



Doosan Machine Tools

# **Doosan** **Medical Device** **Solution** **Reference**

ver. EN 210510 SU

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# Doosan Application Business

Doosan Machine Tools supports the development of the medical device industry.

## Overview of the Medical Device Industry

### Implants

- Bone screws
- Bone plates
- Artificial joints

### Medical instruments

- Surgical instruments

### Medical equipment

- Dental instrument
- Treatment and diagnostic devices
- Pharmaceutical machinery

**Overview of the Medical Device Industry**

Doosan Machine Tools is a key player in the global machining markets, and has built up close relationships with diverse medical customers.

**A rapid increase in the aging population worldwide**  
The global population of over 65s is projected to increase from 600 million in 2015 to 1.6 billion by 2050.\*

2015년      2030      2040      2050

\* U.S. Census Bureau: "An Aging World"

# Doosan Application Business

Doosan Machine Tools has built an optimum competitive system to respond to the wide-ranging demands of the medical industry.

Overview of the Medical Device Industry

## Implants

Bone screws  
Bone plates  
Artificial joints

## Medical instruments

Surgical instruments

## Medical equipment

Dental instrument  
Treatment and diagnostic devices  
Pharmaceutical machinery

### Providing solutions optimized for a variety of complex shapes and conditions

Based on our extensive line-up of machines and our know-how in the field of application engineering, we provide solutions optimized for customer needs.



**450** models + solutions

### Building close relationships

We have created a rapid response system and built close relationships with our customers.



**162** sales networks in **63** countries  
(51 global technical centers)

### An outstanding understanding of materials

Our many researchers at the R&D Center offer outstanding technologies based on their deep understanding of medical device materials.



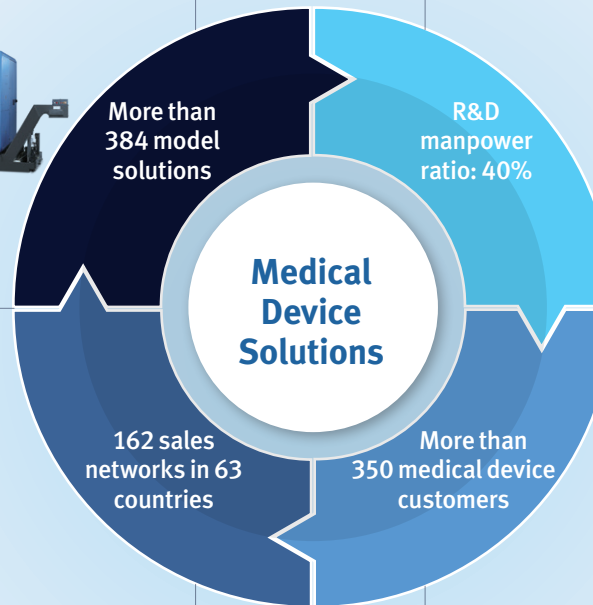
R&D manpower ratio: **40%**

### Doosan is the first choice for diverse customers of medical devices

A variety of medical device customers are increasingly choosing Doosan Machine Tools to generate higher revenues.



**350+** More than  
350 medical device customers





# Doosan Application Business

Doosan Machine Tools supports a wide range of medical devices.

Overview of the Medical Device Industry

**Implants**





- Bone screws
- Bone plates
- Artificial joints

**Medical instruments**

- Surgical instruments

**Medical equipment**

- Dental instrument
- Treatment and diagnostic devices
- Pharmaceutical machinery

Medical implants			Diverse medical devices	Diverse medical equipment parts
Bone screws	Bone plates	Artificial joints		
<p><b>Dental Screws</b></p>  <p><b>Pedicle Screws</b></p>  <p><b>Orthopedic Screws</b></p>  <p><b>PUMA 2100Y II</b></p> 	<p>Diverse shapes and sizes according to human body parts</p>   <p><b>DNM 200/5AX</b></p> 	<p><b>Hip / Shoulder joint</b></p>  <p><b>Knee joint</b></p>  <p><b>PUMA SMX2600ST</b></p> 	<p><b>Forceps</b></p>  <p><b>Mallets and drills</b></p>  <p><b>PUMA ST20GS</b></p> 	<p><b>Dental instrument</b></p>  <p><b>Medical imaging equipment</b></p>  <p><b>Rehabilitation aids</b></p>  <p><b>DNM 5700</b></p> 

