Makino Milling Machine Co., Ltd.

Head Office
3-19 Nakane 2-chome, Meguro-ku, Tokyo-to 152-8578, Japan Tel: +81(0)3-3717-1151 Fax: +81(0)3-3725-2105 URL http://www.makino.co.jp

International Operation Department Atsugi Works
4023 Nakatsu, Aikawa-machi, Aiko-gun, Kanagawa-ken 243-0303, Japan Tel: +81(0)46-284-1536 Fax: +81(0)46-286-4334

Makino J Co., Ltd.
4007 Nakatsu, Aikawa-machi, Aiko-gun, Kanagawa-ken 243-0303, Japan Tel: +81(0)46-286-8350 Fax: +81(0)46-286-8385 URL http://www.makinoj.co.jp/

Makino Inc.
7680 Innovation Way, Mason, Ohio, 45040, U.S.A.
Tel: +1-513-573-7200 Fax: +1-513-573-7360 URL http://www.makino.com

Makino Inc. Makino Die/Mold Technologies Center (Detroit)
2600 Superior Court, Auburn Hills, MI 48326 U.S.A.
Tel: +1-248-232-6200

Makino GmbH/Makino Europe GmbH (Hamburg)
Essener Bogen 5, 22419 Hamburg, Germany
Tel: +49 40 29809-0 Fax: +49 40 29809-400 URL http://www.makino.de

Makino GmbH (Kirchheim)
Kruichling 18, 73230 Kirchheim unter Teck, Germany
Tel: +49 7021 503-0 Fax: 49 7021 503-400 URL http://www.makino.de

Makino France S.A.S.
Bâtiment Ronsard Hall A Paris Nord 2 22, Avenue de Nations
CS 45045 Villepinte 95912 Roissy Charles De Gaulle Cedex France
Tel.: +33 1 787843-43 Fax: +33 1 787843-20 URL http://www.makino.fr

Makino Italia S.r.l.
Strada privata delle Orobie, 5 Localitá Santa Maria in Campo 20873 Cavenago Brianza (MB), Italia
Tel: +39 02 9594 82-90 Fax: +39 02 9594 8240 URL http://www.makino.it

Makino Iberia s.l.u.
C/ Agricultura,16-18, 2° 4ª, 08320 El Masnou,Barcelona,Spain
Tel: +34 93 555 9515

Makino s.r.o.
Tuhovská 31, 83106 Bratislava, Slovakia
Tel: +421 2 4961 2100 Fax: +421 2 4961 2400 URL http://www.makino.sk

Makino Europe GmbH (Moscow)
4th Dobrininsky Pereulok 8 Office C13-02 119049 Moscow Russian Federation
Tel: +7 495 9 89 82 20 Fax: +7 495 9 89 82 21

Makino Asia Pte Ltd
2 Gul Avenue, Singapore 629649
Tel: +65 68615722 Fax: +65 68611600 URL http://www.makino.com.sg

Makino China Co., Ltd.
No.2, Mu Ye Road, Yushan Town, Kunshan City, 215 316, China
Tel: +86-512-5777 8000 Fax: +86-512-5777 9900 URL http://www.makino.com.cn

Makino India Private Limited
No.11, Export Promotion Industrial Park, Whitefield Road, K.R.Puram,
Bangalore 560 066, India
Tel: +91-80-6741 9500 Fax: +91-80-6741 9523 URL http://www.makinoindia.co.in

PT Makino Indonesia
Gading Mediterania Residences RK.008/D
Jl. Boulevard Bukit Gading Raya, Kelapa Gading Jakarta Utara 14240 Indonesia.
Tel: +62 2130041022 Fax: +62 2130041023

Makino Technology Center Sdn Bhd
No. 11,Jalan Teras 2 Kawasan Industri Teras,
43300 Balakong Selangor,Darul Ehsan Kuala Lumpur Malaysia
Tel: +603 89611973 Fax: +603 89611971

Makino (Thailand) Co., Ltd.
57/23 Moo 4, Ramintra Road, km 2, Anusaowaree, Bangkhen, Bangkok 10220 Thailand
Tel: +66 2 971 5750 Fax: +66 2 971 5751 URL http://www.makino.com.th

Makino Asia Pte Ltd Vietnam office
9th Floor, Vinaconex Building 47 Dien Bien Phu Street, Da Kao Ward District 1,
Ho Chi Minh City Vietnam
Tel: +84 839104832 Fax: +84 839104994

Makino Korea Co., Ltd.
335-12, Dokusan-Dong, Geumcheon-Gu, Seoul, Korea
Tel: +82(0)2-856-8686 Fax: +82(0)2-856-8555 URL http://www.makinoseoul.co.kr

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Vertical Machining Center

V22

Going far beyond the concept of direct die/mold machining

Stability of small diameter tools

KEY TECHNOLOGY

- Low vibration spindle with no deflection
- Super GI.4 control

Pursuit of superb machined surface quality

KEY TECHNOLOGY

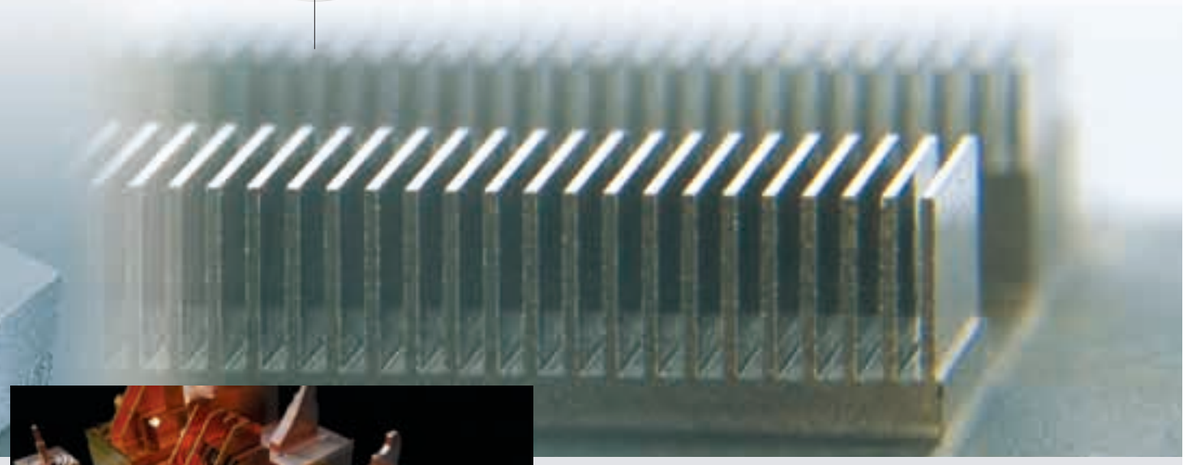
- Low-vibration spindle with no deflection
- Slideways with outstanding vibration absorption
- Super GI.4 control
- 50-nm scale feedback

