MAKINO
AEROSPACE GROUP
T2

T2

FIVE-AXIS HORIZONTAL MACHINING CENTER SPECIFICATIONS

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GENERAL SPECIFICATIONS

Machine	Metric	English
Pallet Size (Metric Type)	1000 mm x 1250 mm	39.4" x 49.2"
Axis Travel X, Table Longitudinal	2000 mm	78.7"
Axis Travel Y, Spindle Vertical	2000 mm	78.7"
Axis Travel Z, Spindle Cross	1800 mm	70.9"
Axis Travel A, Spindle Tilt	+110° / -110°	
Axis Travel B, Table Rotation	360° Infinite	
Spindle Center to Top of Pallet (A = 0)	50 - 2050 mm	1.97" – 80.7"
Spindle Nose to Center of Pallet (A = 0)	-100 - 1700 mm	-3.9 " – 66.9"
Spindle Drive Motor (Continuous)	100 kW AC	134 HP AC
Spindle Speed	50 to 4,000 RPM	
Maximum work piece size	1900 mm dia. x 2000 mm ht.	74.8" x 78.7”
Floor Space (W x L) w/o Accessories	5610 mm x 10550 mm	220.9" x 415.3"
Machine Wt. (aprox.)	60,000kg	132,277 lb.

Bed

Construction	Two Piece Meehanite Casting
Axis Design (X, Y & Z)	Rectangular Box Type Guide Ways

Table (X-Axis)

Rapid Traverse	20 m/min.	787 ipm
Feedrate	16 m/min.	630 ipm
Type of Drive	AC Digital Servo Motor	
Ball Screw Diameter	#70	
Axis Thrust (cont / max)	30,000 / 60,000 N	6,740 / 13,490 lbs

Spindle Carriage (Y-Axis)

Rapid Traverse	20 m/min.	787 ipm
Feedrate	16 m/min.	630 ipm
Type of Drive	AC Digital Servo Motor	
Ball Screw Diameter	#63 twin ball screw	
Axis Thrust (cont / max)	40,000 / 80,000 N	8,990 / 17,980 lbs

Traveling Column (Z-Axis)

Rapid Traverse	20 m/min.	787 ipm
Feedrate	16 m/min.	630 ipm
Type of Drive	AC Digital Servo Motor	
Ball Screw Diameter	#70	
Axis Thrust (cont / max)	30,000 / 60,000 N	6,740 / 13,490 lbs

Accuracies (with proper environment control):

Positioning (Full Travel):		
X-Y-Z: with Scales (std)	± 0.005 mm	± 0.00020”
A-axis	±10 sec	
B-axis	±4 sec	
Repeatability:		
X-Y-Z: with Scales (std)	± 0.002 mm	± 0.000080"
A-axis	±2 sec	
B-axis	±2 sec	

Tilt Spindle (A-Axis)

Tilt Spindle Positioning Range	±110°	
Pivot distance	350 mm	13.78”
Programming Increment	.0.0001°	
Rotation feed	10 rpm	
Indexing Accuracy	± 10.0 arc seconds	
Indexing Repeatability	± 2.0 arc seconds	
Spindle Tilt Torque (cont / peak)	13,000 / 42,000 Nm	9,587 / 30,975 ft.lb

NC Rotary Table (B-Axis)

Work piece Positioning on Pallet 1000 x 1250mm pallet	(25) M20 tapped holes & 2 precision edge locators	
Pallet/Table positioning range	3,600,000 positions, bi-directional	
Programming Increment	.0.0001°	
Rotation feed	6 rpm	
Pallet Indexing Accuracy	± 4.0 arc seconds	
Table Indexing Repeatability	± 2.0 arc seconds	
NCRT clamp torque	20,700 Nm	15,266 ft. lb
NCRT Torque (cont/peak)	20,700 / 58,800 Nm	15,266 / 43,365ft. lb
Locating/Clamp Cone Spacing	880 mm	34.6”
Pallet Clamping Force	240 kN	53,950 lb.

