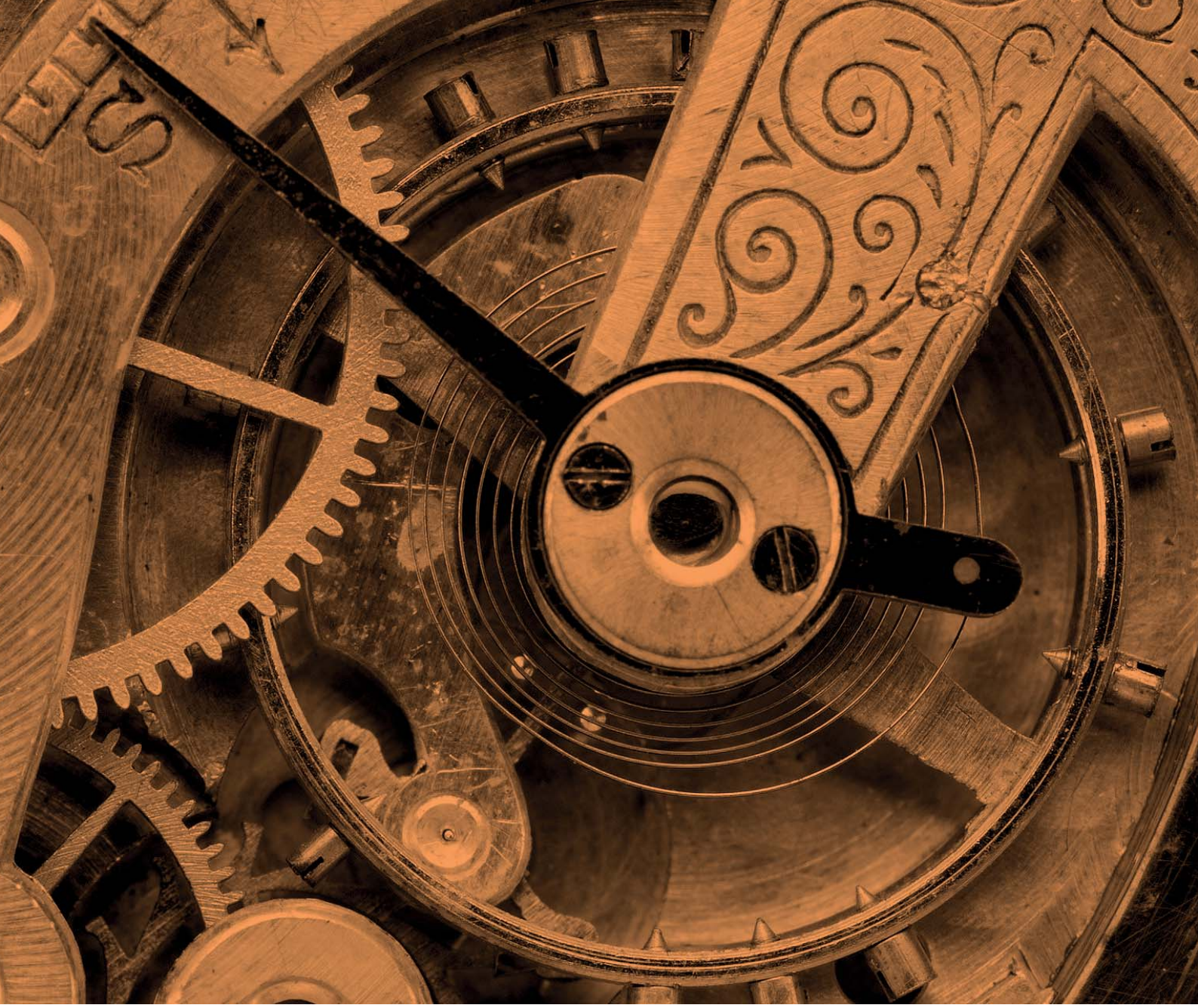


ARAZ TRANS

Melting & Foundry

Don't miss out even details . . .

About Us

Araz Trans Co. is a young company native to Iran and has been founded on 2008 with the aim of developing new technologies in Iran's industry, especially Induction Furnaces and related industries.
Through many years of professional industry experiences, Araz Trans, a group of well-educated engineers, decided to integrate all these experiences and expertise that they had acquired since 2000's into one successful entity.

Directed by Iranian young engineers graduated in power electrics and mechanics engineering as masters of Science, the company grew fast in the power electric related industries and in manufacturing induction furnace equipment. Soon, by cooperating with many steel plants the company expanded its production to be a major supplier for all the equipment for induction furnaces being required by many companies across the country. This includes more than 90 steel plants, equipment for more than 100 furnaces, 120 coils, 900 magnetic yokes and 700 Water Cooled Cables and DC reactors.

Also by expanding its field of work Araz Trans began to manufacture Electric Arc Furnace equipment and supply steel plants which were using these furnaces. Equipment like Copper Contact Shoe, Cooling Panels, …

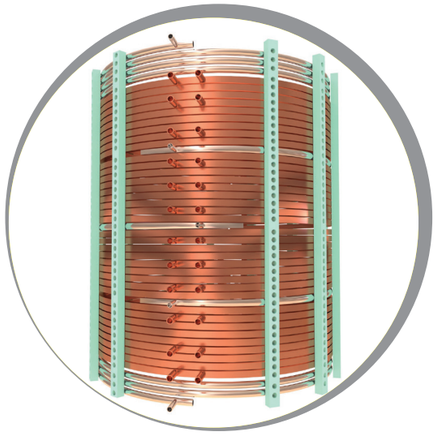
Acquiring latest cutting edge technologies using its experienced R&D engineers, supplying the best raw material with the highest quality from Europe and utilizing advanced machinery to manufacture the equipment with the best quality are the advantages of Araz Trans Co.

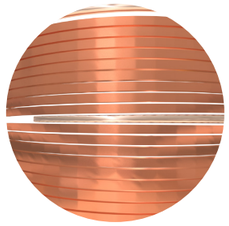
Now After 10 years of working in domestic market and supplying almost 80% of costumer inside the country and other companies in the neighbor countries, recently Araz Trans have begun its international campaign by moving into Turkey and beginning to supply customers all around the world. Now the brand new Araz Trans in Turkey has started production and supplying its costumers aiming to be a major supplier for Induction and Arc Furnace equipment in all the world like what we achieved in Iran.

Induction
Furnace Coil

Induction Furnace Coil

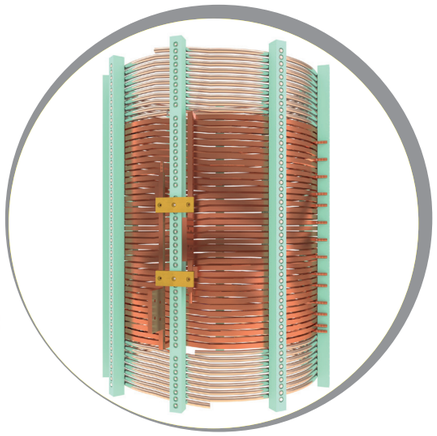
Coil of an induction furnace is considered its main part. The main function of the coil is to create magnetic fields required to conduct eddy currents that leads to heating or melting scrap metals or processed ores. Taking into account the role and importance of this part, the electrical and mechanical properties of coil remarkably affects the function and efficiency of the furnace. Therefore, considering diversity of material and quality of parts used for manufacturing coils, Araz Trans Co. provides a wide range of coil design for the induction furnace, whether designed in the company or as the drawings of the original coil provided by the costumers (in case an spare part is being provided). So, customer will be able to choose design, used material and even properties of the insulation on the intended basis.
A schematic view of conventional designs of coils manufactured by Araz Trans for its costumers all across the world are as follows:

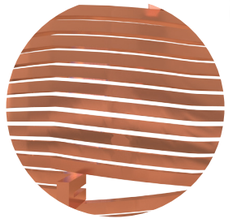




Helical Coil

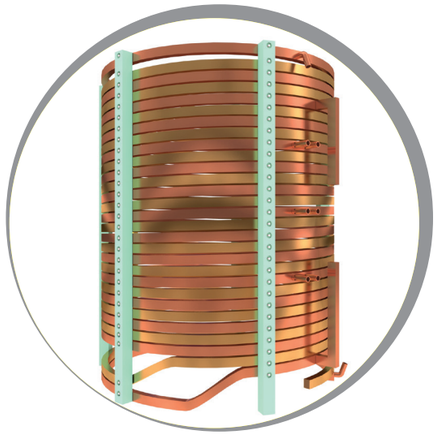
Mostly designed using a number of contrary coils assembled together, Helical Coils, winded as spirals, are the most conventional ones practically. The main flaw for this design is the significant gap created between different parts of the coil including contrary active parts of the coil and neutral cooling parts. Being unable to provide smooth edges and adjust height of the coil precisely and finally imbalance of magnetic field produced by the coil are the other disadvantages. Most of coils manufactured by Chinese companies and some Turkish factories are placed in this category.

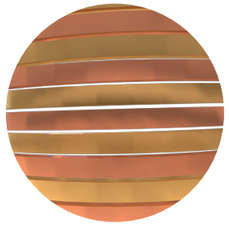




Offset Coil

The design of these coil are similar to the helical ones but with a small difference based on the idea of creating an offset in each 360-degree rotation of loops; so, each layer almost comes to a flat, horizontal condition except the offset area. Therefore the design doesn't have the problems mentioned for the helical coils. Taking into account the physical conditions of coil, there is no airspace between different parts of the coil; the upper and lower parts of the coil are created as flat and parallel to enable manufacturer and user to adjust height of the coil precisely. Because of the perfect balance between loops of the coil, the magnetic field produced by coil is more harmonious in different parts inside it. Most of coils manufactured by Indian companies like Electroterm and Megaterm and also some coils made by American companies like Ajax are places in this category. It is recommended using this kind of coils in high power and high capacity furnaces.



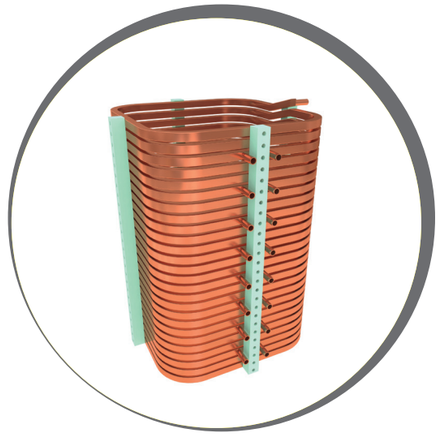


Dual Turns Coil

The main feature of this design is merging the two active parts of the coil together and inside each other. Generally the two active coils located at the centre are designed as spirals (like helical coils) while the upper and lower parts that are neutral cooling coils are winded as offset coil. Advantages of this kind of coil are high functional efficiency and more suitable water circulation. Most of coils manufactured by German Companies and some Turkish companies are placed in this category.