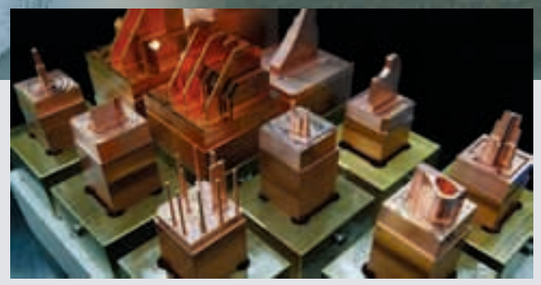
Precise control of the tool tip position

KEY TECHNOLOGY

- Hybrid automatic tool length measuring device
- Spindle core cooling
- Thermal Guard

Going far beyond the concept of electrode machining





Stability of small diameter tools

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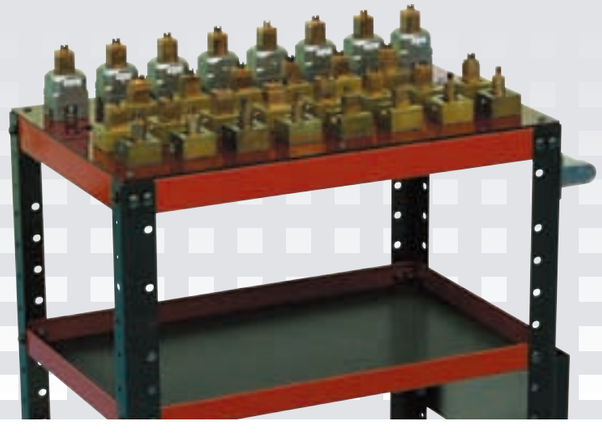


Support for automation

KEY TECHNOLOGY

- Auto-loader specification
- 60 tools magazine

It all began with the development of a new spindle.

Wide spindle speed range
400～40000 min⁻¹ spindle

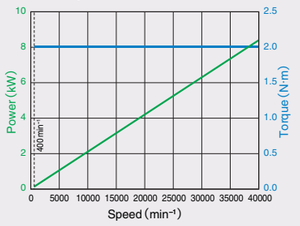
Makino has developed a new high performance spindle that provides practical machining capabilities in many different speed ranges. Its superior cutting prowess clearly distinguishes it from previous high speed spindles, and the extensive steps taken to eliminate vibration, rotational deflection and thermal distortion ensure exceptionally high reliability. This high performance spindle delivers the ideal machining capabilities required of V22.

Speed range —— **400～40000 min⁻¹**
Drive motor —— **8.4 kW**
Taper hole —— **HSK-E32**
Bearing inner diameter — **40 mm**

Cooling and lubrication

Makino's spindle core cooling system circulates temperature controlled cooling oil, which is through the center of the rotating spindle to cool it directly from the inside.
Moreover, with under race lubrication, coolant flowing through the spindle core is circulated also through the holes in the inner bearing races to lubricate the bearings.
The adoption of this unique cooling system results in greater relibility, enhanced accuracy and faster machining speed.
Continuous machining at high speeds is possible without being concerned about limitations on the spindle's operating speed.

Spindle characteristics



HSK-E32

The HSK shank system with two restrained faces simultaneously couples the taper portion of the shank and the flange end face.
The hollow taper changes flexibly while the flange end face fits tightly to the spindle nose.

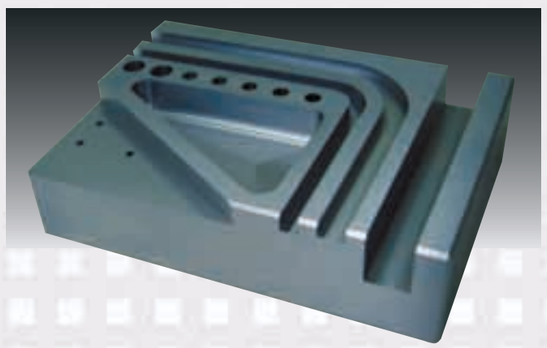
HSK-E32 holder (actual size) →

Machining performance

(Material: Pre-harden steel NAK80; hardness: 40 HRC)

