

digital

FIELD CHANGE ORDER

APPLICABILITY

All RK05's are to be retrofitted.

Installation of this FCO should be performed by technically qualified personnel only. This entire FCO documentation should be read and understood before implementation is begun.

Your special attention is directed to the "Module Rework/Retrofit and Repair Specification" which is included in this FCO.

SPECIAL TEST EQUIPMENT, TOOLS, or SUPPLIES (Not included in the Field Retrofit Kit)

A detailed listing is provided in each section of the FCO.

FIELD INSTALLATION and TEST PROCEDURE

This FCO incorporates:
ECO RK05-00061, Air Handling
ECO RK05-00055, Capacitor Bracket

ECO G180-00008, Head Select
ECO G180-00009, Data Reliability

ECO 5409484-00005, Overvoltage
Module Rework Standard

Note that this FCO has been subdivided to permit separation of the sections for spares retrofitting, reference, etc.

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Level of Urgency (LOU)

STATUS LOU	FCO EXPENSE RESPONSIBILITY		
	WARRANTY	K	PER CALL
Mandatory	DIGITAL		
Required			CUST
Specification			CUST
Improvement			CUST
Hardware Option	PURCHASEABLE OPTION		
Cosmetic	CUST	CUST	CUST

ESTIMATED TIME TO INSTALL and TEST (on-site) (Travel time not included)
3.0
DECIMAL HOURS

INSTALLATION CHARGE NUMBER
(For Field Service reporting)

On-site FCO installation, by DEC, will be in accordance with both APPLICABILITY and the above FCO EXPENSE RESPONSIBILITY matrix.

QUICK CHECK (To determine if FCO has been installed)

LAST PREVIOUS FCO s S062, S061, B055

RELATED OR PREREQUISITE FCO s / MCO s
G180-00009, 5409484-00005, RK05-00055
RK05-00061

FCO KIT CHARGES (United States and Canada only)

KIT ITEM	DOCUMENTATION		PARTS	OTHER
	<input checked="" type="checkbox"/> FCO	<input checked="" type="checkbox"/> PRINTS	\$10.00	\$70.00

Parts charges are as of FCO release date and are subject to change.

PARTS AVAILABILITY DATE IMMEDIATE

LOGISTICS CODING (PF1417 10\$*) (7161) (X) (4000)

LOGISTICS REVIEW _____

QTY PART NUMBER DESCRIPTION

NOTES: This FCO provides additional rework procedures and component information which were not available at the date of release of the original version of this FCO, which was released on July 25, 1975. Neither the July 25 release nor the September 22, 1975 supplemental release is to be used beyond the availability of this documentation.

APPROVED - Field Service Product Support


Dennis Sullivan

DISTRIBUTION CODING

To all Field Offices
 To Regional Offices

LIST 8,11,15
FDQ 350

LKQ 3500

3850

APPROVED - Technical Documentation


FCO RELEASE DATE

AUGUST 6, 1976

RK05 RETROFIT KIT

THE RK05 RETROFIT KIT IS AN IMPORTANT EFFORT BY DEC AT IMPROVING THE RELIABILITY OF THE RK05 DISC DRIVE.

THE RETROFIT KIT CONTAINS SEVERAL ENGINEERING CHANGE ORDERS (ECO'S) THAT MAY BE INSTALLED TO IMPROVE THE FOLLOWING AREAS:

1. AIR HANDLING ECO-RK05-000061
2. CAPACITOR BRACKET ECO-RK05-000055
3. HEAD SELECT ECO-RK05-000008
4. DATA RELIABILITY ECO-RK05-000009
5. OVER VOLTAGE ECO-5409484-000005

TO INCREASE THE RELIABILITY, THE ABSOLUTE AIR FILTER PREVIOUSLY USED (PART# 12-10803) WILL NO LONGER BE STOCKED. THEREFORE, IT IS SUGGESTED THAT DURING THE NEXT SCHEDULED PM, THIS RK05 FCO RETROFIT KIT BE INSTALLED. IT IS HIGHLY RECOMMENDED THAT ALL THE ECO'S IN THIS KIT BE INSTALLED, NOT THE AIR HANDLING PORTION ALONE.

THE NEW FILTER (PART#12-12175-01), WHEN INSTALLED, WILL PROVIDE BETTER FILTERING, EASE OF REMOVAL, AND ELIMINATE FUTURE HEAD ADJUSTMENTS WHEN CHANGING FILTERS, THEREBY REDUCING DOWN-TIME DUE TO BOTH PREVENTIVE AND REMEDIAL MAINTENANCE.

THE ESTIMATED ON-SITE TIME TO INSTALL THE COMPLETE KIT IS APPROXIMATELY 3 HOURS. SOME DOWN-TIME CAN BE CONSERVED IF THE ECO'S ON THE G180 AND POWER SUPPLY ARE PREVIOUSLY COMPLETED AND TESTED ON A DRIVE OTHER THAN THAT USED BY THE SYSTEM. THE PHOTOGRAPHS HEREIN AND/OR A MODEL OF NECESSARY ETCH CUTS AND WIRE ADDITIONS WILL BE VERY HELPFUL IF SEVERAL DRIVES ARE TO BE RETROFITTED.

WARNING

THIS FCO, AND ALL OTHERS ON THE RK05 DISC DRIVE, SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY. IF ANY PROBLEMS ARE ENCOUNTERED, CONTACT YOUR LOCAL DEC FIELD SERVICE OFFICE OR PRODUCT SUPPORT AT (617)-897-5111, X3455 OR 3453.

READ THIS ENTIRE DOCUMENT THOROUGHLY AND BE CERTAIN THAT YOU UNDERSTAND THE PROCEDURES BEFORE ATTEMPTING TO INSTALL. DETERMINE THAT THE PARTS KIT/S IS COMPLETE BEFORE INSTALLATION IS BEGUN. IF ANY PARTS ARE MISSING OR INCORRECT, DO NOT ATTEMPT EVEN PARTIAL INSTALLATION OR SERIOUS DAMAGE MAY RESULT.

INSTALLATION INSTRUCTIONS
FOR
RK05 ABSOLUTE FILTER KIT
(ECO RK05-00061)

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FIG 6	OLD FILTER SYSTEM (BOTTOM VIEW)
FIG 7	NEW FILTER SYSTEM (BOTTOM VIEW)
FIG 8	NEW FILTER SYSTEM (TOP VIEW)
APPENDIX I	- LIST OF ITEM NUMBERS WITH DEC PART NUMBER AND DESCRIPTION.

() CHECK WHEN COMPLETED

I. PRELIMINARY CHECKS

- () 1. REMOVE ALL POWER BEFORE REMOVING COVERS.
- () 2. USING FIGURE 1 AND 2, CHECK THAT ALL PARTS NECESSARY FOR NEW FILTER SYSTEM ARE AVAILABLE.
- () 3. SEE FIGURES 6, 7 AND 8 TO HELP IDENTIFY DIFFERENT PARTS IN THE RK05 DRIVE.

II. INSTALL SEALS

- () 1. REMOVE TOP AND BOTTOM COVERS ON DISC.
- () 2. (FIG #3) USING GAGE (#24) AS INDICATED, REMOVE PROTECTIVE TAPE AND INSTALL SEAL (#23). IF PROPERLY ATTACHED, SEAL WILL CONTACT SIDES OF THE LOGIC BOX (FIG #8), WHEN COVER IS INSTALLED
- () 3. (FIG #3) PLACE BOTTOM COVER GAGE (ITEM #22) ON CORNER OF REAR BOTTOM COVER AS SHOWN. THE HOLE IN GAGE FITS OVER SCREW TO PROPERLY PLACE GAGE. ATTACH SEAL (#21) TO BOTTOM COVER USING GAGE AS GUIDE. THIS SEAL WILL HOLD PRINTED CIRCUIT MODULES FIRMLY IN PLACE WHEN COVER IS INSTALLED.
- () 4. (FIG #4) INSTALL "L" SHAPED JOINT SEAL (#25) IN CORNER OF LOGIC BOX AS INDICATED. FIRST REMOVE THE M7100, M7101 AND M7102 MODULES AND LAY ASIDE, NOTICE PLACEMENT ORDER AND DIRECTION COMPONENT SIDES ARE FACING. IF G180 IS REMOVED, MARK TOP HEAD WIRE PLUG WITH FELT PEN.

WARNING: DO NOT REMOVE THE G180 MODULE WITHOUT REMOVING THE HEAD WIRE PLUGS, OTHERWISE YOU MAY DAMAGE THE HEAD WIRES.

- () 5. (FIG #4) NEXT INSTALL ITEM #26 AND #15 OVER HOLES IN LOGIC BOX AS SHOWN. THE LARGER SEAL WITH SLIT WILL GO OVER HEAD WIRES.

III. INSTALLING AIR DUCTS

- () 1. (FIG #8) REMOVE BLOWER ASSEMBLY BY REMOVING FOUR ALLEN SCREWS IN BASE.

NOTE: IF BLOWER HAS AN OUTWARD FACING FLANGE, REMOVE IT, DO NOT REMOVE ANY INWARD FACING RING.

- () 2. (FIG #4) INSTALL INLET RING SEAL (#20) ON BLOWER, POSITIONING HOLES IN FORM OVER SCREWS ON BLOWER. CLEAN CHASIS OF ANY FOREIGN MATERIAL BUT BE CAREFUL NOT TO DROP ANY IN FILTER INTAKE HOLE.
- () 3. (FIG #4) INSTALL CABLE SLOT SEAL (#16) ON LOGIC BOX OVER TWO WIRES. BEFORE PLACING SEAL ON BOX POSITION SO THAT 3/8" IS OVERHANGING ON THE BOTTOM.
- () 4. (FIG #6) REMOVE PLENUM COVER TO EXPOSE OLD FILTER. AFTER REMOVING OLD FILTER, THE PLENUM COVER CAN BE DISPOSED OF, SINCE IT WILL NOT BE USED WITH THE NEW FILTER.
- () 5. (FIG #5) INSTALL INLET PORT (#11) THROUGH HOLE IN CASTING UNDER BLOWER ASSEMBLY, BE SURE TO INSERT HOOK STRAP (#28) SO THAT ROLLED END IS STICKING OUT FROM UNDER INLET PORT. ALSO FACE THE HOOKED SIDE OF THE HOOK STRAP TOWARD THE CENTER OF THE DRIVE. THIS WILL LATER CONNECT TO THE LOOP PAD (#30) TO RETAIN THE NEW FILTER.
- () 6. (FIG #5) SLIDE COOLING DUCT (#13) UNDER POSITIONER WITH "THIS SIDE UP" MARKINGS FACING UPWARD. THIS WILL GIVE ADDITIONAL COOLING FOR THE REGULATORS.

CAUTION: SOME WIRES MAY BE RUNNING UNDER THE LINEAR POSITIONER; IF SO, CAREFULLY MOVE THEM SO THAT THE COOLING DUCT CAN BE POSITIONED UNDER THE LINEAR TRANSDUCER.

ONCE THE COOLING DUCT IS UNDER THE LINEAR POSITIONER THE 2" SQUARE HOLE SHOULD ALIGN OVER THE INLET PORT (#11).

- () 7. (FIG#5) INSERT STANDOFFS (#14) INTO HOLES PROVIDED IN THE COOLING DUCT (#13). INSURE THE STANDOFFS REST DIRECTLY ON THE BASE CASTING.
- () 8. (FIG#8) REPLACE BLOWER ASSEMBLY ONTO STANDOFFS AND INSTALL BLOWER HOLD DOWN SCREWS (FIG#5, ITEM 32). BEFORE FINAL TIGHTENING CHECK TO SEE IF HOOK STRAP (#25) IS STILL IN PROPER PLACE STICKING OUT FROM UNDER INLET PORT (#11).
- () 9. (FIG#8) REMOVE OLD AIR DUCT (#17), CLEAN OPENING.
- () 10. (FIG#5) INSERT OUTLET PORT (#12) THRU HOLE IN BASE CASTING WHERE AIR DUCT (#17) WAS JUST REMOVED. THE POSITION FOR INSTALLATION CAN BE VIEWED IN FIG #7, ITEM #12.
- () 11. (FIG#8) INSTALL NEW AIR DUCT (#17) AND TIGHTEN SCREWS PROVIDED.
- () 12. (FIG#8) INSTALL GASKET (ITEM#29) ON AIR DUCT.

CAUTION: INSURE TOP SURFACE OF GASKET IS FLAT AND NOT BUCKLED. THEREFORE PUSHING UP ON DISC PACK - THIS MAY CAUSE SERIOUS DAMAGE TO PACK AND DRIVE. THE GASKET CAN BE BROKEN IN BY RUNNING A SCREWDRIVER HANDLE OR OTHER BLUNT OBJECT AROUND THE SEAL. THIS MAKES THE FOAM SEAL SOFT ENOUGH TO ALLOW THE CARTRIDGE TO SEAT EASILY ON THE AIR DUCT AND SUPPORT POSTS. DO NOT CAUSE ANY FOAM PARTICLES TO FALL INTO AIR DUCT. ALSO CHECK THE HEIGHT OF THE FOAM, IT SHOULD MEASURE FROM TOP TO BOTTOM OF THE GASKET ONLY 3/8" OR LESS.

- () 13. (FIG#7) PLACE NEW FILTER IN POSITION IN CAVITY AS VIEWED FROM BOTTOM PHOTOGRAPH. PLACE HOSE CLAMP OVER OUTLET PORT (#12).

IT WILL BE NECESSARY TO FIRST INSERT TUBULAR PORTION OF FILTER INTO OUTLET PORT (#12). BEFORE TIGHTENING HOSE CLAMP INSURE FILTER IS SEATED INTO SQUARE INLET PORT GOING TO BLOWER. ONCE IT IS SEATED, PULL HOOK STRAP TIGHT AND ATTACH TO LOOP PAD (#3).

- () 14. (FIG#7) INSTALL FILTER BRACKET (#9) AS SHOWN AND TIGHTEN HOSE CLAMP (FIG#10). THE HOSE CLAMP MAY NEED TO BE POSITIONED SO IT WILL NOT RESTRICT THE COVERS WHEN INSTALLED ON THE DRIVE.
- () 15. INSTALL PRINTED CIRCUIT MODULES THAT WERE REMOVED IN STEP #4. USE FIGURE #7 FOR MODULE ORDER KEEPING IN MIND THAT THE COMPONENT SIDE OF THE MODULES WILL FACE TOWARD THE POWER SUPPLY SIDE.
- () 16. MAKE A USUAL CHECK OF CABLES, CONNECTORS AND OTHER PARTS THAT MAY HAVE BEEN MOVED OR LOOSENED DURING INSTALLATION.

IV. FINAL CHECKS AND ADJUSTMENTS

- () 1. APPLY POWER TO DRIVE AND LET RUN FOR A FEW MINUTES WITHOUT A DISC PACK. THIS WILL HELP BLOW OUT ANY FOREIGN PARTICLES IN THE FILTER OUTPUT PATH.
- () 2. CHECK AND ADJUST HEAD ALIGNMENT USING THE RK05K-AC ALIGNMENT CARTRIDGE.
- () 3. INSTALL ALL COVERS AND RETURN DRIVE TO ORIGINAL POSITION. DO NOT INSTALL COVERS WITH POWER TO DRIVE.
- () 4. RUN APPROPRIATE RK05 DIAGNOSTIC.

IT WILL BE NECESSARY TO FIRST INSERT TUBULAR PORTION OF FILTER INTO OUTLET PORT (#12), BEFORE TIGHTENING HOSE CLAMP, INSURE FILTER IS SEATED INTO SQUARE INLET PORT GOING TO BLOWER. ONCE IT IS SEATED, PULL HOOK STRAP TIGHT AND ATTACH LOOP TO PAD (#3).

- () 14. (FIG#7) INSTALL FILTER BRACKET (#9) AS SHOWN AND TIGHTEN HOSE CLAMP (FIG#10). THE HOSE CLAMP MAY NEED TO BE POSITIONED SO IT WILL NOT RESTRICT THE COVERS WHEN INSTALLED ON THE DRIVE.
- () 15. INSTALL PRINTED CIRCUIT MODULES THAT WERE REMOVED IN STEP #4. USE FIGURE #7 FOR MODULE ORDER, KEEPING IN MIND THAT THE COMPONENT SIDE OF THE MODULES WILL FACE TOWARD THE POWER SUPPLY SIDE.
- () 16. MAKE A USUAL CHECK OF CABLES, CONNECTORS AND OTHER PARTS THAT MAY HAVE BEEN MOVED OR LOOSENED DURING INSTALLATION.

V. FINAL CHECKS AND ADJUSTMENTS

- () 1. CLEAN PREFILTER LOCATED ON REAR OF DRIVE. FILTER SHOULD ALWAYS BE INSTALLED FACING THE SAME DIRECTION. THIS WILL HELP PREVENT PARTICLES FROM BEING INJECTED INTO THE AIR SYSTEM. FREQUENT CLEANING OF THIS FILTER WILL HELP TO PROLONG THE LIFE OF THE ABSOLUTE FILTER AND PROVIDE CLEANER AIR PASSAGES.
- () 2. APPLY POWER TO DRIVE AND LET RUN FOR A FEW MINUTES WITHOUT A DISK PACK. THIS WILL HELP BLOW OUT ANY FOREIGN PARTICLES IN THE FILTER OUTPUT PATH.
- () 3. CHECK AND ADJUST HEAD ALIGNMENT USING THE RK05K-AC ALIGNMENT CARTRIDGE.

- () 4. INSTALL ALL COVERS AND RETURN DRIVE TO ORIGINAL POSITION.
DO NOT INSTALL COVERS WITH POWER TO DRIVE.
- () 5. RUN APPROPRIATE RK05 DIAGNOSITC.

