic drivers with DSP processors
- New generation components of power electronic
- Quality below legal limit, proper and safe energy consumption

25kW - 5.000kW

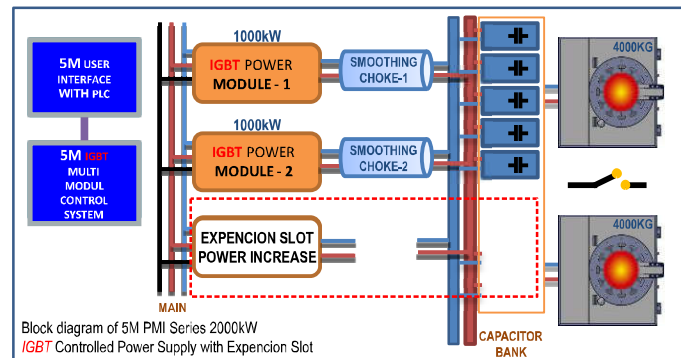
**IGBT Controlled
Modular Design
Power Convertors**

5M
INDUCTION

- High Power Factor ($\cos \phi \approx 0,98$)
- Keeping hot for holding or compensation
- Preparation alloy
- Probeless automatic sintering
- Scrap pre heating
- Furnace heating
- Alloyed casting at high temperature
- No compensation system

IGBT Expendible Modular Technology up to 5000kW

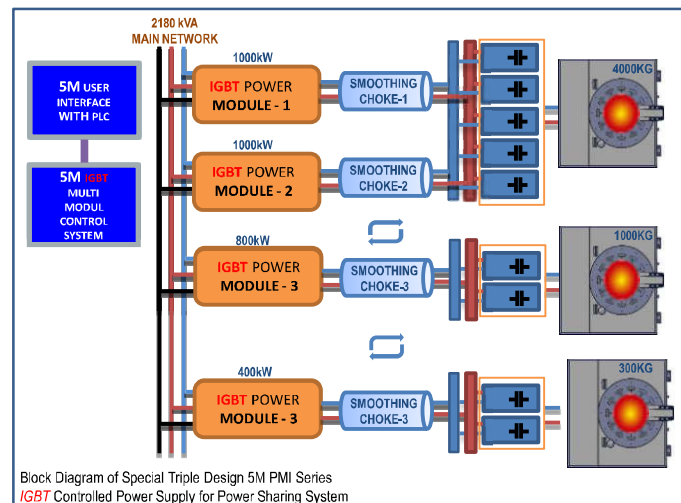
- Ready for power increase in future with ready empty module slot on system
- Capacity increase or capability to manufacture with different materials by working with two melting furnace at full power at the same time and with ability to be fed from different electrical supply .
- Maximum melting power at one furnace with additional module providing power transfer between furnaces
- if required after power increase, ability to work at different powers according to total power of connected modules
- the whole power is collected in single furnace with power increase



IGBT MultiFlex - Multiple Power Adjustment Systems

Provides modern foundries working with different met melt metals with different characteristic by impr production targets and flexible production capabilities, and designed for requirements of changing materials and alloying easily

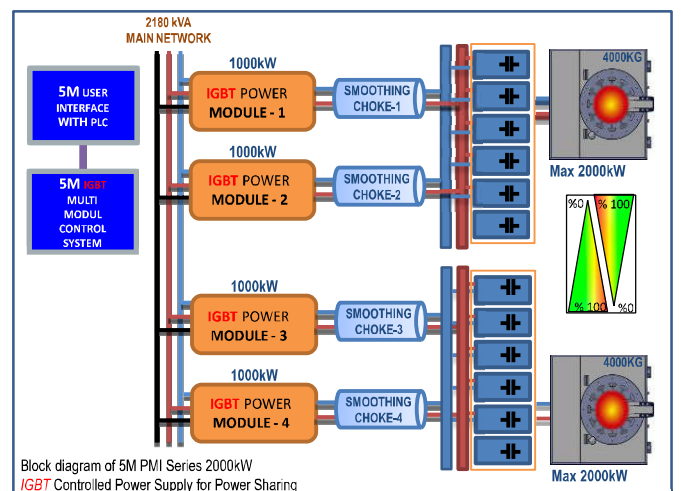
- When there is no need for holding, by providing proportional power transmission and sharing between Furnaces; Poduction with maximum melting power on one furnace or with shared
- Prevents production loss ; in case one of the Fur Work during under maintenance or service proc furnace continue to work
- Easy control and operation with new generation HMI interface touch screen remote.
- Continue to operation during one furnace is un

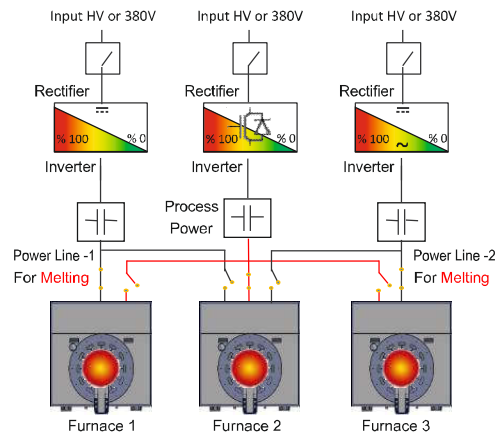


IGBT Controlled Power Sharing Melting Systems up to 5.000kW

It provides melting on both furnaces at the same time or while one furnace works at full power, the other furnace works with process power to proceed on molten metal inside, by sharing power between 0% and 100% ranges on high efficiency with independent power outlets working with single operating system

