

MITSUBISHI

WIRE CUT ELECTRIC DISCHARGE MACHINE

〈F-1 Series〉

OPERATION MANUAL-1

GENERAL CONTENTS

1. SYSTEM DESCRIPTION
2. EXPLANATION OF MECHANICAL SYSTEM
(DWC70, 90, 110 AND 200)
3. EXPLANATION OF DIELECTRIC RESERVOIR
4. DESCRIPTION OF POWER SUPPLY UNIT G15F AND MACHINING
CHARACTERISTIC DATA
5. EXPLANATION OF CONTROL UNIT (W5F)
6. WIRE CUT EDM PROGRAMMING MANUAL
7. OPERATION PROCEDURE AND MACHINING METHOD
8. AUTOMATIC SELECTION FUNCTION OF MACHINING CONDITION
(TYPE II)
9. DESCRIPTION OF OTHER FUNCTIONS
10. MAINTENANCE AND INSPECTION OF MECHANICAL SYSTEM
WEAR PARTS LIST
11. MAINTENANCE AND INSPECTION (W5F)
12. DATA OF WIRE ELECTRODE

1 SYSTEM DESCRIPTION

CONTENTS

SYSTEM DESCRIPTION

1.	CONFIGURATION	1-1
2.	SPECIFICATIONS	1-2
2.1	Machine Unit	1-2
2.2	Power Supply Unit	1-3
2.3	W5F-type CNC System	1-4
3.	INSTALLATION	1-11
3.1	Installation Layout	1-11
3.2	Installation Location	1-11
3.3	Power Source	1-12
3.4	Layout drawings	1-17
3.5	External Dimension Drawings	1-21

2 EXPLANATION OF MECHANICAL SYSTEM

DWC70, 90, 110 AND 200

CONTENTS

	PAGE
1. NAME AND FUNCTION OF MACHINE UNIT	2-1
1-1 Machine Unit (DWC 70)	2-1
1-2 Machine Unit (DWC 90)	2-2
1-3 Machine Unit (DWC 110)	2-3
1-4 Machine Unit (DWC 200)	2-4
2. OPERATION PROCEDURE	2-5
2-1 Wire Loading	2-5
2-2 Setting the Work	2-10
2-3 Cleaning the Lower Wire Guide	2-10
2-4 Replacing the Die for Electric Current Supply to Wire	2-10
2-5 Mounting the Diamond Die	2-11
2-6 Flushing the Dielectric Fluid	2-11
2-7 Wire Electrode Alignment	2-12
2-8 Mounting Method of Upper Water-mist Rubber Cover..	2-14
2-9 Setting the Large Work	2-20
2-10 How to Use the Positioning Pin (Accessory) (In case of DWC 110 and 200)	2-24
3. ACCESSORIES TO MECHANICAL SYSTEM	2-25
3-1 DWC 70	2-25
3-2 DWC 90	2-26
3-3 DWC 110	2-27
3-4 DWC 200	2-28

3 EXPLANATION OF DIELECTRIC RESERVOIR

CONTENTS

	PAGE
1. NAME OF EACH PART OF DIELECTRIC RESERVOIR	3-1
2. OPERATION OF DIELECTRIC RESERVOIR	3-4
3. MAINTENANCE	3-17

4 DESCRIPTION OF POWER SUPPLY UNIT G15F
AND MACHINING CHARACTERISTIC DATA

CONTENTS

	Page
1. GENERAL DESCRIPTION	1
(1) Features	1
(2) Basic configuration	2
2. OPERATION	3
(1) Nomenclature	3
(2) Pilot lamps	3
(3) Knobs on the operation panel	4
(4) Switches on the operation panel	5
(5) Meters on the operation panel	6
3. AUTOMATIC VOLTAGE REGULATOR	7
4. MACHINING CONDITION SETTING METHOD	8
(1) Voltage selector	8
(2) Power setting	8
(3) OFF time	8
(4) Stabilizer A	9
(5) Stabilizer B	9
(6) Mean machining voltage	9
(7) Wire tension, wire speed	10
(8) Dielectric fluid flow rate.....	10
(9) Meter relay	10
5. PRECAUTIONS IN MACHINING	11
(1) Initial condition setting	11
(2) Thickness difference of workpieces	11
(3) Others	12

