

Doosan Heavy Industries & Construction
CASTINGS & FORGINGS



Building your tomorrow today

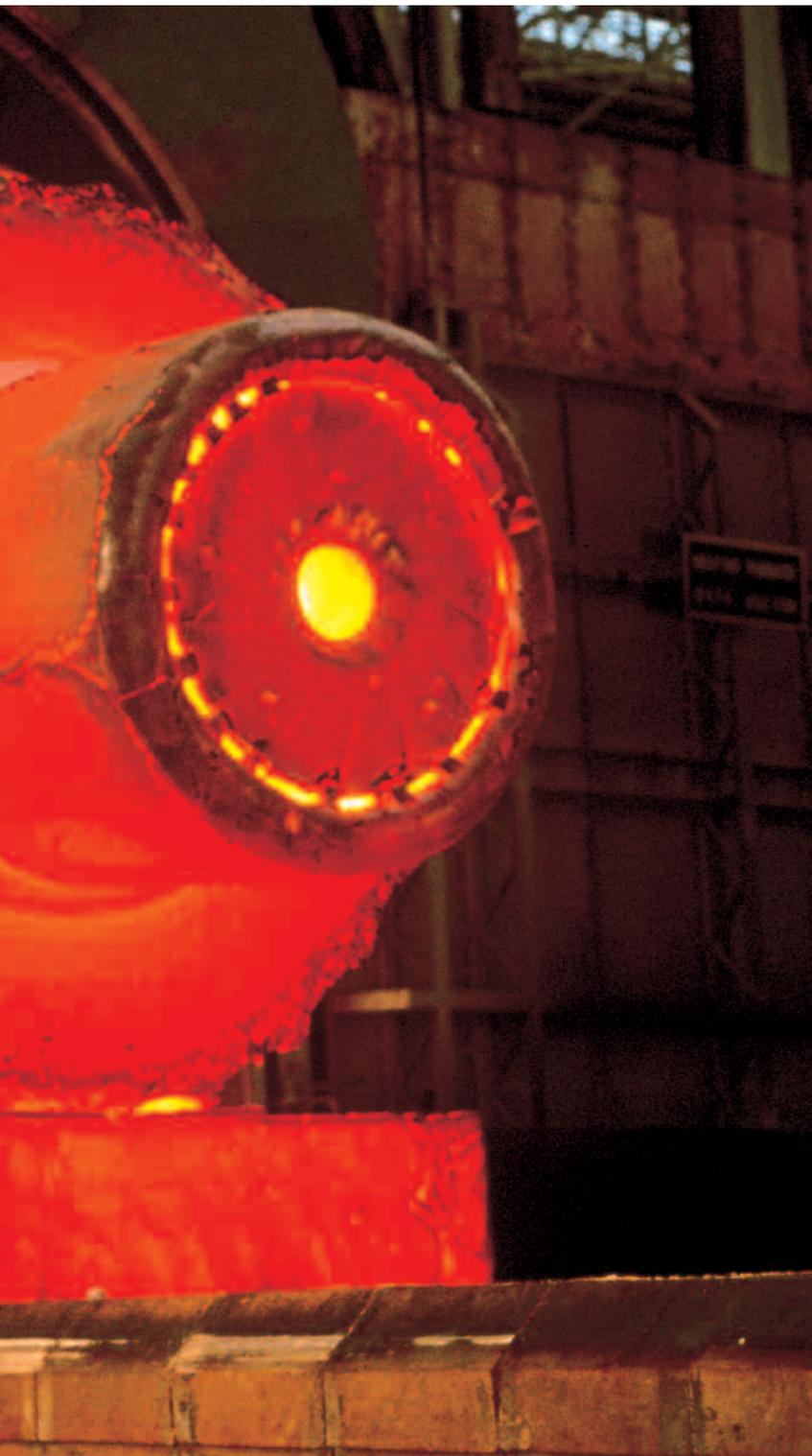
GLOBAL LEADER IN POWER & WATER

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.

