HAKKO

HAKKO 700
REPAIR SYSTEM

INSTRUCTION MANUAL

Please read this Instruction Manual thoroughly before operating the HAKKO 700.

SPECIFICATION

■ CONTROL STATION

Power Consumption	AC100—120, 220 or 240V 150W
Output Voltage	24V
Outer Dimensions	260 (W) × 145 (H) × 255 (D) mm (10.2 × 5.7 × 10")
Weight	7.2 kg (15.84 lb) approx.
Soldering Side	
Temperature	200—480° C (392—896° F)
Desoldering Side	
Temperature	300—400° C (572—752° F)
Vacuum Power	600 mmHg max.

■ SOLDERING IRON

Part Number	M926
Power Consumption	AC24V 50W
Temperature Control	Control Accuracy of setting at idling temperature ±0.5° C (±0.9° F)
Insulation Resistance	Over 300M ohm at 400° C (752° F) by DC500V tester
Leak Voltage	under 0.6mV
Heating Element	Ceramic Heater 3ohm at 20° C
Cord	5 wired burn-proof silicon cord, 1.2m (4') long
Connector	5 pin inter-lock system
Length	190 mm (7.5")
Weight	45g (0.10 lb)
Grip Material	Heat resisting plastic

■ DESOLDERING IRON

Part Number	D700
Power Consumption	AC24V 40W
Heating Element	Ceramic Heater
Filter Pipe	Pyrex Heat Resistant Glass
Cord/Suction Tube	1.5 m (5') long each
Connector	4 pin inter-lock system
Nozzle Inside Diam.	1.0 mm (0.039")—standard 0.8 mm (0.031"), 1.3 mm (0.051") & 1.6 mm (0.064")—optional
Weight	230g (0.51 lb) approx. w/o Cord & Suction Tube

ACCESSORIES

IRON HOLDER FOR SOLDERING IRON	1
IRON HOLDER FOR DESOLDERING IRON	1
CLEANING SPONGE	1
TIP & SPONGE TRAY	1
MAGNETICR TRAY HOLDER	1
SMALL CLEANING PIN (FOR NOZZLE & HEATING CORE)	1
LARGE CLEANING PIN WITH PLASTIC HANDLE (FOR HEATING CORE)	1
CLEANING WRENCH	1
FILTER SET(STEEL WOOL & WHITE FELT FILTERS)	5
ANTI-SEIZING LUBRICANT	1
CHECR VALVE	1

PART NAMES

CONTROL STATION

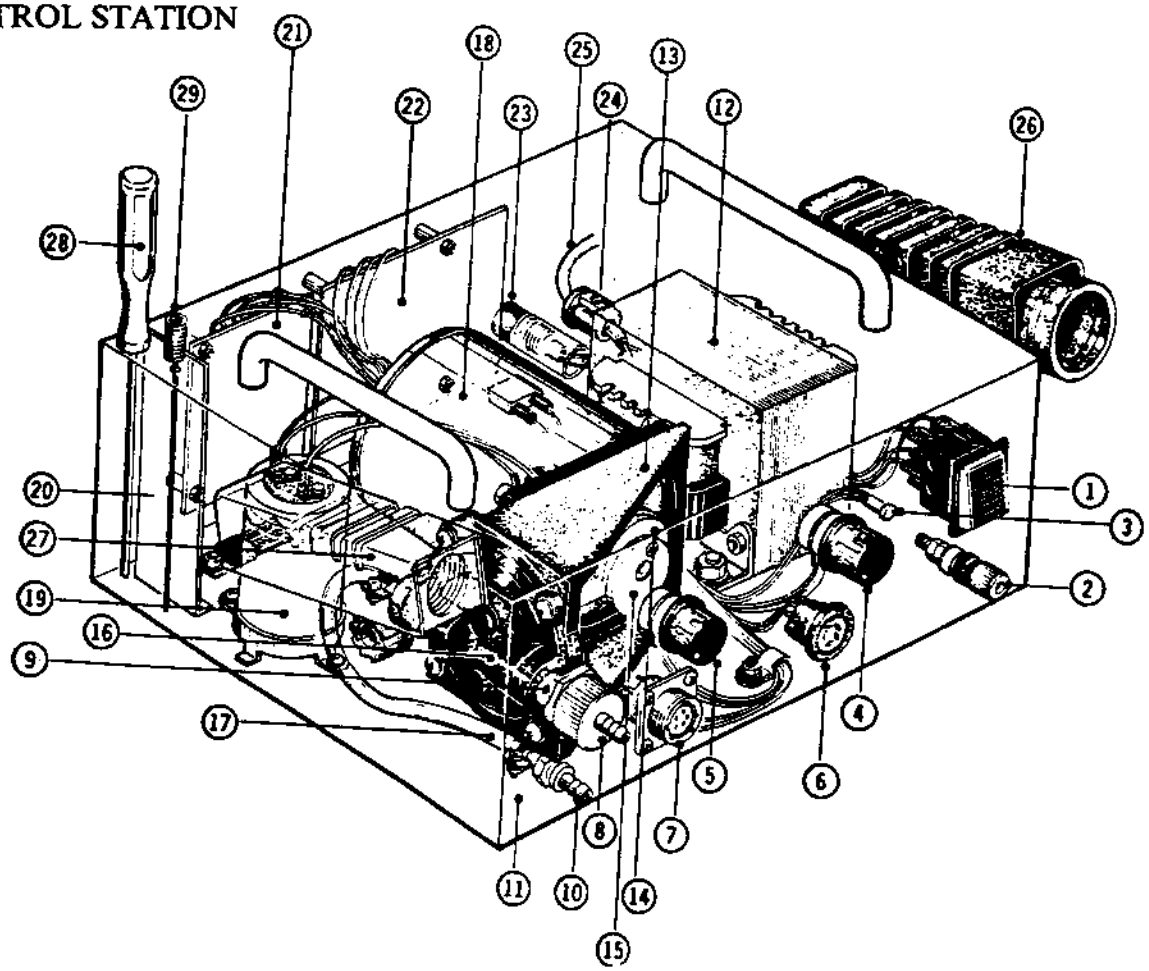
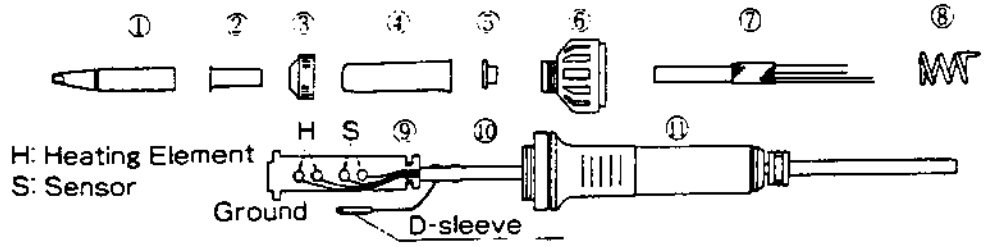


