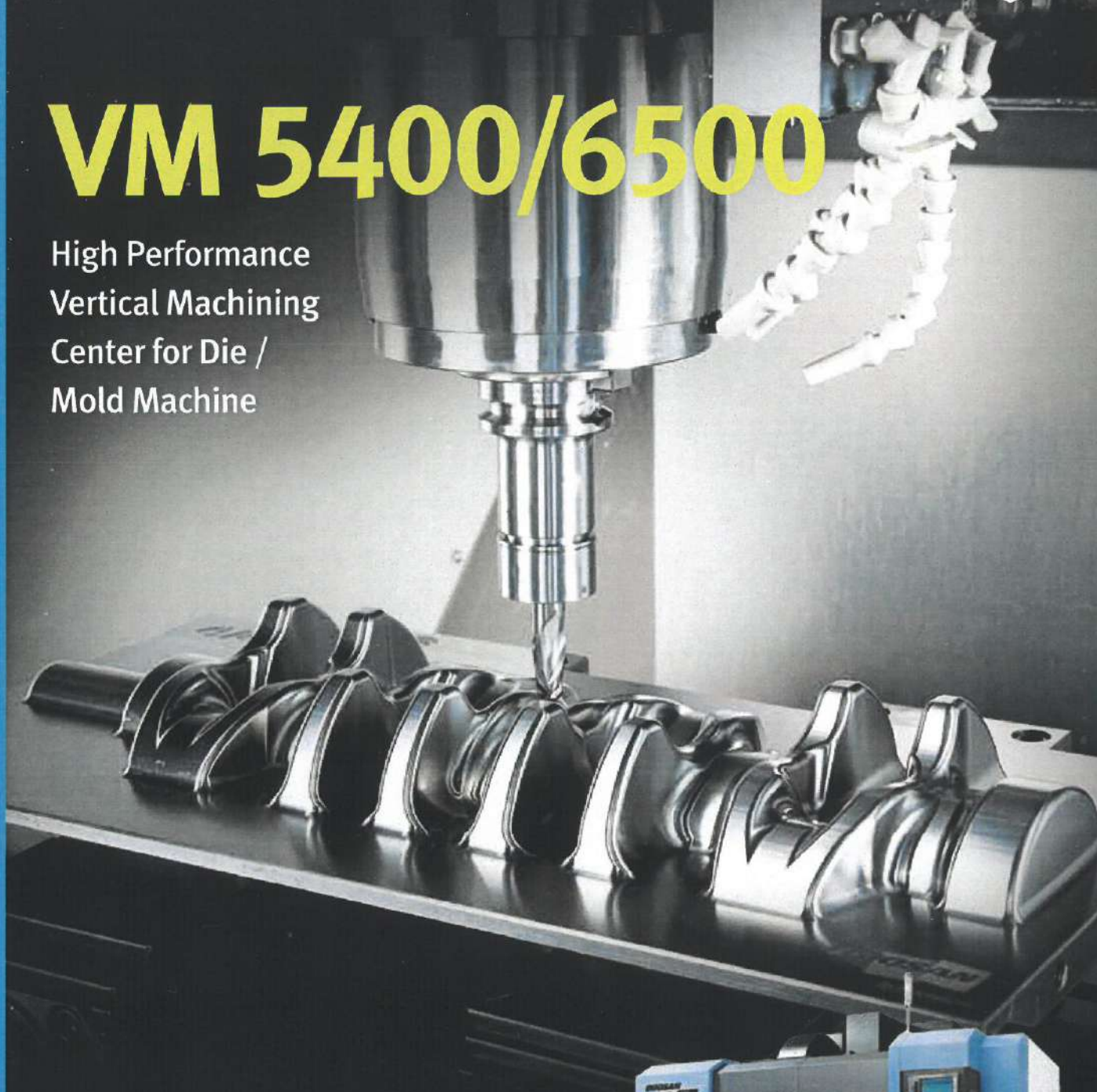


**DOOSAN**



# VM 5400/6500

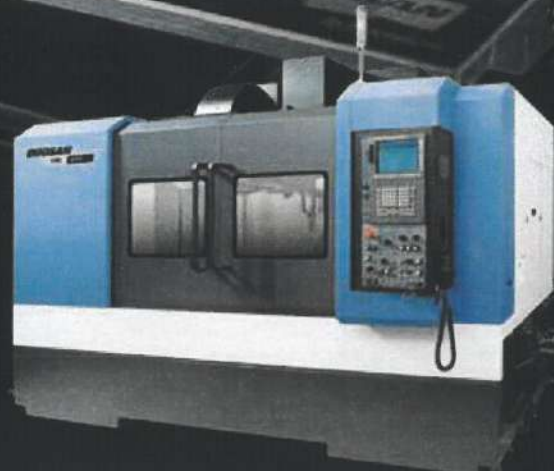
High Performance  
Vertical Machining  
Center for Die /  
Mold Machine



VM 5400 / 6500

VM 5400

VM 6500



**MACHINE  
GREATNESS™**

# VM 5400 / 6500

## Standard core features for high precision mold processing

The efficiency and competitiveness achieved by the user is optimised by the core features which are standard on the machine. These include face / taper contact spindle nose (BBT40), effective spindle cooling system and air blower for chip removal when dry cutting. These features contribute to the machine's capability to produce high quality dies and moulds.