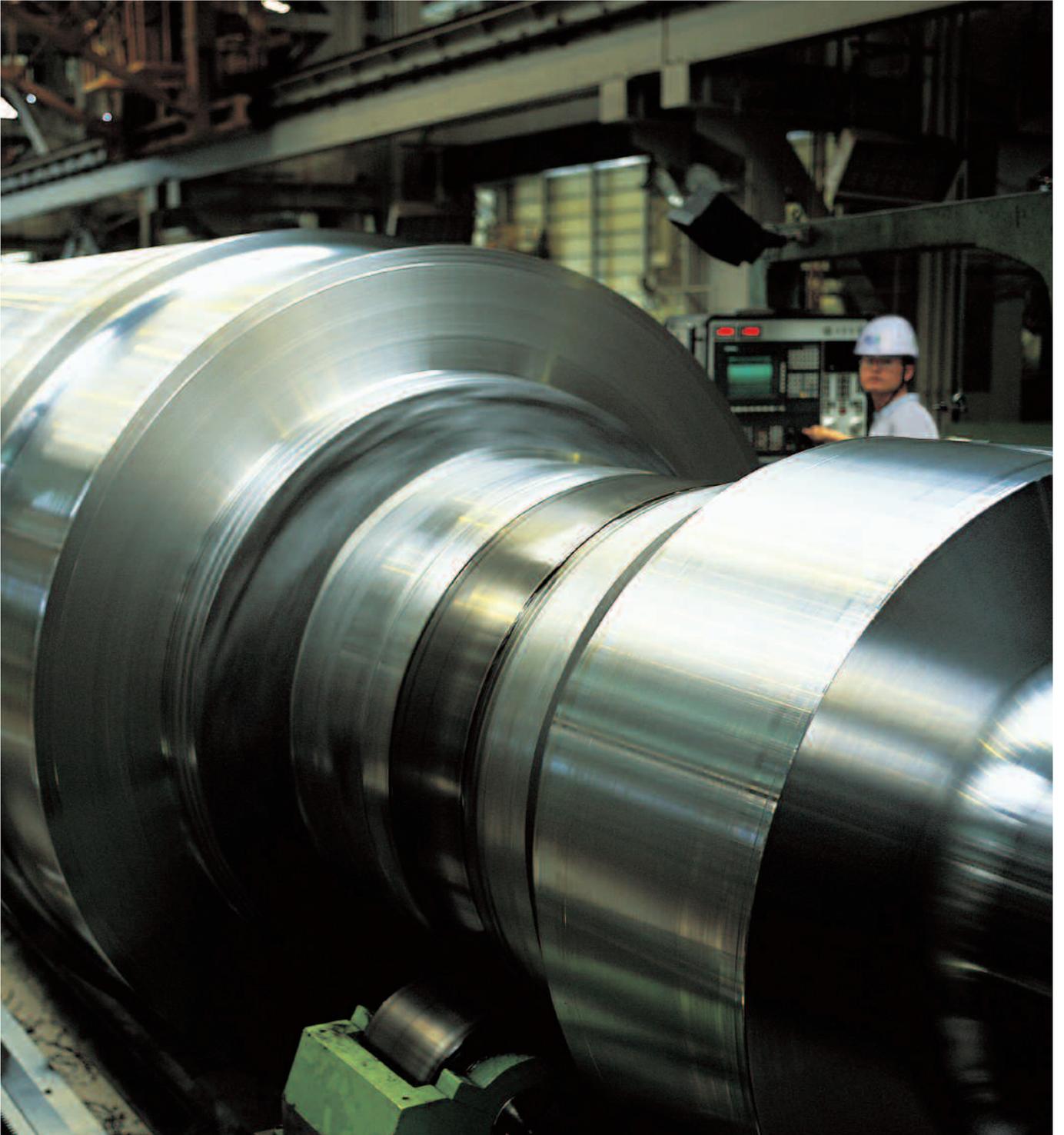


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INTRODUCTION



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 ϕ x20m depth	3 unit
	2m ϕ x20m depth	
	1.5m ϕ x16m depth	
Electro-Slag Remelting Furnace	1,650 ϕ 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.

