

RECEIVED

-4 OCT 1982

FOR LANS

/JB

COSSOR
electronics

Cossor Electronics Limited, The Pinnacles, Harlow, Essex, UK. Telephone: Harlow (0279) 26862. Telex: 81228. Cables: Cossor Harlow

GEC Ltd
Hirst Research Centre
East Lane
Wembley
Middx HA9 7PP

30th September 1982

833/1338/5/A/3512

For the attention of Mr G Swallow

Dear Sirs

With reference to our discussions concerning 29uS and 26.4uS Delay Lines please note the following requirements:

(a) 29uS Delay Line B914842/001

- (i) All new lines will be 6mm wide, with new case allowing provision of gasket and new SMA connector (subject to satisfactory completion of vibration tests). These lines will be identified by the same Cossor part number and NATO number as existing but the GEC Hirst number should be S29/6. It has already been agreed with MOD that the MOD strike number increases with the introduction of the 6mm line.
- (ii) The Cossor drawing will show a greater maximum height for the line to allow a thicker base plate and will call for GEC Hirst type number S29/1 and S29/6.

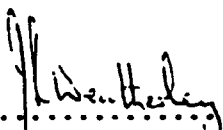
(b) 26.4uS Delay Line B917034/000 (New number TBA)

- (i) The insertion loss figure will be 53 ± 2 dB.
- (ii) Input power testing will be at 5W CW.
- (iii) Following the policy of 29uS lines outlined above, all 26.4uS delay lines will have one Cossor and NATO identification but the line thickness should be identified within the GEC Hirst number, e.g. S26.4/6 and S26.4/8 or similar.

Further to our investigation into burn out failures of 29uS lines, we find that the dc transient on equipment switch on or mode change does not exceed +1.5V at the Delay Line input port. We believe that this is insufficient to cause the damage seen.

The line undergoing power testing has withstood up to 9W CW with no ill effect and has not failed when subjected to the transients measured above.

Yours faithfully
for and on behalf of
COSSOR ELECTRONICS LIMITED


.....
J R Weatherley

c.c. Mr R A Swann, PDS
Mr M McCreary, Purchasing
Mr C Newson, Prog Management

<u>Number</u> SAN70 - 2 -	<u>COMPONENT SPECIFICATION</u>	COSSOR electronics
------------------------------	--------------------------------	------------------------------

<u>PART:-</u> 1	<u>Description</u> DELAY LINE. (R.F).
<u>PAGE:-</u> 2	
<u>ISSUE:-</u> A	

Marking

1. Each device will be marked as follows:-
 - (a) Terminal identification.
 - (b) Manufacturer's type number.
 - (c) Serial number.
 - (d) Factory identification.
2. Each primary package containing one or more devices shall bear the above markings except (a), and in addition:
The British Standard detail specification number.

Ordering information

Orders for devices shall contain the following information:-

- (a) Quantity.
- (b) Type number.
- (c) Centre frequency.
- (d) The British Standard specification number.

Related documents

This specification shall be read in conjunction with:-

- BS2011 Methods for environmental testing of electronic components and electronic equipment.
- BS6001 Sampling procedures and tables for inspection by attributes.
- BS9000 General requirements for electronic components of assessed quality.
- BS9300 Semiconductor devices of assessed quality.
- BS9400 Integrated electronic circuits of assessed quality. Generic data and methods of test.
- BS9450 Custom built integrated circuits of assessed quality. Generic data and methods of test.

COSSOR electronics	<u>COMPONENT SPECIFICATION</u>	<u>NUMBER</u> SAN70 - 2 -				
<p><u>Dimensions in mms.</u></p> <p style="text-align: center;">Fig.1.</p>		<p><u>DESCRIPTION</u></p> <p style="text-align: center;">DELAY LINE. (R.F).</p> <hr/> <p><u>ORIGINAL SOURCE IDENTIFICATION</u></p> <p style="text-align: center;">G.E.C. S26.4</p> <hr/> <p><u>CLIMATIC CATEGORY</u></p> <p style="text-align: center;">40/080/-</p> <hr/> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align: center;">PART 1</td> <td style="width:50%; text-align: center;">PAGE 1</td> </tr> <tr> <td style="text-align: center;">ISSUE B</td> <td></td> </tr> </table>	PART 1	PAGE 1	ISSUE B	
PART 1	PAGE 1					
ISSUE B						

Limiting conditions of use (not for inspection purposes)

Maximum input power.....5 W.
 Operating temperature range.....-35 to +70°C.
 Storage temperature range.....-40 to +80°C.
 Finish.....External surfaces painted Olive Drab Matt to DTD5555 using BS381C Tint 298.
 Weight.....0.51 lb (227 gm) max.

- NOTE TO PURCHASING
- a) For new build of Delay Line, orders should preferably be in multiples of 8 off to reflect the yield from a boule of Spinel material used in the manufacture of the line.
 - b) Delay lines may be produced by modification of existing lines to Cossor Part Number 914842/001 and it is necessary to return lines to the manufacturer in multiples of 9 at correct build state.
 - i.e. multiples of 9 off at mod. strike 2 (8 mm Spinel)
 - multiples of 9 off at mod. strike 2 & 3 (6 mm Spinel)

	G.E.C.	
SAN70-2-626-350B	S26.4	

Raised by Specification Engineer *M Hicks* Issue Authorised by Application Engineer

AMEND- MENT NUMBER	DATE	PART 1		PART 2		PART 3	
		PAGE	ISSUE NUMBER	PAGE	ISSUE NUMBER	PAGE	ISSUE NUMBER
Draft	11.1.84	B	A	A		A	A

CHANGE NOTE PART 2

DRAWING OFFICE ACTION

SHEET NO. 2.

DRAWING B 914842 SHEET 1 ISSUE 2A
DRAWING B 914842 SHEET 2 ISSUE 1D
DRAWING B. 914842 SHEET 3 ISSUE 1B
AMENDED TO SUIT PART 1.

CHANGING

CHANGE NOTE NO.

125/6933.

192

ROSSOR
electronics

COMPONENT SPECIFICATION

Number EXHIBIT NO. 9 (CTD.)

SPECIAL

SAN 70 - 2 -

Description

DELAY LINE. (R.F).

PART:- 2

PAGE:- 1

ISSUE:- A

Recommended conditions of use and associated characteristics (not for inspection purposes).

Operating temperature.....25°C.

Input frequency.....3.00 to 3.41 GHz.

VSWR.....18 : 1 max.

Nominal impedance.....50 ohms.

Spurious signals.....At least 25 dB down on required output.

Ripple.....3 dB max.

COSSOR
electronics

COMPONENT SPECIFICATION

NUMBER

SAN70 - 2 -

DESCRIPTION

DELAY LINE (R.F).

PART	3
PAGE	1
ISSUE	A

INSPECTION REQUIREMENTS

Inspection or test	BS9450 reference and conditions of test	Sample size	Limits		Units
			min.	max.	
<u>Group A</u>					
Subgroup A1 Visual	1.2.2 Correctness of marking. Correctness of terminal identification. Correct encapsulation. Unbroken body.	100%			
Subgroup A2 Electrical Insertion loss	1.2.4 Major static/dynamic characteristics at 25°C. Measured with pulse duration of 10 us and duty cycle 10% at: 3.1 GHz. 3.2 GHz. 3.3 GHz. 3.4 GHz.	100%	50	56	dB
Insertion loss variation (slope)	3.1 to 3.4 GHz.			3	dB
Power test	Pulse duration 10 us. Duty cycle 10%. Test duration 30s min.		5		Watts (pk)
<u>Group B</u>					
Subgroup B1 (b) Dimensions	1.2.3 Length Width Height Fixing hole positions and size Coaxial connector positions	10%			
Subgroup B2 Rapid change of temperature Damp heat, cyclic	1.2.6.13 -40°C to +80°C, 5 cycles 1.2.6.5 6 cycles	10%			
Subgroup B4 Acceleration	Not applicable	10%			
Low pressure	Equivalent to an altitude of 12,000 feet above sea level Test as B2.				
Subgroup B5 Endurance	160 hours at +80°C, non-operating	10%			
Subgroup B6 Post test end points for B2, B5.	Tests as in Subgroup A2				
		As Subgroup A2. Reject on 1 failure			

NUMBER

COMPONENT SPECIFICATION

COSSOR
 electronics

SAN70-2-

PART	3	DESCRIPTION DELAY LINE (R.F).
PAGE	2	
ISSUE	A	

Inspection or test	BS9450 reference and conditions of test	Sample size	Limits		Units
			min.	max.	
Group C					
Subgroup C1 (a)(D) Vibration	1.2.6.8.1 55 to 500 Hz. 98 m/s ² .	10%			
Shock	1.2.6.6 981 m/s ² . 6 ms. Mounting to be agreed.				
Bump	1.2.6.7 Severity (a). 4000 ± 10 bumps at 390 m/s ² .				
Damp heat, cyclic	1.2.6.5 28 cycles				
Subgroup C1 (b) Dimensions and mass	1.2.3 Mass			227	gms
Subgroup C2 (a) Electrical	Subgroup A2 tests at -35°C at +75°C	10%		-3	dB
Subgroup C2 (b) Spurious reflection	Any spurious returns shall be down on the wanted return by		25		dB
Delay			25.9	26.9	us
VSWR			18:1	Ratio	
Subgroup C4 Post test end points for C1.	Tests as in Subgroup A2		As Subgroup A2. Reject on 1 failure.		

(D) = Destructive test.

Samples for destructive tests must be added to quantity ordered.

PURCHASING

CHANGE NOTE PART I

CHANGE REQUEST AND AUTHORIZATION

ACTION		ORIGINATOR'S NAME J.R. WEATHERS	DATE 19-10-82	DEPARTMENT AND SERIAL NO. 833/005(N)/21	
DRAWING SHEET	DRAWINGS	UNIT AFFECTED DELAY WIRE		EQUIPMENT AFFECTED RAPID OLF	
	DRAWING LIST	DRAWING NO. 914842/001		ISSUE	CONNECTIONS AFFECTED: 64215735 Y04 Y05 Y06
	ITEMS LIST	REASON FOR REQUEST MANUFACTURE DESIGN IMPROVEMENTS.			
	WORKING DRAWING ELECTRIC DIAGRAM				

CHANGE AFFECTS MOD STATE?	CHANGE AFFECTS PRICE?
---------------------------	-----------------------

DETAILS OF REQUEST (ATTACH MARKED-UP PRINTS)	DETAILS OF REQUEST
	<p>SHT 1</p> <p>(was 1/16)</p> <p>NOTE 6 TYPE NO. 529/1 OR 527/6</p> <p>SHT 3</p> <p>4. <u>Interchangeability</u></p> <p>Change to read '----- any other 'F' Band' delay line to 914842</p> <p>SHT 2</p> <p>3. The device shall be designed such that it will meet the above electrical specifications - - - - - etc.</p> <p>8273 2569 (Continue on part 2 if Required)</p>
	APPROVED (SIG.)
	DATE
	BY
	FOR
	REASON FOR REQUEST
	APPROVAL
	DATE
	BY

RELEASED FOR PRELIMINARY ACTION	(SEN) [Signature]	DATE: 10-10-82	ADDITIONAL CIRCULATION:
	(DES) [Signature]	DATE: 20/10/82	

PART 1 sheets	PART 2 sheets	PART 3 sheets	PART 4 sheets
---------------	---------------	---------------	---------------

DELETED AS REQUIRED	AMENDMENT MODIFICATION 196
DATE: 28/10/82	DATE: 20/10/82

D. O. ASSISTANT JAS	(Design Authority) [Signature]	DATE: 20/10/82	C/DING: M	CHANGE NOTE NUMBER: 125/6933
------------------------	--------------------------------	----------------	-----------	------------------------------

Rod No. 243/66/8
Serial No. B030M/83
Delay Time _____

'P' Band Delay Line Type S22

POST-MODIFICATION REPORT

Insertion Loss Measurements

Device State	Frequency (GHz)										Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45			3.50
On re-assembly and tuning			59.4		59.1		58.4		57.7			dB	
After heating cycle completed			60.2		59.8		59.0		57.5			dB	
												dB	
Final test			59.6		58.9		58.1		57.0			dB	
Q.A. Check												dB	

Passed for Despatch: Date 18/4/83



S.P. N

Inspectors Signature

Test Report No. MDLS 179

'F' Band Delay Line Type S29

Rod No. 36/56

Serial No. B0747/83

Delay Time _____

POST-MODIFICATION REPORT

Insertion Loss Measurements

Device State	Frequency (GHz)										Units	Comments	
	3.0	3.06	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45			3.50
On re-assembly and tuning			57.3		57.3		57.2		56.7			dB	
After heating cycle completed			57.2		57.0		56.6		56.3			dB	
												dB	
												dB	
Final test			58.8		58.3		57.2		56.2			dB	
Q.A. Check												dB	

Passed for Despatch: Date 18/4/83



K.I. Lewis

Inspectors Signature

Test Report No. MDIS 180

'P' Band Delay Line Type S29

Rod No. 85/21

Serial No. B2067/83

Delay Time _____

POST-MODIFICATION REPORT

Insertion Loss Measurements

EXHIBIT No. 9

(CTD.)

Device State	Frequency (GHz)										Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45			3.50
On re-assembly and tuning			60.3		60.5		60.1		59.5			dB	
After heating cycle completed			60.2		60.3		60.3		60.0			dB	
												dB	
												dB	
Final test			60.1		60.1		60.1		59.5			dB	
Q.A. Check												dB	

Passed for Despatch: Date 18/4/83

[Signature]

Inspectors Signature

Test Report No. MDLS 181

'F' Band Delay Line Type S29

Rod No. B089

Serial No. B290M/83

Delay Time _____

POST-MODIFICATION REPORT

Insertion Loss Measurements

Device State	Frequency (GHz)										Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45			3.50
On re-assembly and tuning			58.2		58.5		58.4		57.9			dB	
After heating cycle completed			58.3		58.4		58.3		57.9			dB	
												dB	
												dB	
Final test			58.8		58.8		58.5		57.9			dB	
Q.A. Check												dB	

EXHIBIT No. 9

(CTD.)

Passed for Despatch: Date 18/4/83



Inspectors Signature

Test Report No. MDIS 182

'F' Band Delay Line Type S22

Rod No. 002R.

Serial No. B4467/83

Delay Time _____

POST-MODIFICATION REPORT

Insertion Loss Measurements

Device State	Frequency (GHz)										Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45			3.50
On re-assembly and tuning			58.4		58.2		57.6		56.7			dB	
After heating cycle completed			59.8		59.7		59.1		58.5			dB	
												dB	
												dB	
Final test			59.3		58.8		57.7		56.7			dB	
Q.A. Check												dB	

Passed for Despatch: Date 16/4/83



P. I. Lewis
Inspector's Signature

Test Report No. MDIS 185.

'F' Band Delay Line Type S22

Rod No. 300/69/7

Serial No. B4667/83

Delay Time _____

POST-MODIFICATION REPORT

Insertion Loss Measurements

EXHIBIT No. 9

(CTD.)

Device State	Frequency (GHz)											Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50			
On re-assembly and tuning			57.0		57.6		57.6		57.9				dB	
After heating cycle completed			58.3		58.7		59.0		59.2				dB	
													dB	
													dB	
Final test			57.1		57.3		57.1		56.9				dB	
Q.A. Check			57.0		57.0		56.0		56.7				dB	

Passed for Despatch: Date 20/4/83

S.T. Lewis 

Inspectors Signature

Test Report No. MDIS 184

'P' Band Delay Line Type S29

Rod No. 78/20.

Serial No. B356M/83

POST-MODIFICATION REPORT

Delay Time _____

Insertion Loss Measurements

Device State	Frequency (GHz)										Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45			3.50
On re-assembly and tuning			57.5		57.8		57.9		57.6			dB	
After heating cycle completed			57.0		57.5		57.3		56.7			dB	
												dB	
												dB	
Final test			57.2		57.6		57.4		57.0			dB	
Q.A. Check			57.0		57.6		57.3		56.7			dB	

EXHIBIT No. 9

(CTD.)

Passed for Despatch: Date 20/4/83



S.P. O.V.

Inspectors Signature

Test Report No. MDLS 183

'F' Band Delay Line Type S22

Rod No. 490/92/3

Serial No. B2344/83

Delay Time _____

POST-MODIFICATION REPORT

Insertion Loss Measurements

Device State	Frequency (GHz)											Units	Comments	
	3.0	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45	3.50			
On re-assembly and tuning			57.2		58.6		59.5		60.0				dB	
After heating cycle completed			56.8		57.9		58.7		59.0				dB	
													dB	
													dB	
Final test			56.6		57.5		58.1		58.5				dB	
Q.A. Check			56.5		57.4		58.0		58.5				dB	

Passed for Despatch: Date 20/4/83



S. T. Lewis
Inspectors Signature

GEC-HRC

COMPANY CONFIDENTIAL

Ref: QA/PI05/1


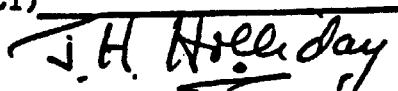
CONTENTS

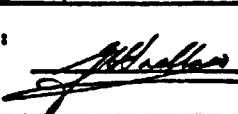
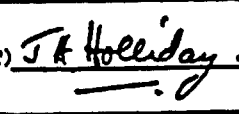
INTRODUCTION

RELATED DOCUMENTS

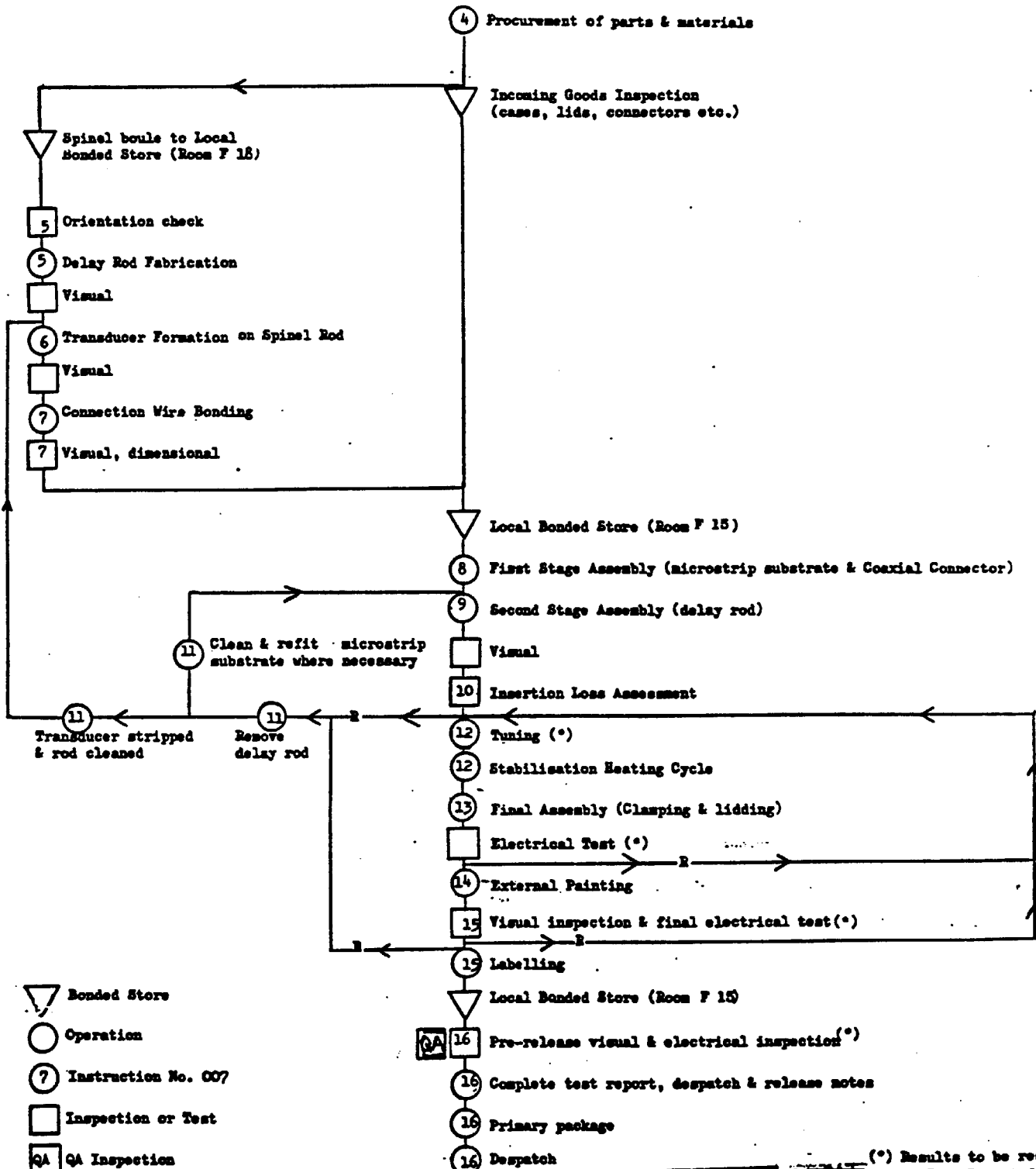
INSTRUCTIONS

	Number of pages	Issue No.
1. Schedule of drawings	1	1
2. Measuring equipment and calibration status	1	1
3. Production flow chart	1	1
4. Procurement of parts and materials	1	1
5. Orientation check and delay rod fabrication	3	1
6. Transducer formation on spinel rod	2	1
7. Connection wire bonding	1	1
8. First stage assembly (microstrip substrate and coaxial connector)	1	1
9. Second stage assembly (delay rod)	1	1
10. Insertion loss assessment	2	1
11. Dismantling and reworking of lines	1	1
12. Tuning and stabilisation heat cycle	2	1
13. Final assembly (clamping and lidding)	1	1
14. External painting	1	1
15. Visual inspection, final electrical test, and labelling	1	1
16. Release and despatch procedure	1	1
.....		

