

1994

VERTICAL MACHINING CENTERS

# MV-45/55/65



**MORI SEIKI**



***Sterling***  
MACHINERY EXCHANGE

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Vertical  
Machining Centers

Superlative engineering means...  
incomparable precision with the functions you need.



**MV**  
*Sterling*  
MACHINERY EXCHANGE

**New vertical machining centers for automated production lines.**

We designed these revolutionary new machining centers for flexibility. They have the speed and accuracy you need for heavy-duty cutting. Rugged construction, especially in the rigid spindle component system, means stability on even the toughest jobs. The cost-performance curve on our MV models will make an impression on your running costs like never before. Nobody uses sophisticated technology like Mori Seiki. Advanced mecha-

tronics, in down-to-earth designs make these vertical machining centers really perform.  
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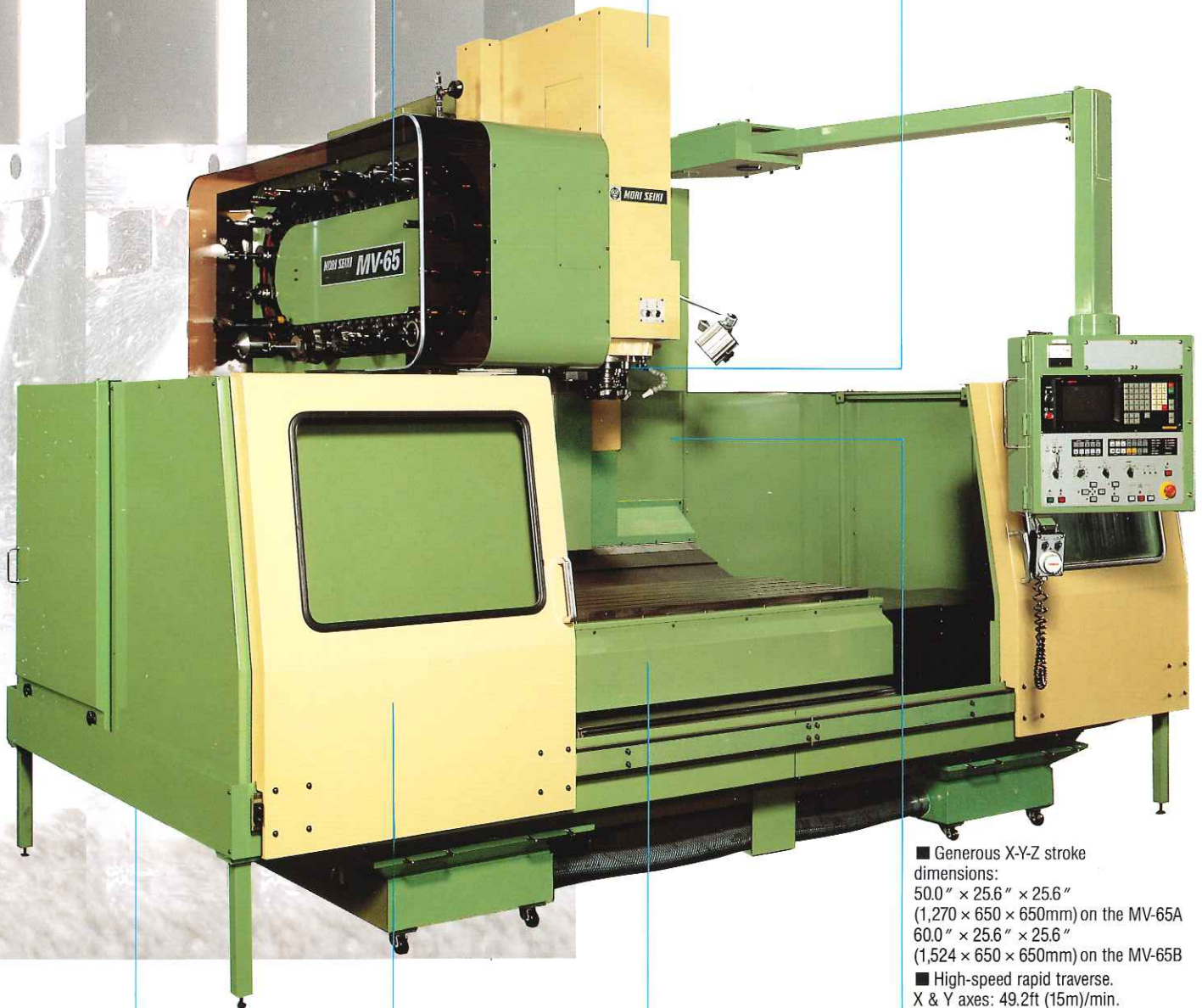
# MV-65

Sets new industry standards for productivity and flexibility

■ High speed ATC: tool-to-tool time is only 2.5/3.0 sec. for No. 40/50 tool shanks.  
■ Standard configuration holds 30 tools. 40-tool option available.

■ Spindle component design and standard oil cooler reduce thermal displacement in spindle to  $\pm 0.0004$ " (0.01mm).

■ Ceramic spindle is standard equipment.



■ Large coolant tank holds 79.2 gallons (300 liters).

■ Complete Cover (Mori Seiki's special full shielding) is standard equipment.

■ 4-slideway bed, 55.9" (1,420mm) wide.

■ Generous X-Y-Z stroke dimensions:  
50.0" x 25.6" x 25.6"  
(1,270 x 650 x 650mm) on the MV-65A  
60.0" x 25.6" x 25.6"  
(1,524 x 650 x 650mm) on the MV-65B

■ High-speed rapid traverse.  
X & Y axes: 49.2ft (15m)/min.  
Z axis: 39.4ft (12m)/min.

■ Positioning accuracy:  
0.0002" (0.005mm)  
(full stroke)

■ Repeatability:  
 $\pm 0.00004$ " (0.001mm)

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# MV-55

Easily expanded as your operations grow.  
Advanced functions make it today's FA leader.

- High-speed ATC: tool-to-tool time is only 2.5/3.0 sec. for No. 40/50 tool shanks.
- Standard configuration holds 30 tools. 40-tool option available.

- Spindle component design and standard oil cooler reduce thermal displacement in spindle to  $\pm 0.0004$ " (0.01mm).

- Ceramic spindle is standard equipment.



- Large coolant tank holds 66 gallons (250 liters).

- Complete Cover is standard equipment.

- 4-slideway bed, 48.0" (1,220mm) wide.

- Generous X-Y-Z stroke dimensions:  
41.3" x 21.7" x 21.7"  
(1,050 x 550 x 560mm)

- High-speed rapid traverse.  
X & Y axes: 49.2ft (15m)/min.  
Z axis: 39.4ft (12m)/min.

- Positioning accuracy:  
0.0002" (0.005mm)  
(full stroke)

- Repeatability:  
 $\pm 0.00004$ " (0.001mm)

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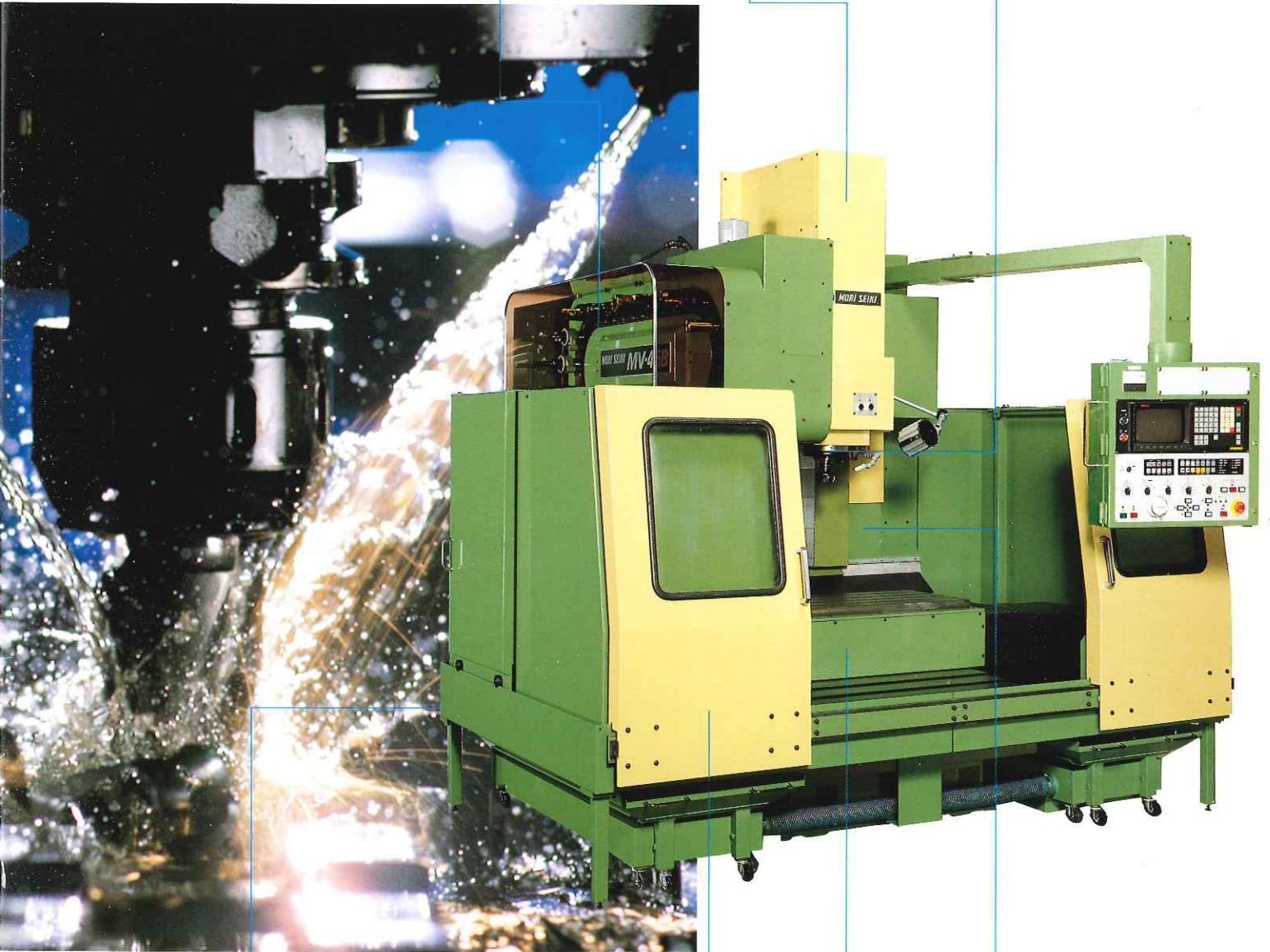
# MV-45

