

**MACHINING CENTER
VS 40
INSTRUCTION MANUAL**

SEIKI - SEICOS Σ 16M/18M

SPECIFICATION

Edition 1.01 11-2000



***Hitachi Seiki Deutschland
Werkzeugmaschinen GmbH***

Introduction

Thank you for your having purchased the machine, favoring our product lines for your use.

This manual contains fundamental information on the specification. Please read and fully understand the contents for your safe machine operation.

In particular, the contents of the items concerning safety in this manual and the descriptions on the “caution plates” attached to the machine are important. Please follow the instructions contained and keep them always in mind to ensure safe operation.

The reference record papers on adjusting setting values such as a parameter list are attached to the machine unit and enclosed in the packing. These are necessary for maintenance and adjustment of the machine later on. Please keep them safely not to be mislaid.

The design and specifications of this machine may be changed to meet any future improvement. As the result, there may arise some cases where explanations in this manual could become partly inconsistent with the actual machine. Please note this point in advance.

In this manual, items on the standard and optional specifications are handled indiscriminately. Please refer to the “delivery note” for the detailed specification of your machine confirmation.

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1. INTRODUCTION

We are obliged to you for using our machining center.

This manual describes the installation, operation, daily maintenance and inspection, etc. of this machine in order for you to be able to properly operate the machine and make full use of its performance. Prior to its installation and test run, read this manual thoroughly to understand the contents described for handling the machine.

To secure safe operation, follow the safety precautions described in this manual and the instructions given on the warning signs attached to the machine.

For your general understanding of this machine, the following documents are provided other than this instruction manual. Refer to them when necessary.

1. Programming Manual
2. Parts List
3. Instruction Manual for OPERATION
4. Instruction Manual for MAINTENANCE
5. Electric Circuit Diagrams
6. Instruction Manual for NC UNIT (PROGRAM, OPERATION, MAINTENANCE)

Such records of adjustment and setting values as "Parameter List" are included in the package of the machine. Be sure to keep these documents, which is necessary for maintenance and adjustment of the machine from now on.

Hitachi Seiki pursues a policy of a continuing improvement in design and performance of its product. The right is therefore reserved to vary specification, and as a result, the contents of these documents may partly differ from your machine.

1-1 General Precautions

These general precautions is quite useful for operators to create good working environment against accidents and to increase productivity.

1. Be sure to put safety goggles on.
2. Be sure to put safety shoes on.
3. Operate with proper dressing, such as putting a utility cap on, fixing the sleeves and the cuffs of working clothes.
4. Don't operate the machine with gloves.
5. Make clean and neat environment by lighting up and keeping dry around the machine. Also don't put any obstacles.
6. Remove dust and chips on the machine, high voltage control panel and NC unit. Also remove them on the floor. Avoid using compressed air as much as possible for these cleanings.
7. Use a strong enough table to be put around the machine, and take anti-sliding measures on the surface.
8. Don't put tools, workpieces, and other items on the machine as well as on the moving parts of the machine.
9. Don't give any remodeling to the machine without our permission.
10. About the Machine with Through Coolant
 - <1> For the spindle core through specifications, be sure to use our specified through pull stud when discharging the coolant. If you use other pull stud, it could cause a trouble.
 - <2> For the DIN through specifications, be sure to use our specified DIN through tool holder when discharging the coolant. If you use other pull stud, it could cause a trouble.

1-1-1 Precautions on Machine Operation

Before trial run, read this manual carefully and understand, the contents well. Witness of our operation instructors is most recommendable.

MAINTENANCE

1. An operator and maintenance personnel should read the precautions on the caution plate fitted to the machine and observe them.

Don't stain, damage or remove the caution plate. If the caution plate becomes hard to read, contact Hitachi Seiki.

2. Close all the doors and covers except when adjusting work is made.

As for the doors of the NC unit and the power control cabinet, be sure to close them with special care.

3. Don't remove or modify the limit switches for the stroke end, for the traveling axes and the mechanism, or the electric circuit employed for safety.
4. Use regular wrenches and spanners for adjusting or repairing work.

LUBRICATION

(with option device)

Since lubrication oil exerts a great influence on machine durability and accuracy, extreme care must be taken for maintenance of the whole lubricating system. Perform the following check and maintenance precautions.

1. Fill with the oil specified in the Maintenance manual to the specified amount.
2. Clear the oil port in advance and be careful that foreign substances such as dust, water and chips do not enter the tank.
3. Check the bottom of the oil jug to see if there is any debris, water or cutting chips, etc. Sufficient care is required to distinguish the oil jug by appropriate color coding and fixed stock location to avoid mixed use of different kinds of oil.
4. Check the oil periodically and if foreign substances are found, clean the inside of the tank promptly and replace it with new oil.

Don't use all of the oil, even from a new can. This is necessary in order to remove water and sediment etc.

5. Although low levels in the lubrication oil tank are detected by a float switch that flashes an alarm signal, check to see if discharging is normal. There are two possible problems:
Oil in the tank decreases extraordinarily fast, or it is decreasing too slowly.
6. As for the suction filter fitted to the pump and the in-line filter in the piping circuit, replace them with new ones once a year as a rule.
7. Air in the main lubrication pipes has been bled when the machine is delivered, but when the piping is removed for maintenance, bleed air completely at the time of reassembly and operate the machine after checking the state of discharging at the end.

COOLANT

The soluble cutting fluid is decomposed due to factors such as mixture of lubrication oil and propagation of micro-organisms that lower cutting and rust prevention efficiency. This causes various troubles to occur.

When using-soluble cutting fluid, care must be taken of the following points.

1. When selecting soluble cutting fluid, carefully consider lubrication, infiltration, rust prevention, bubble prevention, reparability against oil and safety needs.
2. Before operation starts and after operation ends, not only remove chips, but also wipe off soluble cutting oil adhered to each slideway, the rotating parts, the saddle and cross-slide of the machine and then be sure to apply lubrication oil thinly to those parts.
3. Replace soluble cutting fluid immediately if it becomes vitiated.

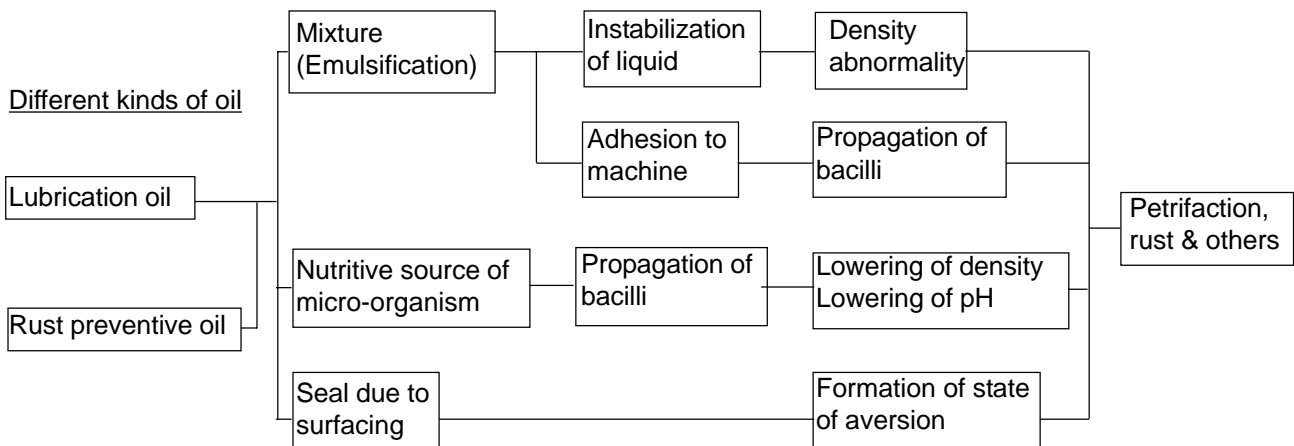
4. Remove the covers every half year and clean each slideway, X, Y, Z axes ball-screws, each limit Switch and feed motors etc.
5. As soluble cutting oil is considered for rust prevention, it may be no problem when the workpiece is wet. However, when dry, it is apt to rust.

Therefore, it is recommendable to apply rust preventive oil before the workpiece dries after finished machining.

6. Since soluble oil is alkaliescent and has a strong degreasing action, the operator is apt to develop dermatitis.

Therefore, the operator should take appropriate precautions.

7. As for the diluting method and soluble cutting fluid, diluting water they are different depending on the type of soluble cutting oil, so use it in accordance with the recommendations of the cutting fluid manufacturer.
8. Since there are instances where extensive micro-organisms are detected in industrial water, it is recommendable either to check it before use as water for dilution or to use service water.
9. Do not use a chemical solution type (synthetic type) in water-soluble cutting agents, because it causes detachment of coating and affects sealing materials and resin materials adversely.
10. The influences of difference kinds of oil on coolant are as follows: Carefully monitor the condition the coolant fluid.



OPERATION

1. Be aware of the position of the push button for emergency stop so that the operator may be able to press it instantly.
2. As for the operation of the machine, proceed in accordance with the procedure described later.
3. During operation, keep hands away from the rotating sections and movable sections.
4. When disposing of chips that wound round tooling or fell onto the table, it is dangerous to grasp and pull them. Further, when disposing of chips, be sure to do it after stopping the machine.
5. When adjusting the position of the coolant nozzle, do it after stopping the machine.

TOOL SETTING

1. When setting up tools, stop a spindle as well as the feed in each axis.
2. Set the tools within the specified lengths and diameters.
3. When setting a tool to the holder, be sure to set outside the machine. If set in the machine, the spindle may rotate.

OPERATION FINISH

1. After operation of the machine is over, be sure to switch the power OFF in the prescribed order, clean the machine and apply rust preventive oil to each section of the machine such as the slide ways.

When soluble cutting fluid is used, perform these jobs with special care.

1-1-2 Electric Equipment and NC Unit

When operating the machine or carrying out maintenance checks, pay special attention to the following points, concerning the electric equipment and NC unit.

1. Do not give shocks to the NC unit, power control cabinet and other machine parts.
2. For the primary wiring of the machine, use the cable size specified in the operation manual. Do not use an excessively long cable.

When the primary wiring has to be put on the floor, protect it with a cover against damage by cutting chips and other sharp objects.

3. While test running the machine, be sure the setting parameter of the NC unit coincides with the parameter sheet attached to the machine.
4. Do not change the current set values of thermal relays in the power control cabinet, various control knobs or the parameter data.
5. Do not apply excessive force, e. g. bending force etc., to the connector portion of plugs, flexible conduits (tubes) or cable cables etc.
6. When carrying out maintenance checks on the electric equipment, turn off the EMERGENCY STOP button on the operation panel, the power of the NC unit, the main switch of the power control cabinet and the power switch installed in your factory, in this order.

Start maintenance work after making sure that these switches are turned off. Lock the power switches in the OFF state as much as possible or put up warning signs. In addition, place a "DO NOT TOUCH !" tag near the operation buttons of the machine to forbid other personnel from operating the machine.

7. Handle electric equipment of the machine with particular care and exercise extreme caution not to allow the machine to get wet.
8. For equipment inside the power control cabinet, use those specified by Hitachi Seiki. Use always specified fuses. Never use fuses with a higher capacity.
9. Never leave the control cabinet door open, because direct sunshine or camera's strobe flash rays may enter the cabinet and damage internal equipment.
10. In case of turning on the power again, execute power on within equal to or more than two seconds after power turned off. If the power is turned on during discharge from control device by power off, pay attention to the alarm of the machine is displayed some time, due to normal process is not available.