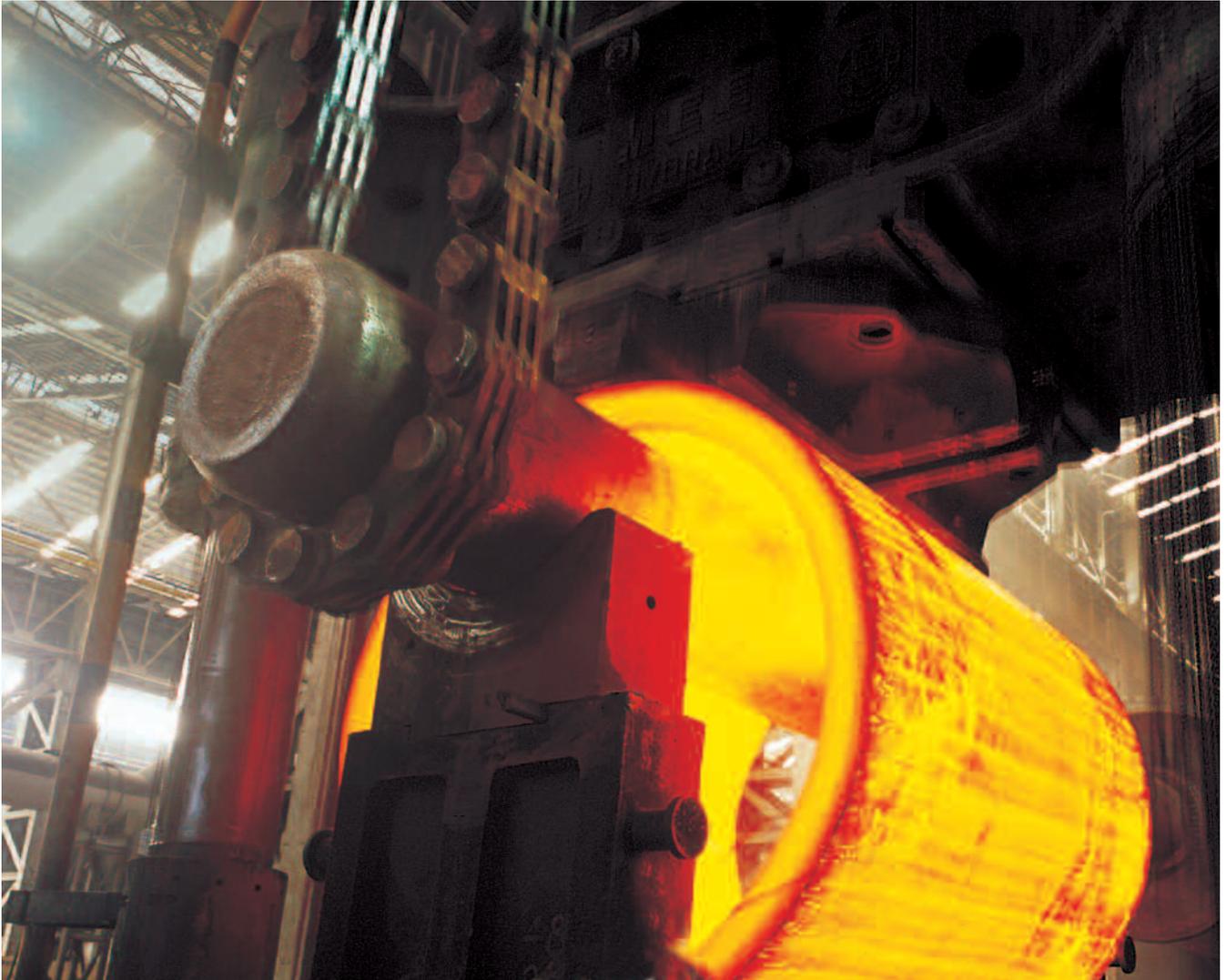
- 8 Mev. X-Ray Equipment
- Magnetic Particle Tester
- Ultrasonic Tester
- Magnatic Flux Tester
- Gamma Ray Source Lr. 192
- Universal Testing M/C
- Impact Testing M/C
- Torsion Testing M/C
- Shore Hardness Tester
- Brinell Hardness Tester