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO.	ISSUE	DATE	PAGE
	QA/105 - 001	1	16/9/80	1 of 1
TITLE: S29 MOD 1 SCHEDULE OF DRAWINGS				COPY NO.
DRAWING No	TITLE			Issue
A73 - 170 A4	CLAMP PLATE			2
A74 - 127 A4	SUBSTRATE CLAMP			1
A74 - 126 A4	COVER PLATE			2
A74 - 125 A4	LID			1
A74 - 124 A2	CASE			1
D73 - 001 A4	LABEL			4
A75 - 391 A4	LABEL			1
A75 - 390 A4	PACKING STRIP - TOP			1
A75 - 389 A4	PACKING STRIP - BOTTOM			1
A75 - 388 A4	PACKING STRIP - SIDES			1
A75 - 387 A4	DELAY ROD-BONDING OF GOLD WIRES			1
A75 - 386 A4	DELAY ROD-EVAP ^D & SPUTT ^D LAYERS			2
A75 - 385 A4	DELAY ROD-GRINDING & POLISHING			2
A75 - 384 A4	SUBSTRATE			2
A75 - 383 A4	EARTH PLANE			1
A75 - 382 A3	SUB-ASSY: CASE WITH ROD CLAMP PLATE			2
A75 - 382 A4	ITEM LIST			1
A75 - 381 A4	ITEM LIST			1
A75 - 381 A3	SUB-ASSY: CASE WITH DELAY ROD			1
A75 - 380 A4	ITEM LIST			1
A75 - 380 A3	SUB-ASSY: CASE WITH SUBSTRATE			1
A75 - 379 A4	ITEM LIST			2
A75 - 379 A3	ASSEMBLY			1
AUTHORISATION: G H Swallow (PROJECT) J H Holliday (Q.A.)				
  206				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE No QA/105 -002	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 MOD 1 MEASURING EQUIPMENT AND CALIBRATION STATUS				COPY No
MEASUREMENT	EQUIPMENT DESCRIPTION	HRC CALIBRATION REGISTRATION	CALIBRATED BY:	
Boule Orientation	Philips quartz crystal goniometer, Model 12074	H528		
Reference angle measurement	Reference angle gauges	H524		
Dimensional checks	Micrometers	HST1554 HST1595	HRC Inspection Department	
Flatness measurement	Slip gauge set	H300C		
Flatness	Fizeau Interferometer			
Flatness	Nikon optical flat	H291C		
	Universal meter AVO Model 8	H538	HRC Inspection Department	
	IF attenuator TEXSCAN SA 50 Ser. 7637	H541	Marconi Stevenage	
	RF piston attenuator FLANN CA/5 Ser. 79	H509	HRC Inspection Department	
	Signal generator, RHOIE & SCHWARZ SLRC BN 4100S Ser. 2954/28	H508	HRC	
	Spectrum Analyser, HP 141 T Display RF Section 8555A - IF Section 8552B	H534 A H534 B H534 C	Hewlett Packard Wokingham	
	Tektronix oscilloscope 585 Ser. 000362	H613		
	Tektronix oscilloscope 533A Ser. 100218	H262	HRC	
Power	Power meter HP 432 A Ser. 1151 002551	H426	Marconi (Stevenage)	
Power	Power meter head HP 478 A	H426 A	Marconi (Stevenage)	
	Frequency counter HP 5254 L Electronic Counter	H267	HRC	
	Frequency divider HP 5260 A	H267 A		
	RF attenuator. 60 dB fixed NARDA 757C No 30214	H625	NARDA Certificate HRC Inspection Dept.	
AUTHORISATION:  G H Swallow (PROJECT)  J H Holliday (Q.A.)				
This instruction must not be modified except by means of a new issue authorized by an Engineering Change Request (ECR)				ECR No.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO.	ISSUE	DATE	PAGE
	QA/IC5 - 003	1	16/9/80	1 of 1
PRODUCTION FLOW CHART FOR DELAY LINE TITLE: TYPE S29, MOD 1.				COPY NO.



- ▽ Bonded Store
- Operation
- ⑦ Instruction No. 007
- Inspection or Test
- QA QA Inspection
- ⊗ Reject

(*) Results to be recorded on Test Report form

AUTHORISATION:	
<i>[Signature]</i> G H Swallow (PROJECT)	J H Holliday (Q.A.)
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)	
ECR NO.	

GEC - HRC

QUALITY ASSURANCE INSTRUCTION		REFERENCE No QA/105 -004	ISSUE 1	DATE 16/9/1980	PAGE 1 of 1	
TITLE: S29 MOD 1 PROCUREMENT OF PARTS AND COMPONENTS					COPY No.	
ITEM	PART OR MATERIAL	DRAWING, PART OR TYPE NUMBER	MANUFACTURER	SUPPLIER	QUALIFICATION STATUS	
1	Strain free, single crystal spinel	- -	Union Carbide Company	Roditi International	HRC Inspection	
2	Clamp plate	A73 - 170 - A4 Issue 2	As supplier	Verdict Engineering	C of C	
3	Substrate Clamps	A74 - 127 - A4 Issue 1	As supplier	Verdict Engineering	C of C	
4	Cover Plate	A74 - 126 - A4 Issue 2	As supplier	Verdict Engineering	C of C	
5	Lid	A74 - 125 - A4 Issue 1	As supplier	Verdict Engineering	C of C	
6	Case	A74 - 124 - A2 Issue 1	As supplier	Verdict Engineering	C of C	
7	Label	D73 - 001 - A4 Issue 4	As supplier	London Nameplate Co. Brighton		
8	Label	A75 - 391 - A4 Issue 1	As supplier	London Nameplate Co. Brighton		
9	Substrate to mask 2095	A75 - 384 - A4 Issue 2	As supplier	HRC Thin Film Facility	BS9450	
10	SMA microwave connector	244 - 4A OSH	Omni-Spectra	Auriana	C of C	
11	External Finish Paint	See Instruction 014			BS 381 C	
12	P.T.F.E Tape					
13	Aluminium foil	See Drawing Nos: A75 - 388 - A4 A75 - 389 - A4 A75 - 390 - A4				
14	Transformer paper					
15	Cellulose Varnish					
16	Silver Dag			Acheson Colloids Co. Plymouth		
AUTHORIZATION: <i>J.H. Azeiday</i> G H Swallow (PROJECT) <i>J.H. Azeiday</i> J H Holliday (Q.A)						
This instruction must not be modified except by means of a new issue authorized by an approved Engineering change Request (ECR)					. ECR No.	

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 005	ISSUE 1	DATE 16/9/80	PAGE 1 of 3
TITLE: S29 MOD 1 ORIENTATION CHECK AND DELAY ROD FABRICATION				COPY NO.
<p>Finished rod requirements are shown in Drawing No A75 - 385 - A4, Issue 2.</p> <p>1. Rods must be oriented with respect to the 100 and 110 crystal planes. These can usually, but not always, be identified on the rough boule by observation of the growth faces. Thus the boule is usually narrower parallel to the 100 direction which is normal to a pair of flat crystal faces, while the 110 axis at right angles to this comes out at the intersection of two faces. The second 110 axis, used to define the rod length, should be parallel to the boule axis within two degrees, as shown in the figure below. In case of doubt or difficulty the boule in question should be submitted to the X-ray Crystallography group for positive identification by Laue techniques.</p> <div data-bbox="638 1030 981 1400" style="text-align: center;"> </div>				
<p>AUTHORISATION: <u>(G H Swallow) (PROJECT)</u> <u>(J H Holliday) (Q.A.)</u></p> <p style="text-align: center;"><i>G H Swallow</i> <i>J H Holliday</i> 210</p>				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/IO5 - 005	ISSUE 1	DATE 16/9/80	PAGE 2 of 3
TITLE: S29 MOD 1 ORIENTATION CHECK AND DELAY ROD FABRICATION				COPY NO.
<p>2. Flat faces must be produced on the boule, orientated parallel to the 100 and 110 crystal planes. Grinding is done on a surface grinder (Jones & Shipman Model 540) which is fitted with a 240 grit resin bonded diamond wheel (Diagrit Diamond Tools). Two accurate tilting tables, the tilt axes of which are mounted mutually perpendicular, are used on the grinder table for correction of orientation errors. Orientation is measured on a Philips Quartz Crystal goniometer, Model 12074. The size of faces produced is, to some extent, affected by the likely yield of rods, but mainly by the amount of angular error present in the boule i.e. the angular difference between the 110 axis and the geometric axis of the boule. Typically the boule width after grinding the 100 and 110 faces is 31-33 mm.</p> <p>3. Two flat and parallel faces at an angle of $53^{\circ}25'$ from the 100 faces must be produced one at each end of the boule. At this stage the length of the boule, as measured between the two angled faces, is longer than the delay length by a lapping and polishing allowance of approximately 0.5 mm. The boule is now stuck down onto a 3-4 mm thick glass with a suitable thermoplastic cement (Shellac or Dekhotmsky), and then both glass and boule are mounted on a flat and parallel steel plate with a lower melting point cement (Opticians cement, 6 to 1 Resin to Beeswax). The steel plate allows the boule to be held by a magnetic chuck on the sawing machine (Type Capco Q25 or Meyar & Burgess TS3) on which the angled ends of the boule are cut. A diamond blade one millimetre thick is used. (Diagrit Diamond Tools). After sawing the boule is demounted, cleaned in a suitable solvent (Methylated Spirits), and is then ready for the next step which is to accurately grind the end faces to the correct angle and length. This is carried out on a surface grinder using the 240 grit resin bonded diamond wheel, the boule being held in an accurate tilting vice. Angles are checked by a Hilger & Watts autocollimator against a glass master angle which is itself calibrated by a stack of reference angle gauges.</p> <p>4. The oriented angled boule is now ready to be lapped and polished on the two angled ends. For this the boule is held in a specially made jig designed to hold two boules at the correct angle; as a further aid to lapping and polishing the jig is faced with scrap spinel to form a symmetrical block. The block is lapped on a cast iron lap using 800 grit carborundum in water on a semi-automatic machine (Logitech PA30). Lapping is continued until all damage from the surface grinding operation is removed at the same time preserving parallelism with the opposite face; control is achieved by offsetting the lapping weights as necessary (about 100g/cm² of spinel). A measurement check is made with the autocollimator. The lapped block is now ready for polishing by one of two methods;</p> <p>(a) by $\frac{1}{2}$ micron diamond powder on a pure tin lap or (b) by 1 micron alumina in water on a pitch polisher.</p>				

GEC - HRC

COMPANY CONFIDENTIAL

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/IO5 - 005	ISSUE 1	DATE 16/9/80	PAGE 3 of 3
TITLE: S29 MOD1 ORIENTATION CHECK AND DELAY ROD FABRICATION				COPY NO.

Method (a) is slightly quicker but requires more skill. Method (b) is somewhat slower but allows more control over the shape of the surface. Both methods can be used on the same machine. Flatness is measured interferometrically against an optical flat or in a Fizeau interferometer; 1 fringe over the face is the maximum error. The boules are reversed in the jig and the second end is processed in exactly the same way.

5. The next operation is to saw the polished angled boule into slabs parallel to the 100 plane using the same techniques as those for sawing the angled ends. The boule is cemented onto a 110 face and cut into three slabs not less than 9 mm thick. At this point crystal orientation must be checked. The two outside slabs will each have one of the original reference faces on it, so all that is necessary here is to grind the sawn faces parallel to them.

Orientation of the middle slab however must be checked on the X-ray goniometer as both faces are sawn and the orientation may have altered in the sawing process. If this has happened then suitable corrections must be made on the surface grinder as before. When all three slabs are oriented they are surface ground to a thickness of 8.2 mm giving a lapping and polishing allowance of 0.2 mm. Finally the central recess is ground as shown in Drawing No A75-385-A4.

6. Both 100 faces must now be lapped to thickness and polished to the same tolerances of flatness and parallelism as the angled faces. To do this 3 oriented slabs are cemented to a plane parallel glass disc with Opticians cement and the first side is lapped and polished parallel to the face of the glass disc. After demounting and cleaning the second side is worked in exactly the same way with one exception, lens tissue is inserted between the polished first side and the glass plate to protect the polish when waxing down.
7. The final operations are to saw the slabs into rods, chamfer all sharp edges, inspect and number each rod. Sawing is carried parallel to the 110 edges as previously described and rods are sawn directly to size without grinding. Chamfering is done by hand on a rotating cast iron lap with 600 grit carborundum. After inspection the rods are given serial numbers.

NOTE: The following equipment must be calibrated.

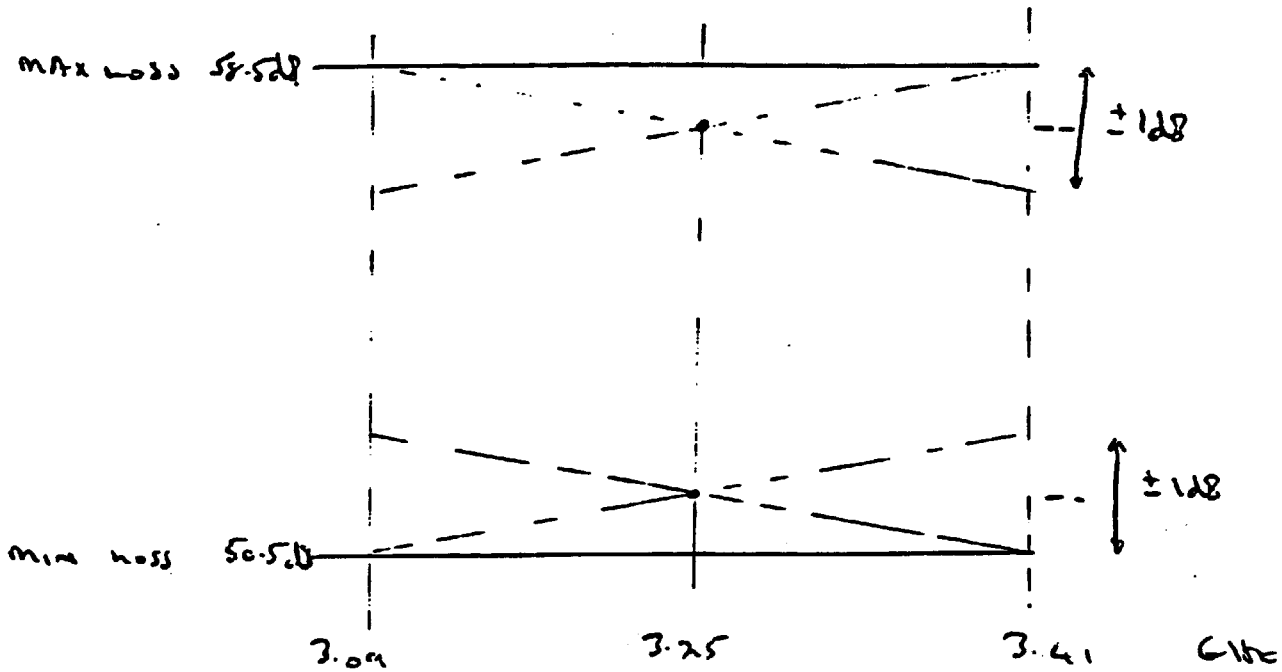
1. Philip's Quartz Crystal Goniometer Model 12074.
2. Reference Angle Gauges.
3. Micrometer
4. Fizeau Interferometer.

F Band Delay 26.4 μ s

Receipt

min loss 50.5 dB
 max loss 58.5 dB

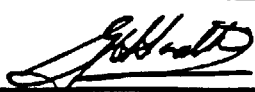
Specify loss at mid band as frequency variation is a slope rather than ripple



Prefer
 max loss 56 dB
 min loss 48 dB


loss may increase by 3dB +25°C to +70°C
 " " reduce by 3dB +25°C to -30°C

Sub group $\frac{k_2}{t}$ 1.5 dB

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 006	ISSUE 1	DATE 16/9/80	PAGE 1 of 2
TITLE: S29 MOD 1 TRANSUCER FORMATION ON SPINEL ROD			COPY NO.	
<p style="text-align: center;">Refer to Drawing No. A75 - 386 - A4, Issue 2</p> <p><u>New Rods</u></p> <ol style="list-style-type: none"> 1. Boil in trichlorethylene (or suitable solvent) to dissolve wax. 2. After rinsing in IPA, blow dry thoroughly with nitrogen gun. Transfer the delay rod quickly into the gold evaporation equipment. 3. Evacuate the chamber to 10^{-5} torr and heat substrate to 100°C. 4. Evaporate NiCr from a tungsten filament, at a rate of approximately 3 \AA per second, to a thickness of about 150 \AA. 5. Evaporate gold from a molybdenum boat at a rate of about 120 \AA per second, to a thickness of 4500 \AA. 6. Allow the system to cool to below 60°C. 7. Transfer the delay rod into the holder, and apply the appropriate mask. 8. Place in sputtering chamber and pump chamber down to 10^{-5} torr. Bake for 1 hour. (Variac setting 60 to 70) or for $\frac{1}{2}$ hour with Variac Setting at 90. 9. Admit argon/oxygen mixture into chamber to a pressure of about 5×10^{-3} torr. Mixture is 80% Ar + 20% O_2. 10. Presputter the ZnO on to the shutter for $\frac{1}{2}$ hour ensuring that the matching is optimised. Adjust sputtering rate to approximately $155 \text{ \AA}/\text{min}$, with the r.f. power adjusted to 1kw. 11. Remove shutter and sputter the ZnO onto the delay rod to a thickness of 8600 \AA, as indicated by the deposition rate data for the equipment. 12. After sputtering is complete, stop argon/oxygen flow and pump chamber down to approximately 10^{-5} torr, keep system at these conditions for 12 hours. 13. Transfer the delay rod into the gold deposition chamber. 14. Using the appropriate mask to define dots 0.25 mm diameter, evaporate 150 \AA of NiCr followed by 500 \AA of gold with the substrate at 25°C. 				
<p>AUTHORISATION:</p> <p style="text-align: center;"> <u>(G H Swallow)</u> (PROJECT) (J H Holliday) (Q.A.) </p> <p style="text-align: center;">  <u>J. H. Holliday</u> 214 </p>				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 006	ISSUE 1	DATE 16/9/80	PAGE 2 of 2
TITLE: S29 MOD 1 TRANSDUCER FORMATION ON SPINEL ROD				COPY NO.
<p>15. When system is cold, remove delay rod from chamber.</p> <p>16. Visually inspect.</p> <p><u>Used Rods</u></p> <ol style="list-style-type: none"> 1. Remove bonds with tweezers. 2. Remove ZnO with dilute HCl and rinse in deionised water. 3. Remove Au and NiCr in gold etch and nichrome etch and rinse in deionised water. Repeat 2 and 3 if spots remain. 4. Soak in chromic acid for at least $\frac{1}{2}$ hour, and rinse in deionised water. Rub rods with a piece of "Ultra Clean" cloth damped with deionised water and using polishing alumina Grade 3/50. Wipe rods free of alumina with another piece of the cloth. 5. Boil in deionised water and neutra-clean for at least $\frac{1}{2}$ hour, and ultra-sonically clean. 6. Warm in deionised water followed by ultra-sonic clean. Repeat at least twice using fresh deionised water each time. 7. Bubble in deionised water. 8. Boil in IPA and dry thoroughly. 9. Soak in concentrated nitric acid followed by rinsing in deionised water. <p>The rod can then be treated as new and the transducer re-formed as described on page 1 of this instruction.</p>				

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 007	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 MOD 1 CONNECTION WIRE BONDING				COPY NO.
<p>A substrate heater is used for this process.</p> <p>The rod (Dwg. No A75 - 385/6 - A4 Issue 2) is clamped firmly in the holder of the bonding machine and the delay rod temperature raised to 150°C for two minutes before bonding commences. Gold wire 25 microns diameter is then bonded to the gold dots using the Kulicke and Soffa Model 447 bonding equipment in Room F15, the pressure being applied for 30 seconds during this operation. (See drawing A75 - 387 - A3, Issue 1).</p> <p>The mechanical bond strength is assessed by gently pulling each wire with a pair of tweezers.</p>				
<p>AUTHORISATION:</p> <p style="text-align: center;">(G H Swallow) (PROJECT) (J H Holliday) (Q.A.)</p> <p style="text-align: center;"><i>[Signature]</i> <u>J. H. Holliday</u> 216</p>				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/105 - 009	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 DELAY LINE. SECOND STAGE ASSEMBLY (DELAY ROD)				COPY NO.
<p>Fit the delay line and packing strips within the case (See Dwg. A75 - 381 - A3 Issue 2).</p> <p>The delay rod is tightly packed in the case by inserting packing strips underneath and on both sides (See Dwg. No A75 - 389 - A4, Issue 1, and Dwg. No A75 - 388 - A4, Issue 2). A stainless steel clamp plate (Dwg. No. A73 - 170 - A4, Issue 2) is finally fitted along the length of the rod away from the gold wires. The delay rod is secured by tightening the 6 BA x $\frac{2}{16}$" stainless steel grub screws in the side of the case.</p> <p>One of the bond wires on the spinel rod is then fixed to the gold pad of the microstrip substrate using a small quantity of silver dag (915/50). A change to one of the other bonds may have to be made subsequently as a result of insertion loss assessment (See Instruction 010).</p>				
<p>AUTHORISATION: <u>(G H Swallow) (PROJECT)</u> <u>(J H Holliday) (Q.A.)</u></p> <p> <u>J. H. Holliday</u> 218</p>				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/IO5 - 010	ISSUE 1	DATE 16/9/80	PAGE 1 of 2
----------------------------------	-------------------------------	------------	-----------------	----------------

TITLE: S29 MOD 1 INSERTION LOSS ASSESSMENT	COPY NO.
--	----------

Refer to CEL specification B914842/001.

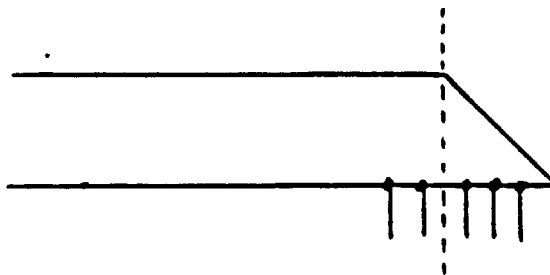
The assembled delay line is placed on the spot frequency insertion loss equipment as shown in the diagram on page 2 of this instruction.

A frequency within the test band is selected, and correct operation is noted by the appearance of a reflected pulse.

It is usual that the selected frequency is either the upper or lower limit of the test band.

As an initial classification process readings of insertion loss are taken at f_L and f_H . With this information it is possible to divide the lines into four types, first those with positive slopes i.e. the insertion loss increases as the frequency increases, secondly those lines with negative slopes i.e. insertion loss decreases as frequency increases, thirdly lines with no slope, that is constant insertion loss ($< \pm 0.5$ dB) across the band, and lastly those with an overall insertion loss at any frequency which makes the returned pulse almost indistinguishable from the noise of the system (for practical applications this will be about 80 dB).

Tuning (MATCHING) of the lines can only begin when the line has been classified. Lines which fall into the last group can be returned for new transducers, however another transducer wire (or dot) should be tried; in the figure below it can be seen that only the three wires on the right are usable, the other two are not in line with the mode changing "face" of the line.



After assessing two or more bonds it can be seen that the insertion loss is constant (within a few dB). When picking bond wires try to select ones at opposite ends of the usable area.