Spindle Rotate (C-Axis *Option*)

Tilt Spindle Positioning Range	360° Infinite	
Programming Increment	.0.0001°	
Rotation feed	10 rpm	
Indexing Accuracy	± 10.0 arc seconds	
Indexing Repeatability	± 2.0 arc seconds	
C-Axis Torque (cont / peak)	10,000 / 29,000 Nm	7,375 / 21,390 ft.lb

Automatic Pallet Changer (APC)

Pallet Load Capacity	5000 kg	11,023 lbs
Pallet Change Time	70 seconds	
Pallet Positioning Repeatability of Pallet Change	± 0.005 mm	± 0.0002"
Distance Floor to Pallet Top	1,670 mm	65.75"

STANDARD HSK- A125 / 100kW SPINDLE:

Spindle Nose Taper	HSK-A125	
Tool Shank Types (Standard)	HSK-A125	
Tool Clamping Force	9,990 kgf	22,000 lbs.
Tool Clamping Method	Disc spring clamp	
Spindle Drive Motor - AC:		
25% ED Rating (@ 955 rpm)	150.0 kW	201 hp
Continuous Rating	100.0 kW	134 hp
Spindle Torque Characteristics:		
25% ED Rating (20~955 rpm)	1,500 Nm	1,107 ft-lbs
Continuous Rating	1,000 Nm	737 ft-lbs
Spindle Speed Range	20 to 4,000 rpm	
Spindle Speed Increment	1 rpm	
Number of Spindle Speed Ranges	1	
Spindle Temperature Controller	Daiken Oil controller	
Spindle Orientation System	Inductive Proximity Sensor Type	
Spindle Speed Override	50% to 120% (8 steps, 10% increments)	

Automatic Tool Changer

Capacity: Standard	120 Tools	
Maximum Tool Size Diameter:	300 mm	11.8"
Maximum Tool Length	600 mm	23.6"
Maximum Tool Weight	30 kg	66.1 lbs.
Maximum Tool Moment	30 Nm	22.1 ft-lbs
Tool Selection Method	Random Selection (fixed address method)	
Tool Change Time:		
Tool-to-Tool	20 seconds	
Chip-to-Chip	40 seconds	

Chip and Coolant System

Chip Conveyor (LUCC)	Rear-Left Discharge Double Type (hinge/scaper)	
Chip Conveyor (Internal)	Spindle side: Hinged type / APC side: Spiral type	
Lift-up Conveyor Discharge Height	1,250 mm	49.2”
Secondary Filtration	Drum filter with permanent Media Mesh, Continuous Back Flush Cleaning	
Secondary Filtration	20 micron (cyclone filtration)	
Coolant Tank Capacity (Clean tank):	4,000L	1,056 gal
Through Spindle Coolant:		
Pressure	7.0 MPa	1,015 psi
Volume	200 *l*/min	53 gal/min
Spindle Face Nozzle Coolant (4 Nozzles)		
Pressure	1.5 MPa	217 psi
Volume	50 *l*/min	13.2 gal/min
Spindle Top Nozzle Coolant (4 Nozzles)		
Pressure	0.5 MPa	72 psi
Volume	50 *l*/min	13.2 gal/min

Utility Requirements

Air:

Air Pressure	0.5 ~ 0.9 MPa	72 ~ 130 psi
Volume	1,500 *l*/min.	52.9 cfm

Supply air line must be ¾" or greater with no reducers or nozzles.

Electrical Specification:

Volts	480
Phase	3
Cycle	60
kVA, Sum of all necessities	300 kVA
kVA Including high volume coolant system	350 kVA

