

Anotronic™ ard

operation manual



Anotronic LTD.

Unit 3, Hollingdon Depot, Stewkley Road, Soulbury,
Nr. Leighton Buzzard, Beds., LU7 0DF. England.
Telephone +44 (01525) 270261 Fax +44 (01525) 270235
E-Mail sales@anotronic.com
Internet <http://www.anotronic.com>



POWER SUPPLY UNIT

P-30
POWER SUPPLY UNIT
P-60

CHAPTER 1	ART POWER SUPPLY INTRODUCTION	2
CHAPTER 2	EDM PRINCIPLES AND TECHNOLOGY.....	3
CHAPTER 3	ELECTRODE MATERIAL.....	5
	3-1 Electrode materials characteristics	
	3-2 Electrode methods of production	
CHAPTER 4	EDM APPLICATION.....	8
CHAPTER 5	POWER SUPPLY OPERATION INSTRUCTION.....	11
	5-1 "BT" high voltage amperage control knob	
	5-2 "AT" low voltage amperage control knob	
	5-3 "PA" pulse duration knob	
	5-4 "PB" interval knob	
	5-5 Servo sensitivity adjustment knob	
	5-6 Discharge gap adjustment knob	
	5-7 Work head vertical movement adjustment knob	
	5-8 Micro spark finish switch	
	5-9 Indicator lamp	
	5-10 Other switches with indicator lamp	
	5-11 Other push buttons	
	5-12 Buzzer and discharge timer	
	5-13 Main switch & Emergency stop	
	5-14 Working light operation manual Lighting equipment both for operating and alarming use	
	5-15 Against fire alarm system	
CHAPTER 6	P30, P60 APPLICATION NOTE.....	28

1. ART POWER SUPPLY INTRODUCTION

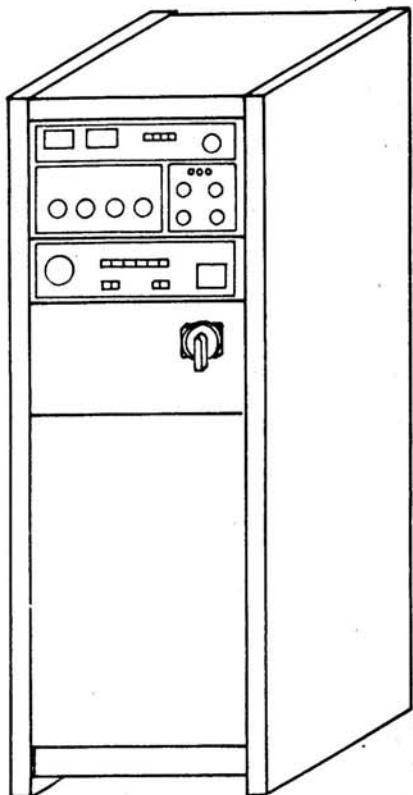
ART is producing three power supply units, the P30, P60 and P120, all of which were designed by electronic experts. Using the latest micro processors we have been able to produce machines that feature expanded automatic control and monitor during EDM processing that result in much greater efficiency.

There are three voltage selections 90, 160, 260. Range of current is 1.5A, 3A, 4.5A, 6A, 9A, 12A, 15A, 21A, 30A, 45A, 60A, 120A.

DURATION 2 Usec 1800 Usec
INTERVAL 2 Usec 900 Usec

The design features an automatic monitoring system and protection against current surges. Transistor is protected against overloads and temperature control. When properly grounded the power supply unit will not produce shocks or other electrical problems. The operation will be safe.

Our EDM's components use of USA, European manufacture and all are standard module designs. Replacement will be easy. We employ enhancement quality control methods and test each machine for 120 hours prior to shipment.



2. EDM PRINCIPLES AND TECHNOLOGY

Electrical discharge occurs in a tank filled with dielectric fluid. The object to be cut or machined is called the work piece. The cutting tool is an electrode. Both are submerged in the dielectric fluid and separated by a very small gap.

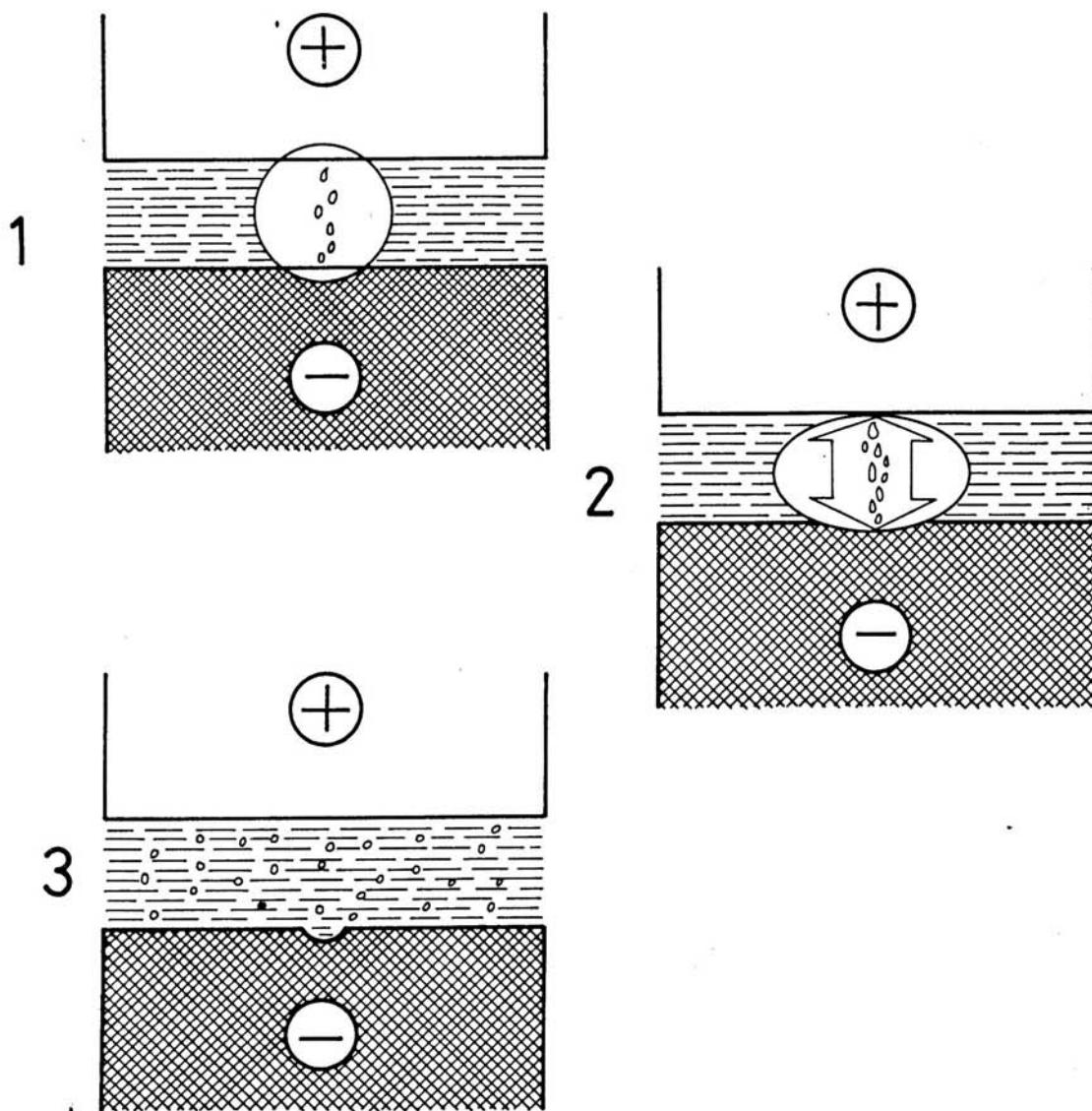
During machining power flows to the work pieces and the electrode creating a strong electrical potential. Due to the gap between the two and the insulator flooding it there is no sparking or arcing, but the servo mechanism continues to reduce the gap until a spark occurs. Actually a period of around one second long is enough for several thousand sparks.

At the point when the spark occurs, the current is converted to heat and the work piece is strongly heated. If the current is interrupted. The discharge channel explosively evaporate carrying away melted material from the work piece. This leaves a small crater. Should discharge resume the crater will grow removing more and more material. Since there is no contact between cutting tool and work piece and no physical force applied the shape which is cut will exactly match the shape of the electrode.

Now we'll try to understand the physical characteristics of EDM. When voltage is applied to the electrode and the workpiece an electrical field forms as the voltage builds up. Conductive particles present in the fluid collect when the field is strong and form a bridge or discharge channel. At the same time negative particles are emitted from the electrode which impact neutral particles in discharge channel and split forming positive particles. This is called impact ionization. The negative flow toward the positive and the positives flow toward the negative and electrical current is established. Current increases to the maximum, temperature and pressure peak (temperatures are around 10,000°C) and vapor bubble expands greatly.

When current is interrupted the discharge particles collapse and the vapor bubble evaporates. The dielectric fluid cools the high temperature metal and flushes away the particles. Some graphite and gas is produced as a break down product from the fluid.

Now we understand the principles and physical characteristics of EDM. There are many factors that influence EDM efficiency. For example, polarity selection; matching of amperage and duration. Electrode wear may vary from 0.3% to 99.77% depending on those factors. Careful control of those variables gap, polarity, amperage, duration is essential to be sure of machining at maximum efficiency.



3. ELECTRODE MATERIAL

Theoretically any material which is a good electrical conductor can be used. Materials with the highest melting point and the lowest electrical resistivity are in theory the best. Cost analysis show that in EDM, electrode cost is the critical factor so selection of electrode material, the quantity and the method of manufacture are all important and needs careful consideration.

Electrode materials can be divided as follows:

- Silver tungsten
- Copper tungsten,
- Copper graphites (Combination of metallic and non-metallic materials)
- Chromium copper
- Electrolytic copper
- Graphites (Non-metallic materials)
- Brass
- Aluminium alloy
- Steel

Of all the above electrolytic copper is the most popular. Silver tungsten, copper tungsten are both quite expensive, so their use is limited to very small high precision party. After cost, the most important factors in electrode selection are low wear and ease of shaping.

GRAPHITE features low electrode wear and high removal rate but due to low density, it is difficult to form & breaks easily. Graphite is best employed when fine finish is not required.

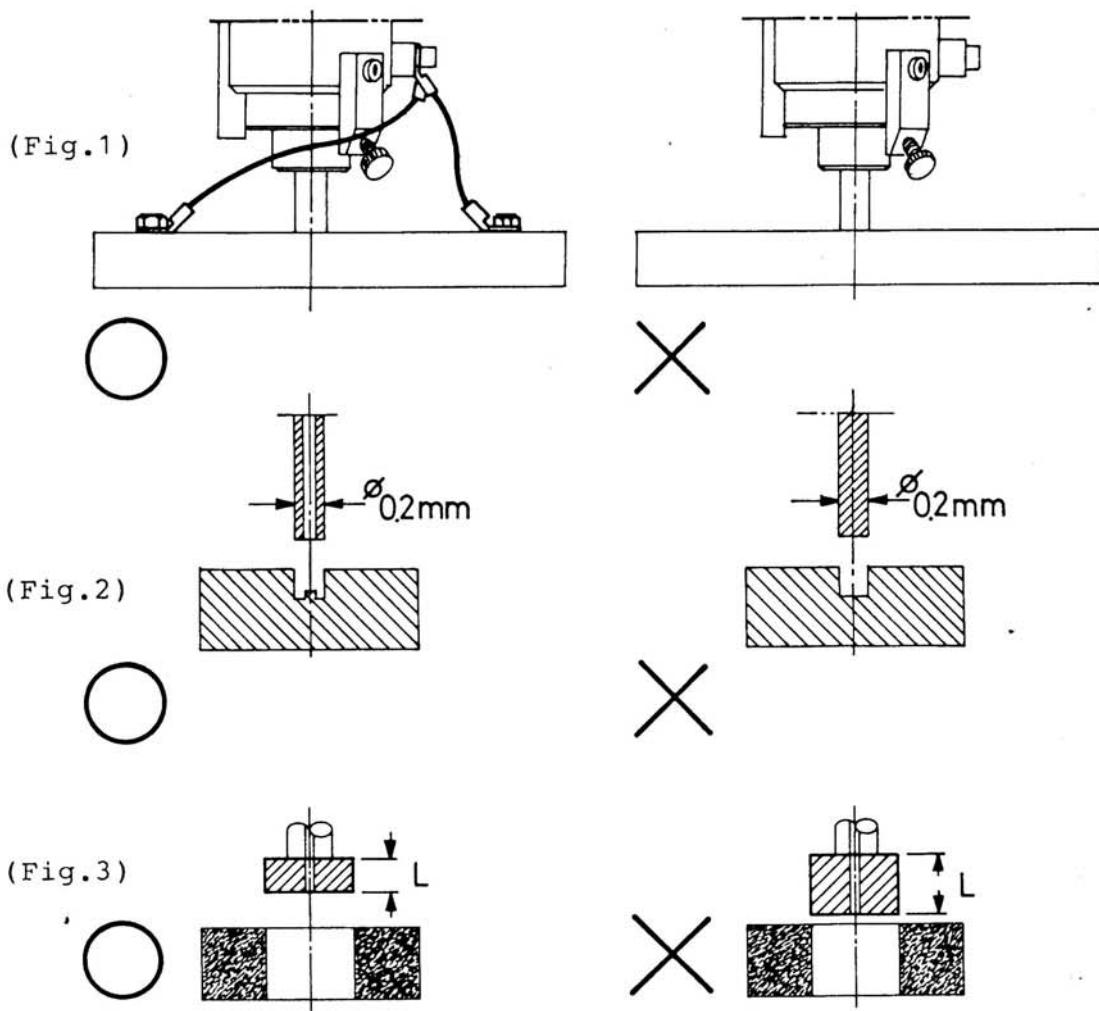
STEEL can be used as an electrode but efficiency is lower than copper or graphite. Its most important EDM application is in the machining of split lines plastic mold and die casting dies. In these cases, the upper part of the mold or die is used as the electrode.

