Hartford innovation

Hartford innovation

Since 1965 50 Anniversary
Innovation makes sustainable development

5A-650

Intelligent Machining Center

Gantry Type 5-axis Machining Center

- Gantry type structure
- Swivel rotary table (B, C-axis)
- Modular spindle head, table and magazine
- 30 m/min. rapid traverse rates
- i-Tech 24,000 rpm built-in spindle (opt.)

Website

Hartford has sold over 46,000 machines globally, resulting in over 37,000 satisfied customers and a wealth of feedback that has added to our arsenal of experience and fine craftsmanship. In accordance with our insistence on providing only the highest quality of machining centers, every possible resource is utilized to constantly upgrade our technological levels in manufacturing and other applications.

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CAT. NO. 5A-650-100215'E01

THE ULTIMATE IN SPEED, PRODUCTIVITY AND VERSATILITY

Hartford 5A-650 is designed specifically for simple and complex parts in small lots production, which require high precision 5-axis machining.

The Hartford 5A-650 Gantry Type 5-Axis Machining Center is designed and engineered for precision machining of simple and complex parts in one setup. Constructed with a swivel rotary table in combination with gantry type machine structure, the Hartford 5A-650 exhibits unmatched rigidity and stability in high speed machining. It's a fully modular machine allowing for flexible choice in spindle head, table and tool magazine.

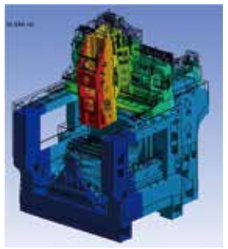
Applicable Industries

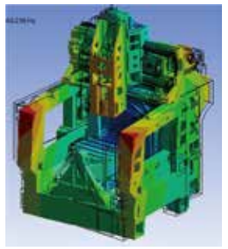
- Molds and dies
- Medical industry
- Aerospace industry
- Automobile and motorcycle industries
- Green energy industry

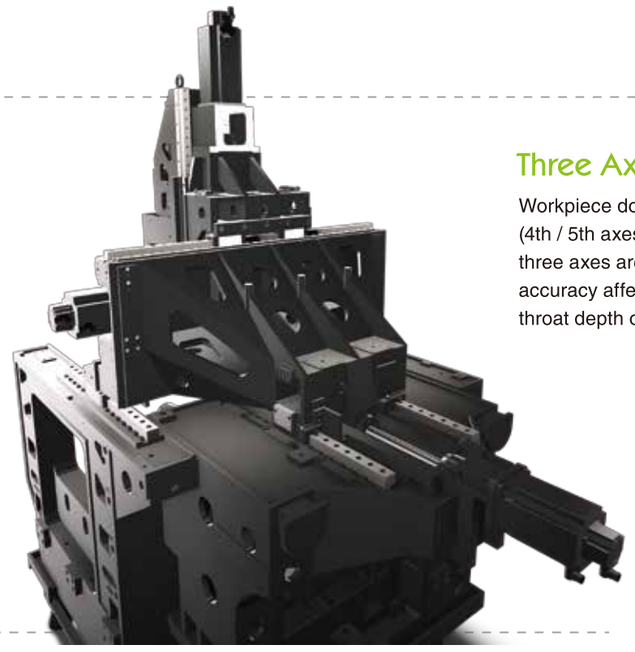
OPTIMAL RIGID DESIGN CONSTRUCTION !

Static Rigidity and Structure Analysis

Static rigidity and machine structure are analyzed by means of ANSYS to confirm structure design quality and safety, so as to exhibit an optimum performance.





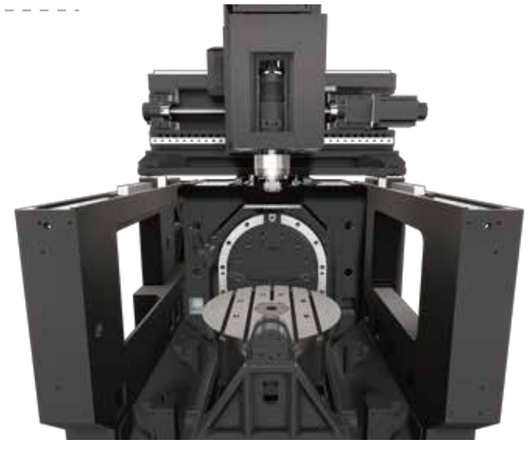


Three Axes Overlap Design

Workpiece does not move with three axes movement (4th / 5th axes are fixed at the base), and hence loads on three axes are constant. As a result, positioning accuracy affection on three axes is minimized. Short throat depth of spindle ensures stable cutting accuracy.