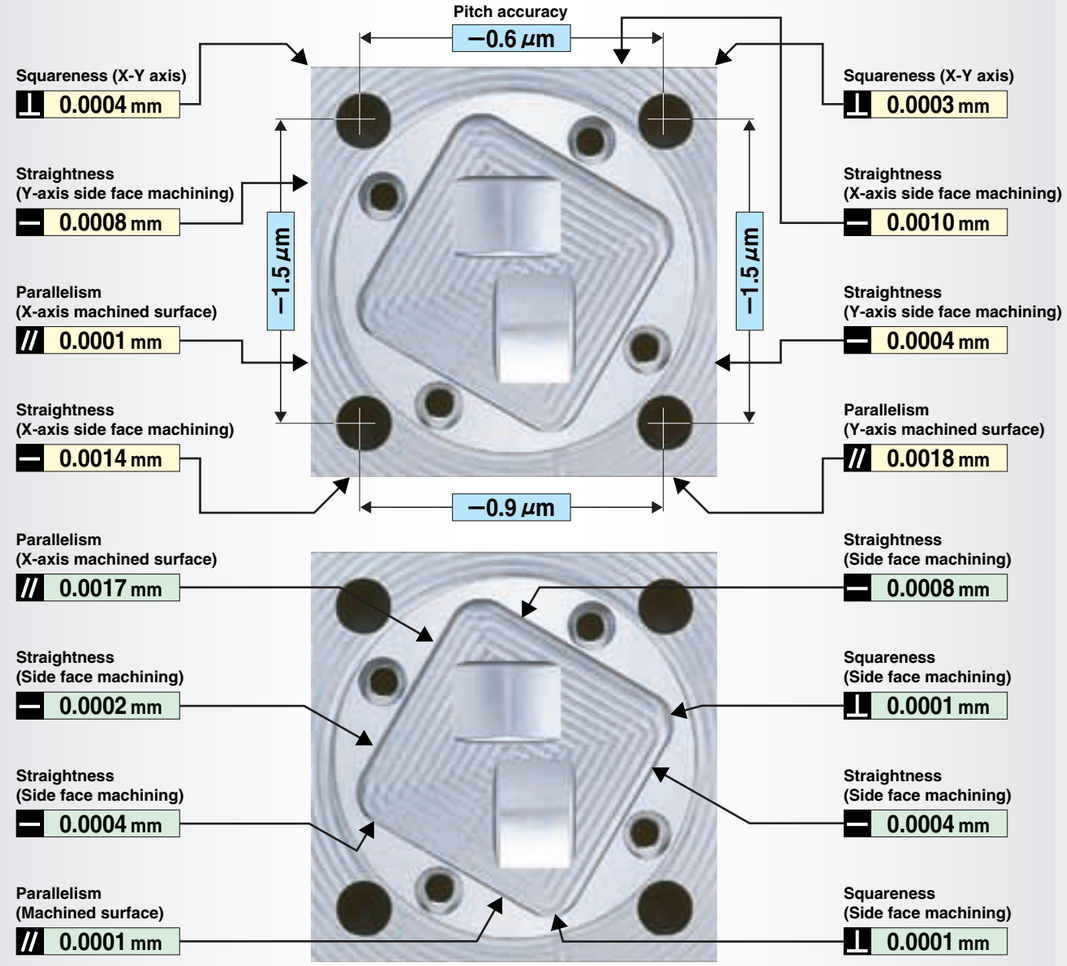
6 mm diameter end mill
(tungsten carbide)
S = 4000 min⁻¹, F = 800 mm/min
Ad = 3 mm, Rd = 6 mm

6 mm diameter drill
(high-speed steel)
S = 800 min⁻¹, F = 80 mm/min
Depth of through holes = 25 mm



All machined accuracies are within 2 μm

Work size: 150 mm x 150 mm (All actual values)



Roundness: 1.2μm (actual measured value)

Feedrate: 900 mm/min

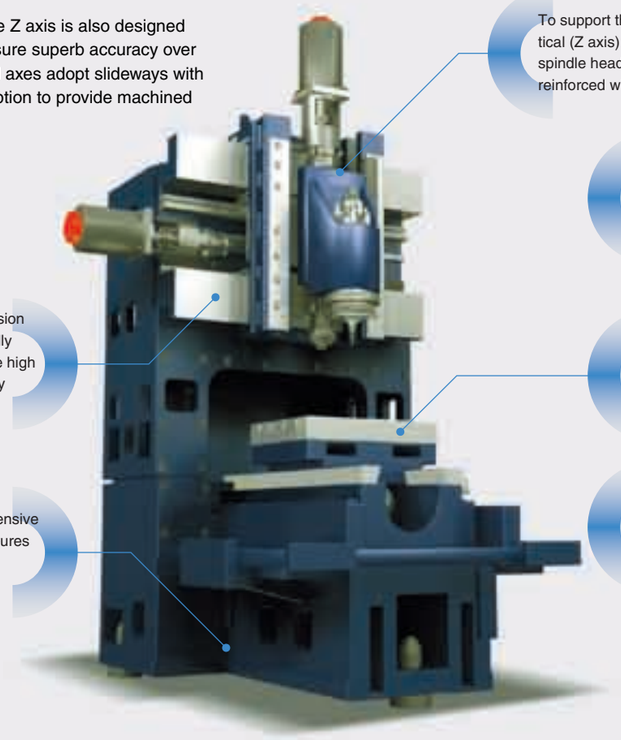
Feed control

The combination of a high performance scale feedback system with 0.05 μm (50 nm) resolution and Makino's Super GI.4 control is remarkably effective for machining fine and intricate geometries. Even in continuous machining of tiny blocks of NC data, error-free shape accuracy is obtained at actual machining speeds close to the command value.

Machine construction

Along with X and Y axes, the Z axis is also designed without any overhang to ensure superb accuracy over the entire range of travel. All axes adopt slideways with outstanding vibration absorption to provide machined surfaces of superior quality.

Axis travels (X x Y x Z)
320 x 280 x 300 mm



To support the lateral (X axis) and vertical (Z axis) movement of the spindle head, the column is amply reinforced with ribs for high rigidity.

Z axis travel is a class-leading 300 mm, which facilitates machining jobs involving the use of various chucking devices.

Meticulously polished to a precision finish, the slideways are integrally cast with the machine to provide high accuracy and rigidity without any change over long years of use.

Throughout its entire range of longitudinal movement (Y axis), the table never hangs over the bed.

Constructed on the basis of extensive structural analyses, the bed ensures excellent squareness and straightness in the XY-axes.

The table size (450 x 350 mm) has been carefully designed with an extra margin in relation to the axis travels for easier attachment of vises or plate-shaped workpieces.

Hybrid automatic tool length measuring device

(optional specification)

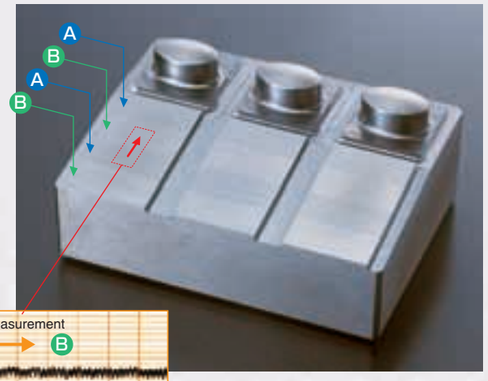
In case of continuously finish machining with different cutters in tool magazine, tiny level differences can occur at the seams of machined surfaces due to the use of different tools. Polishing workpieces to correct such tiny differences can be an enormous time-consuming task.

