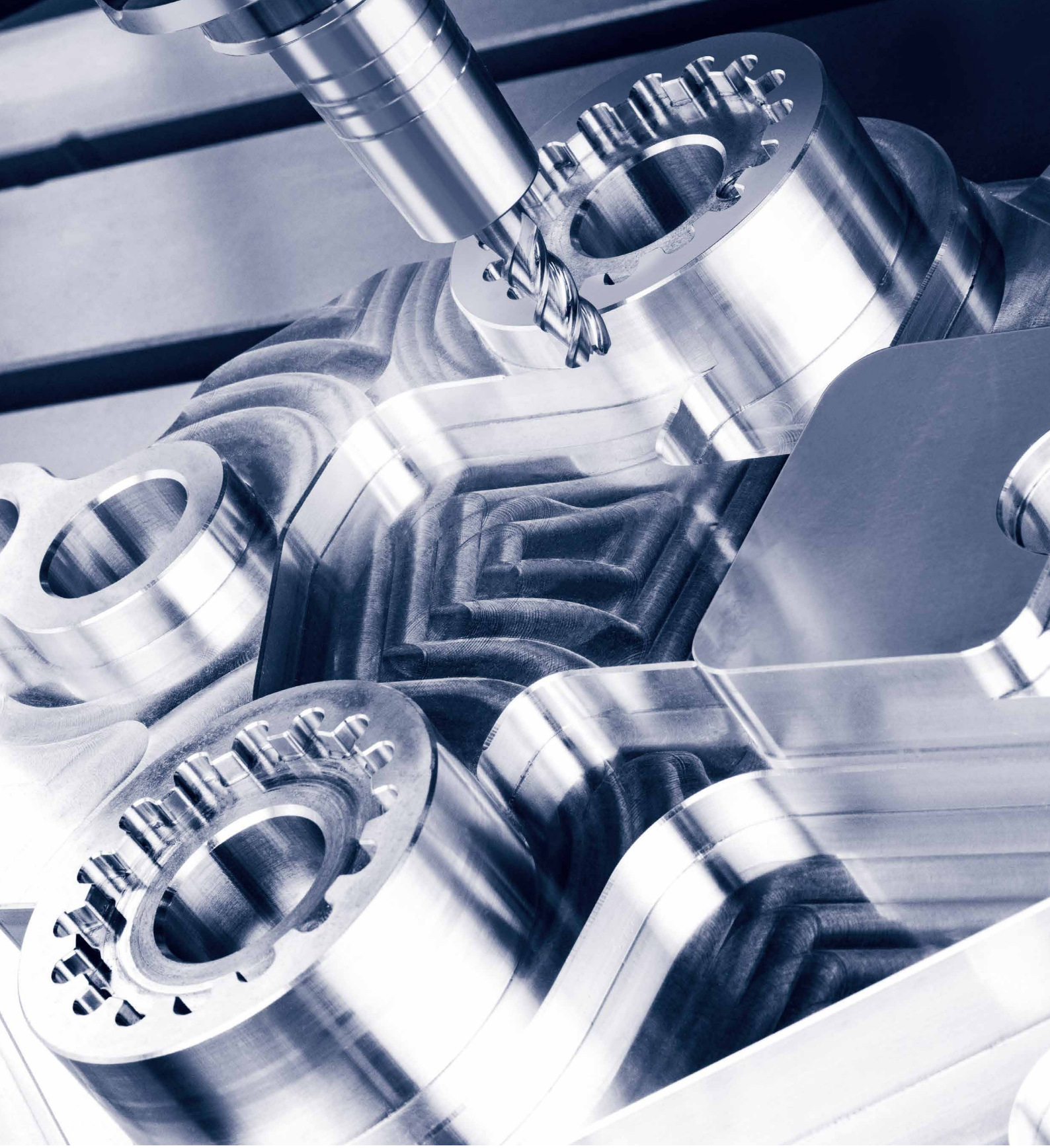
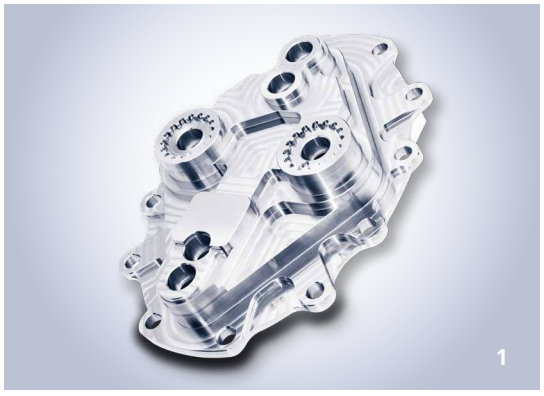


VESTA-1650

Software Optimized Vertical Machining Center

HWACHEON

Contents



1 Front Upright / Automobile Part / Aluminum

750mm Y-axis Vertical Machining Center with Software Function for Enhanced Productivity and Precision

VESTA-1650 is recommended for powerful cutting based on its stable structure. It is equipped with Hwacheon's proprietary technologies such as productivity enhancement software (HECC, HTLD and OPTIMA) and precision enhancement software (HTDC and HAI) and provides differentiated quality different from existing machining center for parts.

Enhanced User Convenience

1. Reduction in work fatigue (Front Two-door)
2. Pendant arm type operator panel
3. The tempered safety glass ensures machining visibility

Easy Maintenance

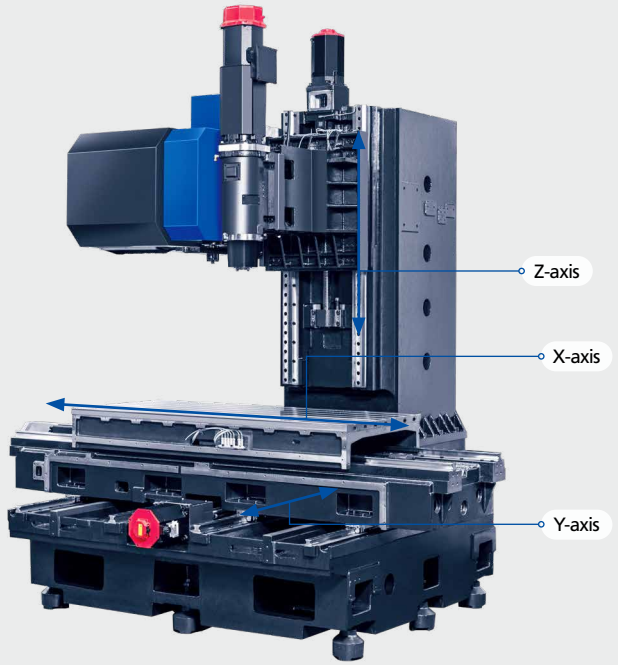
1. Back & Side type chip conveyor
   - STD : Side chip bucket
   - OPT : Back & Side type lift-up chip conveyor
2. Wide side door for user convenience