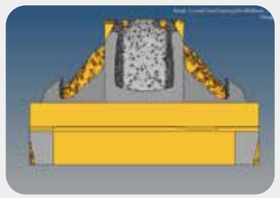
Gantry Type Construction

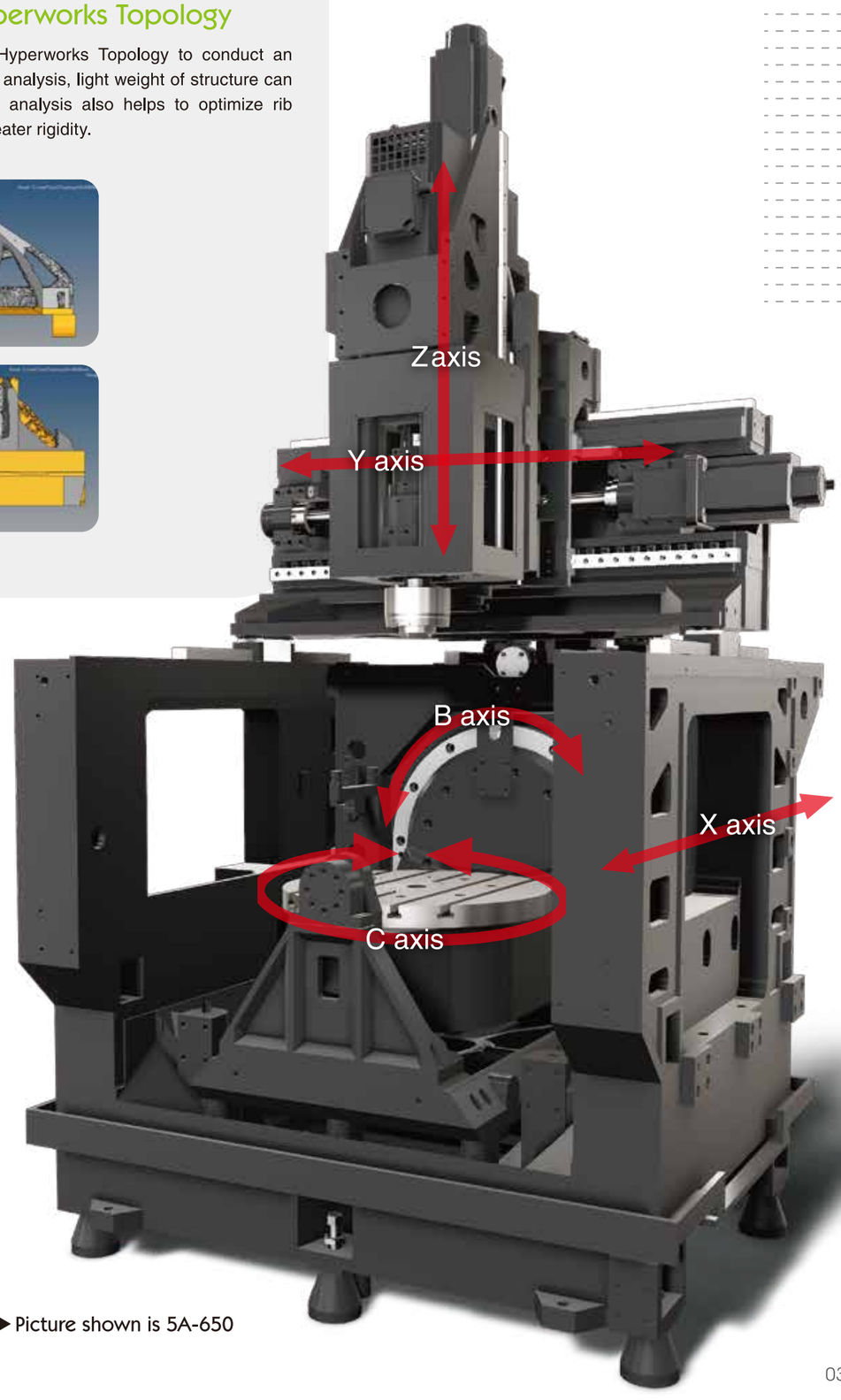
The gantry type construction provides a solid support for the top moving parts. The massive base is rigid enough to support the double-wall columns casted from spheroidal graphite iron. This outstanding structure is capable of resisting impact of high acceleration/deceleration, while providing superior dampening capacity.



Optimum Structure Analysis through Hyperworks Topology

With the use of Hyperworks Topology to conduct an optimum structure analysis, light weight of structure can be achieved. The analysis also helps to optimize rib deployment for greater rigidity.