10,000 rpm top-speed for real cutting power.  
A true high-performance machine.

■ High speed ATC: tool-to-tool time is only 2.5/3.0 sec. for No. 40/50 tool shanks.  
■ Standard configuration holds 30 tools. 40-tool option available.

■ Spindle component design and standard oil cooler reduce thermal displacement in spindle to  $\pm 0.0004$ " (0.01mm).

■ Ceramic spindle is standard equipment.



■ Large coolant tank holds 52.8 gallons (200 liters).

■ Complete Cover is standard equipment.

■ 4-slideway bed, 40.2" (1,020mm) wide.

■ High-speed rapid traverse.  
X & Y axes: 49.2ft (15m)/min.  
Z axis: 39.4ft (12m)/min.

■ Positioning accuracy: 0.0002" (0.005mm) (full stroke)

■ Repeatability:  $\pm 0.00004$ " (0.001mm)

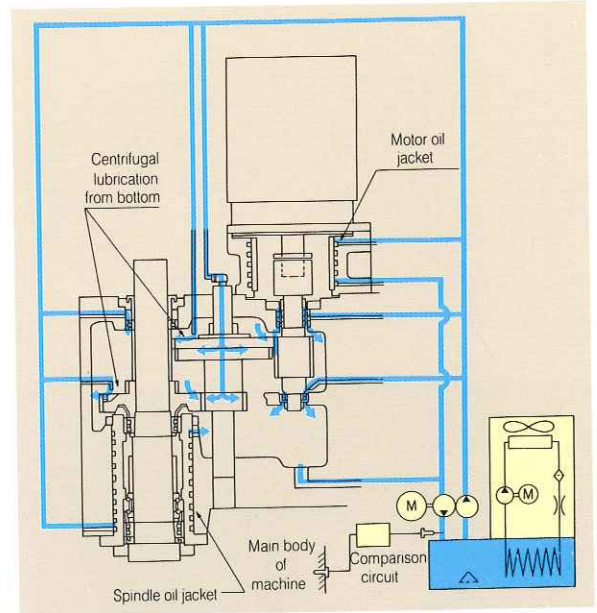
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**Flexibility to meet your plant's toughest demands.  
Top specifications mean you get the job done.**

## **Large-Capacity Oil Cooler** comes as standard equipment.

A 1,500 kcal/h oil cooler reduces heat on the spindle minimizing thermal displacement. Cooled lubricant circulates continuously through all potential heat-accumulating parts of the machine, such as the bearings, gears, and the oil jacket in the spindle cylinder. Naturally the powerful main motor also generates tremendous amounts of heat, so we have integrated oil jackets in the base of the motor, completely insulating the main motor from the spindle head. This keeps the thermal displacement of the spindle down to within  $\pm 0.01$  mm in the X-Y-Z directions, even after a solid two hours of machining at the maximum spindle speed.



*Standard-equipped with large-capacity oil cooler. Cooling oil is injected to all spindle hot-spots. Minimizes the effects of thermal displacement at the spindle.*

## **Rugged Design** for rock-like stability and powerful machining.

All vital parts are made of extra-thick cast iron, including column, bed, and spindle head. This gives the machine incredible stability. The massive construction of the MV models enables them to absorb both machining vibrations and great quantities of heat quickly, keeping thermal displacement to a minimum and machining accuracy at a maximum — even over long hours of continuous heavy-duty operation. The slide-ways of each axis are coated with fluoride resin to minimize friction. This equalizes friction coefficients, eliminating stick-slip, for high-precision positioning and feeding.

*The rigidity of these machines gives a high degree of stability so that they remain unaffected by the shock and vibration inherent in heavy machining. Mori Seiki designs for rigidity right from the start.*

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MV-45

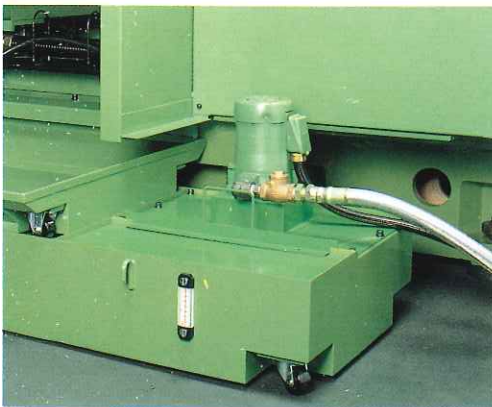
# Variable Spindle Speed & Output

maximize production efficiency.

All models allow you to select the optimum spindle speed and output. This flexibility improves precision and efficiency. On the powerful MV-65/50, the standard 15-kW (20.1 hp) output generates a maximum spindle torque of 506 ft-lbs (70 kgf·m). This translates into a cutting capacity of 33.6 cu.in. (550 cc) per minute. With our high-output option, the MV-65's output and torque can be boosted to 26 kW (34.9 hp) and 875 ft-lbs (121 kgf·m). The MV-45/55/65 models, fitted with a No. 50 tool shank, can machine efficiently at high speeds up to 4,000 rpm; equipped with a No. 40 tool shank, you can do high-speed cutting all the way up 10,000 rpm. The MV Series: Perfect for all your high-speed machining jobs.

## Large Coolant Tanks prevent thermal distortion of the workpiece.

Detachable coolant tanks on each side of the machine ensure highly accurate machining by preventing heat accumulation at the workpiece. Each tank comes with a chip pocket for easy chip disposal.

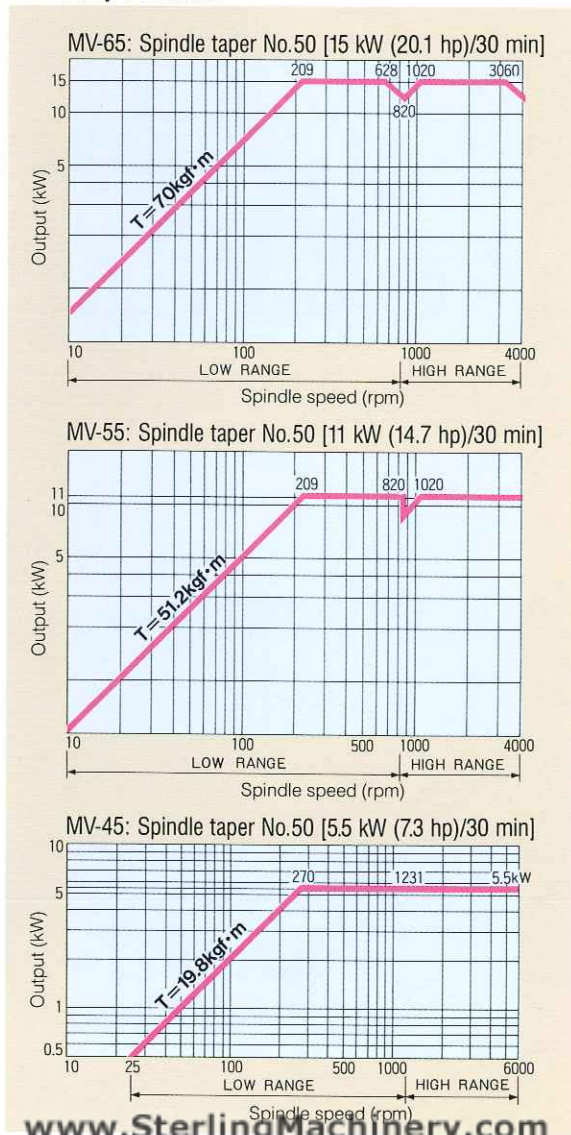


Equipped with generous coolant tanks.  
MV-65: 79.2 gallons (300 liters); MV-55: 66 gallons (250 liters); and MV-45: 52.8 gallons (200 liters).