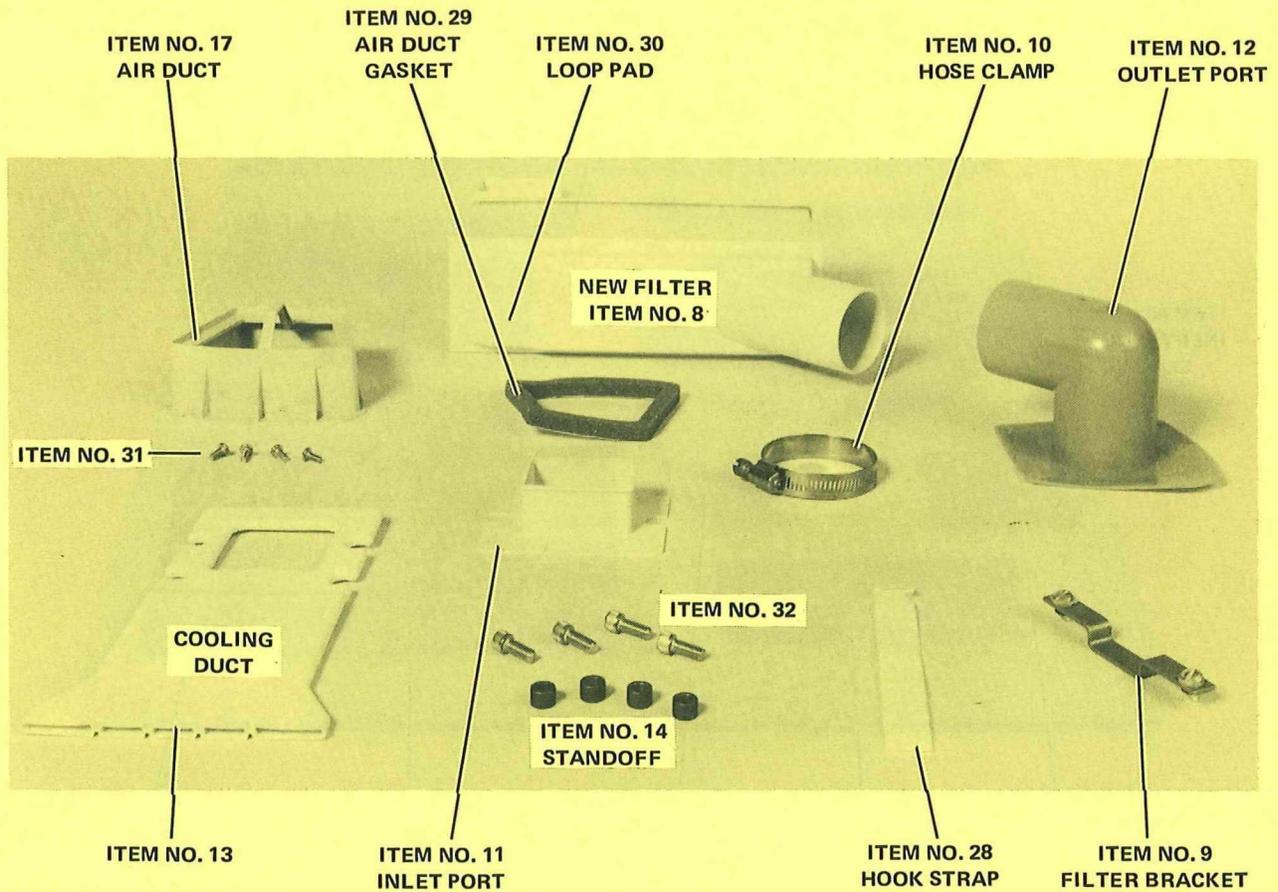


FIGURE NO. 1 AIR HANDLING PARTS REQUIRED WITH NEW FILTER SYSTEM

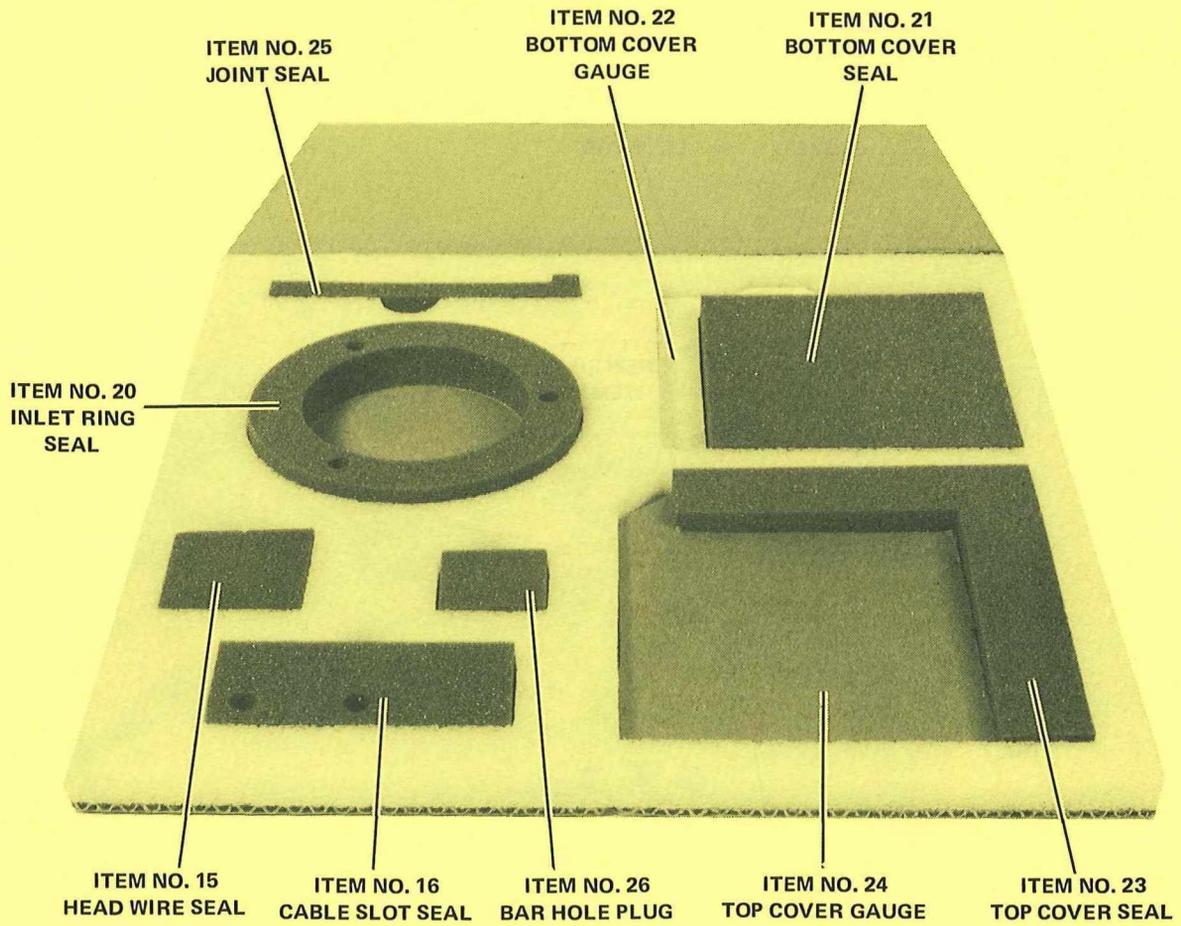


FIGURE NO. 2 AIR HANDLING PARTS REQUIRED WITH NEW FILTER SYSTEM

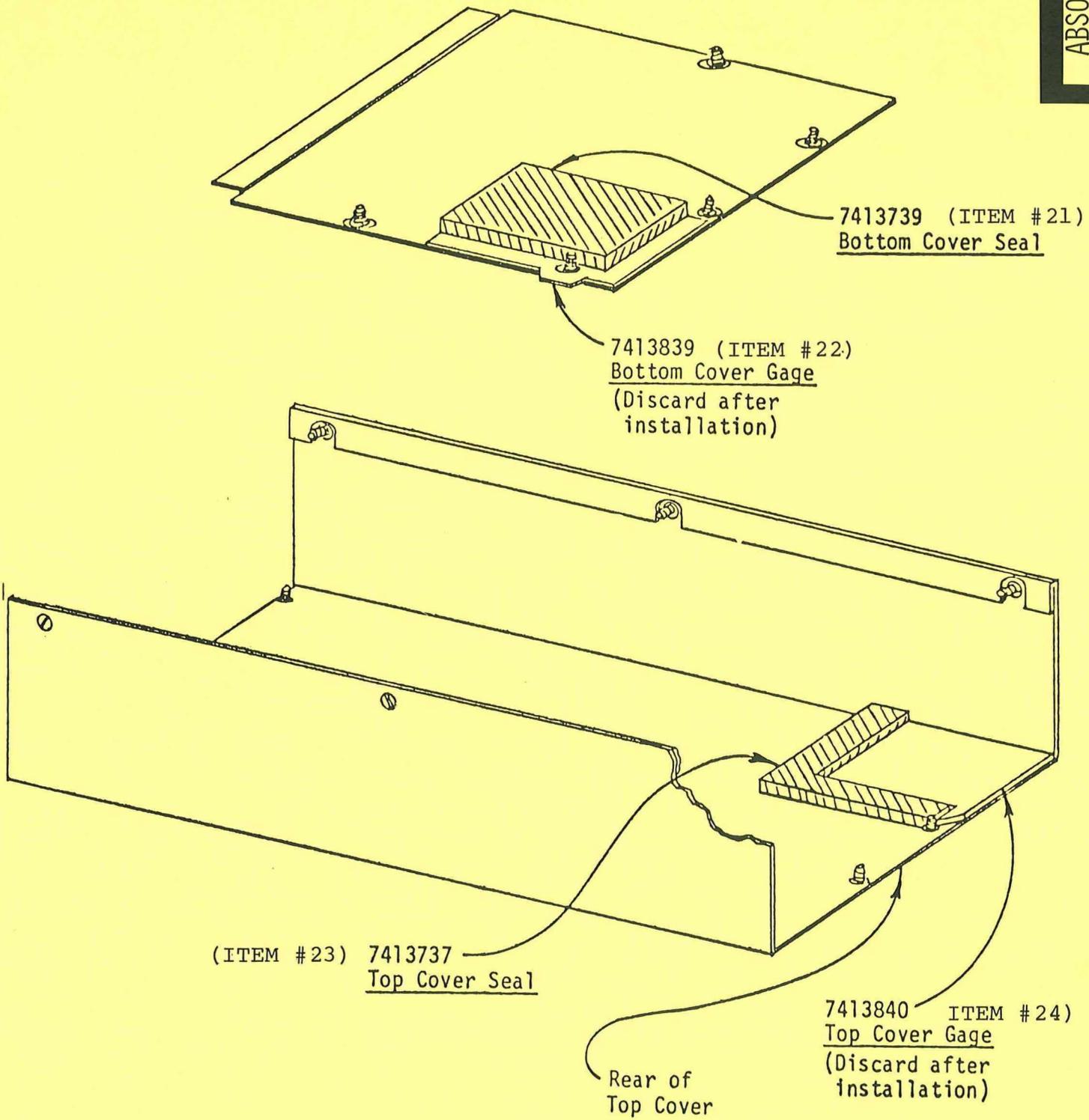


FIGURE #3

NOTE: Position accurately the first time. Almost impossible to reposition in one piece.

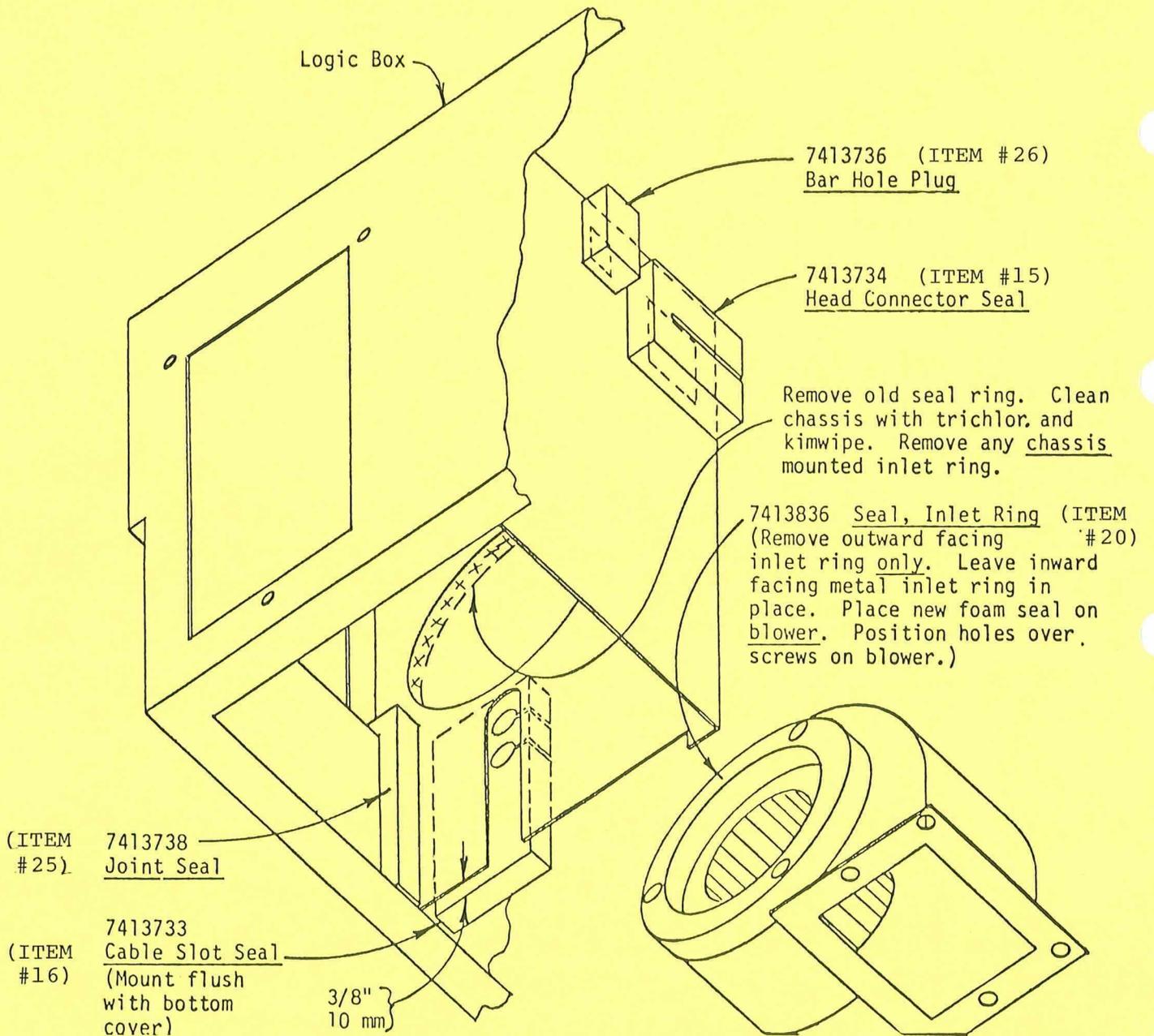


FIGURE #4

Remove and Discard

- (1) Plenum Cover
- (1) Filter with foam gasket
- (1) Air duct, Rev. C
- (4) Old blower hold-down screws
- (4) Blower split ring washers
- (4) Old air duct hold down screws

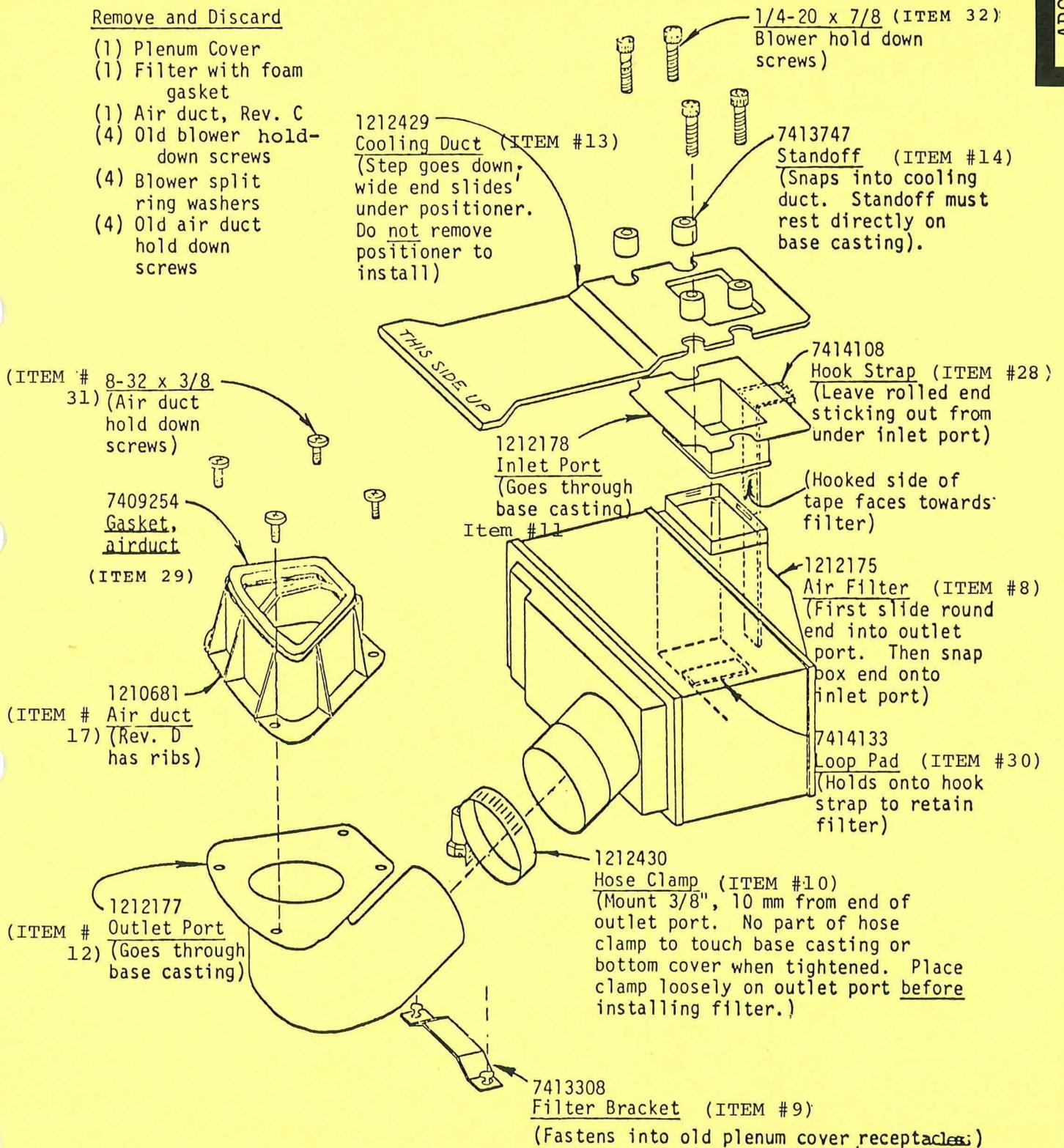


FIGURE #5

This bracket may not be included on newly shipped drives.

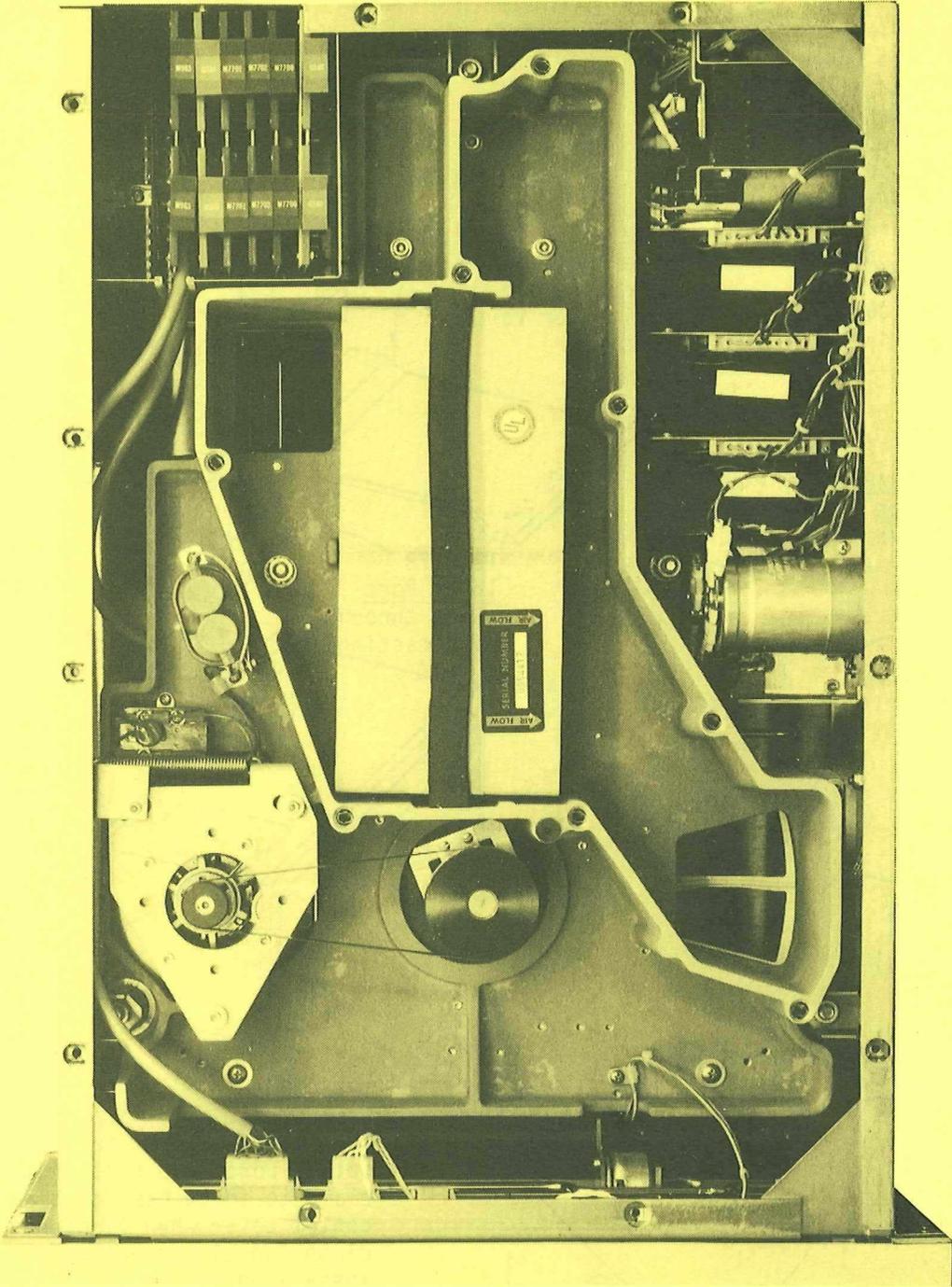


FIGURE NO. 6 OLD FILTER SYSTEM (BOTTOM VIEW)