**Spindle**  
- 12000 r/min



**Cam type ATC**  
ISO #40, 7/24 TAPER  
ATC time : 1.3sec (T-T)  
- 30 Tools  
- 40 Tools **opt.**



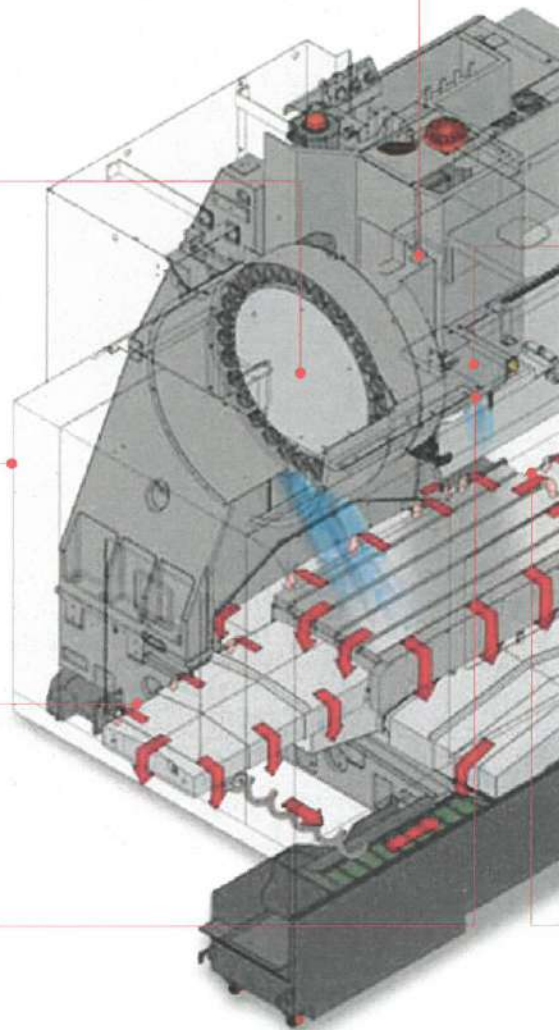
**Oil cooler**



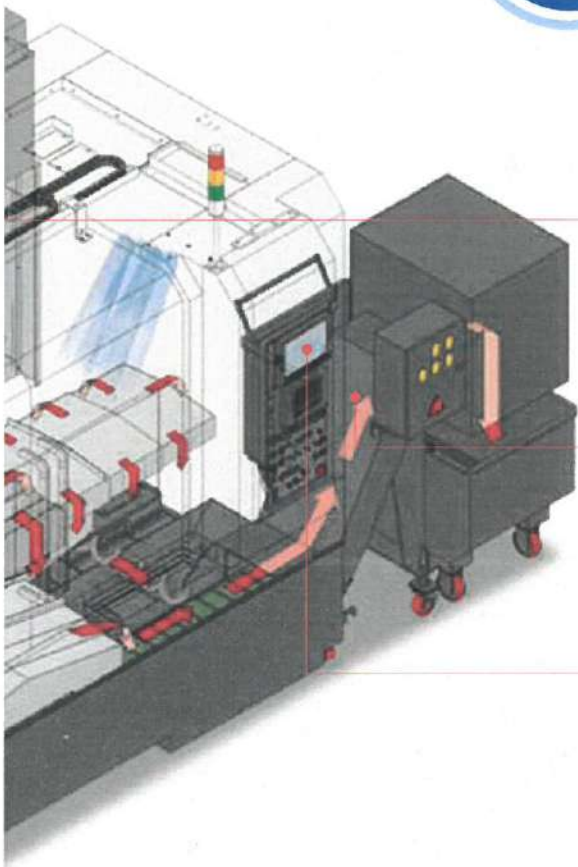
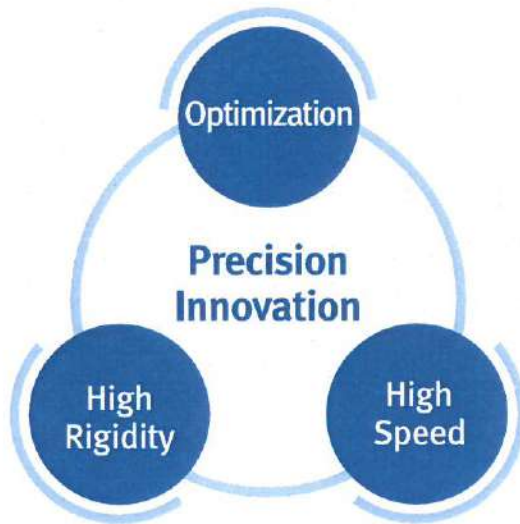
**Screw conveyor**  
- Both sides screw conveyor



**Air blower**  
- MQL Available



# High Performance Vertical Machining Center for Die / Mold Machine



**Spindle thermal compensation system and Dual contact spindle (BBT40)**



**Air port**  
- For Air-gun *opt.*



**Swivelling operator's consol**  
- Fanuc 32i-B  
- DSQ1 (200 Block)



**Automatic tool measurement (TS27R)**



# Die & Mold Solution

The VM Series provides ultra-precise machining capability using high speed / precision contour feed control and the optimum machine stability.