FIG. 1

1	700-272	POWER SWITCH	11		METAL HOUSING CASE	21		HEAT CONTROL PCB FOR DESOLDERING
2		EARTH TERMINAL	12	888-025	TRANSFORMER	22		HEAT CONTROL PCB FOR SOLDERING
3		L.E.D. POWER LAMP	13		PUMP FRAME	23	B1041	FUSE HOLDER
4	B1028	HEAT CONT. SOLDER.	14	481-206	CRANK	24		STRAIN RELIEF BUSHING
5	B1028	HEAT CONT. DESOLD.	15		BALANCE WEIGHT	25		POWER SUPPLY CORD
6	926-209	PLUG RECEP. SOLDER	16	481-203	PUMP HEAD	26	926-022	SOLDERING IRON HOLDER
7	888-031	PLUG RECEP. DESOLD	17		AIR LEAD HOSE	27	707-022	DESOLDER. IRON HOLDER
8	700-213	VAUUM OUTLET CAP	18	SEE BELOW	MOTOR	28	B1085	LARGE CLEANING PIN
9		VACUUM OUTLET RET.	19	SEE BELOW	CAPACITOR	29	B1087	CLEANING PIN (1.0MM)
10		AIR NOZZLE	20		PARTITION PLATE			

■ SOLDERING IRON

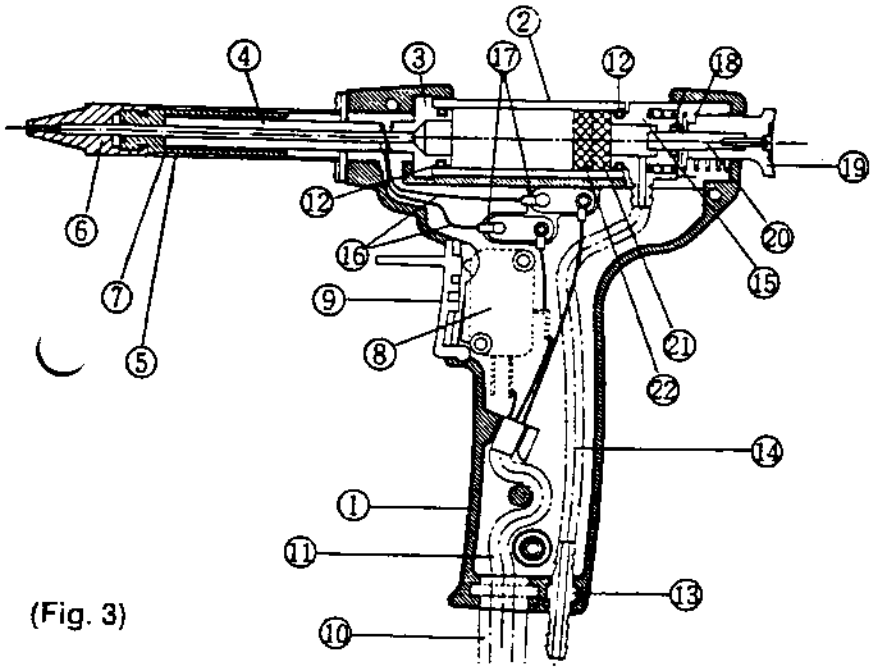


(Fig. 2)

1	900M-T-( )	TIP	5	COMES W #6	FIT. FOR SUP. PIPE	9	900M-101	TERMINAL BOARD
2	COMES W #6	ELEMENT SUP. PIPE	6	~~900M-044~~ B1921	NIPPLE	10	900-039(S)	POWER CORD
3	~~900M-006~~ B1784	NUT	7	~~900M-E~~ A1321	HEATING ELEMENT	11	900-031(S)	HANDLE
4	~~900M-802~~ B1786	TIP ENCLOSURE	8	900M-036	GROUNDING SPRING	12	900-034	GRIP

