

Doosan Heavy Industries & Construction  
**CASTINGS & FORGINGS**



*Building your tomorrow today*



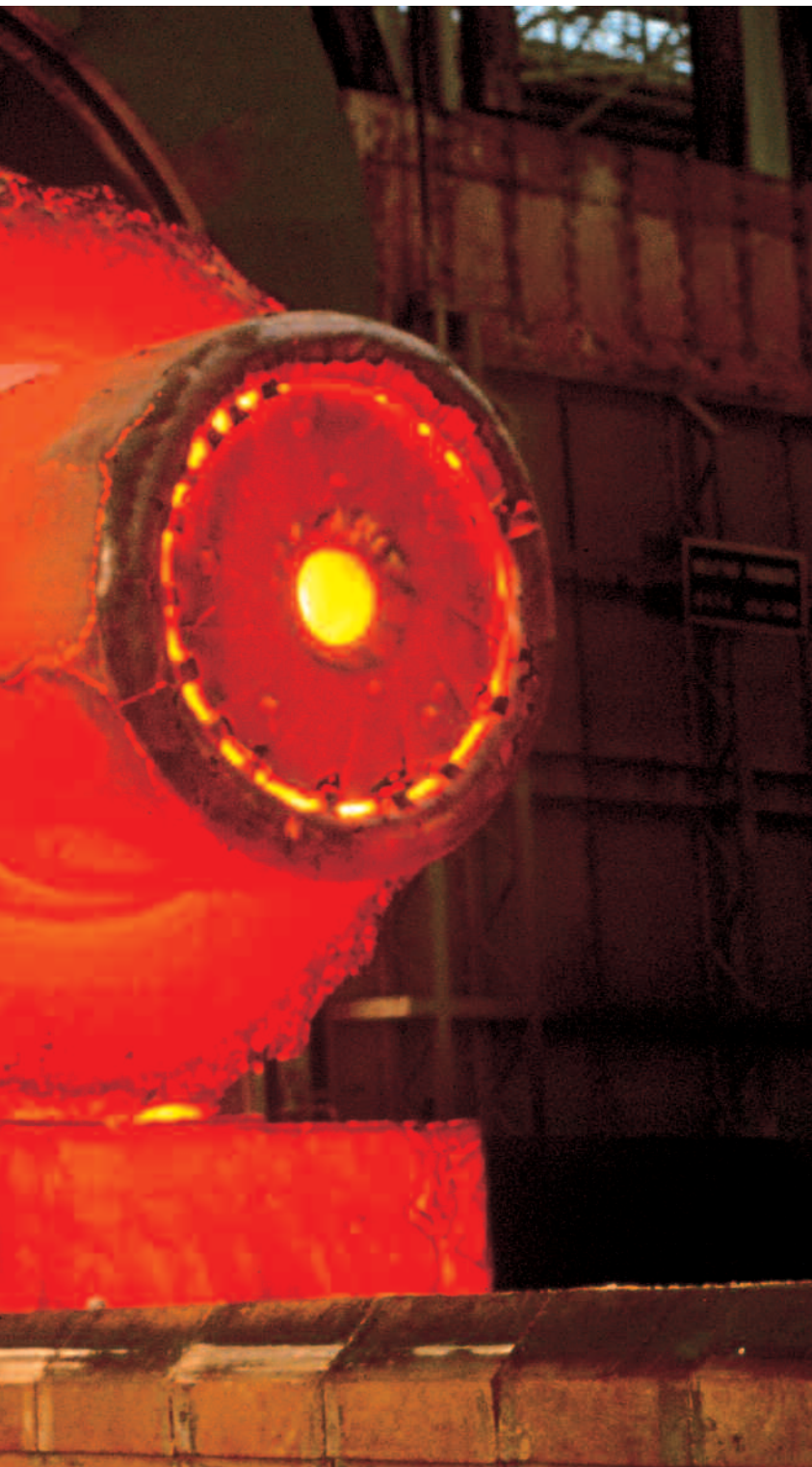
## GLOBAL LEADER IN POWER & WATER

Doosan consistently high quality and superb technology have resulted in a steady stream of requests from loyal overseas customers. Castings and forgings are the pride of Doosan. This business is supported by world-class production systems and a wealth of fabrication experience and know-how.