## Spindle Variations

Spindle taper	Spindle speed rpm	Output kW (hp)	Max. torque ft-lbs (kgf·m)	Applicable models
No. 50	40 – 4000 (2-speed drive)	7.7/5.5 (10.3/7.3)	303 (42)	Standard on the MV-45/50
		11/7.5 (14.7/10.0)	370 (51.2)	Standard on the MV-55/50
		15/11 (20.1/14.7)	506 (70)	Standard on the MV-65/50
		18.5/15 (24.8/20.1)	622 (86)	Optional
		22/18.5 (29.5/24.8)	741 (102.5)	
		26/22 (34.8/29.5)	875 (121)	
		5.5/3.7 (7.3/4.9)	143 (19.8)	
No. 40	60 – 6000 (2-speed drive)	7.5/5.5 (10.0/7.3)	235 (32.5)	Standard on the MV-55/40 and MV-65/40
		100 – 10000 (built-in motor)	7.5/5.5 (10.0/7.3)	45 (6.24)

## Power/speed ratio

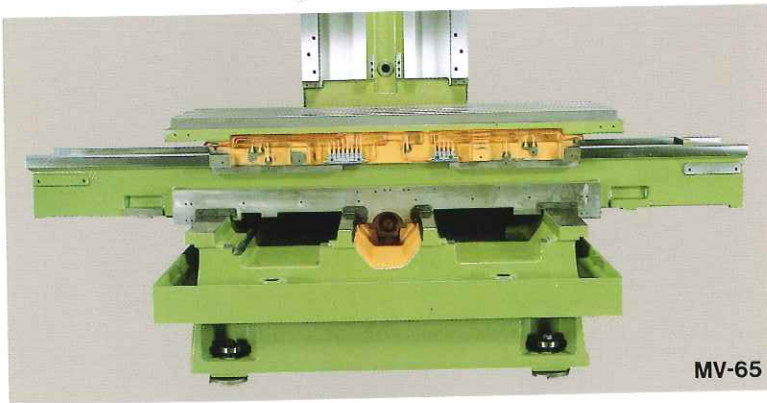


**Creative engineering and innovative design.  
We maximize your machining potential.**

## Extra-Large Bed with 4 Slideways eliminates table overhang.

The large bed greatly reduces the possibility of unstable machining even if it is necessary to perform machining operations that are not centered on the table. Four slideways supporting the weight on the table assures stable machining – even when handling massive workpieces.

	inches (mm)	
	X-axis travel	Bed width
MV-65A	50.0" (1,270)	55.9" (1,420)
MV-65B	60.0" (1,524)	55.9" (1,420)
MV-55	41.3" (1,050)	48.0" (1,220)
MV-45A	23.6" (600)	40.2" (1,020)
MV-45B	31.5" (800)	40.2" (1,020)

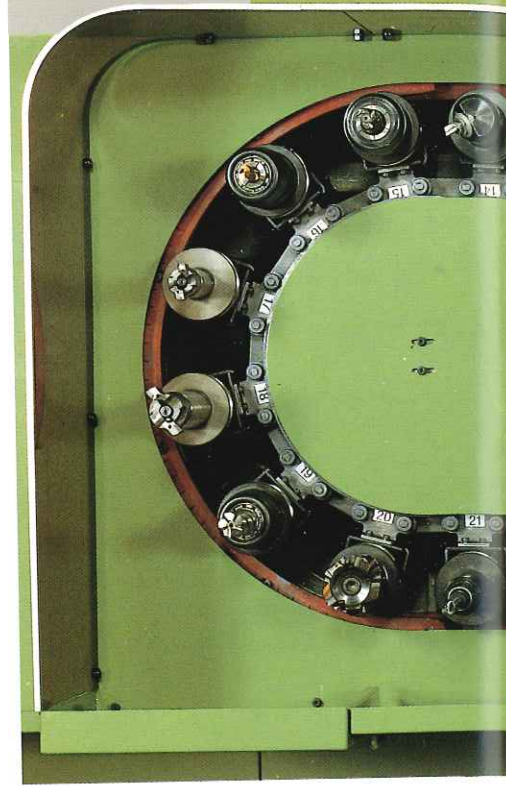


*4-slideway bed is perfect for large workpieces.  
Generous bed width eliminates overhang.*

MV-65

## Special Steel Covers protect all vital machine parts.

Strong steel covers protect slideways, wiring tubes, and ball screws on each axis. This reduces the possibility of malfunction from contamination by chips, coolant, or dust.



## Narrow Guideways and Pre-Loaded Ball Screws

ensure positioning accuracy.

Special central narrow guideways are used for all axes to maintain long-term linear precision.

Large 1.8" -diameter (45mm) ball screws are pre-loaded to reduce the effects of heat and weight. Ball screws are connected directly to the drive motor. This prevents motor backlash and guarantees accurate positioning and feeding. The MV-45/55/65 models boast a fast rapid-traverse speed of 49.2ft (15m)/min on the X-Y axes and 39.4ft (12m)/min on the Z axis. This kind of speed is usually possible only on smaller machines. An optional scale feedback unit further increases positioning accuracy.



*Special narrow guideways maintain linear precision.*

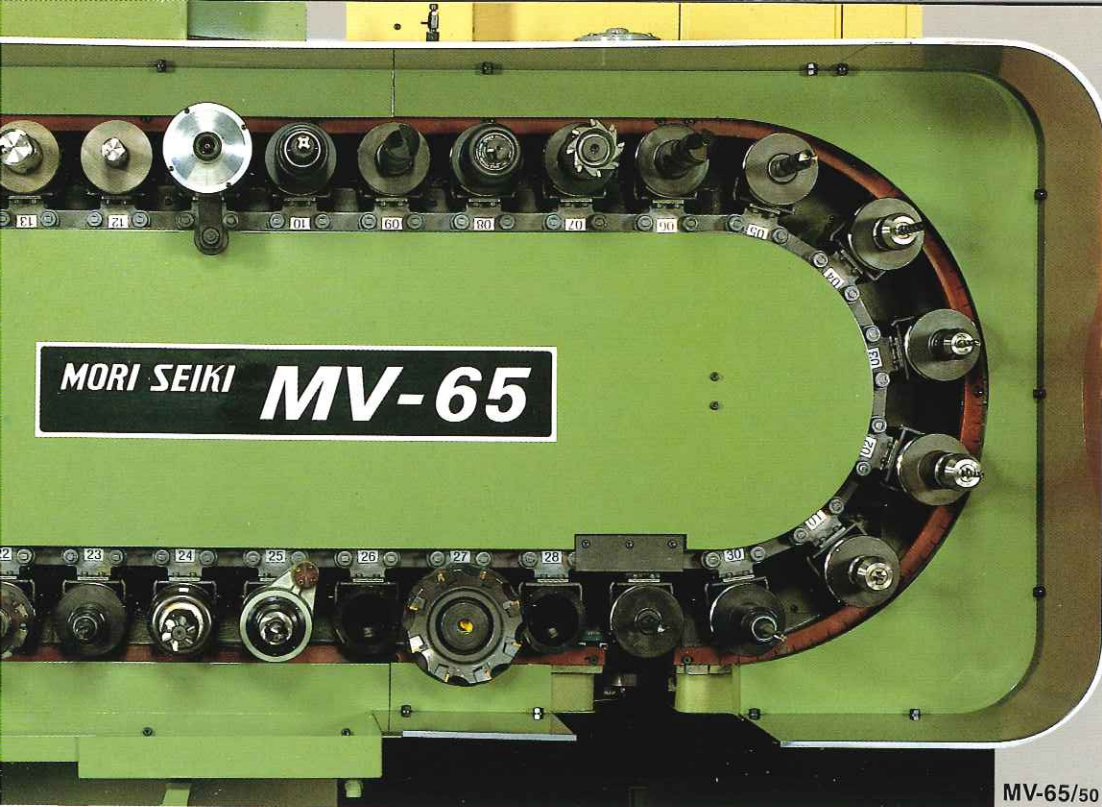
*Large-diameter ball screws are pre-loaded to reduce heat- or load-induced deformation.  
The perfect combination for high-precision positioning.*



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Standard tool magazine holds a generous 30 tools.

