

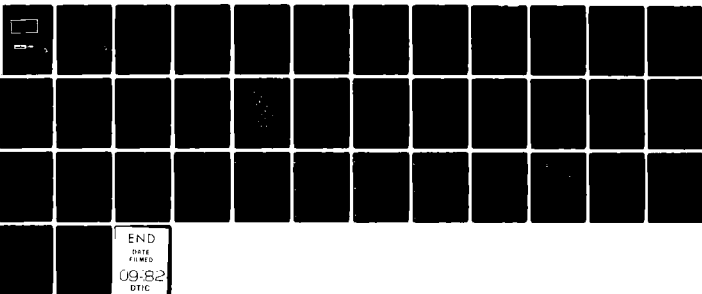
AD-A118 783

ERIE TECHNOLOGICAL PRODUCTS OF CANADA LTD TRENTON (O--ETC F/G 13/8
MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE--ETC(U)
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ELEVENTH AND TWELFTH
PROGRESS REPORT

ON

MANUFACTURING METHODS AND TECHNIQUES
FOR MINIATURE HIGH VOLTAGE HYBRID
MULTIPLIER MODULE

CONTRACT NO. DAAB07-76-C-0041

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4. TITLE (and Subtitle) Manufacturing Methods and Techniques for Miniature High Voltage Hybrid Multiplier Modules		5. TYPE OF REPORT & PERIOD COVERED QUARTERLY 1st Oct. 1980-31st Dec. 1982
7. AUTHOR(s) M.I. MATUSZEWSKI		6. PERFORMING ORG. REPORT NUMBER
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14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The assembly of a multiplier with a notched capacitor was evaluated. The thickness of the capacitor was maintained to ensure high breakdown voltage.		

ELEVENTH QUARTERLY PROGRESS REPORT

MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE
HIGH VOLTAGE HYBRID MULTIPLIER MODULES

CONTRACT NO. DAAB07 - 76 - C - 0041

PREPARED BY: M. I. MATUSZEWSKI, P.ENG.

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Remarks	<input type="checkbox"/>

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PURPOSE

This Contract covers component designs, mounting and inter-connection techniques, tooling and test methods and other manufacturing methods and techniques required for production of rectangular and curved miniature high voltage multiplier modules. These units are to be used in low cost power supplies for image intensifier tubes. The full scope and details of the specification are given in Appendix A to the Eighth Quarterly Report.

Major milestones in this program consist of delivery of the following items:

- (1) First and second engineering samples and test data.
- (2) Production line layout and schedule.
- (3) Confirmatory samples and test data.
- (4) Production line set-up.
- (5) Pilot production run.
- (6) Production rate demonstration.
- (7) Preparation and publication of a final report.

The general approach is to design and set-up a cost-effective production capability, utilizing already established device technologies and materials, and to demonstrate the production line capability to fabricate at the rate of 125 acceptable units per 40 hour week.

1. INTRODUCTION

This report describes briefly the progress in the Manufacturing Methods and Techniques for Miniature High Voltage Hybrid Multiplier Modules Program, made during the latest calendar year

In the First Quarterly Report the design and the manufacturing process for rectangular and curved multiplier modules were described. Prototype rectifier-substrate assemblies were fabricated and then redesigned to simplify the assembly operation. The specification covering the requirements for the multiplier modules forms Appendix A of the Report.

In the Second Quarterly Report results of the electrical evaluation of the first sample batch of rectangular capacitor banks TSK 25-250 and TSK 25-251 were given, the choice of the rectifier was made and electrical test results were presented on non-modular multipliers fabricated with TSK 25-250 and TSK 25-251 capacitor banks and standard HV20PD four-junction rectifiers, to evaluate these components.

In the Third Quarterly Report results of electrical tests on rectangular multiplier modules were presented.

For an input voltage of 1 KV, efficiencies above 96% under no-load conditions and above 95% with 500 nA load currents were achieved for all multipliers assembled with TSK 25-250 and TSK 25-251 and three-chip rectifiers. Low ripple voltages, input capacitances and charging currents were also measured on these multipliers. Results of the mechanical and electrical evaluation of TSK 25-249 curved capacitor banks were also presented in the Third Quarterly Report.

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In the Sixth and Seventh Quarterly Reports were presented the results of testing of rectangular and curved multipliers to the Second Engineering Sample requirements,

steps to improve the frequency performance of the multipliers and optimization of the rectifiers for these devices, as well as results of life testing of multipliers.

In the Eighth Quarterly Report the results of the reliability testing of rectangular and curved multipliers to the Second Engineering Sample requirements were analyzed and further steps to improve the performance of the multipliers and optimize the rectifiers for these devices were discussed.

In the Ninth Quarterly Report the results of further life testing of rectangular and curved multipliers was discussed. The commencement of the Confirmatory Sample phase was described including improvements in the manufacturing methods.

In the Tenth Quarterly Report a data was presented on material and fixtures used in the fabrication of the multiplier modules. The technique of silk screening the conductive epoxy onto the components is described in fabrication of the voltage multipliers.

FABRICATION AND EVALUATION OF MULTIPLIERS

During the first quarter of 1979 most of the work was devoted to manufacturing and assembling of the multiplier modules which were described in the Tenth Quarterly Report.

In January the vacuum fixture for molding parts for the silk-screening process has been built. Additional screens had been received from ERIE, PA.

However, when production started on the 10 curved multipliers, 7 were "open", 1 was "shorted" and the other 2 indicated a short of several rectifiers within the diode chain. In February, 11 pieces were assembled, 3 were good on VF (forward voltage drop), 1 was good on V_0 (optional test), 2 broke physically in assembly, 6 were "open" when tested on VF.

At the time of writing this report, the reject units could not be located to do a reject analysis, but subsequent recommendations by previous program manager were requested and on file.

Most of the March was spent on the design and fabrication of fixtures and tooling for the assembly of capacitors to substrates and for the soldering of leads to capacitors. The Ceramic Engineering Group provided us with another 23 tapped capacitors. They have been informed of the problem of the oversize capacitors and they assured me to be able to supply capacitors that are 80° in arc.

In June 1979, it became obvious that we could not fabricate the parts on any production scale using previous method and design. A new assembly technique was developed and is outlined below.

The same rectifiers were used as before, an additional epoxy roll-coat were given and leads were retained to assure good solder connections. The capacitor is notched to make room for a diode body.

The same thickness of ceramic is retained in order to maintain a sufficiently high voltage breakdown.

The modified assembly is illustrated in an isometric sketch TSE-31-111. The new method, as a simplification of original concept, should give cost saving in large scale production. With regards to the change, the following modifications were requested:

1) Part II Section II, Suppliers Schedule Date - The schedule to be changed to the following:

Item No. 0001AB - Confirmatory Sample

Delivery: 4 February 1980

Item No. 0001AC - Pilot Run

Delivery: 16 June 1980

Item No. B003 - Test Report of Confirmatory Samples

Delivery: 4 February 1980

Item No. C003 - Final Report

Delivery: Draft due 14 July 1980 (First distribution 30 days after approval.)

Item No. C004 - General Report, Step 11

Delivery: 30 days after approval of First Report.

Item No. 0005AA - Reliability Testing

Delivery: 16 June 1980

2) Electronics Command Technical Requirements SCS-495.

a) On pages 20 and 21, para 2.1 on each page to be changed to following:

"2.1 D_i and D_o leads: 0.015 Diameter silver or tinned copper."

b) On pages 20 and 21, AC and GND leads to exit the package on the same face as the D_i lead (as illustrated in sketch TSK 312-112)

The schedule changes result from the delivery of the new capacitors by our vendor. The reason for request 2(a), is simple - we intend to use the diode's own lead for D_1 and D_0 and its diameter is .015". Regarding the change in lead positions, this is necessitated by the fact that the leads can no longer emerge from the sides as there would be too great a probability of breakdown from the leads to the diodes nearest them. Therefore, the only feasible alternative is the one suggested above and any testing on such parts must be performed in a dielectric fluid or after further encapsulating the entire multiplier.

CONCLUSION

Nearly every position within this contract has changed many times in 1976, 1977 and 1978. For example: the Procuring Contracting Officer at Fort Monmouth was changed 3 times, the Contracting Officer's Technical Representative 2 times, the Project Engineer at Fort Belvoir 3 times, the Representative for Canadian Commercial Corporation 3 times.

Finally, the ERIE Programme Manager was initially A. Kennedy, then Dr. M. Korwin Pawlowski (March 77), B. G. Gordon (September 1978) and as of January 1980 M. Matuszewski.

These changes have negative impact in continuation of the project as for delivery schedule. However, additional effort will be made by present Programme Manager to fulfill our commitments.