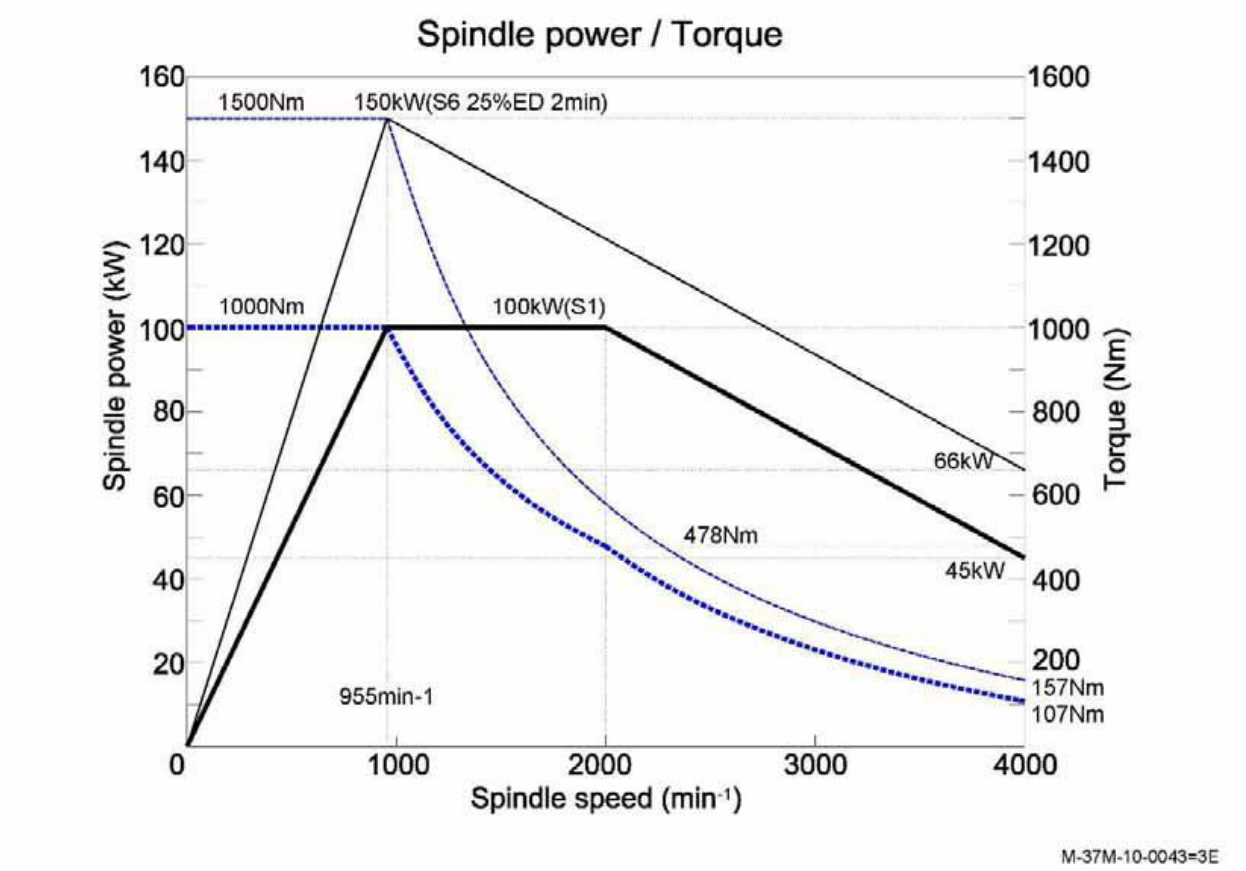
Tank Capacities

Hydraulic Tank	400 Liters	105 gal.
Spindle Cooling Oil	70 Liters	18.5 gal.
Slideway & Ball Screw Lubrication Unit	30 Liters	7.9 gal.
A-Axis Gear Lubricant	15.7 Liters	4.1 gal.