High-speed ATC specs have been improved. Tool-to-tool time is only 2.5/3.0 sec. for No. 40/50 tool shanks. The result? Less non-machining time.

MV-65/50

## Perfect Chip Disposal assures a clean working environment.

A steel cover slides along the Y axis between the column and saddle, and protects the bed and slideways from chips and coolant. A chip sweeper promptly carries the chips into the large chip buckets on each side of the machine. For extra chip capacity, all MV models can be equipped with an optional chip conveyor to carry large amounts of chips away from the machining area.

## High-Speed Automatic Tool Changer (ATC) makes possible 3-sec. tool-to-tool replacement.

With its pneumatic-hydraulic tool unclamp system and unique cam mechanism, the Automatic Tool Changer (ATC) performs tool changes quickly. It takes only 3 seconds to change No. 50 tools weighing 44 lbs (20 kg) and 2.5 seconds to change No. 40 tools. (Chip-to-chip time: 8 seconds) The ATC on these models has a simplified configuration that eliminates the need for conventional hydraulic systems. This results in reduced heat accumulation and tremor transference, adding up to increased reliability and maintenance efficiency. The standard 30-tool magazine (40-tool option available) can be permanently set for several types of machining, reducing setup times.



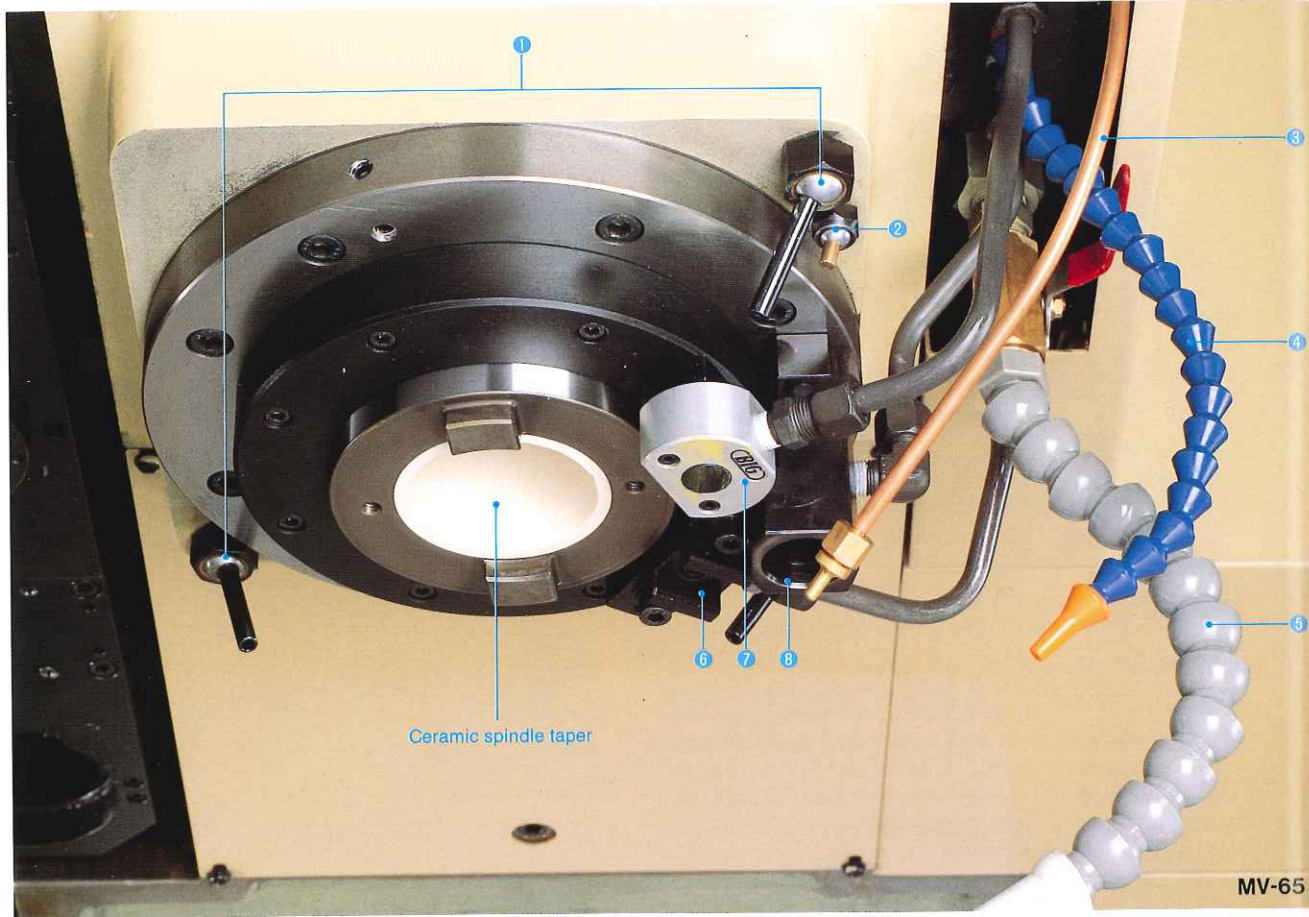
Large chip buckets on both sides of the machine. Optional chip conveyor improves chip disposal.

Steel cover and chip sweeper move along with table. Reduction of splash-back from chips and coolant is why this is the standard on all models.

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MV-65

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**Practical applications of advanced technology ———  
with quality to the smallest detail.**



*Standard ceramic spindles are widely recognized as giving the greatest machining accuracy. Mori Seiki's spindle design incorporates a range of sophisticated devices for unparalleled accuracy and productivity.*

- ① Coolant nozzles (3 locations)    ② Oil shot nozzles (2 locations)    ③ Oil mist
- ④ Compressed air blow    ⑤ Coolant nozzle    ⑥ Special-tool positioning block
- ⑦ Sensor-reception block    ⑧ Angular attachment/dust collector positioning block

## Standard-Equipment Ceramic Spindle boosts machining accuracy.

The standard spindle taper is made of fine ceramics. Spindle tapers made from fine ceramics are highly resistant to heat, abrasion, and corrosion. And even if the surface of a ceramic spindle taper is scratched, it will not form burrs, a condition that can seriously affect machine performance. Because ceramic is a non-magnetic substance, the spindle taper will not attract chips. This eliminates malfunctions caused by chip contamination and greatly enhances machining accuracy.

## Highly Efficient Spindle Design permits flexible machining.

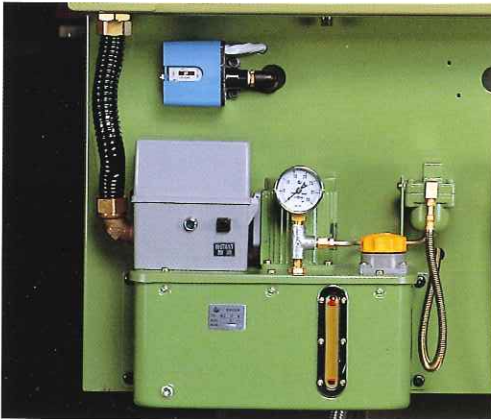
A special-tool positioning block comes as standard equipment on all MV models. This means that multi-spindles, high spindles, and other special tools can be automatically interchanged. An additional optional positioning block is also available for oil hole holders and angular attachments. This permits you to perform a wide range of machining — flexibly and quickly.



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## Concentrated Lubricant Supply System ensures smooth operation.

This innovative lubricant system controls the precise amounts of lubricant sent to each part of the machine.



*Specified amounts of lubricant are sent as needed by concentrated auto-lub system.*

## Expansion-Based Design meets your future machining needs.

A spare wiring duct is provided in the main duct on the pendant control panel. Using the standard interface for 4th axis control, this makes it easy to expand your wiring and piping as your machining needs increase.

## Easy Maintenance is achieved through simple unit design.

The electrical control unit and the NC are combined into a single control/NC unit. The sealed design and indirect cooling system of this control/NC unit assure stable operations under even extreme conditions. On the MV models, we have incorporated an increased number of LSIs into the control panel – for higher reliability and ease of maintenance.



MV-45/55

*The control panel: designed to be easy to use and easy to understand.*

## Easy-to-Use Control Panel lets you use any MV model with confidence.

An intelligent key layout and easy-to-read display make the operation of all MV models simple and straightforward.

## Standard Complete Cover

(Mori Seiki's Special full shielding) keeps your work area safe and clean.

MV-45/55/65 models all come with comprehensive shielding. This standard-equipment cover keeps your work area clean and safe and surrounds the entire machining area to prevent splashing from chips and coolant.



