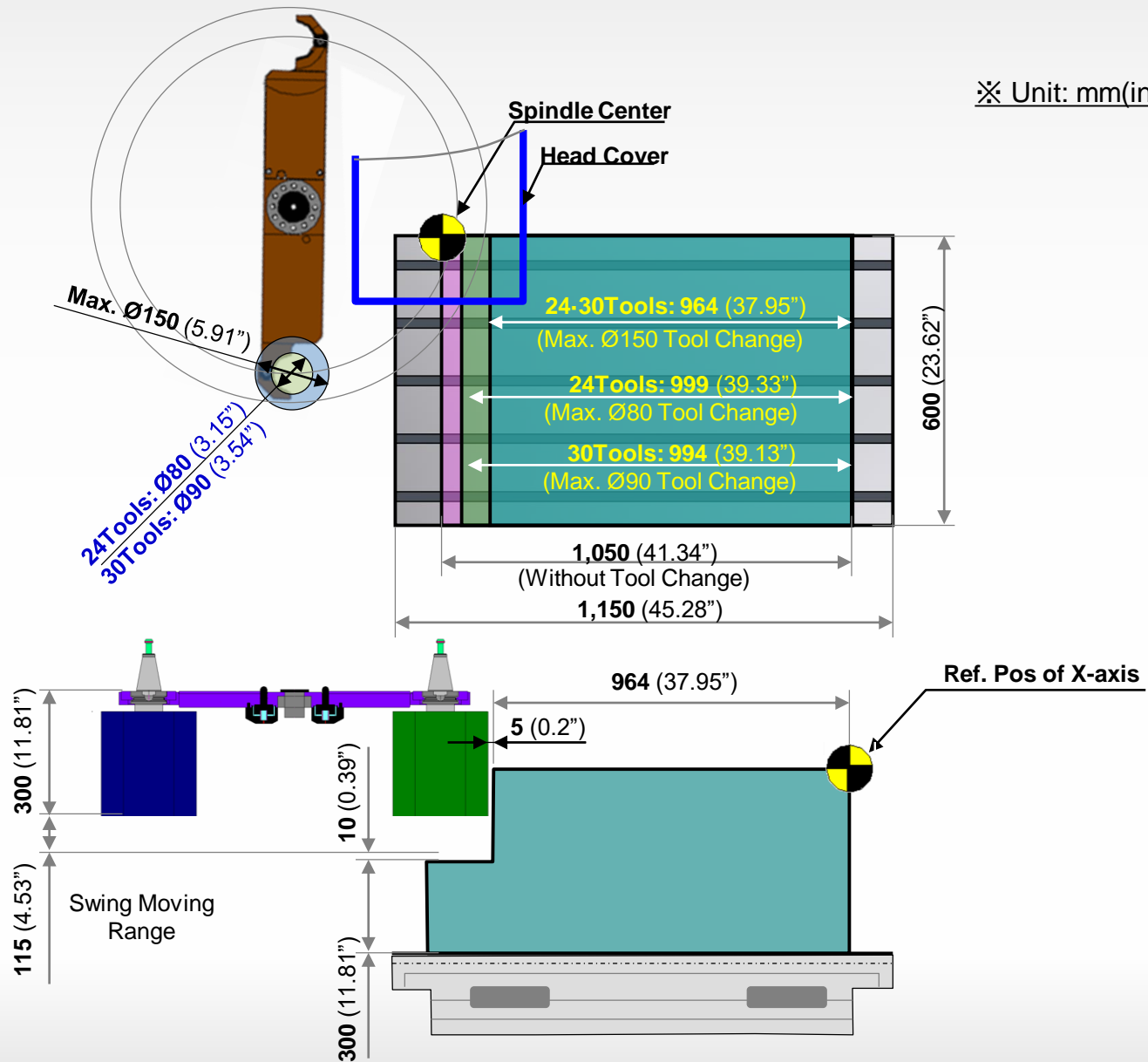
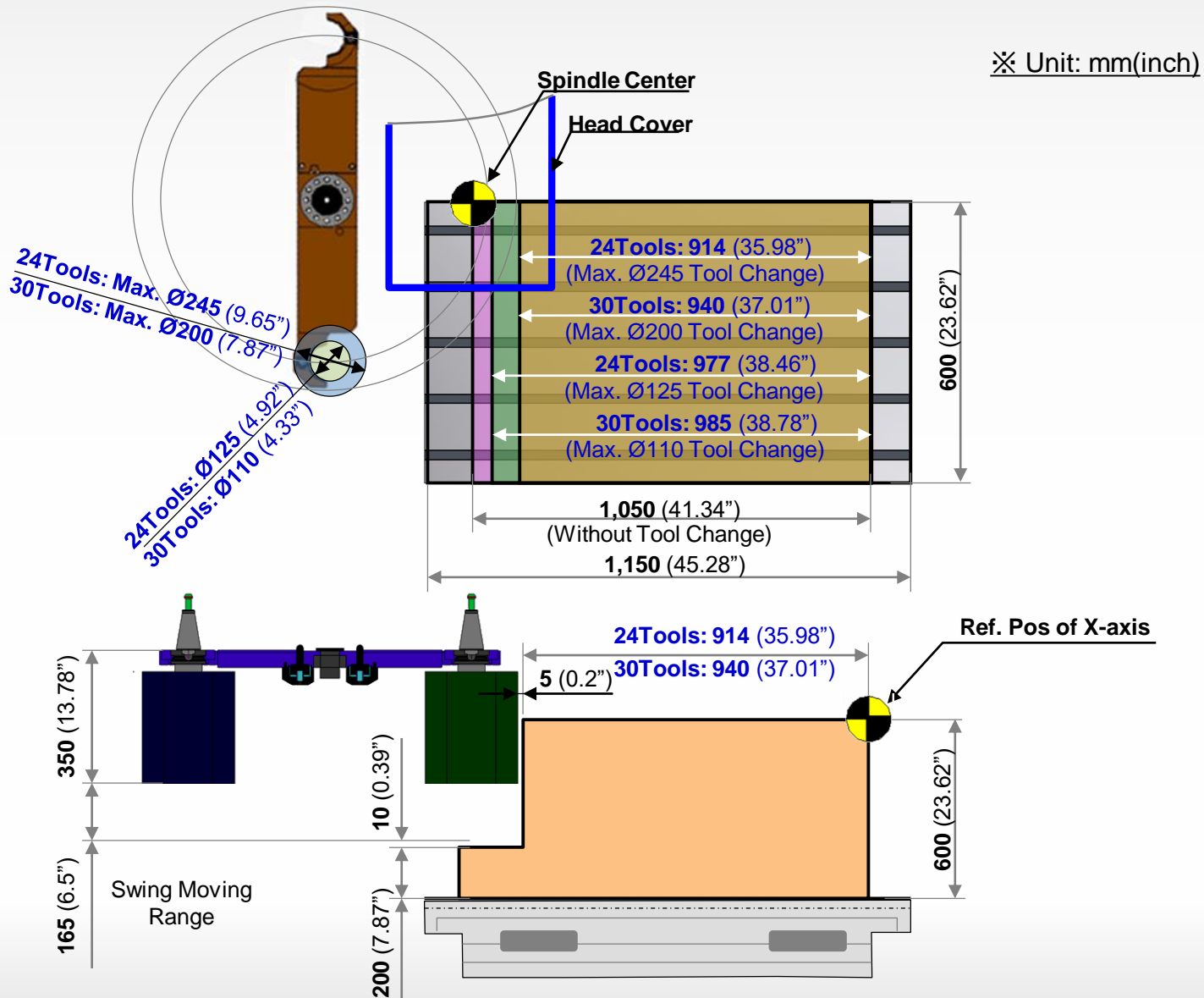



# Moving Range [ATC Interference -BT-40]



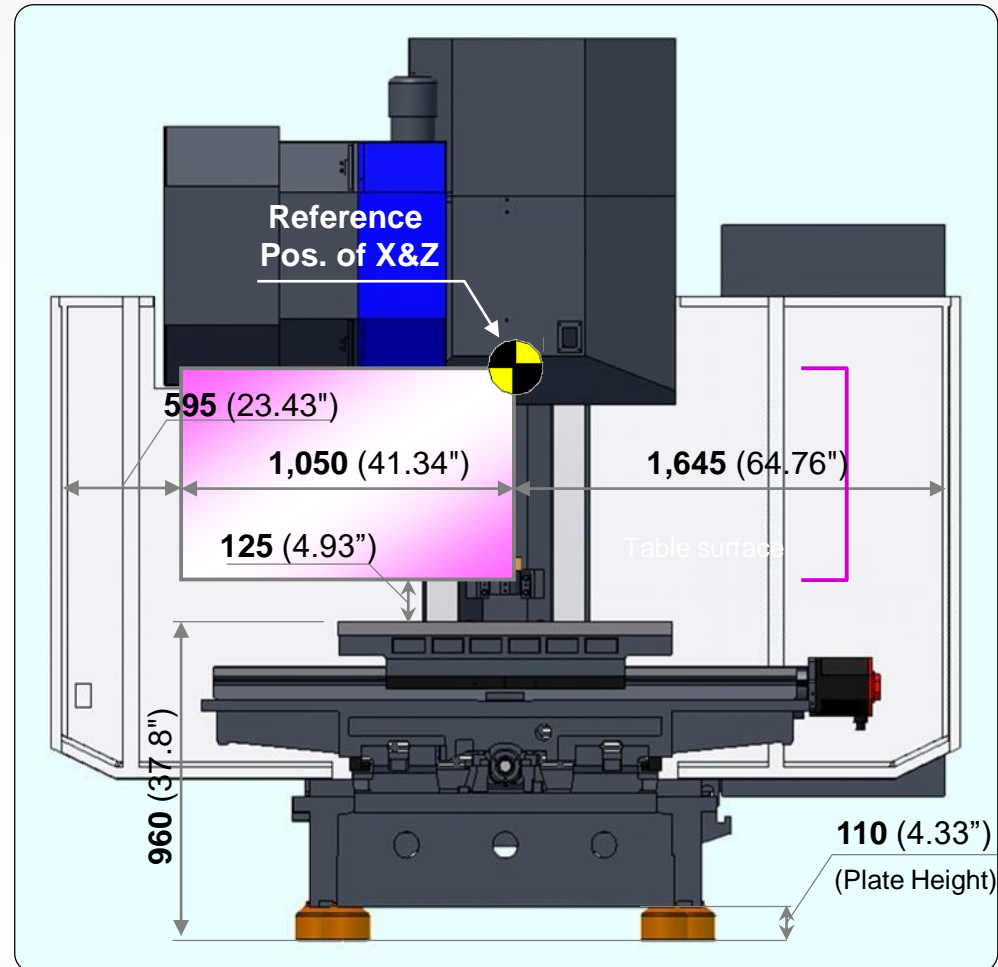
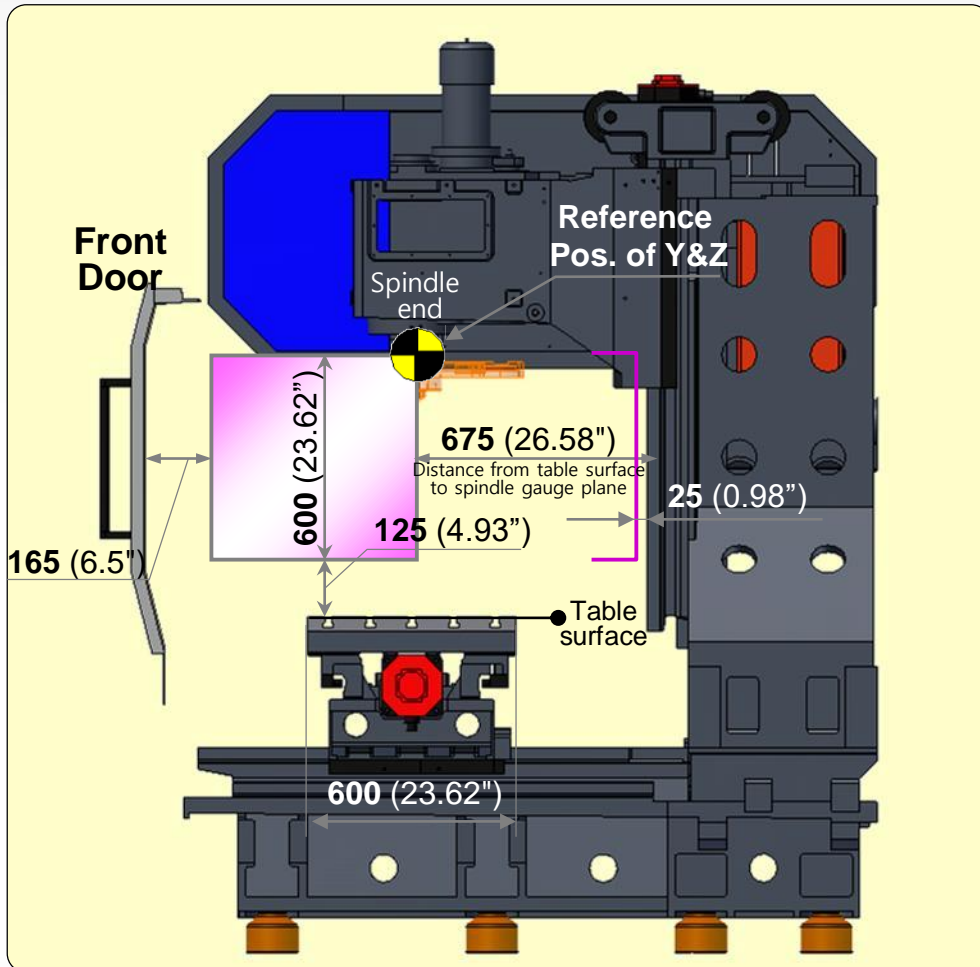
# Moving Range [ATC Interference -BT-50]