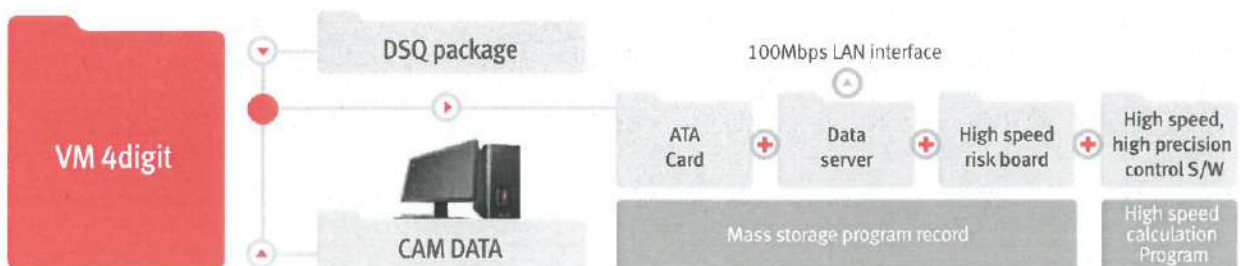
VM 5400 / 6500

## Die & Mold Solution



## Data Server & Risc Board

With a mounted mass storage data server and CPU, it is possible for high end processing of mass storage programs.



DSQ package upgrades productivity and mold processing quality with individual tuning of machinery features, high speed processing by mass storage programs and enhanced superb command following capacity.

# Optimized Tool Processing Solution

Superior surface finishes and machining accuracy are achieved through using standard processing solutions such as high-speed / high - precision contour control and thermal displacement compensation.

VM 5400 / 6500

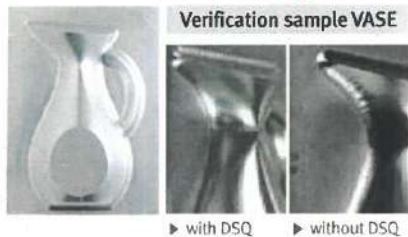


## High speed / Precision contour control

\* DSQ : Doosan Super Quality

Smooths the movement of the machine, improving surface roughness and profile accuracy of corners and edges.

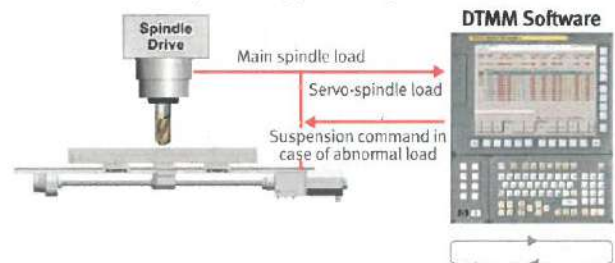
- DSQ1 (AICC2\_200 Block + Machining condition selection function) **std.**
- DSQ2 (DSQ1 + Data server [ 1GB ]) **opt.**



## High efficient DTMM **opt.**

\* DTMM : Doosan Tool load Monitoring for Machining Centers

Damage minimization technology in each tool and device part during processing.



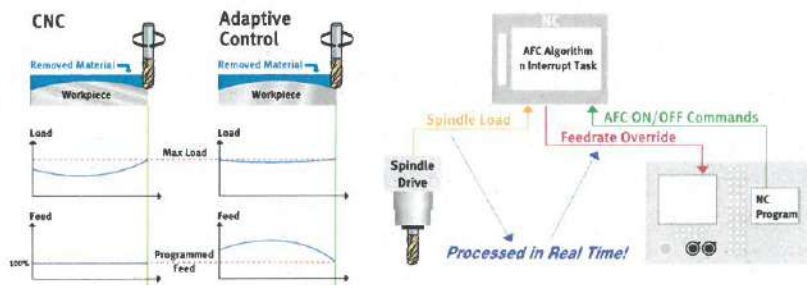
- Detection cycle = Program interpolation cycle
- Equipment suspension command in case of abnormal load
- Replacement tool decision and command to NC



## The optimal feed control **opt.**

\* DAFC : Doosan Adaptive Feed Control

Optimal feed control is based on checking the load of spindle at real time.



## Machining condition selection function

- It is possible to change machining condition in 10 steps by using R code at the program.  
- Improving productivity (high speed at rough machining, high precision at precision machining)
- NC parameter such as maximum feed and acceleration time constant can be set automatically.

Machining condition	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Quality					Initial choice					
Result		Normal							Good	
Tool life		Long							Normal	
Application		High speed							High quality	

## High Rigidity

The highly-rigid body found on the VM series enables exceptionally heavy-duty machining.

### High Rigidity Design

High Rigidity construction is achieved by 3D computer simulation.

#### Static rigidity

The high rigidity structure of VM series has raised the static rigidity up by 30% more than previous model with no weak point through FEM analysis.

