INDUCTION HEATING EQUIPMENT
高周波誘導加熱裝置

韓國熱鍊株式會社
KOREA NETUREN CO.,LTD.
www.korneturen.co.kr

SBCR

Obtained Certificate of
ISO 9001:2008

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COMPANY PROFILE

As a specialized business enterprise of high-frequency induction heating, Korea Neturen joint-ventured with Neturen Japan, has supplied the newest equipment for rapidly growing domestic and overseas industry.

We started with Vacuum-tube type Oscillators and Thyristor(SCR) type, and now manufacture mainly Transistor type power supply. Realizing that the only competitiveness to survive in the industrialized society comes from higher quality products, we make every effort to raise the quality of our customers' products.

BUSINESS ITEMS

- Induction Heating Systems for Hardening & Tempering
- Power Supply of Transistor Inverter Type
- Automatic Heating Machines
- Various kinds of Inductors(heating coils)

COMPANY HISTORY

Nov. 1987 Made a joint venture contract with Neturen Co., Ltd. of Japan.

Jan. 1988 Obtained the approval of foreign investment by the Korean government

Feb. 1988 Established the Corporation.

Jul. 1988 Completed the factory buildings.

Dec. 1988 Appointed as one of the Promising Small & Medium Companies by the Korean General Technology & Financing Corporation.

Dec. 1990 Appointed as one of the Companies with Superior Technology by the Korean Technology Credit Guarantee Funds.

Sep. 1991 Renewed the technical license agreement with Neturen Co.,LTD.

Nov. 1991 Appointed as one of the companies for military service exemption.

Dec. 1991 Awarded a prize for a leading company by the Minister of Commerce and Industry.

Dec. 1992 Awarded a prize for a leading company by the Korean Machinery Industry Promotion Corporation.

Sep. 1996 Renewed the technical licence agreement with Neutren Co.,LTD.

Dec. 1997 Obtained Certificate of ISO9001

Jun. 1999 Selected as a Promising Exporter by Small Business Corporation.

Nov 2004 Obtained Certificate of ISO 9001:2000

Nov. 2005 Awarded the million dollar export prize by the Korea International Trade Association.

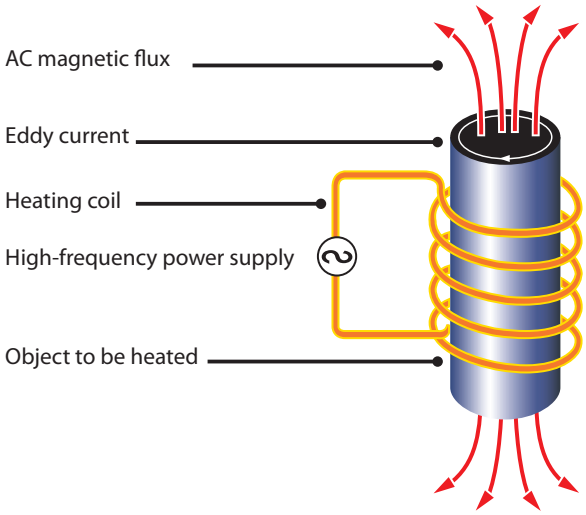
Apr. 2008 Obtained Certificate of Clean Factory

Nov. 2010 Obtained Certificate of ISO 9001:2008

High–Frequency Induction Heating

1. Principle of induction heating

The relation between heating coil and object(metal) to be heated in induction heating is similar to that between the primary and the secondary coils in a transformer. The magnetic flux generated by a high-frequency current in the heating coil is focused on the object as shown in the figure. This flux induces eddy currents in the object and so causes electromagnetic induction heating. By appropriately selecting the frequency and power of the alternating current, heating time, holding time, coil configuration and so on to match the type and shape of the steel material, the quality characteristics of the steel can be finely tailored.



2. High Frequency Current Penetration Depth

A high frequency electric current has a tendency to run concentratedly on the conductor surface, what is called skin effect. Therefore, electric current penetration depth δ is expressed as,

$$\delta = 5.03\times10^{3}\sqrt{\frac{\rho}{\mu s \cdot f}}$$

where μs = relative magnetic permeability

ρ = specific resistance ($\mu\Omega$ · cm)

f = frequency (Hz)

At the points of penetration depth current density becomes 37% of that at the surface.

At the normal temperature(α-steel) $\mu s \leq 100$,

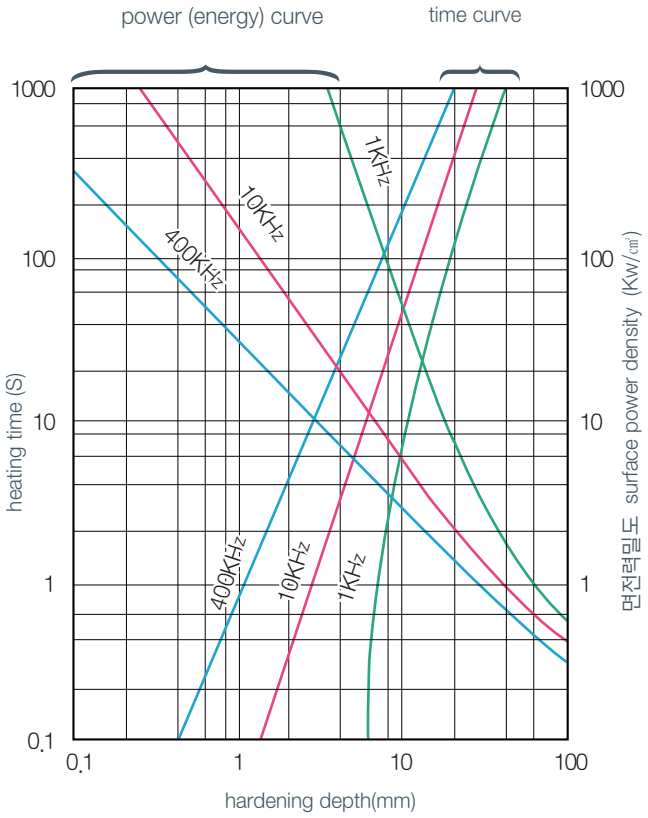
for above curie point (γ-steel) $\mu s = 1$