Upgrades for Enhanced Machining Performance

1. The table wide enough to mount multiple workpieces
2. Various direct-coupled main spindle specifications (STD: 10,000rpm / OPT: 12,000 , 15,000 , 8,000rpm)
3. Various magazine specification (BT-40: 30, 40, 60ea / BT-50: 24, 32, 40ea)
4. Enhanced chip to chip time
5. Hwacheon's proprietary software

Basic Information

Basic Structure



"Machining Stability Ensured"

- Stable machine structure
  (Outstanding rigid base and column structure ensured)
- C type structure for work accessibility
- High rigid LM guide for all axis
  - X-axis: Distributed load structure for 6ea LM Block
  - Y-axis: 4 columns LM guide for saddle rigidity

Stroke mm (inch)			Rapid Speed m/min (ipm)		
X-axis	Y-axis	Z-axis	X-axis	Y-axis	Z-axis
1,650 (64.96)	750 (29.53)	675 (26.57)	30 (1,181)	30 (1,181)	24 (945)

Table

* Unit : mm (inch)

"Wide Workpiece Mounting"

Possible to set workpieces and vices in various sizes

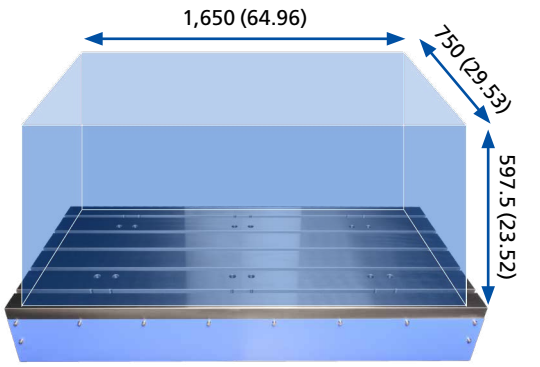
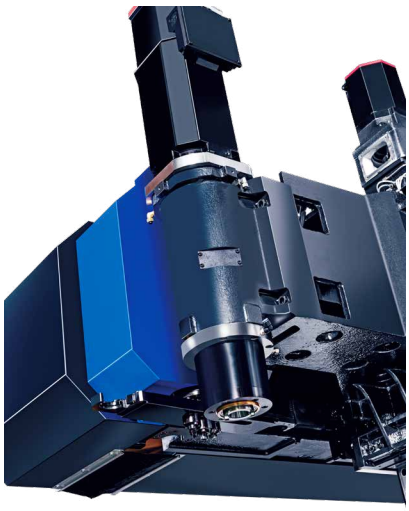


Table Size mm (inch)	T Slot W x P mm (inch)	Max Loading Capacity kg_f (lb_f)
1,700 x 750 (66.93 x 29.53)	18 x 100 (0.71 x 3.94) Number of T Slot: 7ea	1,500 (3,307)

Spindle

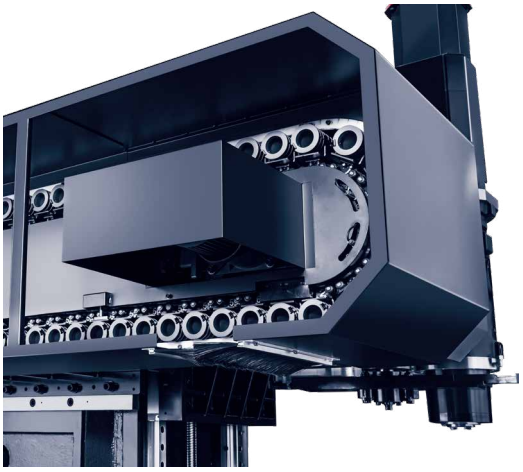
Meeting the customer's machining purposes

"Various Specifications for Direct-Coupled Spindles"



	Max Spindle Speed rpm		FANUC	
			Power kW	Torque Nm
BT-40	10,000 (STD)	Regular Type	18.5	117.7
		CTS Type		
	12,000	Regular Type		
		CTS Type		
	15,000	Regular Type		
		CTS Type		
BT-50	8,000	Regular Type	15	286
		CTS Type	26	165

Magazine



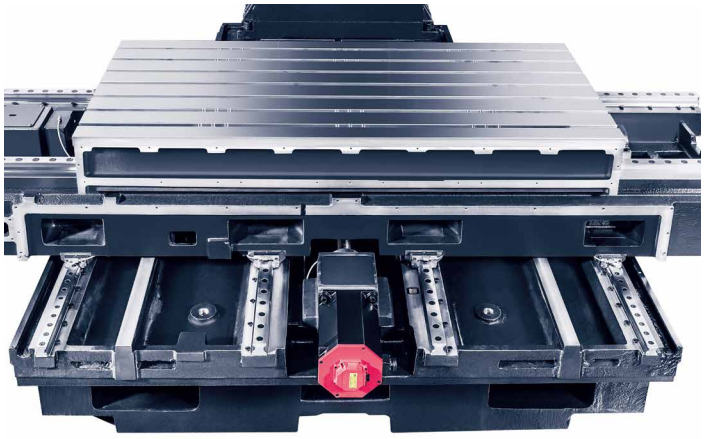
※ BT-40 60 Tools Magazine

"Magazines in Various Specifications"