# Doosan Application Business

## Overview of the Medical Device Industry

### Implants

- Bone screws
- Bone plates
- Artificial joints

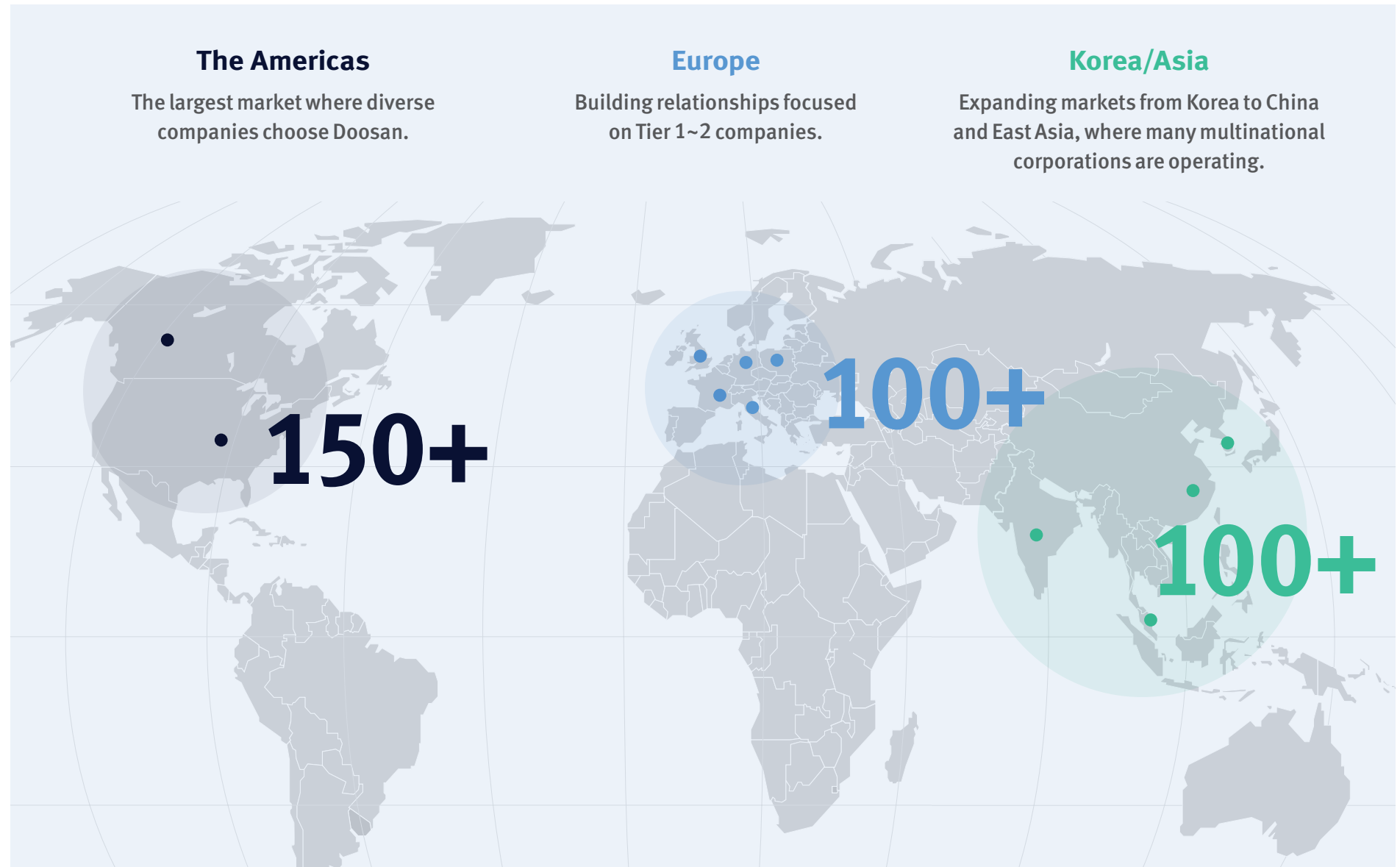
### Medical instruments

- Surgical instruments

### Medical equipment

- Dental instrument
- Treatment and diagnostic devices
- Pharmaceutical machinery

Doosan Machine Tools is increasingly becoming the choice of many global medical device companies.