specific resistance ρ (Ω · cm)=10~100×10-6

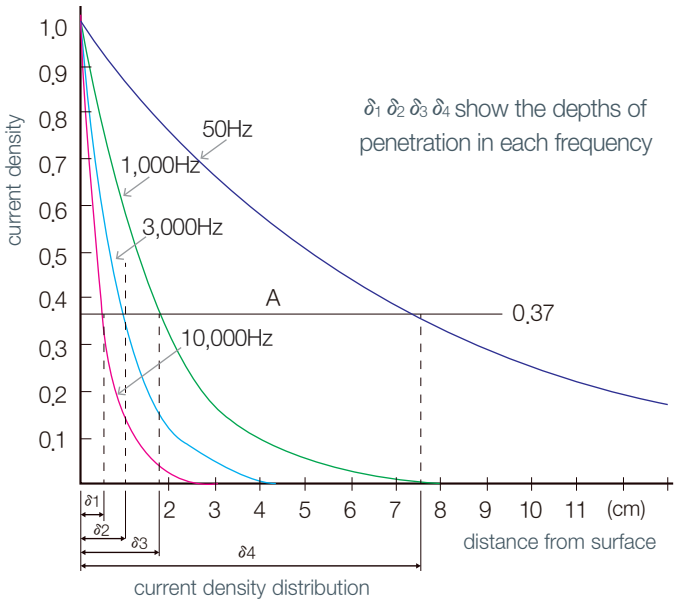
(from the room temp to quench heating temp)

temperature (℃)	specific resistance ($\times10^{6}\Omega$ · cm)	relative permeability (μs)	Frequency (kHz)		
			3	10	100
20	20	100	0.04	0.02	0.01
800	120	20	0.23	0.12	0.04
820~880	120	5	0.45	0.24	0.08
1000	130	1	1.05	0.57	0.18
1200	135	1	1.06	0.57	0.18

※ Current depth in each temperature δ (cm)



〈relationship between hardening depth and high frequency, surface power density and heating time〉



Frequency (kHz)	Penetration depth(mm)	Valid depth of hardening depth (mm)
		0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5
10	5	
20	3.6	
50	2.3	
100	1.5	
200	1.1	

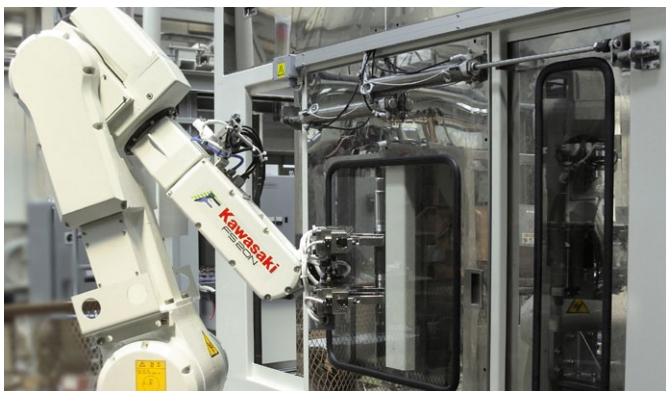
※ Relation between frequency and hardening depth

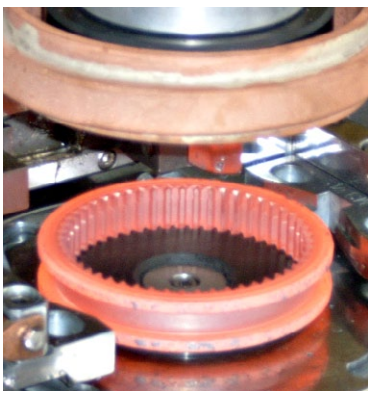
High–Frequency Induction Heating

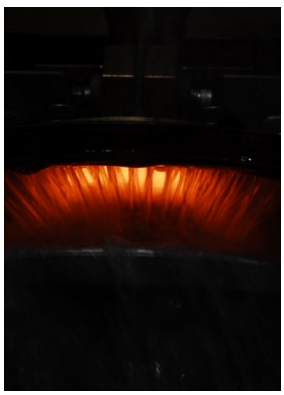
3. Purpose and characteristics of high-frequency heat treatment

The purpose of high-frequency heat treatment for surface hardening is to improve abrasion resistance and fatigue strength by selecting the hardening depth in a flexible way. In induction heating, electromagnetic induction is used to convert electrical energy into heat energy within the metal itself. High-frequency heat treatment using this method has many benefits.

