VM 5400/6500
High Performance Vertical Machining Center for Die / Mold Machine
**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: 1.3 sec (T-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
- Swivelling operator's consol - Fanuc 32i-B - DSQ1 (200 Block)
- Automatic tool measurement (TS27R)

Optimization
Precision
Innovation
High Rigidity
High Speed

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Innovation
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Spindle thermal compensation system and Dual contact spindle (BBT40)
Air port - For Air-gun
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.

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.

**High speed / Precision contour control**

* DSQ : Doosan Super Quality
  Smoothes the movement of the machine, improving surface roughness and profile accuracy of corners and edges.
  - DSQ1 (AICC2_200 Block + Machining condition selection function)
  - DSQ2 (DSQ1 + Data server [1GB])

**The optimal feed control**

* DAFC : Doosan Adaptive Feed Control
  Optimal feed control is based on checking the load of spindle at real time.

**High efficient DTMM**

* DTMM : Doosan Tool load Monitoring for Machining Centers
  Damage minimization technology in each tool and device part during processing.

**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.
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.

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.

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Broader Box Guideways

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

**Scrapping 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

Low friction and heat generation of main spindle

Minimization of direct-connection type main spindle thermal deformation

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

Torque : N·m (ft·lb)

Power : kW (Hp)

165.6 (122.2)

140.0 (103.1)

15.7 (11.6)

11.8 (8.7)

900 1064 12000

30 Minutes Continuous

Z-axis free fall prevention function

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

Face / taper contact spindle

(BBT40)

Dry processing and easy MQL connection

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

Air Blower

std
**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**

<table>
<thead>
<tr>
<th>Cycle time of rubber die machining</th>
<th>PDA mold processing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VASE (Verification sample) cycle time</strong></td>
<td><strong>Air filter mold processing</strong></td>
</tr>
<tr>
<td>A competitor’s machine 42hr 20min</td>
<td>23% up VM 5400 1hr 23min 29s</td>
</tr>
<tr>
<td>12% up VM 5400 37hr 50min</td>
<td>8% up VM 5400 23min 26s</td>
</tr>
<tr>
<td>8% up VM 5400 23min 26s</td>
<td>10% up VM 5400 80hr 55min</td>
</tr>
</tbody>
</table>
Machining Capacity (VM 5400)

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

Machining Capacity

**Face mill** BT40

- ø80mm (3.15 inch) Face mill (5Z)

- **Material:** Carbon steel (SM45C)

  - Machining rate: 427 cm³/min (16.8 in³/min)
  - Spindle speed: 750 r/min
  - Feedrate: 2226 mm/min (87.6 ipm)

**Face mill** BT40

- ø80mm (3.15 inch) Face mill (5Z)

- **Material:** Gray Casting (GC25)

  - Machining rate: 732 cm³/min (28.8 in³/min)
  - Spindle speed: 1060 r/min
  - Feedrate: 2544 mm/min (100.2 ipm)

**Face mill** BT40

- ø80mm (3.15 inch) Face mill (5Z)

- **Material:** Aluminum (AL6061)

  - Machining rate: 1728 cm³/min (68.0 in³/min)
  - Spindle speed: 6000 r/min
  - Feedrate: 9000 mm/min (354.3 ipm)

**Tap** BT40

- **Material:** Carbon steel (SM45C)

  - Tool: M30 x P3.5
  - Spindle speed: 220 r/min
  - Feedrate: 770 mm/min (30.3 ipm)

**Tap** BT40

- **Material:** Gray Casting (GC25)

  - Tool: M36 x P4.0
  - Spindle speed: 200 r/min
  - Feedrate: 800 mm/min (31.5 ipm)

- The results, indicated in this catalogue are provided 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
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
Hinge type
Scraper type
Drum filter type

