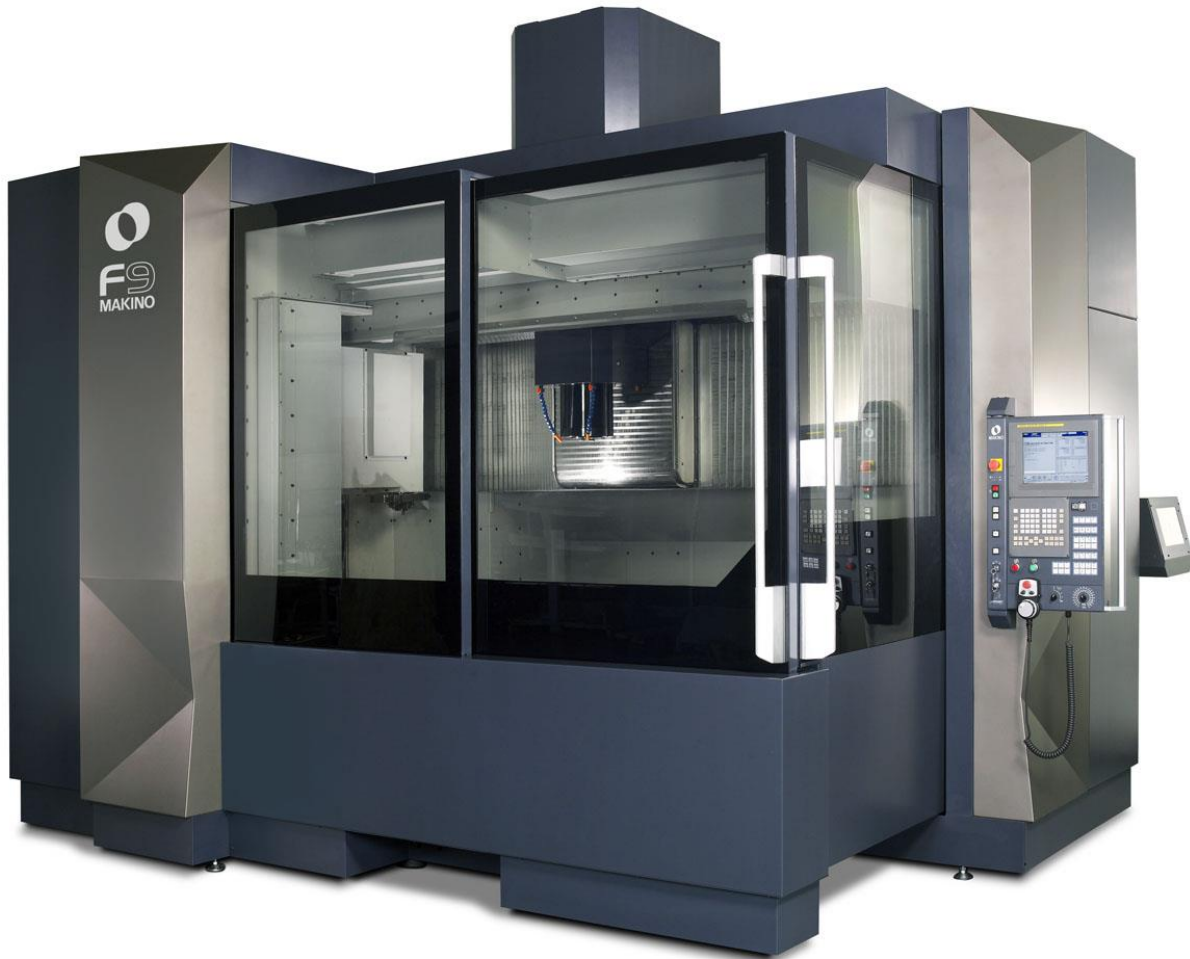


F9



F9 MACHINING CENTER MACHINE SPECIFICATIONS



7680 Innovation Way
Mason Ohio 45040
(800) 552-3288 / (513) 573-7200
Fax (513) 573-7456
www.makino.com

This document and its contents are the property of Makino Inc. No disclosure, duplication, or use of any portion of this document or its contents for any purpose contrary to the interests of Makino Inc. may be made without prior written consent of Makino Inc.