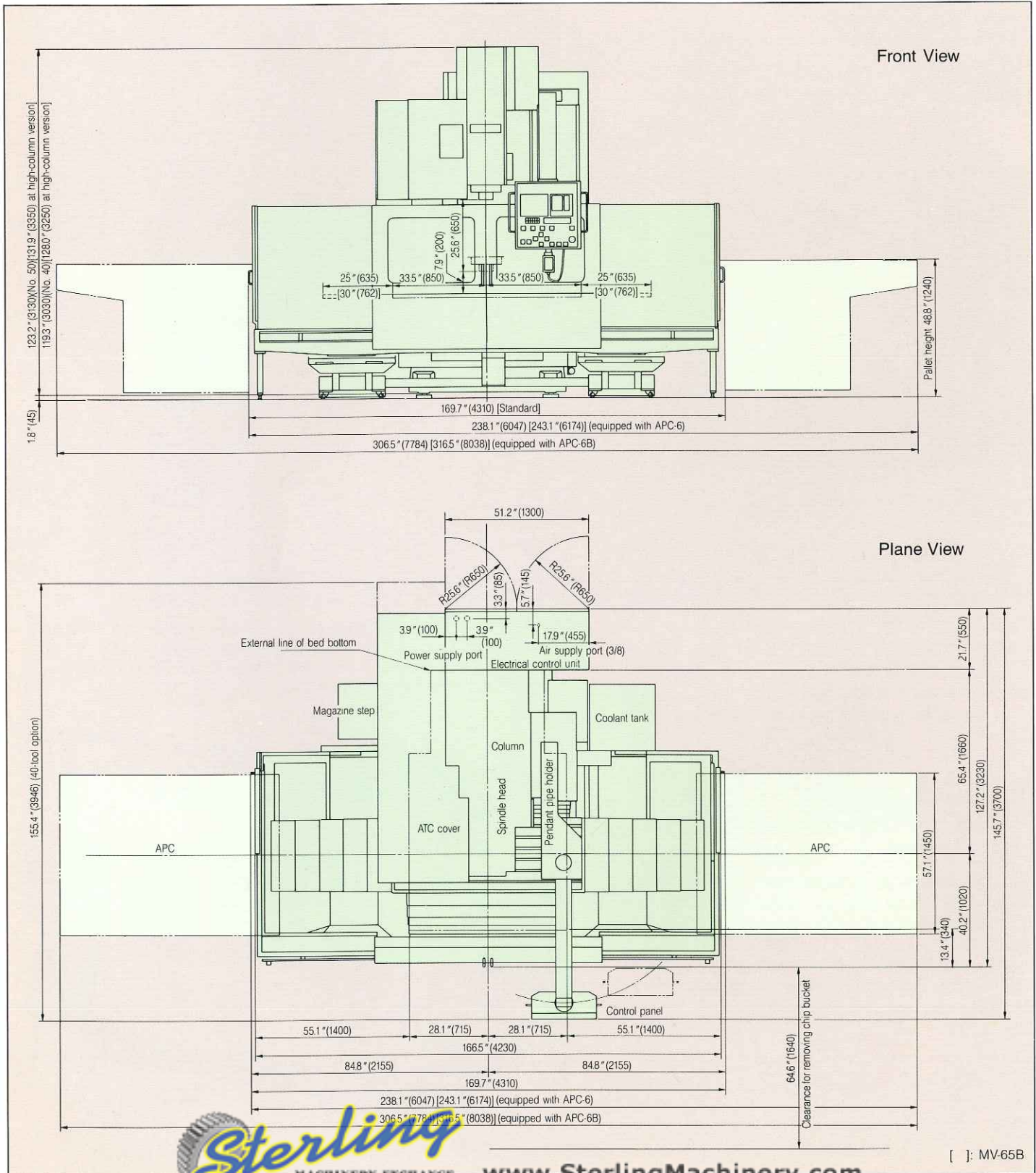
MV-65



Complete Cover protects against splashing from chips and coolant.  
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# MV-65

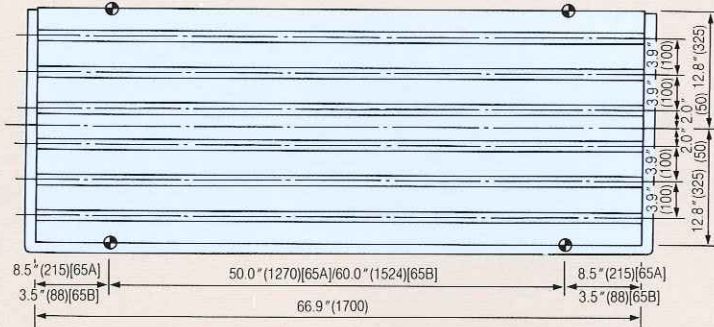
## Installation dimensions inches (mm)



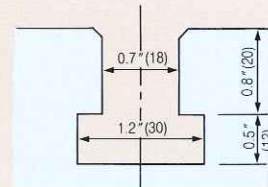
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[ ]: MV-65B

**Table** inches (mm)

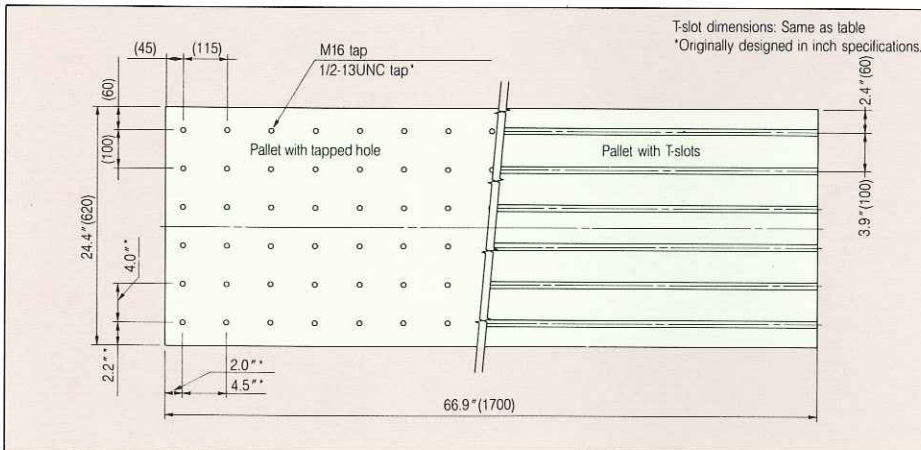


**T-slot**



18<sup>H18</sup>: Two central T-slots  
18<sup>H12</sup>: Other T-slots

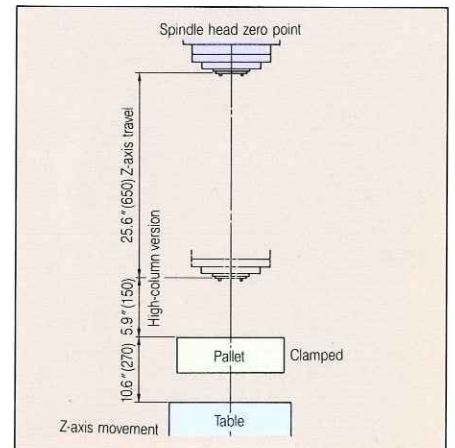
**APC pallet dimensions** inches (mm)



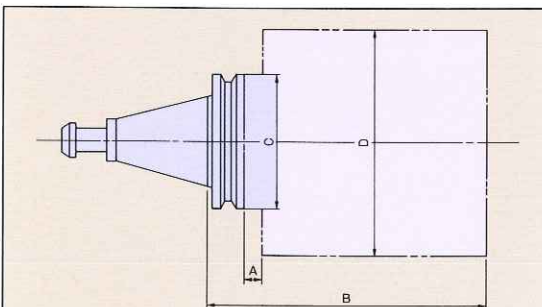
T-slot dimensions: Same as table  
\*Originally designed in inch specifications.

