VERTICAL MACHINING CENTER

VS50/60

INSTRUCTION MANUAL

SPECIFICATIONS

SEIKI-SEICOS Σ16M/18M

Version 1.01

SEIKI Hitachi Seiki Co.,Ltd.

BS-2782-1-0221-E-1-01

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.

CONTENTS

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. insides 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.

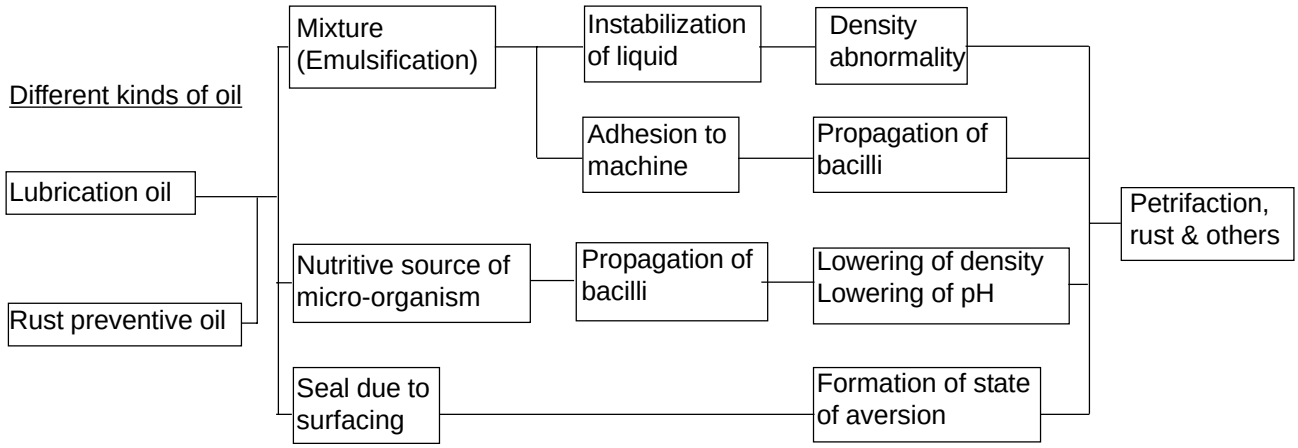
4. Remove the covers every half year and clean each slideway, X, Y, Z axes ball-screws, each limit Switch and feed motors etc.
5. As soluble cutting oil is considered for rust prevention, it may be no problem when the workpiece is wet. However, when dry, it is apt to rust.

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

6. Since soluble oil is alkalescent 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 cabtire 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 cabtire 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 additions, 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 went by equal to or more than two seconds after power turned off. If the power is turned on during discharge from control devise 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. Liner 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

   $1m^2$ (square meter) = 10.764 square feet = 1.196 square yards

   $1cm^2$ (square centimeter) = 0.155 square inch

   $1mm^2$ (square millimeter) = 0.00155 square inch

3. Cubic measure

   $1m^3$ (cubic meter) = 35.315 cubic feet = 1.308 cubic yards

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

   1• (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

   $1cm^3$ (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 kgf/cm^2 (kilogram force per square centimeter) = 14.223 pounds per square inch

   = 0.098 Mpa (Mega Pascal)

   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. Four T-grooves and a straight groove 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)

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 Splash Cover

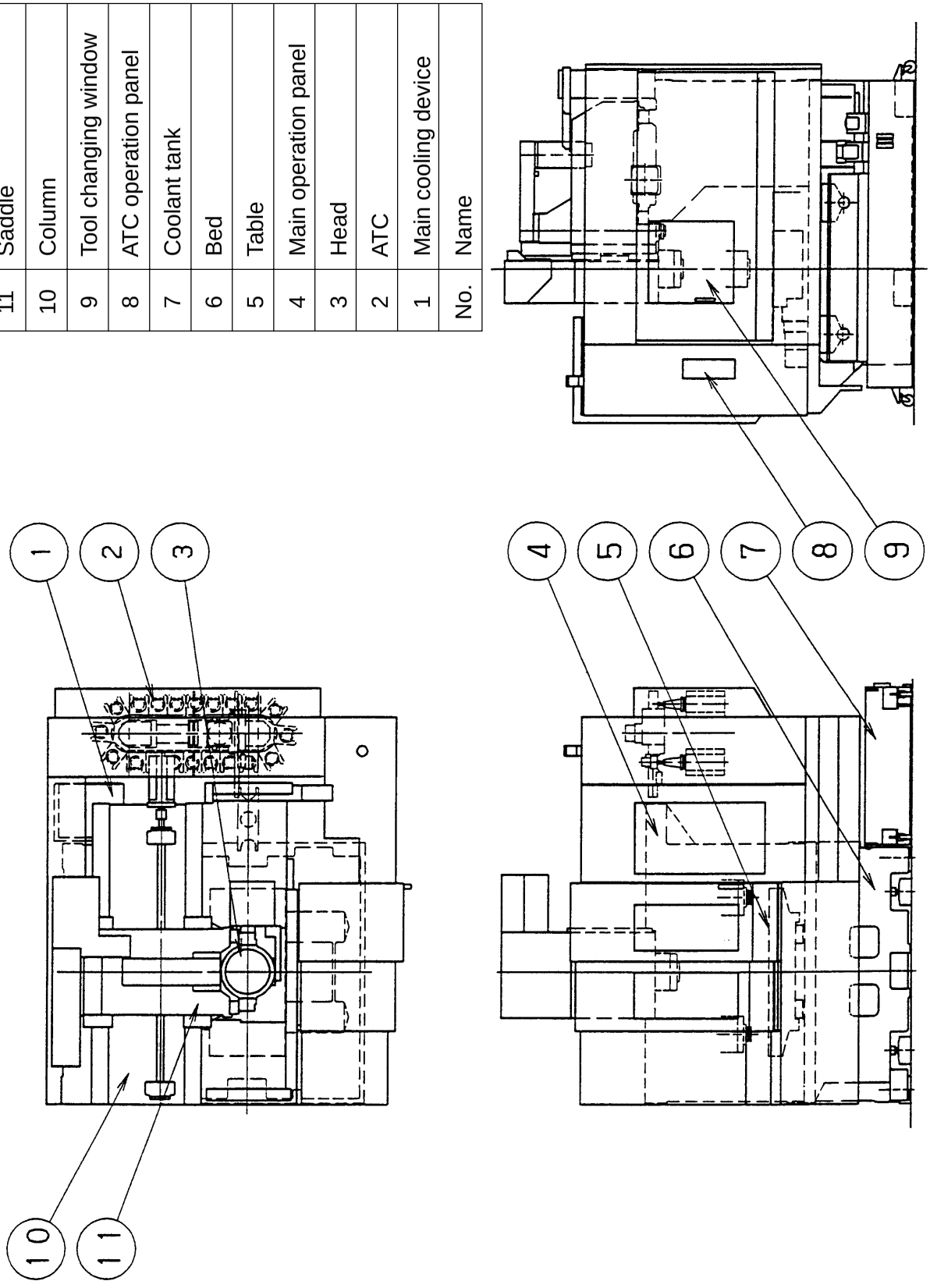
Cover structure which seals the machine until the ceiling is equipped as the standard specification so that coolant mist produced by high speed operation may not leak outside the machine.

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

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



2-3 Specifications of Machine

2-3-1 VS50 Machine Specifications

*Optional specifications

	Specifications		Unit	VS50-50	VS50-40
A	Stroke				
	1) X-axis stroke (Spindle head right & left)		mm	1000 (40”)	
	2) Y-axis stroke (Table crosswise)		mm	510 (20”)	
	3) Z-axis stroke (Spindle head up & down)		mm	450 (17.5”)	
	4) Distance from the table surface to the spindle nose		mm	150 ~ 600	
	5) Distance from the column front to the spindle center line		mm	640	
	Table				
B	1) Table working surface		Mm	1120 × 510	
	2) Max. table loading capacity		kg	750	
	3) Shape of table surface			18mm T-slot 4 lines	
C	Spindle				
	1) Spindle speed	Standard spec. /High power spec.	min^{-1}{rpm}	15~ 4500	35~ 12000
		*High speed spec.	min^{-1}{rpm}	35~ 10000	35~ 20000
	2) Spindle speed change			Stepless	
	3) Spindle hole taper			7/24 Taper No.50	7/24 Taper No.40
	4) Spindle bearing ID	Standard spec. /High power spec.	mm	ϕ100	ϕ75
		*High speed spec.	mm	ϕ110	ϕ65
	5) Max. spindle torque	Standard spec.	Nm {kgfm}	298 {30.4}	135 {13.8}
		*High speed spec.	Nm {kgfm}	233 {23.8}	95.4 {9.7}
		*High power spec.	Nm {kgfm}	——	166{16.9}
D	Feed rate				
	1) Rapid traverse rate	(X,Y)	mm/min	40000	
		(Z)	mm/min	24000	
	2) Cutting feed rate		mm/min	1 ~ 15000	
	3) Jog feed rate		mm/min	0 ~ 5000 (21 steps)	

	Specifications		Unit	VS50-50	VS50-40
E	Automatic tool changer				
	1) Tool shank			MAS 403-BT50	MAS BT40
		*		DIN 50/CAT50	DIN 40/CAT50
	2) Pull-stud			MAS P50-0°	MAS P40T-1 (45°)
		*		MAS P50-45°	MAS P40T-1 (30°)
	3) Tool storage capacity			20	
		*		30	
	4) Max. tool diameter ( ) : When no adjacent tool exists.		mm	ϕ110 (ϕ180)	
	5) Max. tool length		mm	300	
	6) Max. tool weight		kg	15	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	1000 × 450	
	4) Max. pallet loading capacity		kg	400	
G	Motor				
	1) Spindle driving motor	Standard spec.	AC kW	18.5 (25%ED) 11 (CONT)	11kW (10min) 7.5kW (30min) 5.5kW (CONT)
		*High speed spec.	AC kW	25kW (30min) 22kW (CONT)	18.5kW (30min) 15kW (CONT)
		*High power 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	VS50-50	VS50-40
G	4) Spindle cooling system	(Compressor)	AC W	200-2P	
		(Pump)	AC W	400-2P	
H	Power supply				
	1) Power source (Options not included)	Standard spec.		200/220VAC ±10% 25kVA	18kVA
		High speed spec.		40kVA	31kVA
		High power spec.		——	36kVA
	2) Air source	(MIN)	MPa {kgf/cm^2} • /min	0.5 {5} 100 (Atmospheric pressure)	
I	Tank capacity				
	1) Cutting fluid tank capacity	Standard	•	420	
	2) Spindle cooling system tank capacity		•	8.2	
J	Machine dimension				
	1) Height of the machine		mm	2785	
	2) Floor space	Standard	mm	2900 × 2400	
	3) Machine weight (Including NC unit)	Standard	kg	8200	8100