Various specifications are available based on users' tool types

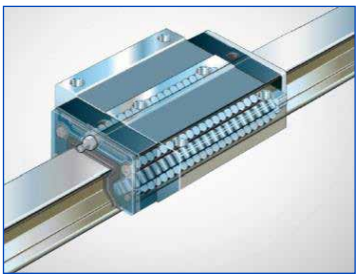
Item \ Tool Shank	BT-40 (OPT: CAT-40, SK-40)		BT-50 (OPT: CAT-50, SK-50)	
Tool Storage Capacity	30ea	40, 60ea	24ea	32, 40ea
Magazine Type	Drum Type	Chain Type	Drum Type	Chain Type
Method of Tool Selection	Memory Random			
Tool Change Type	Swing Arm			

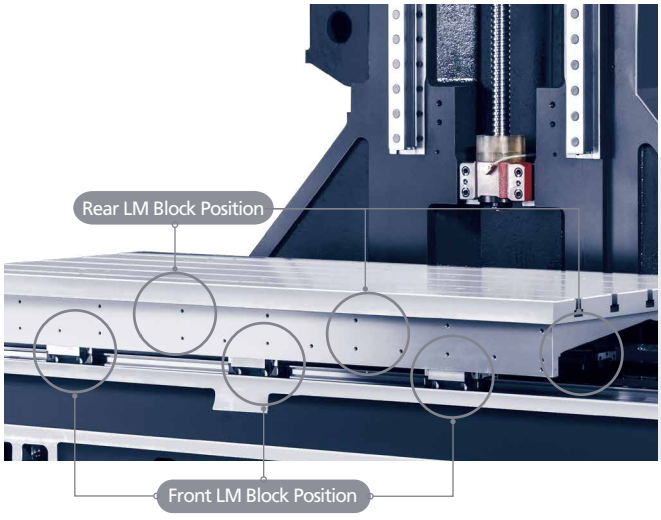
Feed System



"Improved rigidity in feed system"

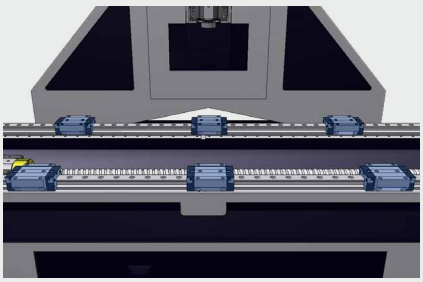
Y-axis has 4 columns LM guide for saddle rigidity



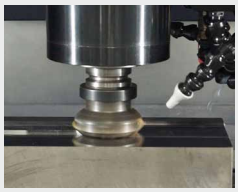


"X-Axis Structure for load distribution"

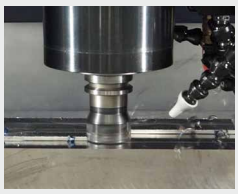
6 High-rigid LM Block



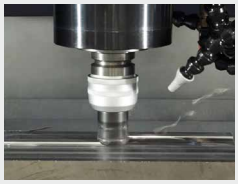
BT-40 Cutting Performance



Face mill, Carbon Steel (SM45C)					
Tool Dia mm (inch)	Material Removal Rate cm^3/min	Spindle Speed rpm	Feed mm/min (ipm)	Axial Depth mm (inch)	Radial Depth mm (inch)
80 (3.15)	246	1,500	820 (32.28)	5 (0.2)	60 (2.36)



Face mill, Carbon Steel (SM45C)					
Tool Dia mm (inch)	Material Removal Rate cm^3/min	Spindle Speed rpm	Feed mm/min (ipm)	Axial Depth mm (inch)	Radial Depth mm (inch)
60 (2.36)	310	1,500	1,550 (61.02)	5 (0.2)	40 (1.57)



Face mill, Carbon Steel (SM45C)					
Tool Dia mm (inch)	Material Removal Rate cm^3/min	Spindle Speed rpm	Feed mm/min (ipm)	Axial Depth mm (inch)	Radial Depth mm (inch)
50 (1.97)	320	1,500	1,600 (62.99)	5 (0.2)	40 (1.57)

U-Drill, Carbon Steel (SM45C)			
Tool Dia mm (inch)	Spindle Speed rpm	Feed mm/min (ipm)	Spindle Load %
30 (1.18)	1,500	360 (14.17)	100

Tap, Carbon Steel (SM45C)			
Tap Size	Spindle Speed rpm	Feed mm/min (ipm)	Spindle Load %
M28 x P3.0	300	900 (35.43)	100

* The machining results above are examples based on the factory test standards, and are subjected to the changes in conditions.