- 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

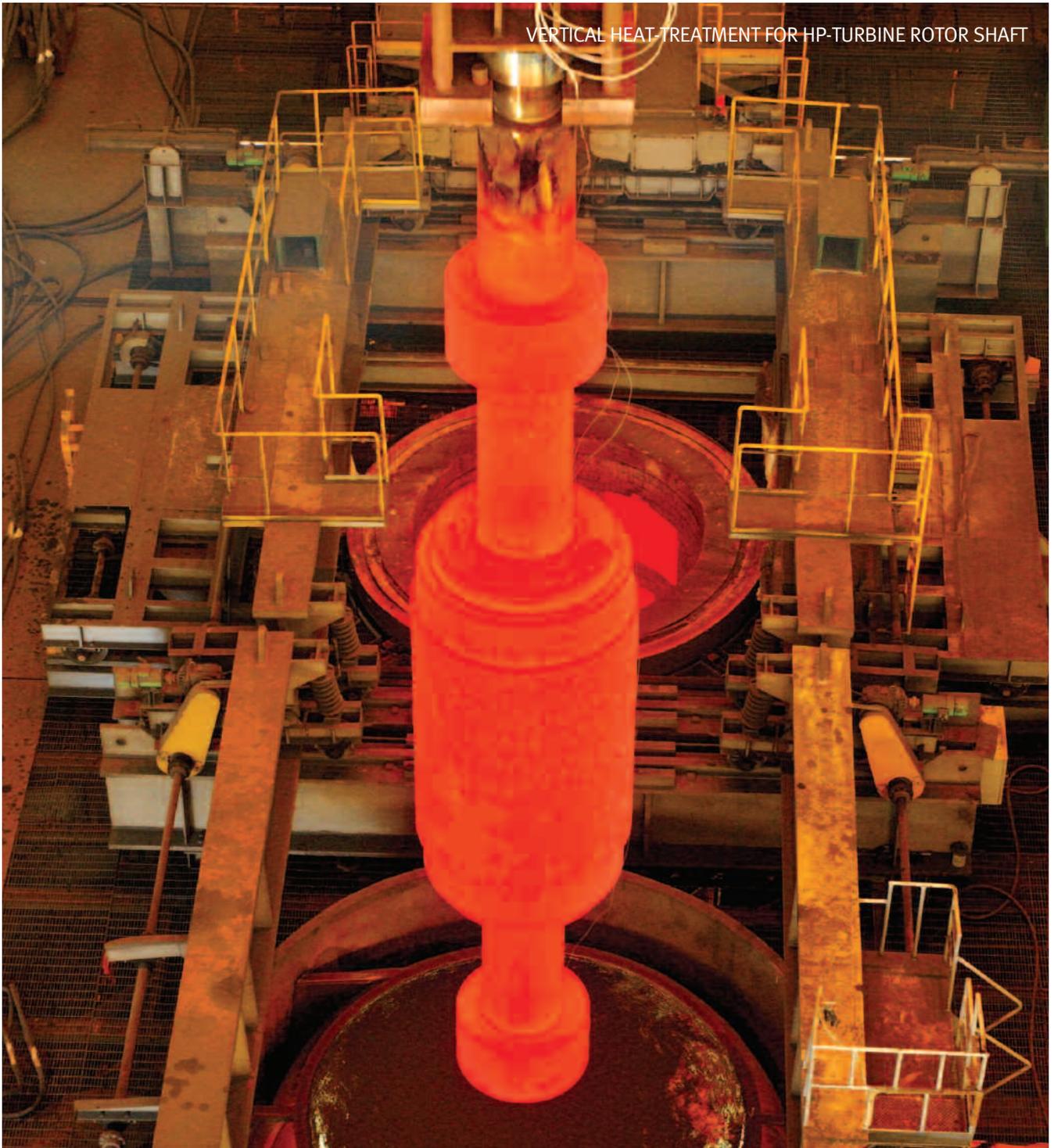
POWER PLANT EQUIPMENT



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

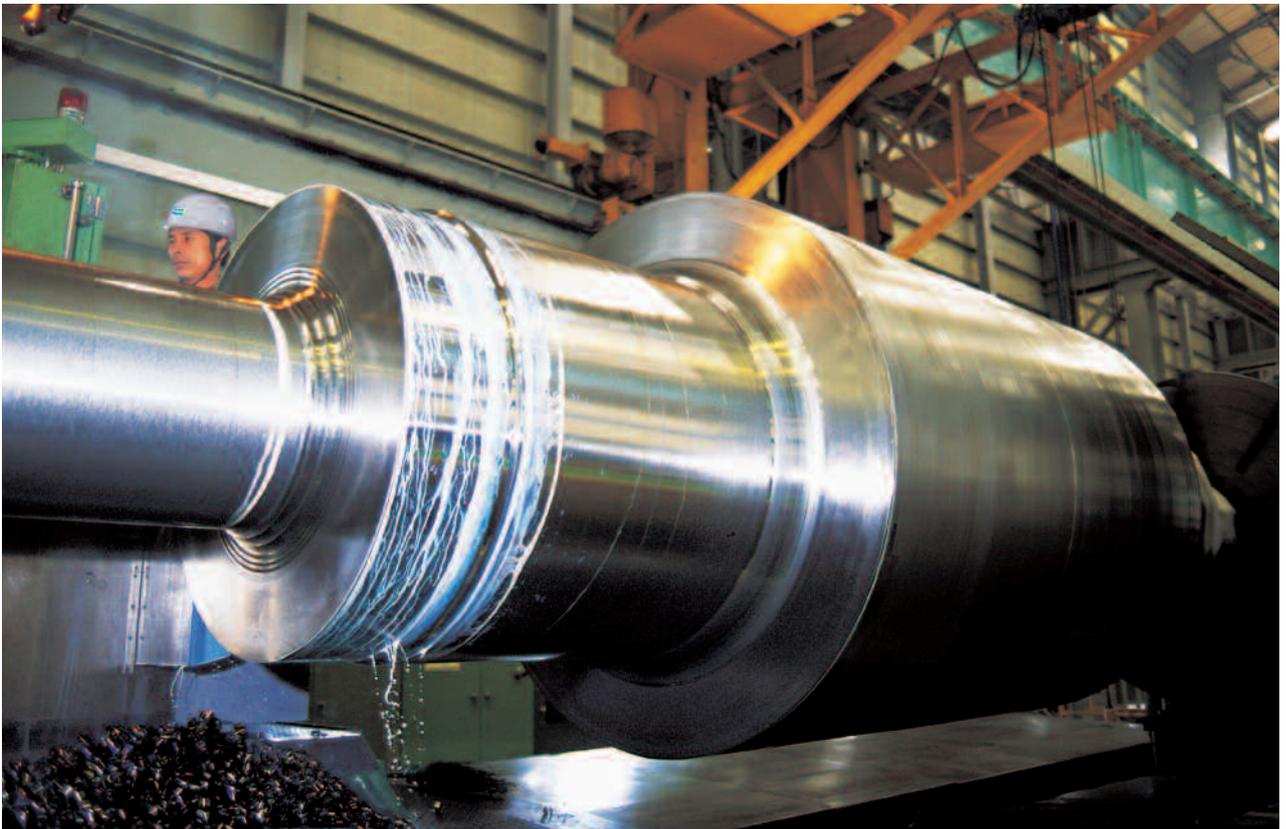
- **Hydro-Turbine Generator**

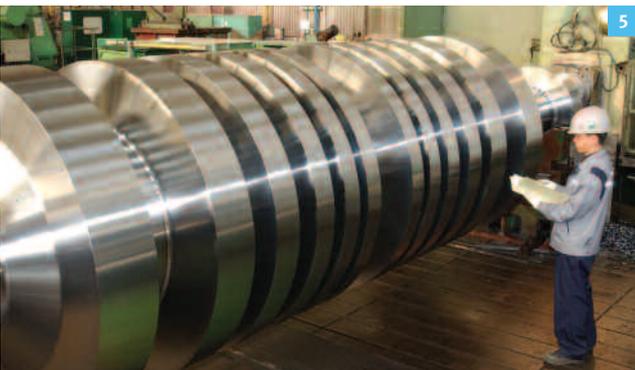