2-3-2 VS60 Machine Specifications

*Optional specifications

	Specifications		Unit	VS60-50	VS60-40
A	Stroke				
	1) X-axis stroke (Spindle head right & left)		mm	1270 (50”)	
	2) Y-axis stroke (Table crosswise)		mm	610 (24”)	
	3) Z-axis stroke (Spindle head up & down)		mm	450 (17.5”)	
	4) Distance from the table surface to the spindle nose		mm	200 ~ 650	
	5) Distance from the column front to the spindle center line		mm	690	
	Table				
B	1) Table working surface		Mm	1400 × 600	
	2) Max. table loading capacity		kg	1000	
	3) Shape of table surface			18mm T-slot 4 lines	
C	Spindle				
	1) Spindle speed	Standard spec. /High power spec.	min^{-1}{rpm}	15 ~ 4500	35~ 12000
		*High speed spec.	min^{-1}{rpm}	35~ 10000	35~ 20000
	2) Spindle speed change			Stepless	
	3) Spindle hole taper			7/24 Taper No.50	7/24 Taper No.40
	4) Spindle bearing ID	Standard spec. /High power spec.	mm	ϕ100	ϕ75
		*High speed spec.	mm	ϕ110	ϕ65
	5) Max. spindle torque	Standard spec.	Nm {kgfm}	298 {30.4}	135 {13.8}
		*High speed spec.	Nm {kgfm}	233 {23.8}	95.4 {9.7}
		*High power spec.	Nm {kgfm}	——	166{16.9}
D	Feed rate				
	1) Rapid traverse rate	(X,Y)	mm/min	40000	
		(Z)	mm/min	24000	
	2) Cutting feed rate		mm/min	1 ~ 15000	
	3) Jog feed rate		mm/min	0 ~ 5000 (21 steps)	

	Specifications		Unit	VS60-50	VS60-40
E	Automatic tool changer				
	1) Tool shank			MAS 403-BT50	MAS BT40
		*		DIN 50/CAT50	DIN 40/CAT50
	2) Pull-stud			MAS P50-0°	MAS P40T-1 (45°)
		*		MAS P50-45°	MAS P40T-1 (30°)
	3) Tool storage capacity			20	
		*		30	
	4) Max. tool diameter ( ) : When no adjacent tool exists.		mm	ϕ110 (ϕ180)	
	5) Max. tool length		mm	300	
	6) Max. tool weight		kg	15	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	1200 × 560	
	4) Max. pallet loading capacity		kg	750	
G	Motor				
	1) Spindle driving motor	Standard spec.	AC kW	18.5 (25%ED) 11 (CONT)	11kW (10min) 7.5kW (30min) 5.5kW (CONT)
		*High speed spec.	AC kW	25kW (30min) 22kW (CONT)	18.5kW (30min) 15kW (CONT)
		*High power 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	VS60-50	VS60-40
G	4) Spindle cooling system	(Compressor)	AC W	200-2P	
		(Pump)	AC W	400-2P	
H	Power supply				
	1) Power source (Options not included)	Standard spec.		200/220VAC ±10% 25kVA	18kVA
		High speed spec.		40kVA	31kVA
		High power spec.		——	36kVA
	2) Air source	(MIN)	MPa {kgf/cm^2} • /min	0.5 {5} 100 (Atmospheric pressure)	
I	Tank capacity				
	1) Cutting fluid tank capacity	Standard	•	420	
	2) Spindle cooling system tank capacity		•	8.2	
J	Machine dimension				
	1) Height of the machine		mm	2835	
	2) Floor space	Standard	mm	3155 × 2450	
	3) Machine weight (Including NC unit)	Standard	kg	10500	10400

2-3-3 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 speed type
  100min^{-1} ~ 10,000min^{-1}
- ATC 30 tools
- Pull stud shape changing (MAS P50-45°)
- 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 (5Ÿ15kgf/cm^2)
- Sp. through coolant
  Kind: Center/DIN
  Discharge volume: 0.5/1.5/3.5/7.0Mpa (5Ÿ15Ÿ35Ÿ70kgf/cm^2)
- 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 Σ16M/18M for details of specifications.

Check list for NC control	SECOS Σ-16M/18M		1998.3.25
(Export only)	VS50/60		Hitachi Seiki Co., LTD.
	standard specifications	Σ16M	Σ18M
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	

	standard specifications	Σ16M	Σ18M
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	

standard specifications		Σ16M	Σ18M
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	1998.3.25
(Export only)	VS50/60	Hitachi Seiki Co., LTD.

Option specifications		Σ16M	Σ18M
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	1998.3.25
(Export only)	VS50/60	Hitachi Seiki Co., LTD.

	Option specifications	Σ16M	Σ18M
13	Advanced control (High speed machin ing)		●Precedent feed forward. ●Rapid feed bell type ac celeration/deceleration ●Linear acceleration/dec eleration before cuttin g feed interpolation. ●Automatic corner dece leration. ●Block overlap function. ●Feed speed clamp by c ircular 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.	

	Option specifications	Σ16M	Σ18M
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)	

Option specifications		Σ16M	Σ18M
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)

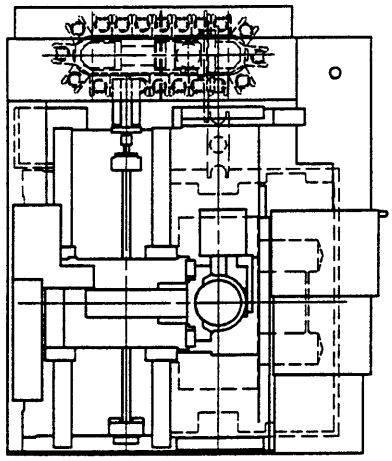
*1 Interface only

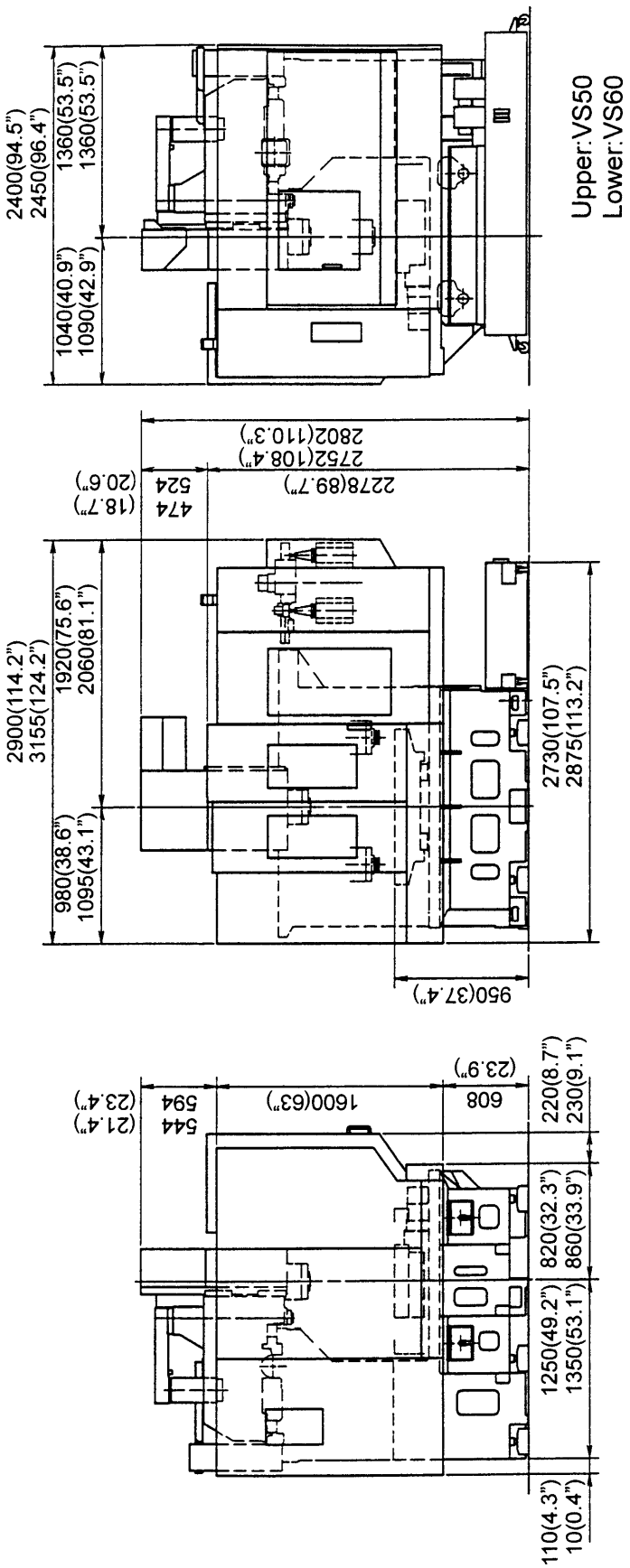
Not include cable.

2-5 Main Dimensions Diagram

Main dimensions diagram (VS50/60)

Dimension : metric (mm)
inch (”)



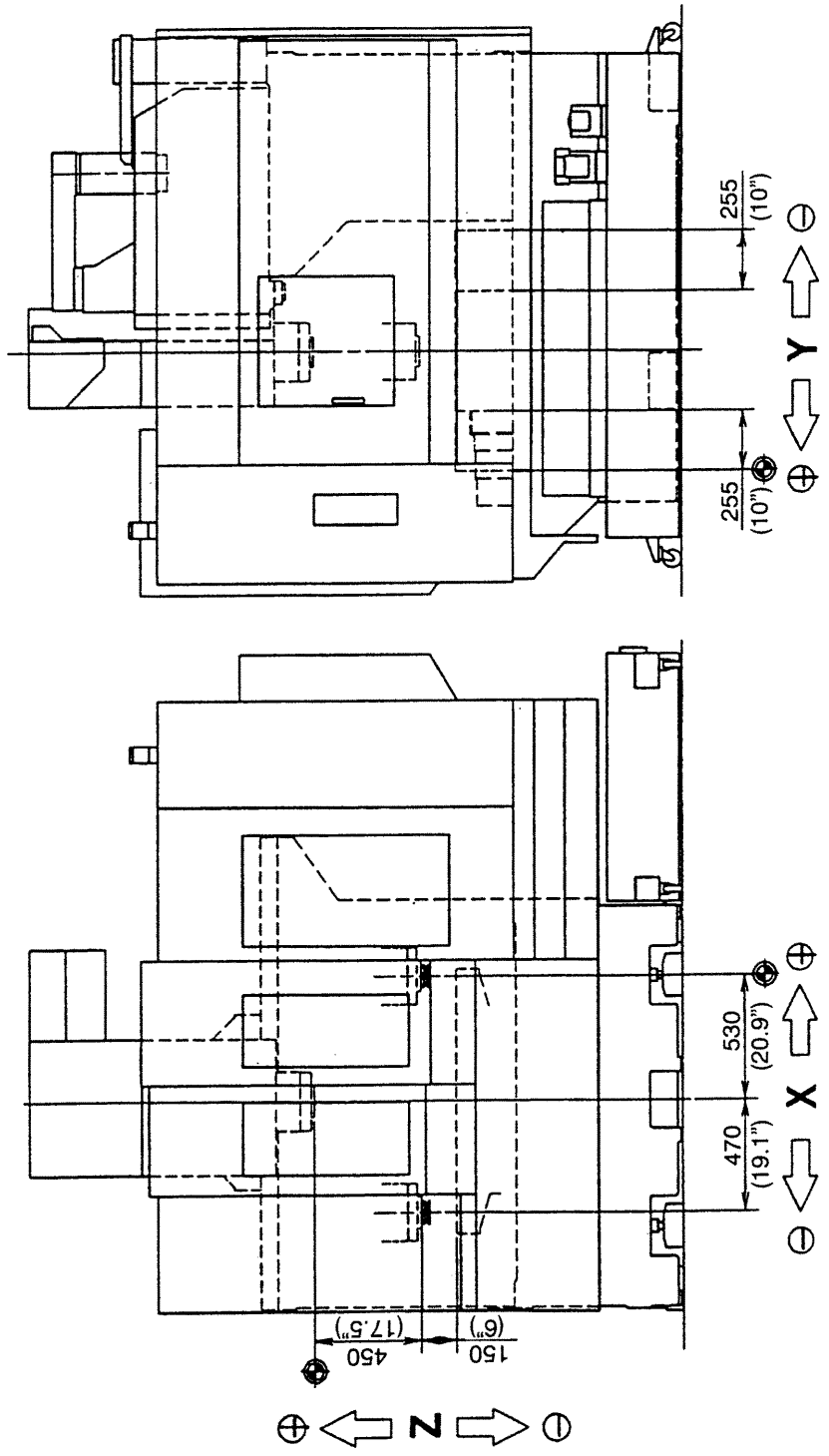


3. SIZE NECESSARY FOR OPERATION

3-1 Strokes and Machine Reference Point

Strokes and machine reference point (VS50)