Larger Coolant Tank Capacity

<table>
<thead>
<tr>
<th>Previous Model</th>
<th>VM series</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM 510</td>
<td>VM 5400</td>
</tr>
<tr>
<td>300ℓ (79.3 galon)</td>
<td>380ℓ (100.4 galon)</td>
</tr>
<tr>
<td>VM 650</td>
<td>VM 6500</td>
</tr>
<tr>
<td>300ℓ (79.3 galon)</td>
<td>380ℓ (100.4 galon)</td>
</tr>
</tbody>
</table>
Easy Set-up

Operating Console

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°

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**Workpiece loading**

**Accessibility**

<table>
<thead>
<tr>
<th></th>
<th>Unit: mm ( inch )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>VM 5400 830 (32.7) VM 6500 895 (35.2)</td>
</tr>
<tr>
<td>B</td>
<td>VM 5400 290 (11.4) VM 6500 224 (8.8)</td>
</tr>
<tr>
<td>C</td>
<td>VM 5400 950 (37.4) VM 6500 950 (37.4)</td>
</tr>
</tbody>
</table>
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

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

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

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

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.
External Dimensions

**VM 5400**

**Top View**

**Front View**

**Side View**

**Table**

<table>
<thead>
<tr>
<th>VM 5400</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1600 (63)</td>
<td></td>
</tr>
<tr>
<td>1500 (59.1)</td>
<td></td>
</tr>
<tr>
<td>600 (23.6)</td>
<td></td>
</tr>
<tr>
<td>600 (23.6)</td>
<td></td>
</tr>
<tr>
<td>1200 (47.2)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VM 6500</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1600 (63)</td>
<td></td>
</tr>
<tr>
<td>1500 (59.1)</td>
<td></td>
</tr>
<tr>
<td>700 (27.6)</td>
<td></td>
</tr>
<tr>
<td>700 (27.6)</td>
<td></td>
</tr>
<tr>
<td>1400 (55.1)</td>
<td></td>
</tr>
</tbody>
</table>