MEEHANITE

▶ Picture shown is 5A-650

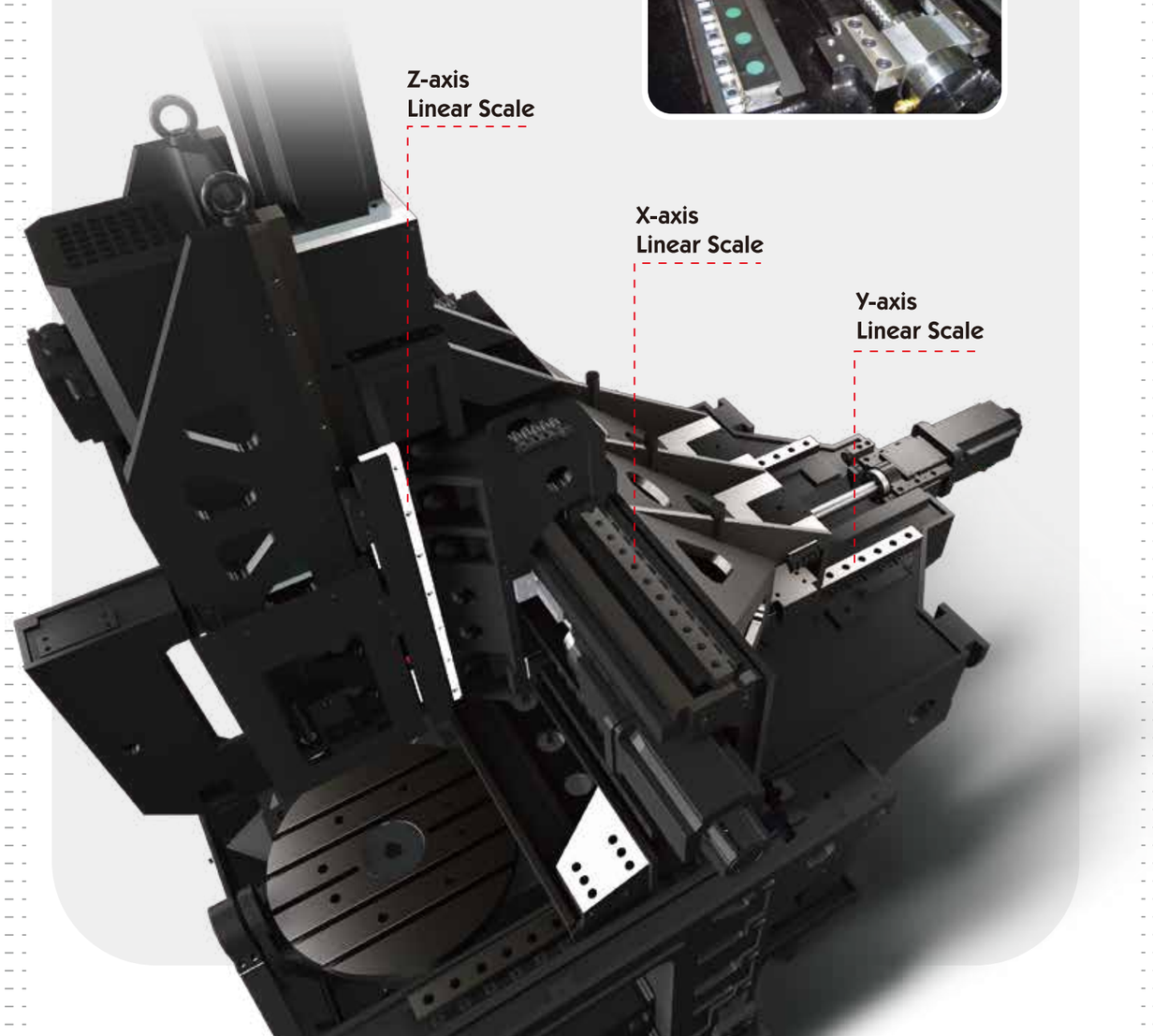
THE DESIGN CONCEPTS BEHIND 5A-650 SERIES

Roller Type Linear Ways on 3 Axes

The linear contact between the rolling body of the roller and the sliding block causes a tiny elastic deformation under a high load condition. This makes high accuracy, heavy load resistance and long lifespan possible.

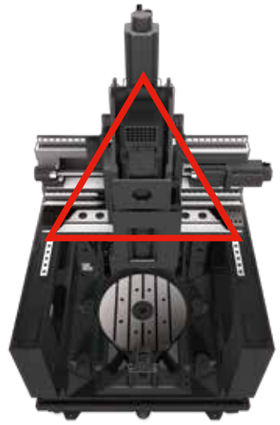
5 Year Warranty Linear Guideway

It will become inactive incase of incorrect operational use or if regular maintenance & procedures are not followed, causing damage on guideway.



Four Linear Ways on Y-axis with Drive through Gravity

The cross beam is supported by four linear ways. with the triangular gravity movement design in combination with 3-axes overlap structure to enhance stable, dependable moving rigidity.