**Z-axis movement range** inches (mm)

for APC-equipped models



**Tool limitations** (MAS BT)

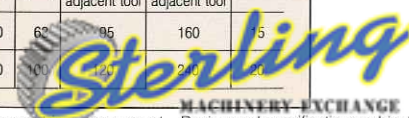


Model	Shank size	A (mm)	B (mm)	C (mm)	D (mm)		Weight (kg)
					With adjacent tool	Without adjacent tool	
MV-65/40	No. 40	5	350	6° 95	160	75	
MV-65/50	No. 50	0	350	10° 125	200	200	



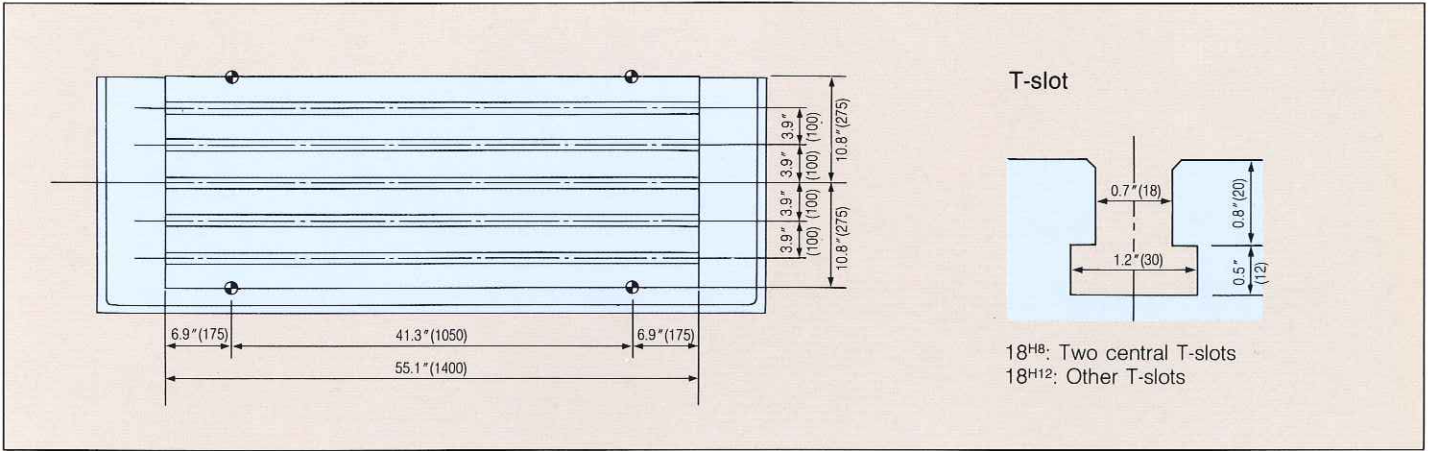
*Model shown is equipped with special-option, space-saving APC-6 pallet changer.*

Figures in inches are converted from metric measurement. Design and specifications subject to change without notice.

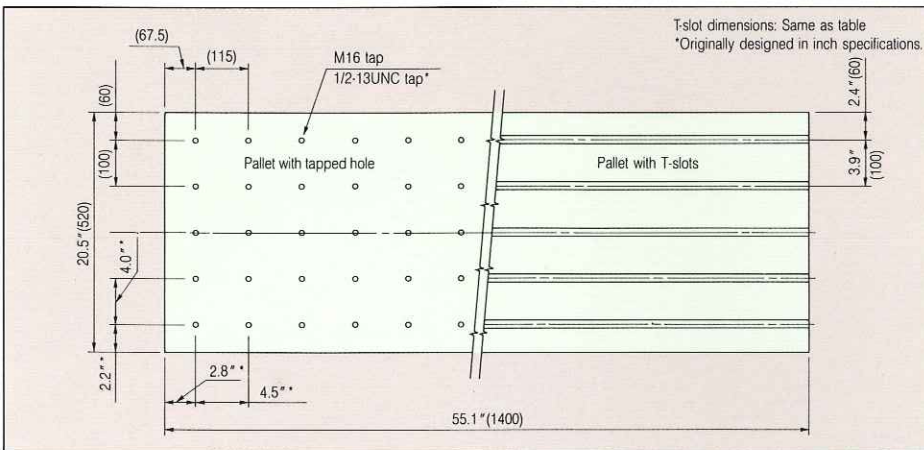




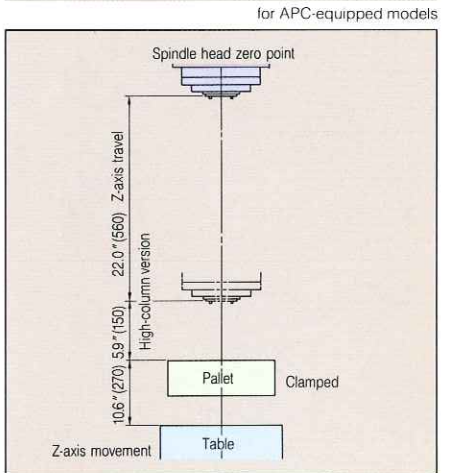
**Table** inches (mm)



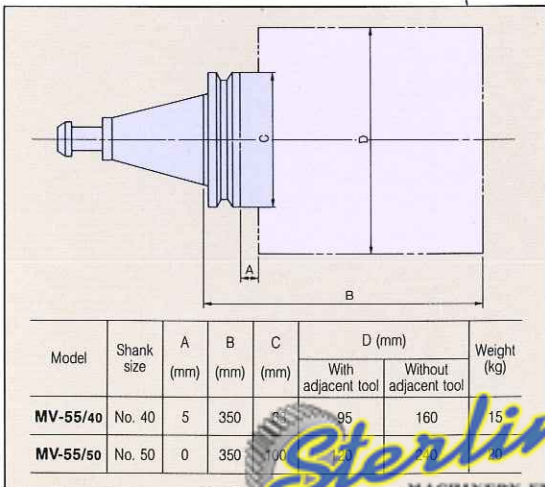
**APC pallet dimensions** inches (mm)



**Z-axis movement range** inches (mm)



**Tool limitations (MAS BT)**



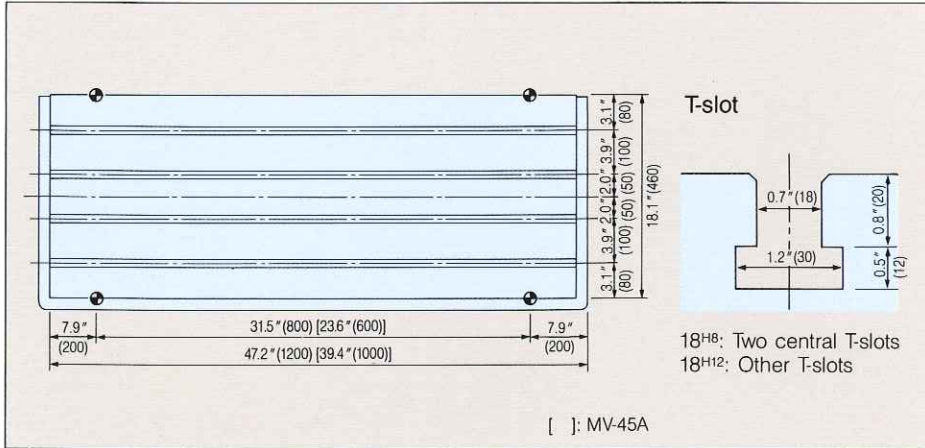
Model shown is equipped with special-option APC-6B pallet changer.

Figures in inches are converted from metric measurement. Design and specifications subject to change without notice.

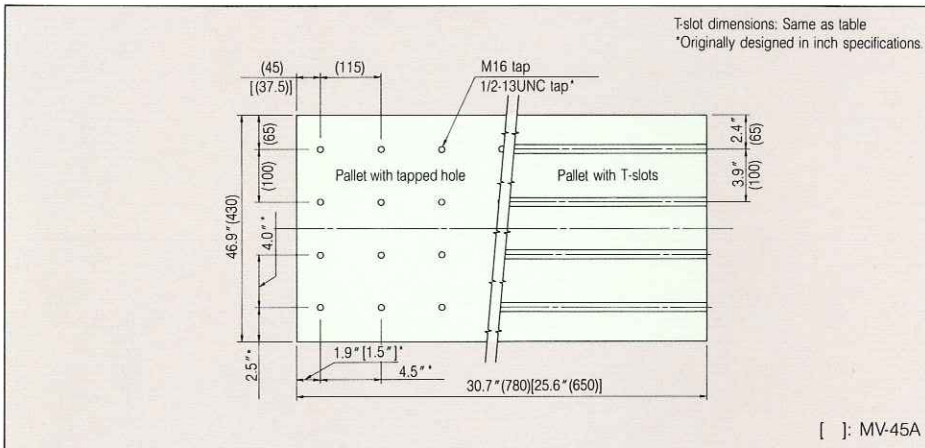




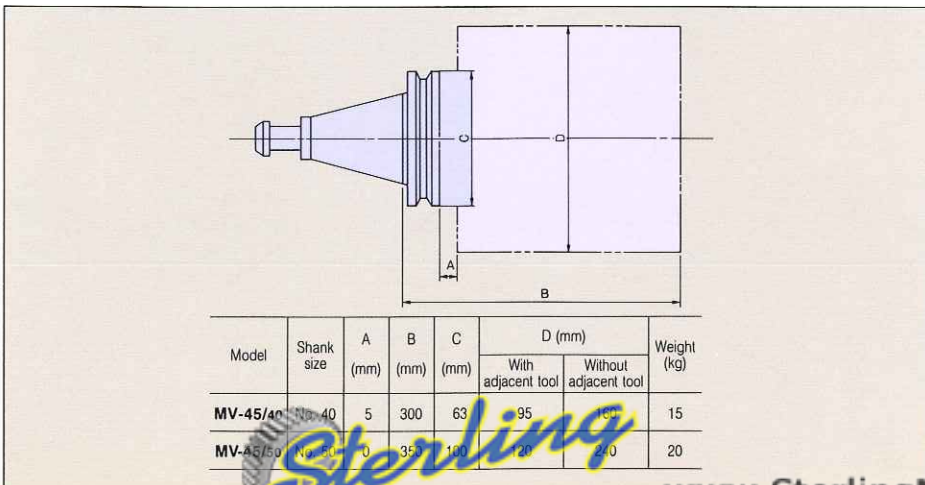
**Table** inches (mm)