The hybrid automatic tool length measuring device precisely measures and controls the position of the tool tip to achieve superior finished surfaces with minimal level differences. (patented)

Machined surface level differences of less than 2μm even when tools or spindle speeds are changed

Ⓐ R2 Ball End Mill
20000 min^{-1},
800 mm/min,
Pick 0.06 mm

Ⓑ R1 Ball End Mill
40000 min^{-1},
1600 mm/min,
Pick 0.03 mm



Kosaka Laboratory : Surfcoder SE-30D

Optimum methods used to measure the tool tip position and spindle nose position

Tool tip position: **Low pressure contact probe**

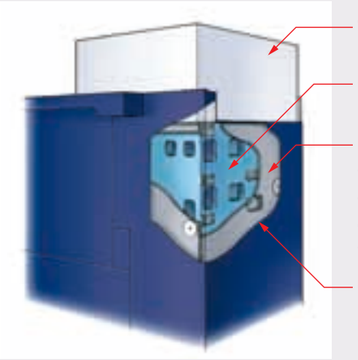
Spindle nose position: **Non-contact sensor**

Measures against ambient temperature changes

Makino Thermal Stabilizer
This is a general name for functions that suppress machine attitude changes caused by the ambient temperature.
The Thermal Guard is a standard feature on V22.

Thermal Guard

The Thermal Guard covers the entire machine to keep out ambient air and thereby minimize machine attitude changes due to the effects of the ambient temperature.



Thermal Guard

Column

Insulation

The column and bed are covered with insulation to suppress attitude changes caused by the effects of the shop environment temperature.

Cover

Space-saving design

The machine body has a compact footprint of only 1.5 x 2 meters for a substantial reduction of floor space. In addition, V22's optimal design secures ample rigidity while still reducing the machine weight, enabling V22 to be installed on a factory's second floor.

Energy savings

ECO mode functions (standard specification)
ECO mode of air consumption volume (optional specification)

V22 automatic work changer variations

Various automatic work changers (AWC) are available to meet diverse machining requirements.

V22A with built-in AWC

↑ Tools and work can be loaded and unloaded in front of the machine.

↑ 20 work storage magazine is located above 60 tools magazine in the left side of this machine. The vertical space is used effectively,designing the saved space ultimately.

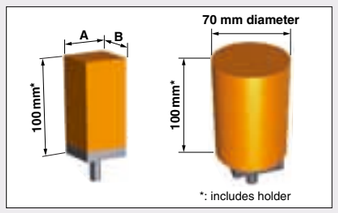
ATC

Tool shank	HSK-E32
Number of tool storage capacity	60
Maximum tool diameter mm	32
Maximum tool length mm	120

AWC

Number of work storage capacity	20
Allowable work size includes holder (A x B) mm	55 x 55 or 70 diameter
Allowable work weight include holder kg	3

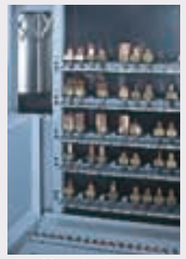
Work size dimension in detail, please contact Makino representative staff in your area.



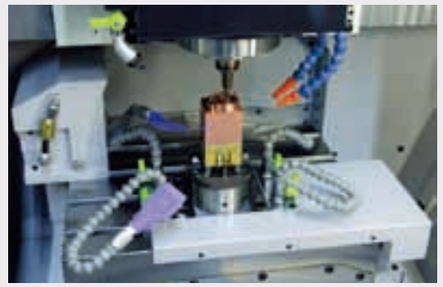
V22 connected with the separate AWC of 3 types.

WPS30 or 40, 60-22S (optional specification) is available.

WPS60-22S

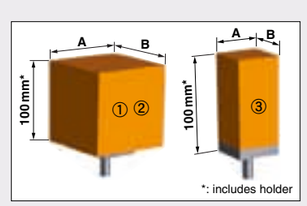


Magazine interior



AWC	① WPS30-22S	② WPS40-22S	③ WPS60-22S
Number of work storage capacity	30	40	60
Allowable work size includes holder (A x B) mm	100 x 100	140 x 75	55 x 55
Allowable work weight includes holder kg	7		

Work size dimension in detail, please contact Makino representative staff in your area.

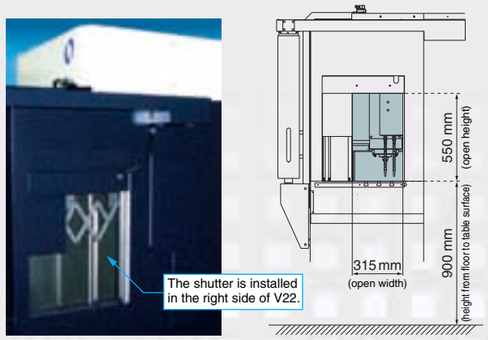


Specifications for AWC and robot

AWC shutter / AWC interface

(optional specification) (optional equipment)

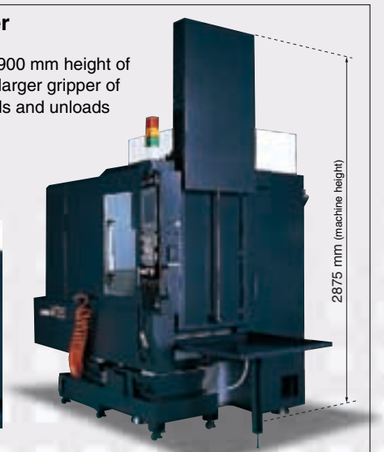
When the customer will install the work loader by himself or retrofit it later.



Robot shutter

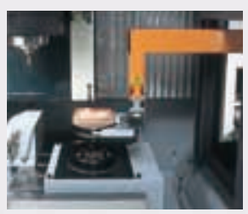
(optional specification)

450 mm width and 900 mm height of open space for the larger gripper of the robot when loads and unloads work.