MACHINING CHARACTERISTIC DATA

[SKD-11]	13
Wire electrode ϕ 0.15 mm (OB-15P)	14
Wire electrode ϕ 0.2 mm (OB-20P)	23
Wire electrode ϕ 0.25 mm (OB-25P)	36
Wire electrode ϕ 0.3 mm (OB-30P)	45
[COPPER]	54
Wire electrode ϕ 0.2 mm (OB-20P)	55
Wire electrode ϕ 0.25 mm (OB-25P)	68
Wire electrode ϕ 0.3 mm (OB-30P)	77
[HARD ALLOY]	86
Wire electrode ϕ 0.2 mm (OB-20P)	87
G15F POWER SUPPLY STANDARD FOR SETTING OF MACHINING CONDITION	96

5 EXPLANATION OF CONTROL UNIT (W5F)

CONTENTS

1.	PREFACE.....	5-1
2.	W5F1 COMPONENT NAMES	5-2
3.	SET/DISPLAY BOARD FUNCTIONS	5-3
4.	SET DISPLAY FUNCTIONS	5-11
4.1	Set and Display Switches	5-12
4.2	Universal Display	5-13
4.3	Command Display	5-13
4.4	Manual Data Input (M.D.I.)	5-15
4.5	Wire Diameter Correction Value Set/display (OFFSET)..	5-16
4.6	Parameter Setting (SETTING)	5-16
4.7	Sequence Number Search (SEARCH).....	5-21
4.8	Position Display (POSITION)	5-22
4.9	Alarm Contents Display (ALARM).....	5-22
4.10	Input/Output Interface Check (I/F CHECK)	5-23
4.11	Tape Edit	5-29
5.	NC OPERATION BOARD	5-33
5.1	Power Failure Recovery (Manual)	5-37
5.2	Automatic Positioning	5-38
5.3	XY Simultaneous Display	5-39
5.4	Tape Reader Winder (Optional)	5-40
5.5	Locus Calculation	5-40
5.6	Memory Operation	5-40
5.7	Automatic Vertical Positioning (Attached to Taper Cutting Device)	5-40
5.8	Automatic Power Failure Recovery (Optional)	5-42
5.9	Automatic Offset	5-43

5.10 Override and Dry-run (Optional)	5-46
5.11 Automatic Workpiece Tilt Compensation	5-46
6. TAPE READER UNIT	5-47
6.1 Tape Reader	5-47
6.2 Tape Case	5-53
6.3 Winder Unit (Optional)	5-54
7. SYSTEM TAPE LOADING METHOD	5-61
8. SPARE PARTS LIST (Including G15F)	5-64

6

6 MITSUBISHI WIRE CUT ELECTRIC DISCHARGE MACHINE

PROGRAMMING MANUAL

CONTENTS

1.	PREFACE	6- 1
2.	PROGRAMMING	6- 1
3.	COMMAND TAPE	6- 3
4.	PROGRAMMING PROCEDURE	6-11
5.	WORD COMMAND FORMATS	6-17
5.1	Sequence Number : Nddd	6-17
5.2	Coordinate Words X, Y, I, and J	6-19
5.3	Feed Speed Command : Fddddd	6-26
5.4	Preparation Function Gdd	6-28
5.4.1	Position command (G00)	6-30
5.4.2	G01 (Straight line interpolation command)	6-31
5.4.3	G(0) 2 (circular arc interpolation clockwise) and G03 (circular arc interpolation counterclockwise)	6-32
5.4.4	G04 (dwell command)	6-34
5.4.5	G20 to G24 (memory cycle)	6-34
5.4.6	Plot rotation	6-38
5.4.7	G40, G41, and G42 (wire diameter compensation)	6-41
5.4.8	Wire compensation of cross-point calculation type	6-50
5.4.9	Taper process function	6-54
5.4.10	G28 (G60) Automatic zero return function	6-61
5.4.11	G90/91 (Absolute/incremental switching command)	6-63
5.4.12	G92 (25) (Coordinate system set command)	6-64
5.4.13	G93/94/95/96 (Mirror image command)	6-64