3-1 ELECTRODE MATERIALS CHARACTERISTICS

ELECTRODE MATERIAL	MELTING POINT	RESISTIVITY $\Omega \text{mm}^2/\text{m}$	DENSITY g/m^3
SILVER TUNGSTEN		0.048	0.016
COPPER TUNGSTEN		0.055	0.015
COPPER GRAPHITES		0.04	0.027
CHROMIUM COPPER		0.0236	0.0081
ELECTROLYTIC COPPER	1083	0.0167	0.0089
GRAPHITES	3700	0.085 – 0.015	0.0015 – 0.0018
BRONZE	1060		0.082
STEEL	1539	0.0971	0.0087

3-2 ELECTRODE METHODS OF PRODUCTION

- Traditional machining methods such as turning, milling, shaping, grinding, engraving etc.
 - Stamping or conining
 - Extrusion or drawing
 - Galvanic plating
1. The above methods of production are all suitable. Selection of one depends on electrode material.
In designing an electrode special attention should be paid to flushing of particles so as to ensure high removal rates.
 2. If electrode shape is very complex or convoluted, it may be produced in two parts.
 3. Irregular shapes must be centered on easily measure axis.
 4. Long, thin electrodes must be installed with current supplied to the ends as well as the center thereby ensuring even discharge over whole length.(Fig.1)
 5. Small diameter hole require pipe electrode to ensure high efficiency in flushing and draining.(Fig.2)
 6. For through the-hole machining ensure work head electrode is thin. Thick electrodes impede particle discharge.(Fig.3)



4. EDM APPLICATION

4-1 EDM applications depend on a skilled operator analyses all the EDM factors to produce high quality work.

- Electrode material
- Workpiece material
- Electrode volume
- Surface roughness
- Spark gap
- Electrode wear
- Removal rate

The above factors are explained in the technology section.

4-2 During sparking (discharge) the gap area must be continuous flushed off particles and residue and the dielectric fluid filtered.

4-3 If flushing and draining are not good enough turn the vertical servo switch to higher speed. To get fine finish vertical movements must be very great.

4-4 To set for no electrode wear; when starting discharge set low amperage. When whole area of electrode contacts work pieces, increase amperage. This will protect sharp corners or angles.

4-5 To set servo sensitivity bear in mind sensitivity depends on current; if current low no amplitude but high sensitivity. When high current, high amplitude but low sensitivity.

4-6 Know and understand the discharge process.

- Refer to page 9.

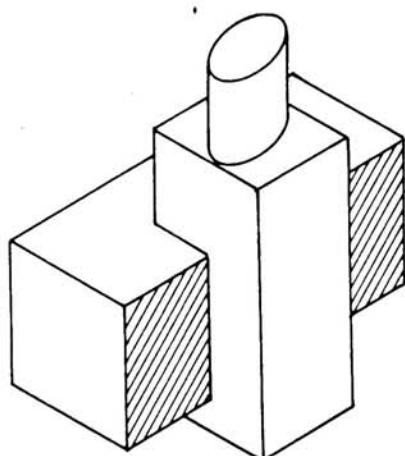
4-7 DISCHARGE OPERATION PROCESS

- Main switch "ON".
- Electrode zero verticle angle and at position zero.
- Polarity, amperage "AT", duration "PA", interval "PB".
- Set servo sensitivity, gap voltage.
- Set synchronous flushing switch and overflow control switch & work head lift control.
- Use the manual control to lower the workhead to the workpiece.
- Dielectric pump "ON".
Adjust overflow gate.
- Discharge switch "ON".

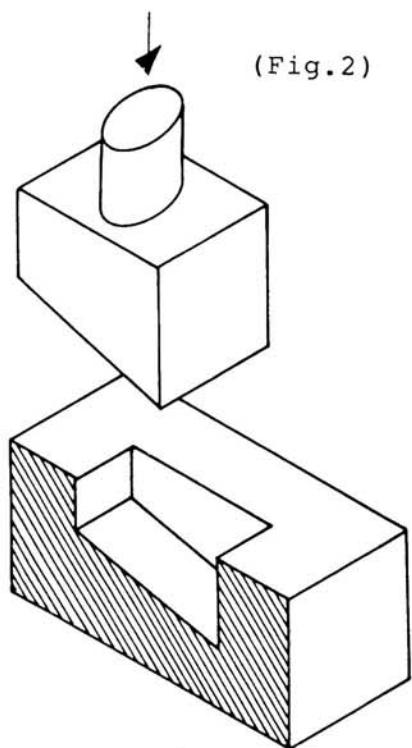
4-8 CATEGORIES OF EDM

- Sinking by EDM (Fig.1 & Fig.2)
- Cutting by EDM (Fig.3)
- Grinding by EDM (Fig.4)

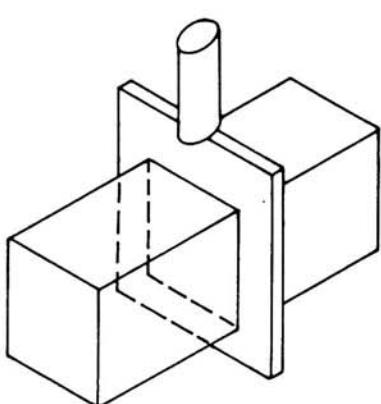
(Fig.1)



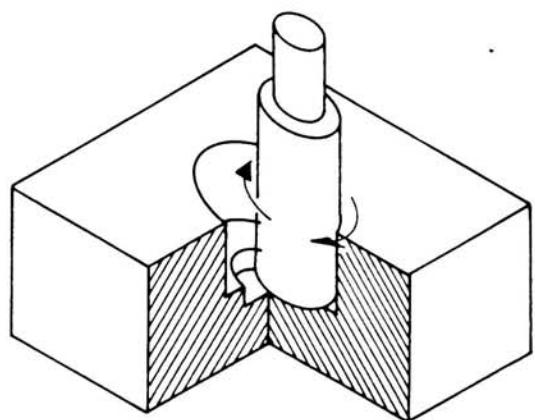
(Fig.2)



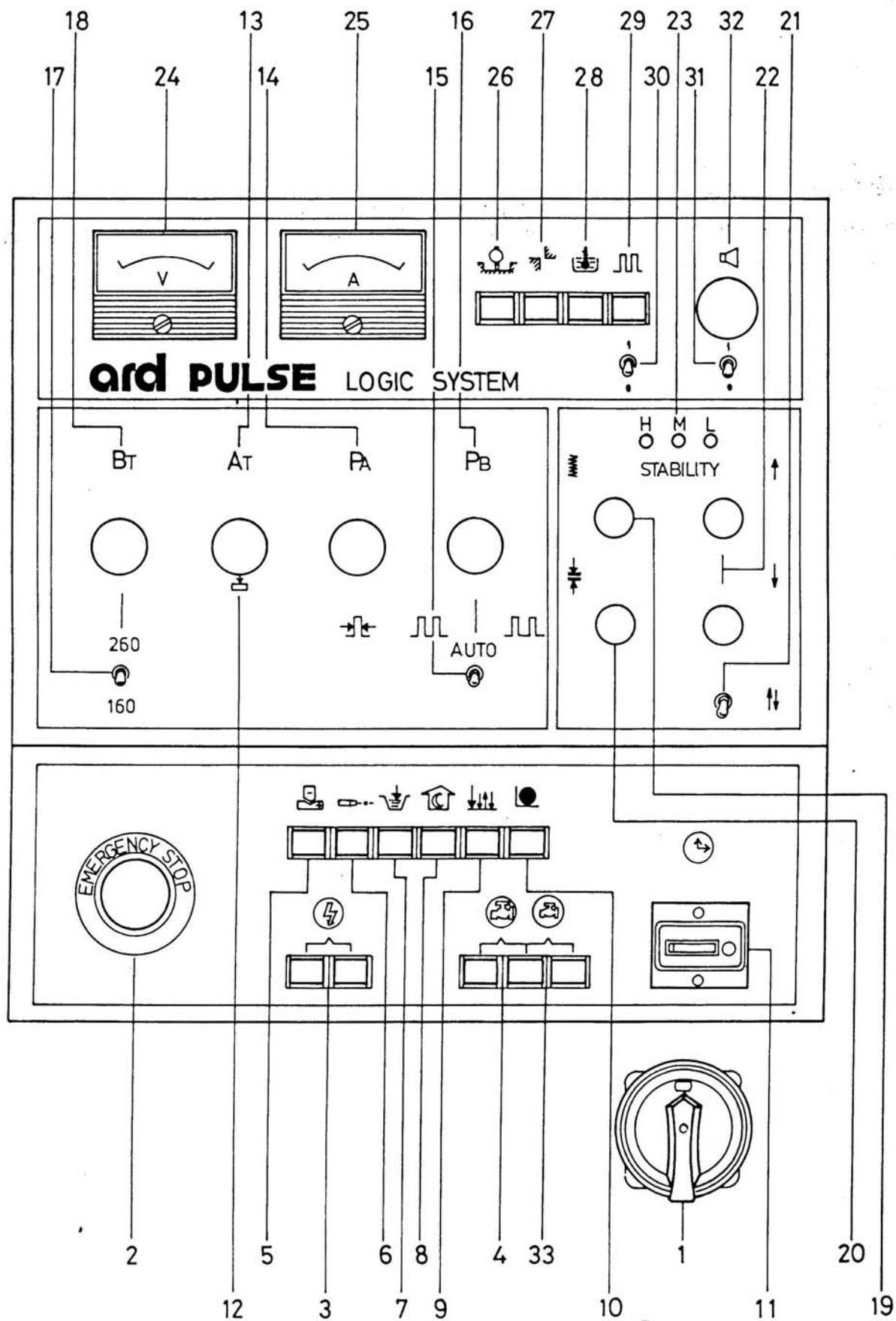
(Fig.3)



(Fig.4)

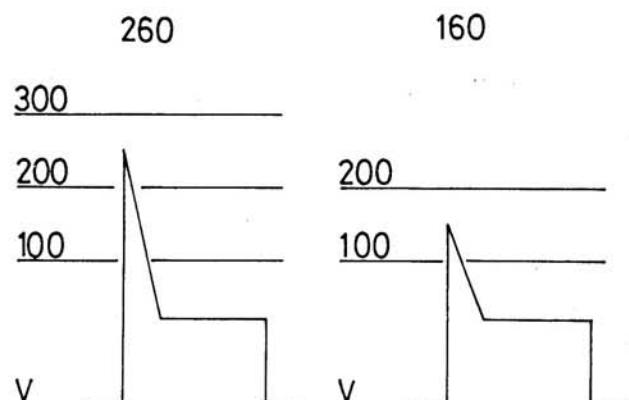
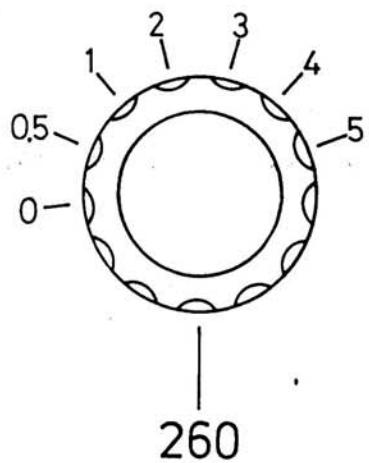


5. POWER SUPPLY OPERATION INSTRUCTION



1. MAIN SWITCH
2. EMERGENCY STOP
3. DISCHARGE SWITCH
4. DIELECTRIC FLUID PUMP SWITCH
5. POLARITY REVERSE CONTROL SWITCH
6. AUTOMATIC SYNCHRONOUS FLUSHING CONTROL
7. OVER FLOW CONTROL
8. WORK HEAD LIFT CONTROL
9. PRESET DEPTH STOP CONTROL FOR ORBITTING USE ONLY
10. SERVO MOTOR STOP CONTROL
11. DISCHARGE TIMER
12. PRESET DEPTH ZEROING
13. "AT" LOW AMPERAGE CONTROL KNOB
14. "PA" PULSE DURATION KNOB
15. INTERVAL AUTO TOGGLE SWITCH
16. "PB" INTERVAL KNOB
17. 260V & 160V TOGGLE SWITCH
18. "BT" HIGH AMPERAGE CONTROL KNOB
19. SERVO SENSITIVITY ADJUSTMENT KNOB
20. DISCHARGE GAP CONTROL KNOB
21. TOGGLE SWITCH TO CONTROL 22
22. WORKHEAD VERTICAL MOVEMENT ADJUSTMENT KNOB
23. "STABILITY" MONITORING INDICATOR LAMP
24. VOLTMETER
25. AMMETER
26. AUTOMATIC DEPTH INDICATOR LAMP
27. EDGE FINDING INDICATOR LAMP
28. TEMPERATURE CONTROL INDICATOR LAMP
29. DISCHARGE ABNORMAL INDICATOR LAMP
30. DISCHARGE ABNORMAL TOGGLE SWITCH
31. BUZZER TOGGLE SWITCH
32. BUZZER
33. PUSH BUTTON AND OFF SWITCH FOR FLUSHING
(ON-FOR LITTLE FLUSHING, OFF-FOR LARGE FLUSHING)

5-1 "BT" HIGH VOLTAGE AMPERAGE CONTROL KNOB



160

These values (low amperage) are only used for fine precision work.