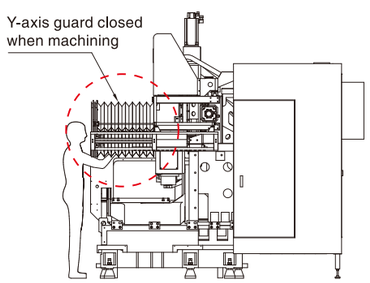


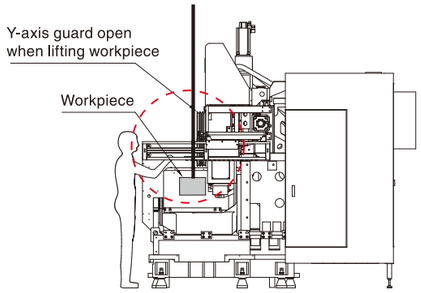
Container Loading

The machine is available to be loaded into a HQ container for saving freight costs and reassembling of parts.

Easy Access to Table

The machine design meets the human engineering principle that allows the operator to load and unload workpieces with ease.





Beautified Machine Back

The entire machine is fully enclosed in splash guards in combination with attractive machine back. This outstanding design not only exhibits the elegant machine oappearance, but also provides increased safety protection for the operator.

Coolant through Ball Screws on Three Axes (Optional)

The use of coolant through ball screws (optional) effectively reduces ball screw running temperature, upgrades dynamic performance and improves surface finishes.

FEATURES OF ROTARY TABLE:

Heavy Loading Capacity
The rotary table is ruggedly constructed.
Fitted with preloaded bearings featuring large diameter, high rigidity and radical/axial resistance, the rotary table can resit loads from any direction. Table diameter 650 mm. 200 kg loading capacity when table tilts to 90°.

Full Circumference Hydraulic Brake
The rotary table positioning brake employs a full circumference hydraulic brake device. A high/low pressure switch is equipped to detect pressure for safety. Braking torque on C-axis is 250 kgf-m and on B-axis is 450 kgf-m.

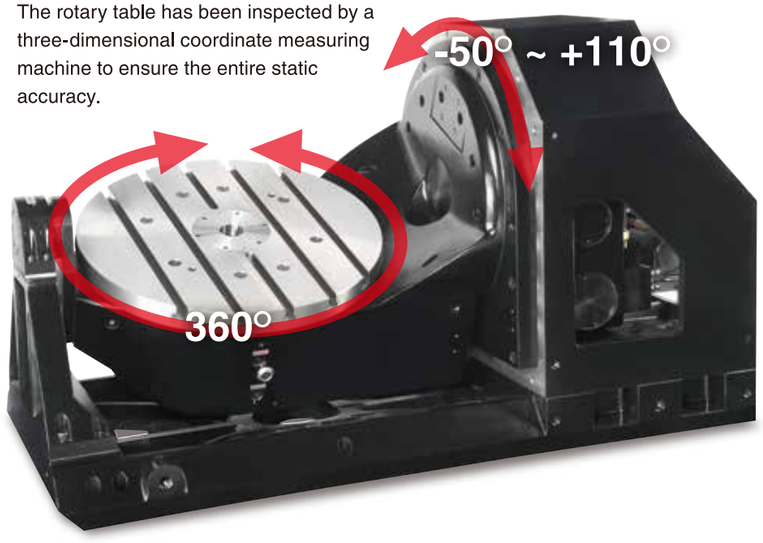
25 RPM Rotating Speed
B, C-axis rotating speeds reach 25 rpm with low inertia feature to fully meet high speed machining requirements.

Accurate Worm & Worm Gear
The worm gear is manufactured from high tensile strength, wear-resistant aluminum bronze (ALBC3). Teeth backlash has been eliminated during assembling which requires no further adjustment, and high indexing accuracy can be ensured.

Table tilting angle (B-axis): -50°~+110°

4th/5th Axis Rotary Table

The rotary table has been inspected by a three-dimensional coordinate measuring machine to ensure the entire static accuracy.



HIGHLY EFFICIENT CHIP REMOVAL

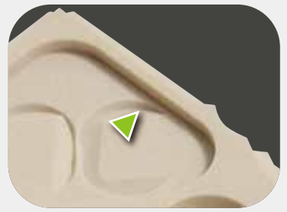
As there is no obstruction between the workpiece and the spindle machining area, chips quickly drop to chip removing channels. This design will prevent the machine from thermal deformation caused by heat of accumulated chips.

5-AXIS ACCURACY TESTING

Complete Quality Control Sub-micron Accuracy

Work Pieces Name :	NCG2005
Work Piece Material :	Necuron 1007
Work Piece Size :	75 x 105 x 50 mm
Work Piece Fixed Angle :	0° & 30°
Cycle Time :	15 min
Tool :	Ø 6mm End mill

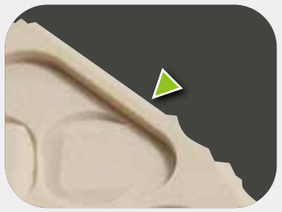
Workpiece Surface Quality Check



High Perpendicularity Accuracy Between Tool and Workpiece.

Accurate Right Angle Between X and Y Plane.

Dimensional Accuracy Measurement



Marginal Lines (1mm) in X, Y-axis are Consistent.

