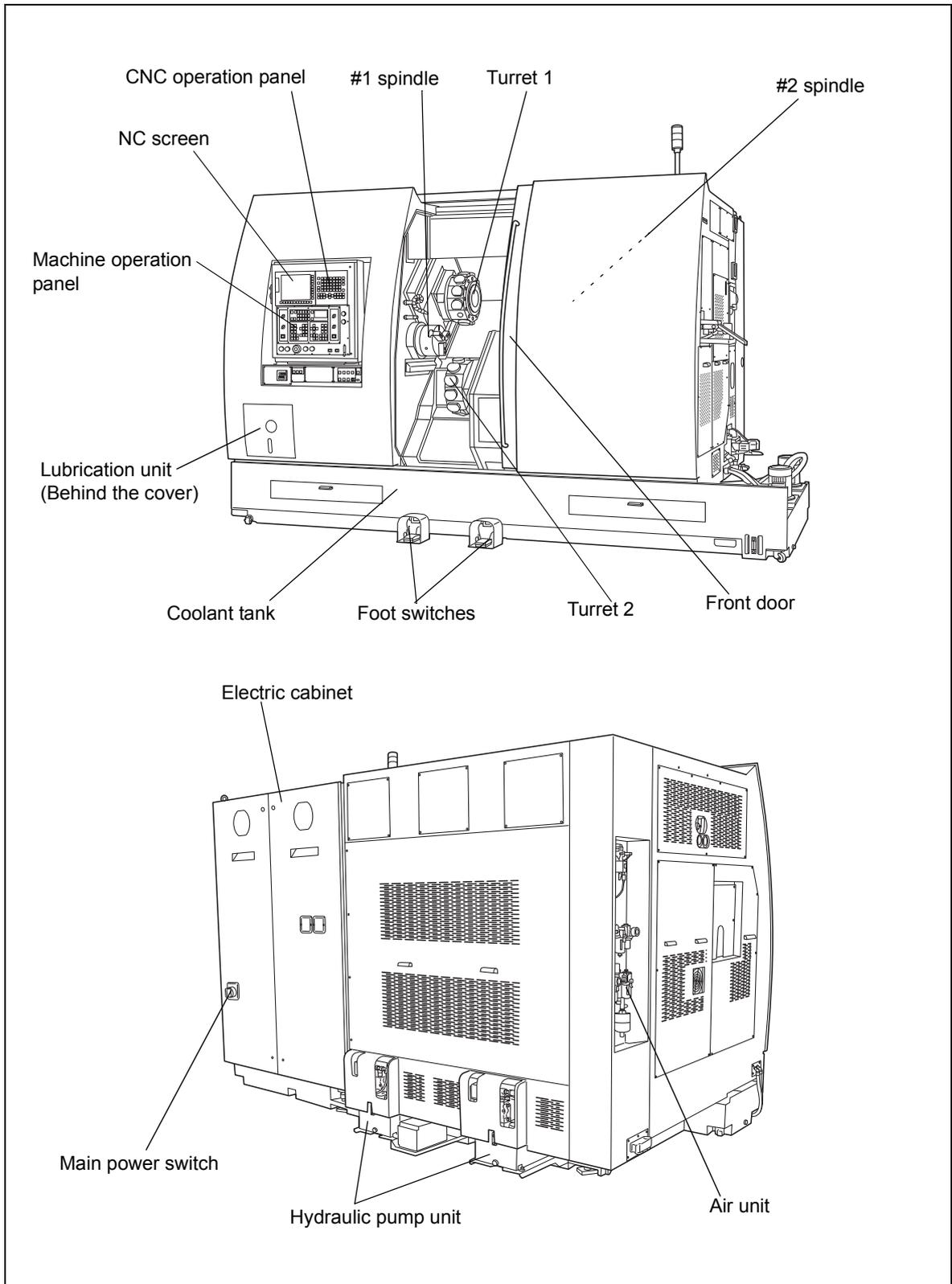


# Chapter 1 Machine Appearance

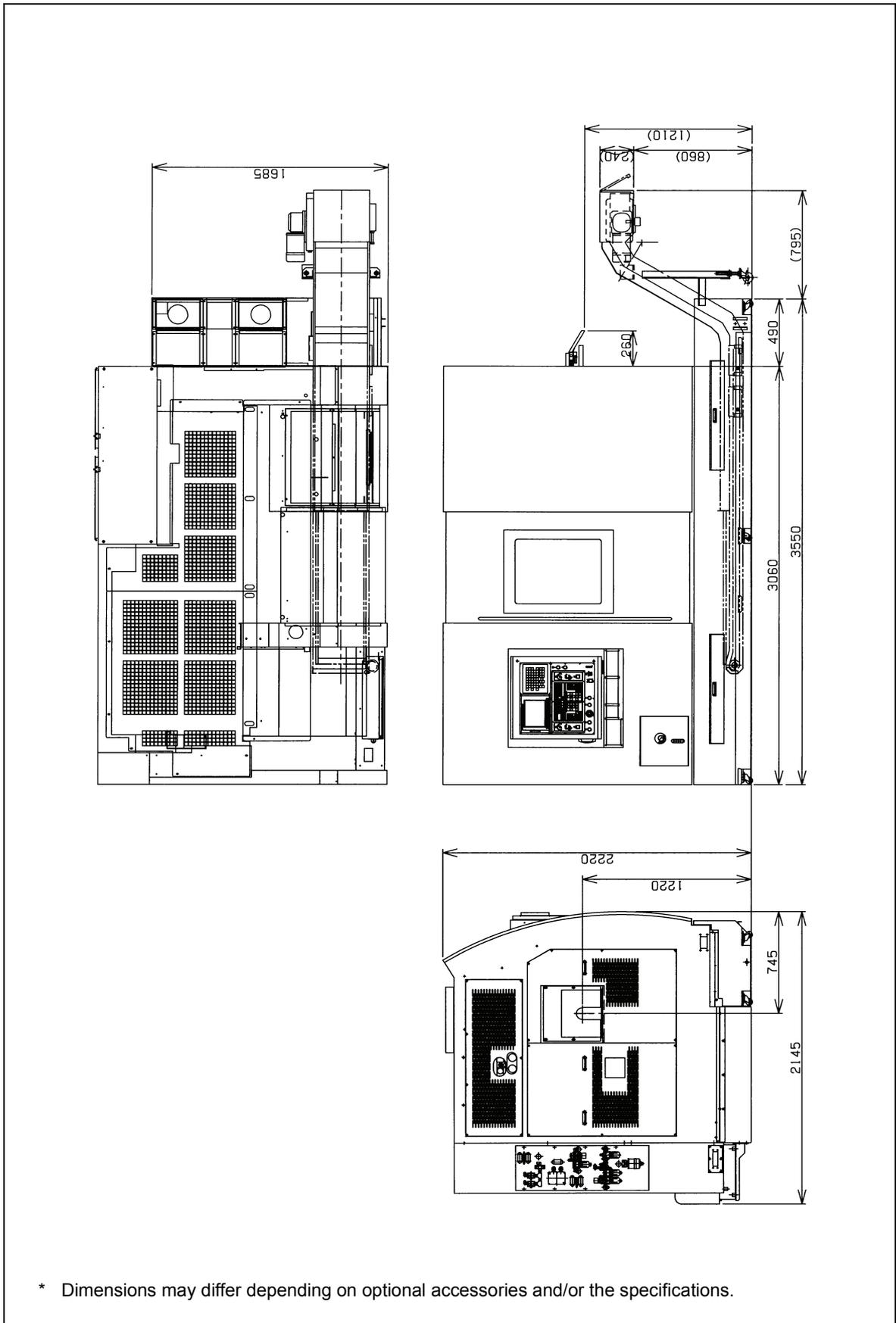
## 1-1 Name of Each Component



Euro

Fig. 1 Machine appearance and name of each component

### 1-2 Dimensional Drawing



Euro

Fig. 2 Dimensional drawing

## Chapter 2 Machine Specifications

### 2-1 Standard Specifications

Item		Unit	#1 spindle	#2 spindle	
Capacity	Optimum turning diameter	mm	φ65 × 150		
	Max. swing over bed	mm	φ240		
	Max. turning diameter	mm	φ240		
	Max. turning length	mm	160 (445: One-side operation)		
	Max. bar diameter	mm	φ51 (φ65)	φ51	
	Chuck size	inch	8		
Spindle	Spindle nose	JIS	A <sub>2</sub> -6 (A <sub>2</sub> -8)	A <sub>2</sub> -6	
	Hole through spindle	mm	φ51 (φ65)	φ51	
	Spindle bearing ID	mm	φ100 (φ120)	φ100	
	Spindle speed	min <sup>-1</sup>	Max. 4,000		
Turret	Type		12-station		
	Tool shank	mm	25 sq.		
	Boring holder ID	mm	40		
	Max. stroke	mm	X: 175		
			Z: 510		
			Y: ±40	–	
	Rapid traverse rate	m/min	–		
			X: 18		
			Z: 24		
			Y: 12	–	
		–	A: 30		
Motor	Spindle motor (30 min/cont.)	kW	AC18.5/15	AC11/7.5	
	Feed motor	kW	X: 2.5	X: 2.7	
			Z: 2.7		
			Y: 2.5	–	
			–	A2.7	
	Power tools motor	kW	AC3.7/2.2		
	Coolant motor	kW	AC0.339		
	Hydraulic motor	kW	AC0.75		
C-axis motor	kW	AC0.75			
Spindle indexing (C-axis)	Rapid traverse rate	deg/min	24,000		
Power tool	Tool storage capacity	pcs	12 each		
	Max. speed	min <sup>-1</sup>	Max. 4,000		
	Capacity	Drill	mm	Max. φ16	
		Endmill	mm	Max. φ16	
		Tap	mm	Max. M16	

Item		Unit	#1 spindle	#2 spindle
Size	Spindle center height	mm	1,220	
	L × W × H	mm	3,050 × 2,125 × 2,365	
	Machine weight	kg	8,100	
Total power capacity		kVA	73	
Controller			TAKAMAZ & FANUC	

- \* The machine weight differs depending on the specifications.
- \* The total power capacity differs depending on the specifications.