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# INTRODUCTION



Doosan came into existence in 1962 as a pioneer in the field of heavy industries in Korea. Since that time, it has manufactured and supplied various types of steel castings and forgings both for domestic and overseas customers.

Doosan Heavy Industries & Construction Co., Ltd. (Doosan), the largest and the most modern fully-integrated manufacturing company in the Republic of Korea, specializes in manufacturing the following main products:

- Power Plant Equipment
- Chemical and Petrochemical Plant Equipment
- Iron and Steel Making Machinery
- Marine Diesel Engines
- Heavy Castings and Forgings

Doosan came into existence in 1962 as a pioneer in the field of heavy industries in Korea. Since that time, it has manufactured and supplied various types of steel castings and forgings both for domestic and overseas customers.

Doosan has two large shops, a steel foundry and a forge shop, for castings and forgings at its Changwon Plant, both of which are equipped with the most up-to-date, fully automated and numerically controlled facilities and equipment.

The steel foundry equipped with a 100-ton electric arc furnace is capable of manufacturing heavy castings up to 350 tons, while heavy forgings up to 300 tons can be manufactured at the forge shop which is equipped with a 13,000-ton hydraulic forging press. With modern facilities and a strict quality assurance system together with the latest technical know-how and many years of experience, Doosan looks forward to supplying its customers with top quality castings and forgings.

## PRODUCT CATEGORY

### Maximum Product Size

Steel Casting ----- 350 tons  
Steel Forging ----- 280 tons

### Material

Carbon Steel  
Low-Alloy Steel  
Stainless Steel  
Heat-Resisting Steel  
Plastic Mold Steel  
Tool Steel  
Others

### Steel Grade

Commercial Steel  
E.S.R. Steel  
Vacuum Treated Steel





# STEEL FOUNDRY



Doosan's steel foundry consists of steel-making and casting shops. The steel-making shop equipped with electric arc furnaces and ladle furnaces has a simultaneous tapping capacity of 700 tons and annual production capability of 260,000 tons of molten steel. This line also has vacuum stream de-gassing equipment to produce heavy ingots for forging and vacuum oxygen de-carburizing equipment for stainless steel.

The casting shop has an annual production capability of 22,000 tons of various steel castings up to a unit weight of 350 tons. The layout of this shop was designed and fitted for the furan sand-molding process, one of the most advanced molding processes. It consists of closed-loop sand preparation, continuous sand mixing, sand reclamation equipment and other related facilities.

Description	Specification	Q'ty
Electric Arc Furnace	100 tons, 30 tons	2 units
Ladle Refining Furnace	155 tons	1 unit
Vacuum Oxygen De-carburization max. Furnace	130 tons	1 unit
Vacuum Stream De-gassing Equipment	500 kg (at 0.5 torr)	1 unit
Mobile Sand Mixer	25 tons/hr	2 units
Table-Type Shot Blast Machine	250 tons	1 unit
Heat-Treatment Furnace	max. 300 tons	5 units

# FORGE SHOP



The forge shop is symbolized by its mammoth 13,000-ton hydraulic forging press. This shop is equipped with a fully automated and computerized forging process, various kinds of heat-treatment and other related facilities. Of particular notes, the 13,000-ton hydraulic forging press is in the largest class in the world. The vertical heat-treatment furnace of which working capacity is up to 3 meters in diameter and 20 meters in length, is another facility. In addition to these, this shop also has the electro-slag remelting furnace which makes it possible for Doosan to manufacture homogeneous and defect-free steel ingots of the highest quality. With all of these modern facilities and equipment, Doosan can deliver various steel forgings in the shapes of shafts, ring forgings, forged plates, forged blocks and bars, and so on up to a unit weight of 300 tons. The annual production capability of this shop is 140,000 tons.

Description	Specification	Q'ty
Forging Press with Manipulator	13,000 tons	3 units
	4,200 tons	
	1,600 tons	
Heating Furnace	15~450 tons	16 units
Heat-Treatment Furnace	50~300 tons	21 units
Vertical Heat-Treatment Furnace	3m $\phi$ x20m depth	3 unit
	2m $\phi$ x20m depth	
	1.5m $\phi$ x16m depth	
Electro-Slag Remelting Furnace	1,650 $\phi$ x5,000 L	1 unit



# QUALITY ASSURANCE



Doosan's quality assurance program is based on a comprehensive and documented quality system encompassing careful inspection and tests of processes and products. The results of inspection and testing are fed back into the engineering and basic manufacturing process to improve the entire system.