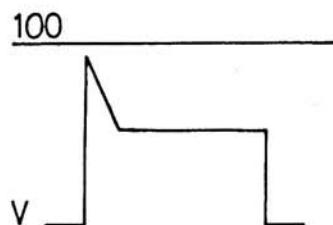
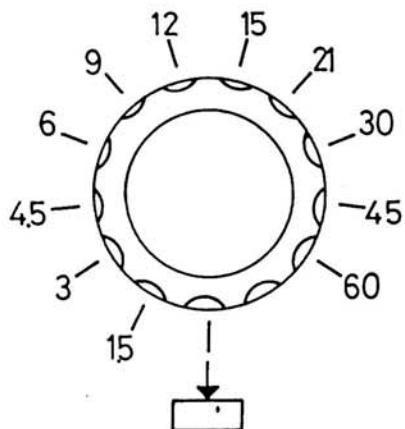
260 : 260 voltage discharge

POSITION	AMPERAGE
0.....	0A
0.5.....	0.5A
1.....	1A
2.....	2A
3.....	3A
4.....	4A
5.....	5A

160 : 160 voltage discharge (without M30D)

POSITION	AMPERAGE
0.....	0A
0.5.....	0.5A
1.....	1A
2.....	2A
3.....	3A
4.....	4A
5.....	5A

5-2 "AT" LOW VOLTAGE AMPERAGE CONTROL KNOB



: Low power position for use in centering & setting of depth.

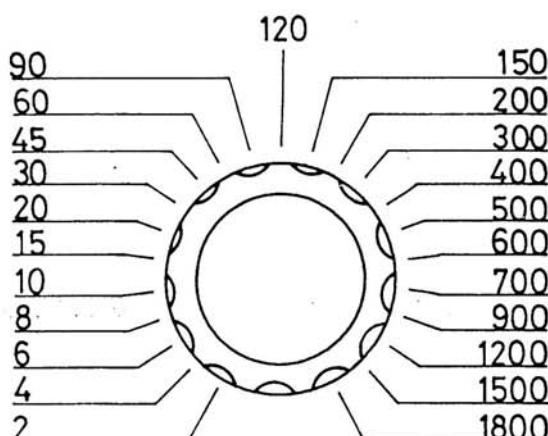
AT : 90 voltage discharge

POSITION	AMPERAGE	POSITION	AMPERAGE
1.5.....	1.5A	15.....	15A
3.....	3A	21.....	21A
4.5.....	4.5A	30.....	30A
6.....	6A	45.....	45A
9.....	9A	60.....	60A
12.....	12A		

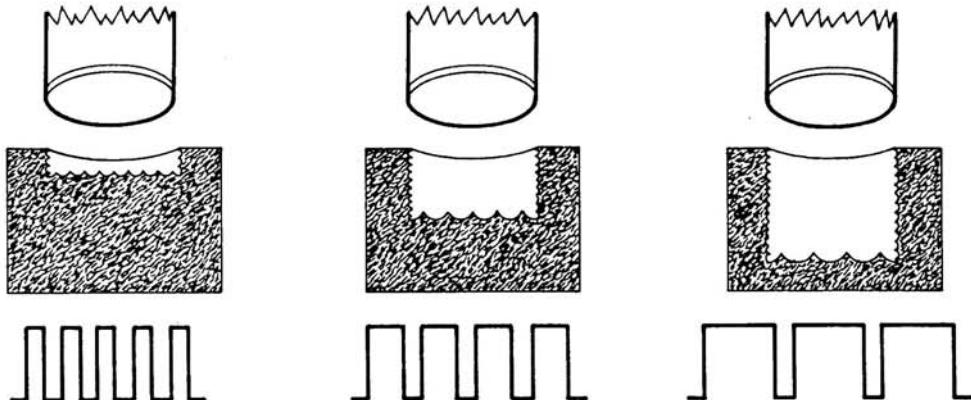
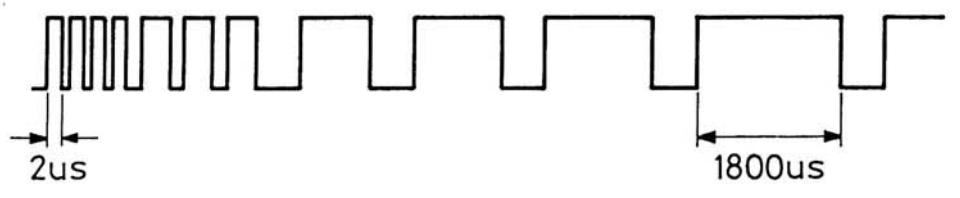
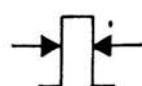
Recommended intensity levels with electrodes and frontal area

FRONTAL AREA	INTENSITY LEVELS WITH			
	Cu+ Cuw+	(ELECTRODES)	Gr+ Gr-	(ELECTRODES)
0mm ² ~ 10mm ²	3A~ 6A	3A~ 6A	3A~ 6A	6A~ 12A
10mm ² ~ 25mm ²	6A~12A	6A~12A	6A~ 12A	12A~ 21A
25 mm ² ~ 100mm ²	12A~21A	12A~21A	12A~ 21A	21A~ 45A
100mm ² ~ 400mm ²	12A~45A	12A~45A	21A~ 45A	45A~ 60A
400mm ² ~1600mm ²	21A~60A	21A~60A	45A~ 60A	60A~120A
1600mm ² ~6400mm ²	21A~60A	21A~60A	60A~120A	120A
6400mm ²	21A~60A	21A~60A	120A	

5-3 "PA" PULSE DURATION KNOB

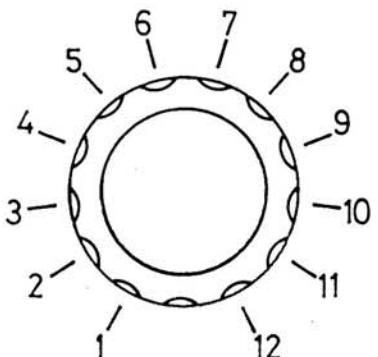


ON TIME		
2= 2us	45= 45us	500= 500us
4= 4us	60= 60us	600= 600us
6= 6us	90= 90us	700= 700us
8= 8us	120=120us	900= 900us
10=10us	150=150us	1200=1200us
15=15us	200=200us	1500=1500us
20=20us	300=300us	1800=1800us
30=30us	400=400us	



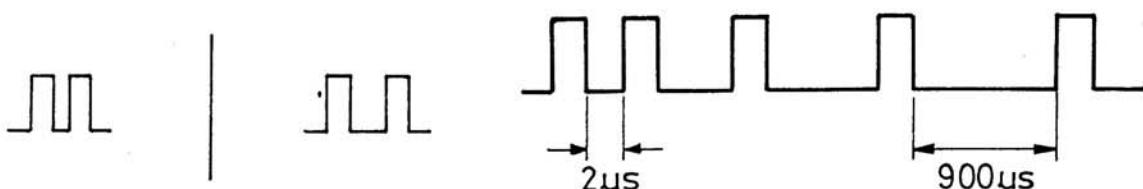
1. Set appropriate duration & amperage to produce the desired finish. Min 2us at the "AT" setting, you can reach Rmax 6-9um, Max 1800us at that setting you can reach Rmax 90-120um.
2. With the duration greater than 40us, duration & amperage can be matched in direct ratio permitting machining with no electrode wear. When duration is short, and current high electrode wear increases.
3. Since different metallic materials have different characteristics, it's necessary to use different duration setting according to the table.

5-4 "PB" INTERVAL KNOB



OFF TIME

1= 2us	7= 60us
2= 4us	8= 90us
3= 6us	9= 150us
4= 10us	10= 300us
5= 20us	11= 500us
6= 30us	12= 900us



AUTO

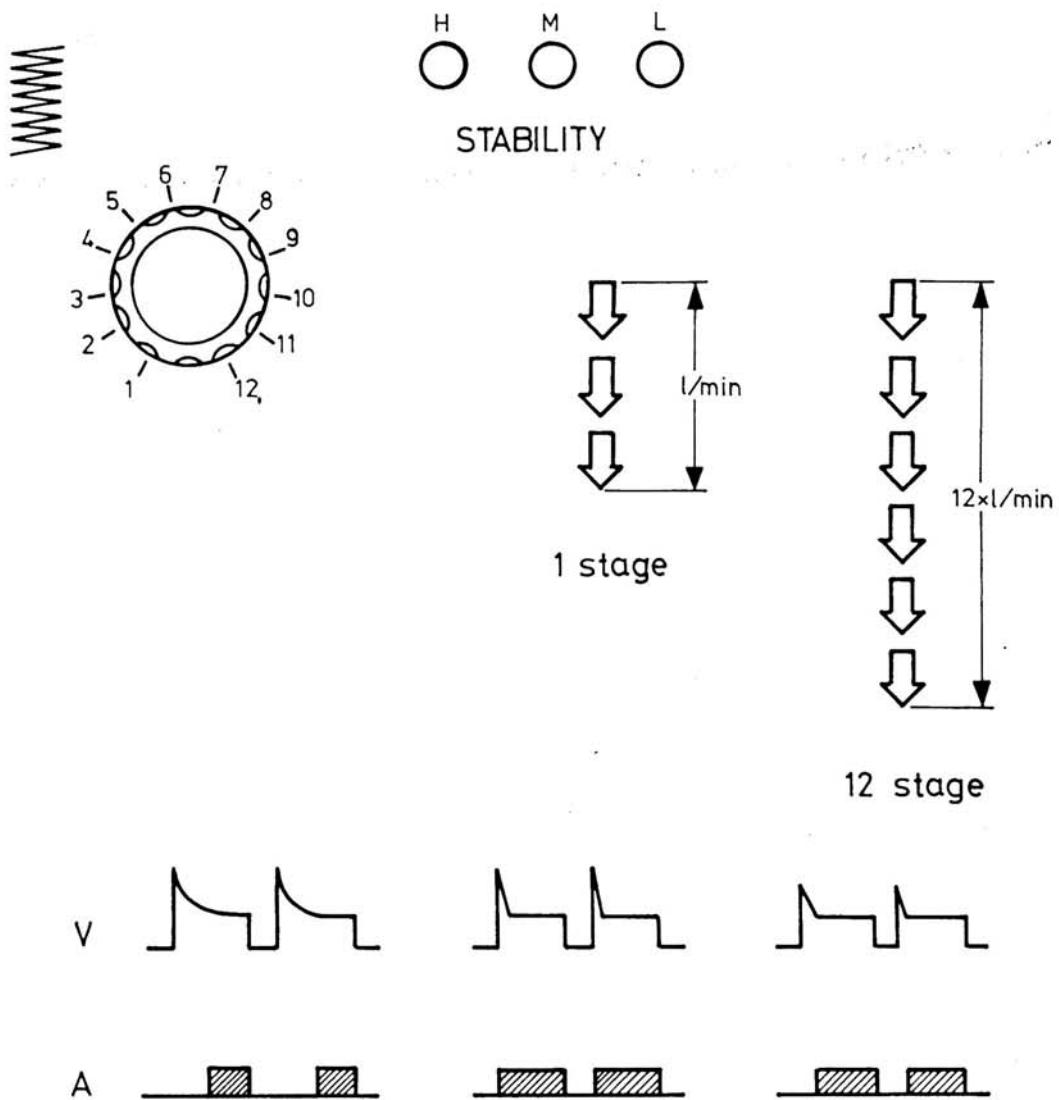
INTERVAL AUTOMATIC SWITCH



If trouble such as short circuit occurs in spark gap. Pulse interval will extend automatically until the trouble is eliminated.