GENERAL SPECIFICATIONS:

METRIC

ENGLISH

X-Axis Travel, Programmable:	1,600 mm	63"
Y-Axis Travel, Programmable:	800 mm	31.5"
Z-Axis Travel, Programmable:.....	650 mm	25.6"
Type of Axis Drives.....	AC Digital Servo Motors	
Bed Construction Meehanite Cast Iron		
Axis Design (X, Y, & Z)	Linear Guide (55 mm width) x 2	
Ballscrew: (pitch) 12 mm	0.472"	
X , Y & Z diameter	50 mm	1.97"
Origin Position: X, Y and Z Axes	(+) End of Stroke	
Origin Detection	Grid Detecting System	
Linear Positioning Accuracy - (with proper foundation and environmental control):		
With Moiré Scales (Standard)	± 0.0015 mm	± 0.000060"
Repeatability:		
With Moiré Scales (Standard)	± 0.001 mm	± 0.000040"
Scales:	0.05 micron	

FEEDS:

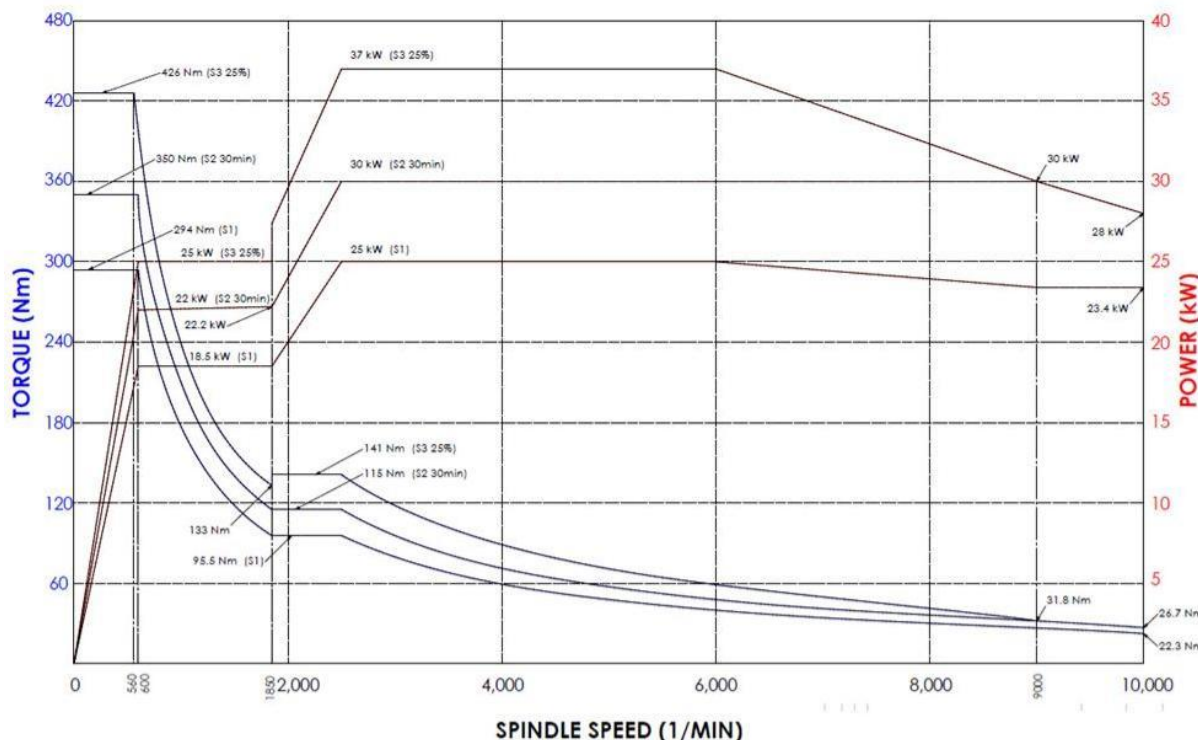
Rapid Traverse Rates:		
X, Y & Z Axes.....	24,000 mm/min.	945 ipm
Feed Rate - X, Y & Z Axes	0 to 24,000 mm/min.	0 to 945 ipm
Jog Feed - X, Y & Z Axes.....	0 to 4,000 mm/min.	0 to 160 ipm
CNC Command Feedback -		
X, Y, Z Axes.....	Absolute Pulse Encoder Feedback System	
Rapid Traverse Override	0 to 100%	
Cutting Feed Override	0 to 200%	