*The oil pan is an optional specification.

The case to connected with system 3R WorkPal



Number of work storage capacity	16
Allowable work size (W x D x H) mm includes holder	180 x 180 x 135
Chuck	Macro Magnum 3R-680.10-2

Available shutters table according to the type of loader

Manufacture	Makino			Others		
Loader type	WPS30-22	WPS40-22	WPS60-22	system 3R WorkPal	Robot	Other automatic work changers
AWC shutter	○	○	○	○*	△	△
Robot shutter	—	—	—	△	△	△

○: available, —: Not available, △: Please contact Makino representative staff in detail.

*: Please contact Makino representative staff in detail when V22-5XR.

Operating ease

Ease of operation is not compromised even by the space constraints of a small machine.

Because the ceiling opens together with the operator's door, no coolant or chips fall on the operator during setup work. In addition, light from the shop's illumination can enter the machining chamber through the ceiling opening to provide better visibility where the operator is working.

The tool magazine is located on the left side of the machine.

(optional specification: 30 tools magazine)

The door window is made of scratch-resistant tempered glass on the inside and tough polycarbonate on the outside to avoid perforation. This strong construction ensures ample safety even in the event a tool breaks while machining.

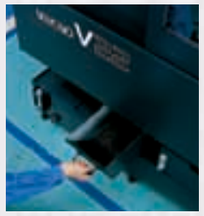
The door opening is wider on the right side of the table center so that work can be done more easily with the right hand inside the machining chamber.

A foot recess is thoughtfully provided at the bottom of the machine for improved approachability.

The height of the table surface is 900 mm from the floor to allow a comfortable work posture.

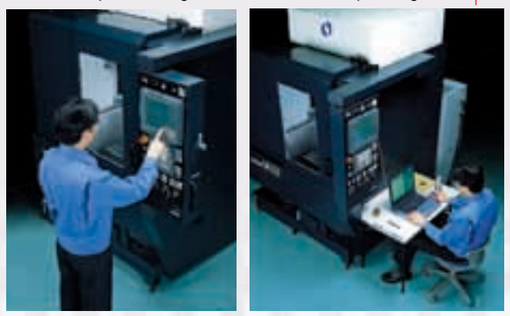
Chip removal

Slanted troughs are provided on both sides of the table for complete and efficient chip removal.



The chip bucket is located at the front of the machine and can be emptied even while machining.

The control panel swings 180° for enhanced operating ease.

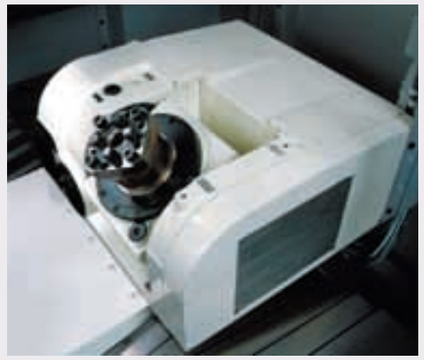


V22-5XB*

By one chucking, continuous operation when machining the muti-faces.

* Except for V22A

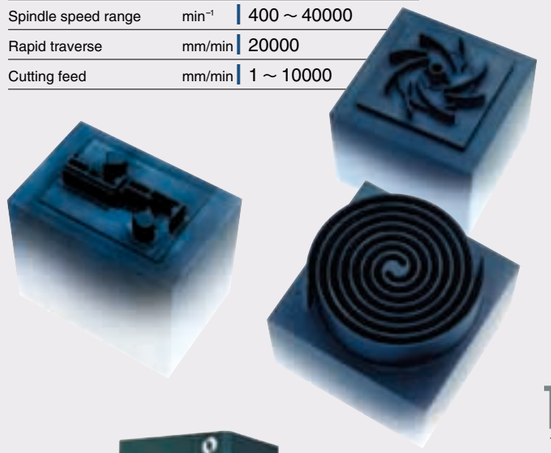
Travels (X × Y × Z)	mm	320 × 280 × 300
(B, C)	degree	120 (-15～+105), 360 (cont.)
Maximum workpiece size (diameter × height) (includes holder)	mm	Selectable specification System3R 90 × 100 mm EROWA 90 × 110 mm
Maximum table load	kg	7
Spindle speed range	min⁻¹	400 ～ 40000



V22 GRAPHITE

For small and complicated graphite electrode

Travels (X × Y × Z)	mm	320 × 280 × 300
Maximum work size	mm	450 × 475 × 200
Maximum table load	kg	100
Spindle speed range	min⁻¹	400 ～ 40000
Rapid traverse	mm/min	20000
Cutting feed	mm/min	1 ～ 10000



This photo includes WPS60-22S (optional specification).

Machine specifications

			V22
Travels	X axis	mm	320
	Y axis	mm	280
	Z axis	mm	300
	Distance to spindle gauge line plate (end) from table surface	mm	150 ~ 450
Table	Table working area	mm	450 × 350
	Maximum work size (W × D × H) with condition	mm	450 × 475 × 200
	Maximum table load weight	kg	100
	Table surface configuration	T slot widt	14 mm
		Number	4
		Pitch	80 mm
Spindle	Speed range	min^{-1}	400 ~ 40000
	Taper hole		HSK-E32
	Bearing inner diameter	mm	40
	Motor rated output power	kW	8.4
	Torque	N·m	2
	Cooling/Lubrication		core and jacket/under race
Feedrates	Rapid traverse	mm/min	20000
	Cutting	mm/min	1 ~ 10000
Automatic tool changer (standard)	Tool shank	mm	HSK-E32
	Number of tool storage capacity	kg	15 or 30*, 60*
	Maximum tool diameter	mm	32
	Maximum tool length	mm	120
	Maximum tool weight	kg	0.5
Machine size (standard)	Height	mm	2250
	Width × Depth	mm	1500 × 2000
	Mass (including NC unit)	kg	4200