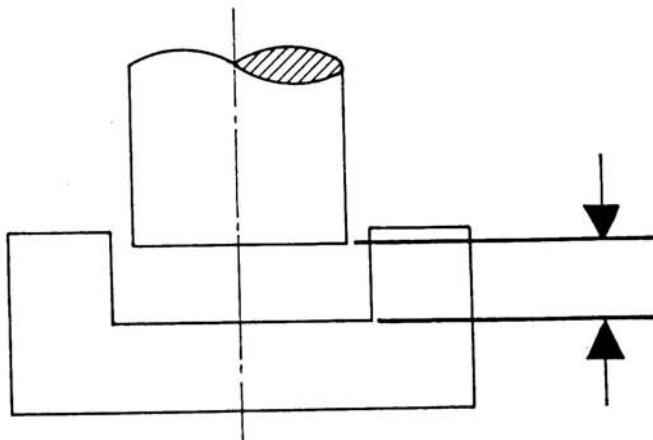
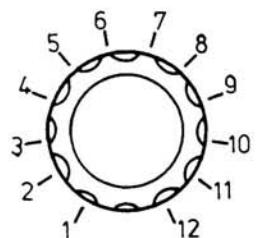
1. Interval PB is the time between pulses off time when no impact ionization occurs and dielectric conditions are re-established. Usually when the discharge is stable and interval is short efficiency is high and a protective coating will form on the electrode. If the flushing is poor, particals are not removed and machining efficiency decreases. So, it's necessary to set the servo to raise the electrode periodically to permit flushing.
2. No matter whether interval is short and amperage high or interval long and amperage low, the voltage must not change.
3. The length of interval must be set according to the materials characteristic to ensure the greatest efficiency.
4. PB knob functions:
 - (1) Adjust PB knob to first position and on-time/off-time ratios are automatically regulated according to on-time requirements.
NOTE: For normal and stable machining always leave PB knob at first position.
 - (2) If machining is unstable then adjust PB knob manually to increase off-time.
 - (3) When amperage is too low for corresponding electrode frontal area, adjust PB knob to increase off-time, Use the table on page 14 of the reference manual as a guide.

5-5 SERVO SENSITIVITY ADJUSTMENT KNOB



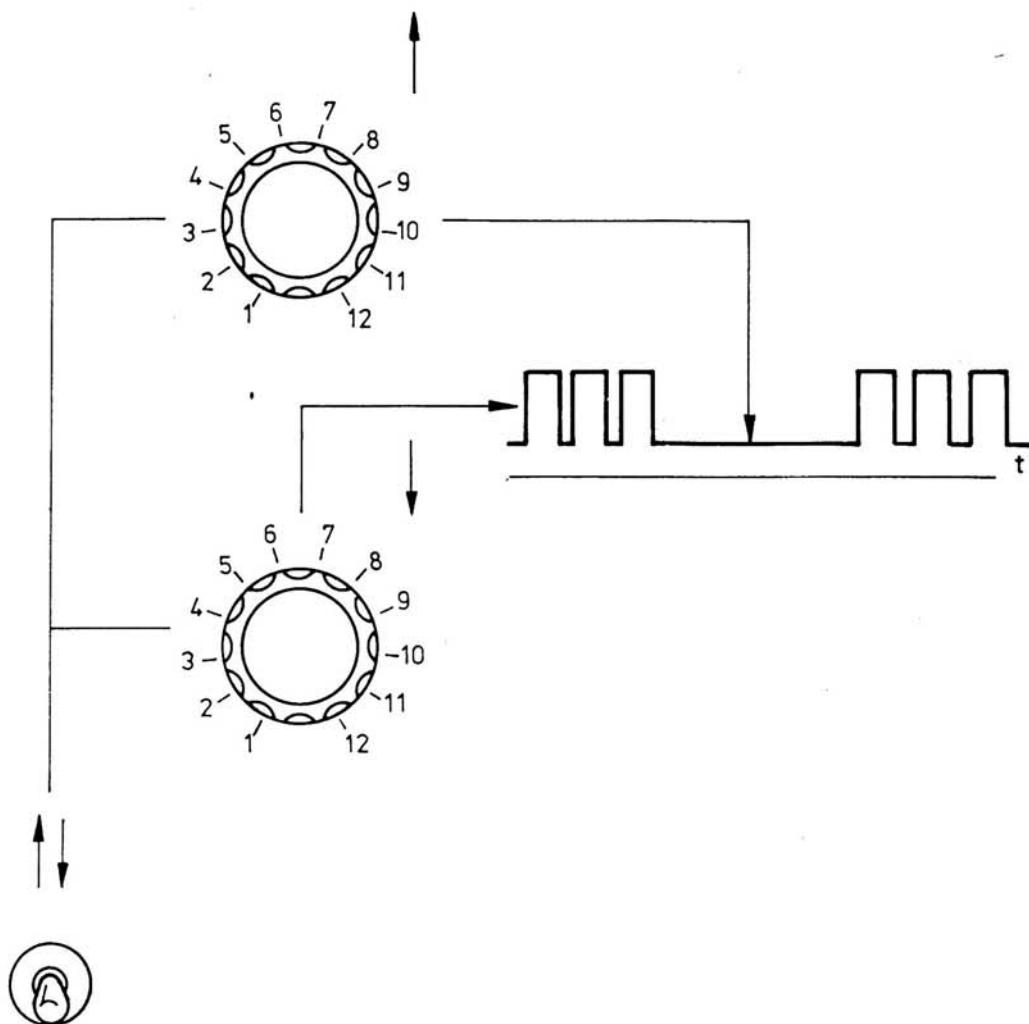
1. Servo's adjustment must be synchronized with discharge duration. When the indicator is steady synchronization has been achieved.
2. The servo monitors the discharge gap during discharge. Maintaining the proper gap is one of the most important factors in EDM. So, we have very carefully designed this system to enable the most difficult work to be performed.

5-6 DISCHARGE GAP ADJUSTMENT KNOB



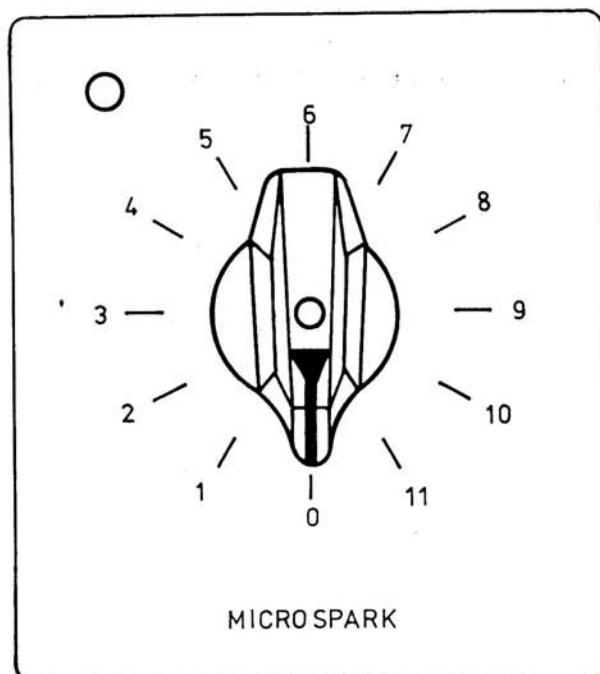
1. Gap average voltage is about 60V.
Gap average voltage is about 40V.
2. Is suitable for fine finish over large areas or deep holes where flushing is very difficult.
Gap is smaller but the current is greater efficiency is high and it's suitable for normal work.

5-7 WORKHEAD VERTICAL MOVEMENT ADJUSTMENT KNOB



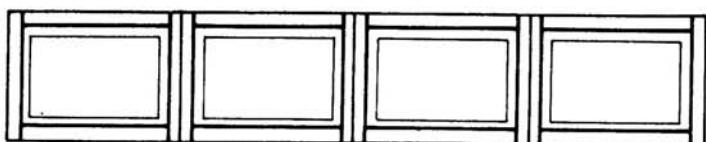
1. Switch on servo pulse for high efficiency particle discharge.
2. When servo begins upward movement the power is shut off to prevent sparking.

5-8 MICRO SPARK FINISH SWITCH



When BT or AT is set for negative discharge; that is the electrode is (-), you must set micro spark switch from 1-11 according to the table. This will prevent arcing adding to discharge efficiency.

5-9 INDICATOR LAMP



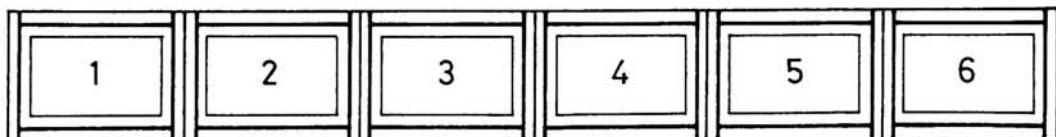
The discharge will be disable, whenever the gap short condition over a time period with the toggle switch position at on.

Illumination of this lamp indicates temperature has risen too high and the machine will stop discharging.

The edge finder lamp lights when the electrode contacts the workpiece, the buzzer may also be used.

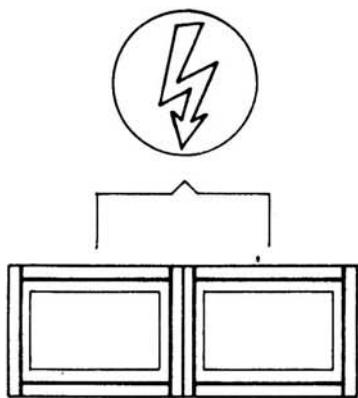
The depth indicator lamp lights when preset machining depth is reached. The buzzer may also be used.

5-10 OTHER SWITCHES WITH INDICATOR LAMP

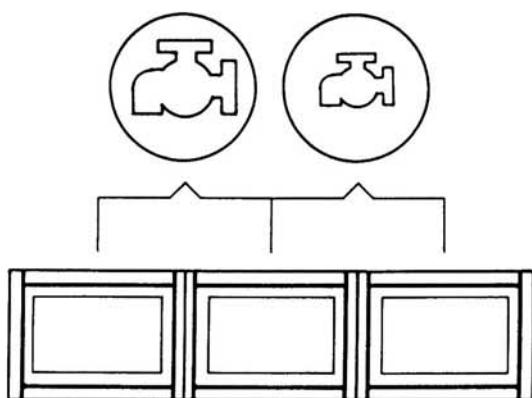


1. Polarity lamp, when on the electrode's polarity is negative and the work piece is positive. When off the electrode is positive and the work piece is negative. Polarity selection depends on characteristics of the work piece.
2. When on servo movement is synchronized with flushing. This indicator should be used when the desired depth is great to ensure adequate flushing.
3. The over flow lamp shall be ON when over flow control is not in operation.
4. Automatic stop light when used will stop discharge and raise the workhead when the preset depth is reached.
5. Preset depth stop where the work spindle remains in its bottom position against an electronic "stop", which permits servo-controlled retraction in the event of interference in the spark gap.
6. Locking of work spindle in any preselected Z position.

5-11 OTHER PUSH BUTTONS



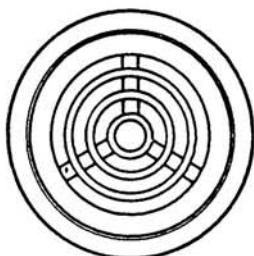
Pushing this button starts discharge and discharge timer. If any problems arise such as fluid insufficient, too high temperature, hole too deep or abnormal discharge. Discharge will automatically stop.



Dielectric pump push button and off switch.

- A. ON (the blue push button) - For little flushing.
- B. OFF - For large flushing.
It to be noted that must push the green push button for large flushing before using the little flushing, otherwise the little flushing can not work.

5-12 BUZZER AND DISCHARGE TIMER

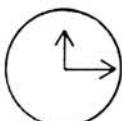


BUZZER

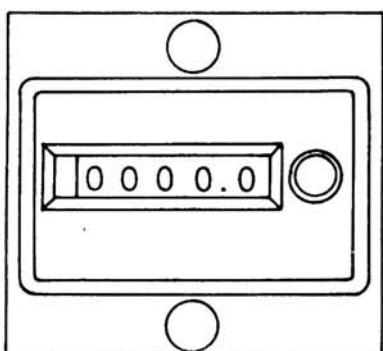
1



0



Usually the switch is on 1 position. When using electronic edge finder it shall be at 0 position.



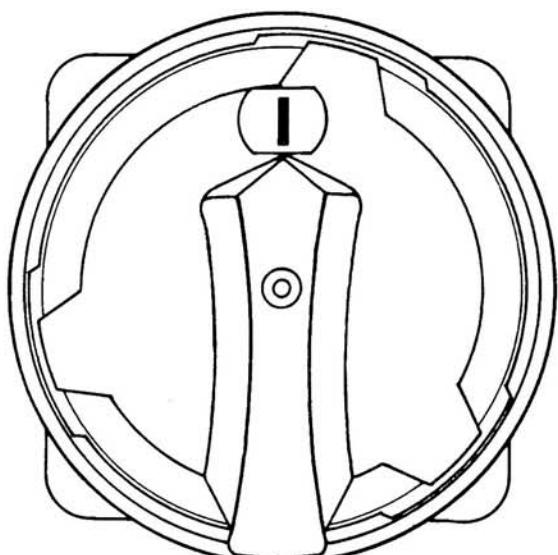
Discharge timer

5-13 MAIN SWITCH & EMERGENCY STOP



EMERGENCY STOP

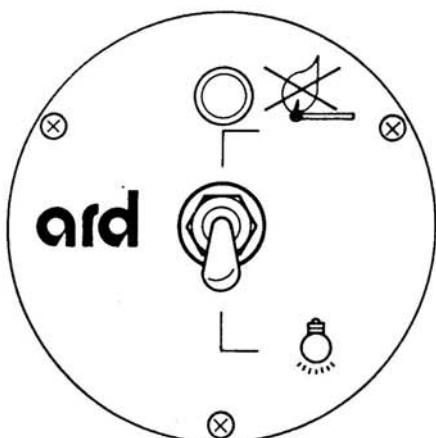
This red mushroom switches off all control circuits, while all the indicator lamps still on.