This system is designed to provide quality products that will meet the needs of customers, and has been designed for nuclear and non-nuclear applications for electric utilities, marine, and other industrial applications.

As a result of this scientific quality program, Doosan has been honored and authorized to use ASME "N" and "NPT" stamps covering nuclear fabrication since 1981, and "A", "PP", "S", "U" and "U2" stamps for boiler piping and vessels since 1982. In addition, Doosan has also been authorized by ASME as a material manufacturer of forgings and castings of carbon, alloy and stainless steel (MO certificate). we also hold an ISO 9001 and the certificate issued by TUV.



## ► Research & Development

Our research center is outfitted with the most up-to-date instruments, equipment and facilities. Concentrated research is conducted day and night, probing into the quality of materials and manufacturing processes.



Doosan's quality assurance program is based on a comprehensive and documented quality system encompassing careful inspection and tests of processes and products. The results of inspection and testing are fed back into the engineering and basic manufacturing process to improve the entire system.



## ► Inspection & Testing

Doosan performs all available modern inspections and tests for parts both in-process and finished by qualified inspectors in accordance with documented and qualified procedures. Major inspections include:

- Chemical, Mechanical and Micro-graphic Checks
- Visual Inspections and Dimensional Checks
- Non-destructive Tests
- Leakage or Pressure Tests
- Heat Indication Tests
- Stress Measurements

Doosan has acquired the most modern and highest quality facilities and equipment for these inspections and tests.

- 8 Mev. X-Ray Equipment
- Magnetic Particle Tester
- Ultrasonic Tester
- Magnatic Flux Tester
- Gamma Ray Source Lr. 192
- Universal Testing M/C
- Impact Testing M/C
- Torsion Testing M/C
- Shore Hardness Tester
- Brinell Hardness Tester

- Rockwell Hardness Tester
- Multiple-Creep Test Unit
- Micro-Hardness Tester
- Direct-Reading Spectrometer
- Carbon-Sulfur Determinator
- Nitrogen-Oxygen Determinator
- Hydrogen Determinator
- Oxygen sensor
- Thermolab Dilatometer
- Universal Sand Strength Tester

- Permeability Tester
- Moisture Tester
- Sand Hardness Tester
- Kelvin Bridge
- Digital Resistance Thermometer
- AC Voltage/Current Calibration Set
- DC Voltage/Current Calibration Set
- Sound and Vibration Set
- X-Ray Stress Analyzer
- Universal Measuring Instrument

- Electronic Readout Gauge
- Digital Outside Micrometer
- Micro-Alignment Telescope
- Surface-Roughness Tester
- 3 Axis Universal Measuring M/C
- Roundness Measuring Instrument
- Calibration Test for Dial Gauge