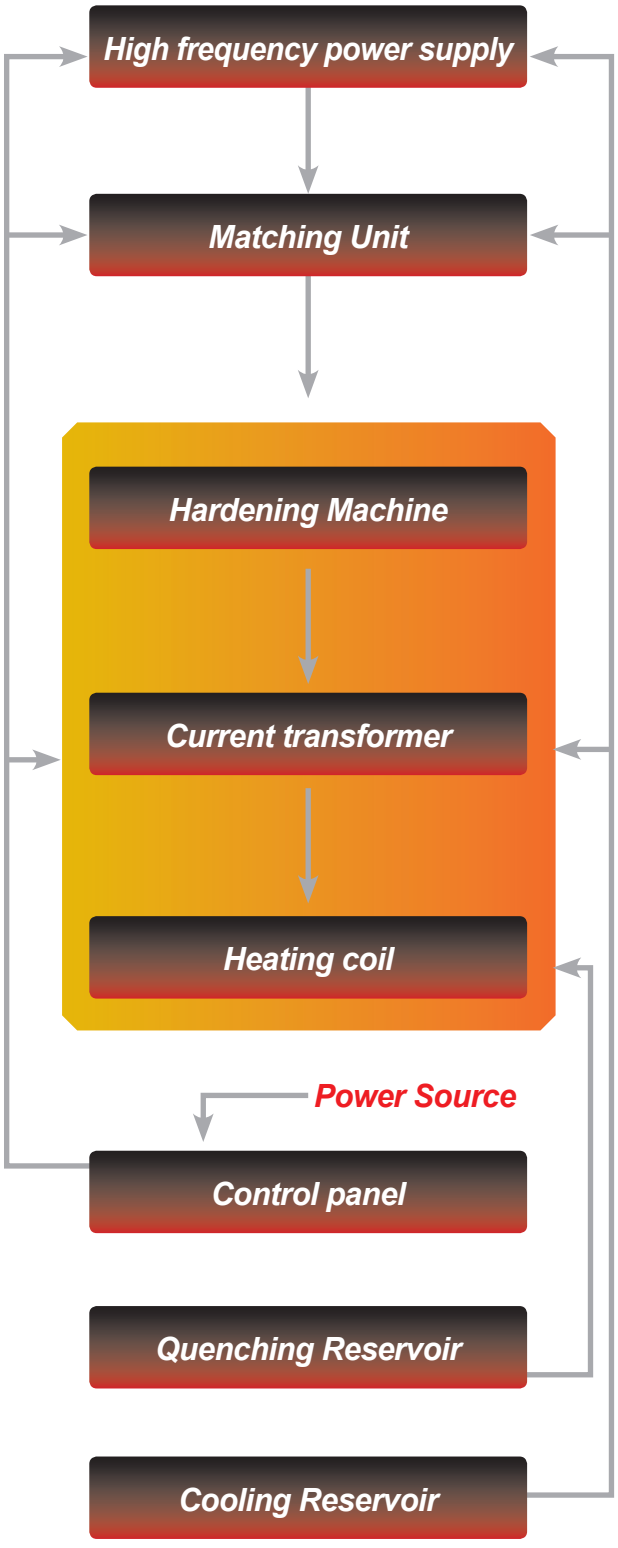
- Heating efficiency is high and work time is short, which results in savings in terms of energy and cost.
- Heating can be done in the specified area, and hardening depth can be selected in a flexible way.
- Rapid heating/cooling is possible, and the compressive residual stress on the surface enhances fatigue strength.
- There is no worry about oxidation or decarburization, and there is less deformation.
- As electro-magnetic energy is used, it is easy to operate/standardize/automate.
- The working environment is pleasant and there is little pollution generated.







Induction Heating System Diagram



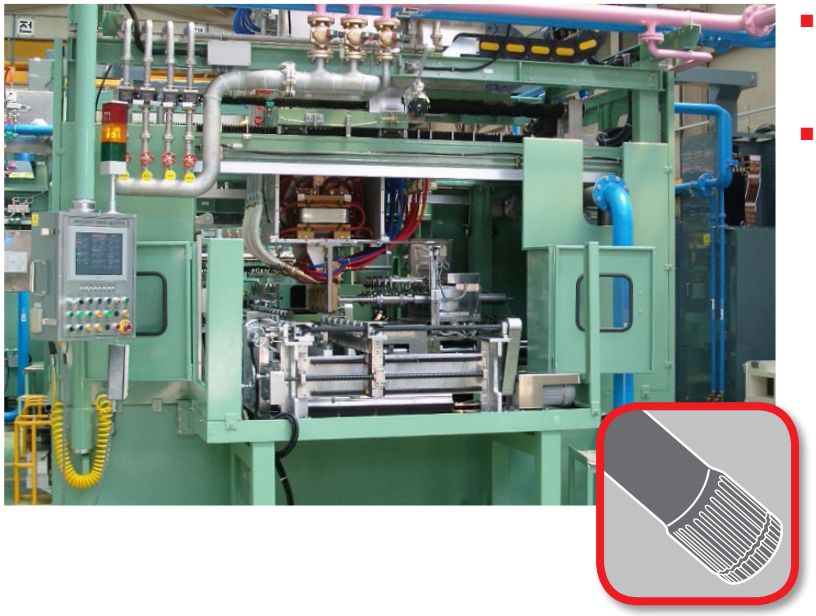
- It is a high frequency power supply for hardening.
- It matches the electrical impedance between hardening unit (loaded unit) and power supply.
- It is a machinery of all sorts that is suitable for hardening type, shape and hardening method of workpiece.
- It transforms the output voltage of High Frequency Power Supply to a proper voltage for Heating Coil.
- It increases the temperature of workpiece according to the heating type and shape of the workpiece.
- It controls the entire hardening process including the operation of hardening machine, high frequency power control, heating and cooling time.
- It is a facility for cooling after the temperature rising of workpiece and it uses a special quenchant instead of normal water.
- Since a high frequency facility needs high current density on parts and circuit components, it needs to cool down itself with water cooling.

Induction Heating Equipment

The Best Component for Total System

For the most reliable induction heating systems, please contact Korea Neturen Co.,Ltd.
Our customer-satisfaction system is designed for your specific application with higher reliability, efficiency and productivity.