MAIN SWITCH

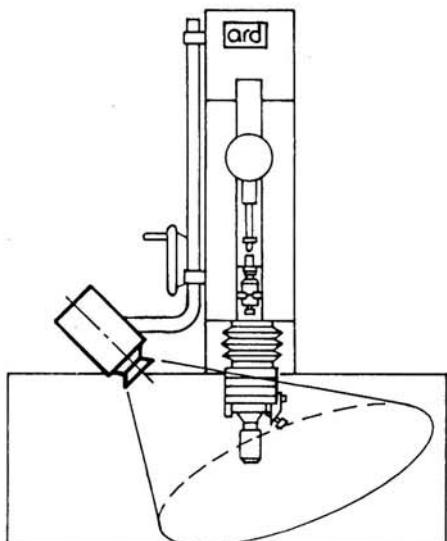
5-14 WORKING LIGHT OPERATION MANUAL

Lighting equipment both for operating and alarming use.



1/ Indicators:

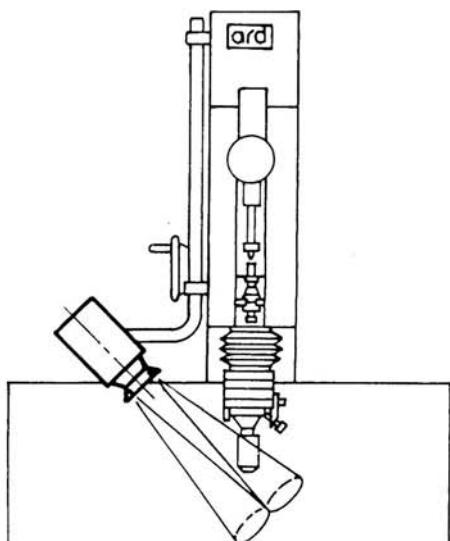
- a. Alarm Indicator
- b. Lighting Switch



2/ Operational Instruction:

A. for lighting use:

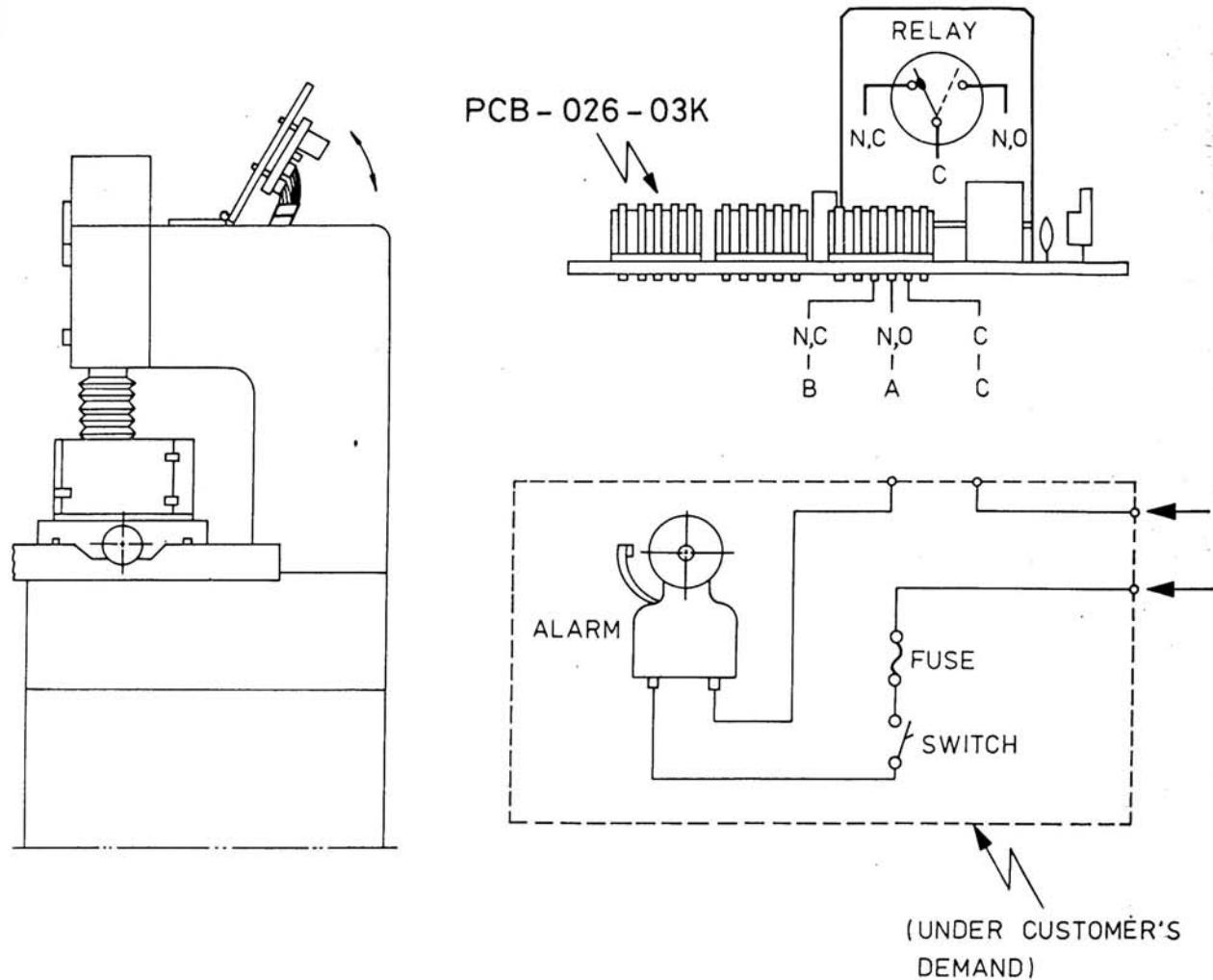
- a. Turn on the lighting switch
- b. Alarm indicator is off



B. for alarm use:

- a. Turn off the lighting switch
- b. Alarm indicator is on - in any case it may cause the fire, such as liquid surface is too low or temperature is too high. It may cut off the power source immediately and sounding a "BEEP BEEP" alarm call.

5-15 AGAINST FIRE ALARM SYSTEM
(UNDER CUSTOMER'S DEMAND)



Features:

1. This system may allow the operator to adopt a alarm system for himself and through the connector A.B.C. one may line the system to other locations (see dotted lines). In case of fire and the operator is not in, this system may inform the operator go back to the firing spot immediately and power supply unit may cut off all power sources automatically.
2. This system is adopting the infrared control system. Power capacity is AC 250V 10A. Connector A.B.C. only use for switching, so no power output and it has to according dotted lines to install input power source.

P30
P60 APPLICATION NOTE

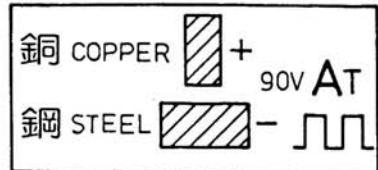
INDEX

1. (90V) ELECTROLYTIC COPPER(+) — STEEL	28
2. (90V) GRAPHITE(+) — STEEL	35
3. (160V) ELECTROLYTIC COPPER(+) — STEEL	40
4. (260V) ELECTROLYTIC COPPER(—) — STEEL	41
5. (90V) COPPER TUNGSTEN(—) — TUNGSTEN CARBIDE	42
6. (90V) ELECTROLYTIC COPPER(—) — COPPER	43
7. (260V, 90V) STEEL — STEEL	44
8. (260V, 90V) ELECTROLYTIC COPPER(+) — STEEL	45

SURFACE FINISH IN EDM

ARD SAMPLE (VDI 3400)	R _a µm
12	= 0.40
15	= 0.56
18	= 0.80
21	= 1.12
24	= 1.60
27	= 2.24
30	= 3.15
33	= 4.50
36	= 6.30
39	= 9.00
42	= 12.5
45	= 18.0





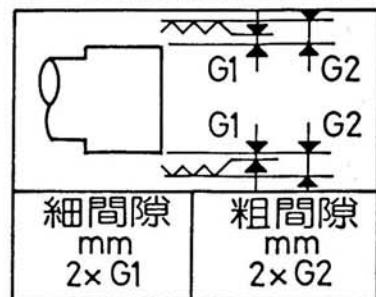
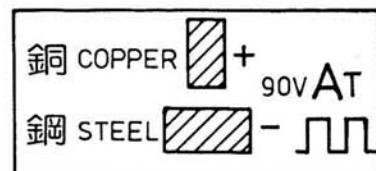
試 驗 條 件

TEST CONDITION

電極材料 ELECTRODE	電解銅 ELECTROLYTIC COPPER
電極極性 POLARITY ELECTRODE	正極 POSITIVE
工件材料 WORKPIECE	鋼 STEEL
加工液 DIELECTRIC	煤油(中國石油) CPC KEROSENE
噴流 INJECTION	: 0.5kg/cm ²
試驗面積 TEST AREA	: 20Ømm

P30 放電操作明細表
P60 APPLICATION NOTE

電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板(粗細度) ARD (VDI3400) SAMPLE	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm^3/min
AT	PA	PB	V			



1.5	2	1	50	20	8	0.5	0.036	0.046
1.5	4	1	50	21	6.5	0.7	0.038	0.050
1.5	6	1	50	21	5	1.0	0.040	0.052
1.5	8	1	50	22	4	1.5	0.042	0.054
1.5	10	1	50	23	3	2	0.046	0.060
1.5	15	1	50	24	2.5	3	0.050	0.066
1.5	20	1	50	25	2	3.5	0.056	0.074
1.5	30	1	50	26	1.5	3	0.060	0.080
1.5	45	1	50	27	0.5	2	0.065	0.087
1.5	60	1	50	28	-	1.5	0.070	0.095

3	2	1	45	22	12	1	0.045	0.060
3	4	1	45	23	10	2	0.048	0.063
3	6	1	45	24	9	2.8	0.050	0.065
3	8	1	45	24	7	4	0.052	0.070
3	10	1	45	25	6	5	0.055	0.073
3	15	1	45	26	4.5	7	0.060	0.080
3	20	1	45	27	2.5	8	0.065	0.087
3	30	1	45	28	1.5	8.5	0.070	0.095
3	45	1	45	29	0.8	7	0.075	0.103
3	60	1	45	30	0.5	6	0.080	0.112
3	90	1	45	31	-	4.5	0.085	0.120
3	120	1	45	32	-	3	0.090	0.130

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

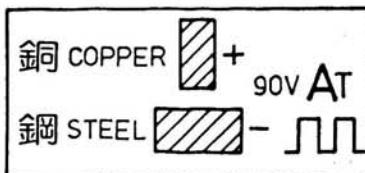
PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

Always select proper AT setting for electrode surface.

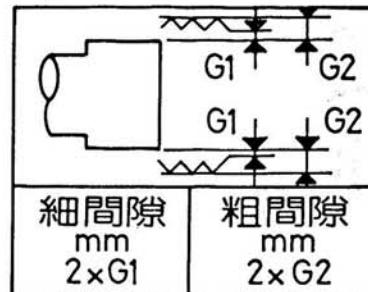
If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance $\pm 10\%$).

P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板 (粗細度) ARD (VDI 3400)	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V	SAMPLE	%	mm ³ /min



4.5	2	1	40	23	21	1.7	0.050	0.064
4.5	4	1	40	24	19	2	0.054	0.070
4.5	6	1	40	25	16	4.5	0.058	0.076
4.5	8	1	40	25	14	8	0.062	0.080
4.5	10	1	40	26	10	9	0.065	0.085
4.5	15	1	40	27	7	16	0.073	0.095
4.5	20	1	40	28	5	19	0.075	0.100
4.5	30	1	40	29	3	22	0.080	0.105
4.5	45	1	40	30	1.5	24	0.085	0.110
4.5	60	1	40	31	1.2	21	0.095	0.130
4.5	90	1	40	32	0.8	17	0.100	0.140
4.5	120	1	40	32	0.5	12	0.110	0.150
4.5	150	1	40	33	-	10	0.120	0.165
4.5	200	1	40	34	-	8	0.130	0.180

6	2	1	40	24	35	2.5	0.056	0.072
6	4	1	40	25	28	4	0.060	0.078
6	6	1	40	25	24	6	0.065	0.083
6	8	1	40	26	20	13	0.068	0.086
6	10	1	40	26	13	18	0.070	0.090
6	15	1	40	27	10	20	0.075	0.095
6	20	1	40	29	5.5	23	0.080	0.108
6	30	1	40	30	4.0	26	0.090	0.122
6	45	1	40	31	2.5	29	0.100	0.135
6	60	1	40	32	2.0	30	0.110	0.150
6	90	1	40	33	1.0	25	0.115	0.160
6	120	1	40	33	0.8	22	0.120	0.165
6	150	1	40	34	0.5	18	0.130	0.180
6	200	1	40	35	-	15	0.140	0.196

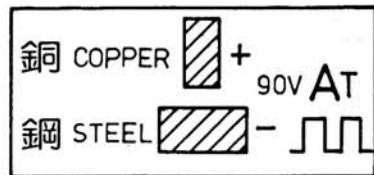
NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency. Always select proper AT setting for electrode surface.