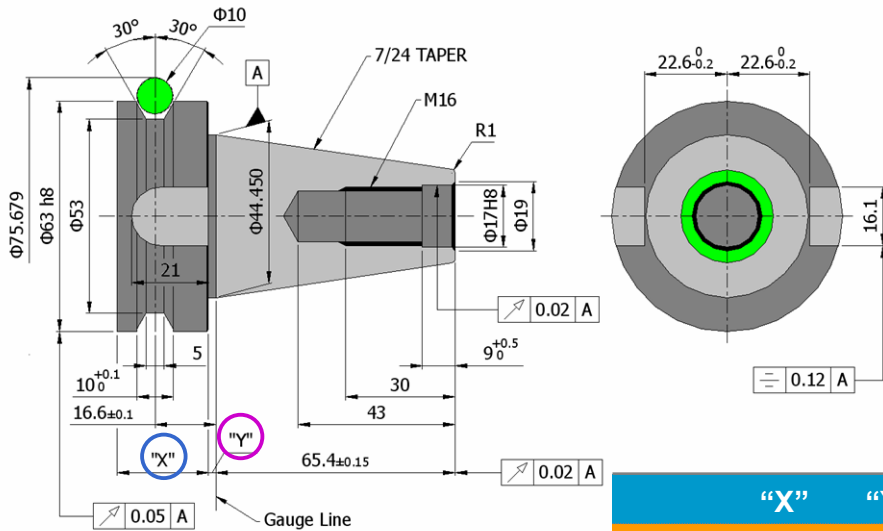
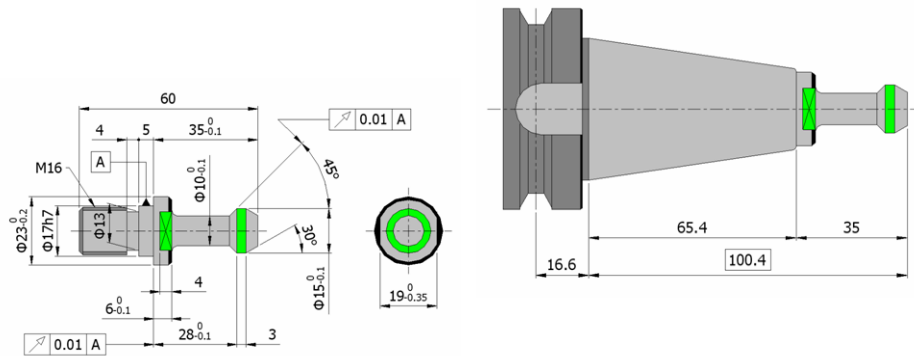
# Moving Range [Internal Interference]

 : Moving Range

※ Unit: mm(inch)



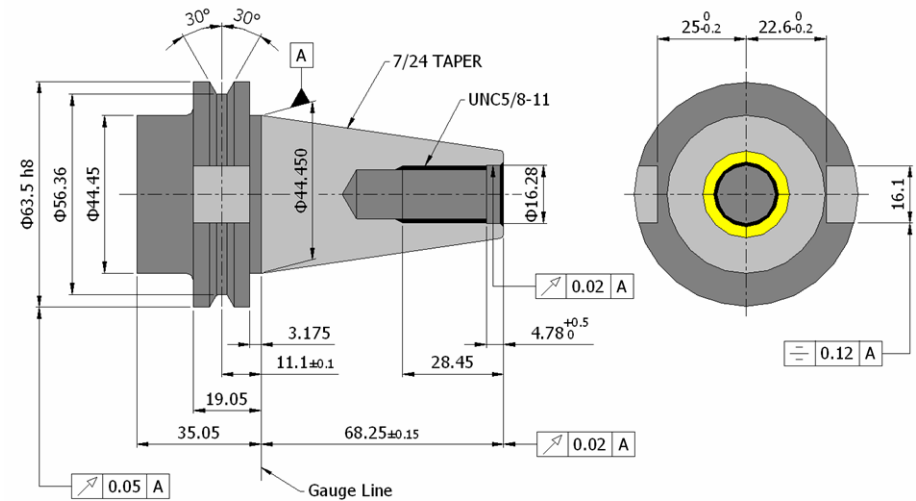
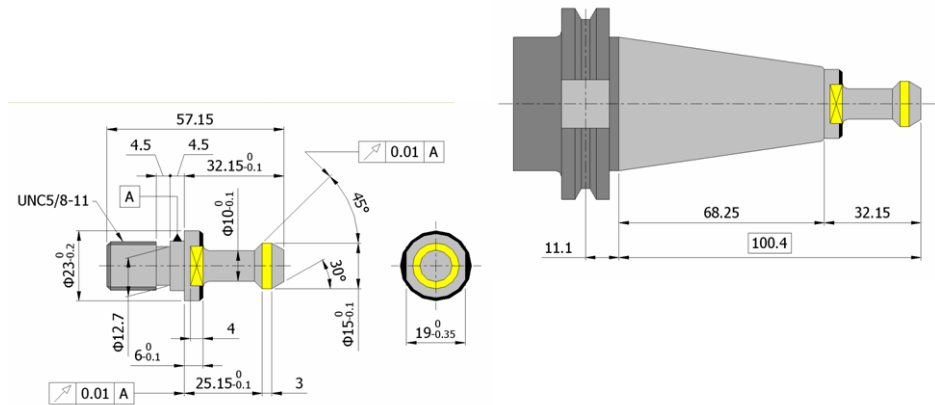
## BT-40 **【Std.】**