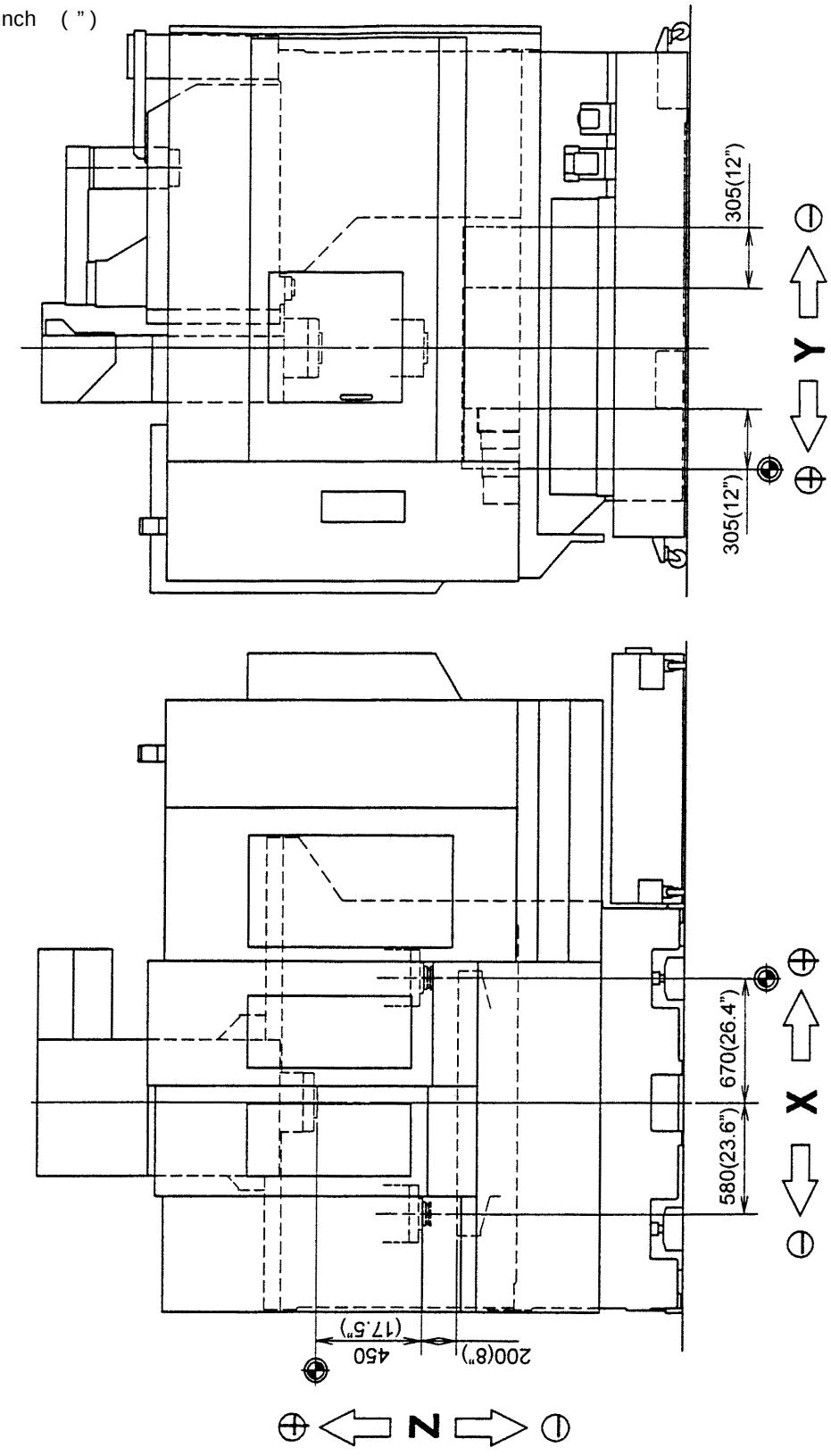
Dimension : metric (mm)
inch (”)



Strokes and Machine Reference Point

Strokes and machine reference point (VS60)

Dimension : metric (mm)
inch (”)



3-2 Table Dimensions and Working Area Diagram

Table dimensions and working area diagram (VS50)

Dimension : metric (mm)
inch (”)

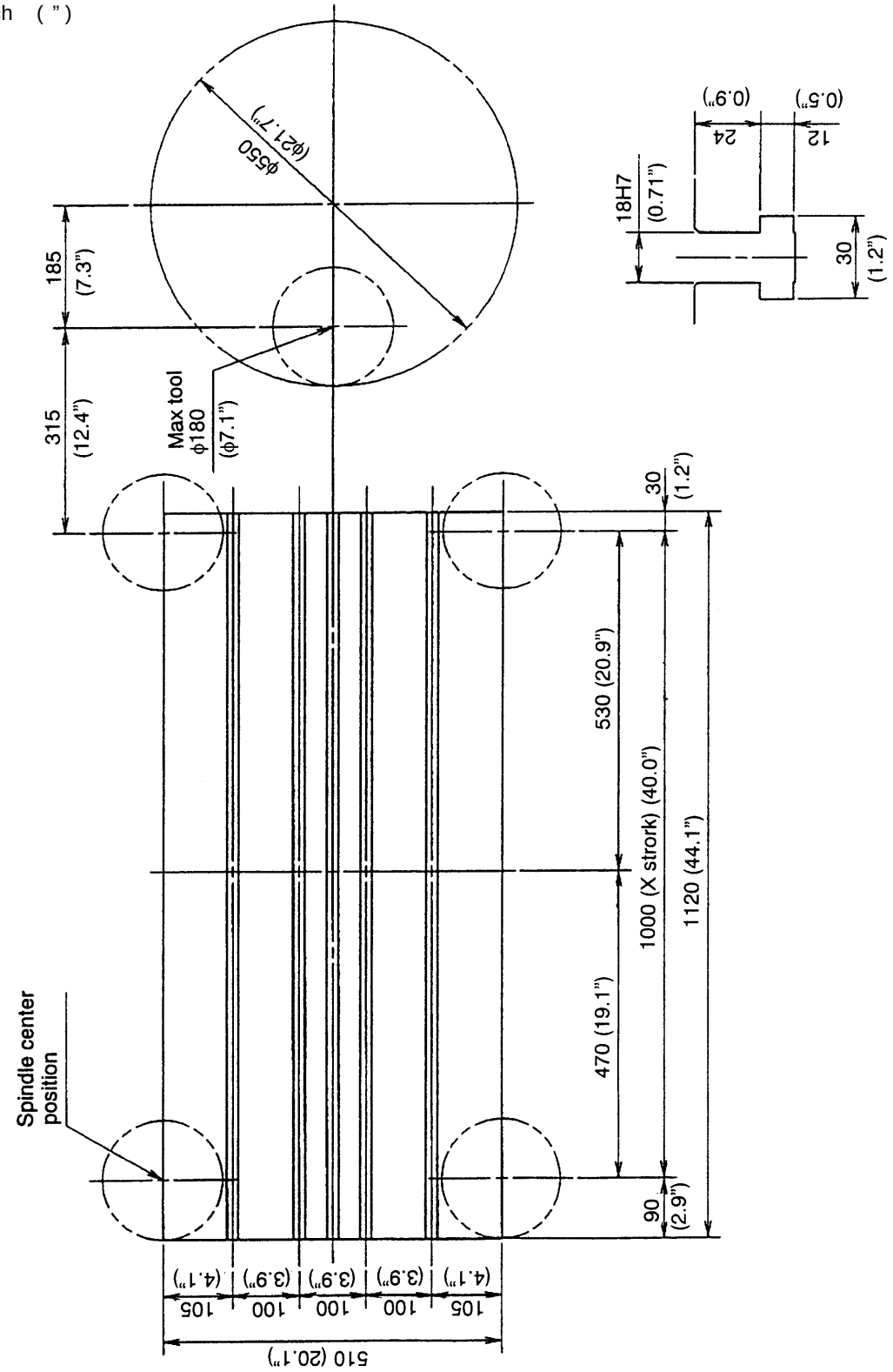
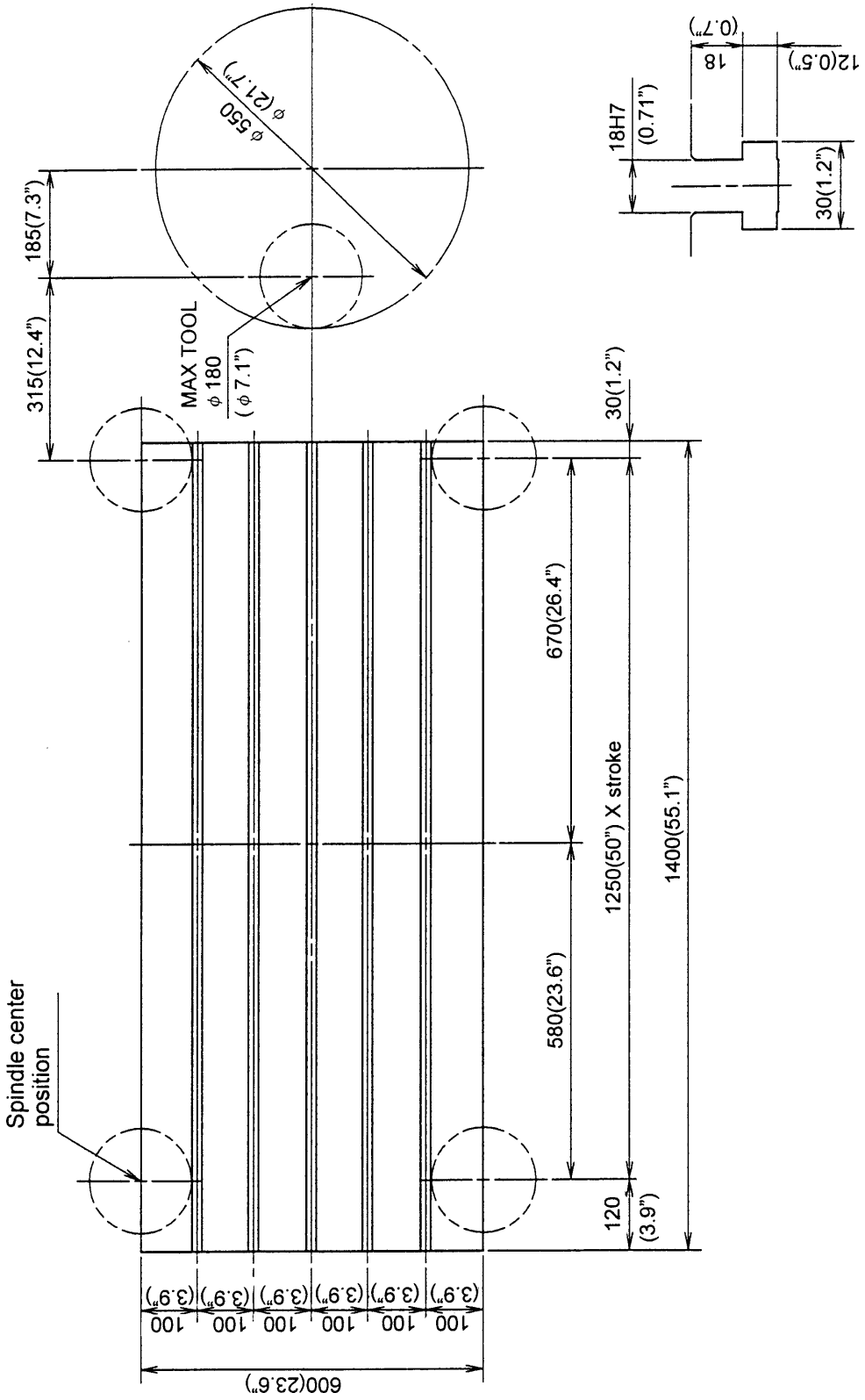