# POWER PLANT EQUIPMENT

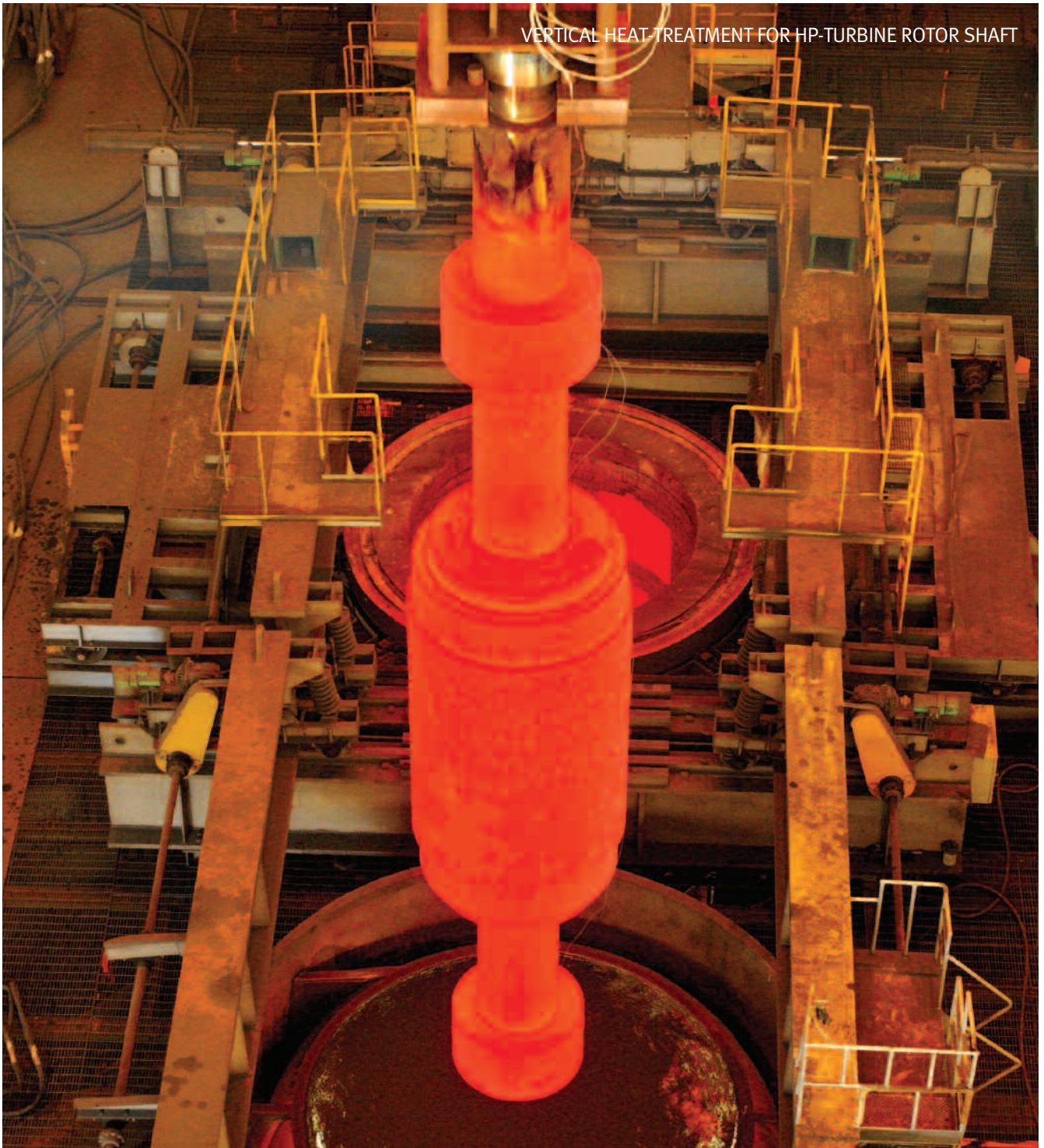


As power plant equipment increases in capacity and is placed under more severe operating conditions, steel castings and forgings for power generation applications are accordingly becoming larger in size and higher in quality.

But reliable sources that can supply high-quality heavy steel components for power generation facilities are very limited in the world despite recent increase in demand.

Doosan, the only manufacturer of power plant equipment in Korea, is one of the top-ranking suppliers in the world of state-of-the-art heavy steel components for power generation. Doosan can manufacture cast steel components such as hydro-turbine runners and steam-turbine castings up to a unit weight of 350 tons as well as forged steel components such as turbine generator shafts, nuclear reactor shells and tube sheets up to 300 tons. Various types of stamps and certificates issued by ASME and TUV represent the reliability of Doosan's steel components for power generation applications.





VERTICAL HEAT TREATMENT FOR HP-TURBINE ROTOR SHAFT

# POWER PLANT EQUIPMENT

## ▶ Main Products

- **Hydro-Turbine Generator**

Francis Runner, Pelton Runner, Kaplan Runner Hub, Turbine Shaft and Blade, Main Rotor Shaft, Pump Turbine Impeller, Scroll Casing, Draft and Discharge Tube, Stay Ring, Spherical Valve Body and Chock, Generator Shaft, Rotot Rim