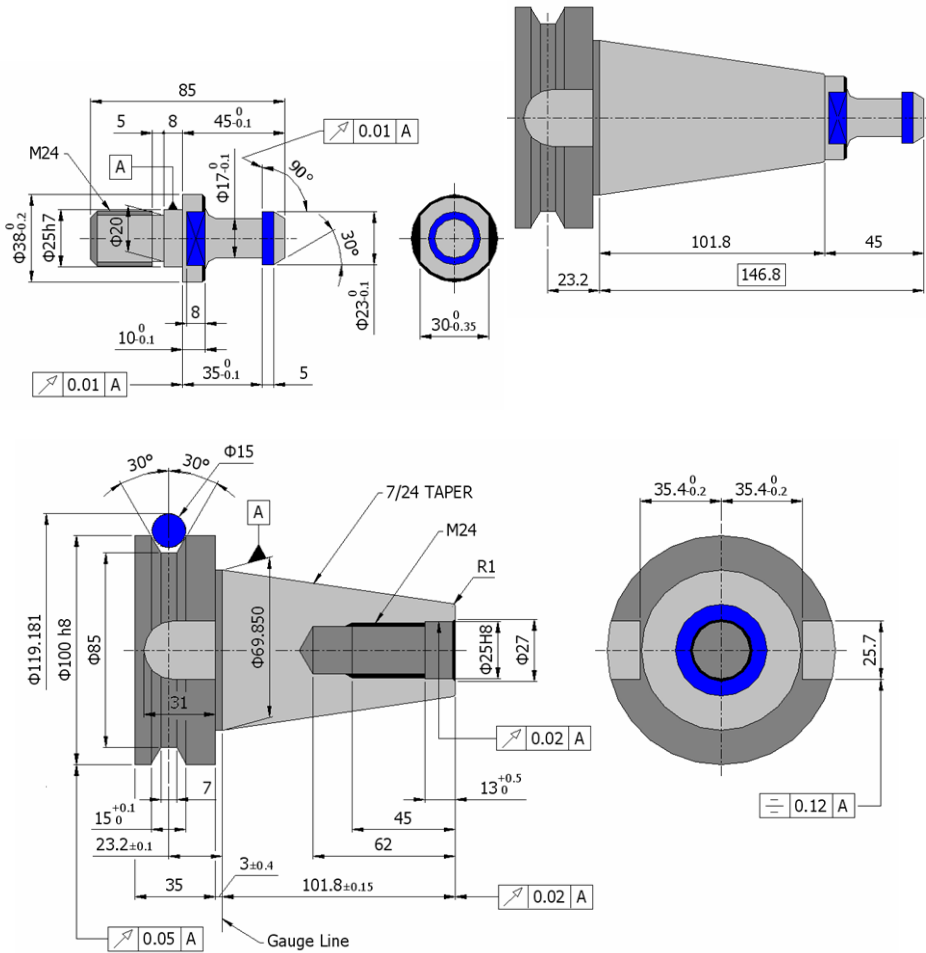
**BT40** 25 2 ±0.4

## CAT-40 **【Opt.】**

↳ USA Specification

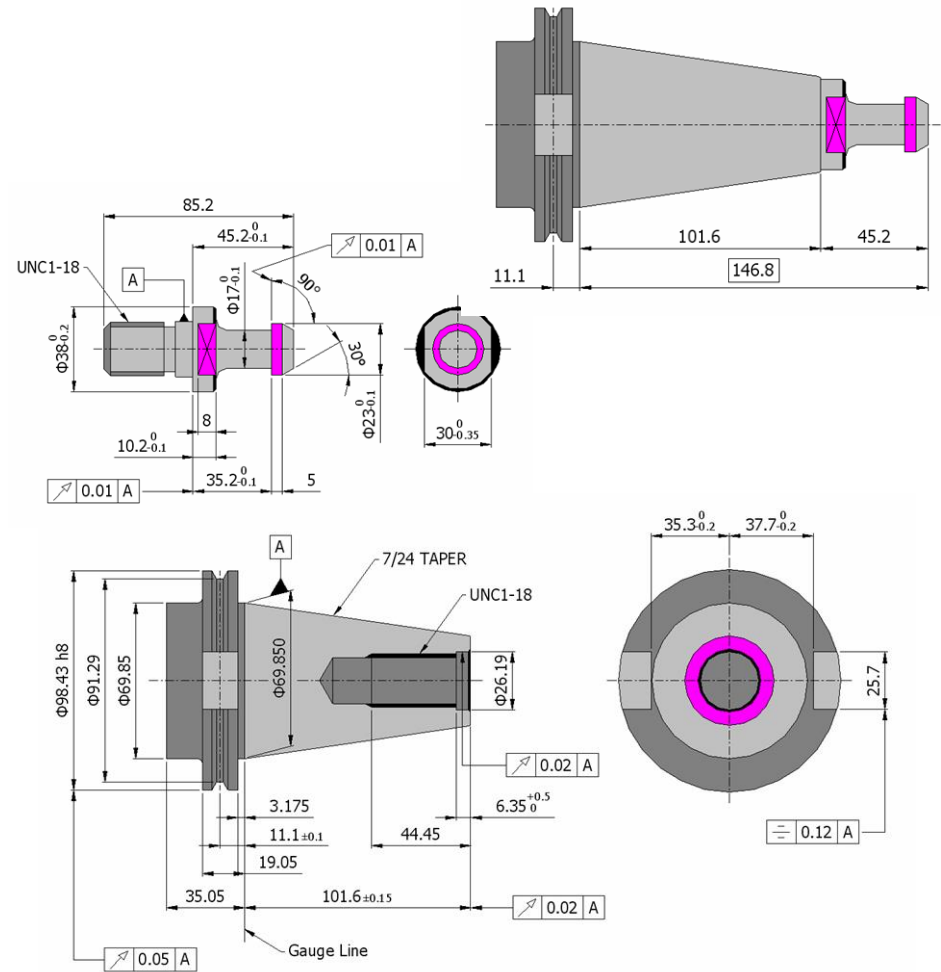


## BT-50 **【Opt.】**



## CAT-50 **【Opt.】**

└ USA Specification

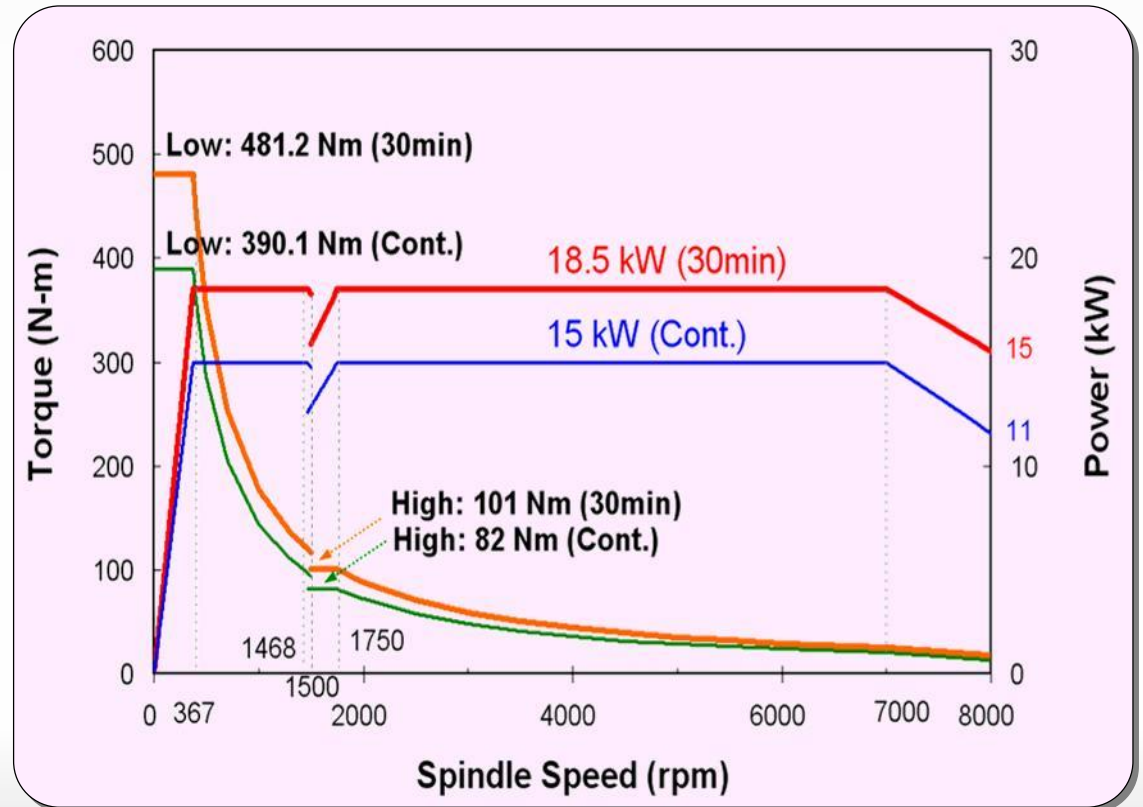
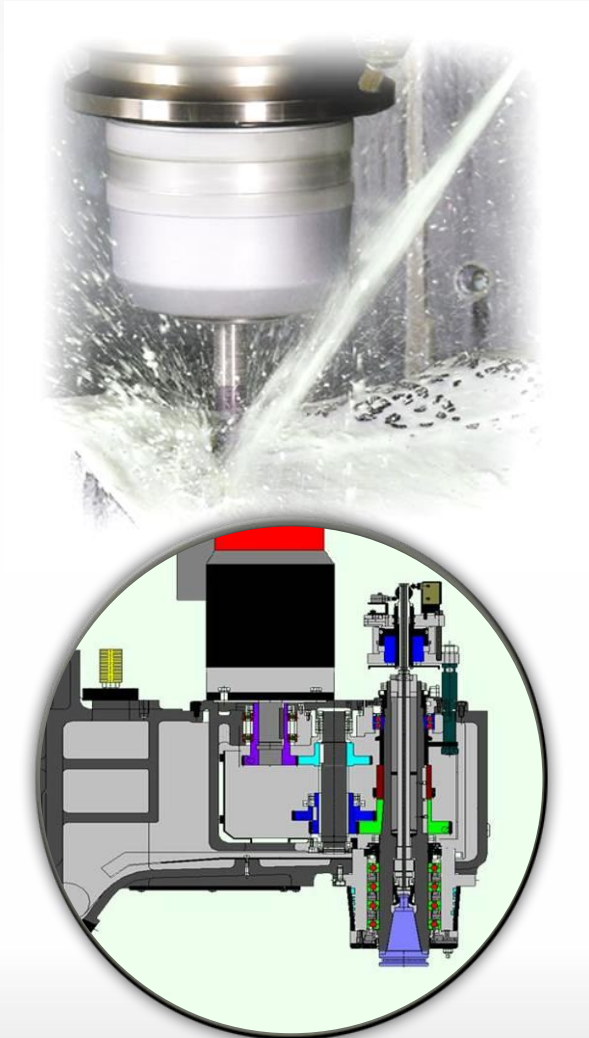


# Torque Diagram 【 Standard, BT-40】



*"High-speed & Torque"*

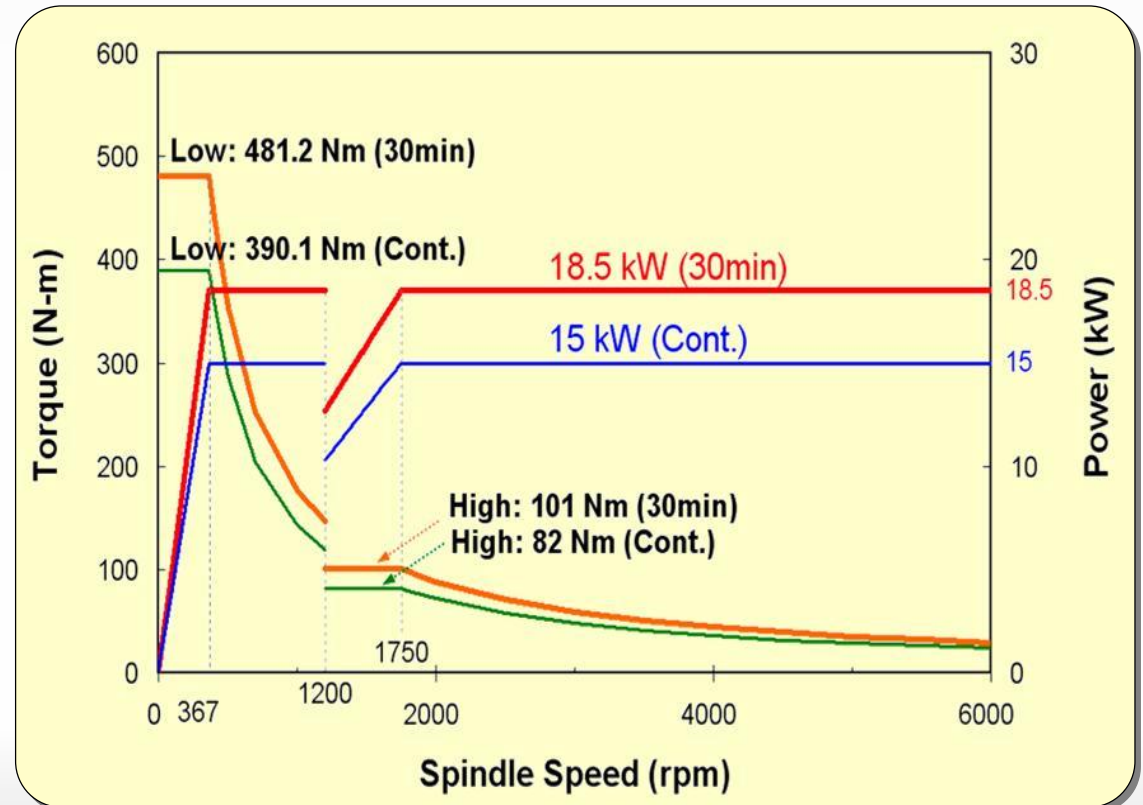
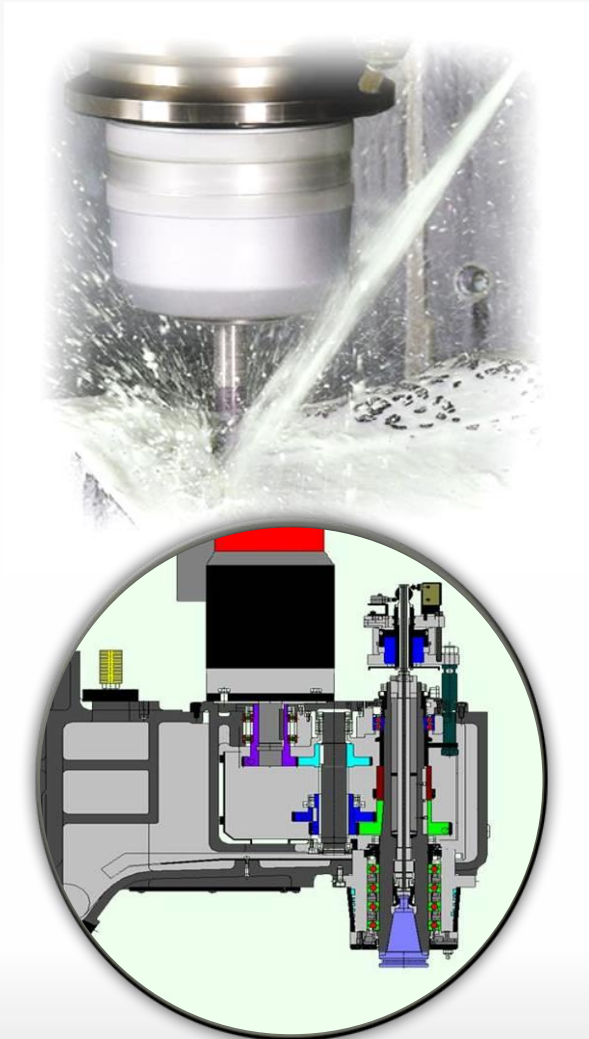
- Power : 18.5/15kW (25/20HP)
- Max. spindle speed : **8,000 rpm**
- Motor : α15/7000i
- Type of spindle : Built-out Motor (Gear Driven Spindle)
- Range of speed or Gear change automatically (rpm):  
1~1500(Low) / 1500~8000(High)



# Torque Diagram **【 Option, BT-50】**

*"High-speed & Torque"*

- Power : 18.5/15kW (25/20HP)
- Max. spindle speed : **6,000 rpm**
- Motor : α15/7000i
- Type of spindle : Built-out Motor (Gear Driven Spindle)
- Range of speed or Gear change automatically (rpm):  
1~1200(Low) / 1200~6000(High)



# High-Rigidity C-type Structure

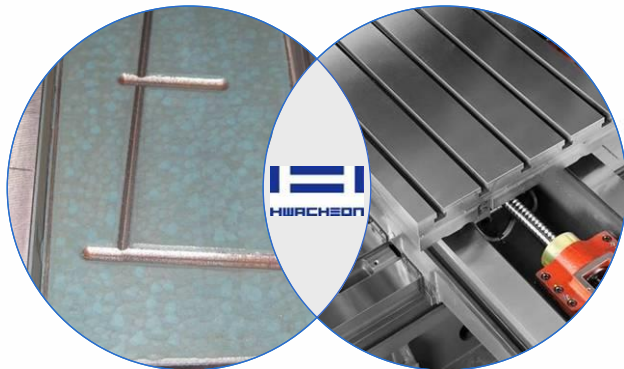
*"High-Productivity"*



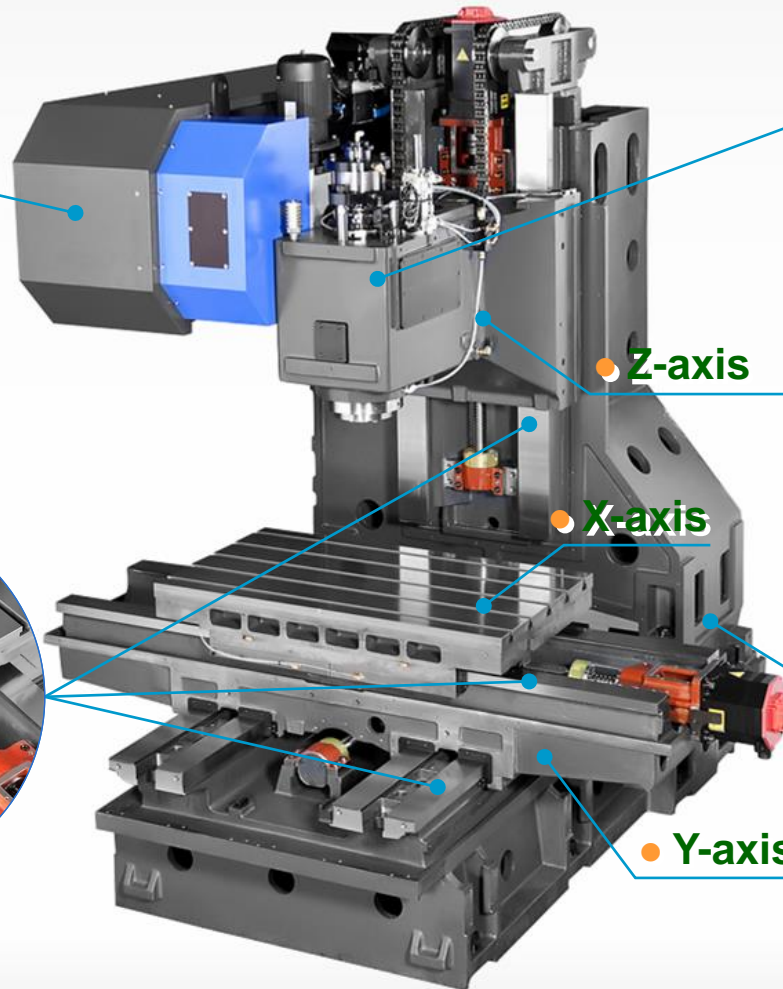
- Quick change ATC
  - ▷ Tool to Tool: 1.5sec
  - ▷ Chip to Chip: 4sec