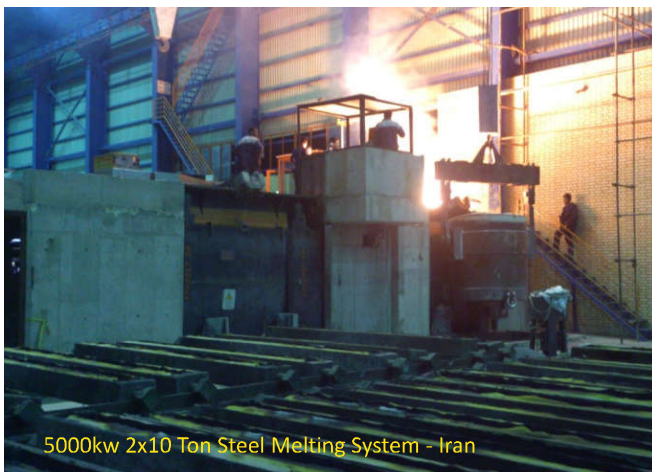
- Economic energy feeding at the same time from single or dual energy line with dual working opportunity.
- High safety of IGBT power modules by independent full controlled input redressers
- %100 More production possibility with just increase in transformer power via independent redressers integrated to modules suitable increase in capacity for future projects
- Easy use by user friendly operating system and touch screen PLC interface
- While one furnace works at full power, other one works at holding power at the same time to prevent holding losses.





W-type melting systems

- Turnkey steel mill solutions
- Continuous W-type melting systems with induction.
- Continuous Billet Casting Lines (CCM)
- Hot rolling mill plants
- Alloying Furnaces (LRF)
- Odor and ingot casting solutions



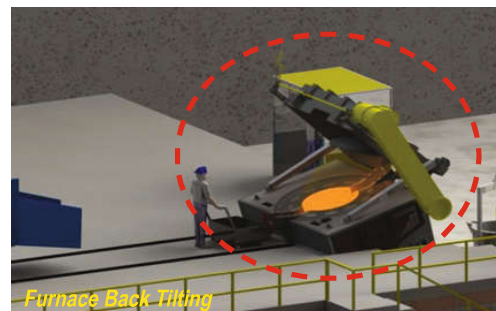
ACCESSORIES



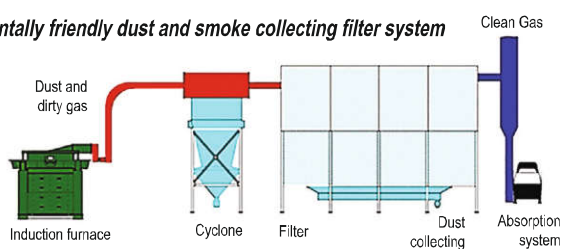
Backward and forward movable exhausted furnace cover



Fixed exhaust gas suction system and hydraulic furnace cover

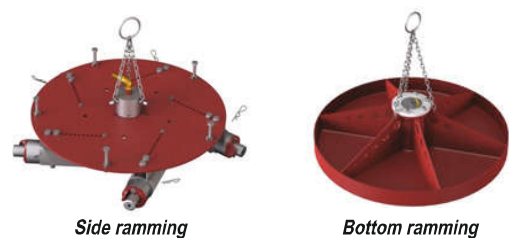


Environmentally friendly dust and smoke collecting filter system



5M Induction Furnaces present useful design for environmental protection by keeping venting specks at minimum level with active dust and smoke collecting system.

Vibratory, pneumatic, automatic refractory forging device



POWER AND CAPACITY CHART

	CONVERTER	FURNACE	STEEL	IRON	BRASS
	POWER (kW)	CAPACITY (kg)	@1650°C (kg/h)	@1480°C (kg/h)	@1170°C (kg/h)
1000-3000Hz	75	100	100	110	190
	100	150	132	144	251
	125	150	185	205	352
	150	200	225	245	428
	175	200	270	300	513
	200	250	315	345	599
	225	300	375	405	713
	250	350	430	475	817
500-3000Hz	300	500	530	590	1.007
	325	350	570	635	1.083
	350	500	625	680	1.188
	400	750	725	815	1.378
	450	750	815	900	1.549
	500	1.000	900	1.000	1.710
	600	1.000	1.090	1.200	2.071
	750	1.500	1.430	1.575	2.717
200-600Hz	800	1.500	1.522	1.659	2.892
	1.000	2.000	1.900	2.100	3.610
	1.250	2.000	2.380	2.625	4.522
	1.500	3.000	2.860	3.150	5.434
	1.750	3.000	3.340	3.675	6.346
	2.000	4.000	3.820	4.200	7.258
	2.500	4.000	4.770	5.250	9.063
	3.000	5.000	5.725	6.300	10.878
100-300Hz	3.500	6.000	6.680	7.350	12.692
	4.000	6.000	7.635	8.400	14.507
	5.000	8.000	9.545	10.500	18.136
	6.000	10.000	11.460	12.600	21.774
	7.000	12.000	13.360	14.700	25.384
	8.000	16.000	15.270	16.800	29.013
	10.000	20.000	19.000	21.000	----
	10.000	25.000	19.000	21.000	----

For other materials, multiply melt rate for steel by the following values: Aluminum: 1.0 – Copper: 1,6 – Silver: 2,85 – Gold: 5,0

5M INDUCTION SYSTEMS

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