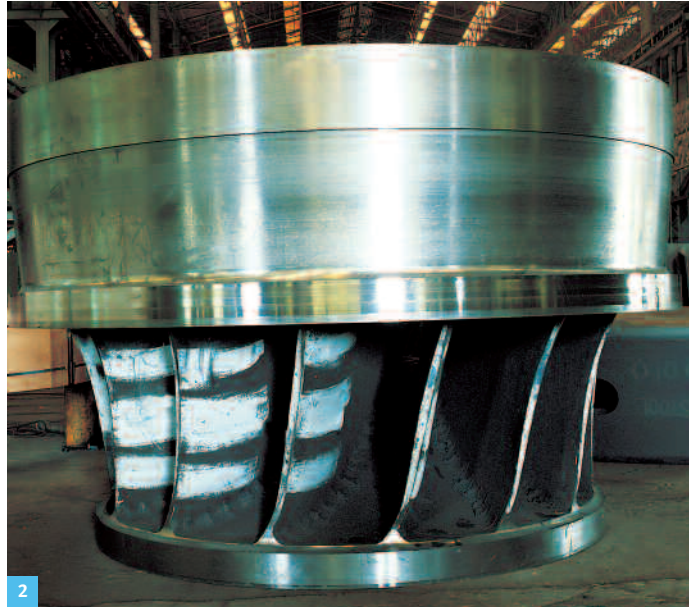
- **Steam-Turbine Generator**

Turbine Casing, Turbine Rotor Shaft, Generator Rotor Shaft, Rotor Disc, Steam Box, Water Box, Various Value Casting, Steam Distributor

- **Reactor Vessel and Steam Generator Shell, Head, Flange, Nozzle, Core Support**







1. Francis Runner
2. Francis Runner
3. Fixed Blade Runner
4. HP Outer Casing
5. Rotor Shaft for Turbine

# MARINE PARTS

Doosan is the largest maker of steel castings and forgings for shipbuilding in Korea. It is authorized by the famous LR, GL, DNV, ABS, BV, NK and KR as a manufacturer of steel castings and forgings for shipbuilding. Doosan manufactures and supplies many kinds of parts for diesel engines, stern structures for marine vessels and so on.

## ▶ Main Products

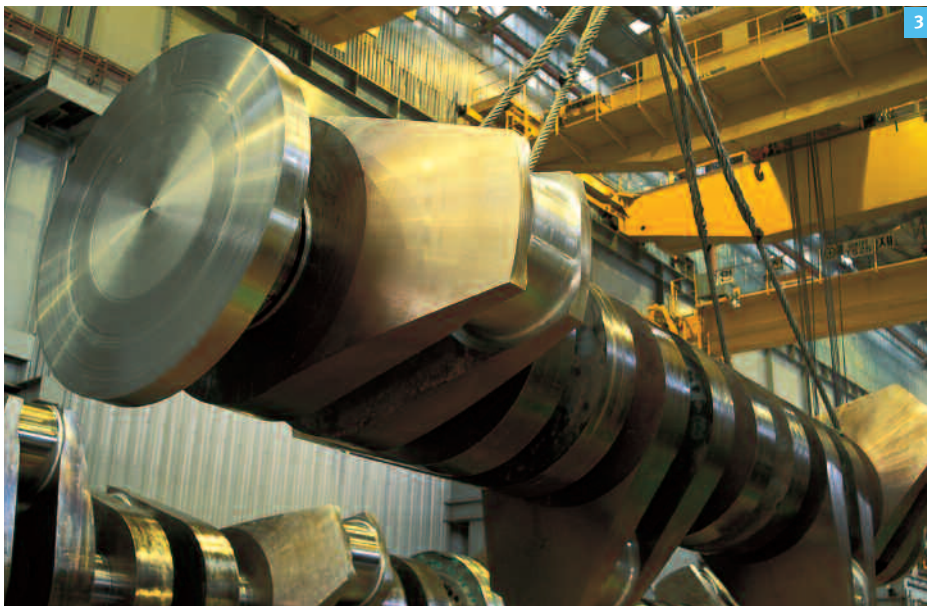
Rudder Horn, Propeller Boss, Stern Tube, Rudder Castings, Propeller and Intermediate Shafts, Connecting Rod, Piston Rod, Guide Rod, Gear and Pinion, Crankshaft