- Powerful Gear driven spindle
- Hwacheon's handmade



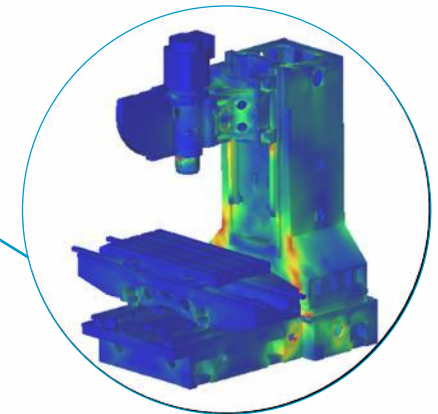
- High rigidity Box way (Turcite)
- 100% hand scrapping by specialist
- Absorption of cutting vibration & shocking relaxation



● Z-axis

● X-axis

● Y-axis



- Analysis by FEM  
(Finite Element Method)



## Original Technology

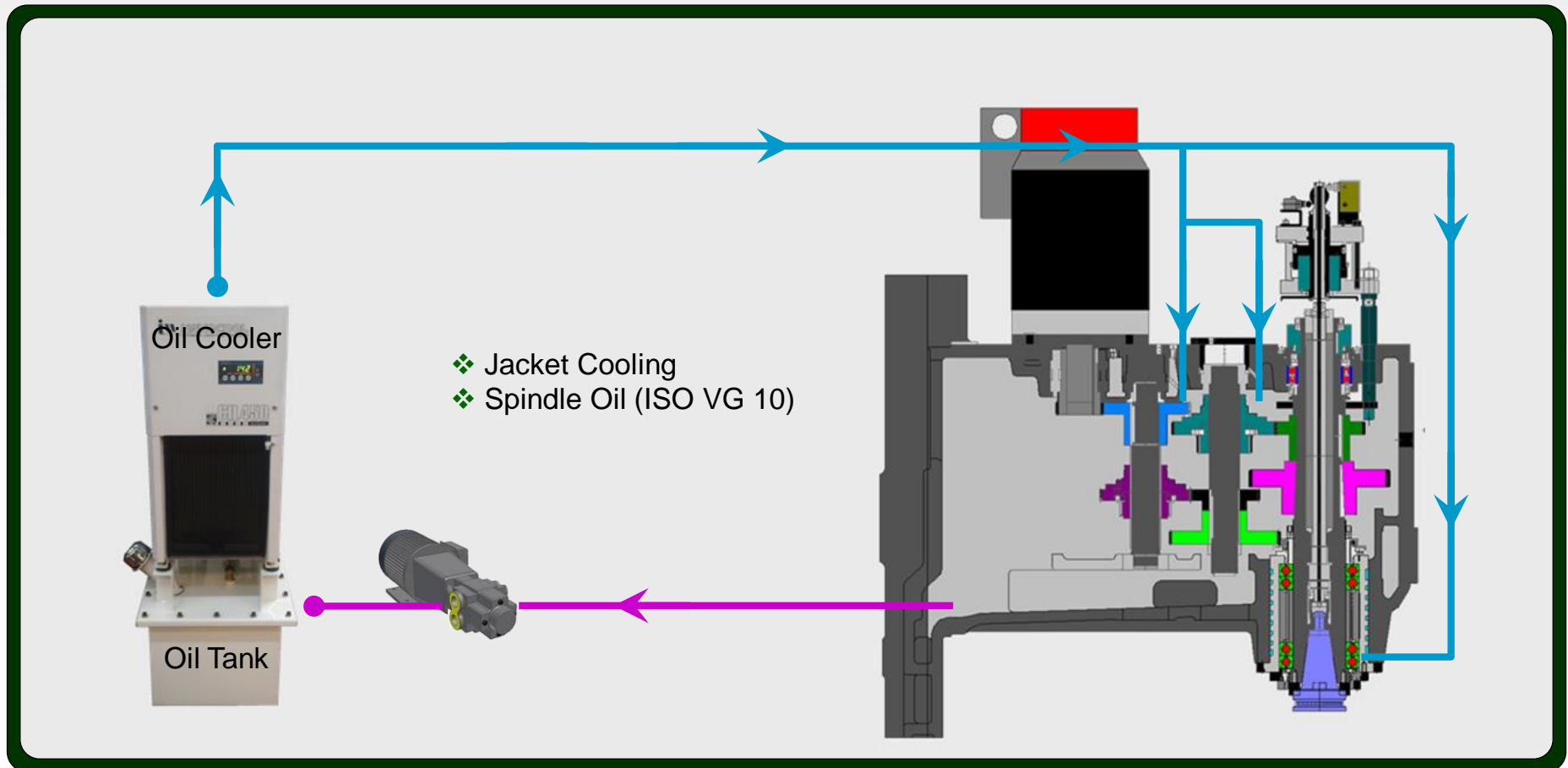
- ❖ Gear Driven Spindle : Power is delivered to the spindle through a transmission allowing high spindle speed as well as powerful low torque
  - Excellent cutting ability for difficult cutting materials
  - Automatic spindle speed change (Gear change)
  - 2step control
- ❖ Tool Shank : BT-40(Std.), CAT-40/BT-50/CAT-50(Opt.)
- ❖ Spindle Power : 18.5/15 kW (25/20 HP)
- ❖ Max. Speed : → 8,000 rpm(BT-40, Std.)  
→ 6,000 rpm(BT-50, Opt.),
- ❖ Bearing Inner Dia.: → 8,000rpm: Ø70 (DmN : 720,000)  
→ 6,000rpm: Ø90 (DmN : 690,000)
- ❖ Bearing cooling & Lubrication : Grease Lubrication
  - Semi permanent Lub.
  - Perfect protection of chip & dust, coolant with Air Curtain System
- ❖ Cooling : Spindle Frame by Jacket circuit

“Made by HWACHEON”



Unique manufacturing technology and original lubrication system

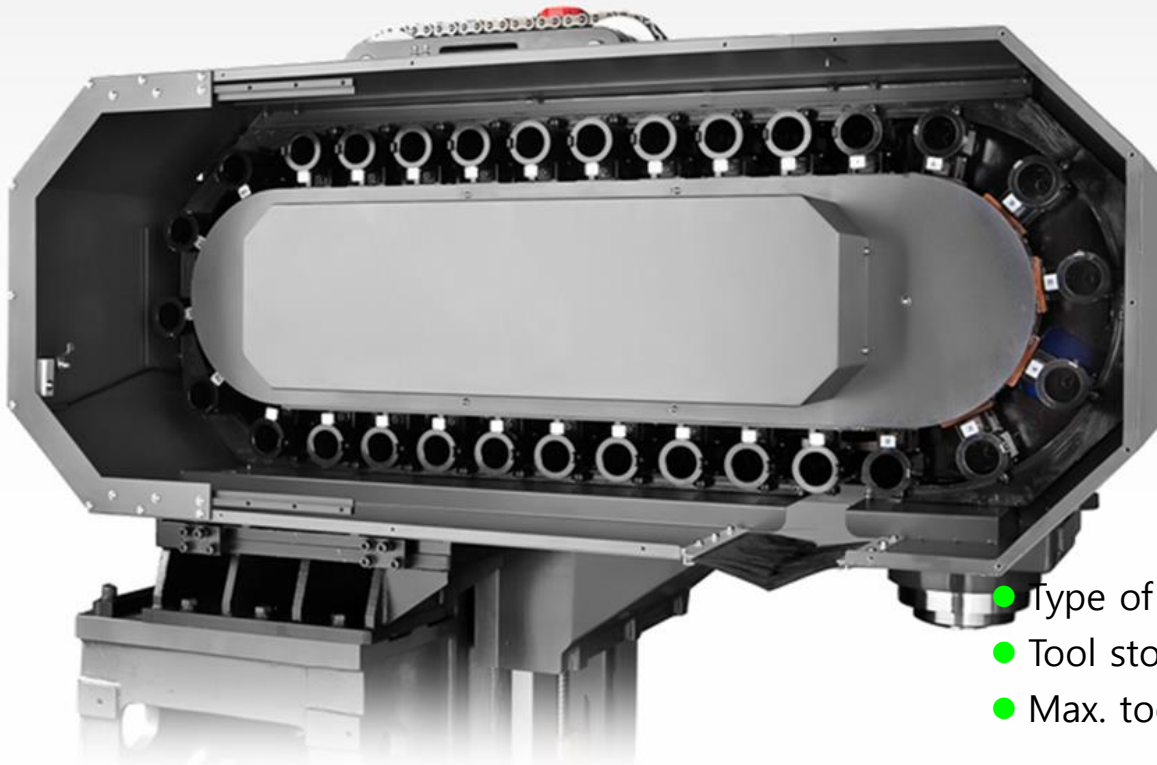
# S pindle Cooling system



- Hwacheon spindle shows outstanding performance for high accuracy and high machining by minimizing displacement with **unique manufacturing technology**
  - Spindle Bearing: Grease lubrication
  - Bering Housing: Jacket cooling
  - Transmission: Spindle Oil circulation

# Automatic Tool Changer 【BT-40】

HS-M241-R1.2-20100429



- Type of tool : MAS-403 BT-40 (Opt.:CAT-40)
- Tool storage capacity: **24ea (Opt.: 30ea)**
- Max. tool diameter (With adjacent tools/Without)
  - 24Tools: Ø80 (3.15") / Ø150 (5.91")
  - 30Tools: Ø90 (3.54") / Ø150 (5.91")
- Max. tool length : 300 mm (11.81 Inch)
- Max. tool weight : 8 kg<sub>f</sub>
- Tool changing time : 1.5 sec (Tool to Tool)  
4 sec (Chip to Chip)
- Tool Change Type : Swing Arm
- Method of tool selection: Technical memory random
- Drive Type : Geared Motor

# Automatic Tool Changer 【BT-50】

HS-M241-R1.2-20100429



- Type of tool : MAS-403 BT-50 (Opt.:CAT-50)
- Tool storage capacity: **24ea (Opt.: 30ea)**
- Max. tool diameter (With adjacent tools/Without)
  - 24Tools: Ø125 (4.92") / Ø245 (9.65")
  - 30Tools: Ø110 (4.33") / Ø200 (7.87")
- Max. tool length : 350 mm (13.48 Inch)
- Max. tool weight : 20 kg<sub>f</sub>
- Tool changing time : 2.5 sec (Tool to Tool)  
5 sec (Chip to Chip)
- Tool Change Type : Swing Arm
- Method of tool selection: Technical memory random
- Drive Type : Geared Motor

## ● Driven type

### ✓ Directly Connected to drive

Servo motor is connected to ballscrew directly by coupling without any transmission parts.

→ Maximize efficiency & minimize backlash in moving.

### ✓ Ball screw Pretension

Ball screw is assembled with pretension by double ball bearing, then the ball screw can minimize thermal deformation for long time moving.



## ● Guide way (Box way)

✓ All guide ways are wide wrap-around rectangular type for unsurpassed long term rigidity and accuracy. A flurplastic resin, Turcite® B, is bonded to the mating way surfaces, for its wear friction characteristics and then hand scraped for a perfect fit and center height.

