AIR PUBLICATION

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TRANSMITTER, TYPES T10158, T10158A, T16719, T10158B, T16719A (MARCONI HS31 (MODIFIED), HS31A, HS31/1 AND HS31A/1)

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

L. T. Dunnett

(Ministry of Defence)

FOR USE IN THE
ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

TRANSMITTER, TYPES T.10158, T.10158A, T.16719, T.10158B, T.16719A

(MARCONI 3.5 kW H.F. I.S.B. TELEGRAPH/TELEPHONE TRANSMITTER TYPES HS31, HS31 (Modified), HS31A, HS31/1 AND HS31A/1)

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FIRST AID IN CASE OF ELECTRIC SHOCK

DO NOT TOUCH THE VICTIM WITH YOUR BARE HANDS until the circuit is broken

SWITCH OFF. If this is not possible, PROTECT YOURSELF with dry insulating material and pull the victim clear of the conductor.

THE EXPIRED AIR METHOD OF ARTIFICIAL RESPIRATION

(Approved by the Royal Life Saving Society)

1. Lay the patient on his back with his arms to his sides. If on a slope have the stomach slightly lower than the chest. Make a brief inspection of the mouth and throat to ensure that they are clear of obvious obstruction.

2. Kneel on one side of the patient level with his head, place one hand under his neck and the other on top of his head. (Fig.1).
LIFT THE NECK AND TILT THE HEAD BACK AS FAR AS POSSIBLE.

FIG 1

3. Move the hand from under the neck and place it on the chin of the patient, the thumb between the chin and mouth, the index finger along the line of the jaw, the remaining fingers curled. (Fig.2). Whilst positioning the patient, open your mouth and take deep breaths.

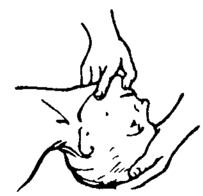

FIG 2

4. Using the thumb of the hand on the chin to keep the lips sealed, open your mouth wide and make a seal round the patient's nose and blow into it. (Fig.3).

FIG 3

5. After blowing, turn your head to observe the rise of the chest. (Fig.4). If no air enters the patient's lungs, the nose may be blocked and the mouth should be opened using the hand on the chin; open your mouth wide and making a seal round his mouth blow into it. Turn the head to observe the chest rise. This may be used as an alternative to blowing into the nose even when the nose is not blocked but the nose must be sealed either with the cheek or by moving the hand from the top of the head and pinching the nostrils. THE HEAD MUST BE KEPT AT FULL BACKWARDS TILT.

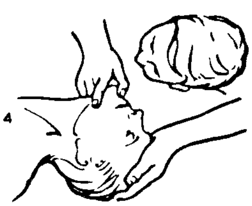

FIG 4

6. Start with ten quick deep breaths and then continue at the rate of twelve to fifteen breaths per minute. This should be continued until the patient revives or a doctor certifies death.

7. In the case of facial injuries it may be necessary to do a manual method of artificial respiration. (Holger Nielsen).

8. It is ESSENTIAL to commence artificial respiration without delay and to send for medical assistance immediately.

TREATMENT FOR BURNS

If the patient is also suffering from burns, then, without hindrance to artificial respiration, observe the following:-

(a) DO NOT ATTEMPT TO REMOVE CLOTHING ADHERING TO THE BURN.

(b) If help is available or as soon as artificial respiration is no longer required the wound should be covered with a DRY dressing.

(c) Oil or grease in any form should NOT be applied.

Further details of charts and books on artificial respiration may be obtained from:-

The Royal Life Saving Society, 14 Devonshire Street, Portland Place, London, W.1.

NSN and UNIT IDENTITY	TRANSMITTER NSN 5820–99–					
	933–2372 (T10158)	933–2182 & 622–8256 (T10158A)	933–2195 (T10158B)	933–2187 (T16719)	222–3831 (ex.T16719)	933–2199 (T16719A)
5820–99–622–8255 Control Power Supply		*				
5820–99–933–2183 Control Power Supply	*	*				
5820–99–933–2221 Control Power Supply			*			
5820–99–933–2168 Control Power Supply				*	*	
5820–99–933–2914 Control Power Supply						*
5820–99–971–7078 Power Supply	*	*		*	*	
5820–99–933–2171 Power Supply			*			*
5820–99–933–2222 Power Supply	*	*		*	*	
5820–99–933–2221 Power Supply			*			
5820–99–933–2915 Power Supply						*
5950–99–933–2188 R.F. Unit	*					
5950–99–933–2196 R.F. Unit			*			
5950–99–933–2217 R.F. Unit						*
5950–99–933–2169 R.F. Unit				*	*	
5950–99–933–2179 R.F. Unit		*				
5820–99–971–2012 Mixer Stage Frequency	*	*				
5820–99–933–2197 Mixer Stage Frequency			*			

NSN and UNIT IDENTITY	TRANSMITTER NSN 5820–99–					
	933–2372 (T10158)	933–2182 & 622–8256 (T10158A)	933–2195 (T10158B)	933–2187 (T16719)	222–3831 (ex.T16719)	933–2199 (T16719A)
5820–99–933–2200 Mixer Stage Frequency						*
5820–99–933–2218 Mixer Stage Frequency				*		
5820–99–222–3833 Mixer Stage Frequency					*	
5820–99–971–2020 Amplifier R.F.	*	*				
5820–99–933–2913 Amplifier R.F.						*
5820–99–933–2207 Amplifier R.F.			*			
5820–99–933–2181 Amplifier R.F.				*	*	

MODIFICATION STATE OF THE EQUIPMENT

Modification Record Labels are fitted to the units of the equipment listed below. Embodiment of a modification is indicated by scoring through the relevant number on the appropriate label.

Where the modification state has not been established at the date of issue of the manual then the date of issue of this page defines the design state.

The amendment state of this manual is related to the modification state of the equipment. To ensure that this relationship may be determined at any time, the following table is re-issued with successive amendments to the manual.

Mod. Summary Page	Unit or Sub-unit Title	Modification State of Unit or Sub-unit Related to Amendment State of Manual											
A	Control Power Supply Type S28/1 5820–99–933–2183	5	5	5	7								
B	Control Power Supply Type S28/2 5820–99–933–2221	3	3	3	5								
C	Control Power Supply Type S28/3 5820–99–933–2168	5	5	5	7								
D	Control Power Supply Type S28/4 5820–99–933–2914	3	3	3	5								
E	Power Supply 5820–99–971–7078	1	1	1	1								
F	Power Supply Type S62/2 5820–99–933–2171	4	4	4	4								
G	Power Supply Type S62/3 5820–99–933–2222	4	4	4	4								
H	Power Supply Type S65/1 5820–99–933–2221	1	1	1	1								
J	Power Supply Type S65/2 5820–99–933–2915	1	1	1	1								
K	R.F. Unit Type S2/1 5950–99–933–2188	7	7	7	7								
L	R.F. Unit Type S2/2 5950–99–933–2196	2	2	2	3								
M	R.F. Unit Type S2/3 5950–99–933–2217	3	3	3	3								
N	R.F. Unit Type S2/4 5950–99–933–2169	9	9	9	9								
	Amendment State of Manual	6	7	8	9								

MODIFICATION STATE (Continued)

Mod. Summary Page	Unit or Sub-unit Title	Modification State of Unit or Sub-unit Related to Amendment State of Manual											
P	R.F. Unit Type S2/5 5950–99–933–2179	7	7	7	8								
Q	Mixer Stage Frequency 5820–99–971–2012	3	3	3	3								
R	Mixer Stage Frequency Type S4/2 5820–99–933–2197	1	1	1	1								
S	Mixer Stage Frequency Type S4/3 5820–99–933–2200	1	1	1	1								
T	Mixer Stage Frequency Type S4/5 5820–99–933–2218	2	2	2	2								
U	Mixer Stage Frequency 5820–99–222–3833	0	0	0	0								
V	Amplifier R.F. 5820–99–971–2020	4	4	4	4								
W	Amplifier R.F. Type S37/1 5820–99–933–2913	1	1	1	1								
X	Amplifier R.F. Type S37/2 5820–99–933–2207	2	2	2	2								
Y	Amplifier R.F. Type S37/3 5820–99–933–2181	3	3	3	3								
Z	Indicator Output Power 5985–99–933–3337	–	–	–	–								
AA	Control Power Supply 5820–99–622–8255	–	–	0	2								
	Amendment State of Manual	6	7	8	9								

MODIFICATION SUMMARY

Control Power Supply
Type S28/1
5820-99-933-2183

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6272. Removal of redundant h.t. overload relays and improvement in valve protection relays.	Existing valve protection inadequate.
2	RMC. Mod.6615. Replaces existing lamps by lamps with tungsten filaments.	To improve longevity.
3	RMC. Mod.9108. Retrospective provisioning and application of identity and modification labels.	To record reference identities and mod. strike-offs.
4	RMC. Mod.9785. Modification to achieve bias control and backfire indication.	Reduces repair time after failure.
5	RMC. Mod.0109. Metal rectifier MR1 repositioned to facilitate removal of Ventaxia fan.	Improved servicing.
6	Mod. A.3978. Fitting, on failure, of a replacement type fan assembly having ball bearings and access for external lubrication.	Bearing seizure has caused burn out of motor of fan assemblies used for air cooling on control power supply cabinet.
7	Mod. A.4745. Replacement contactor.	Old type unobtainable.

MODIFICATION SUMMARY

Control Power Supply
Type S28/2
5820-99-933-2221

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9110. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
2	RMC. Mod.9785. Modification to achieve bias control and backfire indication.	Reduces repair time after valve failure.
3	RMC. Mod.0109. Metal rectifier MR1 repositioned to facilitate removal of Ventaxia fan.	Improved servicing.
4	Mod. A.3978. Fitting, on failure, of a replacement type fan assembly having ball bearings and access for external lubrication.	Bearing seizure has caused burn out of motor of fan assemblies used for air cooling of control power supply cabinet.
5	Mod. A.4745. Replacement contactor.	Old type unobtainable.

MODIFICATION SUMMARY

Control Power Supply
Type S28/3
5820-99-933-2168

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6272. Removal of redundant h.t. overload relays and improvement in valve protection relays.	Existing valve protection inadequate.
2	RMC. Mod.6615. Replaces existing lamps by lamps with tungsten filaments.	To improve longevity.
3	RMC. Mod.9109. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
4	RMC. Mod.9785. Modification to achieve bias control and backfire indication.	Reduces repair time after valve failure.
5	RMC. Mod.0109. Metal rectifier MR1 repositioned to facilitate removal of Ventaxia fan.	Improved servicing.
6	Mod.3978. Fitting, on failure, of a replacement type fan assembly having ball bearings and access for external lubrication.	Bearing seizure has caused burn out of motor of fan assemblies used for air cooling of control power supply cabinet.
7	Mod. A.4745. Replacement contactor.	Old type unobtainable.

MODIFICATION SUMMARY

Control Power Supply
Type S28/4
5820-99-933-2914

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9111. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
2	RMC. Mod.9785. Modification to achieve bias control and backfire indication.	Reduces repair time after valve failure.
3	RMC. Mod.0109. Metal rectifier MR1, repositioned to facilitate removal of Ventaxia fan.	Improved servicing.
4	Mod. A.3978. Fitting, on failure, of a replacement type fan assembly having ball bearings and access for external lubrication.	Bearing seizure has caused burn out of motor of fan assemblies used for air cooling of control power supply cabinet.
5	Mod. A.4745. Replacement contactor.	Old type unobtainable.

MODIFICATION SUMMARY

Power Supply
5820–99–971–7078

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mods.9108 and 9109. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

Power Supply
Type S62/2
5820–99–933–2171

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6615. Various circuit changes (incorporated before delivery on certain units).	Improved protection and performance.
2	RMC. Mods.9110 and 9111. Retrospective provisioning and application of identity and modification labels.	To record reference identities and mod. strike-offs.
3	–	
4	RMC. Mod.9785. Modification to achieve bias control and backfire indication.	Reduces repair time after valve failure.

MODIFICATION SUMMARY

Power Supply
Type S62/3
5820–99–933–2222

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	As RMC. Mod.6615. Various circuit changes (included before delivery).	Improved protection and performance.
2	RMC. Mods.9108 and 9109. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
3	RMC. Mod.7424. Valve BR.191B replaced by Valve Type ACT.70.	Improved performance.
4	RMC. Mod.9785. Modification to achieve bias control and backfire indication.	Reduces repair time after valve failure.

MODIFICATION SUMMARY

Power Supply
Type S65/1
5820–99–933–2221

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9110. Retrospective provisioning and application of identity and modification labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

Power Supply
Type S65/2
5820–99–933–2915

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9111. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

R.F. Unit
Type S2/1
5950–99–933–2188

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6565. Protection against over-heating and entry of dust by improved ventilation, filtering and sealing.	Improved reliability.
2	RMC. Mod.6615 (part). Improved method of adjustment of sliding contacts of the anode tuning assembly.	Improved performance.
3	–	–
4	RMC. Mod.7424. Valve Type BR.191B replaced by Valve Type ACT.70.	Improved performance.
5	RMC. Mod.8281. Improved spring contacts and guide wheels.	Improved reliability.
6	RMC. Mod.8282. Improved end-stops on manual control heads.	Improved reliability.
7	RMC. Mod.8978. Protection against damage by resonance.	Improved in production.
–	RMC. Mod.9136. Changes identity to 'R.F. Unit, Type S2/5, 5950–99–933–2179'. Changes transmitter identity to T10158A. Provides an r.f. output to frequency measuring equipment.	–

MODIFICATION SUMMARY

R.F. Unit
Type S2/2
5950-99-933-2196

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9110. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
2	RMC. Mod.9138. Provides an output for remote frequency measurement.	Improved facilities.
3	Mod. No. A.4049. Resiting of the pick-up and capacitor assembly.	To accommodate further modifications in this area.

MODIFICATION SUMMARY

R.F. Unit
Type S2/3
5950–99–933–2217

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9111. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
2	RMC. Mod.9140. Provides an r.f. output for remote frequency measurement.	Improved facilities.
3	RMC. Mod.1784. Transmitter Types T16719 and T16719A fitted with r.f. filter.	To eliminate overload and resonance.

MODIFICATION SUMMARY

R.F. Unit
Type S2/4
5950–99–933–2169

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6565. Protection against over-heating and entry of dust by improved ventilation, filtering and sealing.	Improved reliability.
2	RMC. Mod.6615. Improved methods of adjustment of sliding contacts of the anode tuning coil assembly.	Improved performance.
3	RMC. Mod.9109. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
4	RMC. Mod.7424. Valve Type BR.191B replaced by Valve Type ACT.70.	Improved performance.
5	RMC. Mod.8281. Improved spring contacts and guide wheels.	Improved reliability.
6	RMC. Mod.8282. Improved end-stops on manual control heads.	Improved reliability.
7	RMC. Mod.8981. Protection against damage by resonance.	Incorporated in production.
8	RMC. Mod.9139. Provides an r.f. output to operate remote frequency measuring equipment.	Improved facilities.
9	RMC. Mod.1784. Transmitter Types T16719 and T16719A, fitted with r.f. filter.	To eliminate overload and resonance.

MODIFICATION SUMMARY

R.F. Unit
Type S2/5
5950-99-933-2179

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.5358. Provides an output for remote frequency measurement.	Improved facilities.
2	RMC. Mod.6565. Protection against over-heating and entry of dust by improved ventilation, filtering and sealing.	Improved reliability.
3	RMC. Mod.6615. Improved method of adjustment of sliding contacts of the anode tuning coil assembly.	Improved performance.
4	RMC. Mod.9108. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
5	RMC. Mod.7424. Valve BR.191B replaced by Valve ACT.70.	Improved performance.
6	RMC. Mod.8281. Improved spring contacts and guide wheels.	Improved reliability.
7	RMC. Mod.8282. Improved end-stops on manual control heads.	Improved reliability.
8	Mod. No.A.4049. Resiting of the pick-up and capacitor assembly.	To accommodate further modifications in this area.

MODIFICATION SUMMARY

Control Power Supply
5820-99-622-8255

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	Mod.A.3978. Fitting, on failure, of a replacement type fan assembly having ball bearings and access for external lubrication.	Bearing seizure has caused burn out of motor of fan assemblies used for air cooling of control power supply cabinet.
2	Mod.A.4745. Replacement contactor.	Old type unobtainable.

MODIFICATION SUMMARY

Mixer Stage Frequency
5820–99–971–2012

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6615. Reduction of bias to afford protection from distortion due to fluctuating mains voltage. Elimination of parasitic oscillation.	Improved protection and performance.
2	RMC. Mod.9108. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
3	RMC. Mod.8980. To provide protection against instabilities and drift. Valve Type CV138 replaced by Valve Type CV4014.	Improved performance and protection.

MODIFICATION SUMMARY

Mixer Stage Frequency
Type S4/2
5820–99–933–2197

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9110. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

Mixer Stage Frequency
Type S4/3
5820–99–933–2200

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9111. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

Mixer Stage Frequency
Type S4/5
5820–99–933–2218

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6615. Reduction of bias to afford protection from distortion due to fluctuating mains voltage. Elimination of parasitic oscillation.	Improved protection and performance.
2	RMC. Mod.9109. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.
–	RMC. Mod.1312. Application of this modification changes the NSN to 5820–99–222–3833.	–

MODIFICATION SUMMARY

Amplifier R.F.
5820–99–971–2020

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6565. Protection against over-heating and ingress of dust.	Improved reliability.
2	RMC. Mod.6567. Provision of mixer level control.	Improved performance.
3	RMC. Mod.9108. Retrospective provisioning and application of identity and modification labels.	To record reference identities and mod. strike-offs.
4	RMC. Mod.8979. Protection against instabilities.	Introduced during production.

MODIFICATION SUMMARY

Amplifier R.F.
Type S37/1
5820–99–933–2913

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.9111. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

Amplifier R.F.
Type S37/2
5820–99–933–2207

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	As RMC. Mod.6615. Various circuit changes (included before delivery).	Improved protection and performance.
2	RMC. Mod.9110. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

MODIFICATION SUMMARY

Amplifier R.F.
Type S37/3
5820–99–933–2181

A Summary of modifications to the above is given below. This summary is provided for information only, and does NOT constitute an authority to demand modification kits where the equipment held has not been modified.

Mod. Strike-off	Summary of Modification	Reason
1	RMC. Mod.6565. Protection against overheating and entry of dust by improved ventilation, filtering and sealing.	Improved reliability.
2	RMC. Mod.6567. Provision of mixer level control.	Improved performance.
3	RMC. Mod.9109. Retrospective provisioning and application of identity and modification record labels.	To record reference identities and mod. strike-offs.

LIST 1

MARCONI IDENTITIES					
Transmitter	Frequency	Control Power Supply	R.F. Unit	Mixer Stage Frequency	Amplifier, R.F.
HS31 (W.37918 Ed.B + WQ.13379 + T30-7476-01 + WQ.14666 Ed.A)	4-27.5 Mc/s	W.37908 Ed.B + T30-7476-01 + WQ.13379 Ed.A	W.37907 Ed.C + WQ.14666 Ed.A	W.37920 Ed.D + T30-7476-01	W.39081 Ed.D + T30-7476-01
HS31 (W.37918 Ed.B + WQ.13506 Ed.A + T30-7476-02 + WQ.13379 Ed.A + WQ.14666 Ed.A)	4-27.5 Mc/s	W.37908 Ed.B + T30-7476-02 + WQ.13379 Ed.A	W.37907 Ed.C + WQ.13506 Ed.A + T30-7476-02 + WQ.14666 Ed.A	W.37920 Ed.D + T30-7476-02	W.39081 Ed.D + T30-7476-02
HS31A (W.37918 Ed.B + WQ.12610 Ed.A + WQ.13379 Ed.A + T30-7476-03 + WQ.14666 Ed.A)	2.5-20 Mc/s	WQ.14953/B Ed.A	WQ.14956/B Ed.A	WQ.14957/B Ed.A	WQ.14958/B Ed.A
HS31/1 (W.37918 Ed.C + WQ.14952/B Ed.A)	4-27.5 Mc/s	WQ.14953/B Ed.A	WQ.14956/B Ed.A	WQ.14957/B Ed.A	WQ.14958/B Ed.A
HS31A/1 (W.37918 Ed.D + WQ.14959/B Ed.A)	2.5-20 Mc/s	WQ.14960/B Ed.A	WQ.14961/B Ed.A	WQ.14962/B Ed.A	WQ.14963/B Ed.A

KEY TO MARCONI MODIFICATION DRAWINGS

WQ.126101	Mod.		Conversion of HS31 to HS31A
WQ.13379	Mod.		Fitting of 6 inch fan
WQ.13506	Mod.		Fitting of additional P.U. point for monitoring
WQ.14666	Mod.		Fitting of ACT70 valve
WQ.14952/B) WQ.14953/B)	Mod.	9110	Addition of Identity and Modification labels
WQ.14956/B	(Mod.	9110	Addition of Identity and Modification labels
	(Mod.	9138	Fitting of additional P.U. point for monitoring
WQ.14957/B	Mod.	9110	Addition of Identity and Modification labels

LIST 2

A.M. IDENTITIES				
Transmitter	Control Power Supply	R.F. Unit	Mixer Stage Frequency	Amplifier, R.F.
T.10158 5820-99-933-2372 (was 10D/20455) HS31	Type S28/1 5820-99-933- 2183	Type S2/1 5950-99-933- 2188	5820-99-971- 2012	5820-99- 971-2020
T.10158A 5820-99-933-2182 (was 10D/22729) HS31	Type S28/1 5820-99-933- 2183	Type S2/5 5950-99-933 2179	5820-99-971- 2012	5820-99- 971-2020
T.16719 5820-99-933-2187 (was 10D/22609) HS31A	Type S28/3 5820-99-933- 2168	Type S2/4 5950-99-933- 2169	Type S4/5 5820-99-933- 2218	Type S37/3 5820-99- 933-2181
T.10158B 5820-99-933-2195 (was 10D/23678) HS31/1	Type S28/3 5820-99-933- 2221	Type S2/2 5950-99-933- 2196	Type S4/2 5820-99-933 2197	Type S37/2 5820-99- 933-2207
T.16719A 5820-99-933-2199 (was 10D/23682) HS31A/1	Type S28/4 5820-99-933- 2914	Type S2/3 5950-99-933- 2217	Type S4/3 5820-99-933 2200	Type S37/1 5820-99- 933-2913

KEY TO MARCONI MODIFICATION DRAWINGS (Contd.)

WQ.14958/B	(Mod. 6616	Incorporated before delivery
	(Mod. 9110	Addition of Identity and Modification labels
	(Mod. 7850	Improvement of neutralizing circuit response.
WQ.14959/B) WQ.14960/B)	Mod. 9111	Addition of Identity and Modification labels.
WQ.14961/B	(Mod. 9111	Addition of Identity and Modification labels.
	(Mod. 9140	Fitting of additional P.U. point for monitoring.
WQ.14962/B) WQ.14963/B)	Mod. 9111	Addition of Identity and Modification labels.
T30-7476-01) T30-7476-02) T30-7476-03)		Addition of Identity and Modification labels.

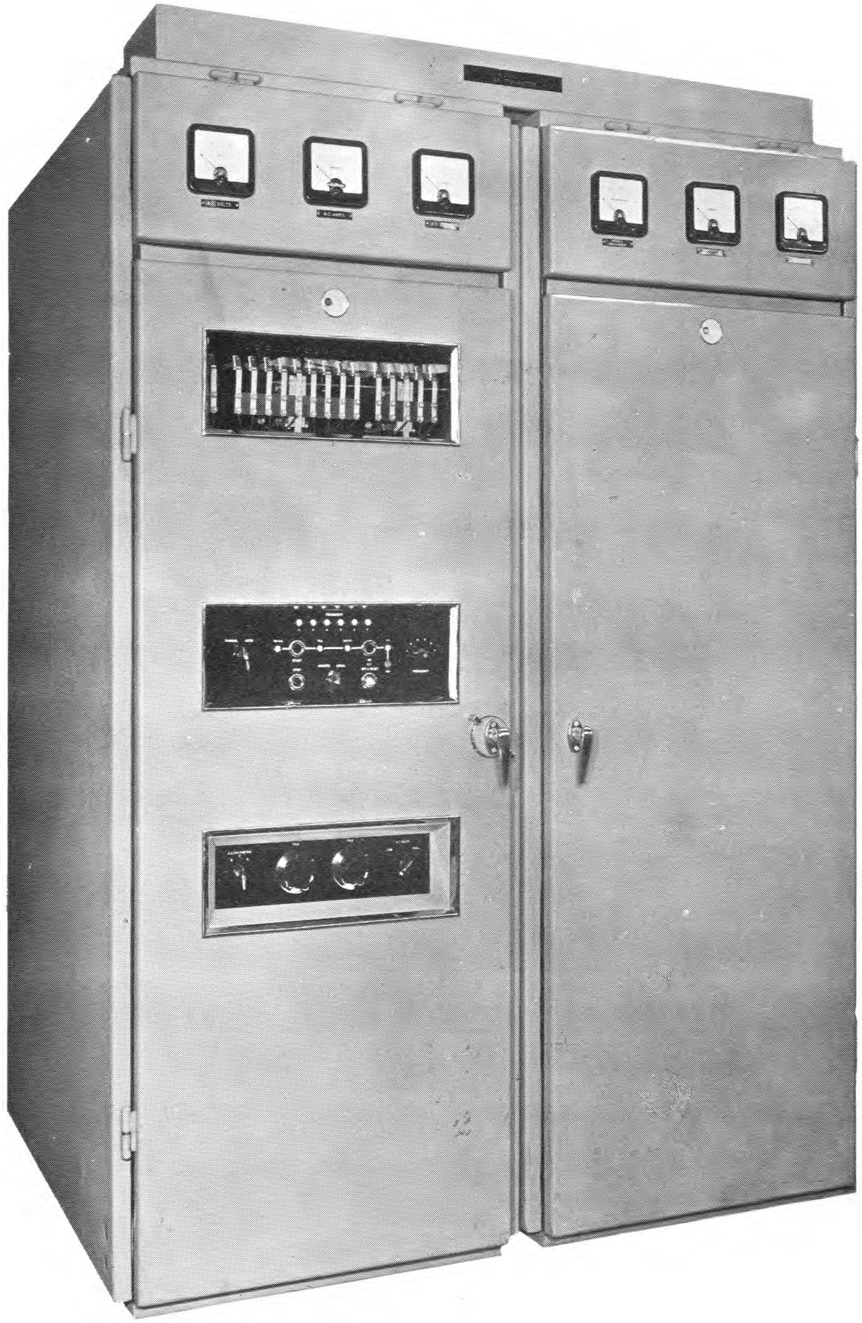

Photo No.33950

Transmitter, Types T.10158, T.10158A,
R.16719, T.10158B, T.16719A

A.P.116E.0231-1
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Oct. '67
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CONTENTS

CONTENTS (Cont.)

CONTENTS (Cont.)

CONTENTS (Cont.)

COMPONENTS LISTS

Refer to Section 11.3 Spare Parts, Page 70.

SUPPLEMENTS
(These follow the Illustrations)

ILLUSTRATIONS

ILLUSTRATIONS (Cont.)

Circuit Diagrams and Component and Fan Layout Diagrams

Component Layout Diagrams

ILLUSTRATIONS (Cont.)

ABBREVIATIONS

I.S.B.	–	Independent Sideband
D.S.B.	–	Double Sideband
C.W.	–	Continuous Wave Telegraphy
P.E.P.	–	Peak Envelope Power
P.S.P.	–	Peak Signal Power
F.S.K.	–	Frequency Shift Keying
R.F.	–	Radio Frequency
Fils	–	Filaments
fHG Mc/s or fHG	–	The Frequency Output of the Harmonic Generator
fRAD Mc/s or fRAD	–	The Radiated Frequency
H.G.	–	Harmonic Generator or Frequency Multiplier
V	–	Volt
A or amp	–	Ampere
Ω	–	Ohm
W	–	Watt
m	–	Milli (0.001)
μ	–	Micro (0.000001)
k	–	kilo (1000)
M	–	Mega (1,000,000)

dB	–	Decibel
A.C.	–	Alternating Current
D.C.	–	Direct Current
IP's	–	Inter-modulation Produc
WW	–	Wire Wound

3.5 kW H.F. I.S.B./TELEGRAPH/TELEPHONE TRANSMITTER TYPES HS31, HS31A, HS31/1 AND HS31A/1

1 INTRODUCTION

This Air Publication, with its Supplement 1, covers the HS31 series of transmitters. Where possible, the differences between the variants are dealt with in the main book, but, where necessary, reference is made to the appropriate section in the Supplement.

The HS31 series, comprising HS31, HS31A, HS31/1 and HS31A/1, are general purpose transmitters for use in the frequency range 2.5 to 27.5 Mc/s, the HS31 and HS31/1 covering 4 to 27.5 Mc/s, and the HS31A and HS31A/1 2.5 to 20 Mc/s.

External units are used to provide the drive and service of operation. Drive frequencies are normally supplied by Type HD21 Crystal Drive Units.

For F.S.K. or FS Diplex services these would normally be used in conjunction with a Type HD20 F.S.K. Drive Assembly providing the necessary Keying and Monitoring Equipment. For FS Diplex operation the Type HD61B Frequency Shift Diplex Equipment may also be employed. In this case the drive output is at radiated frequency and the HD21 Crystal Drive Units are not required.

For HS31A and HS31A/1 see Supp.1 Sect.1.

For I.S.B. operation the Crystal Drives may be used with either Type HD51 or Type SSD2 I.S.B. Drive Equipments.

The frequency range is covered without external change of coils or components, and the transmitter may be tuned, using any one of the six input frequencies supplied by the six Crystal Oscillator Units, without adjustment of these units after the initial setting-up.

Air cooling is provided by a fan mounted in the bottom of the R.F. Cubicle. Air is exhausted from the transmitter and passes via a duct between the two cubicles, leading to a vent on the roof of the transmitter. Provision may be made for fitting ducting to remove the heated air from the transmitter room.

The transmitter is interlocked electrically and mechanically to prevent damage; and to safeguard the user. The doors of the two cabinets are fitted with locks mechanically connected to the isolating and/or earthing switches.

ON/OFF switching, of the transmitter, may be carried out by remote control.

An envelope correction circuit is incorporated in the transmitter to minimize the I.S.B. distortion.

2 TECHNICAL SUMMARY

2.1 SALIENT FEATURES

Types of service available	(a) C.W. Telegraphy ON/OFF keying with optional anti-fading Frequency Modulation (A1 and F2)
	(b) Frequency Shift Telegraphy (F1)
	(c) Independent Sideband (A3b)
	(d) D.S.B. Telephony, Low Power (A3)

NOTE: *To provide services (a) and (b), the Type HD22 Keying Unit or a Type HD61B Frequency Shift Diplex Equipment is used. For services (c) and (d), the Type HD51 I.S.B. Drive or a Type SSD2 Single Sideband Generating Equipment is used.*

Power Supply: Transmitter	380 - 420 three-phase, four wire a.c., 50 - or 60 c/s.
Overall	Voltage regulation ±6% Frequency Tolerance ±2.5%.
Power Consumption (at 0.9 power factor)	I.S.B. with 2 tone modulation 7 kW C.W. Mark 9 kW C.W. Space 3.7 kW F.S.K. 9 kW.
Control	Local operation, with optional remote ON/OFF switching.
Main Unit Dimensions	Height 7 ft 6 in (2.28m) Width 5 ft 6 in (1.67m) Depth 4 ft 4 in (1.32m).
Output Impedance	600Ω balanced. 50Ω can be provided using an external wideband transformer, and a coupling filter.
Cooling	The fan extracts approximately 340 cu. ft of air per minute, at a pressure of 3 inch water gauge.

2.2 PERFORMANCE

Frequency Range	4 to 27.5 Mc/s (HS31 & HS31/1) 2.5 to 20 Mc/s (HS31A & HS31A/1) covered in varying ranges in the various sub-units of the transmitter.

Power to Aerial from 4-21 Mc/s (HS31 & HS31/1) 2.5-20 Mc/s (HS31A & HS31A/1)	(3.5 kW PEP on I.S.B. (3.5 kW on C.W. (ON/OFF) and F.S.K. (1.5 kW Carrier on D.S.B. (
from 21-27.5 Mc/s (HS31 & HS31/1)	(2.5 kW PEP on I.S.B. (2.5 kW on C.W. (ON/OFF) and F.S.K. (1.5 kW Carrier on D.S.B.
Harmonic Radiation	Less than 200 mW.
Drive Input Level	0.1W nominal from Primary Crystal Drive (3.45 to 6.95 Mc/s) 0.25W from I.S.B. or keyed telegraph drive (3.1 Mc/s).
Noise Level	(a) Individual components in a band 200 c/s either side of a carrier up to -16 dB relative PEP are less than -30 dB relative to that carrier. (b) All components of a single tone up to -6 dB relative PEP are less than -50 dB relative PEP.
Pilot Carrier Compression	Less than 1.0 dB for any level of single frequency signal up to PEP.
Non Linear Distortion I.S.B.	3rd Order IP's not greater than -36 dB relative to either of two equal test tones for any power level up to PEP.
D.S.B. Distortion	Less than 10% measured at 80% modulation depth including 2% of D.S.B. Drive Unit.
D.S.B. Frequency Response	Less than 2½ dB from 200-3500 c/s measured at 60% modulation depth (including 2 dB of D.S.B. Drive Unit).

3 EQUIPMENT LIST

3.1 LIST OF UNITS

See Lists 1 and 2 inside front cover.

3.2 LIST OF VALVES

Unit	Type No.	Z77	U54	5B255M	5B254M	STV 280/80	Total
	Services CV No.	138 or 4014	378	391	428	1069	
Rectifier and Control Unit			2			1	3
R.F. Unit					2		2
Mixer Unit		9		2			11
Total		9	2	2	2	1	16

	Type No.	N77 (EL91)	C1112 or ** QY 4250	BR191 or ACT70*	GXU2	QS.12.06 VR 105/30	Total
	Services CV No.	136 or 4063	2131	2383	2518	686	
Rectifier and Control Unit					6	1	7
R.F. Unit			2	1			3
Mixer Unit		2					2
Total		2	2	1	6	1	12

An abridged valve data list is given in Section 11.

* See Section 11.11.

** This valve is not suitable for I.S.B. service unless, on a static test, with Va=1 kV, Vg2=500V and Vg1= -25V, the Ig2 does not exceed, and is preferably less than, 16 mA. If the transmitter is used on I.S.B. service, and a new V3 or V4 is required, order CV2131/2121.

4 DESCRIPTION OF EQUIPMENT

4.1 TRANSMITTER LAYOUT

The HS31 series of Transmitters consists of two cubicles mounted side by side with an air duct between them. The left-hand cubicle is the Rectifier and Control Unit (RCU) and the right-hand cubicle is the Radio Frequency Unit (R.F. Unit).

4.1.1 Rectifier and Control Unit Cubicle

Component Layouts: HS31 & HS31A, Figs.1 & 2: HS31/1 & HS31A/1, Figs.1A and 2A.

This cubicle contains the various sub-units and component panels of the power units.

Across the front of the cubicle are mounted four separate panels bearing the control circuit relays and contactors, the control switches etc., various indicating lamps and the fuses. These panels are protected by a full length door when the transmitter is in operation. In the door are apertures giving access to the control panels, and a glass inspection window revealing the relays and contactors. Above the door is a hinged meter panel fitted with a single mechanical interlock which prevents the door being closed, and therefore prevents the supplies being switched on, while the panel is raised and the backs of the meters exposed. A six inch extractor fan is fitted in the roof of the cubicle to aid ventilation.

4.1.2 Radio Frequency Unit Cubicle

This cubicle contains all of the radio frequency circuits and the cooling fan. Various stages are contained in separate sub-units which are described in Sections 4.3.2.1, 4.3.2.2 and 4.3.2.4.

The aerial feeder terminals are mounted on the roof of the cubicle. Incoming and outgoing connections are made via plugs and sockets also on the roof. The connections to and from the drive equipment are made via the coaxial plugs PLB-PLD.

This cubicle also has a full length front door but it is not interlocked to the control circuit as access is desired when tuning the transmitter.

The three sub-units may all be withdrawn on runners from the cabinet for servicing. The Mixer Unit is not interlocked to the control circuit, as access to controls mounted on the chassis is desired when tuning the transmitter. The other two sub-units are interlocked to the control circuit; the 4th and 5th R.F. Amplifier by the switch on the panel above the unit, and the Aerial Circuit by the rear door of the cubicle which is interlocked and must be opened before the unit can be withdrawn.

4.2 CONTROLS AND THEIR FUNCTIONS

Control Layouts:

Rectifier and Control Unit:	(HS31 & HS31A Fig.2 (HS31/1 & HS31A/1 Fig.2A.
Radio Frequency Unit:	(HS31 & HS31A Fig.3 (HS31/1 & HS31A/1 Fig.3B.

The following section lists all the controls, meters and fuses, together with their functions, under their panel titles.

4.2.1 Meter Panel

A.C. Volts - M1	This may be switched to indicate the voltage of any phase of the supply.
A.C. Amps - M2	Indicates the current taken from the YELLOW phase of the supply.
H.T. Volts - M3	This indicates the main h.t. voltage supply (4 kV) to Stages 5 and 6.

4.2.2 Contactor Panel

This carries the relays and contactors which control filaments, bias and h.t. supplies.

ST Start Relay
FC Filament Relay
FF Full Filament Relay
OR Overload Reset Relay
SP Remote Control Relay
FD Filament Delay Switch
LA Auxiliary H.T. Relay
MC Main H.T. Contactor
ILR External Interlock Pilot Relay (HS31/1 and HS31A/1 only).

4.2.3 Control Panel

This carries the various control switches and push buttons.

Switches

Auto/Manual Selector Switch	- SWN
Local/Remote Selector Switch	- SWG
Frequency Selector Switch	- SWL
Stage 6 Grid Current Overload	- SWR (HS31/1 & HS31A/1 only).

Push Buttons

Start Button	- SWC
Stop Button	- SWD
H.T. ON Button	- SWE
H.T. OFF & Reset Button	- SWF

Also mounted on the control panel are various indicator lamps.

The six frequency indicator lamps are associated with the six-position frequency selector switch, SWL, which controls, via SWG in the Mixer Unit, the selection of primary crystal oscillator.

In line with the push buttons START and H.T. ON are the lamps which indicate the extent of control, i.e. Fils. ON, H.T. ON, etc.

50V D.C. Lamp	- LP1
Filament Lamp	- LP2
Auxiliary H.T. Lamp	- LP3
H.T. Lamp	- LP4
Trip Lamp	- LP5

4.2.4 H.T. and Filaments Panel

This carries four controls.

A.C. Voltmeter Switch - SWH associated with M3 on the meter panel.

Stage 5 and Rectifier Filament Control - RV2, RV3 and RV4.

Stage 6 Filament Control - RV1.

H.T. Volts Low/Full Selector Switch - SWJ.

4.2.5 Fuse Panel

This is the bottom panel of the front assembly.

The functions of the fuses are listed below.

Fuse	Location	Rating
FS1	50V D.C. Rectifier A.C. Input	2 amps
FS2	50V D.C. Rectifier A.C. Input	2 amps
FS3	50V D.C. Rectifier A.C. Input	2 amps
FS4	*Fan Supply	10 amps
FS5	6.3V Filaments and Aux. H.T. Rectifier Filament Supply	2 amps
FS6	Spare	
FS7	Main H.T. Fuse	25 amps
FS8	Main H.T. Fuse	25 amps
FS9	Main H.T. Fuse	25 amps
FS10	Stage 5 and Main H.T. Rectifier Filaments	2 amps
FS11	Stage 5 and Main H.T. Rectifier Filaments	2 amps
FS12	Stage 5 and Main H.T. Rectifier Filaments	2 amps
FS13	Not used	
FS14	Stage 6 Filaments	6 amps
FS15	Stage 6 Filaments	6 amps
FS16	Auxiliary H.T. Unit Supply	2 amps
FS17	Bias Unit Supply	2 amps
FS18	Filament Delay Switch Supply	0.5 amp
FS19	Spare	
FS20	Spare	
FS21	Not used	
FS22	'Ledex' Switch Control Supply (Frequency Selection)	1 amp
FS23	50V D.C. Supply to Control Relays up to Auxiliary H.T. Relay	3 amps
FS24	Main H.T. Contactor and Overload Reset Relay Control Supply	5 amps
FS25	Indicator Lamps Supply	1 amp
FS26	Spare	
FS28-35	Not used on HS31	

* HS31 & HS31A only. For HS31/1 & HS31A/1 see Supp.1.

4.2.6 Meter Panel (R.F. Cubicle)

STAGE 6 GRID CURRENT (M7)	Indicates Stage grid current.
STAGE 6 CATHODE CURRENT (M6)	Stage 6 cathode current.
FEEDER INDICATOR (M10)	Indicates the power to the aerial.

4.2.7 Top Panel (R.F. Cubicle)

RANGE (SWA, SWB, SWC & SWD)	Operates all the frequency range switches in the transmitter via chains and couplings.
FEEDER TUNE (C64, SWP, SWM)	Tunes the coupling coil L20.
STAGE 5 H.T. INTERLOCK switch (SWF)	4th and 5th R.F. Amplifier interlock switch (main h.t.).

4.2.8 4th and 5th R.F. Amplifier

STAGE 5 TUNE (L15)	Turns L15 for tuning purposes
STAGE 4 TUNE (L5-L10, C12)	Turns the coil turret L5-L10 and also capacitor C12.
STAGE 5 NEUTRALIZING (C16)	Turns C16 which neutralizes Stage 5.
DRIVE LEVEL (RV7) (HS31 & HS31A) (RV2) (HS31/1 & HS31A/1)	Varies drive input to Stage 4.
STAGE 4 GRID PEAK VOLTS (M1)	Indicates signal input level to Stage 4.
STAGE 4 ANODE CURRENT (M2)	Indicates anode current to V1 and V2.
STAGE 5 GRID CURRENT (M3)	Indicates grid current to V3 and V4.
STAGE 5 GRID PEAK VOLTS (M4)	Indicates signal input level to Stage 5.
STAGE 5 CATHODE CURRENT (M5)	Indicates cathode current to V3 and V4.

4.2.9 Mixer Unit

H.G. TUNE	This control is ganged to the tuning capacitors of the harmonic generator stages and their associated amplifier stages:- capacitors C5, C14, C25, C41 and C47.

MIXER TUNE — To this control is ganged the anode tuning capacitors of the mixer stage and r.f. amplifier stages 1, 2 and 3:- capacitors C65, C66, C82, C94 and C100.

fHG Mc/s (SWA) — This a three position range switch employed to select the harmonic generator stages to be used and to select the required tuned circuits for the anode circuits of the two amplifier stages which follow the harmonic generators.

NOTE: *The frequency ranges marked against the positions of this switch refer to the harmonic generator output frequencies and not to the final radiated frequencies.*

H.G. METERING (SWB) — This switch selects various currents in the harmonic generator circuit for measurement on M1. Its final position (7) connects the meter to SWD.

MIXER & MONITOR METERING (SWD) — Used in conjunction with SWB (see above) it selects various currents in the mixer and Stages 1, 2 and 3 circuits for measurement on M1.

fRAD Mc/s (SWC) — This a three position range switch which selects the appropriate tuned circuit for the anode circuits of the mixer and Stages 1, 2 and 3.

NOTE: *The frequency ranges marked against the positions of this switch refer to the final radiated frequency.*

MONITOR (LKA) — This U-link is used to connect various monitor signals from Stages 3, 4, 5 and 6 to the Monitor Frequency Changer.

4.2.10 Bottom Panel

STAGE 6 COUPLING (L20) — This control turns a lead screw which propels L20 up or down around L19 thus varying the coupling.

STAGE 6 TUNE (L19) — This control turns L19 which propels a contact assembly up or down its length thus varying its inductance.

FIL. VOLTMETER SWITCH (SWJ)	This switch selects any one of the Stage 4, 5 or 6 filament supplies for measurement on M8 (FIL. VOLTMETER)
AUX. VOLTMETER SWITCH (SWK)	This switch selects various supply voltages for measurement on M9 (AUX. VOLTMETER).
STAGE 5 FEEDBACK CONTROLS 1, 2, 3, 4 and 5	Individually selected by SWB (RANGE above) to provide adjustment of the envelope correction circuit by means of a.f. feedback; one for each range.

HS31 & HS31A only For HS31/1 & HS31A/1 see Supp.1 Sect.4.2.8

4.3 GENERAL DESCRIPTION OF EQUIPMENT

4.3.1 Rectifier and Control Unit

Component Layout: (HS31 & HS31A) Figs.1 & 2
(HS31/1 & HS31A/1) Figs.1A & 2A

The main a.c. supply enters via terminal board TB1 mounted on the left-hand wall of the cabinet at the top rear.

In the upper part of the cabinet, immediately under the roof, are two brackets occupying the width of the cabinet. Mounted on the one nearest the front are the terminal boards carrying the remainder of the incoming and outgoing connections; the Stage 6 filament limiting resistor, R4; and a preset variable resistor, R2, which controls the 6.3V auxiliary filaments supply. On the bracket immediately behind, (i.e. nearer the rear door), are the 6.3V auxiliary filament transformer, TR2, and the Stage 6 filaments transformer TR3. Beside these, on the same bracket, is a terminal board, X2, not used.

Behind this bracket is mounted MR1, the metal rectifier, which provides the 50V d.c. supply for the control circuits.

Mounted on the right-hand wall of the cubicle, at the top, are the overload relays OD and OE. Relays OD and OE are operated by the current flowing in Stages 5 and 6. RV6 is in parallel with OE and provides adjustment of its operating point.

Below the relay assembly is the bias unit. This is contained on a flat chassis mounted on rails, allowing the whole unit to be slid out from the rear of the cubicle.

Immediately below the bias unit is a similarly constructed and mounted unit for the Auxiliary H.T. Supply.

Standing on the floor below the auxiliary h.t. unit are the main h.t. transformer and the smoothing capacitors C9-C11.

The h.t. rectifier valves are assembled on the left-hand wall of the cubicle, mounted on top of their filament transformers. Immediately above them are three resistors, R17, R18 and R19, which form a potentiometer chain providing 600V for the screen grid of Stage 5 from the 4 kV h.t. line. When a Type ACT70 valve is used in Stage 6, resistor R19 is returned to earth instead of to the bias supply.

Below the h.t. rectifier valves are the metal rectifiers forming MR2, which provides 5 volts d.c. for Stage 5 filaments. Mounted underneath these is SWK the Stage 5 filaments reversing switch, and alongside it L1 the filament rectifier smoothing choke, and TR4, the filament rectifier transformer.

Also mounted on the floor of the cubicle, with L1 and TB4, are TR1 the 50V d.c. supply unit transformer, and L7 the main h.t. smoothing choke.

The plug PLAJ on a flexible cable, situated on the left-hand wall of the cabinet, above the main h.t. rectifier valves, is not used in HS31.

The interconnecting cables between the rectifier cubicle and the r.f. cubicle are taken out through an aperture at the top of the left-hand wall at the front, adjacent to the terminal blocks.

In the centre of Fig.1 is shown a rear view of the components mounted on the panels at the front of the cubicle.

r HS31/1
HS31A/1
e also
pp.1
ct.4.3.1.

Behind the h.t. rectifier valves, attached to the left-hand wall of the cabinet, are the two interlock switches, SWA and SWB. These are operated by the 'lock-handles' on the front and rear doors respectively, of the cubicle, and remove the a.c. input from all circuits and earth the 4 kV h.t. line when either door is unlocked.

4.3.2 Radio Frequency Unit

Component Layout: (HS31) Figs.3, 4 & 5. (HS31A) Figs.3A, 4 & 5A. (HS31/1) Figs.3B, 4A, 5B. (HS31A/1) Figs.3C, 4A & 5C.

This unit is described in the following text in a functional order commencing with the mixer unit.

4.3.2.1 Mixer Unit

Component Layout: (HS31) Fig.6. (HS31A) Fig.6A. (HS31/1) Fig.6B. (HS31A/1) Fig.6C.

This is a separate sub-unit in the front centre of the cabinet. It is mounted on runners to enable it to be easily withdrawn for maintenance and adjustment.

The unit contains the harmonic generator (or frequency doubler stages) and its power amplifier stages, a mixer stage, the first three stages of the six stage final amplifier chain and the monitor frequency changer.

Inter-unit connections are made by plugs and sockets on long flexible leads at the rear of the unit.

Also on the rear of the chassis is the Ledex switch SWG. This switch is controlled by SWL the FREQUENCY switch on the front of the Rectifier and Control Unit (R.C.U.) and selects the desired external crystal drive unit and illuminates the appropriate frequency lamp on the Control Panels of the R.C.U., and selects the appropriate gain control potentiometer.

The Monitor Frequency Changer is contained in the front right-hand corner of the unit immediately behind its associated U-link selector. Behind it are the mixer bias potentiometers and their REMOTE/MANUAL changeover switch, SWF. RV5 is the MANUAL bias control (level control) used in place of the preset potentiometers, RV6-RV11, when SWF is in the MANUAL position.

For HS31/1 & HS31A/1 see also Supp.1 Sect.4.3.2.1

If an external Frequency Shift Diplex Equipment is used the Mixer Unit is bypassed and will have no effect on the transmitted signal, although being an integral part of the transmitter it will still function. If the transmitter is set to AUTO the wave indicator lamps will light as the FREQUENCY switch is operated but these will have no significance. The Monitor Frequency Changer is also bypassed by a link which allows the radiated frequency to be fed back to the monitoring receiver.

4.3.2.2 **4th and 5th R.F. Amplifier**

Component Layout: (HS31) Fig.5. (HS31A) Fig.5A. (HS31/1) Fig.5B. (HS31A/1) Fig.5C.

These stages are contained in a separate sub-unit mounted above the Mixer Unit. The unit may be withdrawn on runners and is mechanically interlocked with the Stage 5 interlock switch, SWF, mounted on the front panel immediately above the unit.