Axis Accuracy Check

In Hole Cutting, Tool Feeds in Right and Left Directions are Symmetrical.

N/C Thermal Elongation Check

Connection Wall Thickness Down to 10µm is Not Broken.

Tool Center Point Check

Tool Center Point in 5 Axes (X, Y, Z, B, C) Positions Accurately.

Angle Accuracy Deviation of Rotating Axes

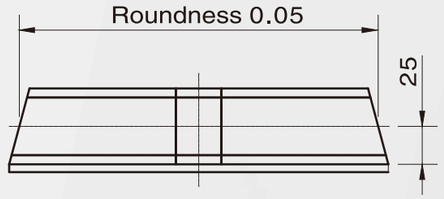
High Angle Accuracy of B/C Axes is Easily Recognized by Surface Finish and Spacing Symmetry.

Contour Accuracy Check

By the High Accuracy of Contour.

5-AXIS MACHINING CENTER ACCURACY TEST

NAS-979 Standard



NAS-979 Cutting Report

	Tolerence	Test Results
Inclination Angle	∠15° (±1° / 20")	15.0007
Roundness	0.05	0.008

Unit: mm

Advanced Measurement & Control Technology

Hartford understands that with high speed 5-axis machining the need for even greater axis accuracy is essential.

Our state of the art machining centers come equipped with the latest measurement and control technology delivering the extreme accuracy and high productivity you demand.

Dynamic Collision Monitoring (DCM)

Heidenhain's new software option automatically monitors the working space of the machine, preventing collisions with machine components and increasing the level of safety for both the operator and the machine.

Kinematic Opt 48

Complex parts with stringent accuracy requirements require precision and repeat accuracy even over long periods. Kinematics Opt is a 3-D touch probe cycle that automatically measures all rotary axes and makes recalibration a fast and efficient process.

Kinematic Comp (Opt)

Heidenhain's Kinematic Comp technology takes volumetric compensation to a new level and has been proven to enhance precision machining of large workpieces.

FULL MODULARITY DESIGN

With its full modularity design, Hartford 5A-650 allows for unlimited machining applications. This means customers can specify their desired spindle, tool magazine and table to suit specific the machining requirements.

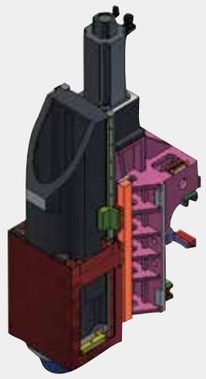
Modular Spindle Head Design

The spindle head provides various spindle speeds to choose from to satisfy customers' requirements.

10/12/15 K
Direct-drive Spindle Head

20 K
Direct-drive Spindle Head (FANUC only)

24 K
Built-in Type Spindle Head



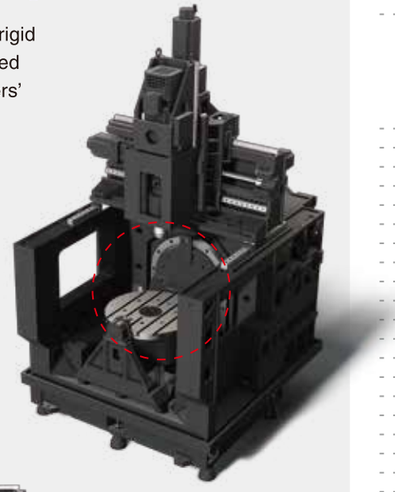
Modular Tool Magazine Design

The modular design of magazine allows users to select a magazine suitable for their specific machining requirement. (24T / 30T / 40T / 60T)

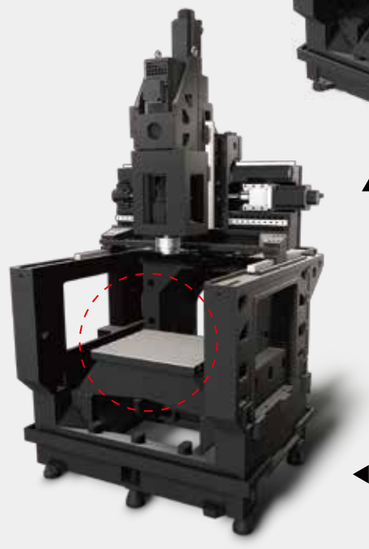
▲ 5A-650

Modular Table Design

The rotary (for 5 axes) and rigid table (for 3 axes) can be used commonly to meet customers' demands.