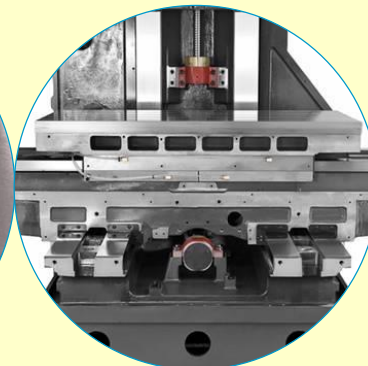
### ✓ Automatic Oil Supply for Lubrication

→ Linear guide & Ballscrew

## ● Specification

✓ Servo motor Power (X/Y/Z) : 3 / 3 / 4 kW

✓ Rapid Speed (X/Y/Z) : 24 / 24 / 18 m/min



# High-Rigid 4 Guide Way

HS-M243-R1.0-20100208



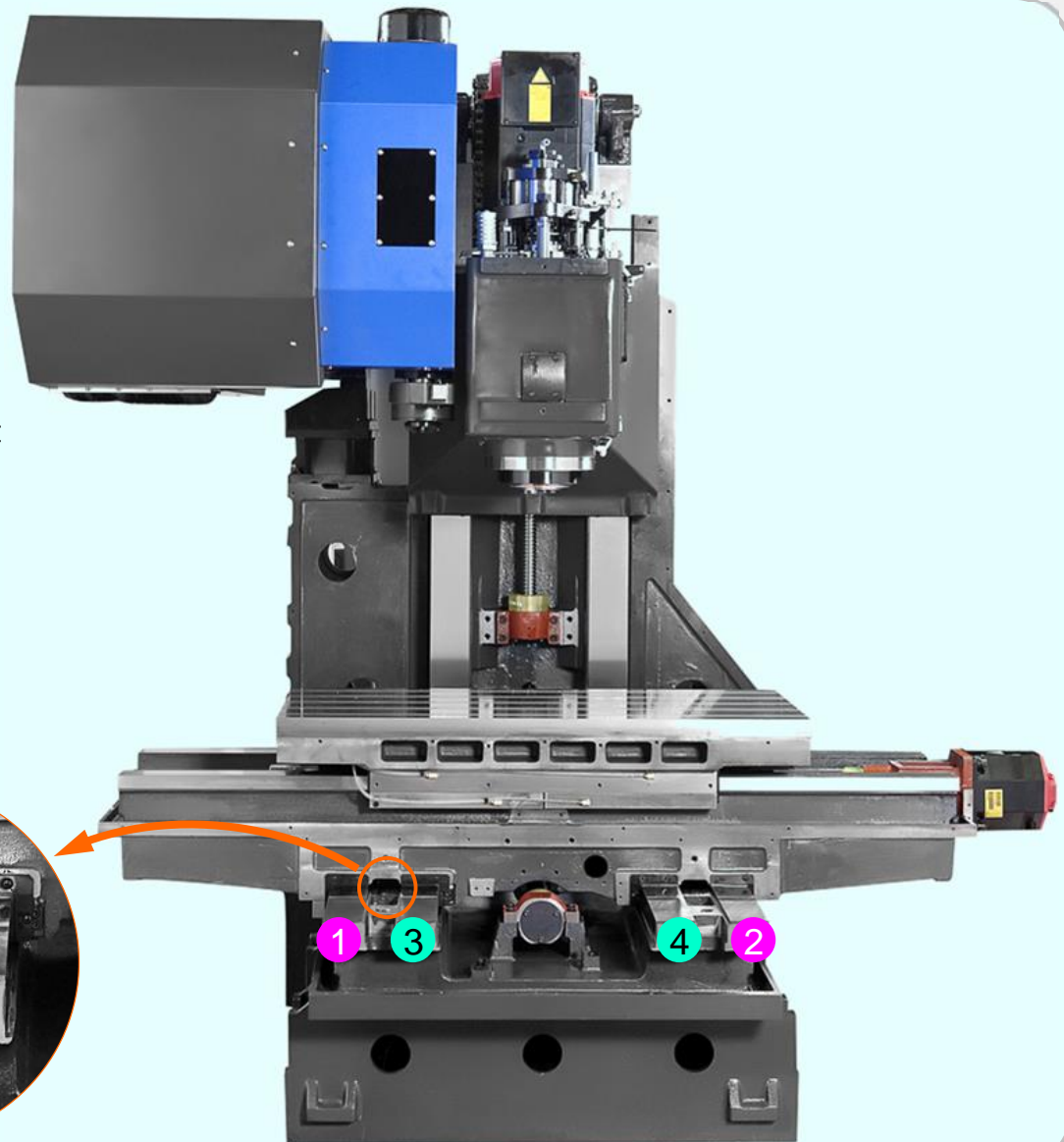
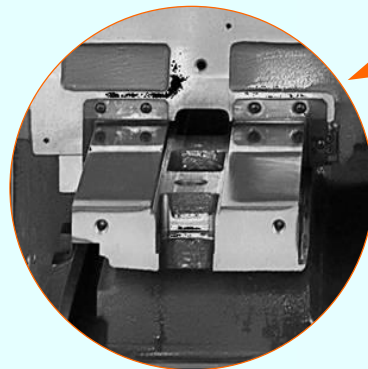
- Optimized supporting structure uniquely

In order to ensure to minimize the deformation or distortion of the whole stroke for each axis, twin main guide ways and additional dual supporting guide ways designed by an optimization.

This unique structure provide the stable movement and precision movement while move on slide way with heavy work piece.

1 2 : Main Guide Way

3 4 : Supporting Way



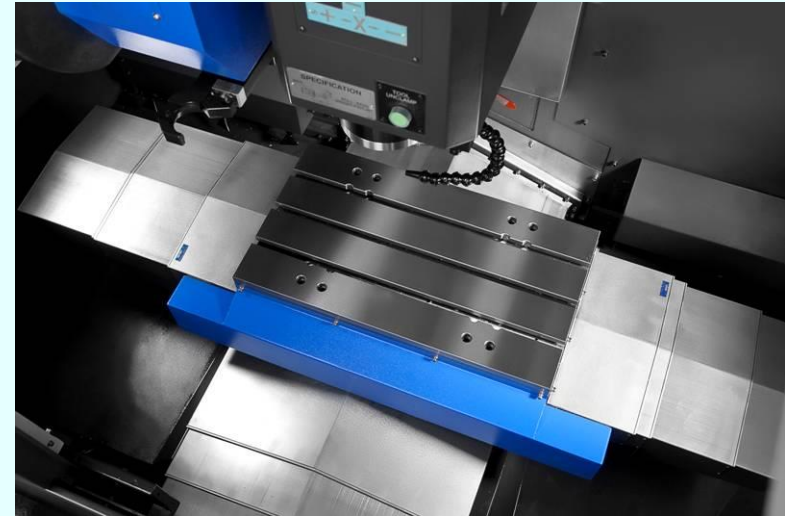
# Wide working area

HS-M243-R1.0-20100208



- Traditional C-type structure

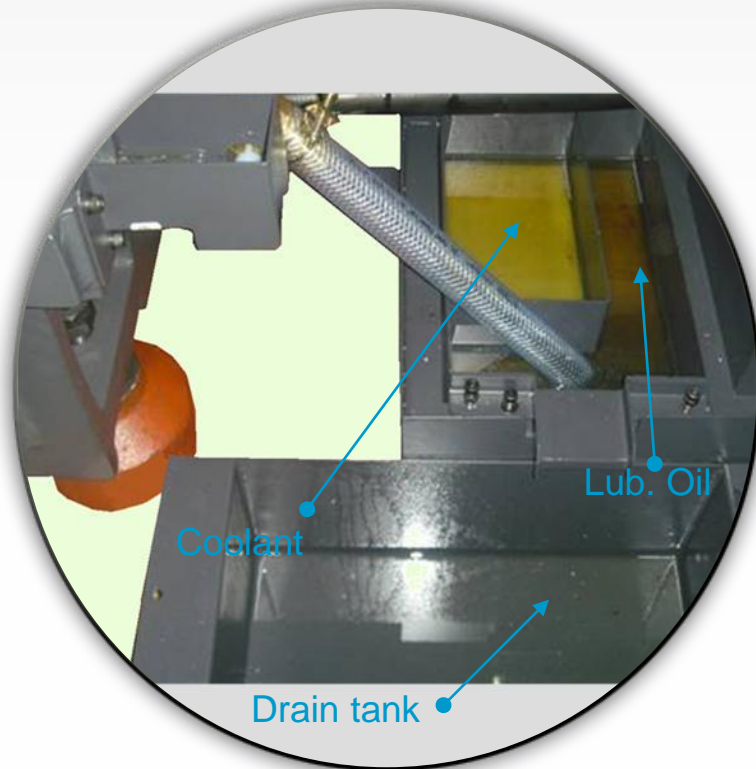
- Wide Working Area & Convenient Installation of work piece



- Perfect Base around splash guard

- Interception of scattering of chip & dust etc.
- Interception of coolant leakage when using the Through coolant with high pressure.

# Lubrication Oil Separation Structure



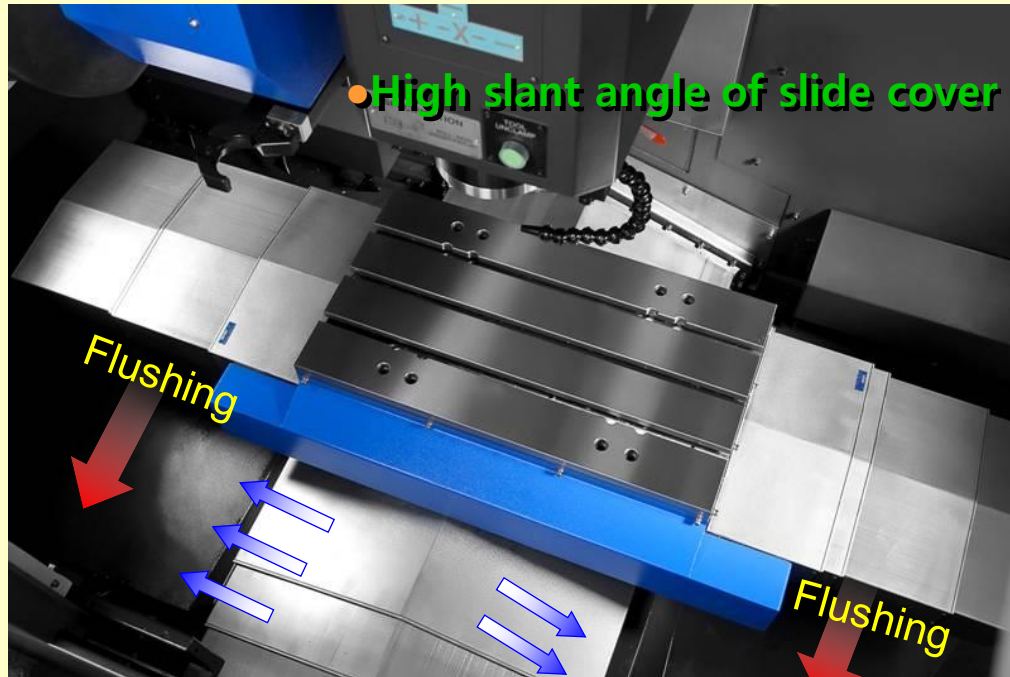
## *“Perfect Oil Separation Structure”*

- ✦ Environmentally-friendly unit is designed to keep lubrication oil separate from coolant.
- ✦ Working environment is always maintained clean, offensive smell and pollution is prevented.

※ Convenient cleaning with drain tank (Std.)



# E xcellent Chip Disposal



"Chip Removal Rate : Max. 5,600 cc/min (Aluminum)"

- High slant angle and chip brushing motor (Std.) and coil conveyor which is installed inside machine are perfectly removed the chip.
- Lift up Chip conveyor is installed in the left side and remove the chip easily. (Opt.)