HS31 & HS31A only. For HS31/1 & HS31A/1 see Supp.1 Sect.4.3.2.2

The plan view of the component layout shows, at the front, the Stage 5 anode tuning coil assembly, an end view of which is also shown in the separate sketch 'J'. In the back left-hand corner is the Stage 5 anode circuit range switch, SWA, which is ganged with range switches associated with Stage 6 and the output circuit and connects in circuit, with the anode tuning coil, the required tuning capacitance (C32, C33, C34). The drive to this switch from the RANGE control on the front of the r.f. cabinet, is made through a coupling so that the whole sub-unit may be withdrawn from the cabinet; care must be taken, therefore, to see that the switch is in the correct position to mate with the driven member of the coupling before the unit is pushed back into the cabinet.

Beside SWA are valves V3 and V4 of Stage 5.

HS31 & HS31A only. For HS31/1 & HS31A/1 see Supp.1 Sect.4.3.2.2

Associated with Stage 5 is a row of five potentiometers, RV1-RV5 situated at the foot of the r.f. cabinet (see front layout Fig.3); these potentiometers provide for adjustment of an envelope correction circuit to minimize i.s.b. distortion. Any one of the five potentiometers may be in circuit, making available individual adjustment of the correction circuit on each frequency range, thus ensuring best possible linearity throughout the tuning range of the transmitter. Switching the potentiometers is done by a small wafer switch, SWB, mounted on and operated by the 'RANGE' control on the front of the r.f. cabinet.

The underside view on the component layout drawing shows the Stage 4 tuning mechanism, in the front left-hand corner (considered from underneath). Mounted immediately behind this are the valves of Stage 4. The flexible drive to the Stage 5 neutralizing capacitor (C16), is also shown. The tuning mechanism of Stage 4 is shown on sketch 'K': its single tuning control on the front panel drives a 6-coil turret, comprised of coils L5 to L10, and at the same time turns a continuously-variable capacitor, C12. Each coil in turn is switched in parallel with the capacitor, which is tuned through its full capacity range for each coil connection. By this arrangement the circuit covers the entire frequency range of the transmitter in six stages, by movement of one control.

The front panel control drives the capacitor shaft and the capacitor tunes during 180° of each revolution of the shaft. The shaft also drives a slotted cam which engages with projections on the face of a small wheel on the coil turret shaft, and during the other half of each revolution of C12, turns the turret through 60°. Thus after each tuning cycle of C12 a different coil is switched into circuit. Connection to each coil is made via sets of studs on mycalex strips adjacent to each coil; the appropriate set engages with contact springs on the framework of the assembly when the associated coil is in circuit.

During the half revolution in which the turret is turning, another cam opens an interlock switch. This is switch SWL, connected in series with the h.t. control circuit, so that h.t. is removed during coil changing.

The Stage 5 anode tuning coil with the end plates (Ref.55 and Ref.59 on the plan view) removed, is shown in sketch 'J'. The tuning control on the front panel turns the coil and an insulated jockey wheel (Ref.85) bearing on the inductor advances a contact carriage (Ref.68) along the length of the coil. Electrical contact with the inductor is made by four ball contacts on the contact carriage.

4.3.2.3 Amplifier Stage 6

Component Layout: (HS31) Figs.3 & 4. (HS31A) Figs.3A & 4.
(HS31/1) Figs.3B & 4A. (HS31A/1) Figs.3C & 4A.

This is the final amplifier and is housed at the rear of the r.f. cabinet. A general rear view is shown in Fig.3. The valve and the associated components, except for the anode tuned circuit components, are contained in the compartment in the top left of the cabinet, an interior view of this compartment appears in the separate sketch, 'B'. The anode coil assembly is contained in the lower compartment and is shown in detail in sketches 'F'and 'G' in Fig.4.

The stage uses a triode in a grounded grid arrangement; this lends itself to compact circuit construction. The valve is supported by its anode cooling fin assembly which fits into a cylinder at the top of the anode coil structure (see sketch 'G') in the lower compartment. On a level with the grid ring of the valve, and surrounding the valve, is an aluminium sheet. Thus the valve grid, together with this sheet, screens the valve input circuit from its output circuit. Mounted on the sheet, which is hinged to facilitate fitting the valve, are the grid circuit components (see sketch 'B'). The anode tuning of the stage is effected by a continuously variable helically wound inductor, L19, mounted in the lower compartment; it is shown in sketch 'G' in Fig.4. The coil is turned by a handle at the bottom right of the front panel of the cabinet, immediately below the mixer unit.

Rotation of the coil causes a four point contact assembly to move up or down the length of coil, making the variable tapping point, at the same time short-circuiting some of the turns to reduce 'end effect'.

In the sketch the valve is shown in position. The anode connection is made by spring ball contacts (item 35) which bear on a brass drum that forms part of the coil end assembly. The other end of the contact springs are attached to the support into which the anode cooling fin structure of the valve fits. An end view of the coil appears in sketch 'A', and shows the connecting clamps and the arrangement of the mycalex supports on which the coil is wound.

Coupling from the anode circuit to the output circuit is made by the coil, L20, wound around L19 (sketch 'G'). Its position with relation to L19 is variable by a lead screw turned by a control mounted beside the anode tuning control, on the front panel.

The entire assembly can be moved from the cabinet, but this is not required for normal maintenance.

HS31 & HS31A only. For HS31/1 & HS31A/1 see Supp.1 Sect.4.3.2.3.

Capacitors are switched across the anode tuning coil to cover the tuning range of the transmitter. The capacitors are on the switch assembly, SWC, which is mounted in the lower compartment of Stage 6 circuit, in the top right-hand corner and is ganged with SWA and SWB, already mentioned in the description of Stage 5 Section 4.3.2.2, and with the output circuit range - switch SWD, described below. SWC is shown in more detail in sketch 'F' in Fig.4.

4.3.2.4 Output Circuit

Component Layout: (HS31) Figs.3, 4 & 5. (HS31A) Figs.3A, 4 & 5A. (HS31/1) Figs.3B, 4A & 5B. (HS31A/1) Figs.3C, 4A & 5C.

The components of the matching circuit between Stage 6 and the aerial feeder, occupy a compartment at the rear of the r.f. cabinet, in the top right-hand corner - see rear view. They are mounted between vertical cast-alloy plates, forming a rigid assembly which can be withdrawn on runners; a left-hand side view (considered from the rear) of this assembly, is shown in sketch 'A'.

The range switch, SWD (SWC in HS31/1 & HS31A/1), which alters tappings on fixed inductors L22 and L23, is ganged to SWC (SWB in HS31/1 & HS31A/1) in Stage 6 and SWA and SWB (SWA only in HS31/1 & HS31A/1) in Stage 5. All of these switches are controlled by the RANGE control on the front of the cabinet.

The drive to SWD (SWC in HS31/1 & HS31A/1) is made through a coupling to enable the unit to be withdrawn from the cabinet; therefore, when replacing the unit, care must be taken to see that the switch is in the same position as when the unit was removed to mate correctly with the driving member of the coupling.

The circuit is tuned by a variable differential capacitor C64, in conjunction with four padding capacitors C68-71, through a switch, SWP, controlled by the FEEDER TUNE control on the front of the r.f. cabinet. Operated in conjunction with SWP is an interlock switch SWM, mounted immediately behind the tuning control, which prevents arcing on SWP by removing h.t. when switching in circuit the padding capacitors.

The variable capacitor has butterfly shaped plates and is set up to turn from maximum capacity at 0°, through minimum at 90°, maximum at 180°, to minimum at 220°.

Padder capacitors C68-C71, are connected into the circuit by switch assembly SWP, which is fixed to the spindle of capacitor C64. This switch is mounted such that the padders are only in circuit when the capacitor turns through its first 120°.

On the gearbox shaft is a cam with which the roller follower micro-switch, SWM, is associated. This switch is an interlock switch which ensures that the h.t. is off when SWP is in transition. The switch, due to the cam, is closed during the period of capacitor travel through the first and third quadrants and open during the second quadrant.

The cycle of operation of the assembly is as follows 0° to 270°.

Capacitor Movement in Degrees	HS31 and HS31A Scale Reading	HS31/1 and HS31A/1 Scale Reading	Capacitor C64 Capacity	Switch SWM	Switch SWP	Capacitors C68-C71 in/out
0	0	0	max	closed	closed	in
90	33	66	min	opens	closed	in
120	43	87		open	open	out
180	67	133	max	closes	open	out
270	100	200	min	closed	open	out

If the feeder tuning control is turned in the opposite direction, the sequence occurs in reverse order. If the control is turned through 0 to 100, the switching completes a full cycle and returns to its original position.

4.3.2.5 Cooling Fan

Mounted in the base of the r.f. cubicle is a suction fan which draws cooling air down through the amplifier stages from an inlet in the top of the cubicle. The inlet is on the rear facia panel and is covered by an air filter which is removable without switching off the transmitter. The hot air drawn by the fan into the duct at the base of the cubicle is expelled from the vent on the cubicle roof via a duct between the two cubicles.

5 CIRCUIT DESCRIPTION GENERAL

5.1 R.F. CIRCUITS

Block Diagram Fig.9.

Any one of the HS31 range may be used as a transmitter or a power amplifier. When used as a power amplifier, the drive at radiated frequency is applied to the grid circuit of Stage 4.

When used as a transmitter two r.f. inputs are applied to the Mixer Unit; one is a frequency from the primary crystal oscillator and is between 3.45 and 6.95 Mc/s. It is applied to the Mixer Unit where it is either doubled or quadrupled in the harmonic generator stages. The resultant frequency, described as the harmonic generator frequency (fHG), is then fed to the control grids of the balanced mixer stage. The second input is the i.f. drive, bearing the signal intelligence to be transmitted.* This is fed to the cathode circuit of the mixer stage. The sum and difference components of the two inputs appear simultaneously in the anode circuit of the mixer, and the required output is selected by tuning the anode circuit to the higher or lower component as desired. The output taken from the anode circuit is the frequency to be radiated and is applied through six amplifier stages to the aerial feeder circuit.

Stage 5 amplifier has an envelope correction circuit in its cathode circuit. This correction circuit minimizes the i.s.b. distortion in the transmitter.

The first three stages of the amplifier chain are contained in the Mixer Unit; Stages 4 and 5 are mounted in a separate sub-unit above the Mixer Unit; Stage 6 occupies most of the rear part of the r.f. cabinet.

5.1.1 Monitoring

To facilitate correct operation of the transmitter, provision is made for feeding monitor signals from various parts of the amplifier chain back to the i.s.b. drive unit for examination in a monitoring receiver. To do this, whichever monitor signal is required is fed into a frequency changer circuit in the Mixer Unit, and there combined with the output of the harmonic generator stages to be converted to a 3.1 Mc/s signal (HS31 & HS31/1 only - 2.15 Mc/s for HS31A and HS31A/1) suitable for feeding to the drive equipment.

5.2 POWER SUPPLIES

All of the various power supplies are located in the Rectifier Cabinet. An input of 380/420V, 50 or 60 c/s, 3-phase, is used.

The main h.t., for Stages 5 and 6, is 4 kV, and is produced by a 3-phase full-wave rectifier using Xenon-filled diodes.

Auxiliary h.t. supplying the remaining stages, is produced by a full-wave hard valve rectifier circuit which provides 450V unstabilized and 280V stabilized.

Bias voltages are produced from a metal rectifier circuit. Various outputs are obtained from an adjustable potentiometer across the output of the rectifier.

Filament voltage for Stage 5 is 5 Volts d.c. provided by a 3-phase metal rectifier circuit. Stage 6 filament supply is 12.6V a.c., and the supply for the remainder of the r.f. valves is 6.3V a.c. All these three supplies are provided by transformers in the Rectifier Cabinet.

* For i.f. drive input frequencies see Supp.1, Table 1.

The various h.t. and filament supply circuits are switched on and off by a sequenced relay and contactor control circuit, the operation of which is initiated by push button switches on the main control panel.

The control circuits are energized by 50V d.c. negative from a metal rectifier circuit.

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The cooling fan is supplied direct from one phase of the a.c. input.

5.3 OVERLOAD PROTECTION AND INTERLOCKS

An increase in the current drawn by Stage 5 or Stage 6, will cause the operation of one of the overload relays mounted in the rectifier cabinet.

The contacts of the relays will interrupt the control circuit of the main h.t. contactor switching off the 4 kV rectifier, and at the same time energizing the overload lockout relay. The lockout relay keeps the h.t. contactor isolated when the overload relays de-energize, lights the H.T. TRIP indicator lamp and operates a warning bell.

Main h.t. is reset by pressing the TRIP RESET button to de-energize the lockout relay and then pressing the H.T. ON button.

The front and rear doors of the rectifier cabinet are fitted with 'lock-handles'; these operate switches which, when the 'lock-handles' are set to 'UNLOCK', to enable the doors to be opened, 'break' the h.t. control circuit and earth the output line of the main h.t. rectifier. The rear door of the r.f. cabinet is also provided with a 'lock-handle'. This similarly operates a switch to break the h.t. control circuits and earth the h.t. line of Stage 6 before the door can be opened.

In addition to these, in the control circuits are contacts of switches associated with certain tuning controls; these remove h.t. if the controls are operated with h.t. on.

In the top centre of the front of the r.f. cabinet is a switch labelled 'STAGE 5 H.T. INTERLOCK', which 'breaks' the h.t. control circuits and earths the Stage 5 h.t. line when it is set to SAFE. A latch associated with it prevents access to Stage 4 and 5 until it has been set to SAFE. Inside the r.f. cabinet at the rear, is a switch associated with a latch on the door to the compartment containing the final amplifier anode compartments. This ensures the removal of the filament supply from the valve before the door can be opened. It protects the valve filament seals from overheating due to loss of cooling air pressure when the compartment is open.

In the air exhaust duct is an air pressure switch which switches off all supplies in the event of failure of the cooling air supply.

6 CIRCUIT DESCRIPTION DETAILED

6.1 GRID REFERENCE

To facilitate explanation, description and ease of reference, the following method of component identification is used. All drawings have a grid round them lettered horizontally and numbered vertically, thus if all these grid points were joined the drawing would be divided into a number of small squares which can be identified by a letter and a number i.e. 1A, 2A etc.

Components referred to in the text following are suffixed by a grid reference, e.g. R25 (7F) which will facilitate location on the drawing concerned. To avoid confusion, this applies, in general, only to HS31 and HS31A, but components on HS31/1 and HS31A/1 circuit diagrams which have similar functions to HS31 and HS31A components will occupy similar positions on the diagrams.

6.2 RADIO FREQUENCY CIRCUITS

6.2.1 Harmonic Generator

Circuit Diagram: (HS31) Fig.12, (HS31A) Fig.12A, (HS31/1) Fig.12B, (HS31A/1) Fig.12C.

The harmonic generator consists of three frequency multiplier stages V1, V2 and V3 followed by two amplifier stages, V4 and V5/V6 in parallel. The tuning capacitors of each stage, C5, C14, C25, C41 and C47, are ganged to a single control on the front panel of the unit.

Various combinations of the multiplier stages are selected by SWA, the harmonic generator frequency range switch (fHG Mc/s), to give an output frequency of twice or four times the primary crystal oscillator frequency (fxtal). These combinations are shown in the table below (HS31 and HS31/1 only. For HS31A and HS31A/1 see Supp.1, Table 3).

SWA Range Mc/s	fxtal Mc/s	Function			fHG Mc/s	Mult. Factor
		V1	V2	V3		
4-8	3.45-4	Doubler	-	-	6.9-8	2
8-16	4-6.95	Ampl.	Doubler	-	8-13.9	2
	3.475-4	Doubler	Doubler	-	13.9-16	4
16-24.4	4-6.1	Ampl.	Doubler	Doubler	16.24.4	4

SWA also selects the appropriate anode tuned circuit of the amplifier stages V4 and V5/6, allowing them to be tuned over the entire frequency range without external change of components, and switches the required final harmonic generator frequency to the control grids of the mixer stage.

The tuned circuit of each amplifier stage has trimmers selected by SWA to enable the circuits to be tracked. Similarly, each tuned circuit of the amplifier stages has a separate trimmer.

The meter M1 (90) and the selector switch SWB, provide monitoring of the following:-

V1	cathode current	- across R8(7B)
V2	cathode current	- across R16(7D)
V3	cathode current	- across R25(7F)
V4	cathode current	- across R37(7H)
V5/V6	grid current	- across R40)7I)
V5/V6	cathode current	- across R44(7J)

In the seventh position of the switch, connection is made via point 'm' (70) to the mixer meter switch SWD, shown in Fig.13 of the circuit diagram. The connections of this switch are listed in the following sub-section.

6.2.2 Mixer Stage

NOTE: *When an external Frequency Shift Diplex Equipment is used the Mixer Unit is, with the exception of the Monitor links on the front panel, bypassed. To ensure non-operation of the FREQUENCY indicator lamps on the control panel giving spurious indication the AUTO/MANUAL switch should be set to MANUAL.*

Circuit Diagram Fig.13.

Valves V7 and V8 form the balanced mixer stage. The i.f. input from the drive equipment is applied to the cathode circuit across R56 and R58, via the unbalanced to balanced transformer TR12(7B) and socket SKS(7C). The output of the harmonic generator stages is applied to the control grids. The resultant output, fHG + i.f. or fHG - i.f., is taken from the anode tuned circuits. Either of these tuned circuits, TR6/C67, TR7/C68 or TR8/C69, are selected by wafers SWC15(2B) and SWC17(6B) of the range switch SWC, depending on the frequency to be radiated. Tuning is effected by the variable capacitors C65 and C66, which are ganged to the mixer tuning control on the front panel of the unit. Trimmers on each tuned circuit enable individual setting-up.

The stage is balanced by the h.t. potentiometer RV1(4B) and the capacitor C63(4B). Resistors R57 and R61(4B) decoupled by C62(4B) provide auto bias.

The output level from the mixer stage is adjusted by variable suppressor grid bias. There are two methods of control; either by variations of potentiometer RV5(5L), when switch SWF(5L), is in the MANUAL position, as drawn, or by automatic selection of six preset potentiometers, RV6-RV11(5M-5N), when SWF is set to REMOTE. Normally MANUAL control is used. Automatic selection of RV6-RV11 by remote control is carried out by the 'Ledex' controller SWG, which also carries out the selection of the six different primary crystal oscillator drives. Thus, if desired, the six potentiometers may be used to preset the mixer output level for the six available radiated frequencies.

The 'Ledex' switch SWG referred to above, is an electrically operated switch and is caused to turn to any of the six positions by operation of the frequency selector switch, SWL, on the Rectifier Unit control panel. Its control circuit is described in Section 6.4.5., here are described only its various functions.

SWG has five wafers. The on/off contact SWG1 and wafer SWG2 are associated with control of movement of the switch. SWG3 lights one or other of the six frequency indicator lamps, by connecting the 50V d.c. supply to the appropriate lamp, via pins 1-6 of PLP. Wafer SWG4 connects the 50V d.c. supply to one of the six pins of socket SKL. This connects via external wiring to the primary oscillator equipment and there controls another electro-mechanical switch which provides the automatic selection of the six different crystal oscillator frequencies.

Wafer SWG5 connects one of the potentiometers RV6-RV11 to the mixer bias supply line coming in on Pin 12 of plug PLN(20). Wafer SWG6 connects the variable points of the same bias potentiometer to the suppressor grids of the mixer valves, V7/V8, to provide the adjustment of mixer output level for each available radiated frequency as described.

6.2.3 Stages 1, 2 and 3

Circuit Diagram: Fig.13(HS.31), Fig.13A (HS31A), Fig.13B (HS31/1), Fig.13C (HS.31A/1)

NOTE: *When an external Frequency Shift Diplex Equipment is used Stages 1, 2 and 3 of the internal Mixer Unit are not used but being an integral part of the transmitter will operate without being driven.*

The output of the mixer stage, i.e. the frequency to be radiated, is transformer coupled by TR6, TR7 or TR8, whichever is in circuit in the mixer stage, to the grid of the first amplifier stage, V9(7E) via SWC13-(6D). Valve V9 is a buffer amplifier operating in class 'A'. It is followed by two class 'AB' amplifiers, Stage 2, V10, and Stage 3, V11.

Each amplifier has three separate tuned anode circuits, each covering a part of the frequency range of the transmitter. They are switched into circuit by the 3-position switch, SWC, which also switches the anode tuned circuits of the mixer stage. Each tuned circuit has its own trimmer capacitor, allowing individual adjustment of tuning over the frequency range covered by that circuit. The main tuning capacitors of each stage, C82(5F) for Stage 1, C94(5G) for Stage 2 and C100(4H) for Stage 3, are ganged to a single tuning control on the front panel of the unit with the tuning capacitors of the mixer stage.

Bias for Stage 1 is auto bias over R78 and R79(7E), decoupled by C77.

Grid bias for Stages 2 and 3 is adjustable by the potentiometers RV3 and RV4(5L) supplied from the 105V stabilized output of the bias rectifier unit, via Pin 3 of plug PLN.

The r.f. output, from Stage 3 is fed via SWC1 and SWC2(6J) to the coaxial socket, SKQ and thence to the sub-unit containing Stages 4 and 5. Also taken from SWC1 is a reduced output to a monitor plug PLBE. This is for use in the monitor frequency changer unit - V12 and V13 - which is described in Section 6.2.7.

Switch SWD(30) is the meter switch associated with harmonic generator meter switch, SWB, and the meter, M1, as explained in Section 6.2.1. It connects to the following points:-

Position

V7/8	-	Mixer cathode current - across R61(4B).
V9	-	Stage 1 cathode current - across R79(8E).
V10	-	Stage 2 cathode current - across R88(8G).
V11	-	Stage 3 cathode current - across R98(8H).
V12	-	Monitor Frequency Changer cathode current - across R117(4K).
V13	-	Monitor Frequency Changer output valve cathode current - across R130)4L).

Power supplies for the unit are brought in on plug PLN(1-2N).

There are two h.t. supplies, both provided by the auxiliary h.t. unit in the Rectifier Cabinet. Firstly, 450V on Pin 1 for Stage 2 and 3 anode supply, secondly, 280V stabilized, on Pin 2 for Stages 2 and 3 screen supplies and anode and screen supplies for all other valves in the unit. The screen supply to Stages 2 and 3 is applied through the tumbler switch, SWE(1H). This enables Stages 2 and 3 to be switched off during balancing of the mixer, to prevent oscillation due to amplification of the harmonic generator frequency through Stages 2 and 3 and subsequent feedback into the harmonic generator.

The filament supply is 6.3V a.c. from the Rectifier Cabinet, supplied via Pins 4, 5, 6 and 7, 8, 9 of plug PLN.

Supplied via Pin 3 of PLN is the 105 volts stabilized supply for Stage 2 and Stage 3 bias potentiometers, RV3 and RV4.

6.2.4 Stages 4 and 5

Circuit Diagram: (HS31) Fig.10, (HS31A) Fig.10A, (HS31/1) Fig.10B, (HS31A/1) Fig.10C.

Stage 4 which consists of two CV428 valves, V1 and V2, operating in parallel as a class A amplifier stage, is fed via plug PLCB the centre pivot of link LKA, C1 and the stopper networks L2/R2 and L3/R7. The two positions of the link allow either: (a) the output of an external Frequency Shift Diplex Equipment to be fed into Stage 4 via SKK, the attenuator network, R34 to R52 and RV7, and plug PLCA, or (b) the output of the amplifier, Stage 3 in the Mixer Unit, via SKH and PLCC.

The attenuator, R34, to R52 and RV7, reduces the power output of the HD61B (20-40 watts) to the required power input of Stage 4 (approximately 1 watt).

Bias for Stage 4 is obtained from the bias unit in the Rectifier Cabinet, and is applied to the control grids via the r.f. choke L1 from Pin 3 of plug PLJ. H.T. is obtained from the 450V line of the auxiliary h.t. unit via Pin 2 of PLJ.

The tuned circuit comprises one of the series of coils, L5-L10, and the variable capacitor C12, with bandspread capacitor C13 switched in on the lower frequencies. Tuning is done by a single control which switches the coils into circuit one at a time and at the same time rotates C12.

The precise functioning of the mechanism is explained in Section 4.3.2.2. Associated with the tuning mechanism is switch SWL(7G), which breaks the control circuit of the auxiliary h.t. supply unit, see Section 6.4.1, when coil switching is in progress. Capacitor C15(4I) provides pickup for the monitoring point, socket SKM(2E), which feeds the monitor frequency changer.

Stage 5 comprises valves V3 and V4 in parallel, operating in class 'AB'. Bias provided from the bias unit in the Rectifier Cabinet is supplied via Pin 10 of plug PLJ(8I), the choke L11(5I) and the tuning coil, L5(4H) in HS31 and HS31A, and L6 in HS31/1 and HS31A/1.

HS31 & HS31/1 only. For HS31A & HS31A/1 see Supp.1 Sect.6.2.4.

The anode tuned circuit consists of L15 and the three ceramic capacitors C32, C33 and C34, switched by the range switch SWA. On the lowest frequency range C32 and C33 are connected in parallel. On the next range C33 only is in circuit and on range 3 the padder capacitor C34 is switched in series with C33. For the highest frequencies, the self capacities of the valve and circuit only are used. It should be noted that on the HS31 the lowest range is not normally used.

The h.t. for Stage 5 is 4 kV supplied by the main h.t. rectifier and applied through the choke L27 and the anti-parasitic choke/resistor combination R28-L14. The short-circuited resistor, R16(4J), provides damping for parasitics at v.h.f. The screen grids are supplied from a 600 volt line, in the HS31 and HS31A, and from a 480 volt line in the HS31/1 and HS31A/1, derived from the 4 kV line by a potentiometer in th Rectifier Cabinet.

The overall linearity of the amplifying stages is improved by an envelope correction circuit operating on Stage 5 as follows:-

The filaments are connected across resistors R25 and R26(6J). The mid-point of these two is connected via R27 and L29 in parallel, and R19 to earth. Resistor R19 is a meter shunt and R27 provides envelope correction. It is virtually short-circuited to d.c. by L29 and therefore has no effect on standing bias, but as it is not decoupled to a.f. there is developed across it a 'Feedback' voltage dependent on the modulation component of the signal. To provide individual adjustment of th correction circuit on all frequency ranges, R27 is shunted by one of th 5 potentiometers, RV1-RV5(6M), switched into circuit by SWB, ganged to the anode circuit range switch, SWA.

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The high gain of the stage necessitates neutralization. This is achieved by a bridge circuit consisting of C24 and C16/C17 and the grid filament capacity (shown dotted) and the anode/grid capacity of the valves. The circuit is adjusted by variation of C16, brought out to a front panel control. Adjustment is only required when setting-up initially and holds over the whole frequency band.

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The output to Stage 6 is via C35.

6.2.5 Stage 6

Circuit Diagram: (HS31) Fig.10, (HS31A) Fig.10A, (HS31/1) Fig.10B, (HS31A/1) Fig.10C.

This stage consists of a single triode, V5, in a grounded grid circuit. This arrangement avoids the need for neutralization, as the anode to grid capacitive currents due to the output voltage do not flow throug the input circuit. In addition, linearity is improved, as the stage has a low and appreciable constant input impedance and thus variation of grid current over the r.f. cycle does not appreciably affect the regulation of the driving stage.

Input to the stage is across C45(3M) which forms a capacity potentiometer with the coupling capacitor C35, and presents a low impedance to harmonics of the input permitting a higher operating efficiency of the stage. (In the HS31A and HS31A/1 the input to the stage is across C45 and C77, with C77 being switched out on the 6 to 20 Mc/s range).

HS31 & HS31/1 only. For HS31A & HS31A/1 see Supp.1 Sect.6.2.5

The filament choke L17 is wound from concentric cable. One leg of V5 filament is connected to the inner conductor, the other leg to the outer conductor and the filament supply is applied to the other end. Thus the supply circuit is isolated from r.f. The cathode circuit is grounded via the centre tap of RV6 in HS31 and via RV1 in HS31/1, connected between the inner and outer of L17, and the meter shunt R22.

The grid is earthed to r.f. by C43, C44 and C48, C49. Grid bias is applied via L18(4N) and the grid current meter shunt R23 from the bias rectifier in the Rectifier Cabinet.

The anode tuned circuit is L19 and one of the capacitors C56, C57 or C58, or, on the higher frequencies, the self capacitance of the valve and circuit. The range switch, SWC, (SWB in HS31/1 and HS31A/1) is ganged to SWA, the Stage 5 range switch. The h.t. supply is 4 kV provided by the main h.t. rectifier unit, fed via the r.f. chokes L21 and L28.

Coupling to the output circuit which provides impedance matching between Stage 6 and the aerial feeder, is provided by the variable mutual inductance between L19 and L20.

6.2.6 Output Circuit

Circuit Diagram: (HS31) Fig.11, (HS31A) Fig.11A, (HS31/1) Fig.10B, (HS31A/1) Fig.10C.

The coupling coil is tuned by C64 and the fixed capacitors C68-C69 and C70-C71, see Section 4.3.2.3. The fixed inductors L22 and L23 assist tuning on the lower frequency ranges, while the parallel inductor L26 is used on the highest range. These inductors are selected by the output range switch, SWD (SWC in HS31/1 and HS31A/1), which is ganged mechanically to the Stage 5 and Stage 6 range switch.

PVM4 is a peak voltmeter unit which feeds the feeder indicator M10. C65 provides pick-up for the monitor frequency changer (see Section 6.2.7).

Where the 50 ohms output impedance is provided, (by the use of an external transformer), filter W.102405 ED.B is connected to the output terminals of HS31 and HS31/1. The filter is mounted externally on the roof of the R.F. unit. Similarly, when 50 ohms output impedance is provided in transmitters HS31A and HS31A/1 filter W.102405 ED.C replaces coils L32 and L33 (in HS31A) or L30 to L33 (in HS31A/1), all located in the roof of the R.F. unit.

6.2.7 Monitor Frequency Changer

Circuit Diagram: (HS31 & HS31A) Fig.13, (HS31/1 & HS31A/1) Fig.13A.

NOTE: *When an external Frequency Shift Diplex Equipment is used the Monitor Frequency Changer, being part of the Mixer Unit, is not used, but use is made of the monitor links on the front panel to feed the monitor signals at radiated frequency to the remote monitoring equipment via SKX.*

This circuit consists of V12 and V13(3K-L) etc. It is used to convert signals from various monitor points throughout the amplifier chain to 3.1 Mc/s in HS31 and HS31/1 and to 2.15 Mc/s in HS31A and HS31A/1, for feeding to the monitoring equipment normally fitted in the i.s.b. drive rack.

Monitor signals at radiated frequency are applied to the cathode of V12 via plug PLBC(1J). PLBC may be connected by the U-link, LKA, to any of plugs PLBA, PLBB, PLBD or PLBE, which connect to monitor points in the output circuit, Stage 5, Stage 4 and Stage 3, respectively. To the grid of V12 is fed the output frequency of the harmonic generator. The two inputs are mixed in V12 and the resultant difference signal at 3.1 Mc/s (HS31 and HS31/1) or 2.15 Mc/s in HS31A and HS31A/1, carrying the modulation, is amplified by V13 and fed via socket SKT(2M) to the monitoring equipment.

6.3 POWER SUPPLIES

Circuit Diagram: (HS31) Figs.14 & 15. (HS31A) Figs.14A & 15.
(HS31/1 & HS31A/1) Figs.14B & 15A.

6.3.1 Main H.T. Rectifier

This provides the 4 kV h.t. supply for Stage 5 and Stage 6. The circuit is a conventional 3-phase, full-wave rectifier. The valves, V1-V6, are filled with Xenon gas and will operate satisfactorily over a wide range of temperature, making an extensive air conditioning system and a long warming up period unnecessary.

Each rectifier valve has its own filament transformer, energized from the three-phase supply, via contacts FC4, FC5 and FC6(7G) of the filament contactor. The rheostats RV2, RV3 and RV4(8G) which are ganged, adjust the filaments supply and also control the input to the rectifier providing Stage 5 filament supply.

The supply to the h.t. transformer TR8(6L), is fed via contacts MC1, MC2 and MC3(8L) of the main h.t. contactor MC when it is energized by pressing the H.T. ON button.

The manner in which the overload relays control the h.t. contactor is explained in Section 6.4.4.

The output of the rectifier is smoothed by L7(1M) and C9(3N) etc.

The potentiometer chain R17, R18, R19(20 & 30) drops the 4 kV supply down to 600V, or 480V in HS31/1 and HS31A/1, for Stage 5 screen supply. M3 is the H.T. Voltmeter, mounted on the front of the Rectifier Cabinet.

Switches SWA4 and SWB4(3N) are contacts of the interlock switches on the front and rear doors of the cabinet. They close, and earth the 4 kV h.t. line when the doors are opened. At the same time other contacts of the same switches break the h.t. control circuits and disconnect the incoming a.c. supply as described in the control circuits Section 6.4.1.

6.3.2 Auxiliary H.T. Unit

This is the full-wave hard valve rectifier circuit, V7, V8 etc. It provides two outputs:- 280V, stabilized by V9, providing screen voltage for Stages 2 and 3 and anode and screen voltage for the rest of the valves in the Mixer Unit.

450V, unstabilized, for Stages 2 and 3 anodes and Stage 4 anode and screen supply.

6.3.3 Bias Rectifier Unit

This is the full-wave rectifier circuit, MR3(4H) etc. It provides five negative voltage outputs.

(a) 105 volts, stabilized by V10, via TB9 terminal 8 to the Stages 2 and 3 grid bias potentiometers.

(b) Grid bias for Stage 6, via TB9 terminal 5, adjustable to 110 volts approximately by RV12 on the meter panel at the front of the cabinet.

(c) Grid bias for Stage 5, via TB5 terminal 15, adjustable to 110 volts approximately by RV11 on the meter panel at the front of the cabinet.

(d) Grid bias for Stage 4, via TB5 terminal 14, adjustable to 25 volts approximately by RV10 on the meter panel at the front of the cabinet.

The bias supplies required depend to some extent on individual valves, and the variable resistors RV10, RV11 and RV12 may therefore require some adjustment when valves are changed (see Section 8.6).

The primary winding of the bias transformer TR5 is used as an auto transformer for the a.c. supply to the six inch ventilator fan on the roof of the cubicle.

6.3.4 Filament Supplies

Stage 6 filament voltage is 12.6 volts, supplied from TR3(3F). R4 is in series at the first instant of switching on, to limit the current in the cold filaments.

Stage 5 filament supply is 5V d.c. from the metal rectifier circuit MR2(3G) etc. The voltage output is varied by RV2, RV3 and RV4(7G) and by the preset resistors R8, R9 and R10)6G). RV2, RV3 and RV4 also control the h.t. rectifier filament voltage, therefore initial setting-up of Stage 5 filament is done by R8, R9 and R10, at the same time adjusting RV2, RV3 and RV4 for correct h.t. rectifier filament voltage.

The filaments of the remainder of the r.f. valves are supplied by 6.3V a.c. from TR2(3F).

6.3.5 Control Circuits Supplies

The majority of the control circuits are supplied by 50V d.c. negative, from the three-phase metal rectifier circuit MR1(3E) etc. The filaments delay switch FD, is energized from the RED phase of the a.c. supply.

The cooling fans in HS31 and HS31A are energized from the YELLOW phase of the a.c. input. The fans in HS31/1 and HS31A/1 are referred to in Supp.1, Sect.5.2.

6.4 CONTROL CIRCUITS

The switching on and off of the transmitter is controlled entirely from the control panel on the front of the Rectifier Cabinet. The filament, bias and h.t. circuits are energized in succession by relays and contactors, operated by pressing the push-buttons on the control panel. Each succeeding relay and contactor circuit is interlocked with the circuit preceding it, so that if, for instance, the filament control circuit failed, or was switched off, the h.t. control circuit would automatically be de-energized.

To protect the user, the a.c. input and the main h.t. control circuits are interlocked with switches operated by lock-handles on the front and rear doors of the Rectifier Cabinet.

6.4.1 Switching On Sequence

Circuit Diagram: (HS31) Figs.14, 15, 17. (HS31A) Figs.14A, 15, 17.
(HS31/1 & HS31A/1) Figs.14B, 15A, 17A.

This section explains the control circuit only; operating procedure appears in Section 10.

For the purpose of this description it is assumed that the transmitter is tuned.

(a) Operate the door switches SWA and SWB. (By closing and locking the front and rear doors of the Rectifier Cabinet).

Contacts SWA1-3 and SWB1-3 will close in the a.c. supply lines. Meter M1 may be switched to show any phase of the supply. The 50V d.c. power supply unit is energized and the 50V d.c. indicator lamp will light.

Contacts SWA4 and SWB4 remove the safety 'earths' from the main h.t. line.

Contacts SWA6 and SWB6 prime the circuit of the auxiliary h.t. relay, LA.

(b) Operate SWH, the associated door switch of the lower internal door of the Stage 6 valve compartment.

(c) Operate SWG, the rear door switch of the r.f. cabinet, by closing and locking the door.

SWG1 removes the safety earth from the Stage 6 4 kV h.t. line.

SWG2 primes the Auxiliary H.T. Contactor LA.

(d) Operate SWF, the Stage 5 Interlock Switch.

SWF removes the safety earth from the Stage 5 4 kV h.t. line.

SWF2 primes the Auxiliary H.T. Contactor LA.

(e) Set the LOCAL/REMOTE switch on the control panel SWG to LOCAL. This puts control of the START RELAY ST to the local START push-button SWC.

(f) Press the START push-button SWC.

Five relays will operate in succession, switching on filaments, bias and auxiliary h.t. in turn.

1. The START RELAY ST, will be energized via SWG and SWH.

Contact ST1, bypasses the START push-button, to allow the button to be released.

ST2 closes, allowing subsequent operation of the filament contactor FC and the full filament relay FF.

ST3 closes in the circuit of the main h.t. contactor MC.

ST4 starts the fan.

ST5 primes h.t. on line.

2. As the fan speeds up the FILAMENT CONTACTOR FC will close, via ST2 and the contact of the air interlock switch SWN.

   SWN is an air pressure switch in the air exhaust duct and is included to ensure filaments are switched off in the event of loss of air cooling.

   When the filament contactor has closed, contact FC1, energizes the 6.3V auxiliary filaments supply and the filament supply for the auxiliary h.t. unit.

   FC2-FC3 energizes the filaments supply of Stage 6, at reduced voltage, via R4.

   FC4-5-6 energize Stage 5 filament supply and main h.t. rectifier filament supply.

   FC7 energizes relay FD.

   FC8 primes relay FF.

   (FC9 is not used).

3. As soon as FC7 has closed, the filaments delay switch FD, will operate, energized from one phase of the a.c. supply.

   FD1 energizes relay FF after 30 secs.

   FD2 energizes the auxiliary h.t. relay LA via a contact of FF, after 35 secs.

   The function of the delay switch is to allow time for the valves to warm up after initial switching on of filaments, before applying full filament voltage to Stage 6 by operation of relay FF and switching on auxiliary h.t. by operation of relay LA.

4. As soon as FD1 'makes' the full filament relay FF operates.

   FF1 short-circuits R4 and puts on full filaments to Stage 6.

   FF2 energizes the bias unit.

   FF3 operates auxiliary h.t. relay LA - when FD2 makes.

   FF4 lights FILS ON lamp.

   (FF5 spare).

5. After FD2 and FF3 have closed, the auxiliary h.t. relay LA 'makes' via ST2 and 4 interlock switches connected in series thence, through SWA6-SWB6 etc. The interlocks are: switch SWF which is the Stage 5 interlock switch on the front of the r.f. cabinet, SWG which is the r.f. cabinet rear door switch, SWL the Stage 4 coil turret interlock and SWM the Feeder tune interlock.

The contacts of LA operate as follows:-

LA2 energizes the auxiliary h.t. unit.
LA3 primes the main h.t. contactor.
LA4 lights the auxiliary h.t. lamp.
(LA1 and LA5 spare).

HS31 & HS31A only. For HS31/1 & HS31A/1 see Supp.1 Sect.6.4.1.

(g) Press the H.T. ON button SWE. The main h.t. contactor, MC, will 'make', energized via: OD1 and OE1 which are contacts of the overload relays and are normally closed; OR1 and OR2 which are contacts of the overload reset relay and are normally closed, and ST3 and LA3 which are contacts of the START relay and the auxiliary h.t. relay previously described.

Contacts MC1, MC2 and MC3 energize the main h.t. rectifier.

MC4 bypasses the H.T. ON button allowing it to be released.

MC5 lights the h.t. lamp.

MC6 opens to remove the short-circuit across the economy resistor R28(C6).

The transmitter is now fully operating.

NOTE: *Interlock Circuits.*

S31 & HS31A nly. For S31/1 & HS31A/1 ee Supp.1 ect.6.4.2.

Facilities exist in this transmitter to extend the control circuit to ancillary equipment. This facility is made available to tagboard TB5 terminals 1 and 2 where in the standard equipment a shorting link is fitted.

The external interlock circuit is therefore connected in series with the Main H.T. Contactor and can be used in connection with feeder switching.

S31 & HS31A nly. For S31/1 & HS31A/1 ee Supp.1 ect.6.4.2.

6.4.2 H.T. OFF and Trip Reset

Pressing SWF, the H.T. OFF & RESET button, will release the main h.t. contactor, MC, switching off the high voltage rectifier only.

Complete switching off may be effected simply by pressing the main STOP button SWD, when all of the control circuit is de-energized.

SWF is also used to de-energize the trip reset relay OR if this has energized subsequent to an overload - see Section 6.4.4. The main h.t. control circuit is then reset, and the contactor MC can be energized by pressing the H.T. ON button.

6.4.3 Remote Control

Control Circuit Diagram: (HS31 & HS31A) Fig.17.
(HS31/1 & HS31A/1) Fig.17A.

Remote control of switching on and off is provided for by relay SP. If the Local/Remote switch SWG is set to remote, the 50V d.c. control supply voltage is connected via FS22 and SWG2 to terminal 7 of TB6 and through the remote ON/OFF switch (shown dotted) to make connection to tag 12 of TB6.

When SP is energized by closing the remote ON/OFF switch, SP1 closes and the 50V control supply energizes the start relay ST through SP1 and SWG (now set to remote). The remainder of the relays operate in the sequence already described. The main H.T. ON push-button SWE, is short-circuited by SWG and the h.t. contactor MC comes on automatically after the operation of LA.

6.4.4 Overload Circuits

The Penultimate and Final stages of the r.f. amplifier each have overload relays in their anode supply circuits. These relays, OD for Stage 5 and OE for Stage 6, are set to operate when excessive current is drawn from the 4 kV h.t. supply. The relay operating current is set by the relay tensioning springs in the case of Stage 5, and in the case of Stage 6 by the tensioning springs and a shunt variable resistor RV6.

When an overload occurs, i.e. a stage draws excessive current, the overload relay will be energized causing its associated contacts to change over.

The relay contacts OD1 and OE1 are connected in series in the control circuit of the main h.t. contactor; they are normally closed, opening on an overload. Contacts OD2 and OE2 are connected in parallel in the operating circuit of the overload trip relay OR; these are normally open, closing on an overload.

When an overload causes one of the relays to operate, its No.1 contact will open and de-energize the main h.t. contactor, removing main h.t. At the same time the No.2 contact will close and energize the overload trip relay OR. OR1 and OR2 in series, open in the circuit of the h.t. contactor, keeping it isolated when the overload relay de-energizes on removal of h.t. OR3 makes a hold-on circuit for OR. OR4 closes to light the trip lamp, OR5 closes to ring the alarm bell.

To reset the circuit, the H.T. OFF/TRIP RESET button SWF, must be pressed. This breaks the circuit of OR. The hold-on contact OR3 opens and contacts OR1 and OR2 close. Main h.t. may then be re-applied by pressing the H.T. ON button SWE.

On remote control, the circuit may be reset remotely only by opening the ON/OFF switch. ST5 then de-energizes the reset relay, OR. The set is then switched on again by reclosing the ON/OFF switch. This procedure would not normally be used; investigation should first be made to discover the nature of the overload. (For HS31/1 and HS31A/1 see also Supp.1, Sect.6.4.4.).

6.4.5 Frequency Selector Control Circuit

NOTE: *This section is not applicable when an external Frequency Shift Diplex Equipment is used.*

To simplify operation of the transmitter, the primary crystal oscillators may be switched to provide six different inputs to the harmonic generator, by operation of the 'Ledex' switch, SWG, in the Mixer Unit. The various functions of the switch are described in Section 6.2.2. Here, is described its operating circuit.

SWG is controlled by the frequency selector switch, SWL, on the main control panel.

SWN is the AUTO/MANUAL changeover switch. There is no requirement for the MANUAL setting on the HS31 range of transmitters; the switch is a standard fitting for this type of control panel and should always be left at AUTO.

SWG is the Local/Remote switch. When set to LOCAL; the 50V d.c control supply is applied via FS22 to one wafer of SWN and from there, in the AUTO position, to SWL. Depending on the setting of SWL, the supply will be fed via one of tags 1-6 on TB6 to pins 10-15 on plug PLP on the mixer unit. Connection is then made through wafers SWG1 and SWG2 of the 'Ledex' switch to its operating coil. The switch then turns until the 'dead' space on wafer SWG2 reaches the control lead contact carrying the 50V supply; the switch will then stop and stay in that position until the setting of the frequency selector switch, SWL, is altered.

There is no provision for remote operation of the switches as the remainder of the transmitter has to be manually tuned.

7 INSTALLATION

Installation requirements differ according to site conditions and each specific installation will normally have supplied its own Installation Folder, containing full instructional drawings. The following therefore, should be regarded as general guidance rather than specific instructions.

7.1 GENERAL

A site plan is invariably included in the installation folder. The transmitter room must be dry and well ventilated.

The overall dimensions of the transmitter are given in Section 2.1. Care must be taken when siting the transmitter, to provide sufficient access on all sides to facilitate the fitting of large components and to allow the doors to be fully opened and units to be withdrawn for maintenance and adjustment.

Provision must be made for running mains supply, traffic, telephone and control leads.

7.2 PACKING, TRANSPORT AND DELIVERY

The equipment is carefully inspected and tested prior to despatch. When it is disconnected and packed for transport, all heavy items are removed from the cabinets and packed separately. The wiring in the cabinets and the inter-unit wiring, is disturbed as little as possible. Where the wiring must be removed, the cable ends and their respective terminal points are marked with corresponding numbers. The cabinets are suitably braced internally to withstand transport.

The serial numbers of the cases and their contents will be clearly indicated on the Advice Notes and Packing Notes. The latter are usually inserted in a tin compartment on the crate or case. Any irregularities should be endorsed on the carrier's documents and the Company or its authorised agents notified immediately. Where damage has occurred, the case, its contents and the packing should be retained for examination.

The cases are despatched in a weatherproof condition, however, it does not necessarily follow that they are in that condition on arrival. Therefore, should installation be delayed, the equipment should be stored under cover as soon as possible.

7.3 ASSEMBLING THE TRANSMITTER

The cabinets are to be mounted on a wooden plinth; the surfaces of this must be level otherwise difficulty will be experienced in opening doors, operation of door switches etc. The rectifier and control cabinet is mounted on the left.

Fit transformers and other heavy items which will have been removed for purposes of transport. NOTE that transformers are not screwed down but are placed on pegs for easy fitting.

Before placing the cubicles in position, remove and discard the outer bolts from the brackets in the lower corners of the cubicles; both front and rear. Once the cubicles have been placed in position and the upper cabinet assembly mark carried out, screw the cubicles to the plinth (through the vacated holes) by means of the coach bolts found in the linen bag attached to the transmitter.

The a.c. input enters via TB1 in the top left (viewed from the rear) of the rectifier cabinet - see Fig.1. The external connections to and from the r.f. cabinet are made via plugs and sockets on its roof - see Fig.3.

Connect up the inter-unit wiring. A diagram of inter-unit connections is shown on drawing Fig.16. Connections between the Rectifier Cabinet and the R.F. Cabinet are made from terminal boards on a bracket at the top of the Rectifier Cabinet. These are shown on the UPPER VIEW on drawing Fig.2 to the plugs and sockets on the roof of the R.F. Cabinet shown on drawing Fig.3. Connection between the various sub-units in the R.F. Cabinet is by plugs and sockets. The wiring is carried on channels inside the cabinet and will not normally be disturbed, therefore simply connect up each sub-unit as it is fitted. The connections between sub-units are best seen on Figs.10 and 11, the r.f. unit circuit diagram, in conjunction with the main inter-unit connections diagram Fig.16. The disposition of the various plugs and sockets may be seen on the relevant component layouts. Fit sub-units, meters and such other components as have been removed for packing and transport.

Check wiring by 'ringing through' or some other quick method. Take care not to 'ring through' any meters.

Check the fuses using the list given in Section 4.2.5. Check for continuity as well as correct rating.

7.4 VALVE INSTALLATION

Fit the valves. Ensure that connections are tight and where flexible connectors are used ensure that there is no strain on those which might damage the seals of the valves.

7.4.1 Fitting the Stage 6 Valve V5 (BR191)

1. Open the r.f. cubicle rear door and the Stage 6 cathode compartment door.

2. Remove the three wing nuts on the front of the valve connectors and lift off the connector assembly.

3. Undo the fasteners, open the grid deck and clip it up by the catch on the left-hand wall.

4. Insert the BR191 with the metal seal towards the rear of the cubicle.

5. Lower the grid deck and fasten down.

6. Reassemble the connector assembly and replace wing nuts.

7. Slacken off the three wing nuts on the rear of the connector assembly, insert the three flexible valve connectors between the plates and tighten up the wing nuts.

8. Check (a) that the capacitor caps are in their correct position,
   (b) that all wing nuts are tight.

9. The valve is now installed.

When fitting a Type ACT70 valve, ensure that the black centre-tap cathode connector is towards the rear of the transmitter.