Program for first quarter of 1980:

- 4.1 Most attention must be placed to keep progress according to schedule.
- 4.2 Necessary changes in design to assure production assembly should be made. Present design proposition is not practical to mass assembly.
- 4.3 Initiate manufacture of the proper capacitors.
- 4.4 Design and fabricate tools and jigs.
- 4.5 Fabricate and test engineering sample.

PUBLICATIONS AND REPORTS

No reports or publications were made on the work associated with this program during the last year.

IDENTIFICATION OF PERSONNEL

Brief descriptions of the background of technical personnel involved were included in the preceding Progress Reports.

The following persons worked in their area of responsibility:

<u>INDIVIDUAL</u>	<u>RESPONSIBILITY</u>	<u>HRS.</u>
B. G. Gordon	Programme Manager	484
J. Pack	Manufacturing Personnel	366
R. Shah	Programme Manager	80
K. Cram	Draughtsman	13
V. Glenn	Q.C. Inspector	15
B. Heidt	Process Engineering Supervisor	112.1
P. Maples	Senior Engineering Technician	306.8
D. Regan	Senior Engineering Technician	48.5
F. Treverton	Senior Test Technician	<u>1</u>

TOTAL HOURS - in 1979 1441.4

TOTAL HOURS - to date 6295.4

METHOD OF ASSEMBLY, AS USED ON THE
PROTOTYPE DUMMY SAMPLES

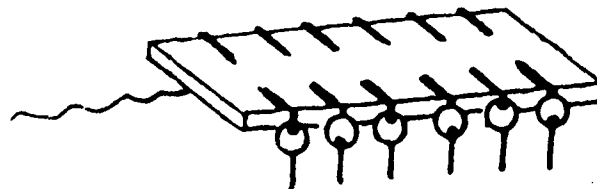
1. Solder input wire to common side of 1st capacitors.



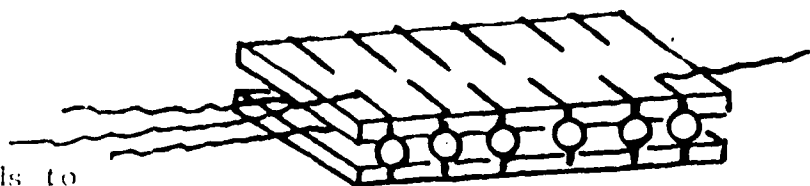
2. Pre-cut and bend 12 diodes (6 cathode to bend, 6 anode to bend.)



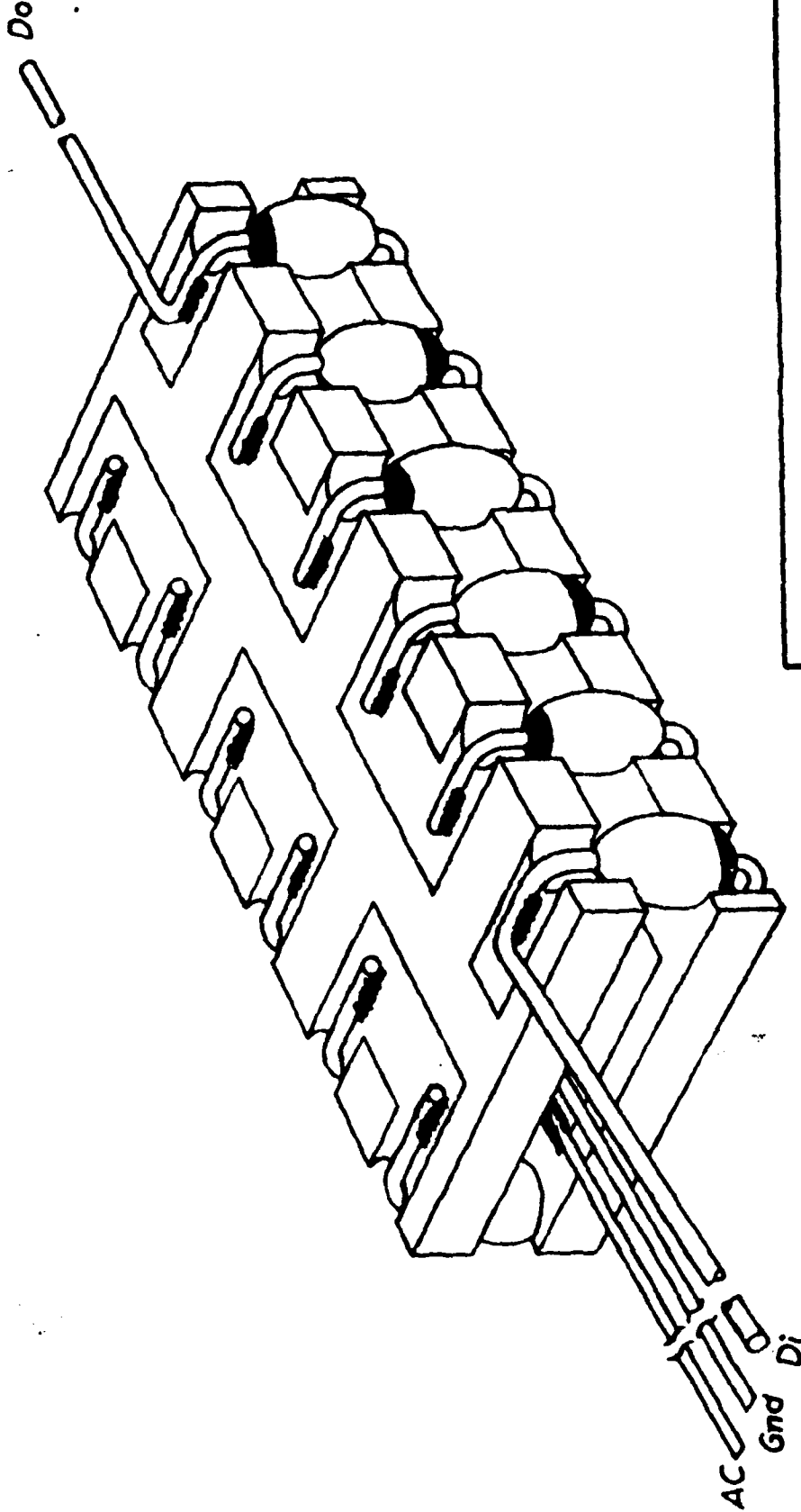
3. Solder 12 diodes to the first capacitor.



4. Locate second capacitor. Bend 12 Diode leads, solder to second capacitor



5. Solder 2 output leads to second capacitor.



MULTIPLIER ASSEMBLY

DWN. *K. Ben* 25 June 79

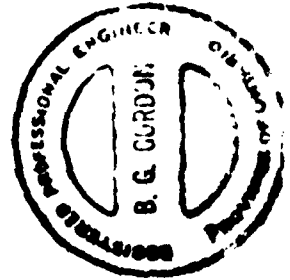
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Erie Technological Products
of Canada Ltd.
Trenton, Ontario

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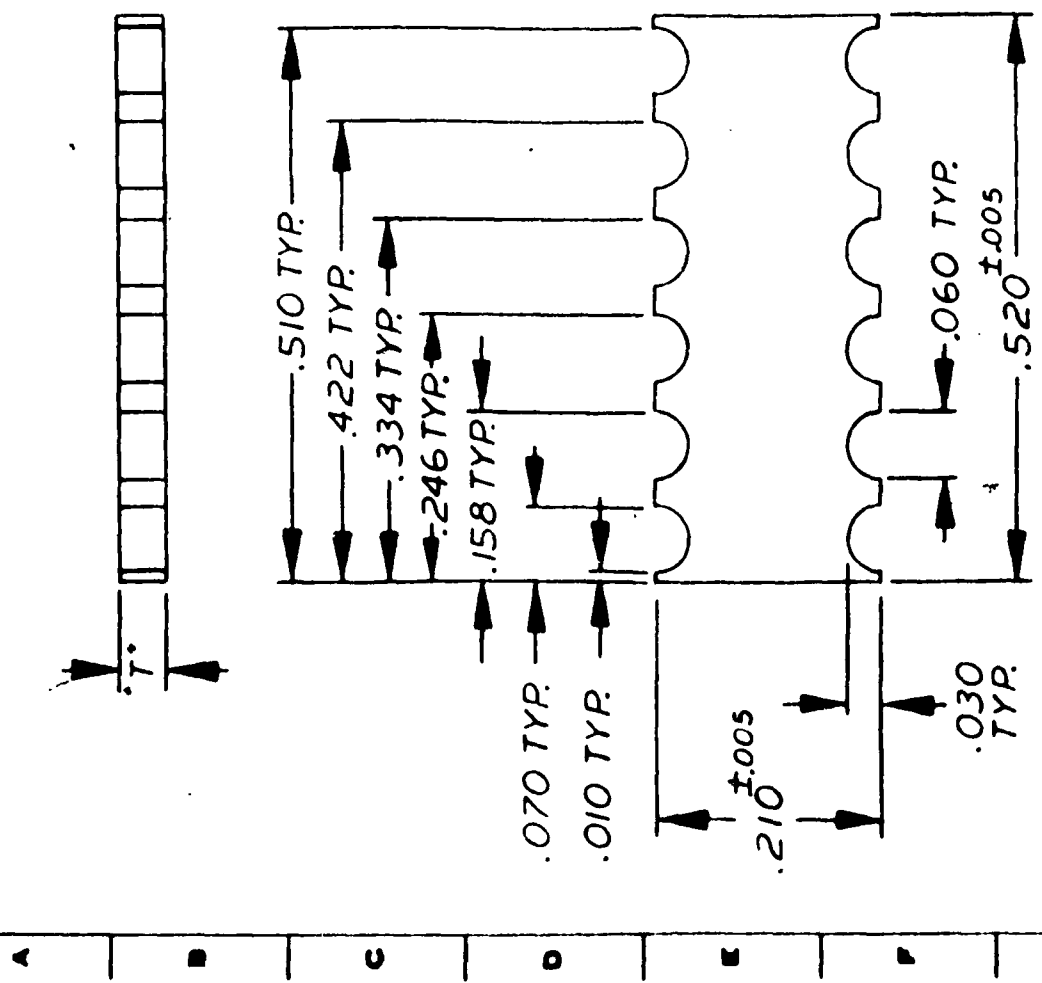
TSK-312-112