Rectangular Coil

Winded in a rectangular section, a rectangular coil is mainly used in channel furnaces and sometimes in the preheating furnaces. The size of these models are generally smaller than the above-mentioned coils. This kind of coil is manufactured and used is two forms: Helical and Bended straight.

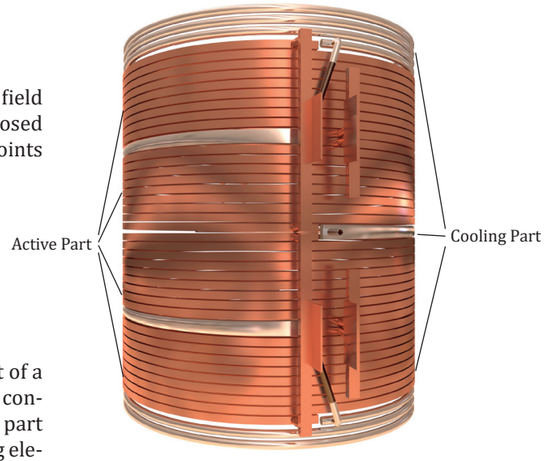


Design

The precise design of a coil, electrically and mechanically, using software and computer simulation is the first step of manufacturing a coil. This step is important not only for coils designed in the company, but also for ones manufactured on the basis of drawings provided by the costumers. Finally, according to the simulations and the results conducted, the necessary drawings and a list of required material is being executed and sent to the production department to begin the production.

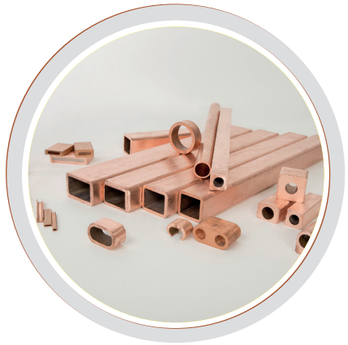
Active Part

The active part of a coil is in charge of creating magnetic field required to run the melting or heating process and is composed of layers of copper tubes. There are three very important points about the copper tubes:



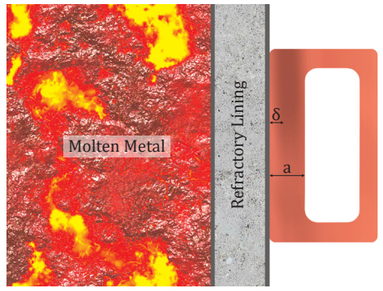
Material of the Copper Tubes

The copper used to make sections applied in the active part of a coil should have the maximum purity (at least 99.9%) and conductivity (at least 58 mega Siemens per meter); the impure part of the material should contain the least amount of disturbing elements like Phosphorus, Oxygen and Iron that cause intense drop of conductivity, explosion and excessive heating of coil. Thus, taking into account the above-mentioned descriptions, Araz Trans uses the refined copper grade ETP-C11000 and sometimes OFC-C10100 for specific orders, to fulfil all the required conditions.



Shape of Sections

Amongst many properties Shape and cross section of copper tubes affects the coils productivity and long-life the most. In addition to this fact that the effective area of the section must be enough to carry the enormous current conducted through the coil, geometric shape of the section is very important and is not generally considered as it deserves. Geometric shape of the section should provide enough space for current flow of the coil considering two points: Firstly, depth of magnetic field penetration inside the section (which depends completely on frequency); secondly, quality of cooling and water flow through the conductors. Generally, blockage, sedimentation and corrosion of the copper is expected to happen at sections with sharp corners on the inside (water channel), especially if quality of coil water is not suitable. So, it is recommended using sections with curved corners while manufacturing active part of a coil, to prevent the above mentioned matter.



$$\delta = 503\sqrt{\frac{1}{\mu_r \cdot \sigma \cdot f}}\ (m);\ a \cong 2\delta$$

$$\mu_r(cu) = 1\ .\sigma(ETPcu) \cong 58\frac{Ms}{m}$$

$$\rightarrow\ \delta \cong 66 \cdot \sqrt{1/f}\ (mm)$$

f (Hz)	δ (mm)	a (mm)
50	9.33	18.66
250	4.67	9.34
350	3.53	7.06
700	2.50	5.00
1000	2.09	4.18

Section	Shape	Application
Rectangular Tube with Square Water Passage		Active parts used in Chinese, Indian and Turkish furnaces
Rectangular Tube with Circular Water Passage		Active parts used in American furnaces like Ajax tocco
Rectangular Tube with Oval Water Passage		Active parts used in German Medium frequency furnaces like Otto-junker & ABP
D Shape Section with Circular Water Passage		Active parts used in German low frequency furnaces like Otto-junker & ABP
Pipe (Circular Tube with Circular Water Passage)		Active parts used in some Chinese furnaces
Asymmetrical Rectangular Tube with Square Water Passage		Invented design by Araz Trans used in coil manufactured and designed by Araz Trans

Cooling Part

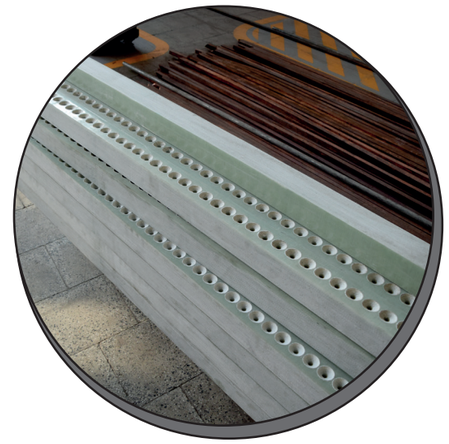
The main function of cooling parts of a coil is to cool down the upper and lower sections of the coil which carry no currents. Cooling parts are generally made by pipes or rectangular tubes made of stainless steel grade 316 or sometimes like active part of the coil, using copper tubes.

Coil Support

The main function of coil supports is to keep the gap between the layers and keeping diameter of the coil fixed during the time. They are made of composite insulators. Specifications of an ideal support are as follows:

- High electrical resistance to ensure isolation between loops
- High tensile and flexural strength to endure electromechanical forces
- Ability to absorb minimal moisture to stabilize mechanical and electrical properties during time
- Thermal endurance in proper limitations.

The following table shows a comparison between grades used in quality of supports.



Type of Composite	NEMA Grade	Reinforcement	Resin (Matrix)	Breakdown voltage A/D-48.50	Electrical Strength Abruptly/ Continuously	Tensile Strength CW/LW	Flexural Strength CW/LW	Operation Temperature Mechanical/ Electrical	Flammability Class	Water Absorption
				KV	KV/mm	Mpas	Mpas	°C	UL94	%
Fiberglass	G-10	Woven Glass Fibers	Normal Epoxy	45 / 40	27.5 / 17.7	245 / 275	345 / 415	140 / 130	H-B	0.25
	G-11		HT Epoxy					180 / 170		
	FR-4		FR Epoxy					140 / 130	V-1	
	FR-5		HT & FR Epoxy					180 / 170		
	GPO-3	Mat Glass Fiber	Polyester	40 / 15	11.8	55 / 55	125 / 125	140 / 120	V-0	0.60
Phenolic Cotton Cloth	CE/LE	Cotton Canvas	Phenolic	23 / 2.5	19.6 / 11.8	62 / 48.5	96.5 / 115	125 / 115	H-B	2.20

Holder Bolts

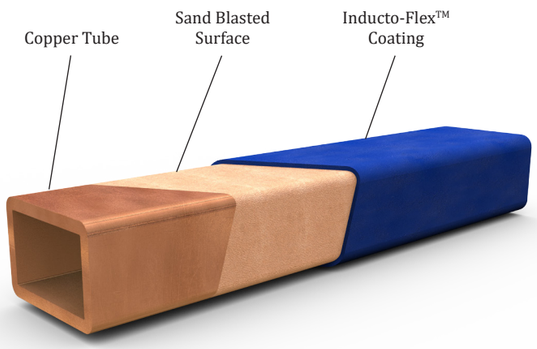
Function of holders is connecting support to the body of the coil and include Stainless steel bolts grade 304 or 316, welded to the surface of copper tubes (with or without copper intermediates) or brass bolts which are restrained by flat washer, spring washer and nuts.

Insulation

Coils manufactured by Araz Trans are always insulated observing all the details; all the points are insulated from each other in a multi-layer way. Since coil insulation prevents coil breakdown and continual stoppage of melting, technical experts of Araz trans consider this matter during stages of coil manufacturing. Thus, Araz Trans suggests three methods depending on the customer's requirement.

Method 1

Inductotherm Co. from US has invented a special insulator for insulating coils made by the company, named Inducto-Flex™, as its brand. The most important property of this special insulator, which is an electrostatic powder dye based on epoxy, is that it doesn't crack or separate from the coil's surface in case of intense expansion and contraction of conductors of the coil during application. High thermal endurance, high insulation strength and uniform adhesion specification while applying with a special instrument are other properties of this special insulator. This insulator is applied solely, without using other auxiliary materials; no need to use other insulators like liquid ones and insulator tapes in addition to Inducto-Flex™ in case of using the coil in standard conditions. Taking into account that it is possible for Araz Trans to apply the said insulator, the coils manufactured may be insulated using Inducto-Flex2M as Method No.1. It should be noted that coil undergoes a complete sandblast before applying the powder insulator to remove oxide layers from its surface.

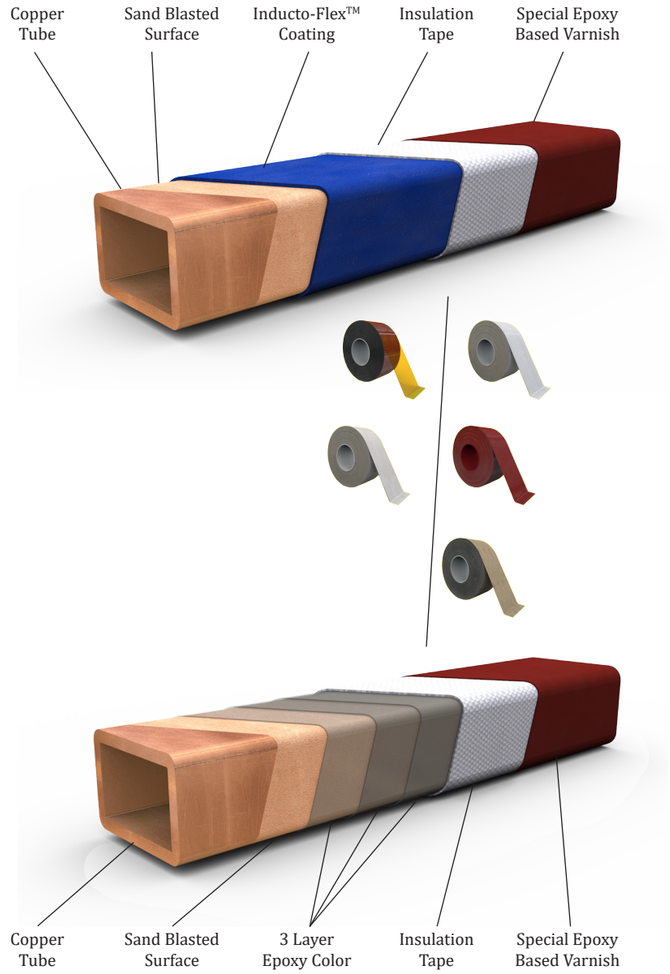


Method 2

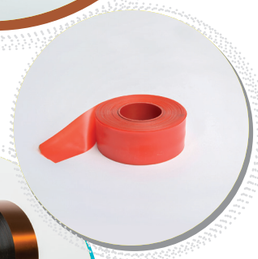
In method no.2, in addition to primary insulation of coil using Inducto-Flex™, a layer[1] insulation tape and a special epoxy liquid are used to improve security margin of application. Using this method is suggested only when the coil is used in a high risk and non-standard conditions; otherwise, in case of using the coil in a proper and standard conditions, Inducto-Flex™ will be sufficient.