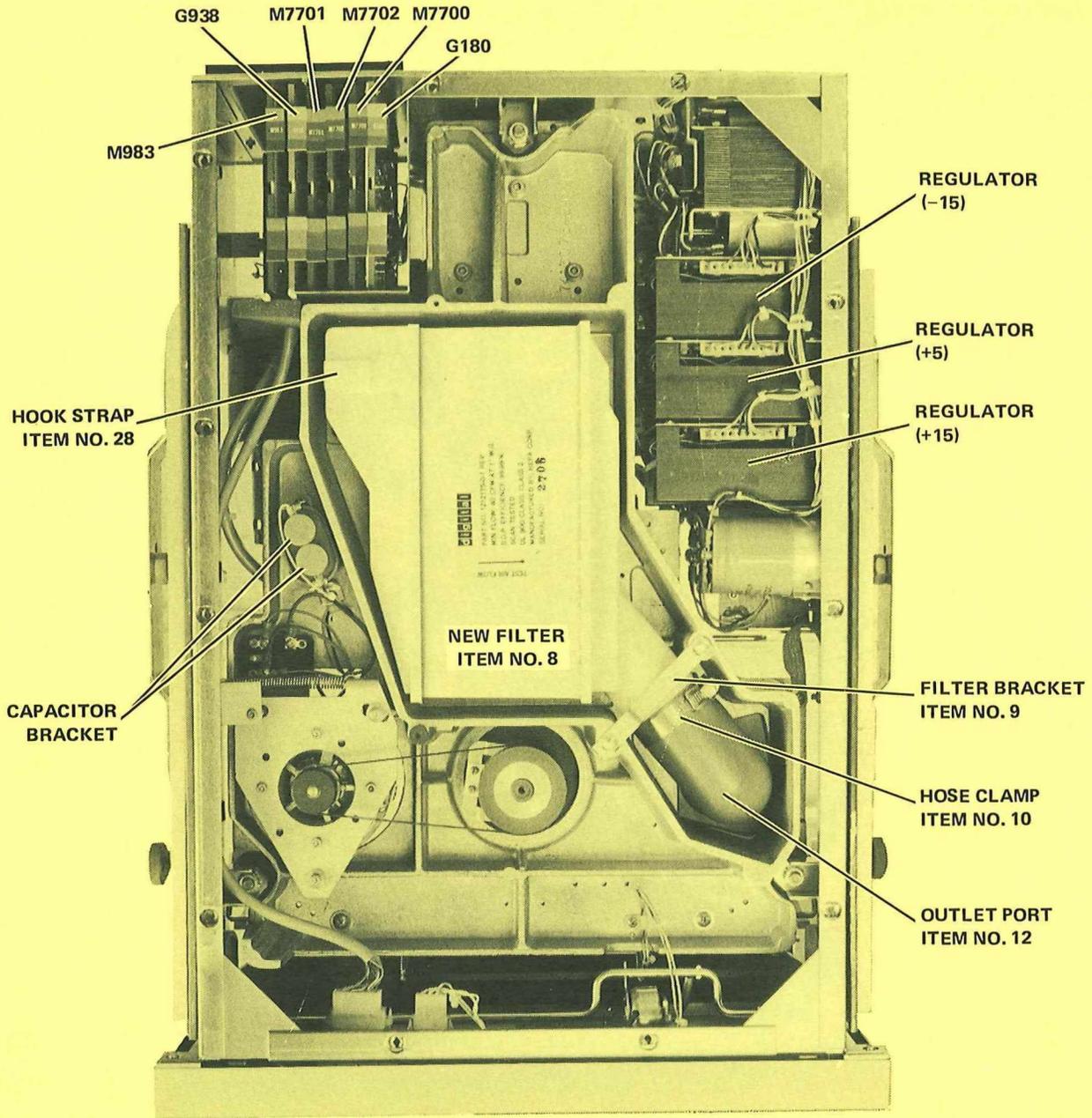


FIGURE NO. 7 NEW FILTER SYSTEM (BOTTOM VIEW)

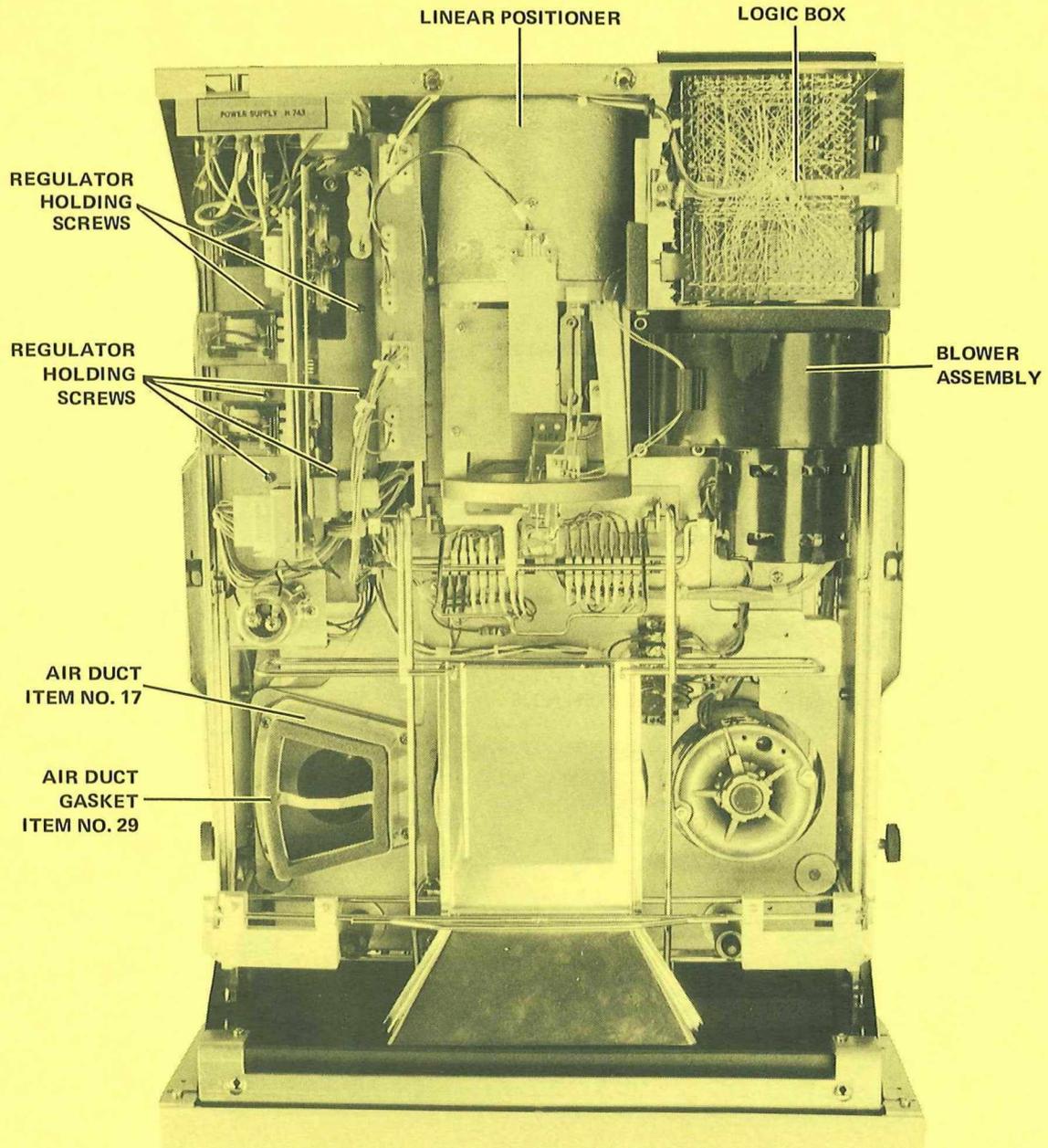


FIGURE NO. 8 NEW FILTER SYSTEM (TOP VIEW)

PART LIST

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION OF MATERIAL</u>
7	9006037-1	SCR PHL HDPAN #8-32 x 3/8
8	1212175-01	FILTER AIR HIGH EFFICIENCY
9	7413308	FILTER BRACKET
10	1212430	HOSE CLAMP
11	1212178	INLET PORT
12	1212177	OUTLET PORT
13	1212429	COOLING DUCT
14	7413747	STANDOFF
15	7413734	HEAD CONNECTOR SEAL
16	7413733	CABLE SLOT SEAL
20	7413836	SEAL, INLET RING
21	7413739-0-0	BOTTOM COVER SEAL
22	7413839-0-0	BOTTOM COVER GAGE
23	7413737-0-0	TOP COVER SEAL
24	7413840-0-0	TOP COVER GAGE
26	7413736-0-0	BAR HOLE PLUG
28	7414108	HOOK STRAP
29	7409254	AIR DUCT GASKET
30	7414133	LOOP PAD
31		SCREWS 8-32 x 3/8
32		SCREWS 1/4-20 x 7/8
17	1210681	AIR DUCT
25	7413738-0-0	JOINT SEAL

INSTALLATION INSTRUCTIONS
FOR
RK05 CAPACITOR BRACKET KIT
(ECO RK05-00055)

CONTENTS

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22	PURPOSE OF ECO
23-26	INSTALLATION INSTRUCTIONS
FIG 1	CAPACITOR BRACKETS AND SCREWS
FIG 2	SKETCH OF BRACKET INSTALLATION

ECO RK05-00055

THE PURPOSE OF THIS ECO IS TO IMPROVE THE GROUNDING PATH FOR THE BLOWER RUN CAPACITOR. THE PRESENT BRACKET AND TAPE MOUNTING SCHEME MAY CAUSE RANDOM READ/WRITE ERRORS.

() CHECK WHEN COMPLETED

I. PRELIMINARY CHECKS

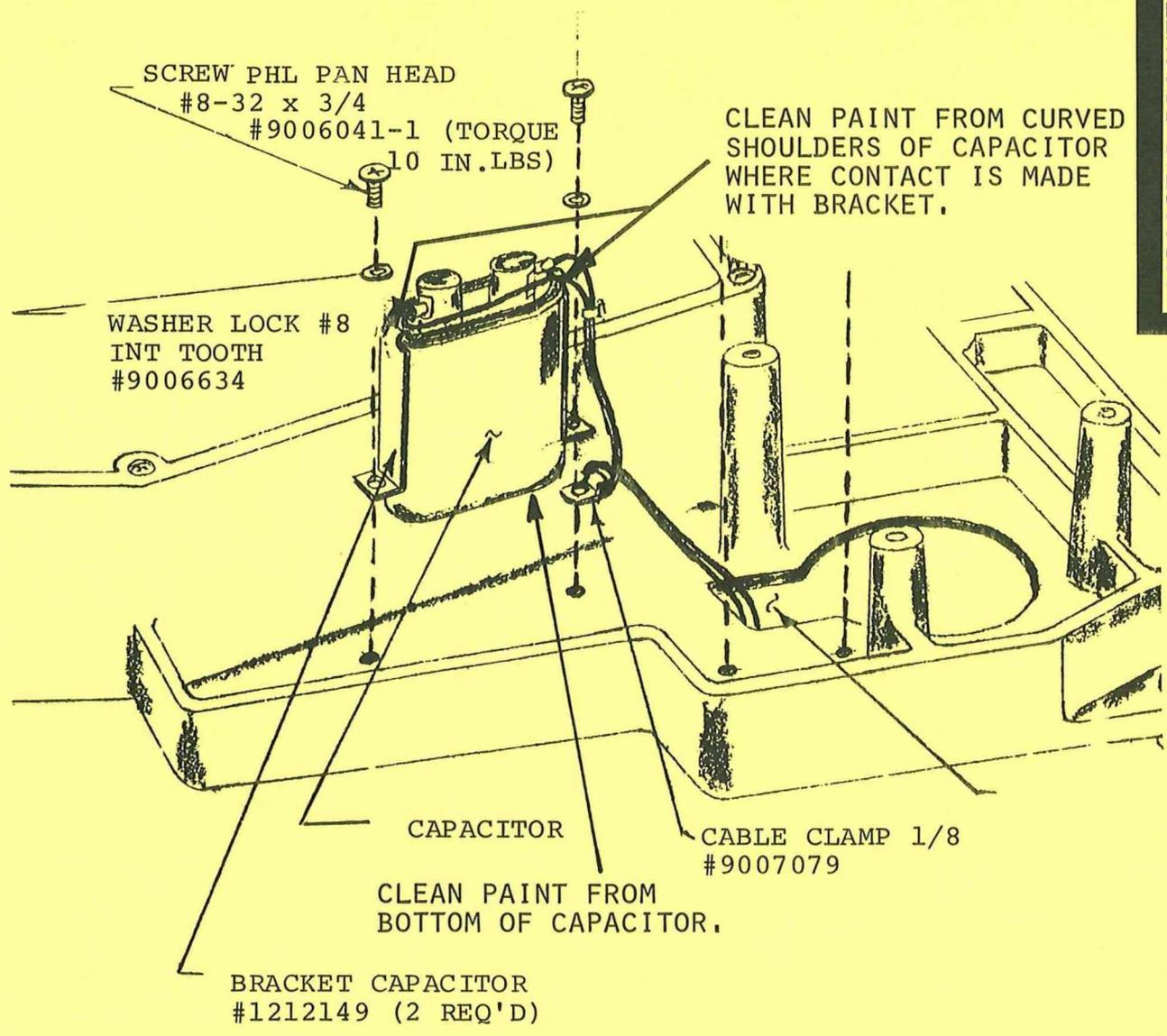
- () 1. REMOVE ALL POWER BEFORE REMOVING COVERS.
- () 2. USING FIG#1, CHECK TO SEE IF ALL PARTS NECESSARY TO INSTALL CAPACITOR BRACKETS ARE AVAILABLE.
- () 3. USE FIG#7 IN AIR HANDLING SECTION TO LOCATE PLACEMENT OF CAPACITOR AND BRACKETS.

II. INSTALLATION OF BRACKETS

- () 1. REMOVE OLD BRACKET FROM CAPACITOR. BE CAREFUL NOT TO DAMAGE WIRES. SAVE WASHERS TO BE USED AGAIN.
- () 2. USING A PIECE OF SANDPAPER, CLEAN PAINT OFF BOTTOM OF CAPACITOR (OPPOSITE END FROM WIRES) AND AROUND EDGE WHERE NEW BRACKETS CONTACT. THIS WILL HELP GROUNDING OF CAPACITOR TO BASE CASTING.
- () 3. INSTALL NEW BRACKETS, FIG 1, USING OLD WASHERS PREVIOUSLY REMOVED; THE SCREWS SHOULD BE TIGHTENED TO 10 " LBS.

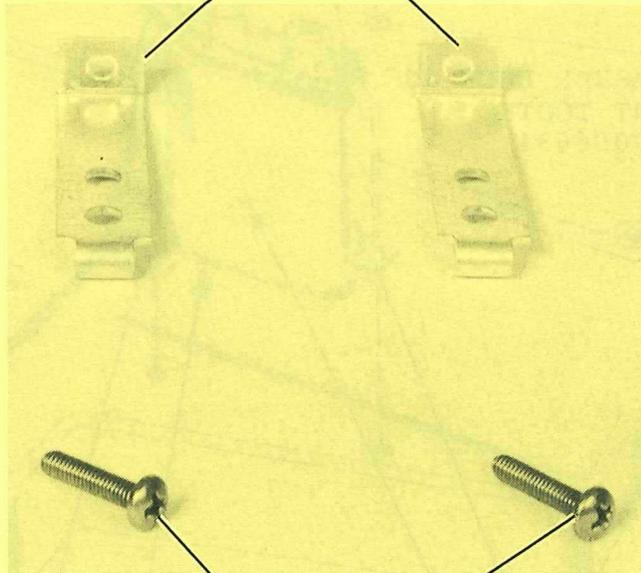
III. FINAL CHECKS

- () 1. CHECK WIRES AND CONNECTIONS.
- () 2. INSURE CAPACITOR IS FIRMLY IN PLACE.



SKETCH OF BRACKET INSTALLATION
FIGURE #2

CAPACITOR
BRACKET
ITEM NO. 7



BRACKET SCREWS
ITEM NO. 9

FIGURE NO. 1 NEW CAPACITOR BRACKETS

PART LIST

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION OF MATERIAL</u>
7	1212149-00	CAPACITOR BRACKET QTY 2
9	9006041-1	SCR, PHL PAN 8-32 X 3/4 QTY 2

CAPACITOR BRACKET

INSTALLATION INSTRUCTIONS

FOR

ECO GI80-00008

ECO GI80-00009

GI80 READ/WRITE MODULE

GI80 READ/WRITE

ECO GI80-00008

THE PURPOSE OF THIS ECO IS TO SOLVE OCCASIONAL HARD CHECK SUM ERRORS OR APPARENT WRITING OF DATA IN THE WRONG SECTORS. HEAD SELECT LINE IS RECEIVED BY A 75452 AND HAS POTENTIALLY ZERO NOISE MARGIN, ALLOWING SIMULTANEOUS SELECTION OF BOTH HEADS, RESULTING IN DATA ERRORS IN THE READ OR WRITE MODE.

ECO GI80-00009

THE PURPOSE OF THIS ECO IS TO CORRECT THE FOLLOWING AREAS:

1. GAIN VARIATIONS IN THE 733 AMPLIFIERS (EI3, EI6) MAY CAUSE THE COMBINATION OF A HIGH AMPLITUDE PACK AND HEAD TO RESULT IN CLIPPING OF DATA.
2. THE PEAKING CAPACITOR AT THE INPUT TO EI3 CAN CAUSE UNDESIRABLE PHASE SHIFTING IN THE VICINITY OF MINOR DISK DEFECTS.
3. VARIATIONS IN HIGH FREQUENCY RESPONSE OF TANTALUM ISOLATION CAPACITORS MAY CAUSE AN IMBALANCE BETWEEN DIFFERENTIAL SIGNAL LINES CAUSING DATA ERRORS.

TOOLS AND EQUIPMENT REQUIRED

1. ECO WIRE (GREEN 30 GAGE) - DEC PART #91-05740-55
2. SOLDERING IRON AND SOLDER
3. CLEANING SOLVENT (TRICHLOROETHYLENE OR EQUIVALENT)
4. CEMENT - PERMABOND #101 CONTACT CEMENT OR EQUIVALENT
5. STIFF BRUSH FOR CLEANING RESIN
6. OSCILLOSCOPE TEKTRONIX #453 OR EQUIVALENT
7. RK05K-AC ALIGNMENT CARTRIDGE
8. RK05 PM OR MAINTENANCE MANUAL
9. RK05 DIAGNOSTICS

THE REWORKING OF THIS MODULE REQUIRES THAT CAREFUL ATTENTION BE GIVEN TO DEC WORKMANSHIP STANDARDS.

THE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION, A-SP-7665265-0-0, WHICH IS REPRINTED AS THE FINAL SECTION OF THIS FCO, SHOULD BE SPECIFICALLY REFERENCED AS FOLLOWS:

REWORK	PAGE	SECTION
CS REVISION LETTER UPDATE	4	4.2
COMPONENT REMOVAL/REPLACEMENT	6	4.3
ETCH CUTTING	14	4.5.2
ADDING LINES (WIRES)	15	4.6

() CHECK WHEN COMPLETED

I. PRELIMINARY CHECKS

- () 1. REMOVE ALL POWER BEFORE REMOVING COVERS.
- () 2. LOCATE HEAD WIRES AND MARK TOP PLUG ON THE GI80 MODULE WITH A FELT TIP PEN. REMOVE THE PLUGS THEN THE GI80 MODULE FROM THE DISC DRIVE.

WARNING: DO NOT REMOVE THE GI80 MODULE WITHOUT FIRST UNPLUGGING THE HEAD WIRES.

- () 3. CHECK THE GI80 MODULE TO DETERMINE IF EITHER ECO HAS BEEN INSTALLED.

THE CIRCUIT SCHEMATIC (CS) REVISION LEVEL WILL BE INDICATED ON THE BACK OF THE PLASTIC HANDLE (SEE FIG I).

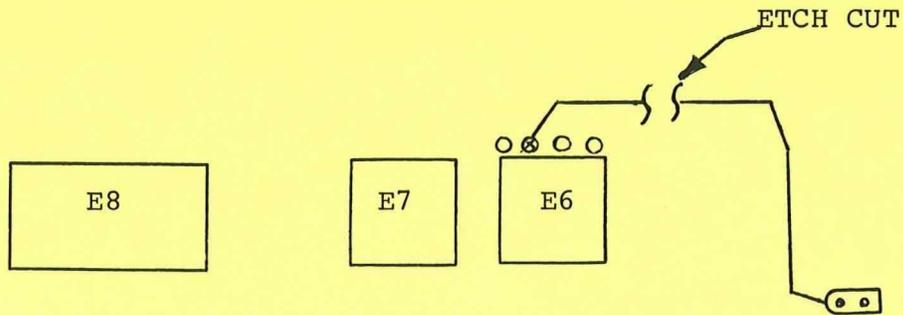
IF THE HANDLE INDICATES THE LATEST LETTER OR NUMBER IS H1, L OR M, ECO GI80-00008 IS INSTALLED.