Standard / Optional Accessories Status

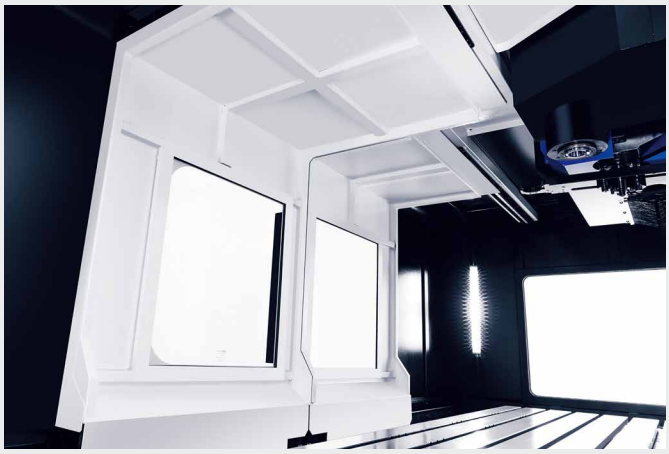
S : Standard O : Option

NO.	Item	Description				VESTA-1650
1	Spindle	#40	10,000rpm (Regular Type)	18.5 / 11kW	117.7Nm	S
2			10,000rpm (CTS Type)			O
3			12,000rpm (Regular / CTS Type)			O
4			15,000rpm (Regular / CTS Type)			O
5		#50	8,000rpm (Regular Type)	15 / 11kW	286Nm	O
6			8,000rpm (CTS Type)	26 / 22kW	165Nm	O
7	Magazine	#40	30 Tools Magazine			S
8			40, 60 Tools Magazine			O
9		#50	24, 32, 40 Tools Magazine			O
10	Tool Shank	#40	BT-40			S
11			CAT-40, SK-40			O
12		#50	BT-50, CAT-50, SK-50			O
13	Coolant Function	Head Coolant Pump (0.05MPa, 0.4kW)				S
14		CTS Coolant Device (Available when applying a back filter for non-aqueous)		3MPa	2.2kW	O
15				7MPa	2.2kW	O
16		Oil Mist (Semi dry cutting system)				O
17	Chip Removal Function	Air Blower				S
18		Coil Conveyor (1ea)				S
19		Air Gun				O
20		Coolant Gun				O
21		Lift-up Chip Conveyor		Hinge Type		O
22				Scraper Type		O
23				Mesh-drum Type		O
24		Mist Collector (Separately Mounting)				O
25	Precision Machining Function	Linear Scare (X / Y / Z)				O
26		Hwacheon Thermal Displacement Control System (HTDC)				S
27		Hwacheon Efficient Contour Control System (HECC)				S
28		Hwacheon Artificial Intelligence Control System (HAI): 40 Block				S
29		Hwacheon Artificial Intelligence Control System (HAI): 200, 400 Block				O
30		Lubrication System				S
31		Spindle Cooler (Jacket Cooling)		Fan Cooler Type (10,000rpm / 8,000rpm)		S
32				Oil Cooler Type (12,000rpm / 15,000rpm)		O
33	Measuring & Automation Function	Tool Measuring System: Renishaw / Blum (Touch Type, Laser Type)				O
34		Workpiece Measuring System: Renishaw / Blum (Touch Type)				O
35		Tool Life Management				O
36		Auto Door				O
37		Hwacheon Tool Load Detect System (HTLD)				S
38		Cutting Feed Optimization System (OPTIMA)				S
39	Convenient Functions	Ethernet Interface				S
40		MPG Handle (1ea)				S
41		MPG Handle (3ea)				O
42		Signal Lamp with 3 Color (R, G, Y)				S
43		10.4" Color LCD				S
44		Tool Box				S
45		NC Cooler				O
46		Oil Skimmer				O
47		Air Dryer		10,000rpm / 8,000rpm		O
48				12,000rpm / 15,000rpm		S
49		Door Interlock				S
50		Workpiece Coordinate System 48 pairs				S
51		Lubrication Oil Separation Tank				S
52		Perfect Base Around Splash Guard				S
53		Part Program Storage Length 1,280m (512kB)				S
54		Data Server (256MB)				O
55		Data Server (1,024MB)				O
56		Data Server Interface				O
57		Transformer				O
58		Manual Guide i				O
59		Monitoring Solution of Real-time Operational Status (M-VISION Plus)				O
60		4-Axis Interface				O

USER FRIENDLY DESIGN, A WIDE RANGE OF OPTIONAL FEATURES

User convenience and various additional function

VESTA-1650 system offers a user friendly design and a wide variety of upgrade options for a faster, more precise machining performance, so you can concentrate on what you do best : creating quality products.



"Improved work environment"

Totally enclosed cover design prevents scattering of chips and coolant while processing, maintaining pleasant work environment

"Excellent Chip Disposal"

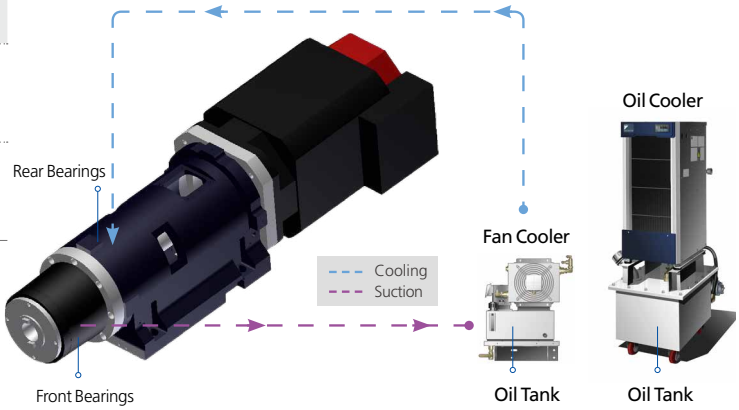
Wide and Steeply slanted slide cover structure that are located at the left and right provide excellent chip disposal performance

[STD]
- 1 Coil Conveyor (Front)
- Chip Flushing

[OPT]
- 2 Coil Conveyor (Front, Right Side)
- Lift-up Chip Conveyor

Cooling System

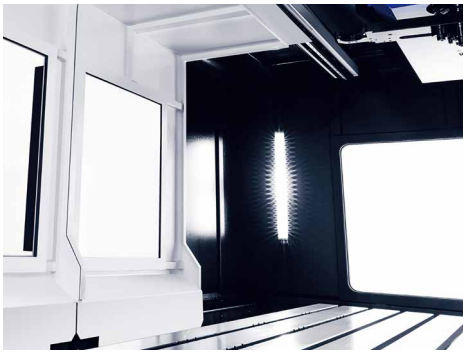
	Jacket Cooling	Bearing Lubrication
10,000 rpm (STD)	Fan Cooler	Grease Type
8,000 rpm		
12,000 rpm	Oil Cooler	Air-Oil Type
15,000 rpm		



Maintenance

Convenient Maintenance

Improved the manageability of machine through the integration of peripheral devices for required maintenance.



LED Work Light

Long-life LED work lights at three places ensures comfortable working environment and minimizes heat generation.

Excellent Coolant Tank and Chip Removal

"Possible to Select Type of Chip Conveyor"

· Hinge Type Chip Conveyor · Scraper Type Chip Conveyor
· Mesh-drum Type Chip Conveyor

External Coolant Tank Tank Capacity : 460 ℓ (121.52 gal)

- High capacity tank is positioned on the right side of machine for easier coolant change, tank cleaning and pump maintenance and etc.

Coolant Pump Specifications

CTS Coolant Pump (OPT)	Head Coolant Pump - Power : 0. 4 kW
- Pressure : 3, 7 MPa	Coolant Gun Pump - Power : 0.4 kW
- Power : 2.2 kW	Chip Flushing - Power : 1.1 kW

* CTS Coolant Pump : Available when applying a back filter for non-aqueous

Micro Chip Separation

Chip filter is used to remove micro chips and keep the coolant tank clean.