Home Positions

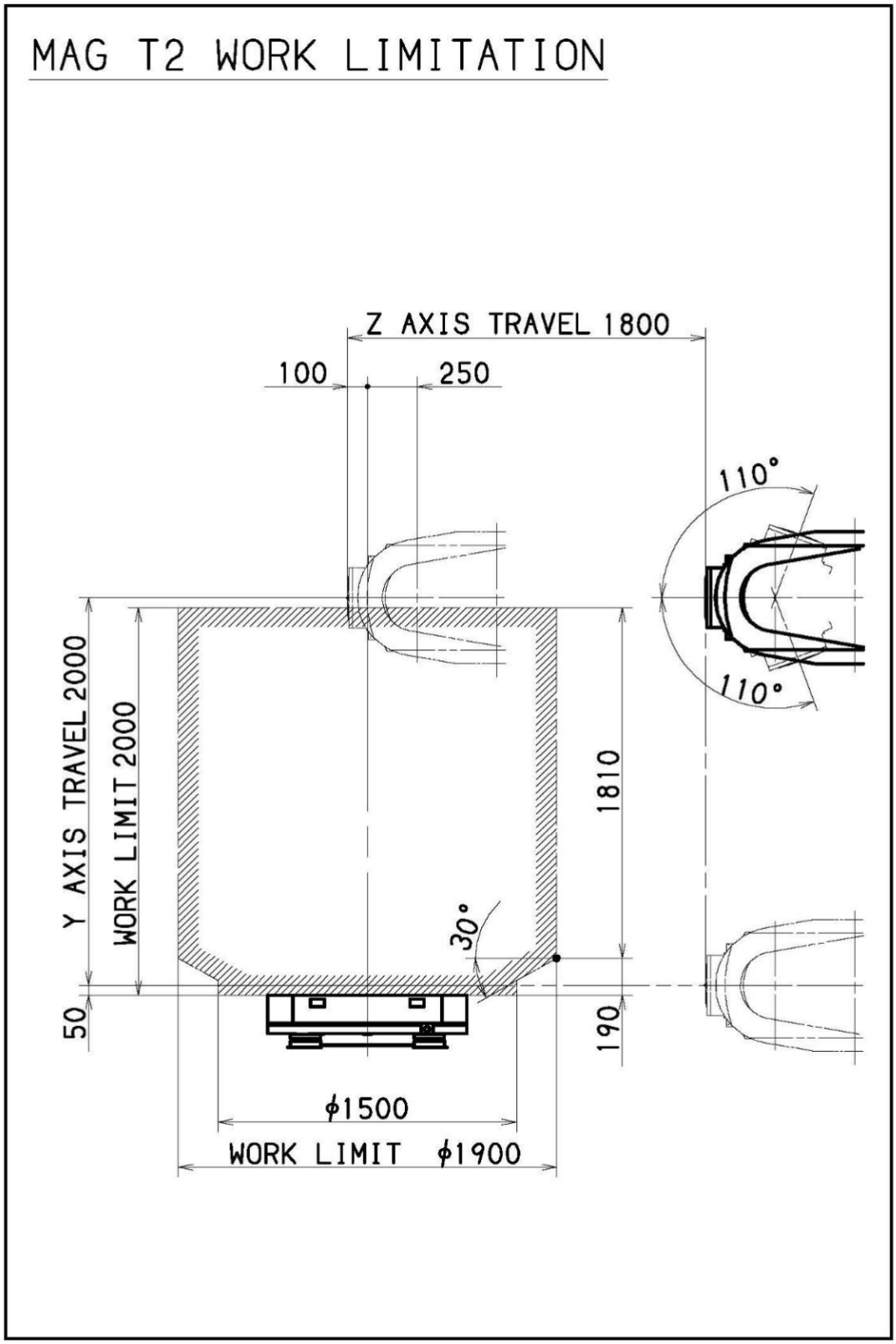
X-Axis	Center of Stroke
Y & Z-Axis	Stroke (+) End
A-Axis	Horizontal position
B-Axis	Long Edge Locator Parallel to X

4,000 rpm Spindle:



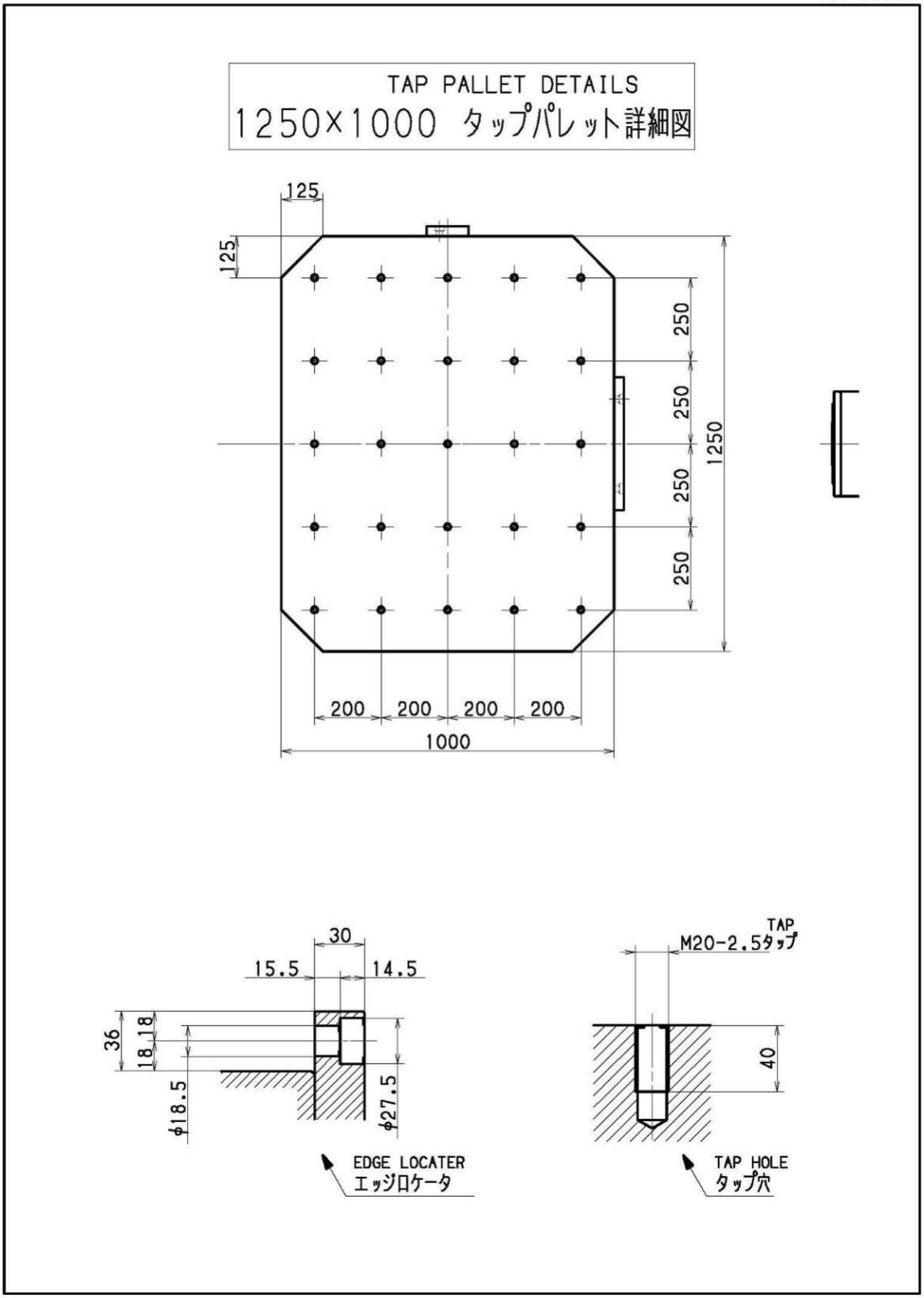
4,000 min-1 standard spindle output and torque characteristics