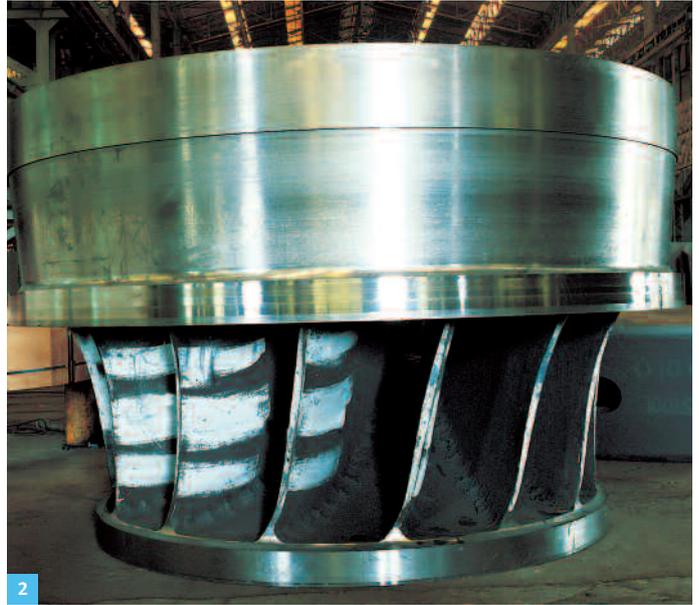
Francis Runner, Pelton Runner, Kaplan Runner Hub, Turbine Shaft and Blade, Main Rotor Shaft, Pump Turbine Impeller, Scroll Casing, Draft and Discharge Tube, Stay Ring, Spherical Valve Body and Chock, Generator Shaft, Rotot Rim