SPINDLE (standard):

Spindle Nose Interface.....	Cat #50	
Optional	HSK – A100	
Tool Shank Types.....	Cat #50	
Optional	HSK – A100	
Tool Clamping Force		
CAT #50	19.6 kN	4,400 lbs.
HSK – A100	44.1 kN	9,914 lbs
Tool Clamping Method	Disc spring clamp/hydraulic unclamp	
Spindle Drive Motor - AC:		
30 Minute Rating	37 kW	49.6 hp
Continuous Rating	25 kW	33.5 hp
Spindle Torque Characteristics (20 to 560 rpm):		
25% ED Rating	426 Nm	314.2 ft. lbs.
Continuous Rating	294 Nm	216.8 ft. lbs.
Spindle Speed Range	20 to 10,000 rpm	
Spindle Speed Increment	1 rpm	
Number of Spindle Speed Ranges	2	
Obtain Full Horsepower	3,000 rpm	
Constant Torque Range	200 to 600 rpm	
Bearing Lubrication.....	Oil - air, jacket cooling	
Spindle Temperature Controller	Oilmatic (spindle and motor jacket)	
Spindle Front Bearing Type	Angular Contact, Ball Type	
Spindle Front Bearing ID/OD.	110 mm / 170 mm	4.33" / 6.69"

Spindle Orientation System Electric Servo Control (built-in sensor)
Spindle Speed Override 50% to 120% (limit to max. spindle speed)
Spindle Nose to Table 250 to 900 mm 9.8" to 35.4"

10,000 rpm Spindle Performance (standard):



SPINDLE (optional 20,000):

Spindle Nose Interface HSK – A63
Tool Shank Types: HSK – A63
Tool Clamping Force 18 N 4,046 lbs.
Tool Clamping Method Disc spring clamp/hydraulic unclamp
Spindle Drive Motor - AC:
 30 Minute Rating 30 kW 40.2 hp
 Continuous Rating 22 kW 29.5 hp
Spindle Torque Characteristics (50 to 2,400 rpm):
 25% ED Rating 104 Nm 76.7 ft. lbs.
 Continuous Rating 59.7 Nm 44 ft. lbs.
Spindle Speed Range 50 to 20,000 rpm
Spindle Speed Increment 1 rpm
Number of Spindle Speed Ranges 2
Obtain Full Horsepower 8,000 rpm
Constant Torque Range 50 to 2,400 rpm
Bearing Lubrication Core cooled, under-race, jacket cooling
Spindle Temperature Controller Oilmatic (spindle and motor jacket)
Spindle Front Bearing Type Angular Contact, Ceramic Ball Type
Spindle Front Bearing ID/OD. 80 mm / 125 mm 3.15" / 4.92"
Spindle Orientation System Electric Servo Control (built-in sensor)
Spindle Speed Override 50% to 120% (limit to max. spindle speed)
Spindle Nose to Table 250 to 900 mm 9.8" to 35.4"

20,000 rpm Spindle Performance (option):