Convenient Operator Panel

Pendant Arm Type Operator Panel (STD)

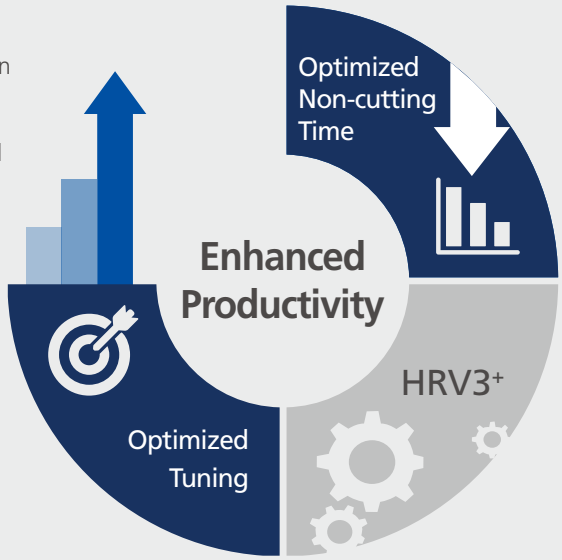
The operator panel is newly designed from the operator's viewpoint and thus enhances the operator's convenience.

"User Friendly Design"

- 10.4" display as standard
  (USB and PCMCIA cards as standard)
- Enhanced operability by optimizing the layout and improving the touch feeling of control buttons
- Horizontal keys enhance user convenience.
- Separately mounting MPG for workpiece setting convenience.
- Long time continuous DNC operation with the CF card even without the data server.

Machine Optimization (STD)

- Smart rigid tap function applied for machining time reduction.
- The cycle machining as well as the operating time and the acceleration / deceleration speed of feeding system are optimized.
- High-level precision, speed and smoothness are realized by enhanced processing performance of tiny segments.
- Dramatically reduced non-cutting time during machining ensures optimal productivity.
- The latest machining technology adopted.
- Machining surface quality enhanced by HRV3+ control.
  (HRV3+: effectively prevents machine oscillation by controlling the servo current to enhance the machining surface quality.)



"Enhanced Productivity"

Operating Convenience Function

< M-CODE LIST >

- M-CODE LIST
- The screen provides easy and quick search and utilization.

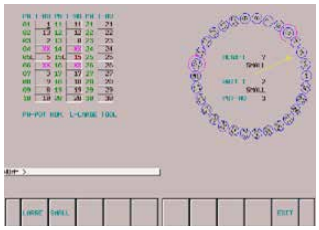
(However, it is necessary to discuss with factory in advance to add and / or change M-codes.)

< GUI (Graphical User Interface) >

- Graphic interface for tool / workpiece measurement
- Automatic offset update function
- Tool setting and damaged tool detection, Workpiece setup and measuring while machining
- Optimized time and failure rate High competitiveness

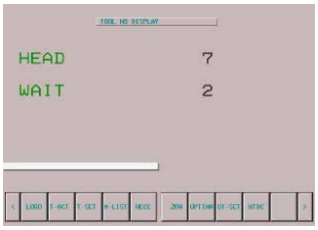
< Tool Management >

Large / Small Diameter Tool Management System



- Magazine tool management system
- Magazine tool check in real time
- Large / small diameter tools setting

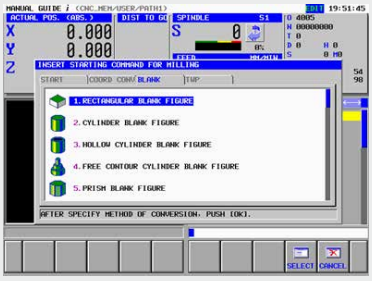
< Tool View >

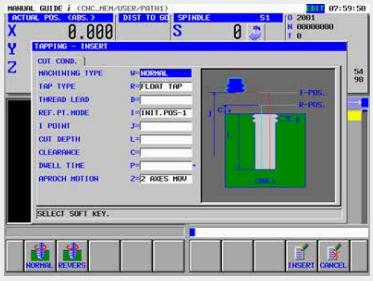


- Head mounted tool check in real time
- Waiting pot mounted tool check in real time

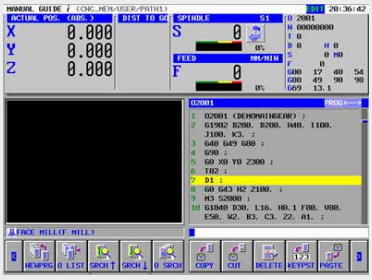
Manual Guide i

With the Manual Guide i, the operator is able to create a machining program for the desired geometry including the pattern simply if he / she enters numeric values for the basic machining geometry.





· Programming in convenient functions and rich machining cycles



· It displays the machine status and the tools in use while machining.

· The realistic machining simulation checks the program.

Hwacheon Software

Hwacheon Tool Load Detect System

"Detect and diagnose the most minute of tool-end point movement"

HTLD constantly monitors the tool wear to prevent accidents, which may occur from a damaged tool and help to stop tool wear from deteriorating the workpiece.
(The load is measured every 8 msec to ensure accuracy.)

Hwacheon High Efficiency Contour Control System

"Roughing quickly, finishing is precisely"

HECC offers an easy to use programming interface for different workpieces and different processing modes. The system provides a precise,custom contour control for the selected workpiece, while prolonging the life of the machine and decreasing process time. The customizable display provides real-time monitoring and quick access.

Cutting Feed Optimization System

"Maximize your productivity with intelligent system"

OPTIMA utilizes an adaptive control method to regulate the feed rate in real time, to sustain the cutting load during a machining process. As a result the tools are less prone to damage and the machining time is optimized.

Hwacheon Spindle Displacement Control System

"Real-time correction for the displacement in the spindle"

When the spindle rotates at high speed, the centrifugal force drives the taper to expand, causing errors in Z axis. HSDC constantly monitors the temperature at each spindle region and makes optimal prediction for thermal displacement. The system then makes necessary adjustments and eff ectively minimizing thermal displacement.