(S) INCLUDED IF THE IRON IS ESD

■ 700D



(Fig. 3)

1	700-112	HOUSING
2	481-002	FILTER PIPE
3	481-101	FRONT HOLDER
4	800M-E	HEATING ELEMENT
5	COMES W #7	ELEMENT COVER
6	483-T-( )	NOZZLE
7	483-012	HEATING CORE
8	B1026	MICRO SWITCH
9	481-014	TRIGGER
10	888-036	STRAIN RELIEF
11	888-001	POWER CORD
12	A1012	O-RING
13	481-113	HOSE JOINT
14	481-011	GUIDE HOSE
15	481-102	BACK HOLDER
16	COMES W #4	ELEMENT LEAD LINE
17		CRIMPED CONNECTOR
18	COMES W #15	HOLDER SPRING
19	COMES W #15	KNOB
20	COMES W #15	HOLDER FITTING
21	481-021 FILTER SET INCLUDES #21 & #22	#21 FELT FILTER #22 STEEL WOOL FILTER

■ OPERATING INSTRUCTIONS

(1) Remove the packing cover from Vacuum Outlet Retainer (Fig.1,No.9), screw Vacuum Outlet Cap (Fig.1,No.8) with White Felt Filter on-to Vacuum Outlet Retainer (Fig.1,No.9).

(2) Set Iron Holder (Fig.1,Nos.26/27) to both sides of Control Station with supplied Thumb Screws and adjust the angel by fixing Screws.

REMARKS: Iron Holder (Fig.1, No.27) shall be set on left side of Control Station with non-slip washer, and another Holder (Fig.1,No.26) shall be attached to right side.

(3) Put Desoldering Iron into leftside and Soldering Iron into right side Iron Holders respectively.

(4) Connect the Power Cords of both Irons to Plug Receptacle (Fig.1, Nos.6/7), and also connect Suction Tube of Desoldering Iron to Vacuum Outlet Cap (Fig.1, No.8).

(5) Put two Cleaning Pins (Fig.1, Nos.28/29) into the holes of Station top.

(6) Dampen Cleaning Sponge (not shown) with water. And set it on Station top with Tip & Sponge Tray and Tray Holder (both not shown).
WARNING: Special coated Tips/Nozzle may be damaged if cleaned in dry condition.

(7) Confirming Power Switch (Fig.1, No.1) is set at 'OFF' position, connect Main Plug to power supply source.
Set the temperatures by turning Heat Control Knobs (Fig.1, Nos.4/5), and turn Power Switch (Fig.1, No.1) on.
WARNING: Always connect or disconnect Plugs of Irons and Mains after Power Switch off, or Control Printed Circuit Boards inside of Station may be damaged.

(8) Soldering Iron can be operated when L.E.D. Power Lamp (Fig.1, No.3) starts to come on and off.
Exceptionally high thermal recovery allows a lower temperature setting thereby protecting sensitive components and extending Tip life.
WARNING: Ceramic Heating Element cannot stand excessive force. Never strike Soldering Iron against work-bench or solid surface. Always remove excess solder from Tip prior to soldering.

(9) For Desoldering Iron, wait approx. 10 minutes for heating-up after switch on.
WARNING: Never attempt to use Iron before it has sufficiently heated-up as Nozzle hole and/or Heating Core inside may become clogged with cold solder and/or flux.

(10) To remove any materials that may clog Nozzle (Fig.3, No.6) and Heating Core (Fig.3, No.7), insert Small Cleaning Pin (Fig.1, No.29) from Nozzle top and clean inside.

(11) Place Nozzle (Fig.3, No.6) on the lead of the component to be removed and gently move Desoldering Iron back and forth for 2 or 3 seconds. When the lead begins to move freely, the solder is sufficiently melted.
Then, pull Trigger (Fig.3, No.9) of Iron, and Vacuum Pump will absorb the melted solder.
REMARKS: If the solder is not sufficiently melted, the component will not be properly desoldered due to insufficient suction.
Should this occur, resolder the component and repeat desoldering process from step item (11) above mentioned.

(12) Air Nozzle (Fig.1, No.10) is to give optional usage for air blowing. Use it connecting to Air Tube or Hot Air Tool for dust cleaning or tube shrinking.
REMARKS: Air suction and air blow functions can not be used at the same time.
WARNING: If Desoldering Iron is used as a Hot Air Tool, be sure to clean Nozzle (Fig.3, No.6) and Heating Core (Fig.3 No.7) inside and remove solder in Filter Pipe (Fig.3, No.2). Or hot melted solder or flux may blow out from Nozzle top.

MAINTENANCE

■ FOR SOLDERING SIDE

a. Replacing Heating Element

(1) Turn Nut (Fig.2, No.3) counterclockwise and remove Tip Enclosure (Fig.2, No.4), Iron Tip (Fig.2, No.1), Element Support Pipe (Fig.2, No.2) and Fitting for Support Pipe (Fig.2, No.5).

(2) Turn Nipple (Fig.2, No.6) counterclockwise and remove it from Iron.

(3) Pull both Heating Element (Fig.2, No.7) and Power Supply Cord (Fig.2, No.10) out of Handle (Fig.2, No.11) : toward Iron Tip.

(4) Pull Grounding Spring (Fig. 2, No.8) out of D-Sleeve.

(5) Measure the resistant value at Sensor and Heating Element of Terminal (Fig.2, No.9).

(6) Desolder the Heater Lead Wire.