## 2-2 Standard and Optional Accessories

### ■ Standard accessories

Y-axis function (turret 1) . . . . .	1 set	Cut-off holder. . . . .	1 pce
C-axis indexing function (for both spindles)	2 sets	Hydraulic chucks (for both spindles)	2 sets
Power tool drive unit (turret 1/2) . . . . .	2 sets	Splash guard. . . . .	1 set
OD holder . . . . .	4 pcs	Service tool kit. . . . .	1 set
Boring holder . . . . .	4 pcs	Instruction manual . . . . .	1 set

### ■ Optional accessories

- Power tools (face/side milling)
- VDI 40 12-station turret
- Bar feeder system
- Parts catcher
- Push rod
- Chuck clamp detector
- Automatic measurement unit
- Work set detector
- Cut-off check device
- Tool presetter
- Toolings
- Bar feeder interface
- #2 spindle ejector
- Chip conveyor (right-side type) (floor type, spiral type)
- Chip bucket
- Air blower (front, rear)
- Rear coolant unit
- Cycle end signal light (1-color, 2-color, 3-color)
- Automatic fire extinguisher
- Automatic power shut-off device
- Magnetic counter (total/preset/multi)
- Special color
- Others

## Chapter 3 Controller Specifications

### 3-1 Standard Specifications

Contents	TAKAMAZ & FANUC 31i-A
Controlled axes	8 axes
Simultaneous controllable axes	4 axes (each path)
Least input increment	0.001 mm (X in diameter), C: 0.001 deg
Least command increment	X: 0.0005 mm, Z/Y/A: 0.001 mm, C: 0.001 deg
Auxiliary function	M-3 digit
Spindle function	S-4 digit
Tool function	T-4 digit
Tape code	EIA (RS232C)/ISO (840) automatic recognition
Cutting feedrate	1 - 5000 mm/min
Command system	Incremental / Absolute
Linear interpolation	G01
Circular interpolation	G02, G03
Cutting feedrate override	0 - 150%
Rapid traverse override	F0, 50%, 100%
Program file name	32 characters
Backlash compensation	0 - $\pm 9999 \mu\text{m}$
Part program storage length	64 Kbyte (160 m, total both paths)
The number of tool offset	32 sets (total both paths)
Number of registerable programs	63 pcs (total both paths)
Geometric offset and wear offset	Standard
Y-axis offset	Standard
Canned cycle	G90, G92, G94
Radius designation on arc	Standard
Tool offset measurement input	Standard
Back ground editing	Standard
Custom macro	Standard
Chamfering, corner R	Standard
Tool nose radius compensation	G40, G41, G42
Programmable data input	G10
Extended part program editing	Standard
Multiple repetitive cycle	G70 - G76
Continuous threading	G32
Constant surface speed control	G96, G97
Clock function	Standard

Contents	TAKAMAZ & FANUC 31i-A
Help function	Standard
Canned cycle for drilling	G80, G83 - G85, G87 - G89
Alarm history display	Max. 60 pcs
Self-diagnosis function	Standard
Sub-program call	up to 10 loops
Decimal point input	Standard
2nd reference point return	G30
Work piece coordinate system	G50, G54 - G59
Stored stroke check 1	Standard
Stored stroke check 2, 3	Standard
Input/output interface	RS232C, memory card
Alarm message display	Standard
Display language (English)	Standard
Spindle orientation	Standard
Spindle synchronization control	Standard
Sub-Spindle torque limit skip	Standard
Abnormal torque detection	Standard
Rigid tapping	Standard
Polar coordinate interpolation	Standard
Cylindrical interpolation	Standard
Axis recomposition	Standard
Balace cut	G68, G69

## 3-2 Optional Specifications

Contents	TAKAMAZ & FANUC 31i-A
Additional custom macro common variable	#100 - #199, #500 - #999
Multiple repetitive cycle II	Pocket shape
Variable lead thread cutting	
Helical interpolation	
Direct drawing dimension programing	
Hours of operation and number of parts	
Tool life management function	
Inch/Metric conversion	G20, G21
Manual guide i	
Multiple M codes in one block	Max. 3

# Chapter 4 Major Unit

## 4-1 Headstock Unit

The headstock unit consists of the spindle, hydraulic cylinder, etc.

A thin, solid hydraulic cylinder is used as standard, increasing rigidity of the spindle within a limited space.

The spindle is driven by an AC spindle motor. The spindle bearing is grease-lubricated, and needs to be replaced every three years. Contact us when replacing the spindle bearing.

Spindle speed

Max. 4000 min<sup>-1</sup> (#1/#2 spindle)