\* The nature of our marketing activities and the market characteristics mean that multiple customers have to be excluded from the total customer count.



# *Medical Device Solution*



## *IMPLANTS*

*Bone screws*

*Bone plates*

*Artificial joints*

## *MEDICAL INSTRUMENTS*

*Surgical instruments*

## *MEDICAL EQUIPMENT*

*Dental instrument*

*Treatment and diagnostic devices*

*Pharmaceutical machinery*



# Our major customers in the medical implants category

Overview of the Medical Device Industry

## Implants

- Bone screws
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### F company in USA

A total service provider and technological leader in new products and treatment methods



### C company in USA

A company specializing in orthopedic implants that designs, manufactures and sells artificial joints such as knees, hips and shoulders as well as dental prosthesis products



### A company in Korea

Korea's best dental implant maker and owner of some 1,400 products



### B company in Korea

A company specializing in spinal medical devices that is striving to enter the global market with the focus on the US market



Americas



Europe



Korea/Asia

### D company in USA

A leading outsourcing company specializing in orthopedic healthcare infrastructure, from design to manufacturing to service



### E company in UK

An orthopedic specialist company that provides artificial joint solutions to hospitals, doctors and patients



# Bone screws

Overview of the Medical Device Industry

## Implants

Bone screws  
Bone plates  
Artificial joints

Medical instruments  
Surgical instruments

Medical equipment  
Dental instrument  
Treatment and diagnostic devices  
Pharmaceutical machinery

## Workpiece

### Dental implant screws



- Major material : Titanium
- Workpiece size :  
 $\Phi 3 \text{ mm} (\sim \Phi 6 \text{ mm}) \times 7.5 \text{ mm} (\sim 15 \text{ mm})$   
 $(\Phi 0.1 \text{ inch} (\sim \Phi 0.2 \text{ inch}) \times 0.3 \text{ inch} (\sim 0.6 \text{ inch}))$

### Characteristics of machining

Flexible response to demand for diverse products

Shortening of machining time

High rigidity / high precision

## Solution

### Lynx 2100LB

High productivity turning center with compact structure



Outstanding machining capability

High productivity

Easy maintenance

### Compact installation area

Scalability of automation system configuration



### Outstanding machining performance

The Lynx 2100LB is equipped with a 15kW high power motor, machine structure and spindles, and a rigidity-enhanced feed axis, giving it outstanding machining capability. It has a maximum machining diameter of  $\Phi 350\text{mm}$  and a maximum machining length of 550mm.

### High reliability

Compared to the existing performance model, the Lynx 2100LB is equipped with a wide support structure, a stable bed structure, and a low-vibration/low-noise structured spindle that ensure a high degree of reliability. It also features a servo turret and a full cover designed to prevent leaks and chip seizure, offering enhanced performance and durability.

Standard chuck size	Models	Travel mm (inch)		Rapid feedrate m/min (ipm)		Functions		
		X-axis	Z-axis	X-axis	Z-axis	2-axis	M	MS
6 inch	Lynx 2100A / MA	205 (8.1)	340 (13.4)	30 (1.2)	36 (1.4)	○	○	-
	Lynx 2100LA / LMA / LMSA		560 (22.0)			○	○	○
8 inch	Lynx 2100B / MB	205 (8.1)	340 (13.4)	30 (1.2)	36 (1.4)	○	○	-
	Lynx 2100LB / LMB / LMSB		560 (22.0)			○	○	○
10 inch	Lynx 2100LC	205 (8.1)	560 (22.0)	30 (1.2)	36 (1.4)	○	○	○



# Bone screws

Overview of the Medical Device Industry

## Implants

Bone screws  
Bone plates  
Artificial joints

## Medical instruments

Surgical instruments

## Medical equipment

Dental instrument  
Treatment and diagnostic devices  
Pharmaceutical machinery

## Workpiece

### Pedicle screw parts



- Major material: : Titanium
- Workpiece size :  $\Phi 7 \times 45 \text{ mm}$   
( $\Phi 0.3 \times 1.8 \text{ inch}$ )