(7) Solder new Heating Element. Solder two Sensor Leads (blue) and Heater Leads (red) on Terminal Fiber-board
*In the above item (5) and (6), be careful not to damage the leads with soldering iron.

(8) Insert Grounding Spring (Fig.2, No.8) into Heating Element (Fig.2, No.7). And connect Grounding Spring and D-Sleeve on the opposite side of Heater Leads.

(9) Pull Power Cord (Fig.2, No.10) and fix Heating Element in Handle to prevent rolling.

(10) Turn Nipple (Fig.2, No.6) and secure Handle.

(11) Replace Fitting for Support Pipe (Fig.2, No.5), Element Support Pipe (Fig.2, No.2), Iron Tip (Fig.2, No.1), Tip Enclosure (Fig.2, No.4) and secure Nut (Fig.2, No.3).

WARNING: Make sure Nut securing Tip Enclosure assembly is properly tightened.
When Heater is replaced, unscrew Nut first, then unscrew Nipple. After replacing Heater, screw Nipple first and screw Nut. Opposite Procedure may cause the damage of Heater.

b. Recalibration of Iron Temperature

(1) After replacing Heating Element, recalibrate the temperature of Soldering Iron.

(2) Connect Plug of Soldering Iron to the Control Station and lock it.

(3) Set Temperature Control Knob (Fig.1, No.4) at 400° C (752° F).

(4) Turn Power Switch (Fig.1, No.1) on and wait till L.E.D. Power Lamp (Fig.1, No.3) comes on and off.

(5) Adjust the temperature of Tip at 400° C (752° F) by "CAL" (Soldering) on the rear pannel of Control Station using thermometer.

■ FOR DESOLDERING SIDE

a. Replacement of the Filters in Desoldering Iron

(1) Should the suction power of Desoldering Iron become reduced due to the accumulated solder in Filter Pipe (Fig.3, No.2), replace Steel Wool and Felt Filters (Fig.3, Nos.21/22) in the following manner.

(2) Pull Knob (Fig.3, No.19) at the back of Desoldering Iron out and turn it approx. 90° to either left or right.

(3) Remove Filter Pipe (Fig.3, No.2) from Desoldering Iron by sliding it approx. 5mm (0.2") and lift it up and out.

WARNING: If Filter Pipe is hot, turn Power Switch off and wait until Filter Pipe has cooled, or wear a glove while replacing it. Do not drop Filter Pipe, as it is made of Pyrex glass and is very fragile.

(4) Remove the accumulated solder from Filter Pipe (Fig.3, No.2). If necessary, replace Steel Wool and Felt Filter (Fig.3, Nos.21/22). Felt Filter should be replaced whenever it has become coloured or hardened with flux.

WARNING: Never attempt to use Desoldering Iron without Filters in place as Vacuum Pump may become damaged.

REMARKS: Be sure to insert Filters so that Felt Filter (Fig.3, No.21) is at the back and Steel Wool Filter (Fig.3, No.22) is at the front of it.

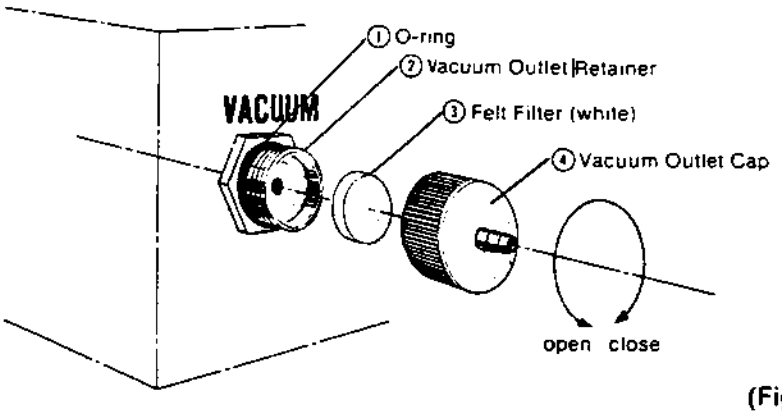
b. Replacement of Filter in Vacuum Outlet Retainer

(1) Should the suction power remains still weak after replacement of Filters in Filter Pipe, Felt Filter in Vacuum Outlet Retainer (Fig.4, No.2) must be replaced. This should be done as follows.

(2) Turn Vacuum Outlet Cap (Fig.4, No.4) to left and remove it.

(3) Replace White Felt Filter (Fig.4, No.3) that is inside Vacuum Outlet Retainer (Fig.4, No.2).

REMARKS: Felt Filter in Vacuum Outlet Retainer is the same one used in Filter Pipe.



(Fig. 4)