### 4-1-1 Spindle

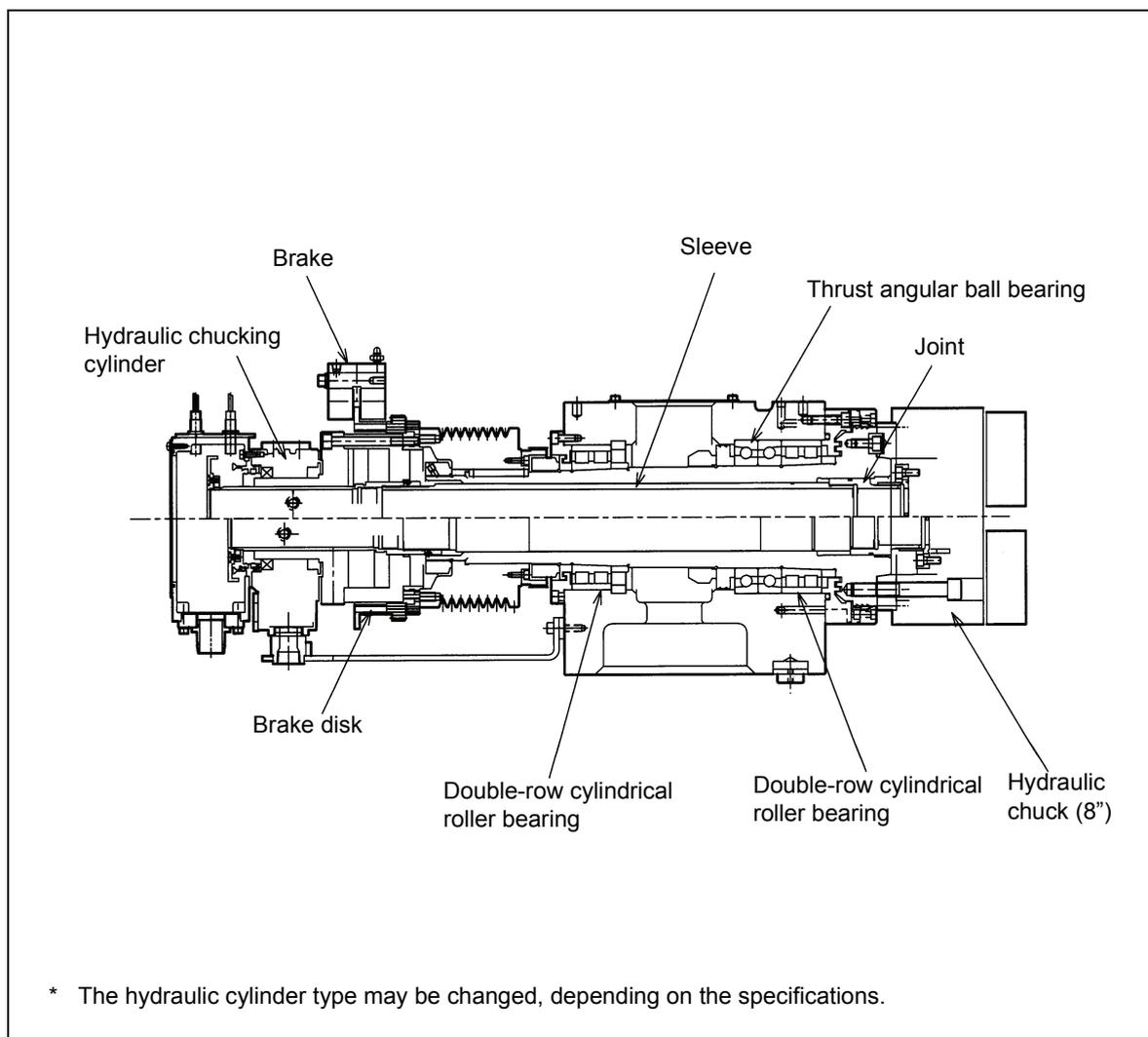


Fig. 3 Structural drawing of headstock

### 4-1-2 Spindle Nose Drawing

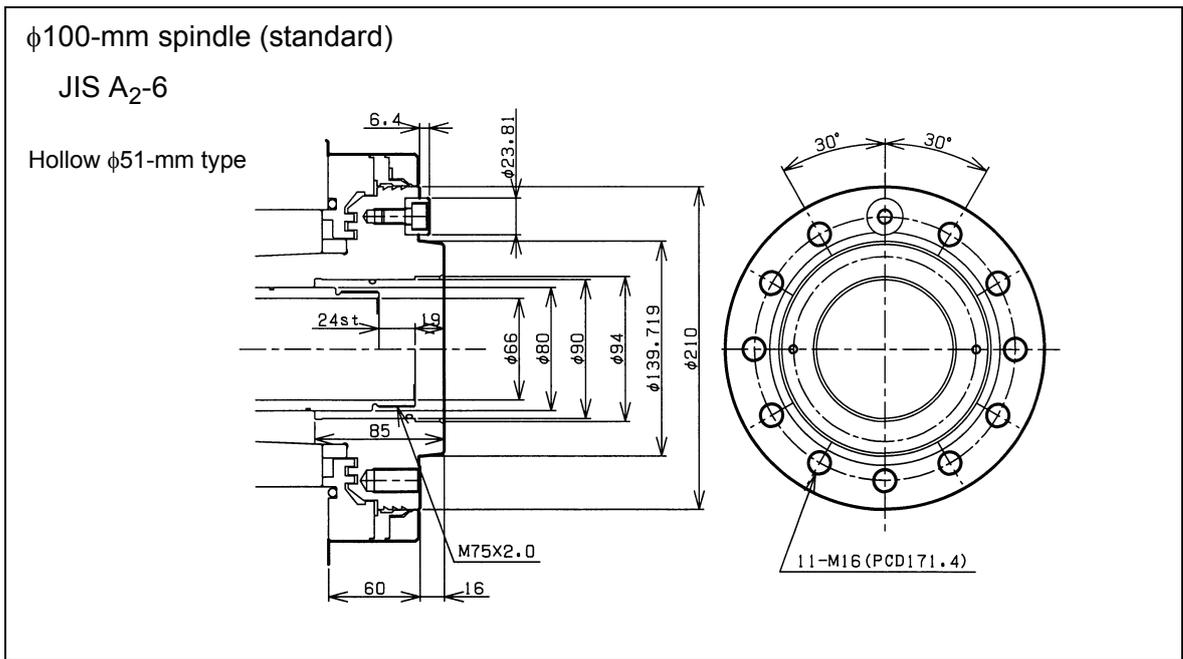


Fig. 4 Spindle nose drawing

### 4-1-3 Power Chuck Mounting Drawing

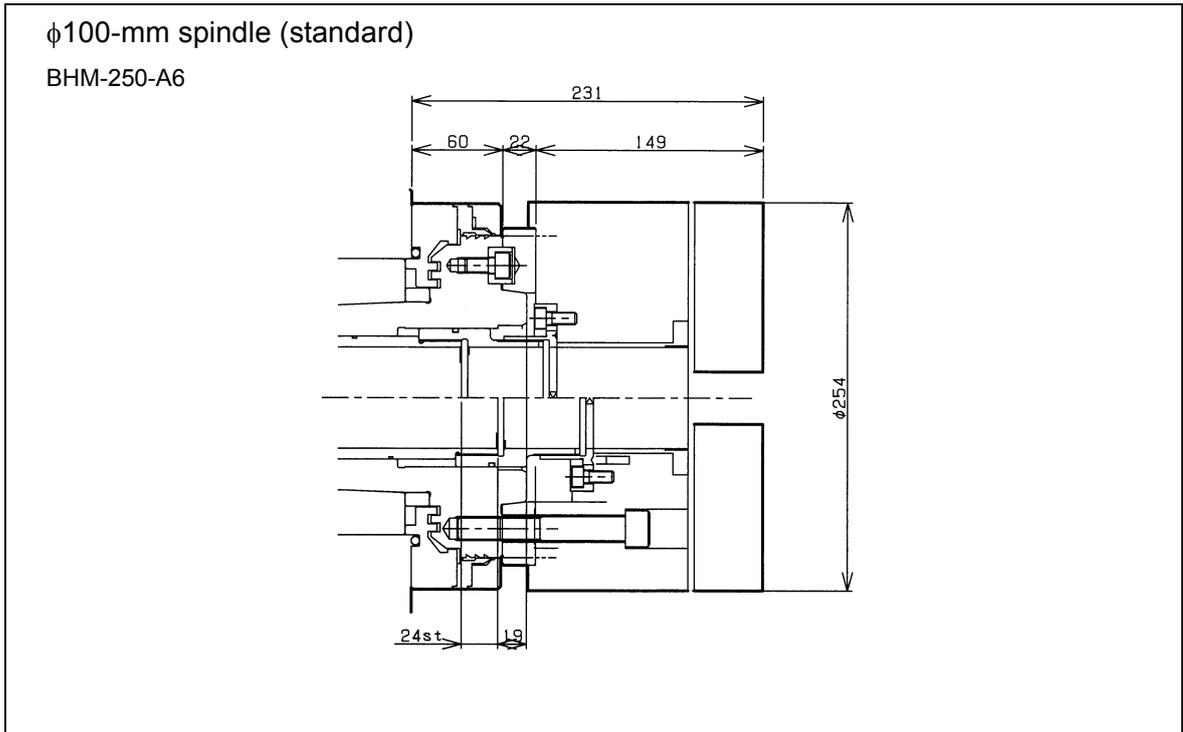


Fig. 5 Power chuck mounting drawing

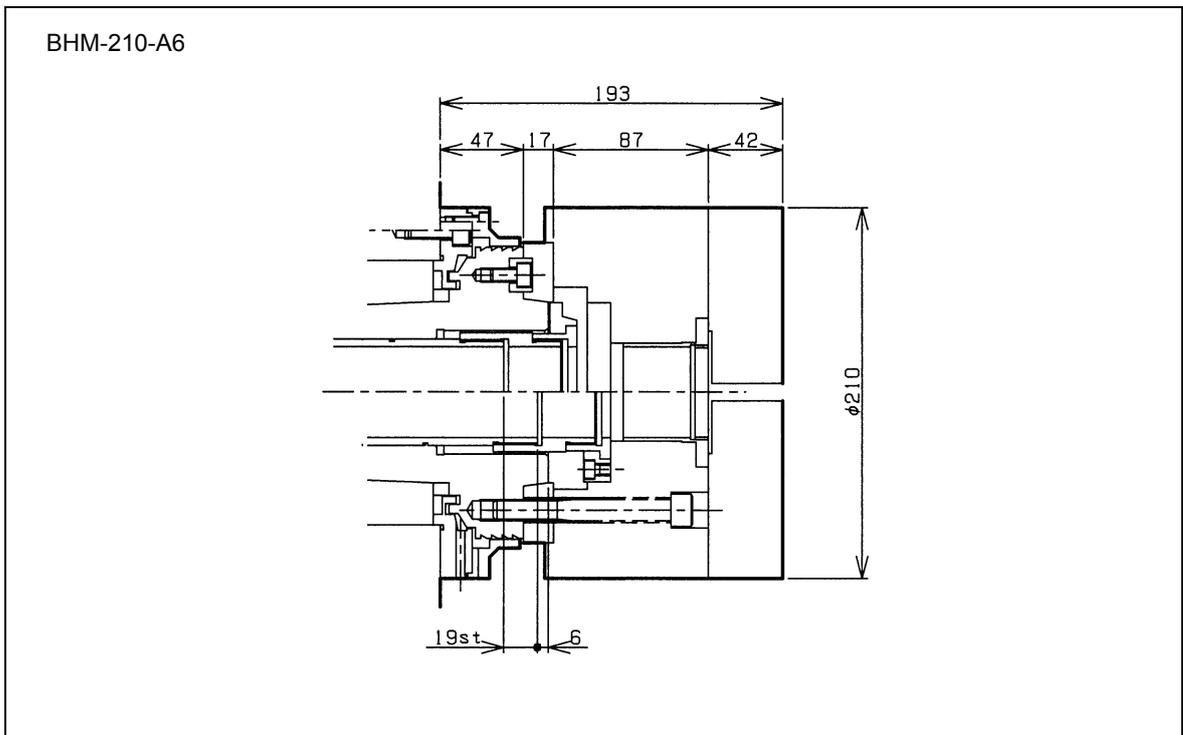


Fig. 6 Power chuck mounting drawing

4-1-4 Collet Chuck Mounting Drawing

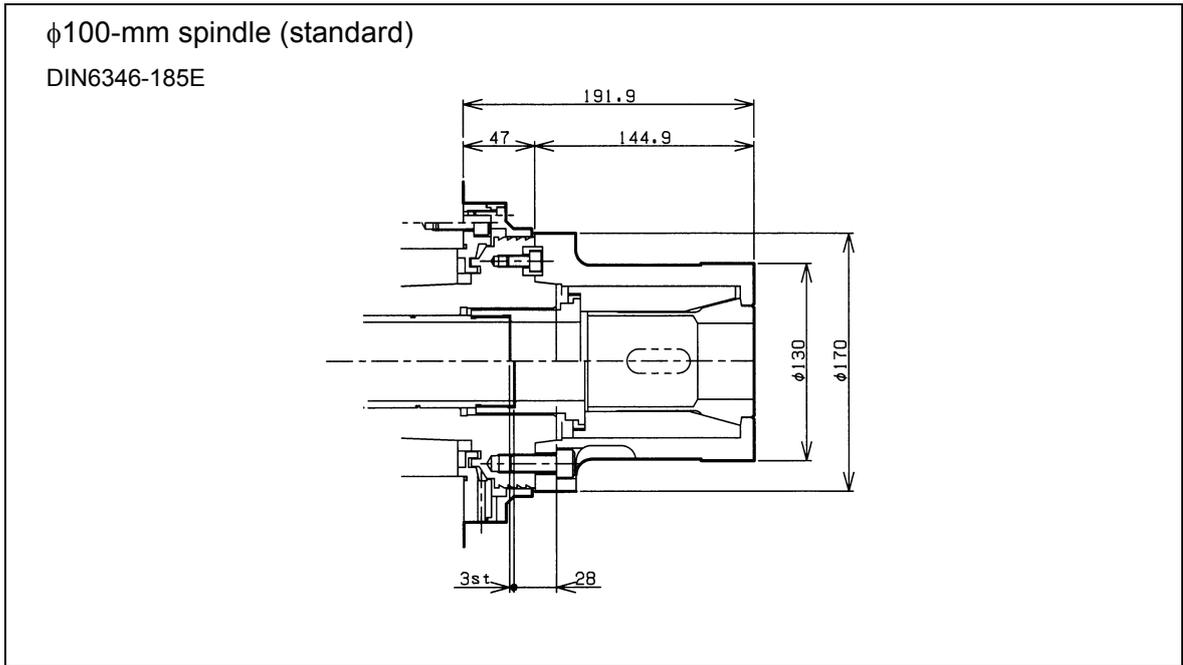


Fig. 7 Collet chuck mounting drawing

4-1-5 Spindle Motor Characteristic Diagram

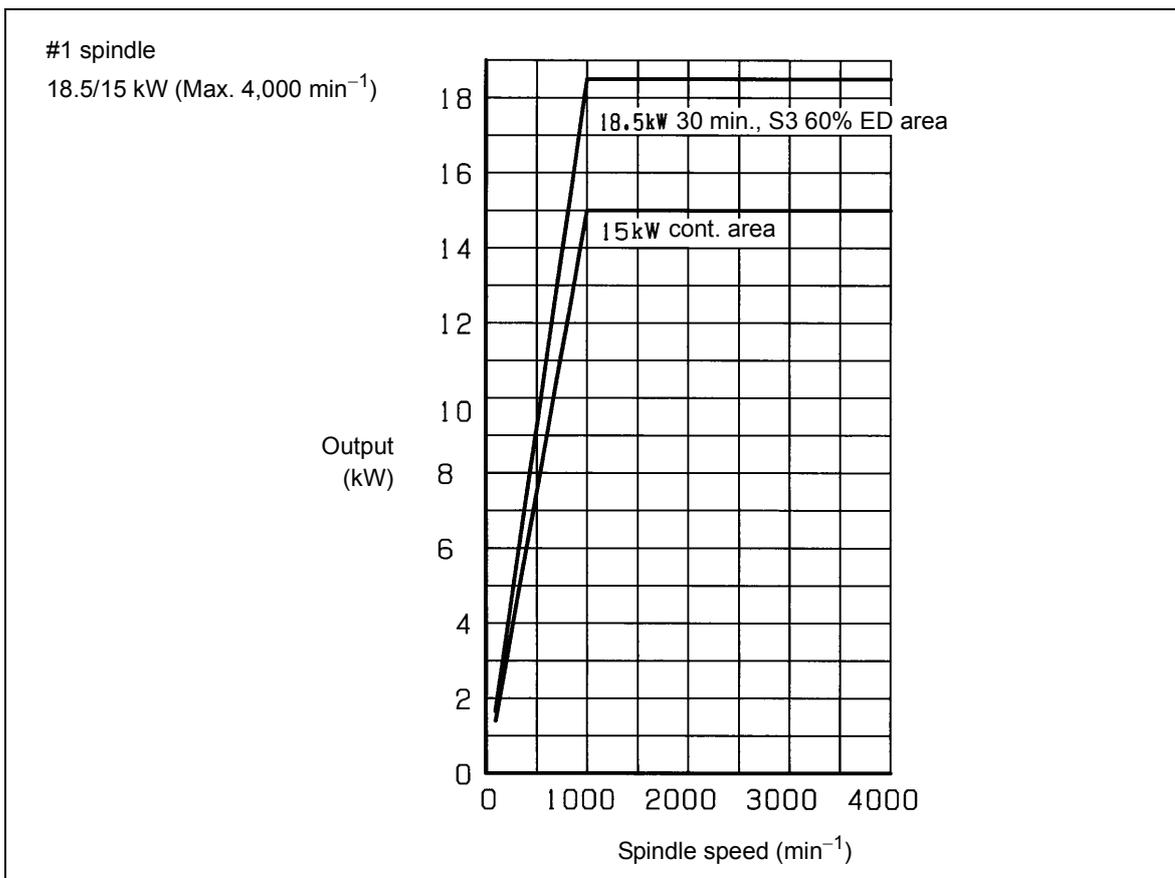


Fig. 8 Spindle motor characteristic diagram

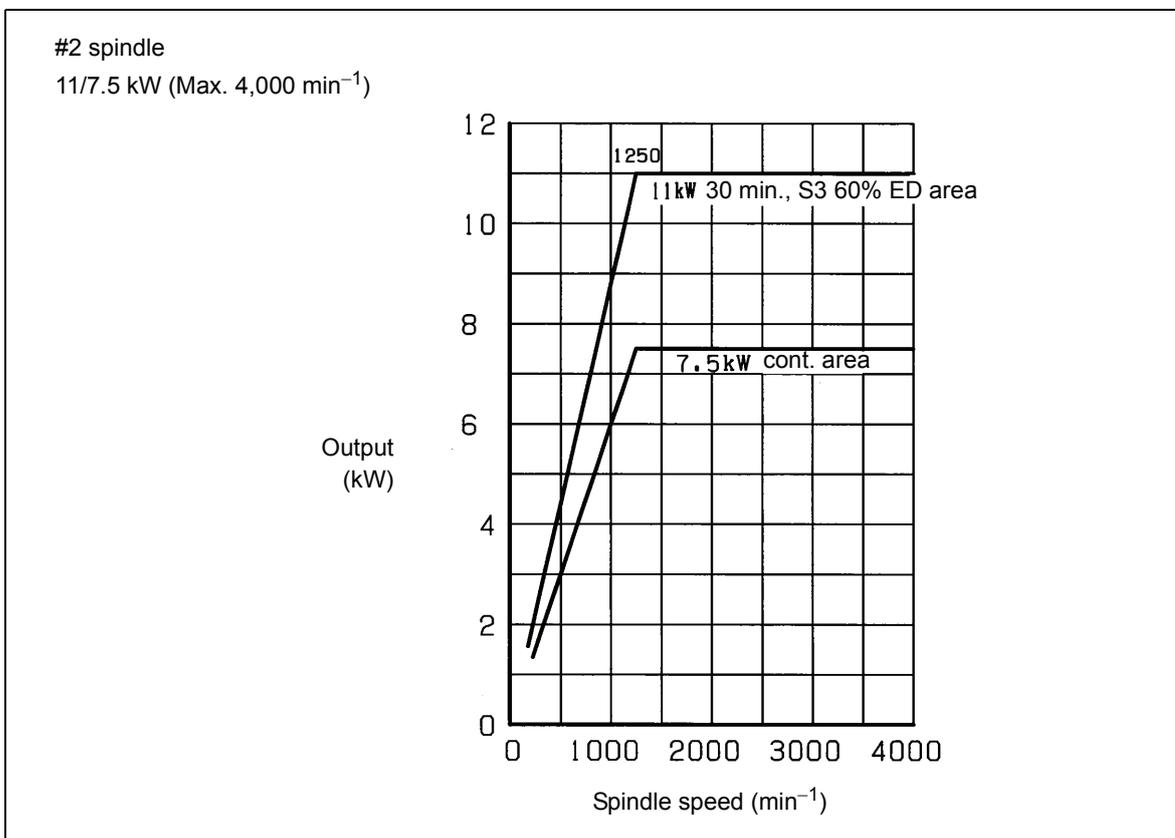


Fig. 9 Spindle motor characteristic diagram

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**4-1-6 Spindle C-axis Indexer**

The spindle angle can be changed easily as required through NC.