Hwacheon Frame Displacement Control System

"System for maintaining processing accuracy for a long period of machining"

HFDC is equipped with highly sensitive thermal sensors in the casting region where thermal activity is suspected; monitoring and correcting displacement.

Hwacheon Thermal Displacement Control System

"Hwacheon Spindle Displacement Control System + Hwacheon Frame Displacement Control System"

HTDC integrates the Hwacheon Spindle Displacement Control system and the Frame Displacement Control System.

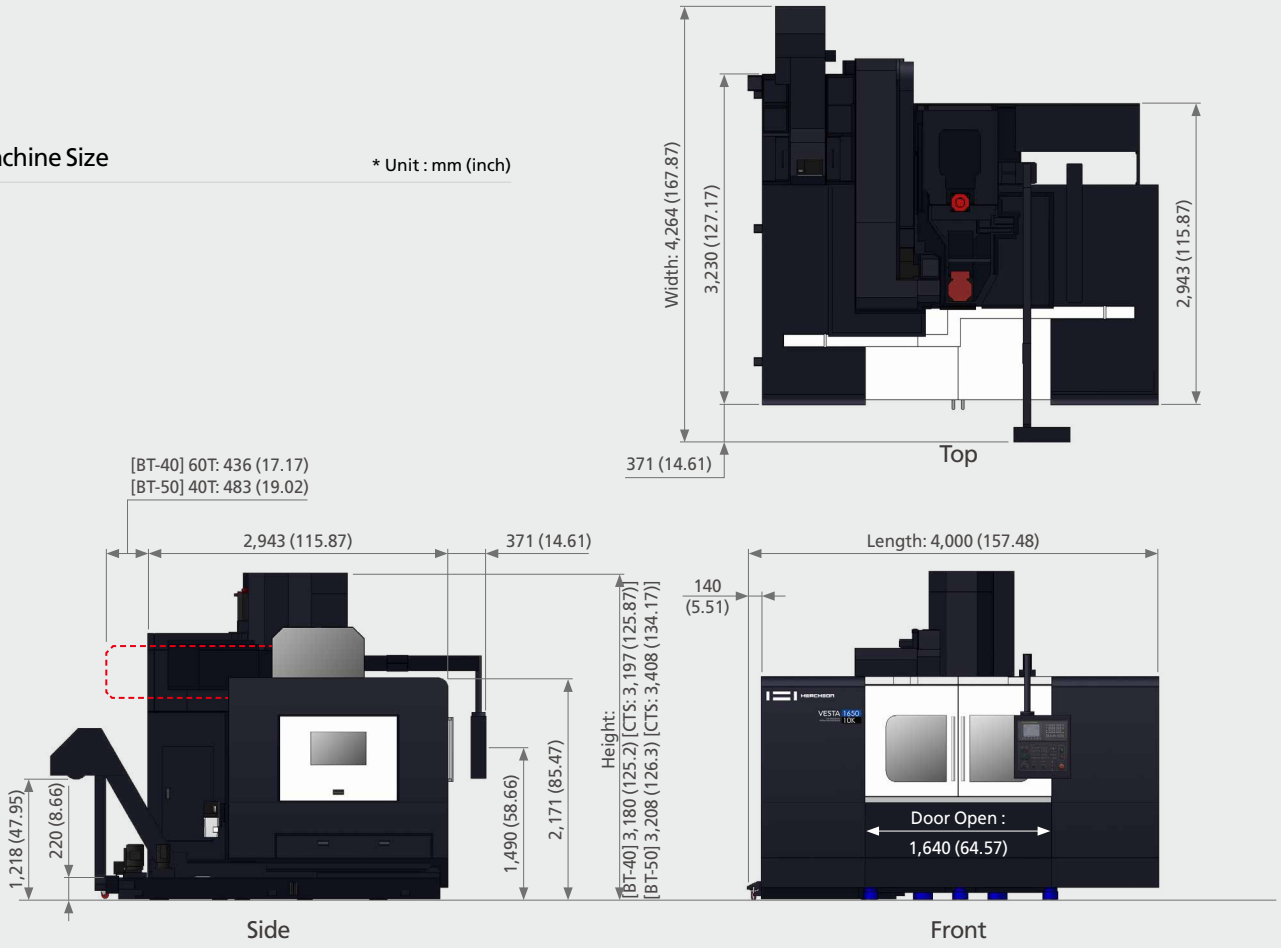
Monitoring Solution of Real-time Operational Status

"See everything everywhere"

- Monitoring system for the User's factory machine management
- User can always check the status of the machine utilizes a smartphone

Machine Size

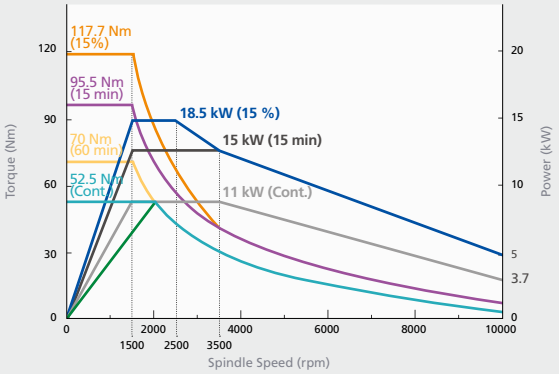
* Unit : mm (inch)



Spindle Power – Torque Diagram

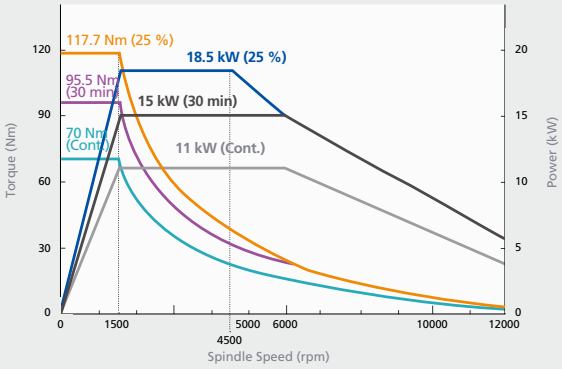
10,000 rpm (STD)