Maximum Work Size:



Maximum work piece size limitation (Y and Z axes travels)

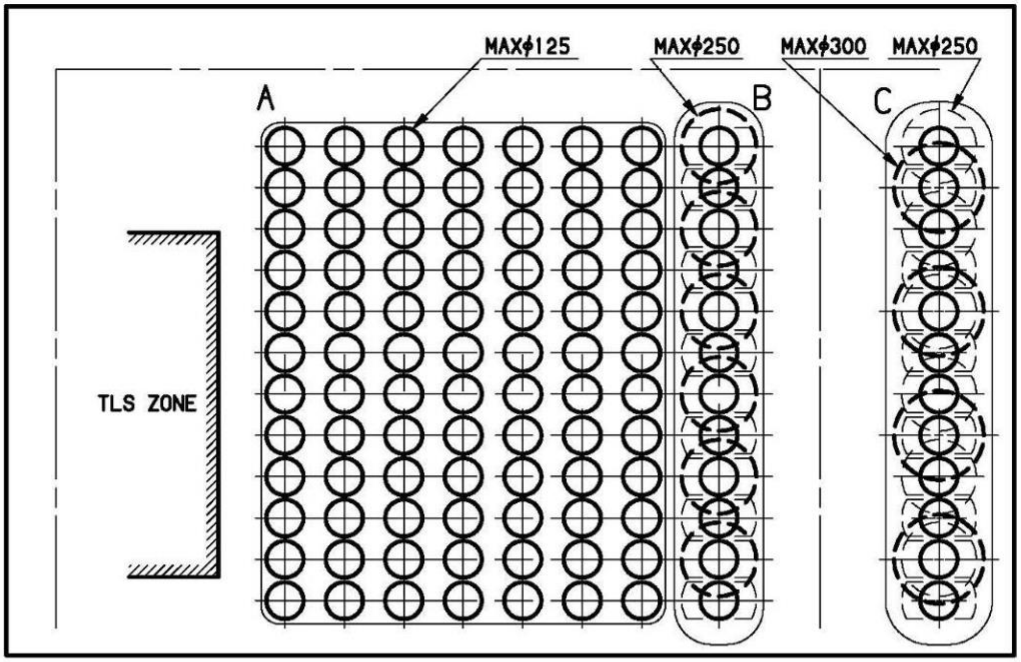
Pallet Drawing:



HSK- A125 Tool Limitations & Locations:

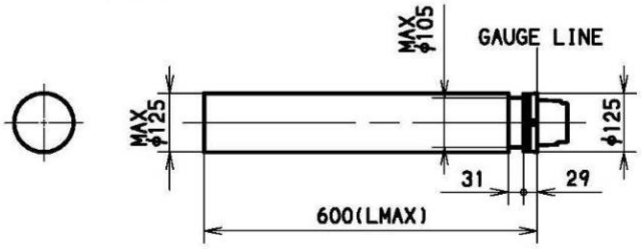
LM-40109(1/2)