8 SETTING-UP

After installation, before any attempt is made to operate the transmitter, it must be systematically checked, commencing with the interlocks and control circuits and working through filaments, bias and auxiliary h.t. supplies, to the main h.t. supply.

8.1 PRELIMINARY

1. Check that the primary taps of all transformers, except TR9-14 are correct for the mains supply in use. In order to obtain adequate control on STAGE 5 and RECTIFIER FILAMENT regulators, the primary taps on TR9-14 must be set to 20 volts less than the mains voltage.

   The single phase transformer primary taps are listed in Table 1 to assist setting-up.

Table 1

Function	Circuit Ref.	Identity No.	Primary Tap				
			240V	220V	220V	0	+10V
6V Fils.	TR2	W.24068 Sh.59	13	11	9	5	3
12V Fils.	TR3	W.24582 Sh.13	18	16	14	6	4
Bias	TR5	W.23241 Sh.33	13	11	9	5	3
Aux. H.T.	TR6	W.24586 Sh.26	13	11	9	5	3
Rect. Fils.	TR7	W.24743 Sh.27	7	6	5	3	2
H.T. Rect. Fils.	TR9-14	W.27206 Sh.4	14	12	10	5	3

For 4.05-4.1 kV the secondary taps on the h.t. transformer, TR8 must be set to the 3000V terminals.

2. Check the secondary taps of the following transformers.

Table 2

Function	Circuit Ref.	Identity	Secondary Taps
50V Control	TR1	W.37518 Sh.2	41V
5V Fils.	TR4	W.37518 Sh.3	6.1V
Bias	TR5	W.23241 Sh.33	190V
Aux. H.T.	TR6	W.24586 Sh.26	435V
Main H.T.	TR8	W.22129 Sh.3	3000V

3. Check the zero settings on all meters and adjust as necessary.

4. Set the following control switches:-

   AUTO/MANUAL switch to AUTO.
   LOCAL/REMOTE switch to LOCAL.

5. Push the 4th and 5th R.F. Amplifier sub-unit firmly into the r.f. cabinet and set the STAGE 5 H.T. INTERLOCK control to 'WORKING'.

6. Test Equipment required: external voltmeter with an accuracy of 1%.

7. Check that TB5(1) and (2) are linked either directly or via an external interlock circuit (HS31/1 and HS31A/1).

8.2 CHECKING RELAY AND CONTACTOR OPERATION

The control circuits are explained in Section 6.4 to which, reference should be made.

1. Remove fuses FS5, FS7-FS12 and FS14-FS17 (see Fig.2 or 2B). This will isolate the filaments and h.t. circuits and allow the operation of the various relays and contactors to be checked without the supplies they control being switched on.

2. Close the external isolator switch. Set the FEEDER TUNE and ST.4 TUNE to 5, set FREQUENCY switch to A and carry out instructions 4 and 5 of Section 8.1.

3. Close and lock the front and rear doors of the Rectifier Cabinet The door switches SWA and SWB will close and the a.c. voltmeter, M1 on the meter panel at the top of the Rectifier Cabinet will now indicate. Using its selector switch (SWH) on the H.T. and FILAMENTS control panel, check the voltage of each phase of the supply.

The 50V d.c. indicator lamp (LP1) and frequency Lamp A (LP6) will light.

Check that the a.c. supply is switched off when either the front or rear door lock-handles are set to 'unlock', this will check the operation of the switches SWA and SWB.

4. Close and relock the doors of the cabinet.

   Close the rear doors of the Stage 6 compartments in the r.f. cabinet and operate the filament interlock (SWH) adjacent to the lower door.

   Close and lock the rear door of the r.f. cabinet.

5. Press the START button, SWC. The start relay ST will close and the fan start. As the air pressure builds up, the air interlock switch SWN, will close and energize the filament contactor FC, which will energize the delay relay FD.

   30 secs after FD has operated, FF will operate and the FILS lamp, LP2, will light. After a further 5 secs, the auxiliary h.t. relay LA will 'make' and the AUX H.T. lamp, LP3, will light.

6. When satisfied that the above sequence has occurred, press the h.t. on button SWE. The main h.t. contactor MC will 'make' and the h.t. lamp, LP4, light.

7. In the auxiliary h.t. contactor control circuit are interlocks associated with the Stage 4 tuning control and the feeder tuning control, the STAGE 5 INTERLOCK switch on the front of the r.f. cabinet and the r.f. cabinet rear door switch; check that the auxiliary h.t. relay, LA, and the main h.t. contactor, MC, immediately de-energize and the associated lamps (LP3 and LP4) go out when either of the tuning controls are moved sufficiently to operate their associated interlocks (see Section 4.3.2.2. and 4.3.2.4 for details) and when the STAGE 5 INTERLOCK switch is set to SAFE, and when the lock-handle on the r.f. cabinet rear door is set to 'unlock', thus proving the operation of each associated interlock.

   After checking each interlock relay LA should automatically operate again and LP3 should light when the interlock is re-closed. Reset the main h.t. by pressing the H.T. ON switch SWE.

8. Set the frequency selector switch, SWL, on the control panel, to each of its six positions in turn. At each setting check that the appropriate indicator lamp lights. This will prove the operation of the 'Ledex' switch in the Mixer Unit.

9. Press the H.T. OFF and TRIP RESET button. The main h.t. contactor MC will de-energize and the h.t. lamp extinguish. Press the STOP button and the remainder of the relays will de-energize and all the lights, except the 50V d.c. indicator, will be extinguished.

8.2.1 Checking the Operation of the Air Pressure Switch

Locate the two nozzles provided in the transmitter air ducting; one is in the bottom of the Stage 6 coil unit and one in the top of the valve compartment.

Remove the sealing screws from the nozzles and connect a pressure gauge. With a piece of card, block the air intake filter and switch on the transmitter. Press the START button. Relay ST will close and the fan will start. The reading on the pressure gauge will be very low. Gradually slide the card from the air intake and check that the air switch closes (indicated by the operating of FC) at 1.2 in w.g.

If the switch does not close at 1.2 in w.g., remove the cover from the air switch and adjust the spring pressure, by means of the knurled screw, until it does. Do not forget to replace the sealing screws before putting the transmitter into service.

Gradually reduce the air flow by sliding the card back over the air intake and check that the lowest point at which the switch opens is greater than 0.8 in w.g.

8.3 CHECKING FILAMENT SUPPLIES

Test Equipment required: voltmeter with accuracy of 1% at 12.6V a.c.

8.3.1 Stage 6 Filament

Replace fuse FS14, and FS15 (6 amp fuses), then close and lock the front door of the Rectifier Cabinet.

Set the Filament Voltmeter on the front of the r.f. cabinet to the Stage 6 filament position (12.6V). Turn the Stage 6 filament control on the front of the Rectifier Cabinet fully anticlockwise.

Press the START button and note the reading on the voltmeter. It should show a reduced reading at first and then after 30 seconds, when relay FF operates, rise to full value.

Adjust the Stage 6 filament control, until the indicated voltage is approximately 12.6V a.c.

Connect the external voltmeter to the filament pins on the BR191. Readjust the Stage 6 filament control for 12.6V a.c. on this meter and note the slightly higher reading on the filament voltmeter M8 on the front panel; when setting Stage 6 filaments this reading should be used Disconnect the external voltmeter.

During operation the filament voltage should be checked and maintained at the slightly higher voltage, noted on the front panel meter, by means of the Stage 6 filament control.

8.3.2 Stage 5 and Rectifier Filaments

Switch off and connect the external voltmeter across the secondary terminals of one of the main h.t. filament transformers, and secure the meter in a position in which it can be seen through the rear window of the Rectifier Cabinet, when the door is shut. Insert fuses FS10, 11 and 12 (2 Amp).

Set the Filament Voltmeter on the r.f. cabinet to show STAGE 5 filament voltage.

Set the STAGE 5 and RECTIFIER FILAMENT control on the front of the Rectifier Cabinet fully anticlockwise.

Shut doors and switch on; adjust the control for a reading of 5V a.c. on the test meter across the rectifier filaments. Note the reading of Stage 5 filament voltage on the meter on the r.f. cabinet. It should be 5 volts. If not, adjust the preset resistors, R8, R9 and R10 inside the Rectifier Cabinet, or the secondary taps on TR4. After each adjustment check the rectifier filament voltage shown on the test meter, and maintain it at 5 volts by adjustment of the front panel control.

Adjustment is correct when both filament voltages are correct with the front panel control at approximately mid-setting, this allows adequate adjustment of both supplies for variations of mains voltage.

Switch off and remove the external voltmeter.

8.3.3 Auxiliary Filaments

This is a preset adjustment for which no panel control is necessary.

Insert fuse FS5(2A) and set the filament voltmeter switch to AUX. 6.3V a.c.

Switch on. The meter should read 6.3V a.c. If not, the preset resistor R2 must be adjusted. To do this it is necessary to switch off and open the rectifier unit door to enable the meter panel to be hinged forward so allowing access to the resistor.

8.4 CHECKING BIAS AND AUXILIARY H.T. SUPPLIES

With the transmitter switched off, replace the fuse FS17 (2 amp).

Close the cabinet doors and press the START button. Wait for the filaments and auxiliary h.t. lamps to light.

Check the bias voltages on the Auxiliary Voltmeter in the r.f. cabinet, they should be approximately as follows:-

Mixer Suppressor, 75V; Stages 2 & 3, 75V; Stage 4, 25V; Stage 5, 110V; Stage 6, 110V.

Any major discrepancy in bias value should be investigated and corrected; the exact bias levels of each stage must be adjusted after application of h.t. see Section 8.6.

Switch off the transmitter and replace fuses FS16(2A). Switch on again and check the auxiliary h.t. voltages on the Auxiliary Voltmeter. They should be:- 450V and 280V. The 450V h.t. may be high if the static feed on Stage 4 has not been adjusted. See 8.6(vi).

8.5 CHECKING THE MAIN H.T. RECTIFIER OUTPUT

With the transmitter switched off, replace fuses FS7, FS8 and FS9(25A). Close the doors. Press the START button and check that the filament and auxiliary h.t. indication lamps light. Press the H.T. ON button. Check that the h.t. indicator lamp lights. The H.T. Voltmeter on the meter panel at the top of the Rectifier Cabinet should show 4 kV. Set the h.t. volts selector switch to LOW. The voltmeter should now show a lower reading, depending upon the load on the rectifier. With only static feeds on the Stage 6 valve it will be about 3.3 kV.

8.6 ADJUSTING THE BIAS VOLTAGES

The bias voltages (except mixer suppressor bias) are set up by adjusting the static feeds (i.e. with no r.f. drive) to each stage, and will require adjustment after valve replacement if optimum performance is to be obtained.

The bias voltages for the mixer and Stages 4-6 are adjusted by variable resistors; those for Stages 2 and 3 in the Mixer Unit are accessible when the unit is pulled forward on its runners, but those for Stages 4-6 are mounted on the meter panel at the front of the Control, Power Supply Cabinet, and can be adjusted without switching the transmitter off.

(i) Close the doors. Press the START button and check that the filaments and auxiliary h.t. lamps light. Press the H.T. ON button and check that the h.t. indicator lamp lights. Set H.T. VOLTS switch to FULL. Set the H.G. METERING switch to MIXER.

(ii) Withdraw the Mixer Unit on its runners.

(iii) Set the MIXER and MONITOR METERING switch to V10 so that the meter indicates Stage 2 cathode current.

Adjust the Stage 2 bias potentiometer RV4 for a reading of 40 mA on the meter.

(iv) Set the meter switch to V11 (reading Stage 3 cathode current).

Adjust RV3 the Stage 3 bias potentiometer, for a reading of 25 mA on the meter.

Push the Mixer Unit back into the cabinet.

(v) Set the AUXILIARY VOLTMETER switch on the front of the r.f. cabinet to read MIXER SUP. BIAS; it should be 105V approx.

(vi) Set the AUXILIARY VOLTMETER switch to read Stage 4 bias; and check the Stage 4 cathode current; it should be 90 mA when the bias reading is 20-25V. If necessary adjust the Stage 4 bias potentiometer RV10, on the meter panel on the front of the Control, Power Supply Cabinet, to obtain a reading of 90 mA. Check that the stage h.t. is approximately 450V. It may be necessary to alter the transformer taps (TR6) to obtain the correct voltage.

(vii) Set the AUXILIARY VOLTMETER switch to read Stage 5 bias; and check the Stage 5 cathode current; it should be 60 mA when the bias reading is 100-110V. If necessary, adjust the Stage 5 bias potentiometer RV11, on the meter panel at the front of the Control, Power Supply Cabinet, to obtain a reading of 60 mA.

(viii) Set the AUXILIARY VOLTMETER switch to read Stage 6 bias and check the Stage 6 cathode current; it should be 0.32A when the bias reading is 100-110V. If necessary, adjust the Stage 6 bias potentiometer RV12, on the meter panel at the front of the Control, Power Supply Cabinet, to obtain a reading of 0.32A*

8.7 SETTING-UP THE OVERLOAD RELAYS

The overload relays are set up when the transmitter has been tuned and is operating on full power. The instructions are contained in this section for the sake of completeness.

The relays are situated in the Rectifier Cabinet, and are not accessible when the power supply is on. Accordingly, adjustments must be made progressively. It will be seen that there is a small red flag associated with each relay contact assembly; this falls into a downward position when the relay operates to provide a rapid indication of which relay has tripped when a fault occurs. Before resuming operation after a trip, the flag must be returned to its normal position manually.

* See Section 11.11 when using an ACT70 valve in Stage 6.

(a) Stage 5 Relay OD

Apply r.f. drive, and set the cathode current of Stage 5 to 280 mA, detune the stage if necessary. Take care to restrict the time duration of this detune period, as excessive temperature rise in the valves may take place. It is also advisable to keep a check on Stage 6 feed, as, with an excessive feed, due to detuning Stage 5, Stage 6 relay OE will operate the overload relay.

If the relay trips before the current reaches 280 mA, switch off, remove the relay cover and tighten up the tensioning spring, then switch on again and carry on increasing the cathode current. Repeat until the relay just trips at 280 mA.

If the relay trips after the current reaches 280 mA, switch off and slacken off the tensioning spring, then switch on and slowly increase the current again. Repeat until the relay just trips at 280 mA.

(b) Stage 6 Relay OE

Setting-up this relay is done by adjustment of its tensioning spring and of shunt resistance, RV6.

Set RV6 to about mid-way. Switch on and adjust Stage 6 cathode current to 1.8 amps. If it is necessary to detune the Stage to obtain this current; it must be done only for very short periods as for Stage 5

If the relay trips at less than 1.8 amps, switch off and turn RV6 clockwise; switch on again and carry on increasing the current. Repeat until the relay just trips at 1.8 amps. If this adjustment cannot be obtained, set RV6 to its mid-position and tighten up the relay tensioning spring. Carry on checking and adjusting the spring until the relay just trips at 1.8 amps.

If the relay does not trip at 1.8 amps, reduce the current, switch off and turn RV6 a little anticlockwise; switch on again and increase the cathode current again. Repeat until the relay just trips at 1.8A. In this case if the adjustment of RV6 does not bring the relay to the required operating point, set it to mid-position and slacken off the relay tensioning spring.

In the HS31/1 and HS31A/1 there are additional overload relays; the setting-up of these is described in Supplement 1, Section 8.7.

8.8 PILOT CARRIER COMPRESSION

(a) Set up the transmitter for Two Tone Operation as described in Section 9.2.

(b) Set the I.F. Drive to give -26 dB carrier and one of the two tones at the level used to check PEP (see Section 9.2 (e)). Check that when the tone is switched off the change in pilot carrier level is less than 1 dB.

8.9 NOISE LEVEL

(a) Set up the transmitter for Single Tone Operation as described in Section 9.1.

(b) Switch off the pilot carrier. Check on the spectrum analyser with the trace running at a 30 second period and the 6 c/s filter in circuit that every noise component is more than 44 dB below the level of the tone.

8.10 METHOD OF NEUTRALIZING

Neutralizing should be carried out when the set is first tuned and subsequently should only be necessary after changing valves. It should be carried out at 20 Mc/s, or alternatively at the highest frequency normally used.

Either of two methods may be used.

(a) Adjust Stage 5 tuning control for minimum cathode current.

With the drive level reduced, detune on either side of the tuning point and note Stage 6 grid current. If Stage 5 is properly neutralized, the drop in cathode current will coincide with a peak of Stage 6 grid current. If there is an increase of Stage 6 grid current on one side of the tuning point, rotate the Stage 5 neutralizing control a little in the same direction as the tuning control was turned to give the rise. Retune Stage 4. Swing the tuning control through the tuning point again and note the cathode and Stage 6 grid currents. Continue adjusting the neutralizing control and checking the currents until the dip in Stage 5 cathode current and the rise in Stage 6 grid current exactly coincide.

NOTE: *It is important to retune Stage 4 after each adjustment of the neutralizing control.*

(b) Completely detune Stage 5.

Adjust the level control to give approximately 100 mA Stage 5 cathode current. Tune through minimum cathode current then detune completely on the other side of the tuning point and note the current.

Adjust the neutralizing control until the cathode reading is the same when the stage is completely detuned on either side of the tuning point, readjusting Stage 4 tune as necessary.

8.11 STAGE 5-6 PRESET CAPACITOR COUPLING

In the HS31/1 and HS31A/1, Stage 5 is coupled to Stage 6 by a preset capacitor C35. The method of setting-up this capacitor is described in Supplement 1, Section 8.11.

9 TUNING

When the transmitter is first installed or after being closed down for maintenance, it should be checked as described in Section 8 before being tuned.

Test Equipment Required: Spectrum Analyser OA.1094 (A.P.103540)
Artificial load for transmitter (600Ω).

9.1 SINGLE TONE OPERATION CW/FSK

9.1.1 Calculation of Harmonic Generator and Crystal Drive Frequency

(AM) For any radiated frequency in the range 4-~~275~~ 27.5 Mc/s the frequency multiplication required in the harmonic generator stages of the mixer unit and the crystal oscillator frequency to be used is calculated as follows:-

fRAD = Final radiated frequency in Mc/s.

fx = Crystal oscillator frequency in Mc/s.

m = Frequency multiplication in harmonic generator stages of the mixer unit.

i.f. = Keyed signal to mixer from keying unit (3.1 Mc/s for HS31 and HS31/1).

<u>When fRAD is less than 10 Mc/s</u>

m = 2

$$\text{fRAD} = 2\text{fx} - \text{i.f. Mc/s or fx} = \frac{\text{fRAD} + \text{i.f.}}{2} \text{ Mc/s.}$$

<u>When fRAD is between 10 and 17 Mc/s</u>

m = 2

$$\text{fRAD} = 2\text{fx} + \text{i.f. Mc/s or fx} = \frac{\text{fRAD} - \text{i.f.}}{2} \text{ Mc/s.}$$

<u>When fRAD is greater than 17 Mc/s</u>

m = 4

$$\text{fRAD} = 4\text{fx} + \text{i.f. Mc/s or fx} = \frac{\text{fRAD} - \text{i.f.}}{4} \text{ Mc/s.}$$

An explanation of the manner of operation of the harmonic generator and the reasons underlying the selection of the primary crystal frequencies appears in Section 6.2.1.

9.1.2 Preliminary

(a) Connect the i.f. drive to SKR and set it to give one tone.

(b) Select the HG input crystal to the frequency required (calculated in Section 9.1.1).

(c) With the exception of the Stage 6 Coupling set all the tuning controls to the settings shown on the calibration curves for the frequency required (calculated in Section 9.1.1).

(d) Set Stage 6 Coupling to 0. Set the Stage 6 grid trip switch on the front of the Rectifier and Control Unit to CW/FSK depending on frequency.

(e) Set the HG input level to 0.1 watt and the i.f. drive to 0.25 watt. Turn all the mixer bias controls to MANUAL and A-F fully counterclockwise. Set the MIXER GAIN switch to MANUAL.

(f) Turn the Drive Control (Stage 4 input) on the 4th and 5th R.F. Amplifier to maximum.

(g) See Supp.1, Sect.9.1.2 for setting of links in the HS31A and HS31A/1.

(h) Press the START button and when AUX. H.T. lamp has lit tune the HG section of the Mixer Unit for Peak Ig of V5/V6 or Peak Ic of V7/V8.

(i) Turn the mixer-gain control, MANUAL, clockwise about halfway and tune the mixer section for maximum reading of Stage 4 Vg. When the maximum has been found adjust the MANUAL control for about 10 volts on the STAGE 4 GRID VOLTS meter.

(j) Set the mixer-gain switch to AUTO and check that the Frequency Selector switch on the control panel selects the appropriate gain control. Set up as for the Manual Control.

(k) Return to MANUAL control.

(l) Tune Stage 4 for a maximum reading on Stage 5 grid peak voltmeter. Adjust the reading by the MANUAL control till the grid current is just showing on Stage 5 grid current meter. Turn the front panel drive control (DRIVE LEVEL) to zero.

(m) Turn the Main H.T. Selector to 'LOW' and increase the drive level till Stage 5 cathode current is about 30 mA.

(n) Tune Stage 5 for minimum cathode current, in Stage 5, keeping the drive level adjusted so that the Stage 6 cathode current does not rise above 0.6A or grid current above 100 mA.

(o) Adjust Stage 6 tuning control for minimum cathode current, taking care that the grid current does not rise above 100 mA.

(p) Set the drive level to give approximately 100 mA Stage 6 grid current and increase the coupling till the grid current just begins to fall or the FEEDER INDICATOR shows a reading. Check the tuning of Stages 4, 5 and 6 keeping Stage 6 grid current below 100 mA.

(q) Adjust the FEEDER TUNE for peak indicator feeding. This should correspond to a fall in grid current and a rise in cathode current indicating the loading of the valve.

(r) Reduce the drive level control to zero and switch the h.t. to 'FULL'.

(s) Increase the drive level to give a Stage 6 grid current of 200 mA and readjust Stage 6 tuning control for minimum cathode current.

(t) Increase Stage 6 coupling, retuning the anode circuit and adjusting the drive level in steps until the cathode and grid currents of Stage 6 are approximately 1.5A and 200 mA respectively.

(u) Check the feeder circuit tune by moving the FEEDER TUNE control a few degrees in each direction. This should cause an increase in grid current in both cases.

(v) If this is not so the control should be adjusted slightly in the direction in which the grid current falls and the anode circuit retuned.

(w) Check again the feeder circuit tune and if necessary repeat the procedure until the grid current rises slightly whichever direction the FEEDER TUNE control is moved.

9.1.3 Checking Neutralizing

Check that when Stage 5 is detuned in either direction the grid current of Stage 6 falls. If the grid current shows a marked tendency to rise, the neutralizing control should be adjusted to correct this, and the control setting logged.

After any adjustment of the neutralizing control it will be found necessary to readjust Stage 4 tune. The method of neutralizing is described in Section 8.10.

9.1.4 Final Tuning

Increase the drive level for the Stage 6 Ig required for the frequency in use, see Table 3. If necessary, readjust the coupling to obtain the requisite cathode current also shown in Table 3.

Table 3

Type	Frequency	Stage 6 Ig	Stage 6 Ic	Stage 5 Ic	Power Output
HS31 & HS31/1	4-21 Mc/s 21.27.5 Mc/s	250 mA 160 mA	1.6A 1.25A	≯ 240 mA ≯ 240 mA	3.5 kW 2 kW
HS31A & HS31A/1	2.5-20 Mc/s	250 mA	1.6A	≯ 240 mA	3.5 kW

If a water cooled artificial load is being used for tuning purposes check the power in the load, it should not be less than the figure given in Table 3.

Check all meter readings against the typical power figures given in Fig.18 (HS31 and HS31/1) or Fig.18A (HS31A and HS31A/1).

9.2 TWO TONE OPERATION (I.S.B.)

(a) Tune the transmitter for Single Tone Operation, Section 9.1.1 to 9.1.4.

(b) Reduce the drive level to zero and switch the I.F. Drive to Two Tone, 0.25 watt output (zero level).

(c) Connect the Spectrum Analyser to the monitor distribution point marked STAGE 6 on the front of the Mixer Unit and tune the analyser to the radiated frequency.

(d) Increase the drive level till the Stage 6 grid current reads approximately 130 mA. Check the tune of Stage 6 and increase the Stage 6 coupling until the Stage 6 grid and cathode currents correspond to the figures given for the frequency in use, see Table 4.

Table 4

Type	Frequency	Stage 6 Ig	Stage 6 Ic	Stage 5 Ic	Power Output
HS31 & HS31/1	4-21 Mc/s 21-27.5 Mc/s	100 mA 60 mA	1.1A 0.8A	160-170 mA 160-170 mA	3.5 kW 2.5 kW
HS31A & HS31A/1	2.5-20 Mc/s	100 mA	1.1A	160-170 mA	3.5 kW

NOTE: *The figures given in Tables 3, 4, 5, 6 and 7 are for a BR191 valve. For figures pertaining to ACT70 valves see Section 11.11.*

Check the tune of the feeder circuit (FEEDER TUNE) and if necessary readjust as described in Section 9.1.2 (r)-(w).

(e) The levels given in (d) will give a mean output level of 1.25 kW (PEP 3.5 kW), if a water cooled load is in use, check this and note the feeder indication to provide a subsequent check of power output level.

(f) Detune Stage 5, moving the control in an anticlockwise direction, till the cathode current increases by 10 mA (this improves the linearity of the stage) and if necessary increase the drive level to maintain the level of power output.

(g) Now adjust the Stage 5 feedback potentiometer appropriate to the frequency range in use, to give the lowest level of IP's as indicated on the Spectrum Analyser.

(h) Check the IP's for each level of drive in 2 dB steps down to -10 dB. In each case the highest IP should not exceed a level of -36 dB below the level of either tone.

It may be necessary to readjust the feedback to obtain a compromise between the best conditions at high and low drive levels. The worst condition is often found when Stage 6 grid current is approximately 15 mA, -6 dB to -8 dB.

NOTE: *It is only necessary to adjust the Stage 5 feedback potentiometers at the centres of the frequency ranges. Therefore, if more than one frequency is used on any one range, the feedback potentiometer should be adjusted on the frequency nearest the centre of the range. It will not be necessary to make further adjustment when shifting a working frequency to anywhere else in that range, for that reason the feedback potentiometers are preset controls and no scale logging facilities are necessary.*

9.2.1 Final Adjustments for Optimum Linearity

The distortion introduced by Stages 5 and 6 is dependent on bias and loading of the valves. It may be found that a considerable departure from the static feeds quoted in 8.4 give a worthwhile improvement in linearity, this applies particularly to Stage 5 valves (C1112) not made by the English Electric Valve Company.

To obtain linearity the static feeds may be set within the limits shown in Table 5.

Table 5

Stage	Static Feed
Stage 5 Ic	45-60 mA
Stage 6 Ig	0.2-0.32A

These figures apply with an h.t. of 4.0 kV, slightly higher figures will apply if the h.t. is greater.

In consequence the loading figures of Stage 6 should be found to lie within the limits shown in Table 6.

Table 6

Stage 6 Loading Limits

Type	Frequency	Ig	Ic	Power Output
HS31 & HS31/1	4-21 Mc/s 21-27.5 Mc/s	75-100 mA 40-60 mA	0.96-1.1A 0.7-0.8A	3.5 kW PEP 2.5 kW PEP
HS31A & HS31A/1	2.5-20 Mc/s	75-100 mA	0.95-1.1A	3.5 kW PEP

The Stage 5 cathode current however should not be allowed to exceed 180 mA, and if the drive level is sufficient to cause Stage 5 grid current to flow then the specification level IP's will be found difficult to achieve.

If Stage 5 is loaded to the limit, i.e. 240 mA at 21 Mc/s CW (HS31 and HS31/1) or 20 Mc/s CW (HS31A and HS31A/1) this will in general be found to be optimum.

The degree of mistune however may require to be slightly less than the nominal 10 mA (see Section 9.2 (f) rise Stage 5 cathode current. When the IP's either side of the two tones are unequal in amplitude it is often useful to detune to the degree required for balance; greater than 10 mA rise of cathode current should not be necessary.

9.3 D.S.B. SIGNAL ADJUSTMENT

(NOTE: *HS31/1 or HS31A/1 Stage 6 grid trip switch set to I.S.B.).*

The carrier level is adjusted by first setting-up the transmitter with a two tone I.S.B. (Section 9.2) signal.

Apply the carrier via the D.S.B. equipment and adjust the gain of the mixer stage with the front panel drive control at maximum for the power output given in Table 7 with the Stage 6 Ig and Ic at the levels indicated.

Table 7 *

Type	Frequency	Stage 6 Ig	Stage 6 Ic	Power Output
HS31 & HS31/1	4-21 Mc/s 21-27.5 Mc/s	60 mA 50 mA	0.95A 0.9A	1.5 kW 1.0 kW
HS31A & HS31A/1	2.5-20 Mc/s	60 mA	0.95A	1.5 kW

Check the response from 200 to 350 c/s at a modulation depth of 60% and the distortion at a number of tone frequencies between 200 and 3500 c/s at 80% modulation depth.

The response should not vary by more than $\pm 2\frac{1}{2}$ dB and the distortion be not greater than 10%.

NOTE: *These figures include the characteristics of the drive unit, i.e. ±2 dB response and 2% distortion.*

10 OPERATING INSTRUCTIONS

This section contains 'switching' instructions only. It is assumed that the transmitter has been set up and tuned as described in Sections 8 and 9, and is in all respects ready for use and that the drive equipment is correctly set up and is switched ON.

10.1 STARTING-UP INSTRUCTIONS

1. Close and secure the front and rear doors of the Rectifier Cabinet and the rear door of the R.F. Cabinet.

2. Close the external wall isolator switch.

* These figures apply to BR191B valve; for ACT70 valve refer to Sect.11.11.

3. Check that the various control switches are set to their correct positions as follows:-

   AUTO/MANUAL switch to AUTO (when using HD61B, to MANUAL).

   LOCAL/REMOTE switch to LOCAL.

   H.T. Volts selector switch to FULL.

   The primary oscillator equipment may be set up to provide crystal drive frequencies for up to six different radiated frequencies. The crystal oscillators are selected by operation of the FREQUENCY SELECTOR switch, which must now be set to the oscillator required.

4. Check the voltage of each phase of the a.c. supply.

5. Check that the 50V d.c. indicator lamp and one of the FREQUENCY indicator lamps have lit. (When using HD61B only 50V d.c. lamp will light).

6. Press the START button.

   The fan will start.

   Check that after half a minute the filament indicator lamp lights, followed by the auxiliary h.t. lamp.

   Check the filament voltages on the voltmeter on the R.F. Cabinet and adjust as necessary by the filament controls on the Rectifier Cabinet.

   Check the bias and auxiliary h.t. supplies on the voltmeter on the R.F. Cabinet, and the static current of Stage 4.

7. Press the H.T. ON button.

   Check that the h.t. indicator lamp lights. Check the reading on the h.t. voltmeter on the meter panel and the static currents of Stages 5 and 6.

8. Apply the i.f. drive input.

Check that the voltage and current readings of each stage are in accordance with the figures obtained when the transmitter was tuned.

10.2 OVERLOAD RESET

If the overload relays trip, the main h.t. contactor will be de-energized and the h.t. indicator lamp will be extinguished.

Unless there is an apparent defect, main h.t. may be restored by pressing the H.T. OFF & RESET button and then the H.T. ON button.

Check the meter readings.

If the overload relays trip again on reapplication of h.t., the cause must be investigated.

10.3 CLOSING DOWN INSTRUCTIONS

(a) Temporary Stoppage.

Transfer any incoming traffic.

Press the H.T. OFF & RESET switch - this will remove main h.t. only.

(b) Complete Close Down.

Transfer any incoming traffic.

Press the STOP button.

All circuits except the 50V supply will be de-energized. The 50V unit will remain on as long as the a.c. supply is connected to the transmitter and the doors of the Rectifier Cabinet are locked. If either of the doors is unlocked, the associated interlock switch will be operated and the a.c. supply disconnected from all circuits.

Finally, open the external a.c. supply switch. The transmitter is now completely disconnected from the mains.

11 MAINTENANCE

11.1 ROUTINE MAINTENANCE

11.1.1 Daily (when the set is in use)

(a) Take a complete set of meter readings and check them against the readings noted when the transmitter was tuned.

(b) Check the filament, bias and h.t. meter readings.

(c) Check the air filter and replace if dirty. Wash the dirty filter as instructed in Section 11.8.

11.1.2 Weekly

Check that the fan is running quietly and is cool.

Check that the filament connections of the high-power valves are tight. Reverse the filament connections of Stage 5 by means of the switch (SWK) every week of service.

Blow out any dust which may have accumulated in the cubicles. Remove any dust from the envelopes of the high-power valves with a soft rag moistened with white spirit. Cleaning must only be done when the valves are quite cold. Check that the dust filters are clean. (Filters of the polythene type may be cleaned in warm water, see Section 11.8.)

Check that the overload relays operate as described in the setting-up instructions, Section 8.7.

Check that the 'Ledex' switch operates when the frequency selector switch is operated.

11.1.3 Two-Monthly

Every two months, remove the caps from the grease cups of the a.c. motor used in the suction fan, and fill the cups with grease ALVAIA RA. Light pressure should be applied to ensure that the grease reaches the bearings. Refit the caps.

11.1.4 Quarterly

Check the functioning of the filament delay switch.

Examine the contactors and relays. The bearings of the contactors may be lightly oiled; over oiling is worse than not oiling at all. The relays should never be oiled.

If the contacts of contactors require cleaning, this should be done with carbon tetrachloride or one of the patent contact cleaning fluids. If they are badly burnt it may be possible to restore the surfaces by careful filling with a smooth file and then burnishing, taking care to maintain the original shape of the contact. Abrasive paper should never be used.

Relay contacts may be cleaned with a cleaning fluid. If contacts are badly burnt, the whole relay should be replaced.

Check the r.f. unit fan. This requires only the normal machine maintenance. The oil level in the bearing will require occasional topping up.

Check that all four ball contacts on the Spring Contact Assembly of the anode coil (L19) are making contact throughout the whole travel of the coil, check also that the contact pressure is approximately $2\frac{1}{2}$ lb

If all the balls do not make contact at the correct pressure, they should be adjusted as follows:-

NOTE: *Reference numbers quoted in the following adjustments will be found in Fig.4.*

1. Wind the Spring Contact Assembly (Ref.84) to the top of the coil.

2. Adjust the pressure on the ball contacts by slackening the special nuts holding the top of the rod in position in the slot in the mounting plate, setting the rod nearer the coil for greater pressure and away from the coil for less pressure. Tighten the special nuts.

3. Wind the Spring Contact Assembly to the bottom of the coil.

4. Adjust the pressure on the ball contacts by slackening the special nuts holding the bottom of the rod in position, and adjusting the rods position in the same way as for (2) above. Tighten the special nuts.

5. Repeat (1) - (4) as often as necessary until the Spring Contact Assembly exerts a uniform pressure of $2\frac{1}{2}$ lb, along the whole length of the coil (L19).

NOTE: *The pressure of these contacts should not be allowed to fall below 2 lb each. Adjust or replace if this figure is not achieved.*

A method of checking the pressure of the ball contacts on the coil; is to make a loop of wire around a contact and hook a spring balance through the loop. Pull the contact away from the coil at its point of contact by means of the ring at the end of the spring balance, and check that the spring balance reads approximately $2\frac{1}{2}$ lb at the 'breaking' point. Check that the anode coil and ball contacts are clean. If not, clean with a soft cloth and apply a very thin film of MS5 Silicon grease to the contact surface of coil. See Section 11.7 for self-lubricating contacts.

11.1.5 Yearly

Check over all terminal connections.

Check all clamp and/or flexible cables for signs of wear.

Check the insulation of the power circuits.

Verify that all cubicles and other pieces of equipment are properly earthed, and that the earth connections are sound.

Lightly oil lock mechanism on door switch.

11.2 ALIGNMENT OF THE MIXER UNIT

Circuit Diagram Figs.12 and 13.

Component Layout Fig.6. Calibration Curves Fig.19.

Test Equipment required:

- 1 Two Tone Test Generator TF1143 (AP.103480 and 103481)
- 1 Spectrum Analyser OA1094 (AP.103540)
- 1 Signal Generator TF1449 or CT218
- 1 Valve Voltmeter TF428 or CT854 (to be connected by 2 yards of coaxial cable and terminated in 220Ω and 33 pF in parallel).
- 2 Avometers 40, 7 or 8 or AP47A
- 1 Insulation test set.
- 1 Test rig for mixer panel
- 1 Artificial load for transmit (600Ω)

Also required crystal oscillator panel such as HD61B or HD21.

The drawing references against component identities throughout this section, refer to the component layout.

The Mixer Unit is set up at the factory and should not require alignment when the transmitter is first installed.

The following section described the complete procedure for alignment, but it should be noted that sub-sections 11.2.3 and 11.2.5, covering balancing and final alignment should be sufficient for normal purposes.

The alignment is to be carried out in a screened room on multi-transmitter stations to eliminate effects of r.f. fields on the test equipment using the test harness described below.

The test ring for the mixer panel is a metal stand with an angle iron framework top pivoted in the centre; it has guides and clips to hold the mixer unit firmly when placed on the rig. This allows the mixer panel to be turned over and locked in any convenient position whilst aligning it.

Around the test rig the test equipment should be placed at a convenient level for the person aligning the units. The unit requires a power supply which gives an output of 280V stabilized, 400V d.c., 6.3V a.c. and -150V d.c.

11.2.1 Preliminary adjustment of the Harmonic Generator.

(i) Withdraw the Mixer Unit on its runners and remove its baseplate.

(ii) Connect a valve voltmeter across R131(4J) in the Monitor Frequency Changer Unit, i.e. across the output of the Harmonic Generator Unit.

Set all cores and trimmers to approximately their mid-positions.

(iii) Set the Harmonic Generator frequency range switch SWA(5K), fHG MHz, to the 4/8 MHz range.

(iv) Connect a Signal Generator to the 'H.G. INPUT' socket, SKR(8B), and apply an input at 4 MHz of approximately 1 to 2 volts.

Set the H.G. TUNE control to the 4 MHz tuning point given by the calibration curves.

Adjust TR1(5B), L2(2H) and TR3(2K) for maximum reading on the valve voltmeter.

(v) Set the H.G. TUNE control to the 8 MHz point given by the calibration curves.

Adjust C6(3C), C32(2H) and C50(2K) for maximum on the valve voltmeter.

(vi) Repeat (iv) and (v) as often as necessary, but tune the 'H.G. TUNE' control for maximum on the valve voltmeter after reference to the calibration curves, adjusting the coils and trimmers until no increase in output occurs on readjustment.

(vii) Set the 'fHG MHz' switch to 8/16 MHz.

(viii) Set the 'H.G. TUNE' control to the 3 MHz point given by the calibration curves.

Adjust TR2(5D), L3(3H) and TR4(3K) for maximum reading on the valve voltmeter.

(ix) Set the 'H.G. TUNE' control to the 16 MHz point given by the calibration curves.

Adjust trimmers C7(4C), C16(7E), C33(3H) and C51(3K) for maximum output on the valve voltmeter.

(x) Set the panel meter switch SWB(7N), to the 'V2' position.

Set the 'H.G. TUNE' control approximately as in (viii) and tune it about this point for maximum reading on the panel meter.

Adjust TR2, L3 and TR4 for maximum on the valve voltmeter.

(xi) Set the 'H.G. TUNE' control as for (ix) and tune it for maximum reading on the valve voltmeter.

Adjust C7, C16, C33 and C51 for maximum on the voltmeter.

(xii) Repeat (x) and (xi) as often as necessary, until no increase in output occurs on readjustment.

Check that the maximum on the panel meter and the maximum on the valve voltmeter are coincident.

(xiii) Set the 'fHG MHz' switch, to 16/24 MHz.

(xiv) Set the 'H.G. TUNE' control to the 16 MHz tuning point given by the calibration curves.

Adjust L1(5F), L4(4H) and TR5(4K) for maximum reading on the valve voltmeter.

(xv) Adjust the Signal Generator frequency to 6.1 MHz and set the 'H.G. TUNE' control to the 24.4 MHz point given by the calibration curves.

Adjust C8(4C), C17(7D), C26(5F), C34(4H) and C52(4K) for maximum reading on the valve voltmeter.

(xvi) Set the panel meter switch SWB, to the 'V3' position.

Adjust the Signal Generator frequency to 4 MHz and set the 'H.G. TUNE' control as in (xiv) and tune it about this point, for maximum on the panel meter.

Adjust L1, L4 and TR5 for maximum output on the valve voltmeter.

(xvii) Adjust the Signal Generator frequency to 6.1 MHz, set the 'H.G. TUNE' control as in (xv) and tune it for maximum on the valve voltmeter, then adjust trimmers C8, C17, C26, C34 and C52 for maximum on the valve voltmeter.

(xviii) Repeat (xvi) and (xvii) as often as necessary until no increas in output occurs on readjustment.

Check that the maximum on the panel meter and the maximum on the valve voltmeter are coincident.

(xix) The Voltage readings obtained on the valve voltmeter at all frequencies should be between 6.0 and 8.0 volts.

The preliminary adjustment of the Harmonic Generator is now complete.

(xx) Disconnect the valve voltmeter.

11.2.2 Preliminary Alignment of the Mixer and Stages 1, 2 and 3

NOTE 1: *If the unit has been removed from the transmitter a dummy load will now be required. The dummy load should consist of a 220Ω 2W resistor in parallel with 33 pF capacitor.*

NOTE 2: *The frequencies involved in this Section and Sections 11.2.3 and 11.2.4 will depend on the transmitter and the Drive Units to that Transmitter. Specific frequencies are therefore not given in the text, but, for convenience, the Table 8 which gives the frequencies appears on pages facing the text concerned. The asterisked figures in text relate to the right-hand column of Table 8.*

(i) Connect the dummy load across the output of the Unit i.e. from SKQ(1I) to earth.

Connect a valve voltmeter in parallel with the load via 2 yds of 75Ω coaxial cable.

If the unit has not been removed from the transmitter, the normal Stage 4 feed and the ST4 GRID PEAK VOLT meter should be used.

(ii) Apply a single tone *1 input at -6 dB relative to PEP (250 mW) to socket SKS(7C).

(iii) Set SWF(5K) to MANUAL.

Set the mixer balance controls RV1(4B) and C63(3B) to mid-position and the manual gain control RV5(5L) to maximum.

(iv) Adjust AMPLIFIER control RV4(5L), the Stage 2 cathode current potentiometer, for 40 mA on the panel meter M1.

Table 8

Alignment Frequencies

Section and Paragraph	HS31 & HS31/1 Mc/s	HS31A & HS31A/1 (using 2.15 Mc/s)	HS31A & HS31A/1 (using 3.1/6.2 Mc/s)	Reference
11.2.2 (ii)	3.1	2.15	6.2	* 1

Continued on Page 63

Adjust RV3(4F), the Stage 3 cathode current potentiometer, for 25 mA on the panel meter M1.

(v) Set the mixer range switch, SWC(3M) (fRAD Mc/s), to * 2 and set M1 to read mixer cathode current (V7/V8).

(vi) Set the 'fHG Mc/s' switch to * 3.

Apply an input of * 4 to SKR.

Set the 'H.G. TUNE' control to the * 5 point given by the calibration curves, then tune it, about this point, for maximum on M1.

(vii) Set the 'MIXER TUNE' control to the * 6 point given by the calibration curves.

Adjust TR6(8M), L12(6L) L16(6L) and TR9(5L) for maximum on the valve voltmeter.

(viii) Set the 'fHG Mc/s' switch to * 7 Mc/s.

Apply an input of * 8 to SKR. (see also * 9 in Table 8).

Set the 'H.G. TUNE' control to the * 10 point given by the calibration curve and then tune it about this point for maximum on M1.

(ix) Set the 'MIXER TUNE' control to the * 11 point given by the calibration curves.

Adjust C67(7F), C73(6G), C84(6G) and C104(4G) for maximum on the valve voltmeter.

(x) Repeat (vi) to (ix) as often as necessary, but tune the 'MIXER TUNE' control for maximum on the valve voltmeter after reference to the calibration curves, adjusting the coils and trimmers until no increase in output occurs on readjustment.

(xi) Set the 'fHG Mc/s' switch to * 12.

Apply an input of * 13 to SKR.

Set the 'H.G. TUNE' control to the * 14 point given by the calibration curves and then tune it, about this point, for maximum on M1.

(xii) Set the 'fRAD Mc/s' switch to * 15.

Set the 'MIXER TUNE' control to the * 16 point given in the calibration curves.

Table 8 (Cont.)

Section and Paragraph	HS31 & HS31/1 Mc/s	HS31A & HS31A/1 (using 2.15 Mc/s)	HS31A & HS31A/1 (using 3.1/6.2 Mc/s)	Reference
11.2.2 (v)	4/8	2.5/5	2.5/5	* 2
(vi)	4/8	4/8	8/16	* 3
	3.55	4.65	4.35	* 4
	7.1	4.65	8.7	* 5
(vii)	4	2.5	2.5	* 6
(viii)	8/16	4/8	4/8	* 7
"	5.55	3.575	4.05	* 8
	If using 3.1/6.2 Mc/s i.f. remove the 6.2 Mc/s I/P and replace with 3.1 Mc/s I/P			* 9
	11.1	7.15	8.1	* 10
(ix)	8	5	5	* 11
(xi)	8/16	4/8	4/8	* 12
	5.55	3.575	4.05	* 13
	11.1	7.15	7.15	* 14
(xii)	8/16	5/10	5/10	* 15
	8	5	5	* 16

Continued on Page 65

Adjust TR7(8M), L13(7M), L17(5L) and TR10(4L) for maximum on the valve voltmeter.

(xiii) Apply an Input of * 17 to SKR.

Set the 'H.G. TUNE' control to the * 18 point given by the calibration curves and tune it about this point, for maximum on M1.

(xiv) Set the 'MIXER TUNE' control to the * 19 point given by the calibration curves.

Adjust C68(8F), C74(7F), C85(5G) and C105(4G) for maximum on the valve voltmeter.

(xv) Repeat (xi) to (xiv) as often as necessary, but tune the 'MIXER TUNE' control for maximum on the valve voltmeter after reference to the calibration curves, adjusting the coils and trimmers until no increase in output occurs on readjustment.

(xvi) Set the 'fHG Mc/s' switch to * 20.

Apply an input of * 21 to SKR. (see also * 22 in Table 8).

Set the 'H.G. TUNE' control to the * 23 point given by the calibration curves and tune it about this point, for maximum on M1.

(xvii) Set the 'fRAD Mc/s' switch to * 24.

Set the 'MIXER TUNE' control to the * 25 point given by the calibration curves.

Adjust TR8(8M), L14(7M), L18(6M) and TR11(4M) for maximum on the valve voltmeter.

(xviii) Set the 'fHG Mc/s' switch to * 26.

Apply an input of * 27 to SKR.

Set the 'H.G. TUNE' control to the * 28 point given by the calibration curves and tune it about this point, for maximum on M1.

(xix) Set the 'MIXER TUNE' control to the * 29 point given by the calibration curves.

Adjust C69(8F), C75(6F), C86(6F) and C106(4F) for maximum on the valve voltmeter.

Table 8 (Cont.)

Section and Paragraph	HS31 & HS31/1 Mc/s	HS31A & HS31A/1 (using 2.15 Mc/s)	HS31A & HS31A/1 (using 3.1/6.2 Mc/s)	Reference
11.2.2 (xiii)	6.45	3.925	3.45	* 17
	12.9	7.85	6.9	* 18
(xiv)	16	10	10	* 19
(xvi)	8/16	4/8	4/8	* 20
	6.45	3.925	3.45	* 21
	Apply Single Tone input of 2.15 (3.1 Mc/s as in Section 11.2.2 (ii))			* 22
	12.9	7.85	6.9	* 23
(xvii)	16/27.5	10/20	10/20	* 24
	16	1C	10	* 25
(xviii)	16/24.4	16/24.4	16/24.4	* 26
	6.1	4.4625	4.225	* 27
	24.4	17.85	16.9	* 28
(xix)	27.5	20	20	* 29

Continued on Page 67

(xx) Repeat (xvi) to (xix) as often as necessary, but tune the 'MIXER TUNE' control for maximum on the valve voltmeter after reference to the calibration curves, adjusting the coils and trimmers until no increase in output occurs on readjustmen·

(xxi) The voltage readings obtained on the valve voltmeter at all frequencies should be between 5 and 7 volts.

(xxii) Replace the baseplate and disconnect the external valve voltmeter if necessary.

11.2.3 Balancing the Mixer Stage

Remove the ⁎ 30 input from the mixer.

Connect a valve voltmeter across C82(6G). (Remove the perspex shield).

Set the Mixer switch to 'V7/V8'.

Set the 'fRAD Mc/s' switch to ⁎ 31.

Set the 'fHG Mc/s' switch to '8/16 Mc/s'.

Set the mixer level control RV5(7E) to maximum.

Set SWF to MANUAL.

(i) Apply an input of ⁎ 32 to SKR.

Set the 'H.G. TUNE' control to the ⁎ 33 point given by the calibration curves and tune it about this point for maximum reading on M1.

Set the 'MIXER TUNE' control to the ⁎ 34 point given by the calibration curves and tune it for maximum on the valve voltmeter.

Adjust the mixer balance capacitor C63(8L) and trimmers C68(8F) and C74(7F) for maximum on the valve voltmeter.

Carefully adjust C63 and the balance potentiometer RV1(7H), alternately, to reduce the reading on the valve voltmeter to a minimum.

Remove the valve voltmeter and return SWE to NORMAL.

Repeat (xiii), (xiv) and (xv) of Section 11.2.2, if necessary use the external load and external valve voltmeter (see Section 11.2.2 note).

Table 8 (Cont.)