Max Power : 18.5 kW (25 HP) / Max Torque : 117.7 Nm



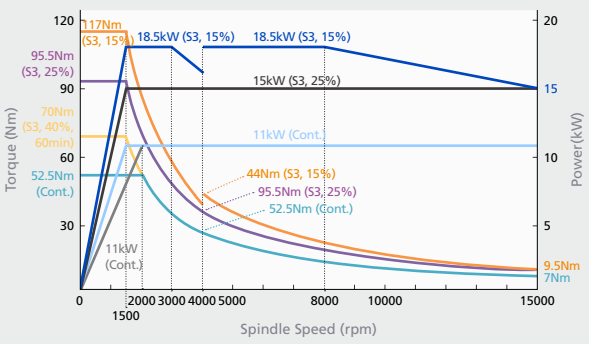
12,000 rpm

Max Power : 18.5 kW (25 HP) / Max Torque : 117.7 Nm



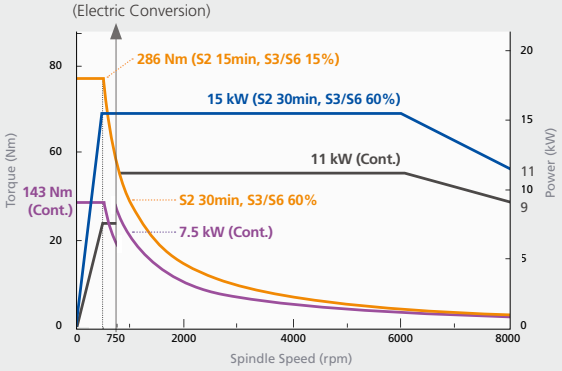
15,000 rpm

Max Power : 18.5 kW (25 HP) / Max Torque : 117.7 Nm



8,000 rpm

Max Power : 15 kW (20 HP) / Max Torque : 286 Nm



Product Line-up

Machine Specifications

Item		VESTA-1650			
Travel					
Stroke (X / Y / Z)	mm (inch)	1,650 / 750 / 675 (64.96 / 29.53 / 26.57)			
Distance from Table Surface to Spindle Gauge Plane	mm (inch)	150 ~ 825 (5.91 ~ 32.48)			
Distance between Columns to Spindle Center	mm (inch)	760 (29.92)			
Table					
Table Size	mm (inch)	1,700 x 750 (66.93 x 29.53)			
Table Loading Capacity	kg_f (lb_f)	1,500 (3,307)			
T Slot (WxP / No. of slots)	mm (inch)	18 x 100 (0.71 x 3.94) / 7ea			
Spindle					
Max Spindle Speed	rpm	10,000 (STD)	12,000	15,000	8,000
Spindle Motor	kW (HP)	18.5 / 11 (25 / 15)			15 / 11 (20 / 15) [CTS: 26 / 22 (35 / 30)]
Type of Spindle Taper Hole	-	ISO#40, 7/24 Taper			ISO#50, 7/24 Taper
Spindle Bearing Inner Diameter	mm (inch)	Ø70 (2.76)			Ø90 (3.54)
Feedrate					
Rapid Traverse (X / Y / Z)	m/min (ipm)	30 / 30 / 24 (1,181 / 1,181 / 945)			
Motor					
Feed Motor (X / Y / Z)	kW (HP)	3 / 3 / 3 (4 / 4 / 4)			
Coolant Motor (Spindle)	kW (HP)	0.4 (0.5)			
Spindle Cooler Motor	kW (HP)	0.18 (0.2)	2.8 / 3.2 (3.8 / 4.3)		0.18 (0.2)
ATC					
Type of Tool Shank	-	BT-40 (OPT: CAT-40, SK-40)			BT-50 (OPT: CAT-50, SK-50)
Type of Pull Stud	-	MAS P40T-1 (45°)			BT-50 (90°)
Tool Storage Capacity	ea	30 (OPT: 40, 60)			24 (OPT: 32, 40)
Max Tool Dia(with / without Adjacent Tools)	mm (inch)	Ø78 / Ø150 (3.07 / 5.91)			Ø110 / Ø220 (4.33 / 8.66)
Max Tool Length	mm (inch)	300 (11.81)			350 (13.78)
Max Tool Weight	kg_f (lb_f)	8 (17.64)			20 (44.09)
Method of Tool Selection	-	Memory Random			
Power Source					
Electric Power Supply	kVA	45			45 (CTS: 55)
Compressed Air Supply (Pressure x Consumption)	-	0.5 ~ 0.7 MPa x 690 N ℓ/min			
Tank Capacity					
Spindle Cooling / Lubrication	ℓ (gal)	20 / 6 (5.28 / 1.59)			
Coolant	ℓ (gal)	460 (121.52)			
Machine Size					
Height	mm (inch)	3,197 (125.87)			3,408 (134.17)
Floor Space (Length x Width)	mm (inch)	4,000 x 3,893 (157.48 x 153.27)			
Weight	kg_f (lb_f)	12,000 (26,455)			12,500 (27,558)
NC Controller		Fanuc 0i-MF			

NC Specifications [Fanuc 0i-MF]