1. Drive Shaft



■ *Work function*

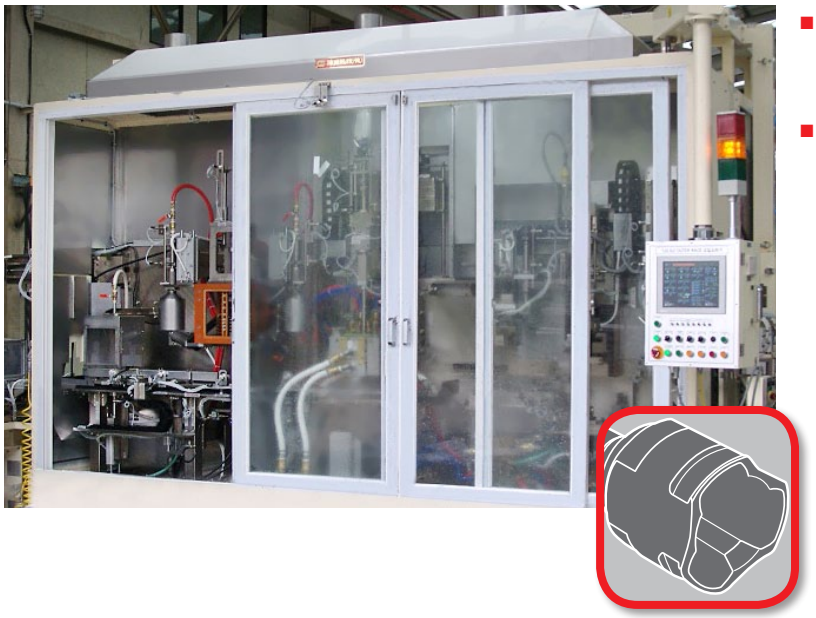
Delivering the traction from T/M joint to wheel joint

■ *Equipment specification*

Generator type : MK16A
- For hardening : 300kW-6kHz
- For tempering : 75kW-3kHz

Machine type : Full automatic hardening & tempering (Four spindle horizontal type)

2. CV Joint (TJ outer race)



■ *Work function*

Delivering the traction from T/M to Trunnion

■ *Equipment specification*

Generator type : MK16A
- For hardening : 300kW-10/50kHz
- For tempering : 50kW-3kHz

Machine type : Full automatic hardening & tempering

Korea Neturen is well known as the leading company of the induction heating technology, and has worked steadily over many years for technical development and quality improvement. With applications in machinery used in construction, agriculture and machine tools and for mechanical parts of vehicles, ships, internal combustion engines and so on, induction hardening is an asset to enhancing quality and performance.

3. CV Joint(BJ outer race)

■ *Work function*

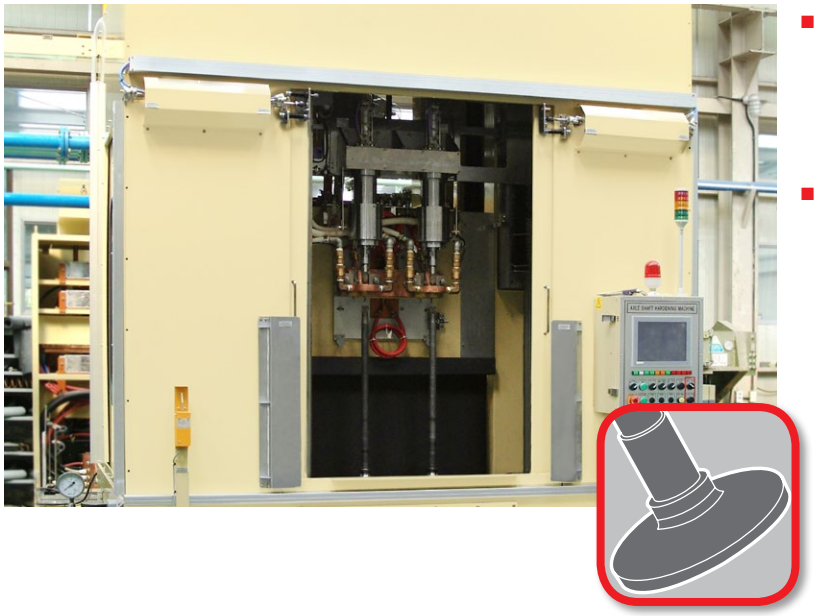
Connected to wheels and delivers transmitted traction from the ball to wheels

■ *Equipment specification*

Generator type : MK16A
- For hardening : 200kW-10/15kHz
- For tempering : 50kW-3kHz

Machine type : Full automatic hardening & tempering

4. Axle shaft



■ *Work function*

Rotates the front wheels of a vehicle by converting rotational motion of the steering wheel into linear reciprocating motion

■ *Equipment specification*

Generator type : MK16A
- For hardening : 300kW-3/10kHz

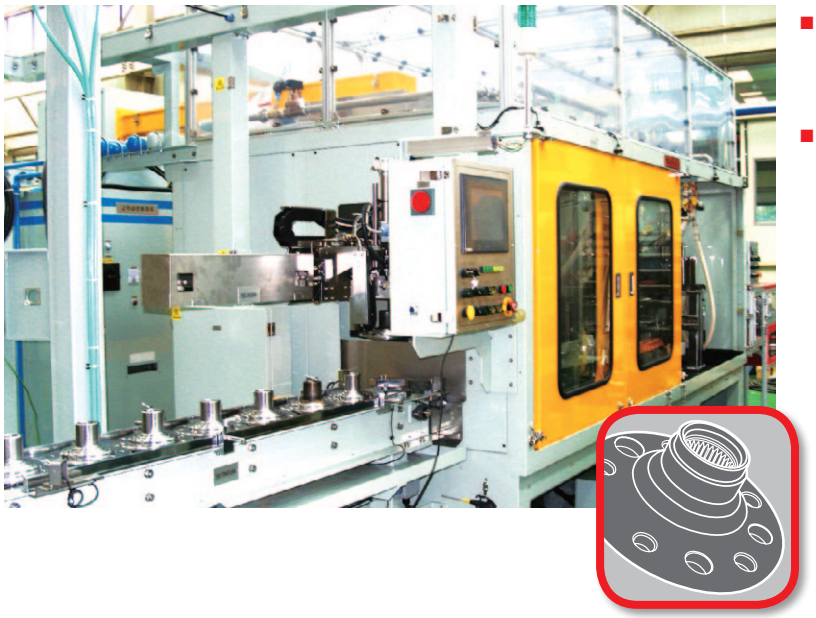
Type of M/C : Semi-auto Hardening (Two spindle vertical type)
Heating process : Auto,
L/Unloading : Manual