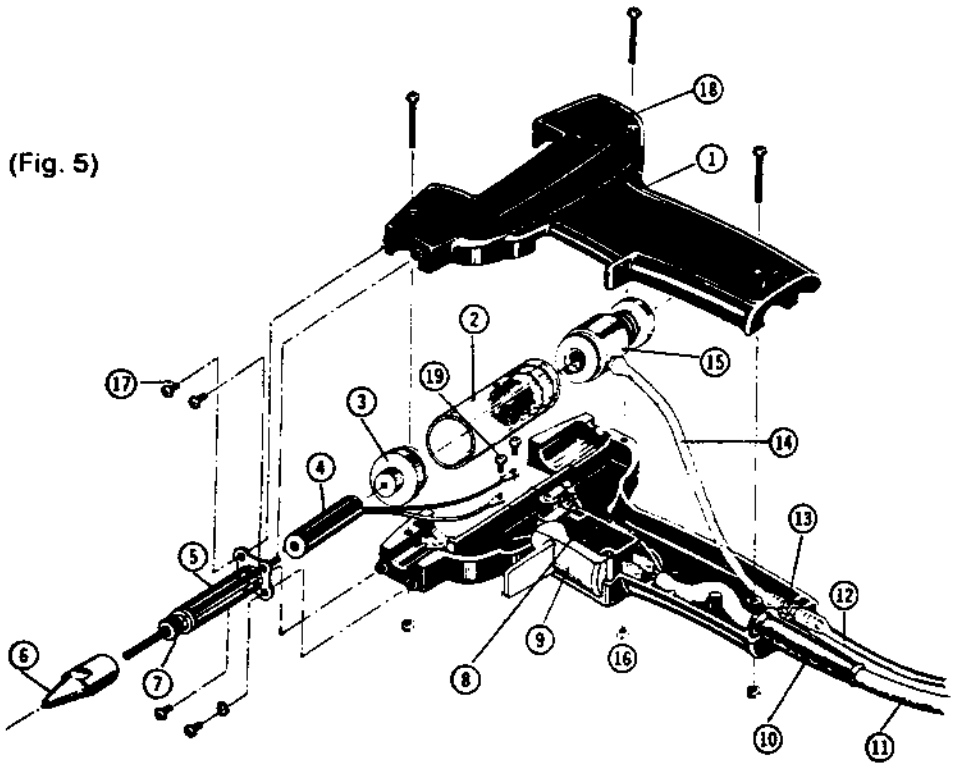
c. Replacement of Nozzle

(1) Use Cleaning Wrench to unscrew Nozzle (Fig.5, No.6).

(2) Coat the threads of New Nozzle with supplied Anti-seizing lubricant and screw Nozzle onto Desoldering Iron.

REMARKS: Nozzle should be replaced while Desoldering Iron is hot as solder may be binding Nozzle to Heating core (Fig.5, No.7). Be careful not to overtighten new Nozzle as you may slip the threads.
At the end of daily use, loosen Nozzle to prevent it from "freezing".

(Fig. 5)



1. Housing (Handle)
2. Filter Pipe
3. Front Holder
4. Heating Element
5. Element Cover
6. Nozzle
7. Heating Core
8. Micro-switch
9. Trigger
10. Cord Protective Covering
11. 4-wired Supply Cord
12. Hose
13. Hose Joint
14. Guide Hose
15. Back Holder
16. Housing Nut
17. Flange Set Screw
18. Housing Set Screw
19. Element Connection Nuts

d. Replacement of Heating Element

(1) Should Heating Element break, replace it in the following manner.

(2) Remove Filter Pipe (Fig.5, No.2)by referring to steps (1) and (2) of Filter Replacement Procedure -a.

(3) Remove Flange Set Screws (Fig.5, No.17).

(4) Remove Housing Set Screws (Fig.5, No.18) and carefully lift it off Housing (Fig.5, No.1).

(5) Unscrew Heating Element connection nuts (Fig.5, No.19).

(6) Remove Front Holder (Fig.5, No.3).

(7) Replace Heating Element (Fig.5, No.4).

(8) Re-assemble Desoldering Iron by above disassemble steps in reverse order.

e. Recalibration after replacement of Heating Element

(1) Loosen the fastener marked "CAL" (Desolder) on the back side of Control Station.

(2) Using a regular point Screwdriver, turn the temperature control potentiometer to Low (fully counterclockwise). After connecting the Unit to power supply, allow it to sit for 10 minutes.

(3) Turn the temperature control potentiometer clockwise until the temperature of Desoldering Iron Tip reaches a stable 300° C with thermometer.

f. Replacement of Heating Core Assembly and Element Cover

(1) Remove Filter Pipe (Fig.5, No.2) by referring to steps (1) and (2) of Filter Replacement procedure -a.

(2) Remove Nozzle (Fig.5, No.6) by referring to step (1) of Nozzle Replacement procedure -c.

(3) Remove four Flange Set Screws (Fig.5, No.17).

(4) Remove Front Holder (Fig.5, No.3).

(5) Remove Element Cover/Heating Core (Fig.5, No.5/7) by gently pulling it off.

(6) Replace Element Cover/Heating Core Assembly.

(7) Insert the small stainless steel pipe of Heating Core Assembly into the hole of Front Holder.

(8) Re-assemble Desoldering Iron by following disassemble steps in reverse order.

(9) Re-attach the grounding wire and Element Cover Flange with 4 Flange Set Screws.

g. Cleaning and Replacement of Diaphragm and Valve

(1) Even though HAKKO 700 incorporates a 3-ply Filter structure in Desoldering side, flux may still occasionally cling to Diaphragm or Valve Plate, causing the vacuum suction power to drop after several days of usage. To clean or replace Vacuum Pump Diaphragm and Valve, follow the procedure outlined below.

(2) Disconnect Power Cord (Fig.1, No.25) from the power supply.

(3) Unscrew Vacuum Outlet Retainer (Fig.4, No.2) and remove it.

(4) Remove Iron Holders (Fig.1, Nos.26/27), Cleaning Pins (Fig.1, Nos.28/29) and Sponge Tray/Tray Holder from Control Station.

(5) Unscrew the screws that secure Cover to Chassis and remove Cover.