CSK-54003 REV

ACCEPTANCE OF MATERIAL SUBJECT TO APPROVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG.

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	\pm
DECIMAL	\pm
ANGLES	\pm



ITEM	K BODY	THICKNESS "T"
-01	K1200	.040
-02	K1600	.050

SCALE: 6=1

CAPACITOR
BLANK

**NOT
CONTROLLED**

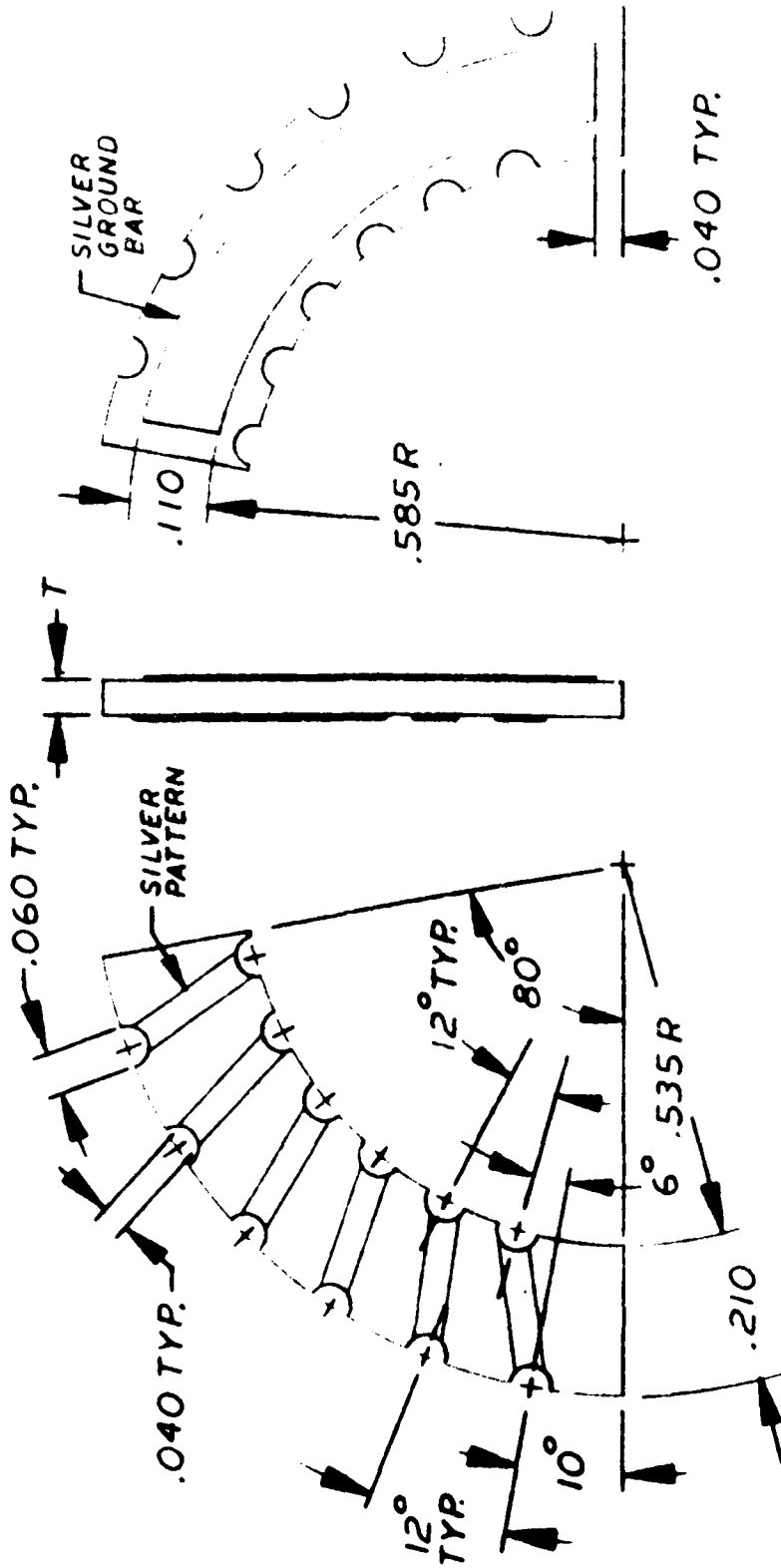
DRAWN BY <i>R. G. G.</i>	FEB. 11/80	MATERIAL CERAMIC
CHECKED BY <i>W. H. Szele</i>		FINISH
DATE FEB. 11/80		
Erie Technological Products Limited Troy, Ontario		CSK-54003 REV

CSK 54002 REV

ITEM	K BODY	THICKNESS
-01	K1200	
-02	K1600	

ACCEPTANCE OF MATERIAL SUBJECT TO APPROVAL OF PRODUCTION SAMPLE BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES. DO NOT SCALE THIS DWG.

TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS	±
DECIMAL	± .005
ANGLES	± 1°



SCALE: 4=1

PLANAR CAPACITOR

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DRAWN BY	DATE	MATERIAL	FINISH
CHECKED BY			
Erie Technological Products Limited Tremont, Ontario			REV
			CSK 54002

REV NO. REVISIONS

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The problems associated with the assembly of multipliers and diode designs have been discussed. Some electrical measurements have been presented and recommendations made to reoptimise capacitor and diode.		

TWELFTH QUARTERLY REPORT
QUARTERLY PROGRESS REPORT
THIRD QUARTER 1981

MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH
VOLTAGE HYBRID MULTIPLIER MODULES

CONTRACT NO. DAAB07 - 76 - C - 0041

PREPARED BY: K.I. SEMY

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PURPOSE

This Contract covers component designs, mounting and inter-connection techniques, tooling and test methods and other manufacturing methods and techniques required for production of rectangular and curved miniature high voltage multiplier modules. These units are to be used in low cost power supplies for image intensifier tubes. The full scope and details of the specification are given in Appendix A to the Eighth Quarterly Report.

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In the Tenth Quarterly Report a data was presented on material and fixtures used in the fabrication of the multiplier modules. The technique of silk screening the conductive epoxy onto the components is described in fabrication of the voltage multipliers.

In the Eleventh Report, fabrication and evaluation of the multiplier was discussed with notched capacitors and P-package diodes from Murata Erie North America, Inc.

ASSEMBLY OF MULTIPLIER (MIREK MATUZEWSKI PROCESS)

1. Dip silvered ceramic capacitors into 60% lead 40% tin solder solution.
2. Solder silver strip to the ground pattern on ceramic as shown on figure 1.