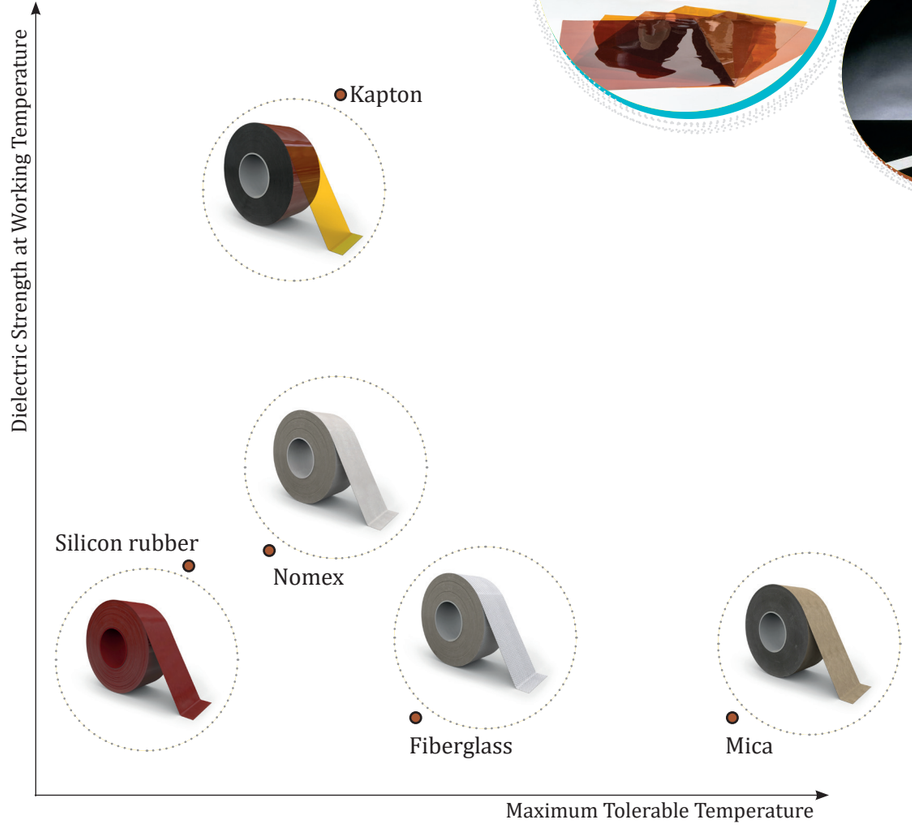
Method 3

using this method, insulation is applied without Inducto-Flex™. After a complete sandblast of the coil, its surface is coated using three layers of especial epoxy dye; then, a layer[1] of insulation tapes are winded on it and finally, a layer of special epoxy liquid varnish is sprayed on the surface. This method is used when repaired coils are insulated and miniature leakage is probable.



1. With 50% overlap



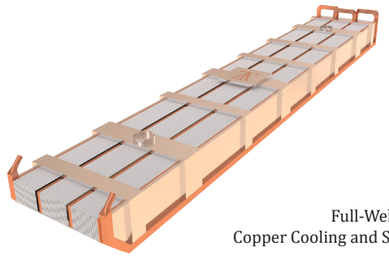


Induction Furnace Yoke

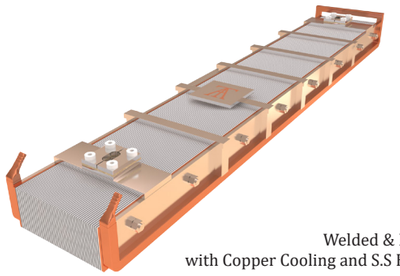
Magnetic Yokes (shunts) of Induction Furnace

Magnetic Yokes of Induction Furnace collect and conduct the magnetic field produced by the coil. The better the material used in the core the higher the furnace efficiency and lower the thermal losses. Also, quality and geometric structure of the yoke affects uniformity of magnetic flux dispersion inside the furnace, turbulence created by the field and quality of melting. Araz Trans manufactures different kinds of magnetic yokes according to the drawings or designs provided by customers or according to its own design based on the application conditions of the customers, using cutting-edge technology and its experienced staff.
A schematic view of convenient models of yokes used in the induction furnaces is as follows:

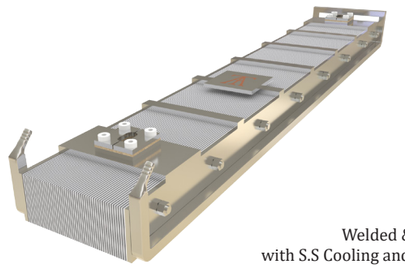
Full-Welded
with S.S[1] Cooling



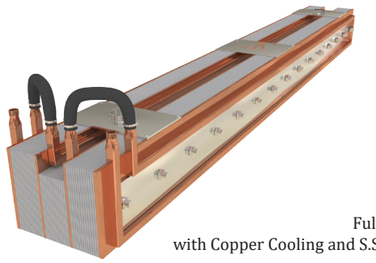
Full-Welded with
Copper Cooling and S.S Holder



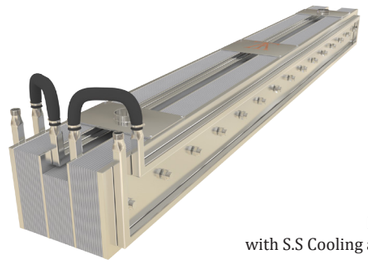
Welded & Bolted
with Copper Cooling and S.S Holder



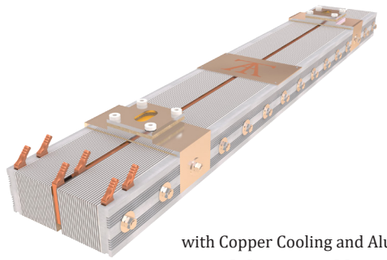
Welded & Bolted
with S.S Cooling and Holder



Full-Bolted
with Copper Cooling and S.S Holder



Full-Bolted
with S.S Cooling and Holder



Full-Bolted
with Copper Cooling and Aluminium Holder

Model Invented by Araz Trans Co.

1. Stainless Steel

The main parts of a yoke which should be considered while design, are: core, cooling system,assembly and connector. Properties and specifications of each element are as follows:

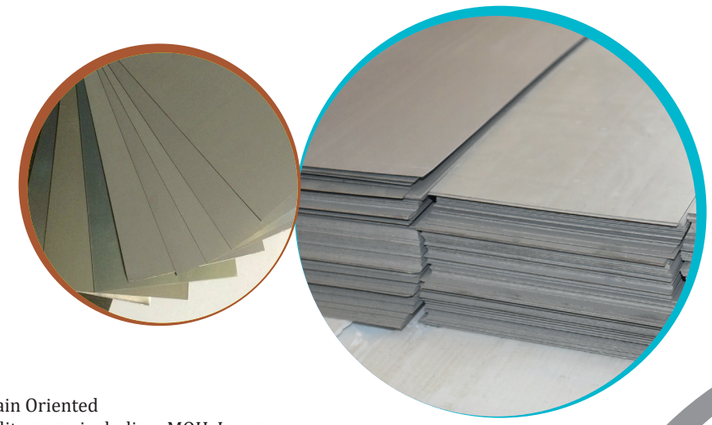
Core

The core of a magnetic yoke is composed of magnetic sheets of various materials. Quality and thickness of the used sheets affects magnetic permeability and flux integration, amount of energy losses and as a result, furnace efficiency. Main Factors affecting the said matters are briefly as follows:

- Thickness of the sheets
- Amount of silicon in the Material
- Dispersion of silicon grains along the sheet
- Magnetic saturation point

The above mentioned factors lead to loss reduction in mass unit, effective life time and magnetic flux capacity. The following table shows a comparison between grades of the used sheets in the core of magnetic yokes produced by Araz Trans

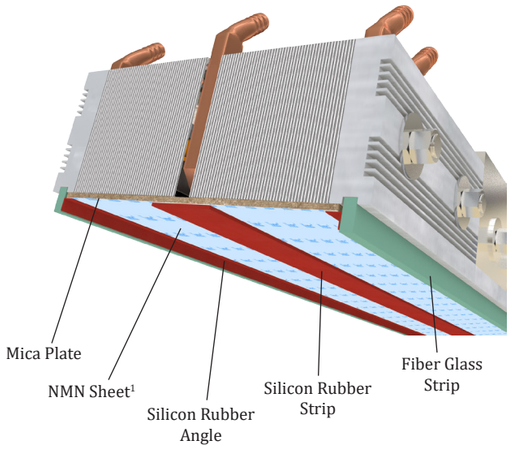
Type	Grade	Thickness (mm)	Iron Losses at 50 Hz			Magnetic Saturation Point[4] (T)
			B=1 T	B=1.5 T	B=1.7 T	
CRGO[1]	M3	0.23	-	0.73-0.80	1.10-1.27	1.75-1.78
	M4	0.27		0.80-0.89	1.20-1.40	
	M5	0.30		0.85-0.97	1.25-1.50	
	M6	0.35		1.00-1.11	1.40-1.65	
Hi-B[2]	M3	0.23		-	0.85-1.00	1.85-1.88
	M4	0.27			0.90-1.03	
	M5	0.30			1.00-1.11	
	M6	0.35			1.25	
CRNGO[3]	M-290	0.50	1.15	2.9	-	1.49
	M-310		1.25	3.1		
	M-330		1.35	3.3		
	M-350		1.50	3.5		1.50
	M-400		1.70	4.00		1.51
	M-470		2.00	4.7		1.52
	M-530		2.30	5.30		1.54
	M-600		2.60	6.00		1.55



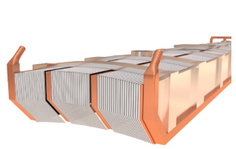
1. Cold Rolled Grain Oriented
2. High permeability cores including: MOH, Laser, ...
3. Cold Rolled Non-Grain Oriented
4. The least guaranteed density of magnetic field which leads to core saturation; this amount is estimated at 800 (A/m) magnetic field intensity for CRGO and Hi-B core sheets and 2500 (A/m) for CRNGO

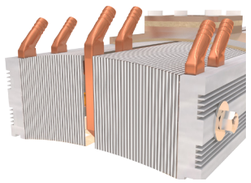
Yoke Base

Base of the yoke means the way yoke sites on the side of the coil. The base may be flat or curvature. Curvature based Yokes provide better mechanical stability compared with the flat based ones. Also, curvature based yokes prevent attraction of dust to the space between yoke and the coil and reduce probability of short-circuit between them. Instead, flat based yokes provide better conditions for discharging vapour produced by sintering the refractory lining, compared with the curvature-based ones.
To attain the advantages for both “flat-based” and “curvature-based” models Araz Trans is providing special insulation pads on its newly invented yokes (full-bolted with copper cooling and aluminium holders). By using this special insulation pads with the yokes you can have the option for discharging sintering vapour while retaining mechanical stability of the yoke and prevent penetration of the dust to the space between the yoke and the coil.