1



2



3



4

1. Rudder Horn
2. Propeller & Intermediate Shafts
3. Crankshaft for Marine Engine
4. Propeller Boss



# CEMENT & MINING PLANTS

Since its establishment in 1962, Doosan has been undertaking cement and mining projects on a turn-key basis throughout the world. One can easily confirm the reputation of Doosan from the Gizan Cement Plant in Saudi Arabia and the Perak Cement Plant in Malaysia. In addition, Doosan has been supplying heavy steel components for cement and mining equipment, both in domestic and foreign markets in large quantities. Of particular notes, Doosan has the record of supplying the largest kiln tires, supporting roller & shafts, and segment mill heads installed up to the present throughout the world. The kiln tires weigh up to 185 tons per unit, while the roller & shafts weigh up to 108 tons. The segment mill heads are up to 10 meter in diameter. This cannot be regarded, however, as a significant accomplishment compared with the production capabilities of Doosan.

## ► Main Products

- Kiln : Kiln Tire, Girth and Pinion Gear, Supporting Roller and Shafts
- Mill : Mill Head, Trunnion, Girth Gear and Pinion, Bearing Base, Cap and Bridge
- Gyratory Crusher : Spider, Shell, Main Shaft, Mantle and Core

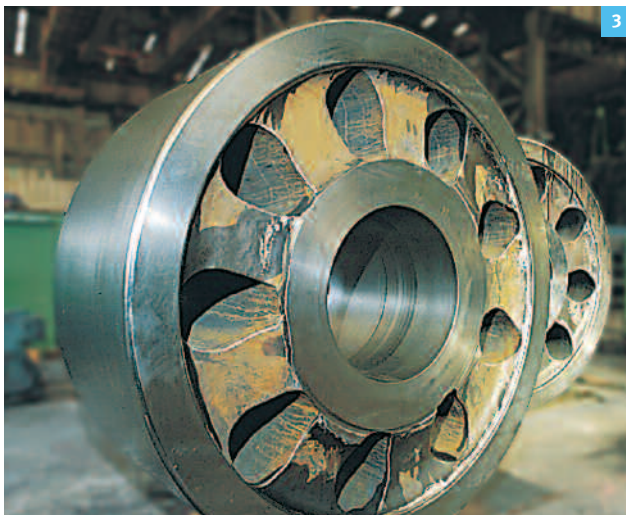


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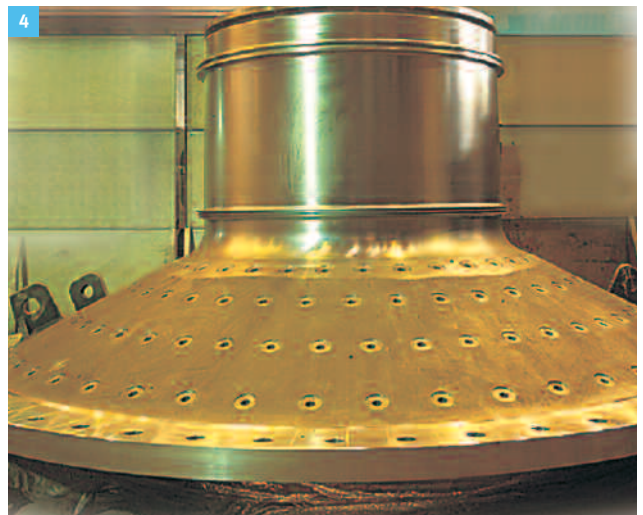