1-1-3 Weights and Measures Table

(Metric and English Conversion)

1. Linear measure

1m (meter) = 39.37 inches = 3.2808 feet = 1.0936 yards

1cm (centimeter) = 0.3937 inch

1mm (millimeter) = 0.03937 inch

2. Square measure

1m² (square meter) = 10.764 square feet = 1.196 square yards

1cm² (square centimeter) = 0.155 square inch

1mm² (square millimeter) = 0.00155 square inch

3. Cubic measure

1m³ (cubic meter) = 35.315 cubic feet = 1.308 cubic yards

= 264.2 U.S. gallons = 220.0 U.K. gallons

1 ℓ (liter, cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inches

= 0.2642 U.S. gallon = 1.0567 U.S. quarts

= 0.2200 U.K. gallon = 0.02745 bushel

1cm³ (cubic centimeter) = 0.061 cubic inch

4. Weight

1 ton (metric ton) = 0.9842 U.S. (long) ton = 2204.6 pounds

= 1.1023 U.K. (short) ton

1 kg (kilogram) = 2.2046 pounds = 35.274 ounces avoirdupois

5. Others

1 kg/cm² (kilogram per square centimeter) = 14.223 pounds per square inch

1 kg-m (kilogram-meter) = 7.233 foot-pounds

2. OUTLINE AND FEATURES OF MACHINE

2-1 Construction of Machine

As shown in Fig. 2-1, the standard configuration of this machine consists of the bed, column, table, saddle, spindle head, feed boxes and automatic tool changer (ATC).

2-1-1 Bed

The bed has been shaped so as to facilitate disposal of cutting chips. It is provided with grooves of chip pan on both sides of table traverse. The two grooves are provided with flow jet coolant as standard specifications. Two oil conveyors also can be provided as option. Chips and coolant are transported from the machine left side to the right side outlet, and collected in the chip box on the coolant tank on the right side of the bed.

The bed has two guides to ensure smooth movement of the table.

Bed also has been designed to fit a splash guard on its circumference in order to protect the surroundings of the machine from being contaminated by cutting fluid and cutting chips. Proximity of an operator and the table is kept at close range.

2-1-2 Column

Column, taking the shape of a wall type double column, is fixed on the rear and both sides of the head by bolts, the column supports the saddles with two horizontal guides on the top, and the saddles supports the spindle head with two vertical guides. The saddles, as they traverse on the column, excellent in rigidity, stability of accuracy and high velocity.

2-1-3 Spindle Head

Spindle head takes a ram form to assure flexible movement, which shift up and down with two stripes on guides provided between the saddle and the head. As to the structure inside the head, the spindle and the tool locking cylinder are arranged in the body. AC built-in motor features low oscillation and high reliability of the spindle rotation.

2-1-4 Table

The table, which is put on the bed, is smoothly driven by a ball screw set in the center of the guides.

Nothing is installed around the table except working surface, which enables coolant and cutting chips to drop without difficulty. Three T-grooves are designed so that they may be used as a reference for jig fixtures. Since a table base size is wide enough compared with a table size, an overhang amount is minimized when the table moves in a traverse direction.

2-1-5 Feed Box

Feed boxes are provided at three spots which are on the front part of the bed, at the left end of the column top and on the top of the saddle. Each driving section has an AC feed motor, which drives the ball screw directly by the precisely machined coupling. The ball screw is isolated from cutting chips and coolant, and maintains longtime accuracy free from maintenance by the self-lubrication system adopted.

2-1-6 Slideway

Each slideway for axial feed uses a precision ball guide having a special structure. Therefore, it is provided with superior dynamic performance which allows both low noises and power saving. Self-lubrication system is adopted to these guides in the same way as the ball screws, which attains maintenance free guides.

Since an appropriate pre-load is given to the bearing of guideways in a radial direction, sufficient rigidity is secured even for heady duty cutting.

2-1-7 Automatic Tool Changer (ATC) (20/30-tool Specification)

The ATC, which is mounted onto the column base, can change tools at the up end position of the head (reference point).

High rigidity cams are adopted for the twin arms driving, and the spindle tool lock and the twin arm action are synchronized, which realizes top level high speed ATC.

A tool magazine can store 20 tools as a standard. Due to employment of a fixed tool address call system, a secure tool change can be done by simple operations

There occurs no interference to workpieces at the time of tool exchange.

2-1-8 Automatic Tool Changer (ATC) (16-tool Specification)

The design of the 16-tool ATC is such that it has an umbrella-shape tool magazine and the spindle jumps into the magazine directly. Because of simple construction, it has realized operation in high stability.

2-1-9 Splash Cover

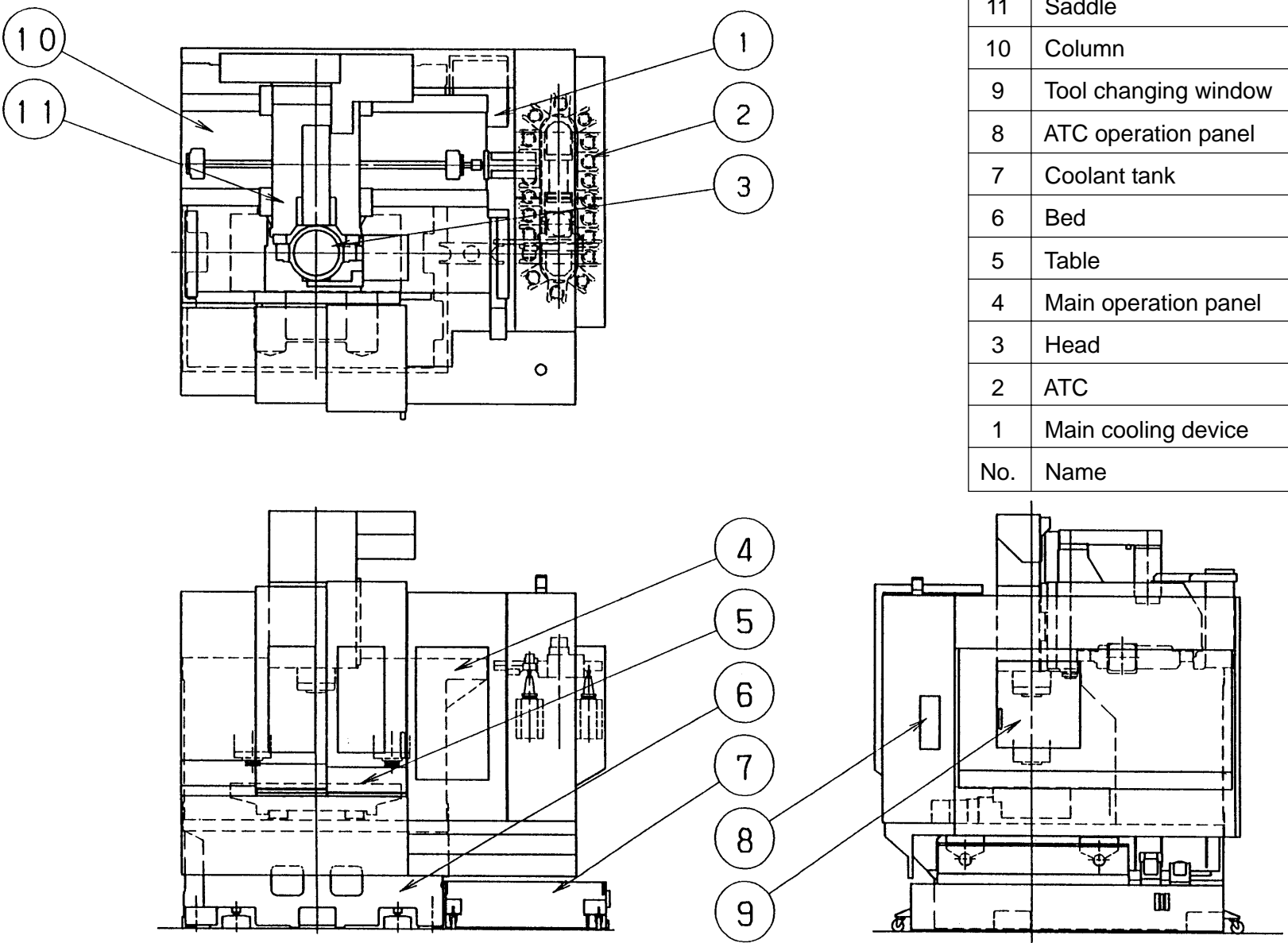
Cover structure which seals the machine until the ceiling is equipped as the standard specification so that coolant mist produced by high speed operation may not leak outside the machine.

The front door also opens widely until the ceiling, which facilitate crane entering at the time of setting up.

2-2 Name of Component Units

Fig.2-1 Name of component units

11	Saddle
10	Column
9	Tool changing window
8	ATC operation panel
7	Coolant tank
6	Bed
5	Table
4	Main operation panel
3	Head
2	ATC
1	Main cooling device
No.	Name



2-3 Specifications of Machine

2-3-1 Specifications of VS Type Machine

*Optional specifications

	Specifications	Unit	VS40 Standard specifications	VS40 economy specifications	
A	Stroke				
	1) X-axis stroke (Spindle head right & left)	mm	600 (24.0")		
	2) Y-axis stroke (Table crosswise)	mm	450 (17.7")		
	3) Z-axis stroke (Spindle head up & down)	mm	450 (17.7")		
	4) Distance from the table surface to the spindle nose	mm	130 ~ 580 (5.1" ~ 22.8")		
	5) Distance from the column front to the spindle center line	mm	525 (20.7")		
B	Table				
	1) Table working surface	mm	900 × 450 (35.4" ~ 17.7")		
	2) Max. table loading capacity	kg	350		
	3) Shape of table surface		18mm T-slot 3 lines		
C	Spindle				
	1) Spindle speed	Standard spec. /High output spec.	min ⁻¹ {rpm}	120 ~ 12000	60 ~ 8000
		*High speed spec.	min ⁻¹ {rpm}	200 ~ 2000	
	2) Spindle speed change		Stepless		
	3) Spindle hole taper		7/24 Taper No.40		
	4) Spindle bearing ID	Standard spec. H/High output spec.	mm	φ75	φ65
		*High speed spec.	mm	φ65	
	5) Max. spindle torque	Standard spec.	Nm {kgfm}	135 {13.8}	105 {10.7}
*High speed spec.		Nm {kgfm}	95.4 {9.7}		
High output spec.		Nm {kgfm}	166 {16.9}		
D	Feed rate				
	1) Rapid traverse rate	(X,Y)	mm/min	40000	
		(Z)	mm/min	30000	
	2) Cutting feed rate		mm/min	1 ~ 15000	
3) Jog feed rate		mm/min	0 ~ 5000 (21 steps)		

	Specifications	Unit	VS40 Standard specifications	VS40 economy specifications	
E	Automatic tool changer				
	1) Tool shank	*	MAS BT40		
			DIN 40/CAT40		
	2) Pull-stud	*	MAS P40T-1 (45°)		
			MAS P40T-1 (30°)		
	3) Tool storage capacity	*	20	16	
			30		
	4) Max. tool diameter () : When no adjacent tool exists.		mm	φ110 (φ125)	φ90 (φ125)
5) Max. tool length		mm	300		
6) Max. tool weight		kg	8		
7) Tool selection system	For 20 tools		Unidirectional random call		
	*For 30 tools		Bidirectional random call		
F	Automatic pallet changer				
	1) No. of pallet		pcs	2	
	2) Pallet change system			Parallel & swing ARM	
	3) Pallet working surface		mm	800 × 400 (31.5" × 15.7")	
4) Max. pallet loading capacity		kg	250		
G	Motor				
	1) Spindle driving motor	Standard spec.	AC kW	11kW (10min) 7.5kW (30min) 5.5kW (CONT)	5.5kW (30min) 3.7kW (CONT)
		*High speed spec.	AC kW	18.5kW (30min) 15kW (CONT)	
		*High output spec.		22kW (25%ED) 18.5kW (CONT)	
	2) Feed motor	X, Y	AC kW	3.8	
		Z	AC kW	3.8	
	3) Coolant motor	Flood	AC W	180 - 2P	
		*Flow jet	AC W	400 - 2P × 2	
		*Gun	AC W	180 - 2P	
		*Jet	AC W	400 - 2P	

	Specifications		Unit	VS40 Standard specifications	VS40 economy specifications
G	4) Spindle cooling system	(Compressor)	AC W	400-2P	
		(Pump)	AC W	400-4P	
	5) Electric motor for oil pressure		AC kW		0.75-4P
H	Power supply				
	1) Power source (Options not included)	Standard spec.		18kVA	200/220V AC ±10%
		High speed spec.		31kVA	
		High output spec.		36kVA	
2) Air source	(MIN)	MPa {kgf/cm ² } ℓ /min	0.5 {5} 100 (Atmospheric)		
I	Tank capacity				
	1) Cutting fluid tank capacity	Standard	ℓ	420	
	2) Spindle cooling system tank capacity		ℓ	8.2	
J	Machine dimension				
	1) Height of the machine		mm	2683	
	2) Floor space	Standard	mm	2300 × 2400	
	3) Machine weight (Including NC unit)	Standard	kg	7300	7000

○ Machine is designed in accordance with JIS (Japanese Industrial Standard).