1. Consist of three layers: Nomex - Mylar - Nomex



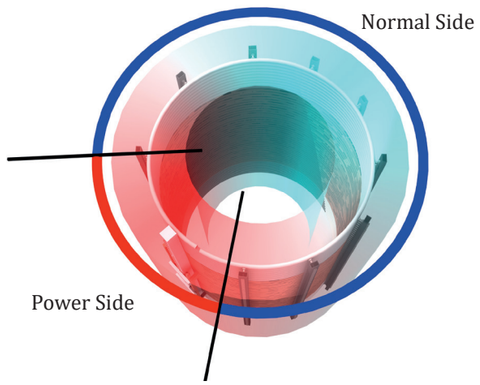


It should be mentioned that considering excessive complexity of manufacturing curvature full-Bolted yokes, all the manufacturers across the world produce the flat bolted models. While, Araz trans is able to manufacture all the models of yokes including full-welded, full-bolted and welded-bolted models in two forms of flat and curvature, using its invented technology.

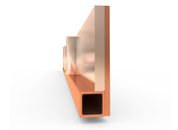
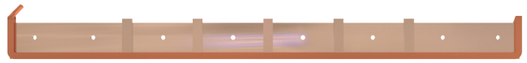
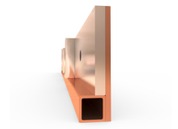
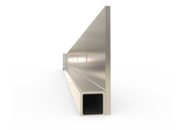
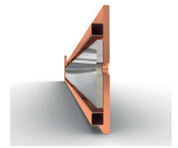
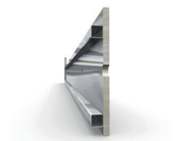
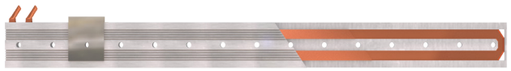
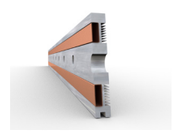
Cooling System

The main function of cooling system is thermal exchange and cooling down the yoke’s core which is heated because of magnetic field flow. Design of the Cooling system is based on water flow through lateral and middle cooling sections of the yoke and the number and places of cooling sections in each yoke is determined by the furnace power, number and place of yokes and water feeding system of the furnace.
Considering density of magnetic field around the coil, this region is divided into two parts:

- Power-Side: space around the coil I/O which magnetic field has higher density because of the magnetic field created by the water cooled cables.
- None-Power Side: the remaining space around the coil which magnetic field’s density is less than Power-Side.

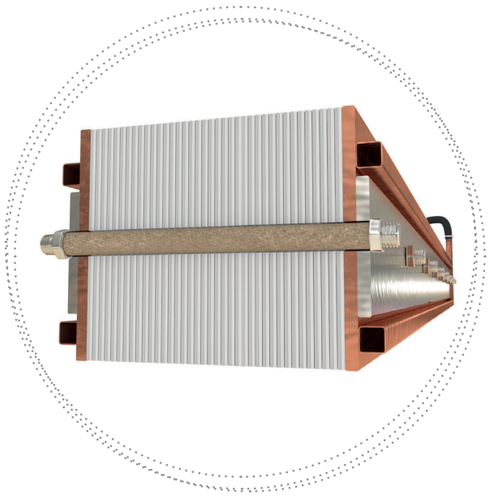


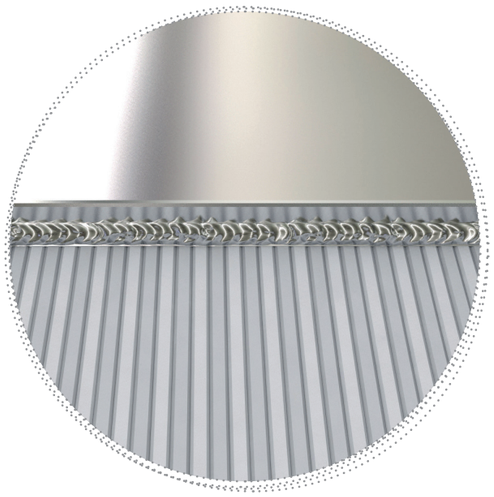
Obviously the cooling system used for “Power-Side” yokes should be more effective because of stronger magnetic field. This matter is generally achieved by adding middle cooling sections to the yoke and sometimes by changing material used for making cooling sections.

No.	Yoke Type	Design	Section
1	Full-Welded with S.S Cooling		
2	Full-Welded with Copper Cooling and S.S Holder		
3	Welded & Bolted with Copper Cooling and S.S Holder		
4	Welded & Bolted with S.S Cooling and Holder		
5	Full-Bolted with Copper Cooling and S.S Holder		
6	Full-Bolted with S.S Cooling and Holder		
7	Full-Bolted with Copper Cooling and Aluminium Holder		

Assembly of the Yoke

The various parts of the magnetic yokes may be assembled together in two ways: through “Bolting” or through “Welding”. The major advantage of bolted yokes is that they can be dissembled in case of breaking down and defected parts can be replaced. Also, the bolted yokes have less Foucault losses than welded types because of not using welding for connecting sheets of the core together and to the body.

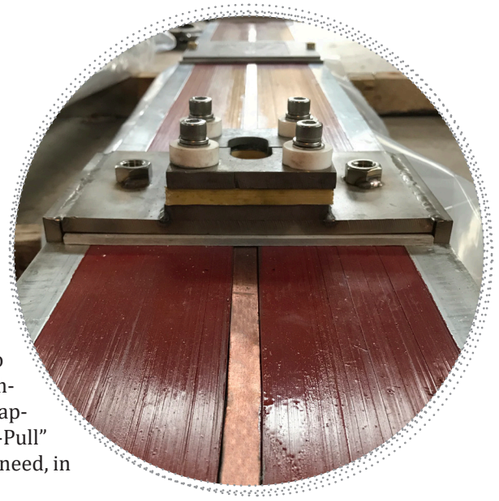




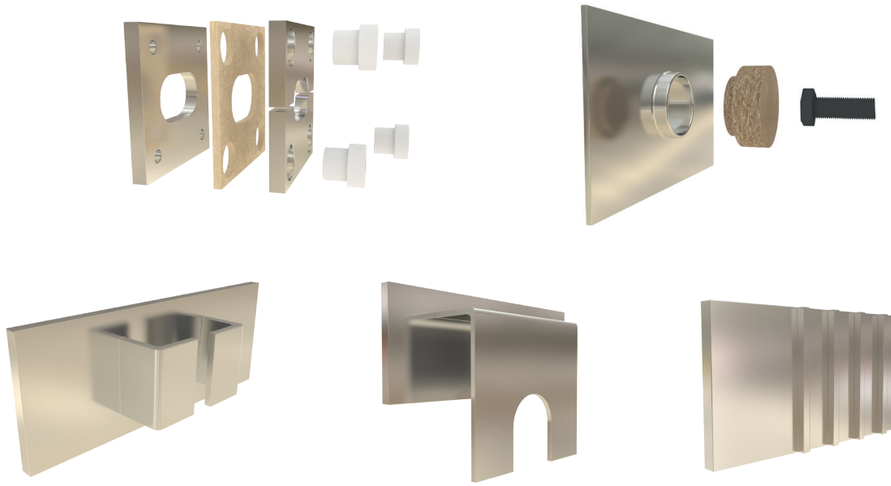
The other problem that is encountered in full-welded yokes is the lower part of the yoke being dissipated and opened up that leads to distance between sheets of the core. In the other words because the connection between all the parts is only on the surface of the yoke, the lower part of the yoke that places next to the coil begins to dissipate and open up because of the tension shifted from the welded points on the surface and the pressure of the structure bolts. This opening and the distance between sheets of the core causes intense sounds during application and worse, swarf and dust are attracted to the space between sheets of the yoke. These dust later can cause short circuit at the furnace.

Corrosion By Time	Carbonizing Capability Excess the Tolerable Temperature	Thickness (mm)	Water Absorption	Flexibility	Maximum Continuous Tolerable Temperature (°C)	Section Image	Material Of Bolt Isolator
High	Yes	1.5	High	Non-flexible	500		Mica Tube
No	No	2.0	Zero	Very High	280		Special Silicon Hose
No	No	0.22 Four layers	Zero	Low	400 For Tape 280 For Resin		Twisted Kapton Strips

Connector of the yoke



In fact, connector of the yoke is the mediator between yoke’s body and the structure bolts which fix the yokes at their place; it is designed and built according to the furnace cradle and installed on the yoke in the ways suggested by Araz Trans. Some convenient models of yoke connectors manufactured in this company, are provided. These models are categorized in two main types regarding their application: “Push” models and “Push-Pull” models. The “Push” model connectors are used only for applying pressure on yoke to attach it to the coil; whereas, “Push-Pull” connectors are used for separating yoke from the coil in case of need, in addition to attaching it to the coil.