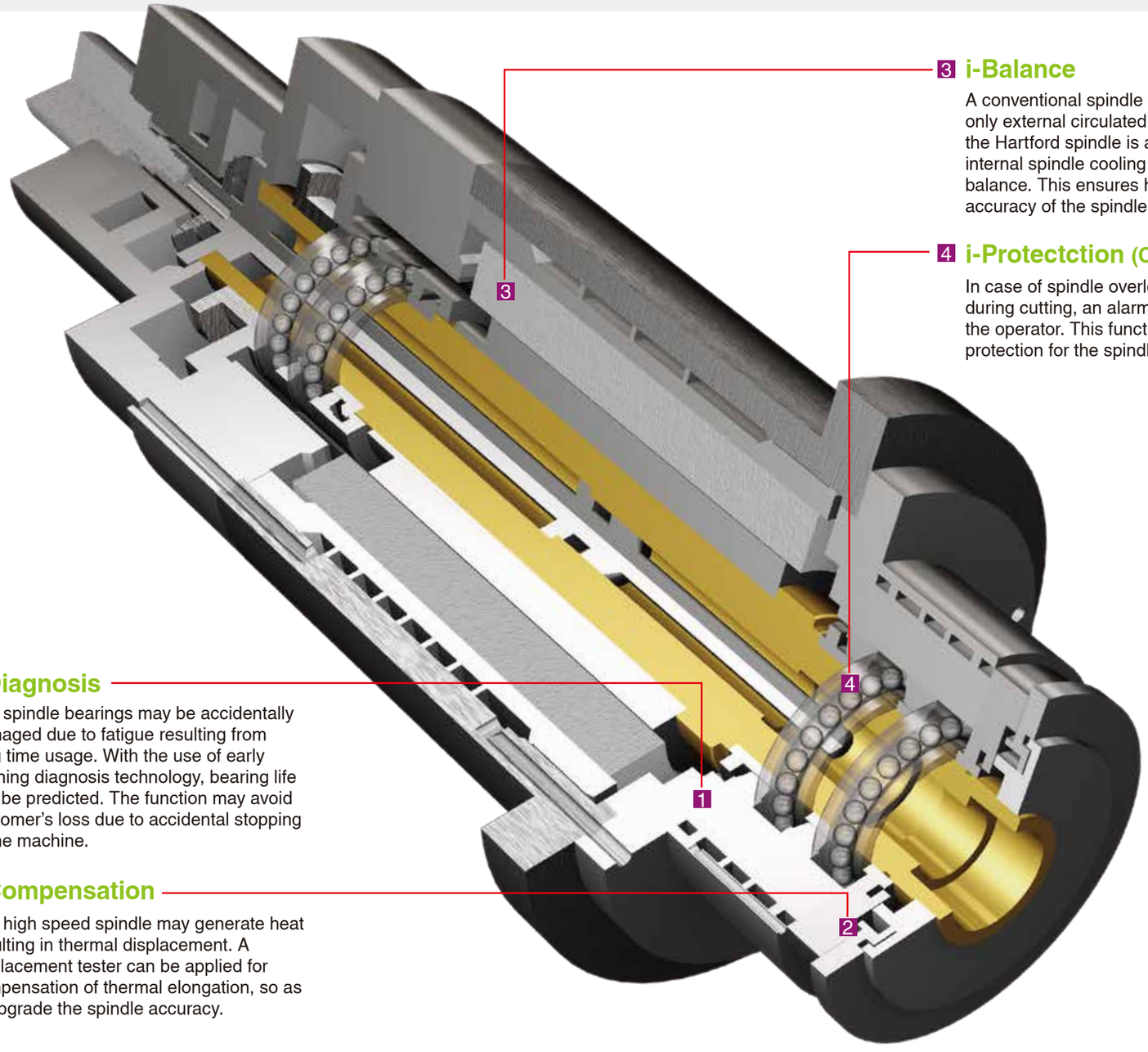
▲ VM-65 (4+1 axis)
Rotary table for 5-axis machining



◀ VM-65 (table type)
Rigid table for 3-axis machining

i-Tech
EXCLUSIVE SMART FUNCTIONS FOR HIGH SPEED SPINDLE

Hartford's 24,000rpm built-in type spindle used on 5A-650 is available to integrate various smart functions that provide safety protection of the spindle, increase the spindle accuracy and reduce down time.



1 i-Diagnosis

The spindle bearings may be accidentally damaged due to fatigue resulting from long time usage. With the use of early warning diagnosis technology, bearing life can be predicted. The function may avoid customer's loss due to accidental stopping of the machine.

2 i-Compensation

The high speed spindle may generate heat resulting in thermal displacement. A displacement tester can be applied for compensation of thermal elongation, so as to upgrade the spindle accuracy.

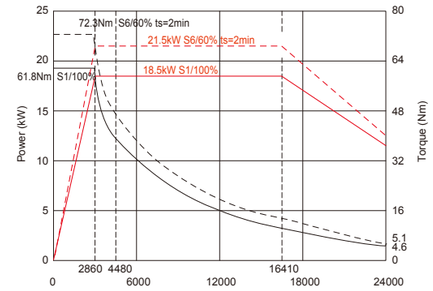
3 i-Balance

A conventional spindle is designed with only external circulated cooling, however the Hartford spindle is available to add internal spindle cooling for better thermal balance. This ensures high machining accuracy of the spindle at all time.