IF THE NUMBER IS MARKED H2, OR M, ECO GI80-00009 IS INSTALLED.

NOTE: AS ENGINEERING CHANGES ARE MADE THE OLD CS REVISION LETTER OR NUMBER IS CROSSED OUT AND THE NEW REVISION NUMBER WILL BE ETCHED INTO THE PLASTIC WITH A SHARP OBJECT.

II. INSTALLATION OF ECO GI80-0008

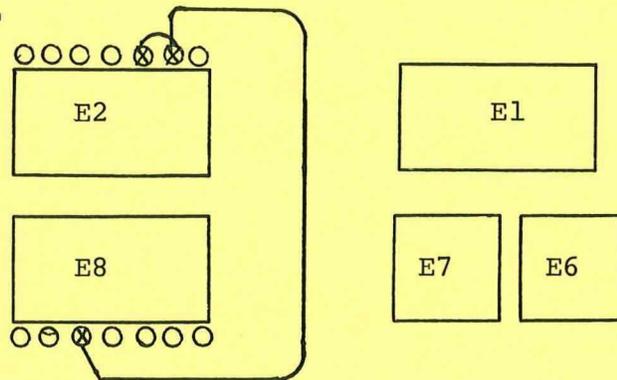
- () 1. (FIG #I) REMOVE THE SCREWS LOCATED IN EACH CORNER OF THE MODULE TO REMOVE THE SHIELD ATTACHED.
- () 2. PERFORM ALL SOLDERING ON THE NON-COMPONENT SIDE. THIS HELPS TO ELIMINATE ACCIDENTAL SPLASHING OF SOLDER ON OTHER PARTS.
- () 3. CUT ETCH THAT RUNS FROM E6 PIN 7 TO FEED THRU SIDE I (COMPONENT SIDE) AS SHOWN BELOW.



SEE FIG. 1 FOR IC LOCATION

USE A SHARP KNIFE AND REMOVE APPROX 1/16" OF THE ETCH.

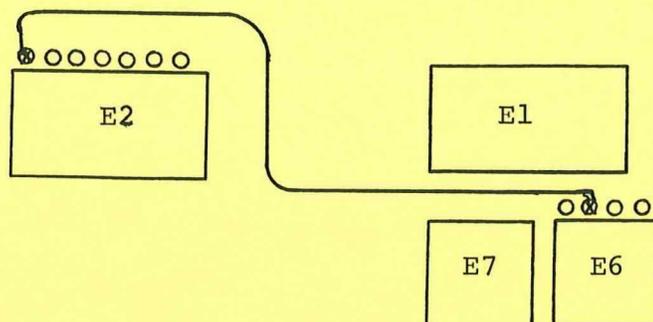
- () 4. ADD WIRE FROM E8 PIN 3 TO E2 PIN 9 AND PIN 10 AS SHOWN BELOW ON THE COMPONENT SIDE OF THE MODULE.



TRY TO PLACE WIRE AS SHOWN BUT DO NOT CEMENT UNTIL ALL WIRES ARE INSTALLED.

WHEN INSTALLING THE SHORT JUMPER FROM E2 PIN 9 TO E2 PIN 10 DO NOT LET ANY BARE WIRE PROTRUDE ENOUGH THAT IT MAY LATER SHORT OUT TO THE ETCH BELOW IT.

- () 5. ADD WIRE FROM E2 PIN 14 TO E6 PIN 7. AS SHOWN BELOW



- () 6. AT THIS TIME CHECK ETCH CUT AND WIRES ADDED FOR CORRECTNESS. IF THE WIRES ARE INSTALLED PROPERLY THEY CAN BE CEMENTED TO THE PRINTED CIRCUIT BOARD. THIS HELPS PREVENT ANY DAMAGE TO WIRES WHEN MODULE IS INSTALLED OR REMOVED FROM THE DRIVE.

III. INSTALLATION OF ECO G180-0009

- I. CHECK KIT FOR COMPONENTS USED IN THIS ECO. FIGURE #1 SHOWS COMPONENTS USED.
 - () 4-CAPACITORS PART #10-01610-00 (ITEM #9)
.014vF 50V AXIAL GLASS
 - () 1-RESISTOR PART #13-00219 (ITEM #5)
68 OHM, 1/4W, 5%
 - () 1-CAPACITOR PART #10-02608 (ITEM #7)
MARKED I8 5%
- () 2. IF THE ATTACHED SHIELD HAS NOT BEEN REMOVED, DO SO BY REMOVING FOUR CORNER SCREWS.
- () 3. PERFORM ALL SOLDERING ON THE NONCOMPONENT SIDE OF THE MODULE.

WARNING: DO NOT CONFUSE THE FOUR DIODES THAT LOOK SIMILAR TO THE CAPACITORS. THE DIODES GENERALLY HAVE A SMALLER DIAMETER GLASS ENVELOPE AND ARE COLOR CODED BLUE, PURPLE, ORANGE. IF YOU CANNOT IDENTIFY THE DIODES, CHECK WITH A MULTIMETER; IN ONE DIRECTION, THE DIODES WILL SHOW A MUCH REDUCED RESISTANCE.

- () 4. (FIG. 1) REMOVE 4 CAPACITORS AS SHOWN (ITEM#8) AND REPLACE WITH 4 CAPACITORS PROVIDED.
- () 5. (FIG 1) REMOVE 1 RESISTOR (ITEM#4) AND INSTALL THE NEW RESISTOR PROVIDED (ITEM#5).
- () 6. (FIG 1) REMOVE 1 CAPACITOR (ITEM#6) AND REPLACE WITH 18 PF CAPACITOR (ITEM#7).
- () 7. USING THE SOLVENT, CLEAN ALL SOLDER JOINTS.
- () 8. CHECK FOR ANY SOLDER SPLASHES OR EXCESS SOLDER.
- () 9. WITH A SHARP OBJECT, ETCH THE NEW CS REVISION INTO THE PLASTIC HANDLE (FIG 1)

USE CHART TO ETCH APPROPRIATE REVISION

ETCH REVISION,

CS REVISION

G180 D

H2

G180 E

H2

G180 F

H3

G180 H

H2

G180 J

H2

G180 K

M

G180 L

M

- () 10. REPLACE SHEILD AND CEMENT AND ANY LOOSE WIRES FROM PREVIOUS ECO'S.

- () 11. INSTALL G180B INTO DRIVE AND REPLACE HEAD WIRES. INSTALL THE BOTTOM PLUG FIRST THEN THE MARKED PLUG ON TOP. IF THE TOP PLUG WAS NOT MARKED, IT CAN BE IDENTIFIED BY FOLLOWING THE WIRE TO THE BOTTOM HEAD.
- () 12. RUN APPROPRIATE RK05 DIAGNOSTICS, AND IF AN RK05 OPERATING SYSTEM WILL BE UTILIZING THE DISK, INSURE THE OPERATING SYSTEM DISC WILL BOOT UP.

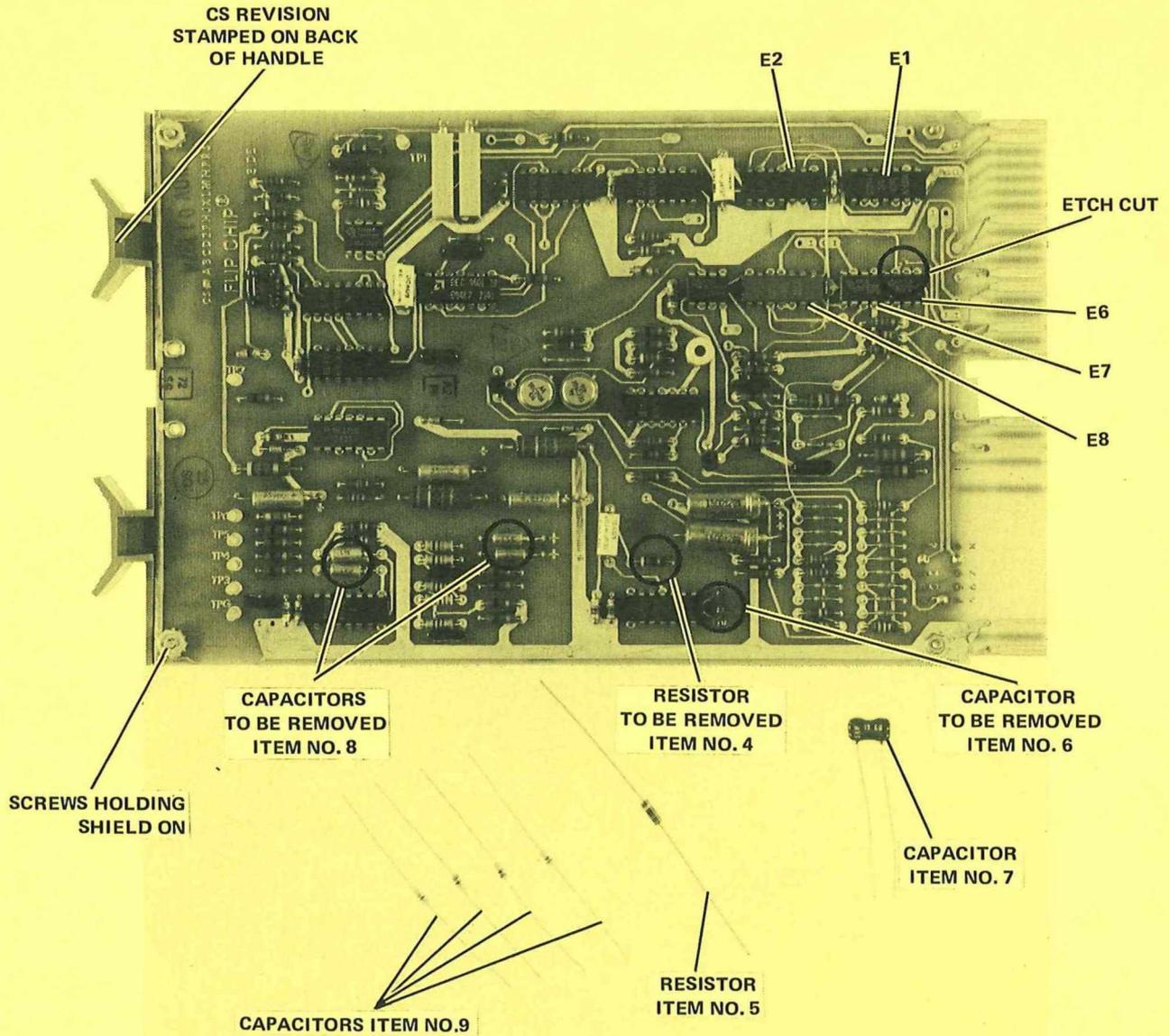


FIGURE NO. 1 ECO G180 00008

PART LIST

<u>ITEM</u> <u>NO.</u>	<u>PART</u> <u>NO.</u>	<u>DESCRIPTION OF MATERIAL</u>
5	1300219	RES 68 OHM 1/4 W 5% QTY 1
7	1002608	CAP 18 PF 100V 5% DM QTY 1
9	1001610-00	CAP .01 YF 50V AXIAL QTY 4

INSTALLATION INSTRUCTIONS
FOR
RK05 8-20 REGULATOR ASSEMBLY
(ECO 5409484-00005)

8-20V REGULATOR

ECO 5409484-00005

THE PURPOSE OF THIS ECO IS TO PREVENT REGULATOR
OVERVOLTAGE AT HIGH LINE VOLTAGE AND LIGHT LOAD
DUE TO VOLTAGE BREAKDOWN OF THE 723 CHIP (E2).

NOTE: TWO REGULATORS ARE TO BE REWORKED. THE PARTS KIT WILL INCLUDE THE PARTS REQUIRED FOR REWORKING BOTH REGULATORS.

THE REWORKING OF THIS MODULE REQUIRES THAT CAREFUL ATTENTION BE GIVEN TO DEC WORKMANSHIP STANDARDS.

THE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION, A-SP-7665265-0-0, WHICH IS REPRINTED AS THE FINAL SECTION OF THIS FCO, SHOULD BE SPECIFICALLY REFERENCED AS FOLLOWS:

REWORK	PAGE	SECTION
CS REVISION LETTER UPDATE	4	4.2
COMPONENT REMOVAL/REPLACEMENT	6	4.3
ETCH CUTTING	14	4.5.2
ADDING LINES (WIRES)	15	4.6

CONTENTS

PAGE	
40	PURPOSE OF ECO
43	TOOLS AND EQUIPMENT REQUIRED
44-54	INSTALLATION INSTRUCTIONS
FIG 1	SIDE 1 8-20 REGULATOR
FIG 2	SIDE 2 8-20 REGULATOR
FIG 3	COMPONENT LOCATOR DRAWING
FIG 4	8-20 REGULATOR SCHEMATIC (WITH ECO INSTALLED)

TOOLS AND EQUIPMENT REQUIRED

1. ECO WIRE (GREEN 30 GAGE) PART #91-05740-55
2. SOLDERING IRON & SOLDER
3. CLEANING SOLVENT (TRICHLOROETHYLENE OR EQUIVALENT)
4. DRILL AND DRILL BIT #56 (1/16")
5. CEMENT - PERMABOND #101 CONTACT CEMENT OR EQUIVALENT
6. STIFF BRUSH FOR CLEANING RESIN
7. OSCILLOSCOPE - TEKTRONIX OR EQUIVALENT
8. RK05K-AC ALIGNMENT CARTRIDGE
9. RK05-P.M. OR MAINTENANCE MANUAL
10. RK05 DIAGNOSTICS

INSTALLATION INSTRUCTIONS

() CHECK WHEN COMPLETED

I. PRELIMINARY CHECKS

- () 1. REMOVE ALL POWER BEFORE REMOVING COVERS.
- () 2. USING FIGURE #1, CHECK TO SEE IF FOUR COMPONENTS NECESSARY TO INSTALL THIS ECO ARE AVAILABLE. (8 TOTAL FOR TWO REGULATORS)
- () 3. (FIG #7) UNPLUG ALL THREE REGULATORS, SQUEEZE BOTH SIDES OF PLUG TO UNLOCK, THEN REMOVE THE -15 AND +15 REGULATORS BY REMOVING TWO SCREWS IN EACH. THE SCREWS CAN BE REACHED ON THE TOP OF THE DRIVE.
- () 4. DO NOT TURN ANY OF THE ADJUSTMENTS ON THE REGULATORS UNTIL SECTION III. IT IS ASSUMED THAT THERE WERE NO PROBLEMS IN THE POWER SUPPLY BEFORE INSTALLING THIS ECO AND THAT THE VOLTAGE LEVELS ARE NORMAL.
- () 5. REMOVE FOUR CORNER SCREWS AND OPEN UP AS SHOWN IN FIGURE #1.

II. INSTALLATION OF ECO

- () 1. (FIG #3) REMOVE R4 - CUT WITH SIDE CUTTERS CLOSE TO P.C. BOARD.
- () 2. (FIG #2) CUT ETCH #1 ON SIDE 2 OF PRINTED CIRCUIT BOARD BETWEEN R3 AND R4.
- () 3. (FIG #2) CUT ETCH #2 ON SIDE 2 OF PRINTED CIRCUIT BOARD BETWEEN R9 AND R22.
- () 4. DRILL FIVE (5) HOLES AS SHOWN IN FIG #2 WITH A #56 DRILL OR EQUIVALENT. WHEN DRILLING THE HOLES BE CAREFUL THE SPACING BETWEEN HOLES IS PROPERLY

SPACED SO THAT THE DIODES (ITEM #10) CAN BE PROPERLY INSTALLED, FIGURE #1.

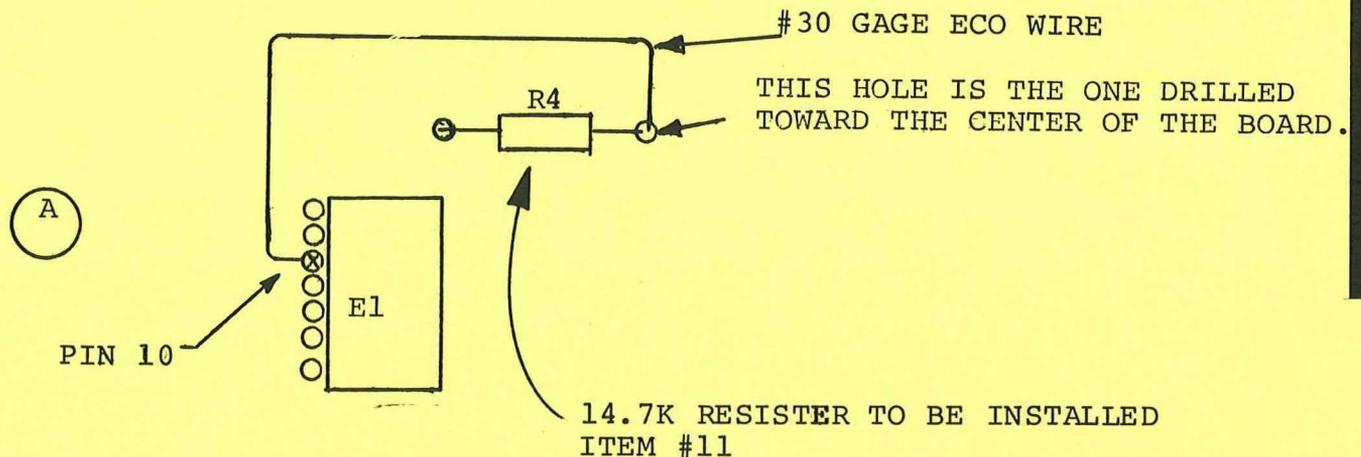
BE CAREFUL THAT YOU DO NOT DRILL THRU ANY PRINTED RUNS ON MODULE.

- () 5. (FIG #3) REPLACE R9 A 27.4K 1/8 W RESISTOR WITH ITEM #9 A 2.4K 1/4 W 5% RESISTOR (COLOR CODE RED-YELLOW-RED).
- () 6. (FIG #3) INSTALL R4 (ITEM #11) THE 14.7K 1/8 W PRECISION RESISTOR WITH ONE OF THE LEADS IN THE HOLE DRILLED IN THE CENTER OF THE BOARD AND THE OTHER IN THE FEED HOLE LOCATED TO THE LEFT AS VIEWED ON FIG #3. THIS IS LOCATED TO THE RIGHT OF Q3 THE LARGE SQUARE TRANSISTOR IN THE CENTER OF THE BOARD. THE HOLES CAN ALSO BE IDENTIFIED ON FIGURE #2.

NOTE: THE FEED THRU MUST HAVE THE SOLDER REMOVED TO INSERT THE RESISTOR.

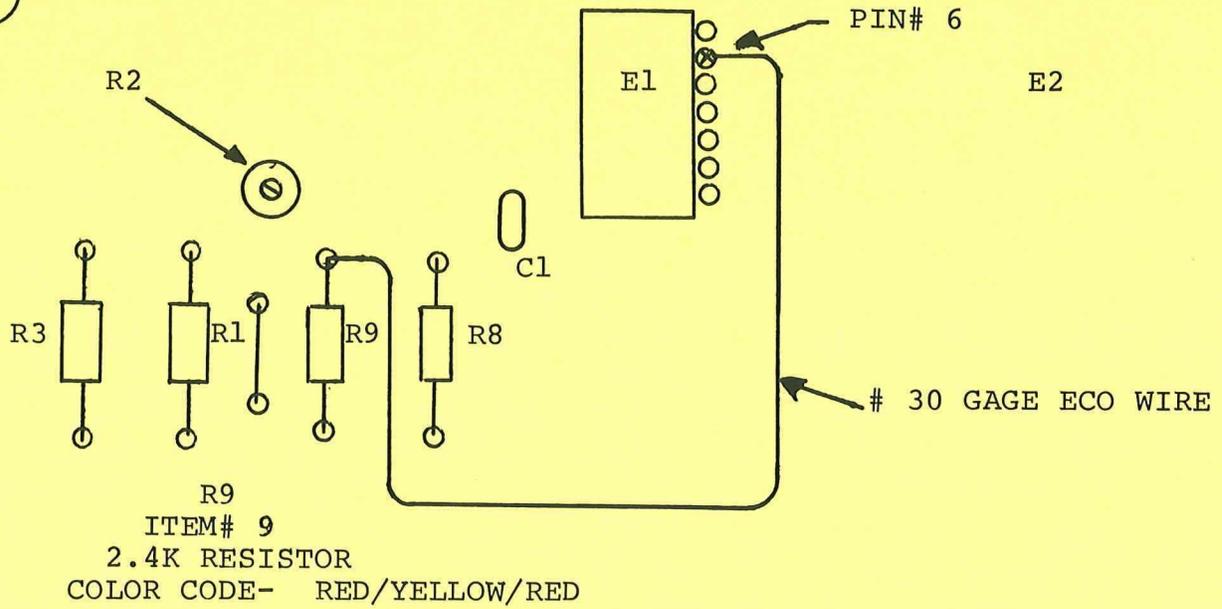
- () 7. USING #30 GAGE ECO WIRE INSTALL THE FOLLOWING THREE WIRES. USE FIGURE #3 TO HELP LOCATE COMPONENT AND WIRE LOCATIONS.