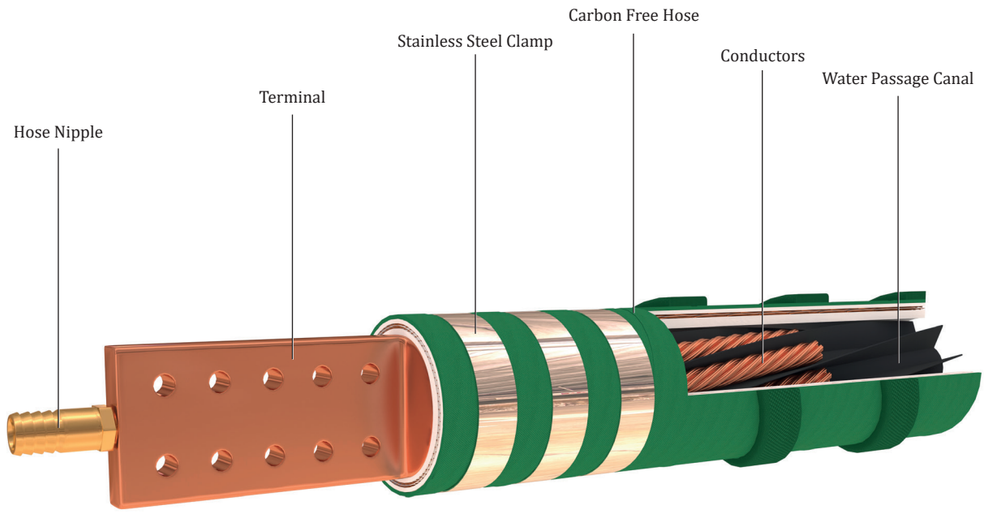


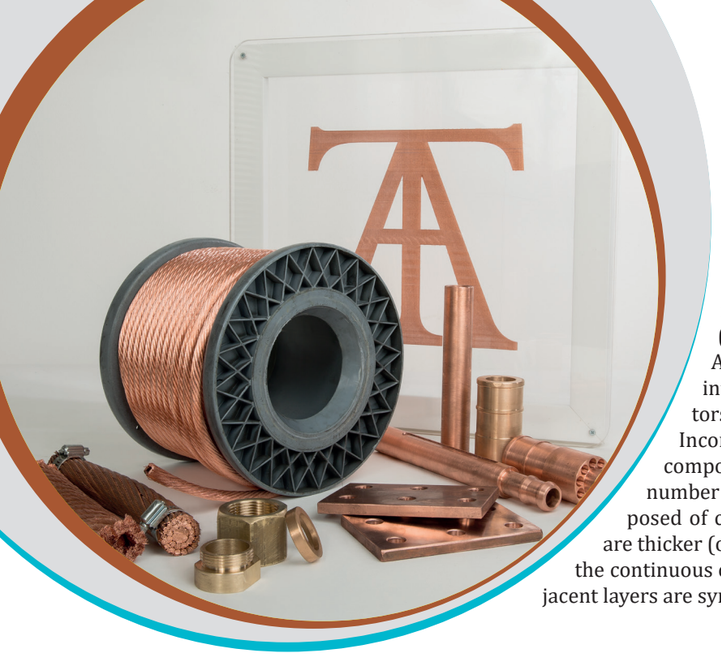
Water Cooled Cable For IF, EAF & LF

Water Cooled Cables

Water Cooled Cables transfer electrical power from power source to the crucible of furnace. The power flows through conductors in the cable and the heat created by the high current is removed by the water flow through the cable. Water Cooled Cables include a wide range of models with different material and designs which are used considering electric current running them and type of usage. Araz Trans designs and manufactures different types of Water Cooled Cables using its experimental and technical knowledge and also qualified material.
The Water Cooled Cables manufactured in this company are categorized in three main groups:

Type	Applications	Schematic View
Low Power Cables (Secondary Cables)	• Welding Equipment & Robots • Electric Pre-heat Furnaces	
Medium Power Cables	• Induction Melting Furnaces (IF) • Laddle Furnaces (LF)	
High Power Cables	• Laddle Furnaces (LF) • Electric Arc Furnace (EAF)	



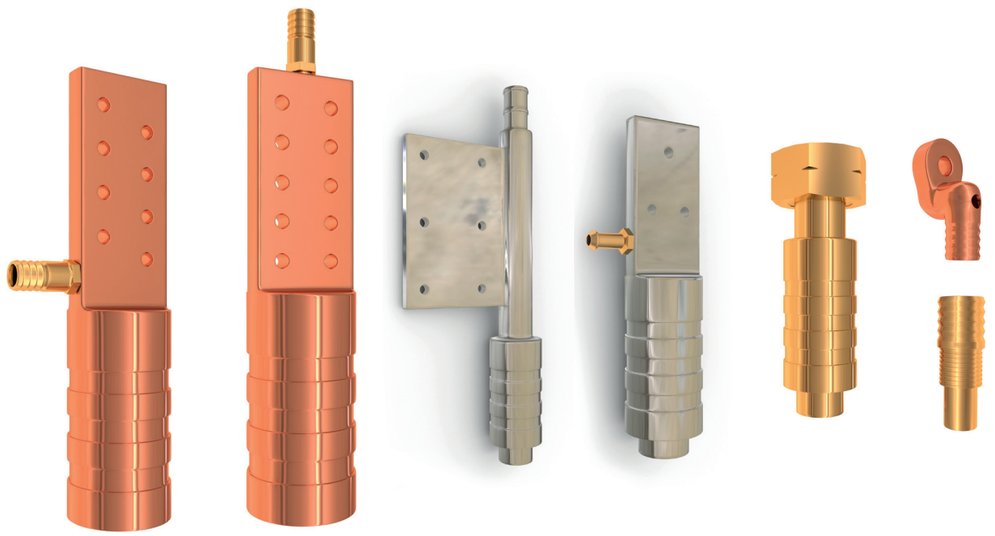


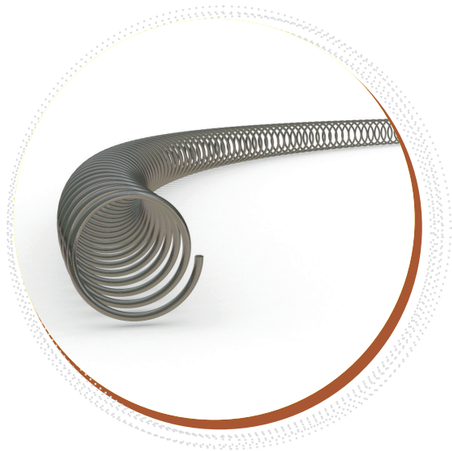
Conductors

Conductors used in Water Cooled Cables are composed of twisted copper wire strings which are mostly bare and sometimes tin-plated (mostly in secondary cables). The copper used for these wire strings is completely softened (annealed) ETP grade Copper (According to ASTM C11000). Water Cooled Cables are divided into two groups regarding arrangement of conductors inside the cable: “Continuous” and “Separated”. Incontinuous Types, conductors of the cables are composed of thin strings in high numbers (with little number of wires); while, the separate cables are composed of conductors with wires in lower numbers which are thicker (or the number of strings is more) compared with the continuous ones. The twist angle of single strings in two adjacent layers are symmetrical.

Terminal

Cable Heads used for manufacturing Water Cooled Cables are produced as designed in the R&D or according to the drawings provided by customers. Cable heads are generally produced as one-piece through forging and machining copper billets. Sometimes they are as multi-piece through welding machined parts which is not advised especially in high-power cables. Material of the copper used is “ETP grade copper” (according to ASTM C11000) in a softened (annealed) way. The following figure shows some of the convenient terminals (cable heads) used for manufacturing Water Cooled Cables.





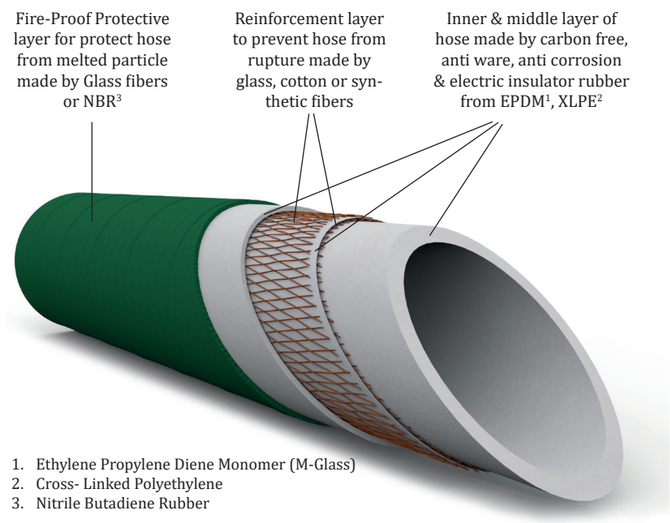
Water Passage

Water Passage Canals are used by water flow to pass through the Water Cooled Cable; otherwise, water flow will be stopped because of ravels of conductors in the cable. These canals are generally used in the average-power cables and the high-power ones; using them in the low-power ones (Secondary Cables) is not necessary. The said canals are used in two ways:

- Spring type: spring formed, made of stainless steel grade 304 or copper;
- One-piece: have a circle (tube) or polygonal cross section, made of extruded plastic, resistant to corrosion.

Hose

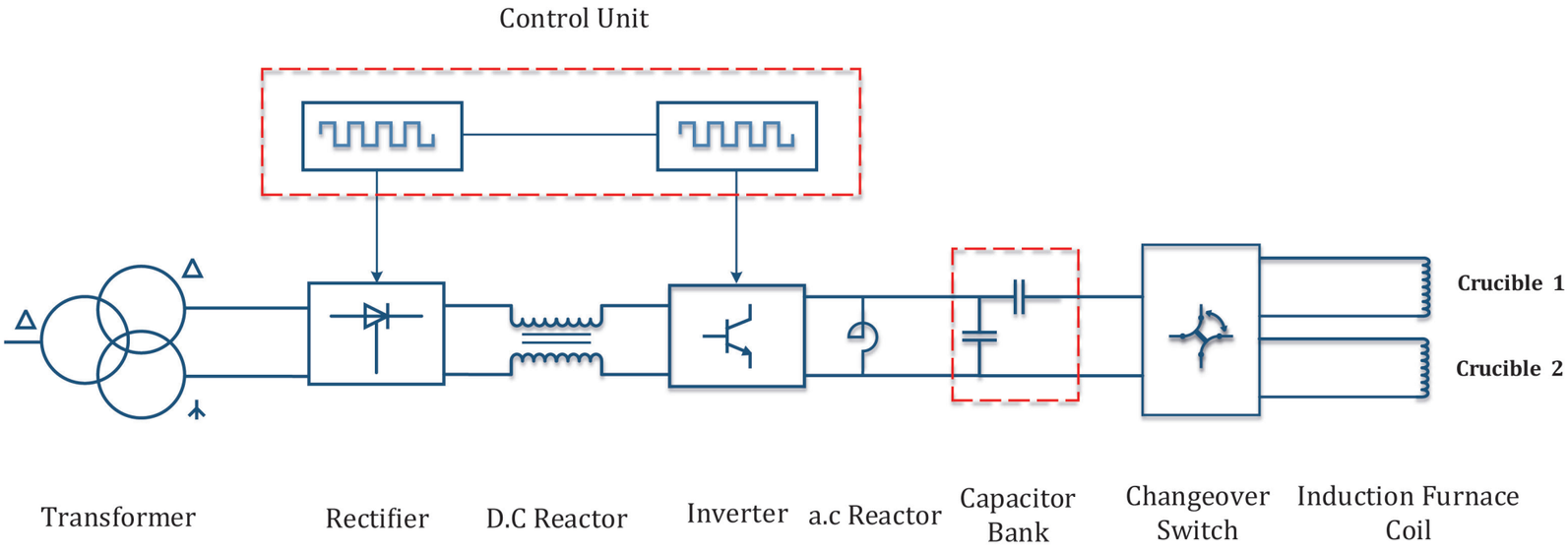
Hoses used for Water Cooled Cables are made of carbon-free materials and are resistant to corrosion; they are strengthened by woven synthetic fibers in one or two layers to prevent from tearing. Also, the outer surface of hoses is protected using a layer of fireproof material. The maximum working pressure for Water Cooled Cables is 10 to 20 bars in case of continuous usage; the maximum tolerable pressure for them (tearing limit) is about 40 to 50 bars.