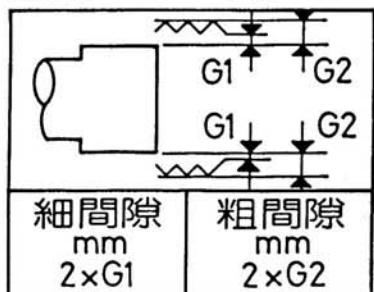
If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance ± 10V).

P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (VDI3400) ARD (VDI3400) SAMPLE	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm³/min
AT	PA	PB	V			



9	10	1	40	27	21	20	0.075	0.097
9	15	1	40	28	16	28	0.080	0.105
9	20	1	40	30	10	34	0.085	0.117
9	30	1	40	31	6	38	0.095	0.130
9	45	1	40	32	45	42	0.105	0.145
9	60	1	40	33	3.0	45	0.115	0.160
9	90	1	40	34	2.0	47	0.125	0.175
9	120	1	40	35	1.5	44	0.135	0.191
9	150	1	40	36	1.0	40	0.150	0.213
9	200	1	40	37	-	37	0.160	0.230

12	10	1	35	28	23	25	0.080	0.150
12	15	1	35	29	18	38	0.085	0.113
12	20	1	35	30	13	47	0.090	0.122
12	30	1	35	32	8	55	0.100	0.140
12	45	1	35	33	6	62	0.110	0.155
12	60	1	35	34	4	67	0.120	0.170
12	90	1	35	35	3	72	0.130	0.186
12	120	1	35	36	2	70	0.140	0.203
12	150	1	35	37	1.5	66	0.155	0.225
12	200	1	35	38	0.5	63	0.170	0.246
12	300	1	35	39	-	60	0.180	0.270
12	400	1	35	40	-	55	0.195	0.295

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

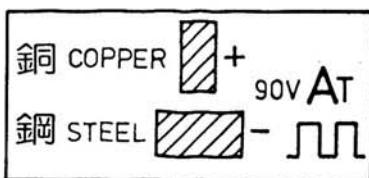
PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

Always select proper AT setting for electrode surface.

If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance $\pm 10\text{V}$).

P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細 (度 ARD (VDI3400))	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V	SAMPLE	%	mm ³ /min

細間隙 mm 2xG1	粗間隙 mm 2xG2
-------------	-------------

15	10	1	35	29	25	35	0.085	0.113
15	15	1	35	30	20	50	0.090	0.122
15	20	1	35	31	16	76	0.100	0.135
15	30	1	35	33	10	85	0.110	0.150
15	45	1	35	34	7	91	0.120	0.170
15	60	1	35	35	5	95	0.130	0.186
15	90	1	35	36	3.8	97	0.140	0.203
15	120	1	35	37	2.5	100	0.150	0.220
15	150	1	35	38	1.5	105	0.165	0.245
15	200	1	35	39	1.0	96	0.180	0.265
15	300	1	35	40	0.5	92	0.195	0.295
15	400	1	35	41	-	88	0.210	0.322
15	500	1	35	42	-	76	0.225	0.350
21	10	1	35	30	28	48	0.095	0.127
21	15	1	35	31	24	92	0.105	0.140
21	20	1	35	32	19	98	0.115	0.155
21	30	1	35	33	15	115	0.128	0.175
21	45	1	35	35	10	138	0.140	0.196
21	60	1	35	36	8	145	0.155	0.218
21	90	1	35	37	5	147	0.165	0.238
21	120	1	35	38	4	150	0.175	0.257
21	150	1	35	39	3	155	0.190	0.280
21	200	1	35	40	1.5	150	0.205	0.305
21	300	1	35	41	1.0	150	0.220	0.330
21	400	1	35	42	0.5	135	0.235	0.355
21	500	1	35	43	0.3	130	0.245	0.370
21	600	1	35	43	-	115	0.270	0.410

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

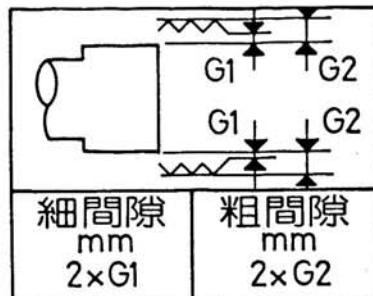
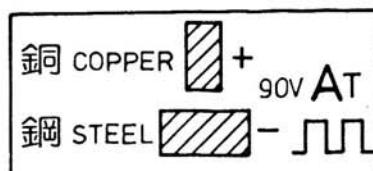
Always select proper AT setting for electrode surface.

If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance ± 10V).

P30 放電操作明細表
P60 APPLICATION NOTE

電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (ARD (VDI3400) SAM-PLE)	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V		%	mm ³ /min



30	10	1	35	31	32	70	0.110	0.145
30	15	1	35	32	27	125	0.115	0.155
30	20	1	35	33	22	130	0.125	0.170
30	30	1	35	34	18	165	0.140	0.190
30	45	1	35	36	15	185	0.155	0.218
30	60	1	35	37	12	205	0.170	0.240
30	90	1	35	38	9	210	0.185	0.265
30	120	1	35	39	7.5	215	0.200	0.290
30	150	1	35	40	6	220	0.215	0.315
30	200	1	35	41	3.5	220	0.230	0.332
30	300	1	35	42	2	230	0.240	0.366
30	400	1	35	43	1	220	0.255	0.395
30	500	1	35	44	0.5	210	0.270	0.430
30	600	1	35	44	0.5	205	0.285	0.445
30	700	1	35	45	0.5	200	0.300	0.480
30	900	1	35	46	0.5	200	0.330	0.530

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

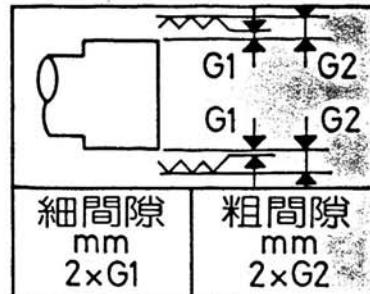
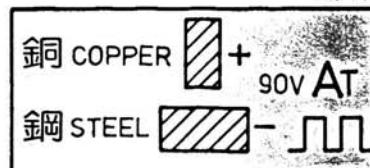
Always select proper AT setting for electrode surface.

If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance ± 10V).

P30 放電操作明細表
P60 APPLICATION NOTE

電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (ARD (VDI3400) SAM-PLE)	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm ³ /min
AT	PA	PB	V	ARD (VDI3400)		



45	10	1	35	32	35	130	0.125	0.165
45	15	1	35	33	32	165	0.130	0.175
45	20	1	35	34	30	190	0.140	0.190
45	30	1	35	35	25	240	0.155	0.211
45	45	1	35	37	20	290	0.170	0.240
45	60	1	35	38	16	320	0.185	0.265
45	90	1	35	39	13	340	0.200	0.290
45	120	1	35	40	10	350	0.215	0.315
45	150	1	35	41	8	360	0.230	0.332
45	200	1	35	42	6	370	0.250	0.376
45	300	1	35	43	4	370	0.270	0.410
45	400	1	35	44	2.5	360	0.290	0.450
45	500	1	35	45	1.5	350	0.310	0.490
45	600	1	35	46	1.0	340	0.325	0.525
45	700	1	35	47	0.8	330	0.340	0.560
45	900	1	35	49	0.5	310	0.380	0.620

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

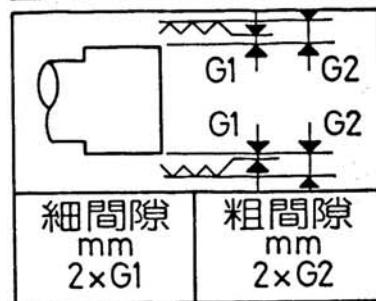
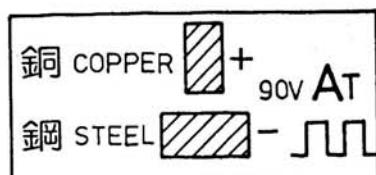
Always select proper AT setting for electrode surface.

If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance ± 10V).

P30 放電操作明細表
P60 APPLICATION NOTE

電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (VDI3400) ARD (VDI3400)	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V	SAMPLE	%	mm ³ /min



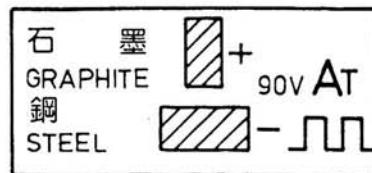
60	10	1	35	33	38	180	0.140	0.185
60	15	1	35	34	34	240	0.145	0.195
60	20	1	35	35	28	290	0.150	0.206
60	30	1	35	36	25	340	0.165	0.228
60	45	1	35	38	22	380	0.185	0.265
60	60	1	35	39	18	420	0.200	0.290
60	90	1	35	40	15	440	0.220	0.320
60	120	1	35	41	12	460	0.235	0.337
60	150	1	35	42	10	470	0.250	0.376
60	200	1	35	43	7	480	0.265	0.405
60	300	1	35	44	4	465	0.285	0.445
60	400	1	35	45	2	460	0.300	0.480
60	500	1	35	46	1	450	0.325	0.525
60	600	1	35	47	0.5	435	0.340	0.560
60	700	1	35	48	0.5	420	0.360	0.600
60	900	1	35	50	0.5	400	0.400	0.660
60	1800	1	35	52	0.5	350	0.480	0.740

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency. Always select proper AT setting for electrode surface.

If power is increased beyond normal setting, reduce PB setting (4-12).

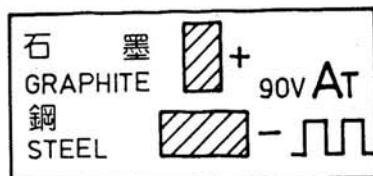
Gap voltage should always be set at voltage level given in table (tolerance ± 10V).



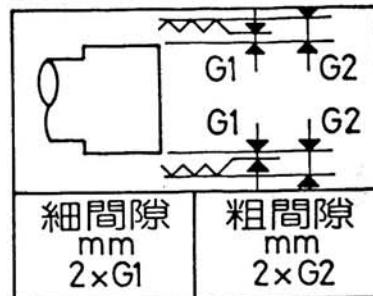
試驗條件 TEST CONDITION

電極材料 ELECTRODE	: 石墨 GRAPHITE
電極極性 POLARITY ELECTRODE	: 正極 POSITIVE
工件材料 WORKPIECE	: 鋼 STEEL
加工液 DIELECTRIC	: 煤油(中國石油) CPC KEROSENE
試驗面積 TEST AREA	: 20Ømm

P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (VDI3400) ARD (SAM-PLE)	消耗比 %	進度 STOCK REMOVAL mm^3/min
AT	PA	PB	V	ARD (VDI3400)	%	mm^3/min



6	2	1	40	24	37	20	0.048	0.064
6	4	1	40	25	34	25	0.051	0.069
6	6	1	40	27	31	43	0.055	0.075
6	8	1	40	28	25	68	0.066	0.087
6	10	1	40	29	20	95	0.070	0.098
6	15	1	40	30	16	15	0.078	0.110
6	20	1	40	31	10	21	0.086	0.121
6	30	1	40	32	6	20	0.098	0.137
6	45	1	40	33	2	19	0.105	0.150
6	60	1	40	33	1.0	17	0.114	0.162
6	90	1	40	34	0.5	15	0.125	0.180

9	2	1	40	25	32	52	0.055	0.075
9	4	1	40	26	28	65	0.057	0.078
9	6	1	40	28	25	78	0.062	0.084
9	8	1	40	29	20	105	0.068	0.096
9	10	1	40	30	18	12	0.072	0.102
9	15	1	40	31	14	20	0.080	0.115
9	20	1	40	32	8	27	0.090	0.126
9	30	1	40	33	5	38	0.105	0.138
9	45	1	40	34	1.8	41	0.117	0.162
9	60	1	40	35	1.0	42	0.120	0.168
9	90	1	40	36	0.5	40	0.135	0.182
9	120	1	40	37	-	32	0.150	0.205
9	150	1	40	38	-	27	0.165	0.220

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

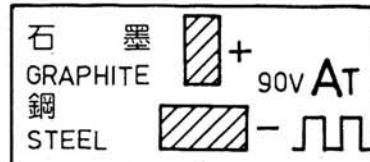
PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

Always select proper AT setting for electrode surface.