CAUTION: WIRES CONNECTED TO THE WRONG POINTS CAN CAUSE SERIOUS DAMAGE THEREFORE BE CAREFUL AND RECHECK ALL WIRE CONNECTIONS.

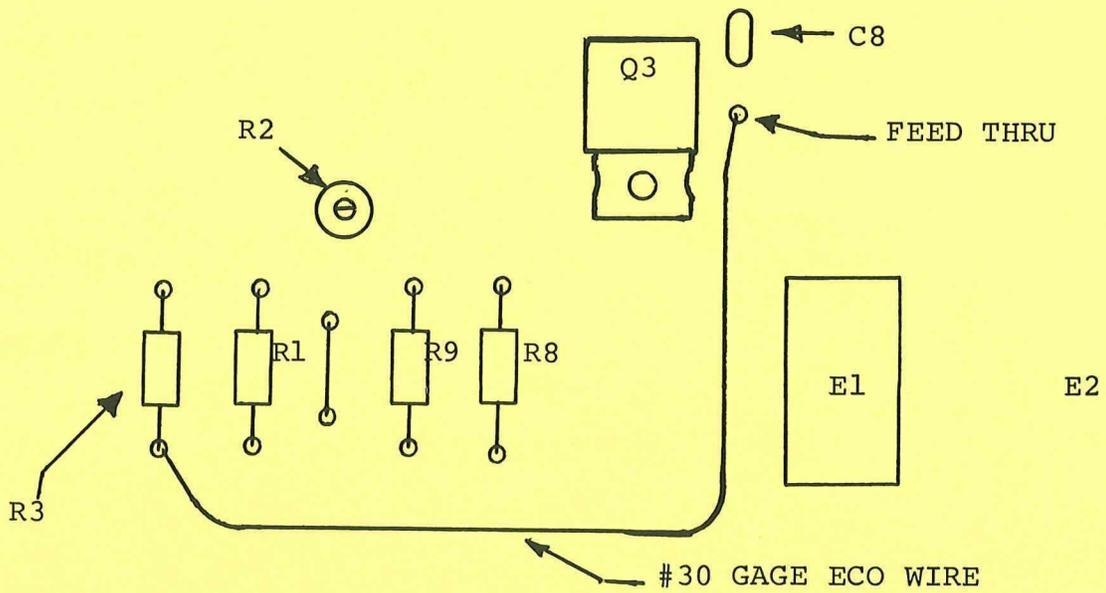


8-20V REGULATOR

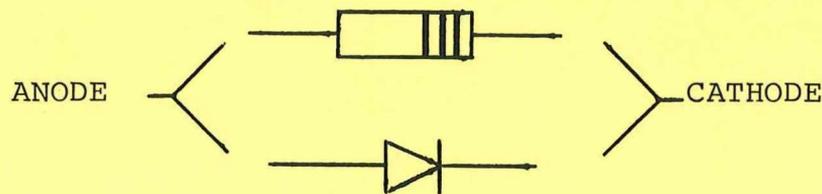
B



C



- () 8. FIG #1 INSERT DIODES (ITEM #10) IN HOLES INDICATED. THE DIODES MUST BE INSTALLED SO THAT THE CATHODE SIDE IS THE SAME AS INDICATED ON FIGURE.



NOTE: DO NOT CUT THE LEADS UNTIL LATER, BECAUSE THEY WILL HAVE TO BE SOLDERED TO THE ETCH ON SIDE #2.

AFTER THE DIODES ARE INSTALLED LOOK AT FIGURE #2, NOW SOLDER THE TWO LEADS ON THE FAR RIGHT TO THE PRINTED CIRCUIT RUN ON ITS LEFT. CHECK THAT IT IS THE SAME AS IN FIG #1.

SOLDER OTHER ENDS TO PRINTED RUNS AS SHOWN ON FIG #2.

DO NOT CONFUSE THE CAPACITORS IN THE ECO KIT WITH THE DIODES PROVIDED. USE AN OHM METER TO DETERMINE WHICH IS WHICH.

III. SET UP PROCEDURE

NOTE: (MAKE SURE ALL MODULES ARE INSTALLED IN THE LOGIC BOX) SO THAT THE PROPER LOAD IS PLACED ON THE REGULATOR FOR ADJUSTMENTS.

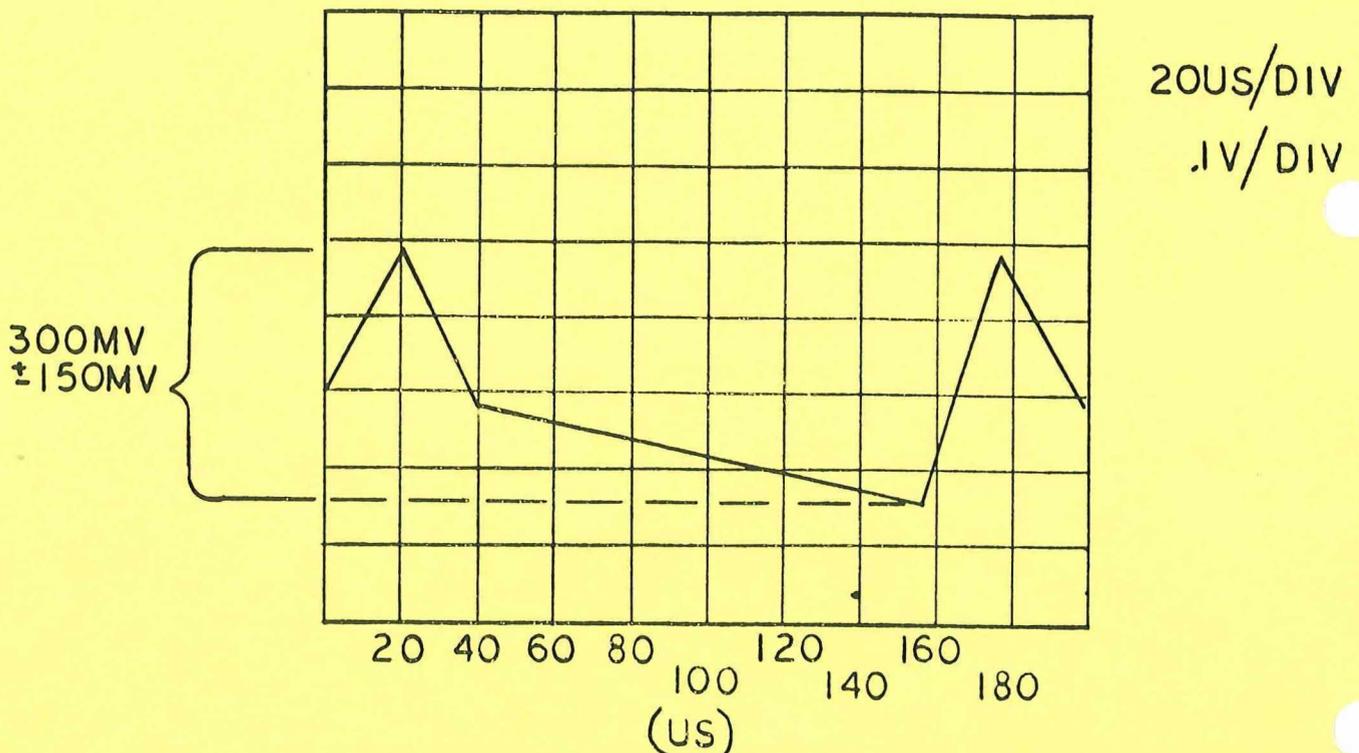
- () I. PLUG ONE OF THE REWORKED REGULATORS INTO THE FRONT (+15) PLUG WHILE LEAVING THE REGULATOR OPEN AS IN FIG 1, THIS IS SO R2 CAN BE ADJUSTED.

CAUTION: BE CAREFUL, ONCE POWER IS ON, THAT PRINTED CIRCUIT BOARD DOES NOT SHORT OUT TO OTHER PARTS.

- () 2. TURN R2 (FIG 1) FULLY CCW. THIS WILL TAKE E1 OVER VOLTAGE REGULATOR OUT OF OPERATION.
- () 3. APPLY AC POWER TO DRIVE UNIT.
- () 4. USING A METER OR SCOPE ON +15V PIN IN THE LOGIC BOX (PIN WITH BIG ORANGE WIRE), ADJUST R17 (FIG #1) FOR 17 VOLTS \pm .5V.

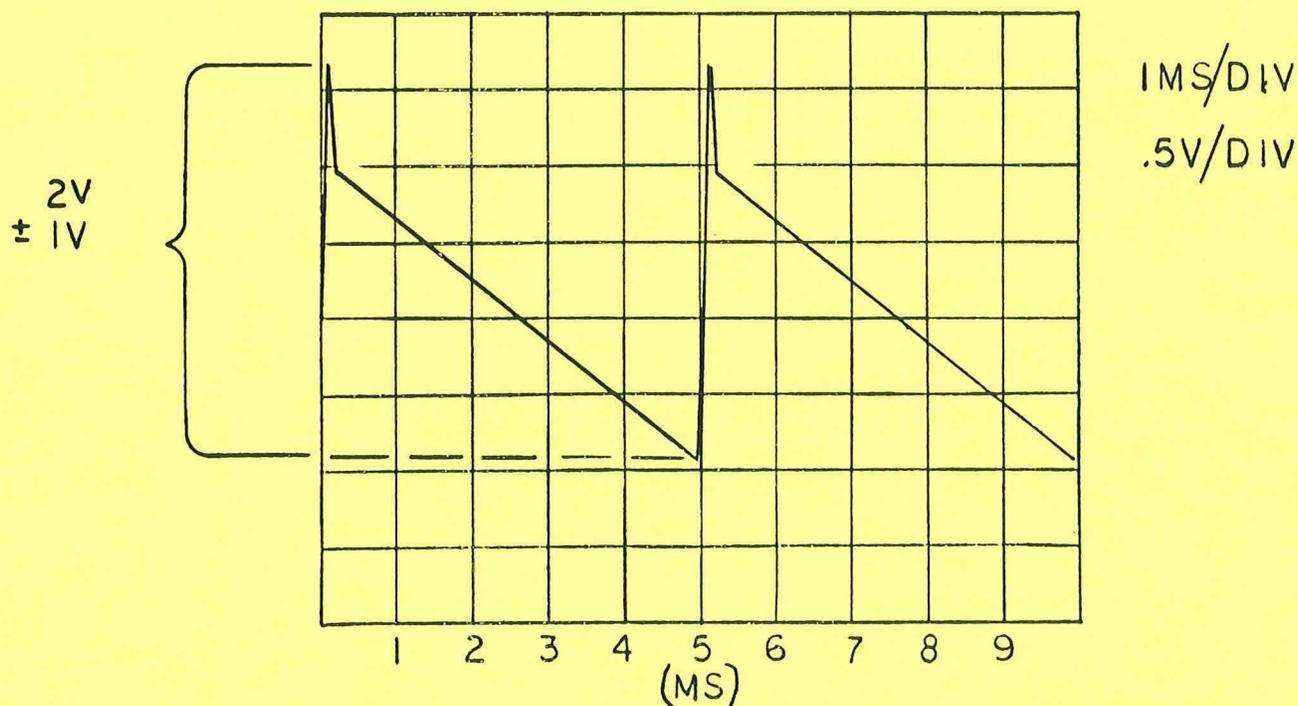
DO NOT EXCEED 17.5V. (CCW INCREASES THE +15 VOLT LINE FROM ITS NORMAL 15V SETTING).

- () 5. USING AC COUPLED SCOPE, SET VERTICAL GAIN AT .1V/DIV AND PLACE PROBE ON THE + SIDE OF C4, PLACE PROBE GND ON OTHER END OF C4. THE SIGNAL SHOULD LOOK SIMILAR TO THE DRAWING BELOW.



- () 6. ADJUST R2 SLOWLY CW UNTIL THE SIGNAL JUMPS OFF THE SCREEN, AT THIS TIME E1, THE SECOND OVER-VOLTAGE REGULATOR, HAS BEGUN TO OPERATE.

WARNING: THIS IS A CRITICAL ADJUSTMENT. DO NOT TURN THE POT ANY FURTHER THAN IT IS NECESSARY TO CAUSE THE P-P RIPPLE TO INCREASE FROM THE 200-500 MV TO BETWEEN 1 AND 2V. AT THIS TIME REDUCE THE GAIN ON THE SCOPE SO THE SIGNAL CAN BE OBSERVED. THE SIGNAL SHOULD RESEMBLE THE DRAWING BELOW.



- () 7. WITH A METER OR SCOPE AS IN STEP #4 ADJUST R17 FOR 15 VOLTS.

- () 8. SHUT OFF AC POWER AND REMOVE THIS REGULATOR. IT NOW CAN BE ASSEMBLED
- () 9. INSTALL NEXT REGULATOR TO SET UP AND PERFORM STEPS 3-4-5-6-7-8.
- () 10. AFTER BOTH REGULATORS ARE ASSEMBLED, INSTALL INTO DRIVE AND CONNECT ALL THE PLUGS.

NOTE: BOTH REGULATORS ARE IDENTICAL AND CAN BE INSTALLED INTO FRONT OR BACK POSITIONS BUT NOT THE MIDDLE (+5) POSITION.

- () 11. APPLY POWER AND RECHECK VOLTAGES (+15, +5, -15) READJUST PROPER POTS IF NECESSARY.

IV. FINAL CHECK

- () I. RUN APPROPRIATE DIAGNOSTICS TO CHECK RELIABILITY OF DRIVE.

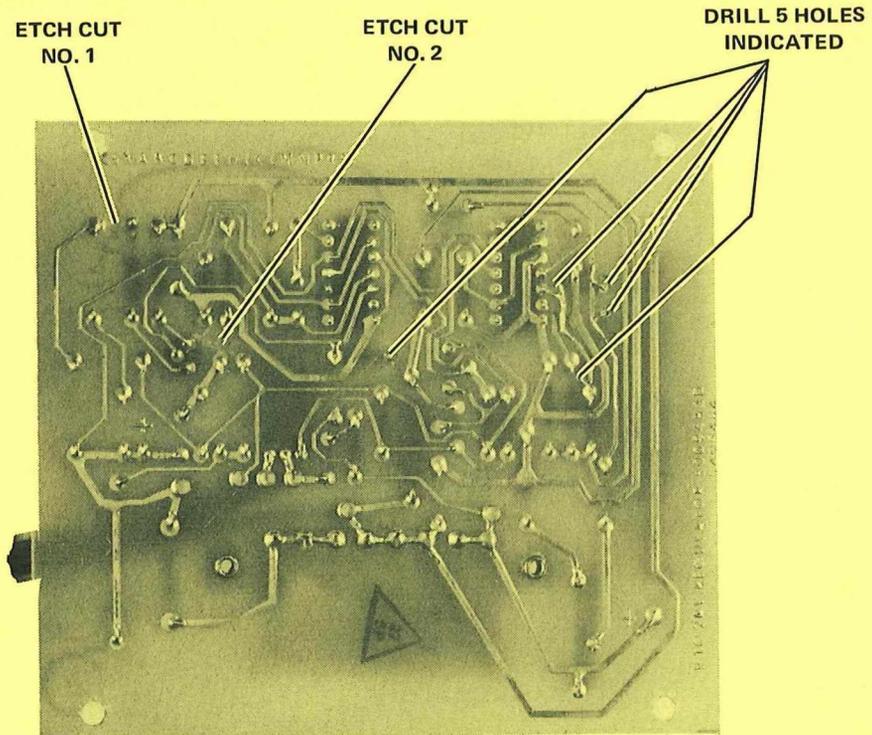


FIGURE NO. 2 8 TO 20V REGULATOR

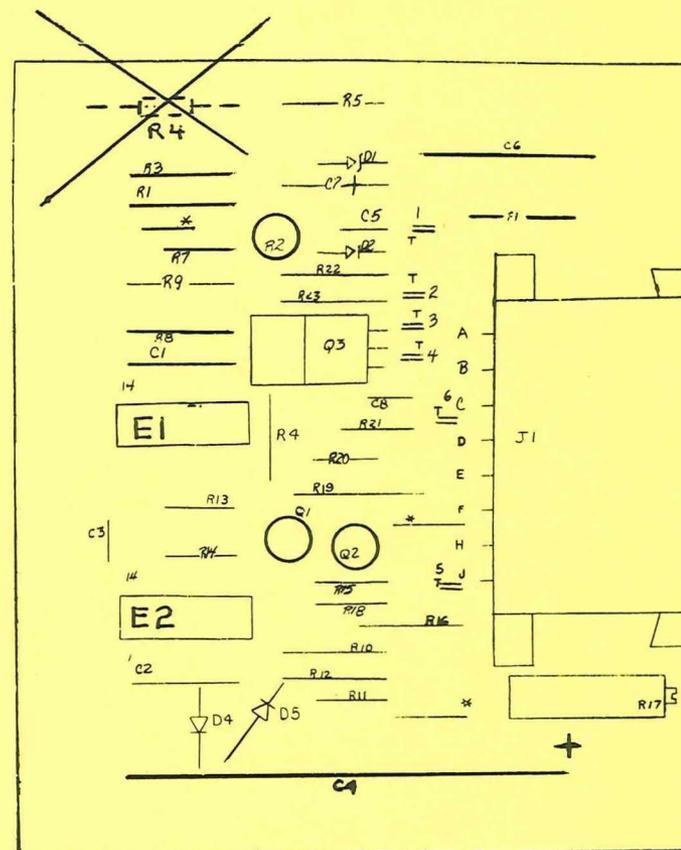
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SET UP SUMMARY

1. PLUG ONLY ONE REGULATOR IN.
2. TURN R2 FULLY CCW.
3. ADJ. R17 FOR 17V.D.C. (MEASURE AT LOGIC BOX)
4. ADJ. R2 UNTIL SIGNAL ACROSS C4 JUMPS
(THE JUMP INDICATES OVER-VOLTAGE IS OPERATING)
5. ADJ. R17 BACK TO 17V.D.C. (MEASURE AT LOGIC BOX)

REPEAT WITH OTHER 8-20 V.D.C. REGULATOR.

TYPOGRAPHICAL ERROR IN FCO
RELEASE OF JUNE 14, 1976.
CORRECT VOLTAGE ADJUSTMENT
IS 15 V.D.C.



54-09484

COMPONENT LOCATOR

FIGURE # 3

8-20V REGULATOR

PART LIST

<u>ITEM</u> <u>NO.</u>	<u>PART</u> <u>NO.</u>	<u>DESCRIPTION OF MATERIAL</u>
9	1303177	RES 2.4K 1/4W 5% QTY 1
10	1105275	DIODE D672 QTY 2
11	1302941	RES 14.7K 1/8W 1% QTY 1

NOTE: THE ABOVE QUANTITIES ARE REQUIRED FOR REWORKING ONE REGULATOR. THE PARTS KIT FOR THE FCO WILL INCLUDE PARTS FOR REWORKING TWO REGULATORS.