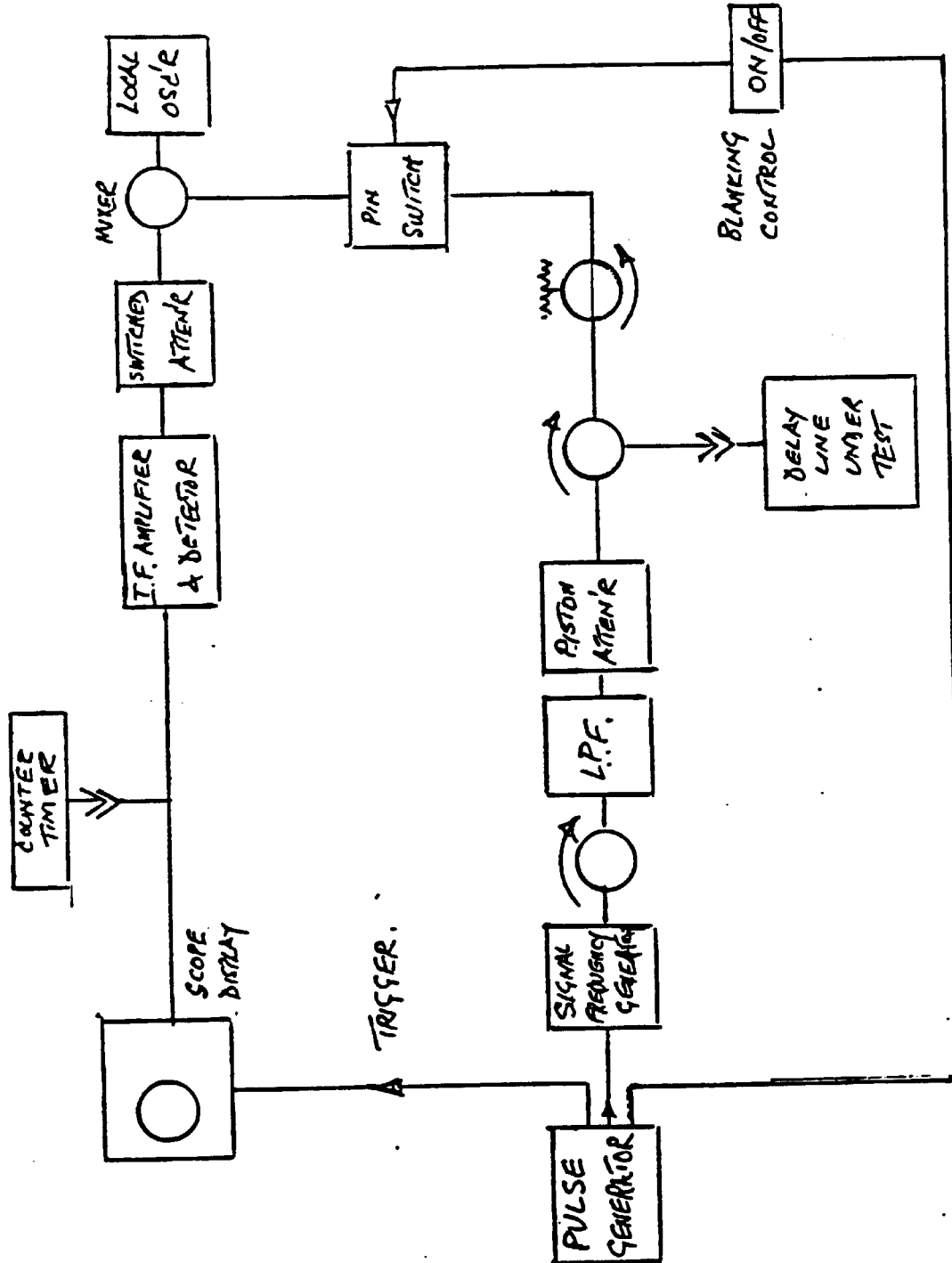
NOTE. The following equipment must be calibrated:

1. S.F. Generator
2. S.F. Attenuator
3. I.F. Attenuator
4. Counter/Timer

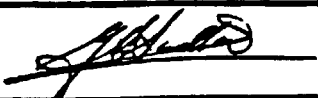
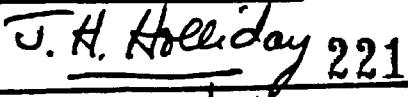
AUTHORISATION:	(G H Swallow) (PROJECT)	(J H Holliday(Q.A.))
	<i>[Signature]</i>	<i>J. H. Holliday</i> 219

This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)	ECR NO.
---	---------

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/105 - 010	ISSUE 1	DATE 16/9/80	PAGE 2 of 2
TITLE: S29 MOD 1 INSERTION LOSS ASSESSMENT				COPY NO.



Reflected pulse attenuation measured as sum of S.F. & I.F. attenuator settings
(Approximately 40dB in the I.F. path & 30dB in the S.F. path)

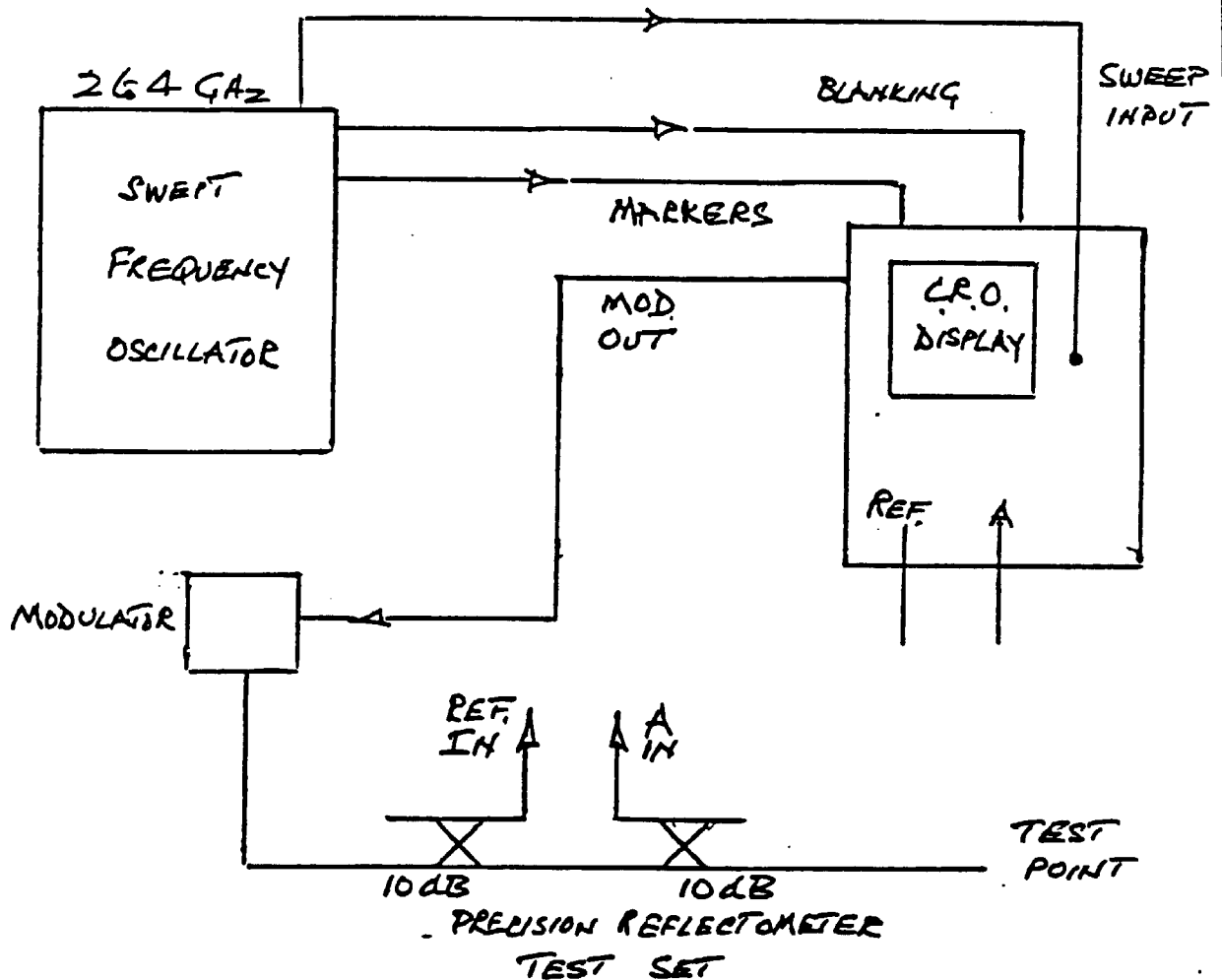
QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/IO5 - 011	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 MOD 1 DISMANTLING AND RE-WORKING OF LINES				COPY NO.
<p>1. <u>Removal of delay rod</u></p> <p>Remove lid and cover plate. Slacken line clamping screws and remove delay rod and packing strips. Return the rod for re-processing as described in Instruction 006 page 2.</p> <p>2. <u>Removal, cleaning and re-fitting of microstrip substrate</u></p> <p>Slacken co-axial connector, remove substrate clamps, and extract substrate.</p> <p>Wipe interior of case clean using acetone.</p> <p>Remove silver dag deposit on microstrip substrate with dag thinners, and remove graphite deposits with acetone.</p> <p>Refit substrate and secure connector as in Instruction 008.</p>				
<p>AUTHORISATION:</p> <p style="text-align: center;">(G H Swallow) (PROJECT) (J H Holliday) (Q.A.)</p> <p style="text-align: center;"> </p>				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 012	ISSUE 1	DATE 16/9/80	PAGE 1 of 2
TITLE: S29 MOD 1				TUNING AND STABILISATION HEATING CYCLE
				COPY NO.

Refer to CEL specification B914842/001.

Lines with positive or negative slopes are matched by "stub" tuning.

Knowing the direction of the insertion loss slope the line is placed on a test set up to measure V.S.W.R.; this is in practice a swept frequency reflectometer, giving a visual display on a C.R.O. of reflected power against frequency, as shown in the figure below.



AUTHORISATION:

(G H Swallow) (PROJECT)

(J H Holliday (Q.A.))

[Signature]

J. H. Holliday

222

This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)

ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO.	ISSUE	DATE	PAGE
	QA/I05 - 012	1	16/9/80	2 of 2
TITLE: S29 MOD 1 TUNNING AND STABILISATION HEATING CYCLE				COPY NO.

The return loss of the line is shown on the display; this can be anything from 1 dB to 10 or 15 dB, depending upon the r.f. impedance of the transducer.

The value of return loss will give the operator an indication of how much power is being lost (reflected due to a mismatch) and so consequently how much is available to reduce the insertion loss.

A good matching microstrip circuit will give a maximum return loss of 15-20 dB. From experience it has been found that a line which is initially 70 dB/insertion loss and say 2 dB return loss can, by improving the match to 15 dB, be brought down to better than 60 dB; however a line of 65 dB and 10 dB return loss may only be improved to a maximum of 63 dB (approx.).

With the return loss noted it is decided if the line is tunable, if yes then the slope must be corrected; this is done by modifying the matching circuit using conductive silver paint (TRADE NAME "DAG").

Frequency selective stubs are painted on, giving gain at either end of the band depending upon the type of slope. Although both ends of the band will receive some gain it is possible to keep most of the gain at one end.

If now the line has a slope better than the spec. requires but the insertion loss is still too high, then more matching is required. This is a reiterative process, tuning then measuring insertion loss is carried out. It is possible however that the specification can not be met, when the line is sent for reprocessing.

If the loss is better than the specification, some form of loss must be added. Many types of lossy materials have been tried, but pencil graphite is favoured as the most practical (H or HB). This is rubbed along the side of the microstrip transmission line while insertion loss is observed. If the line has negligible insertion loss slope, then no slope correction is required, only overall gain adjustment. This is again done with stubs placed to give a broad band performance. When optimum performance has been obtained the results are recorded on the Test Report.

If DAG is used at any stage in the tuning, then the complete line must have a stabilisation bake at 80°C for a minimum of 30 minutes.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/105 - 013	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 MOD 1 FINAL ASSEMBLY (clamping and lidding)				COPY NO.

When stable performance is obtained assembly of the device may be completed. (See sub-assembly Dwg. No. A75 - 382 - A3, Issue 3).

Packing strips (Dwg. No A75 - 390 - A4, Issue 1) are placed on the upper face of the delay rod and over these is placed the cover plate (Dwg. No A74 - 126 - A4, Issue 2). The cover plate secures the delay rod in the vertical plane by means of three 6 BA x $\frac{1}{4}$ " countersunk brass screws threaded into the aluminium case, and the heads secured with cellulose nitrate varnish.

The delay line clamping screws in the side of the case are locked in position, using cellulose nitrate varnish and the serial number of the line placed inside the protective cap which is placed over the coaxial connector before the painting process. The lid is then fitted and secured by 8 - 8BA x $\frac{1}{4}$ " countersunk brass screws. Electrical performance is then rechecked and the results recorded in the Test Report.

AUTHORISATION:

(G H Swallow) (PROJECT) (J H Holliday)(Q.A.)
G H Swallow *J. H. Holliday* 224

This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)

ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 014	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 MOD 1 EXTERNAL PAINTING				COPY NO.

1. The protective cap fitted to the coaxial connector must not be removed at any time.
2. The whole exterior of the unit is painted to DTD 5555 Scheme 1, using BS 381 c Tint No. 298, Olive Drab matt finish.

AUTHORISATION:

(G H Swallow)

(PROJECT)

(J H Holliday)

(Q.A.)

G H Swallow

J. H. Holliday 225

This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)

ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/105 - 015	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
----------------------------------	-------------------------------	------------	-----------------	----------------


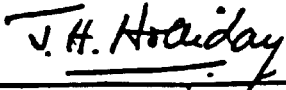
TITLE: S29 MOD 1	VISUAL INSPECTION, FINAL ELECTRICAL TEST, AND LABELLING	COPY NO.
------------------	--	----------

1. When returned from painting the unit is visually inspected, the serial number recovered from the coaxial connector cap and the unit matched with its Test Report. The insertion loss is then re-measured, and the results recorded in the Test Report.
2. If the electrical performance is not satisfactory the lid is removed and an attempt made to re-tune the device as described in Instruction 012.

If re-tuning is not possible the unit may be dismantled and the parts re-worked as in Instruction 011.
3. If the electrical performance is satisfactory the unit is labelled according to Dwg. No A75 - 379 - A3, Issue 2.
4. Before attaching the main identity label, Dwg. D73 - 001 - A4, Issue 4, the unit serial number and year of manufacture are to be stamped in the spaces provided, and the Mod Record marked up.

Completed units are to be held in local bonded store to await despatch.

AUTHORISATION:

(G.H Swallow) (PROJECT) (J H Holliday) (Q.A.)
 

226

This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)

ECR NO.

QUALITY ASSURANCE INSTRUCTION	REFERENCE NO. QA/I05 - 016	ISSUE 1	DATE 16/9/80	PAGE 1 of 1
TITLE: S29 MOD 1 RELEASE AND DESPATCH PROCEDURE				COPY NO.
<p>Prior to despatch, each unit is subjected to visual inspection to Dwg. No A75 - 379 - A3, Issue 2 by a Q.A. representative for external condition of case, co-axial connector, paint finish, and correct labelling and marking. In addition a re-check for electrical performance is made to CEL specification B 914482/001 under Q.A. observation, the results being recorded on the test sheet. For satisfactory items, despatch notes and release notes can then be prepared.</p> <p>Each accepted unit is then placed in its primary package packed between two split-section plastic-foam blocks, and passed to despatch Department.</p>				
<p>AUTHORISATION: _____ (G.H Swallow) (PROJECT) _____ (J H Holliday) (Q.A.)</p> <p><i>[Signature]</i> <i>[Signature]</i> 227</p>				
This instruction must not be modified except by means of a new issue authorised by an approved Engineering Change Request (ECR)				ECR NO.

CERTIFICATE OF CONFORMITY

BS 9450 CAPABILITY APPROVAL
FOR CUSTOM BUILT INTEGRATED CIRCUITS

MOD (PE) DEF STAN 05-21
QUALITY CONTROL REQUIREMENTS FOR INDUSTRY

<p>TO: Cesser Electronics Limited The Pinnacles Harlow Essex</p>	<p>ORDER NO: T.J.A. CONTRACT NO:</p>	<p>FROM: THE GENERAL ELECTRIC COMPANY P.L.C. HIRST RESEARCH CENTRE EAST LANE, WEMBLEY MIDDLESEX HA9 7PP</p>	<p>SERIAL NO: 06468 DATE: 6 April 1983 ADVICE NOTE NO: 40019</p>			
<p>ITEM QTY</p>	<p>DESCRIPTION</p>	<p>PART OR TYPE NO.</p>	<p>SERIAL AND/OR BATCH NO.</p>	<p>SPECN AND/OR DRG NO.</p>	<p>ISSUE</p>	<p>TEST REPORT NO.</p>
1	P Band Delay Line 5895-99-656-2131		Serial Nos B452M/83 B162M/83 B175M/83 B094M/83 B387M/83	B914842/001		<p>MDLS 173 MDLS 174 MDLS 175 MDLS 176 MDLS 177</p>
<p>REMARKS: The above components have been modified in respect of performance originally called for in Drawing Ref B914842/000.</p>						
<p>DEF STAN 05-21: MOD REG NO 11RG02 It is certified that, unless otherwise stated above, the supplies detailed hereon conform to the drawings and specifications called for in the contract or order.</p> <p style="text-align: right;">Signed: <i>[Signature]</i> Stamp: </p>						
<p>DEF STAN 11781M: BS8 APPROVAL NO 11781M The components detailed hereon have been manufactured, inspected and tested in conformity with the specifications quoted.</p> <p style="text-align: right;">Signed: _____ Stamp: _____</p> <p style="text-align: right;">for and on behalf of The General Electric Company P.L.C., Hirst Research Centre</p>						
<p>DISTRIBUTION:</p> <p>White - Consignee with goods Blue - Consignee's Chief Inspector (by post) Pink - Consignor's Despatch Dept Yellow - Consignor's QA File</p>						

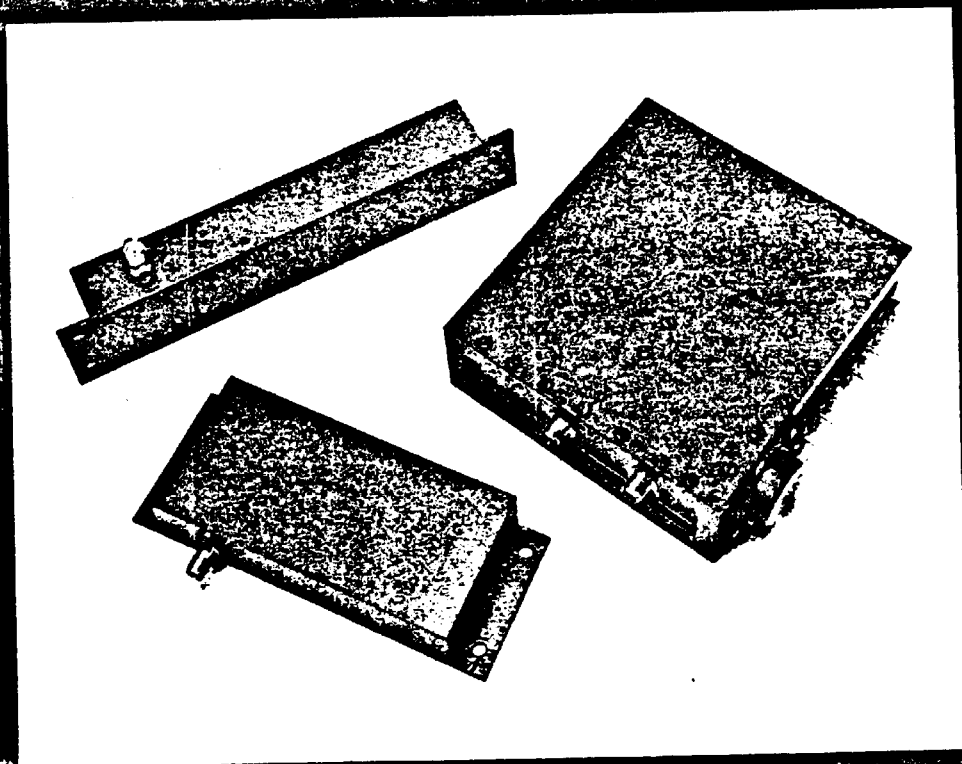
EXHIBIT NO

(5)

Microwave Delay Lines and Modules

Using spinel as delay medium

- Lower losses at Microwave frequencies
- Delays up to 30 μ secs
- Designed for military environment
- Current device range covers 1GHz-4GHz



DRAWING No.
A82-398-A3

ASSEMBLY

THIRD ANGLE PROJECTION

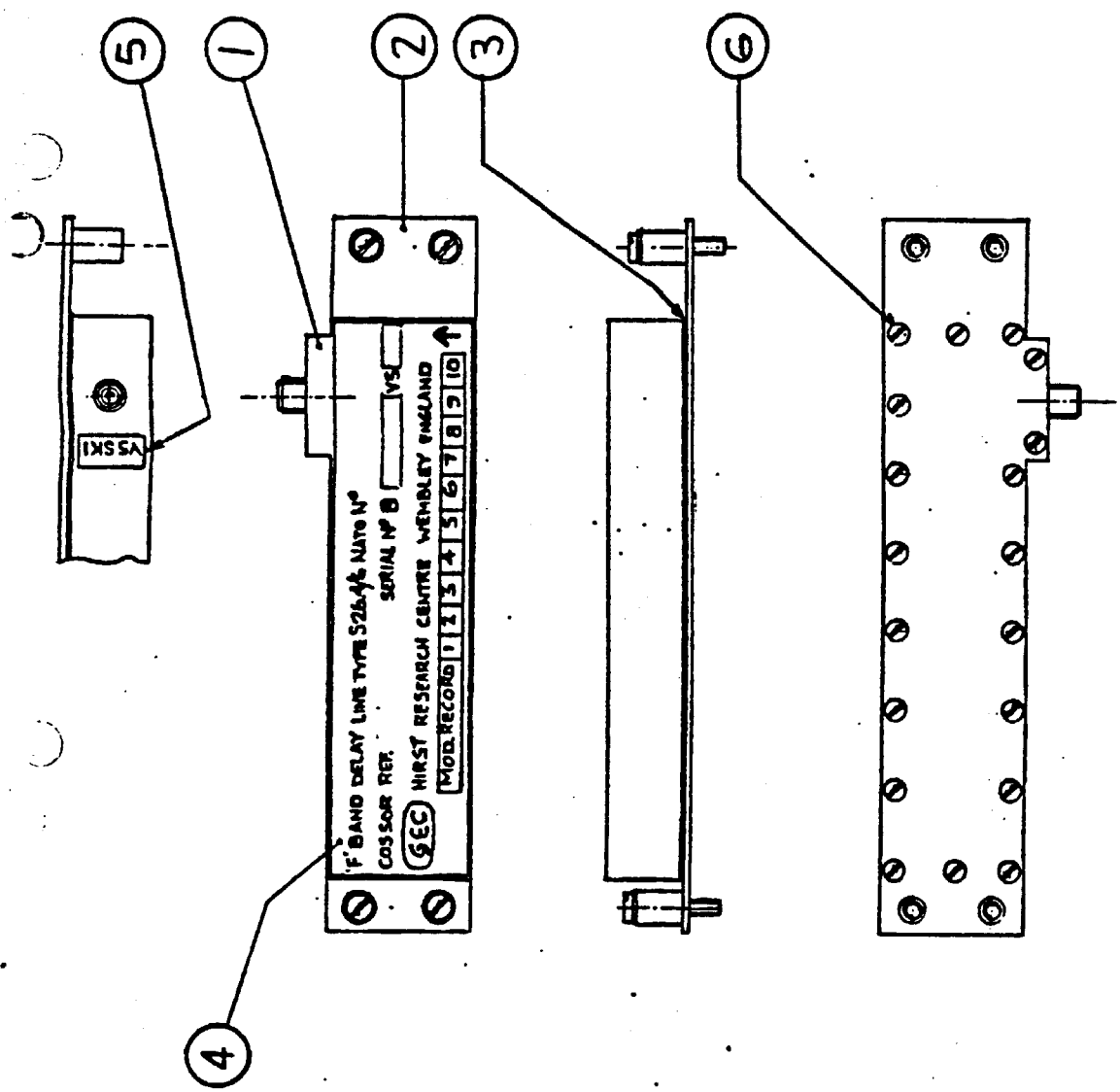
DATE 14/10/82

THIS DRAWING WAS PRODUCED BY THE WORKS

FACTORY CO LTD AND THE INFORMATION CONTAINED

HEREIN IS UNCLASSIFIED

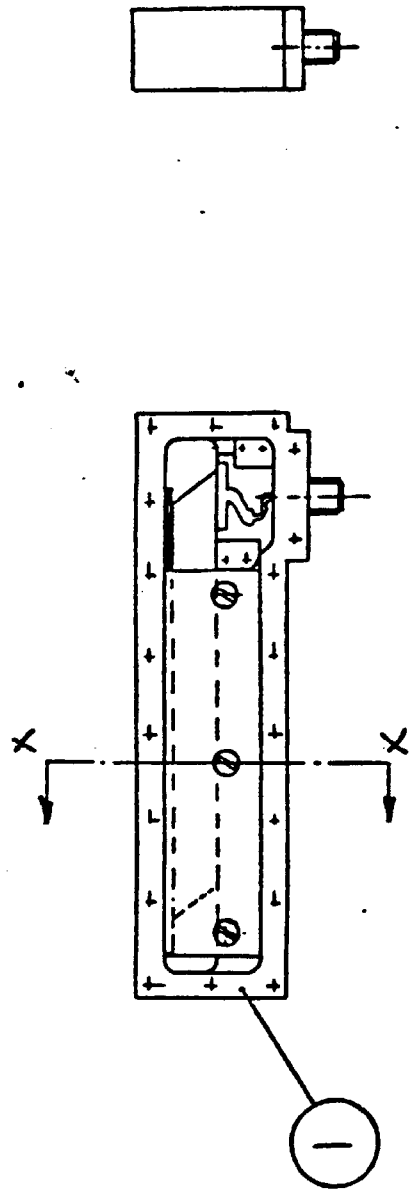
DATE 24/10/82 BY



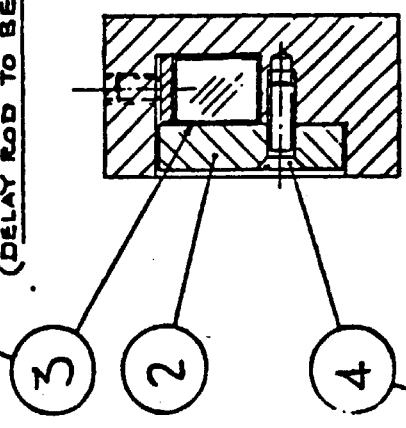
'F' BAND DELAY LINE TYPE S26.46 NATO No
COS SOR REF. [] VS
SERIAL No B []
(SEC) HIRST RESEARCH CENTRE WEMBLEY ENGLAND
MOD. RECORD 1 2 3 4 5 6 7 8 9 10 ↑

FOR OUTLINE DRG. SEE A82-403 A2
FOR ITEM LIST SEE A 82-398 A4
DRAWING No.
ASSEMBLY OF
'F' BAND DELAY LINE Mk3
A82-398-A

SCALE 1:1		TITLE	
DIMENSIONS IN MILLIMETERS		ASSEMBLY OF 'F' BAND DELAY LINE Mk3	
MATERIAL		THE GENERAL ELECTRIC COMPANY LIMITED HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	
FINISH PAINT - PAPER GRAY FINISH: MATT OLIVE DRAG. (BOTH - 2 PART EPOXY TO G.P. 555A)		DRAWING No. A82-398-A	
ISSUE 1		DATE 14/10/82	
BY GDB			
CHECKED			
DRAWN			
JOB No.			
MODIFICATION			



NUMBER & THICKNESS OF PAPER STRIPS TO SUIT ASS'Y
(DELAY ROD TO BE FIRMLY CLAMPED)



LOCK SCREWS WITH CELLULOSE NITRATE VARNISH

SECTION ON XX- SCALE 2:1

FOR ITEM LIST SEE A82-399A4.