- **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



1



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

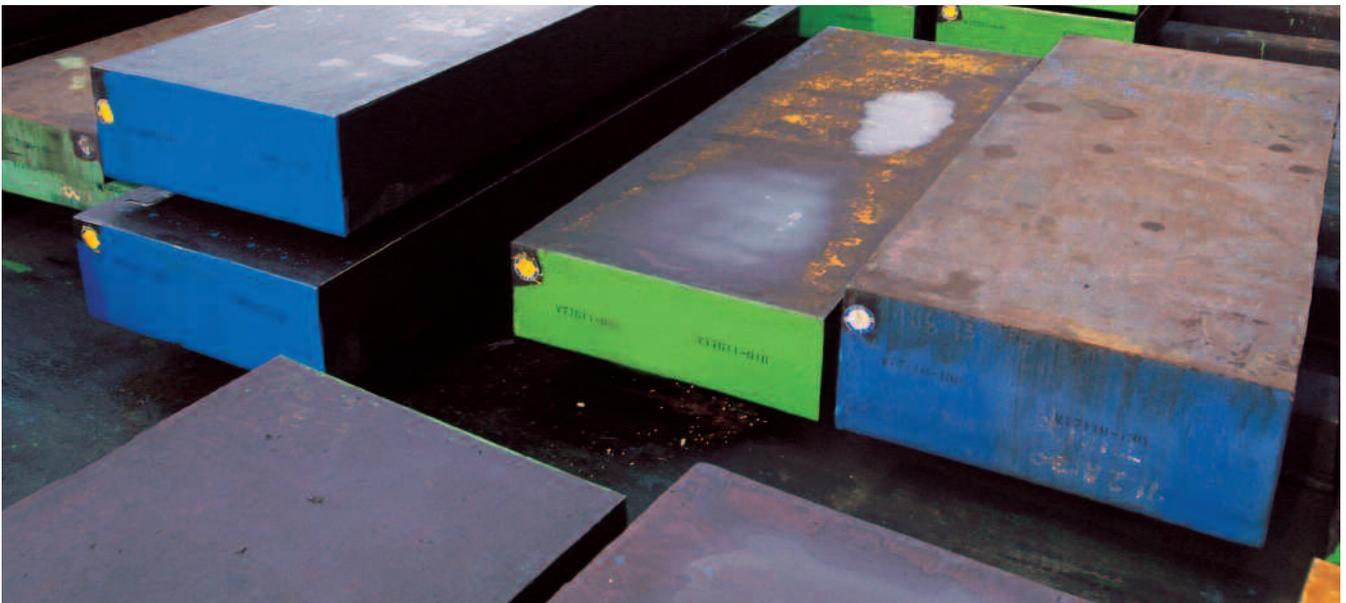
New types of high-quality free-cutting steel for plastic moldings “HP1A, HP4A(D1), HP4MA(D2), HP70 and HEMS1A” have been developed under a strict quality assurance system with Doosan’s modern facilities.

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 ²	TENSILE STRENGTH kg/mm ²	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

DOOSAN POWER SYSTEMS LTD.

11 The Boulevard, Crawley
West Sussex, RH10 1UX, UK
Tel +44-1293-61-2888
Fax +44-1293-58-4816

DOOSAN POWER SYSTEMS LTD. (BABCOCK)

Porterfield Road, Renfrew, PA4 8DJ, UK
Tel +44-141-886-4141
Fax +44-141-885-3338

DOOSAN POWER SYSTEMS AMERICAS LTD.

5 Paragon Drive Montvale,
New Jersey 07645, USA
Tel +1-201-746-8210
Fax +1-201-746-8610

DOOSAN POWER SYSTEMS EUROPE LTD.