Table Dimensions and Working Area Diagram

Table dimensions and working area diagram (VS60)

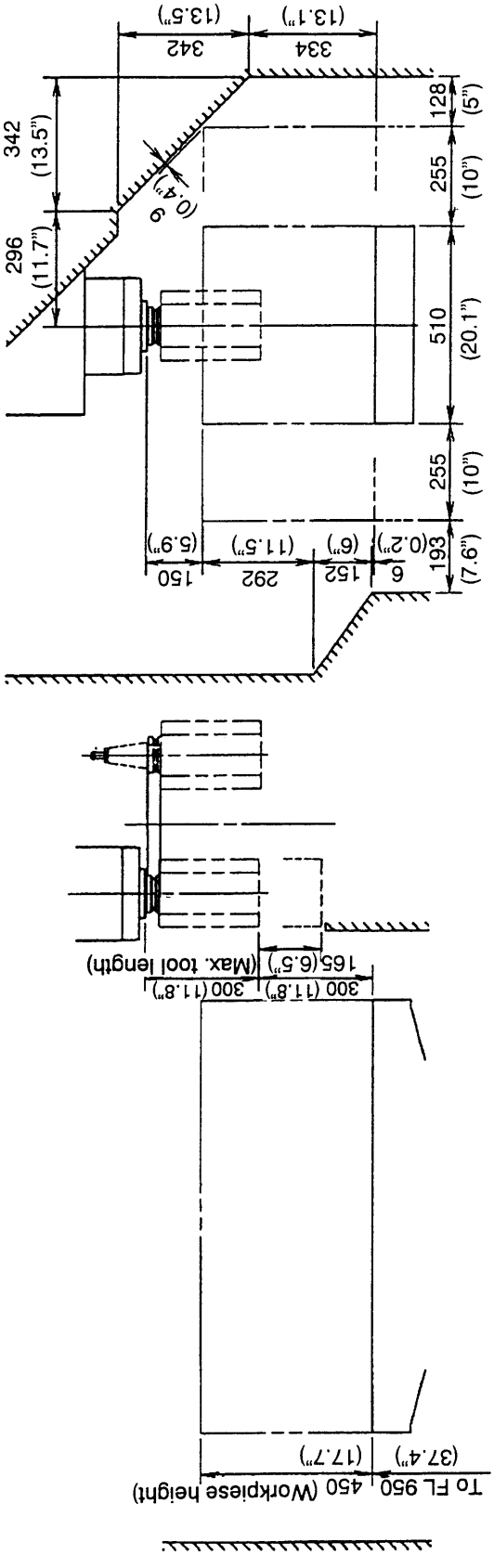
Dimension : metric (mm)
inch (”)



3-3 Machining Area and ATC Interference Range

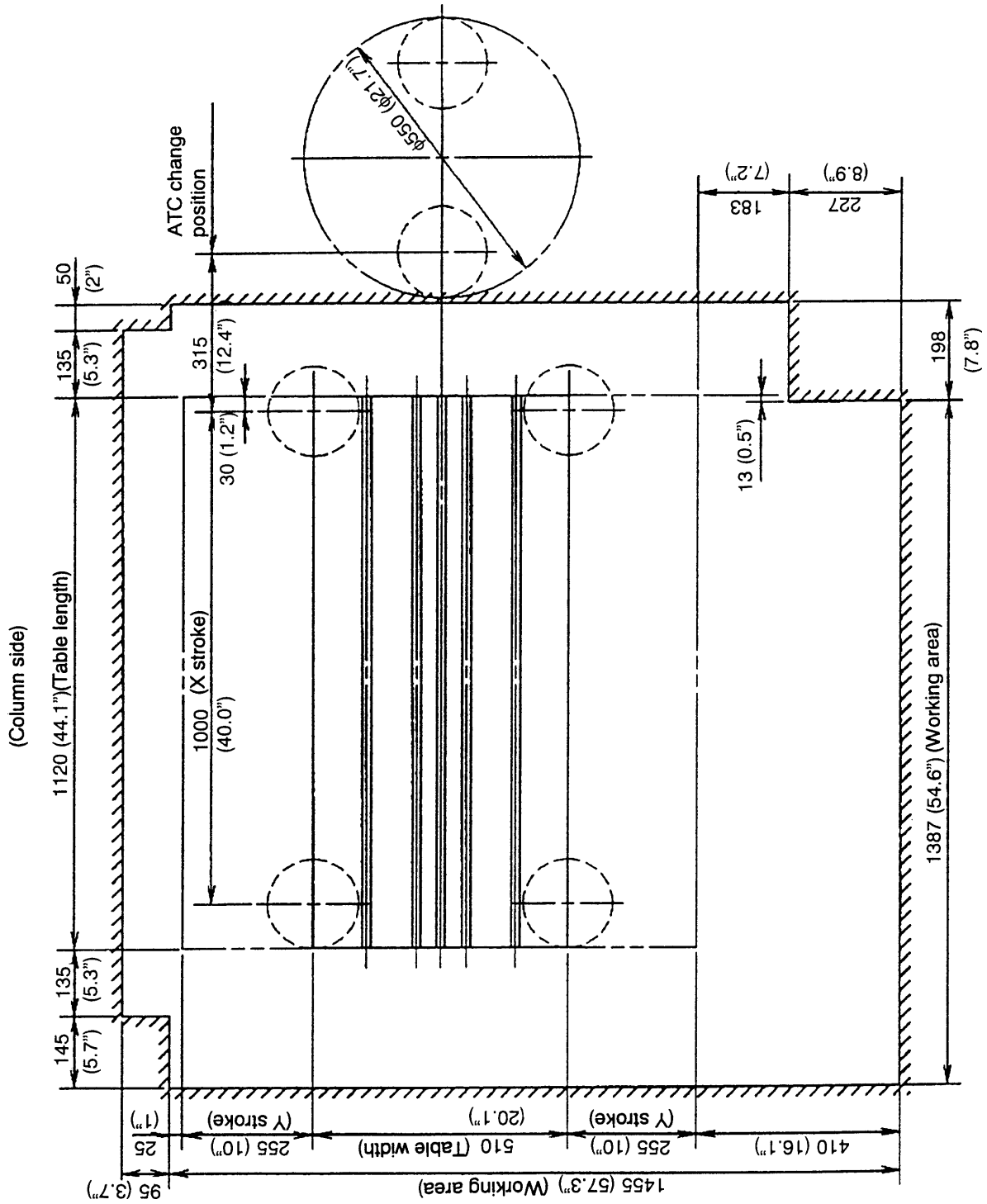
Machining area and ATC interference range (Standard specification) (VS50)

Dimension : metric (mm)
inch (")



***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.*

Dimension : metric (mm)
inch (”)

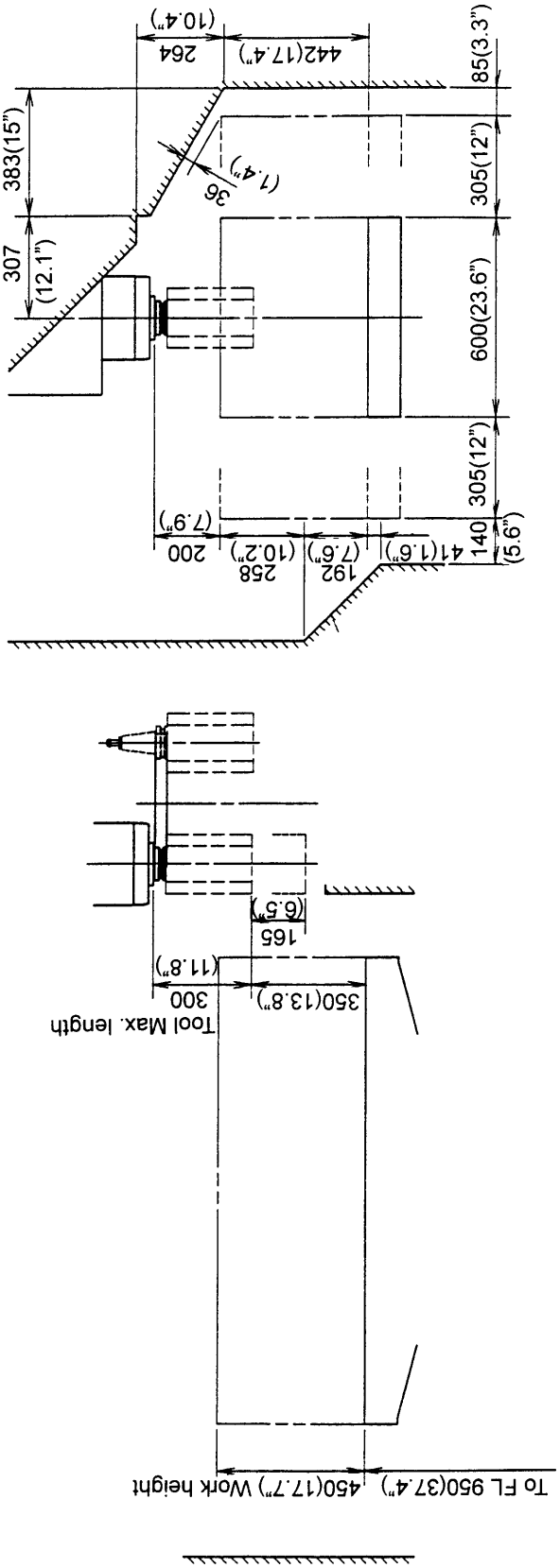


Machining Area and ATC Interference Range

Machining area and ATC interference range (Standard specification) (VS60)