C-axis operation through simultaneous 2-axis control is also available. (X-C, Y-C, Z-C)

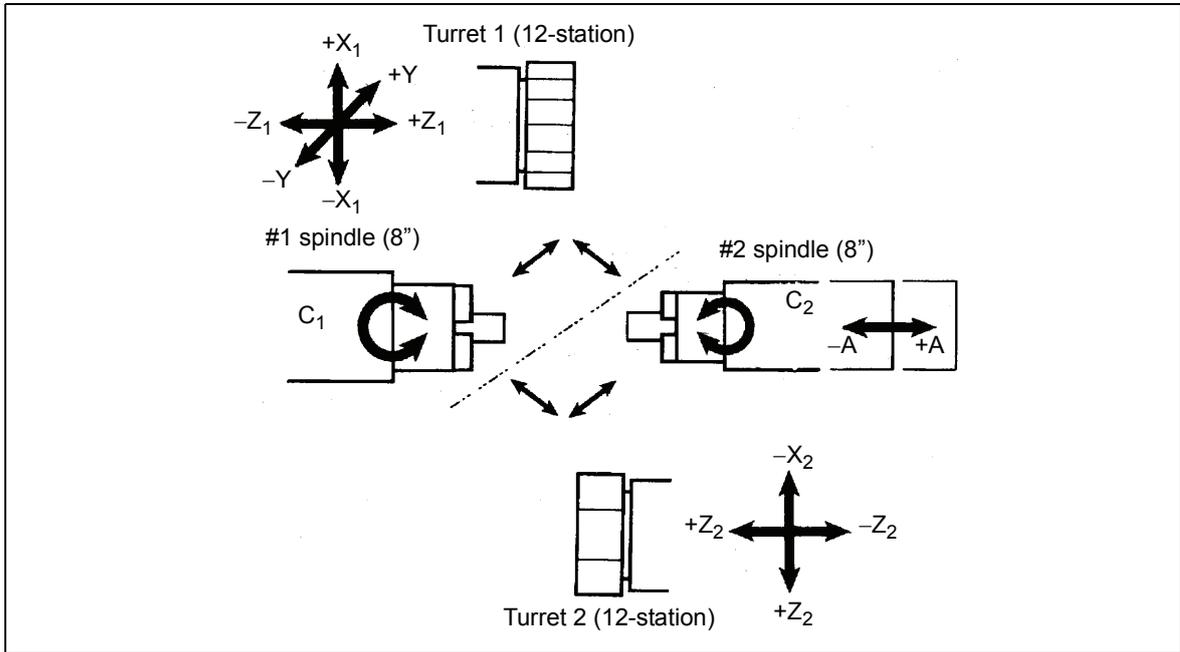


Fig. 10

Rapid traverse rate	deg./min.	24000
Least input increment	deg.	0.001
Least command increment	deg.	0.001

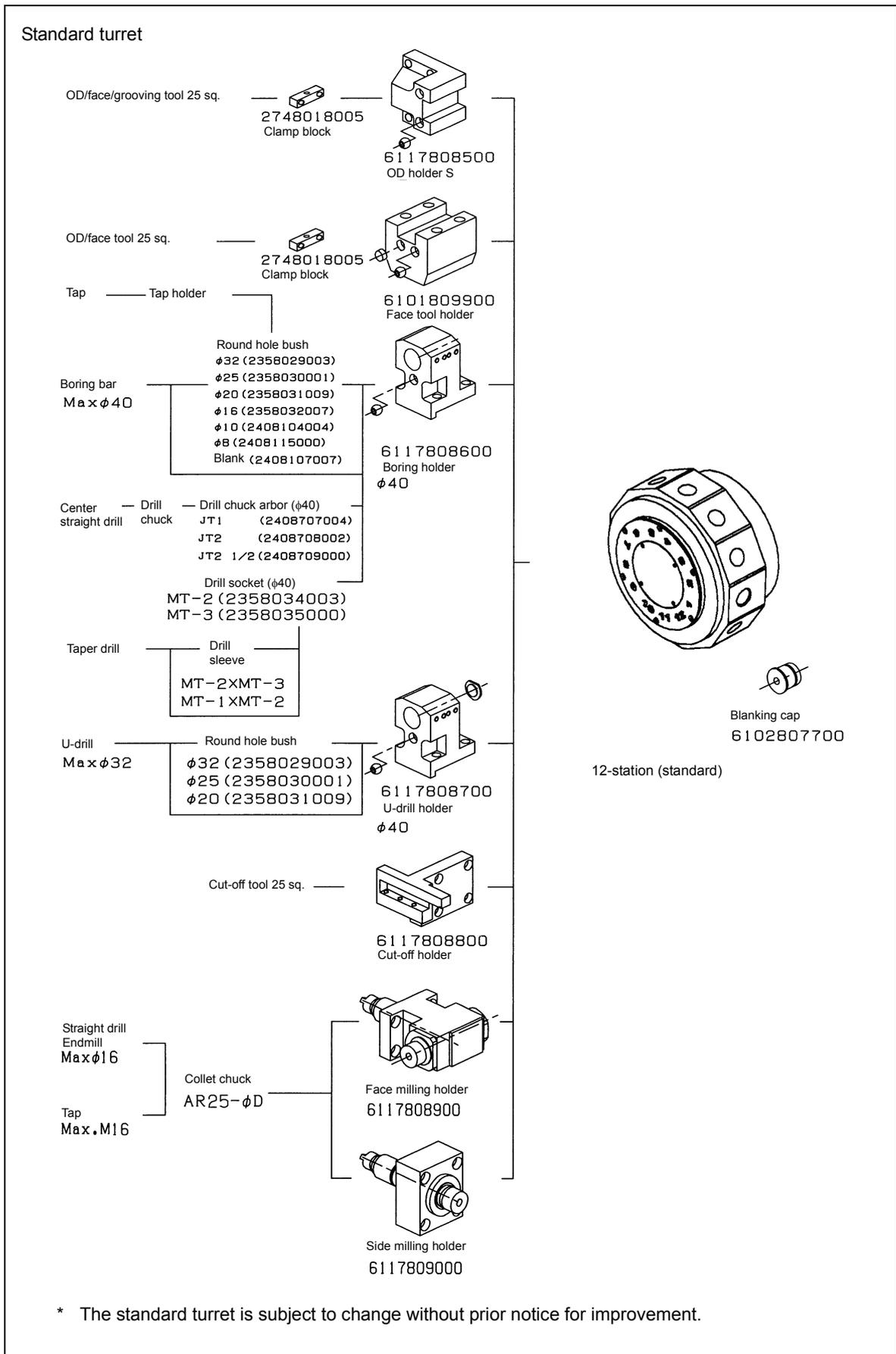
## 4-2 Turret Unit

The turret has 12 stations to mount turning or rotating tools.

Clamping and unclamping motions of the turret are hydraulically controlled.

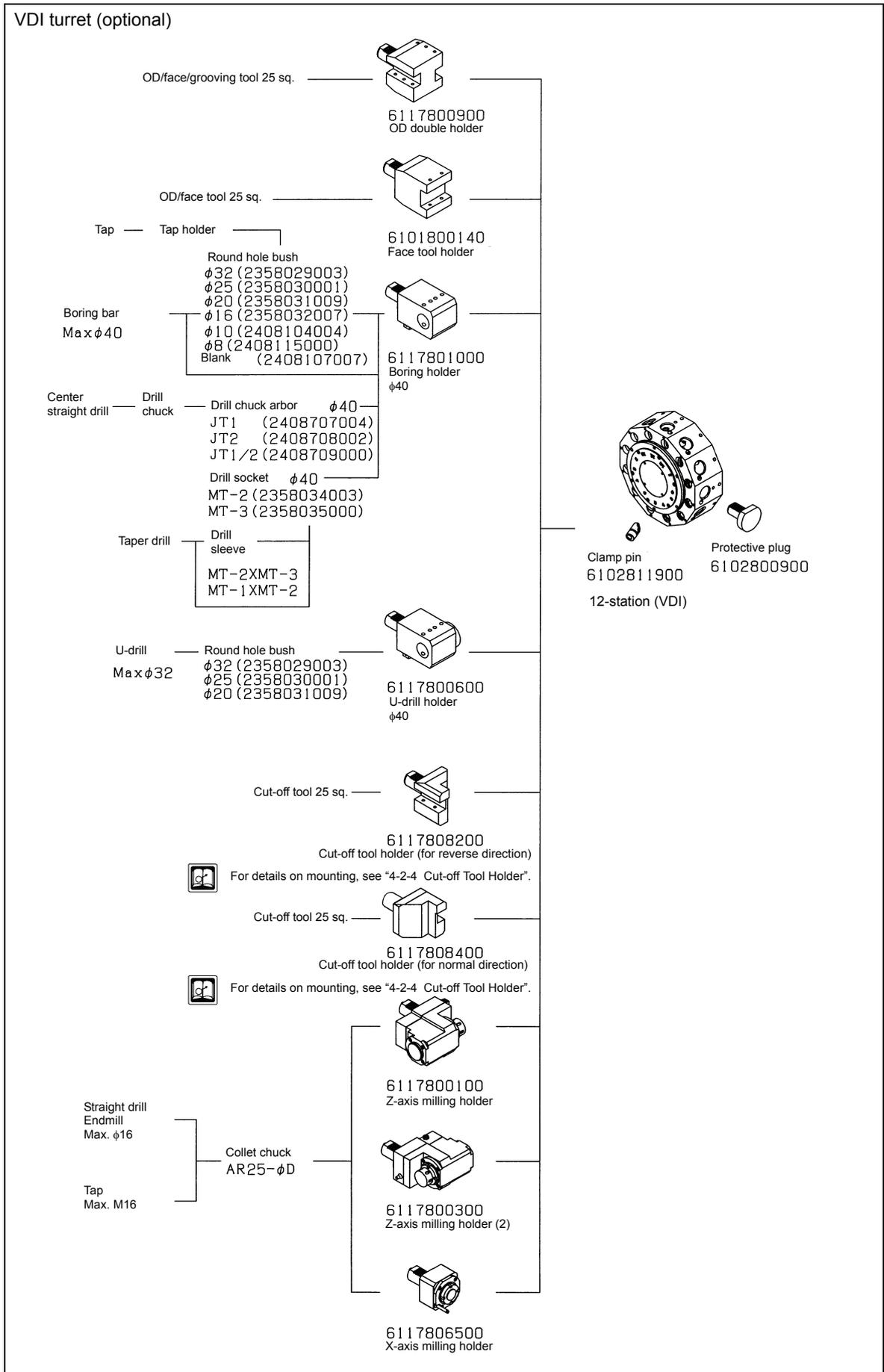
Indexing is driven by a servo motor, and high-speed indexing is assured due to a random selection system.