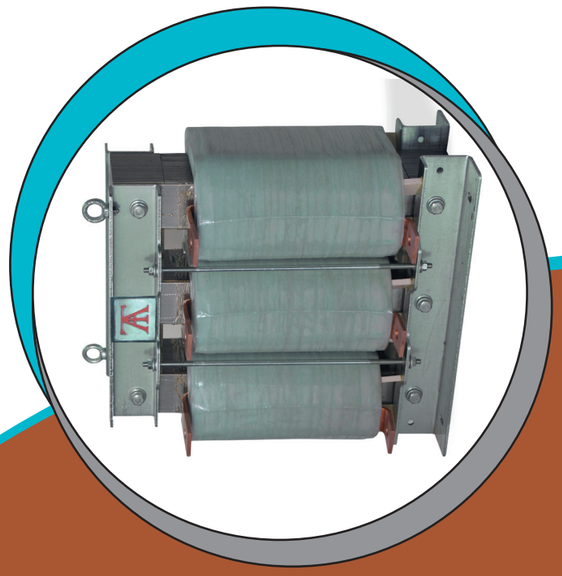
1. Ethylene Propylene Diene Monomer (M-Glass)
2. Cross- Linked Polyethylene
3. Nitrile Butadiene Rubber

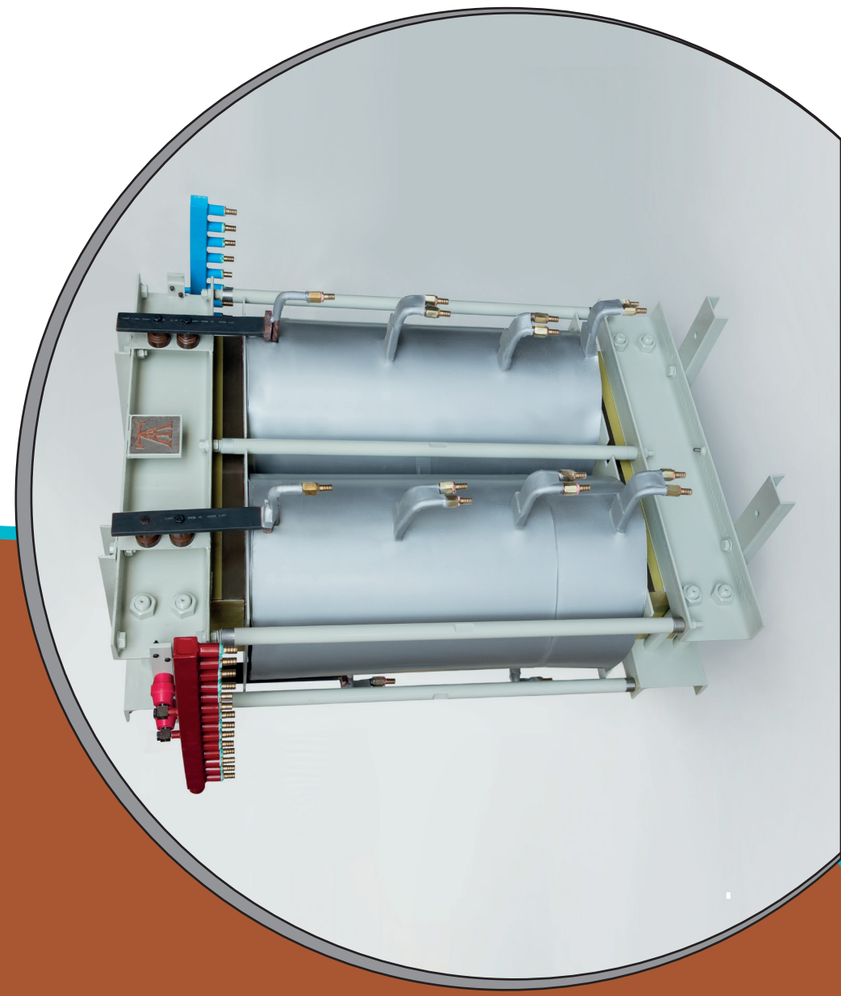
Hose Clamps

The fasteners used for sealing hose of a Water-Cooled cable are made of stainless steel to prevent from heating under magnetic field around the furnace. They are used as disposable and toothless to make sure that they won’t be opened during the time.



Reactor (Choke)



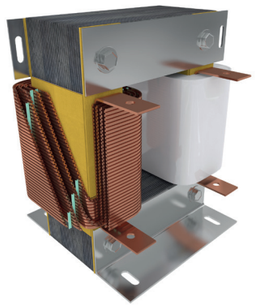


Reactor (Choke)

Reactor is an inductor to be used in electrical circuits in two ways: series or parallel, including AC or DC to fulfil the following aims: a)to supply fixed current sources b)to confront sudden Current alterations and etc. In furnace industries, reactors are installed in AC and DC power circuits of furnaces.

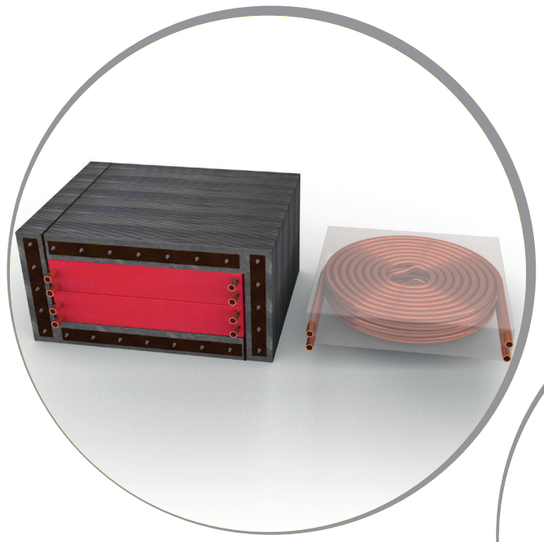
AC Reactor

AC reactors are not necessarily used in power circuit of induction furnaces. The initial design conditions makes them applicable for electrical system of a furnace. In case of using them in an induction furnace, they should be single phase. They are installed in parallel way to the capacitor bank of a furnace to discharge energy of the capacitor in case of need and complete the resonant circuit of the furnace.



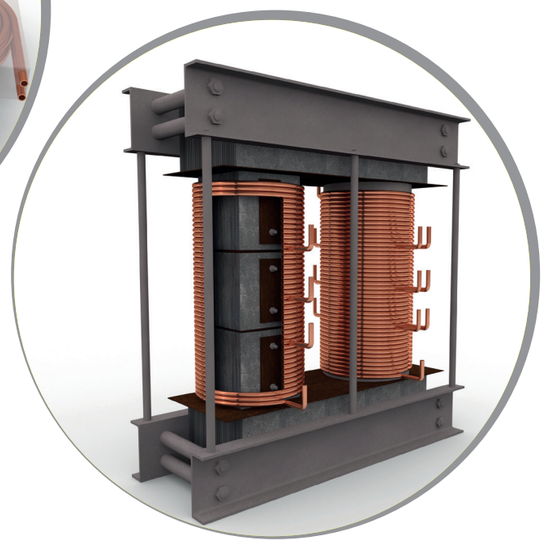
DC Reactor (DC Link)

In fact DC link connects the rectifier and the inverter. Their function is creating a DC current source to feed the furnace inverter. DC reactors are manufactured in a given inductance and power and installed in the furnace system. Meanwhile, Araz Trans manufactures new reactors according to the drawings of the customers to fulfil their requirements and also, recommends its own models as a result of combining and improving different structures.

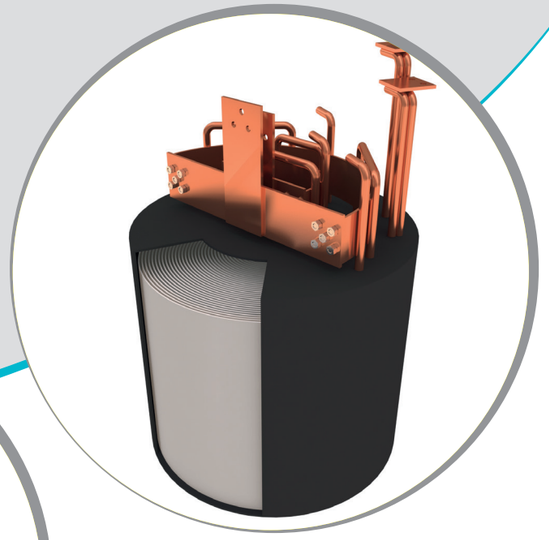


Kasten Out Core Reactor

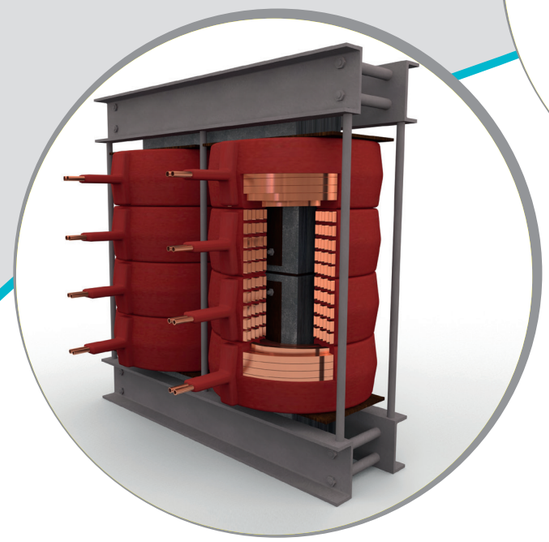
Helical[1] Inside Core Reactor



1. Helical or Login



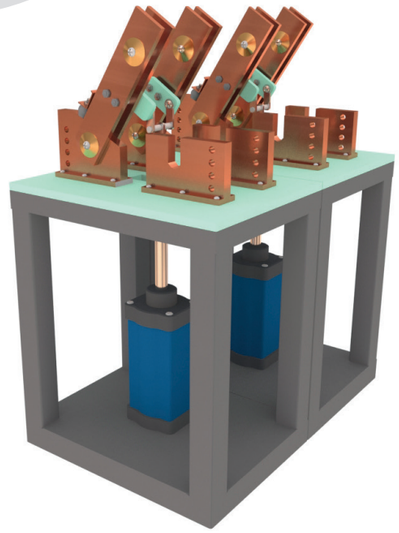
Toroidal Inside Core Reactor



Kasten Inside Core Reactor

The most important parameter of DC reactors is their inductance. It is recommended to manufacture the reactor in multiple taps to make them compatible with other sections of the furnace; they should be used in a tap appropriate to other parameters of the furnace. Naturally, the used tap will change in case of changing parameters of furnace.