Dimension : metric (mm)

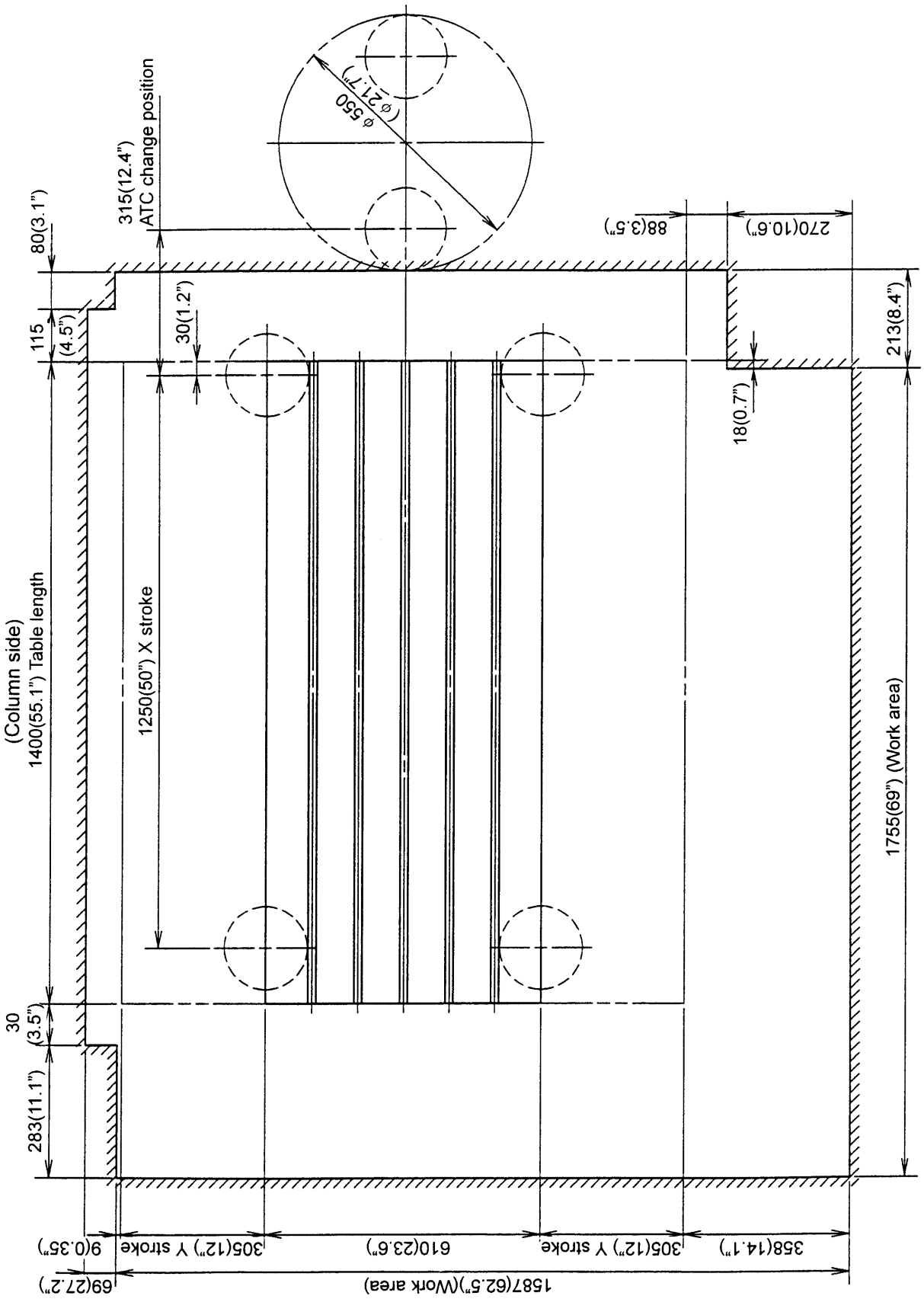
inch (”)



***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.*

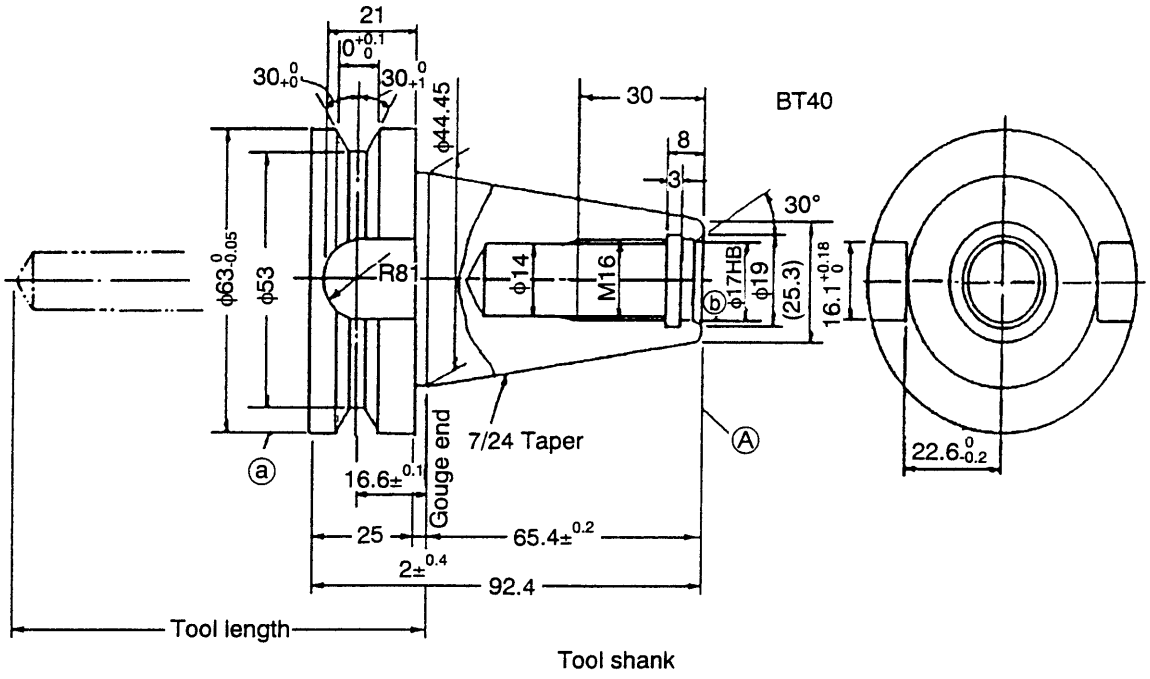
Dimension : metric (mm)

inch (”)

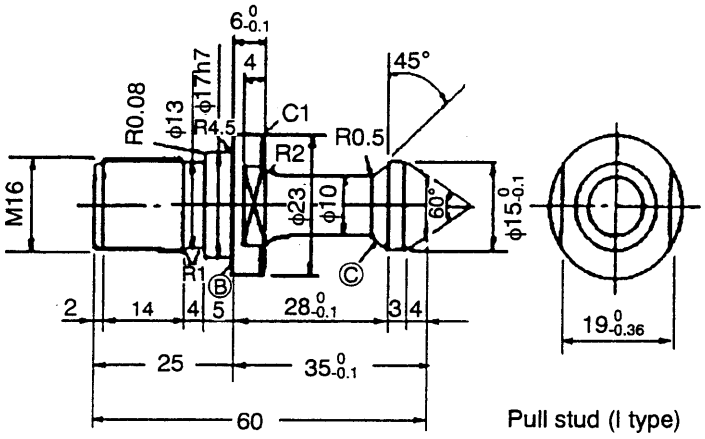


3-4 Tool Shank

3-4-1 Tool Shank (BT-40) and Pull-stud Bolt (12000min^{-1})



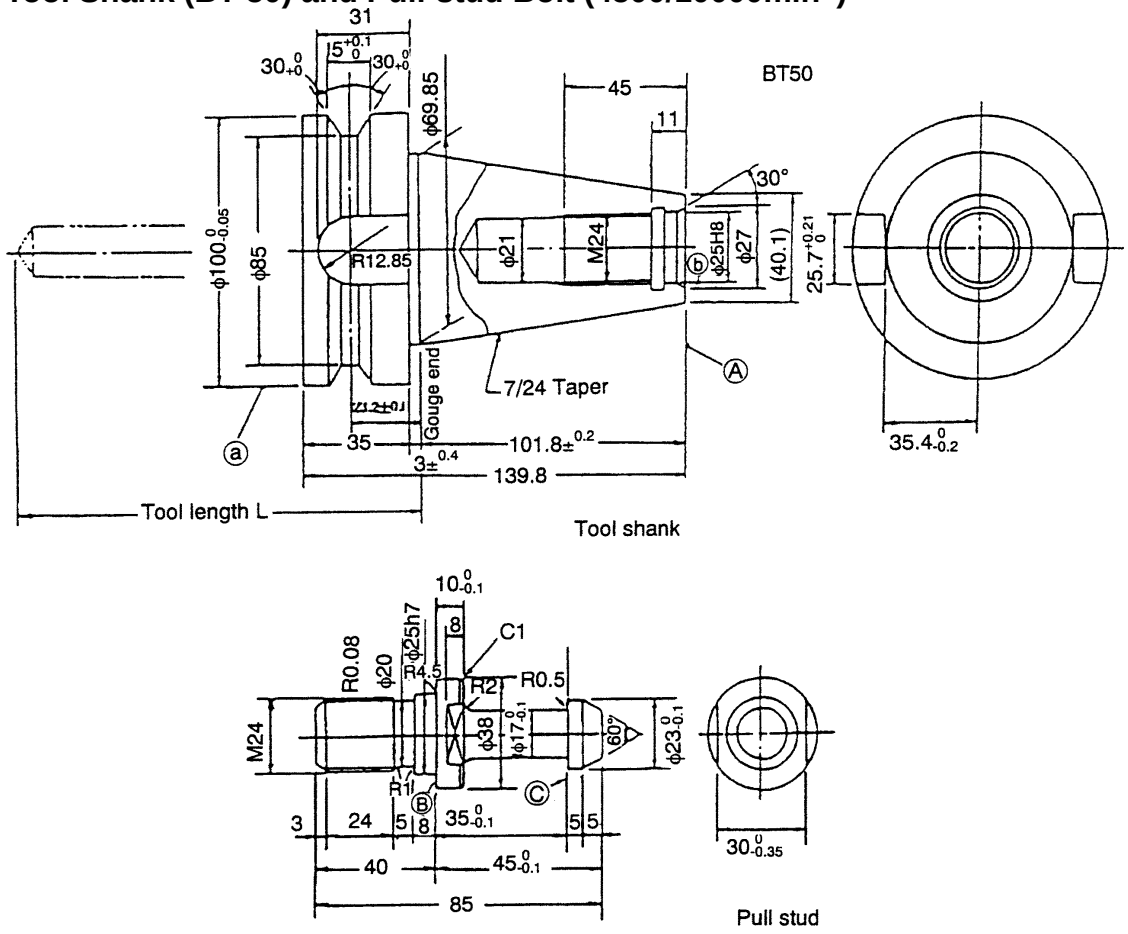
Tool shank



Pull stud (I type)

1. The concentricity of ⓐ and ⓑ parts with the taper shank of a tool shall be 0.025mm
2. The squareness between the taper shank and face Ⓐ 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 ϕ17h7 and face Ⓑ and the rectangular degree of the face Ⓒ with the center line shall be 0.01mm, respectively.