2-3-2 Main Accessories

Standard accessories

• Direct tapping	1 set
• ATC, 20 tools	"
• Chip flow jet coolant	"
• Spindle air flow	"
• Flood coolant	"
• Total enclosed	"
• ATC guard	"
• Operator side door interlock	"
• ATC door interlock	"
• Portable manual pulse generator	"
• Spindle load meter on screen	"
• Spindle speed/feedrate override	"
• Call light (Red or green can select)	"
• Electric leakage detection breaker	"
• W-setter/Easy setter	"
• Safety guard	"
• Spindle cooling unit	"
• Machining completion pre-call/work counter/ Run hour display on screen	"
• Work light	"
• Leveling kit/Spanners and wrenches	"

Optional accessories (Option)

- High column 200mm
- Closed loop (XY-axis)
- Spindle high output specification
120min⁻¹ ~ 12,000min⁻¹
- Spindle high speed type
200min⁻¹ ~ 20,000min⁻¹
- ATC 30 tools
- Pull stud shape changing
MAS P40T-1 (30°)
- APC (Parallel shuttle type)
- Outside the machine chip conveyor
- Discharge direction (Back discharge)
- Discharge method (Flat/Scrape/Rolling
Filter/Magnet Roller conveyor)
- Oil skimmer(Belt type)
- Chip wagon w/rollers
- Air blow for cutting point
- Jet coolant
- Mist collector(Water-soluble/oiliness)
- Gun coolant (For table/APC)
- Oil hole coolant
0.5/1.5Mpa (5•15kgf/cm²)
- Sp. through coolant
Kind: Center/DIN
Discharge pressure: 0.5/1.5/3.5/7.0Mpa
(5•15•35•70kgf/cm²)
- Oil mist (Mist, continuous/Needle, one
shot)
- Auto door
- Pallet single unit type 1/type 2
- Metal fastener
- Power supply on table/pallet
- Hydraulic/pneumatic/hydraulic +
pneumatic
- Power supply on the pallet
- Additional pull stud bolt
- NC rotary table (On the table/on APC)
- Fixture plate (On the table/on APC)
- Sub table for NC rotary table
- Spindle speed meter, (Separate type)
- Spindle load meter, (Separate type)
- Work counter 6-digit
- Run hour meter (Spindle rotation meter/
power on/hydraulic under activating/cycle
under activating)
- Weekly timer
- Additional call light (2/3 Color)
- Call buzzer
- Melody horn
- M-code out put (M70 ~ M73) (2 pcs./4
pcs.)
- Portable type tape reader
- Handy type FD DON
- Tool length measuring & tool breakage
detection
- Auto. centering (UTS/Renishaw)
- Auto. measuring (UTS/Renishaw)
- On the machine measuring (UTS/
Renishaw)
- Measuring master gauge
- Cleaning tool for measuring
- SEIKI-ATAC10 (Y, Z axes thermal change
compensation device.)
- Safety measures for Europe
- Transformer 32kVA
- Tank applicable to Fire Precaution Law
- Operation tools (as specially attached
items)

*The contents of accessories and equipment are subject to change without notice. Please contact the sales department of Hitachi whenever you have any inquiry for answer.

2-4 NC Unit Specifications

Refer to Manual (OPERATION) of SEIKI SEICOS Σ 16M/18M for details of specifications.

Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
	standard specifications	Σ 16M	Σ 18M
1	Controlled axes	3 axes, 3 axes simultaneous	
2	Least input increment	0.001mm/0.0001"	
3	Interpolation	Positioning, Linear, Circular	
4	Inch/Metric conversion		
5	Tape code	EIA/ISO automatic recognition	
6	Designation	INC./ABS.	
7	Decimal point programming		
8	Buffer register		
9	Multi-buffer	12 blocks	
10	Imposition check per cutting/rapid feed		
11	Feedrate command	F code/feedrate direct	
12	Rapid traverse override	0, 1, 10, 50, 100%	
13	Feedrate override	0 ~ 200% (10% step)	
14	Override cancel		
15	Spindle override	50 ~ 150% (10% step)	
16	Automatic override memory		
17	Direct tapping		
18	Manual feed function	Rapid, Jog feed, Handle	
19	Manual pulse generator	×1, ×10, ×100 (inch = ×50)	
20	Part program storage	80m	
21	Add. registered programs	100 pcs.	
22	Back ground editing		
23	Expanded program edit	(Program copy)	
24	Display	10.4" color TFT	9.5" monochrome
25	Memory lock		
26	Language display	English/German	
27	Tape mode operation	RS232C *1	
28	I/O interface	RS232C *1	

Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
standard specifications		Σ 16M	Σ 18M
29	Function	G3, M3, T4	
30	Spindle speed command	S code/speed direct	
31	Tool position offset	G45 ~ G48	
32	Tool length compensation	G43 G44 G49	
33	Tool radius compensation C	G40 ~ G42	
34	Tool offsets	32 pcs.	
35	Tool offset memory C		
36	Machine coordinate system selection	G53	
37	Work coordinate system	G54 ~ G59	
38	Pre-set of Work Coordinates		
39	Local coordinate system setting	G52	
40	Coordinate system setting	G92	
41	Reference point return	Manual, Auto G27 ~ G29	
42	2nd reference point return	G30	
43	3rd-4th reference point return		
44	Graphic display	Before and synchronized machining	
45	Program name	16 characters	
46	Single block		
47	Block skip	1 pcs.	
48	Optional stop		
49	Dry run		
50	Machine lock		
51	Z-axis feed cancel		
52	Program number search		
53	Sequence number search and comparison stop		
54	Program comparison		
55	Manual absolute	[ON] fixed	
56	Custom macro	Common variable 100 pcs.	
57	Coordinate rotation		
58	Fixed cycle	G73 G74 G76 G80 ~ G89	

Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
standard specifications		Σ 16M	Σ 18M
59	Drilling pattern cycle	G70 ~ G72 G77	
60	Right circular interpolation	(Incl. Spiral)	
61	Seiki High Grade-2 (High grade die & mold mach.)	High precision contouring control; (With 64 bit RISC engine) Advanced control Linear accel./decel. Before pre-read interpolation Multi-buffer: Pre-read 180 blocks Feedrate control by circular acceleration Automatic feed control Bell -shaped accel./decel. Pre-read interpolation DNC connection circuit Graphic guidance adjustment software	
62	Mirror image	Setting via screen	
63	Chamfering/corner R any angle		
64	Radius designation on arc		
65	Exact stop	G09 G61 G64	
66	Programmable data input	G10	
67	Backlash compensation		
68	Stored pitch error compensation		
69	Run hour display	(On screen)	
70	Cycle completion pre-call	(On screen)	
71	Cycle time display	(On screen)	
72	Work Count	(On screen)	
73	Clock function		
74	Following up		
75	Stored stroke limit 1		
76	Stroke check before move		
77	NC self diagnostics		

*1 Interface only
Not include cable.

Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
Option specifications		Σ 16M	Σ 18M
1	F1 digit feed		
2	Direct tapping	Pecking cycle	
3	Manual pulse generator	3 pcs.	
4	High resolving power detection function (0.1 specification) specification must be investigated.		
5	Polar coordinate command		
6	Custom macro	Common variable 200 pcs.	
7	Custom macro	Common variable 300 pcs.	
8	Custom macro	Common variable 600 pcs.	
9	Interruption type custom macro		
10	Screen guide special canned cycle Deep hole drilling Drilling pattern cycle Square side surface outer cutting Square lateral cutting Pocket cutting cycle Right circular interpolation	G73, G83 G70 ~ G72 G77 G322 G323 G324 ~ G326 G327 ~ G333 G302 G305	
11	Seiki high grade-1 (High speed machining)	Helical interpolation Advanced control Graphic guidance high speed machining software High speed boring cycle with helical interpolation High speed grooving with Trochoid machining	
12	Programmable mirror image		

Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
Option specifications		Σ 16M	Σ 18M
13	Advanced control (High speed machining)	/	<ul style="list-style-type: none"> • Precedent feed forward. • Rapid feed bell type acceleration/deceleration • Linear acceleration/deceleration before cutting feed interpolation. • Automatic corner deceleration. • Block overlap function. • Feed speed clamp by circular radius.
14	Scaling function		
15	Automatic corner override		
16	Programmable parameter input		
17	Macro print func.		(Need printer w/ RS232C I/F) *1
18	Program memory length		Total 160m
19	Program memory length		Total 320m
20	Program memory length		Total 500m
21	Program memory length		Total 1000m
22	Program memory length		Total 2000m
23	Program memory length		Total 4000m
24	The number of registered programs		Total 200 (160m is necessary)
25	The number of registered programs		Total 400 (320m is necessary)
26	The number of registered programs	Total 800 (1000m is necessary)	
27	The number of registered programs	Total 1000 (1000m is necessary)	
28	Data server	(N/A with DNC connection circuit)	
29	Second auxiliary function		
30	3-dimensional tool compensation	G40 G41	
31	Tool offsets	Total 64 pcs.	
32	Tool offsets	Total 100 pcs.	
33	Tool offsets	Total 200 pcs.	

Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
Option specifications		Σ 16M	Σ 18M
34	Tool offsets	Total 400 pcs.	
35	Tool offset by tool number		
36	Work coordinate system	Total 60 sets	
37	Retract to machining interrupted point	(retract and return)	
38	Retrace	(Retracing)	
39	48-character program name		
40	Block skip	Total 9 pcs.	
41	Block restart		
42	Program restart		
43	Manual interruption in handle mode		
44	Single direction positioning		
45	Helical interpolation	(Incl. add. axis)	
46	Cylindrical interpolation		
47	Hypothetical axis interpolation		
48	Involute interpolation		
49	Smooth interpolation	(Used 64 bit RISC)	
50	NURBS interpolation	(Used 64 bit RISC)	
51	DNC connection circuit RS232C		(Incl. Remote buffer, need technical discussion) (N/A with data server)
52	DNC connection circuit RS422	(Incl. Remote buffer, need technical discussion) (N/A with data server)	
53	DNC2 function	(Only system machine)	
54	External data input	(Need technical discussion)	
55	Outer I/O device control	(Need technical discussion)	
56	Skip function	(High speed)	
57	Tool life management / Spare tool call		
58	Display of machining time per program	10 pcs. (On the screen)	
59	Display of machining time per program	50 pcs. (On the screen)	
60	Cutting monitor	(Incl. tool life management / spare tool call)	

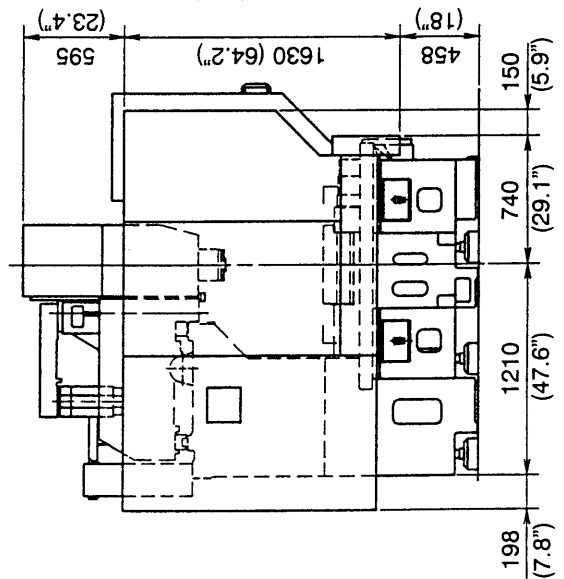
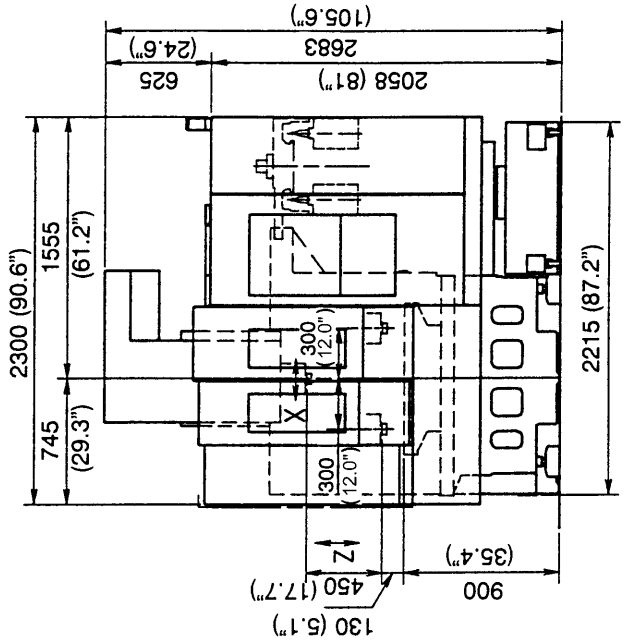
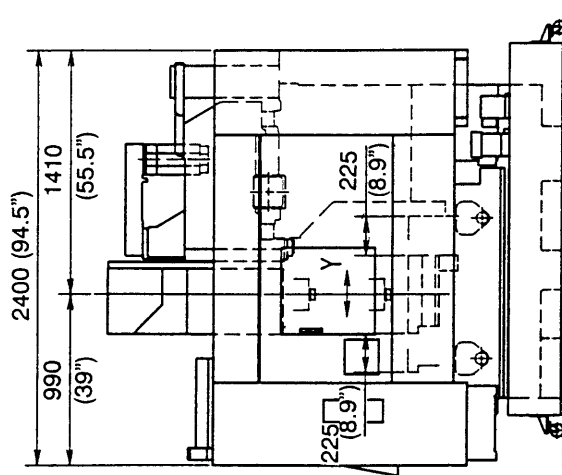
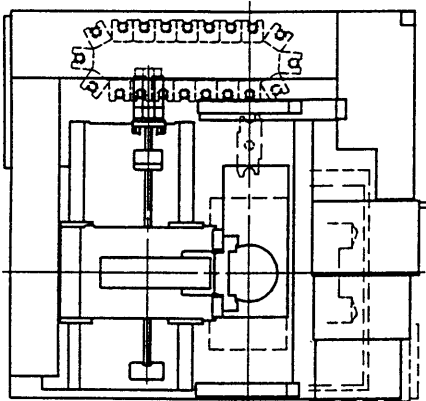
Check list for NC control		SECOS Σ -16M/18M	
(Export only)		VS40	Hitachi Seiki Co., LTD.
Option specifications		Σ 16M	Σ 18M
61	Stored stroke limit 2		
62	Rotary axis control		
63	Add. 1 axis	(Incl. simultaneous control)	
64	Add. 2 axis	(N/A more than 6 axes simultaneous control)	(N/A more than 4 axes simultaneous control)

*1 Interface only
 Not include cable.

2-5 Main Dimensions Diagram

Main dimensions diagram (VS40)

Dimension : metric (mm)
inch (")

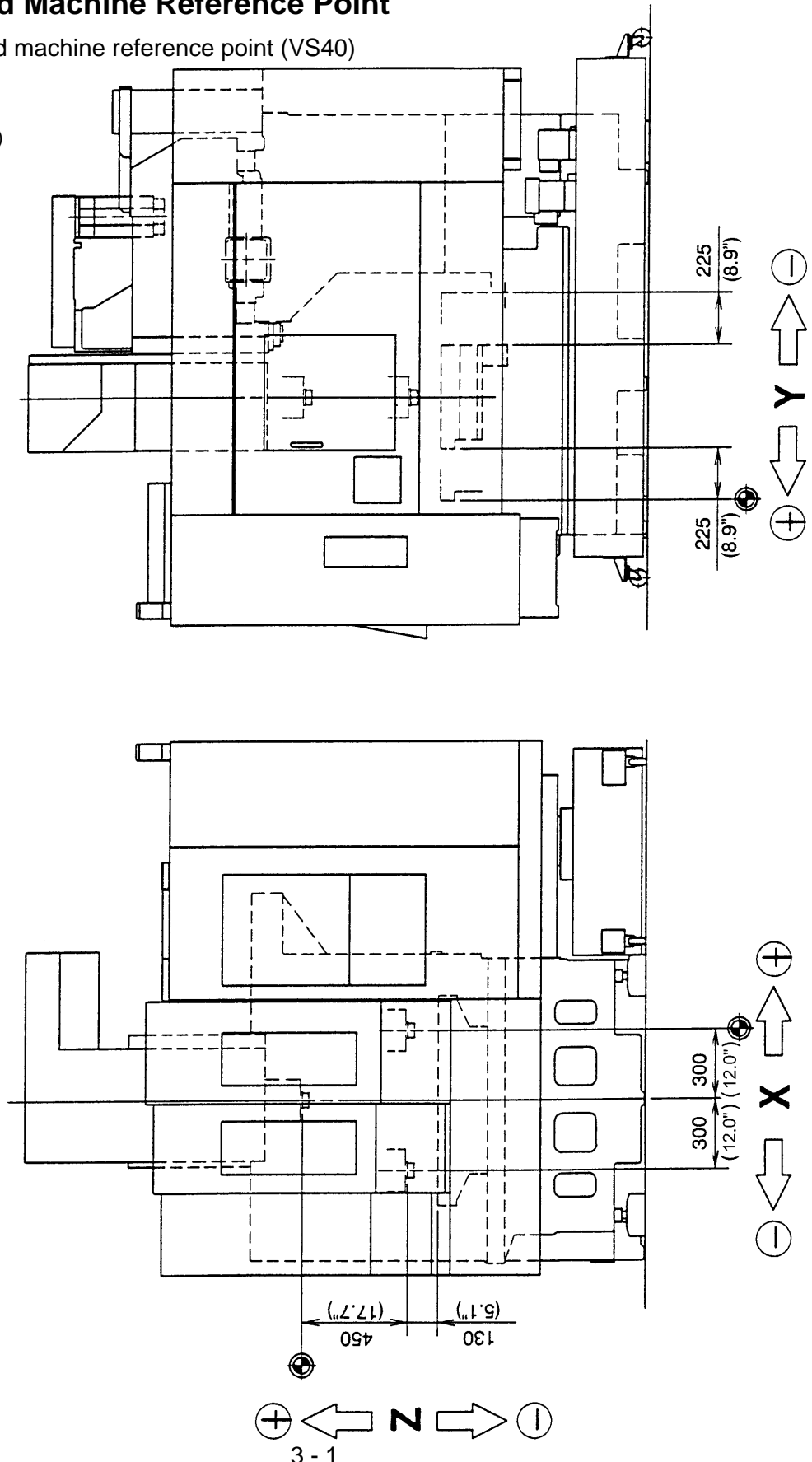


3. SIZE NECESSARY FOR OPERATION

3-1 Strokes and Machine Reference Point

Strokes and machine reference point (VS40)

Dimension : metric (mm)
inch (")



3-2 Table Dimensions and Working Area Diagram

Table dimensions and working area diagram (VS40) (20/30-tool ATC)

Dimension : metric (mm)
inch (")