4-2-1 Tooling System Drawing



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Fig. 11 Tooling system drawing (Standard turret)



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Fig. 12 Tooling system drawing (VDI turret: optional)

### 4-2-2 Turret Interference

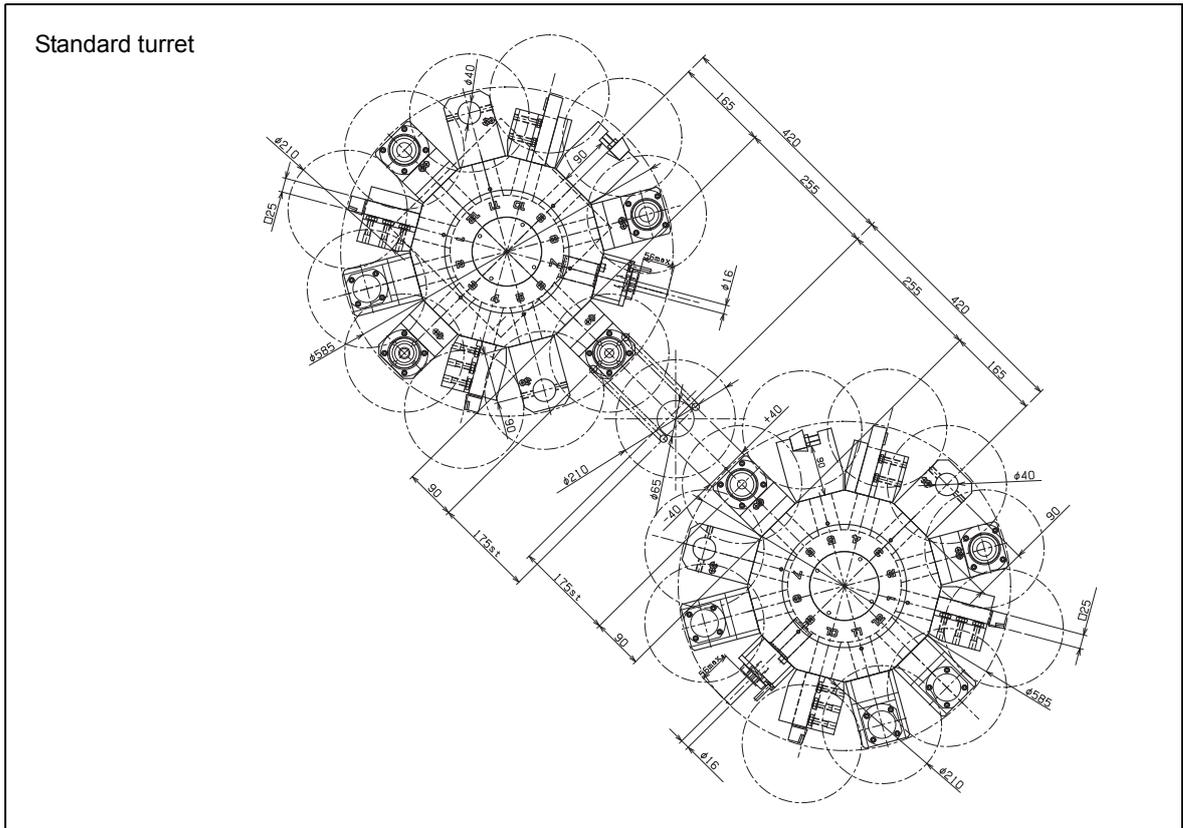


Fig. 13 Tooling interference (standard turret)

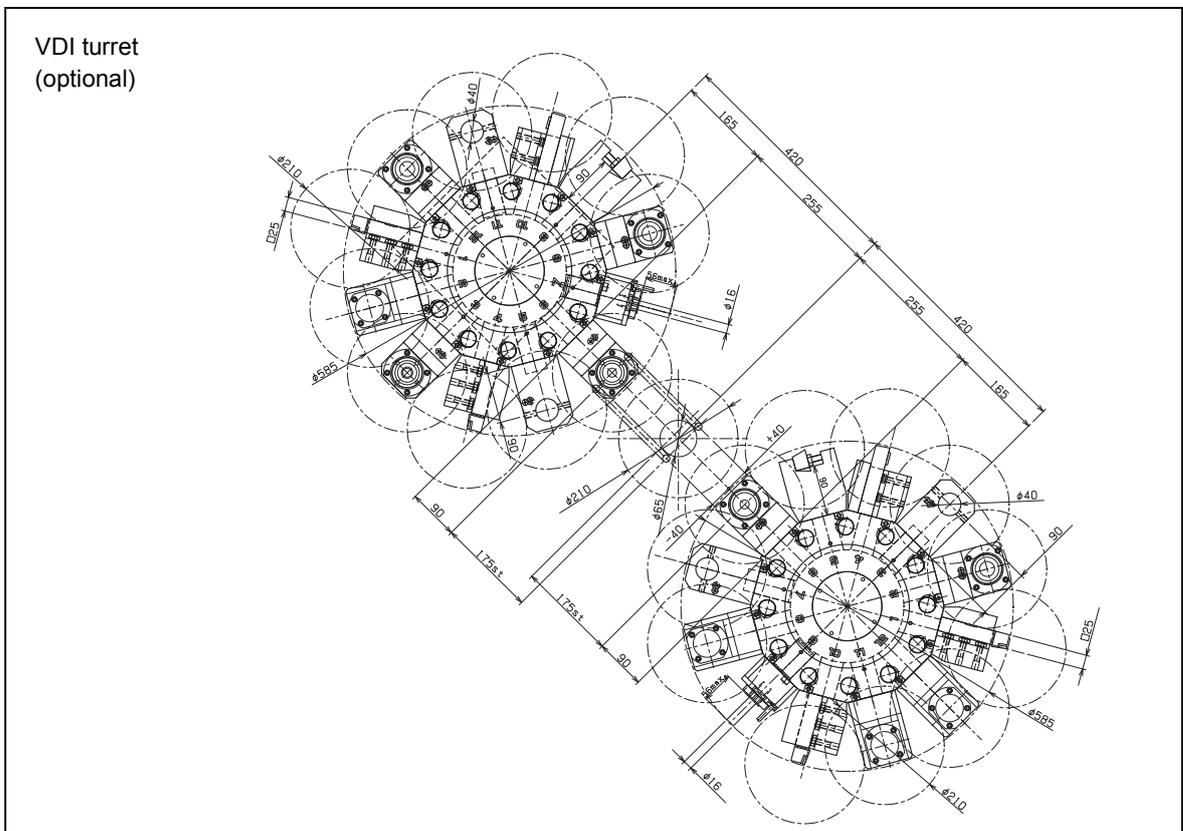


Fig. 14 Tooling interference (VDI turret: optional)

**4-2-3 Power Tool Unit**

Power tools of up to twelve can be mounted on turret 1/2 for secondary machining such as milling, drilling and tapping.

■ Major specifications

Item		Unit	Turret 1/2
Max. number of power tools		pcs	12
Max. rotating speed		min <sup>-1</sup>	4,000
Motor		kW	AC3.7/2.2
Capacity	Drill	mm	Max. φ16
	Endmill	mm	Max. φ16
	Tap	mm	Max. M16

■ Power tool motor output characteristics

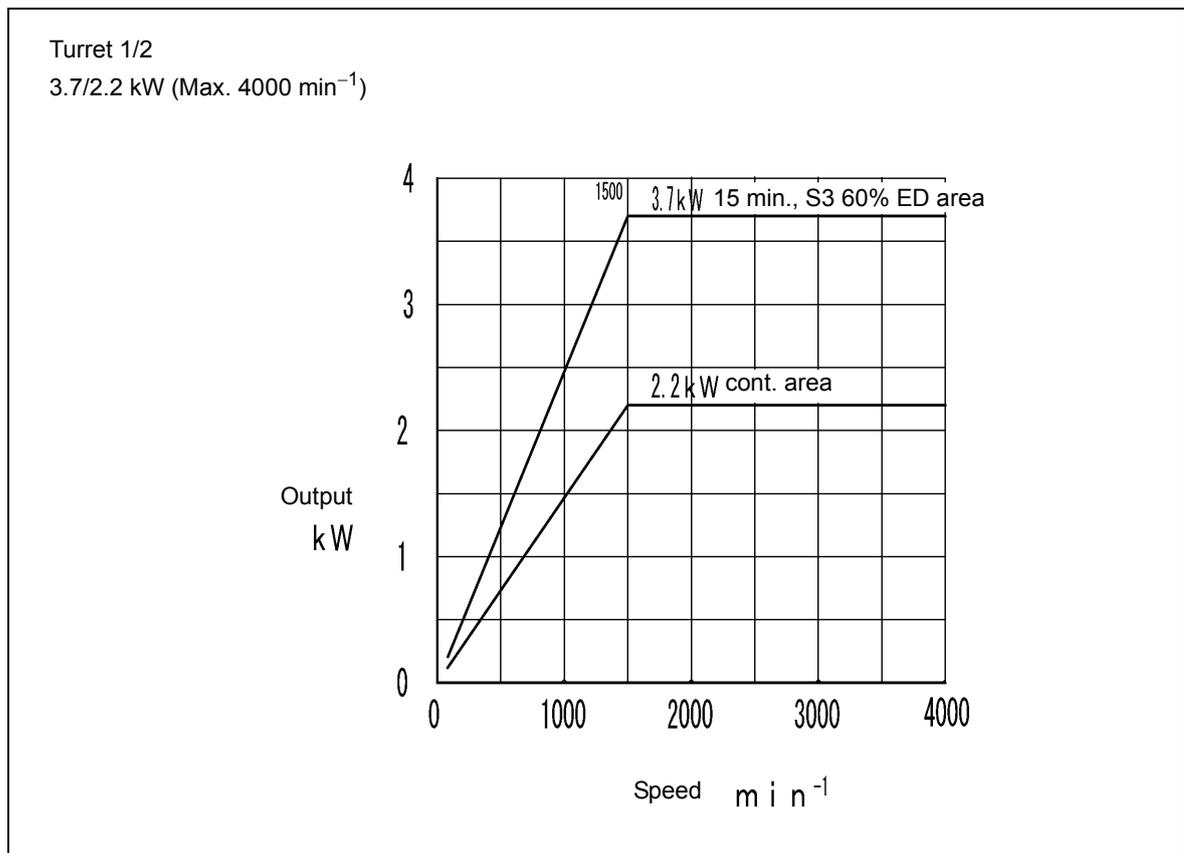
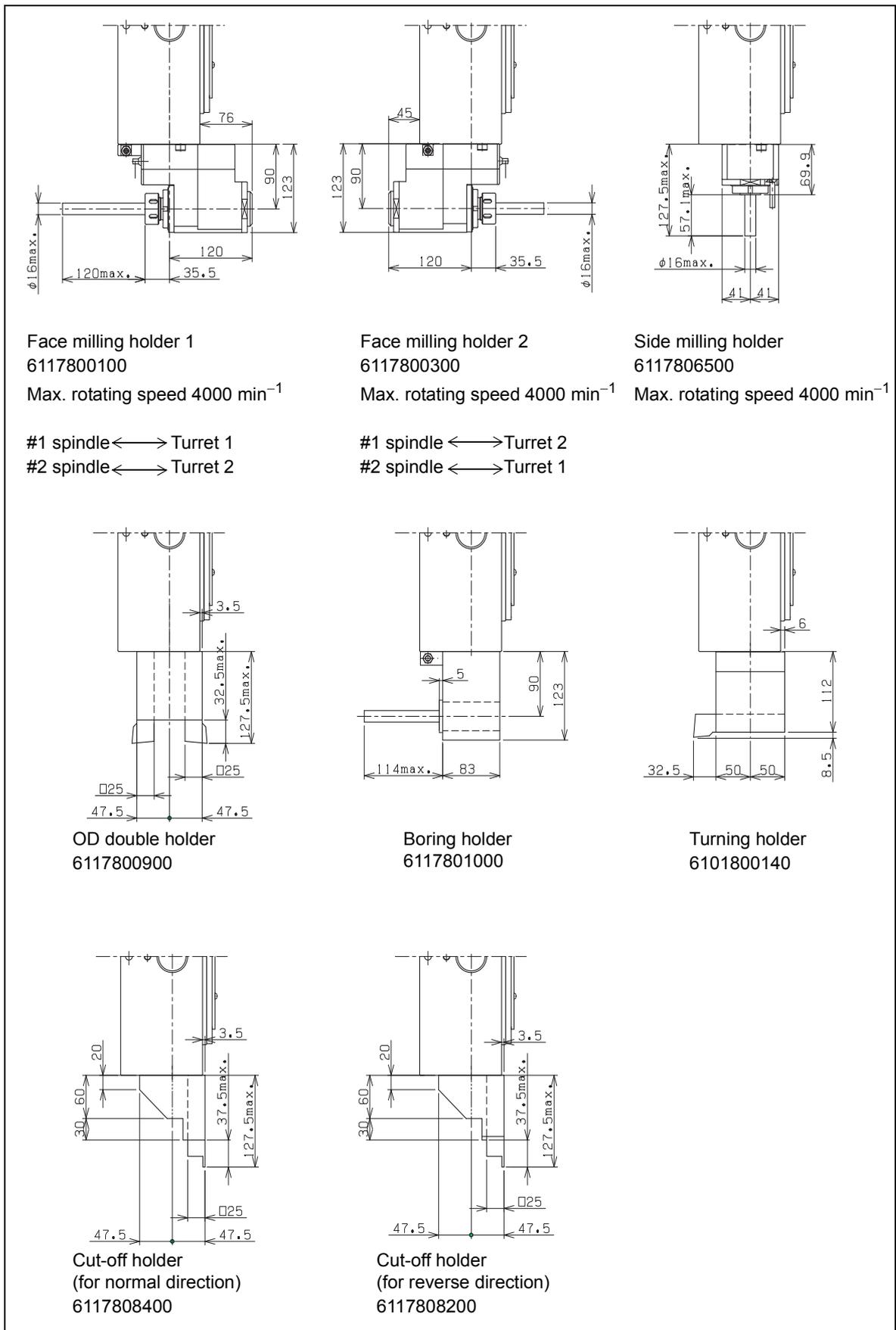