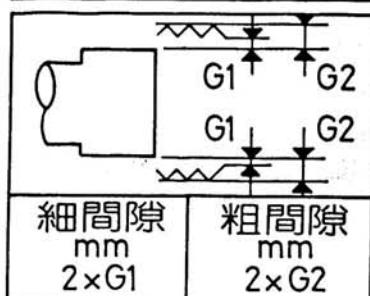
If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance $\pm 10\%$).

P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (ARD (VDI3400))	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V	SAMPLE	%	mm ³ /min



12	10	1	40	30	18	32	0.082	0.114
12	15	1	40	31	14	41	0.087	0.125
12	20	1	40	32	10	50	0.096	0.140
12	30	1	40	34	7	58	0.110	0.152
12	45	1	40	35	4.5	65	0.120	0.174
12	60	1	40	36	3.2	60	0.130	0.182
12	30	1	40	37	2.0	55	0.145	0.195
12	120	1	40	38	1.5	52	0.155	0.220
12	150	1	40	39	0.8	49	0.170	0.245
12	200	1	40	41	-	44	0.185	0.275

15	10	1	40	31	16	37	0.084	0.118
15	15	1	40	32	12	48	0.090	0.130
15	20	1	40	33	9	60	0.098	0.147
15	30	1	40	35	6	68	0.115	0.160
15	45	1	40	36	4	85	0.130	0.180
15	60	1	40	37	3	90	0.140	0.195
15	90	1	40	38	1.5	82	0.155	0.210
15	120	1	40	39	0.8	78	0.165	0.228
15	150	1	40	40	0.5	72	0.175	0.255
15	200	1	40	41	-	64	0.190	0.280
15	300	1	40	42	-	52	0.210	0.310

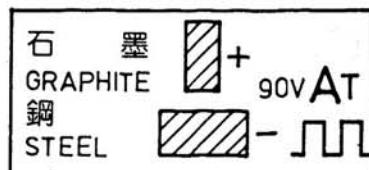
NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency. Always select proper AT setting for electrode surface.

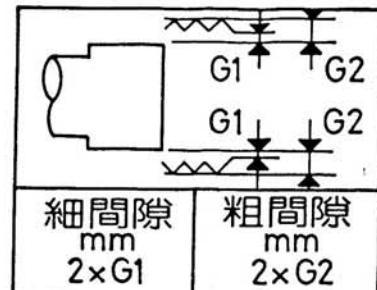
If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance ± 10V).

P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME AT	ON TIME PB	電壓表 VOLTAGE	樣板粗細度 (VDI3400) ARD SAMPLE	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm³/min
21	10	1	40	33	12	55
21	15	1	40	34	9	75
21	20	1	40	35	7	84
21	30	1	40	36	4	105
21	45	1	40	37	2.5	138
21	60	1	40	38	1.5	145
21	90	1	40	39	1.0	140
21	120	1	40	40	0.8	130
21	150	1	40	41	0.3	125
21	200	1	40	42	-	105
21	300	1	40	43	-	91
21	400	1	40	43	-	75



21	10	1	40	33	12	55	0.090	0.130
21	15	1	40	34	9	75	0.095	0.142
21	20	1	40	35	7	84	0.102	0.158
21	30	1	40	36	4	105	0.115	0.178
21	45	1	40	37	2.5	138	0.132	0.202
21	60	1	40	38	1.5	145	0.150	0.225
21	90	1	40	39	1.0	140	0.165	0.260
21	120	1	40	40	0.8	130	0.175	0.270
21	150	1	40	41	0.3	125	0.200	0.295
21	200	1	40	42	-	105	0.225	0.325
21	300	1	40	43	-	91	0.245	0.350
21	400	1	40	43	-	75	0.270	0.390

30	10	1	40	34	9	82	0.108	0.152
30	15	1	40	35	7	110	0.120	0.175
30	20	1	40	36	5	132	0.135	0.200
30	30	1	40	37	3	150	0.145	0.215
30	45	1	40	38	1.5	185	0.160	0.240
30	60	1	40	39	1.0	190	0.170	0.250
30	90	1	40	40	0.5	210	0.190	0.290
30	120	1	40	41	-	220	0.105	0.300
30	150	1	40	42	-	192	0.220	0.330
30	200	1	40	43	-	185	0.260	0.370
30	300	1	40	43	-	165	0.300	0.425
30	400	1	40	44	-	138	0.330	0.470

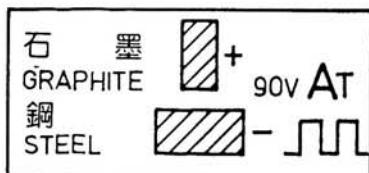
NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency. Always select proper AT setting for electrode surface.

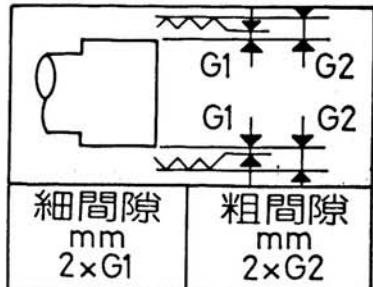
If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance $\pm 10\text{V}$).

P30 放電操作明細表
P60 APPLICATION NOTE



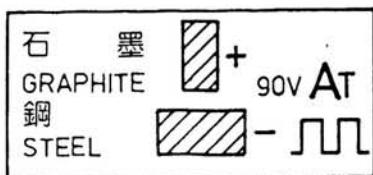
電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (VDI3400) ARD SAMPLE	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm³/min
AT	PA	PB	V			



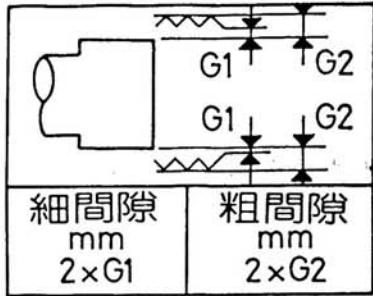
45	10	1	40	35	8	130	0.120	0.165
45	15	1	40	36	5	175	0.135	0.190
45	20	1	40	37	3.8	200	0.145	0.205
45	30	1	40	38	2.5	225	0.165	0.235
45	45	1	40	39	1.5	265	0.180	0.270
45	60	1	40	40	1.0	290	0.190	0.285
45	90	1	40	41	0.5	320	0.215	0.305
45	120	1	40	42	0.3	315	0.230	0.335
45	150	1	40	43	0.3	310	0.250	0.375
45	200	1	40	44	0.3	300	0.280	0.400
45	300	1	40	45	0.3	270	0.320	0.460
45	400	1	40	45	0.3	235	0.360	0.540

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).
 PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.
 Always select proper AT setting for electrode surface
 If power is increased beyond normal setting, reduce PB setting (4-12).
 Gap voltage should always be set at voltage level given in table (tolerance $\pm 10\%$).

P30 放電操作明細表
P60 APPLICATION NOTE



電流	CURRENT POS.	放電時間	ON TIME	休息時間	OFF TIME	電壓表	VOLTAGE	樣板粗細度	(VDI 3400)	ARD	WEAR RATE	消耗比	%	進度	STOCK REMOVAL
At		P _A		P _B		V		SAMPLE		mm ³ /min					



60	10	1	40	36	6	195	0.130	0.185
60	15	1	40	37	4	250	0.145	0.205
60	20	1	40	38	3	270	0.160	0.230
60	30	1	40	39	2	300	0.175	0.255
60	45	1	40	40	1	350	0.200	0.300
60	60	1	40	41	0.5	375	0.215	0.320
60	90	1	40	42	0.3	415	0.235	0.350
60	120	1	40	43	0.3	395	0.260	0.380
60	150	1	40	44	0.3	380	0.295	0.435
60	200	1	40	45	0.3	350	0.330	0.470
60	300	1	40	45	0.3	335	0.370	0.530
60	400	1	40	46	0.3	320	0.410	0.610
60	500	1	40	47	0.3	300	0.450	0.700

NOTE: PB setting test always AT1, if EDM burns unstable, increase PB setting to 2-6 (4us-30us).

PB setting, when the frontal area of the electrode is smaller than the current POS., that results in the unsteady sparking, please set PB stage to extend and note the gap voltage should be setted on 30V-40V for efficiency.

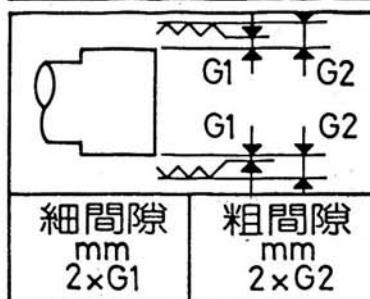
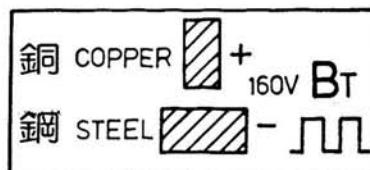
Always select proper AT setting for electrode surface

If power is increased beyond normal setting, reduce PB setting (4-12).

Gap voltage should always be set at voltage level given in table (tolerance + 10V).

P30 放電操作明細表
P60 APPLICATION NOTE

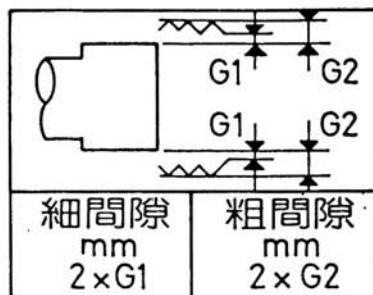
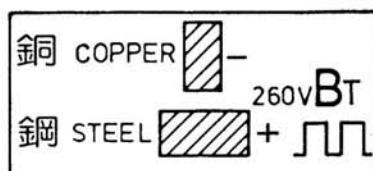
電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板(粗細度) ARD (VDI3400) SAMPLE	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm ³ /min
B _T	P _A	P _B	V			



0.5	10	1	80	18	3	< 1	0.042	0.050
1	10	1	80	20	4	< 1	0.045	0.055
1	30	1	80	22	1	1.5	0.048	0.060
1	60	1	80	24	0.5	1.0	0.052	0.068
2	10	1	80	24	6	2.5	0.050	0.066
2	30	1	80	25	1.5	4.5	0.055	0.073
2	60	1	80	26	0.5	3.5	0.067	0.082
3	10	1	80	26	7	4	0.053	0.078
3	30	1	80	28	2.5	6	0.068	0.093
3	60	1	80	29	0.5	5	0.075	0.103
4	10	1	80	27	8.5	5.5	0.058	0.087
4	30	1	80	29	3	7.5	0.072	0.100
4	60	1	80	30	1	6	0.080	0.116
5	10	1	80	28	10	7	0.065	0.093
5	30	1	80	30	4	9	0.075	0.107
5	60	1	80	31	1.5	8	0.080	0.115
5	90	1	80	33	0.5	6.5	0.095	0.141

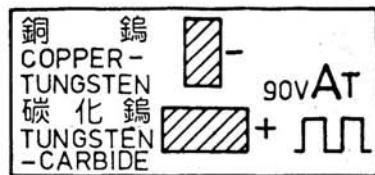
P30 放電操作明細表
P60 APPLICATION NOTE
(HI-VOLT)(高壓部份)

電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	高壓修飾 MICRO-SPARK	樣板粗細度 (ARD VDI 3400) SAMPLE	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm ³ /min
B _T	P _A	P _B	V				

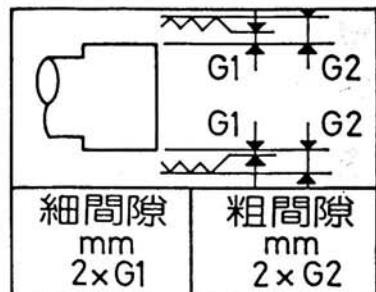


0.5	2	1	150	1	12	25	<1	0.028	0.034
1	2	1	150	2-3	15	26	<1	0.030	0.038
2	2	1	150	4-5	20	28	<1	0.033	0.045
3	2	1	150	6-7	23	30	<1	0.036	0.050
4	2	1	150	8-9	26	31	13	0.042	0.062
5	2	1	150	10-11	29	32	25	0.056	0.084

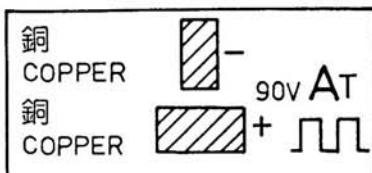
P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	高壓修飾 MICRO-SPARK	樣板粗細度 (VDI 3400) ARD (ARD SAMPLE)	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V		%	mm ³ /min	
3	2	2	30	11	14	16	1.3
4.5	2	2	30	11	16	16	1.8
6	2	2	30	11	17	16	2.1
6	30	3	30	-	22	20	5.5
9	4	2	30	11	19	17	2.6
9	30	3	30	-	25	22	8
12	4	2	30	11	20	18	4
12	30	3	30	-	27	23	11
15	4	2	30	11	22	18	5.5
15	30	4	30	-	28	23	13
21	4	2	30	6	25	18	8
21	30	5	30	-	31	25	18
30	4	2	30	6	26	18	11
30	30	5	30	-	33	26	25
45	4	2	30	6	27	18	13
45	30	6	30	-	35	27	32
60	4	2	30	6	30	18	16
60	30	6	30	-	38	27	40