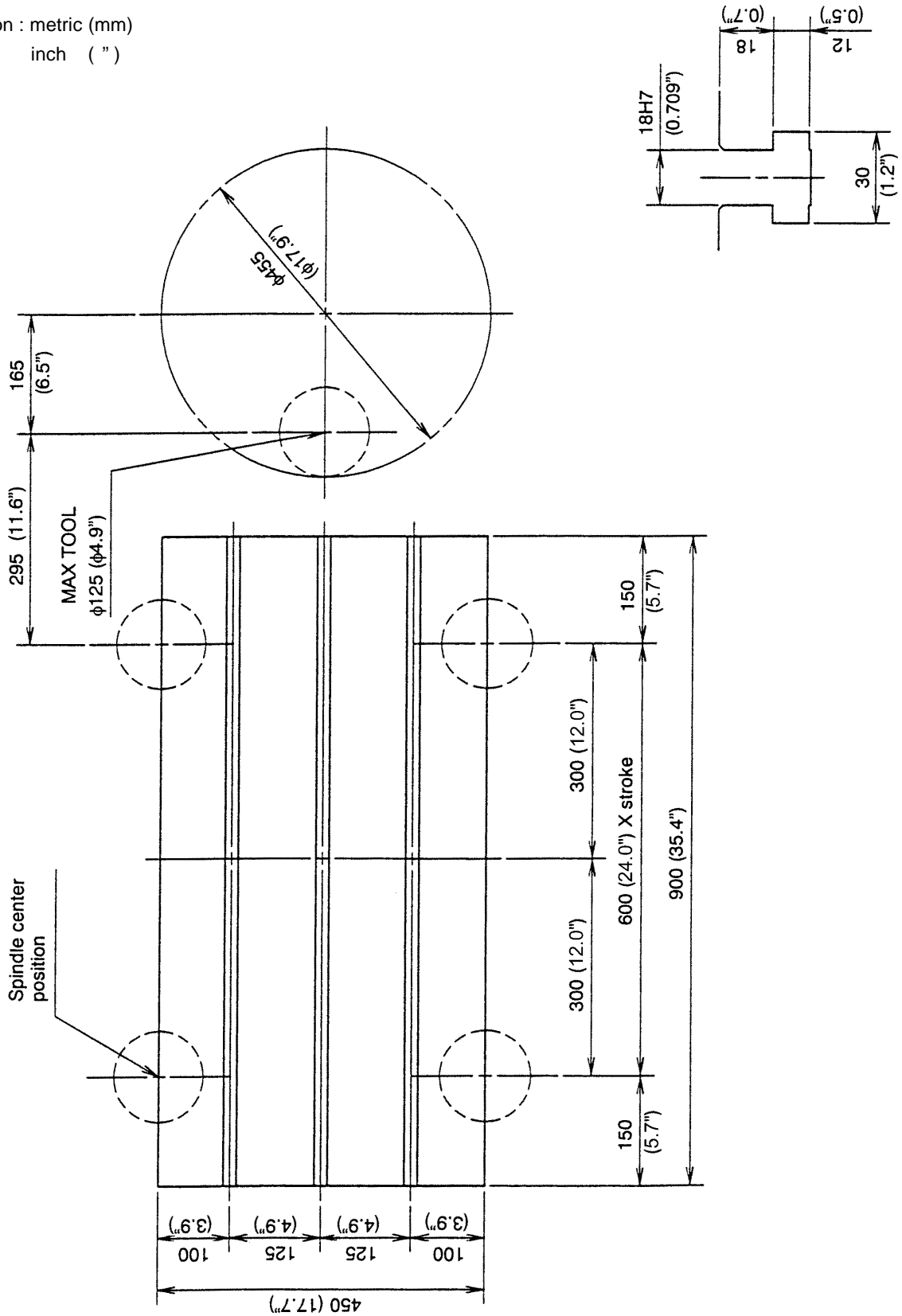
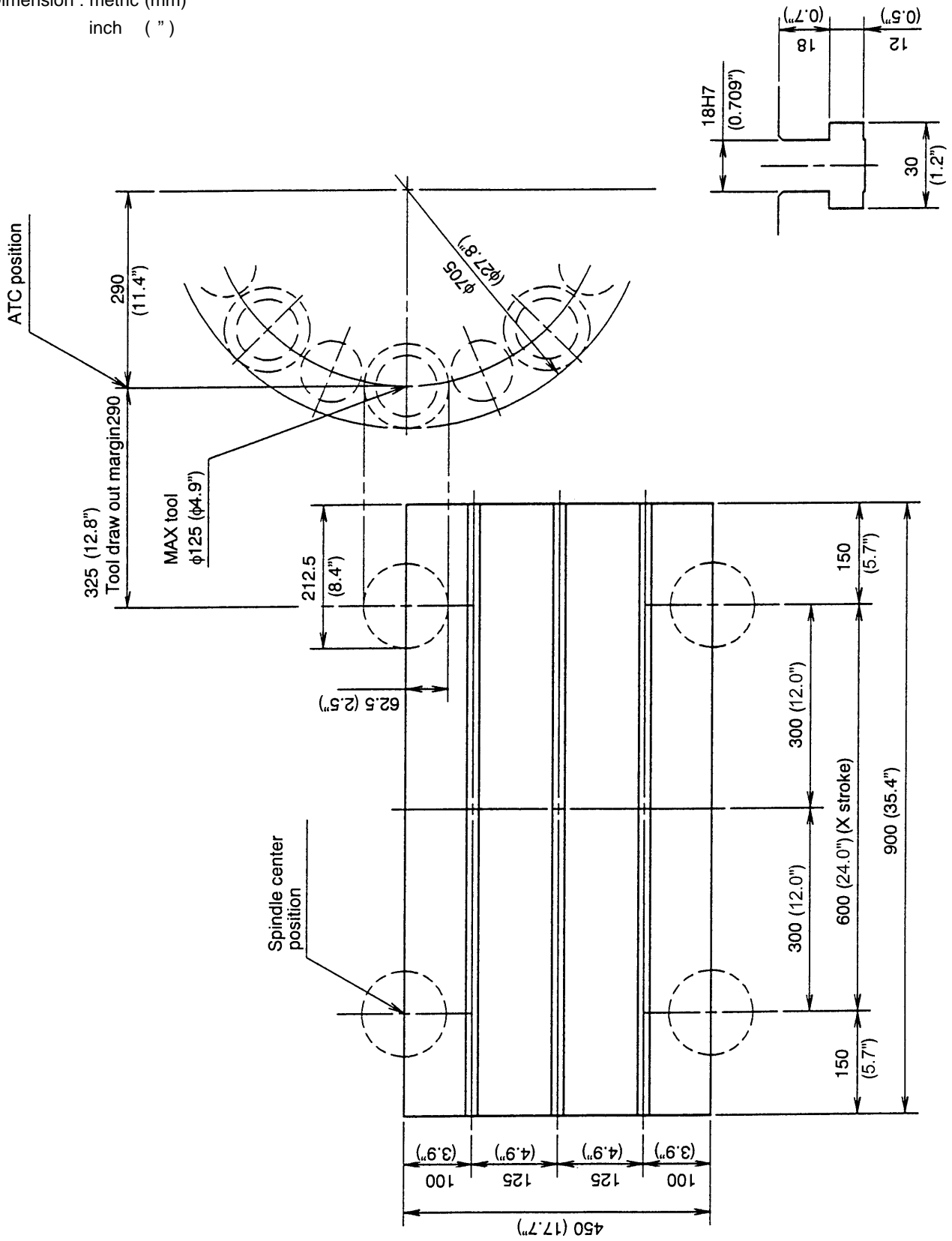


Table Dimensions and Working Area Diagram (16 tool ATC)

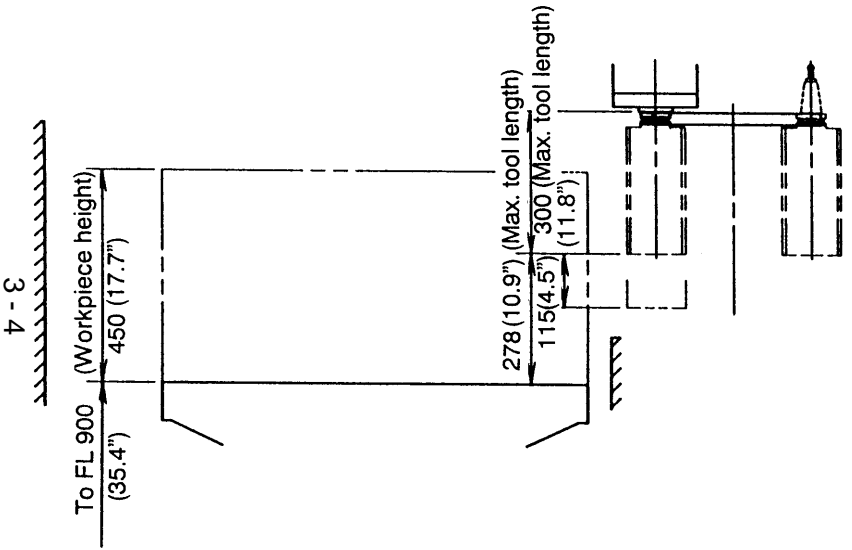
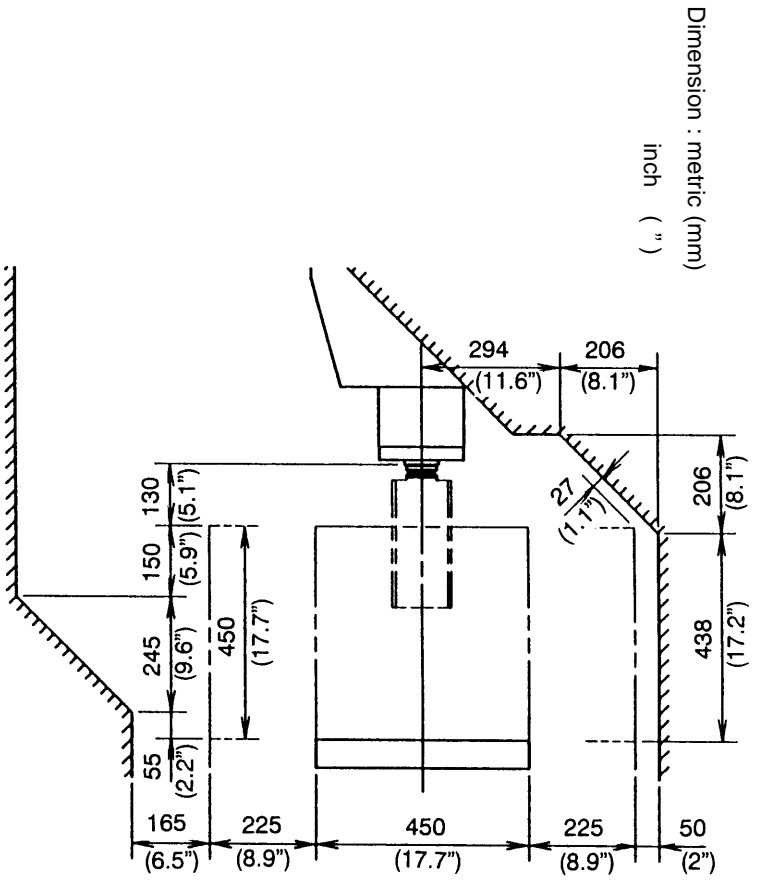
Table dimensions and working area diagram (VS40)

Dimension : metric (mm)
inch (")



3-3 Machining Area and ATC Interference Range

Machining area and ATC interference range (20/30 tool ATC) (VS40)

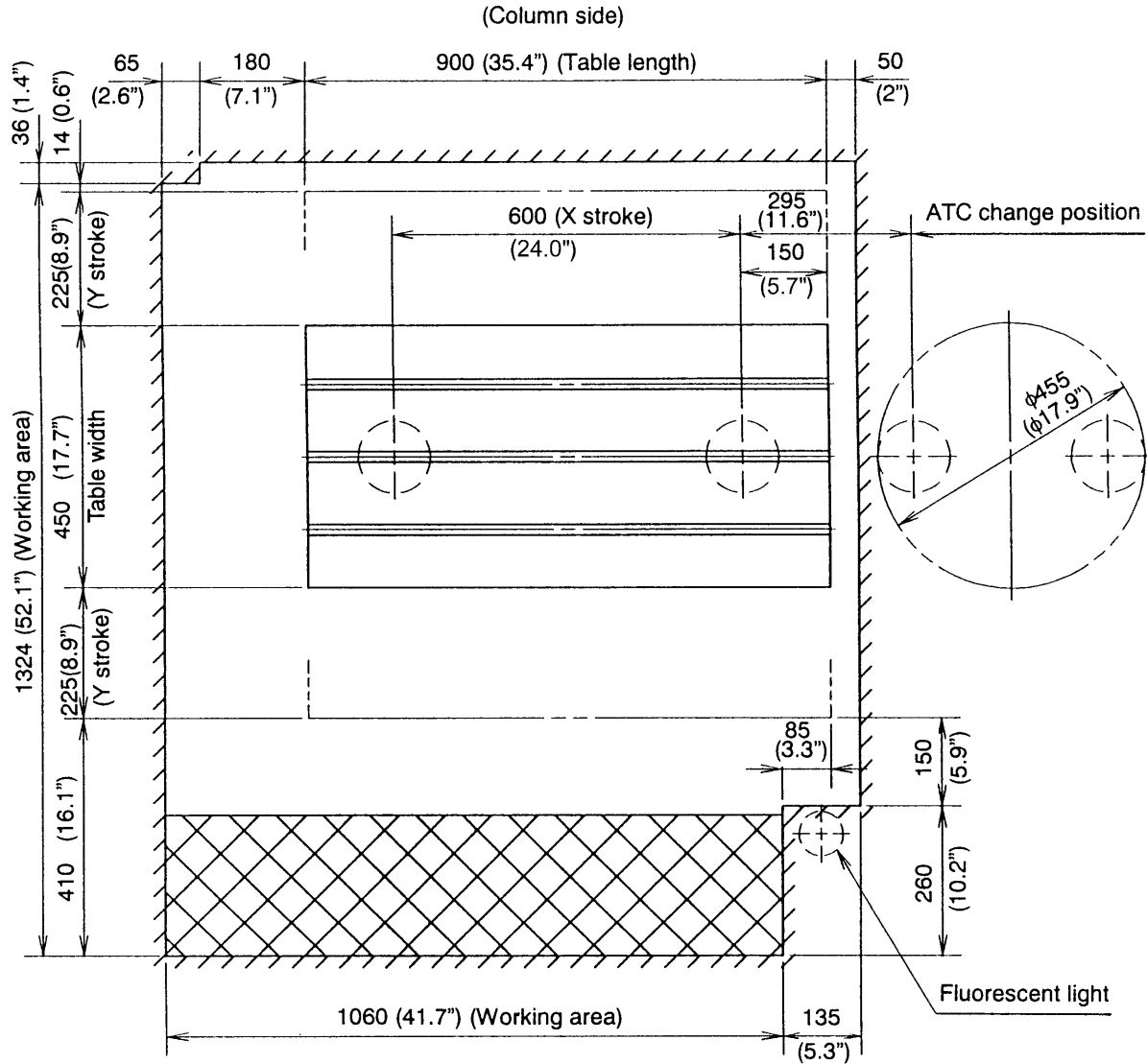


Note) There occurs no interference with workpieces at the tool change position under ATC.
But, during approach from working point from change position, depending shapes of tools and workpieces, interference may be inevitable.