3-4-2 Tool Shank (BT-50) and Pull-stud Bolt (4500/10000min^{-1})



1. The concentricity of ⓐ and ⓑ parts with the taper shank of a tool shall be 0.025mm
2. The squareness between the taper shank and face Ⓐ shall be 0.015/100.
3. The deviation with a 25.7mm 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 ϕ25h7 and face Ⓑ and the rectangular degree of the face Ⓒ with the center line shall be 0.01mm, respectively.

3-4-3 Two-face Clamped Tooling (Spindle Speed: 19,000 min.$^{-1}$ or More)

The BIG-PLUS spindle system(two-face clamping type:made by DAI SHOWA SEIKI) is normally used for the spindle with speed of 20,000 min^{-1}

The two-face clamped tools are to be clamped on the end face and tapered section of the tool shank to prevevt them from biting into the spindle direction by high speed revolution. They are designed to be well balanced when mounted to the spindle.

The following lists the differences from the regular tools:

[1] Special gauge line IN/OUT amount and 7/24 taper tolerance(equivalent to the JIS B0612-1965, 4T)

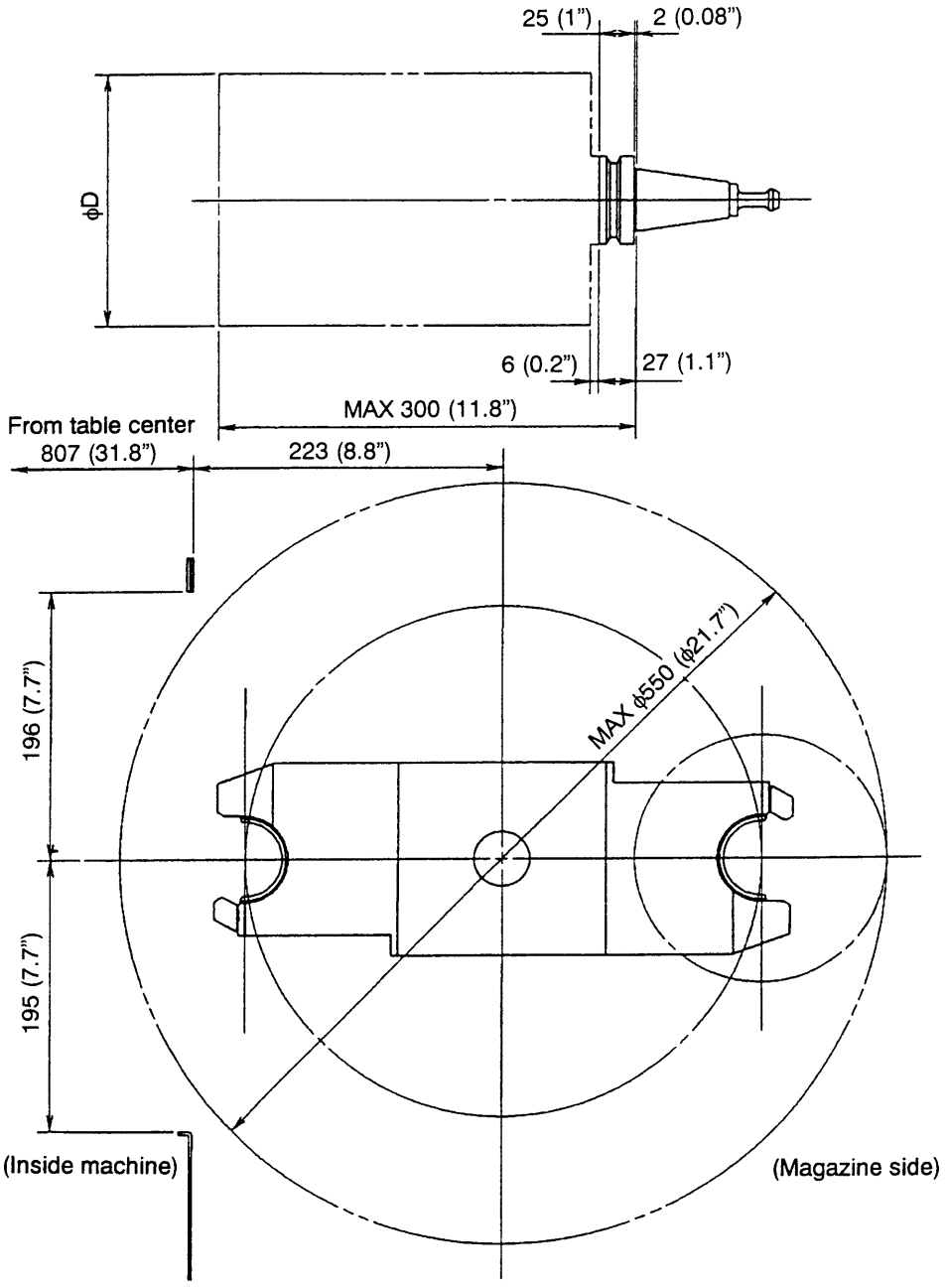
[2] Balance grade (JIS B0905) within G2.5

* To purchase the tools, order them to DAI SHOWA SEIKI.

3-5 ATC Tool Limit (BT40)

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

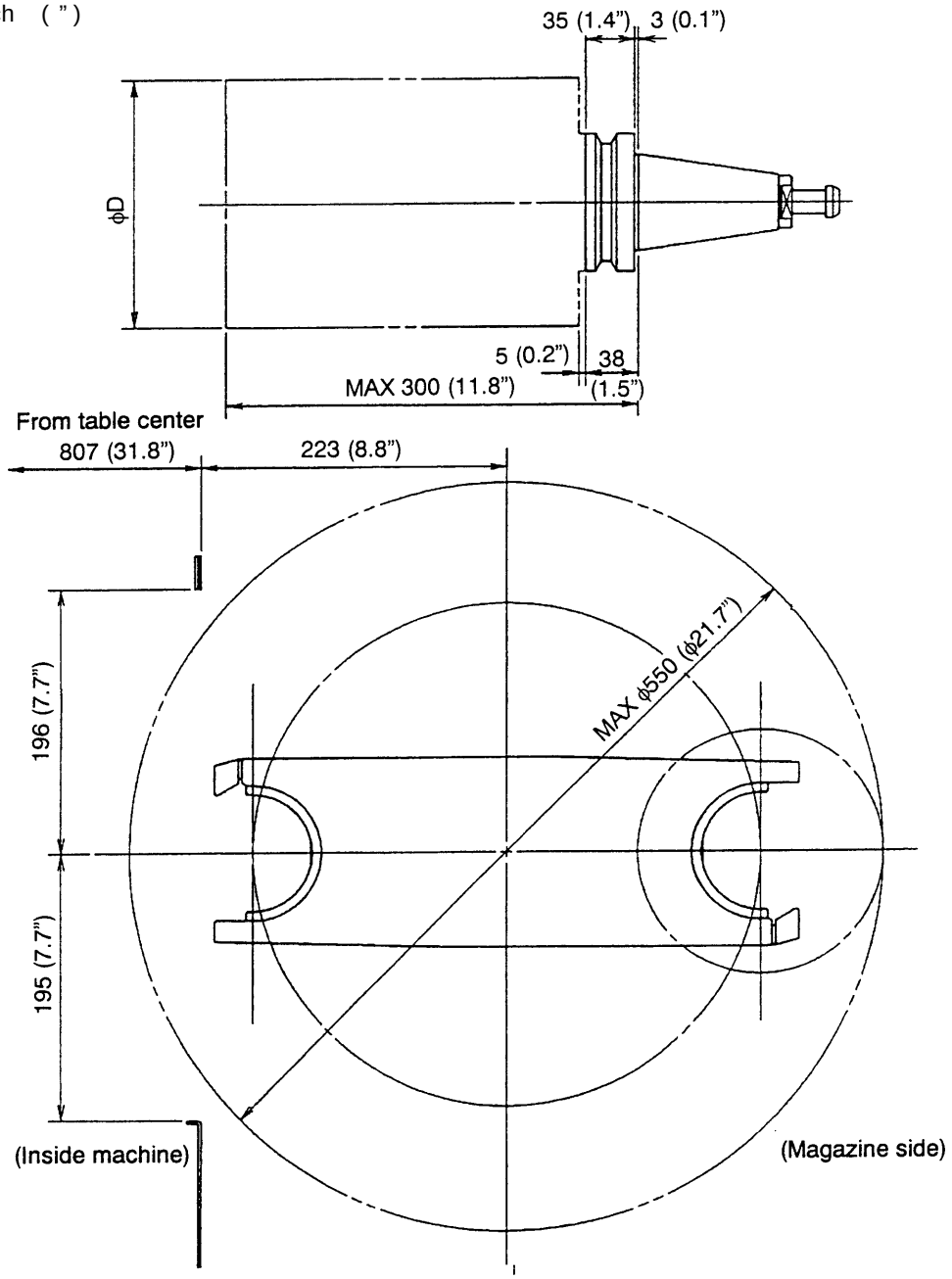
Dimension : metric (mm)
inch (”)



ATC Tool Limit (BT50)