TOOL LOCATION EXAMPLE
工具収納例



	TOOL DIA AND RACK CAPACITY					
	ϕ125		ϕ250		ϕ300	
	CAPACITY	LMAX	CAPACITY	LMAX	CAPACITY	LMAX
A	96	600	—	—	—	—
B	12	600	6(12)	600	—	—
C	12	600	6(12)	600	4(12)	600
TOTAL	120		12		4	

MAX TOOL SHAPE CAN BE PUT ON RACK A.
Aに収納できる最大工具



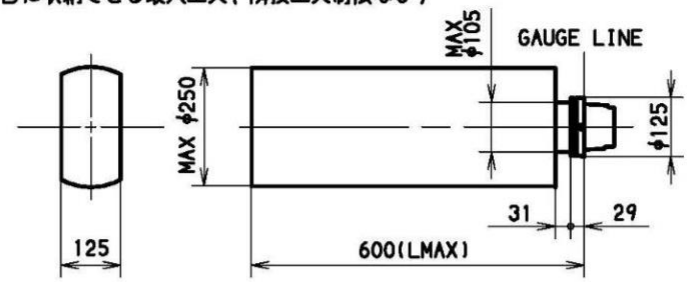
MAX TOOL MASS (INCLUDING SHANK)
1. 最大工具質量(シャンク含) 30kg

MAX TOOL MOMENT
2. 工具最大許容モーメント 30N・m

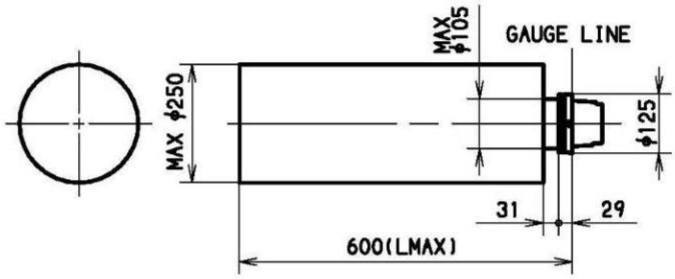
ALLOWABLE TOOL DIMENSION
工具制限図(A120)

LM-40109(2/2)

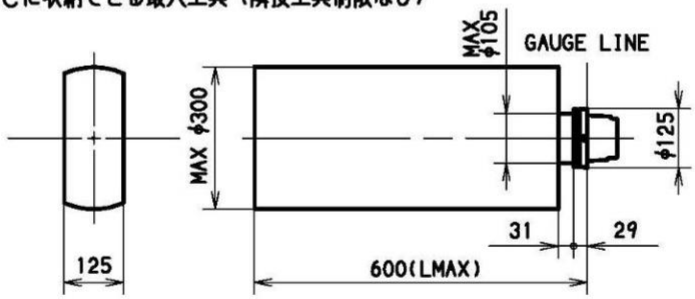
MAX TOOL SHAPE CAN BE PUT ON RACK B.(THERE IS NO ADJACENT TOOL)
Bに収納できる最大工具(隣接工具制限なし)



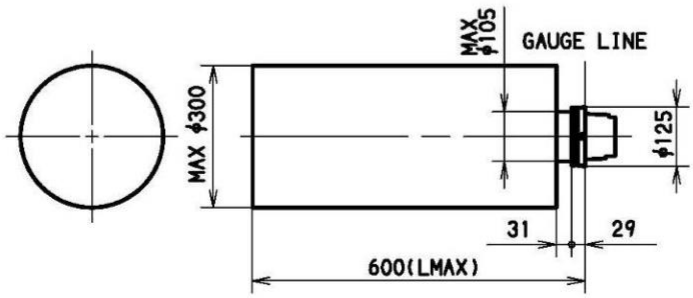
MAX TOOL SHAPE CAN BE PUT ON RACK B.(THERE IS ADJACENT TOOL)
Bに収納できる最大工具(隣接工具制限あり)



MAX TOOL SHAPE CAN BE PUT ON RACK C.(THERE IS NO ADJACENT TOOL)
Cに収納できる最大工具(隣接工具制限なし)