DRAWING No. A 82-399-A3		TITLE SUB-ASS'Y OF BOX WITH ROD CLAMP PLATE - 'F' BAND DELAY ROD MK 3	
SCALE 1:1 & 2:1		THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	
MATERIAL		FINISH	
1 01/72 GDB		ECR	
NOTIFICATION		ECR	

THIRD ANGLE PROJECTION

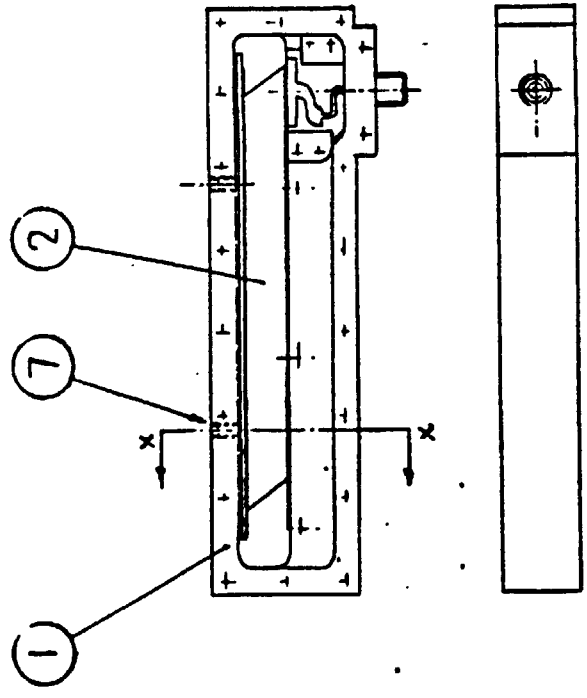
13/10/82

©

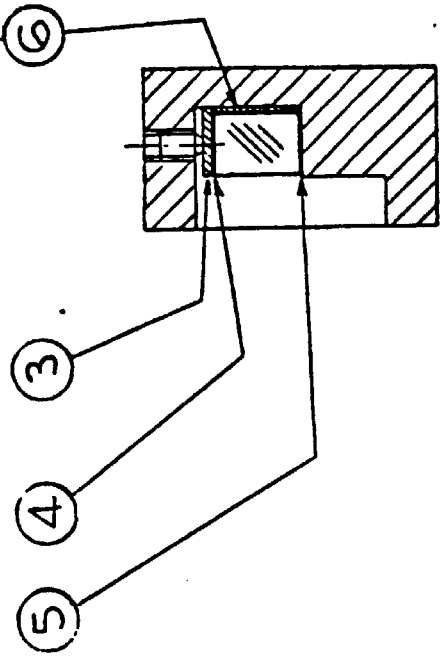
DRAWING NUMBER
A82-401-A3

DATE ON
SECRET
7-399A3

POSITION DELAY ROD LONGITUDINALLY SO THAT CHOSEN
GOLD WIRE IS OPPOSITE ϕ OF CONNECTOR.
JOIN GOLD WIRE TO GOLD PAD ON SUBSTRATE WITH SPOT OF SILVER DAG.



NUMBER OFF & THICKNESS OF PAPER STRIPS
TO SUIT POSITION OF CHOSEN GOLD WIRE
RELATIVE TO UPPER FACE OF SUBSTRATE.



SECTION ON XX
SCALE 2:1

SCREWS ITEM 7 TO BE LOCKED WITH CELLULOSE NITRATE VARNISH
REFER ALSO TO PROCESS INSTRUCTIONS.

FOR ITEM LIST SEE A82-401A4		SCALE 1:1 & 2:1		TITLE SUB-ASSY OF BOX WITH DELAY ROD - FBAND DELAY LINE Mk 3		DRAWING No. A82-401-A3	
Dwg in metric mm		10 PERCENTS		SUCH DIMENSIONS AS SHOWN WITH THIS DRAWING ARE TO BE USED UNLESS OTHERWISE SPECIFIED		THE GENERAL ELECTRIC COMPANY LIMITED HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	
MATERIAL		FINISH		ISSUE DATE BY		MODIFICATION	
				1 4/10/68 GDB			
				ECR			

232



14/10/68

THIRD ANGLE PROJECTION

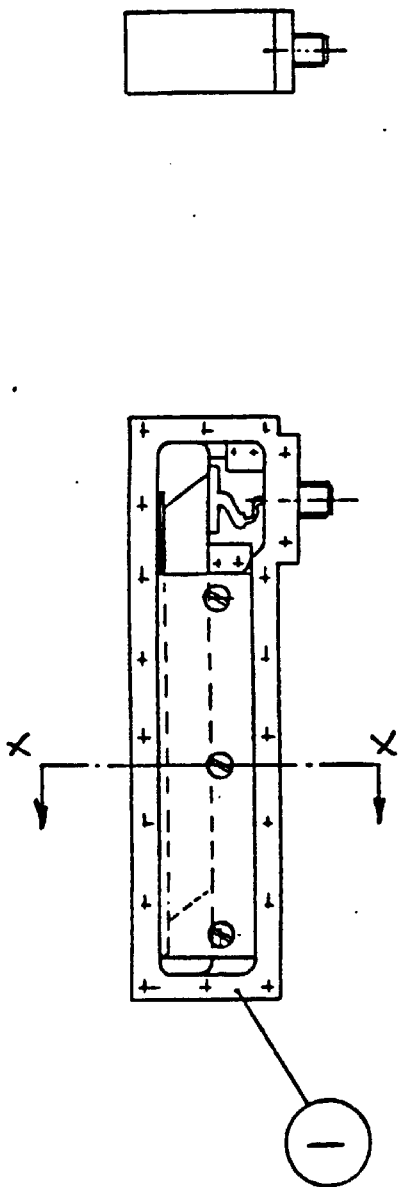
SECTION ON XX AND THE DIMENSIONS OF COMPONENTS
AS SHOWN IN THIS DRAWING ARE TO BE USED UNLESS OTHERWISE
SPECIFIED BY THE DRAWING OR BY THE MANUFACTURER
UNLESS THE MANUFACTURER OF THE COMPONENTS
MATERIALS OR THE MANUFACTURER OF THE COMPONENTS
MATERIALS IS OTHERWISE SPECIFIED

DRAWING NUMBER
A 82-399-A3

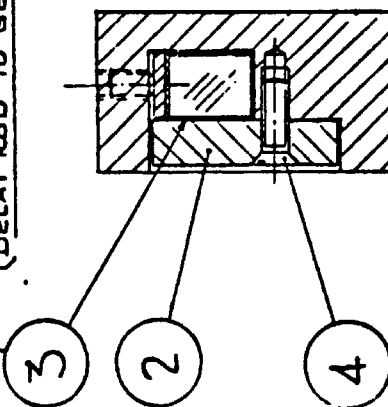
ISSUED ON
ASSEMBLY
82-399A3

THIRD ANGLE
PROJECTION

SECTION ON XX-SCALE 2:1
13/10/82



NUMBER & THICKNESS OF PAPER STRIPS TO SUIT ASS'Y
(DELAY ROD TO BE FIRMLY CLAMPED)

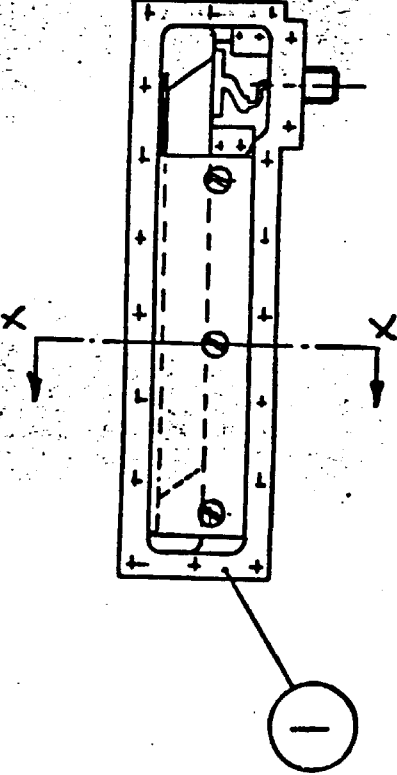


LOCK SCREWS WITH CELLULOSE NITRATE VARNISH

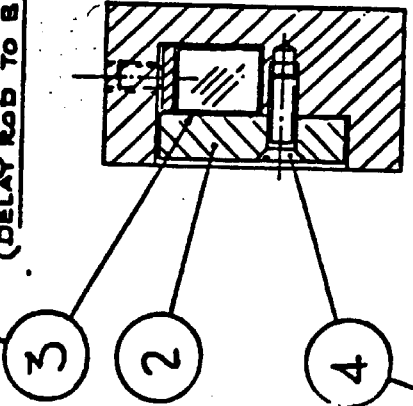
SECTION ON XX-SCALE 2:1

FOR ITEM LIST SEE A82-399A4.

SCALE 1:1 & 2:1		TITLE SUB-ASS'Y OF BOX WITH ROD CLAMP PLATE - 'F' BAND DELAY ROD MK 3		DRAWING No.
DIM'S IN MILLIMETERS AND FRACTIONS		DIM'S IN INCHES AND FRACTIONS		A 82-399-A3
EACH DIMENSION TO BE TO THE NEAREST 0.005		EACH DIMENSION TO BE TO THE NEAREST 0.001		
MATERIAL		FINISH		THE GENERAL ELECTRIC COMPANY LIMITED FIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.
MODIFICATION		ECR		
1	1/4" GDA			
SHEET DATE 82				



NUMBER & THICKNESS OF PAPER STRIPS TO SUIT ASS'Y
(DELAY ROD TO BE FIRMLY CLAMPED)



LOCK SCREWS WITH CELLULOSE NITRATE VARNISH

SECTION ON XX- SCALE 2:1

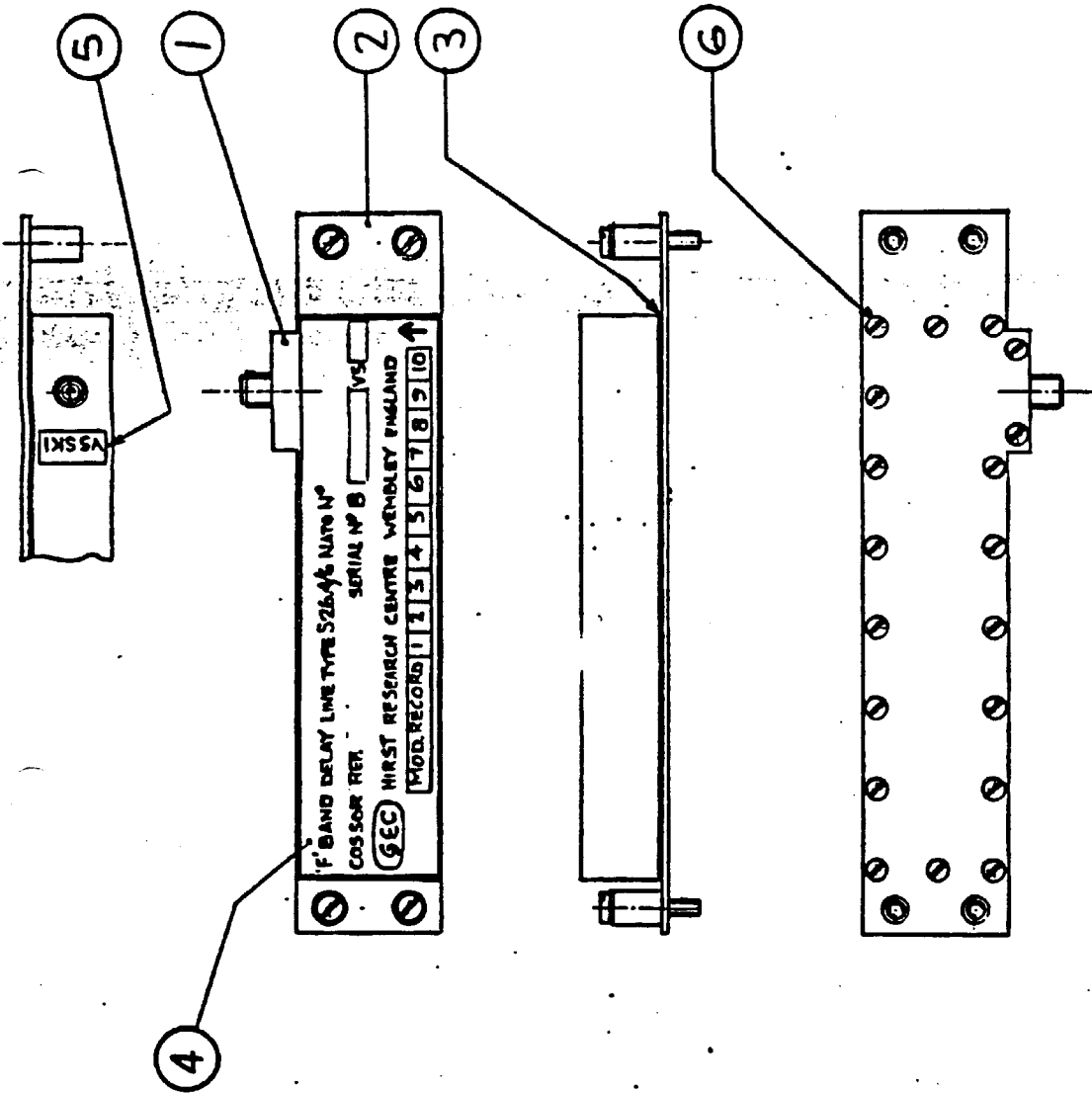
FOR ITEM LIST SEE A82-399A4.

SCALE 1:1 & 2:1 DWS BY COMPANY AND		TITLE SUB-ASS'Y OF BOX WITH ROD CLAMP PLATE- 'F' BAND DELAY ROD MK 3		DRAWING No.
CHECKED BY DATE 13/10/82		DRAWN BY DATE 13/10/82		A82-399-A3
MATERIAL		FINISH		THE GENERAL ELECTRIC COMPANY LIMITED, FIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.
1	308	1	GD8	
2		1	BY	
MODIFICATION		ECR		

THIRD ANGLE PROJECTION

13/10/82

©



FOR OUTLINE DRG. SEE A82-403 A2
 FOR ITEM LIST SEE A82-398 A4

JOB NO.		SCALE 1:1		TITLE	
DRAWN GDB		DIM'S BY REFERENCE, UNLESS OTHERWISE SPECIFIED		ASSEMBLY OF 'F' BAND DELAY LINE Mk3	
CHECKED		TOLERANCES UNLESS OTHERWISE SPECIFIED		DRAWING No.	
TRACED		MATERIAL		A82-398-A	
ISSUE	DATE	FINISH PAINT - PRIMER GRAY FINISH - MATT OLIVE DRAB. (Both - 2 PACK EPOXY 70 D.T.D. 555A)		THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	
1	14/10/82	MODIFICATION			
		BY		ECR	

DRAWING NUMBER
A82-398-A3

SEE ON
 ASSEMBLY

THIRD ANGLE
 PROJECTION

DATE
 14/10/82

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IF YOU ARE NOT AN EMPLOYEE OF THE GENERAL ELECTRIC CO. LTD. YOU SHOULD NOT DISCLOSE OR REPRODUCE THIS INFORMATION WITHOUT THE WRITTEN AUTHORIZATION OF THE GENERAL ELECTRIC CO. LTD.

D WING NO
A82-405 -A4

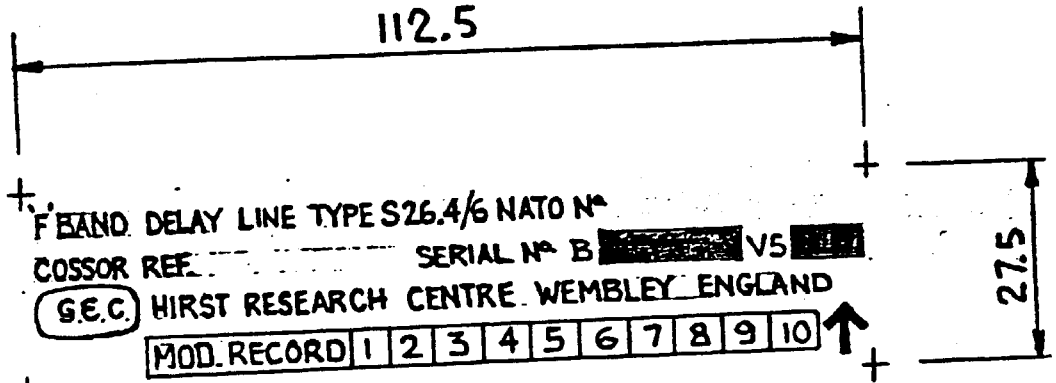
EXHIBIT No. 13

USED ON
ASSEMBLY
A82-398A3

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GE ELECTRIC COMPANY LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G.E.C.

DATE
29/10/82



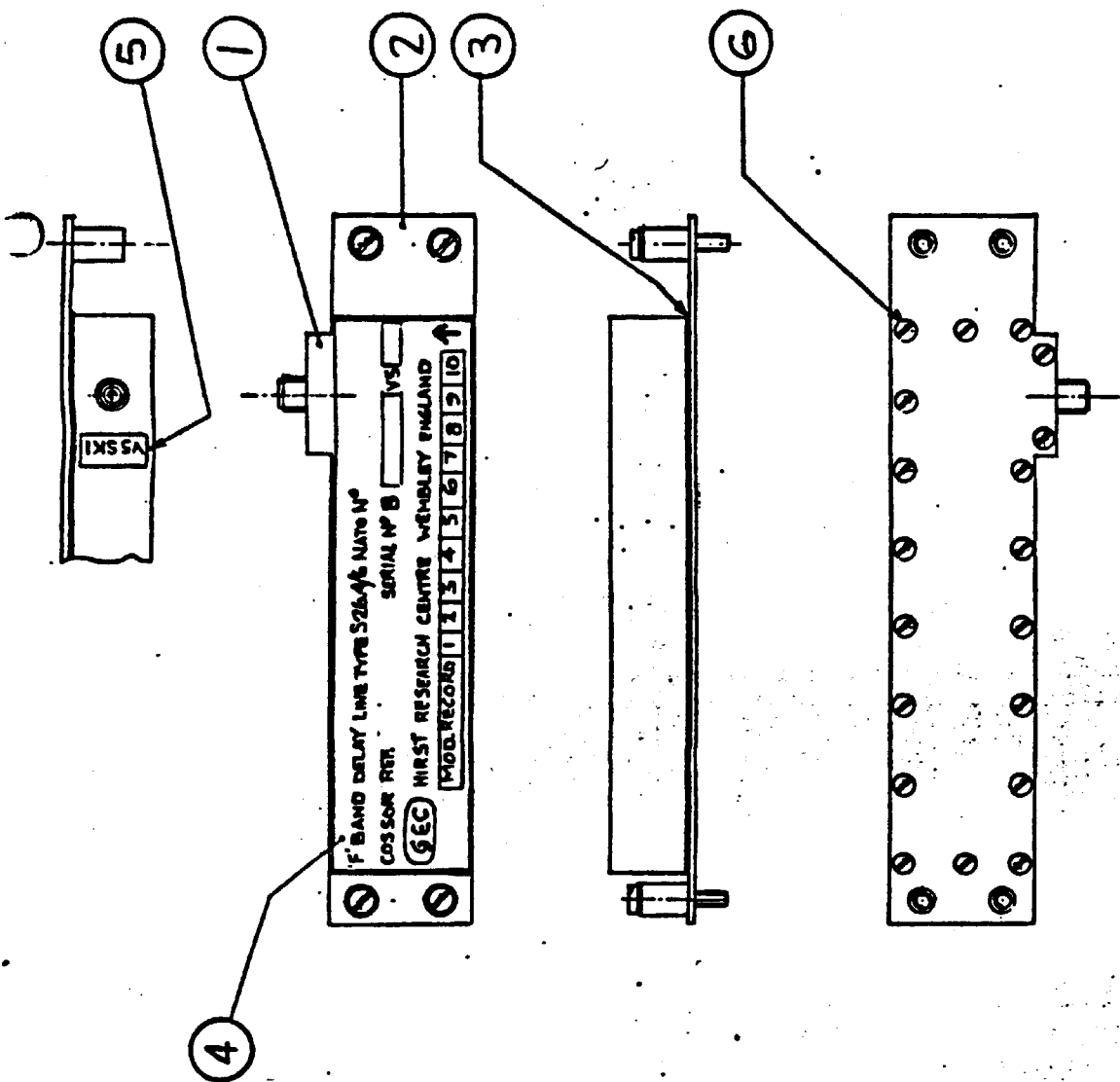
STANDARD GEC MOTIF

'CAL' LABEL: SILVER LETTERS ETC. ON MATT BLACK BACKGROUND, FULLY ANODISED.
SELF-ADHESIVE

(NOTE: DRG. IS A NEGATIVE OF REQUIRED LABEL)

Ⓢ

MATERIAL ALUMINIUM BASE				
FINISH SEE ABOVE	1	20/10/82	GDB	
JOB NO	SCALE 1:1	TITLE LABEL		DRAWING NUMBER
DRAWN GDB	DIMS. IN INCHES / m.m.	'F' BAND DELAY LINE MK3		A82-405 -A4
CHECKED	TOLERANCES INCH DECIMALS ± 0.005 INCH FRACTIONS ± 1/64 METRIC ± mm UNLESS OTHERWISE STATED	THE GENERAL ELECTRIC COMPANY LIMITED, 236 HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.		
TRACED				



FOR OUTLINE DRG. SEE **A82-403 A2**
 FOR ITEM LIST SEE **A 82-398 A 4**

ASSEMBLY OF
F BAND DELAY LINE M3

A 82-398 -A

THE GENERAL ELECTRIC COMPANY LIMITED.
 WIGST. RESEARCH CENTRE WEMBLEY ENGLAND.