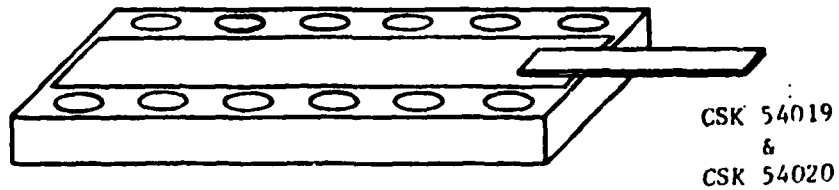
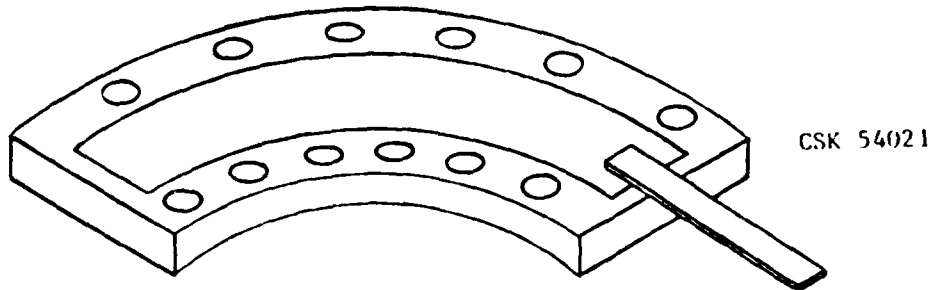
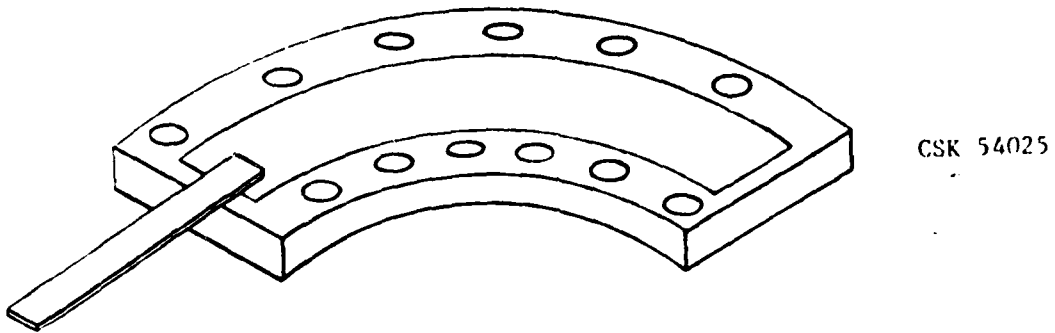
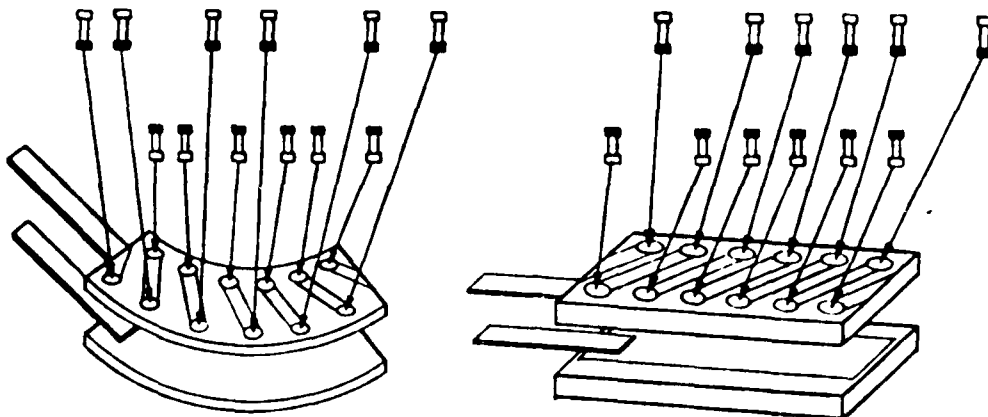


Fig. 1 Position of "ground" terminals.

3. Place capacitors in the assembly fixture.
4. Locate diodes in holes in ceramic capacitors with the orientation as shown on figure 2a and 2b



(a)

(b)

Fig. 2. Diode assembly module.

a) TSK 313-113 module b) TSK 312-114

5. Apply flux and solder to create bridges between ceramic silvered pattern and diodes.
6. Attach silver lead terminals to the input and output of the multiplier.
7. Etch devices for 1 minute, clean in ultrasonic and D.I. water.
8. Dip devices into varnish and cure in 160°C for 24 hours.
9. Place device in the rubber mold and fill it with epoxy coating.
10. Cure epoxy in 160°C for 12 hours.
11. Remove multiplier from rubber mould.

PROBLEMS

1. Extensive cracking of the capacitor during solder dipping operation.
2. The surface damage on the diodes caused by the sawing of the stack was removed after assembly of the multiplier. Assuming 90% test yield on the diode, the overall yield to complete multipliers would be very small as one diode in any 12 diodes used in the multiplier could reject the complete multiplier assembly.
3. During the soldering operation it is difficult to control the size, as a solder bridge had to be formed between the diode and the silver of the ceramic with the solder. This could only be achieved by using large amount of solder. Hence the overall thickness of the multiplier was typically 0-200" to 0-220". The diode had to be subsequently lapped down to size which resulted in some yield loss.
4. The hand soldering operation gives us limited output.

After the departure of Mirek Matuszewski the project responsibilities were assumed by the writer, and therefore actions were taken to modify the process.

The following process changes were made:

1. The diodes used for assembly were etched, varnished, epoxy coated and 100% tested before assembly of multiplier.
2. The overall diameter of the diode had to be maintained to be less than diameter of the hole in the ceramic capacitors. In December 1980, we started soldering multipliers and after eliminating assembly rejects we produced approximately 33 pcs. of TSK 312-000 and 30 pcs of TSK 313-000 to meet the confirmatory sample requirements.

RESULTS:

The multipliers were tested for Cr. 1 test and results are as below.

	<u>No. of Pieces to Test</u>	<u>Good Pieces</u>	<u>Charging Current reject</u>	<u>Efficiency Reject</u>
TSK 312-00	30	20	6	6
TSK 313-00	30	16	7	7
Yield on test	TSK 312-00	60.6%		
	TSK 313-00	53.3%		

The multipliers passing test were showing charging current of 200 to 250 microamps. It was therefore decided to initiate further optimisation of the diode and the capacitor. (Test results pg. 11)

ERIE TECHNOLOGICAL PRODUCTS
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QUALITY CONTROL DEPT. - RECORDED DATA SHEET

Sheet Date

SHEET 1 OF 1

NOTES - PAGE

PO DANCOT-76-C-0041

TEST FOOT MOUNT WITH CONFIRMATORY TESTING (GROUP I)

REV

PART TSK-312 (6 STAGE Rectangular Multi. Module)

REV

SPECIAL DETAILS RE SPEC. No: SCS-495

TEST DATE

TEST COND.

PARAMETER MULTIPLEXER EFFICIENCY CALCULATION P CHG-CURRENT INWAT CAP.
 INPUT VOLT 1000V/p @ 35 kHz SWF WAVE DEFF. 1000V/p
 LOAD CURRENT 2mA 500mA 2mA-500mA 2mA
 SPEC. PARAM. OUTPUT VOL. 3.2-1.1 OUTPUT 3.2-1.3 3.2-1.2
 UNITS: KW/L % KW/L %

REQUIREMENT: 94.8 MIN 4.28 MAX 250 PARAMS 8 PF MAX

IDENTIFICATION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
RED	5.710	5.760	5.740	5.560	5.740	5.360	5.720	5.750	5.410	5.410	5.460	5.580	5.740	5.740	5.700	5.710	5.710	5.700	5.750	5.740	5.690	5.700	5.750	5.740	5.540	5.690	2.740	5.740
	95.2	96.0	95.7	92.7	95.7	89.3	95.3	95.8	90.2	90.2	91.0	93.0	95.7	95.7	95.0	95.2	95.2	95.0	95.8	95.7	92.3	94.8	95.8	95.7	92.3	94.8	95.7	95.7
	94.7	95.5	95.2	91.8	95.2	86.0	94.3	95.3	88.5	89.0	90.7	92.7	95.2	95.2	94.5	94.8	94.7	94.7	95.3	95.2	94.3	94.5	95.5	95.2	92.0	94.5	95.3	95.2
	0.5	0.5	0.5	0.9	0.5	3.3	0.5	0.3	1.2	0.3	0.3	0.3	0.5	0.5	0.4	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.3	0.5	0.3	0.3	0.4	0.5
	260	250	220	220	220	190	220	220	230	260	130	210	250	240	280	350	300	250	130	220	250	220	250	260	230	220	220	200
	5.89	5.04	5.00	5.31	5.55	5.41	5.16	4.76	4.95	5.46	4.22	5.06	5.24	5.15	5.27	5.13	5.77	5.27	5.44	5.44	6.16	5.29	5.32	6.15	5.00	5.44	5.25	5.10

ERIE TECHNOLOGICAL PRODUCTS

RECORDING SHEET

QUALITY CONTROL DEPT. - RECORDED DATA SHEET

SHEET 1 OF 1

NOTES - PAGE:

DAAB07-76-C-0041

TEST FOR MONMOUTH CONFIRMATORY TESTING (GROUP I)

P.O.