(6) Remove Pump Head (Fig.6, No.1).

(7) Unscrew and remove Diaphragm Adjustment Plate (Fig.6, No.2) and Diaphragm (Fig.6, No.3).

(8) Unscrew and remove Fixing Plate (Fig.7, No.5) from inside Pump Head (Fig.7, No.1), and remove Valve Plate (Fig.7, No.4).

(9) Clean off any flux that is adhering to Valve Plate and Diaphragm with alcohol, etc. If any of Pump parts are cracked or deformed, replace them with new parts.

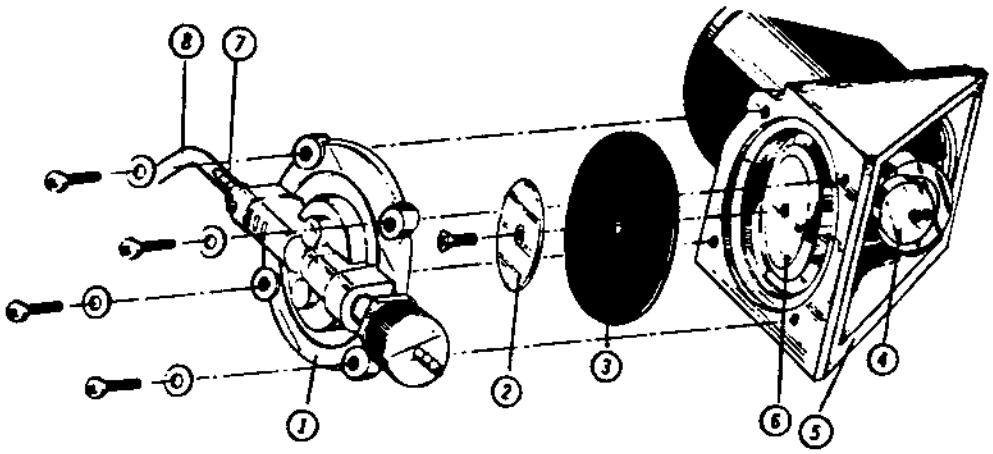
(10) Reassemble the unit by above disassemble steps in reverse order.

WARNING: Be sure to reassemble Fixing Plate (Fig.7, No.5) in proper direction, i.e., so that the countersink in Fixing Plate is opposite the counterbored holes in Pump Head (Fig.7, No.1). Make sure that Crank Arm (Fig.6, No.6) is at the lowest position before replacing Diaphragm (Fig.6, No.3), Diaphragm Setting Plate (Fig.6, No.2) and Pump Head (Fig.6, No.1). Apply a little silicon oil to the surface of Valve Plate (Fig.7, No.4) and Diaphragm (Fig.6, No.3) before reassembling them. This will make future disassembly much easier. Be careful not to allow any dust or other foreign matter to enter Pump inside during reassembling.

h. Others for Maintenance

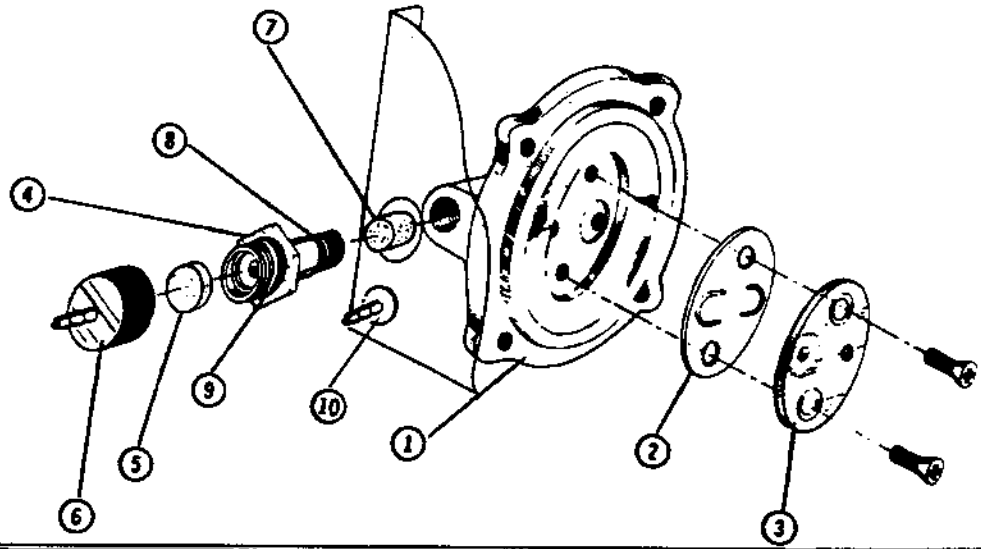
It is very recommendable to clean Nozzle and Heating Core in daily use referring Instruction Sheet which is attached to Cleaning Wrench.

FIG. 6



1	481-203	PUMP HEAD	2	481-204	DIAPHRAGM ADJUST. PLATE
3	SEE BELOW	DIAPHRAGM	4		BALANCE WEIGHT
5		PUMP FRAME	6	481-206	CRANK ARM
7		AIR HOSE JOINT	8		AIR LEAD HOSE

FIG. 7



1	481-203	PUMP HEAD	2	BELOW	VALVE PLATE
3	481-214	FIXING PLATE	4		VACUUM OUTLET RET.
5	A1009	CERAMIC FILTER	6	700-213	VACUUM OUTLET CAP
7	BELOW	AIR INLET FILTER	8	481-209	O-RING P-9
9	481-211	O-RING P-18	10		AIR NOZZLE

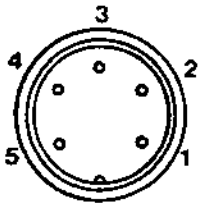
#3 from fig. 6 and #2 & #7 from fig. 7 come together as on part - 481-201

TROUBLE SHOOTING GUIDE

If Power Lamp does not light up and Unit cannot be operated, check first "Fuse" and "Power Cord" from power supply source before checking the following. Replace or repair them, if necessary.