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	15kg

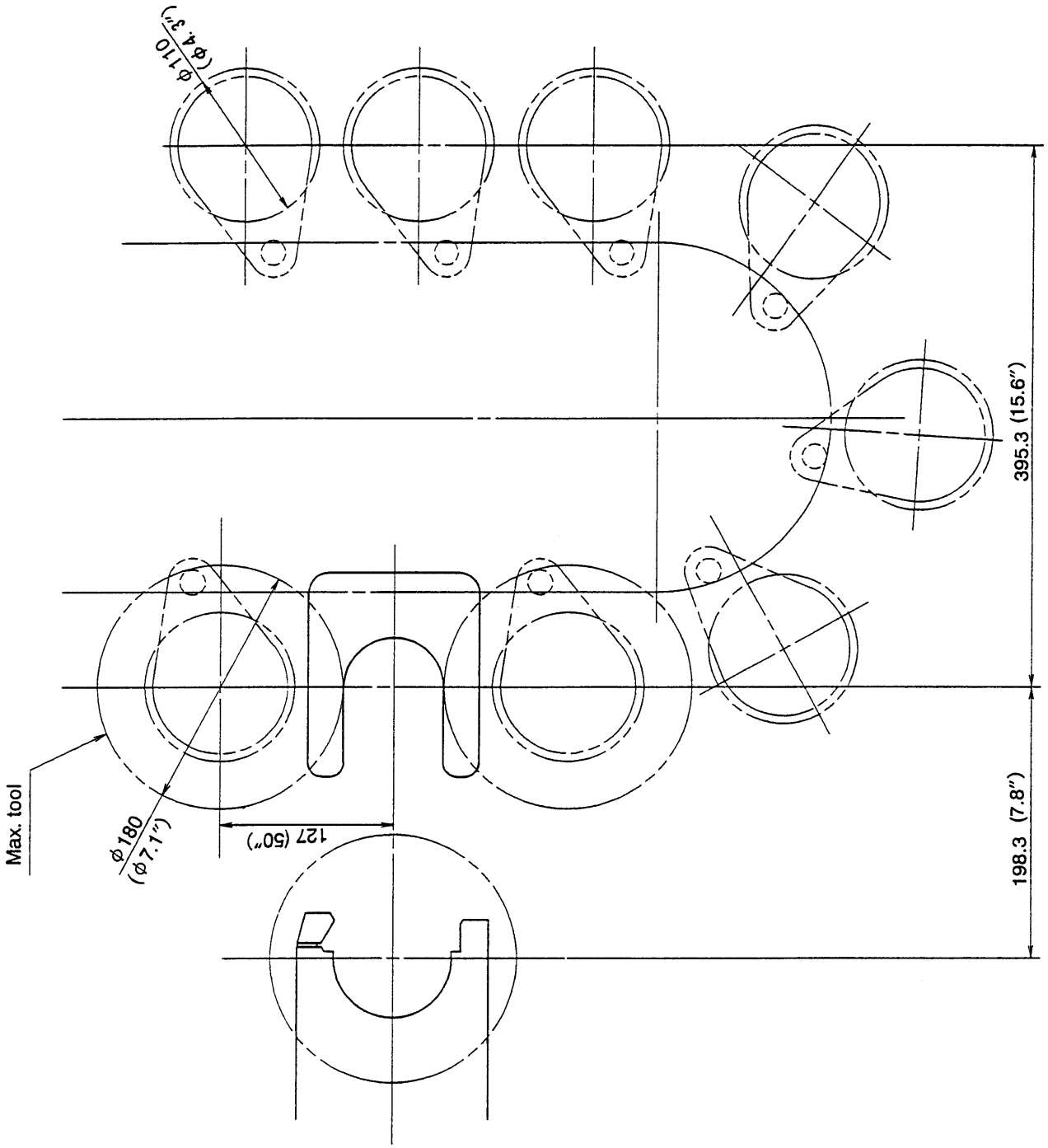
Dimension : metric (mm)
inch (”)



20, 30 ATC Tool Limit

Dimension : metric (mm)

inch (″)



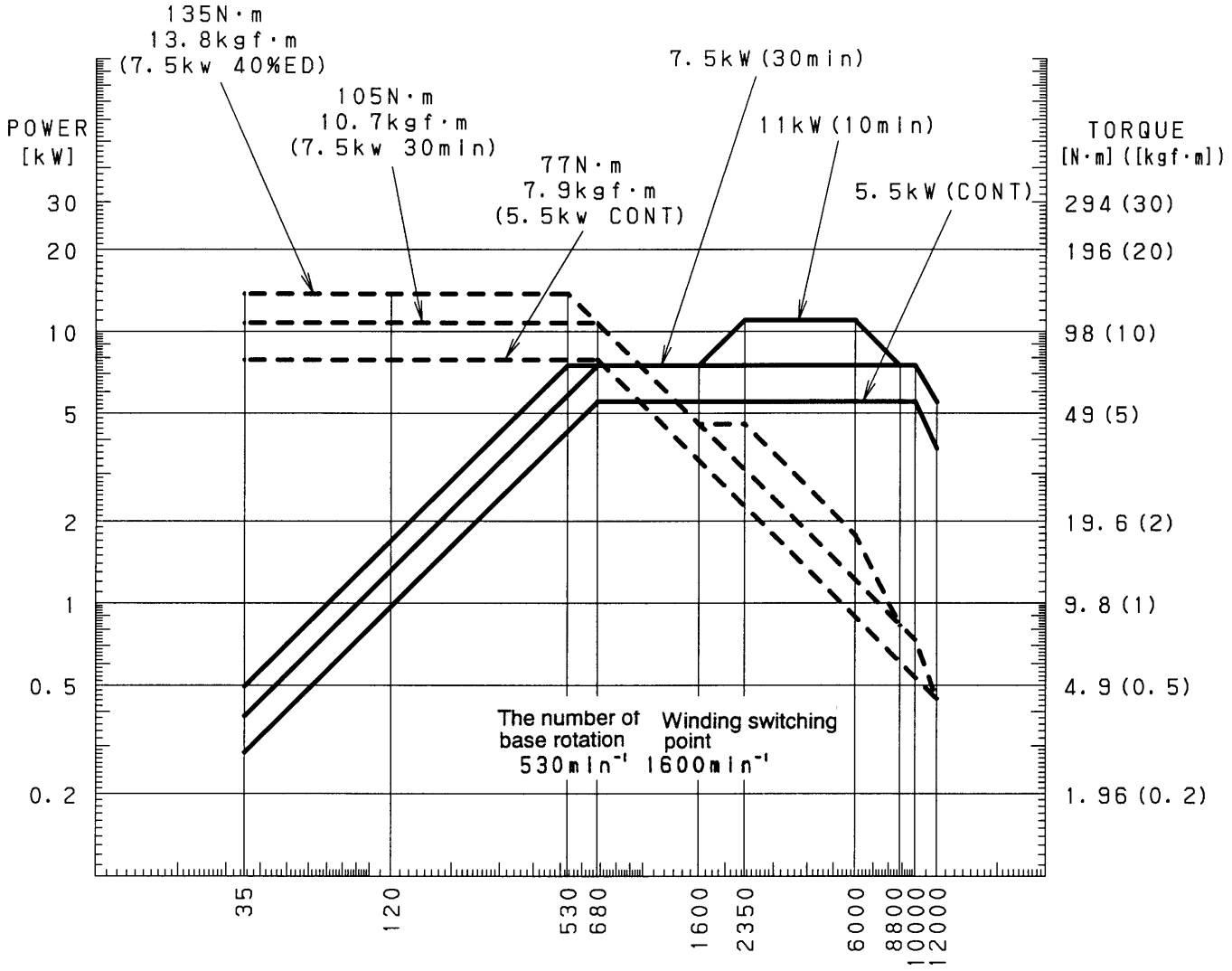
Note) *Can not use a number at each side position of Max. tool that diameter is ϕ95 and over, in the case of using the number on the program, the tool will be collided with the ATC arm.*

3-6 Spindle Torque/Output Diagram (#40 – 12000 Standard spec.)

Motor : FANUC αB112L-5.5

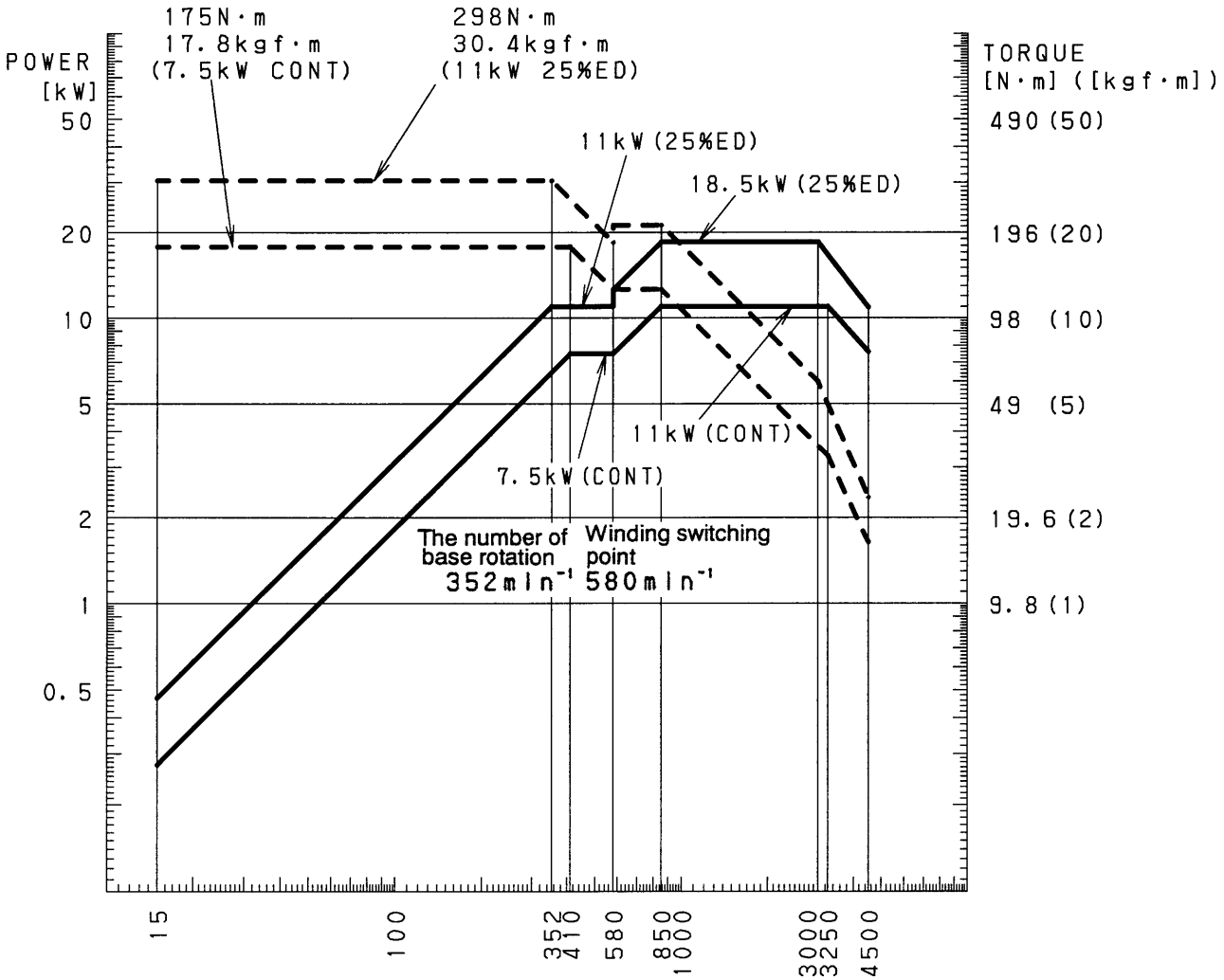
Amplifier : SPM-15

The number of maximum rotation : 12000min^{-1}



Spindle Torque/Output Diagram (#50 – 4500 Standard spec.)