Work Interference Area Diagram (20/30 tool ATC)

Dimension : metric (mm)
inch (")

Plain



NOTE :  Interference area

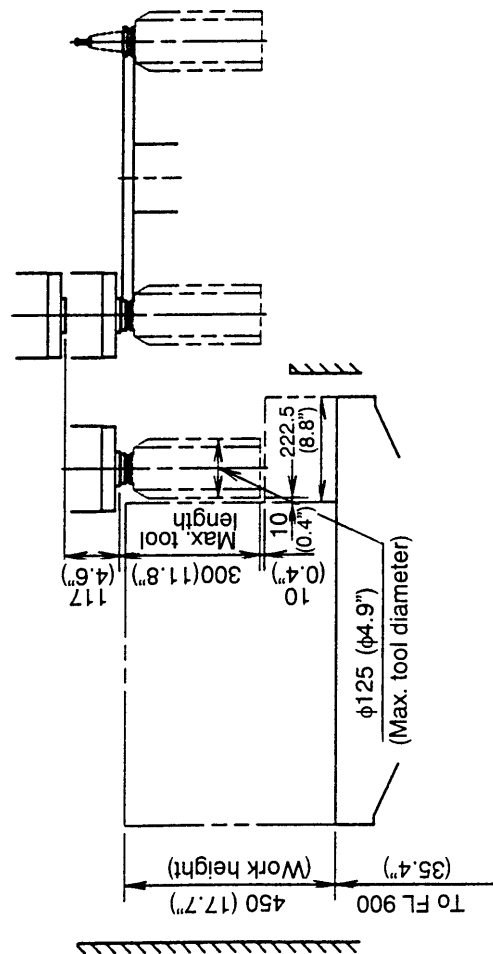
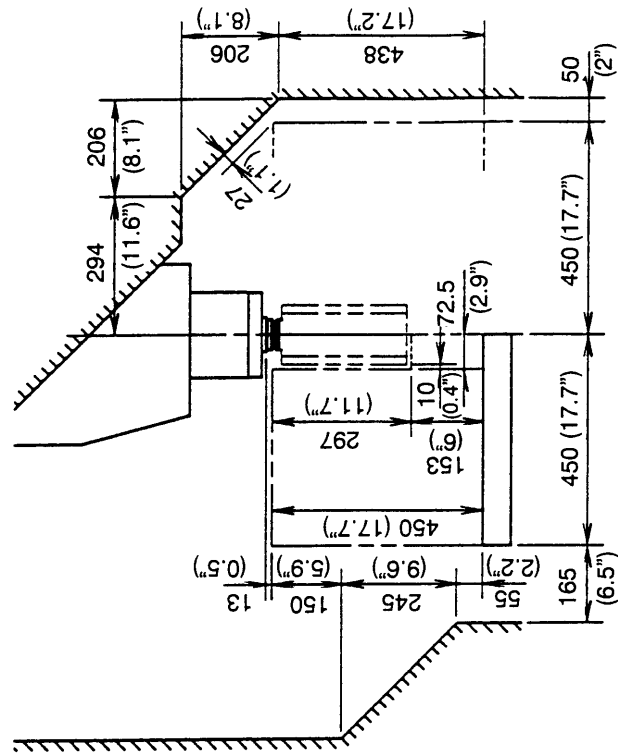
 Range where interference may occur according to height of a workpiece.

(Also refer to the front and the side interference diagrams of the previous page.)

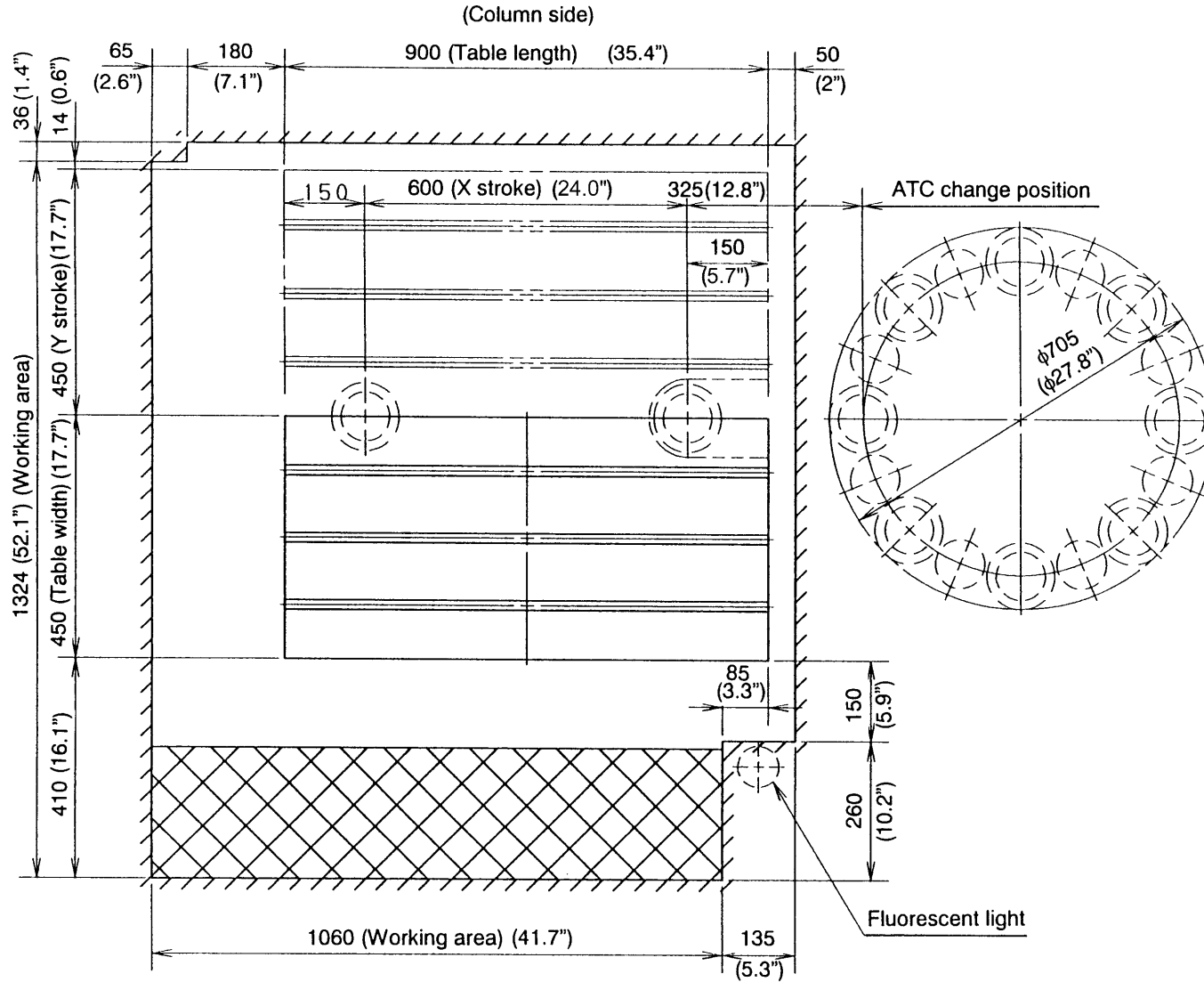
Machining Area and ATC Interference Range (16 tool ATC)



Dimension : metric (mm)

inch (")



Plain

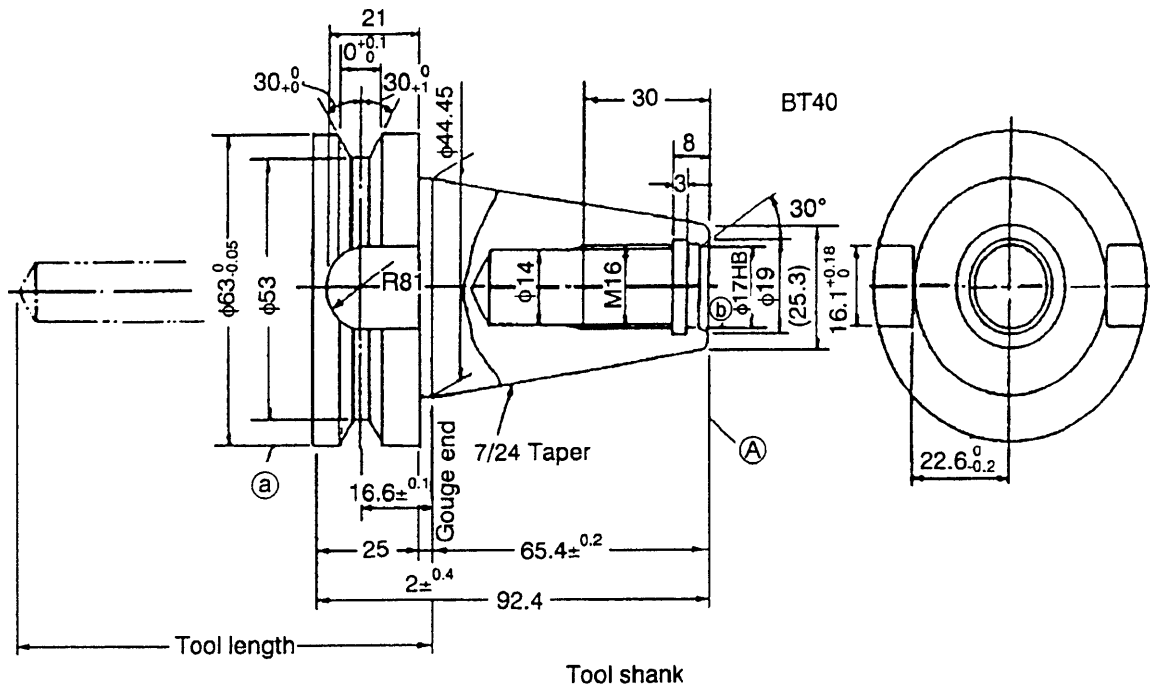


- NOTE :**
-  Interference area
 -  Range where interference may occur according to height of a workpiece.
(Also refer to the front and the side interference diagrams of the previous page.)