PART 7SK-312 (6 STAGE Rectangular Mill Module)

QTY

SPECIAL DETAILS RE SPEC. No. SCS-496

TEST DATE:

TEST COND:

PARAMETER MULTIPLE EFFICIENCY CALCULATION > CHG. CURRENT INHIB. CAP.
 INPUT VOLT 1000 Vp/p @ 35 KHz SINE WAVE COEFF. 1000 Vp/p 1000 Vp/p
 COND. CURRENT < 2mA 500mA 2mA-500mA < 2mA < 2mA
 SPEC PARA OUTPUT VOLT 3.211 OUTPUT VOLT 3.213 3.212
 UNITS: KWH % % % PF
 94.0 max. 8.280 max. 250 PPM MAX. 8 PFC MAX.

REPAIRMENT:

REP #	KWH	%	8.280 max. 250 PPM MAX	8 PFC MAX.
# 29	5730	95.5	5.700	95.0
# 30	5720	95.3	5.690	94.8
# 31	5710	95.1	5.690	94.8
# 32	5720	95.1	5.690	94.8
# 33	5720	95.3	5.690	94.8

IDENTIFICATION NUMBER

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ERIE TECHNOLOGICAL PRODUCTS
OF CANADA, LTD.

QUALITY CONTROL DEPT. - RECORDED DATA SHEET

DATE TESTED
TESTED BY
APPROVED BY

SHEET 1 OF 1
NOTES PAGE

DMB07-76-C-0041
TEST FOR MOUTH CONFIRMATORY TESTING (GROUP I)
PART 1SK-313 (6-STAGE - CURVED MULT MODULE)
SPECIAL DETAILS RE SPEC. NO. SCS-495

TEST DATE

TEST COND.

PARAMETERS: MULTIFREQUENCY EFFICIENCY CALCULATION > CHG CURRENT INWAT CAP.
INPUT VOLT: 1000V/p @ 35 KHZ SINE WAVE OFF. 1000V/p
LOAD CURRENT: < 2NA SOONA SOONA 2NA-SOONA < 2NA 1000V/p
SPEC. PARA: OUTPUT VOLT 3.2.1.1 OUTPUT 3.2.1.3 3.2.1.2
UNITS: KVA % % 3A

REQUIREMENT: 9480 MAX. 4.20 MAX. 250 PARAM.

86ck

IDENTIFICATION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
INPUT VOLT	5.750	4.360	5.710	5.740	5.730	5.710	5.740	5.740	5.710	ARCING	5.740	5.360	5.310	5.740	5.410	5.730	5.740	5.710	5.740	5.710	5.740	5.710	5.740	5.710	5.740
LOAD CURRENT	95.8	72.7	95.2	95.7	95.5	95.2	95.7	95.7	95.2		95.7	89.3	88.5	95.7	90.2	95.5	95.7	95.2	95.7	95.2	95.7	95.2	95.7	95.2	95.7
EFFICIENCY	95.7	67.7	94.7	95.3	95.2	94.3	95.3	94.8	94.8		95.3	81.0	87.7	95.2	84.3	95.0	95.2	94.8	95.3	95.2	95.3	86.7	95.0	95.0	95.0
WAVE OFF.	0.1	9.2	0.5	0.4	0.3	0.4	0.4	0.5	0.4		0.4	3.3	0.8	0.5	0.9	0.5	0.5	0.4	0.4	0.5	0.4	0.1	0.3	0.5	0.5
CHG CURRENT	240	200	200	350	220	200	230	380	250		180	160	200	220	130	230	220	200	400	400	340	180	220	350	350
INWAT CAP.	6.65	6.14	6.34	6.28	7.13	6.17	7.10	6.43	6.18		6.63	6.33	5.47	6.24	6.35	6.53	6.48	6.50	6.36	6.44	6.76	5.77	7.00	6.48	6.48

ERIE TECHNOLOGICAL PRODUCTS
OF CANADA LTD

QUALITY CONTROL DEPT. - RECORDED DATA SHEET

Sheet No. _____
Part No. _____
Rev. No. _____
Approved By _____

SHEET 1 OF 1
NOTES PAGE:

FILE NO. _____
TEST FOR MONMOUTH CONFIRMATORY TESTING (GROUP I)
PART TSK-919 (6 STAGE CURVED MULT. MODULE)
SPECIAL DETAILS RE SPEC. NO. SCS-495

P.O. DMB07-76-C-0041

TEST DATE:

TEST COND:

PARAMETER: MULTIPLIER EFFICIENCY CALCULATION → CHG CURRENT → INPT CAP.
INPUT VOLT: 1000 V_{PP} @ 35 KHz SINE WAVE DEFF. 1000 V_{PP} 1000 V_{PP}
LOAD CURRENT: 52mA 500mA 2mA-500mA 2mA 1000 V_{PP}
SPEC. PARA: output Volt 3.2-1.1 90% 3.2-1.3 3.2-1.2
UNITS: KHz % KHz % V_R RE
REQUIREMENT: 940 min. 8pf max.

Block	25	5740	95.7	5720	95.3	0.4	330	6.93
	26	5720	95.3	5690	94.8	0.5	320	6.66
	27	5790	94.3	5670	94.5	0.3	350	6.63
	28	5490	91.5	5470	91.2	0.3	350	6.24
	29	5710	95.2	5680	94.7	0.5	450	5.80
	30	5730	95.5	5710	95.5	0.3	340	6.42

IDENTIFICATION NUMBER

PLANS

1. Evaluate reduced capacitance.
2. Decrease reverse recovery time of diode.
3. Improve assembly process, automate soldering to increase throughput and yield.

CONCLUSION:

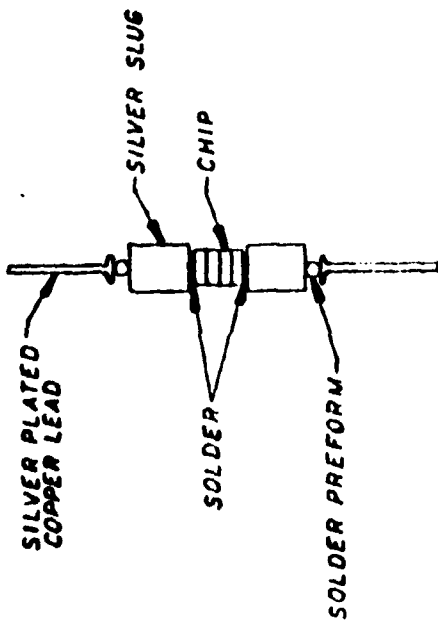
As reported in the eleventh quarterly report every position in the contract has changed many times. We have to report once again that Mirek Matuszewski who has been the Program Manager since January, 1980 left the company and his project responsibilities have been taken over by the writer. We are making a concentrated effort to complete this project and have also recruited one full time operator for fabrication of confirmatory samples and pilot production run.

We have requested for a change in schedule for delivery of samples and it shall be reported in my next quarterly report.

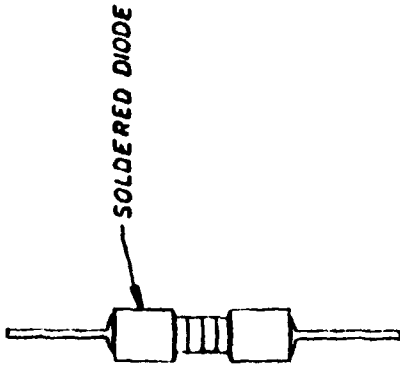
PUBLICATION & REPORT

No publications and reports have been issued in this quarter.

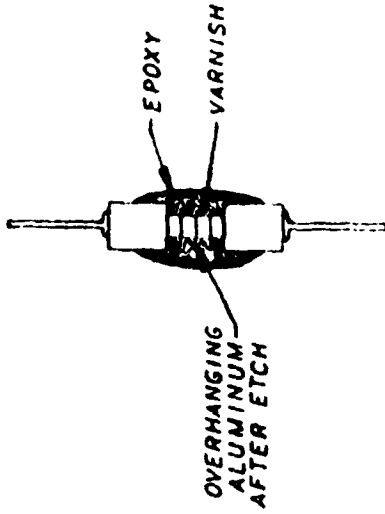
STEP 1
ASSEMBLY IN JIG



STEP 2
FURNACE SOLDERING
IN ASSEMBLY JIG



STEP 3
DIODE ETCHED, VARNISHED,
& EPOXY COATED

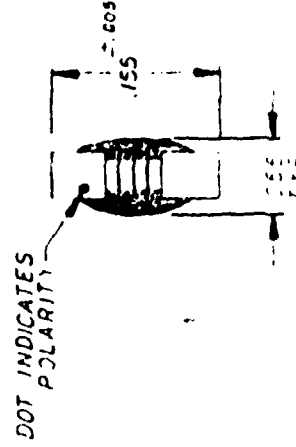


STEP 4

DIODES ARE THEN TESTED FOR:

1. POLARITY
2. FORWARD VOLTAGE DROP $\leq 10\text{mV}$,
MAX 5-0V.
3. REVERSE LEAKAGE $\leq 25^\circ\text{C} \cdot 1\text{KV}$,
 100mA MAX.
4. REVERSE RECOVERY TIME:
IF $\leq 2\text{mA}$, IR = 2mA, 200 NANOSECONDS MAX.

