

MAINTENANCE MANUAL

VERTICAL MACHINING CENTER

FNC 74-A



MAKINO MILLING MACHINE CO., LTD.

SPINDLE HEAD

6FN 10B

(AC MOTOR)

CONTENTS

	Page
1. INTRODUCTION	A - 1
2. SPINDLE DRIVE MECHANISM	A - 2
2.1 Gear Change and Shifter	A - 5
(1) Mechanism	A - 5
(2) Gear combination in speed ranges	A - 7
2.2 Hydraulic Circuit for Shifter	A - 8
2.3 Limit Switches for Shifter	A -10
3. SPINDLE MOTOR	A -12
3.1 Specifications	A -12
3.2 Maintenance	A -12
3.3 Troubleshooting	A -12
4. SPINDLE ORIENTATION MECHANISM	A -15
4.1 Composition	A -15
4.2 Polarity of Magnetic Material	A -16
4.3 Adjustment of Spindle Stop Angle	A -17
5. TOOL CLAMP MECHANISM	A -18
5.1 Mechanism	A -18
5.2 Hydraulic Circuit	A -18
5.3 Air Venting	A -21
5.4 Limit Switches	A -22
6. SPINDLE TAPER CLEANING UNIT	A -23
6.1 Composition	A -23
6.2 Function Each Unit	A -25
6.3 Parts of Each Unit	A -26
6.4 Adjustment	A -28
6.5 Check	A -28

6.6	Disassembly	A -29
7.	DISASSEMBLY AND ASSEMBLY OF MAIN PARTS	A -33
7.1	Tool Clamp Mechanism	A -33
7.2	Shifter	A -36
7.3	First Axile (Fig. 7.5)	A -39
7.4	Intermediate Shaft (Fig. 7.5)	A -39
7.5	Spindle	A -41

FEED MECHANISM

6FN 20A

CONTENTS

	Page
1. INTRODUCTION	B - 1
2. FEED DRIVE MECHANISM	B - 2
2.1 Composition	B - 2
2.2 Mechanism	B - 3
2.3 Pre-load of Ball Screw	B - 6
3. GIB MOUNTING POSITION AND ADJUSTMENT	B - 8
3.1 X Axis	B - 8
3.2 Y Axis	B - 9
3.3 Z Axis	B -10
4. BACKLASH COMPENSATION	B -11
4.1 Principle	B -11
4.2 Backlash Measurement	B -12
4.3 Removing the Backlash	B -13
5. PITCH ERROR COMPENSATION	B -14
6. MACHINE ZERO POINT AND MOVEMENT RANGE SETTING	B -15
6.1 Machine Zero Point	B -15
6.2 Zero Return	B -16
6.3 Movement Range Setting	B -17
7. FEED AXIS LIMIT SWITCHES	B -19
8. LUBRICATING UNIT	B -21
8.1 Specifications	B -21
8.2 Name of Each Part	B -22
8.3 Construction and Operating Principle	B -23
8.4 Delivery Rate	B -26
8.5 Replacement of Suction Filter	B -27
9. LUBRICATION OF X-AXIS BALL SCREW	B -28
10. REPLACEMENT OF FEED MOTOR CARBON BRUSH	B -29

TOOL CHANGER

6FN 120A

CONTENTS

	Page
1. INTRODUCTION	C - 1
2. MECHANISM AND ADJUSTMENT	C - 2
2.1 Arm IN-OUT	C - 2
2.2 Arm Swing	C - 2
2.3 Arm Gripper Lock	C - 3
2.4 Index of Tool Magazine	C - 3
2.5 Swing of Tool Pot	C - 4
2.6 Tool Clamp-Unclamp in Pot	C - 5
2.7 Mounting of ATC Unit	C - 5
3. HYDRAULIC CIRCUIT	C -14
4. CONTROL SEQUENCE	C -15
5. HYDRAULIC EQUIPMENT AND FIXED TERMINAL BOARD	C -16
5.1 Mounting Positions	C -16
5.2 Setting of Operating Speed	C -18
6. LIMIT SWITCHES	C -19
6.1 Mounting Positions and Functions	C -19
6.2 Mounting Method	C -21
6.3 Tool Pot Count System	C -23
7. PERIODIC MAINTENANCE	C -24

HYDRAULIC UNIT

1VN 130A

CONTENTS

	Page
1. INTRODUCTION	D - 1
2. HYDRAULIC CIRCUIT AND MAIN COMPONENTS	D - 2
3. MOUNTING POSITION OF MAIN COMPONENTS	D - 4
4. MAINTENANCE	D - 5
4.1 Daily Maintenance	D - 5
4.2 Periodic Maintenance	D - 6
(1) Replacing the hydraulic oil	D - 6
(2) Cleaning the reservoir	D - 7
5. FUNCTIONS AND CONSTRUCTIONS OF MAIN COMPONENTS	D - 8
5.1 Motor Pump	D - 8
(1) Construction	D - 8
(2) Operation of pressure compensator	D -10
(3) Adjusting method	D -12
(4) Disassembling	D -13
(5) Inspection of parts	D -16
(6) Assembling	D -17
5.2 Filter	D -21
(1) Construction	D -21
(2) Cleaning and replacing the element	D -24
5.3 Solenoid Valve K-DSG-01-3C4-D24 (Yuken Kogyo)	D -26
5.4 Oil Supply Port Breather UC-AB-1163-40 (Yuken Kogyo)	D -28
5.5 Fixed Terminal Board TBD-10P (Todensha)	D -28
6. TROUBLESHOOTING	D -29
6.1 Problem 1	D -29
6.2 Problem 2	D -30
6.3 Problem 3	D -31

SPINDLE TEMPERTAURE CONTROLLER

1VNE 3A

CONTENTS

	Page
1. INTRODUCTION	E - 1
2. SPECIFICATIONS	E - 2
3. OPERATING PRINCIPLE	E - 4
4. ELECTRIC CIRCUIT	E - 6
5. CLEANING OF CONDENSER	E - 8
6. TROUBLESHOOTING	E - 9
7. LINE FILTER (TYPE 50-06-40-R-L)	E - 12
7.1 Construction	E - 12
7.2 Cleaning the Filter	E - 13

DIAGNOSTIC

AND

ALARM

CONTENTS

	Page
1. OVERVIEW	1
2. DIAGNOSTIC FACILITY	1
2.1 Display Mode of Diagnostic Facility (Seven-segment Display Board)	1
2.2 Use of Diagnostic Facility	2
2.3 Menu of Diagnostic Facility	2
2.3.1 Diagnosis number 00	2
2.3.2 Error codes	3
2.3.3 Diagnostic input (DI) ports	4
2.3.4 Diagnostic output (DO) ports	4
2.3.5 Diagnosis number 99	5
3. ALARM DISPLAY FACILITY	5
3.1 Display Mode of Alarm Display Facility (Seven-segment Display)	5
3.2 Use of Alarm Display Facility	6
3.3 Menu of Alarm Display Facility	7
3.3.1 Alarm class number 1	7
3.3.2 Alarm class number 2	7
3.3.3 Alarm class number 3	8
3.4 Alarm Display List	9