Section in A.P.116E-0231-1	HS31 & HS31/1 Mc/s	HS31A & HS31A/1 (using 2.15 Mc/s)	HS31A & HS31A/1 (using 3.1/6.2 Mc/s)	Reference
11.2.3 line 1	3.1	2.15	3.1 or 6.2	* 30
line 5	8/16	5/10	5/10	* 31
line 9	4	5	5	* 32
line 10	16	10	10	* 33
line 13	16	10	10	* 34

Continued on Page 68

11.2.4 Setting-up the Monitor Frequency Changer (See Note 2, Section 11.2.2)

Set the 'fHG Mc/s' switch and the 'fRAD Mc/s' switch to * 35/36.

Set the Monitor Frequency Changer U-link on the front panel to DRIVE (LKA from PLBC to PLBE).

Apply an input of * 37 to the h.g. input socket SKR(4H).

Apply a single tone * 38 input at -6 dB, relative to PEP(250 mW) to socket SKS(8F).

Set the 'H.G. TUNE' control to the * 39 point given by the calibration curves and tune it about this point, for maximum on M1. (Switch setting 'V7/V8' cathode current).

Tune the 'MIXER TUNE' control for maximum output on the ST.4 peak VOLTS meter.

Connect a valve voltmeter in parallel with a 75Ω resistor, across the output of the Monitor Frequency Changer at socket SKT(5E).

Tune C128(4E) and C133(5E) for maximum output on the valve voltmeter.

Remove the valve voltmeter and 75Ω load.

The Monitor Frequency Changer is now set-up.

Table 8 (Cont.)

Section in A.P.116E-0231-1	HS31 & HS31/1 Mc/s	HS31A & HS31A/1 (using 2.15 Mc/s)	HS31A & HS31A/1 (using 3.1/6.2 Mc/s)	Reference
11.2.4 line 1	8/16	4/8	4/8	* 35
line 1	8/16	10/20	-	* 36
line 4	6.45	3.925	-	* 37
line 5	3.1	2.15	-	* 38
line 7	12.9	7.85	-	* 39

11.2.5 Final Adjustment of the Mixer Unit

The final adjustment of the unit must be carried out, working into its normal load, in the transmitter.

Set the meter M1 to show mixer cathode current (position 'V7/V8').

Apply an input of 4 Mc/s to the H.G. INPUT socket, SKR.

Set the 'fHG Mc/s' switch to '4/8 Mc/s'.

Set the 'H.G. TUNE' control to the 4 Mc/s point given by the calibration curves and tune it about this point, for maximum on M1.

Carefully adjust the tuning coils L2 and TR3, of the h.g. amplifier stages, for maximum on M1.

Set the 'H.G. TUNE' control to the 8 Mc/s point given by the calibration curves and tune it about this point, for maximum on M1.

Carefully adjust the trimmers C32 and C50.

NOTE: *Only very slight adjustments will be necessary to obtain optimum results.*

Set the 'fHG Mc/s' switch to '8/16 Mc/s'.

Align the tuning coils, L3 and TR4 at 8 Mc/s and the trimmers C33 and C51 at 16 Mc/s in the same manner as range 4/8 Mc/s has been described.

Set the 'fHG Mc/s' switch to 16/24.4 Mc/s.

Align the tuning coils, L4 and TR5, at 16 Mc/s.

Apply an input of 6.1 Mc/s to SKR.

Align the trimmers C34 and C52 at 24.4 (fHG). This should be carried out in a manner similar to that of the 4/8 Mc/s range the only difference being change in the tuning frequency.

Having completed the final adjustment of the Harmonic Generator, carefully repeat the alignment of the Mixer and Stages 1, 2 and 3 as described in Section 11.2.2, using Stage 4 as the output load and the ST.4 GRID PEAK Volts as the output indicator.

11.3 SPARE PARTS

Three types of Components Lists are used, as follows:-

HS31 Use (a) AP.116E-0231-3 or (b) existing Marconi list retained in this Air Publication as Pages 73-111 (Components List No.1); this has been amended (by AL8) to cover Mod.9785 (External control of bias, and fitting of back-fire indicators).

HS31A Use Components List No.2, identified by T4260 in bottom inside corner of pages, and following the HS31 list, in conjunction with the Cross Reference Lists facing the circuit diagrams for HS31A.

For components used in Mod.9785 see list for HS31.

HS31/1 Use Components List No.3, identified by T5553 in bottom inside corner of pages, and following the HS31A Master Components List, in conjunction with the Cross Reference Lists facing the circuit diagrams for HS31A.

For components used in Mod.9785 see list for HS31.

HS31A/1 Use AP.116E-0243-3
For components used in Mod.9785 see list for HS31.

11.4 SETTING-UP THE MANUAL DRIVE ASSEMBLIES (HS31 & HS31A)

All the variable tuning controls are driven by manual drive assemblies mounted on the front panel. There are basically two types of drive assembly used, these are the single turn type and the multi-turn type. The single turn types, the handles of which rotate less than 360°, are used for the RANGE switch and the FEEDER TUNE controls. The multi-turn types, the handles of which rotate a number of complete revolutions, are used for STAGE 4 TUNE, STAGE 5 TUNE, STAGE 6 TUNE and the STAGE 6 COUPLING.

To set-up the manual drive assemblies it is necessary to check that:-

(a) the dial stops are correctly set.

(b) the components are set in the correct position.

(c) the dials are correctly set.

The correct positions of (a), (b) and (c) for HS31 and HS31A are listed under the control names; for HS31/1 and HS31A/1 refer to Section 11.4 in Supplement 1.

RANGE switch

(a) Dial Stops: 1, 2, 3, 4 & 5.

(b) Components: Set the driving spindle so that the wiper arm of SWB (immediately below it) is in the fully clockwise contact position.

(c) Dial set to: 1.

FEEDER TUNE

(a) Dial Stops: 0 and 100.

(b) Components: Set the capacitor C64 to maximum capacity with the padders C68, 69, 70 and 71 connected by switch SWP.

(c) Dial set to: 0.

STAGE 4 TUNE

(a) Dial Stops: 0 and 210.

(b) Components: Set the turret with the largest inductor (L5) connected across the capacitor C12. Set C12 to maximum capacity (ready to tune L5).

(c) Dial set to: 0.

STAGE 5 TUNE

(a) Dial Stops: 0 and 210.

(b) Components: Set the inductor (L15) wiper contacts to within approximately 1/8 turn (2 in) from the right-hand end of inductor.

(c) Dial set to: 210.

STAGE 6 TUNE

(a) Dial Stops: 0 and 210.

(b) Components: Set the inductor (L19) wiper contacts approximately 1/4 turn (3 in) from the top of the inductor.

(c) Dial set to: 210.

STAGE 6 COUPLING

(a) Dial Stops: 0 to 210.

(b) Components: Lower the inductor to the full extent of the extension rods, and set the inductor by rotating the front driving shaft approximately $\frac{1}{2}$ turn.

(c) Dial set to: 0.

Slight adjustment may be required when fitting the assemblies to the coupling but the settings given allow for this. After fitting check the complete range coverage.

11.5 SETTING-UP THE RANGE CONTROL

Layout: (HS21) Fig.21, (HS31A) Fig.21A, (HS31/1 & HS31A/1) Fig.21B.

It may be necessary to strip the mechanical drive of the range switch assembly for various reasons. Sketch A shows the positions of the drive components:-

<u>HS31 and HS31A</u>	<u>HS31/1 and HS31A/1</u>
SWA in Stage 5	SWA in Stage 5
SWB in Stage 6	SWB in Stage 6
SWC in Stage 6	SWC in the output circuit
SWD in the output circuit	

relative to the spindles and pins.

11.6 SETTING-UP THE FEEDER TUNE CONTROL

Layout: (HS31) Fig.21, (HS31A) Fig.21A, (HS31/1 & HS31A/1) Fig.21B.

It may also be necessary to strip the mechanical drive of the Feeder tune assembly for various reasons. Sketch 'B' shows the positions of the driven components:-

C64)
SWP) In the output circuit
SWM))

relative to the spindles and pins.

11.7 SELF-LUBRICATING CONTACTS

Where the sintered type of self-lubricating contacts are fitted, no oil is required on the coil, which should be kept perfectly clean. If there are any signs of excess wear on the contacts they may require re-impregnating with oil. In this case, the contact should be removed and immersed in a light machine oil warmed to about 60°C. Excess oil should be removed before replacing and after first switching on. When the contact has reached operating temperature, it should again be wiped to remove excess oil exuded from the pores.

NOTE: *Should L19 contacts (see Figs.4 or 4A Sketch G, item 40) require replacing, fit Spring Contact and Guide Wheel Assembly Ref.10AS/5950-99-933-2057 (Marconi WZ.31079/B): this uses silver graphite contacts and incorporates a $1\frac{1}{4}$ inch diameter Guide Wheel (original was $1\frac{1}{8}$ inch diameter).*

To ease running-in of new contacts, apply the thinnest possible film of medium grease to the coil, then wipe it off again immediately - the trace of grease remaining will be adequate for running-in purposes.

In normal use, no lubricant whatever should be applied.

11.8 AIR FILTERS

The air filters consist of closely folded polythene filtering medium rigidly welded at every fold to transverse polythene supports, the whole being mounted into a synthetic resin frame, which is made to make an air-tight seal with the filter holder.

To clean the filters they should be removed from the holder and washed in luke warm (not more than 120°F) solution of any of the common industrial or household detergents. The detergent has no harmful effect on either polythene or resin frame and so in obstinate cases a strong solution may be used. However in normal atmosphere and if washing is carried out regularly the filter should come completely clean in quite a weak solution.

The filter may be soaked and agitated in the solution to help remove the dirt.

When clean the filter should be removed from the detergent solution and rinsed in a cold water bath or under the tap until all signs of the detergent have been removed. The filter should then be allowed to dry naturally before replacing in the filter frame. Artificial heat should not be used to accelerate the drying process.

11.9 REMOVAL OF FRONT PANELS

The upper and lower front panels of the R.F. Unit are removable. The upper panel, containing the RANGE control handle and FEEDER TUNE control can be removed by:

(a) removing the screw in the handle of the STAGE 5 H.T. INTERLOCK switch and pulling off the handle.

(b) releasing the 4 hexagonal headed captive screws, two on each side of the panel and pulling the panel forward.

The lower panel containing the STAGE 6 TUNE and STAGE 6 COUPLING can be removed by:

(a) releasing the 4 hexagonal headed captive screws, two on each side of the panel and easing forward the right-hand side. Care must be taken as the panel is connected to the cabinet cable-form at the left-hand side by a tag-board.

11.10 REMOVAL OF THE MANUAL DRIVE ASSEMBLIES

The manual drive assemblies are removed by unscrewing the four retaining screws and lifting off.

11.11 USE OF TYPE ACT70 VALVE IN STAGE 6

The Type ACT70 valve is mechanically a direct replacement for the Type BR191B. Power output and distortion are not affected by the change, but slightly different setting-up conditions are required as follows:

1. The screen potentiometer of Stage 5 should be connected to earth instead of being returned to the negative side of the bias supply.

2. The static cathode current of Stage 5 should be set initially to 100 mA. This value may be adjusted within the range 60 mA to 100 mA during adjustments for optimum linearity. Similarly Stage 6 may be set between 0.2 and 0.32A.

3. The grid and cathode currents of Stage 6 should be set by adjustment of feeder coupling and drive level as follows:-

2.5/21 Mc/s	C.W./F.S.K.	3.5 kW	Ig = 250 mA	Ic = 1.6A
2.5/21 Mc/s	I.S.B. (2 tone)	3.5 kW P.E.P.	Ig = 100 mA	Ic = 1.1A
2.5/21 Mc/s	D.S.B. (Carrier)	1.5 kW	Ig = 60 mA	Ic = 0.95A
21/27 Mc/s	C.W./F.S.K.	2.5 kW	Ig = 160 mA	Ic = 1.25A
21/27 Mc/s	I.S.B. (2 tone)	2.5 kW P.E.P.	Ig = 60 mA	Ic = 0.8A
21/27 Mc/s	D.S.B. (Carrier)	1.0 kW	Ig = 50 mA	Ic = 0.9A

N.B. *Stage 5 Cathode current should not be greater than 240 mA on C.W./F.S.K. and 180 mA on I.S.B. (2 tone).*

A.P.116E-0231-1
2nd Edn.
Oct. '67
IA

11.12 SIX-INCH VENTILATOR FAN

The fan is mounted on a mild steel plate on top of the Rectifier and Control Unit. For maintenance, the fan (Identity WIS.8262/B Sh.1 Ref.1) is removed by undoing 3 cleats on the power lead, disconnecting the 4-pin plug (WIS.3733/C Sh.1 Ref.1) and socket (WIS.3727/C Sh.1 Ref.2), and unscrewing 10 screws which fix the plate to the Rectifier and Control Unit. The fan and plate can then be dismantled for oiling and surface cleaning; it is recommended that this should be carried out every 3 months.

(i) Oiling

Access to the oil holes is obtained by unscrewing the oiler plugs. At the rear end, the plug will be found under the plastic end cover. Care should be taken to avoid over-oiling.

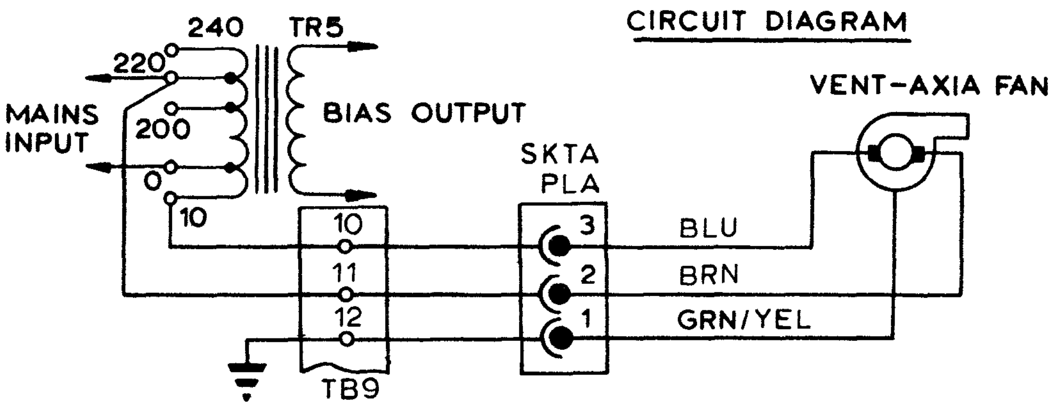
The fan is fitted with porous metal sleeve bearings having felt oil reservoirs. Oil should be added as required but DO NOT use more than ten drops of high grade thin machine oil for each bearing.

(ii) Surface Cleaning

Frequency of surface cleaning will depend on the type of duty that the unit has to perform.

The plastic components should be wiped over with lukewarm water and soap and polished with a clean dry cloth.

When Modification No.A.3978 has been incorporated, fan Identity WIS.8262/B Sh.1 Ref.1 is replaced by ventilating fan Ref.No.10K/4140-99-633-2694. This requires bearing lubrication (34B/9100510 Grease XG271) to be replenished at six monthly intervals.



11.13 BACK-FIRE INDICATORS

The blowing of one or more of the h.t. fuses FS7-9 in the Control Power Supply unit can be due to reverse current i.e., back-fire in one or more of the six GXU2 rectifiers. To ascertain whether any of these have back-fired, use the compass WIS.7204/C provided with the modification kit to check the polarity of the cores of the chokes L11-16 in the anode circuits of the valves V1-V6 as shown in the Figs.1 and 1A facing diagrams. Normally the polarity of all six should be the same, and reversed polarity of any core indicates that the associated rectifier valve has back-fired. After changing the valve, and before switching on, reverse the core of the associated choke so that it will give the same polarity indication as the others.

11.14 SUCTION FAN - MOTOR BEARING AND SWITCH REPLACEMENT

11.14.1 General

An exploded view of the a.c. motor in the suction fan assembly is given in Fig.25. All references in the following procedures are to this illustration

11.14.2 To Remove Motor from Fan Assembly

(a) Gaining access through the fan-casing inlet, slacken off the grub-screws retaining the impeller to the motor shaft.

(b) Supporting the motor in position, remove and retain the four bolts securing the motor to the fan casing.

(c) Holding the fan impeller in position, withdraw the motor from the casing. Lower the impeller gently until it rests on the bottom of the casing.

11.14.3 To Refit the Motor to the Fan Casing

(a) Lift the impeller and position centrally within the casing.

(b) Offer up the motor, aligning the motor shaft with the impeller boss, and ensure that the key on the shaft lines up with the keyway in the boss.

(c) Insert the motor shaft in the impeller boss, and push home. Align and insert the motor-retaining bolts, and tighten fully.

(d) Ensure that the impeller is central within the casing, then tighten fully the retaining grub-screws.

11.14.4 Drive End Bearing Removal

(a) Remove the motor from the fan casing as in para.11.14.2.

(b) Remove and retain the key (5) from the motor shaft.

(c) Remove and retain the three screws (25) securing the bearing caps.

(d) Remove and retain the outer bearing cap (1). Remove and discard the wave washer (24).

(e) Remove and retain the nut (2), spring washer (3) and plain washer (4) from each of the four through studs (6).

(f) Remove the motor end cover (23).

NOTE: *If the cover is difficult to remove, it is permissible to tap it gently, using a hide or rubber mallet.*

(g) Using a suitable extractor, withdraw the bearing (22) from the shaft.

11.14.5 Drive End Bearing Replacement

(a) Using a suitable hollow drift or tube, with an outer diameter such that it bears only on the inner race of the bearing, press the new bearing (22) on to the motor shaft. The ends of the tube or drift must be parallel to ensure that the bearing is pressed on square to the shaft.

(b) Screw a suitably threaded rod of ample length into one of the tapped holes in the inner bearing cap. Refit the motor end cover (23) passing the rod through one of the three bearing cap securing holes. Secure the end cover to the motor body, using the nuts, spring washers and plain washers retained from 11.14.4(e), and ensuring the ventilation holes line up with those in the opposite end cover.

(c) Slide a new wave washer (24) over the motor shaft.

(d) Position the outer bearing cap (1) over the rod inserted in sub-para.(b), and secure by two screws (25) in remaining holes.

(e) Withdraw the threaded rod and refit the third securing screw (25) to the bearing cap.

(f) Fit the key to the motor shaft.

(g) Refit the motor to the fan casing (see 11.14.3).

11.14.6 Non-drive End Bearing Removal

(a) Remove the motor from the fan assembly (11.14.2).

(b) Remove and retain the three screws (12) securing the bearing caps, and withdraw the outer cap (13).

(c) Remove and retain the four screws (8) securing the terminal block cover (7) and withdraw the cover.

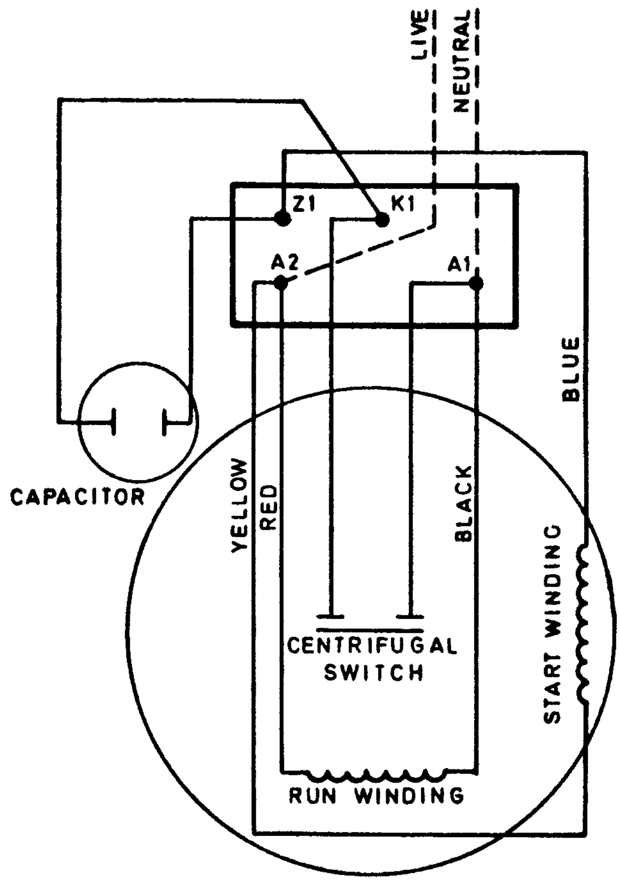
(d) Remove the leads from the four terminals, noting carefully the position of each lead on the terminals.

(e) Remove and retain the nut (11) spring washer (10) and plain washer (9) from each of the four through studs (6). Withdraw the motor end cover (16).

NOTE: *If the end cover is difficult to remove it is permissible to tap it gently, using a hide or rubber mallet.*

(f) Remove and discard the external circlip (14).

(g) Force the weights of the centrifugal switch (21) outwards to move the inner bearing cap away from the bearing (15), then remove the bearing, using a suitable extractor.



WIRING DETAILS

11.14.7 Non-drive End Bearing Replacement

(a) Using a suitable hollow drift or tube, with an outer diameter such that it bears only on the inner race of the bearing, press the new bearing (15) on to the motor shaft. The ends of the tube or drift must be parallel to ensure that the bearing is pressed on square to the shaft.

(b) Fit a new external circlip (14), ensuring that it beds fully into the groove on the motor shaft.

(c) Offer up the motor end cover (16). Pass a suitably threaded rod of ample length through the uppermost of the three bearing cap securing holes, and through the appropriate hole in the inner bearing cap. Ensure that the stationary switch (17) is positioned with the terminal leads uppermost (i.e. towards the terminal block).

(d) Secure the end cover (16) to the motor body, using the nuts (11) spring washers (10) and plain washers (9) retained from para.11.14.6(e). Do NOT tighten at this stage.

(e) Position the outer bearing cap (13) over the rod inserted in sub-para.(c), and secure by two screws (12) in the lower holes.

(f) Withdraw the threaded rod, and refit the third securing screw (12) to the bearing cap.

(g) Tighten fully the four end-cover retaining nuts (11) and the three bearing cap securing screws (12).

(h) Refit the leads to the four terminals, ensuring they are correctly positioned as noted in para.11.14.6(d).

(j) Refit the terminal block cover (7) and secure with the four screws (8).

(k) Refit the motor to the fan assembly, using the procedure given in para.11.14.3.

11.14.8 Removal and Replacement of Stationary Switch

(a) Remove the motor from the fan assembly (para.11.14.2).

(b) Remove the non-drive end end cover and bearing (para.11.14.6).

(c) Remove the inner bearing cap complete with stationary switch (17).

(d) Remove and retain the two screws (19) and spring washers (18) securing the stationary switch to the inner bearing cap. Discard the switch (17).

(e) Secure new stationary switch to the inner bearing cap using the two screws and spring washers retained in (d). Refit switch and inner bearing cap to motor shaft.

(f) Refit bearing and end cover (para.11.14.7).

(g) Refit motor to fan assembly (para.11.14.3).

11.14.9 Removal and Replacement of Centrifugal Switch

(a) Remove motor from fan assembly (para.11.14.2).

(b) Remove non-drive end end cover (16) (para.11.14.6, sub-paras.(b) to (e) inclusive).

(c) Remove drive end end cover (23) (para.11.14.4, sub-paras.(b) to (f) inclusive).

(d) Withdraw the non-drive end bearing (15) from the rotor (para.11.14.6, sub-paras.(f) and (g)).

(e) Withdraw the inner bearing cap complete with stationary switch (17).

(f) Refer to the illustration below. Remove the tension springs from the centrifugal switch and withdraw the bakelite ferrule. Withdraw the switch from the rotor.

NOTE: *As the switch is a force fit on the rotor, care must be taken not to damage the rotor or windings.*

(g) Remove the tension springs and bakelite ferrule from the new switch.

(h) Press the switch on to the motor shaft to the dimensions given in the illustration below.

IMPORTANT: Great care must be taken not to touch the phosphor-bronze stop, pressure on which during this operation can render the switch non-operative.

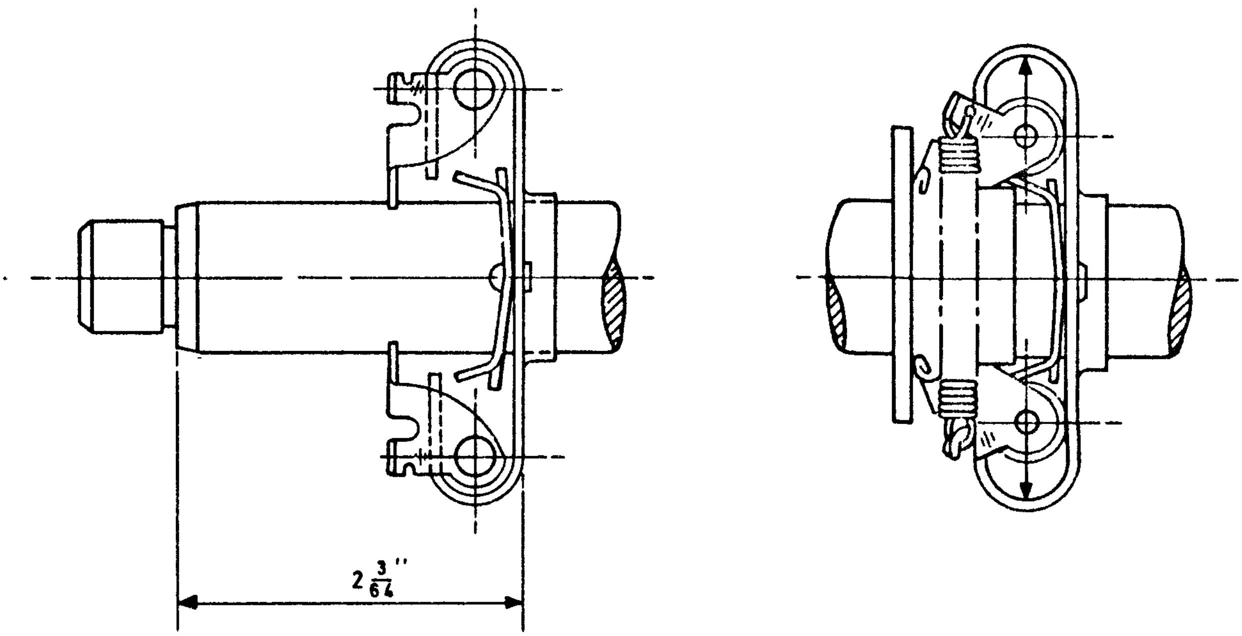
NOTE 1: *Accuracy of positioning to obtain the dimension shown is essential for correct operation.*

NOTE 2: *It is important to ensure that the back face of the switch is square with the axis of the shaft.*

(j) Refit ferrule and tension springs.

(k) Check the action of the switch by pulling the roller spindles outwards (see illustration).

(l) Refit the inner bearing cap complete with stationary switch (17).



CENTRIFUGAL SWITCH - FITTING DIAGRAM

(m) Refit bearing (15) (para.11.14.7, sub-para.(a)).

(n) Refit end covers (para.11.14.5, sub-paras.(b) to (f) inclusive, and para.11.14.7, sub-paras.(b) to (j) inclusive).

(p) Refit the motor to the fan assembly (para.11.14.3).

COMPONENTS LIST

FOR

RECTIFIER AND CONTROL UNIT

(Drg. No. W.37908 Sh.3 Ed.B)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identity only for all other items.

2. The references in column 1 are shown on circuit diagram Figs.14 and 15 and component location diagrams Figs.1 and 2.

3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS						
C1	Paper	10 μF	15	250V DC	WIS.4321/B Sh.1 Ref.11	AP.104384	4
C2	As C1						
C3	As C1						
C4	As C1						
C5	Paper	8 μF	20	600V DC	WIS.4172/B Sh.1 Ref.4	Z.112825	3
C6	As C5						
C7	As C5						
C8	Paper	4 μF	15	750V DC	WIS.2354/B Sh.1 Ref.6	Z.112782	1
C9	Paper	4 μF	10	6 kV DC	WIS.4451/B Sh.1 Ref.4	AP.104325	3
C10	As C9						
C11	As C9						
C12	Not Used						
C13	Not Used						
C14	Not Used						
C15	Not Used						
C16	Not Used						
C17	Mica	10,000 pF	5	350V DC	PC.18801/10	Z.124743	2
C18	As C17						
C19	Paper foil, tub., moulded	.01 μF	20	10 kV	PC.19226/2	5910-99-011-6409	2
C20	As C19						
C21	Electrolytic	100-200 μF	+50 -20	350V DC	PC.18408/4	Z.145606	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS FIXED						
R1	Mica Card WW.	106Ω	10	220W	WIS.3852/B Sh.1 Ref.24	AP.104443	1
R2	Mica Card WW.	107Ω	10	45W	WIS.3852/B Sh.1 Ref.25	AP.104444	1
R3	Comp.Grade 2 Non-Insul.	1.5 kΩ	10	1W	PC.66612/21	Z.222231	1
R4	Non-Vit.WW Double Tube	68Ω	10	2 Amps.	WIS.3320 Sh.2 Ref.18	AP.104446	1
R5	Not Used						
R6	WW Vit. Enam.	33Ω	5	3W	PC.67008/4	Z.243325	2
R7	As R6						
R8	Mica Card, WW.	53Ω	10	45W	WIS.4006/B Sh.1 Ref.20	AP.104445	3
R9	As R8						
R10	As R8						
R11	Non-Vit. WW	2,160Ω	10	90W	WIS.6265/C Sh.1 Ref.1	AP.104347	1
R12	Non-Vit. WW.	419Ω	10	90W	WIS.3615/C Sh.1 Ref.6	AP.104348	1
R13	Vit. WW.	16,500Ω	5	35Ω	P.18282/KP Sh.6	AP.104349	1
R14	Carbon Wire Ends	220 kΩ	20	1W	*WIS.3903 Sh.1 Ref.3	Z.213080	3
R15	As R14						
R16	As R14						
R17	Vit. WW.	43,750Ω	5	150W	P.18282/KK Sh.6	Z.242210	2
R18	As R17						
R19.	Vit. WW.	15,000Ω	5	100W	PC.67006/20	Z.242167	1
R20	to R24 Not Used						
R25	Vit. WW.	1800Ω	5	35W		AP.104350	6
R26	Not Used						
R27	Not Used						
R28	Mica, WW.					AP.103523	1
R29	H.T. Volt. Resistor				WIS.5675/B Sh.1 Ref.1	AP.104456	1
	RESISTORS VARIABLE						
RV1	WW.	12Ω	10	100W	WIS.3147 Sh.1 Ref.4	AP.104447	1
RV2 RV3 RV4	WW. 3 Gang	80Ω	10	50W	WIS.3337 Sh.1 Ref.34	AP.104448	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS VARIABLE (Cont'd.)						
RV5	Not Used						
RV6	WW.	25Ω	10	80	WIS.5865/B Sh.2 Ref.46	-	1
RV7-9	Not Used						
RV10	WW.	1000Ω	10	20	PC.67405/43	-	2
RV11	As RV10						
RV12	WW.	200Ω	10	120	PC.67409/50	-	1
	INDUCTORS						
L1	35A	.0075H			W.24581/B Sh.11	AP.194321	1
L2	600 mA	3.5H			W.31577/B Sh.3	AP.104345	2
L3	As L2						
L4	Not Used						
L5	0.4A	5.5H			W.31577/B Sh.1	AP.104346	2
L6	As L5						
L7	1.5A	3.8H			W.24581/B Sh.10	AP.104320	1
L8-10	Not Used						
L11	Backfire Indicator				W.65949/B Ed.B		6
L12-16	As L11						
	FUSES						
FS1	Cartridge			2A	WIS.5703/C Sh.1 Ref.1	AP.104329	7
FS2	As FS1						
FS3	As FS1						
FS4	Cartridge			10A	WIS.5703/C Sh.1 Ref.4		1
FS5	As FS1						
FS6	Not Used						
FS7	Cartridge			15A	WIS.4806/B Sh.1 Ref.5	AP.104200	3
FS8-9	As FS7						
FS10-12	As FS1						
FS13	Not Used						
FS14	Cartridge			6A	WIS.5703/C Sh.1 Ref.3	AP.104331	2
FS15	As FS14						
FS16	Cartridge			2A	WIS.2947 Sh.1 Ref.9	Z.590110	2
FS17	As FS16						

Ref.	Description	Value	Tol. % +	Rating	Identity	Service Ref.	Qty.
	FUSES (Cont'd)						
FS18	Cartridge			500 mA	WIS.2947 Sh.1 Ref.5	Z.590108	
FS19	Not Used						
FS20	As FS18						
FS21	Not Used						
FS22	Cartridge			1A	WIS.2947 Sh.1 Ref.7	Z.590109	2
FS23	Cartridge			3A	WIS.2947 Sh.1 Ref.10	Z.590111	1
FS24	Cartridge			5A	WIS.2947 Sh.1 Ref.11	Z.590112	1
FS25	As FS22						
FS26	Not Used						
FS27	Not Used						
FS28	Not Used						
FS29	Not Used						
FS30	Not Used						
FS31	Not Used						
FS32	Not Used						
FS33	Not Used						
FS34	Not Used						
FS35	Not Used						
	LAMPS						
LP1	No.2 Carbon Tubular	5.35W		50V	PC.48601/5	X.959220	11
LP2	As LP1						
LP3	As LP1						
LP4	As LP1						
LP5	As LP1						
LP6	As LP1						
LP7	As LP1						
LP8	As LP1						
LP9	As LP1						
LP10	As LP1						
LP11	As LP1						
	METERS						
M1	0-300V AC Voltmeter				WIS.4235 Sh.9 Ref.158	AP.104558	1
M2	0-25A Ammeter				WIS.4235 Sh.9 Ref.159	AP.104559	1

AP.116E-0231-1
2nd Edn.
Oct. '67
GS

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	METERS (Cont'd)						
M3	0-6 kV Voltmeter				WIS.4235 Sh.9 Ref.160	AP.104560	1
	PLUGS						
PLAJ	24 Way				WIS.3738/C Sh.1 Ref.2	AP.104177	1
	RECTIFIERS (METAL)						
MR1	Selenium 3 Phase Full Wave				WIS.4669/B Sh.2 Ref.15	AP.104332	1
MR2	Selenium 3 Phase Full Wave 2 Units Wired in Parallel Making 1 Rectifier				WIS.4669/B Sh.1 Ref.13	AP.104333	2
MR3	Selenium				WIS.3222/C Sh.4 Ref.22	AP.104334	1
MR4	Not Used						
MR5	Not Used						
MR6	Not Used						
	RELAYS & CONTACTORS						
FC	9 Pole Making Contactor				WIS.5609 Sh.1 Ref.1	AP.104339	1
ST	5 Pole Making Contactor					AP.104340	1
FF	5 Pole Making Contactor					AP.104340	1
LA	5 Pole Making Contactor					AP.104340	1
MC	3 Pole Making Contactor * with 3 Aux. Contacts (2 Make 1 Break)					AP.104341	1
OR	Relay - Plug-In Type 3 Making and 2 Breaking Contacts				WQ.8740 Sh.1 Ed.M	AP.104337	1
SP	Relay - Plug-In Type 2 Making Contacts				WQ.8740 Sh.2 Ed.L	AP.104338	1
FD	Time Switch				T31-0964-01	6645-99-955-7533	1
OD	Valve Protecting Relay				WIS.4373/B Sh.2 Ref.7	AP.104510	2
OE	As OD						
OA	Not Used						

* Wotsac replacement for MC:
CC 270003 (Type UCA7)(Mod.A.4745)

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RELAYS & CONTACTORS	(Cont'd)					
0B	Not Used						
0C	Not Used						
	SOCKETS						
SKAJ	24 Way				..41061 Sh.1 Ref.81	AP.104205	1
	SWITCHES						
SWA 1-4 (incl)	4 Pole				W.50027 Sh.1	AP.104470	2
SWA6	Micro S.P. C/Over				W.40269/C Sh.1 Ed.A	AP.104462	1
SWB 1-5 (incl)	As SWA						
SWB6	Micro S.P. C/Over				W.40269/C Sh.1 Ed.A	AP.104463	1
SWC	Push Button D.P. ON/OFF				W.13433/B Sh.1 Ed.A	AP.104206	6
SWD	As SWC						
SWE	As SWC						
SWF	Push Button 2 Gang D.P. On/Off				W.7640 Sh.1 Ed.C	AP.104471	1
SWG	2 Wafer 4 Pole C. Over				WIS.3456/B Sh.148	AP.104464	1
SWH	1 Wafer 1 Pole 3 Posn				WIS.3456/B Sh.111	AP.104465	1
SWJ	Single Pole C/Over			20A	WIS.5197/B Sh.11	AP.104475	1
SWK	Knife D.P. C/Over			30A	WIS.4095/B Sh.1 Ref.10	AP.104572	1
SWL	1 Wafer Single Pole 6 Posn.				WIS.3456/B Sh.155	AP.104466	1
SWM	Micro S.P. C/Over				WIS.5586/C Sh.1 Ref.1	W.4639	1
SWN	3 Wafer 4 Pole C/Over				WIS.3456/B Sh.133	AP.104467	3
	TERMINAL BLOCKS						
TB1	6 Way 30 Amp. Terminals				..57404/C Sh.1 Ref.1	AP.104577	1
TB2	2.1/2" Porcelain Stand Off Type				SK.48864 Sh.1 Ed.H	AP.101048	3
TB3	As TB2						
TB4	As TB2						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	TERMINAL BLOCKS (Cont'd)						
TB5	20 Way				W.22469/B Sh.1 Ed.U	W300+ W301+ W1003	3
TB6	As TB5						
TB7	As TB5						
TB8	4 Way				W.40168/B Sh.2 Ed.A		1
TB9	10 Way				W.22469/B Sh.1 Ed.K	W300+ W301+ W1003	1
TB10	8 Way				W.22469/B Sh.1 Ed.H	W300+ W301+ W1003	1
TB11	Not Used						
TB12	Not Used						
TB13	Not Used						
TB14	Not Used						
TB15	4 Way				WIS.1631 Sh.1 Ref.4		
	TRANSFORMERS						
TR1	Sec. Winding 45/43/41V				W.37518 Sh.2	AP.104323	1
TR2	Sec. Winding 6.3V				W.24068 Sh.59	AP.104460	1
TR3	Sec. Winding 15V				W.24582 Sh.13	AP.104461	1
TR4	Sec. Winding 6.3/6.0/5.7V				W.37518 Sh.3	AP.104322	1
TR5	Sec. Winding 180/160/140/0/10V				W.23241 Sh.33	AP.104459	1
TR6	Sec. Winding 450/425/400/0/400/425/450V				W.24586 Sh.26	AP.104457	1
TR7	Sec. Winding 5V				W.24743 Sh.27	AP.104458	1
TR8	Sec. Winding 2900/3000/3100V				W.22129 Sh.3	AP.104324	1
TR9	Sec. Winding 5V.C.T.				W.27206 Sh.4	AP.104535	6
TR10	As TR9						
TR11	As TR9						
TR12	As TR9						
TR13	As TR9						
TR14	As TR9						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	VALVES						
V1	CV.2518 (GXU-2)					CV.2518	6
V2	As V1						
V3	As V1						
V4	As V1						
V5	As V1						
V6	As V1						
V7	CV.378 (U54)					CV.378	2
V8	As V7						
V9	CV.1069 (STV280/80)					CV.1069	1
V10	CV.686 (VR.105/30)					CV.686	1
	MISCELLANEOUS MECHANICAL ITEMS						
1	Fuseholder				WIS.4809/C Sh.1 Ref.9	AP.104328	3
2	Fuseholder				WIS.5612/C Sh.1 Ref.1	AP.104327	12
3	Fuseholder				WIS.4154/C Sh.1 Ref.1	Z.590100	20
4	Valveholder, International Octal.				PC.81814	Z.560031	2
5	Valveholder B5				PC.81805	Z.560013	1
6	Lamp Jack				WIS.1877 Sh.1 Ref.1	AP.104227	11
7	Resistor Mounting				WIS.5742/C Sh.1 Ref.1		4
8	Resistor Mounting				WSK.3172 Sh.1 Ed.K		6
9	Anode Clip				W.30330/C Sh.1 Ref.2	AP.104543	6
10	Resistor Mounting				W.40253/B Sh.1 Ed.A		1
11	Valve Retainer				WIS.3449/C Sh.1 Ref.1	AP.104412	1
12	Valve Retainer				WIS.3701/C Sh.1 Ref.22	AP.68388	2
13	Not Used						
14	Not Used						
15	Stand Off Insulator				WIS.5416/C Sh.1 Ref.1	AP.104441	3
16	Valve Retainer				WIS.6271/C Sh.1 Ref.1	AP.70240	

Schedule WZ.12784/A

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	MISCELLANEOUS ELECTRICAL ITEMS						
X1	Alarm Indicator					AP.104586	
X2	Terminating Board				W.41618/C Sh.1 Ed.A		1
X3	Fan Axial					10K/ 1070564	1
	Wotsac replacement for X3: Fan Ventilating (Mod. A.3978).					10K/4140-99-633-2694	1

COMPONENTS LIST

FOR

R.F. UNIT

(Drg.No. W.37907 Sh.9 Ed.C)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identify only for all other items.