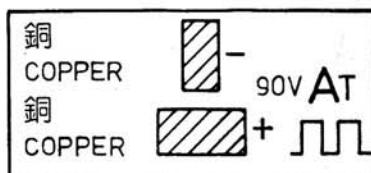
3	2	2	30	11	14	16	1.3	0.036	0.044
4.5	2	2	30	11	16	16	1.8	0.038	0.048
6	2	2	30	11	17	16	2.1	0.041	0.052
6	30	3	30	-	22	20	5.5	0.048	0.060
9	4	2	30	11	19	17	2.6	0.045	0.055
9	30	3	30	-	25	22	8	0.050	0.063
12	4	2	30	11	20	18	4	0.048	0.060
12	30	3	30	-	27	23	11	0.054	0.068
15	4	2	30	11	22	18	5.5	0.050	0.064
15	30	4	30	-	28	23	13	0.058	0.083
21	4	2	30	6	25	18	8	0.056	0.072
21	30	5	30	-	31	25	18	0.065	0.097
30	4	2	30	6	26	18	11	0.060	0.077
30	30	5	30	-	33	26	25	0.080	0.125
45	4	2	30	6	27	18	13	0.068	0.085
45	30	6	30	-	35	27	32	0.094	0.150
60	4	2	30	6	30	18	16	0.080	0.112
60	30	6	30	-	38	27	40	0.110	0.190



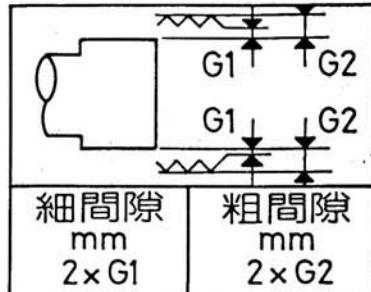
試驗條件 TEST CONDITION

電極材料 ELECTRODE	電解銅 ELECTROLYTIC COPPER
電極極性 POLARITY ELECTRODE	負極 NEGATIVE
工作材料 WORKPIECE	銅 COPPER
加工液 DIELECTRIC	煤油(中國石油) CPC KEROSENE
噴流 INJECTION	: 0.5kg/cm ²
試驗面積 TEST AREA	: 20Ømm

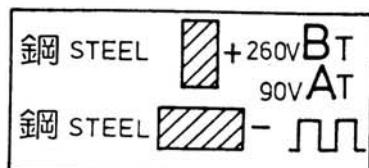
P30 放電操作明細表
P60 APPLICATION NOTE



電流 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板(粗細度) ARD (VDI3400) SAMPLE	消耗比 WEAR RATE	進度 STOCK REMOVAL
AT	PA	PB	V	SAMPLE	%	mm ³ /min



3	2	3	40	18	42	<1	0.050	0.058
45	2	3	40	19	40	<1	0.052	0.061
6	2	3	40	20	38	<1	0.055	0.065
9	2	3	40	22	35	1	0.060	0.072
12	6	4	40	24	30	3.5	0.080	0.096
15	6	4	40	25	27	5.5	0.085	0.103
21	10	5	35	27	23	16	0.100	0.122
30	10	5	35	29	20	27	0.125	0.153
30	15	5	35	30	20	48	0.135	0.167
30	20	6	35	31	25	36	0.150	0.185
45	15	5	35	32	20	65	0.180	0.220
60	15	5	35	33	20	90	0.225	0.270



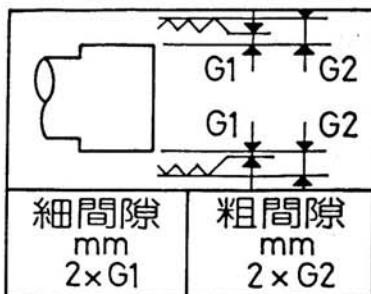
試驗條件 TEST CONDITION

電極材料 ELECTRODE	: 鋼 STEEL
電極極性 POLARITY ELECTRODE	: 正極 POSITIVE
工件材料 WORKPIECE	: 鋼 STEEL
加工液 DIELECTRIC	: 煤油(中國石油) CPC KEROSENE
噴流 INJECTION	: 0.5kg/cm ²
試驗面積 TEST AREA	: 20Ømm

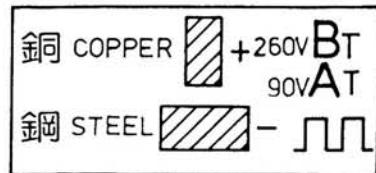
P30 放電操作明細表
P60 APPLICATION NOTE

鋼 STEEL + 260V BT
90V AT
鋼 STEEL - □□

高壓 CURRENT POS.	低壓 CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板粗細度 (VDI 3400) ARD (ARD SAMPLE)	消耗比 WEAR RATE %	進度 STOCK REMOVAL mm ³ /min
BT	AT	P _A	P _B	V			
0.5	1.5	2	3	80	22	80	<1
1	3	2	3	80	23	65	<1
1	4.5	2	3	80	24	60	0.8
1	6	2	3	80	25	55	1.5
2	9	2	4	80	26	50	2.0
2	12	2	4	80	27	45	3.0
3	15	2	4	80	28	42	4.5
3	15	6	4	70	31	30	12
3	15	10	4	70	32	28	20
3	15	15	4	70	33	25	25
3	15	20	4	70	34	18	30
3	15	30	4	60	35	12	38
3	15	45	5	60	36	10	45
3	15	60	5	60	37	7	55
3	15	90	5	60	38	6	60
3	15	120	6	60	39	5	65
3	15	150	6	60	40	4.5	65
3	15	200	7	60	41	4	70
3	15	300	7	60	42	3	72
3	15	400	7	60	43	2	75
3	15	500	8	60	44	2	75
3	21	500	8	60	45	2	90
3	30	500	8	60	45	2.5	125
3	30	600	8	60	45	2	135
5	45	600	9	60	47	3	190
5	60	600	9	60	49	3	250



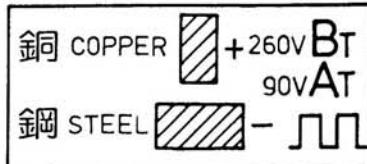
0.5	1.5	2	3	80	22	80	<1	0.040	0.052
1	3	2	3	80	23	65	<1	0.045	0.059
1	4.5	2	3	80	24	60	0.8	0.050	0.066
1	6	2	3	80	25	55	1.5	0.055	0.073
2	9	2	4	80	26	50	2.0	0.057	0.077
2	12	2	4	80	27	45	3.0	0.060	0.082
3	15	2	4	80	28	42	4.5	0.065	0.090
3	15	6	4	70	31	30	12	0.085	0.120
3	15	10	4	70	32	28	20	0.120	0.160
3	15	15	4	70	33	25	25	0.150	0.195
3	15	20	4	70	34	18	30	0.180	0.230
3	15	30	4	60	35	12	38	0.210	0.266
3	15	45	5	60	36	10	45	0.230	0.293
3	15	60	5	60	37	7	55	0.250	0.320
3	15	90	5	60	38	6	60	0.270	0.350
3	15	120	6	60	39	5	65	0.280	0.370
3	15	150	6	60	40	4.5	65	0.290	0.390
3	15	200	7	60	41	4	70	0.310	0.422
3	15	300	7	60	42	3	72	0.330	0.456
3	15	400	7	60	43	2	75	0.340	0.480
3	15	500	8	60	44	2	75	0.350	0.510
3	21	500	8	60	45	2	90	0.400	0.580
3	30	500	8	60	45	2.5	125	0.450	0.630
3	30	600	8	60	45	2	135	0.470	0.670
5	45	600	9	60	47	3	190	0.540	0.760
5	60	600	9	60	49	3	250	0.620	0.880



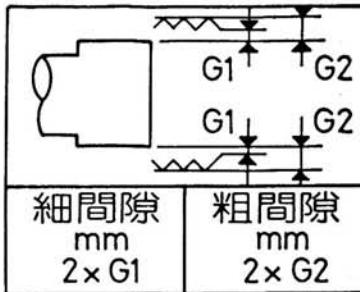
試 驗 條 件 TEST CONDITION

電極材料 ELECTRODE	電解銅 ELECTROLYTIC COPPER
電極極性 POLARITY ELECTRODE	正極 POSITIVE
工作材料 WORKPIECE	鋼 STEEL
加工液 DIELECTRIC	煤油(中國石油) CPC KEROSENE
噴流 INJECTION	: 0.5kg/cm ²
試驗面積 TEST AREA	: 20Ø mm

P30 放電操作明細表
P60 APPLICATION NOTE



高壓電流 BT	低壓電流 AT	HI CURRENT POS. LOW CURRENT POS.	放電時間 ON TIME	休息時間 OFF TIME	電壓表 VOLTAGE	樣板 (粗細度) ARD (VDI 3400)	消耗比 WEAR RATE	進度 STOCK REMOVAL
			PA	PB	V	SAMPLE	%	mm³/min
0.5	1.5		2	1	60	21	10	0.7
0.5	1.5		4	1	60	22	8	1.0
0.5	1.5		6	1	60	22	6.5	1.5
0.5	1.5		8	1	60	23	5	2.5
0.5	1.5		10	1	60	24	4.5	4
0.5	1.5		15	1	60	25	3	4.5
0.5	1.5		20	1	60	26	2.5	5
0.5	1.5		30	1	60	27	2	5
0.5	1.5		45	1	60	28	1.5	4
0.5	1.5		60	1	60	29	1.0	3
0.5	1.5		90	1	60	30	0.5	2
0.5	1.5		120	1	60	30	-	1.5



0.5	1.5	2	1	60	21	10	0.7	0.045	0.057
0.5	1.5	4	1	60	22	8	1.0	0.050	0.062
0.5	1.5	6	1	60	22	6.5	1.5	0.060	0.072
0.5	1.5	8	1	60	23	5	2.5	0.065	0.079
0.5	1.5	10	1	60	24	4.5	4	0.070	0.086
0.5	1.5	15	1	60	25	3	4.5	0.075	0.093
0.5	1.5	20	1	60	26	2.5	5	0.080	0.100
0.5	1.5	30	1	60	27	2	5	0.085	0.107
0.5	1.5	45	1	60	28	1.5	4	0.090	0.115
0.5	1.5	60	1	60	29	1.0	3	0.092	0.120
0.5	1.5	90	1	60	30	0.5	2	0.095	0.127
0.5	1.5	120	1	60	30	-	1.5	0.100	0.132

0.5	3	2	1	60	23	13	1.5	0.055	0.070
0.5	3	4	1	60	24	12	2.5	0.060	0.075
0.5	3	6	1	60	25	10	3.5	0.062	0.080
0.5	3	8	1	60	25	8.5	5	0.065	0.083
0.5	3	10	1	60	26	7	6.5	0.070	0.090
0.5	3	15	1	60	27	5.5	8	0.075	0.097
0.5	3	20	1	60	28	4	9.5	0.080	0.105
0.5	3	30	1	60	29	2.5	11	0.085	0.113
0.5	3	45	1	60	30	1.5	10	0.095	0.127
0.5	3	60	1	60	31	1.0	8	0.100	0.135
0.5	3	90	1	60	32	0.5	6	0.105	0.145
0.5	3	120	1	60	33	-	5	0.110	0.155



Anotronic
Electrochemical
Deburring Machines (ECD)



CNC Wire EDM Sub-Contract
On The Latest Technology
Machines



Anotronic-Ocean
EDM Drilling Machines
Manual, ZNC, CNC



Anotronic-SKM EDMs
Manual, ZNC, CNC



Multi axis CNC Turning



Fully Automated 5axis cnc Milling



CNC CMM inspection



Saxis cnc Milling



AnotronicTM

- Full High capacity Machine Shop including fully Automated 5axis cnc Milling, Multi axis CNC Turning, Grinding etc.
- Laser Part marking
- CNC CMM inspection
- Sale of Standard Electric Discharge Machines (Manual, ZNC & CNC) to take components up to 2500mm x 1200mm x 700mm.
- Design, Manufacture & Sale of Electrochemical Deburring Machines (ECM)
- Comprehensive After Sales Service.
- Design, Manufacture & Sales of EDM & ECM Tooling and Electrodes.
- Multi axis CNC EDM & ECM Sub-Contract Service.
- ECM Sub-Contract Service.
- Wire EDM Sub-Contract Service with cutting areas up to 500mm x 320mm x 420mm HIGH.
- EDM small hole drilling Machines and Sub-Contract Service.
- EDM/ECM Consultancy Service.

Anotronic LTD.TM

Unit 3, Hollingdon Depot, Stewkley Road, Soulbury,
Nr. Leighton Buzzard, Beds., LU7 0DF. England.

Telephone +44 (01525) 270261 Fax +44 (01525) 270235

E-Mail sales@anotronic.com Internet <http://www.anotronic.com>