Induction Heating Equipment

The Best Component for Total System

From power input to finish processing, Korea Neturen system is designed to keep you most competitive. Surface heat treatment helps to enhance mechanicial properties such as abrasion resistance, flexual strength, torsional rigidity and fatigue strength of complex, irregularly shaped parts used in major components of automobiles, construction machinery, machine tools and so on.

5. Wheel bearing(HUB)



■ *Work function*

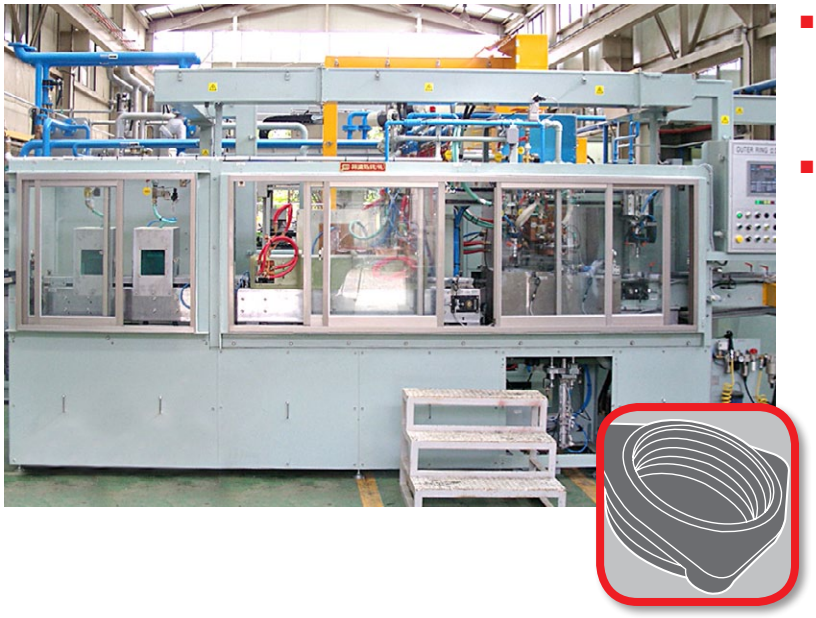
Delivering the power of BJ outer ring to disc

■ *Equipment specification*

Generator type : MK16A
- For hardening : 200kW-15kHz
- For tempering : 50kW-3kHz

Machine type : Full automatic hardening & tempering

6. Wheel bearing (Outer ring)



■ *Work function*

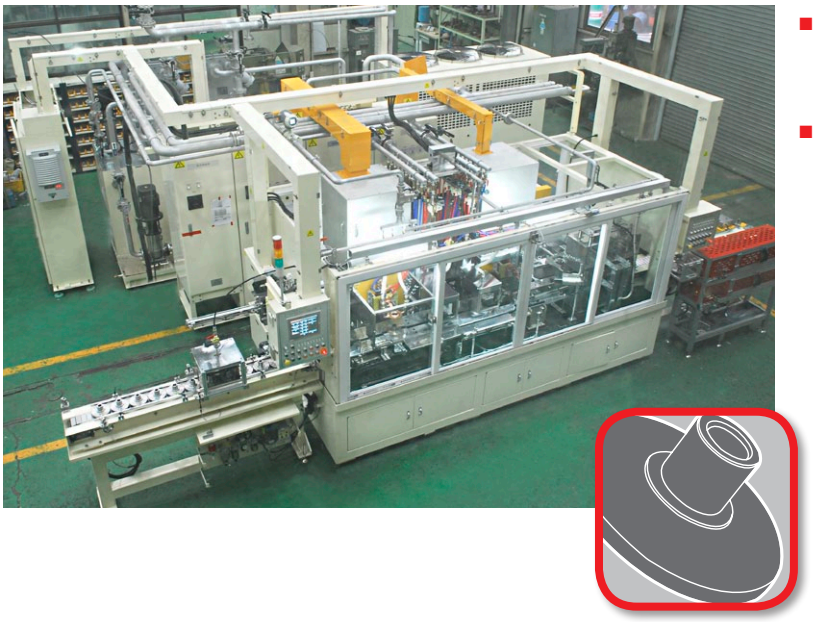
Minimizing the friction and power of BJ outer ring and delivering them smoothly

■ *Equipment specification*

Generator type : MK16A
- For hardening : 200kW-30kHz
- For tempering : 50kW-10kHz