STEP 5



1. LEADS CUT OFF TO EXPOSE SILVER SLUG
ON BOTH SIDES.
2. DIODE READY FOR ASSEMBLY.

CSK-54019

ACCEPTANCE OF MATERIAL SUBJECT TO APPROVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG.

UNLESS OTHERWISE SPECIFIED

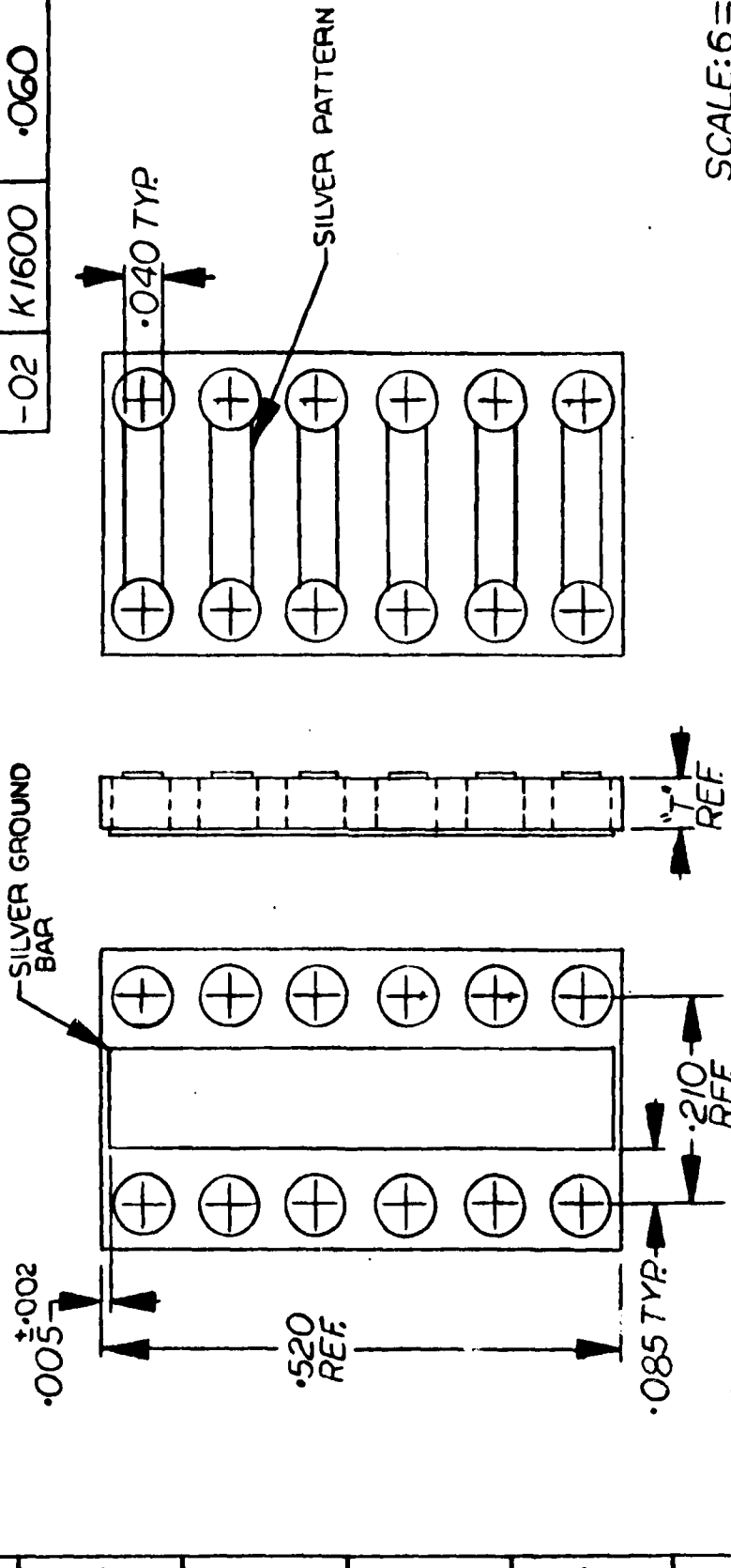
FRACTIONS	±
DECIMAL	±.005
ANGLES	±

CX: 50/75 F PER SECT.
FLASH: 8 KVOLTS PER SECTION.

NOTES

- REFER TO: T147-028, T147-027 SCREEN PATTERN
- MAKE FROM CSK-54018

ITEM	K BODY	THICKNESS
-01	K1200	.060
-02	K1600	.060



REV. NO	REVISIONS
1	085 15.06 FEB 81
2	0. # 8128 2 JULY 81
3	CD # 7953 4 AUG 81
4	20 9058 30 DEC 81
5	0. # 9407 23 MAR 82

CAPACITOR

DRAWN BY BONNY LANE

CHECKED BY *[Signature]* DATE: 3/04/80

DATE: APRIL 3/80

MATERIAL CERAMIC

FINISH

Errie Technological Products Limited

CSK-54019

REV

NOT CONTROLLED

CSK-54020

REV

ACCEPTANCE OF MATERIAL SUBJECT TO A 1/2 OVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG.

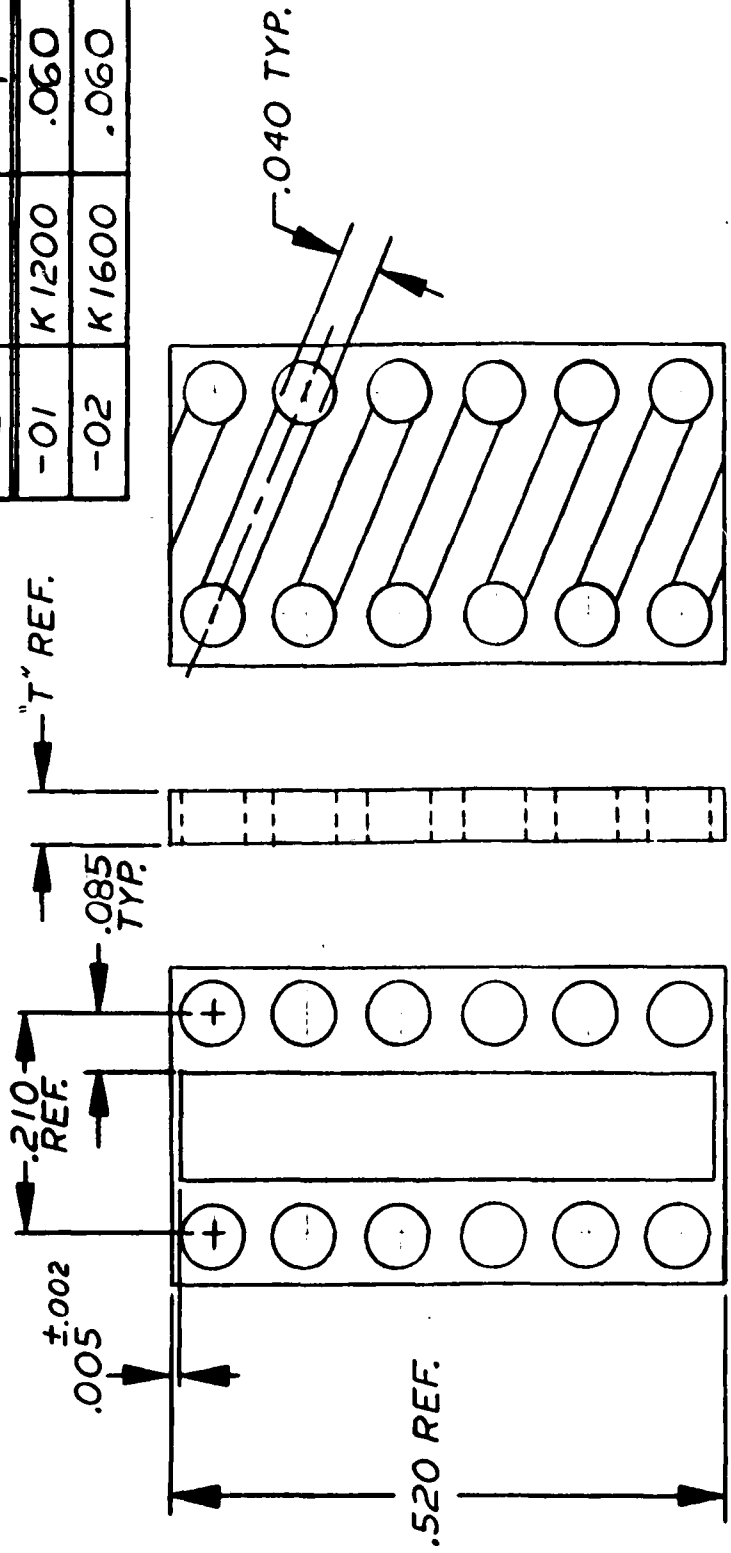
UNLESS OTHERWISE SPECIFIED	
FRACTIONS	±
DECIMAL	±.005
ANGLES	±

CX :50/75 PF PER SECT.
FLASH: 8KVOLTS PER SECTION

NOTES

- 1) REFER TO T147 029, T147 027 SCREEN PATTERN
- 2) MAKE FROM CSK-54018
- 3) END SECTION TO HAVE A CX OF 25/40 PF EACH.