### Characteristics of machining

Multi-axis / compound machining

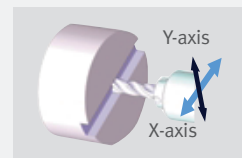
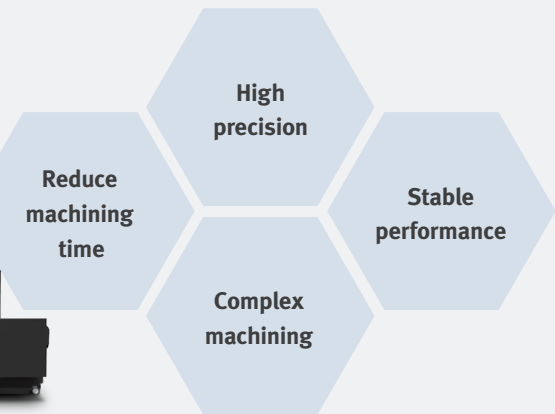
Improved cycle time

High rigidity / high precision

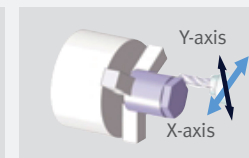
## Solution

### PUMA 2100Y II

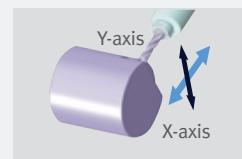
High Performance Horizontal Turning Center



Groove finish cutting using the Y-axis



Multi-face cutting



Milling in an eccentric position



X & Y axes circular interpolation

### Stable high rigidity structure ensures precision machining

- All axes are fitted with Box guideways.
- Rigidity-reinforced spindle and support bearings ensure the precision of heavy cutting.

### High performance Y-axis complex machining

- Vertical and horizontal free operation of rotary milling tools enabled via the Y-axis.

# Bone plates

Overview of the Medical Device Industry

## Implants

Bone screws  
Bone plates  
Artificial joints

Medical instruments  
Surgical instruments

Medical equipment  
Dental instrument  
Treatment and diagnostic devices  
Pharmaceutical machinery

## Workpiece

### Small bone plates



- Major material : Titanium
- Workpiece size : 100 x 20 x 3 mm  
(3.9 x 0.8 x 0.1 inch)

### Characteristics of machining

5-axis machining for cutting curved surface shapes

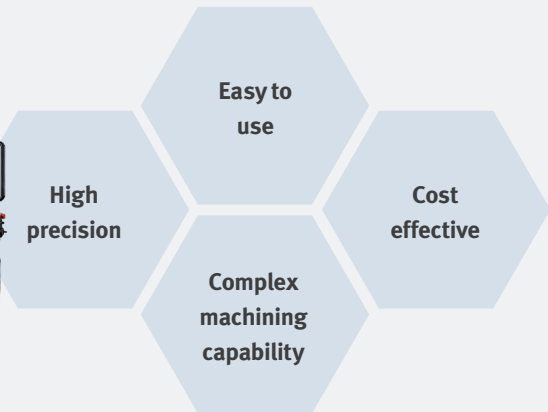
In particular, an efficient manufacturing process for free curved shapes in bolt joints

High rigidity / high quality

## Solution

### DNM 200/5AX

A high productivity 5-axis vertical machining center



### Direct-coupled spindle

The DNM 200/5AX is equipped with direct coupled spindles to minimize noise and vibration, and can perform everything from high speed machining to powerful cutting with just one setting.

Max. spindle speed

**12000** r/min

(DNM 350/5AX : 20000 r/min option )

Max. motor power

**18.5 / 11** kW (24.8 / 14.8 Hp)

### High precision feeding system

The DNM 200/5AX is equipped with a roller-type LM guideway and high rigidity coupling to increase the rigidity and precision of the X-, Y- and Z-axis straight-line feeding system.

### Automatic tool change arm

Division	Tool storage capacity (ea)	Tool change time (sec.)
DNM 200/5AX	30 (40)	1.3
DNM 350/5AX	30 (40, 60)	1.3

### Rotary table

High rigidity and high precision A-axis and C-axis roller bearings



# Artificial joints

Overview of the Medical Device Industry

## Implants

Bone screws  
Bone plates  
Artificial joints

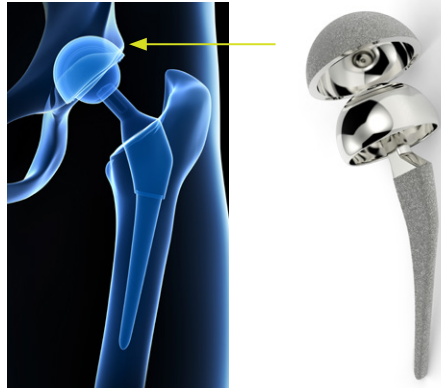
Medical instruments  
Surgical instruments