2. The references in column 1 are shown on circuit diagrams Figs.10 & 11 component location diagrams Figs.3,4,5.

3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS						
C1	Mica Metallised Moulded Case	6.800 pF	5	350V DC	PC.18801/8	Z.124737	1
C2	Mica, Disc	.003 μF	20	800V DC	WIS.4522/C Sh.1 Ref.5	Z.104484	15
C3	Paper Foil, Tubular, Metal Case, Insul.	.01 μF	25	350V DC	PC.19202/7	Z.115625	17
C4	As C3						
C5	As C3						
C6	As C3						
C7	As C3						
C8	Ceramic, Tubular, Insulated	33 pF	10	500V DC	PC.18202/7	Z.132283	1
C9	As C3						
C10	As C3	16-250 pF					
C11	As C3						
C12	Variable, Air	16-250 pF			WIS.3699/C Sh.1 Ref.11	AP.104190	1
C13	Ceramic, Tubular	200 pF	5		*WIS.3450/B Sh.1 Ref.9	Z.132344	1
C14	As C3						
C15	Ceramic, Tubular	2.2 pF	10	500V DC	PC.18201/3	Z.132250	1
C16	Variable Air,	0-210.6 pF			WIS.9367/C Ref.1		1
C17	Ceramic, Tubular, Insulated	270 pF	2	750V DC	PC.18223-18	5910-99-012-7123	1
C18	Mica, Disc.	500 pF	20	800V DC	WIS.4522/C Sh.1 Ref.2	AP.104485	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service	Ref.
	CAPACITORS (Cont'd)						
C19	As C3						
C20	As C2						
C21	As C2						
C22	As C2						
C23	As C2						
C24	Air Dielectric Fixed						1
C25	As C2						
C26	As C3						
C27	As C2						
C28	As C2						
C29	As C2						
C30	As C2						
C31	As C2						
C32	Hi-Load	200 pF	20	7.5 kV peak	*WIS.5080/B Sh.1 Ref.3D	AP.104479	2
C33	Hi-Load	125 pF	20	7.5 kV peak	*WIS.5080/B Sh.1 Ref.3D	AP.104480	2
C34	Hi-Load	200 pF	20	7.5 kV peak	*WIS.5080/B Sh.1 Ref.3C	AP.104481	1
C35	Vacuum	25 pF	10	32 kV peak	WIS.4735/C Sh.1 Ref.2	AP.67742	1
C36	Hi-Load	1250 pF	20	7.5 kV peak	*WIS.5080/B Sh.1 Ref.1E	AP.104482	1
C37	Not Used						
C38	Not Used						
C39	Not Used						
C40	Not Used						
C41	Mica Foil	2.200 μF	20	750V DC	PC.18702/B	AP.5910-115729	1
C42	As C2						
C43	Mica Disc.	.01 μF	20	2000V DC	WIS.4721/C Sh.1 Ref.1A	AP.104486	4
C44	As C43						
C45	Hi-Load Capacitor	130 pF	10	7.5 kV peak	WIS.4418/C Sh.1 Ref.4	AP.104487	1
C46	Hi-Load	50 pF	20	7.5 kV peak	*WIS.4114/C Sh.1 Ref.4	AP.63494	2
C47	As C46						
C48	As C43						
C49	As C43						
C50	As C2						
C51	As C3						
C52	As C2						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS (Cont'd)						
C53	Mica Foil	.01 µF	20	350V DC	PC.18701/5	Z.124484	2
C54	As C2						
C55	As C3						
C56	As C32						
C57	As C33						
C58	Hi-Load Capacitor	125 pF	20	7.5 kV peak	*WIS.5080/B Sh.1 Ref.3C	AP.104552	1
C59	Hi-Load Capacitor	1250 pF	20	7.5 kV peak	*WIS.5080/B Sh.1 Ref.1	AP.104478	2
C60	As C59						
C61	As C3						
C62	As C3						
C63	As C3						
C64	Variable Air Dielectric				W.48433 Sh.1 Ed.A	AP.104533	1
C65	Preset Air Dielectric				W.49688 Sh.1 Ed.A	AP.104534	2
C66	As C65						
C67	As C3						
C68	Hi-Load Capacitor	125 pF	20	7.5 kV peak	WIS.5080/B Sh.1 Ref.3F	AP.104483	4
C69	As C68						
C70	As C68						
C71	As C68						
C72	Mica Foil	10.000 pF	10	750V DC	H.31-8847-01 ~~WIS.4342/B~~ ~~Sh.1 Ref.7~~	624-6495 ~~Z.124382~~	1 ~~1~~
C73	As C53						
C74	Mica Disc	.002 µF	20		WIS.7478/C Sh.1 Ref.3	5910-99-972-9622	1
C75	Not Used						
C80	Silvered Ceramic	10 pF	20	4 kV DC	WIS.4240/C Sh.1 Ref.2		2
C81	As C80						
	RESISTORS (FIXED)						
R1	Comp.Grade 2	220Ω	10	1/2W	PC.66611/17	Z.221153	1
R2	Comp.Grade 1	33Ω	5	1/4W	PC.66602/2	Z.219016	2
R3	WW Vit. Enam.	10 kΩ	5	4.1/2W	PC.67009/19	Z.244097	1
R4	WW Vit. Enam.	15 kΩ	5	6W	PC.67010/20	Z.244114	1
R5	Comp.Grade 2	100Ω	10	1/4W	PC.66610/13	Z.221110	2
R6	Shunt, WW 250 mA 100 mV		1		WIS.3914/C Sh.2 Ref.19	AP.104267	1
R7	As R2						
R8	As R5						
R9	Comp.Grade 2	10 kΩ	10	1W	PC.66612/31	Z.222241	3
R10	As R9						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS (FIXED) (Cont'd)						
R11	As R9						
R12	Comp.Grade 2	15 kΩ	10	1W	PC.66612/33	Z.222243	3
R13	Shunt WW 5 mA 100 mV		1		WIS.3914/C Sh.3 Ref.31	AP.104450	1
R14	Comp.Grade 2	33Ω	10	1/2W	PC.66611/7	Z.221048	2
R15	Comp.Grade 2	100Ω	10	1W	PC.66616/13	Z.211110	2
R16	Carbon	20Ω	20	50W	WIS.5161/C Sh.1 Ref.22	AP.104511	1
R17	As R15						
R18	As R14						
R19	Shunt 400 mA 100 mV		1		WIS.3914/C Sh.3 Ref.45	AP.104451	1
R20	Not Used						
R21	Not Used						
R22	Shunt 2A 100 mV		1		WIS.3914/C Sh.3 Ref.46	AP.104452	1
R23	Shunt 350 mA 100 mV		1		WIS.3914/C Sh.4 Ref.51	AP.104453	1
R24	Wirewound			600V Wkg.	WIS.4235 Sh.7 Ref.129		1
R25	WW Vit. Enam.	2.2Ω	10	3W	PC.67008/25	Z.243459	2
R26	As R25						
R27	WW Vit. Enam.	1 kΩ	5	4.1/2W	PC.67009/13	Z.244001	1
R28	Carbon	20Ω	10	35W	WIS.5161/C Sh.1 Ref.21	AP.104512	1
R29	As R12						
R30	As R12						
R31	Carbon	20Ω	20		WIS.5161/C Sh.1 Ref.21	AP.104512	1
R32	Comp.Grade 2	75Ω	2	3/4W	PC.66619/5	Z.215383	
R33	Comp.Grade 2	100Ω	10	1/2W	PC.66611/13	Z.221111	1
R34	Comp.Grade 2	1.2 kΩ	10	2W	PC.66616/26	Z.212017	2
R35	Comp.Grade 2	18Ω	10	2W	PC.66616/4	Z.211017	2
R36	As R35						
R37	As R34						
R38	Comp.Grade 2	1 kΩ	10	2W	PC.66616/25	Z.212005	2
R39	Comp.Grade 2	22Ω	10	2W	PC.66616/5	Z.211026	2
R40	As R39						
R41	As R38						
R42	Comp.Grade 2	820Ω	10	2W	PC.66616/24	Z.211227	1
R43	Comp.Grade 2	33Ω	10	2W	PC.66616/7	Z.211047	2
R44	As R43						
R45	Comp.Grade 2	560Ω	10	2W	PC.66616/22	Z.211206	2
R46	As R45						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS (FIXED) (Cont'd)						
R47	Comp.Grade 2	47Ω	10	2W	PC.66616/9	Z.211068	2
R48	As R47						
R49	Comp. Grade 2	390Ω	10	2W	PC.66616/20	Z.211185	1
R50	Comp.Grade 2	220Ω	10	2W	PC.66616/17	Z.211152	3
R51	As R50						
R52	As R50						
R53	Comp.Grade 2 Ins.	33Ω	10	1/4W	PC.66610/7	Z.221047	4
R54	As R53						
R55	As R53						
R56	As R53						
R57	Carbon, Silohm.	50Ω	20	25W	WIS.5161 Sh.1 Ref.6	5905-99-918-9047	1
R69	Type 712 Grade 7	150Ω	20	40	WIS.7663/B Ref.9		1
	RESISTORS VARIABLE						
RV1	Preset WW Pot	1 kΩ	10	2.1/2W	PC.67403/29	Z.271607	5
RV2	As RV1						
RV3	As RV1						
RV4	As RV1						
RV5	As RV1						
RV6	Preset WW Pot.	3Ω	10	60W	PC.67407/39	AP.104536	1
RV7	Comp.Linear Pot.	1 kΩ	20	3/4W	PC.67203/2	Z.261179	1
	INDUCTORS						
L1	Choke	1.5 mH	5		WIS.3069 Sh.1	AP.100643	1
L2	Choke 3 Turns				68/W32056/C		4
L3	As L2						
L4	Choke	2500-3000 μH			WCP.341 Sh.1 Ed.BC	AP.104579	1
L5	34 Turns				W.40509/C Sh.1 Ed.A	AP.104377	1
L6	15 5 Turns				W.40509/C Sh.1 Ed.B	AP.104378	1
L7	9 Turns	2.15 μH	5		W.34446/C Sh.1 Ed.B	AP.104379	1
L8	5 Turns	0.83 μH	5		W.34445/C Sh.1 Ed.B	AP.104380	1
L9	8 Turns				74/W32738/C	AP.104381	1
L10	6 Turns				75/W32738/C	AP.104382	1
L11	Choke Assembly 150 Turns				W.32060/B Sh.1 Ed.A	AP.104383	1
L12	As L2						
L13	As L2						
L14	Choke 34 Turns				W.49681 Sh.1 Ed.A	AP.104544	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	INDUCTORS (Cont'd)						
L15	Variable, Complete Assy.				W.39080 Sh.1 Ed.A	AP.104550	1
L16	Not Used						
L17	Choke				W.40912 Sh.1 Ed.A	AP.104568	1
L18	Choke 20 Turns				W.32060/B Sh.1 Ed.C	AP.104546	1
L19	Anode Coil Assy.				W.40700 Sh.1 Ed.B	AP.104313	1
L20	Coupling Coil Assy.				W.49270 Sh.1 Ed.A		2
L21	Choke 43 Turns				W.33076/B Sh.1 Ed.D	AP.104545	1
L22	22.1/2 Turns				104/W40408/C	AP.104547	2
L23	As L22						
L24	Not Used						
L25	Not Used						
L26	Single Loop				W.49084/B Sh.1 Ed.A	AP.104548	1
L27	Choke 1600 Turns				WSK.13422 Sh.1 Ed.H	AP.104570	1
L28	Choke 76 Turns	350 µH			W.6171 Sh.1 Ed.V	AP.104567	
L29	Choke				W.24575/B Sh.6	AP.104569	
	LINKS						
LKA	Coaxial				WIS.3408/C Sh.1 Ref.1	AP.100830	1
	METERS						
M1	D.C. Moving Coil Scaled 0.15V	500 µA 100 mV	1		WIS.3954/B Sh.13 Ref.11	AP.104388	1
M2	D.C. Moving Coil Scaled 0.250 mA	1 mA 100 mV	1		WIS.3686 Sh.6 Ref.85	AP.104243	1
M3	D.C. Moving Coil Scaled 0-5 mA	1 mA 100 mV	1		WIS.3954/B Sh.13 Ref.113	AP.104385	1
M4	D.C. Moving Coil Scaled 0-250 mA	500 µA 100 mV	1		WIS.3954/B Sh.13 Ref.114	AP.104386	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	METERS (Cont'd)						
M5	D.C. Moving Coil Scaled 0.400 mA	1 mA 100 mV	1		WIS.3686 Sh.12 Ref.189	AP.104387	
M6	D.C. Moving Coil Scaled 0-2A	1 mA 100 mV	1		WIS.4235 Sh.14 Ref.218	AP.104555	1
M7	D.C. Moving Coil Scaled 0-350 mA	1 mA 100 mV	1		WIS.4235 Sh.16 Ref.247	AP.104556	1
M8	D.C. Moving Coil Rectifier Dual Scale to Read A.C. or D.C.	0-15V	1		WIS.4235 Sh.14 Ref.214	AP.104551	1
M9	D.C. Moving Coil Scaled 0-600V D.C.	1 mA 100 mV	1		WIS.4235 Sh.7 Ref.129	AP.104259	1
M10	D.C. Moving Coil Scaled 0-1000	500 µA 50 mV	1		WIS.4235 Sh.10 Ref.174	AP.104557	1
	PEAK VOLTMETERS						
PVM1					W.38793 Sh.1 Ed.D	AP.104410	1
PVM2					W.38793 Sh.1 Ed.A	AP.104389	2
PVM3	Not Used						
PVM4	As PVM2						
	PLUGS						
PLA	Coaxial				W.36715/B Sh.1 Ref.2	AP.64650	1
PLB	Coaxial				W.36715/B Sh.1 Ref.3	AP.64650	1
PLC	Coaxial				W.36715/B Sh.1 Ref.4	AP.64650	2
PLD	Coaxial				W.36715/B Sh.1 Ref.5	AP.64650	1
PLE	18 Way				W.41113 Sh.1 Ref.1	AP.104585	1
PLF	18 Way				WIS.3738/C Sh.1 Ref.1	AP.104176	5
PLG	As PLF						
PLH	As PLC						
PLJ	As PLF						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	PLUGS (Cont'd)						
PLK	Coaxial				WIS.5355/B Sh.1 Ref.8	AP.67169	1
PLL	6 Way (Red)				W.41113 Sh.1 Ref.2	AP.104584	1
PLM	Coaxial (Yellow)				W.36715/B Sh.1 Ref.6	AP.64650	1
PLN	to PLP Not Used						
PLQ	Coaxial (Black)				W.51158/C Sh.1 Ref.1	AP.61032	1
PLR	Coaxial (Green)				W.51158/C Sh.1 Ref.2	AP.61032	1
PLS	Coaxial (Blue)				W.51158/C Sh.1 Ref.3	AP.61032	1
PLT	Coaxial (Red)				W.51158/C Sh.1 Ref.4	AP.61032	1
PLU	Coaxial (Yellow)				W.51158/C Sh.1 Ref.5	AP.61032	1
PLV	Coaxial (Grey)				W.51158/C Sh.1 Ref.6	AP.61032	1
PLW	Coaxial (Brown)				W.51158/C Sh.1 Ref.7	AP.61032	1
PLCA	Coaxial				WIS.3106/C Sh.1 Ref.3	AP.101016	3
PLCB	As PLCA						
PLCC	As PLCA						
PLAB	As PLF						
PLAC	to PLAY Not Used						
PLAZ	As PLF						
	SOCKETS						
SKA	Coaxial				WIS.5355/B Sh.1 Ref.9	AP.104571	7
SKB	As SKA						
SKC	As SKA						
SKD	As SKA						
SKE	18 Way				WIS.3732/C Sh.1 Ref.1	AP.104204	1
SKF	18 Way				W.41061 Sh.1 Ref.6	AP.104202	1
SKG	18 Way				W.41061 Sh.1 Ref.7	AP.104202	1
SKH	As SKA						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	SOCKETS (Cont'd)						
SKJ	18 Way (Green)				W.41061 Sh.1 Ref.9	AP.104202	1
SKK	As SKA						
SKL	Not Used						
SKM	As SKA						
SKN	12 Way (Light Grey)				W.41061 Sh.1 Ref. 102	AP.104202	1
SKP	18 Way (Tan)				W.41061 Sh.1 Ref.105	AP.104202	1
SKR to SKZ	Not Used						
SKAA	Not Used						
SKAB	18 Way				W.41061 Sh.1 Ref. 26	AP.104202	1
SKAC to SKAY	Not Used						
SKAZ	18 Way (Tan)				W.41061 Sh.1 Ref.106	AP.104202	1
	SWITCHES						
SWA	1 Pole, 5 Pos.				W.38959 Sh.1 Ed.A	AP.104369	1
SWB	1 Wafer, Single Pole, 5 Way				WIS.5670/C Sh.97		1
SWC	1 Pole, 5 Pos.				W.40066 Sh.1 Ed.A	AP.104472	1
SWD	4 Pole, 5 Pos.				6/W.40408/C	AP.104573	1
SWE	Not Used						
SWF1	Complete Assy.				W.39161 Sh.1 Ed.A	AP.104474	1
SWF2	1 Pole c/o				WIS.5586/C Sh.1 Ref.2	AP.104208	4
SWG1	Complete Assy.				W.36725 Sh.1 Ed.B	AP.104473	1
SWG2					W.40269/C Sh.1 Ed.B	AP.104463	1
SWH	1 Pole			2.5 kVA	WIS.5197/B Sh.6	AP.104476	1
SWJ	2 Pole 1 Wafer				WIS.5820/B Sh.34	AP.104468	1
SWK	1 Pole, 2 Wafers				WIS.5820/B Sh.34	AP.104468	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	SWITCHES (Cont'd)						
SWM	As SWF2						
SWN	As SWF2						
SWP	Part of Tuning Capacitor C64 for Contacts see Ref.87						
	TERMINAL BLOCKS						
TB1	20 Way				W.33265 Sh.1 Ed.Q	AP.104574	1
TB2	2 Way				42/W39081/C		1
TB3	3 Way				WIS.1632 Sh.1 Ref.3	AP.104576	1
TB4	10 Way				W.33265 Sh.1 Ref.W	AP.104575	1
	VALVES						
V1	CV.428					CV.428	2
V2	As V1						
V3	QY.4250 *					CV.2131	2
V4	As V3						
V5	BR.191 or ACT70					CV.2383	1
	MISCELLANEOUS ELECTRICAL ITEMS						
X1	Suction Unit				WIS.5731/B Sh.2 Ref.3	AP.104318	1
X2	Ball Contactor				W.40987/C Sh.1 Ed.A	AP.104506	1
X3	Spring Contact				47/W39081/C	AP.104507	1
X4	Ball Contact				W.41074/C Sh.1 Ed.A	AP.104504	2
X5	As X4						
X6	Spring Contact				41/W35056/C	AP.104505	2
X7	As X6						
	MISCELLANEOUS MECHANICAL ITEMS (Note the following items do not appear on the Circuit Diagram)						
1	Insulator Ceramic				WP.984	AP.104477	2
2	Air Filter				WIS.4726/B Sh.1 Ref.4	AP.104342	1
3	Not Used						
4	Mounting Board Mycalex				1/W49688/C	AP.104529	1
5	Mounting Board Mycalex				177/W37907/C	AP.104530	2
6	Insulator				SP.10996	AP.101034	2

Schedule WZ.17588/A

* If required to operate on I.S.B., s[illegible] Note at bottom of Page 4.

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	MISCELLANEOUS MECHANICAL ITEMS (Cont'd)						
7	Not Used						
8	Not Used						
9	Not Used						
10	Not Used						
11	Coil Mounting Plate Mycalex				107/W40408/C	AP.104523	2
12	Top Panel Mycalex				108A/W40408/B	AP.104524	1
13	Contact Mounting Mycalex				3/W40408/C	AP.104525	4
14	End Cheek Mycalex				1/W48433/C	AP.104526	1
15	Contact Mounting Mycalex				51/W40408/C	AP.104527	1
16	Rotor Mounting Mycalex				5/W40408/C	AP.104528	2
17	Contact Assy.				W.41075/C Sh.1 Ed.A	AP.104488	4
18	Contact Assy.				W.18195/C Sh.1 Ed.A	AP.104489	54
19	Not Used						
20	Spring Contact				101/W37907/C	AP.104500	4
21	Stand-Off Insu-lator				WIS.5416/C Sh.1 Ref.3	AP.104441	2
22	Mounting Board Mycalex				49/W32056/C	AP.104513	1
23	Spring Contact				101A/W37907/C	AP.104501	3
24	Grid Contact Spring				94/W37907/C	AP.104537	12
25	Stand-Off Insu-lator				WIS.5416/C Sh.1 Ref.4	AP.10442	10
26	Ball Contact Assy.				W.18195/C Sh.1 Ed.A	AP.104489	4
27	Spring				W.7447/C Sh.1 Ref.28B	AP.104538	1
28	Switch Blade Assy.				W.39454/B Sh.1 Ed.A	AP.104565	1
29	Contact Panel Mycalex				15/W39161/C	AP.104514	1
30	Insulating Pillar				WSK.10464 Sh.1 Ref.9	AP.104562	4
31	Mounting Plate, Mycalex				1/W40066/B	AP.104515	1
32	Ball Contact Assy.				W.38961/C Sh.1 Ed.A	AP.104490	16
33	End Plate Mycalex				5/W37919	AP.104516	1
34	Bearing Plate Mycalex				65/W37919	AP.104517	1

Schedule WZ.17588/A

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	MISCELLANEOUS MECHANICAL ITEMS (Cont'd.)						
35	Spring Contact Assy.				W.40784/C Sh.1 Ed.A	AP.10449.	3
36	End Plate Mycalex				109/W.37919	AP.104518	1
37	Spring Contact Assy.				W.40785/C Sh.1 Ed.A	AP.104492	4
38	Spring Contact Assy.				W.49276/C Sh.1 Ed.A	AP.104493	1
39	Spring Contact Assy.				W.40785/C Sh.1 Ed.A	AP.104492	
40	Spring Contact Assy.				W.50138/B Sh.1 Ed.A	AP.104494	1
41	Spring Flat				127/W.37919/C	AP.104539	2
42	Coupling Coil Mtg. Plate Mycalex				34A/W.37919/B	AP.104519	1
43	Spring Contact Assy.				W.40712/C Sh.1 Ed.A	AP.104495	2
44	Spring Contact Assy.				W.40713/C Sh.1 Ed.A	AP.104496	2
45	Spring Contact				72/W.37919/C	AP.104502	6
46	Spindle Assy.				W.40693 Sh.1 Ed.A	AP.104562	1
47	Coil Support Mycalex				3/W.40700/B	AP.104433	1
48	Coil Support Mycalex				4/W.40700	AP.104434	1
49	Coil Support Mycalex				4A/W.40700	AP.104435	1
50	Coil Support Mycalex				4B/W.40700	AP.104436	1
51	Coil Support Mycalex				4C/W.40700	AP.104437	1
52	Coil Support Mycalex				8/W.40700/B	AP.104438	1
53	Insulator - Conical Porcelain				SP.10996	AP.101034	2
54	Insulating Piece Mycalex				3/W.40203/C	AP.104531	
55	Mounting Board, Mycalex				1/W.39080/B	AP.104439	1
56	Support Plate, Mycalex				2/W.38959/B	AP.104419	1
57	Coupling Bar, Mycalex				W.21029/C Sh.1 Ref.8	AP.104420	1
58	Mounting Plate, Mycalex				1/W.38959/B	AP.104421	1
59	Mounting Board, Mycalex				1A/W.39080/B	AP.104422	1
60	Spring Assy.				W.39660/C Sh.1 Ed.A	AP.104540	2

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	MISCELLANEOUS MECHANICAL ITEMS (Cont'd)						
61	Shaft Assy.				W.39617/B Sh.1 Ed.A	AP.104561	1
62	Former Mycalex				10/W.39080/B	AP.104423	1
63	Former Mycalex				10A/W.39080/B	AP.104424	1
64	Former Mycalex				10B/W.39080/B	AP.104425	1
65	Former Mycalex				10C/W.39080/B	AP.104426	1
66	Former Mycalex				14/W.39080/B	AP.104427	1
67	Former Mycalex				15/W.39080/B	AP.104428	1
68	Contact Assy.				W.49358/B Sh.1 Ed.B		1
69	Insulating Rod				WSK.10464 Sh.1 Ref.10	AP.104532	4
70	Conical Insulator				WIS.626/C Sh.1 Ref.1		1
71	Valveholder Ceramic 5 Pin				WIS.4844/C Sh.1 Ref.2	AP.104411	2
72	Insulator Stand-Off				WIS.5416/C Sh.1 Ref.4	AP.194442	10
73	Insulator Stand-Off				WIS.5416/C Sh.1 Ref.1	AP.104440	2
74	Base Mycalex				49/W.32056/C	AP.104429	1
75	Terminal Block Mycalex				16/W.32738/C	AP.104430	6
76	Spring Contact				30/W.32738/C	AP.104503	4
77	Spring Contact Plate Mycalex				28/W.32738/C	AP.104431	1
78	Condenser Plate Mycalex				54/W.32738/C	AP.104432	1
79	Flexible Drive Assembly				WIS.5716/C	AP.104414	1
80	Manual Drive Assembly				W.38958 Sh.1 Ed.A	AP.104415	3
81	Manual Drive Assembly				W.38958 Sh.2 Ed.B	AP.104416	1
82	Manual Drive Assembly				W.39163 Sh.1 Ed.A	AP.104417	1
83	Manual Drive Assembly				W.39340 Sh.2 Ed.B	AP.104418	1
84	Spring Contact Assembly				W.49274/C Sh.1 Ed.A	AP.104497	2
85	Spring				23/W.39080/C	AP.104541	4
86	Contact Mounting Mycalex				3A/W.40408/C	AP.104520	1
87	Contact Assembly				W.18195/C Sh.1 Ed.A	AP.104489	

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	MISCELLANEOUS MECHANICAL ITEMS (Cont'd)						
88	End Cheek Mycalex				2/W.48433/C	AP.104521	1
89	Contact Assembly				W.18195/C Sh.1 Ed.D	AP.104498	8
90	Coupling Mycalex				16/W.38936/C	AP.104522	1
91	Suction Fan Motor a.c.				C32G2 S.E.M. Ltd.	6105-99-622-3206	1
92	Bearing, Ball Journal				FAFNIR 6203	3110-99 710-3460	1
93	Bearing, Ball Journal				SKEFCO 6004Z	3110-99-622-3756	1
94	Switch, Centrifugal				ECP 8098 S.E.M. Ltd.	5930-99 622-3732	1
95	Switch, Stationary				ECP 8100 S.E.M. Ltd.	4450-99-622-2217	1
96	Capacitor, fixed Electrolytic	50/65 pF		275 r.m.s. wkg.	ECP 14208	5910-99-622-4408	1
97	Wave Washer				EP 36285		1
98	Circlip				EP 25676		1

COMPONENTS LIST

FOR

MIXER UNIT

(Drg. No. W.37920 Sh.7-9 Ed.D)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identity only for all other items.

2. The references in column 1 are shown on circuit diagrams Figs.12 and 13 and component location diagrams Fig.6.

3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS						
C1	Ceramic	.001 µF	20	350V DC	PC.18203/5	Z.132630	2
C2	Paper	.01 µF	20	500V DC	PC.19203/14	Z.115546	29
C3	As C2						
C4	As C2						
C5	Variable. Air spaced. Two 3 Gangs Coupled	9.5-225 pF per Sect.			WIS.5537 Sh.1 Ref.2	Part of AP.104343	10
C6	Variable, Air Spaced	3-30 pF		75V	W.53587/C Sh.1 Ed.A		6
C7	As C6						
C8	As C6						
C9	Ceramic	10 µµF	20	500V	PC.18202/1	Z.132253	1
C10	Ceramic	100 µµF	10	500V DC	PC.18202/13	Z.132300	3
C11	As C2						
C12	As C2						
C13	As C2						
C14	As C5						
C15	Not Used						
C16	As C6						
C17	As C6						
C18	Ceramic Tubular Insulated Temp. Coeff. -750	47 µµF	10	500V DC	PC.18202/9	Z.132289	5
C19	As C10						
C20	As C2						
C21	As C18						
C22	As C2						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS (Contd.)	1000 pF			H.31S 8547-01	624-6098	25
C23	Mica	~~[illegible]~~	10	750V DC	~~*WIS.4342/B Sh.1 Ref.7~~	~~Z.124382~~	~~25~~
C24	As C23						
C25	As C5						
C26	As C6						
C27	As C18						
C28	As C10						
C29	As C1						
C30	Ceramic	6.8 µµF	10	750V DC	PC.18201/7	Z.132422	1
C31	As C2						
C32	Variable air spaced	4.8-100 pF			WIS.3040/C Sy.1 Ref.9	Z.160006	20
C33	As C32						
C34	As C32						
C35	As C18						
C36	As C2						
C37	As C23						
C38	As C23						
C39	As C23						
C40	As C23						
C41	As C5						
C42	As C2						
C43	As C23						
C44	As C23						
C45	As C23						
C46	As C23						
C47	As C5						
C48	As C23						
C49	As C2						
C50	As C32						
C51	As C32						
C52	As C32						
C53	As C18						
C54	As C2						
C55	As C2						
C56	Paper	.01 µF	20	400V DC	PC.19308/7	Z.115827	7
C57	As C2						
C58	As C2						
C59	Silvered Mica	220 µµF	5	350V DC	*WIS.4483/B Sh.1 Ref.1	Z.123288	1
C60	Silvered Mica	390 µµF	5	350V DC	*WIS.4483/B Sh.1 Ref.1	Z.123376	1
C61	As C56						
C62	As C56						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS (Cont'd.)						
C63	Variable Air Spaced	3.3-34.5 μμF			WIS.3534/C Sh.1 Ref.2	AP.104344	1
C64	As C2						
C65	As C5						
C66	As C5						
C67	As C32						
C68	As C32						
C69	As C32						
C70	Mica, Foil	150 μμF	10	750V DC	PC.18802/15	Z.123663	1
C71	As C2						
C72	Not Used						
C73	As C32						
C74	As C32						
C75	As C32						
C76	Mica Metallised	68 μμF	10	750V DC	PC.18802/11	Z.123918	1
C77	As C2						
C78	Paper	.05 μF	20	500V DC	PC.19203/17	Z.115505	1
C79	As C23						
C80	As C23						
C81	As C23						
C82	As C5						
C83	As C2						
C84	As C32						
C85	As C32						
C86	As C32						
C87	As C23						
C88	As C2						
C89	As C23						
C90	As C23						
C91	As C23						
C92	As C23						
C93	Not Used						
C94	As C5						
C95	As C23						
C96	As C2						
C97	As C23						
C98	As C23						
C99	As C23						
C100	As C5						
C101	As C23						
C102	Not Used						
C103	Paper	.25 μF	25	150V DC	PC.19301/2	Z.115563	2
C104	As C32						
C105	As C32						
C106	As C32						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS (Contd.)						
C107	Mica, Foil, Moulded Case	.001 µF	20	350V DC	PC.18701/2	Z.124479	4
C108	Not Used						
C109	Mica Foil, Moulded Case	220 µµF	20	750V DC	PC.18702/2	Z.123293	1
C110	As C23						
C111	Not Used						
C112	As C103						
C113	Not Used						
C114	Not Used						
C115	As C107						
C116	As C2						
C117	As C107						
C118	As C2						
C119	As C56						
C120	As C56						
C121	As C107						
C122	Not Used						
C123	Not Used						
C124	Paper	.1 µF	20	350V DC	PC.19207/15	Z.115597	2
C125	Mica	100 µµF	10	750V DC	PC.18802/13	Z.132300	1
C126	As C2						
C127	As C2						
C128	As C32						
C129	As C2						
C130	Mica, Metallised, Moulded Case	470 µµF	5	750V DC	PC.18802/21	Z.123948	1
C131	Mica, Metallised, Moulded Case	10 µµF	10	750V DC	PC.18802/1	Z.123900	1
C132	As C2						
C133	As C32						
C134	As C2						
1135	As C56						
C136	As C57						
	RESISTORS						
R1	Comp. Grade 2	22Ω	10	1/2W	PC.66611/5	Z.221027	1
R2	Comp. Grade 2	56Ω	10	1/2W	PC.66611/10	Z.221081	1
R3	Comp. Grade 2	33 kΩ	10	1/2W	PC.66611/43	Z.222195	6
R4	Comp. Grade 2	33Ω	10	1/4W	PC.66610/7	Z.221047	26
R5	As R4						
R6	Comp. Grade 2	100 kΩ	10	1/2W	PC.66611/49	Z.223039	5
R7	Comp. Grade 2	2.2 kΩ	10	1/2W	PC.66611/29	Z.222048	4

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS (Contd.)						
R8	Wirewound	5.55Ω	1	3W	*WIS.2896/C Sh.2 Ref.10	AP.103023	6
R9	Comp. Grade 2	6.8 kΩ	10	1/2W	PC.66611/35	Z.222111	10
R10	As R4						
R11	As R6						
R12	As R3						
R13	As R4						
R14	As R4						
R15	As R7						
R16	As R8						
R17	As R9						
R18	As R4						
R19	Comp. Grade 2	10 kΩ	10	1/2W	PC.66611/37	Z.222132	6
R20	As R3						
R21	As R4						
R22	As R4						
R23	As R6						
R24	As R7						
R25	As R8						
R26	As R9						
R27	As R4						
R28	As R9						
R29	Comp. Grade 2	150 kΩ	10	1/2W	PC.66611/51	Z.223060	1
R30	Comp. Grade 2	1 kΩ	10	1/2W	PC.66611/25	Z.222006	5
R31	As R9						
R32	Comp. Grade 2	8.2 kΩ	10	1/2W	PC.66611/36	Z.222123	4
R33	As R4						
R34	As R4						
R35	As R4						
R36	Comp. Grade 2	330Ω	10	1/2W	PC.66611/19	Z.221174	3
R37	As R8						
R38	Comp. Grade 2	22 kΩ	10	1/2W	PC.66611/41	Z.222174	2
R39	As R9						
R40	As R8						
R41	As R4						
R42	As R4						
R43	As R36						
R44	Wirewound	.505Ω	5	3W	*WIS.2896/C Sh.2 Ref.10	AP.103024	6
R45	As R4						
R46	As R4						
R47	Comp. Grade 2	220Ω	10	1/2W	PC.66611/17	Z.221153	9
R48	As R47						
R49	Comp. Grade 2	3.3 kΩ	10	1/2W	PC.66611/31	Z.222069	2

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS (Contd.)						
R50	Comp. Grade 2	180Ω	10	1/2W	PC.66611/16	Z.221144	2
R51	As R50						
R52	As R6						
R53	As R47						
R54	As R47						
R55	As R4						
R56	Comp. Grade 2	33Ω	10	1/4W	PC.66609/1	Z.221046	2
R57	As R36						
R58	As R56						
R59	As R4						
R60	Not Used						
R61	As R44						
R62	As R32						
R63	As R9						
R64	Comp. Grade 2	3.9 kΩ	10	1/2W	PC.66611/32	Z.222081	1
R65	As R9						
R66	As R32						
R67	As R9						
R68	Not Used						
R69	Not Used						
R70	As R30						
R71	As R49						
R72	As R19						
R73	As R4						
R74	As R4						
R75	As R30						
R76	As R47						
R77	As R47						
R78	Carbon	330Ω	10	3/4W	*WIS.3903 Sh.1 Ref.5	Z.221174	1
R79	As R8						
R80	Comp. Grade 2	120Ω	10	1/4W	PC.66609/8	Z.221121	1
R81	As R19						
R82	As R9						
R83	As R32						
R84	As R4						
R85	WW Enam. Vit.	1 kΩ	5	4.1/2W	PC.67009/13	Z.244001	1
R86	As R4						
R87	Comp. Grade 2 Insulated	100Ω	10	1/4W	PC.66609/7	Z.221109	1
R88	As R44						
R89	Not Used						
R90	As R19						
R91	Not Used						
R92	Not Used						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS (Contd.)						
R93	As R47						
R94	As R47						
R95	Not Used						
R96	Not Used						
R97	Not Used						
R98	As R44						
R99	Comp. Grade 2	100Ω	10	1/4W	PC.66610/13	Z.221110	2
R100	As R4						
R101	As R30						
R102	As R3						
R103	Not Used						
R104	As R19						
R105	Comp. Grade 2	330Ω	10	1/4W	PC.66610/19	Z.221173	1
R106	Comp. Grade 2	270Ω	10	1/4W	PC.66610/18	Z.221164	1
R107	Thermistor				WIS.5740/C Sh.1 Ed.4	AP.104326	1
R108	As R19						
R109	Comp. Grade 2	680Ω	10	1/2W	PC.66611/23	Z.221216	2
R110	Comp. Grade 2	68Ω	10	1/2W	PC.66610/11	Z.221089	1
R111	As R99						
R112	Comp. Grade 2	47 kΩ	10	1/2W	PC.66611/45		1
R113	As R38						
R114	Comp. Grade 2	4.7 kΩ	10	1/2W	PC.66611/33	Z.222096	1
R115	Comp. Grade 2	100Ω	10	1/2W	PC.66611/13	Z.221111	2
R116	As R7						
R117	As R44						
R118	Comp. Grade 2	56Ω	10	1/2W	PC.66611/10	Z.221081	3
R119	As R118						
R120	Comp. Grade 2	22Ω	10	1/2W	PC.66611/5	Z.221027	3
R121	As R120						
R122	Comp. Grade 2	68Ω	10	1/2W	PC.66611/11	Z.221090	1
R123	As R120						
R124	As R118						
R125	As R6						
R126	As R4						
R127	As R30						
R128	As R115						
R129	As R109						
R130	As R44						
R131	As R47						
R132	As R43						
R133	As R3						
R134	As R4						
R135	As R4						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	RESISTORS VARIABLE						
RV1	Comp. Linear	5 kΩ	20	3/4W	PC.67203/9	Z.261510	1
RV2	Not Used						
RV3	Wirewound	25 kΩ	10	3W	WIS.4175/B Sh.1 Ref.63	Z.272301	8
RV4	As RV3						
RV5	Wirewound	25 kΩ	10	3W	WIS.4175/B Sh.1 Ref.64	Z.272302	1
RV6	As RV3						
RV7	As RV3						
RV8	As RV3						
RV9	As RV3						
RV10	As RV3						
RV11	As RV3						
	INDUCTORS						
L1	3.1/2 Turns				W.26958/B Sh.154 W.36413/C Sh.1 Ed.0	AP.104370	1
L2	21 Turns				W.50593 Sh.1 Ed.F	AP.104372	2
L3	10 Turns				W.37149 Sh.1 Ed.C		2
L4	4 Turns				W.50593 Sh.1 Ed.B	AP.104373	2
L5	3.1/2 Turns				147/737628/C		10
L6	600 Turns & 400 Turns				W.18936/C Sh.1 Ed.A	AP.104566	2
L7	As L5						
L8	As L5						
L9	As L5						
L10	As L5						
L11					WIS.1161 Sh.1 Ref.1	AP.104567	1
L12	22 Turns				W.37206/B Sh.1 Ed.A	AP.104374	1
L13	9 Turns				W.37207/B Sh.1 Ed.A	AP.104375	1
L14	3 Turns				W.37208/B Sh.1 Ed.A	AP.104376	1
L15	As L5						
L16	21 Turns				W.50593 Sh.1 Ed.F	AP.104372	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	INDUCTORS (Contd.)						
L17	10 Turns				W.37149 Sh.1 Ed.C		1
L18	As L4						
L19	As L5						
L20	As L6						
L21	Not Used						
L22	Not Used						
L23	As L5						
L24	As L5						
L25	As L5						
L26	A6 Turns				W.33035/B Sh.1 Ed.D	AP.104363	1
L27	Not Used						
L28	Not Used						
L29	'Ledex' Selector				WIS.5540/B Sh.7	AP.104368	1
	LINKS						
LKA	Coaxial				WIS.3409/C Sh.1 Ref.1	AP.100830	1
	METERS						
M1	M.C. F.S.D. = 1 mA DC Scale 0-10 Res. 50Ω				WIS.3686 Sh.4 Ref. 61	AP.104351	1
	PLUGS						
PLA to	Not Used						
PLM	12 Way				WIS.3737/C Sh.1 Ref.9	AP.70371	1
PLO	Not Used						
PLP	18 Way				WIS.3738/C Sh.1 Ref.1	AP.104176	1
PLQ to PLZ	Not Used						
PLAB to PLAZ	Not Used						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	PLUGS (Contd.)						
PLBA	Coaxial				WIS.3106 Sh.1 Ref.1	AP.101024	5
PLBB	As PLBA						
PLBC	As PLBA						
PLBD	As PLBA						
PLBE	As PLBA						
PLBF	Not Used						
PLBG	Not Used						
	SOCKETS						
SKQ	Coaxial				WIS.3956/C Sh.1 Ref.3	AP.67823	8
SKR	As SKQ						
SKS	As SKQ						
SKT	As SKQ						
SKU	As SKQ						
SKV	As SKQ						
SKW	As SKQ						
SKX	As SKQ						
	SWITCHES						
SWA	8 Wafer 12 Way				WIS.3421/C Sh.50	AP.104364	1
SWB	2 Wafer 7 Way				WIS.1197/C Sh.1099	AP.104366	1
SWC	9 Wafer 12 Way				WIS.3421/C Sh.51	AP.104365	1
SWD	1 Wafer 6 Way				WIS.1197/C Sh.1205	AP.104367	1
SWE	1 Pole On-Off				2/WIS.1012	AP.100811	1
SWQ	1 Pole Double throw				WIS.2834 Sh.1 Ref.3	W.3893	1
SWG	'Ledex' Selector (Part)				WIS.5540/B Sh.7		1
	TRANSFORMERS						
TR1	24 Turns & 20 Turns				W.26958/B Sh.152	AP.104352	1

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	TRANSFORMERS (Contd.)						
TR2	12 Turns & 9 Turns				W.26958/B Sh.153	AP.104353	1
TR3	21 Turns & 6 Turns				W.50593 Sh.1 Ed.G	AP.104360	2
TR4	9 Turns & 2 Turns				W.50593 Sh.1 Ed.D	AP.104355	2
TR5	4 Turns & 1 Turns				W.50593 Sh.1 Ed.E	AP.104356	1
TR6	28 Turns & 1 Turns				W.41184/B Sh.45	AP.104357	1
TR7	13 Turns & 1 Turns				W.41184/B Sh.46	AP.104358	1
TR8	7 Turns & 1 Turns				W.41185/B Sh.6	AP.104359	1
TR9	As TR3						
TR10	As TR4						
TR11	4 Turns & 1 Turns				W.37149 Sh.1 Ed.M	AP.104361	1
TR12	Input Transformer				W.33035/B Sh.1 Ed.E	AP.104362	1
TR13	Output Transformer				W.33035/B Sh.1 Ed.D	AP.104363	1
	VALVES						
V1	CV138				CV.138		9
V2	As V1						
V3	As V1						
V4	As V1						
V5	As V1						
V6	As V1						
V7	CV.4014						
V8	As V7						
V9	As V1						
V10	CV.391				CV.391		2
V11	As V10						
V12	N77				CV.136		2
V13	As V12						

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	MISCELLANEOUS MECHANICAL ITEMS						
1	Spring Contact				54/W.36728/C	AP.104542	3
2	Valveholder B8G				PC.81813/1	Z.561146	2
3	Valveholder B7G				PC.81811/1	Z.560127	11
4	Insulator				WIS.5593/C Sh.1 Ref.5	AP.103779	11

COMPONENTS LIST

FOR

PEAK VOLTMETER

(Drg. No. W.38793 Sh.1 Ed.A)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identity only for all other items.

2. The references in column 1 are shown on circuit and component location diagram Fig.7.

3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS						
C1	Silvered Ceramic	10 pF	20	4 kV DC	*WIS.4240/C Sh.1 Ref.2	AP.102961	1
C2	Ceramic Tubular	47 pF	5	750V DC	*WIS.3450/B Sh.1 Ref.7	Z.132288	1
C3	Ceramic Tubular	2,200 pF	20	350V DC	PC.18203/7	Z.132631	1
	RESISTORS FIXED						
R1	Comp. Grade 1	3.9 kΩ	5	1/4W	PC.66604/32	Z.215311	1
R2	Comp.	62 kΩ	5	1/4W	WIS.3903 Sh.1 Ref.5	Z.216097	1
	INDUCTORS						
L1	250 mA	1.5 mH	5		WIS.3069 Sh.1	AP.100643	1
	RECTIFIERS						
MR1	Germanium Crystal				WIS.4203/C Sh.1 Ref.2	CV.448	1
	MISCELLANEOUS MECHANICAL ITEMS						
1	Terminal				WIS.4793/C Sh.1 Ref.7	Z.560882	3

COMPONENTS LIST

FOR

PEAK VOLTMETER

(Drg. No.W.38793 Sh.1 Ed.D)

NOTES

1. When ordering spares quote information from all columns for identities marked * or identity only for all other items.

2. The references in column 1 are shown on circuit and component location diagram Fig.8.

3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol. % ±	Rating	Identity	Service Ref.	Qty.
	CAPACITORS						
C1	Ceramic, Tubular	330pF	20	350V DC	PC.18203/2	Z.132627	1
C2	Ceramic, Tubular	2,200 pF	20	350V DC	PC.18203/7	Z.132631	1
	RESISTORS FIXED						
R1	Comp. Grade 1	3.9 kΩ	5	1/4W	PC.66604/32	Z.215311	1
R2	Comp. Insul.	62 kΩ	5	1/4W	WIS.3903 Sh.1 Ref.5	Z.216097	1
	INDUCTORS						
L1	250 mA	1.5 mH	5		WIS.3069 Sh.1	AP.100643	1
	RECTIFIERS						
MR1	Germanium Crystal				WIS.4203/C Sh.1 Ref.2	CV.448	1
	MISCELLANEOUS MECHANICAL ITEMS						
1	Terminal				WIS.4793/C Sh.1 Ref.7	Z.560882	3

Schedule WZ.12771/A

MASTER COMPONENTS LIST
FOR
TRANSMITTER TYPE HS.31A
TYPE NO.3975A

Technical Handbook Ref. T.4260

NOTES:

1. Component schedules in this handbook are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1, in addition to the normal part identity in column 6.
2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.
3. For spares ordering purposes it is only necessary to quote the exact handbook reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but are not necessary.
4. Prices are subject to change without notice.
5. The following abbreviations are used throughout this Master List:

Cap.	Capacitor
Carb.	Carbon
Cer.	Ceramic
C/O	Changeover
Coef.	Coefficient
Comp.	Composition
DP	Double Pole
DT	Double Throw
En.	Enamelled
Elyc.	Electrolytic
Fil.	Filament
FSD	Full Scale Deflection
Gd.	Grade
HS	High Stability
Indr.	Inductor
Insd.	Insulated
Insr.	Insulator
Lg.	Long
Lin.	Linear
Metd.	Metallised
Mld.	Moulded
Neg.	Negative
Osc.	Oscillator
Pap.	Paper
pF	Picofarad Micro-Microfarad
Psn.	Position
Potr.	Potentiometer
Prim.	Primary (winding)
PVC	Polyvinyl Chloride Compound Insulated
Rect.	Rectifier
Res.	Resistor
Sec.	Secondary (winding)
Sil.Mica.	Silver Mica
Sil.Mica.Prot.	Silver Mica Protected
SP	Single Pole
Temp.	Temperature
Term.	Terminal
Transf.	Transformer
Tub.	Tubular
Vble.	Variable
Vit.	Vitreous
W/W	Wirewound

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
1	Cap. Cer. Insd.	330pF	20	500V	PC.18208-2	1	1. 0	1S
2	Cap. Cer. Insd.	2200pF	20	500V	PC.18208-7	2	1. 0	1S
3	Cap. Cer.	10pF	20	4kV	WIS.4240-C-1-2	1	11. 0	1S
4	Cap. Cer. Tub.	47pF	5	750V	WIS.3450-B-1-7	1	2. 6	1S
5	Cap. Pap.	10µF	15	250V	WIS.4321-B-1-11	4	1. 3. 0	1S
6	Cap. Pap.	8µF	20	600V	WIS.4172-B-1-4	3	1.17. 0	1S
7	Cap. Pap.	4µF	15	750V	WIS.2354-B-1-6	1	19. 6	1S
8	Cap. Pap.	4µF	10	6kV	WIS.4451-B-1-4	3	28. 9. 0	1S
9	Cap. Mica	0.01µF	5	350V	PC.18801-10	2	6. 0	1S
10	Cap. Pap.	0.01µF	20	10kV	PC.19226-2	2	16. 0	1S
11	Cap. Elyc. Double Section	100 - 200µF	+50 -20	350V	PC.18408-4	1	12. 0	1S
12	Cap. Mica	6800pF	5	350V	PC.18801-8	1	10. 0	1S
13	Cap. Mica	3000pF	20	800V	WIS.4522-C-1-5	15	12. 0	3S
14	Cap. Pap.	0.01µF	25	350V	PC.19202-7	16	2. 0	4S
15	Cap. Cer.	33pF	5	750V	PC.18223-7	1	1. 0	1S
16	Cap. Vble.	16-250pF			WIS.3699-C-1-11	1	1.10. 6	
17	Cap. Cer.	270pF	2	750V	PC.18223-18	1	1. 0	1S
18	Cap. Cer.	2.2pF	±½pF	750V	PC.18212-3	1	1. 0	1S
19	Cap. Vble. 2 Gang	7-100pF	+ 7-100pF		WIS.5346-C-1-4	1	1. 2. 6	
20	Cap. Cer.	270pF	20	350V	PC.18202-18	1	1. 0	1S
21	Cap. Mica	500pF	20	800V	WIS.4522-C-1-2	1	7. 6	1S
22								
23	Cap. Hi-Load	150pF	20	7.5kV	WIS.5080-B-1-3C	1	3. 9. 0	1S
24	Cap. Vacuum	25pF	10	32kV	WIS.4735-C-1-2	2	15. 0. 0	1S
25	Cap. Hi-Load	1250pF	20	7.5kV	WIS.5080-B-1-1E	1	3. 0. 0	1S
26	Cap. Mica Foil	2200pF	20	750V	PC.18702-8	1	2. 0	1S
27	Cap. Mica Disc	0.01µF	20	2000V	WIS.4721-C-1-1A	4	4.14. 6	1S
28	Cap. Hi-Load	130pF	10	7.5kV	WIS.4418-C-1-4	1	4. 6. 0	1S
29	Cap. Hi-Load	50pF	20	7.5kV	WIS.7665-B-1-3	2	2.11. 6	1S
30	Cap. Mica Foil	0.01µF	20	350V	PC.18701-5	2	2. 6	1S
31	Cap. Hi-Load	200pF	20	7.5kV	WIS.5080-B-1-3D	1	3. 9. 0	1S
32	Cap. Hi-Load	125pF	20	7.5kV	WIS.5080-B-1-3D	1	3. 9. 0	1S
33	Cap. Hi-Load	125pF	20	7.5kV	WIS.5080-B-1-3C	1	3. 9. 0	1S
34	Cap. Hi-Load	1250pF	20	7.5kV	WIS.5080-B-1-1	2	3. 0. 0	1S
35	Cap. Vble. Air				W.48433-1-A	1	95. 0. 0	
36	Cap. Preset Air				W.52596-C-1-A	2	3. 0. 0	
37	Cap. Hi-Load	125pF	20	7.5kV	WIS.5080-B-1-3F	4	3. 9. 0	1S
38	Cap. Mica	0.01µF	20	750V	WIS.4342-B-1-7	1	9. 0	1S
39	Cap. Mica Disc	.002µF	20	800V	WIS.7478-C-1-3	1	11. 0	1S
40	Cap. Sil. Cer.	80pF	20	7.5kV	WIS.4142-c-1-6	1	1.18. 6	1S
41	Cap. Hi-Load	200pF	20	4.5kV	WIS.4418-C-1-4	1	1.18. 0	1S
42	Cap. Hi-Load	200pF	20	7.5kV	WIS.5080-B-1-3F	2	3.12. 6	1S
43	Cap. Sil. Cer.	10pF	20	4kV	WIS.4240-C-1-2	2	11. 0	1S
44	Cap. Cer. Insd.	.001µF	20	500V	PC.18208-5	2	1. 0	1S
45	Cap. Pap. Metd.	0.01µF	20	500V	PC.19203-14	29	1. 6	5S
46	Cap. Vble. Two 3-gang	9.5-225pF per section			WIS.5537-1-2	2	9.10. 0	

†

B

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CP

XDC H31-8847-01 624-609

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
47	Cap. Vble.	3-30pF		75V	W.53587-C-1-C	6	6. 6	
48	Cap. Cer. Insd.	10pF	±½pF	750V	PC.18223-1	1	1. 0	1S
49	Cap. Cer. Insd.	100pF	2	750V	PC.18223-13	3	1. 0	1S
50	Cap. Cer. Insd.	47pF	2	750V	PC.18223-9	5	1. 0	2S
51	Cap. Mica	1000pF [illegible]	10	750V	~~WIS.4342-B-1-7~~	25	9. 0	5S
52	Cap. Cer.	6.8pF	10	750V	PC.18201-7	1	1. 0	1S
53	Cap. Vble.	4.8-100pF			PC.20002-7	20	9. 0	2S
54	Cap. Pap.	0.01µF	20	400V	PC.19308-7	7	2. 6	2S
55	Cap. Mica Metd.	47pF	5	750V	PC.18802-9	2	3. 0	1S
56	Cap. Vble.	3.3-34.5pF			WIS.3534-C-1-2	1	1. 3. 6	
57	Cap. Mica	150pF	10	750V	PC.18802-15	1	3. 0	1S
58	Cap. Mica	68pF	10	750V	PC.18802-11	1	3. 0	1S
59	Cap. Pap.	0.05µF	20	500V	PC.19203-17	1	2. 0	1S
60	Cap. Pap.	0.25µF	25	150V	PC.19301-2	2	3. 0	1S
61	Cap. Mica	1000pF	20	350V	PC.18701-2	4	1. 6	1S
62	Cap. Mica	220pF	20	750V	PC.18702-2	1	1. 6	1S
63	Cap. Pap.	0.1µF	20	350V	PC.19202-15	1	2. 0	1S
64	Cap. Mica	100pF	10	750V	PC.18802-13	1	2. 6	1S
65	Cap. Mica	470pF	5	750V	PC.18802-21	1	3. 0	1S
66	Cap. Mica	10pF	10	750V	PC.18802-1	1	2. 6	1S
67	Cap. Mica	0.01µF	20	750V	WIS.7494-B-1-1	1	8. 6	1S
68								
69								
70								
71								
72								
73								
74								
75	Fuse Cartridge	2A			WIS.5703-C-1-1	7	2. 0	12S
76	Fuse Cartridge	10A			WIS.5703-C-1-4	1	2. 0	6S
77	Fuse Cartridge	15A			WIS.4806-B-1-5	3	4. 0	12S
78	Fuse Cartridge	6A			WIS.5703-C-1-3	2	2. 0	6S
79	Fuse Cartridge	2A			WIS.2947-1-9	2	*3. 6	6S
80	Fuse Cartridge	500mA			WIS.2947-1-5	2	*3. 6	6S
81	Fuse Cartridge	1A			WIS.2947-1-7	2	*3. 6	6S
82	Fuse Cartridge	3A			WIS.2947-1-10	1	*3. 6	6S
83	Fuse Cartridge	5A			WIS.2947-1-11	1	*3. 6	6S
84								
85								
86	Indr.	1.5mH	±5	250mA	WIS.3069-1	2	4. 0	1S
87	Indr.	.0075H		35A	W.24581-B-11	1	42.15. 0	
88	Indr.	3.5H		600mA	W.31577-B-3	2	6.10. 0	1B
89	Indr.	5.5H		0.4A	W.31577-B-1	2	16. 5. 0	1B
90	Indr.	3.8H		1.5A	W.24581-B-10	1	41. 0. 0	
91	Choke 3 Turns				68-W.32056-C	4	19. 0	
92	Choke	2500-3000µH			WCP.341-1-BC	1	2.14. 0	1B
93	Indr. 34 Turns				W.40509-C-1-A	1	2. 4. 0	1B

†

* per doz.