5.5	Auxiliary Function Mdd	6-64
5.6	Scale Magnification Factor Sddddd Command	6-67
5.7	Auxiliary Input Function Hdd or Hddd	6-68
5.8	Machining Condition Automatic Selection Edddddd Command	6-68
5.9	Address Adddd	6-69
5.10	Address Pdd	6-69
5.11	Address Kdddddd	6-69
6.	SPECIAL CODE OPERATION METHODS	6-70
6.1	EOB Code	6-70
6.2	EOR Code	6-70
6.3	Insignificant Information on Tape	6-71
7.	PROGRAMMING CHECK FUNCTIONS	6-75
7.1	Parity Check	6-75
7.2	Program Error Check	6-80

7 OPERATION PROCEDURE AND MACHINING METHOD

1.	HOW TO TURN POWER "ON" AND DRIVE TABLE	7-2
1-1	Power Supply ON	7-2
1-2	How to Drive Table	7-3
1-2-1	How to drive table manually	7-3
1-2-2	How to drive table by remote control (pendant)	7-6
1-2-3	How to drive table by manual data input (M.D.I).....	7-7
1-2-4	How to check the current position	7-9
2.	OPERATION OF CONTROL UNIT	7-10
2-1	Positioning Operation by Manual Data	7-10
2-1-1	Incremental method	7-10
2-1-2	Absolute value method	7-13
2-2	How to Plot	7-18
2-3	How to Apply the Magnification	7-19
2-4	How to Apply the X Mirror Image	7-21
2-5	How to Apply the Y Mirror Image	7-22
2-6	How to Apply the X-Y Mirror Image	7-24
2-7	How to Cancel the Mirror Image	7-25
2-8	How to Apply the Axis change.....	7-27
2-9	How to Cancel the Axis change.....	7-28
2-10	How to Combine the Mirror Image and Axis change	7-30
2-11	How to Input Offset	7-30
2-12	How to Make Offset Inputs in a Sequence from H1	7-33
2-13	Specification of "F" (machining speed) by Manual Data Input	7-36

3.	PREPARATION AND ADJUSTMENT	7-39
3-1	How to Load Wire	7-39
3-2	How to Mount Wire Reel (Bobbin)	7-43
3-3	Selection of Wire, Wire Tension and Speed	7-45
3-3-1	Selection of wire	7-45
3-3-2	How to adjust wire tension	7-47
3-3-3	Work piece thickness and wire feed rate	7-50
3-4	How to Set alignment	7-52
3-5	How to Set Upper Head	7-54
3-6	How to Perform Positioning	7-55
3-6-1	How to set work piece and adjust parallelism	7-55
3-6-2	Automatic centering	7-58
3-6-3	Automatic plane positioning	7-60
4.	HOW TO ADJUST THE FLOW OF DIELECTRIC FLUID	7-63
5.	HOW TO ADJUST SPECIFIC RESISTANCE OF DIELECTRIC FLUID	7-65
6.	SELECTION OF MACHINING CONDITION.....	7-67
6-1	Layout of Machining Power Supply Unit Operation Panel	7-67
6-2	Selection of Electrical Conditions	7-73
6-3	Specific Resistance of Dielectric Fluid	7-74
7.	HOW TO SET THE MACHINING CONDITIONS.....	7-76
7-1	Average Machining Voltage and Machining Speed Setting Procedure (In the case of machining at the adaptive control ON)...	7-77