SCALE 1:1
 DIMS IN INCHES AND
 DECIMALS
 TOLERANCES
 UNLESS OTHERWISE SPECIFIED
 FINISH: PRIMER, PAINT: GARY
 FINISH: HAFT OLIVE DRAB,
 (BOTH - 3 PACK PROPERTY OF
 GPO, SSSKA)

TITLE	
ASSEMBLY OF F BAND DELAY LINE M3	DRAWING No.
A 82-398 -A	

MATERIAL	
FINISH: PRIMER, PAINT: GARY	SCR
FINISH: HAFT OLIVE DRAB, (BOTH - 3 PACK PROPERTY OF GPO, SSSKA)	MODIFICATION

JOB No.	
1	14/10/82
ISSUE 1 OF 1	BY
BY	BY
CHECKED	
DATE	

DRAWING NUMBER
A82-398-A3

ASSEMBLY

THIRD ANGLE PROJECTION

THIS DRAWING HAS BEEN PREPARED BY THE GENERAL ELECTRIC COMPANY LIMITED, WEMBLEY ENGLAND. IT SHALL BEY IN FORCE UNLESS OTHERWISE SPECIFIED IN THE DRAWING. FOR THE GENERAL ELECTRIC CO. LTD.

DATE
14/10/82



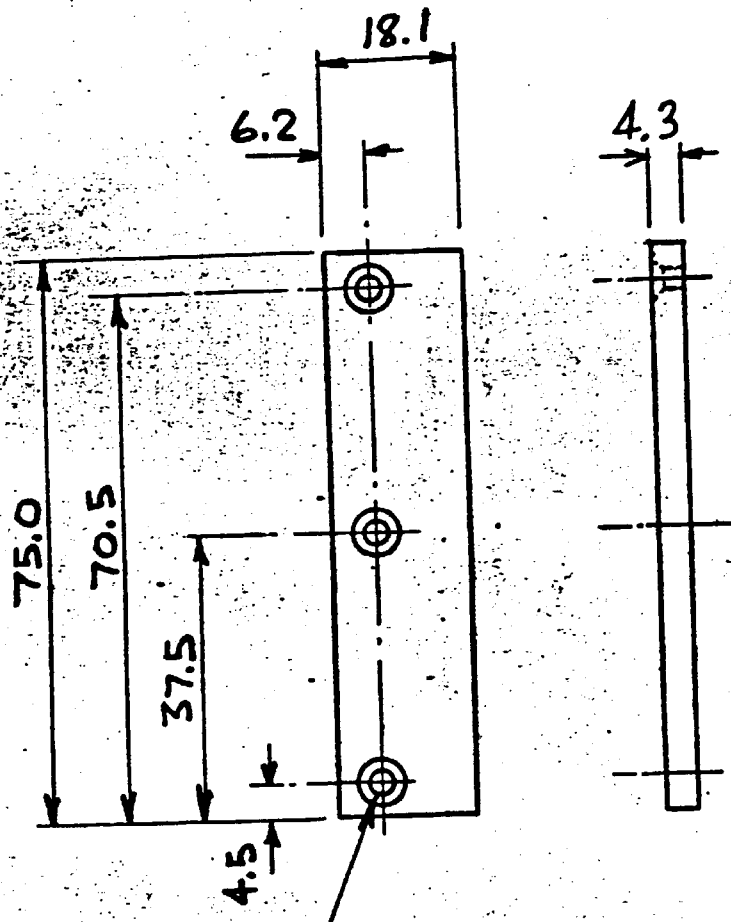
DRA NO
A82-406-A4

USED ON
ASSEMBLY
A82-399A3

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GEN. ELECTRIC CO LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT THE WRITTEN AUTHORITY FROM THE G. E. C.

DATE
13/10/82



3 HOLES DRILL $\phi 2.7$
C'SINK TO $\phi 5.0$ AT 90°

REMOVE SHARP EDGES
& CORNERS

C	MATERIAL ALUM. ALLOY			
	GRADE HS 30 T.F			
	FINISH -	1	13/10/82	GDB
		ISSUE	DATE	BY
		MODIFICATION		
JOB NO	SCALE 1:1	TITLE CLAMP PLATE.		DRAWING NUMBER
DRAWN GDB	DIMS. IN INCHES / m.m.	F'BAND DELAY LINE MK3		A82-406 -A4
CHECKED	TOLERANCES			
	INCH DECIMALS ± 0.005			
	INCH FRACTIONS $\pm 1/32$			
TRACED	METRIC ± 0.05 mm			
	UNLESS OTHERWISE STATED			

THE GENERAL ELECTRIC COMPANY LIMITED. 238
FIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

DRAWING NO

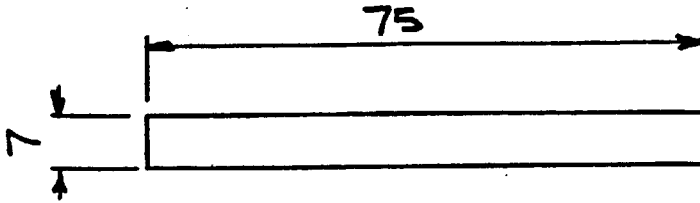
A 82-407-A4

EXHIBIT No. 14 (CTD.)

USED ON ASSEMBLY

A82-399A

THIRD ANGLE PROJECTION



THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC COMPANY LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DRG N° A82- A4/1 0.25 (-010") THICK
 " " A82- A4/2 0.13 (-005") THICK.

MATERIAL: TRANSFORMER PAPER - 'ELEPHANTIDE'
 BRAND GRADE 3 MULTI-PLY PRESSPAPER.

SUPPLIER: BS. & W. WHITELEY LTD.,
 POOL-IN-WHARFEDALE, OTLEY, YORKS

DATE

14/10/82

MATERIAL

SEE ABOVE

FINISH

-

ISSUE

DATE

BY

MODIFICATION

1 14/10/82 GDB

JOB N°

SCALE

1:1

TITLE PACKING STRIPS-TOP

DRAWING NUMBER

DRAWN

GDB

DIMS. IN INCHES / m.m.

'F'BAND DELAY LINE MK3

A82-407-A4

CHECKED

TOLERANCES

INCH DECIMALS ± 0.005

INCH FRACTIONS ± 1/32

METRIC ± 0.3 mm

UNLESS OTHERWISE STATED

TRACED

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

DR. 1G N°
A82-409 -A4

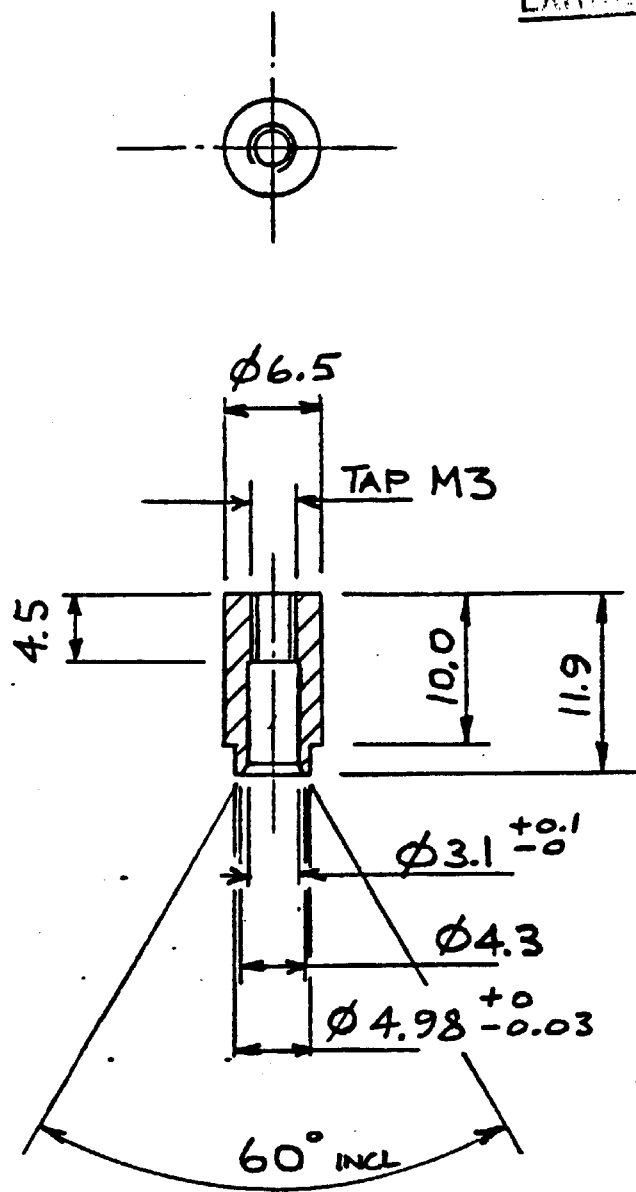
EXHIBIT No. 15

USED ON
 ASSEMBLY
 A82-400A3

THIRD ANGLE
 PROJECTION

THIS DRAWING WAS PREPARED BY THE GE. ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DATE
 7/10/82



MATERIAL ALUM. ALLOY GRADE HE15TB				
FINISH -	1	7/10/82	GDB	
	ISSUE	DATE	BY	MODIFICATION
JOB N°	SCALE 2:1	TITLE RETAINING PILLAR FOR SCREW - 'F' BAND DELAY LINE MK3		DRAWING NUMBER A82-409 -A4
DRAWN GDB	DIMS. IN THOUS / m.m.	THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.		
CHECKED	TOLERANCES			
	INCH DECIMALS ± 0.005			
TRACED	INCH FRACTIONS ± 1/64 METRIC ± 0.1 mm UNLESS OTHERWISE STATED			

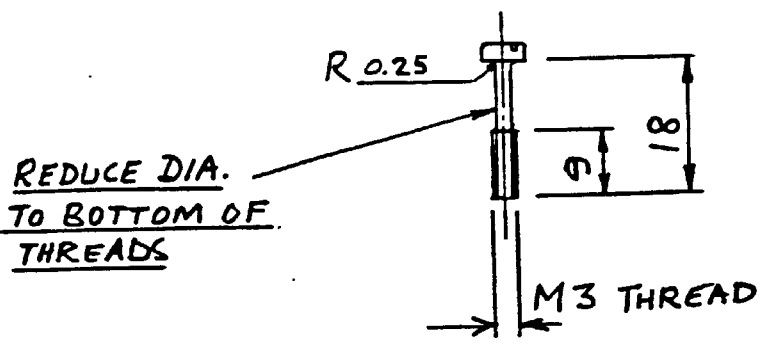
240

DRA. N^o
A82-410 -A4

EXHIBIT No. 15 (CTD.)

USED ON
 ASSEMBLY
 A82-400A3

THIRD ANGLE
 PROJECTION



THIS DRAWING WAS PREPARED BY THE GE ELECTRIC CO LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

MAKE FROM STD. M3 STAINLESS STEEL
SCREW

DATE
 7/10/82

MATERIAL	AS ABOVE		
FINISH	1	7/10/82	GDB
JOB N ^o	SCALE	TITLE	DRAWING NUMBER
	1:1	CAPTIVE SCREW	A82-410 -A4
DRAWN	DIMS. IN INCHES / m. m.	'F' BAND DELAY LINE MK3	
GDB	TOLERANCES		
CHECKED	INCH DECIMALS ± 0.005		
	INCH FRACTIONS ± 1/64		
TRACED	METRIC ± 0.3 mm		
	UNLESS OTHERWISE STATED	THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	

WINGBY

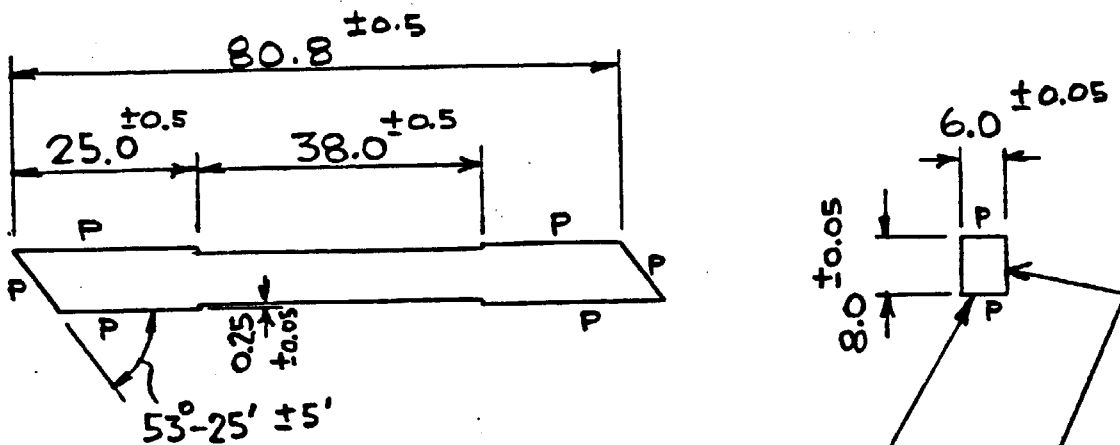
A82-411-A4

EXHIBIT No. 16

USED ON ASSEMBLY

A82-401A3

THIRD ANGLE PROJECTION



THIS FACE PARALLEL TO 100 CRYSTAL PLANE

THIS FACE PARALLEL TO 110 CRYSTAL PLANE

POLISH FACES MARKED 'P'

REMOVE ALL SHARP EDGES

PARALLELISM OF POLISHED FACES ± 2 MINS.

FLATNESS " " " > 1 FRINGE (1/2)

MATERIAL SUPPLIER:- UNION CARBIDE VIA RODITI INTERNATIONAL

MATERIAL STRAIN FREE SINGLE CRYSTAL SPINEL

FINISH

AS STATED

ISSUE DATE BY

MODIFICATION

JOB NO

SCALE 1:1

TITLE DELAY ROD

DRAWING NUMBER

DRAWN

DIMS. IN MICRONS / m.m.

(GRINDING & POLISHING)

A82-411-A4

CHECKED

TOLERANCES INCH DECIMALS ± 0.005

'F' BAND DELAY LINE MK3

TRACED

INCH FRACTIONS ± 1/64

METRIC ± m.m. UNLESS OTHERWISE STATED

THE GENERAL ELECTRIC COMPANY LIMITED, 242 HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

DATE 14/10/82

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO LTD AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G.E.C.

82-5-5

REVISION NO

82-412 -A4

EXHIBIT No. 16 (C102)

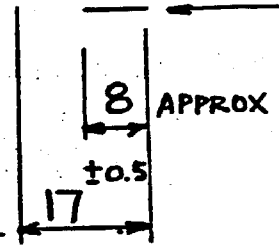
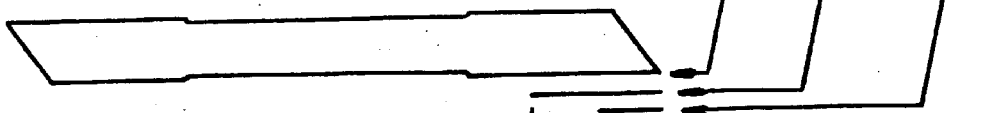
USED ON ASSEMBLY
A82-401A3

SPUTTERED LAYER OF ZINC OXIDE APPROX 8600 Å THICK

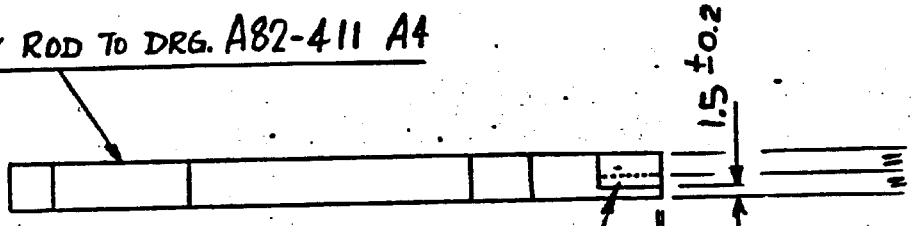
EVAPORATED LAYER OF GOLD APPROX 4500 Å THICK

EVAPORATED LAYER OF Ni.Ct. APPROX. 150 Å THICK

THIRD ANGLE PROJECTION



DELAY ROD TO DRG. A82-411 A4



1st. GOLD SPOT

B. OFF EVAPORATED GOLD SPOTS APPROX 0.25 DIA. x 450/500 Å THICK
ON EVAPORATED Ni.Ct. UNDERLAY APPROX. 150 Å THICK.
SPACING CENTRES OF SPOTS = 1 mm

FOR DETAILS OF PREPARATION & COATING SEE PROCESS INSTRUCTIONS

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DATE
14/10/82

MATERIAL	AS STATED					
FINISH	1	14/10/82	GDB	MODIFICATION		
JOB NO	SCALE 1:1	TITLE	DRAWING NUMBER			
DRAWN GDB	DIMS. IN INCHES / m.m.	DELAY ROD (EVAPORATED - SPUTTERED LAYERS)		A82-412 -A4		
CHECKED	TOLERANCES	'F' BAND DELAY LINE MK3				
TRACED	HIGH DECIMALS ± 0.005	THE GENERAL ELECTRIC COMPANY LIMITED,				
	INCH FRACTIONS ± 1/64	HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX				
	METRIC ± mm					
	UNLESS OTHERWISE STATED					

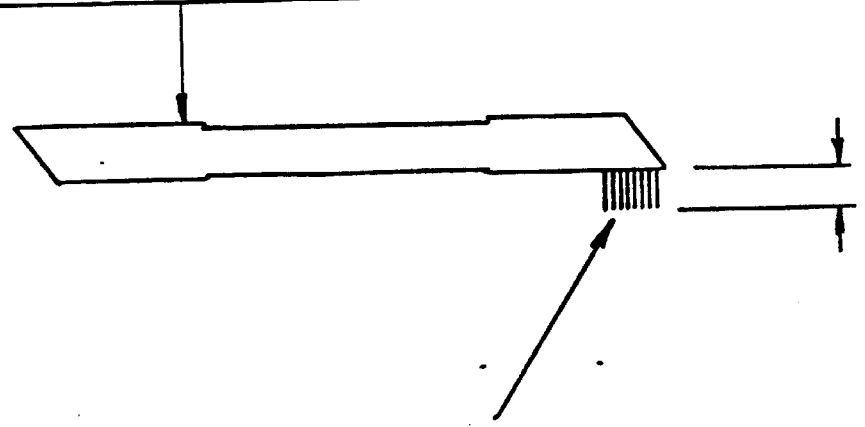
DR. NY
A82-413 -A4

EXHIBIT No. 17

USED ON
 ASSEMBLY
 A82-401 A3

THIRD ANGLE
 PROJECTION

DELAY ROD TO DRG. A82-411 A4



8 GOLD WIRES 1 MICRON DIAMETER BONDED TO GOLD SPOTS ON DELAY ROD. ONE OF THESE WIRES IS SELECTED, AND THE REMAINDER ARE REMOVED

FOR DETAILS OF BONDING TESTING & SELECTION SEE PROCESS INSTRUCTIONS SECTION - BONDING.

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G.E.C.

DATE
 14/10/82

MATERIAL AS STATED				
	FINISH -	ISSUE	DATE	BY
				MODIFICATION
JOB NO	SCALE 1:1	TITLE DELAY ROD - BONDING OF GOLD WIRE.		DRAWING NUMBER
DRAWN GDB	DIMS. IN INCHES / m.m.	'F' BAND DELAY LINE MK3		A82-413 -A4
CHECKED	TOLERANCES INCH DECIMALS ± 0.005 INCH FRACTIONS $\pm 1/64$ METRIC \pm mm UNLESS OTHERWISE STATED	THE GENERAL ELECTRIC COMPANY LIMITED, FIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.		
TRACED				

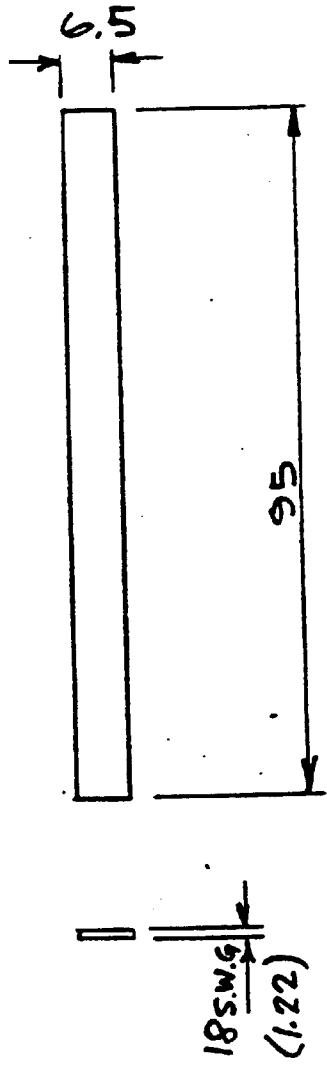
(C)

USED ON ASSEMBLY
A82-401A3

THIRD ANGLE PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G.E.C.

DATE
20/10/82



REMOVE SHARP EDGES & CORNERS

C	MATERIAL STAINLESS STEEL GRADE EN58B				
	FINISH -	1	20/10/82	GDB	
JOB NO	SCALE 1:1	TITLE CLAMP			DRAWING NUMBER
DRAWN GDB	DIMS. IN INCHES / m.m.	F'BAND DELAY LINE MK3			A82-414 -A4
CHECKED	TOLERANCES INCH DECIMALS ± 0.005 INCH FRACTIONS ± 1/64 METRIC ± 0.1 mm UNLESS OTHERWISE STATED				
TRACED		THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.			245

DRAWING NO

A82-416-A4

EXHIBIT No. 18

USED ON ASSEMBLY

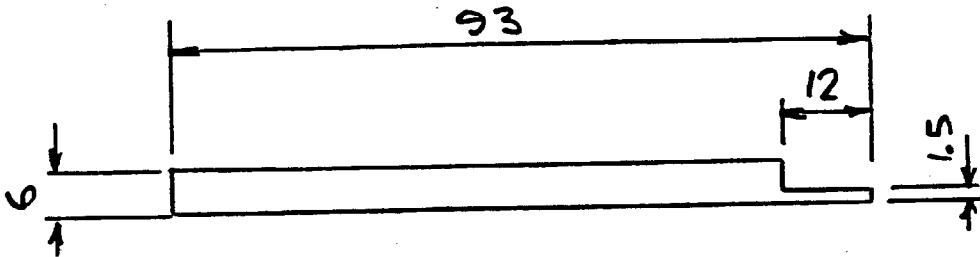
A82-401A3

THIRD ANGLE PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DATE

14/10/82



MATERIAL **TINFOIL**
0.05 (.002") THICK
 FINISH **-**

1	14/10/82	GDB
ISSUE	DATE	BY

MODIFICATION

JOB NO

SCALE 1:1

TITLE **EARTH STRIP -**

DRAWING NUMBER

DRAWN **GDB**

DIMS. IN INCHES / m.m.