Fig. 15 Power tool motor output characteristics

■ Power tool dimensional drawing (VDI turret: optional)



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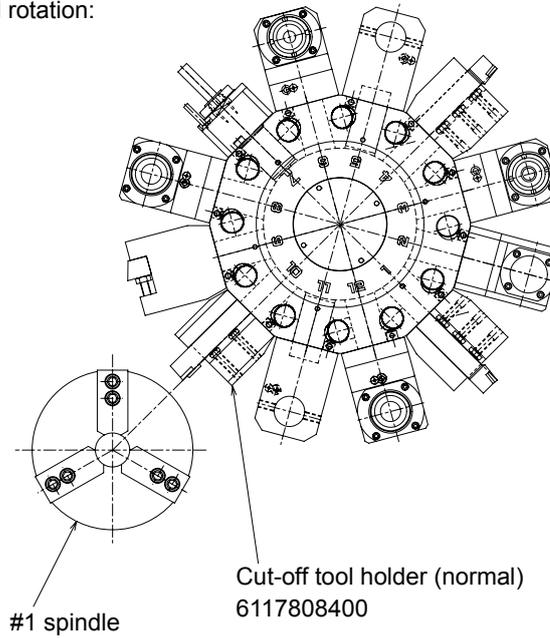
Fig. 16 Power tool dimensional drawing (VDI turret: optional)

**4-2-4 Cut-off Tool Holder**

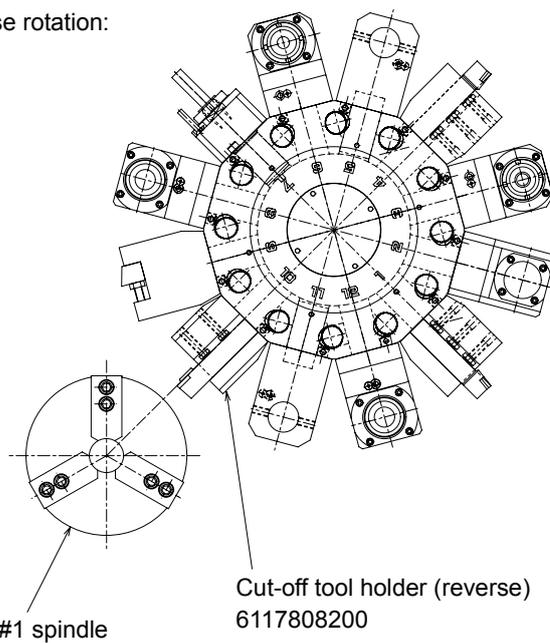
When mounting a cut-off tool holder on the VDI turret (option), check the information given in the following table, and mount it correctly.

	#1 spindle rotation direction	
	Normal rotation	Reverse rotation
Turret 1	Cut-off tool holder (normal) 6117808400	Cut-off tool holder (reverse) 6117808200
Turret 2	Cut-off tool holder (reverse) 6117808200	Cut-off tool holder (normal) 6117808400

For turret 1 with #1 spindle normal rotation:



For turret 1 with #1 spindle reverse rotation:



Euro

Fig. 17

### 4-3 Slide Unit

The X, Z, Y and A axes are driven by AC servo motors via ball screws, thus moving on the slideways.

Max. rapid traverse rate (turret 1/2)

- In the X-axis direction 18 m/min.
- In the Z-axis direction 24 m/min.
- In the Y-axis direction 12 m/min.
- In the A-axis direction 30 m/min.