■ FOR SOLDERING SIDE

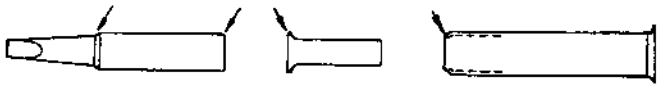
In spite Power Lamp lights up, but Soldering Iron does not heat-up, or uncontrollable and Tip becomes over-heat. After confirming Iron Plug is connected properly, disconnect Iron Plug and measure the resistance value between pins of Iron Connector as under:



a	Between pin 4 & pin 5 (Heating Element)	2.5—3.5 ohm (Normal)
b	Between pin 1 & pin 2 (Sensor)	43 — 58 ohm (Normal)
c	Between pin 3 & Tip (Grounding)	Under 10 ohm

a. If the value of "a" and "b" is different from above value, replace Heating Element (Sensor) or Silicon Cord.

b. If the value of "c" - between pin 3 and Tip (grounding) is over above value, remove the oxidization film by rubbing points shown as under with sand-paper or steel wool.



■ FOR DESOLDERING SIDE

a. Vacuum Pump does not work.
- Is Desoldering Iron properly connected?

b. Solder is not absorbed.
- Is Vacuum Pump working?
- Is Suction Tube properly connected?
- Is Nozzle hot enough?
- Is Filter Pipe full of accumulated solder?
- Are Felt Filter hardened or discoloured with flux?
- Is there a vacuum leakage between Filter Pipe and either Front or Back Holders?
- Is there a vacuum leakage between Vacuum Outlet Retainer and Cap?
- Is Nozzle or Heating Core clogged with solder?

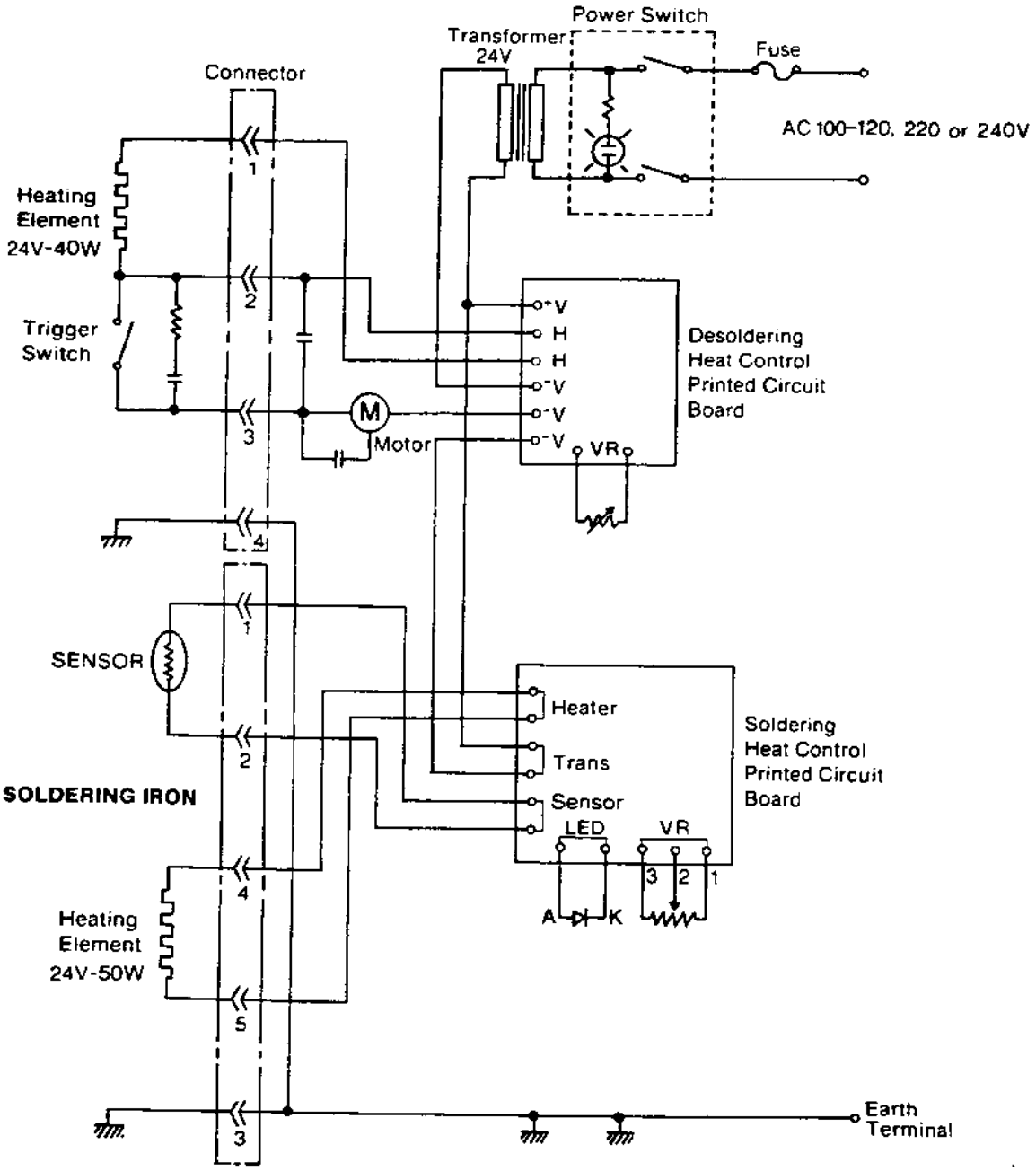
c. Solder cannot be melted completely.
- Is Desoldering Iron properly connected?
- Is Heating Element broken?
  (in this case, Nozzle does not become warm at all)
- Is Nozzle properly tightened?
- Is Nozzle oxidized or become contaminated with flux?