2

1. Assembly of Roller & Roller Shaft
2. TYRE
3. Supporting Roller
4. Mill Head



3



4

# IRON & STEEL MAKING MACHINERY

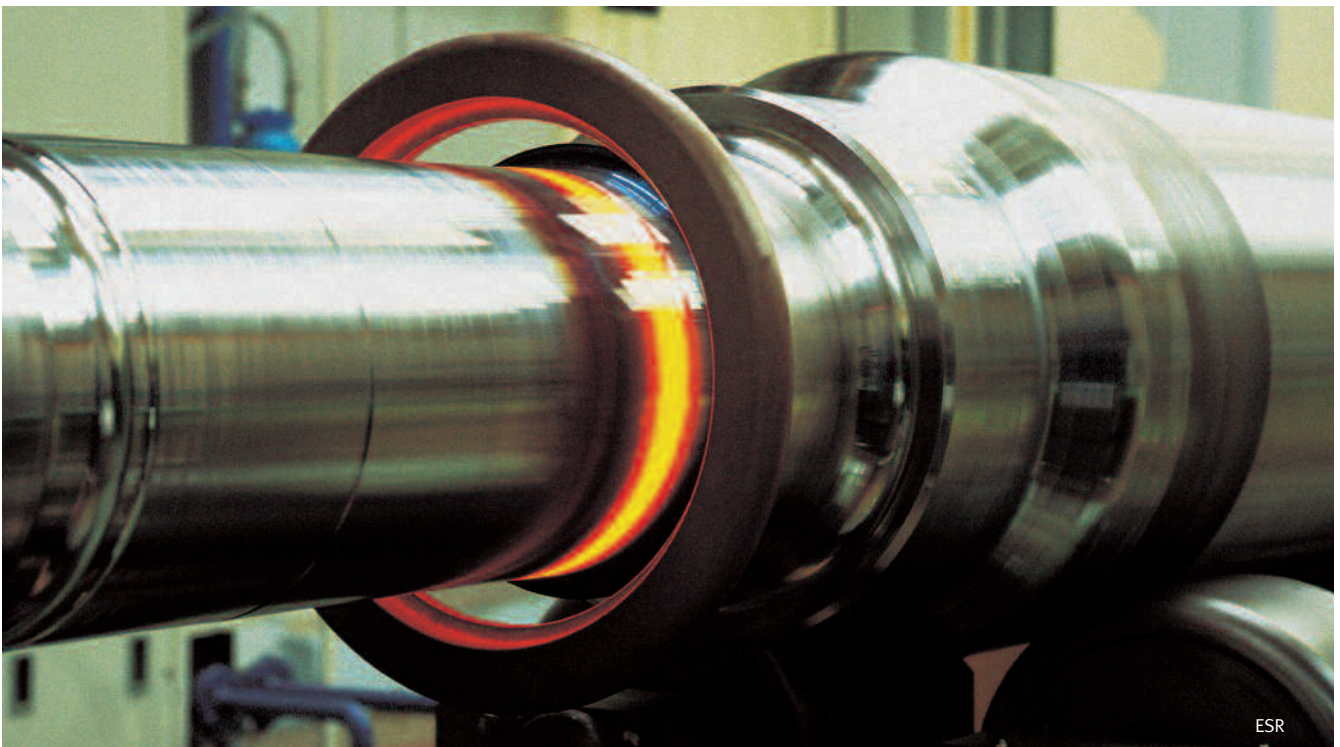
Doosan as an expert manufacturer of forged steel rolls has been supplying works roll for cold mills and back-up rolls which earn a good reputation around the world for the good quality and extremely long life. The most up-to-date technologies such as vacuum steel making, ESR(Electrode Slag Remelting) and low frequency induction hardening are utilized in the manufacture of the rolls in order to achieve the highest resistance to wear, thermal-cracking, spalling and breakage of the rolls. In addition, Doosan has been supplying heavy steel components for steel mills, presses, continuous casters and blast furnaces to iron and steel making plants.

## ► Main Products

Forged Plate Back up Roll, Back up Roll, Work Roll, Intermediate Roll, Mill Housing, Roll Chock, Cylinder Housing, Ram, Anvil, Table Roller and Slag Pot