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CP

C

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
94	Indr. 15.5 Turns				W.40509-C-1-B	1	2. 4. 0	1B
95	Indr. 9 Turns	2.15µH	5		W.34446-C-1-B	1	3. 0. 0	1B
96	Indr. 5 Turns	0.83µH	5		W.34445-C-1-B	1	2.10. 0	1B
97	Indr. 8 Turns				74-W.32738-C	1	1. 8. 0	
98	Indr. 6 Turns				75A-W.32738-C	1	19. 0	
99	Choke 150 Turns				W.32060-B-1-A	1	4. 7. 6	1B
100	Choke 34 Turns				W.49681-1-A	1	7.10. 0	1B
101	Indr. Vble. Assembly				W.58081-1-A	1	462.10. 0	
102	Choke 20 Turns				W.32060-B-1-C	1	3. 2. 6	1B
103	Anode Coil Assembly				W.40700-1-B	1	137.16. 0	
104A	Coupling Coil		Part of		W.54807-1-A	1	8.15. 0	
104B	Coupling Coil		Part of		W.54808-1-A	1	8.15. 0	
105	Indr. 43 Turns				W.33076-B-1-D	1	3. 6. 6	1B
106	Indr. 22½ Turns				104-W.40408-C	2	2. 9. 6	
107	Indr. 2 Turns				W.53021-B-1-B	1	4. 4. 0	1B
108	Choke 1,600 Turns				WSK.13422-1-H	1	2.15. 0	1B
109	Choke 76 Turns	350µH			W.6171-1-V	1	14. 7. 6	1B
110	Choke				W.24575-B-6	1	13.15. 0	1B
111	Choke				W.57573-1-A	1	52.10. 0	
112	Choke				W.40912-1-A	1	22. 6. 6	
113	Choke 7 Turns				2-W.52576-B	2	6.11. 6	
114	Indr. 3½ Turns				W.36413-C-1-O	1	4.14. 0	1B
115	Indr. 21 Turns				W.50593-1-F	1	1. 2. 0	1B
116	Indr. 10 Turns				W.37149-1-C	1	2. 7. 6	1B
117	Indr. 4 Turns				W.50593-1-B	1	1. 2. 0	1B
118	Indr. 3½ Turns				147-W.37628-C	10	1. 0. 0	
119	Indr. 600 & 400 Turns				W.18936-C-1-A	2	17. 6	1S
120	Indr.				WIS.1161-1-1	1	3. 0	1S
121	Indr. 34 Turns				W.41184-B-36	1	3. 0. 6	1B
122	Indr. 15 Turns				W.41184-B-37	1	3. 0. 6	1B
123	Indr. 7 Turns				W.41185-B-3	1	3. 3. 0	1B
124	Indr. 33½ Turns				W.48441-1-A	1	6.11. 6	1B
125	Indr. 16½ Turns				W.48441-1-B	1	6.11. 6	1B
126	Indr. 7½ Turns				W.48441-1-C	1	6.11. 6	1B
127	Indr.				W.33035-B-1-G	1	5.10. 0	1B
128								
129								
130								
131								
132								
133								
134	Lamp Tub.	0.24W		6V	PC.48601-2	11	3. 0	6S
135								
136								
137	Link Coaxial				PC.60211-1	2	12. 0	
138	Link				W.57575-C-1-1	1	3.19. 0	
139	Link				W.57575-C-1-2	1	3. 5. 6	
140								

D †

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
87	Contact Assembly W.41075-C-1-A					4		1S
88	Contact Assembly W.18195-C-1-A					61		6S
89	Contact 101-W.37907-C					4		1S
90	Contact 101A-W.37907-C					3		1S
91	Contact 94-W.37907-C					12		1S
92								
93	Contact W.38961-C-1-A					16		2S
94	Contact Assembly W.40784-C-1-A					1		1S
95	Contact Assembly W.40785-C-1-A					4		1S
96	Contact Assembly W.49276-C-1-A					1		1S
97	Contact Assembly W.50138-B-1-A (To be supplied with No.531)					1		1S
98	Contact Assembly W.40712-C-1-A					2		1S
99	Contact Assembly W.40713-C-1-A					2		1S
100	Contact 72-W.37919-C					6		2S
101	Contact Assembly W.49358-B-1-B					1		1S
102	Contact 30-W.32738-C					4		1S
103	Contact Assembly W.49274-C-1-A					2		1S
104								
105	Contact Assembly W.18195-1-D					8		2S
106	Contact Spring 47-W.39081-C					5		1S
107	Contact Ball W.41074-C-1-A					2		1S
108	Contact Spring 41-W.32056-C					5		2S
109								
110								
111	Contactor Panel WIS.9273-1-1					1		
112	Contactor 250V PC.64911-7					1		1B
113	Contact Ball W.40987-C-1-A					1		1S
114								
115	Coupling Mycalex 16-W.38936-C					1		
116	Coupling Bar Mycalex W.21029-C-1-8					1		
117								
118	Drive Flexible Assembly WIS.5716-C-1-1					1		
119	Drive Manual Assembly W.38958-1-A					4		
120	Drive Manual Assembly W.38958-2-B					1		
121	Drive Manual Assembly W.39163-1-A					1		
122								
123	Fan Axial 10K/1070564 *					1		
124								
125	Filter Air W.65675-2-B					1		
126								
127	Former Mycalex 10-W.39080-B					1		
128	Former Mycalex 10A-W.39080-B					1		
129	Former Mycalex 10B-W.39080-B					1		

†

* Wotsac replacement for item 123: Fan Ventilating 10K/4140-99-633-2694 (Mod.A.3978)

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
130	Former Mycalex 10C-W.39080-B					1		
131	Former Mycalex 14-W.39080-B					1		
132	Former Mycalex 15-W.38080-B					1		
133								
134	Fuse Cartridge 2A WIS.5703-C-1-1					7		12S
135	Fuse Cartridge 10A WIS.5703-C-1-4					1		6S
136	Fuse Cartridge 25A WIS.4806-B-1-7					3		12S
137	Fuse Cartridge 6A WIS.5703-C-1-3					5		12S
138	Fuse Cartridge 2A WIS.2947-1-9					2		
139	Fuse Cartridge 500mA WIS.2947-1-5					2		
140	Fuse Cartridge 1A WIS.2947-1-7					2		
141	Fuse Cartridge 3A WIS.2947-1-10					1		
142	Fuse Cartridge 5A WIS.2947-1-11					1		
143								
144	Fuseholder WIS.4809-C-1-9					3		
145	Fuseholder WIS.5612-C-1-1					12		
146	Fuseholder WIS.4154-C-1-3					20		
147								
148	Indr. 250mA 1.5mA WIS.3069-1-1					4		1S
149	Indr. 30A 0.0075H W.24581-B-11					1		
150	Indr. 600mA 3.5H W.31577-B--3					2		1B
151	Indr. 0.4.A 5.5H W.31577-B-1					2		1B
152	Indr. 1.5A 3.8H W.24581-B-10					1		
153								
154	Indr. 68-W.32056-C					4		
155	Indr. 2500-3000μH ±5% WCP.341-1-BC					1		
156	Indr. W.40509-C-1-A					1		
157	Indr. W.40509-C-1-B					1		
158	Indr. 2.15μH ±5% W.34446-C-1-B					1		
159	Indr. W.34445-C-1--B					1		
160	Indr. 74-W.32738-C					1		
161	Indr. 75A-W.32738-C					1		
162	Indr. W.32060-B-1--A					1		
163	Indr. W.49681-1-A					1		
164	Indr. W.39080-1-A					1		
165	Indr. W.40912-1-A					1		
166	Indr. W.32060-B-1-C					1		
167	Indr. W.40700-1-B					1		
168	Indr. W.49270-1-A					2		
169	Indr.,W.33076-B-1-D					1		
170	Indr. 104-W.40408-C					2		
171	Indr. W.49084-B-1-A					1		
172	Indr. WSK.13422-1-H					1		

F †

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
236	Res. Comp. Non-Insd.	22Ω	10	2W	PC.66616-5	2	1. 0	
237	Res. Comp. Non-Insd.	820Ω	10	2W	PC.66616-24	1	1. 0	
238	Res. Comp. Non-Insd.	33Ω	10	2W	PC.66616-7	2	1. 0	
239	Res. Comp. Non-Insd.	560Ω	10	2W	PC.66616-22	2	1. 0	
240	Res. Comp. Non-Insd.	47Ω	10	2W	PC.66616-9	2	1. 0	
241	Res. Comp. Non-Insd.	390Ω	10	2W	PC.66616-20	1	1. 0	
242	Res. Comp. Insd.	33Ω	10	1/4W	PC.66610-7	32	1. 0	
243	Res. Carb.	50Ω	20		WIS.5161-C-1-6	1	4. 4. 0	
244	Res. Comp. Non-Insd.	3.9kΩ	5	1/4W	PC.66604-32	2	1. 0	1S
245	Res. Comp. Insd.	62kΩ	5	1/4W	WIS.3903-1-5	2	2. 0	
246	Res. Comp. Insd.	22Ω	10	1/2W	PC.66611-5	4	1. 0	
247	Res. Comp. Insd.	56Ω	10	1/2W	PC.66611-10	4	1. 0	
248	Res. Comp. Insd.	33kΩ	10	1/2W	PC.66611-43	5	1. 0	
249	Res. Comp. Insd.	100kΩ	10	1/2W	PC.66611-49	5	1. 0	
250	Res. Comp. Insd.	2.2kΩ	10	1/2W	PC.66611-29	4	1. 0	
251	Res. W/W	5.55Ω	1	3W	WIS.2896-C-2-10	6	7. 6	2S
252	Res. Comp. Insd.	6.8kΩ	10	1/2W	PC.66611-35	10	1. 0	
253	Res. Comp. Insd.	10kΩ	10	1/2W	PC.66611-37	6	1. 0	
254	Res. Comp. Insd.	150kΩ	10	1/2W	PC.66611-51	1	1. 0	
255	Res. Comp. Insd.	1kΩ	10	1/2W	PC.66611-25	5	1. 0	
256	Res. Comp. Insd.	8.2kΩ	10	1/2W	PC.66611-36	4	1. 0	
257	Res. Comp. Insd.	330Ω	10	1/2W	PC.66611-19	3	1. 0	
258	Res. Comp. Insd.	22k	10	1/2W	PC.66611-41	2	1. 0	
259	Res. W/W	0.505Ω	5	3W	WIS.2896-C-2-10	6	5. 0	2S
260	Res. Comp. Insd.	220Ω	10	1/2W	PC.66611-17	9	1. 0	
261	Res. Comp. Insd.	3.3kΩ	10	1/2W	PC.66611-31	2	1. 0	
262	Res. Comp. Insd.	180Ω	10	1/2W	PC.66611-16	2	1. 0	
263	Res. Comp. Insd.	3.9kΩ	10	1/2W	PC.66611-32	1	1. 0	
264	Res. Carb. Insd.	330Ω	10	3/4W	WIS.3903-1-5	1	2. 0	
265	Res. Comp. Insd.	120Ω	10	1/4W	PC.66609-8	1	1. 0	
266	Res. Comp. Insd.	100Ω	10	1/4W	PC.66609-7	1	1. 0	
267	Res. Comp. Insd.	330Ω	10	1/4W	PC.66610-19	1	1. 0	
268	Res. Comp. Insd.	270Ω	10	1/4W	PC.66610-18	1	1. 0	
269	Res. Thermistor				WIS.5740-C-1-4	1	1. 0. 0	1S
270	Res. Comp. Insd.	680Ω	10	1/2W	PC.66611-23	2	1. 0	
271	Res. Comp. Insd.	68Ω	10	1/4W	PC.66610-11	1	1. 0	
272	Res. Comp. Insd.	47kΩ	10	1/2W	PC.66611-45	1	1. 0	
273	Res. Comp. Insd.	4.7kΩ	10	1/2W	PC.66611-33	1	1. 0	
274	Res. Comp. Insd.	68Ω	10	1/2W	PC.66611-11	1	1. 0	
275	Res. Comp. Insd.	15kΩ	10	1/2W	PC.66611-39	1	1. 0	
276	Res. Comp. Insd.	82Ω	10	1/4W	PC.66610-12	2	1. 0	
277	Res. Comp. Insd.	220Ω	10	1/4W	PC.66610-17	1	1. 0	
278								
279								
280								
281								
282								

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
283								
284								
285								
286								
287	Res. Vble. W/W	12Ω	10	100W	WIS.3147-1-4	1	4. 0. 0	1S
288	Res. Vble. W/W 3 Gang	80Ω	10	50W	WIS.3337-1-34	1	10.11. 6	1B
289	Res. Vble. W/W	25Ω	10	80W	WIS.5865-B-2-46	1	3. 4. 6	1S
290	Res. Vble. W/W	1kΩ	10	$2\frac{1}{2}$W	PC.67403-29	5	12. 0	2S
291	Res. Vble. W/W	3Ω	10	60W	PC.67407-39	1	2. 8. 0	1S
292	Res. Vble. W/W	500Ω	20	1/2W	PC.67401-18	1	9. 6	1S
293	Res. Vble. Comp. Lin.	5kΩ	20	3/4W	PC.67203-9	1	11. 0	1S
294	Res. Vble. W/W	25kΩ	10	3W	WIS.4175-B-1-63	8	11. 0	2S
295	Res. Vble. W/W	25kΩ	10	3W	WIS.4175-B-1-64	1	11. 0	1S
296								
297								
298	Socket 24 way				W.41061-1-81	1	2.15. 0	
299	Socket Coaxial				WIS.5355-B-1-9	7	6. 6	
300	Socket 18 way				W.41061-1-6	1	2. 8. 0	
301	Socket 18 way				WIS.3732-C-1-1	1	12. 6	
302	Socket 18 way				W.41061-1-7	1	2. 8. 0	
303	Socket 18 way				W.41061-1-9	1	2. 8. 0	
304	Socket 12 way				W.41061-1-102	1	1.18. 0	
305	Socket 18 way				W.41061-1-105	1	2. 4. 0	
306	Socket 18 way				W.41061-1-26	1	2. 8. 0	
307	Socket 18 way				W.41061-1-106	1	2. 8. 0	1B
308	Socket Coaxial				WIS.3956-C-1-3	8	1. 0	
309	Socket 6 way				WIS.3731-C-1-7	1	7. 6	
310								
311								
312								
313	Switch 5 Pole				W.50027-1-A	1	24. 5. 6	
314	Switch Micro SP C/O				W.40269-C-1-A	1	2.17. 6	
315	Switch 5 Pole				W.50027-1-B	1	22.10. 0	
316	Switch Micro SP C/O				W.40269-C-1-B	1	2.17. 6	
317	Switch Push Button DP				W.13433-B-1-A	3	2. 6. 6	
318	Switch Push Button 2 Gang DP				WQ.7640-1-C	1	33.15. 0	
319	Switch 2 Wafer 4 Pole C/O				WIS.3456-B-148	1	5.17. 0	
320	Switch 1 Wafer 1 Pole 3 Psn.				WIS.3456-B-111	1	4. 6. 6	
321	Switch SP C/O			20A	WIS.5197-B-11	1	18. 0	
322	Switch Knife DP C/O			30A	WIS.4095-B-1-1C	1	3. 6. 0	
323	Switch SP 1 Wafer 6 Psn.				WIS.3456-B-155	1	4. 6. 6	
324	Switch Micro SP C/O				WIS.5586-C-1-1	1	12. 0	
325	Switch 3 Wafer 4 Pole C/O				WIS.3456-B-133	1	6. 7. 6	
326	Switch Assembly SP 5 Psn.				W.38959-1-A	1	175. 0. 0	
327	Switch SP 5 way				WIS.5670-C-97	1	1. 1. 0	
328	Switch Assembly SP 5 Psn.				W.40066-1-A	1	131. 5. 0	
329	Switch 4 Pole 5 Psn.				6-W.40408-C	1	7.10. 0	
330	Switch Assembly				W.39161-1-A	1	90. 0. 0	

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H

T.4260
1736
CP

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
331	Switch SP C/O				WIS.5586-C-1-2	4		
332	Switch Assembly				W.36725-1-B	1		
333	Switch				W.40269-C-1-B	1		
334	Switch 1 Pole			2.5 kVA	WIS.5197-B-6	1		
335	Switch 2 Pole 1 Wafer				WIS.5820-B-34	1		
336	Switch 1 Pole 2 Wafer				WIS.5820-B-35	1		
337	Switch 8 Wafer 12 Way				WIS.3421-C-50	1		
338	Switch 2 Wafer 7 way				WIS.1197-C-1099	1		
339	Switch 9 Wafer 12 way				WIS.3421-C-51	1		
340	Switch 1 Wafer 6 way				WIS.1197-C-1205	1		
341	Switch SP				2-WIS.1012	1		1S
342	Switch SP DT				WIS.2834-1-3	1		1S
343	Switch Ledex				WIS.7166-B-3	1		
344								
345								
346								
347								
348								
349	Term. Block 6 way				W.57404-C-1-1	1		
350	Term. Block				SK.48864-1-H	3		
351	Term. Block 20 way				W.22469-B-1-U	3		
352	Term. Block 4 way				W.40168-B-1-A	1		
353	Term. Block 10 way				W.22469-B-1-K	1		
354	Term. Block 8 way				W.22469-B-1-H	1		
355	Term. Block 4 way				WIS.1631-1-4	1		
356	Term. Block 20 way				W.33265-1-Q	1		
357	Term. Block 2 way				42-W.39081-C	1		
358	Term. Block 3 way				WIS.1632-1-3	1		
359	Term. Block 10 way				W.33265-1-W	1		
360								
361								
362								
363	Transf. Sec. 45/43/41V				W.37518-2	1		
364	Transf.				W.24068-59	1		1B
365	Transf.				W.24582-13	1		
366	Transf.				W.37518-3	1		
367	Transf.				W.23241-33	1		1B
368	Transf.				W.24586-26	1		1B
369	Transf.				W.24743-27	1		1B
370	Transf.				W.22129-3	1		
371	Transf.				W.27206-4	6		1B
372	Transf. 24 & 20 Turns				W.26958-B-152	1		1B
373	Transf. 12 & 9 Turns				W.26958-B-153	1		1B
374	Transf. 21 & 6 Turns				W.50593-1-G	1		1B
375	Transf. 9 & 2 Turns				W.50593-1-D	1		1B
376	Transf. 4 & 1 Turns				W.50593-1-E	1		1B
377	Transf. 44 & 2 Turns				W.41184-B-79	1		1B

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No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
378	Transf. 22 & 2 Turns				W.41184-B-80	1		1B
379	Transf. 13 & 2 Turns				W.41185-B-8	1		1B
380	Transf. $33\frac{1}{2}$ & 9 Turns				W.48442-1-K	1		1B
381	Transf. $16\frac{1}{2}$ & 4 Turns				W.48442-1-D	1		1B
382	Transf. $7\frac{1}{2}$ & 2 Turns				W.48442-2-L	1		1B
383	Transf. Input				WIS.5680-B-88	1		1B
384	Transf. Output				W.33035-B-1-G	1		1B
385								
386								
387								
388								
389	Valve GXU-2				CV2518	6		
390	Valve U54				CV378	2		
391	Valve STV280/80				CV1069	1		
392	Valve OA3 or VR75/40				CV3798	1		
393	Valve				CV428	2		
394	Valve QY4250					2		
395	Valve BR.191					1		
396	Valve CV138				CV138	7		
397	Valve				CV4014	2		
398	Valve				CV391	2		
399	Valve N77					2		
400								
401								
402								
403	Alarm Indicator		To Customer's Requirements.					
404	Terminating Board				W.41618-C-1-A	1		
405	Suction Unit				WIS.5731-B-2-3	1		
406	Ball Contact				W.40987-C-1-A	1		1S
407	Spring Contact				47-W.39081-C	1		1S
408	Ball Contact				W.41074-C-1-A	2		1S
409	Spring Contact				41-W.32056-C	2		1S
410								
411	Fan Axial*				10K/1070564	1		
412								
413	Air Filter				W.65675-2-B	1		1B
414	Anode Clip				W.30330-C-1-2	6		
415	Ball Contact Assembly				W.18195-C-1-A	4		1S
416	Ball Contact Assembly				W.38961-C-1-A	16		2S
417	Bearing Plate Mycalex				65-W.37919	1		
418	Base Mycalex				49-W.32056-C	1		
419	Coil Support Mycalex				3-W.40700-B	1		
420	Coil Support Mycalex				4-W.40700	1		
421	Coil Support Mycalex				4A-W.40700	1		
422	Coil Support Mycalex				4B-W.40700	1		
423	Coil Support Mycalex				4C-W.40700	1		
424	Coil Support Mycalex				8-W.40700-B	1		

K † * Wotsac replacement for item 411: Fan ventilating
10K/4140-99-633-2694 (Mod.A.3978)

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
425	Coil Mounting Plate Mycalex				107-W.40408-C	2	15. 6	
426	Contact Assembly				W.41075-C-1-A	4	1. 5. 0	1S
427	Contact Assembly				W.18195-C-1-A	54	11. 6	3S
428	Contact Assembly				W.18195-D-1-D	8	12. 0	1S
429	Contact Assembly				W.49358-B-1-B	1	1. 5. 0	1S
430	Contact Mounting Mycalex				3-W.40408-C	4	2. 9. 6	
431	Contact Mounting Mycalex				51-W.40408-C	1	1. 7. 0	
432	Contact Mounting Mycalex				3A-W.40408-C	1	2.11. 0	
433	Contact Panel Mycalex				15-W.39161-C	1	16. 6	
434	Condenser Plate Mycalex				54-W.32738-C	1	16. 0	
435	Conical Insr.				WIS.626-C-1-1	1	1. 0	1S
436	Coupling Coil Mounting Plate Mycalex				34A-W.37919-B	1	4.16. 6	
437	Coupling Bar Mycalex				W.21029-C-1-8	1	1. 3. 6	
438	Coupling Mycalex				16-W.38936-C	1	3.13. 0	
439	End Cheek Mycalex				1-W.48433-C	1	2. 7. 0	
440	End Cheek Mycalex				2-W.48433-C	1	2.11. 0	
441	End Plate Mycalex				5-W.37919	1	8. 1. 6	
442	End Plate Mycalex				109-W.37919	1	19. 8. 6	
443	Flexible Drive Assembly				WIS.5716-C-1-1	1	3. 5. 0	
444	Fuseholder				WIS.5612-C-1-1	12	6. 6	1S
445	Fuseholder				WIS.4154-C-1-1	20	3. 6	2S
446	Fuseholder				WIS.4809-C-1-9	3	6. 0	1S
447	Grid Contact Spring				94-W.37907-C	12	11. 6	2S
448	Insr.				WIS.5593-C-1-5	11	1. 6	
449	Insr. Stand-Off				WIS.5416-C-1-1	5	6. 6	
450	Insr.				SP.10996	4	2. 0	
451	Insr. Cer.				WP.984	2	1.10. 0	
452	Insr. Pillar				WSK.10464-1-9	4	4. 4. 6	
453	Insr. Rod				WSK.10464-1-10	4	3. 6	
454	Insr. Stand-Off				WIS.5416-C-1-4	10	4. 6	
455	Lamp Jack				WIS.1877-1-1	11	5. 0	2S
456	Manual Drive Assembly				W.38958-1-A	3	87.10. 0	
457	Manual Drive Assembly				W.39163-1-A	1	120. 0. 0	
458	Manual Drive Assembly				W.39340-2-B	1	137.10. 0	
459	Manual Drive Assembly				W.38958-2-B	1	87.10. 0	
460	Mounting Board Mycalex				1-W.49688-C	1	4.15. 6	
461	Mounting Board Mycalex				177-W.37907-C	2	1.11. 0	
462	Mounting Board Mycalex				49-W.32056-C	1	7. 0	
463	Mounting Plate Mycalex				1-W.40066-B	1	3.18. 0	
464	Mounting Plate Mycalex				1-W.38959-B	1	4.19. 0	
465	Res. Mounting				WIS.5742-C-1-1	4	3. 0	
466	Res. Mounting				WSK.3172-1-K	6	5.12. 6	
467	Res. Mounting				W.40253-B-1-A	1	6.11. 6	
468	Rotor Mounting Mycalex				5-W.40408-C	2	1. 7. 0	
469	Spring				23-W.39080-C	4	2. 0	
470	Spring				W.7447-C-2-28B	1	2. 6	
471	Spindle Assembly				W.40693-1-A	1	22. 6. 6	

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T.4260
1736
CP

L

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.	Price † Each £. s. d.	Scale
472	Spring Assembly				W.58293-C-1-B	1	6.11. 0	
473	Spring Assembly				W.58293-C-1-A	1	6.11. 0	
474	Spring Assembly				W.58294-C-1-A	2	4.12. 0	
475	Spring Contact				30-W.32738-C	4	7. 6	1S
476	Spring Contact				72-W.37919-C	6	6. 6	2S
477	Spring Contact				101-W.37907-C	4	1. 0. 0	1S
478	Spring Contact				101A-W.37907-C	3	15. 0	1S
479	Spring Contact				54-W.36728-C	3	6. 0	1S
480	Spring Contact Assembly				W.49274-C-1-A	2	2. 2. 6	1S
481	Spring Contact Assembly				W.40784-C-1-A	3	1. 4. 0	1S
482	Spring Contact Assembly				W.40785-C-1-A	4	13. 0	1S
483	Spring Contact Assembly				W.49276-C-1-A	1	1.10. 0	1S
484	Spring Contact Assembly				W.50138-B-1-A	∅1	2.10. 0	1S
485	Spring Contact Assembly				W.40712-C-1-A	2	2. 0. 0	1S
486	Spring Contact Assembly				W.40713-C-1-A	2	2. 4. 0	1S
487	Spring Flat				127-W.37919-C	2	5. 0	
488	Switch Blade Assembly				W.39454-B-1-A	1	4. 1. 6	
489	Spring Contact Plate Mycalex				28-W.32738-C	1	10. 0	
490	Support Plate Mycalex				2-W.38959-B	1	4.14. 0	
491	Stand-Off Insr.				WIS.5416-C-1-3	2	5. 6	
492	Stand-Off Insr.				WIS.5416-C-1-4	10	4. 6	
493	Term.				WIS.4793-C-1-7	6	1. 6	
494	Term. Block Mycalex				16-W.32738-C	6	8. 0	
495	Top Panel Mycalex				108A-W.40408-B	1	9. 0. 0	
496	Valveholder Cer. 5 Pin				WIS.4844-C-1-2	2	17. 0	
497	Valveholder International Octal				PC.81814-1	2	1. 0	
498	Valveholder B5				PC.81805-1	1	1. 6	
499	Valve Retainer				WIS.3449-C-1-1	1	3. 6	
500	Valve Retainer				WIS.3701-C-1-22	2	2. 0	
501	Valve Retainer				WIS.6271-C-1-1	1	5. 0	
502	Wheel				22-W.39080-C	1	5. 7. 6	
503	Socket 10 way				WIS.5609-1-1E	2	13. 6	
504	Valveholder B8G				PC.81813-1	2	3. 6	
505	Valveholder B7G				PC.81811-1	11	1. 0	
506	Wheel (to be supplied with No 484)				134A-W37919-C	1	2. 4. 0	

M †

∅ To be supplied with No.506

T.4260
1736
CP

MASTER COMPONENTS LIST

FOR

3.5kW HF ISB/TELEGRAPH/TELEPHONE TRANSMITTER TYPE HS.31/1

(W.37918 Ed.C)

NOTES:

1. Component schedules are presented in the form of a master components list, which includes all components used in this equipment. Each component is identified by means of a spares reference number, column 1, in addition to the normal part identity.
2. Components shown on individual circuit diagrams may be identified in the master list by means of the cross-reference tables associated with each circuit diagram. The numbers given are the spares reference numbers.
3. For spares ordering purposes it is only necessary to quote the exact reference at the top of this page together with the spares reference number. Individual part identities can be given as a cross check if desired, but are not necessary.
4. Prices are subject to change without notice.
5. All items reference PC are standardised items and comply with Government specifications where these exist.
6. All items reference WIS are manufactured by component or other suppliers to a Marconi specification which, where appropriate, complies with a Government specification.
7. All items reference W are manufactured by MWT and while materials and practices are in accordance with appropriate Government specifications, these items cannot be regarded as 'Standard Items'.
8. The scale column shows the suggested spares per equipment edition or type. Where applicable, S & B relate to Station and Base spares respectively.

P.T.O.

9. The following abbreviations are used throughout this Master List:

Cap.	Capacitor	Osc.	Oscillator
Carb.	Carbon	Pap.	Paper
Cer.	Ceramic	pF	Picofarad Micro-Microfarad
C/O	Changeover	Psn.	Position
Coef.	Coefficient	Potr.	Potentiometer
Comp.	Composition	Prim.	Primary (winding)
DP	Double Pole	PVC	Polyvinyl Chloride Compound Insulated
DT	Double Throw	Rect.	Rectifier
En.	Enamelled	Res.	Resistor
Elyc.	Electrolytic	Sec.	Secondary (winding)
Fil.	Filament	Sil.Mica.	Silver Mica
FSD	Full Scale Deflection	Sil.Mica.Prot.	Silver Mica Protected
Gd.	Grade	SP	Single Pole
HS	High Stability	Temp.	Temperature
Indr.	Inductor	Term.	Terminal
Insd.	Insulated	Transf.	Transformer
Insr.	Insulator	Tub.	Tubular
Lg.	Long	Vble.	Variable
Lin.	Linear	Vit.	Vitreous
Metd.	Metallised	W/W	Wirewound
Mld.	Moulded		
Neg.	Negative		

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
1	Base Mycalex 49-W.32056-C	1	1.45	
2				
3	Cap. Cer. 10pF ±20% 4kV PC.18220-2	1	0.60	1S
4	Cap. Cer. 47pF ±5% 750V PC.18120-23	1	0.15	1S
5	Cap. Cer. 2200pF ±20% 500V PC.18208-7	2	0.05	1S
6	Cap. Cer. 330pF ±20% 500V PC.18208-2	1	0.05	1S
7	Cap. Pap. 10uF ±10% 250V WIS.4321-B-1-11	4	1.40	1S
8	Cap. Pap. 8uF ±20% 600V WIS.4172-B-1-4	3	1.85	1S
9	Cap. Pap. 4uF ±15% 750V PC.19072-6	1	1.70	1S
10	Cap. Pap. 4uF ±10% 6kV PC.19185-4	3	24.50	
11	Cap. Mica 0.01uF ±5% 350V PC.18801-10	3	0.35	1S
12	Cap. Pap. 0.25uF ±25% 350V PC.19303-3	1	0.20	1S
13	Cap. Mica 10000pF ±5% 350V PC.18801-10	2	0.35	1S
14	Cap. Pap. 0.01uF ±20% 10kV PC.19226-2	2	0.85	1S
15	Cap. Elyc. 100-200uF +50% -20% 350V PC.18408-4	1	0.80	1S
16	Cap. Mica 6800pF ±5% 350V PC.18801-8	1	0.35	1S
17	Cap. Mica 3000pF ±20% 8000V PC.18738-1	16	0.60	3S
18	Cap. Pap. 0.01uF ±25% 350V PC.19202-7	16	0.10	3S
19	Cap. Cer. 33pF ±5% 750V PC.18223-7	1	0.05	1S
20	Cap. Vble. Air 16-250pF PC.20144-11	1	4.70	
21	Cap. Cer. 200pF ±5% WIS.7326-B-1-8	1	0.15	1S
22	Cap. Cer. 2.2pF ±½pF 750V PC.18212-3	1	0.05	1S
23	Cap. Vble. Air 7-100pF per Section PC.20008-3	1	1.30	
24	Cap. Cer. 270pF ±20% 750V PC.18223-18	0		
25	Cap. Mica 500pF ±20% 800V PC.18738-5	1	0.45	1S
26	Cap. Air Dielectric ST.5 Neutralising Pick-Up W.49362-C-1-A	1	10.00	
27	Cap. Hi-Load 200pF ±20% 7.5kV PC.18333-7	2	3.80	
28	Cap. Hi-Load 125pF ±20% 7.5kV PC.18333-8	2	3.95	
29	Cap. Hi-Load 200pF ±20% 7.5kV PC.18333-9	1	3.80	
30	Cap. Vble. Vacuum 8-50pF 15kV PC.20408-1	1	97.00	
31	Cap. Hi-Load 1250pF ±20% 7.5kV PC.18333-6	1	3.80	
32	Cap. Pap. 4uF ±20% 600V PC.19212-3	1	0.95	1S
33	Cap. Mica 0.01uF ±20% 2000V D.C. WIS.4721-C-1-1	1	6.95	
34	Cap. Mica 10000pF ±20% 250V PC.18701-5	2	0.15	1S
35	Cap. Mica 0.01uF ±20% 2000V WIS.4721-C-1-1A	4	5.90	
36	Cap. Hi-Load 130pF ±10% 7.5kV PC.18304-7	1	2.85	1S
37	Cap. Hi-Load 50pF ±20% 7.5kV PC.18216-5	2	2.60	1S
38	Cap. Hi-Load 125pF ±20% 7.5kV PC.18333-10	1	3.80	
39	Cap. Hi-Load 1250pF ±20% 7.5kV PC.18335-7	2	3.65	
40	Cap. Air Dielectric W.48433-2-B	1	160.00	
41	Cap. Air Dielectric W.49688-1-A	2	26.00	
42	Cap. Cer. 125pF ±20% 70kVA PC.18219-1	4	3.80	
43	Cap. Mica 10000pF ±20% 350V PC.18701-5	1	0.20	1S

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
44	Cap. Mica 0.002uF ±20% 800V PC.18738-3	1	0.50	1S
45	Cap. Cer. 10pF ±20% 4kV WIS.7711-C-1-4	2	0.55	1S
46	Cap. Cer. 0.001uF ±20% 500V PC.18208-5	2	0.05	1S
47	Cap. Pap. 0.01uF ±20% 500V PC.19203-14	29	0.05	5S
48	Cap. Vble. 3-Gang 9.5-225pF per Section WIS.5537-1-2	2	x11.00	
49	Cap. Vble. 3-30pF 75V W.53587-C-1-C	6	0.45	
50	Cap. Cer. 10pF ±½pF 750V PC.18223-1	1	0.05	1S
51	Cap. Cer. 100pF ±2% 750V PC.18223-13	3	0.05	1S
52	Cap. Cer. 47pF ±2% 750V PC.18223-9	5	0.05	2S
53	Cap. Mica 0.01uF ±10% 750V WIS.7494-B-1-1	23	0.45	5S
54	Cap. Cer. 6.8pF ±½pF 750V PC.18212-7	1	0.05	1S
55	Cap. Vble. 4.8-100pF PC.20002-7	19	0.40	
56	Cap. Mica 220pF ±5% 350V PC.18802-17	1	0.10	1S
57	Cap. Mica 390pF ±5% 350V PC.18802-20	1	0.15	1S
58	Cap. Pap. 0.01uF ±20% 400V PC.19308-7	4	0.15	1S
59	Cap. Vble. 3.3-34.5pF WIS.3534-C-1-2	1	2.20	
60	Cap. Vble. 4.8-16pF PC.20002-4	1	0.35	
61	Cap. Mica 150pF ±10% 750V PC.18802-15	1	0.10	1S
62	Cap. Mica 68pF ±10% 750V PC.18802-11	1	0.10	1S
63	Cap. Pap. 0.05uF ±20% 500V PC.19203-18	1	0.10	1S
64	Cap. Pap. 0.25uF ±25% 150V PC.19301-2	2	0.15	1S
65	Cap. Mica 1000pF ±20% 350V PC.18701-2	4	0.05	1S
66	Cap. Mica 220pF ±20% 750V PC.18702-2	1	0.05	1S
67	Cap. Pap. 0.1uF ±20% 350V PC.19202-15	1	0.05	1S
68	Cap. Mica 100pF ±10% 750V PC.18802-13	1	0.10	1S
69	Cap. Mica 470pF ±5% 750V PC.18802-21	1	0.15	1S
70	Cap. Mica 10pF ±10% 750V PC.18610-1	1	0.10	1S
71	Cap. 0.01uF ±10% WIS.7494-B-1-15	1	0.45	1S
72	Cap. Cer. 0.01uF -20% +80% 500V PC.18207-7	4	0.05	1S
73	Cap. Pap. 0.02uF ±20% 500V D.C. PC.19203-16	2	0.05	1S
74	Cap. Mica 330pF ±20% 750V PC.18702-3	1	0.05	1S
75				
76				
77				
78				
79				
80				
81	Cheek End Mycalex 1-W.48433-C	1	4.30	
82	Cheek End Mycalex 32-W.48433-C	1	4.30	
83				
84	Clip Anode W.30330-C-1-2D	6	1.00	2S
85				
86	Contact 54-W.37628-C	3	0.40	1S

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x per set

No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
141								
142	Meter 0-300V AC Voltmeter				WIS.4235-9-158	1		
143	Meter 0-25A Ammeter				WIS.4235-9-159	1		
144	Meter 0-6kV Voltmeter				WIS.4235-9-160	1		
145	Meter 0-15V		±1		WIS.3954-B-13-112	1		
146	Meter 0-250mA		±1		WIS.3686-6-85	1		
147	Meter 0-5mA		±1		WIS.3954-B-13-113	1		
148	Meter 0-250mA		±1		WIS.3954-B-13-114	1		
149	Meter 0-400mA		±1		WIS.3686-12-189	1		
150	Meter 0-2A		±1		WIS.4235-14-218	1		
151	Meter 0-350mA		±1		WIS.4235-16-247	1		
152	Meter 0-15V		±1		WIS.4235-14-214	1		
153	Meter 0-600V		±1		WIS.4235-7-129	1		
154	Meter 0-1000V		±1		WIS.4235-10-174	1		
155	Meter 0-10V				WIS.3686-4-61	1		
156	Meter Peak Voltmeter				W.38793-1-D	1		
157	Meter Peak Voltmeter				W.38793-1-A	2		
158								
159								
160								
161	Rect. Selenium				WIS.4669-B-1-13	2		1B
162	Rect. Selenium				WIS.3222-C-4-22	1		1B
163	Germanium Crystal Rect.				WIS.4203-C-1-2	2		1S
164	Rect. Selenium				WIS.4669-B-2-15	1		1B
165								
166								
167	Plug 24 way				WIS.3738-C-1-2	1		
168	Plug Coaxial				W.36715-B-1-2	1		
169	Plug Coaxial				W.36715-B-1-3	1		
170	Plug Coaxial				W.36715-B-1-4	2		
171	Plug Coaxial				W.36715-B-1-5	1		
172	Plug 18 way				W.41113-1-1	1		
173	Plug 18 way				WIS.3738-C-1-1	6		
174	Plug Coaxial				WIS.5355-B-1-8	1		
175	Plug 6 way				W.41113-1-2	1		
176	Plug Coaxial				W.36715-B-1-6	1		
177	Plug Coaxial				W.51158-C-1-1	1		
178	Plug Coaxial				W.51158-C-1-2	1		
179	Plug Coaxial				W.51158-C-1-3	1		
180	Plug Coaxial				W.51158-C-1-4	1		
181	Plug Coaxial				W.51158-C-1-5	1		
182	Plug Coaxial				W.51158-C-1-6	1		
183	Plug Coaxial				W.51158-C-1-7	1		
184	Plug Coaxial				WIS.3106-C-1-3	3		
185	Plug Coaxial				WIS.3106-C-1-1	5		
186	Plug 12 way				WIS.3737-C-1-9	1		
187								

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No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
188								
189	Contactor*				WIS.5609-1-1B*	1		
190	Contactor 5 Pole				WIS.5609-1-1C	3		
191	Contactor 9 Pole				WIS.5609-1-1D	1		
192	Relay 3M 2B				WQ.8740-1-M	1		1B
193	Relay 2M				WQ.8740-1-L	1		1B
194	Relay Time Switch				W.88142-B-1-A	1		1B
195	Relay Valve Protecting				WIS.4373-B-2-7	2		1B
196								
197								
198	Res. W/W	106Ω	10	220W	WIS.3852-B-1-24	1		1S
199	Res. W/W	107Ω	10	45W	WIS.3852-B-1-25	1		1S
200	Res. W/W	1.8kΩ	2	14W	WIS.7415-B-1-37	1		1S
201	Res. W/W	68Ω	10	2Amp	WIS.3320-2-18	1		1S
202	Res. W/W	33Ω	5	3W	PC.67008-4	2		1S
203	Res. W/W	53Ω	10	45W	WIS.4006-B-1-20	3		1S
204	Res. W/W	2160Ω	10	90W	WIS.6265-C-1-1	1		1S
205	Res. W/W	419Ω	10	90W	WIS.3615-C-1-6	1		1S
206	Res. W/W	16.5kΩ	5	35W	P.18282-KP-6	1		1S
207	Res. Carb.	220kΩ	20	1W	WIS.3903-1-3	3		
208	Res. W/W	43.750Ω	5	150W	P.18282-KK-6	2		1S
209	Res. W/W	15kΩ	5	100W	PC.67006-20	1		1S
210	Res. W/W	1.8kΩ	5	35W	PC.67919/1	1		1S
211	Res. H.T. Voltmeter				WIS.5675-B-1-1	1		
212	Res. W/W	1.2kΩ	5	3W	WIS.7417-B-1-7	11		3S
213	Res. Comp. Non-Insd.	220Ω	10	2W	PC.66616-17	3		
214	Res. Insd.	33Ω	5	1/4W	PC.66602-2	2		1S
215	Res. W/W	10kΩ	5	4½W	PC.67009-19	1		1S
216	Res. W/W	15kΩ	5	6W	PC.67010-20	1		1S
217	Res. Insd.	100Ω	10	1/4W	PC.66610-13	4		
218	Res. W/W Shunt	250mA	±1	100mV	WIS.3914-C-2-19	1		1S
219	Res. Insd.	10kΩ	10	1W	PC.66612-31	3		
220	Res. Insd.	15kΩ	10	1W	PC.66612-33	3		
221	Res. W/W Shunt	5mA	1	100mV	WIS.3914-C-3-31	1		1S
222	Res. Comp. Insd.	33Ω	10	1/2W	PC.66611-7	2		
223	Res. Comp. Non-Insd.	100Ω	10	1W	PC.66616-13	2		
224	Res. Carb.	20Ω	20	50W	WIS.5161-C-1-22	1		
225	Res. W/W Shunt	400mA	1	100mV	WIS.3914-C-3-45	1		1S
226	Res. W/W Shunt	2A	1	100mV	WIS.3914-C-3-46	1		1S
227	Res. W/W Shunt	350mA	1	100mV	WIS.3914-C-4-51	1		1S
228	Res. W/W				WIS.4235-7-129	1		
229	Res. W/W	2.2Ω	10	3W	PC.67008-25	2		1S
230	Res. W/W	1kΩ	5	4½W	PC.67009-13	2		1S
231	Res. Carb.	20Ω	20	35W	WIS.5161-C-1-21	2		
232	Res. Comp. Insd.	100Ω	10	1/2W	PC.66611-13	3		
233	Res. Comp. Non-Insd.	1.2kΩ	10	2W	PC.66616-26	2		
234	Res. Comp. Non-Insd.	18Ω	10	2W	PC.66616-4	2		
235	Res. Comp. Non-Insd.	1kΩ	10	2W	PC.66616-25	2		

F † *Wotsac replacement for item 189: CC 270003 (Type UCA7)
(Mod. A.4745)

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
173	Indr. 350uH W.6171-1-V	1	14.00	
174	Indr. W.24575-B-6	1	13.50	
175	Indr. W.91388-B-1-A	2	20.50	
176	Indr. W.92003-C-1-A	2	2.40	
177	Indr. (Former) W.26958-B-154	1	2.25	
178	Indr. (Winding) W.36413-C-1-0	1	5.50	
179	Indr. W.50593-1-F	2	2.20	
180	Indr. W.37149-1-C	2	2.40	
181	Indr. W.50593-1-B	2	1.20	
182	Indr. 147-W.37628-C	10	0.40	
183	Indr. W.18936-C-1-A	1	1.35	1S
184	Indr. WIS.1161-1-1	1	0.15	1S
185	Indr. W.37206-B-1-A	1	2.05	
186	Indr. W.37207-B-1-A	1	2.05	
187	Indr. W.37208-B-1-A	1	1.65	
188	Indr. W.33035-B-1-D	1	1.35	
189	Indr. 'Ledex' Selector WIS.7166-B-3	1	7.85	
190	Indr. W.91403-C-1-A	5	1.25	
191				
192				
193				
194				
195				
196	Indicator (Alarm) To Customer's requirements.			
197				
198	Insr. Cer. PC.43003-1	2	6.40	1S
199	Insr. Conical PC.43312-1	4	0.15	1S
200	Insr. Stand-Off WIS.5416-C-1-3	2	0.30	1S
201	Insr. Stand-Off WIS.5416-C-1-4	21	0.25	3S
202	Insr. (Pillar) WSK.10464-1-9	4	4.25	1B
203	Insr. (Piece Mycalex) 3-W.40203-C	1	4.30	1B
204	Insr. (Rod) WSK.10464-1-10	4	4.35	1B
205	Insr. Conical PC.43311-1	1	0.05	1S
206				
207	Insr. Stand-Off WIS.5416-C-1-1	3	0.35	1S
208	Insr. WIS.5593-C-1-5	11	0.20	3S
209				
210	Jack Lamp WIS.1877-1-1	11	0.25	
211				
212	Lamp 0.24W 6V PC.48601-2	11	0.05	12S
213				
214	Link R.F. Coaxial PC.60211-1	2	0.65	1S
215				

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No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
216	Meter Volt W.38793-1-D	1	80.50	
217	Meter Volt 0-300V WIS.4235-9-158	1	7.35	
218	Ammeter 0-25A WIS.4235-9-159	1	4.20	
219	Meter Volt 0-6kV WIS.4235-9-160	1	5.55	
220	Meter 0-15V WIS.3954-B-13-112	1	6.45	
221	Meter 0-250mA ±1% WIS.3686-6-85	1	5.85	
222	Meter 0-5mA ±1% WIS.3954-13-113	1	5.50	
223	Meter 0-250mA ±1% WIS.3954-13-114	1	6.20	
224	Meter 0-400mA ±1% WIS.3686-12-189	1	3.30	
225	Meter 0-2A ±1% WIS.4235-14-218	1	9.90	
226	Meter 0-350mA ±1% WIS.4235-16-247	1	10.50	
227	Meter ±1% WIS.4235-14-214	1	7.90	
228	Meter ±1% WIS.4235-7-129	1	4.05	
229	Meter ±1% WIS.4235-10-174	1	10.00	
230	Meter M.C. F.S.D. 1mA D.C. 0.10V 50 ohms WIS.3686-4-61	1	6.10	
231	Meter Volt W.38793-1-A	2	28.00	
232				
233	Mounting Res. WIS.5742-C-1-1	4	0.20	
234	Mounting Res. WSK.3172-1-K	6	14.50	
235	Mounting Res. W.40253-B-1-A	1	7.50	
236	Mounting Board Mycalex 1-W.49688-C	1	9.95	
237	Mounting Board Mycalex 177-W.37907-C	2	0.95	
238	Mounting Plate Coil 107-W.40408-C	2	4.30	
239	Mounting Contact 3-W.40408-C	4	2.00	
240	Mounting Contact 51-W.40408-C	1	1.70	
241	Mounting Rotor 5-W.40408-C	2	1.80	
242	Mounting Board 49B-W.32056-C	1	1.45	
243	Mounting Plate 1-W.40066-B	1	4.30	
244	Mounting Coupling Coil Plate 34A-W.37919-B	1	7.65	
245	Mounting Board 1-W.39080-B	1	4.30	
246	Mounting Plate 1-W.38959-B	1	9.20	
247	Mounting Board 1A-W.39080-B	1	4.30	
248	Mounting Contact 3A-W.40408-C-1	1	4.30	
249				
250				
251	Panel Mycalex 108B-W.40408-B	1	16.50	
252	Panel Contact 15-W.39161-C	1	1.60	
253				
254	Plate 65-W.37919	1	1.95	
255	Plate 109-W.37919	1	15.95	
256	Plate 2-W.38959-B	1	4.30	
257	Plate 5-W.37919	1	13.50	
258	Plate 54-W.32738-C	1	4.30	

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No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
259	Plate 28-W.32738-C	1	0.45	
260				
261				
262	Plug 24-way WIS.3738-C-1-2	1	0.80	
263	Plug Coaxial PC.60207-1	15	0.20	
264	Plug 18-way W.41113-1-1	1	2.90	
265	Plug 18-way WIS.3738-C-1-1	6	0.55	
266	Plug Coaxial (Blue) W.36715-B-1-2	1	0.70	
267	Plug Coaxial WIS.5355-B-1-8	1	0.45	
268	Plug 6-way (Red) W.41113-1-2	1	7.35	
269	Plug Coaxial (Yellow) W.36715-B-6	1	5.65	
270	Plug Coaxial (Black) W.51158-C-1-1	2	1.90	
271	Plug Coaxial (Green) W.51158-C-1-2	1	2.05	
272	Plug Coaxial (Blue) W.51158-C-1-3	1	2.05	
273	Plug Coaxial (Red) W.51158-C-1-4	1	2.15	
274	Plug Coaxial (Yellow) W.51158-C-1-5	1	2.00	
275	Plug Coaxial (Grey) W.51158-C-1-6	1	2.00	
276	Plug Coaxial (Brown) W.51158-C-1-7	1	2.15	
277				
278				
279	Rect. Germanium Crystal CV448	2	0.20	3S
280	Rect. Selenium 3 Phase Full Wave WIS.4669-2-15	1	10.50	
281	Rect. Selenium 3 Phase Full Wave WIS.4669-1-13	2	14.50	
282	Rect. Selenium WIS.3222-C-4-22	1	6.50	
283				
284	Relay 3M & 2B WQ.8740-1-M	1	13.50	
285	Relay 2M WQ.8740-1-L	1	13.50	
286	Relay WIS.5551-1-4	1	10.00	
287	Relay PC.64903-16	1	2.05	1S
288	Relay Valve Protecting PC.63706-7	2	43.00	
289	Res. Comp. 3.9k ohms ±5% 0.25W PC.66604-32	2	0.05	1S
290	Res. Comp. 62k ohms ±5% 0.25W 1/PC.66773-49	2	0.10	1S
291	Res. W/W 106 ohms ±10% 220W WIS.3852-B-1-24	1	2.20	1S
292	Res. W/W 107 ohms ±10% 45W WIS.3852-B-1-25	1	0.70	1S
293	Res. W/W 1.8k ohms ±2% 14W PC.67103-37	1	0.20	1S
294	Res. W/W 68 ohms ±10% 2A WIS.3320-2-18	1	6.75	
295	Res. W/W 33 ohms ±5% 3W PC.67008-4	2	0.10	1S
296	Res. W/W 53 ohms ±10% 45W WIS.4006-B-1-27	3	0.65	1S
297	Res. W/W 2160 ohms ±10% 90W WIS.6265-C-1-1	1	0.95	1S
298	Res. W/W 419 ohms ±10% 90W WIS.3615-C-1-6	1	0.80	1S
299	Res. W/W 16500 ohms ±5% 35W P.18282-KP-6	1	0.60	1S
300	Res. Carb. Wire Ends 220k ohms ±20% 1W PC.66321-76	3	0.05	
301	Res. W/W 43750 ohms ±5% 150W P.18282-KK-6	2	1.45	1S