Machine type : Full automatic hardening & tempering

7. Wheel bearing (Front HUB)



■ *Work function*

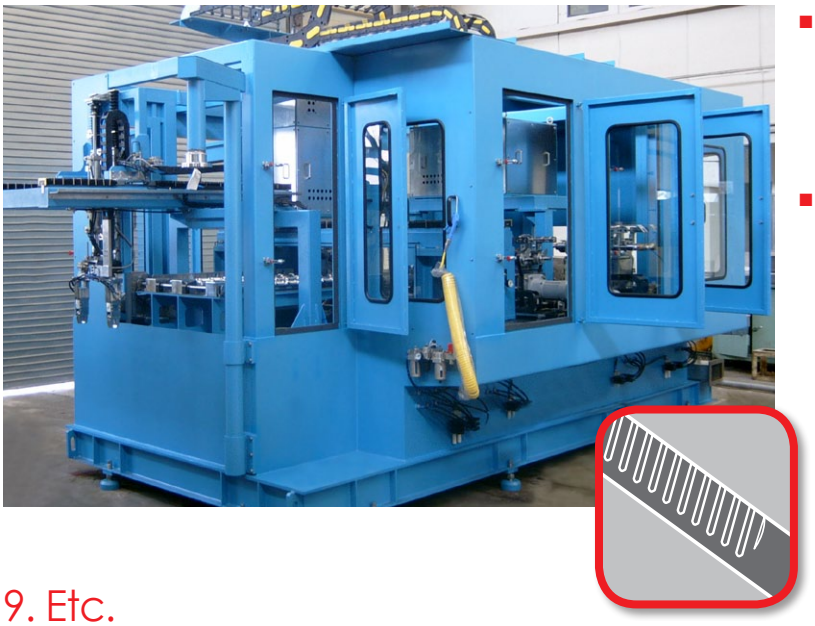
Delivering the power of BJ outer ring to disc

■ *Equipment specification*

Generator type : MK16A
- For hardening : 200kW-15kHz
- For tempering : 50kW-3kHz

Machine type : Full automatic hardening & tempering

8. Rack steering bar



■ *Work function*

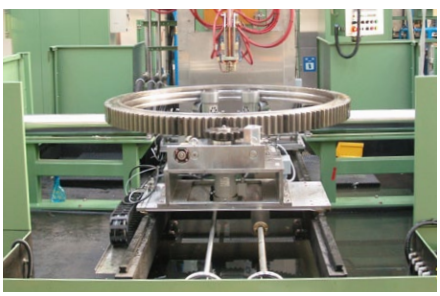
Rotates the front wheels of a vehicle by converting rotational motion of the steering wheel into linear reciprocating motion

■ *Equipment specification*

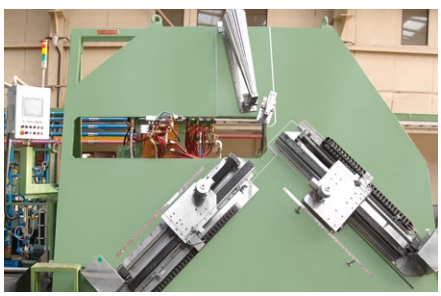
Generator type : MK16A
- For hardening : 200kW-25kHz
- For tempering : 75kW-3kHz

Type of M/C : Full automatic hardening & tempering (Two spindle horizontal type)

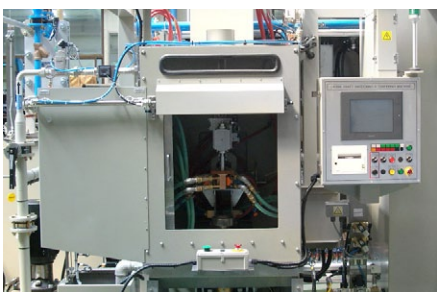
9. Etc.



■ *Work name* : GEAR



■ *Work name* : BALL RACE



■ *Work name* :
CRANK SHAFT FOR MOTOR CYCLE

Induction Power Supply (MK16A)

The diversity of induction heating application calls of a broad range of power sources, both in frequency and output power.
Korea Neturen supplies wide range of induction generators.

Features

■ *Frequency and Output*

The MK16A accommmodates a frequency range of 1kHz to 50 kHz at an output range of 50kW to 600kW. Refer to the following ratings for details.

■ *Energy Savings*

MK16A Transistor inverters are operated with phase angle 0(cos ø ≒ 1)and use high-speed and low-loss device. This results in a 5% reduction in input power and a 44% reduction in the required cooling water.

■ *Compact Design*

The comprehensive semiconductor design reduces the installation space by 73% compared with our Thyristor inverters and 84% with our Vacuum tube oscillators. (See attached table).

■ *Easy maintenance and Inspection*

Transistors, printed circuit boards and other components are all placed at the front for easy maintenance access.
Cooling water circulation system(option) helps to solve the water problems.

■ *Dependable Protective Circuits*

The following protective circuits ensure safe inverter operation in case of touching coils, no-load operations, over-load operations and other operations errors.

■ *Tripping operations*

- Door Interlock
- Cooling Water Flow
- Water temp.
- IDC trip
- VDC trip
- LOW.F trip
- HI.F trip
- Phase trip

■ *Limited operations*

- IDC limit
- VL limit
- Power limit

■ MK16A Transistor Inverter Ratings

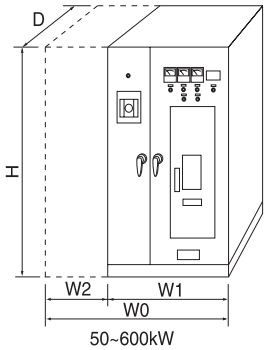
Output	Output capacity(kW)	50	75	100	150	200	250	300	400	500	600
	Frequency(kHz)	1-50									
Input	Voltage(V)	3ø, 440V±10%, 50/60Hz									
	capacity(kVA)	Output(kW)÷0.95=Input(kW) Output(kW)×1.4=Input(kVA)									
Cooling Water	Water flow(L/min)	25/35			45/60		60/80		85/115	100/135	120/160
	Water inlet/outlet dia.	20A/25A					25A/32A		40A/50A		
	Common Specifications	Water pressure : 0.2-0.4MPa, Water temperature : below 35℃									
External Dimensions	Height H(mm)	1650			1950					2350	
	Inverter W1(mm)	800					1000		1200	1400	1800
	Cooling System W2(mm)	500							700		
	Total Width W0(mm)	1300					1500		1900	2100	2500
	Depth D(mm)	800							1000		
	Mass(kg)	470/700	550/800		600/900		800/1100		1100/1400	1300/1600	1500/1800

* Input capacity does not include KVA for cooling water system.
* Larger values in dual ratings are for equipment with cooling water circulation system and smaller for without system.