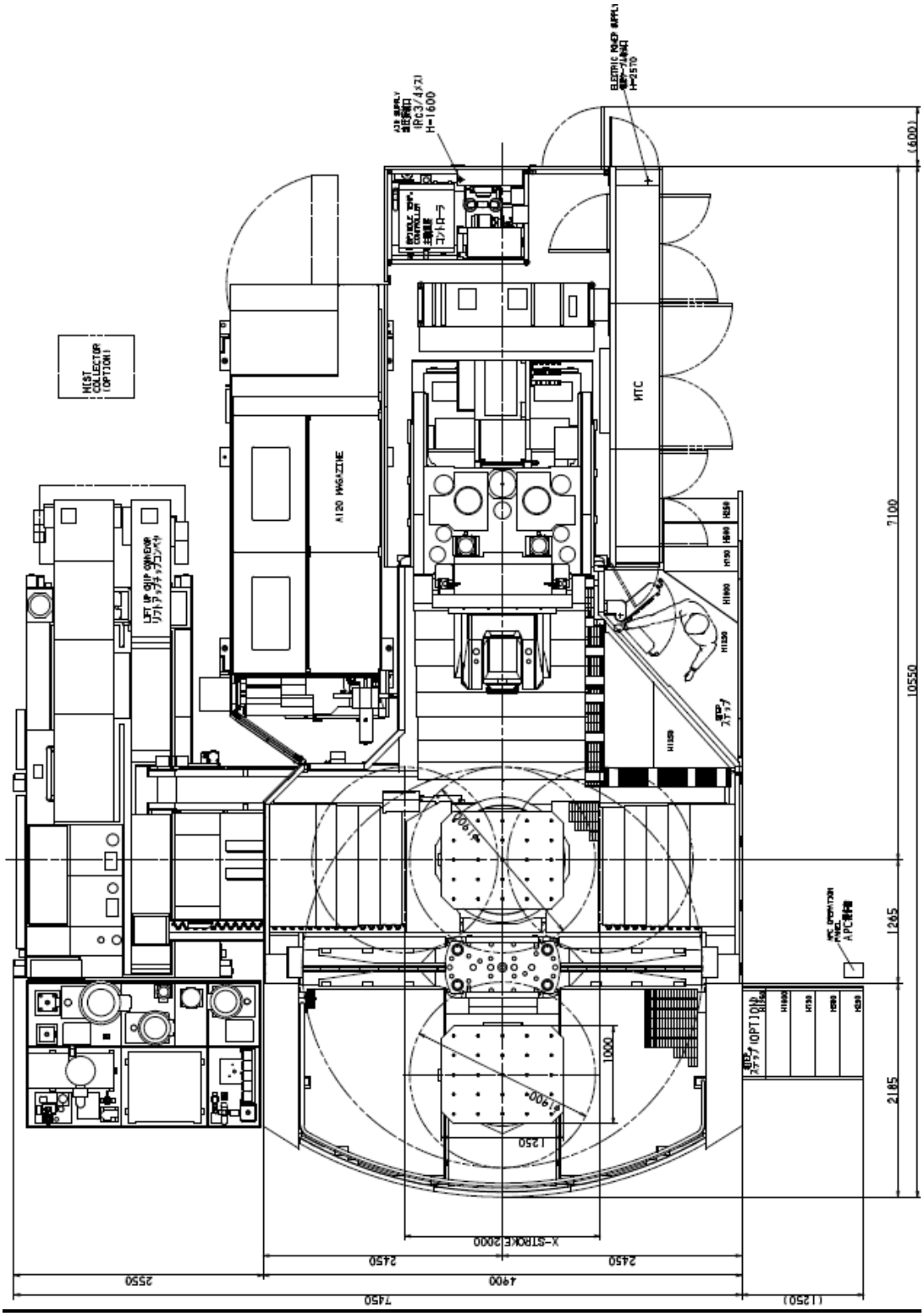


MAX TOOL SHAPE CAN BE PUT ON RACK C.(THERE IS ADJACENT TOOL)
Cに収納できる最大工具(隣接工具制限あり)



Floor Layout with Standard ATC 120 Tool Magazine

Note: Prior to installation, check for updated drawings



Operator Control Panel

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

· Fanuc 310i Control
· 12.1" Color LCD
· NC Power ON/OFF
· Emergency Stop Push-button
· NC Program Start/Stop
· Mode Selector Switches
· NC Function Switches
· Coolant Control Switches
· Spindle Start/Stop
· Spindle Tool Unclamp
· Over Travel Release Switch
· Alarm Release Switch
· Memory Protect Unlock Key Switch
· Splash Guard Door Interlock Key Switch
· Routine Function Switches
· Jog Switch
· Portable MPG with tool position display
- Rotary Switch Manual Feedrate
· Rotary Switch Rapid Feed Override
· Rotary Switch Feedrate Override
· Rotary Switch Spindle Speed Override
· Main Control Panel Flexible Switch allows assignment of main control panel switches to the PC screen