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No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
302	Res. W/W 15000 ohms ±5% 100W PC.67006-20	1	0.80	1S
303	Res. W/W 1800 ohms ±5% 35W P.18282-KT	1	0.35	1S
304	Res. W/W Part of Main Contactor Panel WIS.9273-1-1		7.40	
305	Res. HT Voltmeter WIS.5675-B-1-1	1	35.00	
306	Res. W/W 1.2k ohms ±5% 3W WIS.7417-B-1-7	11	0.25	3S
307	Res. Carb. 150 ohms ±20% 55W WIS.7549-B-1-9	3	1.65	1S
308	Res. W/W 15 ohms ±5% 6W PC.67010-2	1	0.10	1S
309	Res. W/W 1k ohms ±5% 3W PC.67008-13	1	0.10	1S
310	Res. W/W 2.2k ohms ±5% 6W PC.67010-15	1	0.10	1S
311	Res. Comp. 33 ohms ±5% 0.5W PC.66611-7	3	0.05	
312	Res. W/W 47 ohms ±5% 1.5W PC.67007-5	1	0.15	1S
313	Res. W/W 150 ohms ±5% 1.5W PC.67007-8	1	0.15	1S
314	Res. W/W 330 ohms ±5% 1.5W PC.67007-10	1	0.15	1S
315	Res. W/W 680 ohms ±5% 1.5W PC.67007-12	1	0.15	1S
316	Res. W/W 2.2k ohms ±5% 1.5W PC.67007-15	1	0.15	1S
317	Res. Comp. 220 ohms ±10% 2W PC.66616-17	3	0.05	
318	Res. Comp. 33 ohms ±5% 0.25W PC.66602-2	2	0.05	1S
319	Res. W/W 10k ohms ±5% 4.5W PC.67009-19	1	0.15	1S
320	Res. W/W 15k ohms ±5% 6W PC.67010-20	1	0.15	1S
321	Res. Comp. 100 ohms ±10% 0.25W PC.66610-13	4	0.05	
322	Res. W/W ±1% WIS.3914-C-2-19	1	0.95	1S
323	Res. Comp. 10k ohms ±10% 0.75W PC.66612-31	3	0.05	
324	Res. Comp. 15k ohms ±10% 0.75W PC.66612-33	3	0.05	
325	Res. W/W ±1% WIS.3914-C-3-31	1	0.95	1S
326	Res. Comp. 100 ohms ±10% 2W PC.66616-13	2	0.05	
327	Res. Comp. 20 ohms ±20% 50W WIS.5161-C-1-22	1	5.15	
328	Res. W/W 400mA 100mV ±1% WIS.3914-C-45	1	0.95	1S
329	Res. W/W 2A 100mV ±1% WIS.3914-C-46	1	0.95	1S
330	Res. W/W 350mA 100mV ±1% WIS.3914-C-51	1	0.95	1S
331	Res. W/W 600V Operation WIS.4235-7-129	1	0.95	1S
332	Res. W/W 2.2 ohms ±10% 3W PC.67008-25	2	0.15	1S
333	Res. W/W 1k ohms ±5% 4.5W PC.67009-13	1	0.15	1S
334	Res. Comp. 20 ohms ±10% 35W PC.66408-21	2	4.85	
335	Res. Comp. 100k ohms ±10% 2W PC.66616-49	1	0.05	
336	Res. Comp. 100 ohms ±10% 0.5W PC.66611-13	1	0.05	
337	Res. Comp. 1.2k ohms ±10% 2W PC.66616-26	2	0.05	
338	Res. Comp. 18 ohms ±10% 2W PC.66616-4	2	0.05	
339	Res. Comp. 1k ohms ±10% 2W PC.66616-25	2	0.05	
340	Res. Comp. 22 ohms ±10% 2W PC.66616-5	2	0.05	
341	Res. Comp. 820 ohms ±10% 2W PC.66616-24	1	0.05	
342	Res. Comp. 33 ohms ±10% 2W PC.66616-7	2	0.05	
343	Res. Comp. 560 ohms ±10% 2W PC.66616-12	2	0.05	
344	Res. Comp. 47 ohms ±10% 2W PC.66616-9	2	0.05	

No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
345	Res. Comp. 390 ohms ±10% 2W PC.66616-20	1	0.05	
346	Res. Comp. 33 ohms ±10% 0.25W PC.66610-7	4	0.05	
347	Res. Comp. 50 ohms ±20% WIS.5161-C-1-6	1	2.10	
348	Res. Comp. 22 ohms ±10% 0.5W PC.66611-5	1	0.05	
349	Res. Comp. 56 ohms ±10% 0.5W PC.66611-10	1	0.05	
350	Res. Comp. 33k ohms ±10% 0.5W PC.66611-43	5	0.05	
351	Res. Comp. 33 ohms ±10% 0.25W PC.66610-7	28	0.05	
352	Res. Comp. 100k ohms ±10% 0.5W PC.66611-49	5	0.05	
353	Res. Comp. 2.2k ohms ±10% 0.5W PC.66611-29	4	0.05	
354	Res. W/W 5.55 ohms ±1% 3W PC.66902-30	6	0.30	2S
355	Res. Comp. 6.8k ohms ±10% 0.5W PC.66611-35	10	0.05	
356	Res. Comp. 10k ohms ±10% 0.5W PC.66611-37	6	0.05	
357	Res. Comp. 150k ohms ±10% 0.5W PC.66611-51	1	0.05	
358	Res. Comp. 1k ohms ±10% 0.5W PC.66611-25	5	0.05	
359	Res. Comp. 8.2k ohms ±10% 0.5W PC.66611-36	4	0.05	
360	Res. Comp. 330 ohms ±10% 0.5W PC.66611-19	4	0.05	
361	Res. Comp. 22k ohms ±10% 0.5W PC.66611-41	2	0.05	
362	Res. Comp. 220 ohms ±10% 0.5W PC.66611-77	9	0.05	
363	Res. Comp. 3.3k ohms ±10% 0.5W PC.66611-31	2	0.05	
364	Res. Comp. 180 ohms ±10% 0.5W PC.66611-16	2	0.05	
365	Res. W/W 0.505 ohms ±5% 3W PC.66902-33	5	0.35	2S
366	Res. Comp. 3.9k ohms ±10% 0.5W PC.66611-32	1	0.05	
367	Res. Comp. 120 ohms ±10% 0.25W PC.66609-8	1	0.05	
368	Res. W/W 1k ohms ±5% 4.5W PC.67009-13	1	0.10	1S
369	Res. Comp. 100 ohms ±10% 0.5W PC.66611-13	3	0.05	
370	Res. Comp. 330 ohms ±10% 0.25W PC.66610-19	1	0.05	
371	Res. Comp. 270 ohms ±10% 0.25W PC.66610-18	1	0.05	
372	Res. Thermistor WIS.5740-C-1-4	1	1.00	2S
373	Res. Comp. 680 ohms ±10% 0.5W PC.66611-23	2	0.05	
374	Res. Comp. 168 ohms ±10% 0.25W PC.66610-11	1	0.05	
375	Res. Comp. 47k ohms ±10% 0.5W PC.66611-45	1	0.05	
376	Res. Comp. 4.7k ohms ±10% 0.5W PC.66611-33	1	0.05	
377	Res. Comp. 56 ohms ±10% 0.5W PC.66611-10	4	0.05	
378	Res. Comp. 22 ohms ±10% 0.5W PC.66611-5	4	0.05	
379	Res. Comp. 68 ohms ±10% 0.5W PC.66611-11	1	0.05	
380	Res. Comp. 15k ohms ±10% 0.5W PC.66611-39	1	0.05	
381	Res. Comp. 10 ohms ±10% 0.25W PC.66610-1	1	0.05	
382	Res. Comp. 150 ohms ±20% 40W WIS.7663-B-1-9	1	0.05	
383				
384				
385				
386				
387				

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No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
388				
389	Res. Vble. W/W 12 ohms ±10% 100W WIS.3147-1-4	1	2.40	
390	Res. Vble. W/W 3-Gang 80 ohms ±10% 50W WIS.3337-1-34	1	11.10	
391	Res. Vble. W/W 25 ohms ±10% 80W PC.47408-60	1	2.85	
392	Res. Vble. W/W 500 ohms 0.5W PC.67401-18	2	0.50	1S
393	Res. Vble. W/W 3 ohms ±10% 60W PC.67407-39	1	2.45	
394	Res. Vble. W/W 500 ohms ±20% 0.5W PC.67401-18	0	0.50	1S
395	Res. Vble. W/W 250 ohms ±10% 2.5W PC.67403-22	1	0.70	1S
396	Res. Vble. Comp. 5k ohms ±20% 0.75W PC.67203-9	1	1.15	1S
397	Res. Vble. W/W 25k ohms ±10% 2.5W PC.67403-46	9	0.60	2S
398				
399	Retainer Valve WIS.3449-C-1-1	1	0.20	1S
400	Retainer Valve WIS.3701-C-1-22	2	0.15	1S
401	Retainer Valve WIS.6271-C-1-1	1	0.35	1S
402				
403	Shaft Assembly W.39617-B-1-A	1	15.00	
404				
405	Socket Coaxial PC.60204-1	10	0.05	
406	Socket Coaxial PC.60209-1	5	0.55	
407	Socket 18-way WIS.3732-C-1-1	1	0.65	
408	Socket 18-way W.41061-1-6	1	1.15	
409	Socket 18-way W.41061-1-7	1	1.15	
410	Socket Coaxial WIS.5355-B-1-9	3	0.45	
411	Socket 18-way Green W.41061-1-9	1	1.15	
412	Socket 12-way Light Grey W.41061-1-102	1	0.85	
413	Socket 18-way W.41061-1-118	1	4.15	
414	Socket 18-way W.41061-1-119	1	1.15	
415	Socket 18-way W.41061-1-26	1	1.15	
416	Socket 24-way W.41061-1-81	1	4.15	
417				
418				
419	Spring W.7447-C-2-28B	1	0.15	1S
420	Spring Flat 127-W.37919-C	2	0.25	1S
421	Spring Assembly W.39660-C-A	2	3.00	1S
422	Spring (Contact Angle) 23-W.40408-C	1	2.85	
423				
424	Spindle Assembly W.40693-1-A	1	13.00	
425				
426	Starter WIS.8063-B-1	0		
427				
428	Suction Unit WIS.6412-B-5-7	1	87.00	
429				
430	Support Mycalex 3-W.40700-B	1	4.30	

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No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
431	Support Mycalex 4-W.40700	1	4.30	
432	Support Mycalex 4A-W.40700	1	4.30	
433	Support Mycalex 4B-W.40700	1	4.30	
434	Support Mycalex 4C-W.40700	1	4.30	
435	Support Mycalex 8-W.40700-B	1	4.30	
436				
437	Switch 5 Pole W.50027-1-A	1	22.50	
438	Switch Micro W.40269-C-1-A	1	2.90	1S
439	Switch 5 Pole W.50027-1-B	1	23.00	
440	Switch Micro W.40269-C-1-B	1	2.90	1S
441	Switch Push Button W.13433-B-1-A	3	1.85	
442	Switch Push Button WQ.7640-1-C	1	16.50	
443	Switch 4 Pole C/O WIS.3456-B-148	1	4.60	
444	Switch SP WIS.3456-B-111	1	2.90	
445	Switch SP C/O 20A WIS.5197-B-11	1	1.35	
446	Switch Knife 2 Pole 30A WIS.4095-B-1-1C	1	4.65	
447	Switch SP WIS.3456-155	1	3.70	
448	Switch Micro SP WIS.5586-C-1-1	1	0.70	1S
449	Switch 4 Pole WIS.3456-133	1	5.45	
450	Switch 2 Pole WIS.5670-C-138	1	1.00	
451	Switch 12-way WIS.3421-C-50	1	5.70	
452	Switch 7-way WIS.5670-C-145	1	1.25	
453	Switch 12-way WIS.3421-C-51	1	7.95	
454	Switch 6-way WIS.5670-C-146	1	1.00	
455	Switch SP On/Off PC.71301-2	2	0.35	1S
456	Switch 'Ledex' Selector WIS.7166-B-3-1	1	16.50	
457	Switch SP 5 Psn. W.38959-1-C	1	275.00	
458	Switch SP 5 Psn. W.40066-1-A	1	230.00	
459	Switch 4 Pole 5 Psn. 6-W.40408-C	1	4.10	
460	Switch SP C/O WIS.5586-C-1-2	3	0.65	
461	Switch Assembly W.39161-1-A	1	71.50	
462	Switch Assembly W.36725-1-B	1	46.50	
463	Switch W.40269-C-1-B	1	2.90	
464	Switch SP 2.5kVA WIS.5197-B-6	1	0.90	
465	Switch 2 Pole WIS.5820-B-34	1	3.70	
466	Switch SP WIS.5820-B-35	1	3.75	
467	Switch SP WIS.12824-4	1	22.50	
468	Switch. Output Circuit Pad Switch - Part of No.40 (Tuning Cap)			
469	Switch Time T31-0964-01	1	39.00	
470				
471				
472	Switch Blade Assembly W.39454-B-1-A	1	4.25	
473				

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No.	Description and Identity	Qty.	Price Each F.O.B. U.K. £ Sterling	Scale
474	Term. PH.76201-3	6	0.10	1S
475	Term. 6-way 30A W.57404-C-1-1	1	11.50	
476	Term. Porcelain SK.48864-1-H	3	0.85	1S
477	Term. 20-way W.22469-B-1-U	3	4.00	
478	Term. 4-way W.40168-B-1-A	1	10.00	
479	Term. 10-way W.22469-B-1-K	1	8.50	
480	Term. 8-way W.22469-B-1-H	1	7.30	
481	Term. 4-way WIS.1631-1-4	1	0.25	
482	Term.:	1	0.35	
482A	W.21988-C-1-2	1	4.55	
483	Term. 20-way W.33265-1-Q	1	7.70	
484	Term. 2-way 42-W.39081-C	1	5.30	
485	Term. 3-way WIS.1632-1-3	1	0.25	
486	Term. 10-way W.33265-1-W	1	10.50	
487	Term. Block 16-W.32738-C	6	4.30	
488	Term. Board W.41618-C-1-A	1	9.15	
489				
490				
491	Transf. 6.3V W.24068-59	1	24.00	1B
492	Transf. 15V W.24582-13	1	60.50	1B
493	Transf. W.37518-3	1	70.00	1B
494	Transf. W.23241-33	1	27.50	1B
495	Transf. W.24586-26	1	48.50	1B
496	Transf. W.24743-27	1	21.50	1B
497	Transf. W.22129-3	1	575.00	
498	Transf. W.27206-4	6	33.50	1B
499	Transf. W.37518-2	1	93.00	1B
500	Transf. W.26958-B-152	1	2.70	1B
501	Transf. W.26958-B-153	1	2.85	1B
502	Transf. W.50593-1-G	2	3.20	
503	Transf. W.50593-1-D	2	2.95	
504	Transf. W.50593-1-E	1	2.95	
505	Transf. W.41184-B-45	1	2.20	
506	Transf. W.41184-B-46	1	2.15	
507	Transf. W.41185-B-6	1	2.15	
508	Transf. W.37149-1-17	1	2.40	
509	Transf. Input W.33035-B-1-E	1	2.25	
510	Transf. Output W.33035-B-1-D	1	1.35	
511				
512				
513	Valve GXU-2 CV2518	6		
514	Valve U.54 CV378	2		
515	Valve STV.280 - 80S	1		

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No.	Description	Value	Tol. % ±	Rtg.	Identity	Qty.		Scale
516	Valve OA3 or 75/40 CV3798					1		
517	Valve CV428					2		
518	Valve C.1112					2		
519	Valve BR.191					1		
520	Valve CV138					7		
521	Valve CV4014					2		
522	Valve CV391					2		
523	Valve N.77					2		
524								
525								
526	Valveholder B8G PC.81813-1					2		1S
527	Valveholder B7G with Skirt PC.81811-1					11		3S
528	Valveholder I.O. PC.81814-1					2		1S
529	Valveholder B5 PC.81805-1					1		1S
530	Valveholder Cer. WIS.4844-C-2					2		1S
531	Wheel 134A-W.37919 (To be supplied with No.97)							
532	Starter T31-2589-01					1		
533	Contactor, 9 pole making (FC) WIS.9273-3-2D					1		
534	Contactor, 5 pole making (ST) WIS.9273-3-2C					1		

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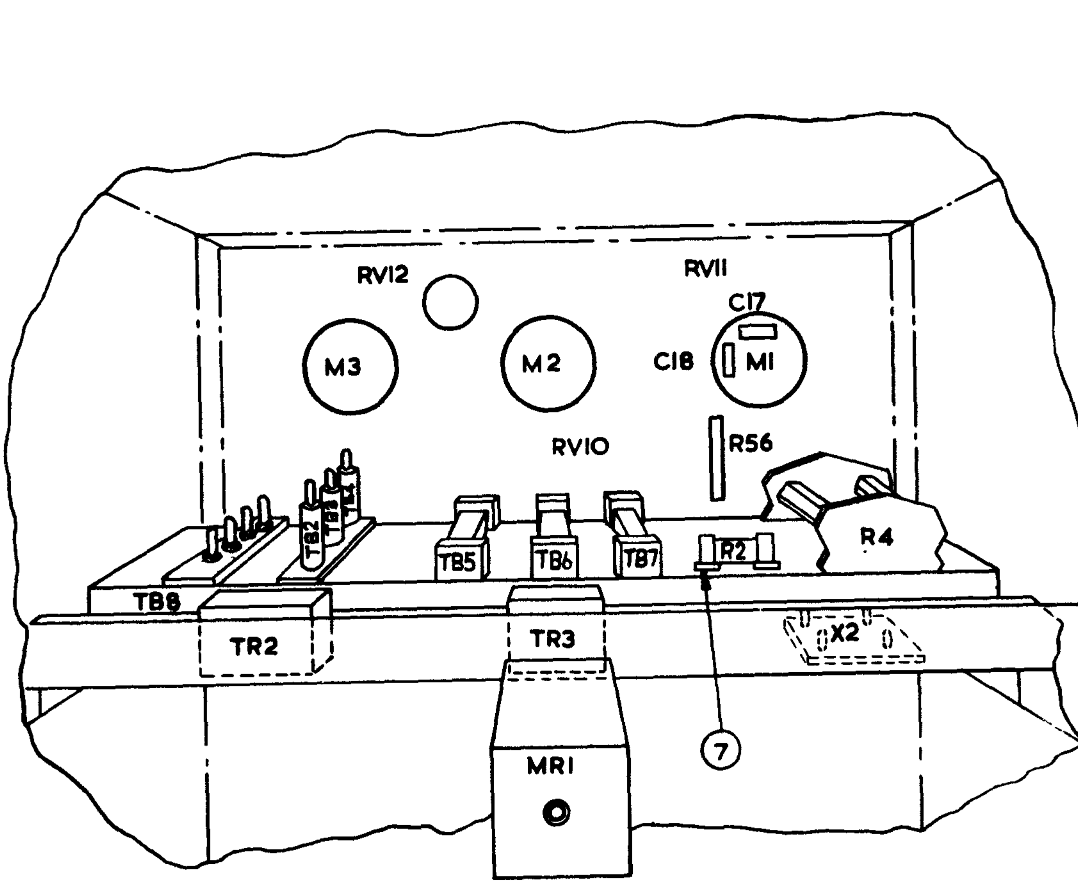

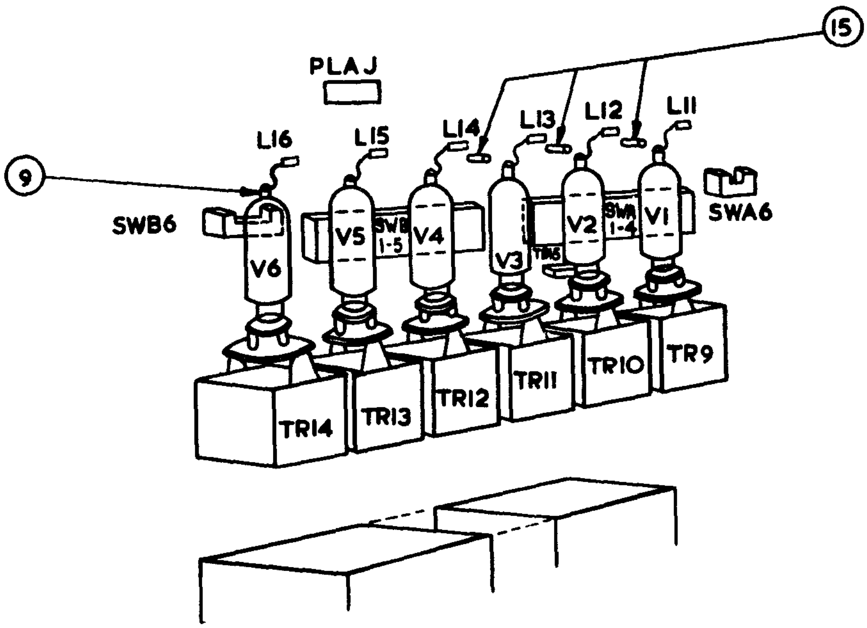

COMPONENT LAYOUT CHANGES ARISING
FROM MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)

o face
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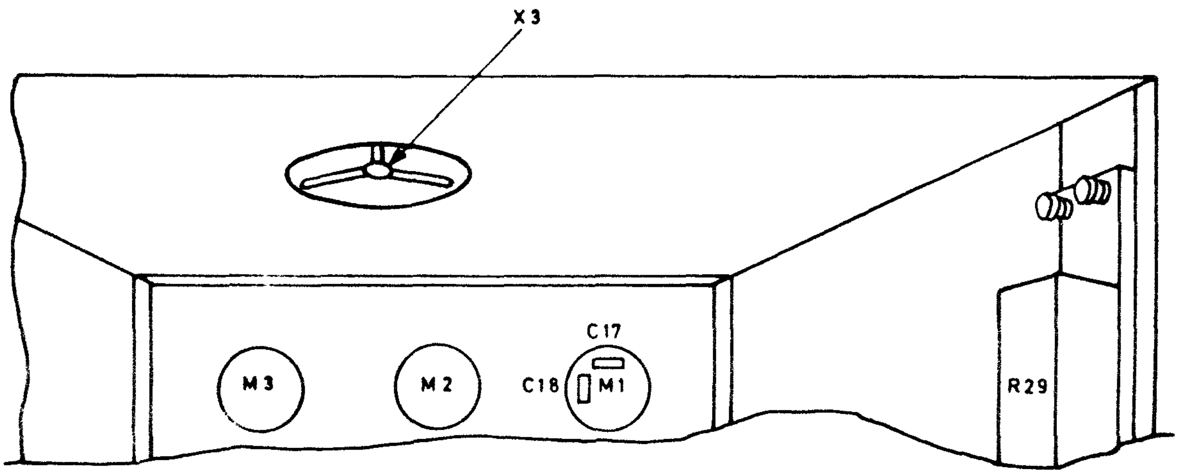


FIG. 1(a) PART VIEW OF R.C.U. SHOWING
LOCATION OF FAN X3 (MOD. 3978)

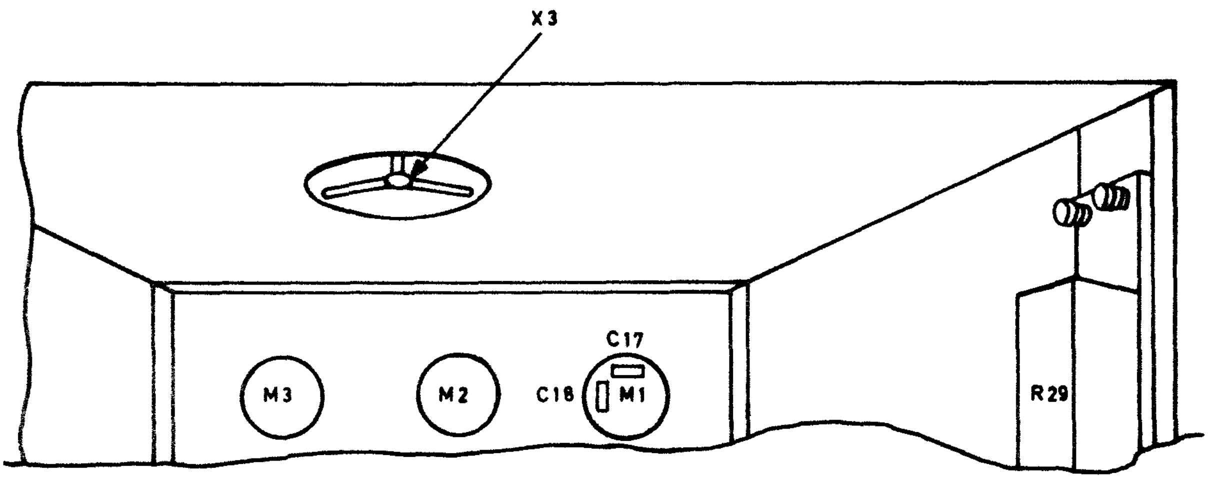
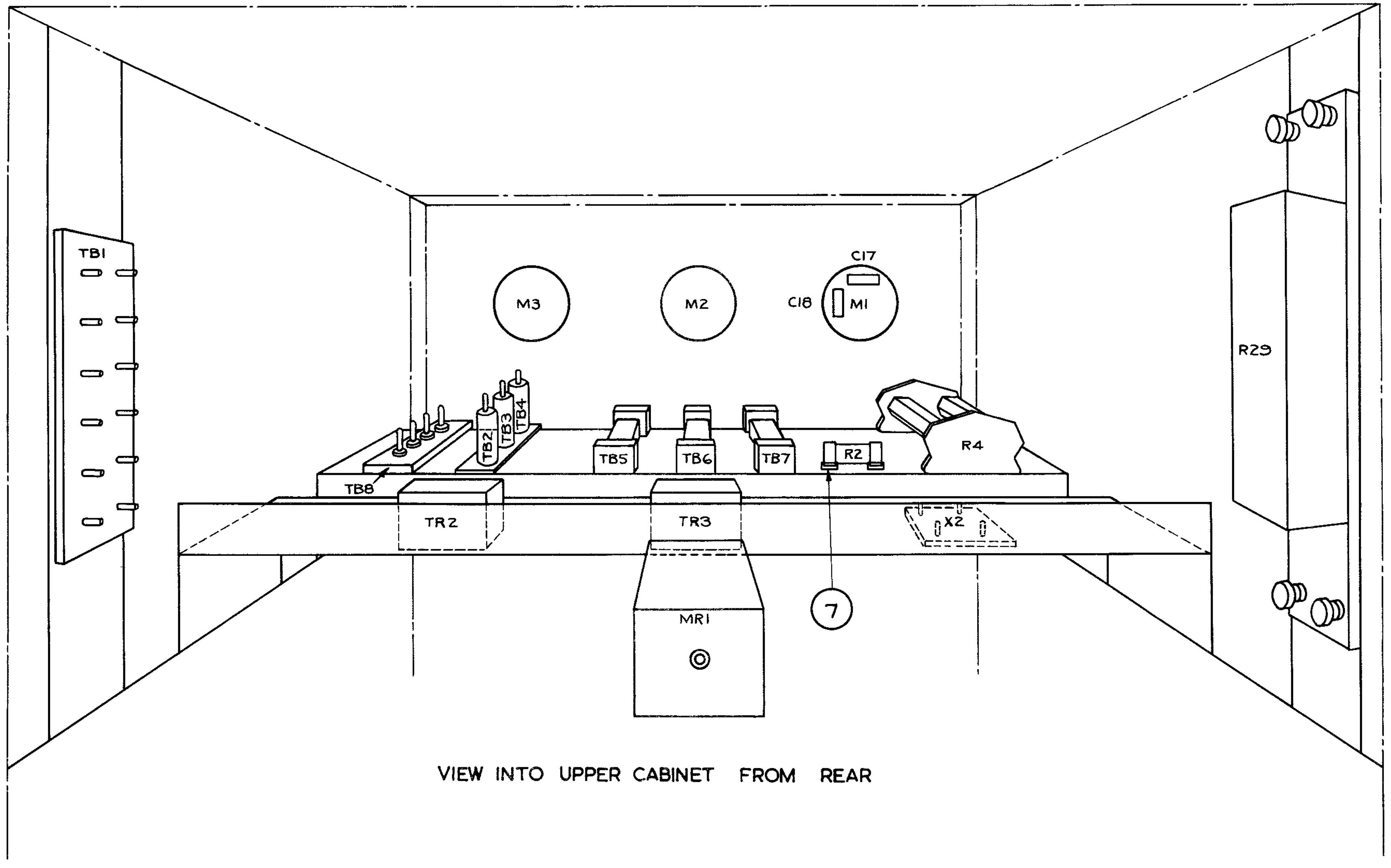
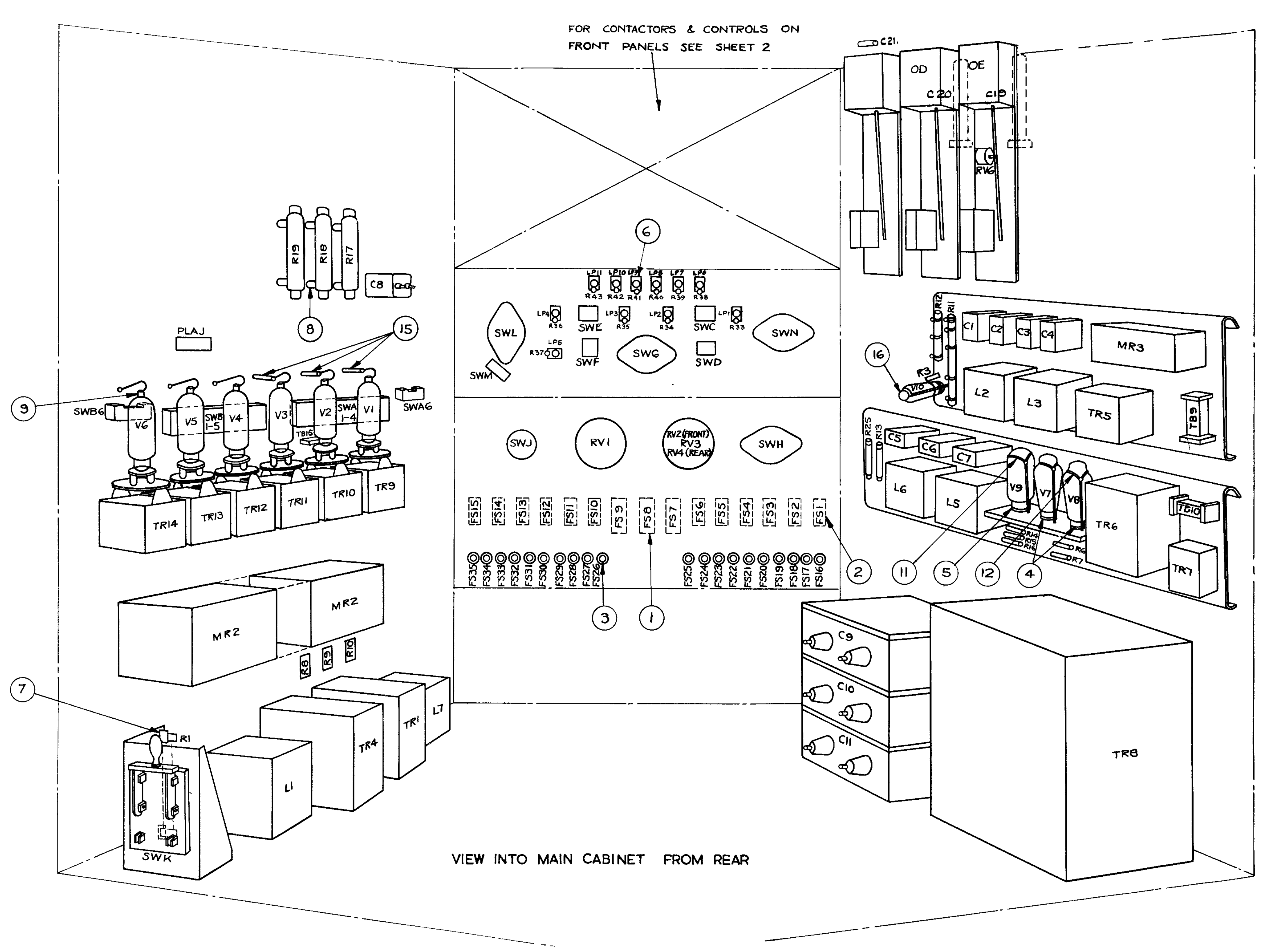


FIG. 1A(a) PART VIEW OF R.C.U. SHOWING LOCATION OF FAN X3 (MOD. A3978)



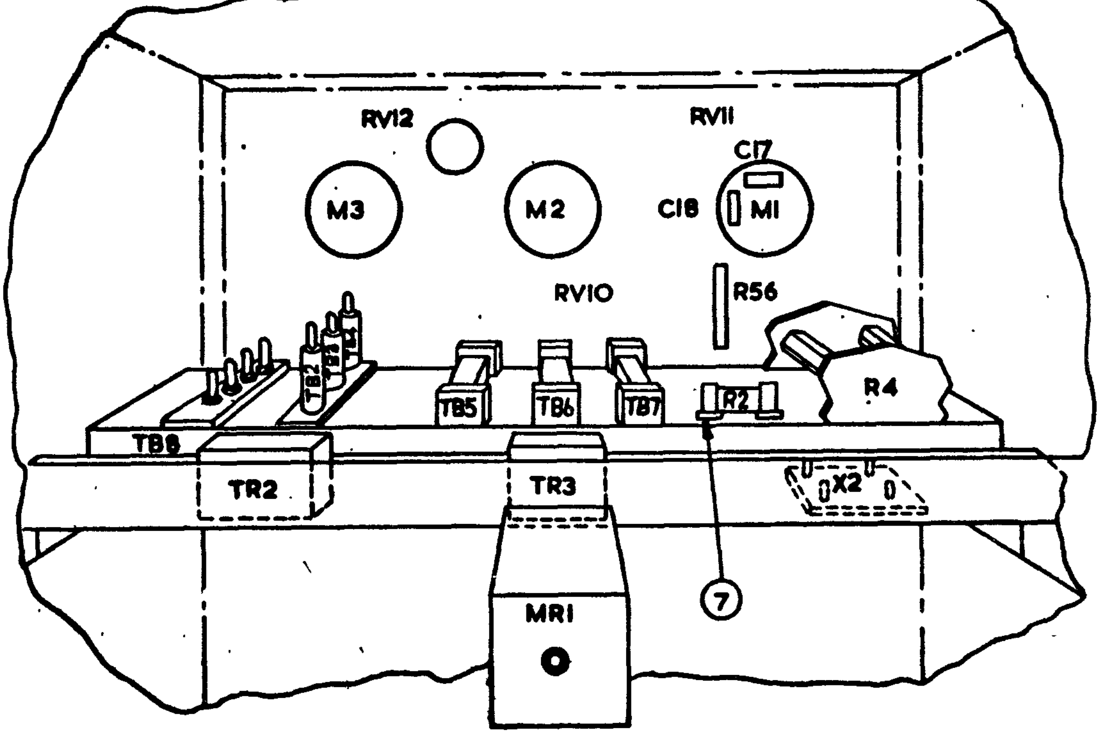
VIEW INTO UPPER CABINET FROM REAR

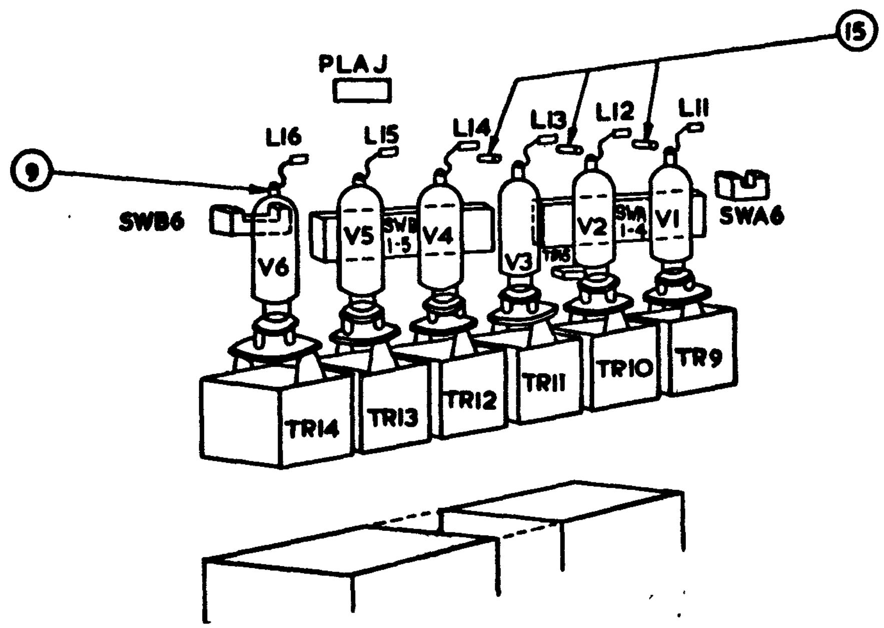


VIEW INTO MAIN CABINET FROM REAR

COMPONENT LAYOUT
RECTIFIER AND CONTROL UNIT, SHEET 1
WZ.12785/D Sh.1 Iss.11

FIG.1





COMPONENT LAYOUT CHANGES ARISING
FROM MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)

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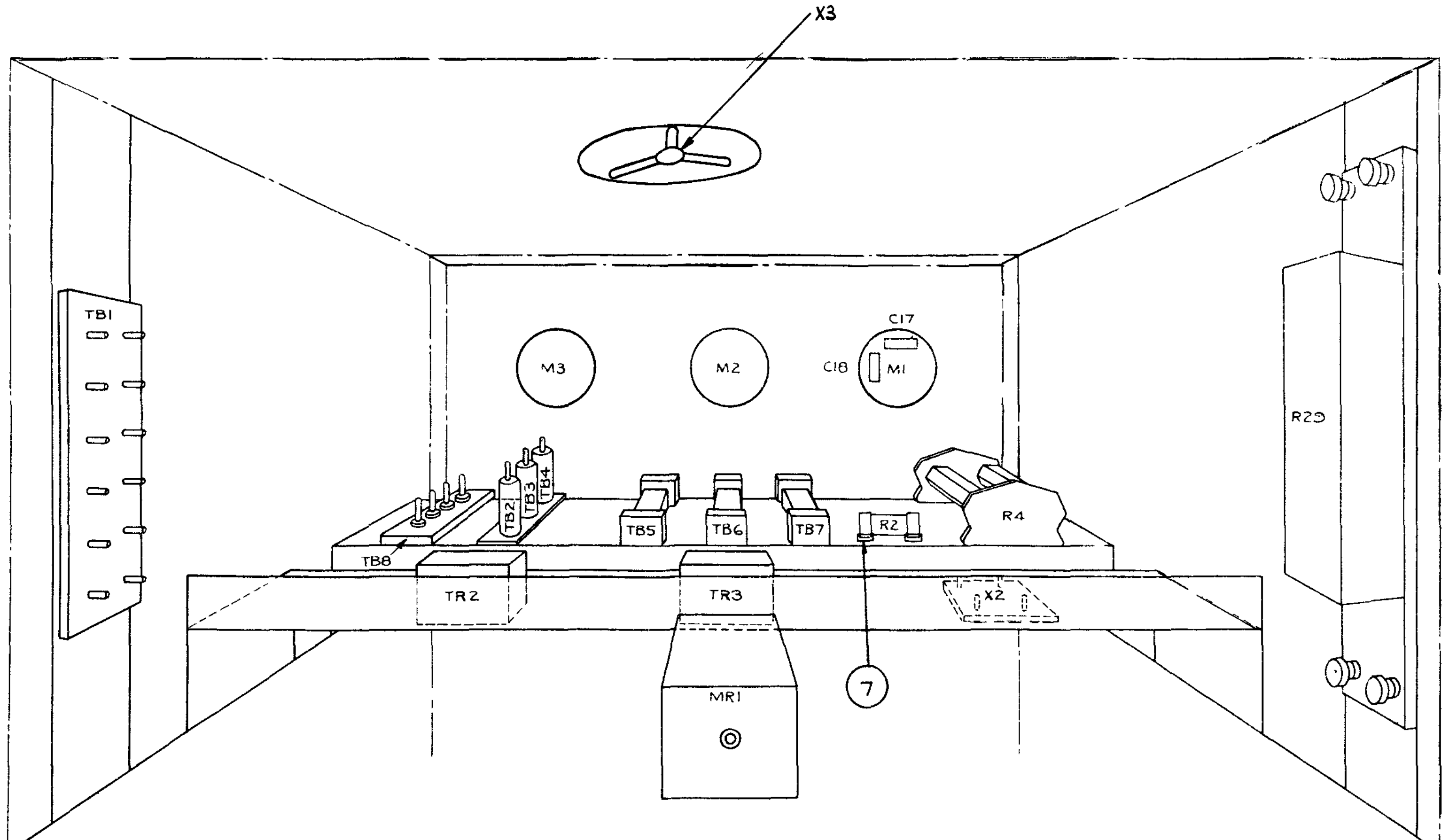
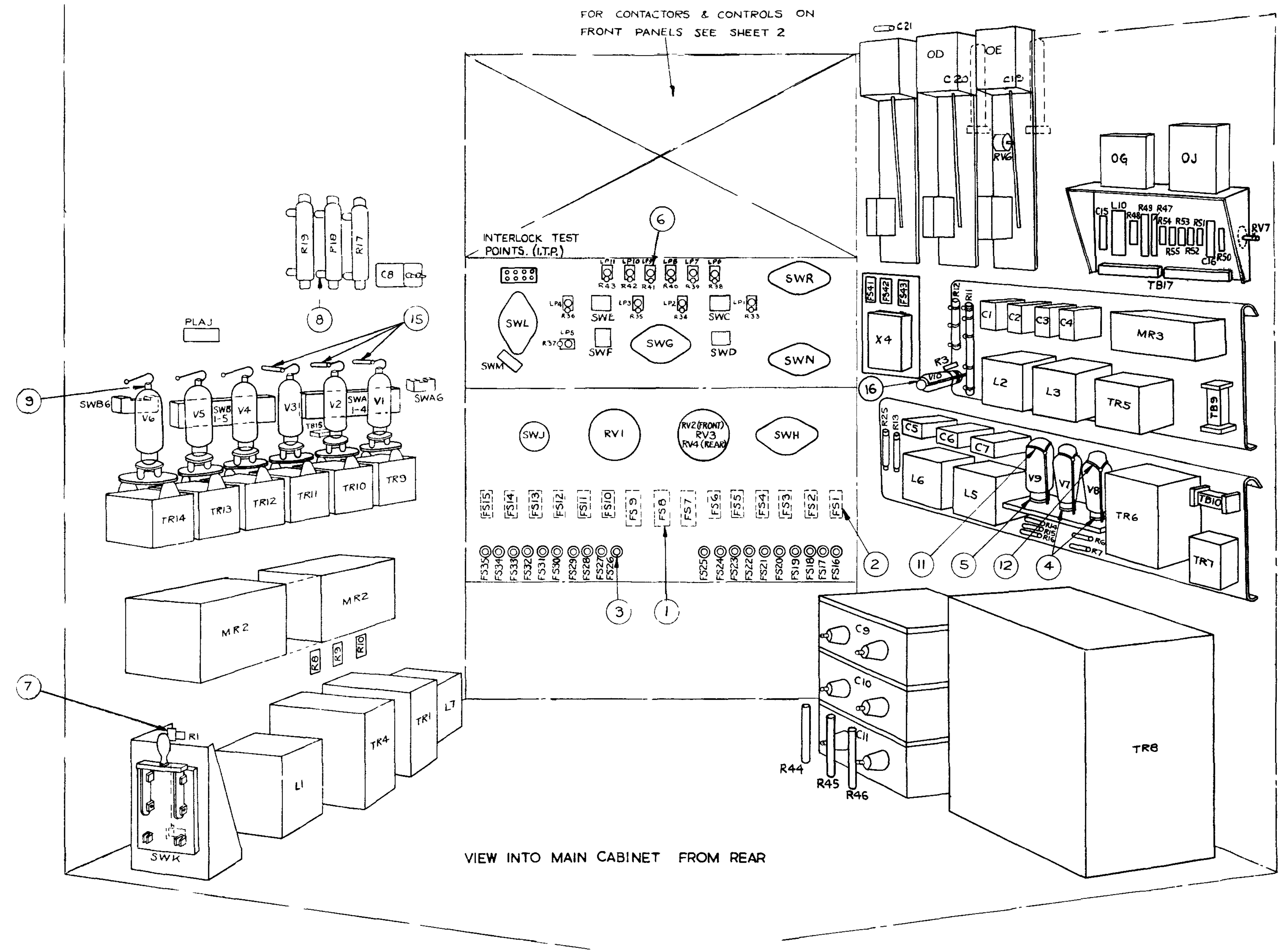
.g.1A)



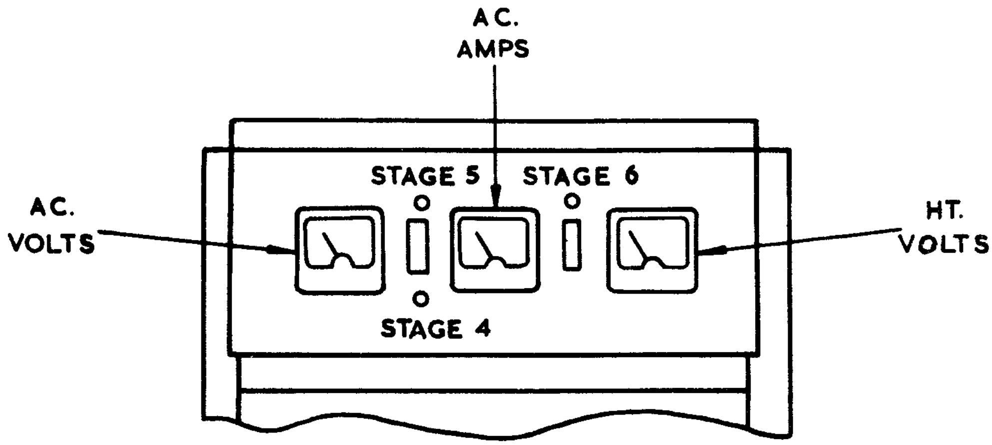
VIEW INTO UPPER CABINET FROM REAR



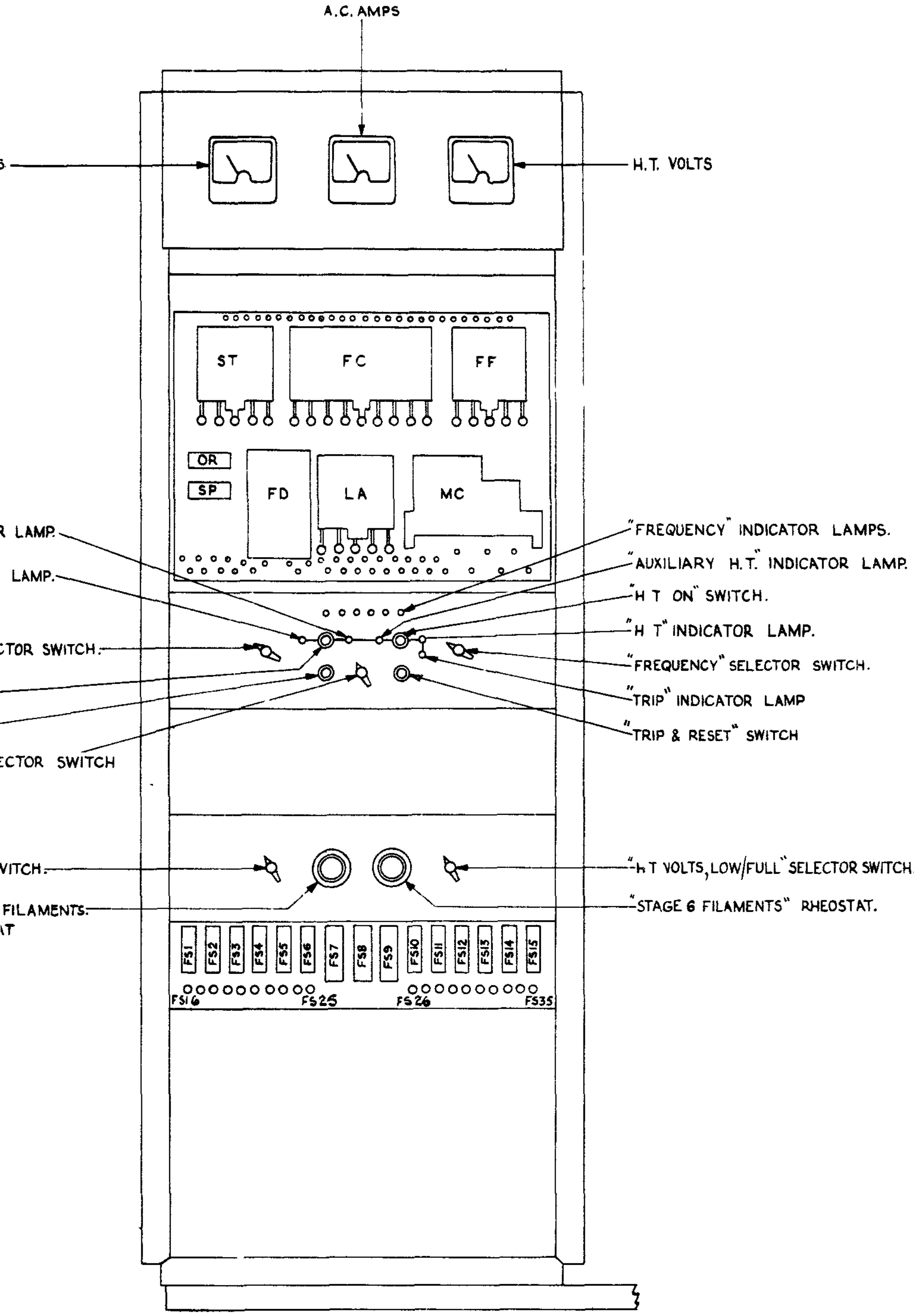
VIEW INTO MAIN CABINET FROM REAR

COMPONENT LAYOUT
RECTIFIER AND CONTROL UNIT, PART 1
HS31/1 AND HS31A/1

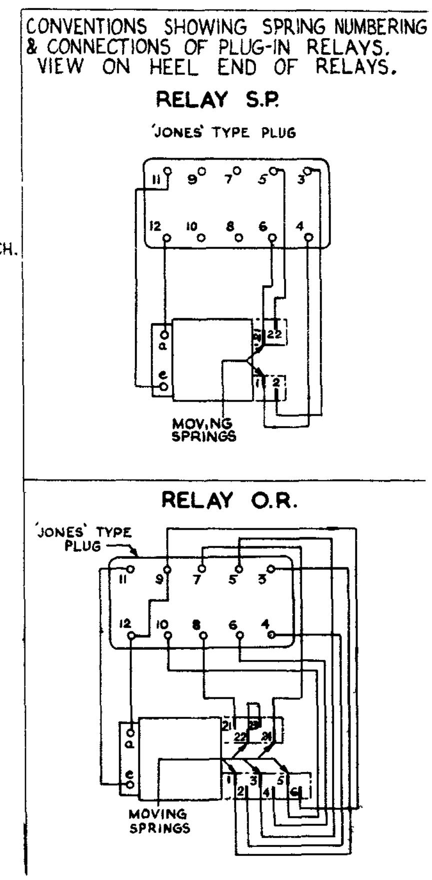
FIG.1A
WZ.26507/D SH.1
ISS.1



COMPONENT LAYOUT CHANGES ARISING
FROM MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)