Dimension : metric (mm)
Inch (")

3-4 Tool Shank

Tool Shank (BT-40) and Pull-stud Bolt

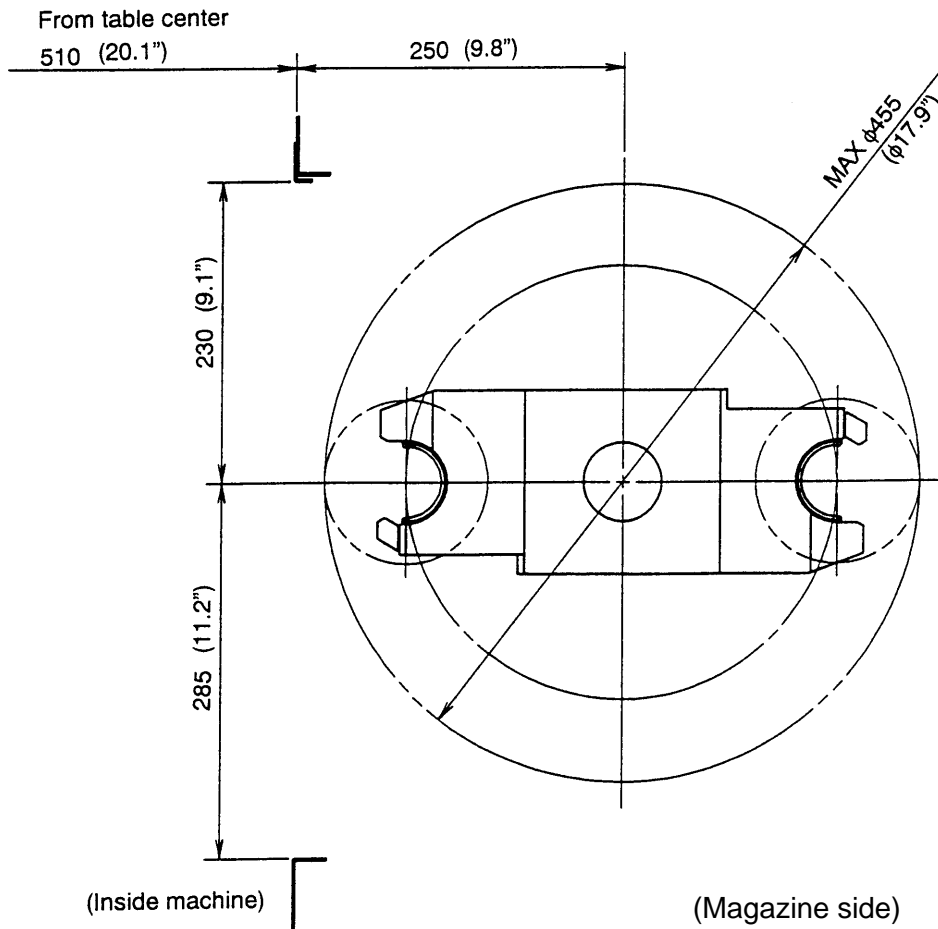
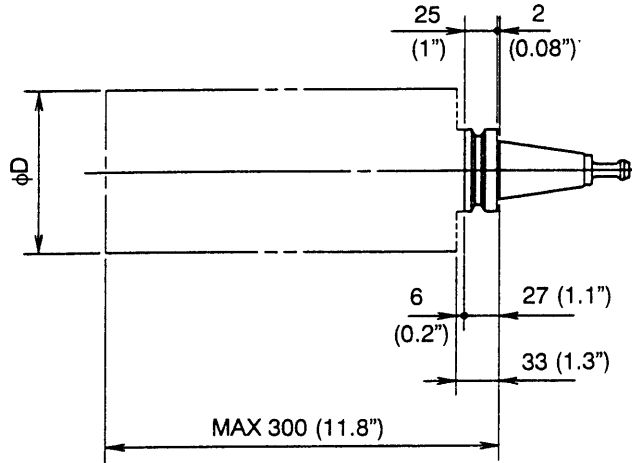


1. The concentricity of (a) and (b) parts with the taper shank of a tool shall be 0.025mm
 2. The squareness between the taper shank and face (A) shall be 0.015/100.
 3. The deviation with a 16.1mm wide groove shall be 0.06mm in reference to the groove center.
 4. The tolerance of taper shall be +0.000063 (4T of JIS B0612-1965).
- 0
5. The applicable threads shall comply with JIS B0205-1968, and their accuracy shall meet the 2nd class requirements of JIS B0209-1968.
 6. The squareness between the center line of $\phi 17h7$ and face (B) and the rectangular degree of the face (C) with the center line shall be 0.01mm, respectively.

3-5 ATC Tool Limit (20 tool ATC)

- Max. tool diameter D=φ110mm (Tools are stored in the adjacent tool pots)
- D=φ180mm (No tools are stored in the adjacent tool pots)
- Max. tool length 300mm
- Max. tool weight 8kg

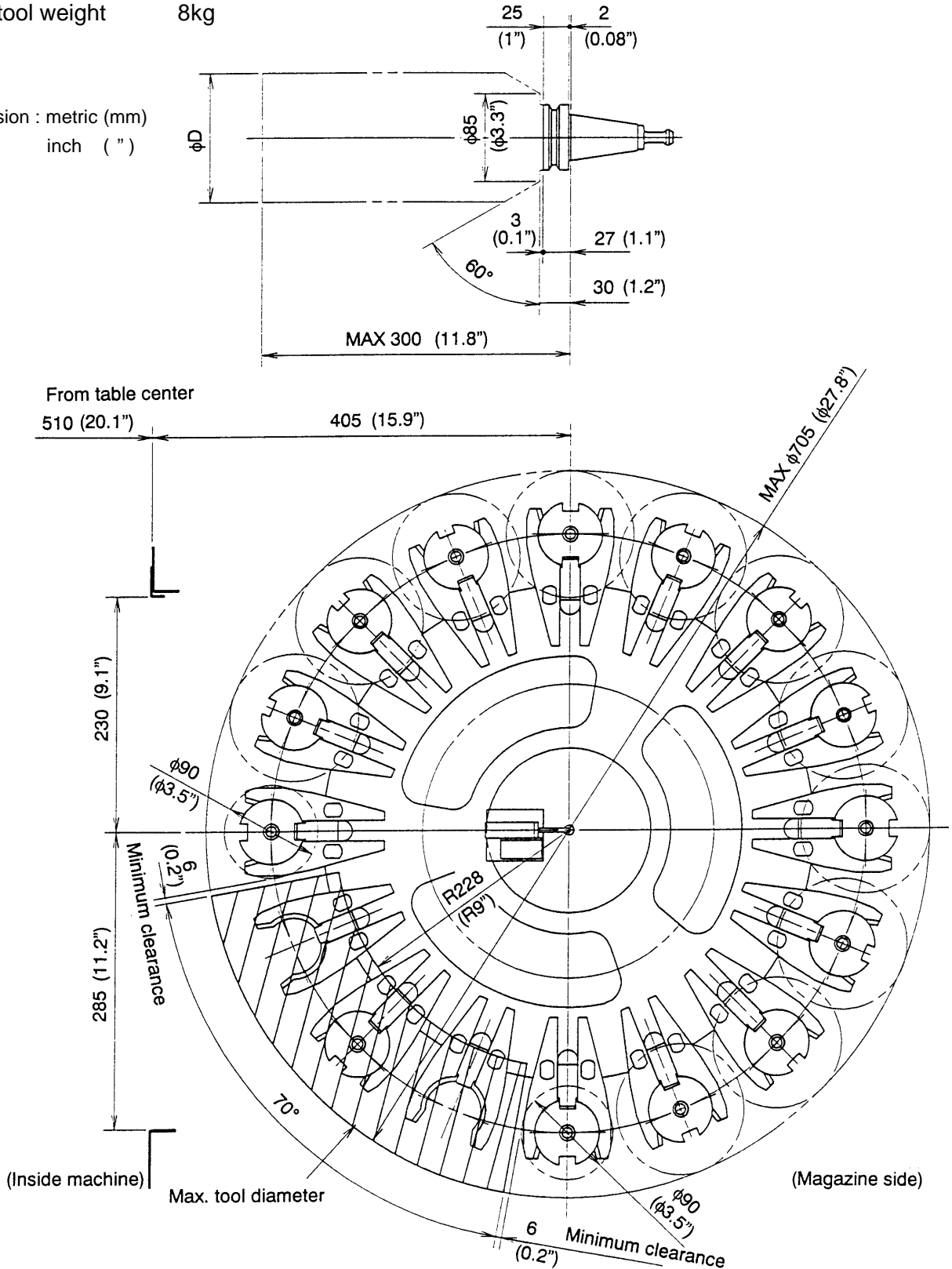
Dimension : metric (mm)
inch (")



ATC Tool Limit (16 tool ATC)

- Max. tool diameter D=φ90mm (Tools are stored in the adjacent tool pots)
 D=φ125mm (No tools are stored in the adjacent tool pots)
- Max. tool length 300mm
- Max. tool weight 8kg

Dimension : metric (mm)
 inch (")



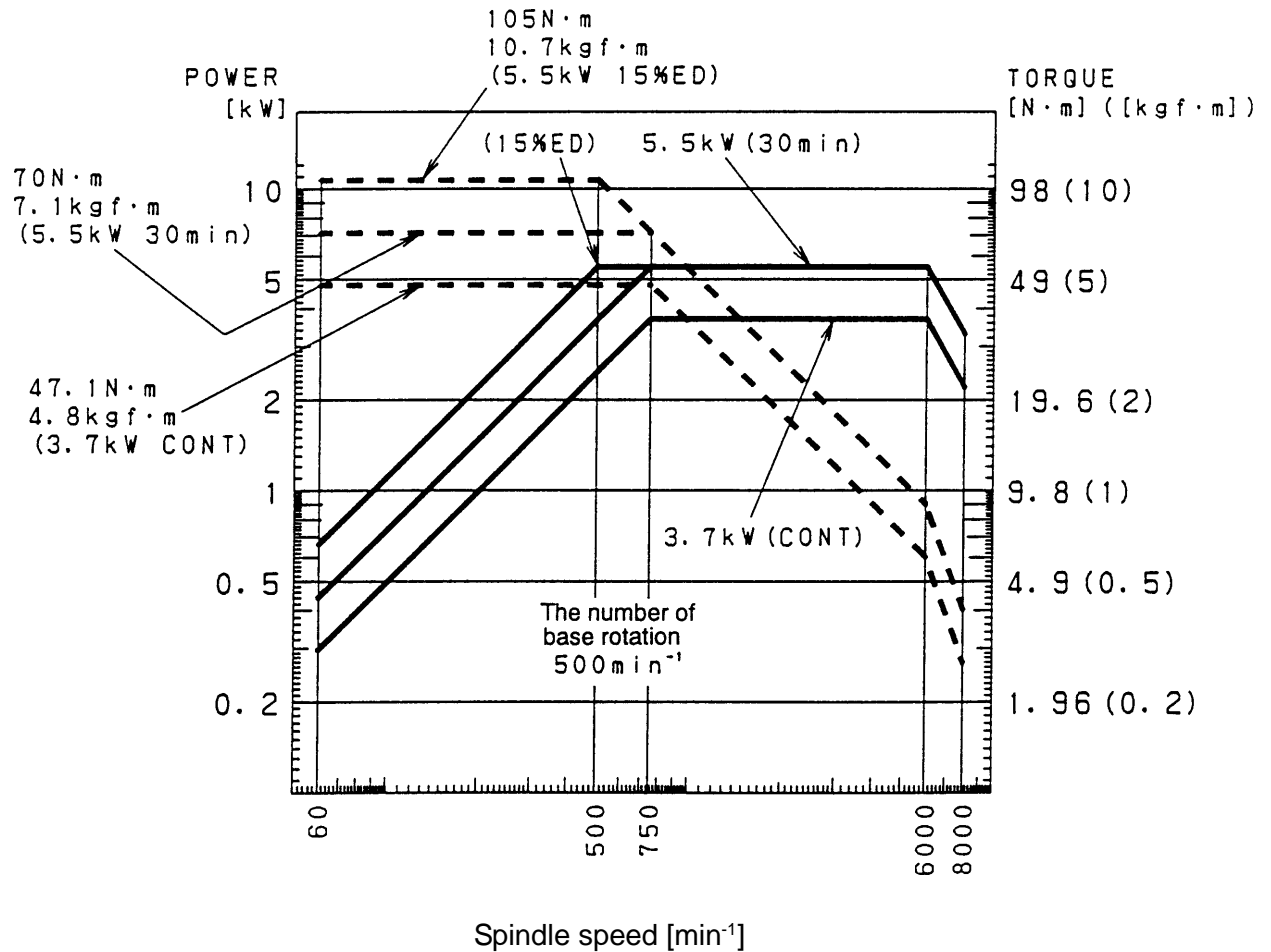
3-6 Spindle Torque/Power Diagram

3-6-1 #40 - 8000 Economy Spec.