## Medical equipment

Dental instrument  
Treatment and diagnostic devices  
Pharmaceutical machinery

## Workpiece

### Hip - Acetabular Cup



- Major material : Stainless Steel
- Workpiece size :  $\Phi 60$  mm ( $\Phi 2.4$  inch)

### Machining conditions

#### OD Turning

- 250 r/min(Spindle)
- 0.25 min/rev(Feed)

#### 4 Ball Endmill

- 5000 r/min(Spindle)
- 1000 min/rev(Feed)

#### Lower turret for fixture

#### Main/Sub SPD One set-up

## Solution

### PUMA MX1600ST

A complex machining and turning center that integrates both turning center and machining center functions.



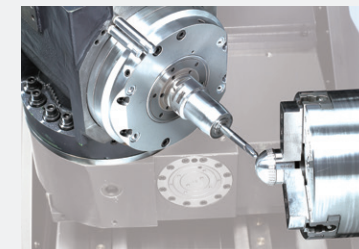
### Simultaneous control of complex multiple axes

With a configuration of up to 9 axes, the machine can rapidly machine all types of shapes to the micron unit level of precision with just one setting.



### Outstanding control capability, enhanced precision

- Adoption of 0.001-degree precision control of the B-axis and C-axis ensures ever higher precision machining.
- Adoption of high speed cooling system minimizes thermal displacement of the spindles and feed axis, while the smart thermal displacement compensation function ensures high precision even during long periods of machining.



# Artificial joints

Overview of the  
Medical Device  
Industry

## Implants

Bone screws  
Bone plates  
Artificial joints

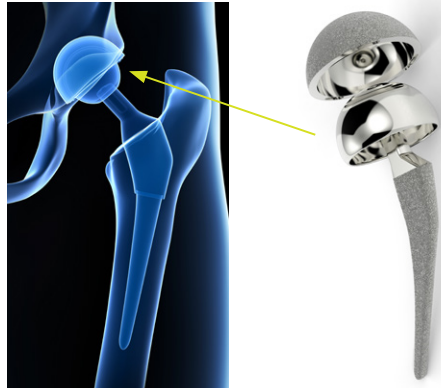
Medical instruments  
Surgical instruments

## Medical equipment

Dental instrument  
Treatment and  
diagnostic devices  
Pharmaceutical  
machinery

## Workpiece

### Hip - Femoral head



- Major material : **Stainless Steel**  
**Cobalt chrome**
- Workpiece size : **Φ 35 mm (Φ 1.4 inch)**

### Characteristics of machining

Excellent surface quality

High rigidity

High productivity

Optical inspection prove for both turrets  
> Check broken tools

## Solution

### PUMA TT1800SY

A high productivity turning center equipped with 2 opposing spindles and 2 upper and lower turrets



Rapid  
machining  
speed

Outstanding  
machining  
capability

Multi-process  
capability

### Productivity doubled with the adoption of a right spindle and a lower turret!

- The left and right spindles and the upper and lower turrets operate independently
- Wide range of sewing diameters (Φ42~Φ81mm)
- Addition of upper and lower turrets to the Y-axis
- Equipped with an advanced finished-part removal system for both spindles!



### Excellent rigidity and power implemented with axis travel system optimization technology!

- The product's rapid traverse rate of 40 m/min are designed to meet the required characteristics of machines whose users require a very high level of productivity.
- Equipped with high rigidity roller LM guide ways

Left spindle, Right spindle (8 inch)

Max. Power

**22 / 15 kW (29.5 / 20.1 Hp)**

Max. Speed

**5000 r/min**



**Implants**

- Bone screws
- Bone plates
- Artificial joints

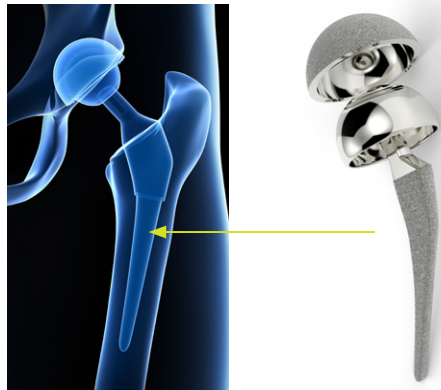
- Medical instruments
- Surgical instruments