'F' BAND DELAY LINE MK3

A82-416-A4

CHECKED

TOLERANCES

INCH DECIMALS ± 0.005

INCH FRACTIONS $\pm 1/64$

METRIC ± 0.3 mm

UNLESS OTHERWISE STATED

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

246

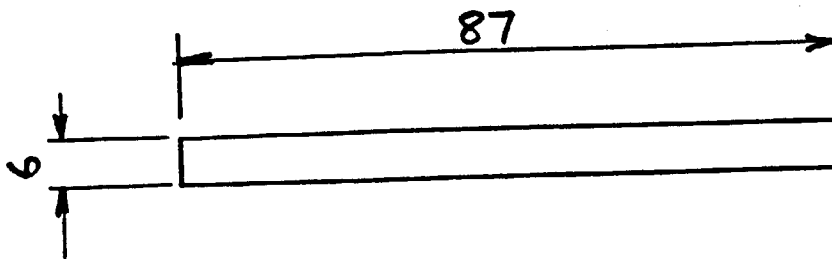
DRAWING NO
A82-415-A4

USED ON
 ASSEMBLY
A82-401A3

THIRD ANGLE
 PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G.E.C.

DATE
14/10/82



MATERIAL :- 0.25 (.010") THICK TRANSFORMER PAPER - 'ELEPHANTIDE' BRAND GRADE 3 MULTI-PLY PRESSPAPER.

SUPPLIER : BS. & W. WHITELEY LTD., POOL-ON-WHARFEDALE, OTLEY, YORKS.

MATERIAL	SEE ABOVE		
FINISH	1	14/10/82	GDB
	ISSUE	DATE	BY
	MODIFICATION		

JOB NO	SCALE 1:1	TITLE PACKING STRIP-SIDE	DRAWING NUMBER
DRAWN GDB	DIMS. IN INCHES / m.m.	'F' BAND DELAY LINE MK3	A82-415-A4
CHECKED	TOLERANCES INCH-DECIMALS ± 0.005 INCH-FRACTIONS $\pm 1/64$ METRIC ± 0.3 mm UNLESS OTHERWISE STATED		
TRACED	THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX		

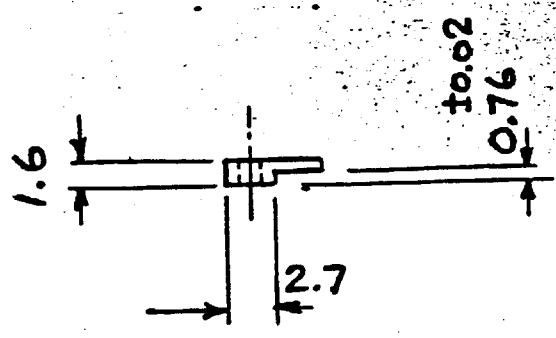
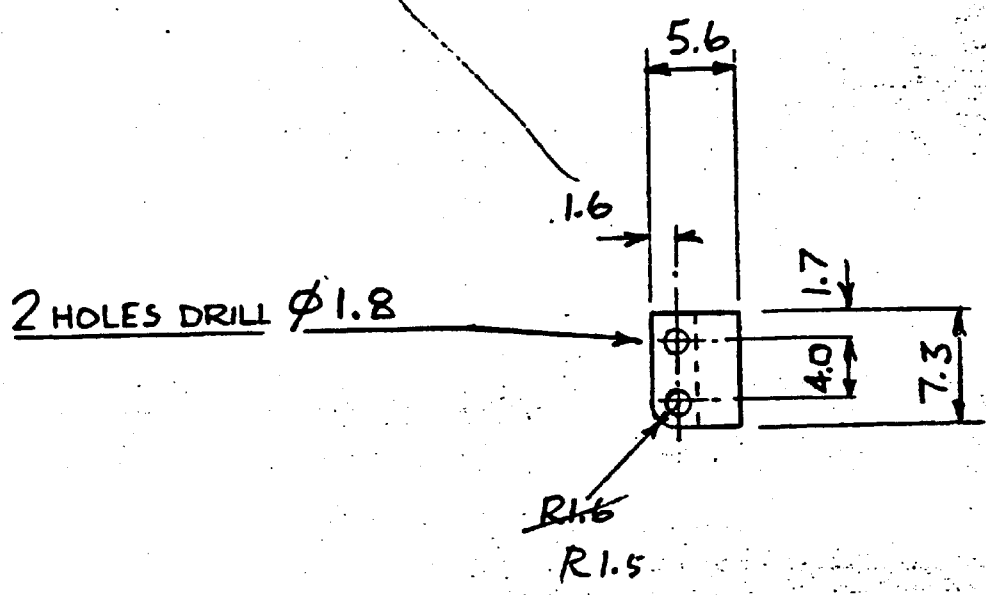
DRAWING NO. **82-419-A4**

EXHIBIT No. **19**

USED ON ASSEMBLY
A82-402A3

change to 1.5

THIRD ANGLE PROJECTION



THIS DRAWING WAS PREPARED BY THE GEN. ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DATE **6/10/82**

C	MATERIAL ALUM. ALLOY				
	GRADE HS30TF				
	FINISH	1	6/10/82	GDB	
		ISSUE	DATE	BY	MODIFICATION
JOB NO	SCALE 2:1	TITLE CLAMP FOR SUBSTRATE			DRAWING NUMBER
DRAWN GDB	DIMS. IN INCHES / m.m.	F'BAND DELAY LINE MK 3			A82-419 -A4
CHECKED	TOLERANCES				
	INCH DECIMALS ± 0.005				
	INCH FRACTIONS ± 1/64				
TRACED	METRIC ± 0.05 mm				
	UNLESS OTHERWISE STATED				

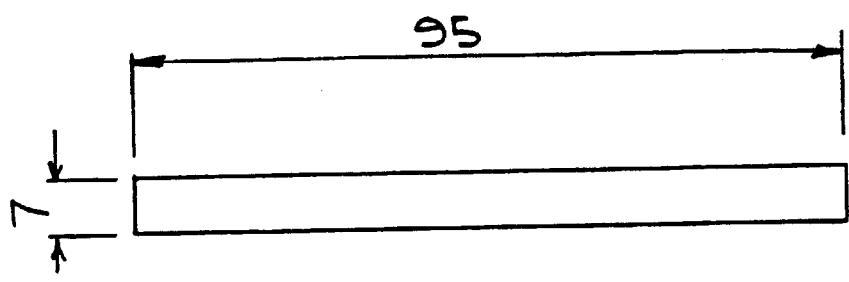
THE GENERAL ELECTRIC COMPANY LIMITED 248
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX

DR IG No
A82-417-A4

EXHIBIT No. **19** (CTD.)

USED ON ASSEMBLY
A82-401A3

THIRD ANGLE PROJECTION



THIS DRAWING WAS PREPARED BY THE GEN. EL. ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DRG N° A82-417A4/1 0.25 (.010") THICK
" - A82-417A4/2 0.13 (.005") THICK

MATERIAL: TRANSFORMER PAPER - 'ELEPHANTIDE' BRAND GRADE 3 MULTI-PLY PRESSPAPER.

SUPPLIER: BS. & W WHITELEY LTD., POOL-IN-WHARFEDALE, OTLEY, YORKS

DATE
14/10/82

C	MATERIAL: SEE ABOVE				
	FINISH -	1	14/10/82	60B	
JOB N°	SCALE 1:1	TITLE PACKING STRIPS, BOTTOM.			DRAWING NUMBER A82-417-A4
CHECKED	DIMS. IN mm / m.m.	F BAND DELAY LINE MK 3.			
TRACED	TOLERANCES ±0.005 METRIC ±0.3 mm UNLESS OTHERWISE STATED	THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.			249

DRAWING NO
82-421 -A4

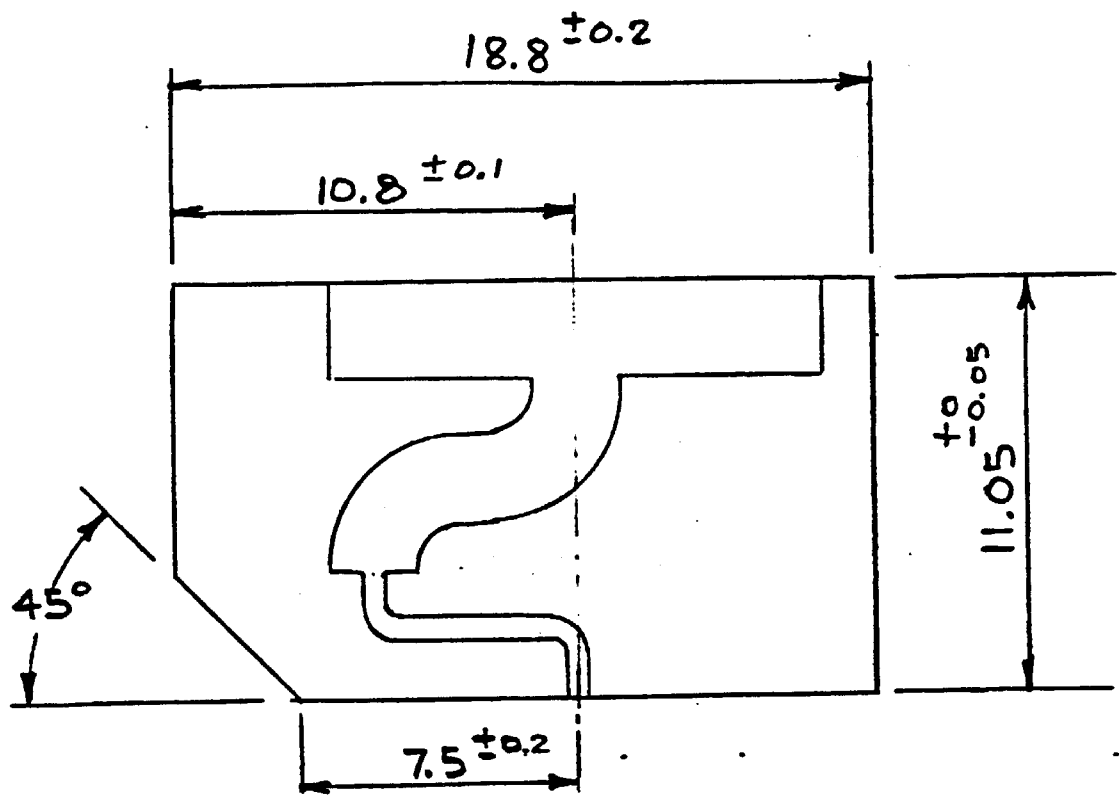
EXHIBIT No. 20

USED ON
 ASSEMBLY
A82-402A3

THIRD ANGLE
 PROJECTION

THIS DRAWING WAS PREPARED BY THE GEN. ELECTRIC
 CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL
 IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT
 PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

DATE
6/10/82



REFER TO MASK NO 2095

GOLD PATTERN 5 TO 6 μm THICK EVAPORATED
 AND PLATED ON Ni Cr UNDERLAY.
 UNDER FACE OF SUBSTRATE ENTIRELY
 COATED WITH EVAPORATED AND PLATED
 GOLD 5 TO 6 μm THICK ON Ni Cr UNDERLAY

FOR DETAILS OF PREPARATION & COATING
 REFER TO PROCESS INSTRUCTIONS

©

MATERIAL: 0.635mm
 (.025") THICK ALUMINA
 'DERANOX 995'
 (ANDERMAN & RYDER
 FINISH

1	6/10/82	GDB	-
ISSUE	DATE	BY	MODIFICATION

JOB NO
 DRAWN
GDB
 CHECKED
 TRACED

SCALE **5:1**
 DIMS. IN INCHES / m.m.
 TOLERANCES
 INCH FRACTIONS ± 1/64
 METRIC AS STATED
 UNLESS OTHERWISE STATED

TITLE **SUBSTRATE FOR
 'F' BAND DELAY LINE MK3**

DRAWING NUMBER
A82-421 -A4

THE GENERAL ELECTRIC COMPANY LIMITED,
 HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX **250**

DRAWING NO

82-420-A4

EXHIBIT No.

20

(CTD.)

USED ON ASSEMBLY

A82-402A3

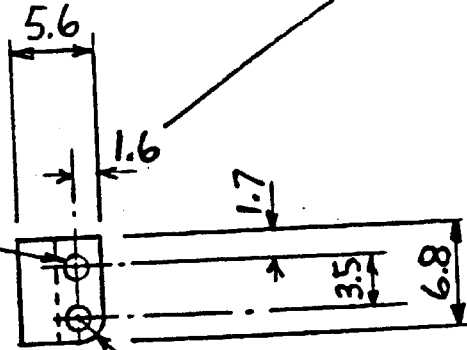
THIRD ANGLE PROJECTION

THIS DRAWING WAS PREPARED BY THE GEN. ELECTRIC CO LTD AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE G. E. C.

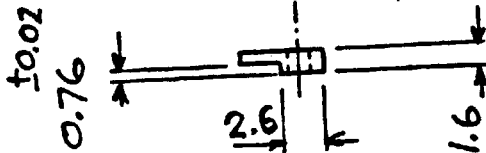
DATE

6/10/82

2 HOLES
DRILL $\phi 1.8$



R1.6 R1.5



MATERIAL ALUM. ALLOY
GRADE HS30TF

FINISH

6/10/82 GDB

MODIFICATION

JOB NO

SCALE 2:1

TITLE CLAMP FOR SUBSTRATE

DRAWING NUMBER

DRAWN GDB

DIMS. IN INCHES / m.m.

F'BAND DELAY LINE MK3

A82-420-A

CHECKED

TOLERANCES
INCH DECIMALS ± 0.005
INCH FRACTIONS $\pm 1/64$
METRIC ± 0.05 mm
UNLESS OTHERWISE STATED

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

TRACED

Patent No. 2051003 B DRG

DWG No.	TITLE	ISS	REMARKS
A82-398 A3	ASSEMBLY	1	
398 A4	ITEM LIST	1	
398 A4	DRAWING LIST (2 SHEETS)	1	(THESE SHEETS)
399 A3	SUB-ASS'Y	1	
399 A4	ITEM LIST	1	
400 A3	SUB-ASS'Y	1	
400 A4	ITEM LIST	1	
401 A3	SUB-ASS'Y	1	
401 A4	ITEM LIST	1	
402 A3	SUB-ASS'Y	1	
402 A4	ITEM LIST	1	
403 A3	OUTLINE DRG	1	
404 A3	SEALING GASKET	1	
405 A4	LABEL	1	
406 A4	CLAMP PLATE	1	
407 A4	PACKING STRIP, TOP	1	
408 A3	LID	1	
409 A4	RETAINING SCREW	1	
410 A4	CAPTIVE SCREW	1	
411 A4	DELAY ROD	1	
412 A4	" "	1	
413 A4	" "	1	

DATE 20/10/82



JOB No			
DRAWN		1	20/10/82
GDB		ISS MOD	DATE SIG.

CHECK	THE GENERAL ELECTRIC COMPANY LIMITED FIRST RESEARCH CENTRE, WEMBLEY, MIDDX.	G.E.C. DRG. LIST FOR A82-398 A3
-------	--	---

TRACED	TITLE ASSEMBLY OF 'F' BAND DELAY LINE MK 3.	SHEET 1 OF 2 SHEETS	DRG. LIST A82-398 A4 ²⁵²
--------	--	---------------------------	---

USED ON

ITEM	DRAWING No.	TITLE	ISS	REMARKS
	A82-414A4	CLAMP PLATE	1	
	A82-415A4	PACKING STRIP-SIDE	1	
	A82-416A4	EARTH STRIP	1	
	A82-417A4	PACKING STRIP-BOTTOM	1	
	A82-418A2	BOX	1	
	A82-419A4	CLAMP FOR SUBSTRATE	1	
	A82-420A4	" " "	1	
	A82-421A4	SUBSTRATE	1	
	A75-391A4	LABEL	1	

DATE 20/10/82



JOB No

DRAWN:

IDB

CHECK

ISS 1 20/10/82 GDB
 DATE SIG.

THE GENERAL ELECTRIC COMPANY LIMITED
 FIRST RESEARCH CENTRE, WEMBLEY, MIDD.

G.E.C. DRG LIST FOR
 A82-398 A3

253

TRACED

TITLE ASSEMBLY OF 'F' BAND
 DELAY LINE MK 3

SHEET 2 OF 2 SHEETS

DRG LIST
 A82-398 A4

ISSUED ON

ITEM	DRAWING No.	TITLE	No OFF	REMARKS
1	A82-399 A3	SUB-ASS'Y OF BOX	1	
2	A82-400 A3	" " " LID	1	
3	A82-404 A3	SEALING GASKET	1	
4	A82-405 A4	LABEL	1	
5	A75-391 A4	LABEL	1	
6	N.D.	SCREWS. C'SK H'D. M2 x 5 LONG STAINLESS STEEL	19	
	A82-403 A3	OUTLINE DRAWING.		

DATE 14/10/82

U

C

DB No

RAWN

ADB

CHECK

RACED

1 14/10/82
ISSUED DATE SIG.

THE GENERAL ELECTRIC COMPANY LIMITED
FIRST RESEARCH CENTRE, WEMBLEY, MIDDX.

G.E.C. ITEM LIST FOR
A82-398 A3

ASSEMBLY OF 'F' BAND
DELAY LINE MK3

SHEET OF SHEETS

ITEM LIST
A82-398 A4

EDON
98A3DATE
13/10/82

ITEM	DRAWING No.	TITLE	No OFF	REMARKS
1	A82-401 A3	SUB-ASS'Y OF BOX & DELAY ROD	1	
2	A82-406 A4	CLAMP PLATE	1	
3	A82-407 A4	PACKING STRIP, TOP	AS REQ ^d	
4	N.D.	SCREW, C/SK HD M2.5 x 8 LUNG STAINLESS STEEL	3	

JOB No

DRAWN

GDB

CHECK

TRACED

1 13/10/82 GDB

155
MOD DATE SIG.

THE GENERAL ELECTRIC COMPANY LIMITED
FIRST RESEARCH CENTRE, WEMBLEY, MIDD.

G.E.C. ITEM LIST FOR

A82-399 A3

TITLE SUB-ASS'Y OF BOX & ROD CLAMP
PLATE - F BAND DELAY ROD. MK 3

SHEET
OF
SHEETS

ITEM LIST

A82-399 A4

255

USED
32-399A3

ITEM	DRAWING No.	TITLE	No OFF	REMARKS
1	A82-402 A3	SUB-ASSY OF BOX WITH SUBSTRATE	1	
2	(A82-411 A4	DELAY ROD	1	
	A82-412 A4			
	A82-413 A4			
3	A82-414 A4	CLAMP PLATE	1	
4	A82-415 A4	PACKING STRIP - SIDE	1	
5	A82-416 A4	EARTH STRIP	1	
6	A82-417 A4	PACKING " - BOTTOM	AS REQ	
7	N.D.	SCREW, HEX. SOCKET GRUB, M3x4 LONG. STAINLESS STEEL	2	

DATE
14/10/82

U

JOB No			
DRAWN	GDB.	1	14/10/82 GDB
CHECK		ISS	DATE SIG.
TRACED		MOD	

CHECK THE GENERAL ELECTRIC COMPANY LIMITED
FIRST RESEARCH CENTRE, WEMBLEY, MIDDX.

TRACED TITLE SUB-ASSY OF BOX WITH
DELAY ROD. 'F'BAND DELAY
LINE MK 3

G.E.C. ITEM LIST FOR
A82-401 A3
ITEM LIST **256**
A82-401 A4

SHEET OF SHEETS

USED ON 82-39878

ITEM	DRAWING No.	TITLE	No OFF	REMARKS
1	A82-408 A3	LID	1	
2	A82-409 A4	RETAINING PILLAR FOR SCREW	4	
3	A82-410 A4	CAPTIVE SCREW	4	
4	N.D.	WASHER - PLAIN M3	4	STAINLESS STL

DATE 7/10/82



JOB No				
DRAWN	GDB	1	7/10/82	GDB
CHECK		ISS	MOD	DATE
				SIG.

CHECK THE GENERAL ELECTRIC COMPANY LIMITED
HIRST RESEARCH CENTRE, WEMBLEY, MIDDX. G.E.C. ITEM LIST FOR A82-400 A3

TRACED 2051003B DRG TITLE SUB-ASS'Y OF LID - Patent No. 2051003B DRG SHEET 257 A82-400 A4
F BAND DELAY LINE MK 3 SHEETS

ITEM	DRAWING No.	TITLE	No OFF	REMARKS
1	A82-418 A2	Box	1	
2	A82-419 A4	CLAMP FOR SUBSTRATE	1	
3	A82-420 A4	" " "	1	
4	A82-421 A4	SUBSTRATE	1	
5	N.D.	P.T.F.E. SHEET 0.254mm (0.010") THICK	2	CUT TO FIT
6	N.D.	SCREW, CH'SE H'D M1.6 X 4 LONG. STAINLESS STEEL	4	
7	N.D.	CONNECTOR - CABLEWAY SYSTEMS LTD. PART NO 705971-027	1	

SECTION 401A3

DATE 13/10/82

Ⓢ

DB No	
DRAWN BY	—
DATE	13/10/82
MOD	GDB
SIG.	