**APC pallet dimensions** inches (mm)



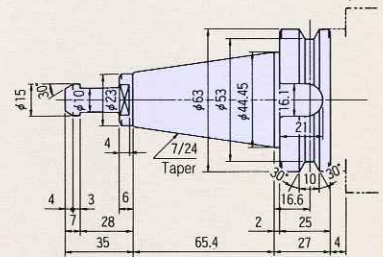
**Tool limitations (MAS BT)**



**Tool shank**

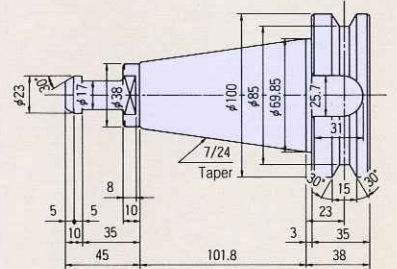
**MAS BT-40 mm**

Applicable models: MV-65/40, 55/40, 45/40



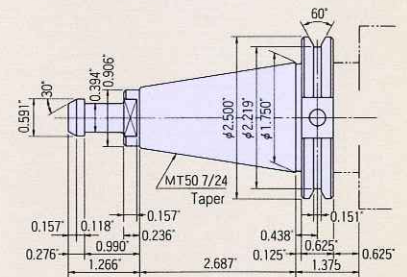
**MAS BT-50 mm**

Applicable models: MV-65/50, 55/50, 45/50



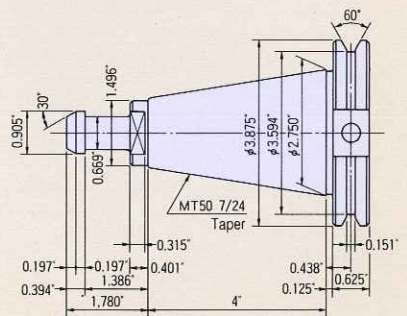
**CAT-40 inches**

Applicable models: MV-65/40, 55/40, 45/40



**CAT-50 inches**

Applicable models: MV-65/50, 55/50, 45/50



Figures in inches are converted from metric measurement. Design and specifications subject to change without notice.

## Machine Specifications

			MV-45/50	MV-45/40	MV-55/50	MV-55/40	MV-65/50	MV-65/40
Travel	Max. table travel (X axis)	inches(mm)	23.6" (600)[45A]/31.5" (800)[45B]		41.3" (1,050)		50.0" (1,270)[65A]/60.0" (1,524)[65B]	
	Max. saddle travel (Y axis)	inches(mm)	18.1" (460)		21.7" (550)		25.6" (650)	
	Max. spindle head travel (Z axis)	inches(mm)	20.1" (510)		22.0" (560)		25.6" (650)	
	Distance between spindle nose and table top	inches(mm)	5.9" - 26.0" (150 - 660)		7.9" - 29.9" (200 - 760)		7.9" - 33.5" (200 - 850)	
	Distance between spindle center and column front	inches(mm)	20.1" (510)		23.6" (600)		27.6" (700)	
	Ball screw size (X, Y, Z axes)	inches(mm)	1.77" (45) dia. x P0.39" (10)					
Table	Table size	inches(mm)	39.4" x 18.1" (1,000 x 460)[45A]/47.2" x 18.1" (1,200 x 460)[45B]		55.1" x 21.7" (1,400 x 550)		66.9" x 25.6" (1,700 x 650)	
	Max. weight on table	lbs(kg)	2,200(1,000)		3,300(1,500)		4,400(2,000)	
	Distance between table center and column front	inches(mm)	11.0" - 29.1" (280 - 740)		12.8" - 34.4" (325 - 875)		14.8" - 40.4" (375 - 1,025)	
	Distance between table top and floor	inches(mm)	33.5" (850)		33.5" (850)		35.4" (900)	
	Number of T-slots x size x pitch		4 x (18) x 3.9" (100mm)		5 x (18) x 3.9" (100mm)		6 x (18) x 3.9" (100mm)	
Spindle	Max. speed	(rpm,min <sup>-1</sup> )	4,000	6,000	4,000	6,000	4,000	6,000
	Spindle taper		No. 50 (No. 45: Optional)	No. 40	No. 50 (No. 45: Optional)	No. 40	No. 50 (No. 45: Optional)	No. 40
	Front bearing diameter	inches(mm)	3.9" (100)	3.1" (80)	3.9" (100)	3.1" (80)	3.9" (100)	3.1" (80)
	Spindle orientation		Electric control					
Feed	Rapid traverse rate (X/Y/Z axes)	inches(mm)/min	X/Y axes: 590.6" (15,000), Z axis: 472.4" (12,000)					
	Cutting feed rate	inches(mm)/min	0.0001" - 196.9" (0.001 - 5,000)					
	Jog feed rate	inches(mm)/min	0 - 49.6" (0 - 1260) [MF-M4]		0 - 78.7" (0 - 2,000)		[MF-M5, MY-M4]	
ATC	Number of tools		30 (option: 40)					
	Max. tool diameter	inches(mm)	4.7" (120)	3.7" (95)	4.7" (120)	3.7" (95)	4.7" (120)	3.7" (95)
	Max. tool diameter without adjacent tools	inches(mm)	9.4" (240)	6.3" (160)	9.4" (240)	6.3" (160)	9.4" (240)	6.3" (160)
	Max. tool length	inches(mm)	13.8" (350)	11.8" (300)	13.8" (350)			
	Max. tool weight	lbs(kg)	44(20)	33(20)	44(20)	33(15)	44(20)	33(15)
	Tool pocket pitch	inches(mm)	5.0" (127)	4.0" (101.6)	5.0" (127)	4.0" (101.6)	5.0" (127)	4.0" (101.6)
	Automatic tool changer		Double arm swing method					
	Tool selection		Technical memory random					
	Tool change time (tool-to-tool)	sec	3	2.5	3	2.5	3	2.5
	Motor	Spindle motor <i>(For custom specifications see the table in page 5)</i>	kW (hp) (30min/cont)	7.5/5.5(10.3/7.3) AC	5.5/3.7(7.3/4.9) AC	11/7.5(14.7/10.0) AC	7.5/5.5(10.3/7.3) AC	15/11(20.1/14.7) AC
Drive motor (X axis)		kW (hp)	1.8(2.4)				2.8(3.7)(FANUC)/2.9(3.8)(YASNAC)	
Drive motor (Y axis)		kW (hp)	1.8(2.4)				2.8(3.7)(FANUC)/2.9(3.8)(YASNAC)	
Drive motor (Z axis)		kW (hp)	2.8(3.7)(FANUC)/2.9(3.8)(YASNAC)				3.3(4.4)(FANUC)/4.4(5.9)(YASNAC)	
Total power consumption		kVA	28(FANUC)/32(YASNAC)	25(FANUC)/29(YASNAC)	32(FANUC)/38(YASNAC)	27(FANUC)/31(YASNAC)	41(FANUC)/49(YASNAC)	31(FANUC)/37(YASNAC)
Pneumatic supplier	Mpa	0.5 100Nl/min or more						
Machine height	inches(mm)	113.8" (2,890)	109.8" (2,790)	117.7" (2,990)	113.8" (2,890)	123.2" (3,130)	119.3" (3,030)	
Installation area	inches(mm)	89.4" x 131.7" (2,270 x 3,345)[45A]/117.3" x 131.7" (2,980 x 3,345)[45B]		133.9" x 142.3" (3,400 x 3,615)		169.7" x 145.7" (4,310 x 3,700)		
Machine weight	lbs(kg)	16,060(7,300)[45A]/16,940(7,700)[45B]		22,000(10,000)		30,800(14,000)		

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### Standard accessories

- Levelling blocks
- Hand tools
- Oil cooler
- Ceramic spindle
- Coolant unit
- Work light
- Positioning block for special tools
- T-nuts for table slots
- Complete cover
- Automatic power off system

### Optional accessories

- Chip conveyor
- Coolant unit for oil hole drill
- Air blower
- Machining completion buzzer/lamp
- High-pressure coolant unit
- Linear scale feedback (X, Y, Z)
- Oil shot unit
- Oil mist unit
- Dust collector
- Indexing unit
- Tool length automatic measuring system
- Z-axis zero-point setting tools
- Centering indicator arbor
- Axial indicator arbor
- Automatic centering system
- Pallet changer (APC-6)
- Tool presetter
- Tool breakage detector
- Metal contact sensor