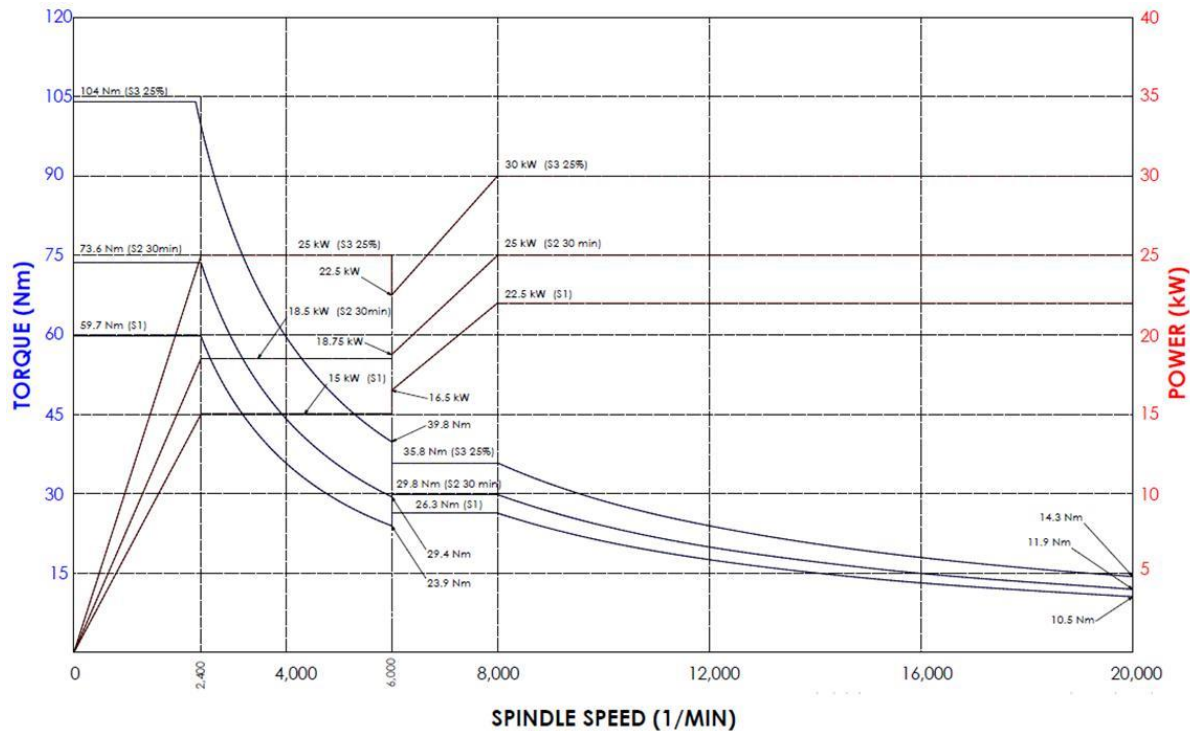


TABLE:

Type of Table	Rectangular Type	
Work Area on Table	1,850 x 800 mm	72.8" x 31.5"
Table Load Capacity.....	2,500 kg	5,511 lbs.
Maximum Workpiece Size:		
Length of Workpiece	1,850 mm	72.8"
Depth of Workpiece	800 mm	31.5"
Height of Workpiece	550 mm	21.6"
Table Top Configuration		
Size of T-Slot/Number.....	18H8 x 7	
Height of Table Top from Floor.....	950 mm	37.4"

AUTOMATIC TOOL CHANGER:

Capacity:	Standard	30 Tools
Maximum Tool Size Diameter:		
All Pockets Full (30 Tools).....	125 mm	5.9"
Adjacent Pockets Empty	200 mm	7.87"
Maximum Tool Length.....	400 mm	15.7"
Maximum Tool Weight	20 kg	44 lbs.
Tool Selection Method	Random Selection (fixed address method)	
Tool Change Time:		
Tool-to-Tool	4 seconds	

AUTOMATIC TOOL CHANGER (option):

Capacity:	Standard	48 Tools (HSK – A63)
Maximum Tool Size Diameter:		
	All Pockets Full (30 Tools).....	75 mm 2.95"
	Adjacent Pockets Empty	150 mm 5.9"
Maximum Tool Length.....	300 mm	11.8"
Maximum Tool Weight	7 kg	15.4 lbs.
Tool Selection Method	Random Selection (fixed address method)	
Tool Change Time:		
	Tool-to-Tool	2 seconds

UTILITIES:

Air Supply for Use on Machine:

Pressure	0.5 to 0.8 Mpa	72.5 to 116 psi
Volume		
Standard.....	480 l/min.	16.9 ft ³ /min.
With TSA	560 l/min.	19.8 ft ³ /min.
TSA & Air Blow	900 l/min.	31.8 ft ³ /min.

Electrical Specifications:

Volts	380 to 415
Phase	3
Hertz	60
KVA	50

Air Dryer Specifications Inlet Air Temperature of 35 degree C or below.

MOTORS:

For 10K Spindle	37/25 kW	49.6/33.5 hp
For 20K Spindle	30/22 kW	40.2/29.5 hp
For X & Y Axes	4 kW	5.36 hp
For Z Axis	5.5 kW	7.4 hp
For ATC Magazine.....	1.2 kW	1.6 hp
For ATC Arm	1.12 kW	1.5 hp
Spindle Temperature Controller (10K)	2.35 kW	2.35 hp
Spindle Temperature Controller (20K)	4.65 kW	6.3 hp
Coolant Pump (Nozzle Coolant)	0.96/1.5 kW	1.3/2.0 hp
Coolant Pump (Coolant Flush).....	0.96/1.5 kW	1.3/2.0 hp
Coolant Pump (Work Washing Gun)	0.96/1.5 kW	1.3/2.0 hp
Coolant Pump (Suction for Oilmatic).....	0.76/1.17 kW	1.0/1.6 hp
Coolant Pump (Suction for Secondary Tank)	1.5 kW	2.0 hp
Coolant Pump (Through Spindle Coolant 1.5 Mpa)	2.2 kW	2.95 hp
Coolant Pump (Through Spindle Coolant 3.0 Mpa)	2.2/2.55 kW	2.95/3.4 hp
Hydraulic Pump	0.37/0.44 kW	0.49/0.59 hp
Spiral Conveyor	0.2 kW x 2	0.27 hp x 2
Chip Conveyor (Lift-up Type)	0.37 kW	0.49 hp
Oil Skimmer	0.015 kW	0.02 hp
Air Dryer	0.18/0.20 kW	0.24/0.27 hp
Coolant Temperature Controller	2.0 kW	2.7 hp

CUTTING CHIP DISPOSAL OPTIONS:

Coolant System (Nozzle Coolant):		
Pressure	0.37 Mpa	53.6 psi
Volume	66.7 l/min.	17.6 gal/min.
Coolant System (Coolant Flush):		
Pressure	0.37 Mpa	53.6 psi
Volume	66.7 l/min.	17.6 gal/min.
Coolant System (Through Spindle 1.5 Mpa):		
Pressure	1.5 Mpa (at the pump)	217 psi
Volume	50 l/min.	13.2 gal/min.
Coolant System (Through Spindle 3.0 Mpa):		
Pressure	3 Mpa (at the pump)	435 psi
Volume	22.5 l/min.	6 gal/min
Through Spindle Air (20K):		
Pressure	0.5 Mpa	72.5 psi
Through Spindle Filtration		
	In-line filter x 2, 50 micron filtration (1.5 Mpa system)	
	In-line filter x 2, 20 micron filtration (3.0 Mpa system)	
Reservoir Capacity:		
Standard System	750 liters	198 gal.
Chip Pan Filtration	1 mm mesh plate	

SIZE OF MACHINE:

Machine Height:	3,560 mm	140.2"
Size of Required Floor Space (Rear Tank):		
Standard (W x D)	4,300 mm x 4,090 mm	169.3" x 161"
Machine Weight:		
Standard	17,000 kg	37,479 lbs.
Standard Machine Color:.....		
	Raptor Silver and Raptor Dark Grey	

Operator Control Panel

Located conveniently next to the work area. This panel includes the following:

- **Makino Professional 5 Control** (FS31is-MB)
- 12" Color LCD
- Touch sensitive, on-screen selection
- Windows CE platform, capability, flexibility and integration
- Menu driven
- Screen configurability
- Data Center Type A (400 MB)
- Full Ethernet network capability
- Manage multiple data storage locations simultaneously
- Windows type file tree
- Background editing function
- Cut, paste, and replace function
- NC Power ON/OFF
- Emergency Stop Push-button
- NC Program Start/Stop
- Mode Selector Switches
- NC Function Switches
- Coolant Control Switches
- Machine Control Switch
- Spindle Start/Stop
- Spindle Tool Unclamp
- Machine Monitoring Indicator
- Over Travel Release Switch
- Alarm Release Switch
- Memory Protect Unlock Key Switch
- Splash Guard Door Interlock Key Switch
- Routine Function Switches
- Jog Switch
- Rotary Switch Manual Feedrate
- Rotary Switch Rapid Feed Override
- Rotary Switch Feedrate Override
- Rotary Switch Spindle Speed Override
- Remote Umbilical MPG

Control Specifications – Makino Professional 5

Controlled Axes

4 simultaneous controllable axes (up to 5 axes optional – but, ONLY 4 simultaneous)

Programming Method

Inch/metric Selection (G20, G21);

Custom Macro

Minimum increment: 0.0001 mm, 0.001 deg, 0.00001 inch;

Maximum programmable dimension: ± 9 digits (± 99999.9999);

Absolute/incremental programming (G90/G91);

Decimal point Programming/Calculator type decimal point input;

Automatic recognition of EIA/ISO code;

Interpolation

Positioning (G00);
Linear interpolation (G01);
Circular interpolation (G02, G03);
Helical Interpolation (G02, G03));
Plane Selection (G17, G18, G19)