CHECK THE GENERAL ELECTRIC COMPANY LIMITED FIRST RESEARCH CENTRE, WEMBLEY, MIDDX. G.E.C. ITEM LIST FOR **A82-402 A3**

DRAWN BY TITLE SUB-ASSY OF Box & SUBSTRATE - SHEET OF SHEETS ITEM LIST ~~FOR~~ **A82-402 A4**

DRAWING NUMBER
A82-398-A3

USED ON
ASSEMBLY

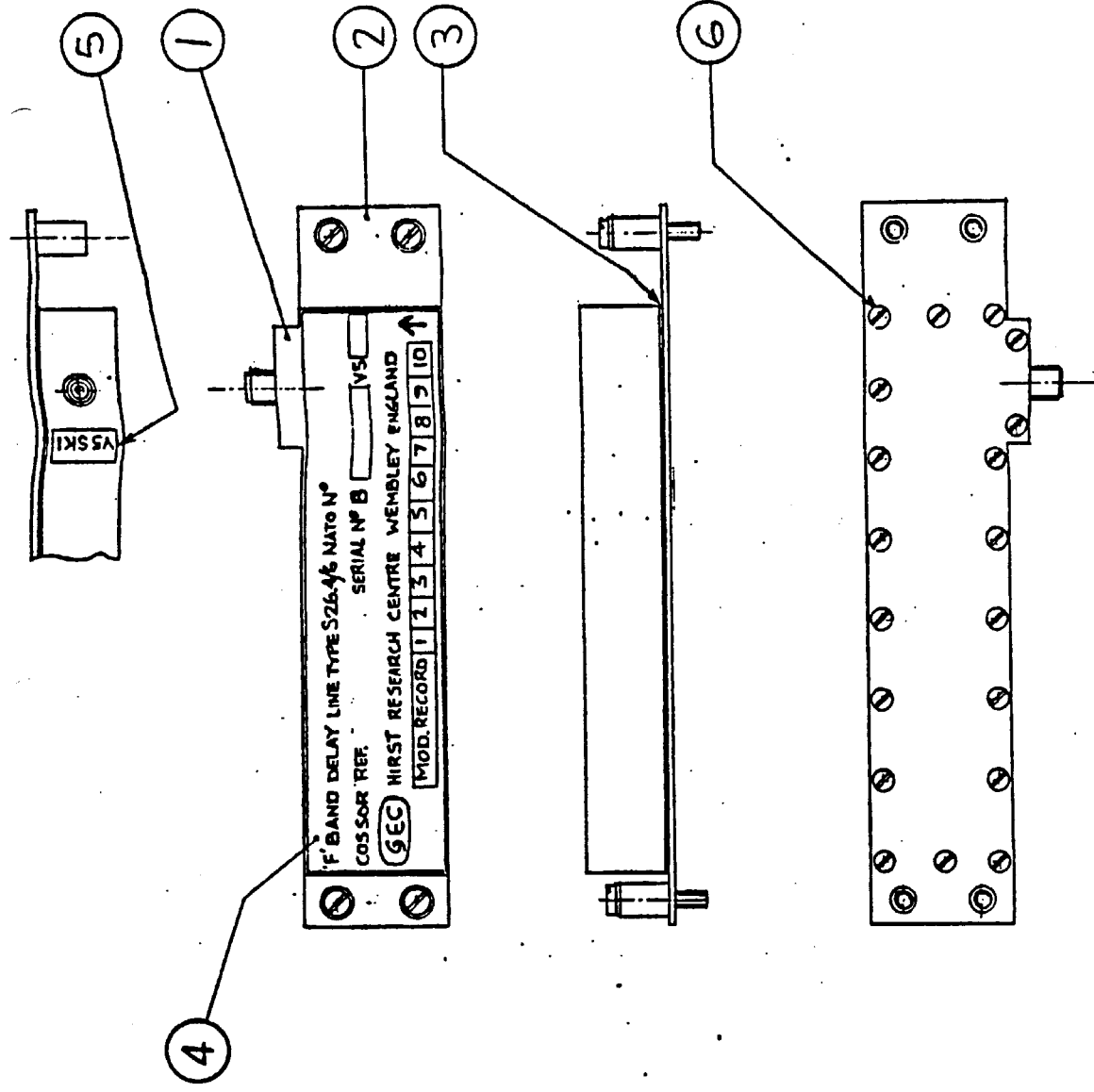
THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PERMISSION WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

DATE
14/10/82



JOB No.	
DRAWN	GD
CHECKED	GD
TRACED	GD
DATE	14/10/82
BY	GD



FOR OUTLINE DRG. SEE A82-403 A2
FOR ITEM LIST SEE A82-398 A4

TITLE		DRAWING No.	
ASSEMBLY OF		A82-398-A3	
'F' BAND DELAY LINE MK3			
SCALE 1:1	TOLERANCES	DIM'S IN INCHES. UN	
		INCH-DECIMALS → 0.005	
		MILS → 0.001	
		MILS → 0.001	
		UNLESS OTHERWISE SPECIFIED	
MATERIAL		FINISH PAINT - PRIMER: GREY FINISH: MATT OLIVE DRAB. (BOTH - 2 PACK EPOXY TO DTD. 555A)	
MODIFICATION		ECR	

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

DRAWING NUMBER
A82-398-A3

USED ON
ASSEMBLY

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

DATE
14/10/82

JOB No.

DRAWN
GDB

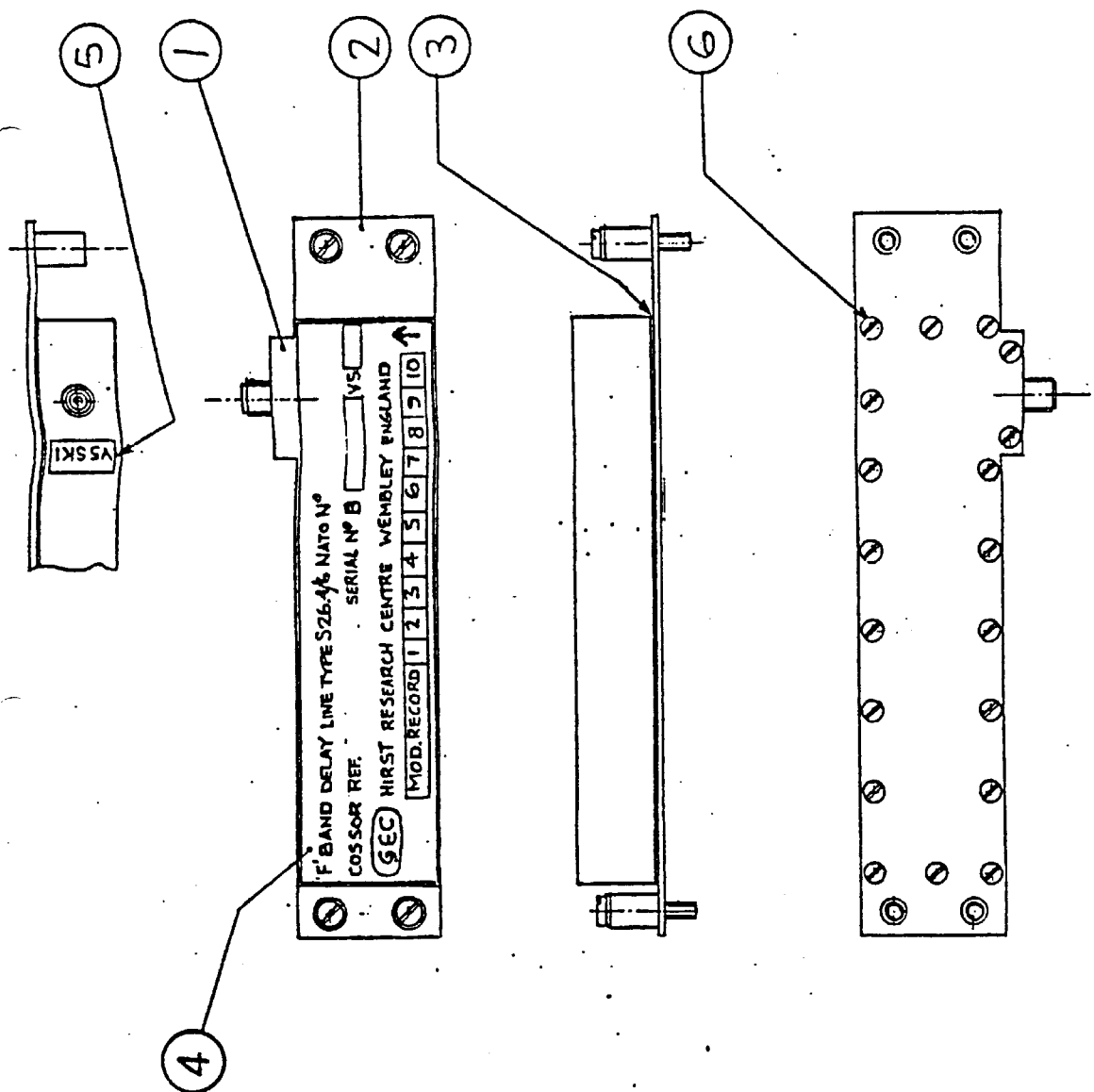
CHECKED
GDB

TRACED
GDB

DATE BY

MODIFICATION

ECR



FOR OUTLINE DRG. SEE A82-403 A2

FOR ITEM LIST SEE A 82-398 A4

SCALE	1:1	TITLE	ASSEMBLY OF 'F' BAND DELAY LINE Mk3	DRAWING No.	A82-398-A3
DIMS IN METRES. mm					
TOLERANCES	mm				
mm	0.003				
mm	0.005				
mm	0.010				
mm	0.020				
mm	0.050				
mm	0.100				
mm	0.200				
mm	0.500				
mm	1.000				
mm	2.000				
mm	5.000				
mm	10.000				
mm	20.000				
mm	50.000				
mm	100.000				
mm	200.000				
mm	500.000				
mm	1000.000				
MATERIAL		FINISH PAINT - PRIMER: GREY FINISH: MATT OLIVE DRAB. (Both - 3 PACK EPOXY TO D.P. 555A)			

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

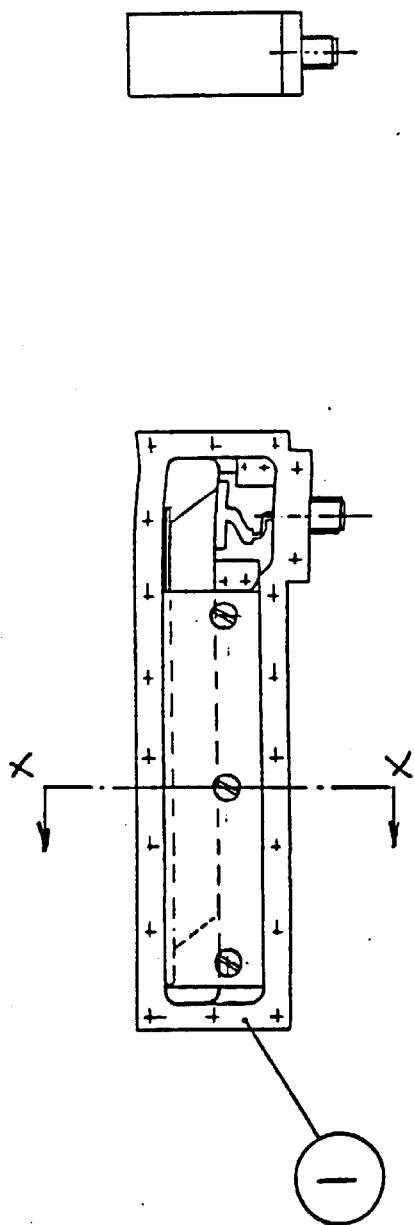
DRAWING NUMBER
A 82-399-A3

USED ON
ASSEMBLY
82-399-A3

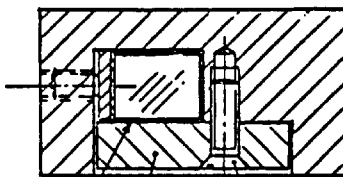
THIRD ANGLE
PROJECTION

ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS
IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR
REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY
FROM THE GENERAL ELECTRIC CO. LTD.

13/10/82



NUMBER & THICKNESS OF PAPER STRIPS TO SUIT ASS'Y
(DELAY ROD TO BE FIRMLY CLAMPED)



LOCK SCREWS WITH CELLULOSE NITRATE VARNISH

FOR ITEM LIST SEE A82-399A4.

SECTION ON XX- SCALE 2:1

3 No. 200 CHECKED DATED	1982	13/10/82	GDB	DATE	BY	ECR
TITLE SUB-ASS'Y OF BOX WITH ROD CLAMP PLATE - 'F' BAND DELAY ROD MK3		SCALE 1:1 & 2:1 DIMS IN MILLIMETRES AND INCHES TOLERANCES FRACTIONS DECIMALS INCHES MILLIMETRES 1/16" 0.0015" 0.0015" 0.0015"		DRAWING No. A 82-399-A3 THE GENERAL ELECTRIC COMPANY LIMITED FIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.		

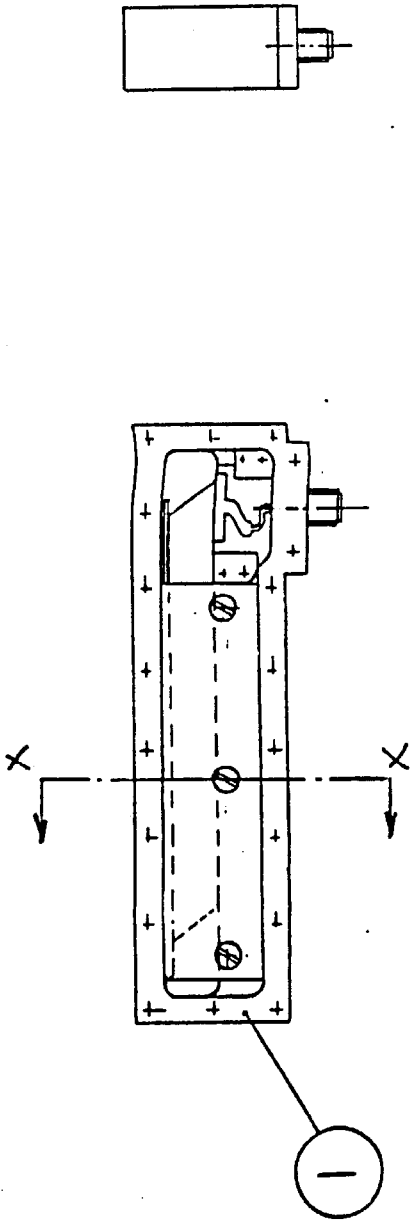
DRAWING NUMBER
A 82-399-A3

USED ON
ASSEMBLY
82-399A3

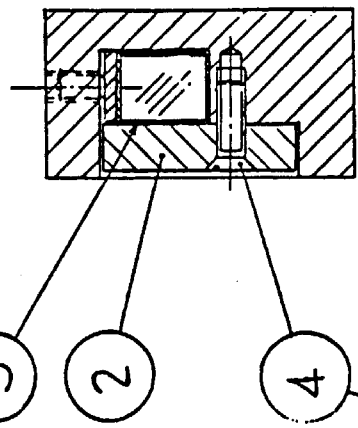
THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PERMISSION AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

13/10/82



NUMBER & THICKNESS OF PAPER STRIPS TO SUIT ASS'Y
(DELAY ROD TO BE FIRMLY CLAMPED)



LOCK SCREWS WITH CELLULOSE NITRATE VARNISH

FOR ITEM LIST SEE A82-399A4.

DRAWING No.		A 82-399-A3	
TITLE		SUB-ASS'Y OF BOX WITH ROD CLAMP PLATE - 'F' BAND DELAY ROD MK 3	
SCALE		1:1 & 2:1	
DIMENSIONS		INCH	
TOLERANCES		FRACTIONS	
FINISH		E.C.R.	
MATERIAL		-	
MODIFICATION		-	
DATE		13/10/82	
ISSUE		292	
CHECKED		GDB	
DRAWN		GDB	
BY		GDB	
DATE		13/10/82	
ISSUE		292	
MODIFICATION		-	
DATE		13/10/82	
ISSUE		292	
CHECKED		GDB	
DRAWN		GDB	
BY		GDB	
DATE		13/10/82	
ISSUE		292	

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

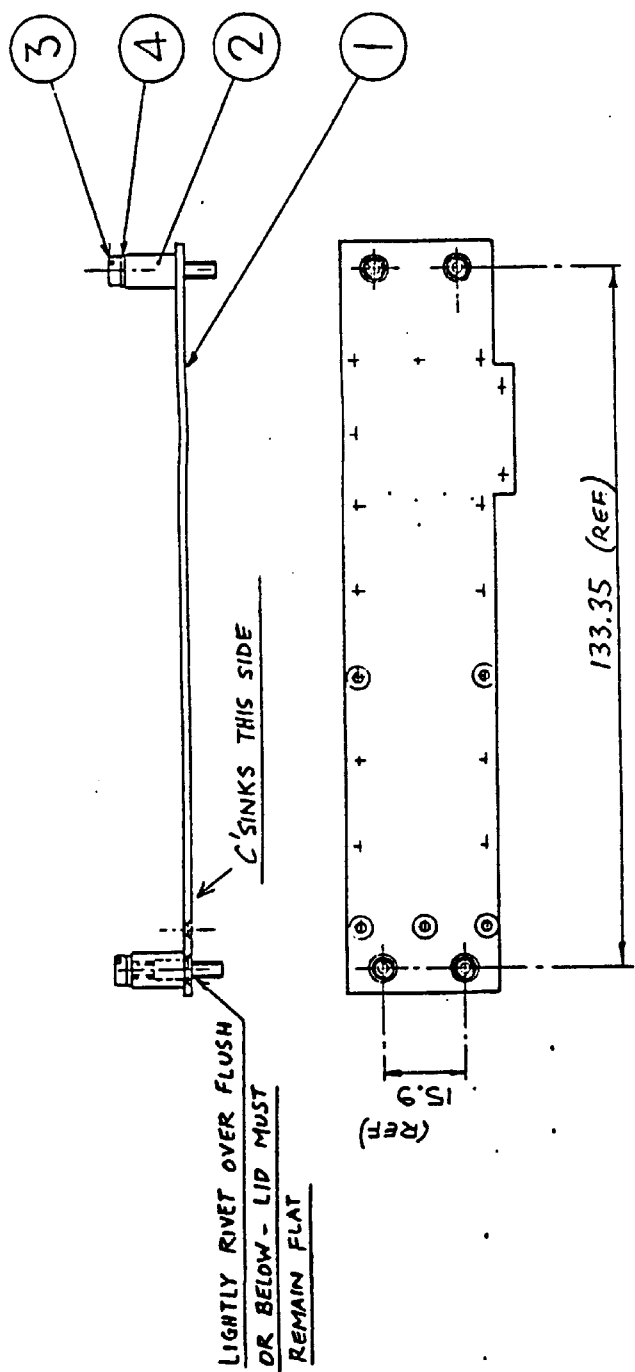
DRAWING NUMBER
A82-400 -A3

USED ON
 ASSEMBLY
 182-398A3

THIRD ANGLE
 PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

7/10/82



JOB No.
 DRAWN BY
 CHECKED
 TRACED
 ISSUE DATE
 28
 29
 30
 31
 32
 33
 34
 35
 36
 37
 38
 39
 40
 41
 42
 43
 44
 45
 46
 47
 48
 49
 50
 51
 52
 53
 54
 55
 56
 57
 58
 59
 60
 61
 62
 63
 64
 65
 66
 67
 68
 69
 70
 71
 72
 73
 74
 75
 76
 77
 78
 79
 80
 81
 82
 83
 84
 85
 86
 87
 88
 89
 90
 91
 92
 93
 94
 95
 96
 97
 98
 99
 100

ISSUE DATE
 MODIFICATION
 ECR

MATERIAL
 FINISH

SCALE 1:1
 THIS DRAWING IS IN
 TOLERANCES
 UNLESS OTHERWISE SPECIFIED
 DIMENSIONS IN MILLIMETERS
 DIMENSIONS IN INCHES
 DIMENSIONS IN FEET AND INCHES

TITLE
 SUB-ASS'Y OF LID
 F BAND DELAY LINE MK3

DRAWING No.
A82-400 -A3
 FOR ITEM LIST SEE A82-400 A4
 THE GENERAL ELECTRIC COMPANY LIMITED,
 HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

DRAWING NUMBER
A82-401-A3

USED ON
ASSEMBLY
882-399A

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. FROM THE GENERAL ELECTRIC CO. LTD. IS REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY. IN COMMERCIAL, IT MUST NOT BE USED, DISCLOSED OR

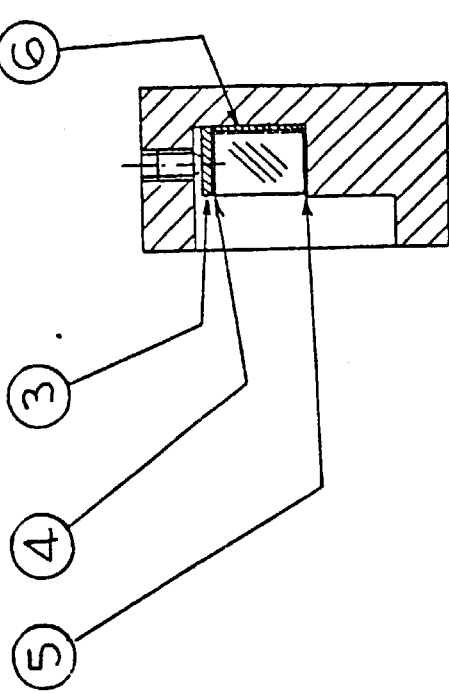
14/10/82



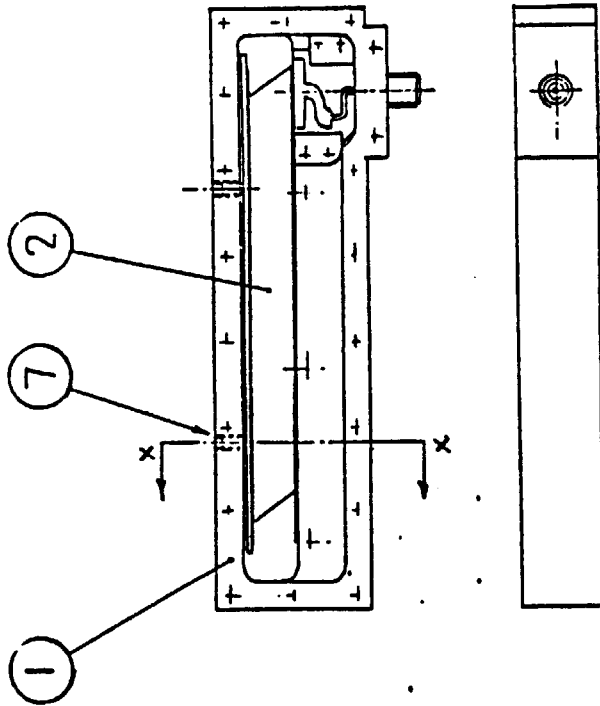
POSITION DELAY ROD LONGITUDINALLY SO THAT CHOSEN GOLD WIRE IS OPPOSITE $\frac{1}{2}$ OF CONNECTOR.

JOIN GOLD WIRE TO GOLD PAD ON SUBSTRATE WITH SPOT OF 'SILVER DAG'

NUMBER OFF & THICKNESS OF PAPER STRIPS TO SUIT POSITION OF CHOSEN GOLD WIRE RELATIVE TO UPPER FACE OF SUBSTRATE.



SECTION ON XX
SCALE 2:1



SCREWS ITEM 7 TO BE LOCKED WITH CELLULOSE NITRATE VARNISH.
REFER ALSO TO PROCESS INSTRUCTIONS.