Motor : FANUC α P8/8000

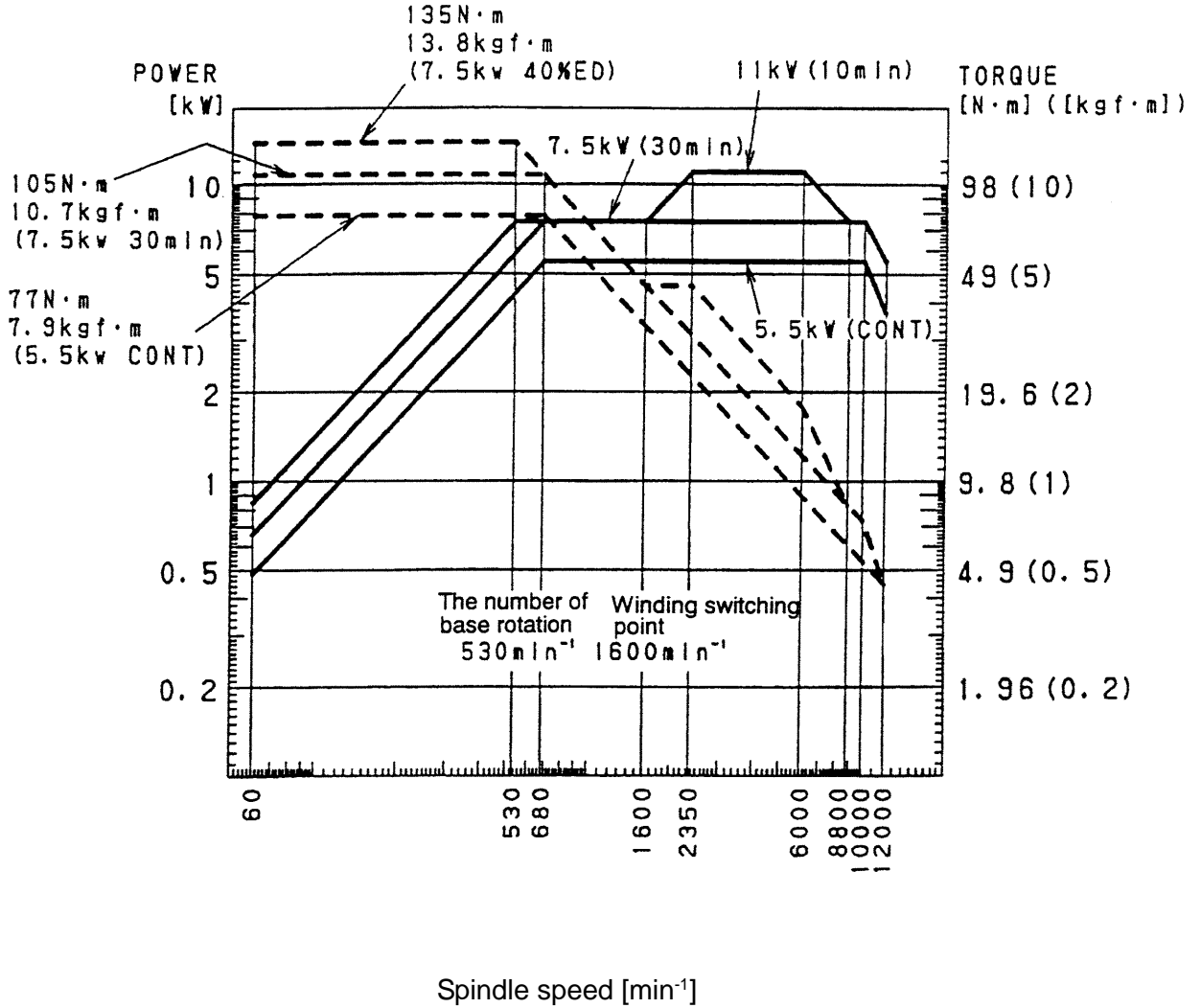
Amplifier : SPM-11

The number of maximum rotation : 8,000min⁻¹



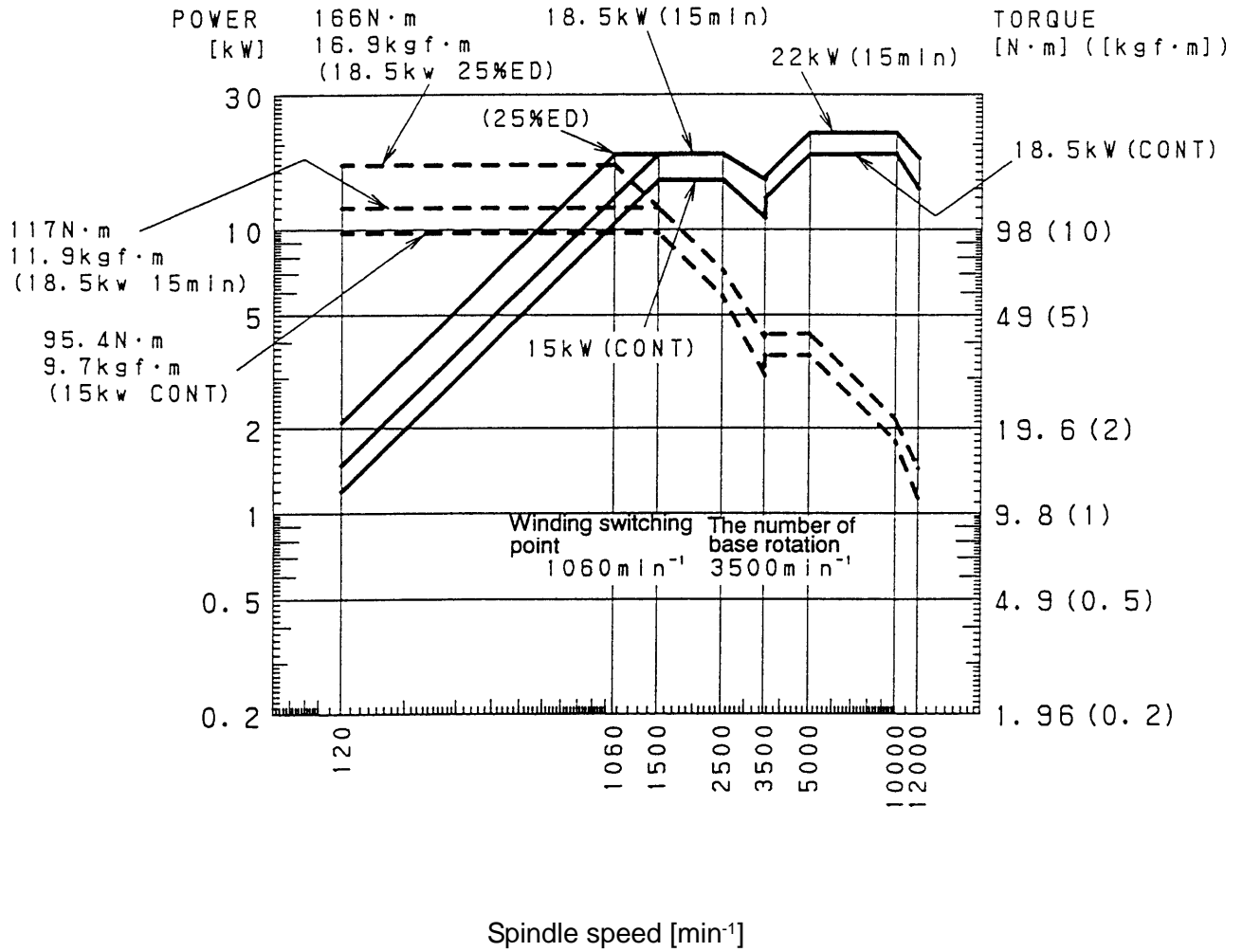
3-6-2 #40 - 12000 Standard Spec.

Motor : FANUC α B112L-5.5
 Amplifier : SPM-15
 The number of maximum rotation : 12,000min⁻¹



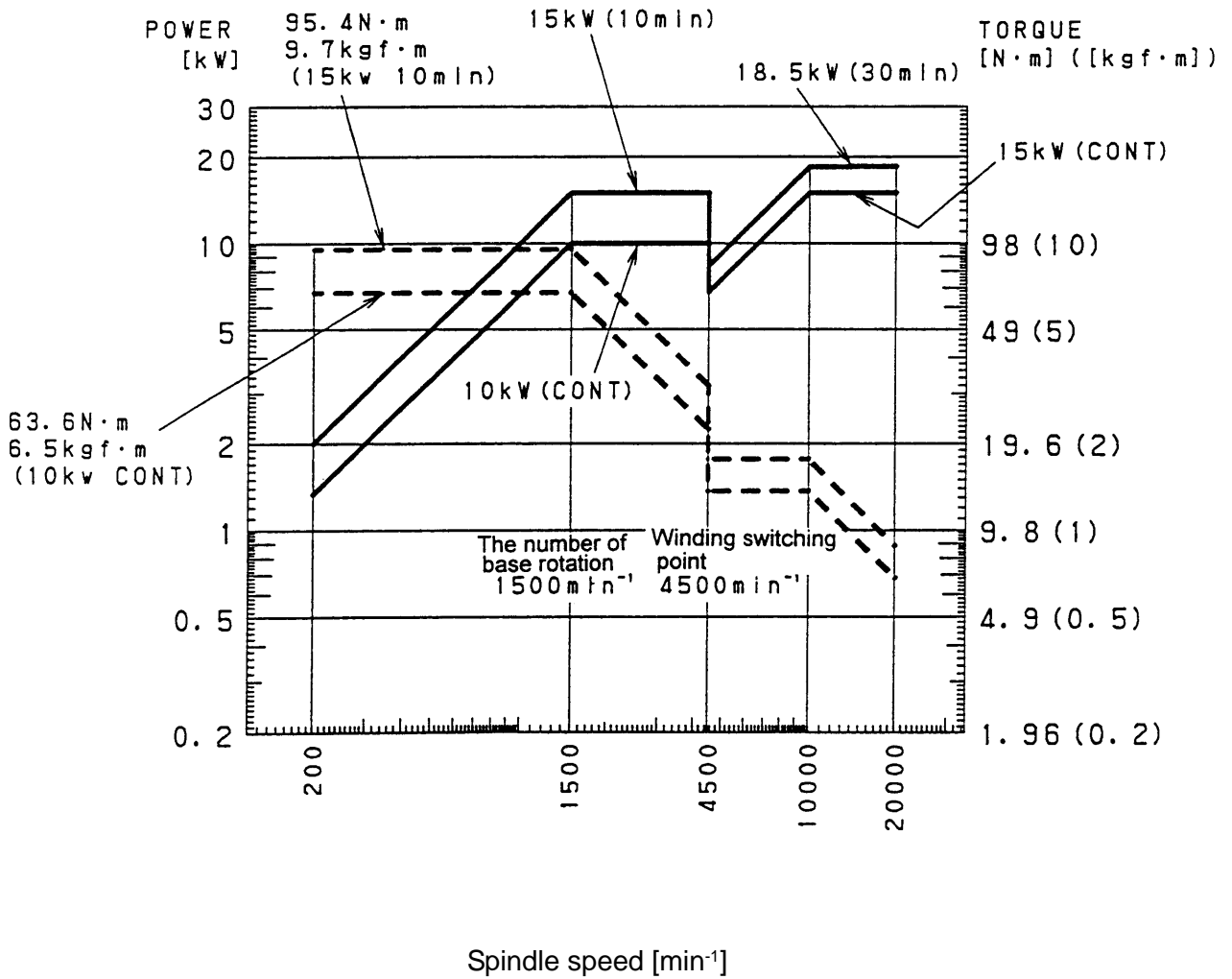
3-6-3 #40 - 12000 High Power Spec.

Motor : FANUC α B112L-18.5
 Amplifier : SPM-30
 The number of maximum rotation : 12,000min⁻¹



3-6-4 #40 - 20000 Spec.

Motor : FANUC α B112M-15/20000
 Amplifier : SPM-30
 The number of maximum rotation : 20,000min⁻¹



VERTICAL MACHINING CENTER
VS40
INSTRUCTION MANUAL
SPECIFICATION
SEIKI-SEICOS Σ 16M/18M
Version 1.01

03-1999 First Edition
03-2000 Revision