**VM 6500**

**Top View**

**Front View**

**Side View**

**Tool Shank**

BT40 Tool

※ Pull Stud installation required with 15 degrees as the standard
### Machine Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>VM5400</th>
<th>VM6500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel distance</td>
<td>mm ( inch)</td>
<td>1020 (40.2)</td>
<td>1270 (50.0)</td>
</tr>
<tr>
<td>X-axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y-axis</td>
<td>mm ( inch)</td>
<td>540 (21.3)</td>
<td>670 (26.4)</td>
</tr>
<tr>
<td>Z-axis</td>
<td>mm ( inch)</td>
<td>530 (20.9)</td>
<td>625 (24.6)</td>
</tr>
<tr>
<td>Distance from spindle nose to table top</td>
<td>mm ( inch)</td>
<td>150 – 680 (5.9 - 26.8)</td>
<td>150 – 775 (5.9 - 30.5)</td>
</tr>
<tr>
<td>Distance from spindle nose to column</td>
<td>mm ( inch)</td>
<td>676 (26.6)</td>
<td>772 (30.4)</td>
</tr>
<tr>
<td><strong>Feedrates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid Traverse Rate (X / Y / Z-axis)</td>
<td>m/min (ipm)</td>
<td>30 / 30 / 24 (1181.1 / 1181.1 / 944.9)</td>
<td></td>
</tr>
<tr>
<td>Cutting feedrate</td>
<td>mm/min ipm</td>
<td>12000 (472.4)</td>
<td></td>
</tr>
<tr>
<td><strong>Table</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table size</td>
<td>mm ( inch)</td>
<td>1200 × 540 (47.2 × 21.3)</td>
<td>1400 × 670 (55.1 × 26.4)</td>
</tr>
<tr>
<td>Table loading capacity</td>
<td>kg ( lb)</td>
<td>800 (1763.7)</td>
<td>1000 (2204.6)</td>
</tr>
<tr>
<td><strong>Spindle</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Spindle speed</td>
<td>r/min</td>
<td>12000</td>
<td></td>
</tr>
<tr>
<td>Spindle taper</td>
<td>-</td>
<td>ISO #40 7/24 Taper</td>
<td></td>
</tr>
<tr>
<td>Max. Spindle torque</td>
<td>N·m (ft·lb)</td>
<td>165.6 (122.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Automatic Tool Changer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of tool shank</td>
<td>-</td>
<td>MAS406-BT40</td>
<td></td>
</tr>
<tr>
<td>Tool storage capa.</td>
<td>ea</td>
<td>30 (40)</td>
<td></td>
</tr>
<tr>
<td>Max. tool diameter (Without Adjacent Tools)</td>
<td>mm ( inch)</td>
<td>80 [150], 76 [150]* (3.1 [5.9], 3.0 [5.9])</td>
<td></td>
</tr>
<tr>
<td>Max. tool length</td>
<td>mm ( inch)</td>
<td>300 (11.8)</td>
<td></td>
</tr>
<tr>
<td>Max. tool weight</td>
<td>kg ( lb)</td>
<td>8 (17.6)</td>
<td></td>
</tr>
<tr>
<td>Tool selection</td>
<td>-</td>
<td>Random</td>
<td></td>
</tr>
<tr>
<td>Tool change time (Tool-to-tool)</td>
<td>s</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Tool change time (Chip-to-chip)</td>
<td>s</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td><strong>Motors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spindle motor power (30min)</td>
<td>kW (Hp)</td>
<td>41.7</td>
<td>45.1</td>
</tr>
<tr>
<td><strong>Power source</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric power supply (rated capacity)</td>
<td>kVA</td>
<td>4045 / 2855 (119.9 / 112.4)</td>
<td>3140 / 2950 (123.6 / 116.1)</td>
</tr>
<tr>
<td>Air consumption</td>
<td>NL/min</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td><strong>Machine Dimensions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (with TSC / without TSC)</td>
<td>mm ( inch)</td>
<td>3045 / 2855 (119.9 / 112.4)</td>
<td>3140 / 2950 (123.6 / 116.1)</td>
</tr>
<tr>
<td>Length × Width</td>
<td>mm ( inch)</td>
<td>2444 × 3350 (96.2 × 131.9)</td>
<td>2674 × 3350 (105.3 × 131.9)</td>
</tr>
<tr>
<td>Weight</td>
<td>kg ( lb)</td>
<td>7000 (15432.1)</td>
<td>9000 (19841.3)</td>
</tr>
</tbody>
</table>

*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

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

FANUC 32i-B

AXES CONTROL
- Controlled axes \(3 \times (X, Y, Z)\)
- Simultaneously controllable axes
- Positioning (GO0): Linear interpolation (GO1): 3 axes
- Circular interpolation (GO2, GO3): 2 axes
- Backlash compensation
- Emergency stop / overtravel
- Follow up
- Least command increment \(0.001 \text{mm} / 0.0001\text{inch}\)
- Least input increment \(0.001 \text{mm} / 0.0001\text{inch}\)
- Machinelock 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 GO2, GO3
- Dwell GO4
- Exact stop check G09, G61 (mode)
- Feed per minute
- Feerate override (10% increments) 0 - 200%
- Jog override (10% increments) G01
- Manual handle feed 1 unit
- Manual hand feedrate \(x_1, x_{10}, x_{100} \) (per pulse)
- Override cancel M48 / M49
- Positioning GO0
- 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
- Feerate 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
- Rapid tapping G64, 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, Geometery / 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 softwear size 512KB
- Extended P-code Variables size 512kB
- Decimal point input
- Reader / puncher interface R5 - R232C
- Inch / metric conversion G20 / G21
- Label skip
- Local / Machine coordinate system G52 / G53
- Maximum commandable value \(+9999.9999\text{mm} \) (+9999.9999 inch)
- Part program storage size 256KB (640m)
- No. of Registered programs S00ea
- Optional block skip 1
- Optional stop M01
- Program file name S2s
- Sequence number N 8-digit
- Program protect
- Program stop / end M00 / M02
- Programnable data input Tool offset and work offset are entered by G10, G11
- Sub program call Up to 10 nesting
- Tape code ISO / EA 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)
- Graphical 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