※ S : Standard O : Option

Item	Specification	
Controlled Axis		
Controlled Axis	3-axis	S
Controlled Axis	5-axis (Max)	O
Simultaneously Controlled Axes	3-axis	S
Simultaneously Controlled Axes	4-axis (Max)	O
Least Input Increment	0.001mm, 0.001deg, 0.0001inch	S
Least Input Increment 1 / 10	0.0001mm, 0.0001deg, 0.00001inch	O
inch / metric Conversion	G20, G21	S
Store Stroke Check 1		S
Store Stroke Check 2		S
Mirror Image		S
Stored Pitch Error Compensation		S
Backlash Compensation		S
Operation		
Automatic & MDI Operation		S
DNC Operation by Memory Card	PCMCIA Card is Required	S
Program Number Search		S
Sequence Number Search		S
Dry Run, Single Block		S
Manual Handle Feed	1Unit	S
Manual Handle Feed Rate	x1, x10, x100	S
Handle Interruption		S
Interpolation Function		
Positioning	G00	S
Linear Interpolation	G01	S
Circular Interpolation	G02, G03	S
Dwell (Per Deconds)	G04	S
Cylindrical Interpolation	4-Axis Interface Option is Required	S
Helical Interpolation	Circular interpolation plus max 2 axes linear interpolation	S
Reference Position Return Check	G27	S
Reference Position Return Return	G28,G29	S
2nd Reference Position Return	G30	S
Skip Function	G31	S
Feed Function		
Rapid Traverse Override	F0, F25, F50, F100	S
Feedrate (mm/min)		S
Feedrate Override	0 ~ 200 %	S
Jog Feed Override	0 ~ 6,000 mm/min	S
Override Cancel	M48, M49	S
Program Input		
Tape Code	EIA / ISO	S
Optional Block Skip	9 ea	S
Program Number	O4 - Digits	S
Sequence Number	N8 - Digits	S
Decimal Point Programming		S
Coordinate Dystem Detting	G92	S
Workpiece Coordinate System	G54 - G59	S
Workpiece Coordinate System Preset		S
Addition of Workpiece Coordinate Pair	48 ea	S
Extend Program Edit Function	Copy / Move / Etc.	S
Manual Absolute ON and OFF		S
Chamfering / Corner R		S
Programmable Data Input	G10	S
Sub Program Call	10 Folds Nested	S
Custom Macro B		S
Addition of Custom Macro Common Variables	#100 - #199, #500 - #999	S
Feedrate Control With Acceleration in Circular Interpolation		S

Item	Specification	
Program Input		
Scaling		S
Canned Cycles for Drilling		S
Automatic Corner Override		S
Coordinate System Rotation		S
Polar Coordinate Command		S
Programmable Mirror Image		S
Tape Format for Fanuc Series 10 / 11		S
Manual Guide i		O
Spindle Speed Function		
Spindle Serial Output		S
Spindle Override	50-120 %	S
Spindle Orientation		S
Rigid Tapping		S
Tool Function / Compensation		
Tool Function	T4-digits	S
Tool Offset Pairs	±6-digits / 400 ea	S
Tool Offset Memory C		S
Cutter Compensation C		S
Tool Length Measurement		S
Tool Life Management		O
Tool Length Compensation		S
Editing Operation		
Part program Storage length	1,280 m (512 kB)	S
Number of Register Able Programs	400 ea	S
Background Editing		S
Extended Part Program Editing		S
Play Back		S
Setting and Display		
Clock Function		S
Self-Diagnosis Function		S
Alarm History Display		S
Help Function		S
Graphic Function		S
Run Hour and Parts Count Display		S
Dynamic Garphic Display		O
Multi-language Display	English, German, French, Italian, Chinese, Spanish, Korean, Portuguese, Polish, Hungarian, Swedish, Russian	S
Data Input / Output		
Reader / Puncher Interface Ch1	RS232C	S
Data Server	256 MB / 1,024 MB	O
Data Server Interface		O
Ethernet Interface		S
Memory Card Interface		S
USB Interface		S
Others		
Display Unit	10.4" Color LCD	S
HWACHEON Machining Software		
Hwacheon Artificial Intelligence Control System (HAI) : 40 Block		S
Hwacheon Artificial Intelligence Control System (HAI) : 200 / 400 Block		O
Hwacheon Efficient Contour Control System (HECC)		S
Hwacheon Tool Load Detect System (HTLD)		S
Cutting Feed Optimization System (OPTIMA)		S
Hwacheon Thermal Displacement Control System (HTDC)		S
4-Axis Interface Function (Option)		
Controlled Axis	Included 4-axis interface Option	O
Simultaneously Controlled Axis	Included 4-axis interface Option	O
Control Axis Detach	Included 4-axis interface Option	O

Hwacheon Global Network

Hwacheon Headquarters Hwacheon Europe Hwacheon Asia Hwacheon America

HWACHEON

Please contact us for product inquiries.

www.hwacheon.com

The product design and specifications may change without prior notice.
Read the operation manual carefully and thoroughly before operating the product,
and always follow the safety instructions and warnings labels attached on the surfaces of the machines.

HEAD OFFICE
HWACHEON MACHINE TOOL CO., LTD.
123-17, HANAMSANDAN 4BEON-RO, GWANGSAN-GU, GWANGJU, KOREA
TEL: +82-62-951-5111 FAX: +82-62-951-0086

SEOUL OFFICE
46, BANGBAE-RO, SEOCHO-GU, SEOUL, KOREA
TEL: +82-2-523-7766 FAX: +82-2-523-2867

USA
HWACHEON MACHINERY AMERICA, INC.
555 BOND STREET, LINCOLNSHIRE, ILLINOIS, 60069, USA
TEL: +1-847-573-0100 FAX: +1-847-573-9900

SINGAPORE
HWACHEON ASIA PACIFIC PTE. LTD.
21 BUKIT BATOK CRESCENT, #08-79 WCEGA TOWER,
658065, SINGAPORE
TEL: +65-6515-4357 FAX: +65-6515-4358

VIETNAM
HWACHEON MACHINE TOOL VIETNAM CO., LTD.
UNIT 507, 5TH FLOOR, LOT T2-4, D1 ROAD, SAIGON HI-TECH PARK,
TAN PHU WARD, DISTRICT 9, HO CHI MINH CITY, VIETNAM
TEL: +84 (0)28-2253-2613 FAX: +84 (0)28-2253-2614

GERMANY
HWACHEON MACHINERY EUROPE GMBH
JOSEF-BAUMANN STR. 25, 44805, BOCHUM, GERMANY
TEL: +49-234-912-816-0 FAX: +49-234-912-816-60

INDIA
HWACHEON MACHINE TOOL INDIA PVT. LTD.
LUNKAD SKY VISTA, UNIT NO.202, 2ND FLOOR PLOT NO.84,
LOHEGAON, VIMAN NAGAR, PUNE 411014, INDIA
TEL: +91-96-73-986633

CHINA
HWACHEON MACHINE TOOL CHINA CO., LTD.
B03A LIANGUAN JUHE INTERNATIONAL HARDWARE CITY, NO.
143 ZHENANZHONG ROAD, JINXIA, CHANGAN TOWN,
DONGGUAN CITY, GUANDONG PROVINCE , CHINA #523852
TEL: +86-769-8932-0601 FAX: +86-769-8932-0602

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