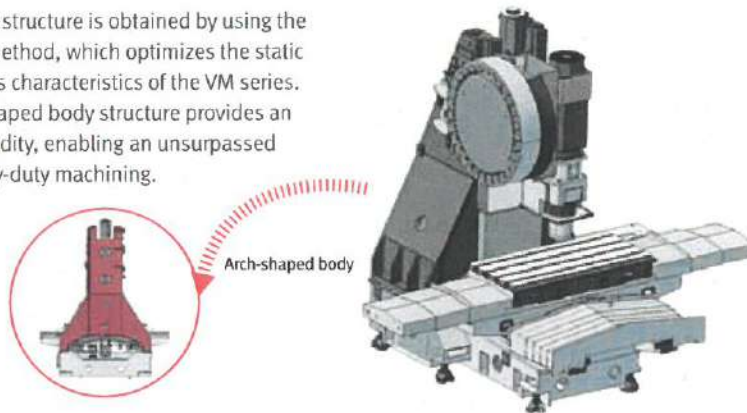
#### Dynamic rigidity

Improving the frequency response and the damping ability of vibration makes it possible to increase the high eigenfrequency 30% up on the previous model.



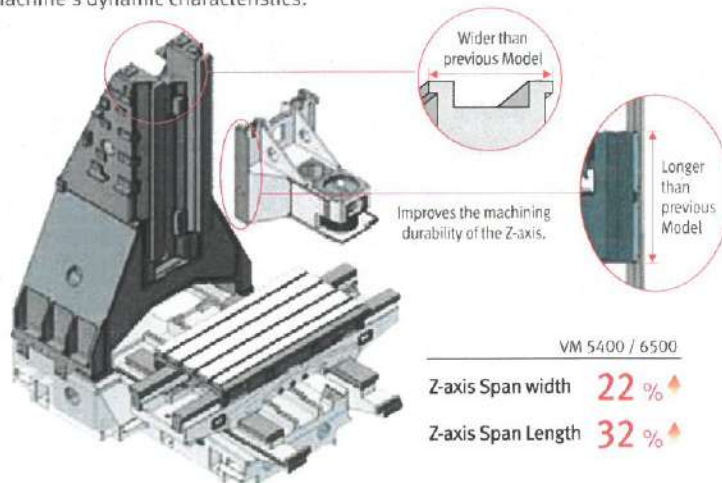
• FEM analysis used to design a stable body. ( FEM : Finite Elements Method )

The highly-rigid body structure is obtained by using the latest FEM analysis method, which optimizes the static and dynamic stiffness characteristics of the VM series. The resulting arch-shaped body structure provides an unrivalled level of rigidity, enabling an unsurpassed performance in heavy-duty machining.



### Broader Box Guideways

Compared to the previous models, the broader box guideways greatly improve the machine's dynamic characteristics.



### Scraping of surface

The sliding surface of each guideway is bonded with Rulon® 142 to reduce friction, then hand scraped for a perfect fit.



# High Speed / Precision Built-in Spindle

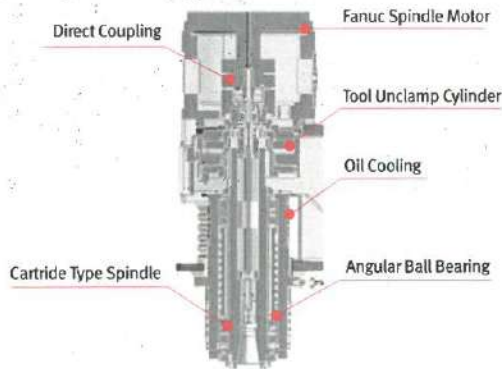
Since the main spindle is supported by 4 rows of P4 level high precision bearings, it maintains stable precision under high speed cutting operation for long periods. Moreover, the high torque 15.6 kW (20.9 Hp) direct connection type main spindle motor is equipped for high speed mold processing.

## High Speed / Precision Built-In Spindle

Spindle motor  
**15.6 kW (20.9 Hp)**

Max. speed  
**12000 r/min**

Minimization of direct-connection type main spindle thermal deformation



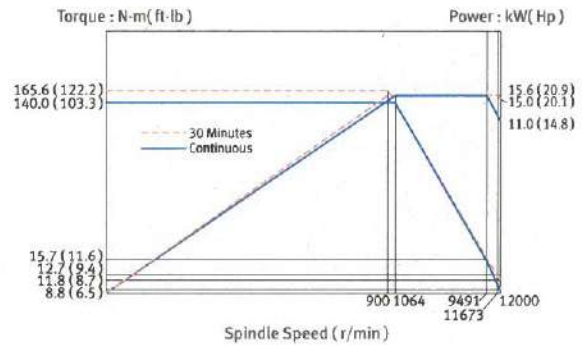
## Low friction and heat generation of main spindle



**Main spindle head cooling system**  
Actualization of low noise in accordance with adoption of special grease lubrication for main spindle cooling device and dramatic reduction of compressed air consumption allows minimization of main spindle thermal deformation.



## Spindle power- torque diagram

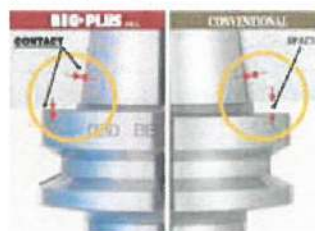


## Z-axis free fall prevention function **std.**

Prevention of damage caused by Z axis freefall following power shutdown is included as standard.