DIGITAL EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

ENGINEERING SPECIFICATION

DATE 3/10/75

TITLE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION

REVISIONS

REV	DESCRIPTION	CHG NO	ORIG	DATE	APPD BY	DATE
A	ECO CHANGE	76652-65-1	D.KIMBALL	1-76	D. Kimball	1/26/76
B	ECO CHANGE	00002	D.WIDDER	4-76	D. Kimball	4/28/76

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ENG Conrad Vandenberg	APPD Dave Widder	SIZE A	CODE SP	NUMBER 7665265-0-0	REV P
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DEC FORM NO.
DRA 107

Sheet 1 of 27

REWORK STANDARD

ENGINEERING SPECIFICATION

d7665265

CONTINUATION SHEET

TITLE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION

Table of Contents

- 1.0 Scope.
- 2.0 Applicable Documents
- 3.0 Definition of the basic type of Printed Circuit Boards.
- 4.0 Module Rework (ECO/Retrofit).
 - 4.1 ECO's that do not physically affect the Printed Circuit Board.
 - 4.2 Updating Circuit Schematic Revision Letters.
 - 4.3 Component Removal/Replacement.
 - 4.4 Component Additions.
 - 4.5 Cutting Etch Lines.
 - 4.6 Adding Lines (wire additions).
 - 4.7 Tack Soldering.
 - 4.8 Drilling Holes.
 - 4.9 Soldering to gold finger contacts.
- 5.0 Module Repairs
 - 5.1 Component Removal/Replacement.
 - 5.2 Repairing Etch Lines.
 - 5.3 Repairing Etch Pads (Lands).
 - 5.4 Soldering to gold finger contacts.
 - 5.5 Repairing surface blemishes.
 - 5.6 Drilling holes for griplets or eyelets.
 - 5.7 Removing shorts on Inner Layers on Multilayer Printed Circuit Boards.

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7665265-0-0REV
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TITLE MODULES REWORK/RETROFIT AND REPAIR SPECIFICATION

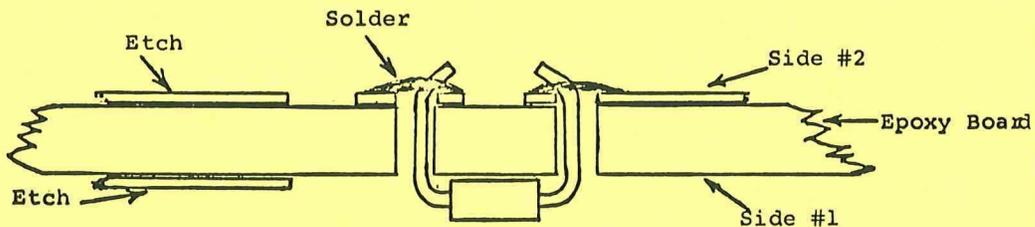
1.0 Scope

- 1.1 The purpose of this specification is to establish uniform methods in the reworking and repairing of modules.
- 1.2 The Rework/Retrofit sections of this specification act as guidelines, unless noted otherwise, to minimize large variations in methods on retrofitting modules.
- 1.3 The Repair sections of this specification are not guidelines, but requirements; so as to ensure that all modules that are repaired will meet the original reliability and workmanship standards of the initially produced module.
- 1.4 This specification is to apply to all modules intended for sale or for use in products intended for sale by Digital Equipment Corporation

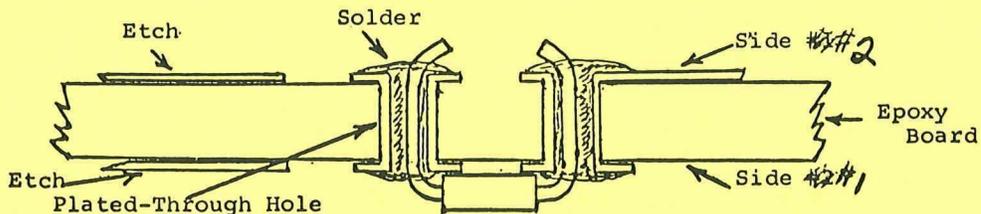
2.0 Applicable Documents

- 2.1 Workmanship Standards Manual (DEC-STD-116)
- 2.2 Digital's Standard 030 (Module Manufacturing Specification)

3.0 Definition of the Basic Types of Printed Circuit Boards



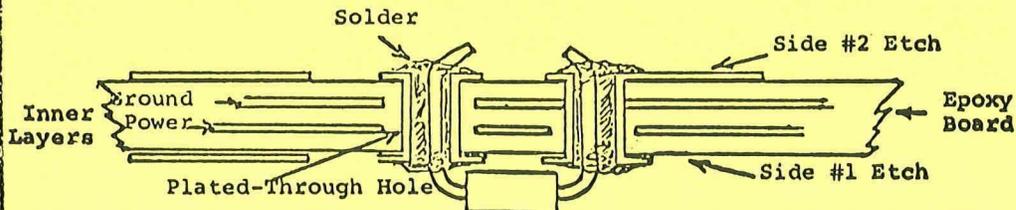
3.1 Cross-section of Single sided or Double sided Non-PTH Printed Circuit Board. (Print & Etch)



3.2 Cross-section of a Double Sided, Plated-through hole, (PTH,PCB) Printed Circuit Board.

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TITLE MODULE REWORK/RETROFIT REPAIR SPECIFICATION,



3.3 Cross-Section of a double sided, plated through hole multilayer Printed Circuit Board

4.0 Module Rework ECO/Retrofit

4.1 ECO's that do not physically affect the Printed Circuit Board.

4.1.1 A higher revision level will be indicated on the module board handle; when the ECO affects print-sets and has no physical affects to the Printed Circuit Board itself, but changes the circuit schematic to a higher revision level.

This higher revision level will be indicated within a 60-day period after the final released print of the ECO is issued.

4.2 Updating circuit schematic revision letters.

4.2.1 Revision letters shall be marked on module handles on Side #2, reading from left to right in alphabetical order, latest revision always to the right. (See Figure #1) on sheet #5.

4.2.2 Field, production line, test, etc: updating will be done in accordance with the ECO package and/or model.

4.2.3 All new updating of C/S revisions will be located on the far left handle on side #2 and permanently marked on the handle. A metal marking stamp or a vibration type marking tool can be used to indicate the revision on the handle. This will be accomplished by using a rubber stamp and special ink or permanently scribed onto the handle. The ink used must be permanent and cannot smudge, fade or disappear when dried and must be resistant to normal solvents (freon or Tri). (Ink is available through L.E. Muran Co., Crown black super marking ink).

4.2.4 Only one handle per module needs to be lettered with the C/S update, being sure to mark the same handle that contains the "Previous" revision letters.

SIZE A	CODE SP	NUMBER 7665265-0-0	REV B
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ENGINEERING SPECIFICATION

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CONTINUATION SHEET

TITLE MODULE REWPRL/RETROFIT REPAIR SPECIFICATION

- 4.2.5 Updating in the field will be accomplished by use of the alphabet, (Alphabet for Field Service use only), which is etched onto side #1 of the module. Upon completing the installation of an ECO, remove all letters up to and including previous Rev. LTR. Removal may be accomplished by use of an exacto knife or by applying heat with a soldering iron and lifting the letter.
- 4.2.6 Updating circuit schematic revision on non-handled modules will be performed with black ink and a rubber stamp on Side #1 of the module in any convenient location, (but not on the gold finger contact fingers.)

Note: Indelible Black Ink should be used.

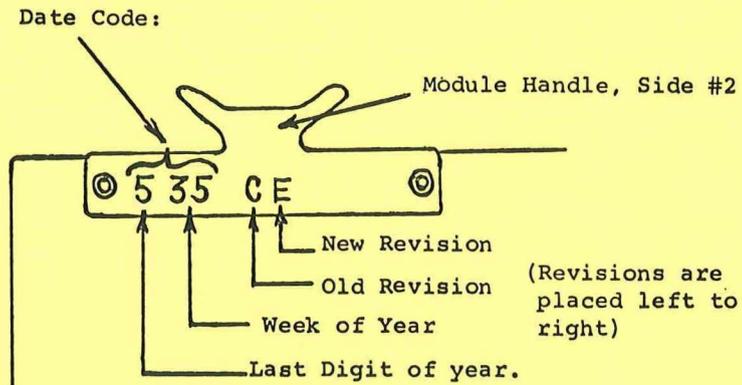


Figure #1 *

* This requirement is described in DEC-STD-030.

SIZE A	CODE SP	NUMBER 7665265-0-0	REV B
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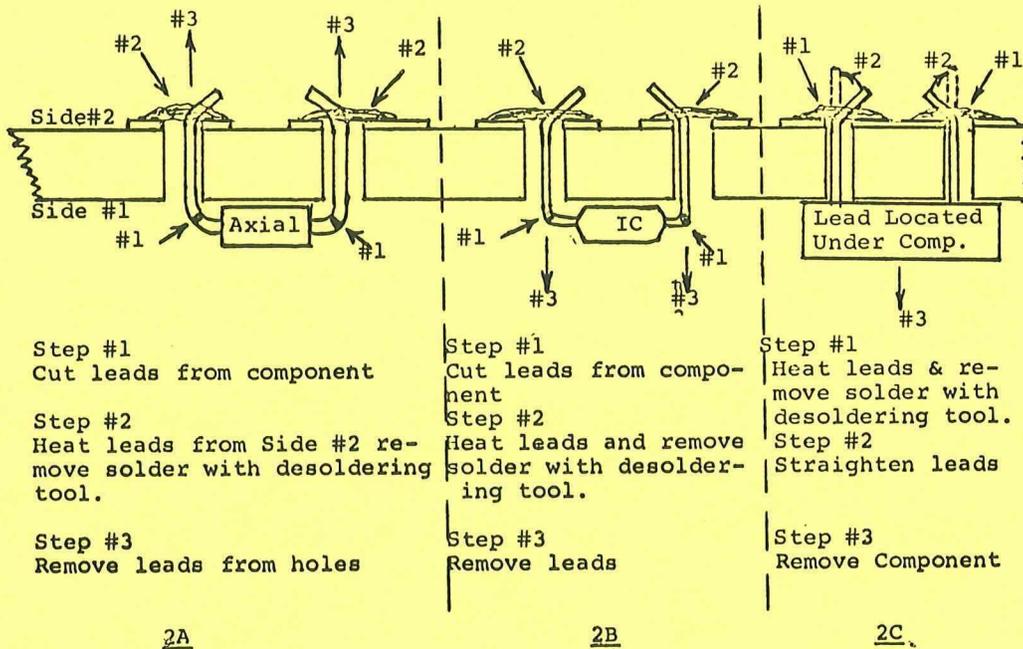
TITLE Modules Rework/Retrofit and Repair Specification

4.3 Component Removal/Replacement

4.3.1 Component Removal

4.3.1.1 Caution-Components should be removed with heat applied to the etch for as little time as possible.

4.3.1.2 Component Removal from single sided or double sided, Non-PTH, Printed Circuit Board. (Figure #2 Below)



Step #1
Cut leads from component

Step #2
Heat leads from Side #2 remove solder with desoldering tool.

Step #3
Remove leads from holes

Step #1
Cut leads from component

Step #2
Heat leads and remove solder with desoldering tool.

Step #3
Remove leads

Step #1
Heat leads & remove solder with desoldering tool.

Step #2
Straighten leads

Step #3
Remove Component

2A

2B

2C

Print & Etch Printed Circuit Board

(Figure #2)

ENGINEERING SPECIFICATION

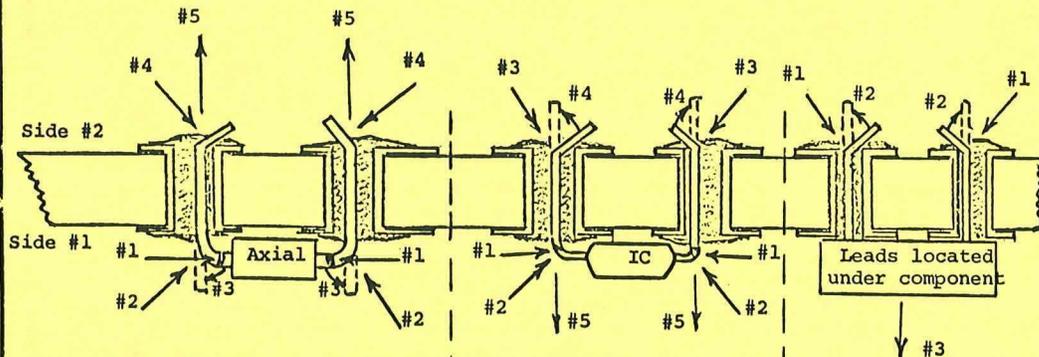
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CONTINUATION SHEET

TITLE Module Rework/Retrofit and Repair Specification

4.3.1.3 Cautions - Never hold lead with pliers while applying heat. Pliers will draw heat away from the lead. Always use a small tip on your soldering iron when removing leads.

4.3.1.4 Component removal from a double sided, plated through hole, Printed Circuit Boards.



Step #1
Cut leads from component.
Step #2
Heat leads from Side #1, remove solder with desoldering tool.
Step #3
Straighten leads
Step #4
Heat leads, remove solder with desoldering tool, if needed
Step #5
Remove leads from holes.

3a

Step #1
Cut leads from component.
Step #2
Heat leads from Side #1 remove solder with desoldering tool.
Step #3
Heat leads from Side #2 remove solder with desoldering tool, if needed
Step #4
Straighten leads
Step #5
Remove leads

3b

(Figure #3)

Step #1
Heat leads from Side #2, remove solder with desoldering tool.
Step #2
Straighten leads.
Step #3
Remove component
Note: If this procedure does not work; it maybe necessary to destroy the component body to remove solder from side #1.

3c

4.3.1.5 Caution - When cutting the lead from the component body, make sure your not cutting the etch, or over stressing the solder joint.

ENGINEERING SPECIFICATION

000001

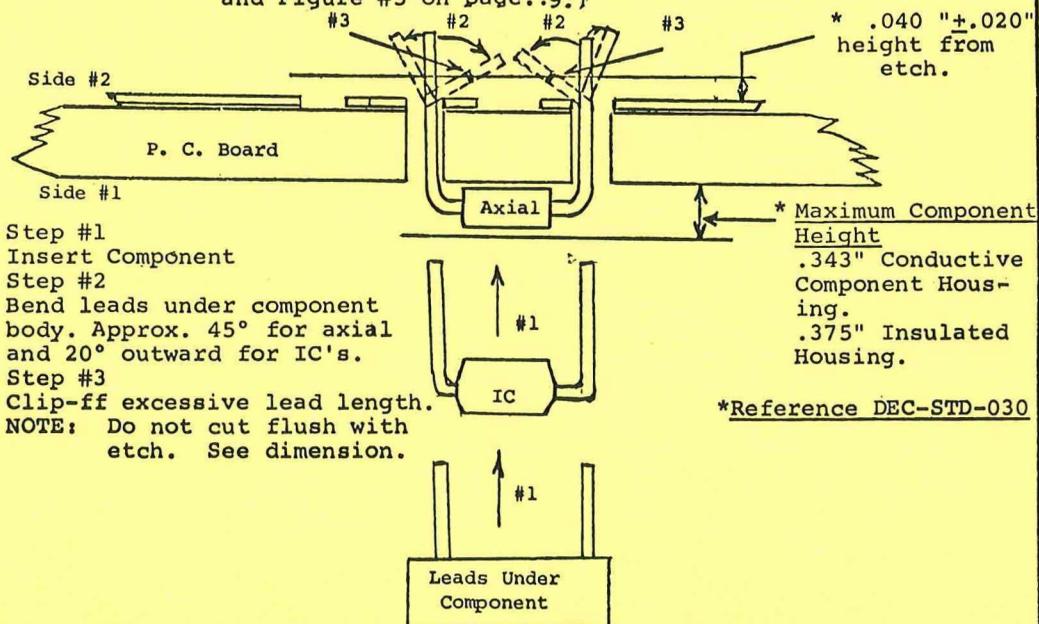
CONTINUATION SHEET

TITLE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION

- 4.3.1.6 Alternative - If there is difficulty in removing the leads from the plated through hole, due to inadequate removal of solder by the desoldering tool, heat the individual leads and remove while the solder is molten. Never force a lead from the plated through hole.
- 4.3.1.7 Hint - When using the solder removal tool; solder may be added to hole first to improve heat transfer and aid in solder removal.
- 4.3.1.8 Component removal from a double sided, plated through hole, multilayer board.
 - 4.3.1.8.1 The same procedure is used as in (figure #3) on page 7.
 - 4.3.1.8.2 Note: - You may find Component Lead removal more difficult with multi-layer Boards. The reason for this greater difficulty will be caused by the innerlayers; which draws heat away from the solder. Greater skill will be needed to remove the component leads without damaging the plated through holes.

4.3.2 Component Replacement

4.3.2.1 The rules for component replacement apply to all components and the three basic types of Printed Circuit Boards defined in this standard.. (See Figure #4 below and Figure #5 on page.9.)



(Figure #4)

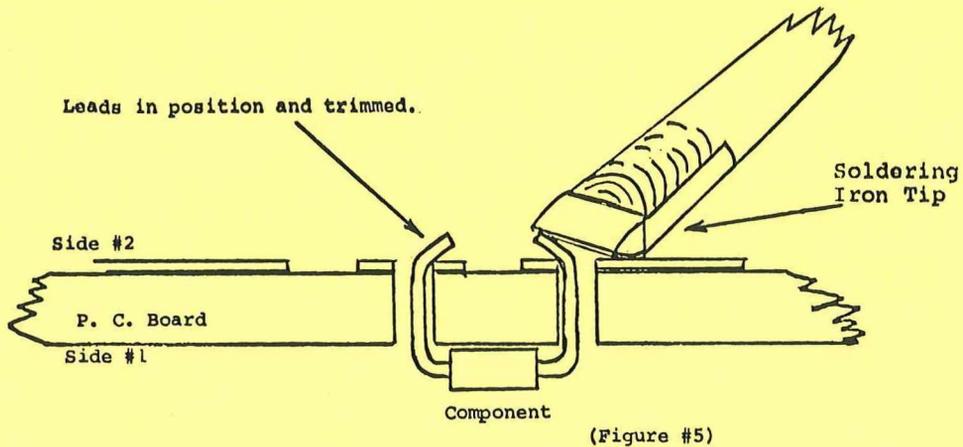
SIZE A	CODE SP	NUMBER 7665265-0-0	REV B
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ENGINEERING SPECIFICATION

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CONTINUATION SHEET

TITLE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION



4.3.2.2 Solder all leads on Side #2 of the module.

4.3.2.3 Place the iron tip on lead and etch to insure a good solder joint.
Caution - Do not over heat.

4.3.2.4 Clean flux from both sides of the PC Board with Freon or equivalent per specification A-SP-7665266-0-0.

Caution - Restrict the use of these cleaning solvents to the area to be cleaned.

Caution - A solvent of this type could damage plastic module handles or other areas of the module.

4.3.2.5 (Figures #6 and #7) on sheet 10 shows how to remove and replace a component when Side #2 of the module is blocked by another device.

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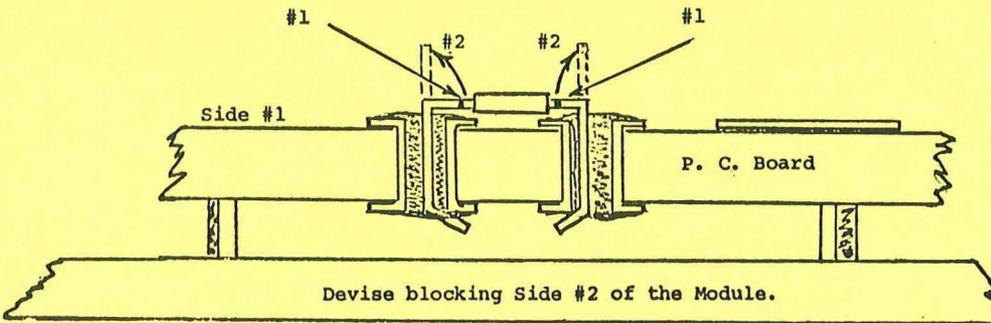
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ENGINEERING SPECIFICATION

076761

CONTINUATION SHEET

TITLE Module Rework/Retrofit and Repair Specification

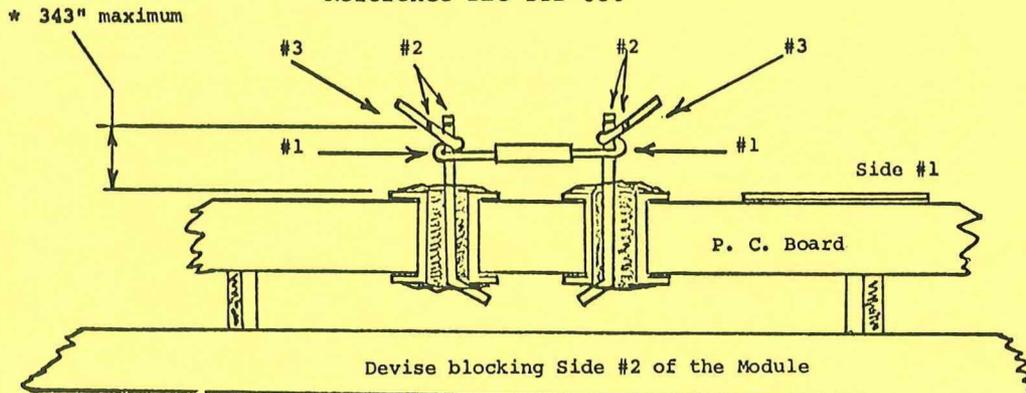


Step #1 Cut leads from component

Step #2 Straighten Leads

(Figure #6)

* Reference DEC-STD-030



Step #1 Twist leads of replacement component around old leads, (must encircle old leads by 360°).