#### 4-3-1 Stroke Diagram

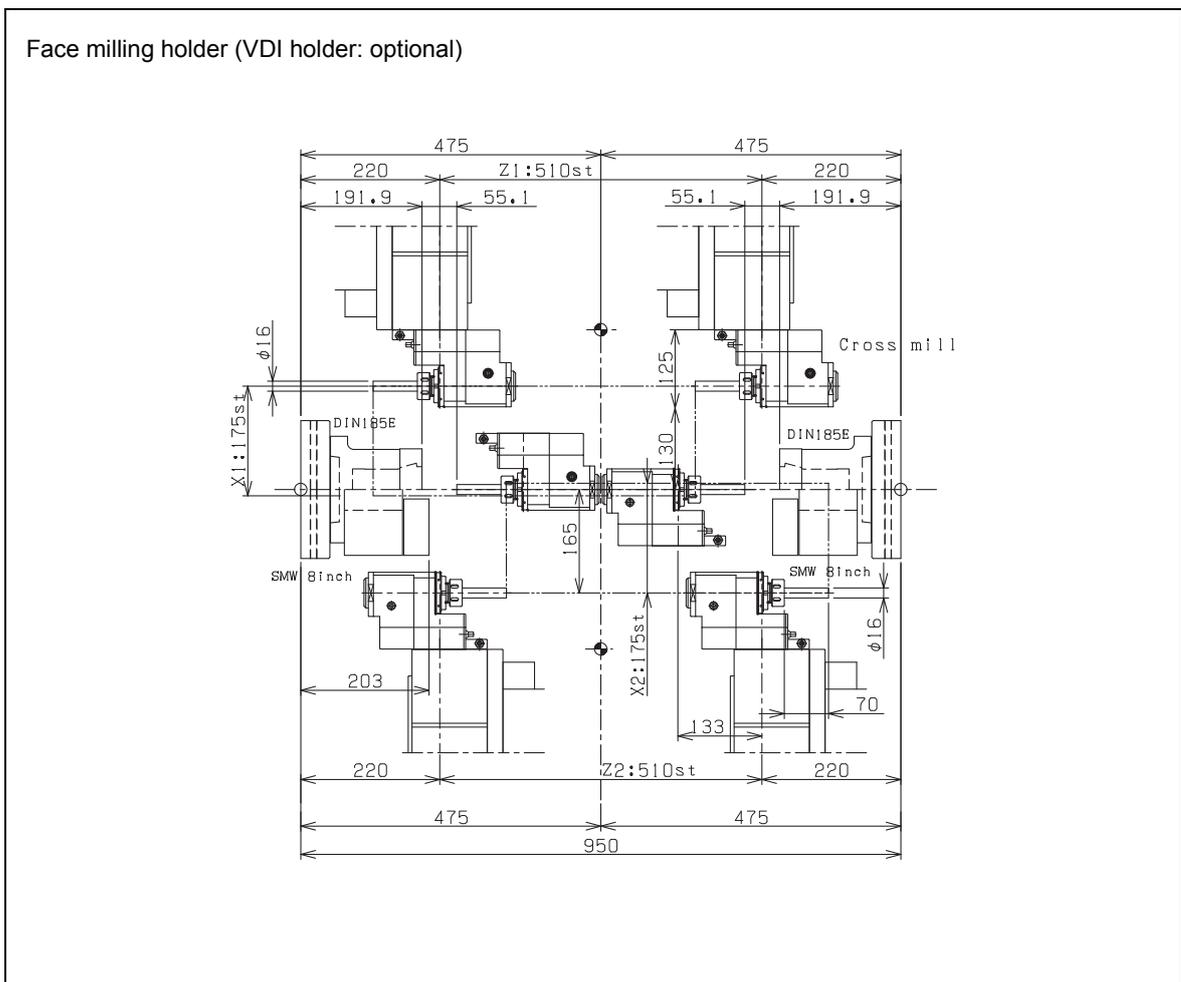


Fig. 18 Stroke diagram 1

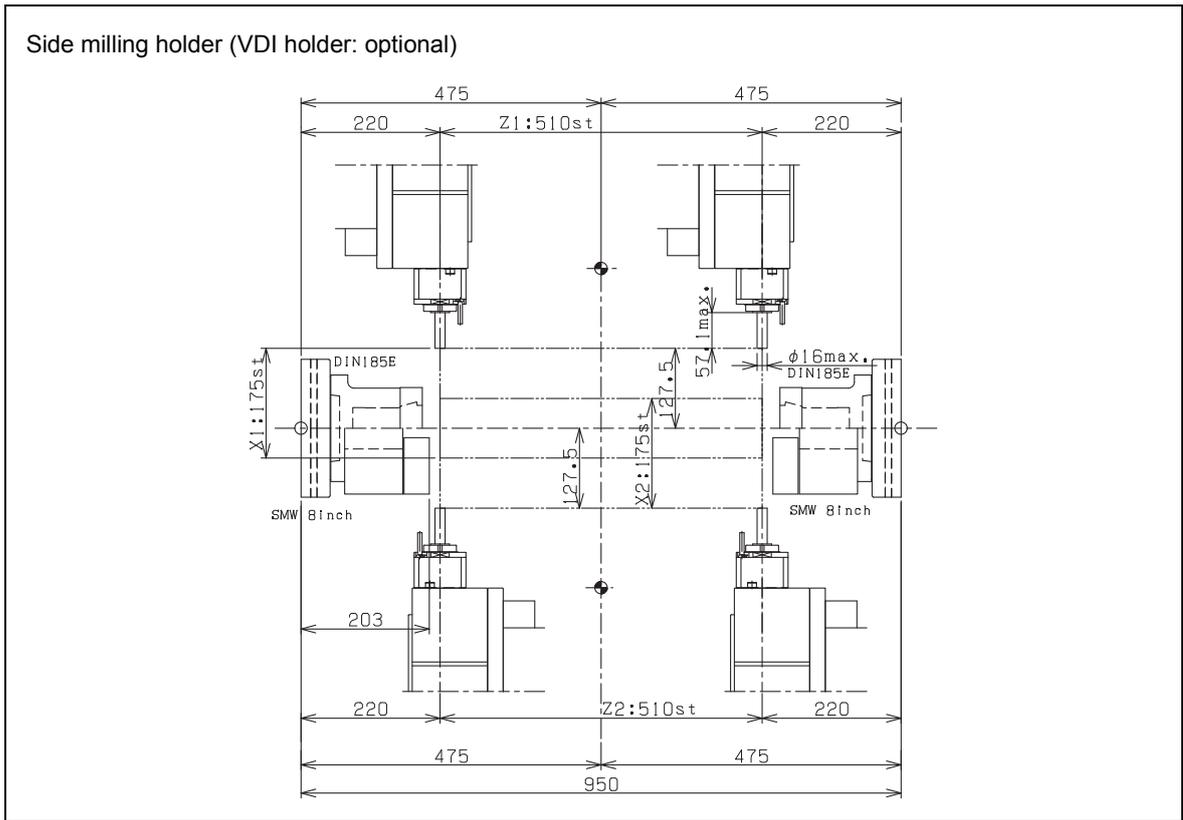


Fig. 19 Stroke diagram 2

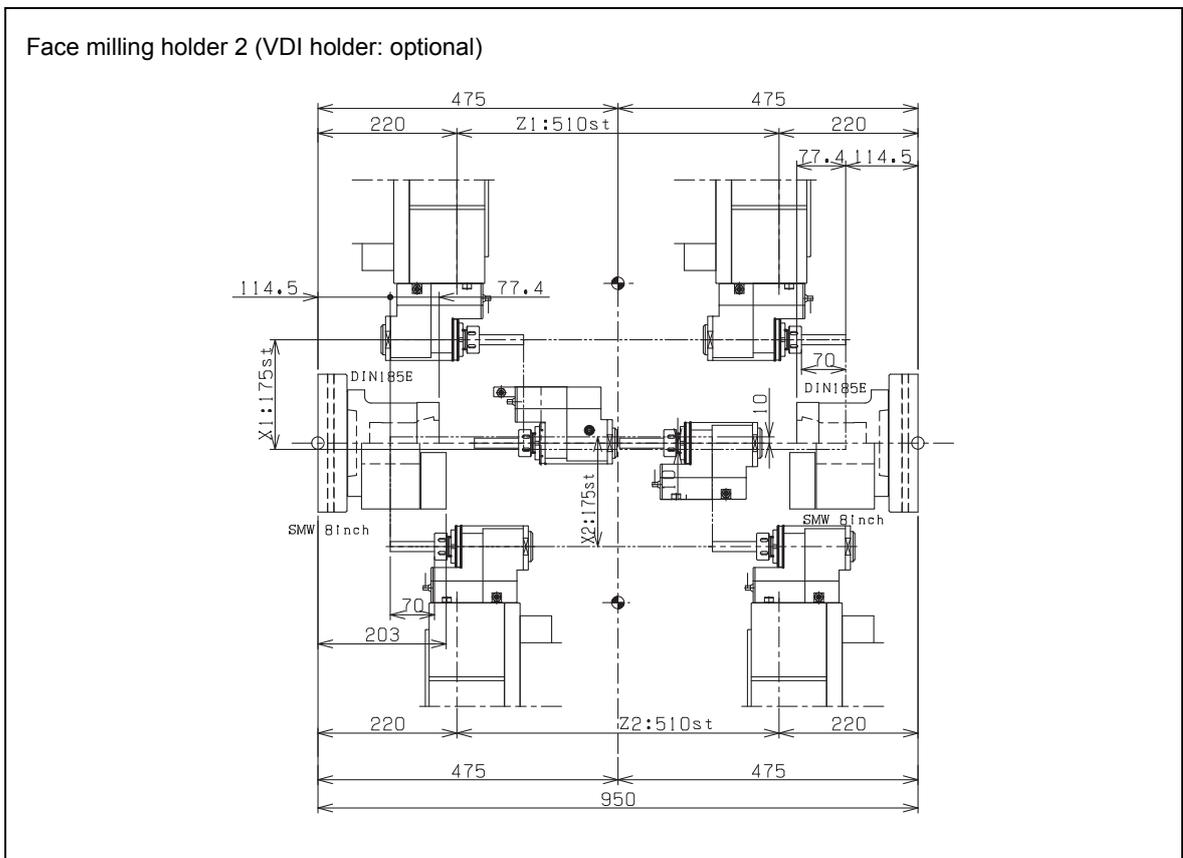


Fig. 20 Stroke diagram 3

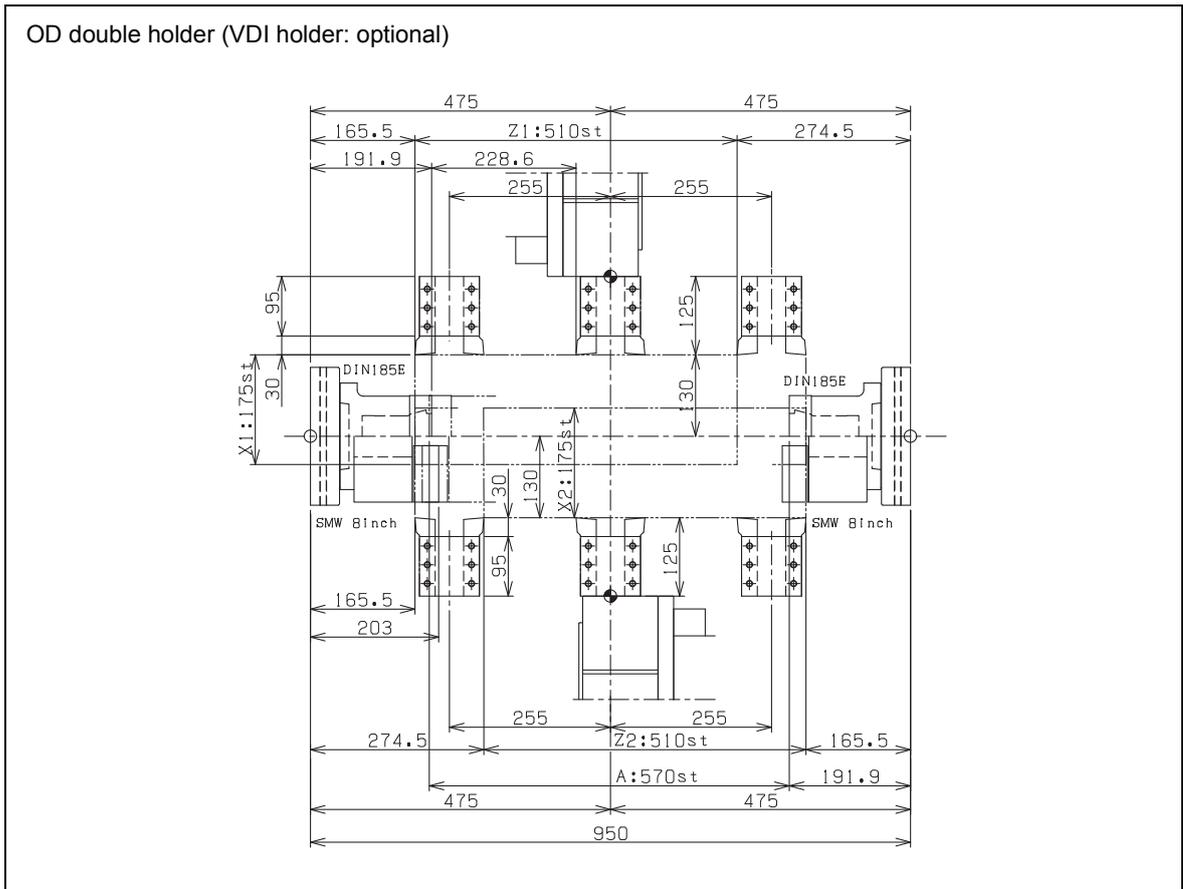


Fig. 21 Stroke diagram 4

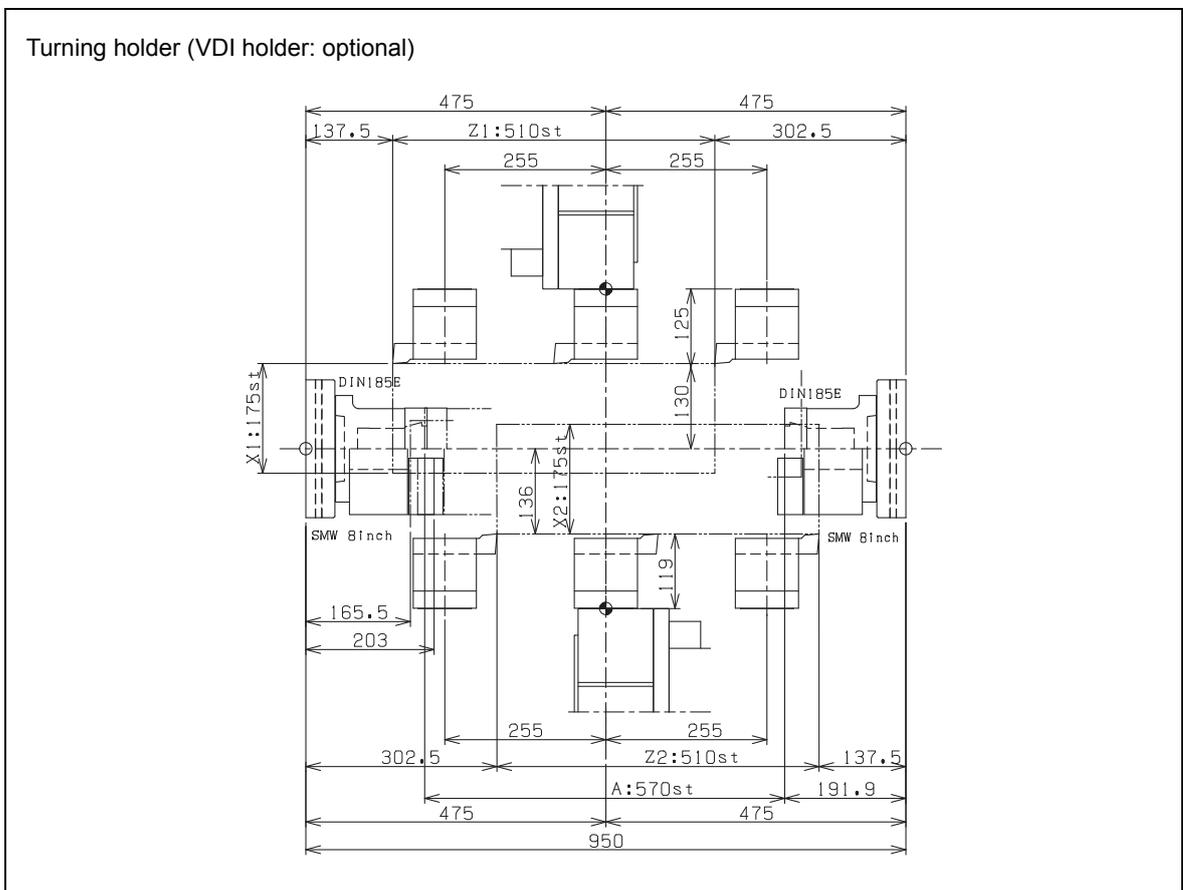


Fig. 22 Stroke diagram 5



## 4-4 Hydraulic Pump Unit

The hydraulic pump is used to drive the spindle chucking cylinder (for clamping and unclamping motions) and the turret (for clamping and unclamping motions)

Tank capacity: 15 lit.

- \* Specifications are subject to change according to the improvement of the machine. Check the types and quantities of parts to be replaced, and place an order with Takamatsu.