*: optional specification

Standard specifications

- 40,000 min^{-1} spindle (core cooling) (HSK-E32)
- 15 tools magazine
- Automatic spindle (lubricant) temperature controller
- Moire scale feedback (X and Y, Z axis 0.05 μm)
- Fully enclosed splash guard (S/G)
- Lighting device inside of S/G (1 fluorescent light)
- Operator door lock (operation mode)
- ATC door interlock
- Thermal Guard (with bed and column insulation)
- 2 coolant nozzles
- 2 automatic air blow nozzles
- Chip bucket
- Portable manual pulse generator with the handle enable button
- Automatic power shutoff
- Rigid tap
- GI.4 control
- Data center
- Automatic lubricant supply unit for slide guideways
- Interface for automatic fire extinguisher
- Spindle-table crash avoidance function
- ECO mode functions
- Standard tool length function
- Leveling bolts (3 points support)

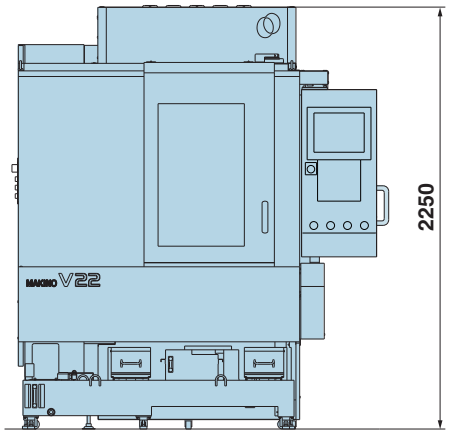
Optional specifications (●) / Optional equipment (★)

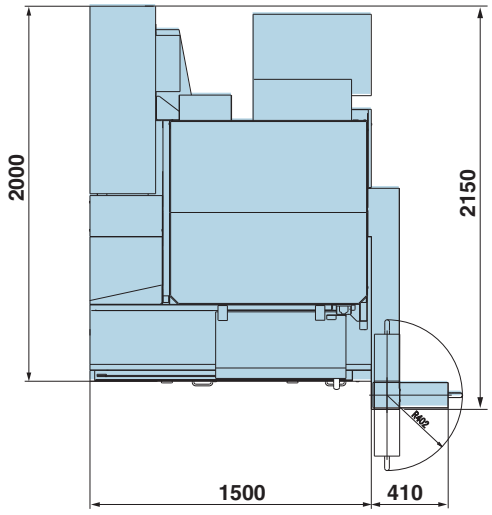
- ☐ ● 30 tools magazine
- ☐ ● 40 tools magazine
- ☐ ● Operator door lock & ATC door lock (with power shut off)
- ☐ ★ Additional lighting device inside of splashguard (1 fluorescent light)
- ☐ ★ ATC door lock
- ☐ ★ Nozzle coolant flow switch
- ☐ ★ Coolant temperature controller
- ☐ ★ Mist collector
- ☐ ★ Joint mount for Mist collector
- ☐ ★ Oil skimmer
- ☐ ★ MQL unit
- ☐ ★ Workpiece washing gun
- ☐ ● Hybrid automatic tool length measuring device
- ☐ ● Automatic tool length measuring device (low pressure contact)
- ☐ ● Automatic non-contact tool measuring device
- ☐ ● WPS30-22S*1
- ☐ ● WPS40-22S*1
- ☐ ● WPS60-22S
- ☐ ● AWC shutter
- ☐ ★ AWC interface
- ☐ ● Robot shutter*2
- ☐ ★ Super GI.4 control
- ☐ ★ Portable manual pulse generator with tool position display and the handle enable button
- ☐ ★ Run hour meter
- ☐ ★ Warmup timer
- ☐ ★ Signal light 3-layer
- ☐ ★ Air dryer
- ☐ ● Customer specified machine color
- ☐ ● Tool wagon (28 Tools HSK-E32)

*1 This is not available only when V22-5XB is selected.
*2 This is not available only when WPS30-22S or WPS40-22S, WPS60-22S is selected

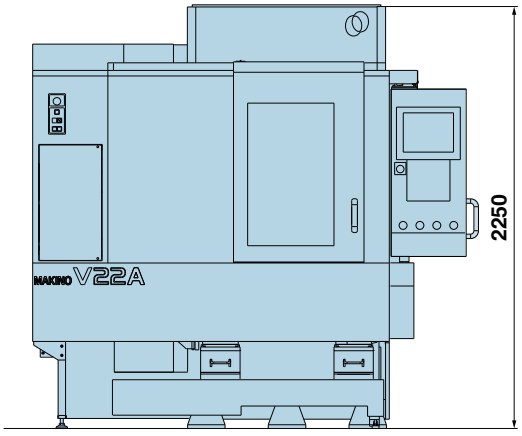
Front view / Floor Plan

V22 [Standard specifications]

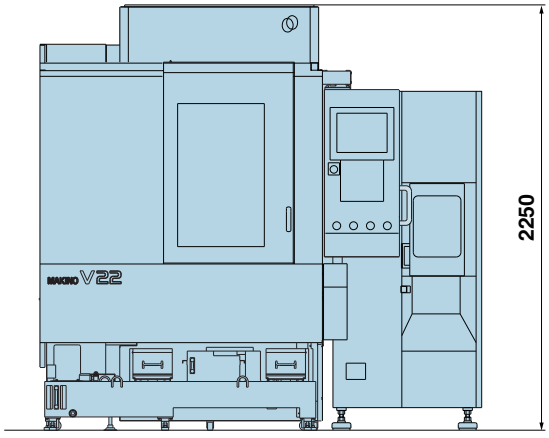


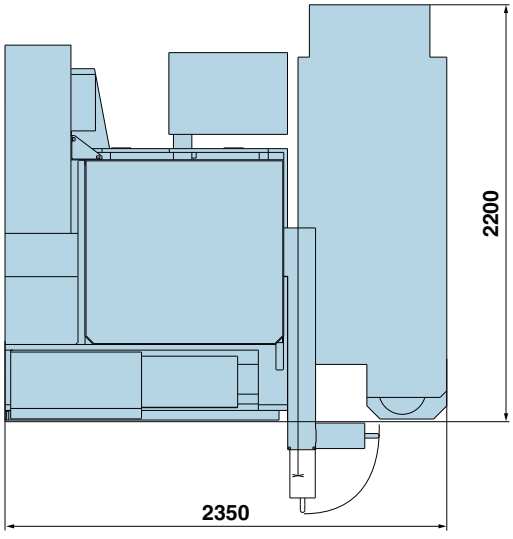


V22A



V22 [Automatic work changer]