Bredeneayer Strasse 2b, 45133
Essen, Germany
Tel +49-201-4517-320
Fax +49-201-4517-328

ŠKODA POWER LTD.

Tylova 1/57, 301 28 Plzen, Czech
Tel +420-378-185-128
Fax +420-378-185-900

DOOSAN POWER SYSTEMS INDIA PVT., LTD.

[New Delhi Office]
DLF Building No. 8A, 3rd Floor
DLF Cyber City Phase II
Gurgaon 122 002, Haryana, India
Tel +91-124-439-8200
Fax +91-124-414-7007

[Chennai Office]

Gee Gee Universal, 5th Floor No. 2
McNichols Road Chetpet,
Chennai 600 031, India
Tel +91-44-2836-6930
Fax +91-44-2836-6936

DOOSAN CHENNAI WORKS PVT., LTD.

18/2A Senneerkuppam Bypass Road,
Poonamallee, Chennai 600 056, India
Tel +91-44-2649-2050
Fax +91-44-2649-4012

DOOSAN HYDRO TECHNOLOGY INC.

912 Chad Lane, Tampa,
FL 33619 USA
Tel +1-813-805-8860
Fax +1-813-623-6092

DOOSAN HF CONTROLS CORP.

1624 West Crosby Road, Suite 124
Carrollton, TX 75006, USA
Tel +1-469-568-6526
Fax +1-469-568-6589

DOOSAN IMGB

104 Berceini Road, Bucharest 4,
Romania
Tel +40-21-301-3745
Fax +40-21-301-2502

DOOSAN ENGINEERING & SERVICES LLC

5 Paragon Drive Montvale,
NJ 07645, USA
Tel +1-201-746-8200
Fax +1-201-746-8210

DOOSAN HEAVY INDUSTRIES VIETNAM CO., LTD. (DOOSAN VINA)

Dung Quat Economic Zone,
Binh Thuan Commune
Binh Son District,
Quangngai Province, Vietnam
Tel +84-55-713-001
Fax +84-55-713-008

DOOSAN VINA HAIPHONG CO., LTD.

Km 92, National Highway 5,
So Dau Ward Hong Bang District,
Haiphong City, Vietnam
Tel +84-31-371-2710~11
Fax +84-31-371-2714

HANJUNG POWER LTD.

P.O.Box 2803, Borokom
NCD, Papua New Guinea
Tel +675-320-0529
Fax +675-321-2984

Overseas Branches

AMERICAS

DOOSAN HEAVY INDUSTRIES AMERICA CORP.

Parker Plaza, 10th Floor 400 Kelby Street,
Fort Lee, NJ 07024, USA
Tel +1-201-944-4554 31, 24
Fax +1-201-944-5022

PITTSBURGH OFFICE

C/O Westinghouse Electric Company
Suite 115C, 600 Cranberry Woods Drive,
Cranberry Township, PA
16066, USA
Tel +1-412-374-6071
Fax +1-724-720-0903

SANTIAGO OFFICE

Nueva Tajamar 481, Oficina 1103,
Las Condes, Santiago, Chile
Tel +56-2-657-3333
Fax +56-2-657-3343

SCHENECTADY OFFICE

General Electric Building 33,
Room 202A, One River Road
Schenectady, NY 12345, USA
Tel +1-518-385-5218
Fax +1-518-385-4984

TAMPA OFFICE

912 Chad Lane, Tampa, FL
33619, USA
Tel +1-813-805-8800
Fax +1-813-623-6666

WINDSOR OFFICE

20 International Drive, Windsor,
CT 06095, USA
Tel +1-860-731-6479
Fax +1-860-731-6482

SÃO PAULO OFFICE

(DOOSAN POWER SYSTEMS)
Alameda Santos 787, 7th floor,
Sao Paulo, 01419-001, Brazil
Tel +55-11-2348-0100

ATLANTA OFFICE

(DOOSAN POWER SYSTEMS)
1050 Crown Pointe Parkway Suite
1200, Atlanta GA 303385, USA
Tel +1-770-551-5750
Fax +1-770-551-5753

ASIA

DOOSAN HEAVY INDUSTRIES JAPAN CORP.