7-2	Setting Procedure of Machining Speed for Machining at Adaptive Control Off (average machining speed)	7-92
7-3	How to Determine the Offset Value	7-96
8.	MACHINING BY NC TAPE (ACTUAL MACHINING)	7-99
8-1	Standard Machining Operation Flow	7-99
8-2	Pattern Check	7-101
8-3	Wire and Work Piece Positioning	7-102
8-4	Machining Procedure.....	7-104
8-5	Stop during Machining.....	7-115
8-6	Change of Machining Speed F during Machining	7-116
9.	APPLIED OPERATION	7-119
9-1	Procedure to be Performed for Power Failure	7-119
9-1-1	Manual procedure for power failure	7-119
9-1-2	Automatic recovery (Option)	7-121
9-2	Remachining after Wire Break	7-122
9-3	Travel Operation for pitch Machining, Progressive Machining	7-128
9-4	How to Perform Manual Machining (without use of NC tape)	7-132
9-5	Machining by Memorized Run	7-135
9-6	Automatic Setting of Wire Perpendicularity (optional)	7-136
9-7	How to Determine Offset Value Automatically	7-138

10.	REFERENCE DATA	7-144
10-1	How to Load System Tape	7-144
10-2	Parity Check (Vertical Parity) Setting	7-146
10-3	How to Designate the ISO and EIA codes ..	7-149
10-4	How to Designate Millimeter and Inch	7-153
10-5	How to Input Backlash Compensation Volume	7-154
10-6	How to Perform Tape Search	7-158
10-7	Self-diagnosis Indication	7-161
11.	PERIPHERAL ECHNOLOGY	7-164
11-1	Jigs and Tools	7-164
11-2	Preparation of Work Piece	7-166
11-3	Heat Treatment on Work Piece for Wire Cut Electrical Discharge Process	7-168
11-4	Machining by Wire Cut Electrical Discharge Machine	7-170
11-5	Role of Water in Wire Cut Electrical Discharge Machine	7-174
11-6	Cause of Wire Break	7-177
11-7	Maintenance of Wire Guide	7-184
11-8	Prevention of Dielectric Fluid from Dispersion	7-188
11-9	Notes on Machining	7-192

8 INSTRUCTION MANUAL OF AUTOMATIC SELECTION FUNCTION
OF MACHINING CONDITION (TYPE II)

CONTENTS

	(Page)
1. OUTLINE	8-1
2. FUNCTIONAL COMPOSITION	8-2
3. CONTROLLED MACHINING CONDITIONS	8-3
4. OPERATING METHOD OF MACHINING	8-4
4-1 How to Use Soft Servo Function	
A. Initial setting of average working voltage	8-4
B. Method to change average working voltage during machining	8-6
C. Method of initial setting of machining rate	8-7
D. Method to change initial-selected machining rate during machining	8-9
4-2 How to Use Corner Optimum Function	8-11
4-3 How to Use Optimum Function of Change in Plate Thickness	8-11
4-3-1 Input items	8-11
4-3-2 Preparation method of NC tape	8-15
5. MACHINING PROCEDURE	
5-1 Test Machining	8-24
5-2 Production Machining	8-27

6.	APPLIED OPERATION	
6-1	Cautions for the Setting Method of Work	8-28
6-2	Confirmation Method of Electric Conditions	8-29
6-3	Confirmation Method of Machining State and Its Operation	8-30
6-4	Method to Change the Control Distance in the Corner Section	8-35
6-5	Measures to be Taken at the Time of Power Failure	8-38
7.	REFERENCE DATA	
7-1	Electric Conditions for Machining Condition Type II	8-43
7-2	Example of Program	8-45
7-3	Supplemental Explanation of Operation	8-46
8.	MACHINING CONDITION SETTING FUNCTION	8-48
	(MACHINING CONDITION TYPE III)	

9 DESCRIPTION OF OTHER FUNCTIONS

CONTENTS

1.	LOCUS CALCULATION	9-1
2.	COORDINATE SYSTEM TURNING	9-2
3.	MEMORY CYCLE	9-3
4.	AUTOMATIC ZERO RETURN	9-20
5.	TAPE EDIT FUNCTION	9-22
6.	AUTOMATIC WORK PIECE TILT COMPENSATION FUNCTION	9-30
7.	PITCH ERROR CORRECTION FUNCTION	9-36
8.	AUTOMATIC OFFSET	9-41