**Medical equipment**

- Dental instrument
- Treatment and diagnostic devices
- Pharmaceutical machinery

## Workpiece

### Hip - Femoral Stem



- Major material : Stainless Steel
- Workpiece size : 50 x 200 mm (2.0 x 7.9 inch)

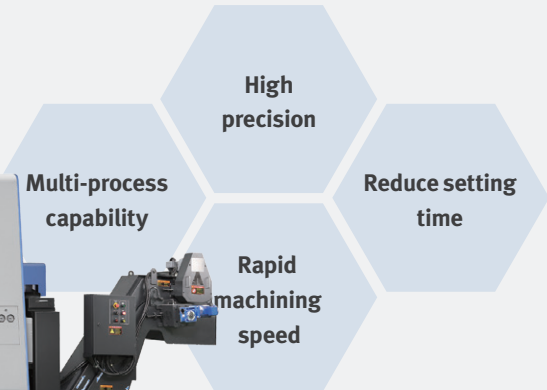
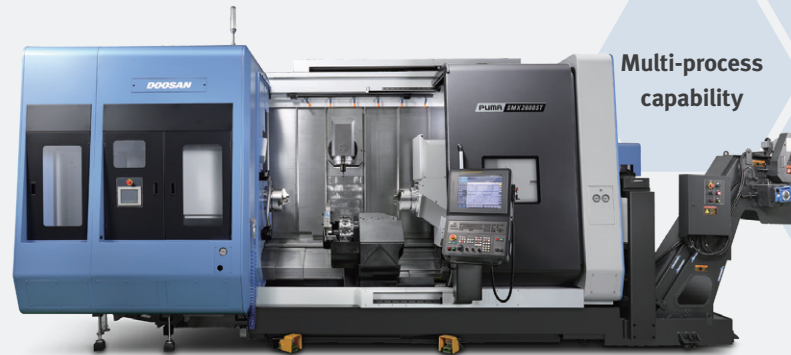
### Characteristics of machining

- Shortens the process and minimizes the work time
- High quality / high precision/ high rigidity
- Flexible production

## Solution

### PUMA SMX2600ST

Super Multi-tasking Turning Center



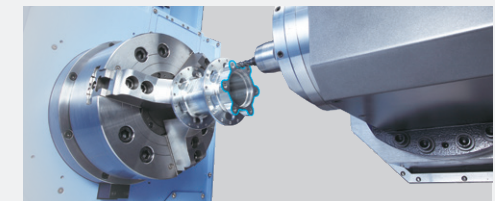
### Higher Productivity through Powerful Multi-tasking Functions

- Complex machining capabilities of left spindle, right spindle, B-axis , milling spindle and lower turret
- Maximized Y-axis machining area through orthogonal design structure
- 12-angle servo turret for powerful cutting (optional)



### Enhanced Precision through High Accuracy Control Functions

- Precision control of B and C axes
- Adoption of high speed cooling system that minimizes thermal displacement, with smart thermal displacement compensation function



1<sup>st</sup> spindle C-axis position control capability  
**0.0001°**

# Major customers in the category of diverse medical instruments

Overview of the Medical Device Industry

## Implants

- Bone screws
- Bone plates
- Artificial joints

## Medical instruments

Surgical instruments

## Medical equipment

- Dental instrument
- Treatment and diagnostic devices
- Pharmaceutical machinery

### G company in USA

A company specializing in orthopedic instrumentation that provides diverse services ranging from design to manufacturing and holds more than 30 US patents



### H company in USA

A specialist provider of professional solutions, including the development and production of orthopedic surgical instruments



### K company in Germany

A Tier 1 company in the medical industry and leader in various product solutions including cardiovascular systems, nerve, and laparoscopy, in addition to general surgical instruments



Americas

Europe

Korea/Asia

### I company in USA

A total medical service provider as well as a specialist provider of spinal and orthopedic products



### J company in Korea

A company specializing in medical surgical instruments that offers customized solutions for various surgical instruments