Makino Professional 5 Control Enhanced Features

High Speed High Precision
Geometric Intelligence SM Control (SGI.4);

Monitoring
Spindle Load Display
Tool Life Monitoring (TL);
Spindle Load Monitoring (SL);
Spare Tool Selection;
Parts Count Function;
Machining Result Function;

One Touch
Automatic Tool Change with tool in ready position
Registered tool automatic selection and ATC function;
All axes automatic return to reference point;
Automatic return to work setting position;
Z axis retraction

Guidance
Self-diagnostics and instruction display;
Number and position of limit switches and solenoids display for alarm;
Automatic recovery function for ATC-ARM standby position
Alarm history function;
Automatic display for regular maintenance advice;
User defined function for regular maintenance

Control Specifications - Professional 5 System CNC

Controlled Axes

Simultaneous 5-axis control

Programming Method

Inch/metric Selection (G20, G21) (5120A) (MM STD);
Custom Macro Common Variables: 100;
Minimum increment: 0.0001 mm;
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;

Data Center & Program Input Functions

Data Center memory expansion – 360MB
File Management function;
DNC simple schedule function
Back ground Editing;
Cut & Paste and replace function;
Coordinate value insert function;
2-program Simultaneous edit function;
G code insertion
M code insertion
Final MDI insert function;

Control Functions for 5-axis

Geometric Intelligence SM Control (SGI.4);
Tool Center point control;
3-Dimensional cutter compensation;
3-Dimensional manual feed;
Tilted working plan command;
Variable Posture (VP) Control;

Interpolation

Positioning (G00);
Linear Interpolation (G01);
Circular Interpolation (G02, G03);
Helical Interpolation (G02, G03);
NURBS Interpolation (G06.2); optional

Feeds

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

Part Program Storage & Editing

Part program storage (320 meters tape);

Registerable programs (63);
Background editing;
Program number search;
Sequence number search;
Address, word search;

Operation And Display

12.1" color LCD data display;
Clock function;
Manual data input (MDI);

I/O Devices

I/O interface (RS232C);
USB interface
PCMCIA card interface

STM Functions

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

Tool Offsets

Tool length offsets (99 total) (G43, G44/G49);
Tool radius offset (G41, G42/G40);
Tool offset memory Type A;

Coordinate Systems

Manual return to reference point;
Automatic return to reference point (G28);
2nd Reference point return (G30)
Reference point return check (G27);
Return from reference point (G29);
Coordinate system setting (G92);
Local coordinate system setting (G52);
Machine coordinate system setting (G53);
Work coordinate system selection (G54-G59);

Operation Support Functions

Label skip:
Control in/out;
Single block;
Program stop (M00);
Optional stop (M01);
Optional block skip (/);
Dry run;
Machine lock;
Z-axis feed cancel;
Auxiliary function lock;
Mirror image (M21, M22/M23);
Manual absolute;
Tool length measurement (manual);
Help function;

Programming Support Functions

FS-15M format;
Circular interpolation radius programming;
Canned cycles (G73, G74, G76, G80 to G89);
Rigid Synchronous Tapping (G84)
Sub-programming (10 folds nested);
Exact stop check (G09);
Exact stop check mode (G61);
Tapping mode (G63);
Cutting mode (G64);
Programming data input (G10) (offset value, parameter);

Machine Error Compensation

Stored pitch error compensation;
Backlash compensation;
Single direction positioning (G60)

Maintenance & Safety

Emergency stop;
Over travel;
Stored stroke limit 1;
Self-diagnostics;
Interlock;
Alarm history display (last 25 alarms);
Low air pressure alarm;
Low spindle lubricant level alarm;

Installation

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

Temperature			
	Average	23 ± 1.5°C	73.4 ± 2.7°F
	Warm	26 ± 1.5°C	78.8 ± 2.7°F
	Cool	20 ± 1.5°C	68.0 ± 2.7°F
Fluctuation	≤ 1°C/30 min.		≤ 1.8°F/30 min.
Humidity	50% ± 10%		
Dust	Not applicable		
Air Supply	72-128 psi and 35.3 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 utility requirements, 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.