### 4-4-1 Assembly Drawing of Hydraulic Pump Unit

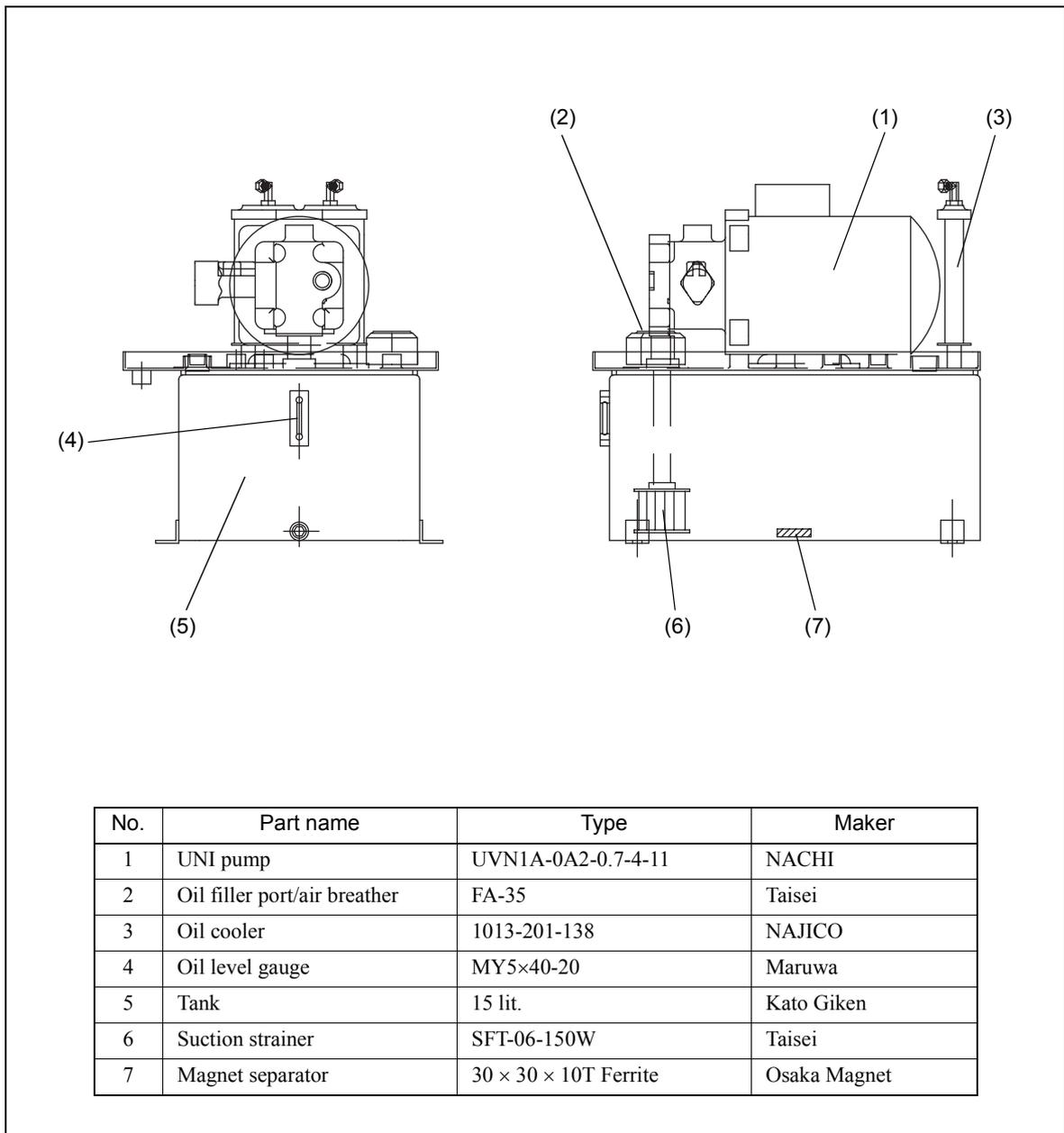


Fig. 25 Hydraulic pump unit

4-4-2 Hydraulic Circuit Diagram

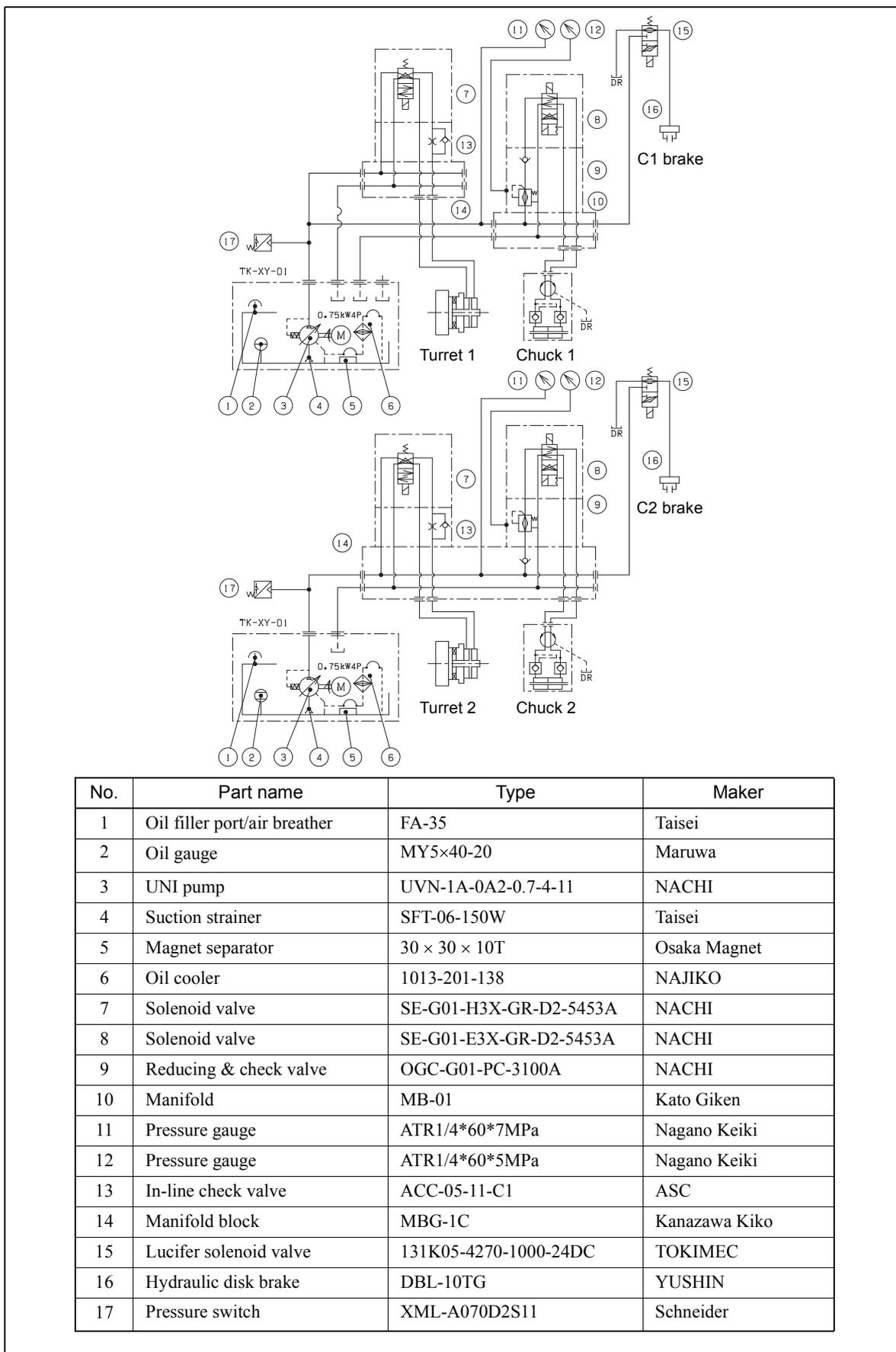


Fig. 26 Hydraulic circuit diagram 1

### 4-4-3 Arrangement of Valves

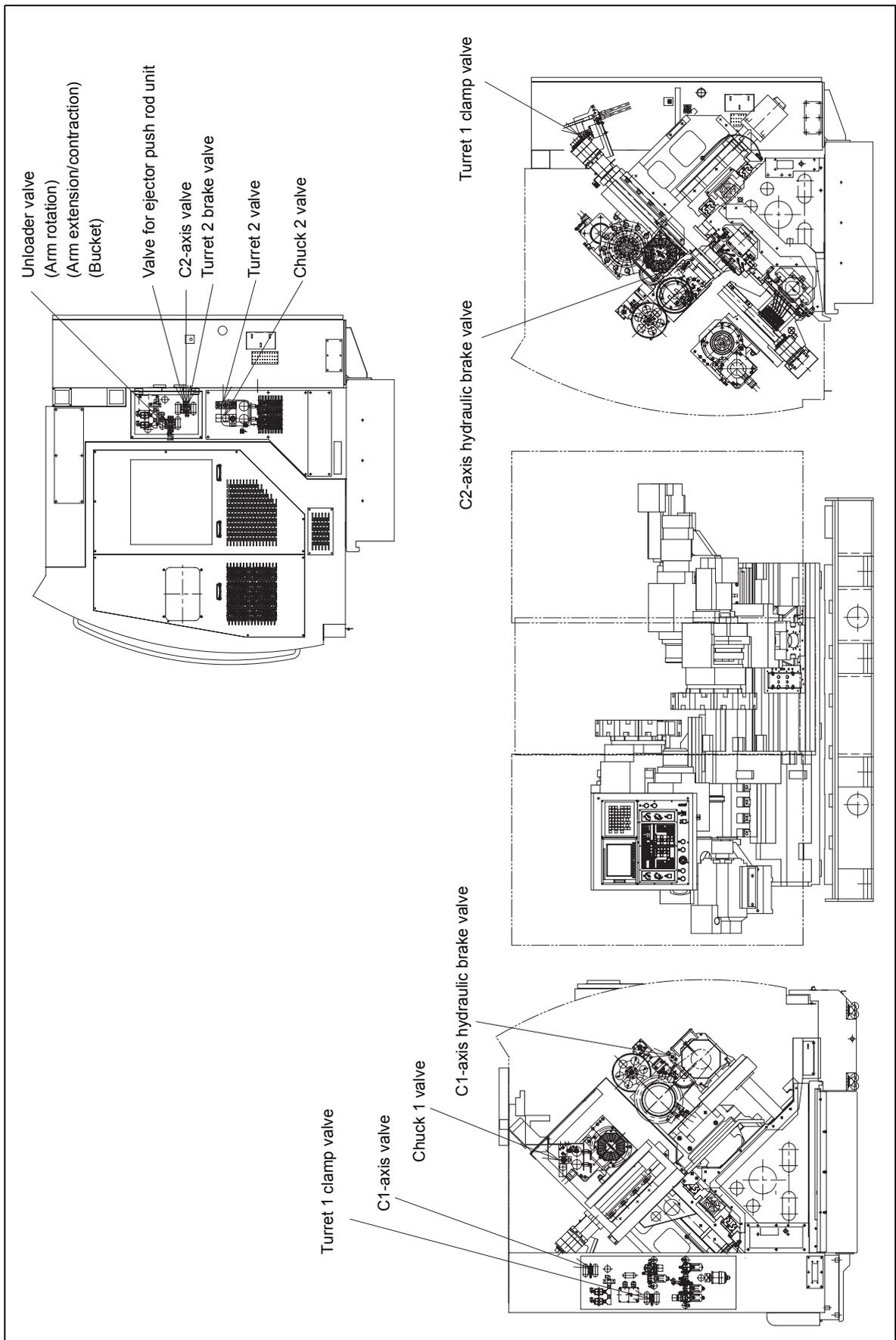


Fig. 27 Arrangement of valves