■ Meeting the Growing Demand for High Performance & Compact Design

Comparison of MK16A Inverter with Thyristor Invertoer and Vacuum tube oscillator
(Compared with 150kW-8.5kHz Neturen Thyristor Inverter and Vaccum 150kW-200kHz Vaccum Tube Oscillator)

Item \ Equipment	Transistor Inverter	Thyristor Inverter	Remarks	Vacuum tube oscillator	Remarks
Overall conversion efficiency(%)	95	90	Output/power input	65-70	Output/power input
Input capacity(kVA)	210	180	3ø,440V	300	3ø,440V
DC Voltage(kV)	0.7	0.7		14	
Cooling water flow (L/min)	45	80	44% reduction in water consumption	150	70% reduction in water consumption
Dimensions(mm)	800(W)×800(D)×1950(H)	2000(W)×1200(D)×2050(H)	73% reduction in floor space	2610(W)×1530(D)×2050(H)	84% reduction in floor space
Mass(kg)	Approx. 600	Approx. 1,700	65% reduction in total mass	Approx. 4,200	86% reduction in total mass
Start/Stop	Momentary	Momentary		Preheat and cool time for filament	
Service life	Infinite	Infinite		Life of vacuum tube (5,000-10,000Hrs.)	
Radio wave Emission	Small	Small		Large	
Operation cost	Lower cost due to higher efficiency and less water	Higher cost due to lower efficiency and more water		Higher cost due to lower efficiency and more water	



■ *Outline Drawings*

* Dotted line indicates cooling water circulation system and it is optionally available.
* Cooling water circulation system with ion-exchanger and without
(Supply and circulate deionized water) ion-exchanger are both available.

Induction Power Supply (MK22B)

Next Generation Transistor Inverter developed by Hi-Tech & Extensive Experience

Features

■ *Frequency and Output*

The MK22B accommodates a frequency range of 100kHz to 350kHz at an output range of 80kW to 480kW. In case of short time heating, output power can be incresed. Refer to the following ratings for details.

■ *Energy Savings*

Because transistors are used instead of vacuum tubes, input power can be reduced 22% and cooling water can be saved 61%

■ *Compact Design*

The comprehensive solid-state and low-voltage design facilitates the compact unit size to reduce the required installation space to 31% the space required by conventional vacuum tube oscillator models.

■ *Easy maintenance and Inspection*

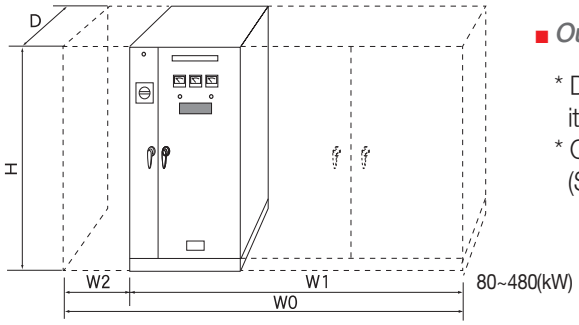
Transistors, printed circuit boards and other components are all placed at the front for easy maintenance access. Cooling water circulation system(option) helps to solve the water problems.

■ *Dependable Protective Circuits*

The following protective circuits ensure safe inverter operation in case of touching coils, no-load operations, over-load operations and other operation errors.

■ *Tripping operations*

- Door Interlock
- Cooling Water Flow
- Water inlet/outlet temp.
- IAC trip
- IDC trip
- Phase fault
- LOW.F trip
- HI.F trip
- Tank fault(coil short)
- Tank cap. V trip



■ *Outline Drawings*

* Dotted line at the left side indicates cooling water circulation system and it is optionally available.
* Cooling water circulation system with ion-exchanger and without (Supply and circulate deionized water) ion-exchanger are both available.

MK22B Transistor Inverter Ratings

Output	Output capacity(kW)	80	120	160	200	240	280	480
	Frequency(kHz)	100, 200, 300, 350					100, 200	
Input	Voltage(V)	3ø, 440V±10%, 50/60Hz						
	capacity(kVA)	Output(kW)÷0.9=Input(kW) Output(kW)×1.4=Input(kVA)						
Cooling Water	Water flow(L/min)	32/45	50/75	65/90	85/120	125/175	140/200	200/280
	Water inlet/outlet dia.	20A/25A	25A/32A		32A/32A	40A/50A		50A/50A
	Common Specifications	Water pressure : 0.2-0.4MPa, Water temperature : below 35℃						
External Dimensions	Height H(mm)	1950			2050			
	Inverter W1(mm)	800	1000			1700		2900
	Cooling System W2(mm)	500				700		
	Total Width W0(mm)	1300	1500			2400		3600
	Depth D(mm)	800				1200		
	Mass(kg)	600/900	1000/1300	1300/1600	1400/1700	2000/2800		3000/3800

* Input capacity does not include KVA for cooling water system.
* Larger values in dual ratings are for equipment with cooling water circulation system and smaller for without system.