d. Melted solder is blown-out from Nozzle, when Pump begins to work.
- Place supplied Check Valve into Pump Head instead of Sponge Filter referring Instruction Sheet which is attached to Check Valve.

If the problem remains unsolved after checking Unit, please contact with your nearest HAKKO representative.

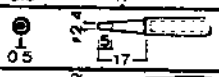
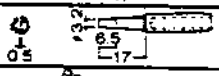
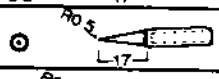
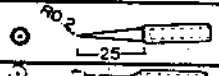
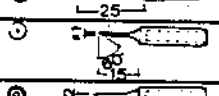
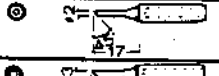
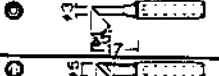
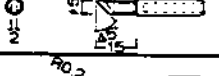
WIRING DIAGRAM

DESOLDERING IRON



REPLACEMENT PARTS

■ SOLDERING SIDE

PART NUMBER	DESCRIPTION	SPECIFICATIONS	CONTROL SETTING RESOLUTION
900M-T-1.6D	TIP		0 (480°C-896°F)
900M-T-2.4D	TIP		0 (480°C-896°F)
900M-T-3.2D	TIP		0 (480°C-896 °F)
900M-T-B	TIP		0 (480°C-896°F)
900M-T-LB	TIP		-10°C (470°C-878°F)
900M-T-1C	TIP		0 (480°C-896°F)
900M-T-2C	TIP		0 (480°C-896°F)
900M-T-3C	TIP		0 (480°C-896°F)
900M-T-K	TIP		+30°C (510°C-950°F)
900M-T-I	TIP		-10°C (470°C-878°F)

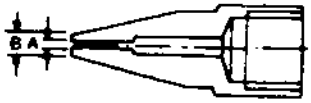
900M TIP OUT DIAM. 6.5Ø

~~900M-H~~ A1321	HEATING ELEMENT	
~~900M-002~~ B1786	TIP ENCLOSURE	
~~900M-006~~ B1784	NUT	
~~900M-044~~ B1921	NIPPLE	
900M-101	TERMINAL BOARD	
900-039(S)	POWER CORD	(S) WOULD BE FOR ESD TYPE
900-001(S)	HANDLE	(S) WOULD BE FOR ESD TYPE
900-034	GRIP	

CAUTION

1) Use exclusive tips for the 926 only. All tips have hallmarks of 900M-T-( ) and black line.
2) The set temperature should be adjusted according to the tip configuration. If required, adjust the temperature with "CAL" potentiometer on the rear panel of the station when changing tip configurations. The temperature is increased by turning "CAL" clockwise.
3) When using the Soldering Iron continuously, loosen Tip and remove oxide once a week. This helps prevent seizure and reduction of tip temperature.
4) Tin the tip daily as follows:
    1. Clean the Tip.
    2. Set the temperature at 200°C(392°F).
    3. Melt the solder gradually at the tip.

■ DESOLDERING SIDE

PART NUMBER	DESCRIPTION	SPECIFICATIONS
483-T-0.8	NOZZLE 0.8Ø	
483-T-1.0	NOZZLE 1.0Ø	
483-T-1.3	NOZZLE 1.3Ø	
483-T-1.6	NOZZLE 1.6Ø	
481-021	FILTER SET	ONE STEEL WOOL & 2 CERAMIC FILTERS
481-002	FILTER PIPE	WITH FILTER SET
800M-H	HEATING ELEMENT	40W 24V
483-012	HEATING CORE	WITH ELEMENT COVER
481-101	FRONT HOLDER	WITH O-RING
481-102	BACK HOLDER	ASSEMBLY
A1012	O-RING	P-12
481-201	DIAPHRAGM SET	VALVE PLATE, DIAPHRAGM AND SPONGE FILTERS
B1085	CLEANING PIN	HEATING CORE
B1086	CLEANING PIN	0.8MM NOZZLE
B1087	CLEANING PIN	1.0MM NOZZLE
B1088	CLEANING PIN	1.3MM NOZZLE
B1089	CLEANING PIN	1.6MM NOZZLE
700-112	HOUSING	
	4-WIRED CORD	WITHOUT CONNECTOR PLUG
	4-WIRED CORD	WITH CONNECTOR PLUG
483-020	CLEANING WRENCH	

	0.8ϕ	1.0ϕ	1.3ϕ	1.6ϕ
A	0.8	1.0	1.3	1.6
B	2.5	2.5	3.0	3.0