10

MAINTENANCE AND INSPECTION OF MECHANICAL SYSTEM
WEAR PARTS LIST

11

MAINTENANCE AND INSPECTION (W5F)

CONTENTS

	Page
1. EXTERNAL VIEW WITH REAR DOOR REMOVED	11-1
2. EXTERNAL VIEW WITH FRONT DOOR REMOVED	11-2
3. EXTERNAL VIEW OF FRONT DOOR INSIDE	11-3
4. HOW TO RELEASE DOOR INTERLOCK	11-4
5. CHECKS BEFORE POWER SUPPLY ON	11-5
5-1 Voltage change-over	11-5
5-2 SCR AMP frequency change-over	11-7
6.	
6-1 Wire-cut EDM system control unit block diagram ..	11-8
6-2 Replacing and handling logic card	11-9
6-3 Periodic check of logic card	11-13
7. FUNCTIONS AND HANDLING OF STANDARD BOARD (BNP-A2007)	11-14
7-1 Standard board and its function	11-14
7-2 Periodical check of standard board	11-15
7-3 Check procedure and setting	11-15
7-4 Parts list of standard board	11-16
8. DAILY MAINTENANCE	11-17
8-1 Inspection method	11-17
8-2 Troubleshooting guide	11-19

	Page
9. FUNCTION AND HANDLING OF POWER SUPPLY (PD11A) ...	11-21
9-1 Function	11-21
9-2 Replacement	11-22
9-3 Check on power supply	11-24
9-4 Parts list	11-25
10. FUNCTION AND HANDLING OF CHARGER PM10A (BNP-A2015)	11-26
10-1 Function	11-26
10-2 Replacement	11-27
10-3 Check procedure	11-27
10-4 Parts list	11-28
10-5 Charger related standard list	11-29
10-6 Handling the battery (BNP-A2016)	11-31
11. FUNCTION AND HANDLING OF DRIVE AMPLIFIER (SA20/40A/B)	11-32
11-1 Function	11-32
11-2 Replacement	11-33
11-3 Periodical check	11-34
11-4 Check procedure and setting	11-34
12. INSPECTION AND MAINTENANCE OF TAPE HANDLER (OPTION)	11-36
12-1 Inspection	11-36
12-2 Troubleshooting	11-37

	Page
13. SELF-DIAGNOSIS	11-39
13-1 Alarm and status indication	11-39
13-2 Check of alarm data	11-40
13-3 Interface (I/F) check	11-40
14. TROUBLESHOOTING GUIDE (BNP-A2027)	11-47
14-1 NC power remains OFF	11-47
14-2 "ALARM" lamp goes ON	11-48
14-3 SERVO ALARM lamp goes ON	11-49
14-4 Tape reader does not start	11-50
14-5 Tape reader does not stop	11-51
14-6 Machine does not stop at stroke end	11-52
14-7 "BATTERY" lamp ON	11-53
14-8 "ERROR" lamp ON	11-54
14-9 Manual feed inoperative	11-55
14-10 Machine does not stop if the stop procedure is taken	11-56
14-11 Machine operates differently from the command in the program	11-57
14-12 Travelling speed is different from the command ..	11-58
14-13 Faulty zero-point resetting	11-59
14-14 Zero-point varies	11-60
14-15 Faulty coupling with detector	11-61
14-16 High frictional torque of machine	11-61
14-17 Variation of back-lash	11-62

	Page
14-18 Due to deflection of machine	11-62
14-19 Hunting	11-62
14-20 Faulty TG properties	11-63
14-21 Faulty TG coupling	11-63
15. CABLE CONNECTION DIAGRAM BETWEEN W5F-MACHINE	11-64
15-1 DWC 70F, DWC 90F	11-64
15-2 DWC 110F1, DWC 200F1	11-65

12 DATA OF WIRE ELECTRODE