Professional 5 specifications

NC specifications

• : standard
□ : optional equipment

Controllable axes	• Simultaneous 3 axes □ Simultaneous 4 axes □ Simultaneous 5 axes
Programmings	• Programming unit: 0.0001 mm • Programmable maximum: ±9 digits (±99999.9999) • Absolute/incremental programming (G90/G91) • Decimal point/Pocket calculator style programming • Automatic ISO/EIA recognition □ Inch/metric selection (G20/G21)
Interpolations	• Positioning (G00) (Linear interpolation positioning) • Linear (G01) • Circular interpolation (G02, G03) • Nano □ Helical (G02, G03) (Cylindrical + 2 axis linear) □ Involutes (G02.2, G03.2) □ Polar coordinate (G12.1, G13.1) (NC Rotary unit is required.) □ Cylindrical (G07.1) (NC Rotary unit is required.) □ NURBS □ Spiral/conical
Feeds	• 5-digit F • Dwell (G04) • Rapid traverse override • Feedrate override (0 - 200%) • Feedrate override cancel (M49/M48) □ One-digit F code feed (F1 - F9) □ Automatic corner override (G62) □ Inverse time feed
Program storage and editing	• Part program storage size: 80 m □ Additinal storage: total 160 m, 320 m, 640 m, 1280 m, 2560 m 5120 m, 10240 m, 20480 m (Quantity including standard) • Registered program number: 63 □ Additinal registered program number: total 125, 250, 500, 1000, 2000, 4000 (*1) • Editing • Program search • Sequence search • Address word search □ Voluntary program name (32 digits)
Display	• 12.1 type color LCD • Clock function • Manual Data Input • Operation history display □ Run hour and parts quantity display □ Machining time stamp function
I/O・Device	• RS232C interface □ HSSB Connection kit (for μCell Expert or μDMS5)
S/T/M function	• S functions direct commanding: Spindle function S5-digit • T functions: Tool Function T4-digit □ T functions: Tool Function T8-digit • M functions
Tool offsets	• Length compensation (G43, G44 / G49) • Radius compensation (G41, G42 / G40) • Tool offset pairs: 32 □ Additinal tool offset pairs: total 64, 99, 200, 400, 499, 999 • Type A memory □ Type B memory □ Type C memory □ Three dimensional tool compensation
Coordinate	• Manual reference position return • Automatic reference position return (G28) □ 3rd/4th reference position return (*2) • Reference position check (G27) • Retrieve position (G29)

Coordinate	• Establish coordinate (G92) • Establish machine coordinate (G53) • Select work coordinate (G54 - G59) • Establish local coordinate (G52) □ Floating reference position return (G30.1) □ Work coordinate system preset (G92.1) □ Additional work coordinate pair (+48 pair) □ Additional work coordinate pair (+300 pair)
5-axis function	□ 3-dimensional manual feed □ Three dimensional circular interpolation □ Three dimensional coordinate conversion □ Rotary table dynamic fixture offset □ Tool center point control (Super GI.4 is required) □ 3-dimensional cutter compensation (Super GI.4 is required) □ Tilted working plane indexing command [Standard for 5-axis machine (*3)]
For 5-axis machining center only (*3)	Smooth TCP Workpiece setting function (includes tilted working plane indexing command) VP control [Standard for 5-axis machine]
Operating conveniences	• Label skip • Control in/out • Single block • Program stop (M00) • Optional stop (M01) • Optional block skip 1 (/) □ Additional optional block skip: total 9 (/1 - /9) • Dry run • Machine lock • Freeze Z axis • Ignore M/S/T-functions • Mirror image (M21, M22/M23) • Manual absolute • Manual measurement of tool length □ Handle interrupt interactive programming □ Program restart □ Sequence number comparison and stop
Programming conveniences	• FS-15M format • Radius designation (12 digits) • Canned cycle • Sub program call (10 folds nested) • Exact stop (G09) • Exact stop mode (G61) • Tapping mode (G63) • Cutting mode (G64) • Rigid tapping • Programmable data input (G10) □ Optional angle chamfering, corner R programming □ Programmable mirror image (G51.1/G50.1) □ Scaling (G51/G50) □ Coordinate rotation (G68/G69) □ Figure copying (G72.1/G72.2) □ Polar coordinate command (G15/G16) □ Normal direction control □ Custom macro: common variables 100 □ Custom macro: additional common variables: total 600 □ Custom macro: additional common variables: total 1000 □ Chopping function (*4) □ Mold package (*5)
Error compensations	• Pitch • Backlash □ Single direction positioning (G60)
Maintenance / Safety	• Emergency stop • Stored stroke limit □ Stored stroke limit 2 • Self-diagnostics • Spindle-table interference preventive function • Standard tool length • Interlock • Help function

(*1) Number of registable programs are restricted according to program storage size.
(*2) Pallet changer specification, Automatic work changer specification and V22A are not avoilable.
(*3) 5-axis machine: V22-5XB, V33i-5XB and V56i-5XB
(*4) When selecting this function, please contact to us.
(*5) Including F-one digit, automatic corner override, programmable mirror image, scaling, coordinate rotation and figure copying