## Workpiece

### Surgical instruments

#### Mallet



- Major material : Stainless Steel

### Characteristics of machining

High productivity

Flexible production of diverse products

Automation

## Solution

### PUMA TT1800SY

A high productivity turning center equipped with 2 opposing spindles and 2 upper and lower turrets



Rapid machining speed

Outstanding machining capability

Multi-process capability

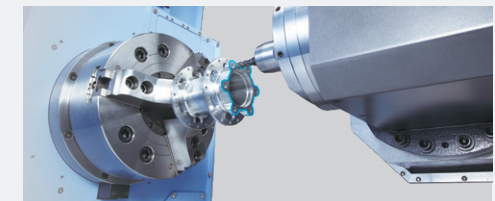
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**0.0001°**

# Major customers in the category of diverse medical equipment

## Overview of the Medical Device Industry

### Implants

- Bone screws
- Bone plates
- Artificial joints

### Medical instruments

- Surgical instruments

### Medical equipment

- Dental instrument
- Treatment and diagnostic devices
- Pharmaceutical machinery

## P company in USA

A company that offers innovative treatment efficiency based on the development and production of diverse medical cabinets and chairs



## Q company in Canada

A company specializing in surgical instruments that develops and manufactures surgical treatment beds and clinical seating



Americas

Europe

Korea/Asia

## Q company in USA

A leader in mobility products that provides support for patient mobility



## L company in Korea

A company that manufactures the core small parts of dental treatment devices, specializing in nerve treatment products



## O company in Korea

A company that specializes in developing and manufacturing various dental treatment devices, with a particular focus on exporting dental X-ray machines globally



## N company in Korea

A technology-intensive company that manufactures more than 300 types of ultra-precision parts annually, with the focus on ultrasonic devices



## M company in Korea

A company that provides diverse solutions from development to assembly, specializing in medical device frames



# Dental treatment equipment parts

Overview of the Medical Device Industry

Implants

Bone screws  
Bone plates  
Artificial joints

Medical instruments

Surgical instruments

Medical equipment

Dental instrument  
Treatment and diagnostic devices  
Pharmaceutical machinery

## Workpiece

### Dental prosthetic kit



• Major material : Stainless Steel

### Characteristics of machining

Precision machining of complex small parts

Flexible production of diverse shapes

High rigidity

## Solution

### PUMA ST20GS

High precision, high productivity Swiss type turning center



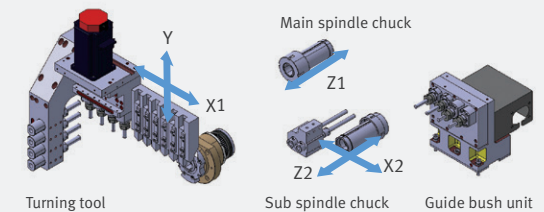
### Excellent Rigidity and Precision

- Designed with FEM analysis to provide high stability and productivity.
- Precision machining capability is further improved due to minimal thermal error design.

### Provide a Tool Solution Applicable for a Diversity of Machining Processes

- Up to 5 cross tools can be used for highest efficiency in milling and other special machining processes.
- Easy operation and control software
- Adoption of more diverse peripherals enhances productivity

### PUMA ST20GS / 26GS / 32GS / 35GS



### Travel specification

Description	Unit	Z1	X1	Y	Z2	X2
Travel distance (PUMA ST20GS)	mm (inch)	200 (7.9)	90 (3.5)	350 (13.8)	190 (7.5)	345 (13.6)
Travel distance (PUMA ST26GS)	mm (inch)	200 (7.9)	90 (3.5)	386 (15.2)	186 (7.3)	345 (13.6)
Rapid traverse rate	m/min (ipm)	32 (1259.8)				