Feeds

Rapid traverse; bell shape acc/dec
Cutting feedrate:
F direct command;
Dwell (G04);
Rapid traverse override (0-100%)
Cutting feedrate override (0-200%);
Feedrate override cancel (M49/M48);

Part Program Storage & Editing

Part program storage (320 m or 1,050 feet tape or 128 K);
Registerable programs (250);
Part program editing
Background editing (Dual program view screen)
Program number search;
Sequence number search;
Address, word search;
Part program collation/comparison and stop;

I/O Devices

Data Center;
File management functions (NC programs, various data files)
DNC simple schedule function (multiple programs executable)
Program review function
Cut, paste, and replace function
Background edit function
2 program simultaneous edit function
G code insert function
M code insert function
Fixed-form statement insert function
Final MDI program insert function
Other program insert function
I/O interface (RS232C);
Wincon Communication Interface
PCMCIA slot;

STM Functions

S-function direct command (direct spindle programming) (S5);
T-function (T4);
M-function;

Tool Offsets

Tool length compensation (64 tool offset pairs) (G43, G44/G49) (MM STD);
Cutter compensation C (G41, G42/G40);
Tool offset memory Type C (geometry/wear/cutter/tool length);

Coordinate Systems

Manual return to reference point;
Automatic return to reference point (G28);
Reference point return check (G27);
Return from reference point (G29);
Coordinate system setting (G92);
Machine coordinate system setting (G53);
Work coordinate system selection (G54-G59);
Local coordinate system setting (G52);

Operation Support Functions

Label skip;
Single block;
Program stop (M00);
Optional stop (M01);
Optional block skip (/);
Dry run;
Machine lock;
Mirror image (M21, M22/M23);
Manual absolute;
Tool length measurement (manual);
Follow-up;
Help function;
Run hour and parts quantity display; (Pro 5)
Machining time stamp function; (Pro 5)
Skip function; (G31)
Sequence number comparison and stop
Z-axis feed cancel;
Ignore M/S/T functions;
Data protection key;

Programming Support Functions

FS-15M format;
Circular interpolation radius programming;
Canned cycles (G73, G74, G76, G80 to G89);
Sub-program call (4 fold nested);
Exact stop check (G09);
Exact stop check mode (G61);
Tapping mode (G63);
Cutting mode (G64);
Programming data input (G10) (offset value, parameter) (MM STD);
Custom macro
Manual absolute ON & OFF
Extended part program editing
Cut, paste and replace function
Program directory
M code insert from M code table
Data input safety check function
Rigid Tapping (G84.2, G84.3, M135)

Machine Error Compensation

Stored pitch error compensation;
Backlash compensation;

Maintenance & Safety

Emergency stop;
Over travel;
Stored stroke limit 1;
Self-diagnostics;
Interlock;
Alarm history display

Makino Professional 5 Operation Specification

Geometric Intelligence SM Control;
Clock Function;
MDI Function;
Operation History Display;
Spindle Load Display;
Spindle Load Monitoring Function;
Tool Life Management;
Direct Spare Tool Selection Function;
Parts Count Function (run hour & parts quantity)
Machining Record Function (machining time stamp function)
Registered tool automatic selection and changing function;
All axes automatic return to reference point;
Automatic return to work setting position;
Automatic Z-axis retraction
Self-diagnostics and instruction display;
Number and position of limit switches and solenoids display for alarm;
Alarm history function;
Automatic display for regular maintenance advice;
User Create Function for regular maintenance;

Installation

Environmental conditions for machine run-off at Makino are controlled to the following level:

Temperature	Warm	28 $\pm$ 2°C	82.4 $\pm$ 3.6°F
	Cool	18 $\pm$ 2°C	64.4 $\pm$ 3.6°F
Fluctuation		≤ 1°C/30 min.	≤ 1.8°F/30 min.
Humidity		65% or less	
Dust		Not applicable	
Air Supply 72-116 psi and 31.8 cfm of DRY air supplied through a minimum supply pipe of 3/4" diameter with no reducers or nozzles.			

NOTE: The quoted accuracies are attained through proper application of environmental conditions and suitable industrial floor for machine stability.

Specifications may be changed without prior notice to incorporate improvements resulting from ongoing R&D programs. Cover machine photo is equipped with optional features.