FOR ITEM LIST SEE A82-401A4
DRAWING No. **A82-401-A3**

TITLE SUB-ASSY OF BOX WITH DELAY ROD -
F BAND DELAY LINE Mk3

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

SCALE: 1 & 2:1	CONVERSION FACTORS
INCHES TO MILLIMETERS	1 INCH = 25.4 MILLIMETERS
MILLIMETERS TO INCHES	1 MILLIMETER = 0.03937 INCHES
METRIC	1964

JOB NO.	ISSUE	DATE	BY	MODIFICATION	MATERIAL	FINISH	ECR
264	1	14/10/82	GDB				

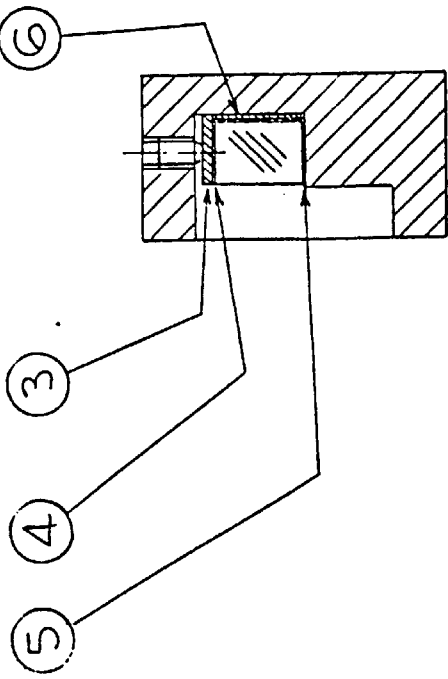
DRAWING NUMBER
A82-401-A3

USED ON
ASSEMBLY
Apr-399A

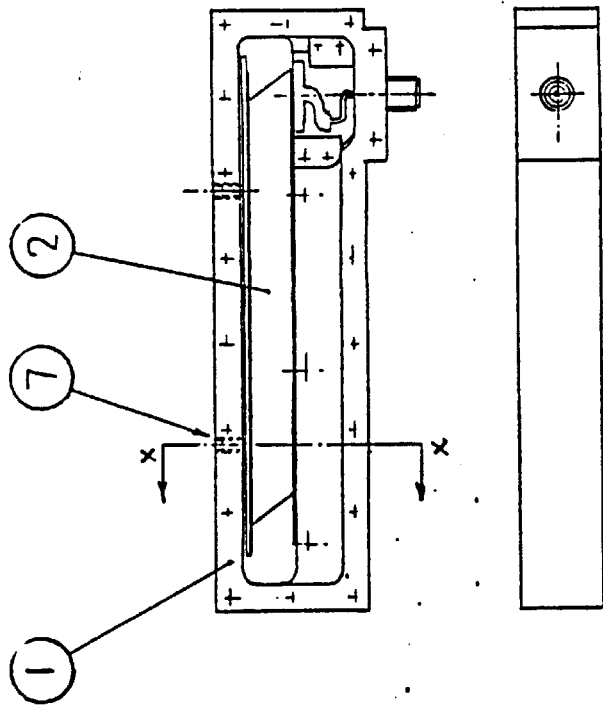
POSITION DELAY ROD LONGITUDINALLY SO THAT CHOSEN
GOLD WIRE IS OPPOSITE ϕ OF CONNECTOR.

JOIN GOLD WIRE TO GOLD PAD ON SUBSTRATE WITH SPOT OF "SILVER DAG"

NUMBER OFF & THICKNESS OF PAPER STRIPS
TO SUIT POSITION OF CHOSEN GOLD WIRE
RELATIVE TO UPPER FACE OF SUBSTRATE.



SECTION ON XX
SCALE 2:1



SCREWS ITEM 7 TO BE LOCKED WITH CELLULOSE NITRATE VARNISH
REFER ALSO TO PROCESS INSTRUCTIONS.

FOR ITEM LIST SEE A82-401A4

DRAWING No.

A82-401-A3

TITLE
SUB-ASSY OF BOX WITH
DELAY ROD -
FBAND DELAY LINE Mk3

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

SCALE: 1 & 2:1	DIMS IN INCHES / MM
TOLERANCES	
INCH DECIMALS ± 0.001	
INCH FRACTIONS ± 1/64	
METRIC	
Light microscope	

JOB No.	MATERIAL	FINISH	MODIFICATION	DATE	BY	ECR
295				14/10/82	GDB	
DRAWN						
CHECKED						
TRACED						

©

14/10/82

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

THIRD ANGLE PROJECTION

DRAWING NUMBER
A82-402-A3

USED ON
ASSEMBLY
A82-401A3

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, REPRODUCED OR REPRODUCED WITHOUT PERMISSION FROM THE GENERAL ELECTRIC CO. LTD.

DATE
13/10/82



JOB No.

DRAWN
22

CHECKED
53

TRACED
53

ISSUE DATE
13/10/82

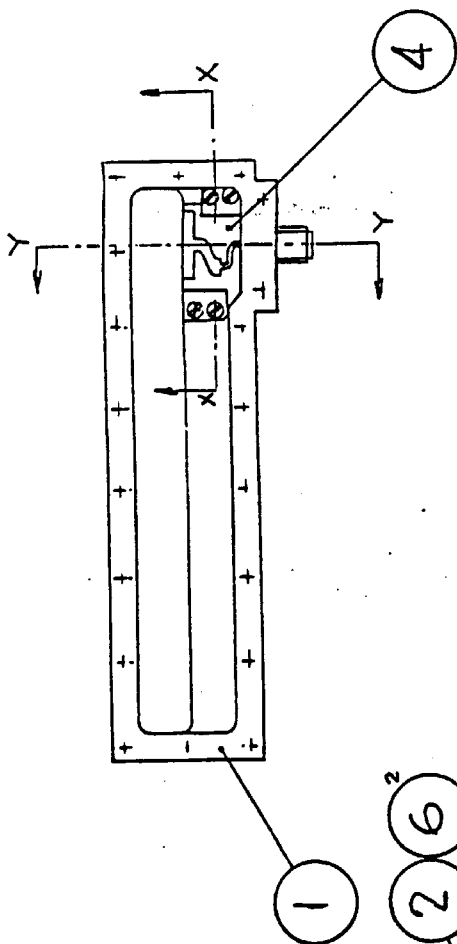
BY
abb

MODIFICATION

ECR

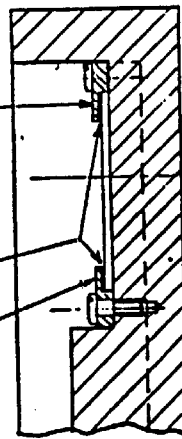
MATERIAL

FINISH



CENTRE CONDUCTOR OF CONNECTOR SHOULD TOUCH TANGENTIALLY ON SUBSTRATE TRACK & BE JOINED TO TRACK WITH CONDUCTIVE ADHESIVE (OR BONDED GOLD TAPE)

ITEM 5 (0.254 mm ± 0.010 THICK P.T.F.E.) CUT TO FIT



SECTION ON XX - SCALE 2:1

FOR ITEM LIST SEE A82-402A4

SCALE 1:1 & 2:1	DIMS IN INCHES - MM
TOLEANCES	
INCH DIMENSIONS - 0.005	
INCH DIMENSIONS - 0.010	
METRIC DIMENSIONS - 0.050	
METRIC DIMENSIONS - 0.100	

TITLE
SUB-ASSY OF BOX & SUBSTRATE - 'F' BAND DELAY LINE MK 3

DRAWING No.

A82-402-A3

THE GENERAL ELECTRIC COMPANY LIMITED
FIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

DRAWING NUMBER
A82-403-A3

USED ON
ASSEMBLY
PARTS LIST

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, REPRODUCED OR TRANSMITTED IN ANY MANNER WITHOUT WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

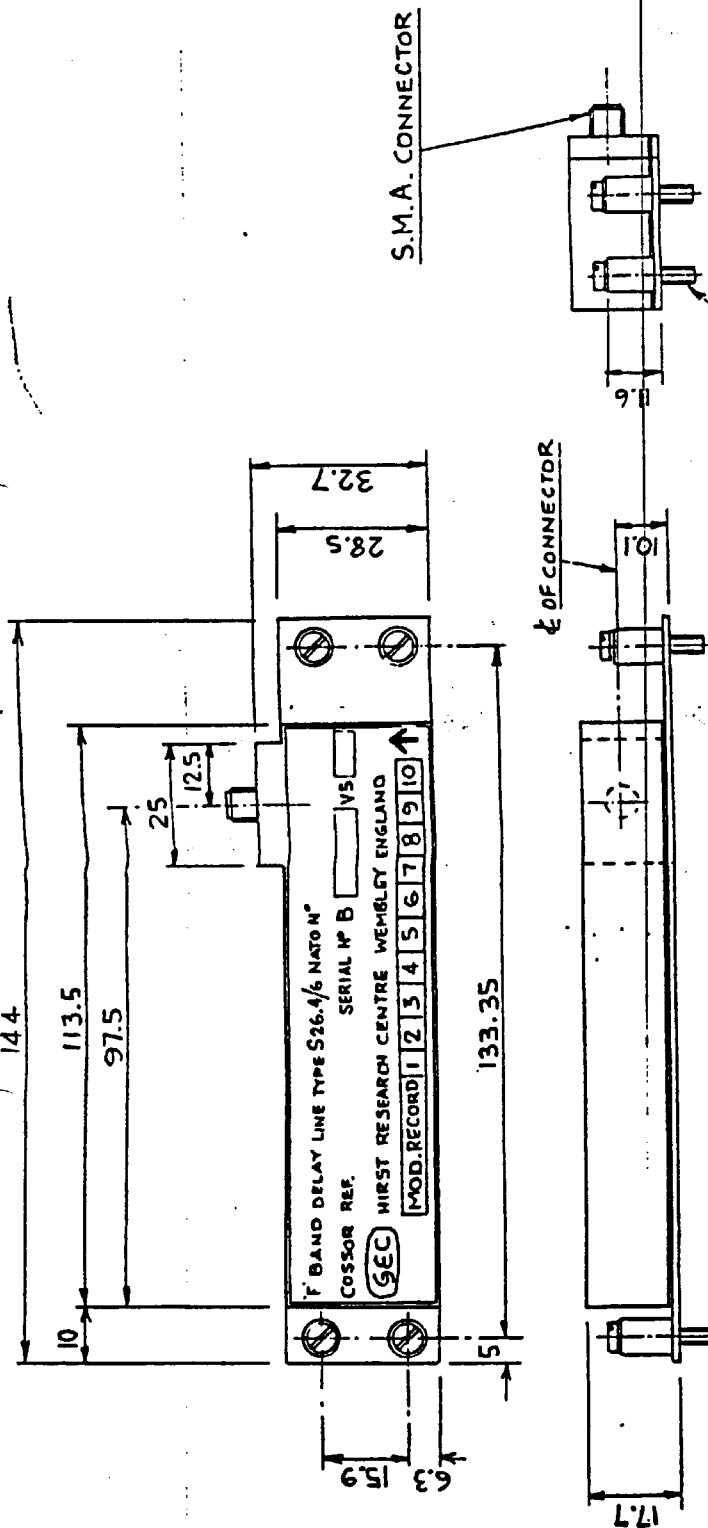
20/10/82



28 No.
DRAWN
CHECKED
TRACED

20/10/82
GDB
GDB

DATE BY
E.C.R.



FOR ASSEMBLY SEE A82-398 A3

SCALE 1:1		TITLE OUTLINE DRAWING		DRAWING No	
TOLERANCES UNLESS OTHERWISE SPECIFIED		F BAND DELAY LINE Mk3		A82-403-A3	
MATERIAL		FINISH		THE GENERAL ELECTRIC COMPANY LIMITED, HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	
MODIFICATION		ECR		PAGE 8 of 10 PAGES	

AWING NUMBER
82-403-A3

SEE ON
DRAWING
1-398A3

THIRD ANGLE
PROJECTION

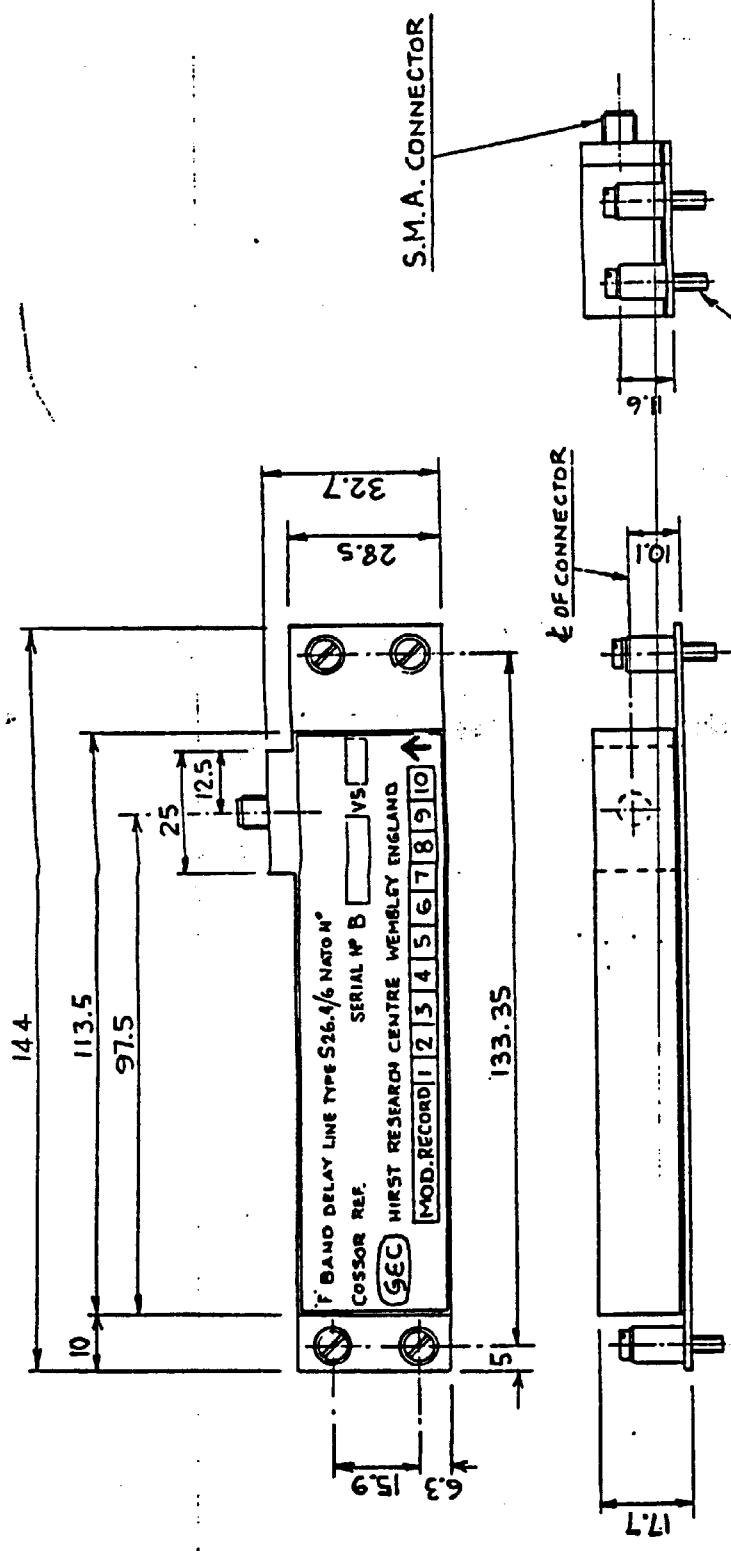
ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS
IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR
REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY
FROM THE GENERAL ELECTRIC CO. LTD.

20/10/82

©

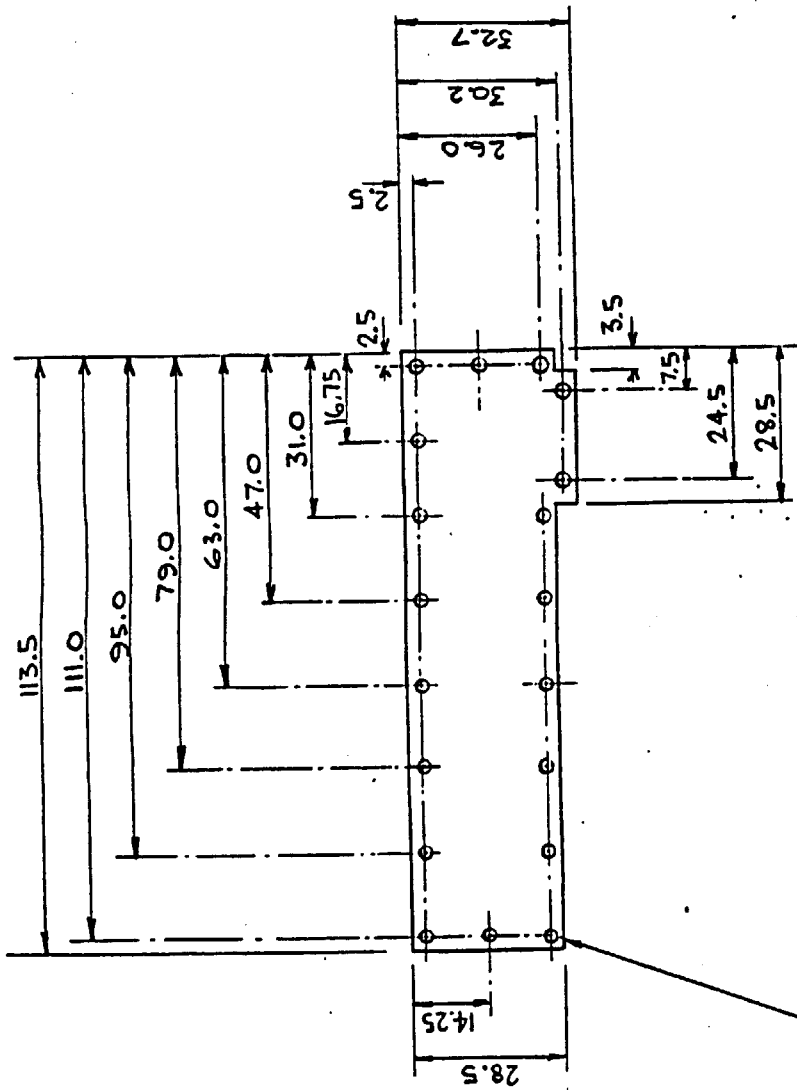
3. No.
DATE BY
20/10/82 GDB
RECORDED
INDEXED

PAGE 8 OF 10 PAGES



FOR ASSEMBLY SEE A82-398 A3

DRAWING No		A82-403 -A3	
TITLE		F BAND DELAY LINE Mk3	
SCALE 1:1	TOLERANCES TO WHICH DIMENSIONS ARE TO BE MADE	THE GENERAL ELECTRIC COMPANY LIMITED, HIROSE RESEARCH CENTRE, WEMBLEY, MIDDLESEX.	
MATERIAL	FINISH	E.C.R.	
MODIFICATION	DATE BY	20/10/82 GDB	



19 HOLES ϕ 2.2

DRAWING NUMBER
A82-404-A3

USED ON
ASSEMBLY
A82-404-A3

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC COMPANY, LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, REPRODUCED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC COMPANY, LTD.

DATE
20/10/82



JOB No.

DRAWN
GAB

CHECKED
GAB

TRACED

ISSUE

DATE

BY

MODIFICATION

ECP

MATERIAL "ECCOSHIELD" CLV
0.5 (0.020") THICK. SUPPLIED BY
EMERSON & CUMING
FINISH

SCALE 1:1

DIMS IN mm ± 0.15 / mm
TOLERANCES
MICH. DECIMALS ± 0.004
METRICS 0.1 mm
Unless otherwise noted

TITLE GASKET -

'F' BAND DELAY LINE MK3

DRAWING No.

A82-404-A3

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST, RESEARCH CENTRE, WEMBLEY, MIDDLESEX.

93311

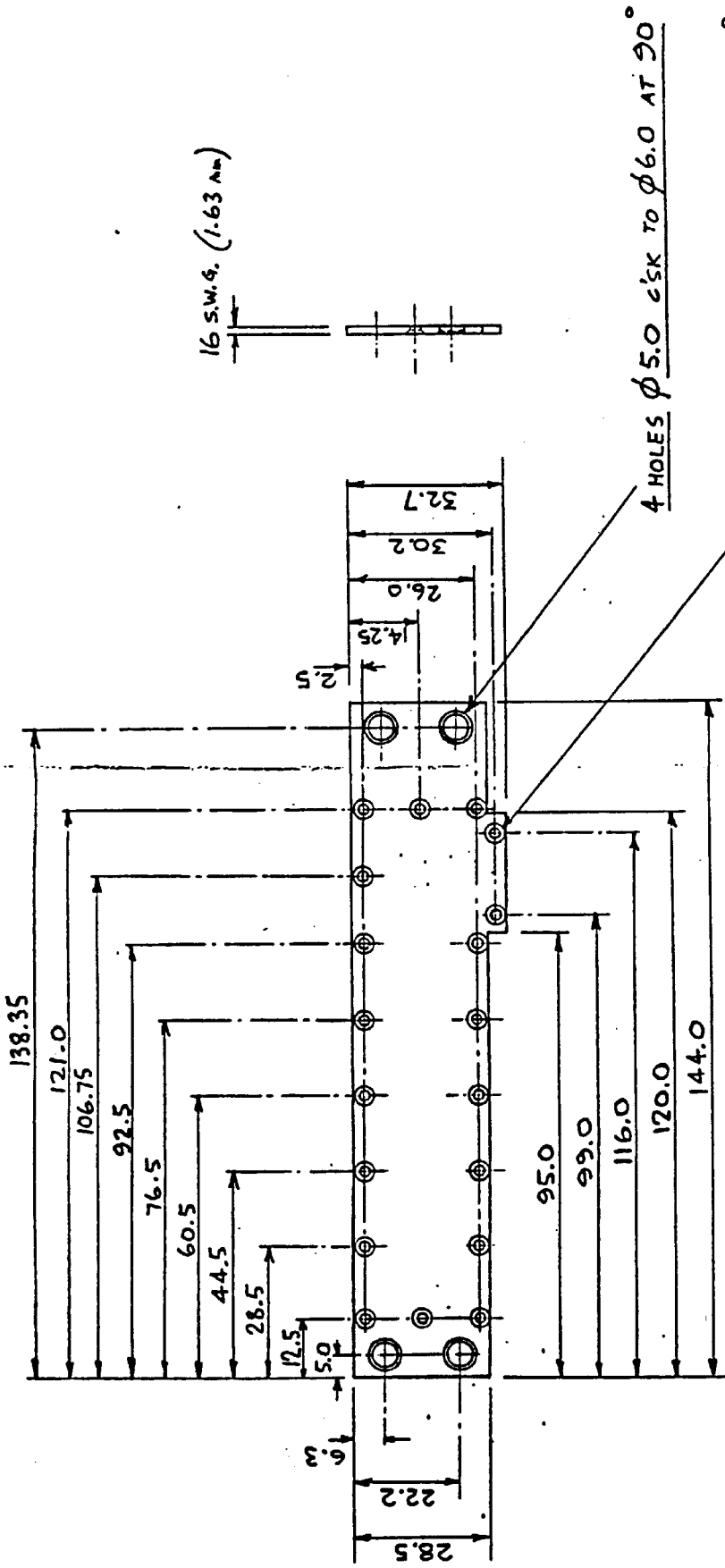
DRAWING NUMBER
A82-408-A3

USED ON
ASSEMBLY
A82-408A3

THIRD ANGLE
PROJECTION

THIS DRAWING WAS PREPARED BY THE GENERAL ELECTRIC CO. LTD. AND THE INFORMATION IT CONTAINS IS CONFIDENTIAL. IT MUST NOT BE USED, DISCLOSED OR REPRODUCED WITHOUT PRIOR WRITTEN AUTHORITY FROM THE GENERAL ELECTRIC CO. LTD.

7/10/82



REMOVE SHARP EDGES & CORNERS

1/2 Lsd

JOB No.	DRAWING No.		TITLE	DRAWING No.
	A82-408A3			
DRAWN GDB	SCALE 1:1		MATERIAL	FINISH
	DIMENSIONS IN MILLIMETERS			
CHECKED	TOLERANCES		METRIC	UNITED STATES
TRACED	FRACTIONS			
DATE	BY	MODIFICATION	ECR	
7/10/82	GDB			
99				

THE GENERAL ELECTRIC COMPANY LIMITED,
HIRST RESEARCH CENTRE, WEMBLEY, MIDDLESEX.