Motor	: FANUC αB160M-11
Amplifier	: SPM-30
The number of maximum rotation	: 4500min^{-1}

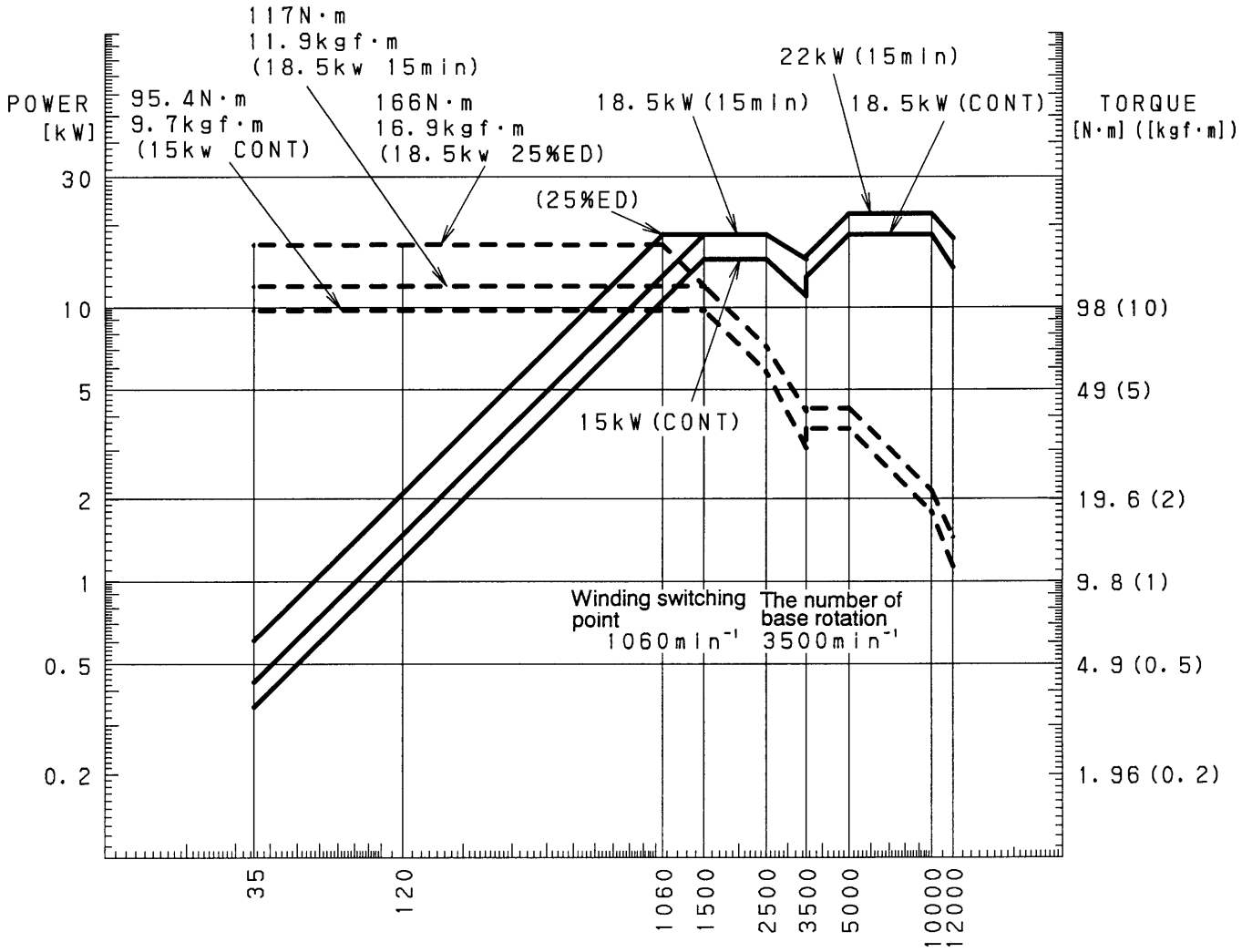


Spindle Torque/Output Diagram (#40 – 12000 High power spec.)

Motor : FANUC αB112L-18.5

Amplifier : SPM-30

The number of maximum rotation : 12000min^{-1}



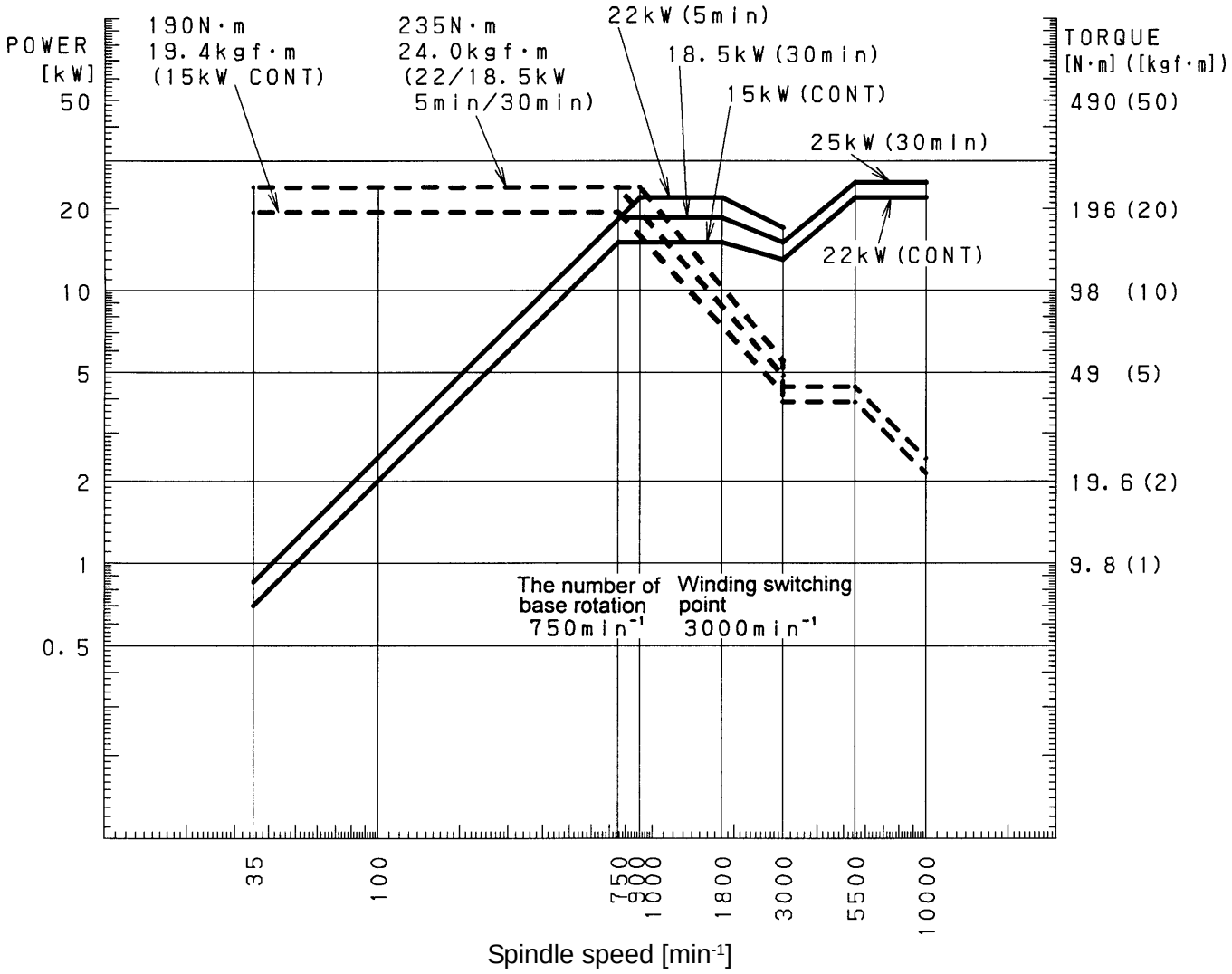
Spindle speed [min^{-1}]

Spindle Torque/Output Diagram (#50 – 10000 Spec.)

Motor : FANUC αB132L-22

Amplifier : SPM-30

The number of maximum rotation : 10000min^{-1}

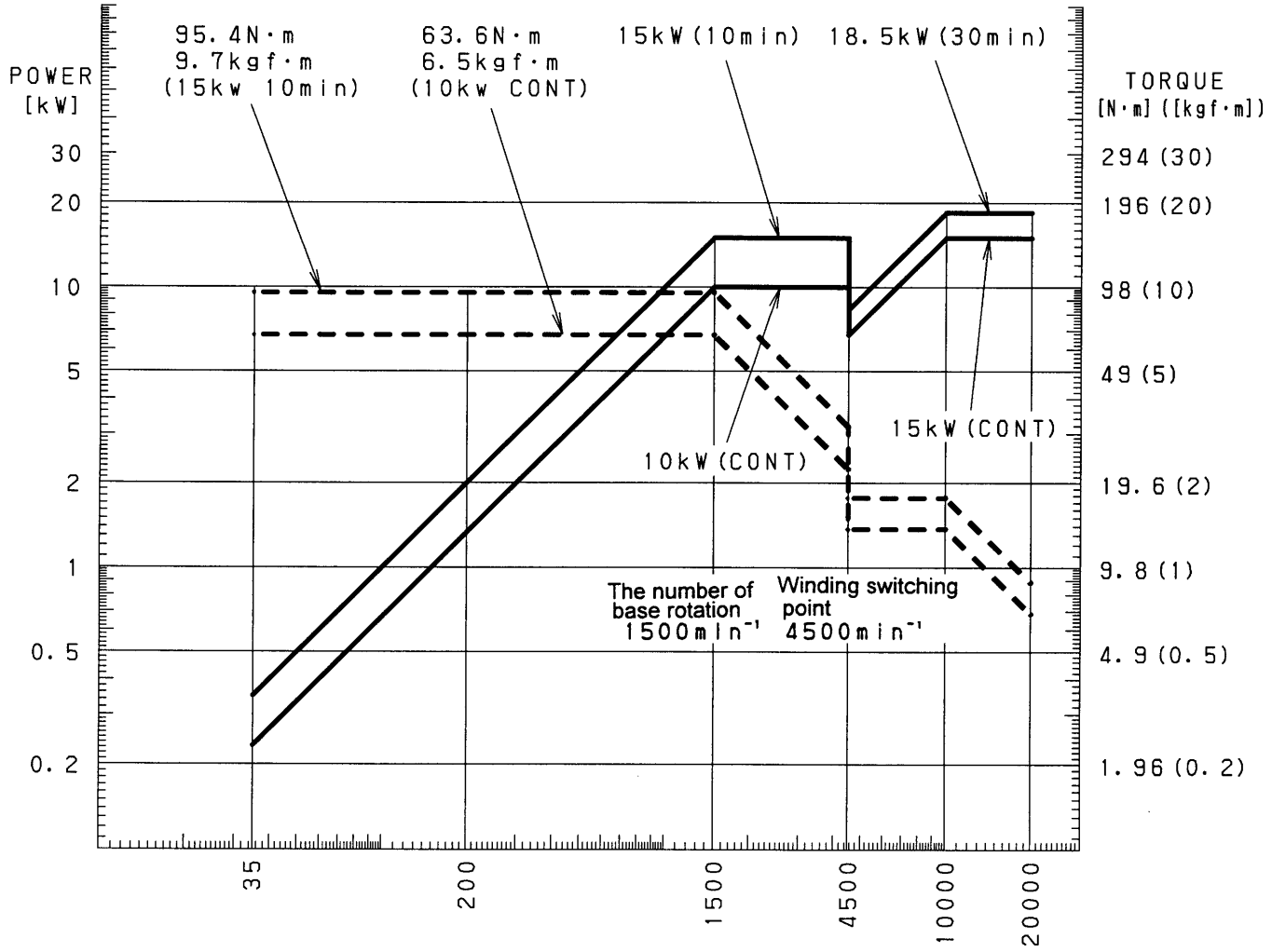


Spindle Torque/Output Diagram (#40 – 20000 Spec.)

Motor : FANUC αB112M-15/20000

Amplifier : SPM-30

The number of maximum rotation : 20000min^{-1}



TURNING CENTER

VS50/60

INSTRUCTION MANUAL

SPECIFICATIONS

SEIKI-SEICOS Σ16M/18M

Version 1.01

11-2000

First Edition 2-1998