Changeover Switch

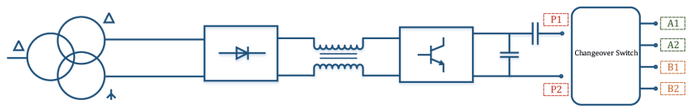


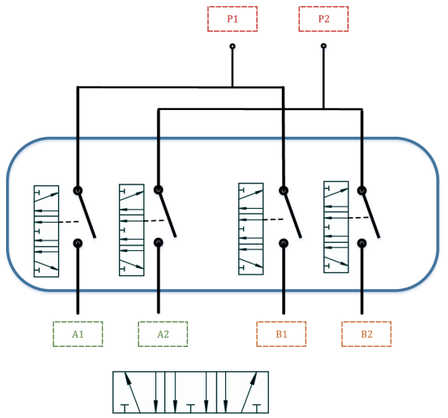
Changeover Switch

Changeover Switch is a tool to change the crucible connected to the feeder. These switches are categorized in different types regarding number of input and output; they are introduced based on number of feeders of the furnace and also their crucibles. Generally, number of feeders of an induction furnace is one or two and number of crucibles connected to feeders is two or three. The most convenient type used in changeover switches have one input and two outputs.
Changeover switches are divided into three groups regarding function mechanism: manual, electrical and pneumatic.

- **Manual**: In this group, changing the crucible is applied using a lever connected to the switch manually.
- **Electrical**: in this group, changing the crucible is applied using electromotor power.
- **Pneumatic**: pneumatic changeover switches change crucible from the feeder using pneumatic cylinders. This group is the most convenient ones used in steel industry.

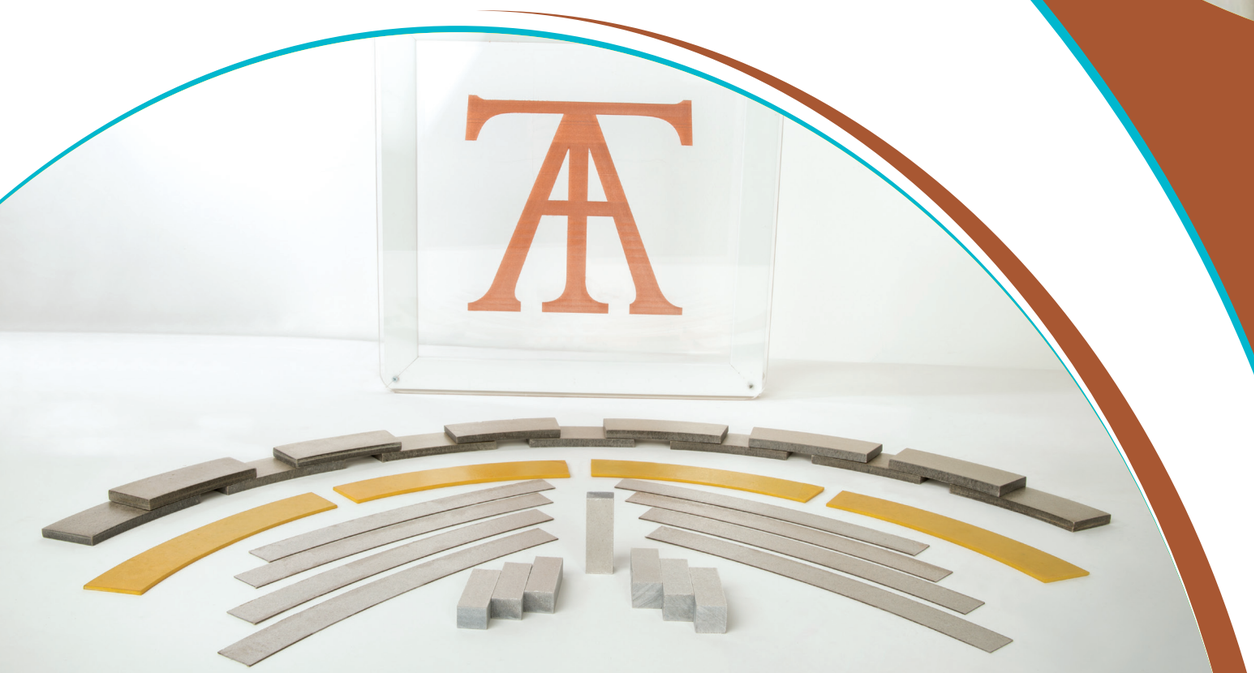
A schematic view of pneumatic changeover switches with one input and two outputs which are manufactured by Araz Trans is as follows:





5/3 Pneumatic Valve

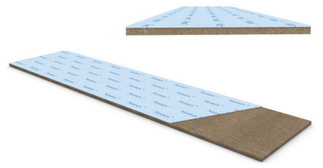
Insulation Materials Used In Induction Furnaces



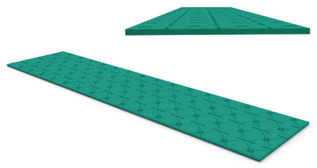
Insulation Pad

Insulation pad is a set of insulating layers placed between the coil and the yokes of an induction furnace which are used to isolate them. Araz Trans provides insulation pads in different types with special properties and applications. The following images show compositions and layers of provided insulation pads by this company.

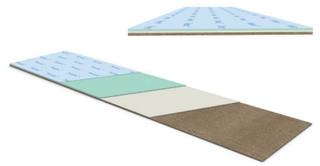
Rigid Mica Sheet



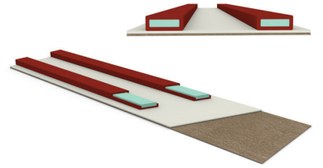
NMN Sheet[1]
Rigid Mica Sheet



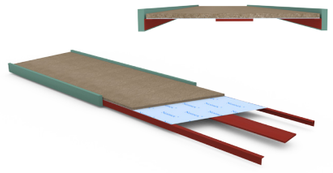
Jointing Sheet



NMN Sheet[1]
Fiber Glass Sheet
Teflon Sheet
Rigid Mica Sheet



Silicon Rubber Tube Reinforced by Fiber Glass Strips
Teflon Sheet
Rigid Mica Sheet

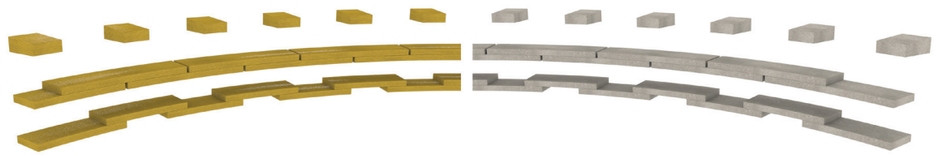


Araz Trans Invented Insulation Pad
Mentioned in
“Induction Furnace Yoke” Section

1. Consist of three layers: Nomex - Mylar - Nomex

Spacer

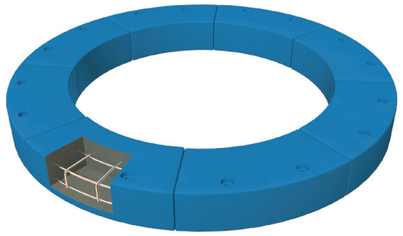
Using insulation materials in all the electrical parts of an induction furnace is very important and inevitable. Any small insulation defect may lead to an error or a short circuit, and thus an stoppage of melting process in a furnace. Spacers should be necessarily applied between loops of a coil. Spacers strengthen the coil’s coating in addition to reinforcing insulation power in the space between loops of a coil. Spacers are divided into groups regarding their material: Mica and Fiberglass; They are also divided into two groups regarding their form: lunate spacers and wedge spacer. Lunate spacers are used in a continuous mode and the wedge ones are used in an interrupted mode.

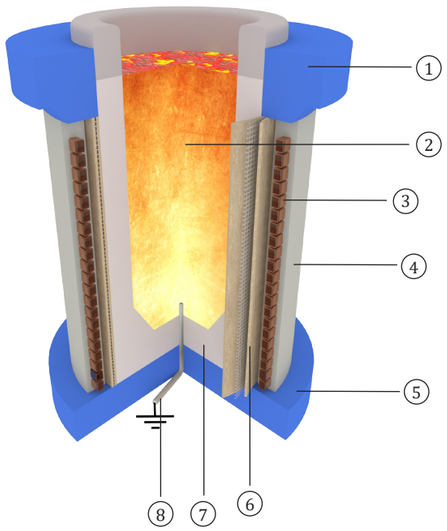


- Mica spacers have more thermal capacity compared with the fiberglass ones and instead, they cost more.
- lunate spacers provide more electrical and mechanical strength compared with the wedge ones.
- The continuous lunate spacers are produced through machining and overlaying with a certain overlap. (0 to 50 percent overlap) More overlap means more strength and so, more assurance. Instead, in this case moisture outlet will be more difficult during sintering.

Refractory Blocks

Refractory blocks are installed between the coil and the structure, at the upper and lower sections, as isolator. They are manufactured by moulding Alumina (50 percent purity and having fibers) in the desired form and dimension. Metallic non-magnetic material is used during moulding to reinforce concrete and prevent from fragility. Refractory blocks are used in “One-piece” or “Multi-piece” way. The advantage of using multi-piece types is to provide space between blocks to prevent their cracking because of expansion as a result of furnace heat.





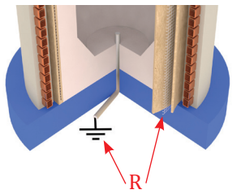
No.	Item	Convenient Material
1	Top Ring	Alumina[1] 50%
2	Molten Metal Bath	
3	Furnace Coil	Special Copper Tubes
4	Grout Coil	Alumina 95%
5	Bottom Ring	Alumina 50%
6	Middle Isolator Layer	Mica-based Compositions Roll
7	Refractory Lining[2]	Silica Ramming Mass or Magnesium Aluminate Spinel
8	Earth Leakage Rod (Antenna)	

1. Al_2O_3
2. Hot Face Lining

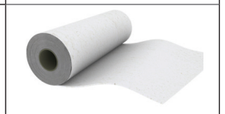
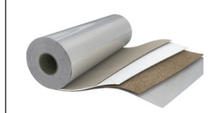
Isolator Between the Refractory and the Coil Grout

This isolator is used behind the refractory lining of induction furnaces to isolate coil grout from the refractory materials. These isolators prevent the leakage of the melt to penetrate the coil grout. In addition, a specific type of these isolators is used as a part of melt leakage warning system and are generally produced and used as a roll of flexible mica-based material in different grades. A table on the next page shows different grades of rolls which can be used and provided by Araz Trans.