ITEM	K BODY	THICKNESS
-01	K1200	.060
-02	K1600	.060



SCALE: 6=1

REV NO	REVISIONS
1	CSK-54020 1 APR 80
2	C.O. # 8128 2 JULY 81
3	(D# 7953 4 AUG 81
4	CO 9057 29 DEC 81
5	CO 9408 1 APR 82

NOT CONTROLLED

CAPACITOR	
DRAWN BY <i>R. Chan</i>	APR. 8/80
CHECKED BY <i>W. H. ...</i>	8/04/80
DATE	
Erie Technological Products Limited	
CSK-54020	REV

SK 54021

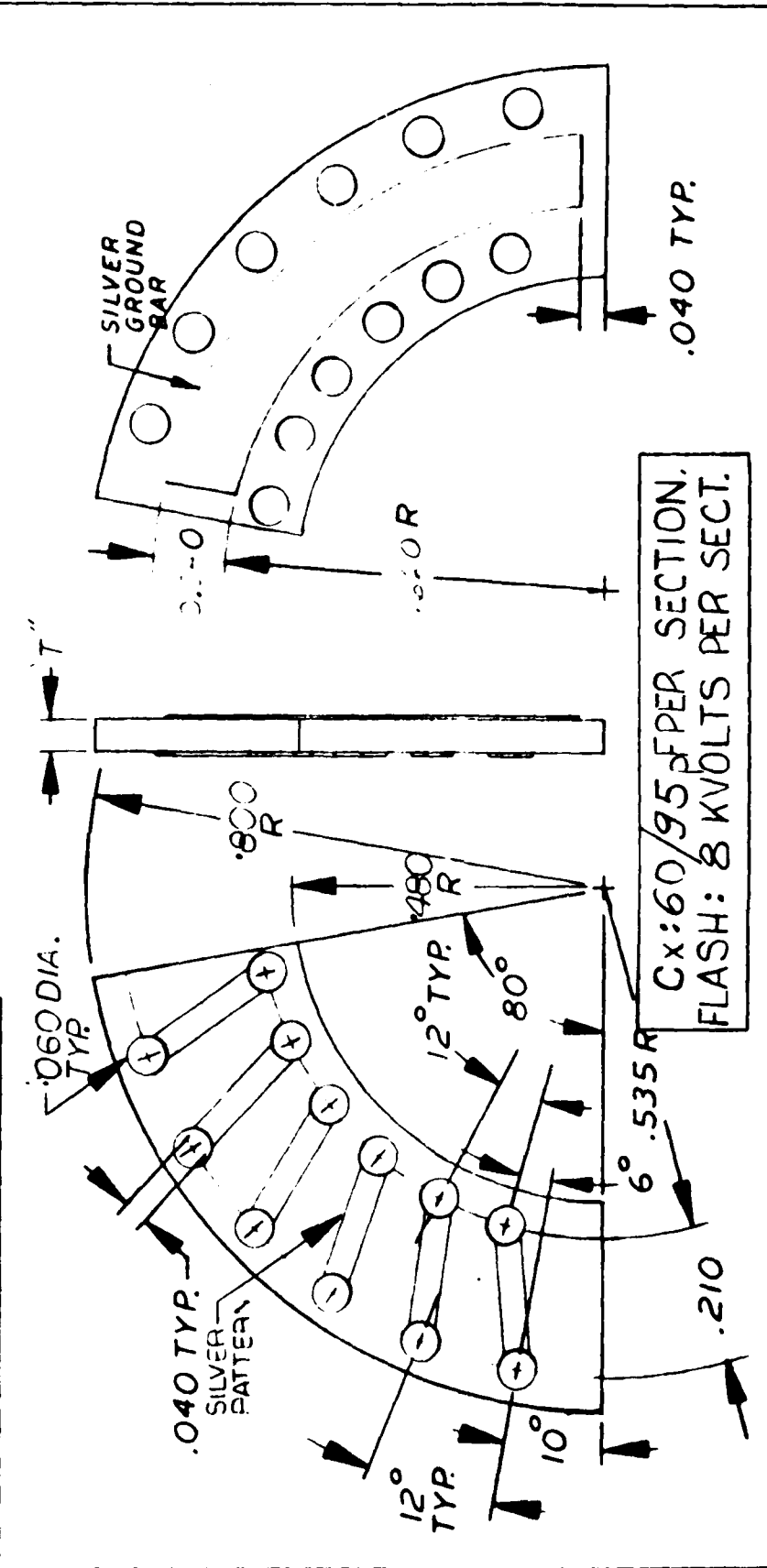
ACCEPTANCE OF MATERIAL SUBJECT TO OVAL OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT
DIMENSIONS IN INCHES DO NOT SCALE THIS DWG

ITEM	K BODY	THICKNESS
-01	K1200	.055
-02	K1600	.055

NOTES

1) REFER TO: T 147023 SHT. # 2, T147030
SCREEN PATTERN.

2) SILVER FROM CSK-54072



SCALE: 4=1

REV NO	REVISIONS
6	FOR 9/12 1/17/82
5	CO 9411 1 APR 82
4	CO 9059 30 DEC 81
3	CO 8128 2 JULY 81
2	CS-26 5/8/81
	CRS. WITHN 8/11/80
	0.070
	GROUND BAR 0.110 TO
	BLANK APR 9/80

PLANAR CAPACITOR

DRAWN BY BONNY LANE

CHECKED BY *[Signature]* 6.3.038

DATE APRIL 2/80

Erie Technological Products Limited

NOT CONTROLLED

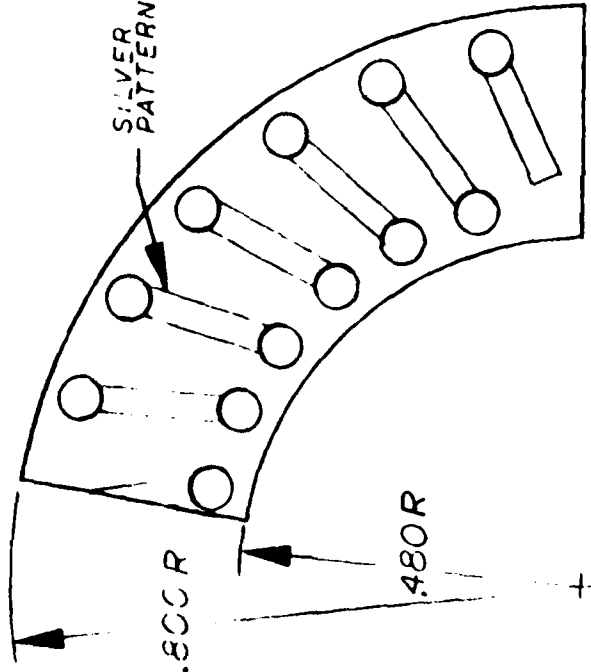
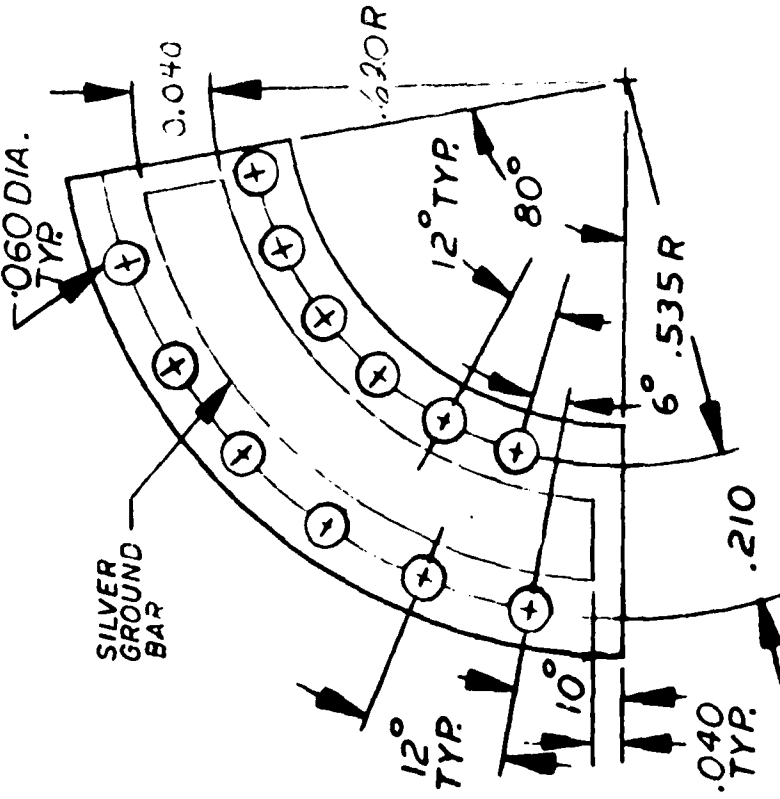
CSK 54025