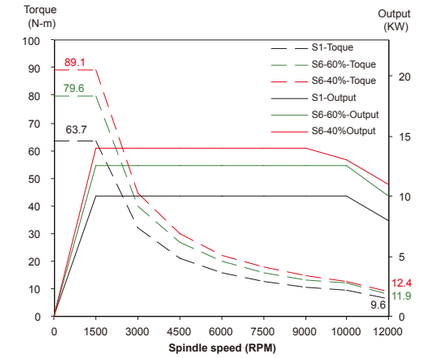
4 i-Protectction (Optional)

In case of spindle overload or colliding during cutting, an alarm will display to alert the operator. This function gives safety protection for the spindle.

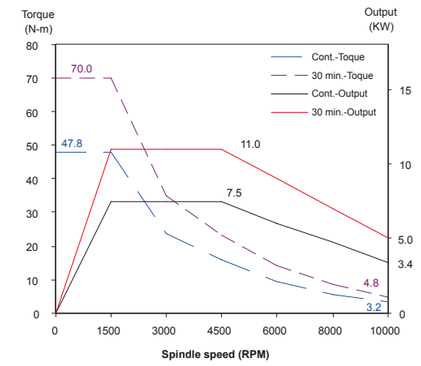
Bulit-in type Spindle 24,000RPM



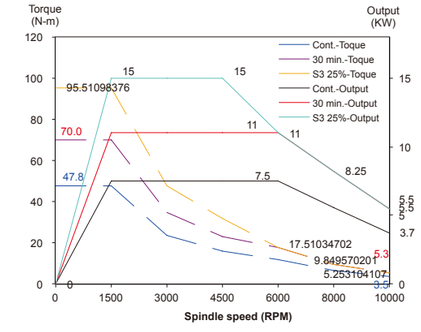
HEIDENHAIN QAN200U*12000RPM



Meldas SJ-D11/100-01



FANUC αil 8*10000



SPECIFICATIONS

ITEM		UNIT	5A-650	VM-65(4+1 axis)	VM-65(table type)
Table					
Table size		mm (inch)	Ø650 (25.59")	Ø650 (25.59")	750 x 620 (29.53" x 24.41")
T-slot (size x number x pitch)		mm (inch)	18 x 5 x 100 (0.71" x 5 x 3.94")	18 x 5 x 100 (0.71 x 5 x 3.94")	18 x 6 x 100 (0.71" x 6 x 3.94")
Max. Table load		Kg (lbs)	Horizontal: 300 (661.4) Vertical: 200 (440.9)	Horizontal: 300 (661.4) Vertical: 200 (440.9)	500 (1102.3)
Travel					
Longitudinal travel (X-axis)		mm (inch)	660 (25.98")	660 (25.98")	660 (25.98")
Cross travel (Y-axis)		mm (inch)	550 (21.65")	550 (21.65")	550 (21.65")
Vertical travel (Z-axis)		mm (inch)	460 (18.11")	460 (18.11")	460 (18.11")
Cross travel (B-axis)		Deg.	+110°~-50°	+110°~-50°	
Vertical travel (C-axis)		Deg.	360°	360°	
Distance from spindle end to table		mm (inch)	150~610 (5.91" x 24.02")	150~610 (5.91" x 24.02")	150~610 (5.91" x 24.02")
Spindle					
Spindle nose taper			ISO40/HSK-A63 (20K/24K only)	ISO40/HSK-A63 (20K/24K only)	ISO40/HSK-A63 (20K/24K only)
Spindle speed (standard)	Direct-drive Type	rpm	10K(OPT：12K/15K/20K)	10K(OPT：12K/15K/20K)	10K(OPT：12K/15K/20K)
	Built-in Type	rpm	OPT：24K	OPT：24K	OPT：24K
Feed					
Cutting feed rate	X, Y, Z-axis	m / min (ipm)	20 (787.4)	20 (787.4)	20 (787.4)
	B-axis	rpm	25	25	-
	C-axis	rpm	25	25	-
Rapid traverse	X, Y, Z-axis	m / min (ipm)	30 (1181.1)	30 (1181.1)	30 (1181.1)
	B-axis	rpm	25	25	-
	C-axis	rpm	25	25	-
ATC					
Tool storage capacity	A type	Kg (lbs)	24 (OPT:30 / 40 / 60) 52.9 (66.1 / 88.2 / 132.3)	24 (OPT：30/40/60) 52.9 (66.1 / 88.2 / 132.3)	24(OPT：30/40/60) 52.9 (66.1 / 88.2 / 132.3)
Max. Tool weight		mm	7 (0.28")	7 (0.28")	7 (0.28")
Max. Tool size (dia. x length)		mm (inch)	Ø75 x 250L (Ø2.95" x 9.84")	Ø75 x 250L (Ø2.95" x 9.84")	Ø75 x 250L (Ø2.95" x 9.84")
Tool selection		sec	Random	Random	Random
Tool change time (Approx)	A type	sec	5	5	5
Tool shank			ISO40/HSK-A63	ISO40/HSK-A63	ISO40/HSK-A63
Tool stud bolt			MAS-P40T-1/ CAT-40/DIN69872	MAS-P40T-1/ CAT-40/DIN69872	MAS-P40T-1/ CAT-40/DIN69872
Motor					
Spindle drive motor	MITSUBISHI	kW (HP)	-	-	11 (14.8)
(30 min rating)	FANUC	kW (HP)	-	11 (14.8)	11 (14.8)
	HEIDENHAIN (TNC 640)	kW (HP)	12.5 (16.8)	12.5 (16.8)	12.5 (16.8)
X.Y.Z axis drive motor	MITSUBISHI	kW (HP)	-	-	3.5 / 3.5 / 3.5 (4.7 / 4.7 / 4.7)
	FANUC	kW (HP)	-	4 / 4 / 4 (5.4 / 5.4 / 5.4)	4 / 4 / 4 (5.4 / 5.4 / 5.4)
	HEIDENHAIN (TNC 640)	kW (HP)	4.5 / 5.1 / 5.4 (6 / 6.8 / 7.2)	4.5 / 5.1 / 5.4 (6 / 6.8 / 7.2)	4.5 / 5.1 / 5.4 (6 / 6.8 / 7.2)
B.C axis drive motor	MITSUBISHI	kW	-	-	-
	FANUC	kW (HP)	-	7 / 3 (9.4 / 4)	-
	HEIDENHAIN (TNC 640)	kW (HP)	8.6 / 4.5 (11.5 / 6)	8.6 / 4.5 (11.5 / 6)	-
Positioning Accuracy					
Three Axes Laser Positioning Accuracy (JIS B6330)					
Positioning Accuracy / Full Travel		mm	±0.006	±0.006	±0.006
Repetitive Positioning Accuracy		mm	±0.002	±0.002	±0.002
Three Axes Laser Positioning Accuracy (VDI 3441) / Repeated 5 Times					
Positioning Accuracy		mm	0.008	0.008	0.008
Repetitive Positioning Accuracy		mm	0.006	0.006	0.006
Accuracy					-
Accuracy Positioning	B-axis(Optical Encoder Included)	sec	10	10	-
	C-axis(Optical Encoder Included)	sec	6	6	-
Accuracy Repeatability	B-axis(Optical Encoder Included)	sec	6	6	-
	C-axis(Optical Encoder Included)	sec	3	3	