Professional 5 specifications

Mechanical controller specifications

• : standard
□ : optional equipment

High speed, High precision	• GI.4 control □ Super GI.4 control □ Nano-smoothing function □ FT function (Super GI.4 is required)
I/O	• Data center (Standard memory: 4 MB) • File management function (NC programs, various data files) • DNC simple schedule function (Multiple main programs are execatable) □ Data center memory extension function A (Total 360 MB) □ Data center memory extension function B (Total 800 MB) □ Data center memory extension function C (Total 1.6 GB) □ Twist-pair cable (10 m, 20 m, 30 m, 40 m, 50 m) □ 8 port HUB □ Special user I/O interface • Automatic fire extinguisher interface □ Loader interface (for WPS) □ Macro variable file output function
Program Editing	• Program preview function • Cut, paste and replace function (equivalent to FANUC "Extended tape editing") • Background edit function (Equivalent to FANUC "Background edit function") • 2-program simultaneous edit function • G code insert function • M code insert function • Fixed-program insert function • Final MDI program insert function • Coordinate value insert function (Equivalent to FANUC "Playback function") • Other program insert function
Monitor	• Spindle load display • Spindle load monitoring function (SL) • Tool life monitoring function (TL) □ Adaptive control function (AC) • Direct spare tool selection function • Parts count function (Equivalent to FANUC "Run hour and parts quantity") *6 • Machining record function (Equivalent to FANUC "Machining time stamp function") *7
One touch	• Registered tool automatic selection/changing function • All axis automatic return to reference point • Automatic work setting position • Z axis retraction □ Automatic Z-axis retract and restart function
Guidance	• Self-diagnostic and instruction display • Number & position of LS & SOL display for alarm • Alarm History function (Machine side & NC side) • Automatic display for regular maintenance advice • User create function for regular maintenance
Soft ware	□ FF-PATH (Custom macro (common variables : 100) and helical interpolation are required) □ External setting type orientation □ Coordinate calculation setting function by rotation angle □ 3D shape measuring function A (Automatic workpiece measuring device is required)

*6 If the run hour and parts quantity are got by using the FANUC FOCAS Library, FANUC "Run hour & Parts quantity display" option is required.

*7 If the machine time is got by using the FANUC FOCAS Library, FANUC "Machining time stamp function" option is required.

*The specifications in this catalogue may be changed without prior notice to incorporate improvements resulting from ongoing R&D programs.

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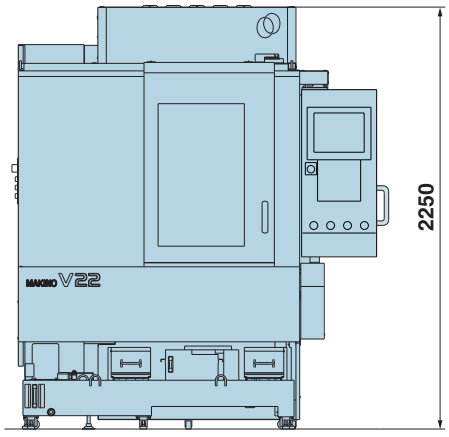
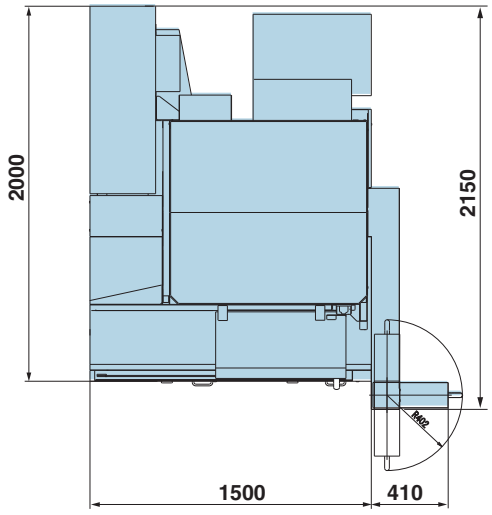
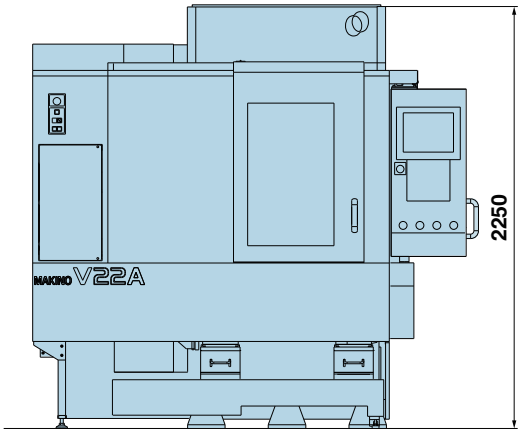
Front view / Floor Plan

V22 [Standard specifications]

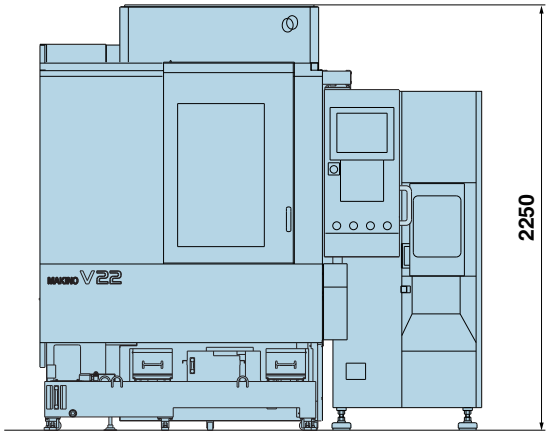


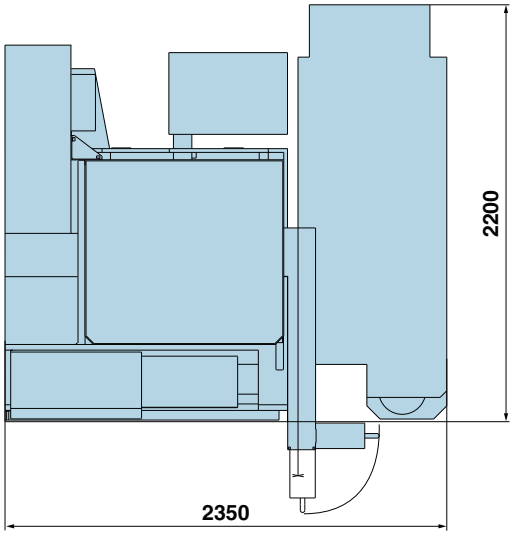


V22A



V22 [Automatic work changer]





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