## Face / taper contact spindle **std.** (BBT40)



Common utilization of BT40 Tool and 2-face binding tool (BIG PLUS)



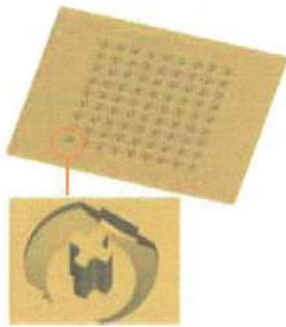
Dry processing and easy MQL connection

## High speed / High precision

The unsurpassed quality and accuracy of the DVM series achieves world-class performance in the machining of die & mold products.

### High Productivity

#### Cycle time of rubber die machining



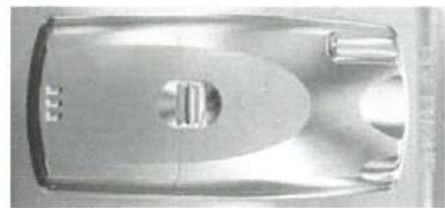
The comparison of cycle time ( actual result )

A competitor's machine  
42hr 20min

12% up

VM 5400  
37hr 50min

#### PDA mold processing



The comparison of cycle time ( actual result )

A competitor's machine  
1hr 48min 38s

23% up

VM 5400  
1hr 23min 29s

#### VASE (Verification sample) cycle time



The comparison of cycle time ( actual result )

A competitor's machine  
25min 42s

8% up

VM 5400  
23min 26s

#### Air filter mold processing



The comparison of cycle time ( actual result )

A competitor's machine  
89hr 42min

10% up

VM 5400  
80hr 55min

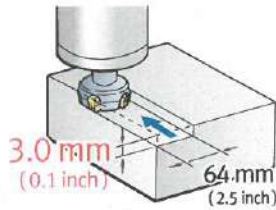
# Machining Capacity (VM 5400)

The VM series provides high machining performance in various cutting processes.

## Machining Capacity

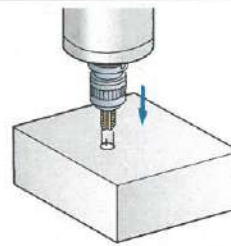
**Face mill BT40** Carbon steel (SM45C)

• ø80mm (3.15 inch) Face mill (5Z)



Machining rate	<b>427</b> cm <sup>3</sup> /min (16.8 in <sup>3</sup> /min)
Spindle speed	<b>750</b> r/min
Feedrate	<b>2226</b> mm/min (87.6 ipm)

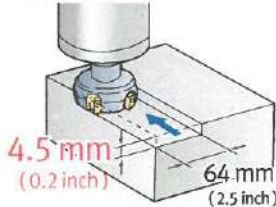
**Tap BT40** Carbon steel (SM45C)



Tool	<b>M30 x P3.5</b>
Spindle speed	<b>220</b> r/min
Feedrate	<b>770</b> mm/min (30.3 ipm)

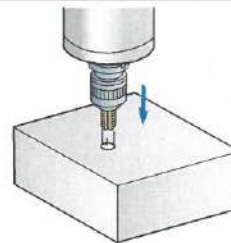
**Face mill BT40** Gray Casting (GC25)

• ø80mm (3.15 inch) Face mill (5Z)



Machining rate	<b>732</b> cm <sup>3</sup> /min (28.8 in <sup>3</sup> /min)
Spindle speed	<b>1060</b> r/min
Feedrate	<b>2544</b> mm/min (100.2 ipm)

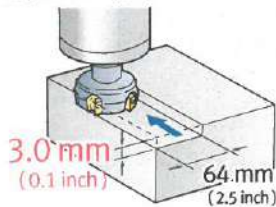
**Tap BT40** Gray Casting (GC25)



Tool	<b>M36 x P4.0</b>
Spindle speed	<b>200</b> r/min
Feedrate	<b>800</b> mm/min (31.5 ipm)

**Face mill BT40** Aluminum (AL6061)

• ø80mm (3.15 inch) Face mill (5Z)



Machining rate	<b>1728</b> cm <sup>3</sup> /min (68.0 in <sup>3</sup> /min)
Spindle speed	<b>6000</b> r/min
Feedrate	<b>9000</b> mm/min (354.3 ipm)

• The results, indicated in this catalogue are provides as example. They may not be obtained due to differences in cutting conditions and environmental conditions during measurement.

# Chip Disposal

Chip control is important to increase productivity and to enhance the operator's working environment. The VM series offers many features to optimize chip disposal.

## Chip Removal

### Inner structure for effective chips and coolant flow

The inner structure of the Mynx series machines is designed to lead the flow of chips and coolant into a front-mounted chip pan for effective chip disposal.