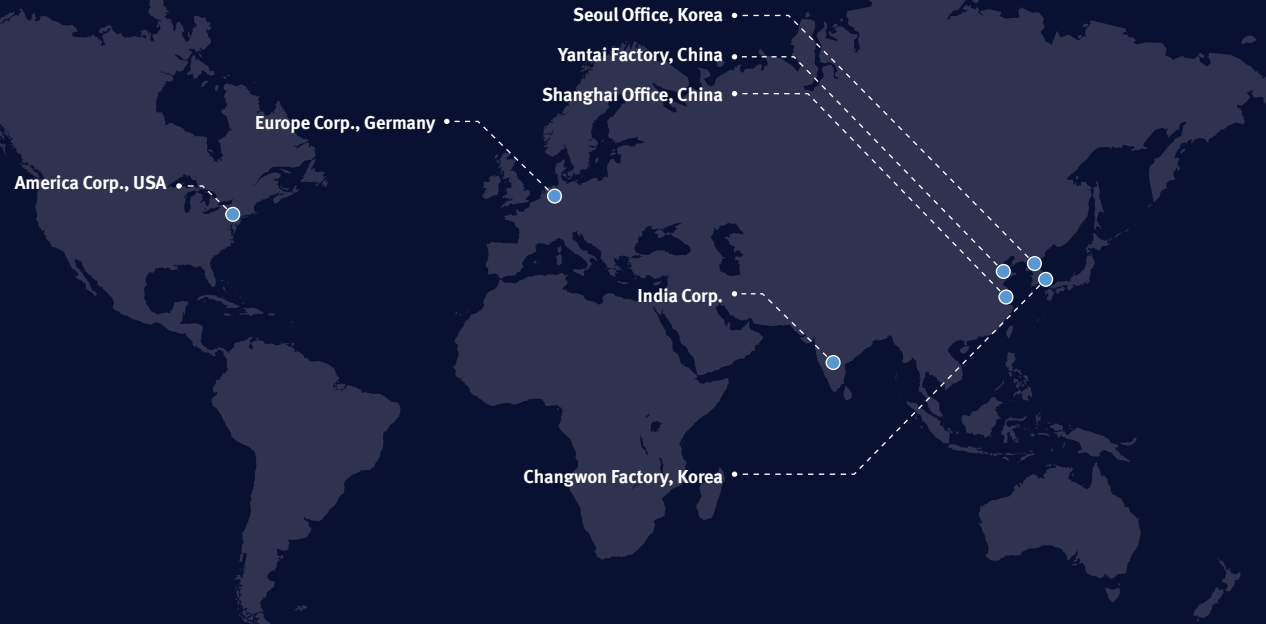
# Doosan Machine Tools in the World

In an effort to provide solutions that fit each partners' unique needs, we constantly innovate our thinking, processes, and the way we do business. These optimal solutions lay the foundation for the success of our partners, which adds value to our partners' businesses.

## Global Sales and Service Support Network

**4** Corporations  
**167** Dealer Networks  
**51** Technical Centers  
**200** Service Post  
**3** Factories

Technical Center: Sales Support, Service Support, Parts Support



## Supplying Parts

- Supplying parts without charges
- Supplying parts with charges
- Parts repair



## Field Services

- On-site services
- Installment and trials
- Scheduled maintenance/ Preventive maintenance
- Repairs with/without charges



## Technical Support

- Supporting machining technology
- Responding to technical inquiries
- Providing technical materials



## Training

- Programming / Machine operation
- Maintenance
- Application engineering

## Doosan Machine Tools

[www.doosanmachinetools.com](http://www.doosanmachinetools.com)



### Head Office

22FT Tower, 30, Sowol-ro 2-gil, Jung-gu, Seoul, Korea, 04637  
Tel +82-2-6972-0370 / 0350  
Fax +82-2-6972-0400

### Doosan Machine Tools America

19A Chapin Rd., Pine Brook, NJ 07058, U.S.A.  
Tel +1-973-618-2500  
Fax +1-973-618-2501

### Doosan Machine Tools Europe

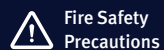
Emdener Strasse 24, D-41540 Dormagen, Germany  
Tel +49-2133-5067-100  
Fax +49-2133-5067-111

### Doosan Machine Tools India

No.82, Jakkur Village, Yelahanka Hobli, Bangalore-560064

### Doosan Machine Tools China

Room 101,201,301, Building 39 Xinzhuan Highway No.258 Songjiang District,China Shanghai(201612)  
Tel +86-21-5445-1155  
Fax +86-21-6405-1472



### Fire Safety Precautions

There is a high risk of fire when using non-water-soluble cutting fluids, processing flammable materials, neglecting use coolants and modifying the machine without the consent of the manufacturer. Please check the SAFETY GUIDANCE carefully before using the machine.

- \* For more details, please contact Doosan Machine Tools.
- \* The specifications and information above-mentioned may be changed without prior notice.
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