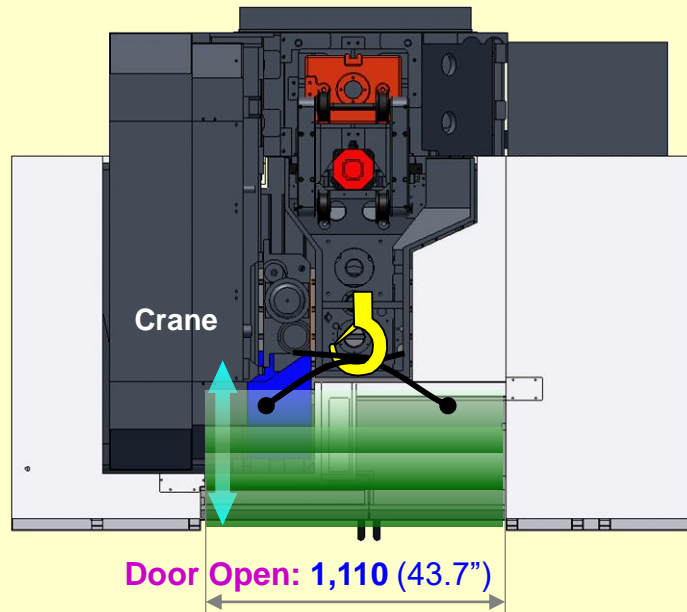


# C onvenient handling

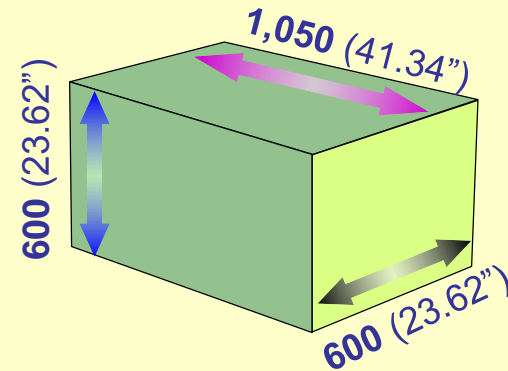
HS-M243-R1.0-20100208



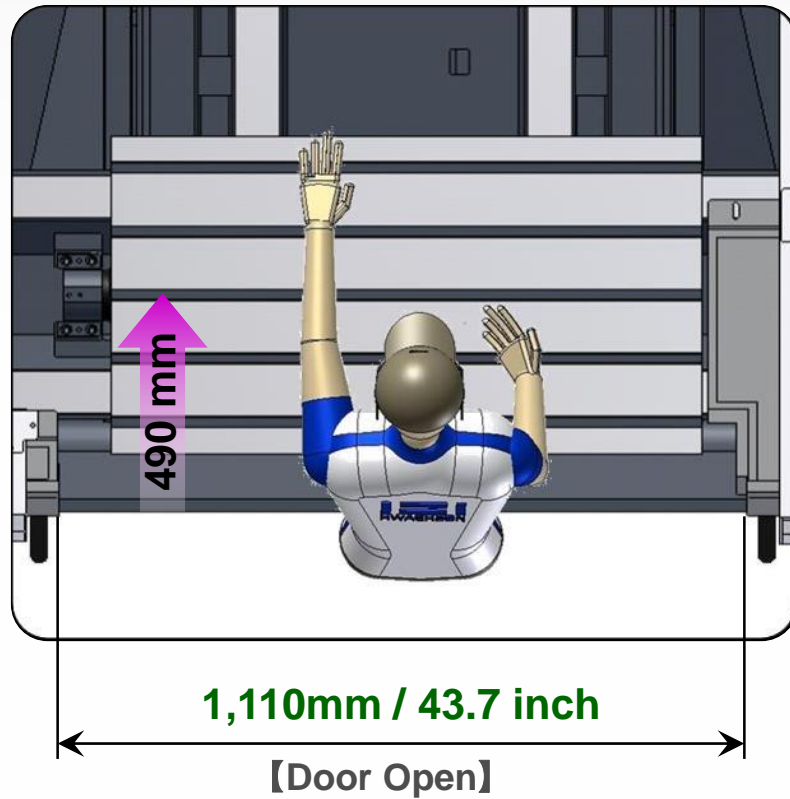
※ Unit: mm(inch)



※ Max. Work size



- ✚ Providing the convenient operation & easy handling of work piece by crane into the machine.
- ✚ It is possible to move the maximum work piece size into the machine by crane without any interference.
  - ▶ Length x Width x Height (LxWxH): 1,050x600x600 (mm)



## “Customization Design”

- + Convenient access to whole table
  - ▶ Wide width of door
  - ▶ Minimization of cumbersome around working area
  - ▶ No need to the additional footboard

## ● Lubrication method

### ✓ Lubrication Oil

3-axes guide way & ball screws are lubricated by oil.

### ✓ Automatic Oil Supply system

Oil pump supplies lubrication oil to each parts automatically.

→ For stable accuracy of whole axes

→ Life of parts is increase

### ✓ Safety

A low level alarm prevents the machine from restarting without lubricant.

## ● Specification

✓ Using Oil : ISO VG 68

✓ Tank capacity : 6 l (1.59gals)

✓ Discharge rate: 200 cc/50Hz, 240cc/60Hz

✓ Pressure : 20 bar

✓ Power : 42 W



## ● Coolant supplier

### ✓ External Tank

External coolant tank is installed in the left side of machine  
→ Easy to exchange coolant and clean the tank, maintain pump

### ✓ Separate Chip Bucket

Movable Chip bucket is adapted on the tank  
→ User can remove chip conveniently

### ✓ Oil Separation from Coolant

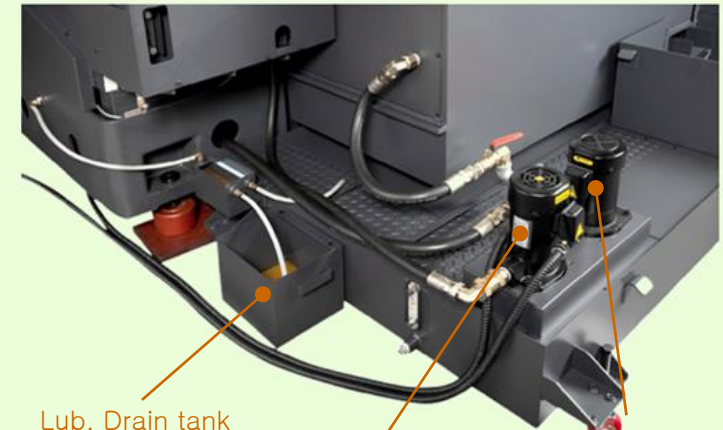
Oil used to lubricate & drain is separated from coolant for clean environment & long coolant life

### ✓ Variable Options on the tank

Lift-up chip conveyor : Hinge, Scraper type  
High pressure coolant (Opt.): **30 bar, 70 bar**

## ● Specification

- ✓ Using Oil (viscosity) : ISO VG 32
- ✓ Tank capacity : 270 l (71.33 gals)
- ✓ Pump power : 0.4 kW 1ea (Spindle)  
0.9 kW 1ea (Chip flushing)



Lub. Drain tank

Coolant pump for chip flushing

Coolant pump for spindle

Cool-Jet



Through coolant (Opt.)

## ● Compressed air supplier

### ✓ Air Requirement

- Air Blower
- Automatic Door
- Protect spindle bearing against dust (Air curtain)
- Input the booster for unclamp tool in spindle
- Blow off dirt & chip in spindle taper while tool is changed automatically
- Drive pot on magazine

### ✓ Using Option Parts

- Air gun
- Semi dry cutting system (Oil Mist)
- Tool measuring system

## ● Specification

- ✓ Required pressure : 5~7 bar
- ✓ Inlet hose : Ø12
- ✓ Max. consumption rate: 690 Nℓ/min (BT-40)  
760 Nℓ/min (BT-50)



# Tool Measuring & Compensation **【Option】**

HS-M243-R1.0-20100208

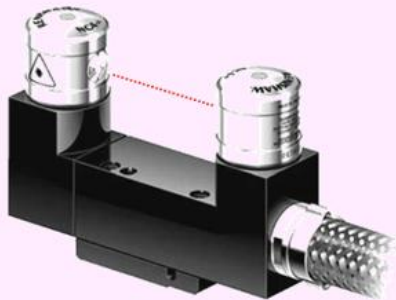
WORLD-CLASS QUALITY

**HWACHEON**

**RENISHAW**  
apply innovation



- Model : TS27R
- Type : Touch Probe
- Repeatability :  $\pm 1 \mu\text{m}$

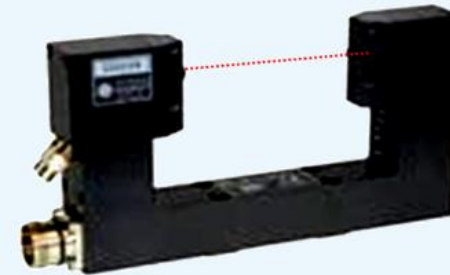


- Model: NC4 F145
- Type : Laser
- Repeatability :  $\pm 1 \mu\text{m}$
- Min. tool diameter for measure: 0.08 mm

**BLUM**



- Model : Z-3D
- Type : Touch Probe
- Repeatability :  $\pm 1 \mu\text{m}$



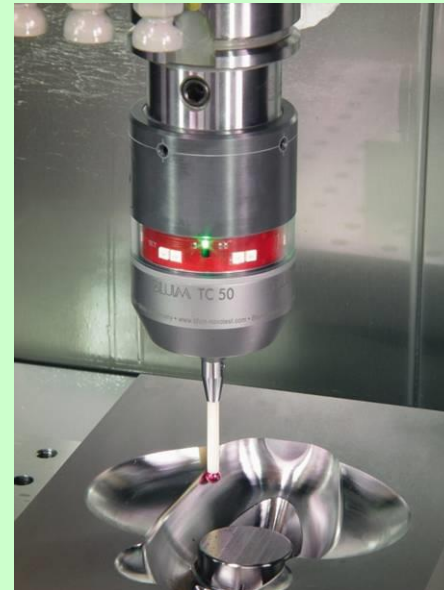
- Model: LASER NT
- Type : Laser
- Repeatability :  $\pm 0.2 \mu\text{m}$
- Min. tool diameter for measure: 0.03 mm

# Work piece Measuring System **[Option]**

HS-M243-R1.1-20100409



- Model : OMP60
- Type : Touch Probe
- Repeatability :  $\pm 1\mu\text{m}$
- Operation :  $360^\circ$ , 6 m
- Transmission Type : Optical type (Infra red)



- Model : TC50
- Type : Touch Probe
- Repeatability :  $\pm 1\mu\text{m}$
- Operation :  $360^\circ$ , 6 m
- Transmission Type : Optical type (Infra red)



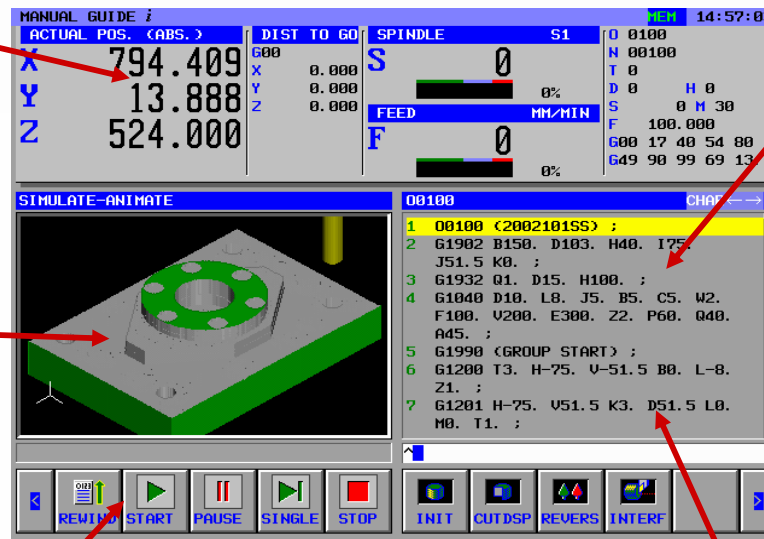
## ◆ Communication Programming Manual Guide i

□ Operation Guidance, which supports whole operations on an all-in-one screen .

**All-in-one Screen**  
Only one screen concentrated  
all operations

### Machine status window

Machine status such as actual position, feed rate and load meter are displayed always



The screenshot displays the 'MANUAL GUIDE i' interface. The top section shows 'ACTUAL POS. (ABS.)' with X: 794.409, Y: 13.888, Z: 524.000. It also shows 'DIST TO GO' (0.000), 'SPINDLE S1' (0), and 'FEED' (0). The middle section features a 'SIMULATE-ANIMATE' window with a 3D model of a part being machined. The bottom section shows a list of program lines (1-7) with ISO code. The bottom-most row contains control buttons: REWIND, START, PAUSE, SINGLE, STOP, INIT, CUT/DSP, REVERS, INTERF.