#### Through spindle coolant **opt.**

Middle pressure 1.96 Mpa (284.2 psi) [20 bar]  
 High pressure 6.86 Mpa (994.7 psi) [70 bar]

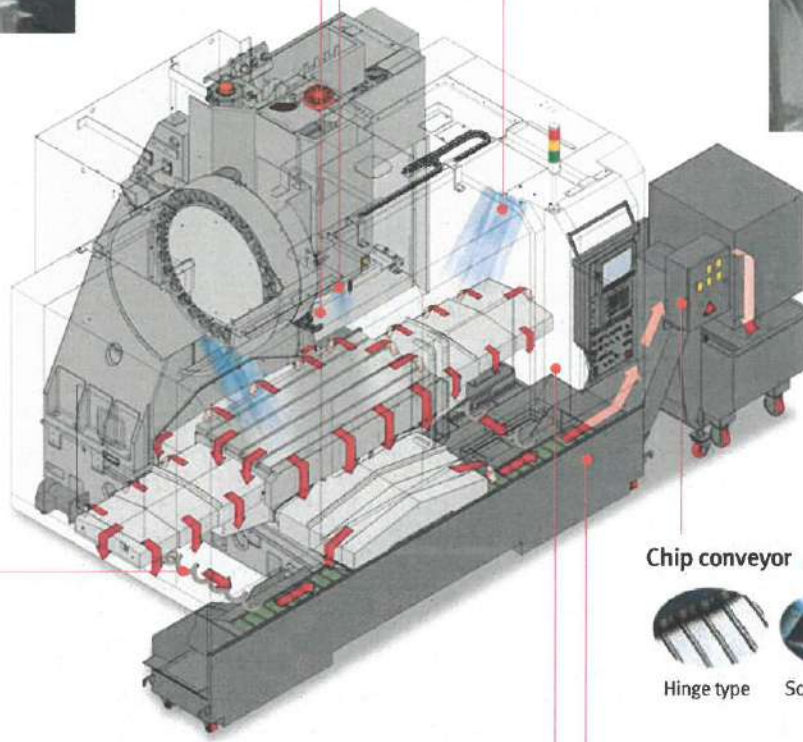
• Measured at pump outlet with 60Hz power.



#### Flood coolant **std.**



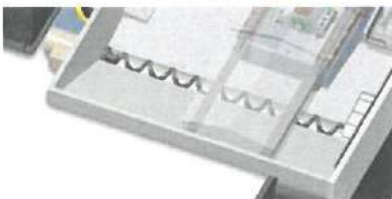
#### Shower coolant **opt.**



#### Chip conveyor **opt.**



#### Internal screw conveyor **std.**



#### Coolant Gun **opt.**



#### Larger Coolant Tank Capacity

Previous Model	VM series
VM 510 300 ℓ (79.3 gallon)	VM 5400 380 ℓ (100.4 gallon)
VM 650 300 ℓ (79.3 gallon)	VM 6500 380 ℓ (100.4 gallon)

## Easy Set-up

### Operating Console std.



#### 1 10.4" Color TFT LCD Monitor as Standard Feature

The wide screen displays more useful information for the operator. Doosan's customized pages make setting up, operating, and machine condition monitoring easier.



#### 2 Pentium Board is standard.

#### 3 Portable MPG

It makes workpiece setting easier for the operator



#### 4 Easier ATC operation and maintenance.

Magazine : CW



Magazine : CCW

It gives much easier operation and maintenance for ATC.

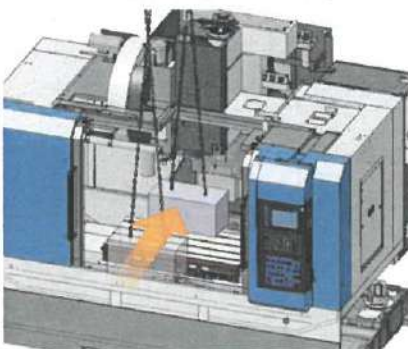
#### 5 PCMCIA Card

#### 6 Embedded Ethernet / RS-232C

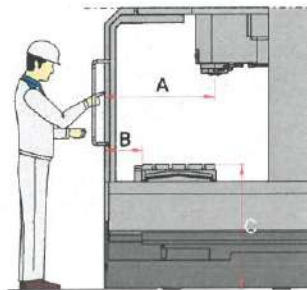
#### 7 Swivelling Operating Console

The easy-to-use operation panel can swivel 0-90°

## Workpiece loading



## Accessibility



Unit : mm ( inch )

A VM 5400 **830** (32.7)

VM 6500 **895** (35.2)

B VM 5400 **290** (11.4)

VM 6500 **224** (8.8)

C VM 5400 **950** (37.4)

VM 6500 **950** (37.4)

## Easy Operation Package \*EOP ( Easy Operation Package )

Doosan's easy operation software package is customized to provide fast and easy operation for tooling, workpiece and program setup. These features maximize productivity by minimizing time lost during process setup.

### Programming



- Doosan Fanuc 32i-B
- 10.4" color TFT LCD
- Embedded Ethernet

#### G Code List



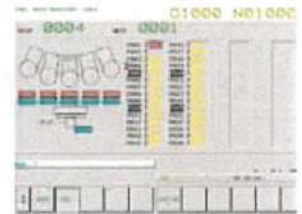
Operator can check the meaning of each G-code.

#### M Code List



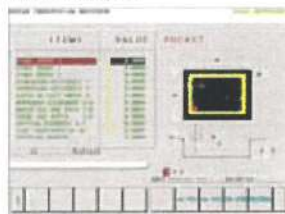
Operator can check the meaning of each M-code.

#### Tool Data Registry Table



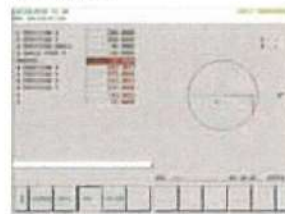
Operator can edit & check the tool number of the tool magazine pot.