ACCEPTANCE OF MATERIAL SUBJECT TO DIVISION OF PRODUCTION SAMPLES BY ENGINEERING DEPARTMENT DIMENSIONS IN INCHES - DO NOT SCALE THIS DWG

DIMENSIONS UNLESS OTHERWISE SPECIFIED	
FRACTIONS	±
DECIMAL	± .005
ANGLES	± 1°

ITEM	K BODY	THICKNESS
-01	K1200	.055
-02	K1600	.055

NOTES
 1) REFER TO : T 147023 SHT. #2, T147030 SCREEN PATTERN.
 2) SILVER FROM CSK-54072
 3) END SECTION (INCOMPLETE ELECTRODE) - CX TO BE 25/50 pF MIN



Cx: 60/95 pF / SECTION
 FLASH: 8 KVOLTS / SECTION

SCALE: 4=1

VISIONS REV. NO.

1	5.26 FEB. 81	0. # 8128	2 JULY 81.	0.9060	8 DEC 81	0.9912	APR 82	APR 82	0. # 8128
2									
3									
4									
5									

IS WITH 0.510 X
 CUB BAR 0.110 TO
 0.40

5.26 FEB. 81

0. # 8128

2 JULY 81.

0.9060

8 DEC 81

0.9912

APR 82

APR 82

0. # 8128

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APR 82

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8 DEC 81

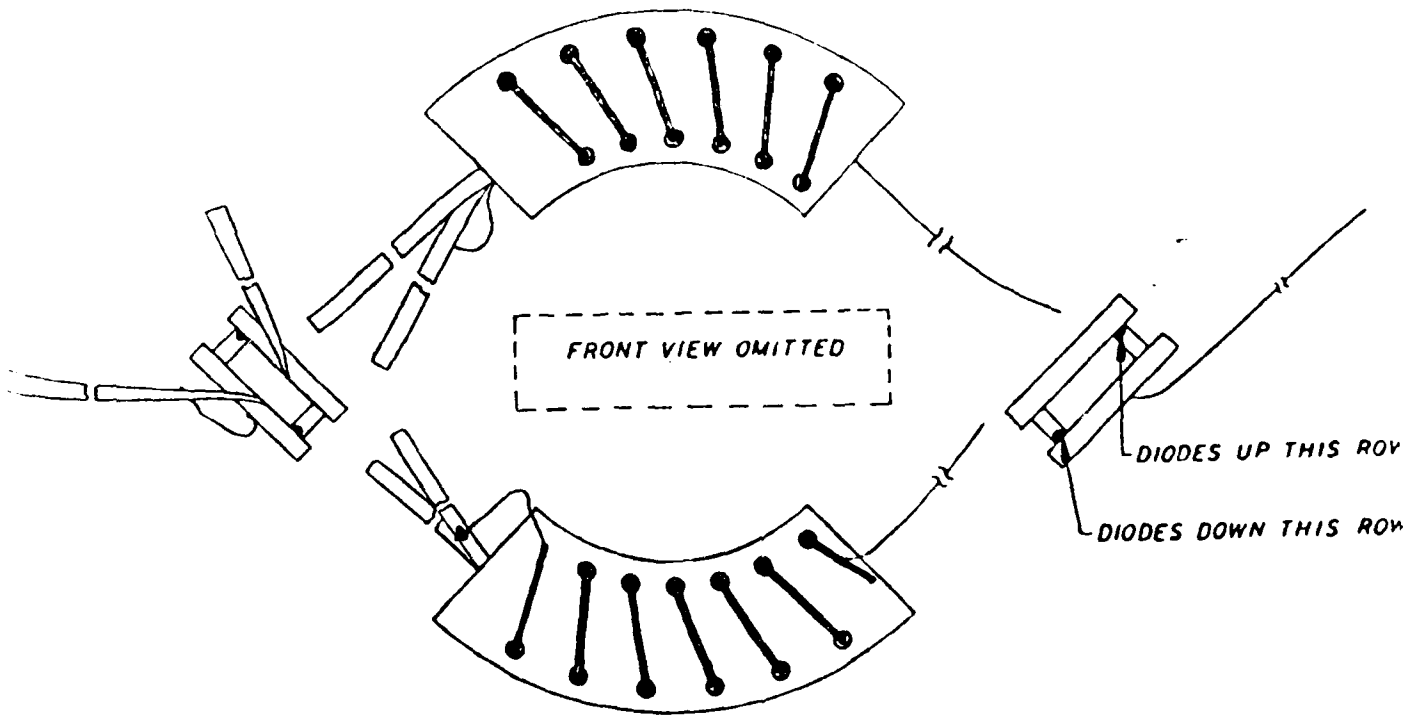
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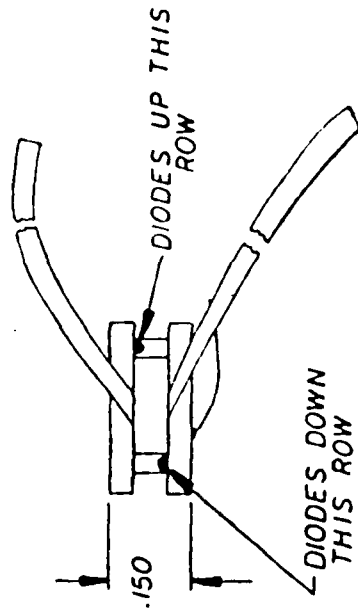
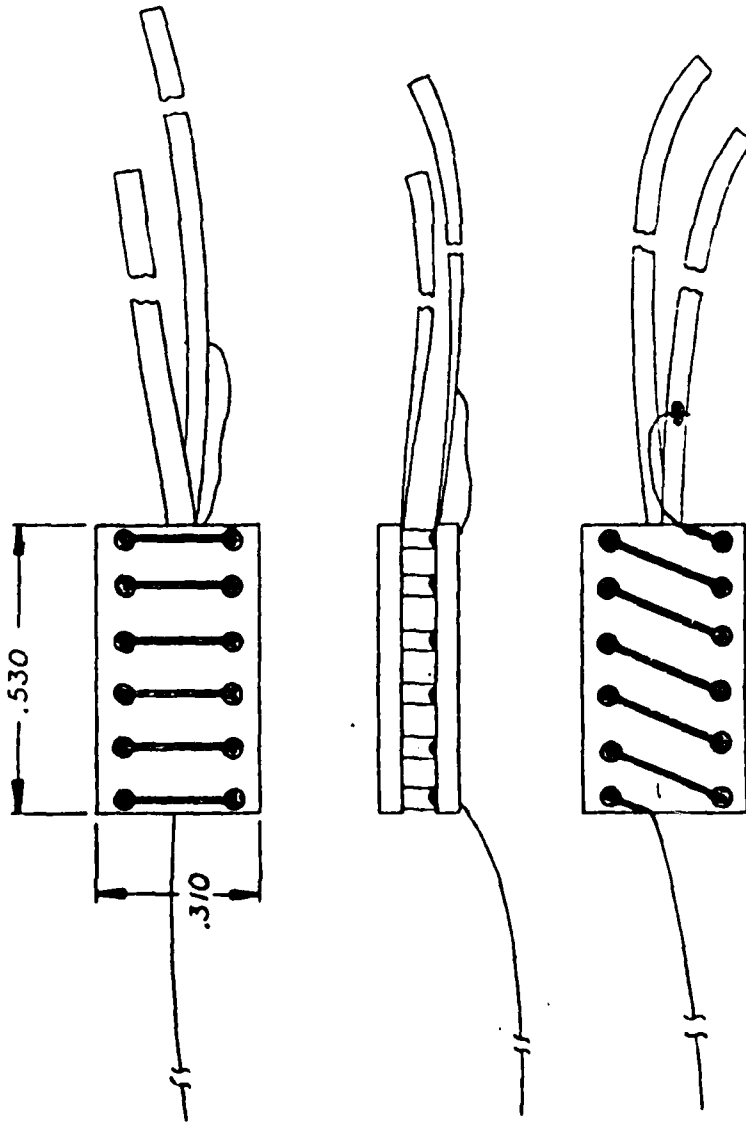
APR 82

APR 82

ASSEMBLED MULTPLIER

TSK 313-00





DATE
ILME