Mita Kokusai Building, Room
2410 1-4-28, Mita, Minato-gu Tokyo
108-0073, Japan
Tel +81-3-3452-5451~3
Fax +81-3-3452-5624

BANGKOK OFFICE

10th Floor, M-Thai Tower, All Seasons
Place, 87 Wireless Road Phatumwan,
Bangkok 10330, Thailand
Tel +66-2-654-0690
Fax +66-2-654-0693

BEIJING OFFICE

Gateway Plaza, Tower B, 19th Floor
No. 18 Xiaguangli, North Road,
East Third Ring Chaoyang District,
Beijing 100027, China
Tel +86-10-8454-7131~33, 7122
Fax +86-10-8484-7139

HANOI OFFICE

#1101, Daeha Business Center,
360 Kim Ma, Ba Dinh District
Hanoi, Vietnam
Tel +84-4-6273-0545
Fax +84-4-6273-0550

JAKARTA OFFICE

Plaza Bapindo, Mandiri Tower 20F,
Jl Jend Sudirman No 54-55,
Jakarta, Indonesia
Tel +62-21-2995-0105
Fax +62-21-2995-0108

MUMBAI OFFICE

501, CNB Square, Sangam Complex,
Andheri Kurla Road, Andheri(E),
Mumbai 400059, India
Tel +91-22-6177-0500

NEW DELHI OFFICE

515, Fifth Floor, Time Tower, MG Road
Gurgaon, 122002, Haryana
New Delhi, India
Tel +91-11-4665-3300
Fax +91-11-4665-3333

HYDERABAD OFFICE

119, 1F, White House, Block-3,
6-3-1192/1/1, Kundan Bagh, Begumpet,
Hyderabad 500 016, India
Tel +91-40-6613-2444
Fax +91-40-6613-4227

SHANGHAI OFFICE

Rm 809, Building A, Far East
International Plaza No. 319,
Xian Xia Road, Chang Ning District
Shanghai 200051, China
Tel +86-21-5877-8696
Fax +86-21-5877-5938

TAIPEI OFFICE

7 Fl 4, No.51, Keelung Road
Section 2, Taipei, Taiwan, R.O.C.
Tel +886-2-2739-2255
Fax +886-2-2739-2266

EUROPE

FRANKFURT OFFICE

Arabella Center, 9th Floor,
Lyoner Strasse 44-48
Frankfurt am Main 60528, Germany
Tel +49-69-69-5004-11
Fax +49-69-69-5004-10

MIDDLE EAST & AFRICA

ABU DHABI OFFICE

Al Ghaith Tower, 5th, Room 508, Hamdan
Street P.O. Box 27767, Abu Dhabi, UAE
Tel +971-2-627-6273
Fax +971-2-627-6274

MIDDLE EAST OPERATIONS CENTER

Monarch Office Tower, Level 30, Sheikh
Zayed Road, P.O.Box 11859, Dubai, UAE
Tel +971-4-327-5545
Fax +971-4-327-5592

DUBAI OFFICE

30th Floor, Monarch Office Tower,
One Sheikh Zayed Road,
P.O. Box 11859, Dubai, UAE
Tel +971-4-327-5545
Fax +971-4-327-5529

DOOSAN WATER DUBAI R&D CENTER

Monarch Office Tower, Level 29,
Sheikh Zayed Road, P.O.Box 11859,
Dubai, UAE
Tel +971-4-327-5545
Fax +971-4-327-5596

RIYADH OFFICE

Office No. 205 & 206, The Plaza
Building (Akariya No.4), Olaya Street,
P.O.Box 9656, Riyadh 11423,
Kingdom of Saudi Arabia
Tel +966-1-419-1696
Fax +966-1-419-1995

DOHA OFFICE

Abdulla Al Kuwari Building, Al Muntaza
Area, C Ring Road, Doha, Qatar
Tel +974-4443-5201
Fax +974-4443-5218

CAIRO OFFICE

2nd floor, Land Mark Building 1,
Southern 90th Road (just after NATA
Building, City Center, the first section)
Cairo, Egypt
Tel +20-2-2613-1038



Doosan Heavy Industries & Construction

SEOUL OFFICE

465 Gangnam-daero, Seocho-Gu, Seoul
137-920 Korea
Tel. 82-2-513-6114 Fax. 82-2-513-6200

www.doosanheavy.com

HEAD OFFICE AND CHANGWON PLANT

22 DoosanVolvo-ro, Seongsan-Gu
Changwon, Gyeongnam 642-792 Korea
Tel. 82-55-278-6114, 7114 Fax. 82-55-264-5551,5552