Step #2 Trim leads.

Step #3 Solder twisted joint.

Note: Dimensional limitation on component and lead height (Side #1)

CAUTION - Heat the leads when soldering, minimize heating time; to prevent solder from dropping to the lower device.

Hint - Place a sheet of paper between module and lower device in case of solder dripping from Side #2.

(Figure #7)

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4.4 Component Additions

- 4.4.1 Components may not be tack soldered directly to IC leads unless ECO package or model shows this procedure (See Figure #8) Below. (All efforts should be used to avoid using this method; allowable but not preferred).

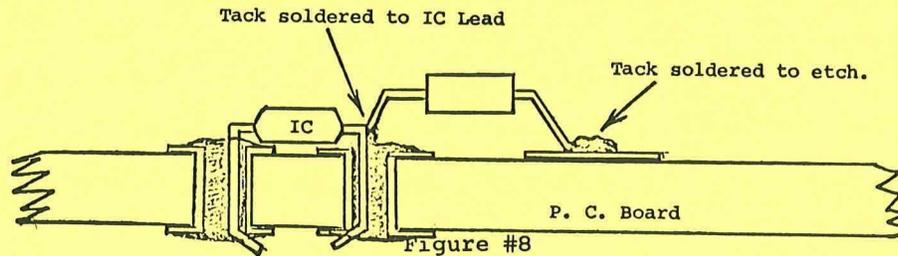


Figure #8

- 4.4.2 1/4 watt resistors and DO7 diodes and other similar sized components may be "Tack Soldered" directly to the etch without any further mechanical support (See Figures #9, 10 on sheet 12).
- 4.4.3 Adding components with lead diameters .026"/.032" (1/2 watt resistors, etc.), with no available holes for this addition, drill the necessary holes for griplet (Berg #47644) or eyelet (DEC #90-06731). In a space that is legally available. These griplets and eyelets are not to come within .010" to any existing pad or etch line or each other. (See Figure #11 on sheet 13) (Does not apply to Multilayers).
- 4.4.4 When components with more than two leads such as IC's transistors and transformers are to be added and no pre-drilled hole pattern exists, drill holes and insert griplets only using #54 drill.
- 4.4.5 Components may be installed into holes which already have components (See Figure #12 on sheet 13).
- 4.4.6 TFE thin wall extruded tubing (PS-91-00001-GS) is to be used on component leads which run near an undesired etch or where any potential short may exist.
- 4.4.7 Adding components with lead diameter greater than .032"; shall be added according to special instruction given by engineering & quality control.

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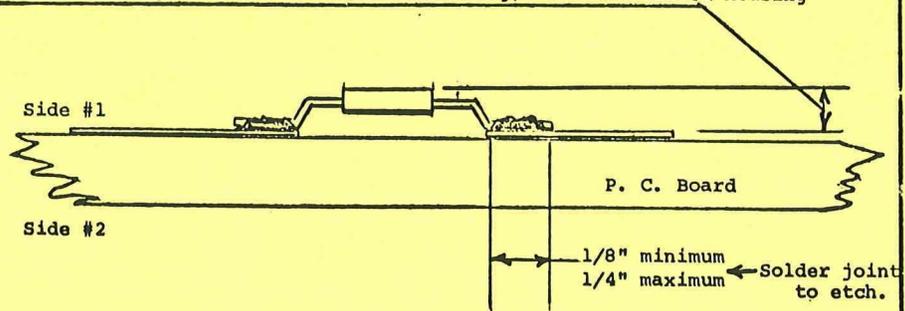
ENGINEERING SPECIFICATION

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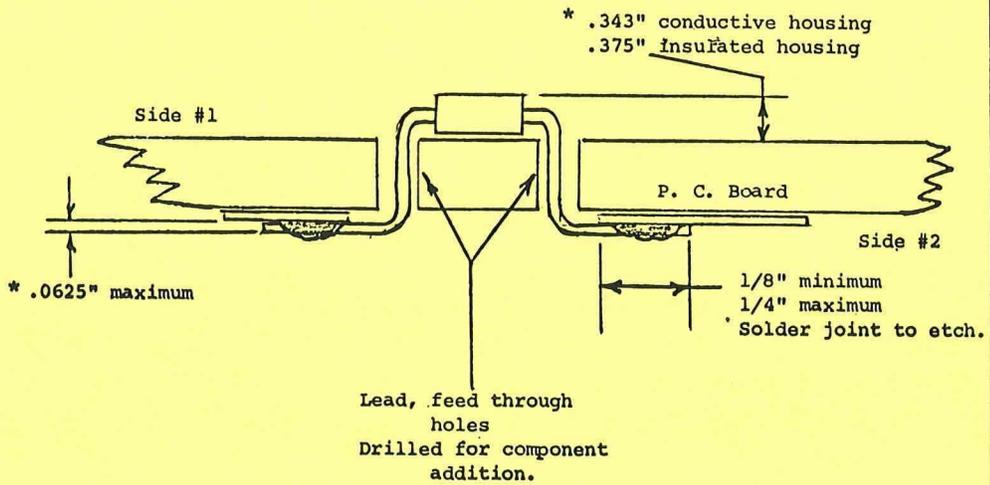
TITLE Module Rework/Retrofit and Repair Specification

* Component height - .343" conductive housing, .375" insulated housing



* Reference DEC-STD-030

(Figure #9)



* Reference DEC-STD-030

Note: This does not include Multi-layers.

(Figure #10)

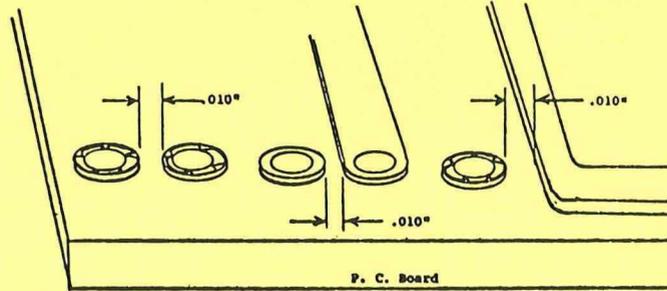
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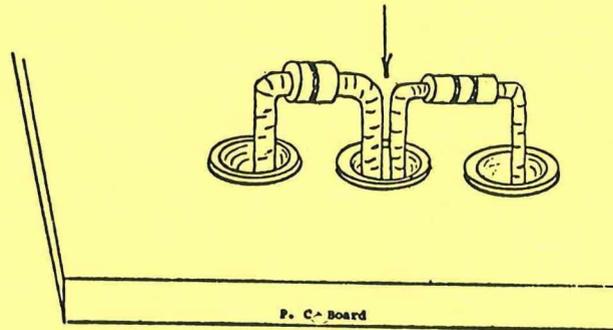


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Note: (This does not include multi-layers).
(Figure #11)



Leads must be able to fit in the same hole without using force.
(Figure #12)

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4.5 Cutting Etch Lines

4.5.1 Etch lines cut for the purpose of trouble shooting is not allowed on single sided or double sided PC Boards. Etch lines can be cut on multi-layers due to the difficulty of component removal.
Cut component lead, on single and double sided PC Boards if it becomes necessary to disconnect points of a signal run. This component must be replaced once trouble shooting is completed. Repair of a cut etch lines is shown in module repair section.

4.5.2 Etch lines cut and removed as part of an ECO or retrofit.

4.5.2.1 The piece cut and removed from an etch line shall be, .062" , (1/16") minimum, (See Figure #13, Below).

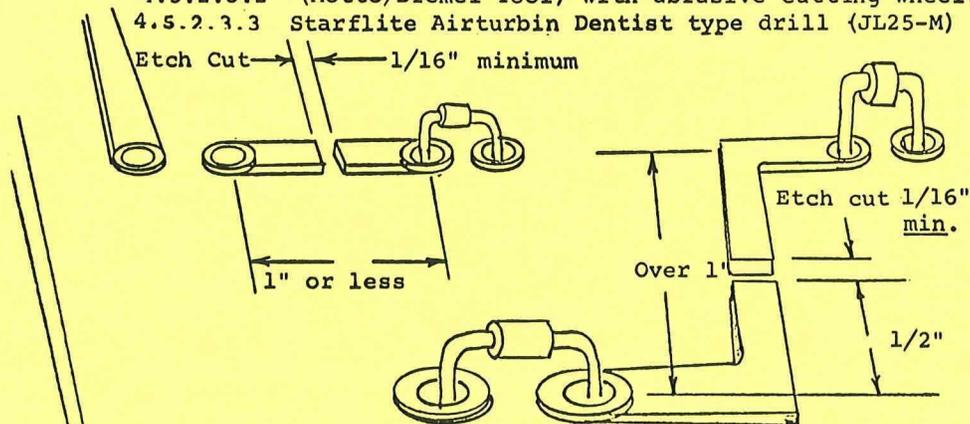
4.5.2.2 When possible an etch cut is to be made (1/2") from PTH or component hole to allow tack soldering of wires or components if later required, (See Figure #13 below).

4.5.2.3 Preferred methods in cutting etch lines are:

4.5.2.3.1 Exacto Knife to cut and remove etch. Hint-careful heating of the cut portion of etch with a soldering iron will aid in removal.

4.5.2.3.2 (Motto/Dremel Tool) with abrasive cutting wheel.

4.5.2.3.3 Starflite Airturbin Dentist type drill (JL25-M)



Caution: In some instances, it may be necessary to cut an etch line at both ends to eliminate possible antenna effects. These type cuts should be stipulated on the ECO

P. C. Board

Etch Cutting Rules

(Figure #13)

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4.5.2.4 Etch lines shall be cut in approximately the same location on all boards, per the model, that require such rework. In the field, production line, test, etc. line cutting will be done according to the artwork supplied with the ECO package and/or model, to obtain the correct pattern and position of etch cuts.

4.6 ADDING LINES (WIRES)

4.6.1 Models may use #30 gauge multiple color wires to ease assembly and traceability, however, solid green Kynar Wire is to be used in all ECO & retrofit module rework, unless specified differently on the ECO.

4.6.2 WIRES ADDED ON PC BOARDS USED IN POWER SUPPLIES, ETC. MAY REQUIRE THE USE OF HEAVIER GAUGE WIRE. THIS MUST BE SPECIFIED IN THE ECO AND BE REFLECTED ON THE MODEL.

4.6.3 ECO wires added to modules will be located on Side #1, the component side unless otherwise directed by ECO, Drawings, or if it's a Piggy-Back Module System. Caution - ECO wires added to Side #2 could cause snagging and damage on PC Boards designed for insertion and removal from connector blocks. ECO wires located on Side #2 must be placed after the solder wave process.

4.6.4 Lines (wires) added to modules shall not run over, under or in contact with any components, except at points of connection (start and termination.) This is to keep heat dissipating components and/or sharp edged components such as IC's and SCR component bodies and leads from damaging the wire and causing problems in existing circuitry.

4.6.5 All wire runs should be neat, with rounded corners (minimum radius of one wire diameter) when changing directions, vertical and horizontal avenues. Caution - Extreme care is necessary when using tools to form wire runs. (Non metallic tool is recommended). It is important that you do not nick, tear, or crack the insulation on the wire when forming these avenues or terminations. ECO and retrofit work shall generally follow the model for direction and position of the wires. (See Figure #14 on sheet 17.)

4.6.6 All wires are to be bonded to the board every two inches when length permits. When wire length is two inches or less tack bond in the center of the wire between the two points of connection. The cement used must not dis-color when Trichloroethylene is applied or be corrosive to board or wire insulation, it also must be quick drying. Adhesive used today and proven to be the best thus far is Permabond #101 contact adhesive, DEC P/N 90-09157. (See Figure #14 on sheet 17).

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Note: Use a minimum amount of adhesive for a good bond, and neat appearance.

- 4.6.7 When it is necessary to remove added lines and doing so would damage the PC Board or Components, it is allowable to cut the wire ends and leave the wire in place. Wires shall not be cut such that exposed ends will create a potential electrical short circuit. (See Figure #14 on sheet 17). The preferred alternative is to dissolve the adhesive, and remove the wire. This can be accomplished with Super Glue Solvent from Edmund Scientific Co., Barrington, New Jersey. It is formulated to dissolve PermaBond 101.
- 4.6.8 Connections to component leads on un-assembled PC Boards shall be accomplished by placing stripped end of insulated wire to be added into hole along with component lead or tack solder to connecting etch line for 1/8" to 1/4". Use a suitable amount of solder to secure lead fully to etch to have an acceptable solder connection. (See Figure #15 on sheet 18).
- 4.6.9 If two or more wires are to be added to the same component hole or plated through-hole, it will not be necessary to twist the ends of the wires together.
- 4.6.10 When adding wires to components and plated-through-holes, make sure there is no insulation in the hole, this will assure a good solder joint. (See Figure #15 on sheet 18).
- 4.6.11 Wires added to plated-through-holes or component holes, shall not have un-insulated wire extending from the hole on Side #1 for more than 1/16 of an inch and shall not come within 1/32 of an inch to any adjacent etch, pad or component lead. (See Figure #15 on sheet 18).
- 4.6.12 To make connections from Side #1 to Side #2 etch runs, it may be necessary to drill ECO wire feed-through-holes. (See Figure #15 on sheet 18).
- 4.6.13 When adding lines to two adjacent IC leads, the two leads will be connected with insulated #30 gauge kynar wire with a slight loop to make its presence obvious. This also minimizes shorting. (See Figure #15 on sheet 18).
- 4.6.14 Two wires that run together are not to be twisted around one another unless so specified on the model. They should be separated enough so that they can be traced easily by eye.
- 4.6.15 Multilayer Printed Circuit Boards.
 - 4.6.15.1 When it becomes necessary to run the wires from Side #1 to Side #2; the following techniques are to be followed:

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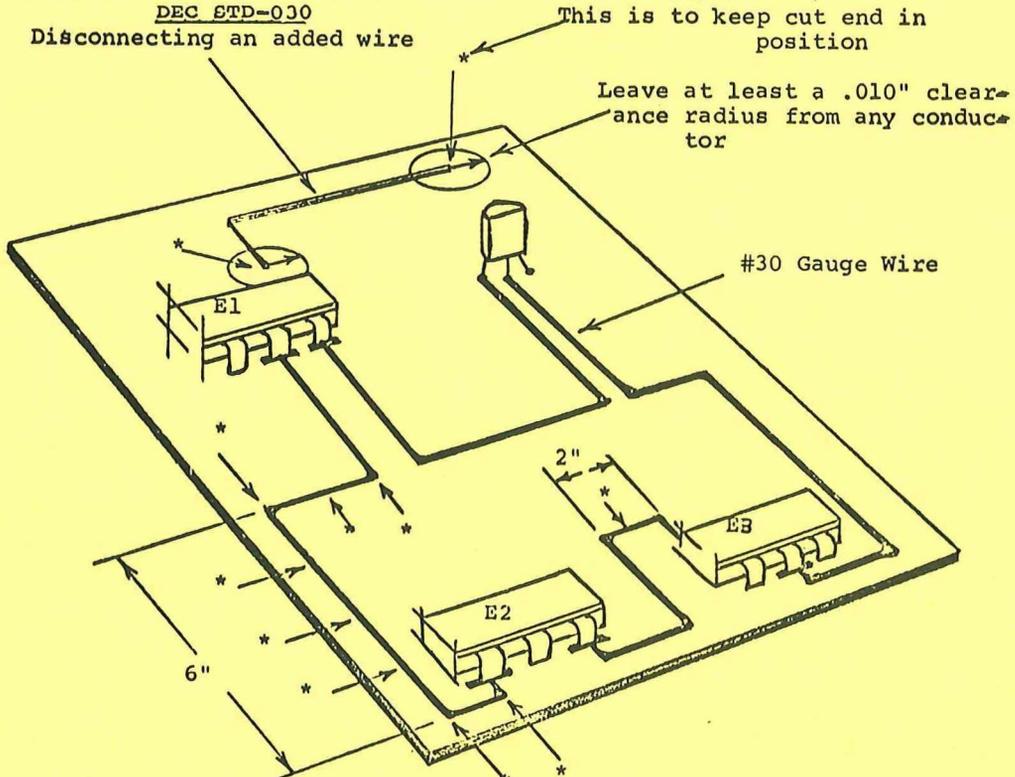
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4.6.15.1.1 The preferred method is to utilize an existing hole that has no component. Remove any solder in the hole and run the ECO wire through, insuring that no uninsulated portion of the wire is in the hole. The alternate method is to drill a ECO wire feed-through-hole.

4.6.15.1.2 All new holes should be drilled with a #58 drill; through a clearance hole in the inner layers. After drilling the hole; inspect the hole for any copper smears between the inner layers and test the board for power to ground short. If a short exist, run the drill through the hole again, "lightly," reinspect & test. (See Figure #15 for clearance hole illustration. On sheet 18.

CAUTION: All wires should be located in the component areas - DEC STD-030
 Disconnecting an added wire



Caution: If imprecise wire routing causes specific performance problems; it must be noted on the ECO.
 Hint - Use a Q-tip stick to form rounded corners.
 * Glueing points (Examples)
 (Figure #14)

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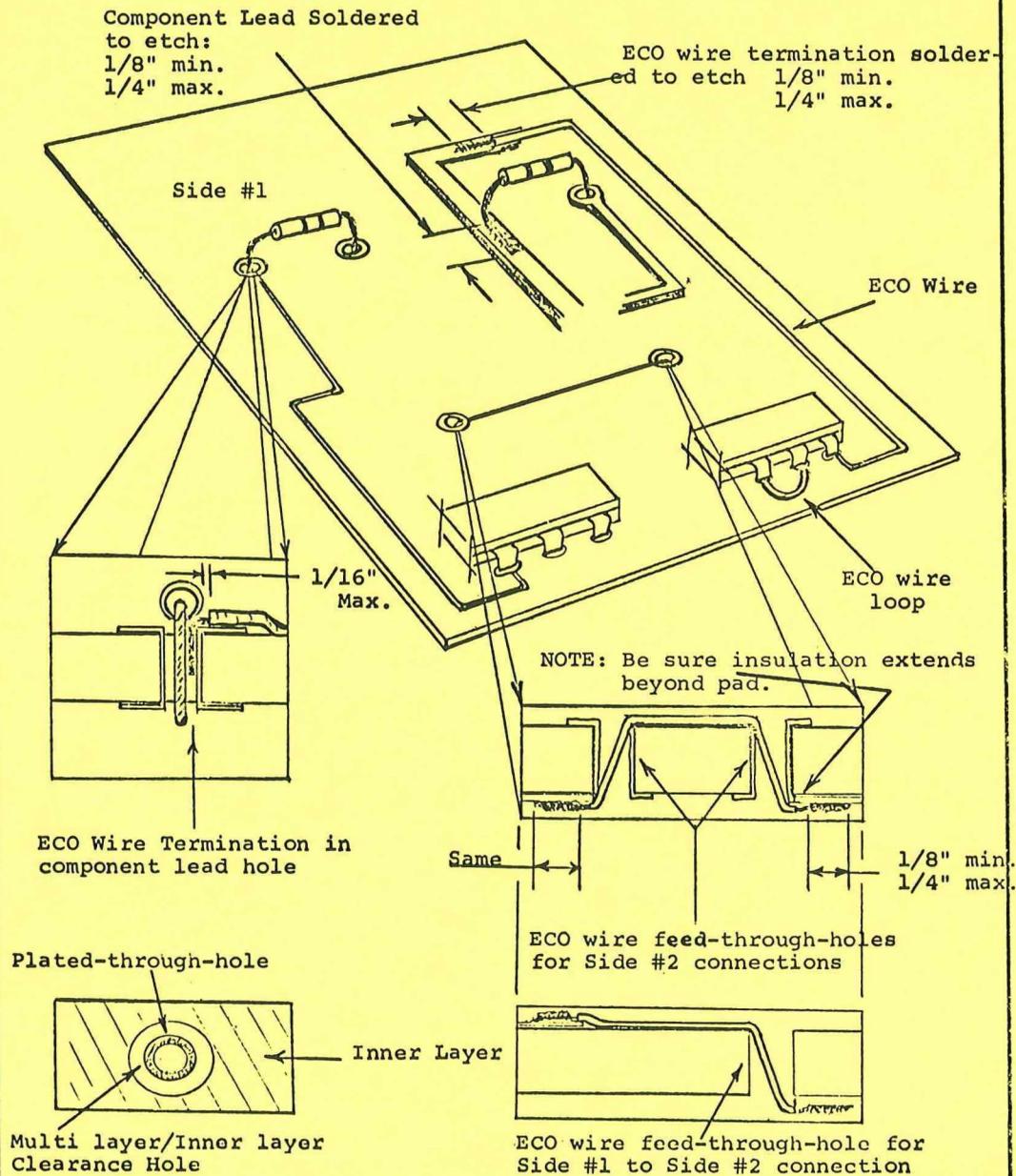
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(Figure #15)

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TITLE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION

4.7 Tack Soldering

- 4.7.1 Tack soldering wires or other component leads to component leads can only be done if no alternative exist in making connection between two points. Tack soldering to component leads must be approved on the ECO model by the responsible engineer for that module.
- 4.7.2 Tack soldering to etch lines will be 1/8" minimum, 1/4" maximum.