In case of using the material which is mentioned at No. 2 of the table, melt leakage warning system that is suitable with this material, may be used. To achieve this, at first, the required modifications should be applied to furnace system and then, a special resistance measuring instrument that is being provided by Araz Trans should be installed to measure and monitor momentary resistance between middle layer of the isolator (non-magnetic SS layer) and the earth neutral (that is already connected to melting by antenna). This way, in case of gradual leakage of the melt and its approach to the isolator layer, the measured resistance gradually reduces and in case of dropping more than the amount defined before, the installed system warns and even sends trip order in case of emergency. This method is one of the effective and cheap methods for melt leakage warning system in a furnace.

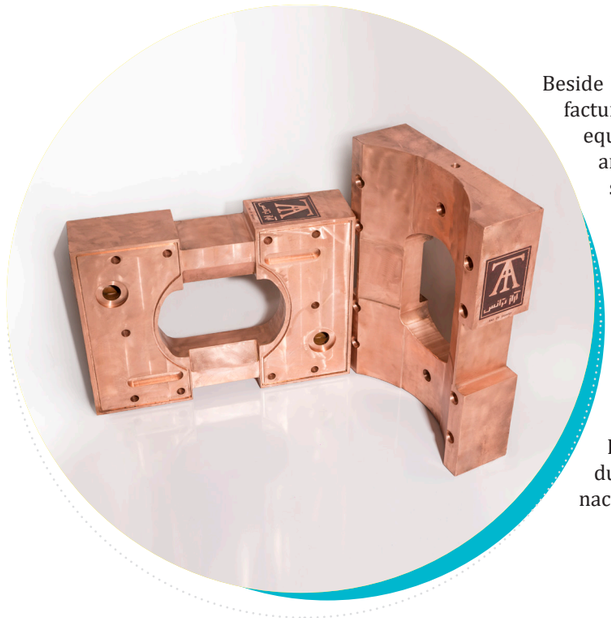


Online Monitoring of Resistance

No.	Layers	Technical Properties			Dimensions			Description	Schematic
		Heat Transfer Coefficient[1] (W/m/°C)	Maximum Tolerable Temperature (°C)	Electrical Strength[2] (KV/mm)	Roll Length (m)	Roll Width (mm)	Thickness (mm)		
1	• Flexible Phlogopite Mica Sheet	0.20	1000	>18	Max 2.4	1000	0.1-0.6	-	
2	• Flexible Phlogopite Mica Sheet • Antimagnetic Stainless Steel Net • Flexible Phlogopite Mica Sheet	0.25	1000	>23	Max 2.4	1000	0.9±0.1	This case is used in furnaces equipped with leakage diagnosis based on them	
3	• Flexible Muscovite/ Phlogopite Mica Sheet • Woven Glass Fibers	0.35	Mus=1000 Ph=1200	Mus>25 Ph>23	Max 300	500 or 1000	0.14-0.49	-	
4	• Flexible Muscovite/ Phlogopite Mica Sheet • Woven Glass Fibers • Flexible Muscovite/ Phlogopite Mica Sheet	0.35	Mus=1000 Ph=1200	Mus>25 Ph>23	Max 300	500 or 1000	0.14-0.49	-	
5	• Fiber Glass Mat • Flexible Phlogopite Mica Sheet • Woven Glass Fibers	0.35	1200	>23	Max 100	1000	0.40	-	
6	• Fiber Glass Mat • Flexible Phlogopite Mica Sheet • Woven Glass Fibers • Fiber Glass Mat	0.35	1200	>23	Max 100	1000	0.4 or 0.5	-	
7	• Woven Glass Fibers • Flexible Muscovite/ Phlogopite Mica Sheet • Calcium Silica Soluble Fibers	0.10	1100	Mus>25 Ph>23	12.5 20 25	500 or 1000	2.3-3.3	-	
8	• Flexible Muscovite/ Phlogopite Mica Sheet • Woven Glass Fibers • Calcium Silica Soluble Fibers	0.10	1100	Mus>25 Ph>23	12.5 20 25	500 or 1000	2.3-3.5	-	
9	• Calcium Silica Soluble Fibers	0.60	1100	-	10 15 20 25	500 or 1000	1-10	-	
10	• Woven Glass Fibers • Flexible Micro-particle Phlogopite Mica Sheet • Calcium Silica Soluble Fibers • Special Aluminium Alloy	0.10	1100	>23	According to the Order		2.4	This case is used to prevent penetration of Zinc towards the coil	
11	• Flexible Micro-particle Phlogopite Mica Sheet • Fiber Glass Mat	0.10	900	>23	20	1000	0.65±0.05	-	

1. In 400 °C
2. According to IEC60243 Standard in 20 °C

Electric Arc Furnace Equipment

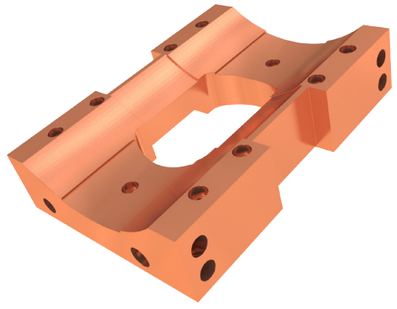


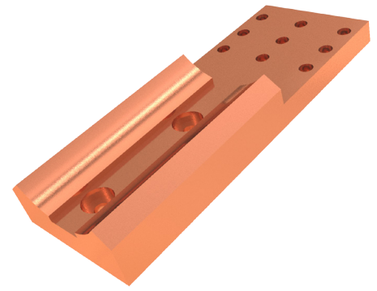
Beside Induction furnace equipment Araz Trans also manufactures some equipment of Electrical Arc Furnaces. This equipment, that are mainly copper parts used in EAFs, are initially designed by simulators and computer designing software by professional technicians and basic information provided by the customers; then, they are manufactured by experienced staff of the company, using high quality raw material. Each level of production requires necessary attention to quality improvement and the related details because these equipment's function is very sensitive; otherwise, the consequences of the furnace stoppage leads to serious losses.

Below is a summary of the parts and equipment produced by this company to be used in Electrical Arc Furnaces:

Copper Contact Shoe

Copper Contact Shoe is made of copper providing cooling water passage canals in it and its main application is to transfer electric current of the furnace to its electrodes. These parts are mainly produced in two models: "Moulded" and "Forged".
For producing moulded models, copper moulding is executed after providing a mould according to the design; then, the moulded copper is machined to achieve exact dimensions and according to the drawings of the design. Quality of the moulding is very important regarding impurities and holes in the structure; So, a radiographic test is performed to control quality and to detect weak points and air bubbles in it, in addition to hydro-test that is performed to detect water leakage. Otherwise, even if there is no leakage identified in the hydro-test, we may face microscopic and termite leakage in the future. Electrical conductivity of the contact shoes produced in the moulding types is about 85% of standard electrical conductivity of copper (IACS).





The "Forged" Type is produced by making a specific forge mould or directly by forging a copper block or a semi-prepared moulded part which its dimensions are close to the final one; this model's electrical conductivity is above 101% of IACS and is more consistent. Thus, the forged model is more reliable compared with the Moulded one and of course, final price is higher compared with moulded types.

Araz Trans manufactures both "Moulded" and "Forged" copper contact shoes according to technical properties and original drawings provided by the customer, or by designs of the company according to the customers' requirements, using its facilities including qualified raw material and high technology machining and moulding equipment.

Cooling Panel

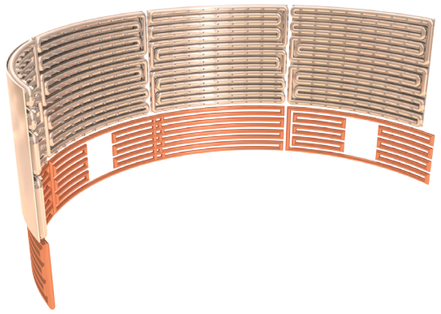
The main function of cooling panels is to cool down the structure of the furnace. These panels are categorized based on the section being cooled in the structure of an Electrical Arc Furnace, including: Roof, Lateral walls and the Bottom. Also, another type of cooling panel is used for the outlet exhaust of the furnace.

Roof Cooling Panel

This part is made of special steel alloy tubes and joints (grade S235JR, as ASTM A 106) and is located at the top of the furnace. Its special steel composition includes: 1.2% Manganese and 0.35% Silicon is to endure the heat up to 475˚C. Joints and tubes of the panel are welded specially after forming according to the manufacturing plan.

Lateral Wall Cooling Panel

Lateral wall cooling panels are made as a composition of steel and copper alloys as tubes and joints (as mentioned before); The bottom part, close to the melting metal (about 8 rows), is made of copper and the top part is made of steel alloys. Also, small slices of the same material are welded to the tubes from inside to restrain the molten slag and protect the panel. To manufacture the panel all the parts are formed after attaching them as a welded unit and then, are mounted on the wall of furnace body to complete the panel.

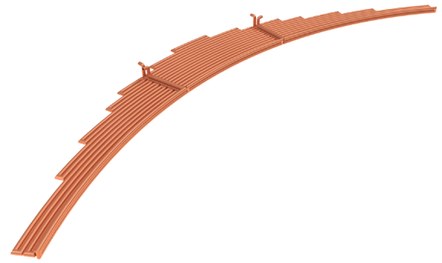


Exhaust Cooling Panel

Exhaust cooling panels, as they are called, are installed in the exhaust to cool down the mist going out of the furnace. The route of the mist out of the furnace should be equipped with exhaust cooling panel at least up to 30% for the panel to be able to cool down the outlet mist sufficiently. These panels are made in two forms: straight or bended (45 and 90 degrees); They are made of steel alloys and are equipped with a joint flange to be connected to each other and to the top part of the furnace.

Bottom Cooling Panel

The Bottom cooling panel which is installed on the EBT section of the furnace, consists of ETP and DHP grade copper tubes and joint. The tubes used in this section are extruded fine copper tubes that are sometimes in form of finned tubes to increase the contact surface with the air around in order to add cooling efficiency. The joints between the tubes are welded using Argon TIG welding or brazed after forming them.



ARAZ TRANS

"God is in the details"

Ludwig Mies van der Rohe

Note

Note

Ziya Gökalp Mah. Süleyman Demirel Bulvarı
Mall Of İstanbul, No:7, Kat:17, Daire No:136
Başakşehir / İstanbul / Türkiye
Address Code: 3285723072
T: +90 212 9428744 F: +90 850 2200451

GSM: +90 534 0398283

info@araztrans.com

ArazTransCo.

SÖNMEZ İNDÜKSİYON

www.araztrans.com