FORGED WORK ROLL





# PLASTIC MOLD STEEL

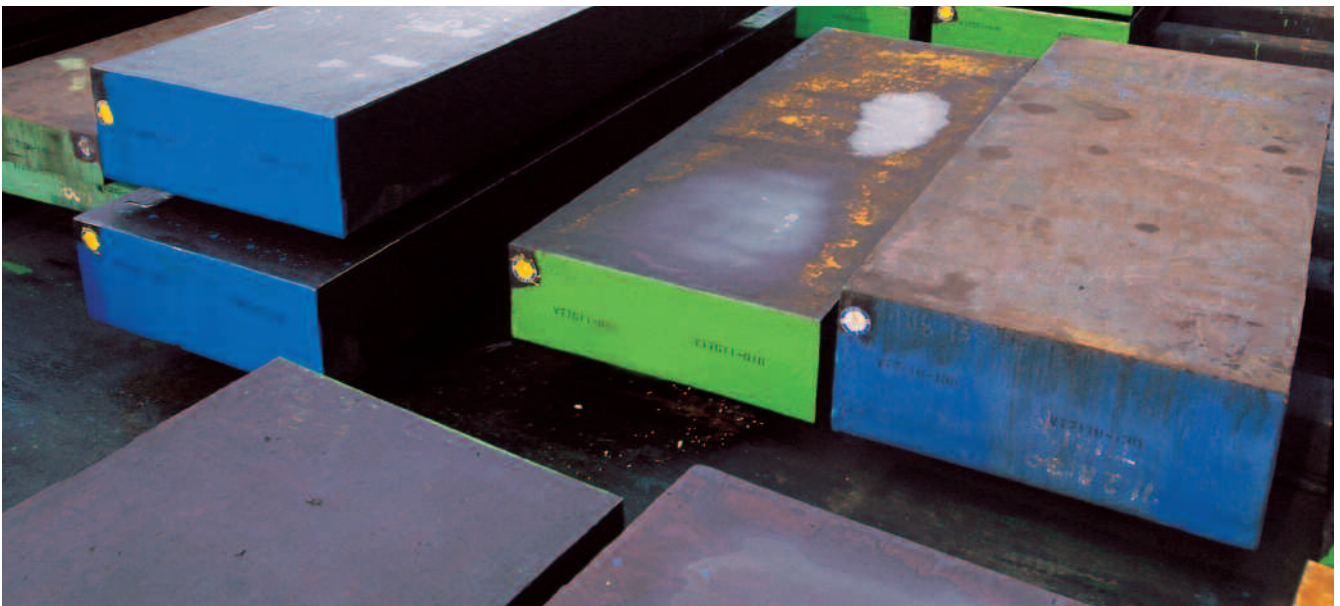
New types of high-quality free-cutting steel for plastic moldings “HP1A, HP4A(D1), HP4MA(D2), HP70 and HEMS1A” have been developed under a strict quality assurance system with Doosan’s modern facilities.

Compared with the conventional steel materials of other companies, the machining time for our new products can be reduced by maximum 40%. Because of special alloy elements in HP1A, HP4A(D1), HP4MA(D2), HP70 and HEMS1A, one can obtain better etching workability, polishing workability and weldability than in many other products.

As a result, not only is the efficiency of metal mold work improved and the service life of the cutting tools greatly extended, but one can also make excellent plastic products. HP70 and HEMS1A are high performance and high-precision plastic mold steel.

Use of our newly developed HP1A, HP4A(D1), HP4MA(D2), HP70 and HEMS1A can make a major contribution to the improvement of productivity and rationalization of production.

MECHANICAL PROPERTIES					
	YIELD STRENGTH kg/mm <sup>2</sup>	TENSILE STRENGTH kg/mm <sup>2</sup>	ELONGATION (%)	REDUCTION AREA (%)	HARDNESS (HS/HRC)
HP1A	35-45	70-80	>15	>35	HS 28-33
HP4A(D1)	65-80	80-90	>15	>40	HRC 28-32
HP4MA(D2)	75-90	90-110	>15	>40	HRC 31-34
HP70	100-115	120-135	>17	>52	HRC 37-41
HEMS1A	60-70	75-85	>25	>55	HRC 23-52



## DIE & TOOL STEEL

From early on, Doosan has been supplying forged tool materials, particularly hardened steel for dies. STF series steel is very tough and highly resistant to heavy shock loads. This steel is widely used for various kinds of forging dies, especially in drop-forging applications. STD series steel has excellent resistance to heat at high temperatures and is well suited for extrusion dies, drawing dies and die-casting dies.





# GLOBAL NETWORK

## Overseas Subsidiaries

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Fax +44-141-885-3338

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New Jersey 07645, USA  
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### DOOSAN POWER SYSTEMS EUROPE LTD.

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Essen, Germany  
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Fax +49-201-4517-328

### ŠKODA POWER LTD.

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Fax +420-378-185-900

### DOOSAN POWER SYSTEMS INDIA PVT., LTD.

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DLF Cyber City Phase II  
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Tel +91-124-439-8200  
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