4.8 Drilling Holes

- 4.8.1 Extra holes may be drilled to facilitate the addition of wires or components. This can be accomplished by either hand or machine.
- 4.8.2 Hole diameter for griplets or eyelets will be .055" #54 drill unless stated otherwise.
- 4.8.3 Hole diameter for wire-feed-through will be .042" #58 drill, unless stated otherwise.
- 4.8.4 No extra holes are to be located beneath any components or cut through any etch; unless stated as part of an ECO and noted with sketches in the ECO package and reflected on the ECO model.
- 4.8.5 Extra holes should be kept at least 1/8" away from existing etch not involved in rework.
- 4.8.6 Multilayer Printed Circuit Boards
 - 4.8.6.1 See paragraph 4.6.15.1.2 on sheet 17) in ECO wire addition section.

4.9 Soldering to Gold Finger Contacts

- 4.9.1 The tack-soldering of an ECO wire onto the extended or unextended gold finger contact will be performed in the following manner.
 - 4.9.1.1 ECO wire termination should be tack-soldered as illustrated. (See Figure #16 on sheet 20).
 - 4.9.1.2 1/8" dimension is the maximum from the reference edge of the module notch to the furthest edge of the solder. (See Figure #16 on sheet 20).

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REWORK STANDARD

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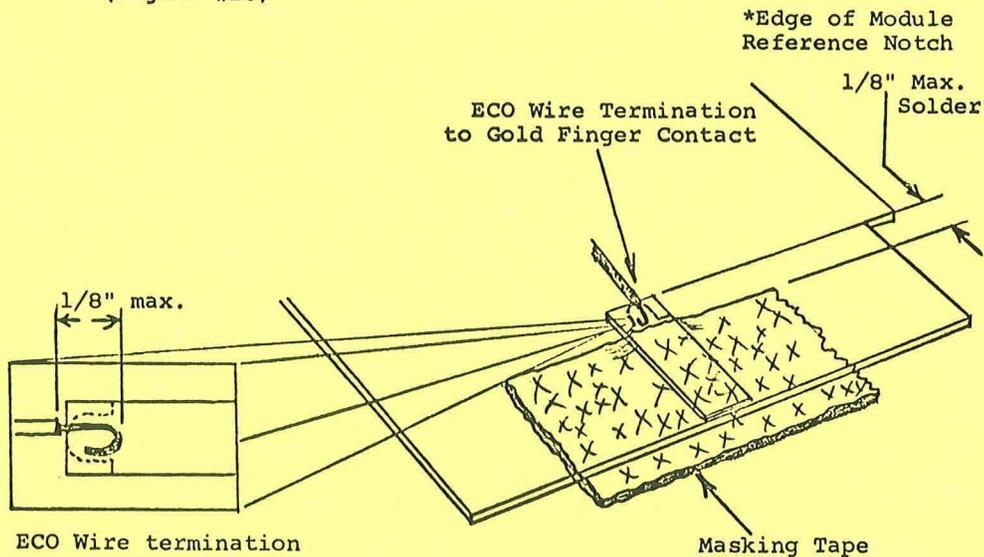
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4.9.1.3 Masking Tape is used to mask the critical area of the gold finger; so as to prevent solder from reaching the critical area. (See Figure #16 Below).

4.9.1.4 After you have completed the tack soldering; remove the masking tape and clean the contact finger and the termination area with Freon or equivalent to remove adhesive from masking tape and flux from termination area.

Caution - Restrict the area of use with solvents; they could be damaging to other parts of the module.

(Figure #16)



ECO Wire termination suggested, termination shape of strip portion, conductor. 1/8" from insulation to curved portion of the conductor.

*Reference DEC-STD-030

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5.0 Module Repairs

5.1 Component Removal/Replacement

5.1.1 The same techniques are used as in the Module Rework Section on sheet 6).

5.2 Repairing Etch Lines

5.2.1 Figure #17 on sheet 25.

5.2.1.1 Illustration #1 - Repairing of etch line on Side #2 with .042" diameter feed-through holes. Installation of repair wire should extend through the feed-through hole.

5.2.1.2 Illustration #2 - Repairing of missing etch line between two PTH holes. Missing etch line portion greater than (1/4").

5.2.1.3 Illustration #3 - Repairing of missing etch line between etch line and PTH hole. Missing etch line portion is (1/4") or less.

5.2.1.4 Illustration #4 - Repairing of missing etch line between etch line and PTH hole. Missing etch line portion greater than (1/4").

5.2.1.5 Illustration #5 - Repairing of missing etch line portion greater than (1/4").

5.2.1.6 Repairing of missing etch line portion (1/4") or less. Illustration #6

5.2.2 Tack soldering repair wire terminations to etch shall be a distance of (1/8") minimum - (1/4") maximum. Reference Tack Soldering, Module Rework Section on sheets 11, 12, 19.

5.2.3 Etch line breaks (1/4") or less can be repaired by a repair wire with no insulation.

5.2.4 Etch line breaks over (1/4") shall be repaired by a repair wire with insulation extending over the missing etch line portion.

5.2.5 Number #(30) gauge, Kynar, Color - White, wire is used in module repair work.

Note: Wires added on PC Boards used in power supplies etc., may require the use of heavier gauge wire. This must be determined by the responsible engineer for that module, and specified on the ECO.

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5.2.6 Any repair wires that "must" be added to Side #2 of the module; should be added after the solder wave process and secured to the PC Board with Permabond #101 cement if the length is greater than one inch. (Reference Figure #15 on sheet 18).

5.3 Repairing etch pads (Lands)

5.3.1 (Figure #18 on sheet 26).

5.3.1.1 Type #1 - illustrates a lifted etch pad, land, not damaged. This can be repaired with a suitable adhesive (Permabond #101) or equivalent to secure etch pad to epoxy board.

5.3.1.2 Type #2 - illustrates a damaged or missing etch pad. This can be repaired by drilling the existing hole by using a #54, .055" dia. drill and inserting a griplet or eyelet.
 Note: This type of repair does not include multilayers.

5.3.1.3 Type #3 - illustrates a damaged or missing pad and etch line. This can be repaired by drilling the existing hole by using a #54, (.055" dia.) drill and inserting a griplet or eyelet; then insert and solder a repair wire from the griplet or eyelet to the etch line. This type repair does not include multilayers.
 Note: Observe the rules of (Figure #17 on sheet 25).

5.3.1.4 Griplets or eyelets must be securely soldered to the appropriate etch on sides #1 & #2.)

5.3.1.5 Reference drilling holes in Module Rework Section.

5.4 Soldering to Gold Finger Contact

5.4.1 The nature of the type of repair, would be missing or damaged etch lines to gold finger contacts.

5.4.2 Repairs on Side #2 would be performed after the solder wave process.

5.4.3 Reference

5.4.3.1 (4.9) Soldering to Gold Finger Contacts, Module Rework Section. (Figure #16 on sheet 20).

5.4.3.2 Reference (Figure #17) and (5.2), repairing etch lines. On sheets 25 & 21.

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5.5 Repairing Surface Blemishes

- 5.5.1** Blemishes such as scorches, scratches, burns and discoloration of small areas are successfully removed by lightly erasing the blemish area with a Rush, fiberglass eraser. This can be purchased from: The Eraser Company, c/o Production Devices, 189 Main Street, Stoneham, MA. E-111 Rush Eraser (Holder) & (E-112 Industrial Fiberglass Refills).

Caution: Care must be taken not to touch, blow or rub by hand the fibers on the PC Board. Cleaning of the blemished area must be perfumed by washing with Freon or equivalent. Restrict the area of use with solvents, they could cause damage in other areas of the module.

5.6 Drilling Holes for Griplets or Eyelets

- 5.6.1 This does not include Multi-layer PC Board
- 5.6.2 Reference (4.4.3), Component Additions, Module Rework Section on sheet 11.
- 5.6.3 Reference Figure #11 Module Rework Section on sheet
- 5.6.4 Reference (Figure #18 on sheet 26).

5.7 Repairing Shorts on Inner Layers, On Multilayer Printed Circuit Boards

- 5.7.1 (Figure #19 on sheet 27).
- 5.7.1.1 Illsutration #1 shows a copper clearance ring on an inner-layer.
- 5.7.1.2 Illustration #2 shows a short between an Inner-layer, and the plated-through hole.
- 5.7.2 It is possible to salvage the module by removing the short between the inner layer and plated-through hole; and regaining the necessary electrical connection by using #30 gauge, color-white, repair wire between the component and an appropriate plated-through hole.
- 5.7.3 If there is a component lead in the shorting hole, remove the component.
- 5.7.4 Drill out the plated-through hole with a #54 drill (.055" dia.). Inspect that the walls of the plated-through hole have been removed by the drilling. Also check for the removal of the short with an ohmmeter.

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- 5.7.5 If the short still exist or copper smears are visible in the drilled hole, clean the hole with the next size larger drill.
- 5.7.6 Since the end of the copper trace, that was causing the short is still present at the side of the drilled hole, (See illsutration #3), NO Uninsulated wire or component lead shall be inserted in the hole.
- 5.7.7 Before inserting a new component, cut off the component lead, at the seating plane, see (illustration #4, Figure #19) that corresponds to the driller hole(sheet 27.)
- 5.7.8 A new component should be used to replace the one you removed; due to the probability that it was damaged during removal.
Reference: Component Removal/Replacement in Module Rework Section.
- 5.7.10 Wrap a 30 gauge white wire one to two turns around the cut component lead and solder it. The uninsulated portion of the wire should not come within 1/32 of an inch from an adjacent lead.

CAUTION: Minimize heating to component lead.
Excessive heat could cause damage to the component.
- 5.7.11 Tack solder the other termination end of the repair wire to the necessary etch.
Note: Placing repair wires to a boards must follow the same rules as adding ECO wires; Reference Adding Line, Wires, in the Module Rework Section
 - 5.7.11.1 If this termination to an etch is on Side #2 run the repair wire through the drilled hole and attach.
- 5.7.12 For Example: If a short was removed which was internally connected to a "power". inner-plane, the connection may be regained by terminating the repair wire to a plated-through hole which has a "power" inner-plane electrical connection. (See Figure #19 on sheet 27.)

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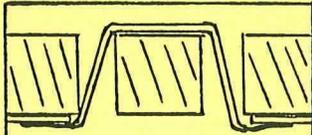
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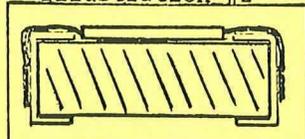
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Cross section of PCB
Illustration #1



Cross section of PCB
Illustration #2



Cross section of PCB
Illustration #3

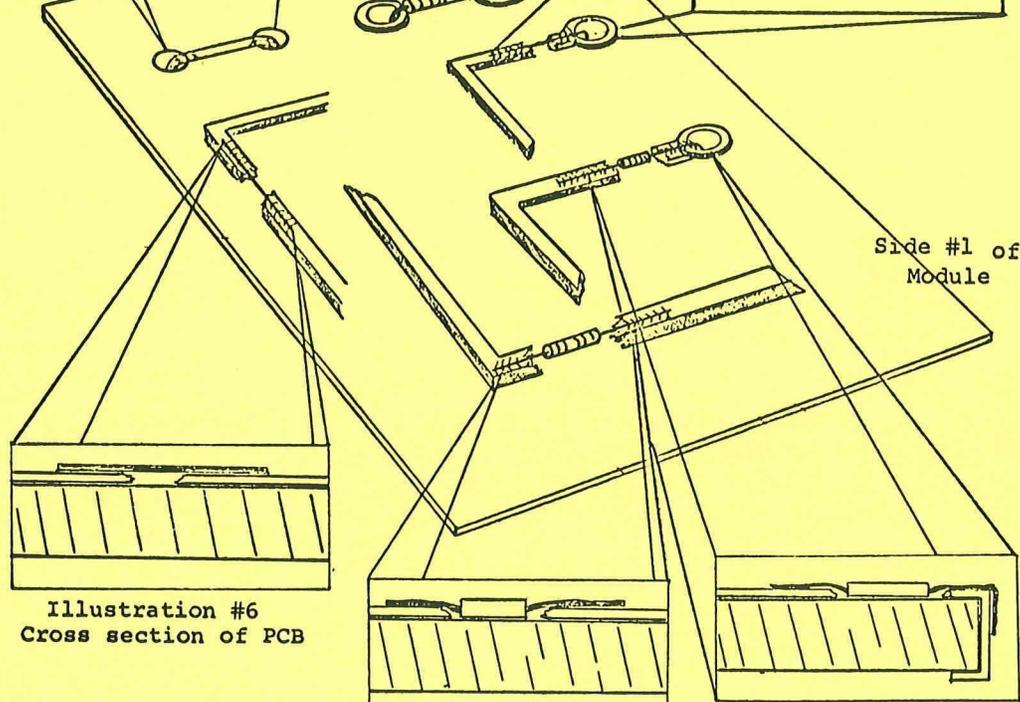
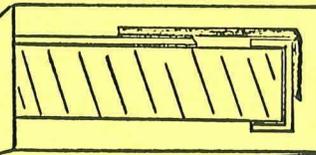


Illustration #6
Cross section of PCB

Illustration #5
Cross section of PCB

Illustration #4
Cross section of PCB

Repairing damaged or missing etch lines

(Figure # 17)

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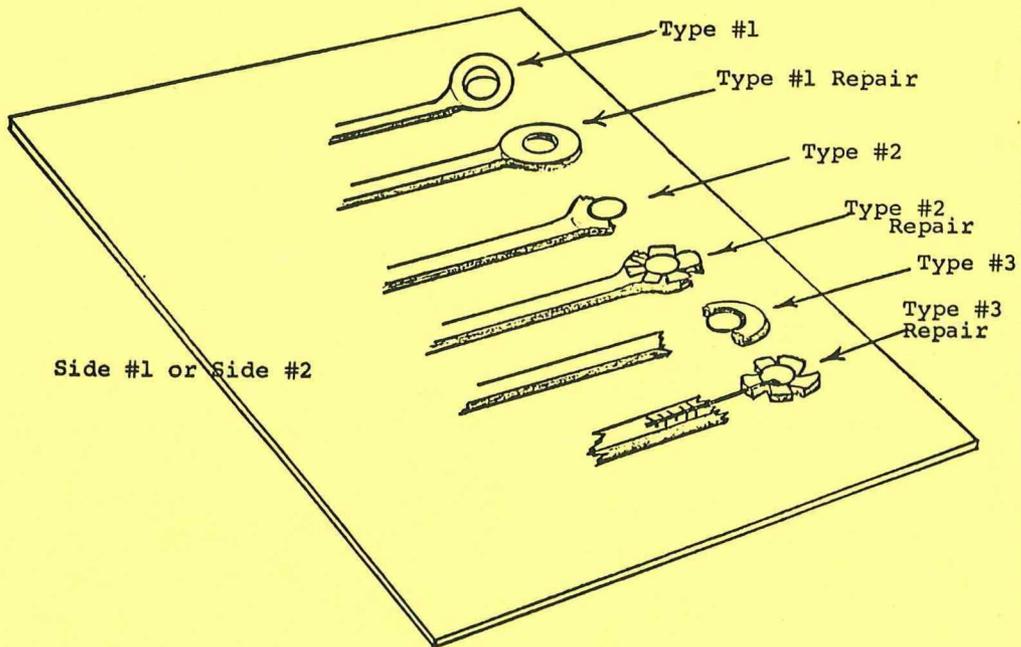
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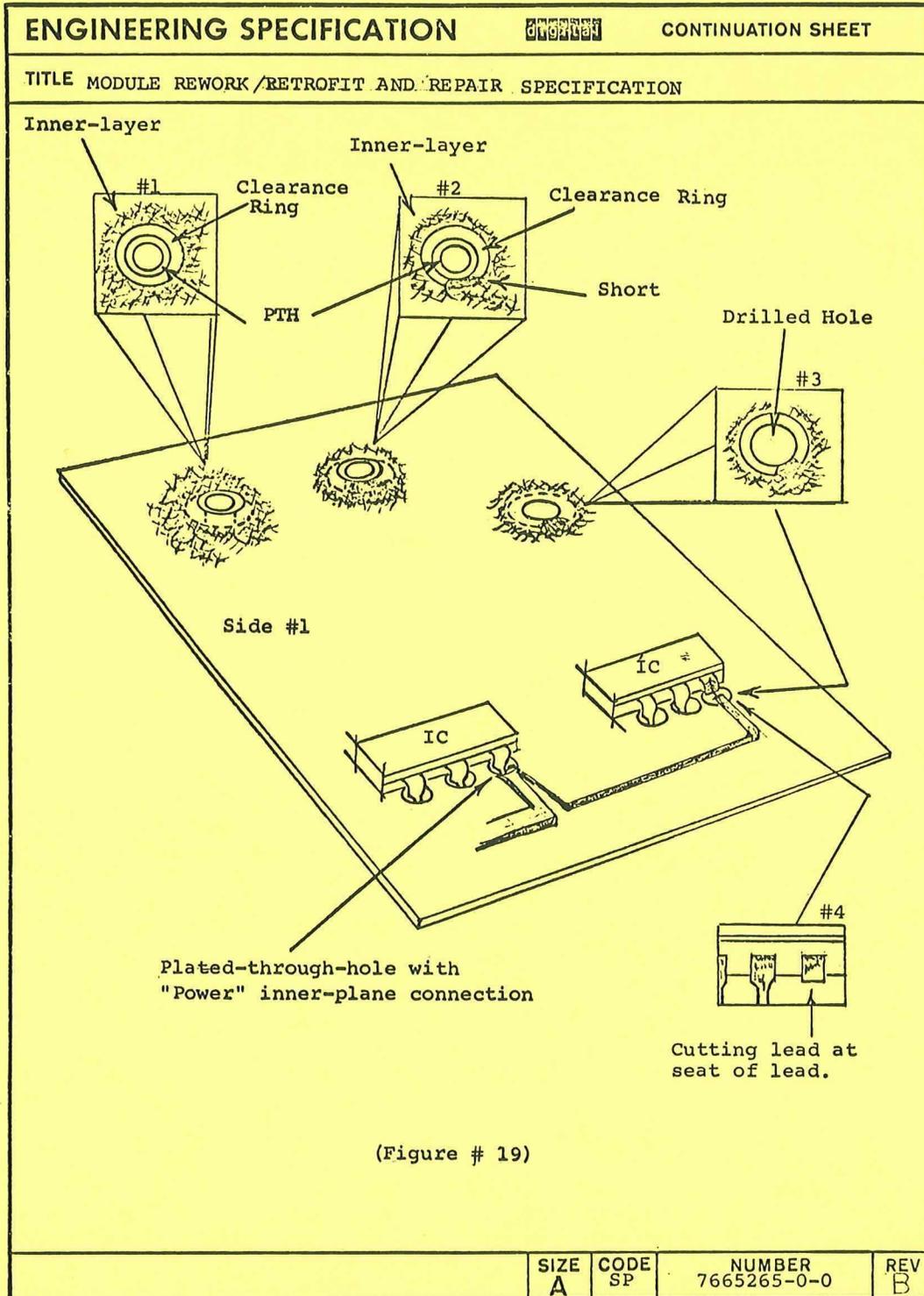
TITLE MODULE REWORK/RETROFIT AND REPAIR SPECIFICATION

- Note: 1) All repairs on Side #2 should be performed after the solder wave process.
- 2) Griplets or eyelets are not used as a repair technique for multi-layer PC Boards.



Repairing Etch Pads (Lands)
(Figure # 18)

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