#### Pattern Cycle



It is easy to make pattern cycle program by this function.

#### Calculator



Operator can calculate numerical formula in relation to arc and hole easily.

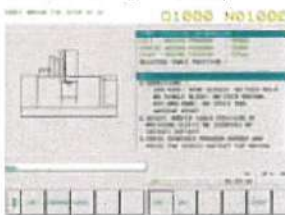
#### ENGRAVING <sup>opt</sup>



It makes "Engraving" programming easy.

### Operation / Maintenance

#### Table Moving for Setup



Enables quick and easy table movement to either of three positions during setup.

#### ATC Recovery Help



Allows easy recovery of ATC from ATC alarm status.

#### Sensor Status Monitor



Solenoid valve and sensor status can be checked without the electric diagram.

#### Alarm Guidance



The alarm remedy method for selected important alarms is displayed on the screen.

#### Easy NC Parameter Help



Operator can check some useful parameters for easy operation.

#### Operation Rate



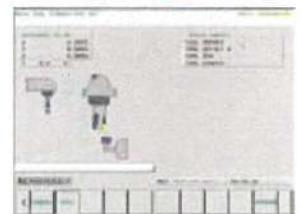
Manages working and operation times for each operator.

#### Tool Load Monitor <sup>opt</sup>



Damage to tools is minimized by monitoring the axis and spindle load during cutting operations.

#### Renishaw Gui <sup>opt</sup> Tool measure Work measure



Tooling and the work piece measurement are operated through a conversational control screen.



# Machine Specifications

Description		Unit	VM5400	VM6500
Travels	X-axis	mm (inch)	1020 (40.2)	1270 (50.0)
	Y-axis	mm (inch)	540 (21.3)	670 (26.4)
	Z-axis	mm (inch)	530 (20.9)	625 (24.6)
	Distance from spindle nose to table top	mm (inch)	150 ~ 680 (5.9 - 26.8)	150 ~ 775 (5.9 - 30.5)
	Distance from spindle nose to column	mm (inch)	676 (26.6)	772 (30.4)
Feedrates	Rapid Traverse Rate (X / Y / Z-axis)	m/min (ipm)	30 / 30 / 24 (1181.1 / 1181.1 / 944.9)	
	Cutting feedrate	mm/min(ipm)	12000 (472.4)	
Table	Table size	mm (inch)	1200 × 540 (47.2 × 21.3)	1400 × 670 (55.1 × 26.4)
	Table loading capacity	kg (lb)	800 (1763.7)	1000 (2204.6)
Spindle	Max. Spindle speed	r/min	12000	
	Spindle taper	-	ISO #40 7/24 Taper	
	Max. Spindle torque	N·m (ft·lb)	165.6 (122.2)	
	Type of tool shank	-	MAS406-BT40	
	Tool storage capa.	ea	30 { 40 }	
Automatic Tool Changer	Max. tool diameter (Without Adjacent Tools)	mm (inch)	80 [ 150 ], 76 [ 150 ]* ( 3.1 [ 5.9 ], 3.0 [ 5.9 ] )	
	Max. tool length	mm (inch)	300 (11.8)	
	Max. tool weight	kg (lb)	8 (17.6)	
	Max. tool moment	N·m (ft·lb)	5.88 (4.3)	
	Tool selection	-	Random	
	Tool change time ( Tool-to-tool )	s	1.3	
	Tool change time ( Chip-to-chip )	s	3.7	
Motors	Spindle motor power ( 30min )	kW (Hp)	15.6 (20.9)	
Power source	Electric power supply ( rated capacity )	kVA	41.7	45.1
	Air Consumption	NL/min	250	
Machine Dimensions	Height ( with TSC / without TSC )	mm (inch)	3045 / 2855 ( 119.9 / 112.4 )	3140 / 2950 ( 123.6 / 116.1 )
	Length × Width	mm (inch)	2444 × 3350 ( 96.2 × 131.9 )	2674 × 3350 ( 105.3 × 131.9 )
	Weight	kg (lb)	7000 (15432.1)	9000 (19841.3)

\*40 Tools { } : opt.

## Standard Feature

- Air blower
- Assembly & operation tools
- Automatic power off
- Coolant tank & chip pan
- Door interlock
- DSQ1 (AICC II \_ 200 Block + Machine condition selection function)
- Full enclosure splash guard
- Installation parts
- Portable MPG
- Screw conveyor
- Signal tower (red, yellow, green)
- Spindle head cooling system
- work light

## Optional Feature

- 3th axis MPG
- 4th axis preparation
- Air dryer
- Automatic tool length measurement with sensor
- Automatic tool measurement
- Chip conveyor & chip bucket
- DSQ2 (DSQ1+Data server [ 1GB ])
- Mist Collector
- Rotary table
- Test bar (BT40)
- Through spindle coolant
- Coolant level switch : Sensing level - Low / High\*\*

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

\*\* Special Quotation.