### Easy programming

Based on ISO-code program format, complex machining motions can be created easily by menu form

### Realistic machining simulation

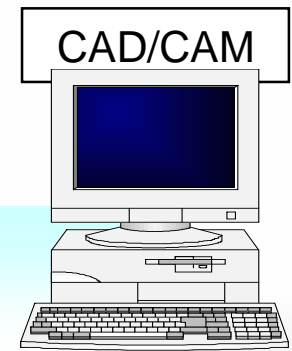
3-D solid model machining simulation is available

### Intuitive menu selecting

Menu can be selected easily and intuitively by soft-key with icon

### Good affinity with CAD/CAM

Most popular ISO-code program format on CAD/CAM can be dealt as it is



## 【Standard】



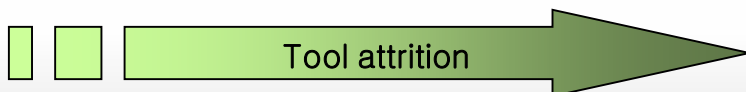
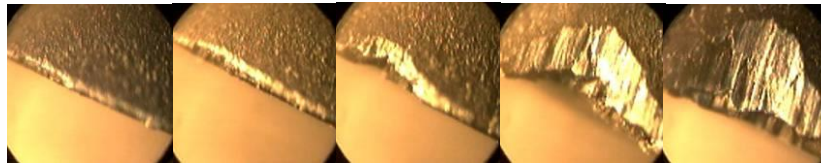
## Hwacheon Tool Load Detect

### What is HTLD?

- Measurement of tool load in real time for safe machining
- Prevention against any accident by breakage of tool

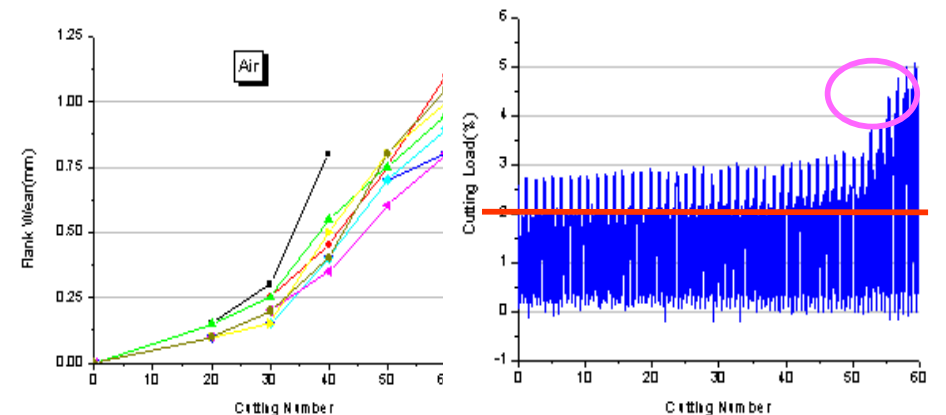
### About tool attrition load change

Cutting Length (Ad=0.3 Rd=20.0 1회=800mm)				
6mm(20 times)	9mm(30 times)	12mm(40 times)	15mm(50 times)	18mm(60 times)



⊕ *Protection of machine trouble*  
according to tool damage

⊕ *Protection of deterioration*  
according to abrasion of tool



▶ When tool attrition growth up, the cutting load increase in a crack.

**【Option】**



**Hwacheon Efficient Contour Control System**

*By choosing a process mode fit to the purpose sharply,  
"shorten the time for rough, medium, or precision cutting"*

## What is the HECC?

- With smoothing interpolation, "the elapsed time for CAM-Data creation and mapping reduced"
- With the function of overload automatic detection, "safe unattended process achieved and machine operation ratio improved"
- Choice Cycle time or Accuracy as each purpose → Maximization of machining efficiency
- Programmable by NC program easily (G-code)

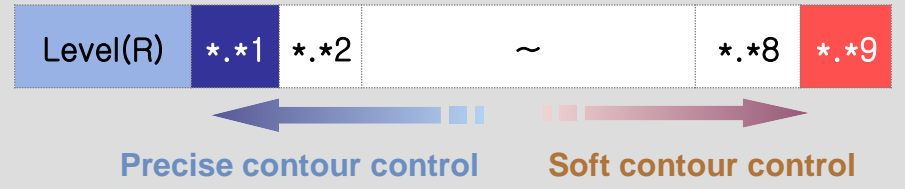
## Control of cutting speed & accuracy

- ✓ Level selection for Hwacheon M/C characteristic
- ✓ R1.0 ~ R9.0 Automatic calculation with 90 level parameters



## Control of smoothing interpolation

- ✓ Level selection according to production purpose
- ✓ R\*.1 ~ R\*.9 Automatic calculation with 9 level parameters



# Hwacheon's Original Machining control



WORLD-CLASS QUALITY

HWACHEON



## Cutting Feed Optimization System

### What is the OPTIMA?

With one method of adaptive control, the HTLD OPTIMA control the feed velocity to keep the cutting load regularity. The method of existing, the NC-DATA optimized the NC-DATA From the PC was the method which it change to the feed command (F) in NC-Code.

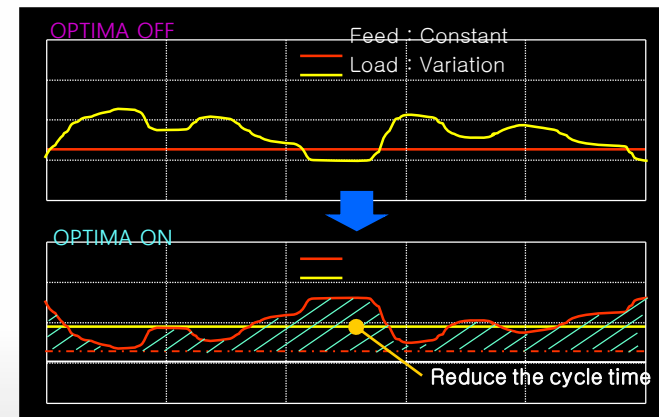
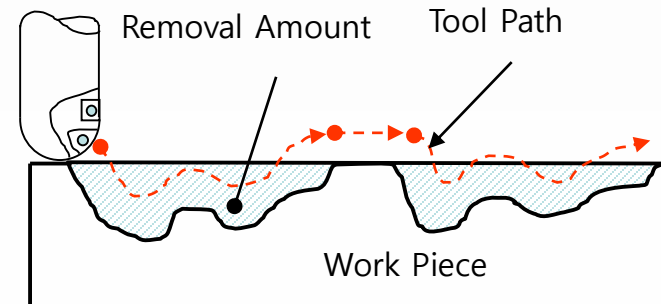
### Providing function with OPTIMA

- Graphic display with Load and Feedrate
- Convenient operation with simple G code
- Various data control according to Tool & Process
- Combined with HTLD function

## 【Standard】

- Advantage of *tool break detect*
- *High-Productivity*

*Reduction of cycle time because of a change the machining environment inclusive of tool state reacts immediately*



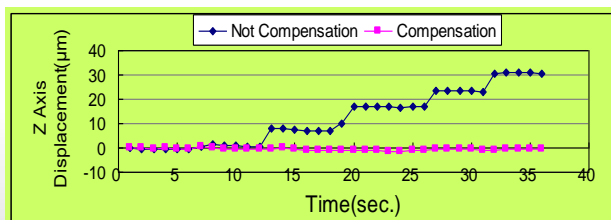
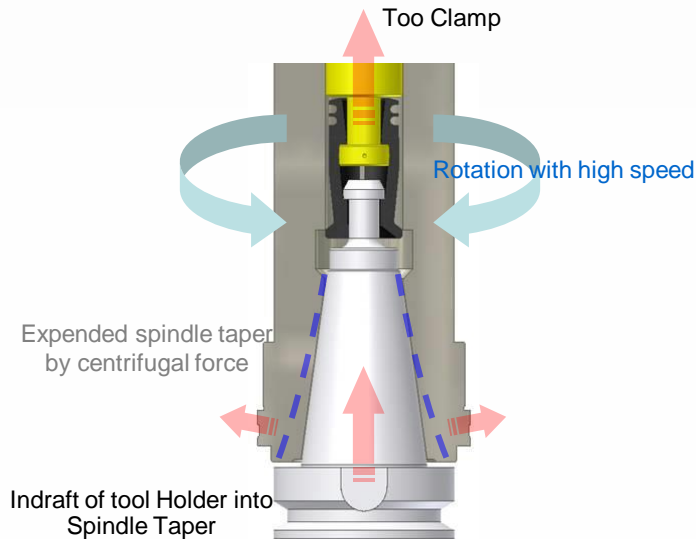
**【Standard】**



## Hwacheon Spindle Displacement Control System

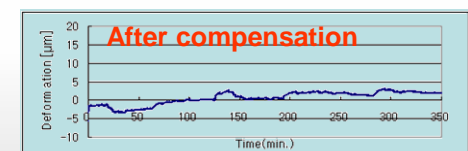
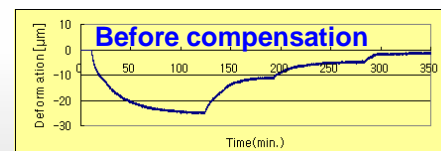
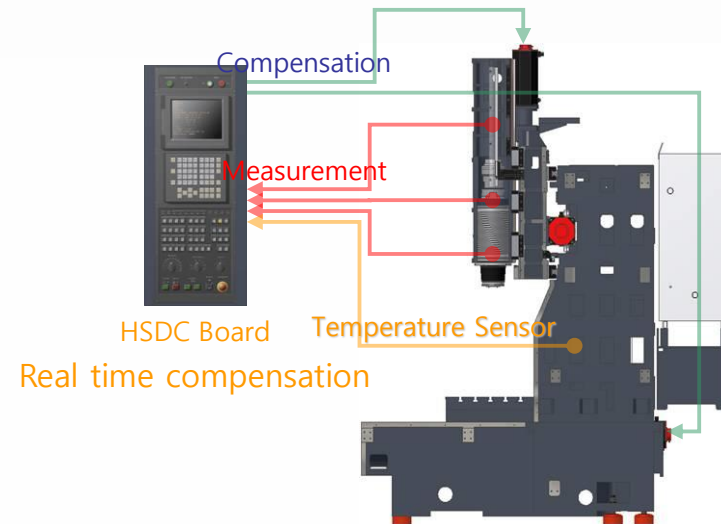
### ● Compensation of **Dynamic** deformation

Compensation of deformation according to the centrifugal force



### ● Compensation of **Thermal** Deformation

Compensation of spindle displacement in real time for high precision machining



**【Standard】**



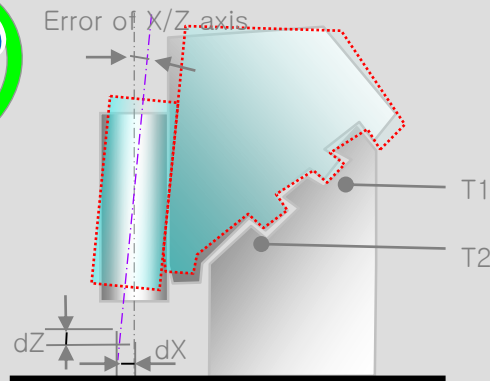
## Hwacheon Frame Displacement Control System

### ● What is the HFDC?

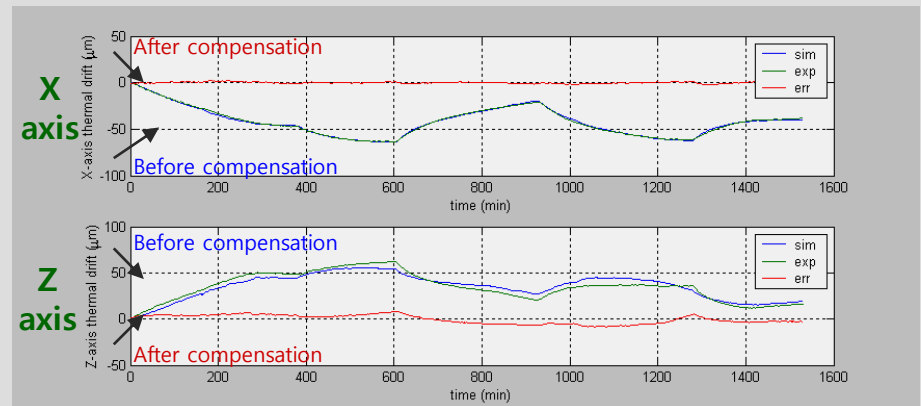
According to the movement of axes continuously, the heat occurs on the frame from the each integral part of the machine and gets up the expansion or a bending of the frame as below picture.

Therefore, this displacement makes trouble which is accuracy and surface problem while processing.

The Hwacheon Frame Displacement Control system (HFDC) compensate the error according to the temperature automatically. The high sensitivity temperature sensors are installed at integral elements and real-time perceives while processing. It is an artificial intelligence system of next generation.