Comparision of MK22B Inverter and Vacuum Tube Oscillator

(Compared with 200kW-200kHz Neturen Vaccum Tube Osillator)

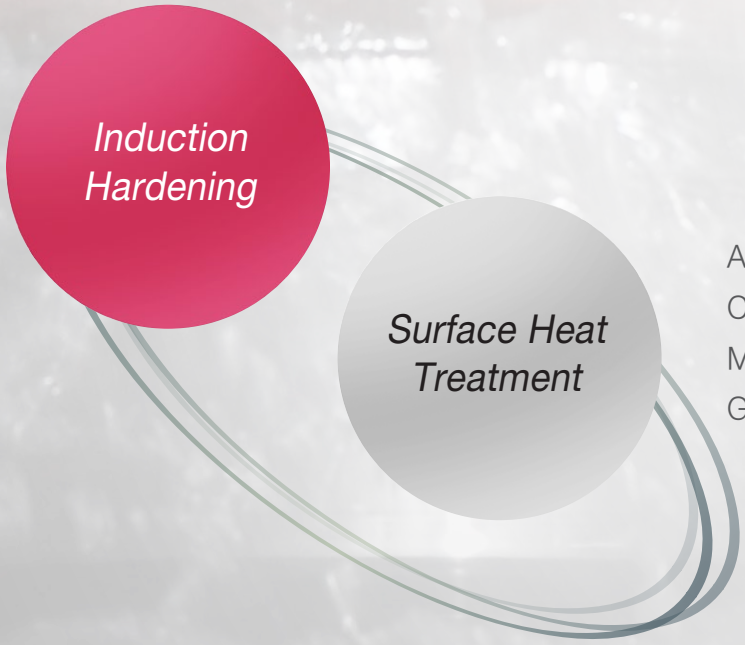
Item \ Equipment	Transistor Inverter	Vacuum tube oscillator	Remarks
Overall conversion efficiency(%)	90	65-70	Output/input power
Input capacity(kVA)	280	400	3ø,400/440V
DC Voltage(kV)	0.7	13	
Cooling water flow (L/min)	85	220	61% reduction in water consumption
Dimensions(mm)	2000(W)×800(D)×2050(H)	3350(W)×1530(D)×2650(H)	69% reduction in floor space
Mass(kg)	Approx. 1,400	Approx. 4,200	67% reduction in total mass
Start/Stop	Momentary	Preheat and cool time for filament	
Service life	Infinite	Life of vacuum tube (5,000-10,000Hrs.)	
Operation cost	Lower cost due to higher efficiency and less water	Higher cost due to lower efficiency and more water	

* Dimension of Transistor Inverter is included matching panel for comparision with Vacuum Tube Oscillator.
Dimension of Vacuum tube oscillator including High tension rectifier transformer.

KOREA NETUREN FINE HEAT TECHNOLOGY

Induction Heat Treatment Services

With induction power supplies for a wide range of frequency and specific jigs for hardening use, we provide induction hardening services tailored to nearly all types of machine parts.



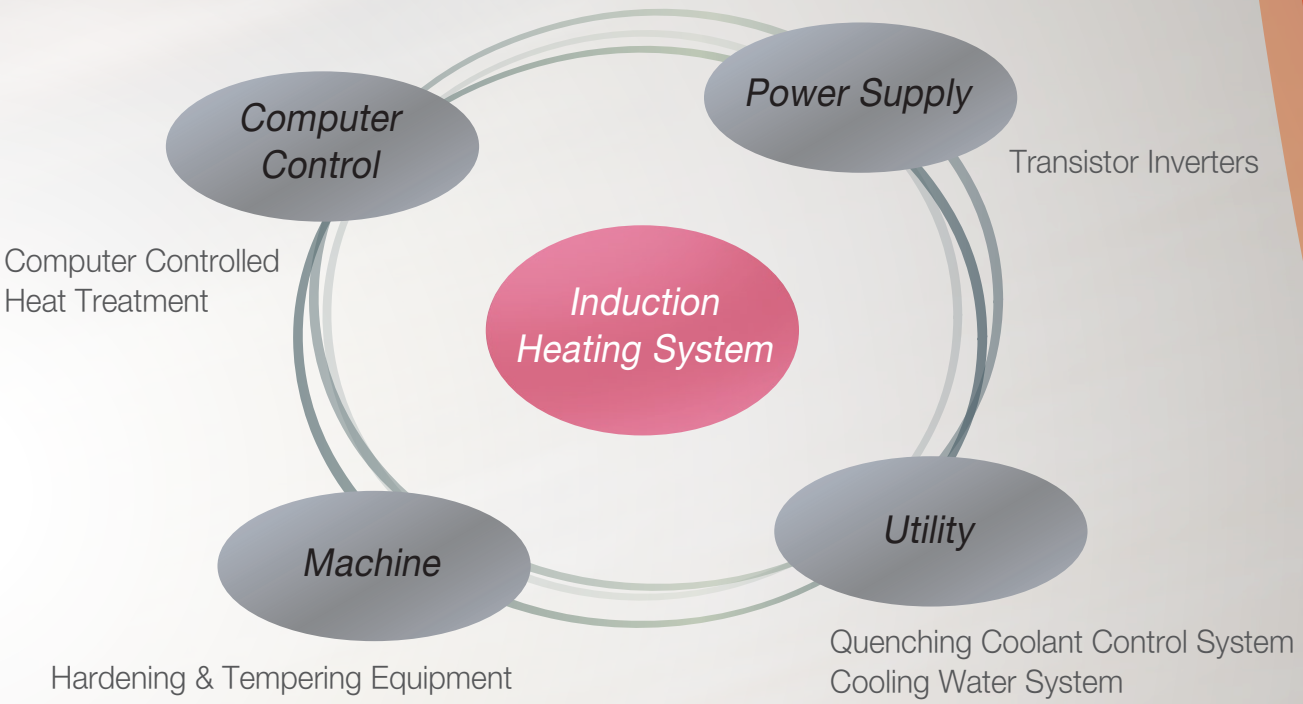
Automotive Parts
Construction Machine Parts
Machine Tool Parts
General Industrial Machine Parts

Inspection Instruments for Quality Check

Realizing that the only competitiveness to survive in the industrialized society comes from higher quality products, we make every effort to raise the quality of our customers' products.

Power Cutting Machine

Rockwell hardness testing machine



EXAMPLES

Polisher & Mounting press

Micro vickers testing machine