# NC Unit Specifications

## FANUC 32i-B

### AXES CONTROL

- Controlled axes	3 (X, Y, Z)
- Simultaneously controllable axes	
- Positioning(G00)/ Linear interpolation (G01) : 3 axes	
- Circular interpolation (G02, G03) : 2 axes	
- Backlash compensation	
- Emergency stop/overtravel	
- Follow up	
- Least command increment	0.001mm / 0.0001inch
- Least input increment	0.001mm / 0.0001inch
- Machinlock	All axes/ Z axis
- Mirror image	Reverse axis movement ( Setting screen and M - function )
- Stored pitch error compensation	
- Pitch error offset compensation for each axis	
- Stored stroke check 1	Overtravel controlled by software
- Absolute pulse coder	

### INTERPOLATION & FEED FUNCTION

- 2nd reference point return	G30
- Circular interpolation	G02, G03
- Dwell	G04
- Exact stop check	G09, G61 (mode)
- Feed per minute	
- Feedrate override ( 10% increments )	0 - 200%
- Jog override ( 10% increments )	0 - 200%
- Linear interpolation	G01
- Manual handle feed 1 unit	
- Manual handle feedrate	x1, x10, x100 (per pulse)
- Override cancel	M48 / M49
- Positioning	G00
- Rapid traverse override	F0 (fine feed), 25 / 50 / 100%
- Reference point return	G27, G28, G29
- Skip function	G31
- Helical interpolation	
- DSQ1 (AICC II+ Machining condition selection function)	200 block preview
- Thread cutting, synchronous cutting	G95
- Program restart	
- Automatic corner deceleration	
- Feedrate clamp by circular acceleration	
- Linear ACC / DEC before interpolation	
- Linear ACC / DEC after interpolation	
- Rapid traverse bell-shaped acceleration/deceleration	
- Smooth backlash compensation	

### SPINDLE & M-CODE FUNCTION

- M-code function	M3 digits
- Spindle orientation	
- Spindle serial output	
- Spindle speed command	S5 digits
- Spindle speed override ( 10% increments )	50 - 150%
- Spindle output switching 1st	
- Retraction for rigid tapping	
- Rigid tapping	G84, G74

### TOOL FUNCTION

- Tool nose radius compensation	G40, G41, G42
- Number of tool offsets	64ea
- Tool length compensation	G43, G44, G49
- Tool number command	T2 digits
- Tool life management	
- Tool offset memory C	H/D code, Geometry / Wear memory
- Tool length measurement	

### PROGRAMMING & EDITING FUNCTION

- Absolute / Incremental programming	G90 / G91
- Auto. Coordinate system setting	
- Background editing	
- Canned cycle	G73, G74, G76, G80 - G89, G99
- Circular interpolation by radius programming	
- Plane selection	G17, G18, G19
- Custom macro B	
- Custom software size 512kB	
- Extended P-code Variables size 512kB	
- Decimal point input	
- Reader / puncher interface	RS - 232C
- Inch / metric conversion	G20 / G21
- Label skip	
- Local / Machine coordinate system	G52 / G53
- Maximum commandable value	+99999.999mm (+9999.9999 inch)
- Part program storage size 256KB ( 640m )	256 KB
- No. of Registered programs	500ea
- Optional block skip 1	
- Optional stop	M01
- Program file name	32s
- Sequence number	N 8-digit
- Program protect	
- Program stop / end	M00 / M02, M30
- Programmable data input	Tool offset and work offset are entered by G10, G11
- Sub program call	Up to 10 nesting
- Tape code	ISO / EIA Automatic discrimination
- Work coordinate system	G54 - G59
- Additional work coordinate system	G54.1 P1 - 48 pairs
- Coordinate system rotation	G68, G69
- Extended part program editing	
- Optional angle chamfering corner R	
- Macro executor	

### OTHERS FUNCTIONS ( Operation, Setting & Display, etc )

- Alarm display	
- Alarm history display	
- Clock function	
- Cycle start / Feed hold	
- Display of PMC alarm message	Message display when PMC alarm occurred
- Dry run	
- Ethernet function ( Embedded )	
- Graphic display	Tool path drawing
- Help function	
- Loadmeter display	
- MDI / DISPLAY unit	10.4" Color LCD, Keyboard for data input, soft-keys
- Memory card interface	
- Operation functions	Tape / Memory / MDI / Manual
- Operation history display	
- Program restart	
- Run hour and part number display	
- Search function	Sequence NO. / Program NO.
- Self - diagnostic function	
- Servo setting screen	
- Single block	
- External data input	
- Multi language display	

### OPTIONAL SPECIFICATIONS

- 3D Coordinate Conversion	
- 3D tool compensation	
- 3rd / 4th reference return	
- Addition of tool pairs for tool life management	1024 pairs
- Additional controlled axes	max. 5 axes in total
- DSQ 2 ( AICC II+ Machining condition selection function + Data server + 1GB )	
	200 block preview

## Major Specifications

### VM 5400/6500



Description	Unit	VM 5400	VM 6500
Max. spindle speed	r/min	12000	
Max. Spindle motor power	Kw (Hp)	15.6 (20.9)	
Max. Spindle motor torque	N·m (ft·lbs)	165.6 (122.2)	
Travel distance (X/Y/Z)	mm (inch)	1020 / 540 / 530 (40.2 / 21.3 / 20.9)	1270 / 670 / 625 (50 / 26.4 / 24.6)
Tool storage capacity	ea	30 (40)*	
Table size	mm (inch)	1200 x 540 (47.2 x 21.3)	1400 x 670 (55.1 x 26.4)

\*(): Option