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## Numerical Control Unit Specifications

		MF-M4	MY-M4	MF-M5
<b>Controls</b>	Controlled axes	Simultaneously controllable axes: Three axes (positioning and linear interpolation), two axes (circular interpolation)		
	Controls	Linear and circular interpolation		
	Minimum output	0.0001" (0.001mm)		
	Minimum input	0.0001" (0.001mm)		
<b>Spindle functions</b>	Spindle speed command	S5 digits direct command		
	Spindle override	50 – 150% (in 10% increments)		
<b>Feed functions</b>	Feed rate override	0 – 150% (in 10% increment)	0 – 200% (in 10% increments)	
	Dwell	Stop time command G04		
	Zero return	Return to machine zero point: G27, G28, G29, G30		
	Manual pulse generator	0.0001, 0.001, 0.01 inch/pulse (0.001, 0.01, 0.1 mm/pulse)		
	Jog traverse	0 – 496"/min (0 – 1260mm/min) (15 steps)	0 – 78"/min (0 – 2,000 mm/min) (20 steps)	
	Dry run	Moves at jog traverse rate regardless of feed command		
<b>Tool functions</b>	Rapid traverse override	Override on rapid traverse: 25%, 50%, 100%, F0		
	Tool No. command	T4 digits command, technical memory random		
	Tool length measurements	Offset value input when MEASURE and INPUT are pressed.	Offset value entered when switch is on.	Offset value input when MEASURE and INPUT are pressed.
	Tool diameter offset	G40 – G42	G40 – G42	G40 – G42
	Tool length offset		G43, G44, G49	
<b>Programming functions</b>	Tool position offset		G45 – G48	
	No. of tool offsets	32 sets	99 sets	32 sets
	Command system	Incremental/absolute		
	Fixed cycle	G73, G74, G76, G80 – G89, G98, G99	G73, G74, G76, G77, G80 – G89, G98, G99	G73, G74, G76, G80 – G89, G98, G99
	Decimal point input	Inputs values with decimal point		
	Inch/metric conversion	G20, G21		
<b>Tape functions</b>	Work coordinate system selection	G54 – G59	G54 – G59	G54 – G59
	Local coordinate system	G52	Option	G52
	Maximum designation	± 3,937,0078" (99,999,999mm)		
	M function	M2 digits		
	Tape code	EIA RS-244A, ISO 840		
	Tape reader	—	Standard (without reel)	Option
<b>Other functions</b>	Code input	ISO/EIA automatic discrimination		
	I/O interface	RS-232C, RS-422 (option)	RS-232C	RS-232C, RS-422 (option)
	Memory capacity	131.2 ft (40m)	262.5 ft (80m)	
	Search function	Sequence No. search: N5 digits Program No. search: O4 digits	Character string starting with an address No. and consisting of less than 10 characters	Sequence No. search: N5 digits Program No. search: O4 digits
<b>Options</b>	MDI/CRT unit	Keyboard for data input, function keys, CRT display		
	Backlash compensation	Max. 255 pulses	– 8191 – 8191 pulses	Max. 9999 pulses
	Store stroke limit 1	Overtravel controlled by software		
	Stored pitch error offset	Pitch error offset up to 128 positions for each axis	Pitch error offset up to 512 positions for all axes	Pitch error offset up to 128 positions for each axis
	Program restart	Designates restart block sequence No.	The program will re-start at the block following the specified Sequence Number.	Designates restart block sequence No.
	Z-axis command cancel	Machine lock only on Z axis		
	Auxiliary function lock	M, S, T function signal relay eliminated (menu switch)	M, S, T function signal relay eliminated (setting)	M, S, T function signal relay eliminated (menu switch)
	Machine lock, display lock	Machine lockup, (setting)	Machine lockup (pushbutton), display lockup (setting)	Machine lockup, display lockup (setting)
	Mirror image	Reverse of X, Y, Z axes (setting switch); X, Y axes (M function) during continuous automatic operation	Reverse of X, Y axes (M function) during continuous automatic operation	Reverse of X, Y, Z axes (setting switch); X, Y axes (M function) during continuous automatic operation
	Background editing	Part program storage and editing during automatic operation	—	Part program storage and editing during automatic operation
	Self-diagnosis function	Self check by NC		
	Programmable tool offset input	Tool offset amount and work offset are entered by programming (G10)	Tool offset amount and work offset are entered by programming (G10)	Tool offset amount and work offset are entered by programming (G10)
	Helical interpolation	Option	G02, G03	Option
	Exact stop check		G09, G61, G64	
	Skip function	Option	G31	Option
Single direction positioning	Option	Always positions from single direction G60	Option	
Error detect	—	G06	—	
<b>Options</b>	<ul style="list-style-type: none"> <li>• Optional block skip addition • F1 digit feed • Custom macro • Handle interrupt • Tool life management • Stored stroke limit 2</li> </ul>			
	<ul style="list-style-type: none"> <li>• Controllable axis expansion (additional axes: max. 4) • Memory capacity: max. 125990" (320m) • No. of tool offsets: 200 sets</li> <li>• Running time display • Programs stored in memory: 100, 200 • Expanded tape editing • Coordinate system rotation • Scaling</li> </ul>	<ul style="list-style-type: none"> <li>• Additional axes control: max. 5</li> <li>• Memory capacity: 525 ft (160m), 1,050 ft (320m) • No. of tool offsets: 299</li> <li>• Remote buffer</li> </ul>	<ul style="list-style-type: none"> <li>• Controllable axis expansion (additional axes: max. 6) • Memory capacity: max. 16,800 ft (5,120m) • Remote buffer • Programmable mirror image • No. of tool offsets: 999 sets</li> <li>• Running time display • Programs stored in memory: 200, 400, 1000 • Expanded tape editing • Coordinate system rotation</li> </ul>	<ul style="list-style-type: none"> <li>• Dimensions and offset • Scaling</li> </ul>

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Iga Plant

**MORI SEIKI CO., LTD.**

**Head Office:** 362 Idono-cho, Yamato Koriyama-city, Nara 639-11, Japan  
 Phone: (07435) 3-1121 Telex: 72-5522-785 Fax.: (07435) 2-8713

**Nara Plant:** 362 Idono-cho, Yamato Koriyama-city, Nara 639-11, Japan  
 Phone: (07435) 3-1121

**Iga Plant:** 201 Midai, Iga-cho, Ayama-gun, Mie 519-14, Japan  
 Phone: (059545) 4151

**R&D Center:** 106 Kita Koriyama-cho, Yamato Koriyama-city, Nara 639-11, Japan  
 Phone: (07435) 3-1125

**MORI SEIKI U.S.A., INC.**

**Head Office:** 9145 Currency Street, Irving, Texas 75063  
 Phone: 214-929-8321 Fax.: 214-929-8226

**Los Angeles Office:** 115 West Victoria Street, Long Beach, California 90805  
 Phone: 213-537-0711 Fax.: 213-537-4543

**Chicago Office:** 5 E. Messner Dr. Wheeling, Illinois 60090  
 Phone: 708-520-2600 Fax.: 708-520-0948

**Detroit Office:** 27003 Hills Tech Court Farmington Hills, Michigan 48331  
 Phone: 313-553-2802 Fax.: 313-553-0294

**Boston Office:** 1455 Concord Street, Framingham, Massachusetts 01701  
 Phone: 508-788-0044 Fax.: 508-872-1327

**New Jersey Office:** 600-E Corporate Court, So. Plainfield, New Jersey 07080  
 Phone: 201-757-2900 Fax.: 201-757-2730

**Cincinnati Office:** 4920 Olympic Blvd. Erlanger, Kentucky 41018  
 Phone: 606-282-8200 Fax.: 606-282-8340

**MORI SEIKI G.m.b.H.**

**Head Office:** Siemens-Ring 19, 4156 Willich 1, F. R. Germany  
 Phone: 02154-427035 Telex: 8531908 MORI D Fax.: 02154-40935

**Stuttgart Office:** Schurwaldstr 15, 7303 Neuhausen Filder, F. R. Germany  
 Phone: 07158-6645 Telex: 722887 Fax.: 07158-9110

**MORI SEIKI (UK) LTD.**

**Head Office:** Michigan Dr. Tongwell, Milton Keynes MK15 8HQ, United Kingdom  
 Phone: 0908-618040 Telex: 825176 MORI UK Fax.: 0908-618033

**MORI SEIKI SINGAPORE PTE LTD.**

**Head Office:** 70 Toh Guan Road, Singapore 2260  
 Phone: 560-5011 Fax.: 567-6234

**Overseas Offices:**

**North America:** Chicago, Detroit, Cleveland, Cincinnati, Boston, New Jersey, Charlotte, Orlando, Dallas, Los Angeles, San Francisco, Seattle, Dusseldorf, Stuttgart, Milton Keynes, Paris, Milan

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