※ The above picture shows the displacement value excessively for easy understanding.



※ The thermal deformation value of Y axis is almost 0 because symmetrical structure. So machine hasn't the function for Y-axis.

# Hwacheon's Original Machining control

HS-M243-R1.0-20100830



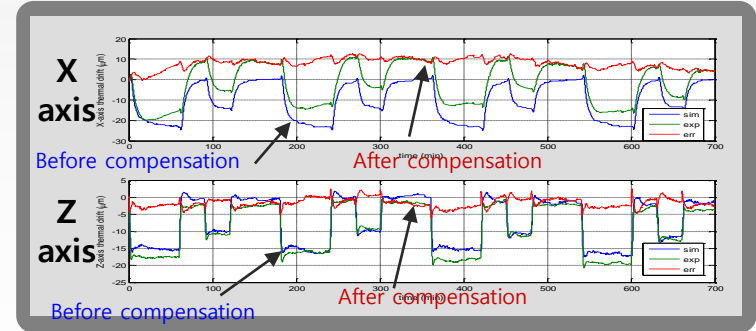
**[Standard]**

**NEW**  
**2009**  
New Function



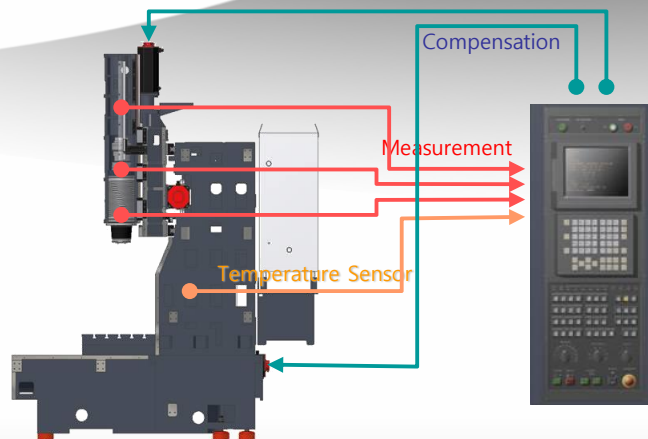
*Hwacheon Thermal Displacement Control System*

*The Best Solution For You!*

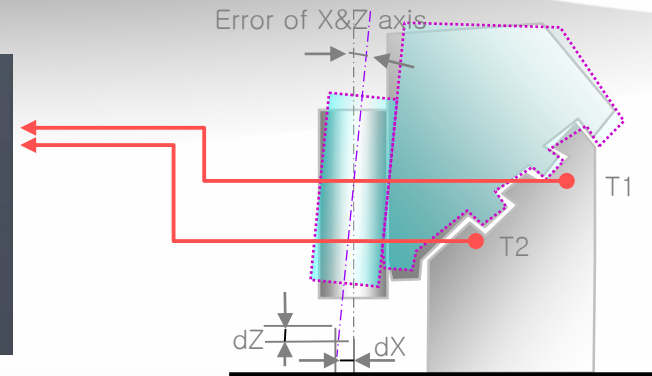


*Hwacheon Spindle Displacement Control System*

*Hwacheon Frame Displacement Control System*

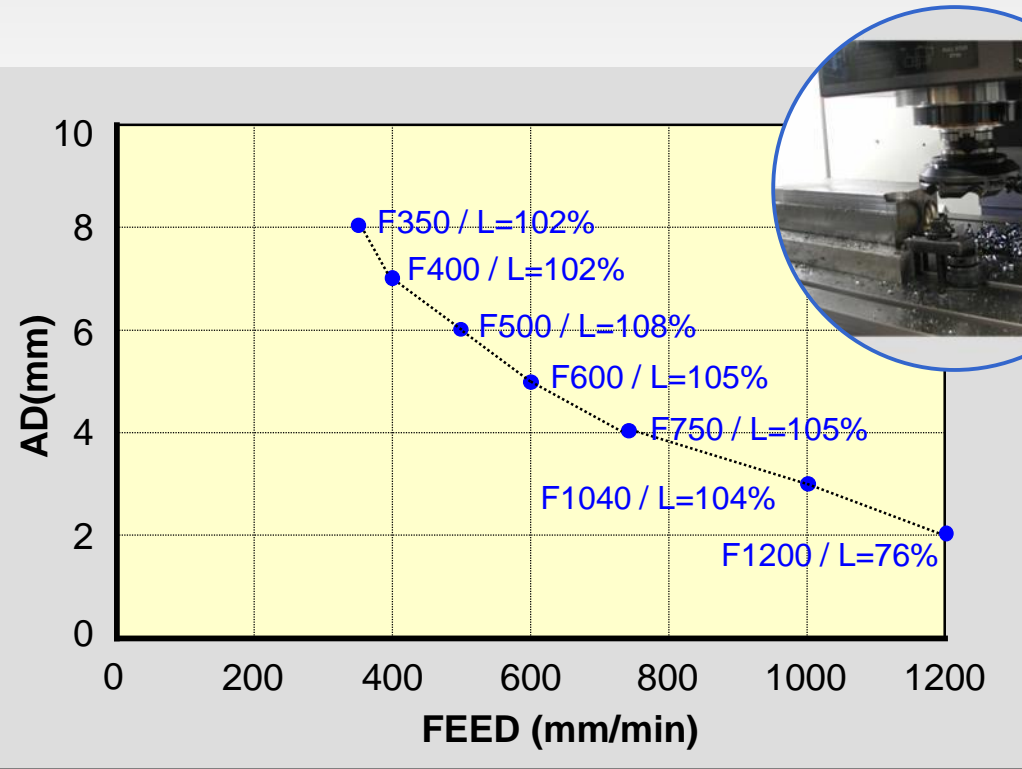


♠ **Spindle** Displacement Control



♠ **Frame** Displacement Control

# Cutting Ability 【Heavy cutting】



## ※ Condition

- Machine: **VESTA-850B**
- Spindle Motor power: **18.5/15kW**
- Servo Motor power (X/Y/Z): **3/3/4kW**
- Ball Screw Pitch (X/Y/Z): **12/10/10mm**
- Type of tool shank: **BT-50**
- Tool: **Face Mill (Ø160×8z)**
- Material: **SM 45C**

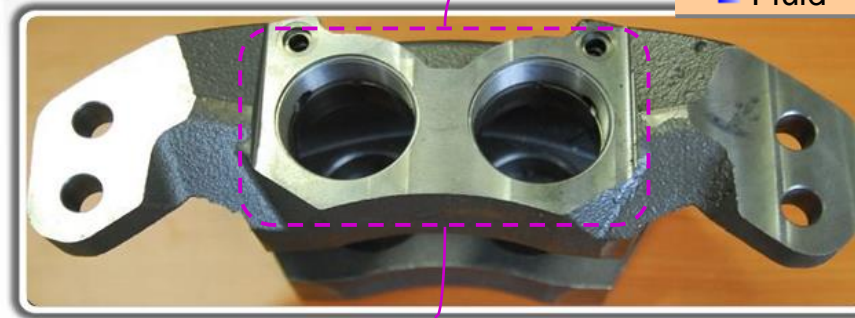
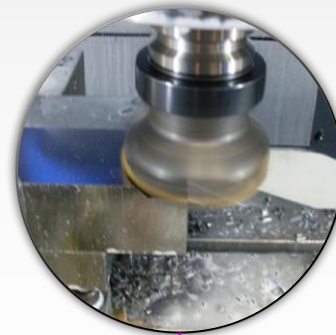
No	RPM(min-1)	F (mm/min)	Rd (mm)	Ad (mm)	Spindle Load (%)	Servo Load (%)
1	367	1200	140	2	76	-
2	367	1040	140	3	104	-
3	367	750	140	4	105	-
4	367	600	140	5	105	-
5	367	500	140	6	108	-
6	367	400	140	7	102	<b>83</b>
7	367	350	140	8	102	<b>83</b>



# Cutting Ability 【Heavy cutting】

## × Appeal point

- Provided stable cutting while heavy cutting and big drilling, tapping by Box way structure & Gear driven spindle

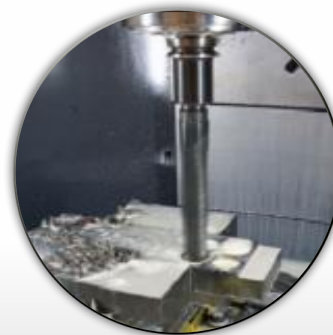


## Heavy cutting 1

■ Tool	Ø50 x 5z Face Mill
■ Material	GCD 300
■ Spindle Speed	1,300 rpm
■ Feedrate	1,300 mm/min
■ Cutting Depth	4 mm
■ Spindle Load	100%
■ Fluid	Water-soluble coolant

## Heavy cutting 2

■ Tool	Ø55 U-Drill
■ Material	GCD 300
■ Spindle Speed	450 rpm
■ Feedrate	100 mm/min
■ Cutting Depth	4 mm
■ Spindle Load	105%
■ Fluid	Spindle Through Coolant



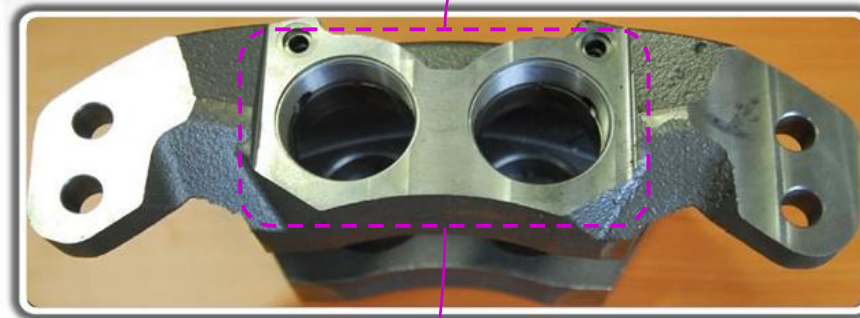
# Cutting Ability 【Precision cutting】

## ※ Appeal point

- Provided the high accuracy cutting due to stable high speed spindle and rigid machine structure
- Roundness:  $3\mu\text{m}$
- Positioning:  $3\mu\text{m}$



Precision Boring	
■ Tool	Ø60 Boring Bar
■ Material	GCD 300
■ Fluid	Water-soluble coolant
■ Cutting Ability	Roundness less than $3\mu\text{m}$



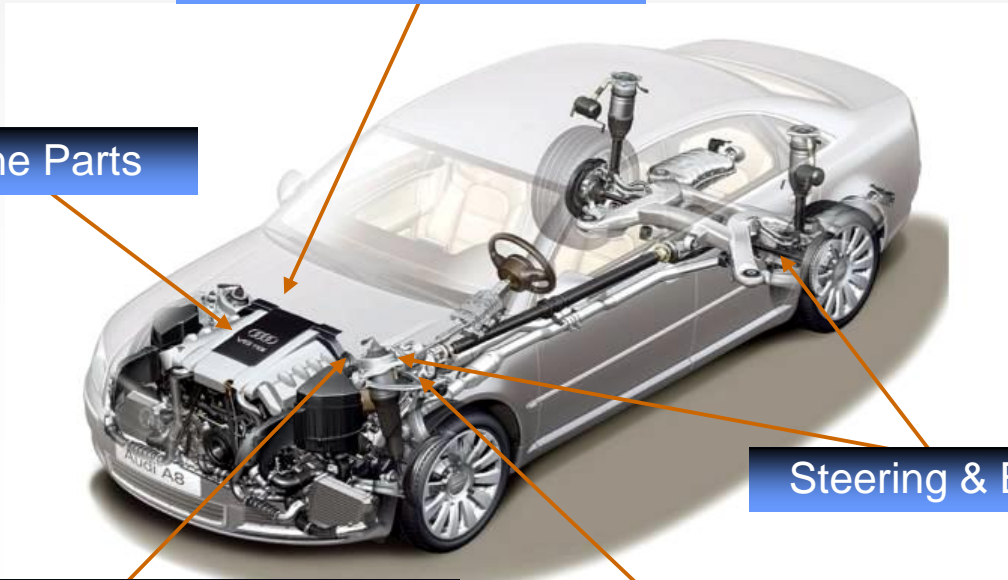
Positioning Accuracy	
■ Tool	Ø 60 U-Drill
■ Material	GCD 300
■ Fluid	Spindle Through Coolant
■ Cutting Ability	Positioning Accuracy less than $\pm 3\mu\text{m}$

※ The above accuracies may change according to the cutting condition.

# Application

Climate Control Parts

Engine Parts



Steering & Brake

Power Transmission & Mission

Propeller Shaft



**& parts for Job Shop**