STANDARD AND OPTION

1. ELECTRICAL FUNCTION

(STANDARD)

- Kinematics opt.
- DCM collision
- Software option 1: PLANE function
- Software option 2: TCPM, Linear in 5-axis

(OPTION)

- Kinematics comp
- DXF converter
- AFC: Adaptive feed control
- CTC: Cross talk comp.
- PAC: Pos. adaptive control
- LAC: Load adaptive control
- MAC: Motion adaptive control
- ACC: Active chatter control
- AVD: Active vibration damping

2. MECHANICAL ACCESSORIES

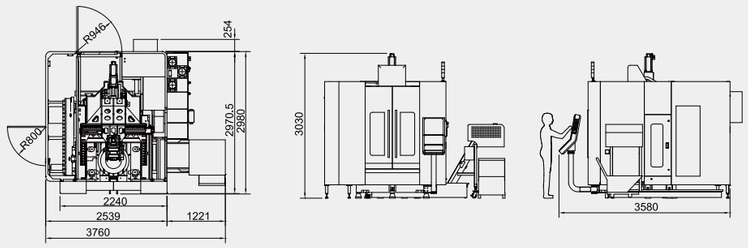
(STANDARD)

- Full-enclosed splash guard
- Full-enclosed splash guard & top cover
- Coolant jets around spindle
- Centralized automatic lubrication equipment
- Spindle air curtain
- Fluorescent lamp
- Air blast through spindle
- Handy coolant gun
- Remote manual pulse generator
- Operation finish lamp
- Oil fluid separator
- Rapid traverse 30*30*30 m/min
- Spindle oil cooler
- Preloaded ballscrew on 3 axes
- Convection heat exchanger in control
- Auto power off
- Rs-232 interface
- Operation manual & electric drawing equipment
- Leveling bolts and blocks
- #40 10000 rpm directly coupled spindle

(OPTION)

- Link type chip conveyor and portable chip bucket
- 20 / 25 / 70 bar standard type CTS
- Cooling through the tool and tool holder sys.
- Oil mist coolant system
- Oil mist collector
- Auto tool length measurement
- Auto work piece measurement
- Closed loop linear scale positioning system
- #40 12000 / 15000 / 20000 / 24000 rpm direct drive spindle
- 30/40/60t arm type ATC

MACHINE DIMENSIONS



* Layout drawing for machine with link type chip conveyor