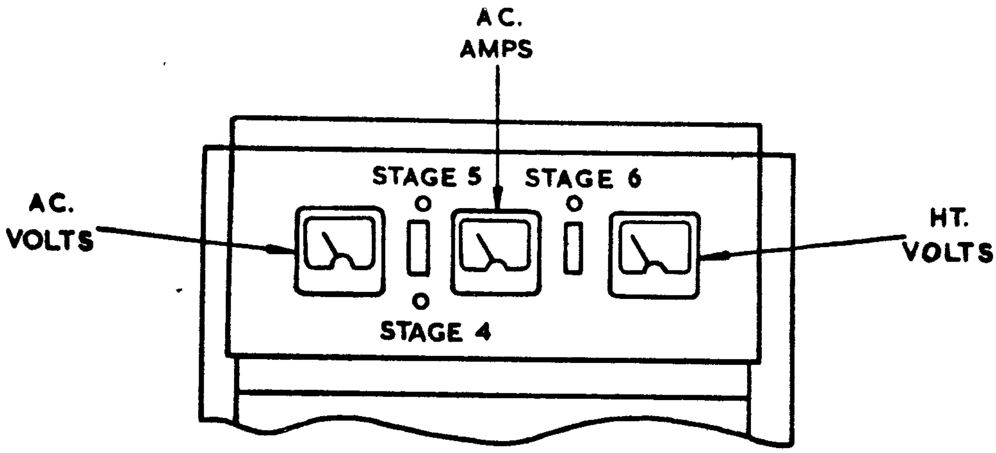


COMPONENT & CONTROL LAYOUT
VIEW ON FRONT OF RECTIFIER & CONTROL UNIT
(DOOR REMOVED)

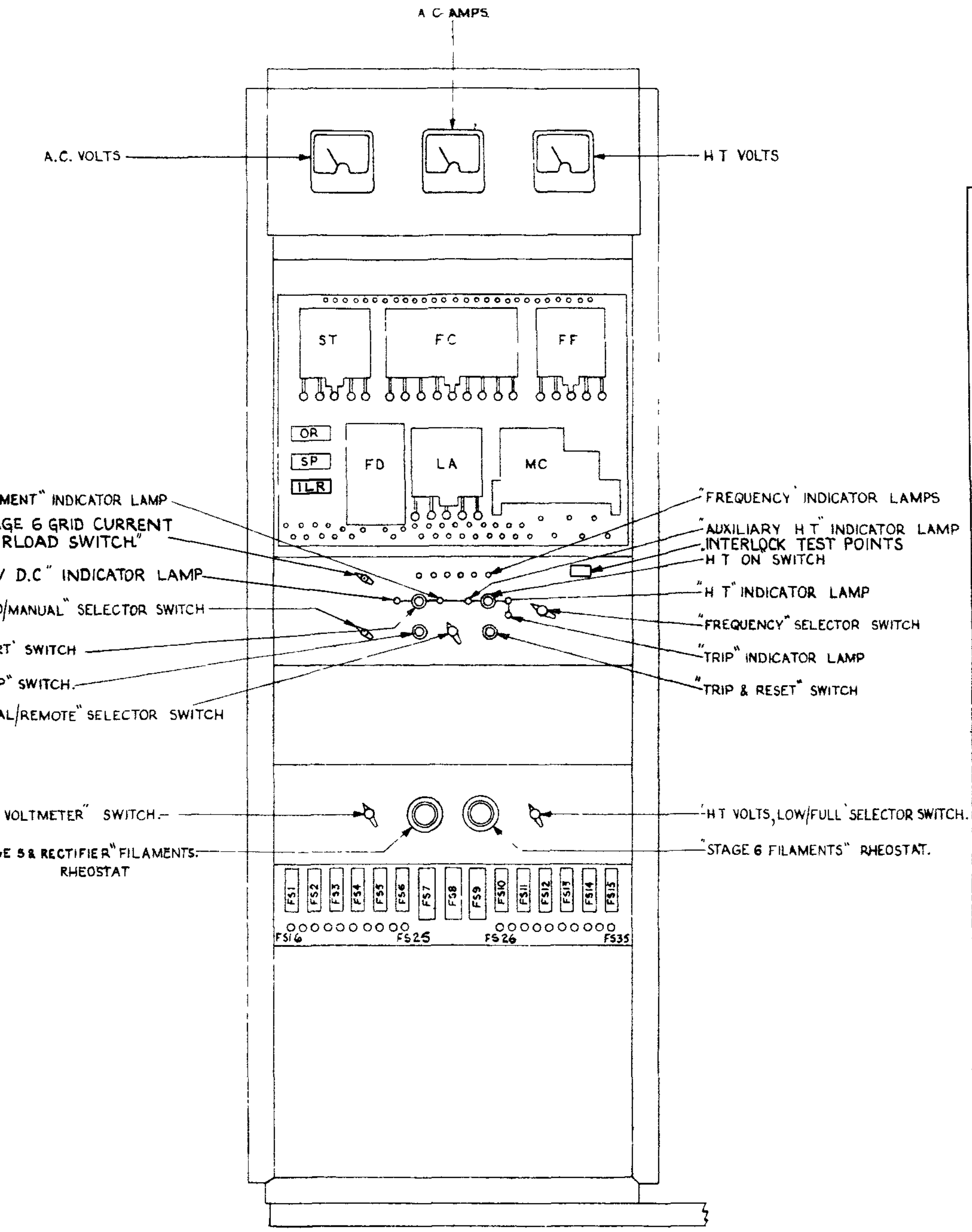


COMPONENT LAYOUT
RECTIFIER AND CONTROL UNIT, SHEET 2
WZ.12785/B Sh.2 Iss.5

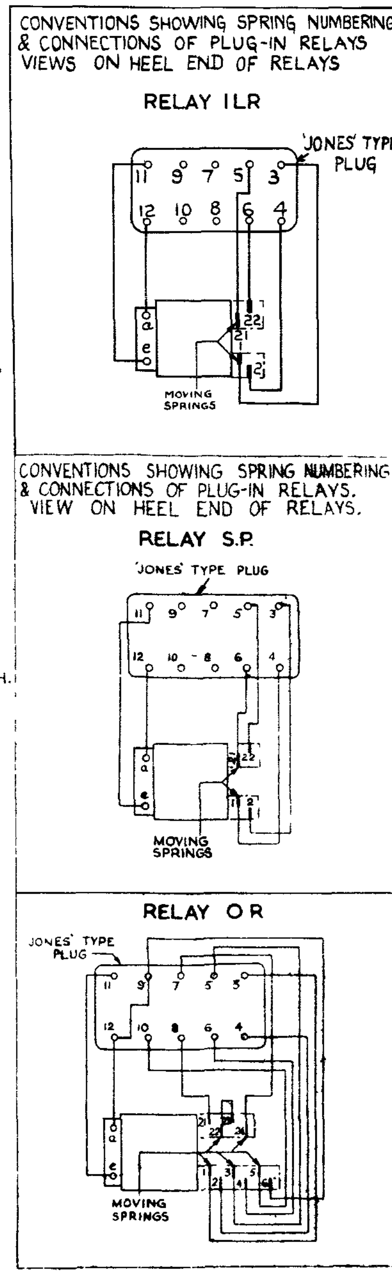
FIG.2



COMPONENT LAYOUT CHANGES ARISING
FROM MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)



COMPONENT & CONTROL LAYOUT
VIEW ON FRONT OF RECTIFIER & CONTROL UNIT
(DOOR REMOVED)



COMPONENT LAYOUT
RECTIFIER AND CONTROL UNIT, PART 2
HS31/1 AND HS31A/1

FIG.2A
WZ.26507/B SH.2
ISS.1

Component Layout R.F. Unit HS31
(WZ.17589/D Sh.1)

Modification No.1785

Modification No.1785 entails the addition of R.F. Filter Type W.102405 Ed.B to the R.F. unit of HS31 when 50 ohms output impedance is provided by the use of Transformer Type HA112. The filter and the transformer are both located on the roof of the cabinet.

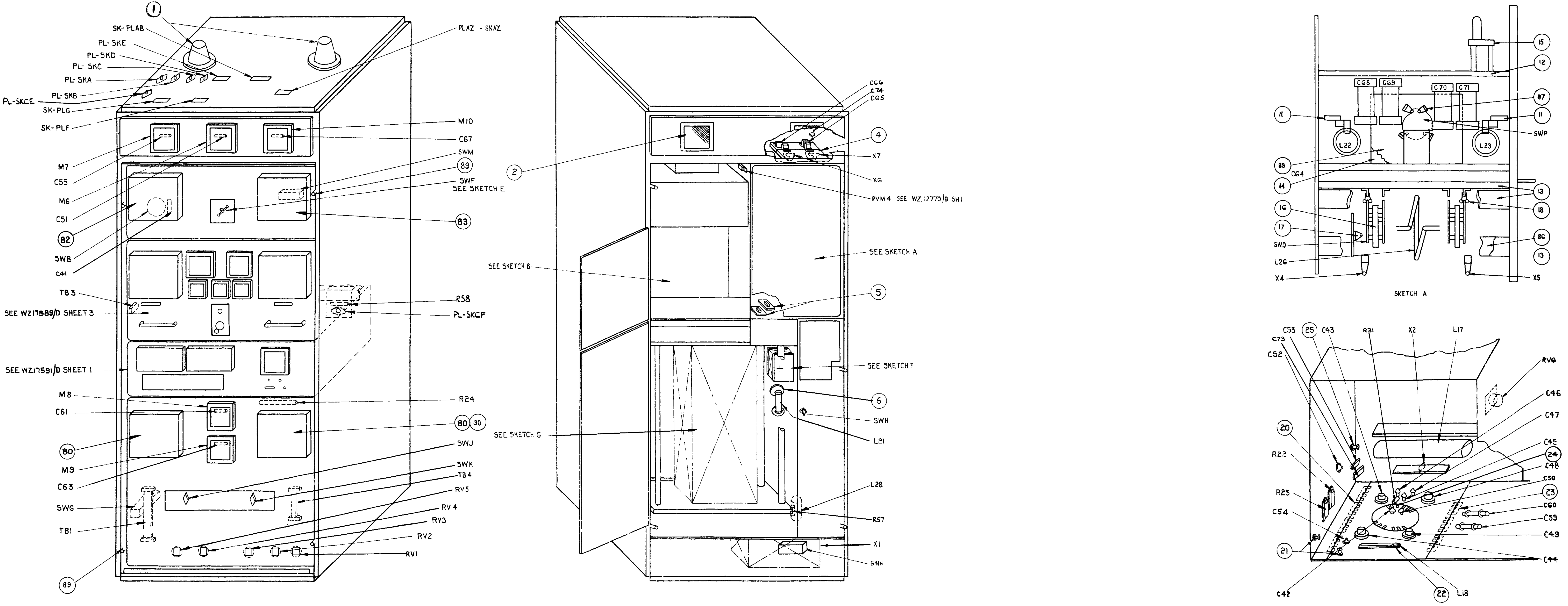


FIG.3

COMPONENT LAYOUT
RADIO FREQUENCY UNIT, SHEET 1
WZ.17589/D Sh.1 Iss.6

R.F. UNIT 3.5kW ISB TRANSMITTER TYPE HS.31A
(WQ.12610 Ed.A & W.37907 Ed.C)

Cross Reference List
for WZ.17365/D Sh.1

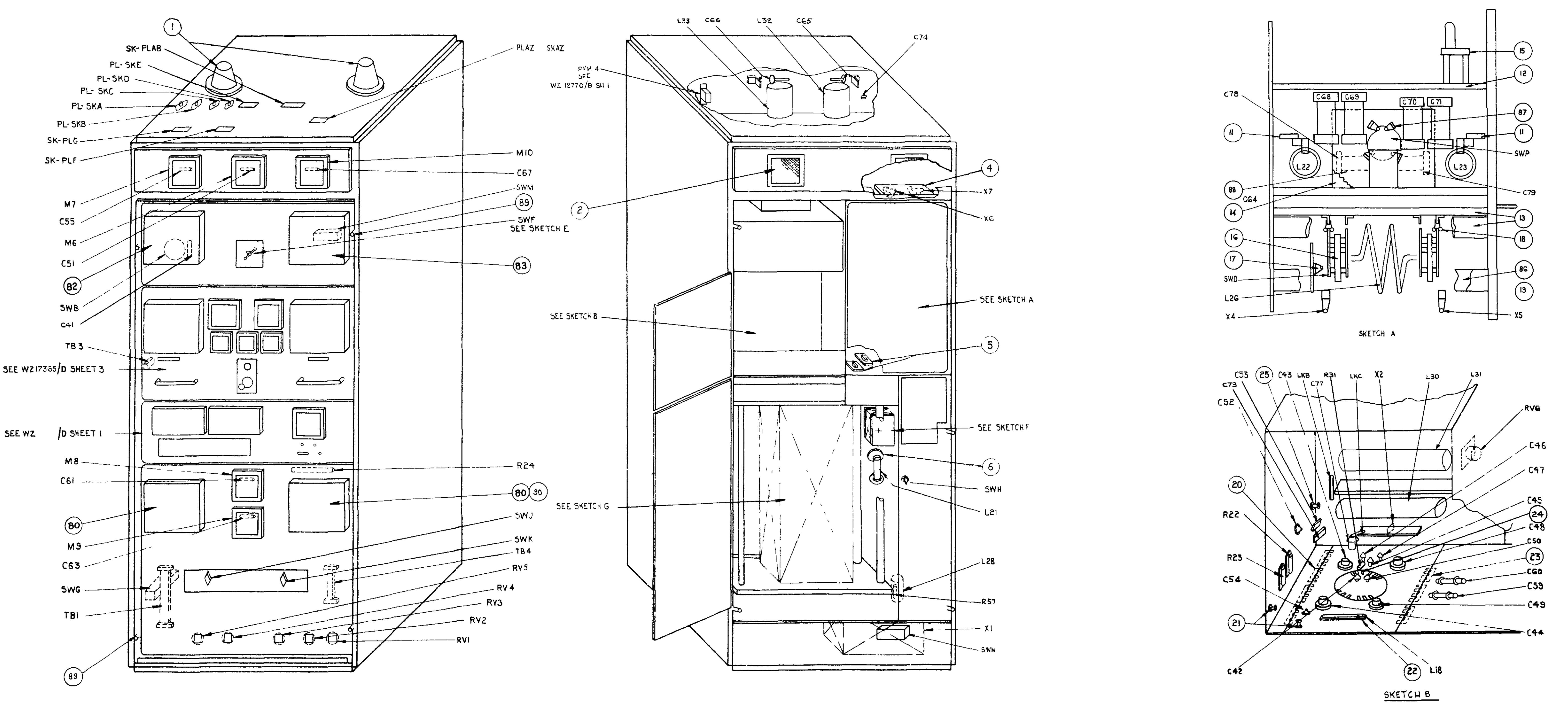
Ref. 1	Insulator Ceramic	No.451
Ref. 2	Air Filter	No.413
Ref. 4	Mounting Board Mycalex	No.460
Ref. 5	Mounting Board Mycalex	No.461
Ref. 6	Insulator	No.450
Ref.11	Coil Mounting Plate Mycalex	No.425
Ref.12	Top Panel Mycalex	No.495
Ref.13	Contact Mounting Mycalex	No.430
Ref.14	End Cheek Mycalex	No.439
Ref.15	Contact Mounting Mycalex	No.431
Ref.16	Rotor Mounting Mycalex	No.468
Ref.17	Contact Assembly	No.426
Ref.18	Contact Assembly	No.427
Ref.20	Spring Contact	No.477
Ref.21	Stand-Off Insulator	No.491
Ref.22	Mounting Board Mycalex	No.462
Ref.23	Spring Contact	No.478
Ref.24	Grid Contact Spring	No.447
Ref.25	Stand-Off Insulator	No.492
Ref.80	Manual Drive Assembly	No.456
Ref.82	Manual Drive Assembly	No.457
Ref.83	Manual Drive Assembly	No.458
Ref.86	Contact Mounting Mycalex	No.432
Ref.87	Contact Assembly	No.427
Ref.88	End Cheek Mycalex	No.440
Ref.89	Contact Assembly	No.428
Ref.90	Coupling Mycalex	No.438
Ref.91	Wheel	No.502

T.4260
1736
CP

R.F. Unit of Transmitter HS31A
(WZ.17365/D Sh.1)

Modification No.1784

L32 and L33 are replaced by R.F. Filter W.102405 Ed.C when 50 ohms output impedance is provided by the use of Transformer Type HA112. The filter is located in the top section of the cabinet in place of L32 and L33 and the transformer is located on top of the cabinet.



A.P.116E-0231-1
2nd Edn. Oct. '67

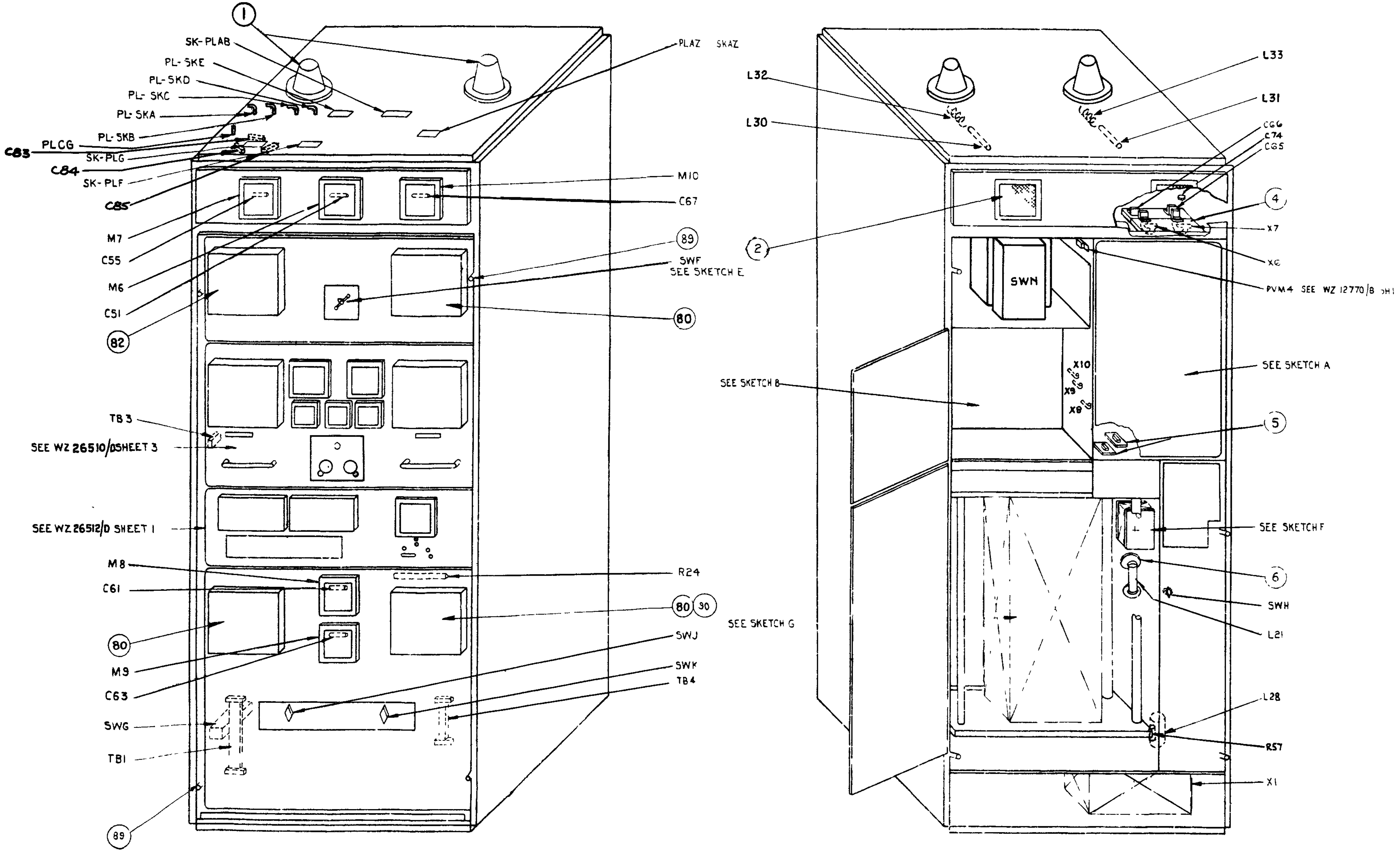
COMPONENT LAYOUT
R.F. UNIT, PART 1
HS31A

FIG.3A
WZ.17365/D SH.
ISS.6

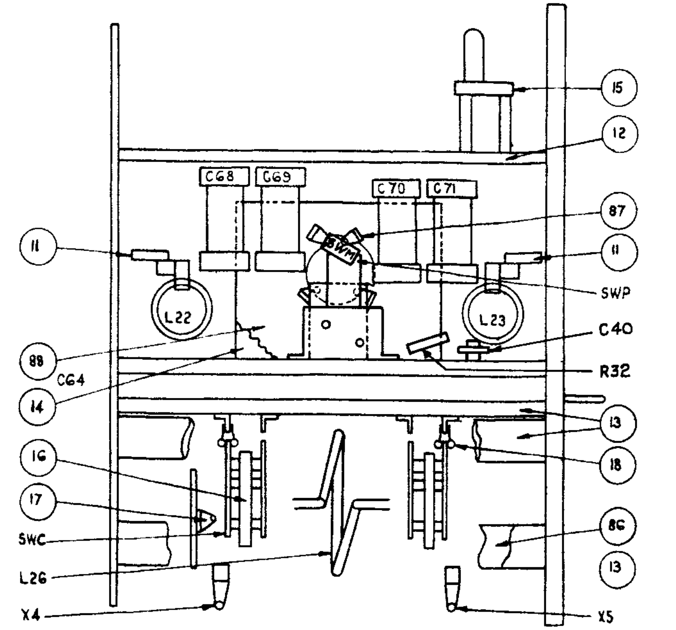
Component Layout R.F. Unit HS31/1
(WZ.26510/D Sh.1)

Modification No.1785

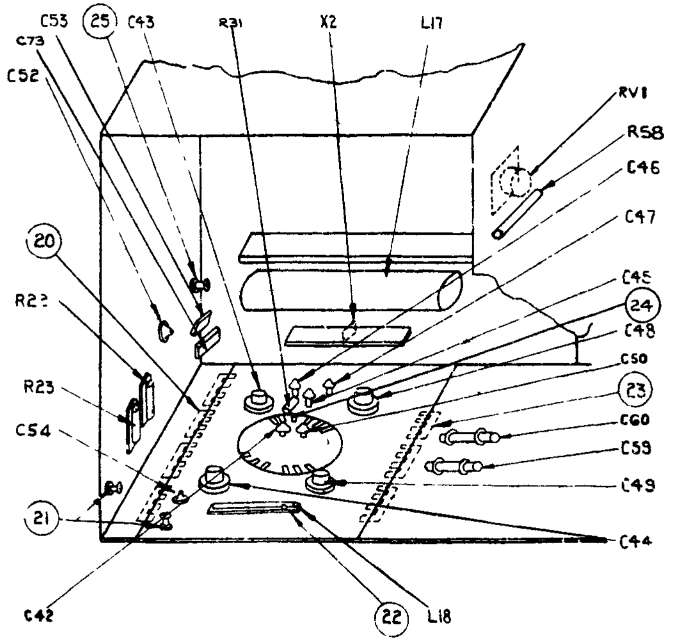
Modification No.1785 entails the addition of R.F. Filter Type W.102405 Ed.B to the R.F. unit of HS31/1 when Transformer Type HA112 is used to provide 50 ohms output impedance. The filter and the transformer are both located on top of the cabinet.



COMPONENT LAYOUT
R.F. UNIT, PART 1
HS31/1



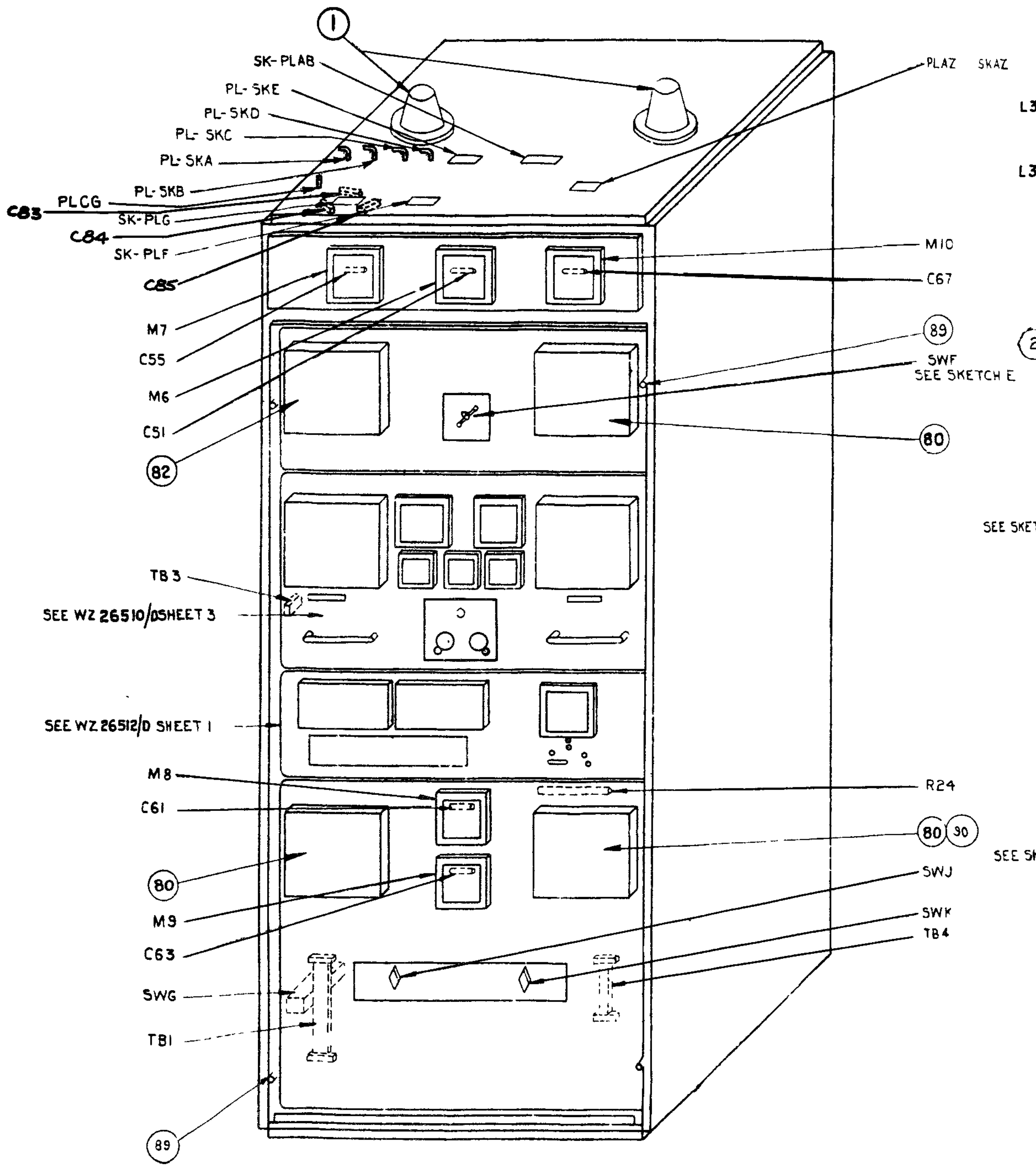
SKETCH A

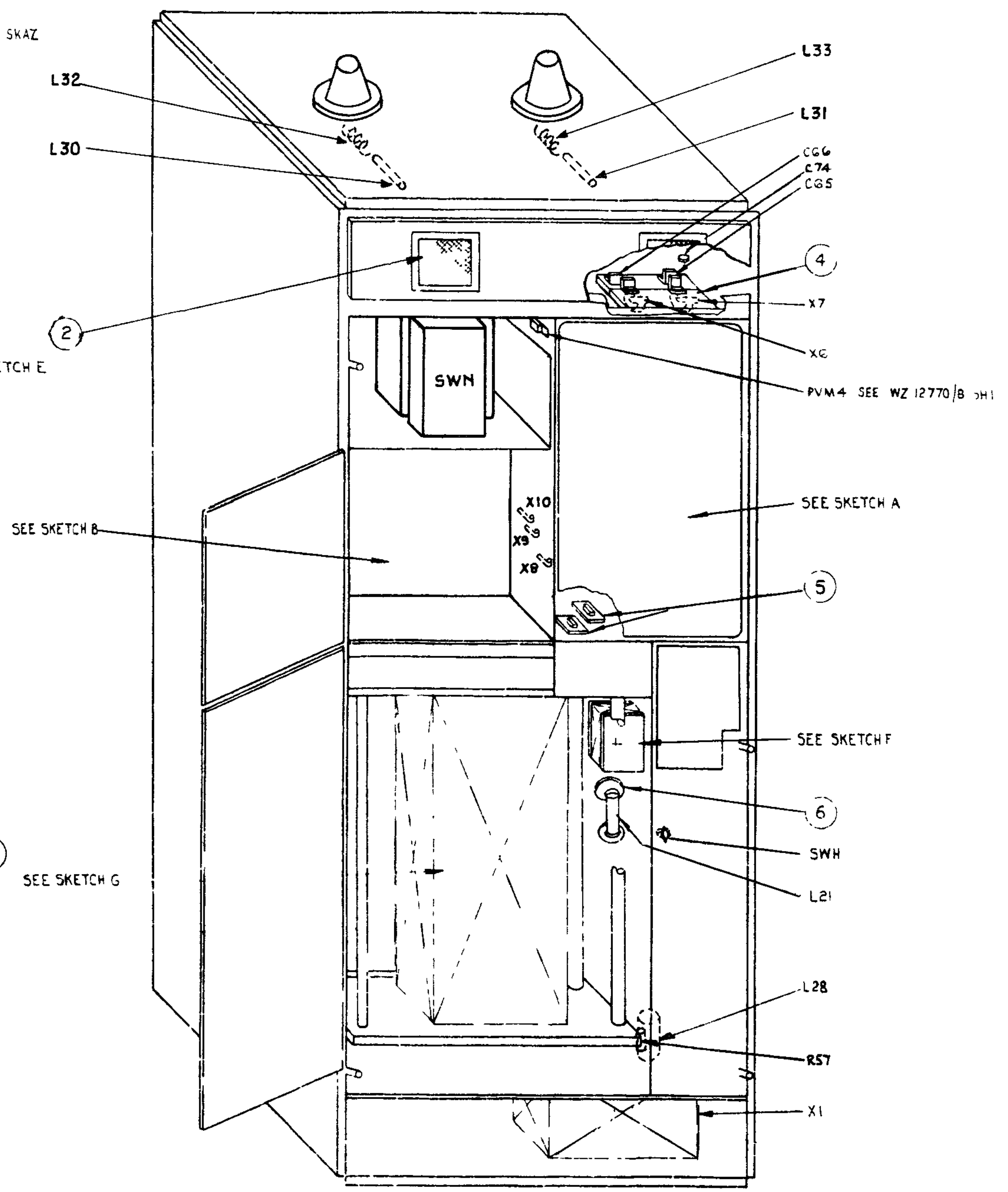


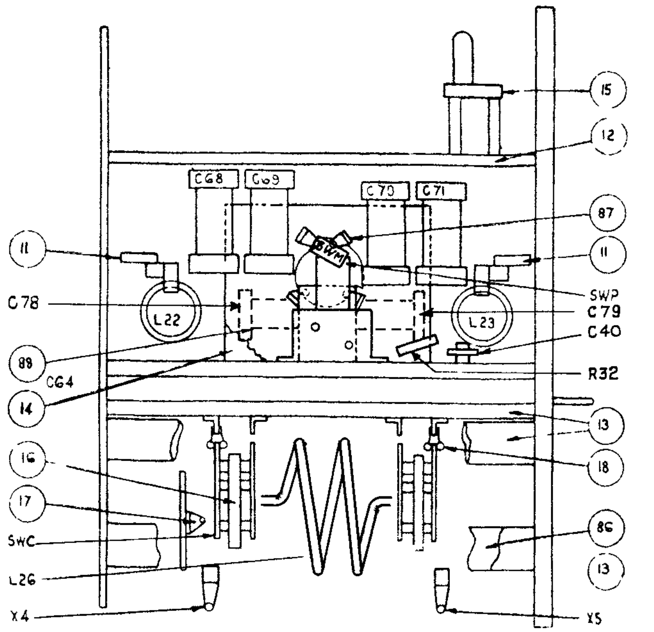
SKETCH B

FIG.3B
WZ.26510/D SH.1
ISS.3

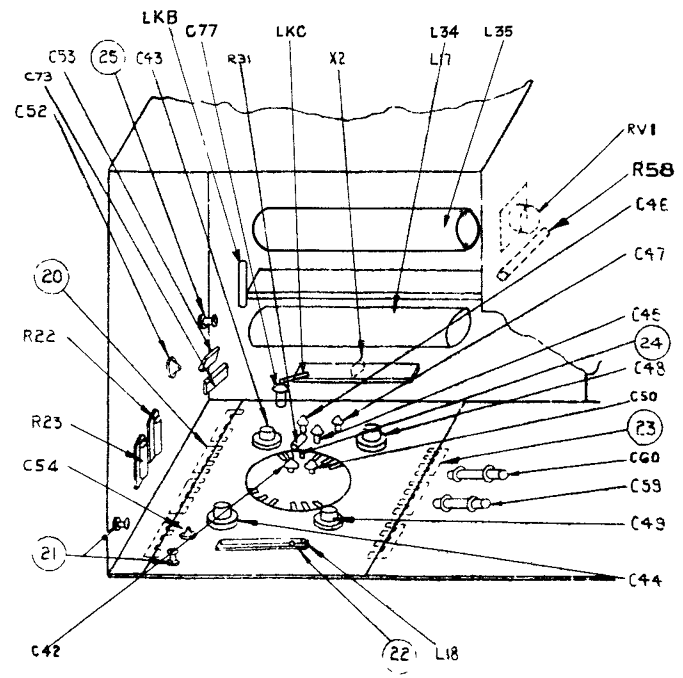
A.P.116E-0231-1
2nd Edn. Oct. '67







SKETCH A



SKETCH B

A.P.116E-0231-1
2nd Edn. Oct. '67

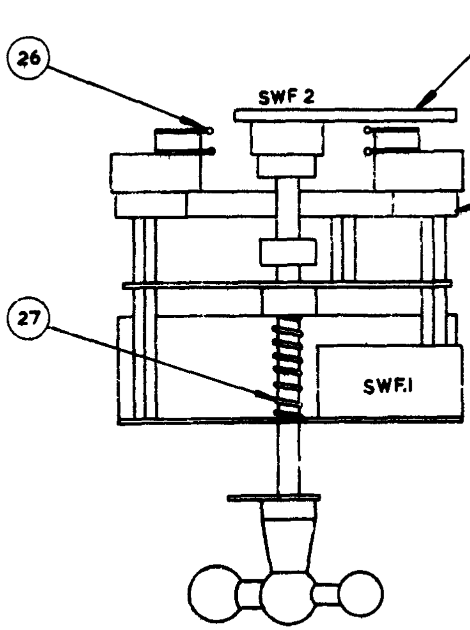
COMPONENT LAYOUT
R.F. UNIT, PART 1
HS31/1

FIG.3C
WZ.27280/D SH.1
ISS.3

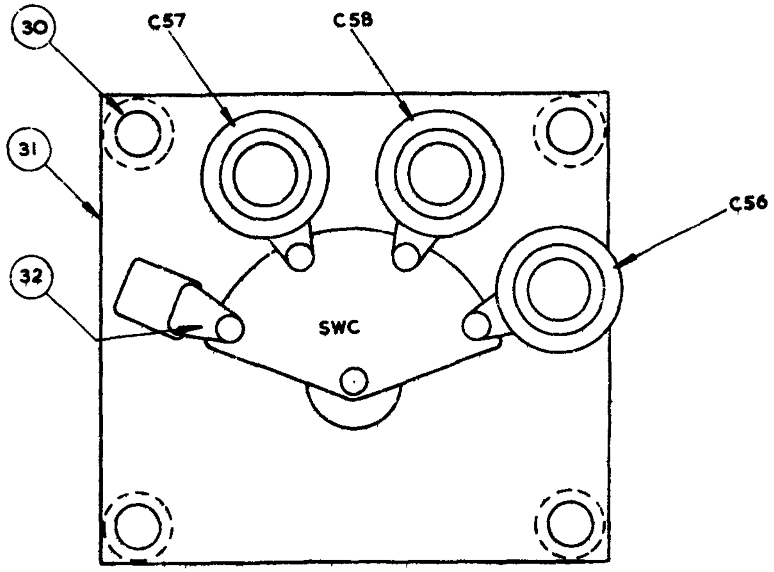
R.F. Unit of Transmitter HS31A/1
(WZ.27280/D Sh.1)

Modification No.1784

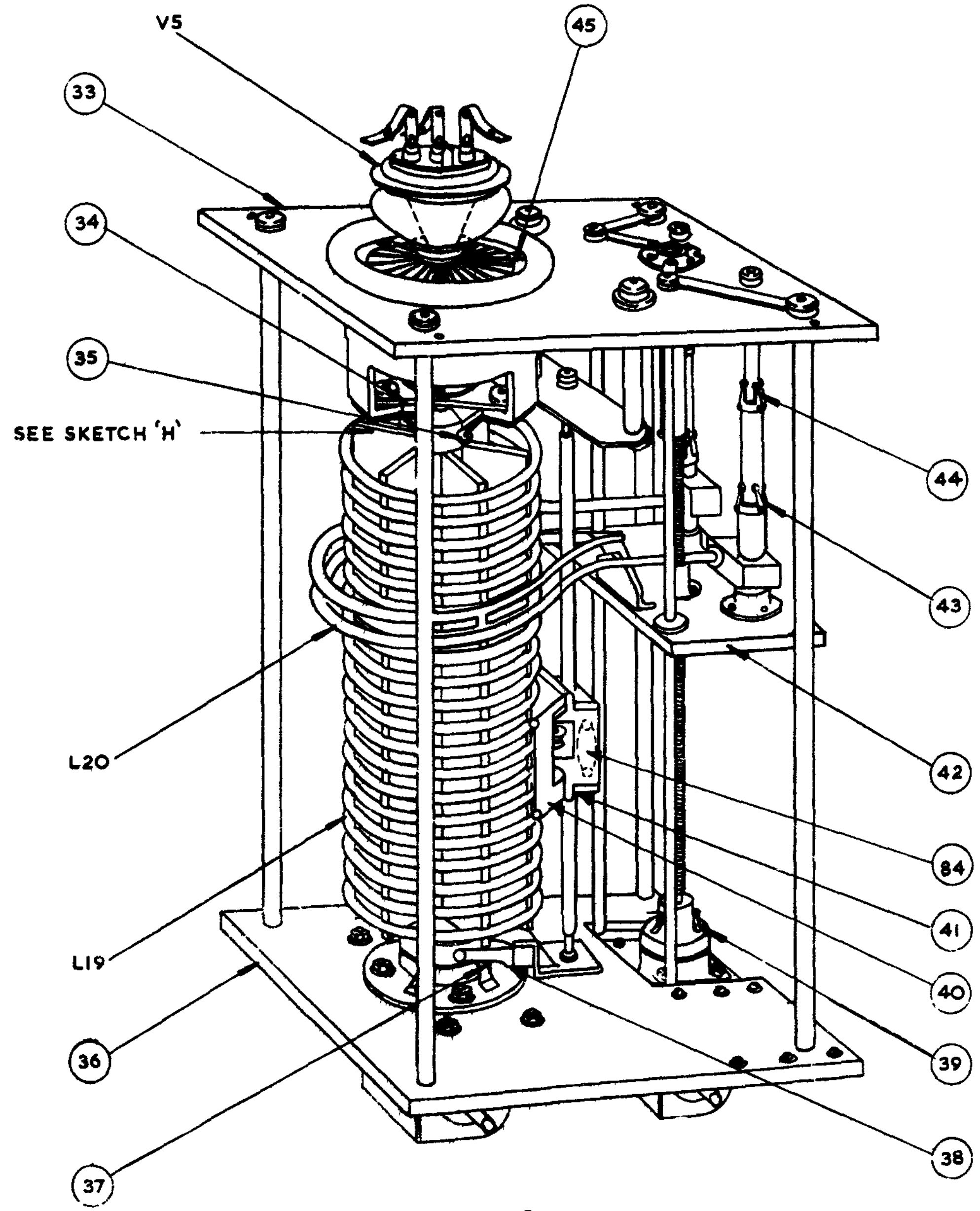
L30, L31, L32, and L33 are replaced by R.F. Filter Type W.102405 Ed.C when 50 ohms output impedance is provided by the use of Transformer Type HA112. The filter is located in the top section of the cabinet in place of L30, L31, L32, and L33, the transformer is located on top of the cabinet.



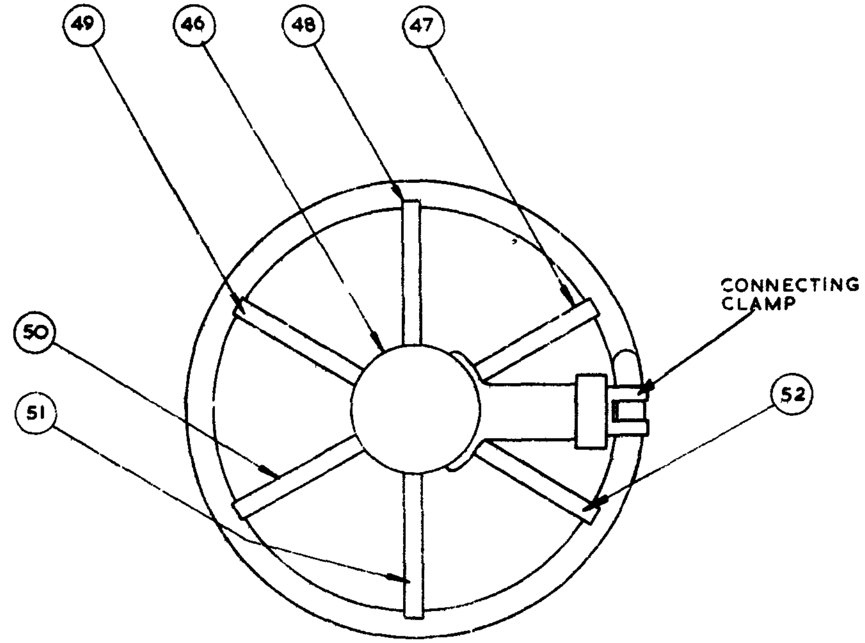
SKETCH E
PLAN VIEW



SKETCH F



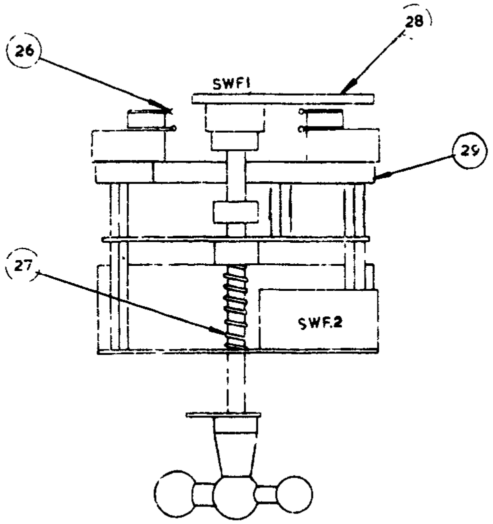
SKETCH G



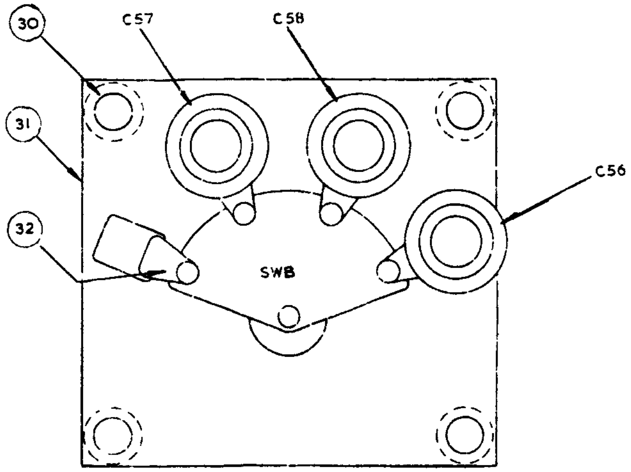
SKETCH H
A VIEW LOOKING ON TOP OF THE ANODE COIL ASSEMBLY SHOWING POSITIONS OF MYCALEX COIL SUPPORTS RELATIVE TO CONNECTING CLAMP

COMPONENT LAYOUT
RADIO FREQUENCY UNIT, SHEET 2
WZ.17589/D Sh.2 Iss.1

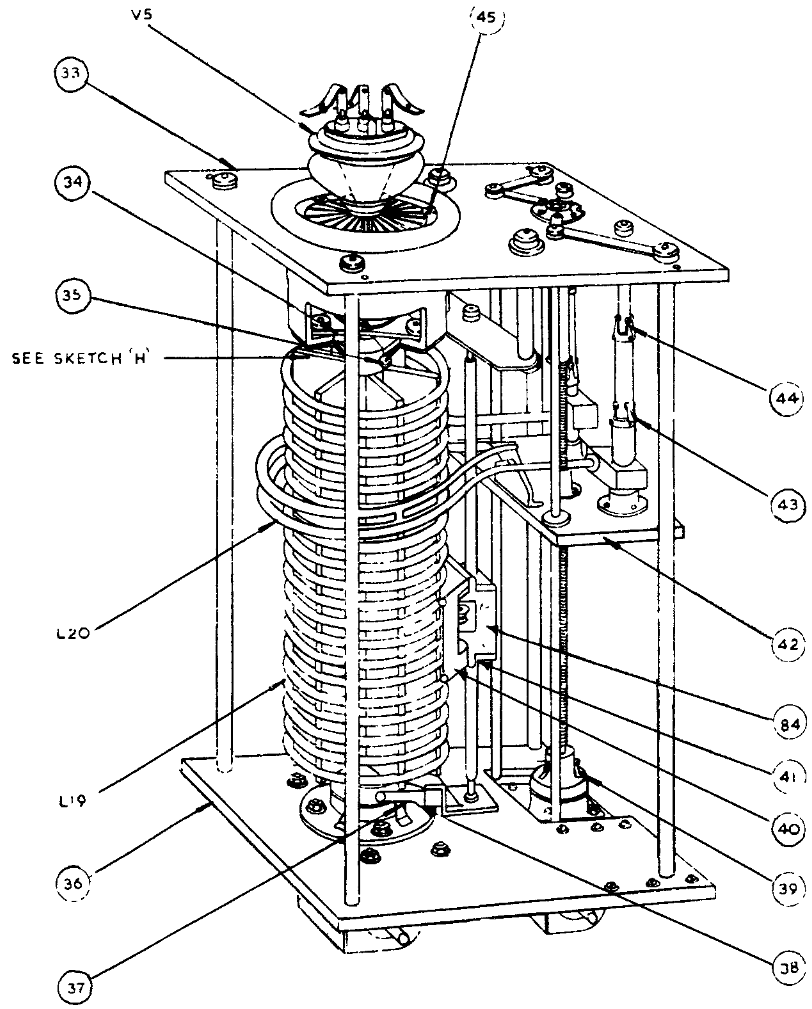
FIG.4



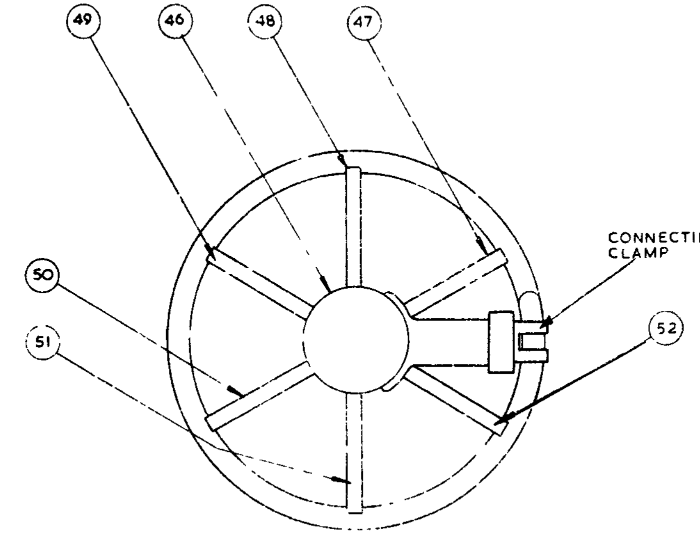
SKETCH E
PLAN VIEW



SKETCH F



SKETCH G



SKETCH H
A VIEW LOOKING ON TOP OF THE ANODE COIL ASSEMBLY SHOWING POSITIONS OF MYCALEX COIL SUPPORTS RELATIVE TO CONNECTING CLAMP

COMPONENT LAYOUT
R.F. UNIT, PART 2
HS31/1 AND HS31A/1

FIG.4A
WZ.26510/D SH.2
ISS.1

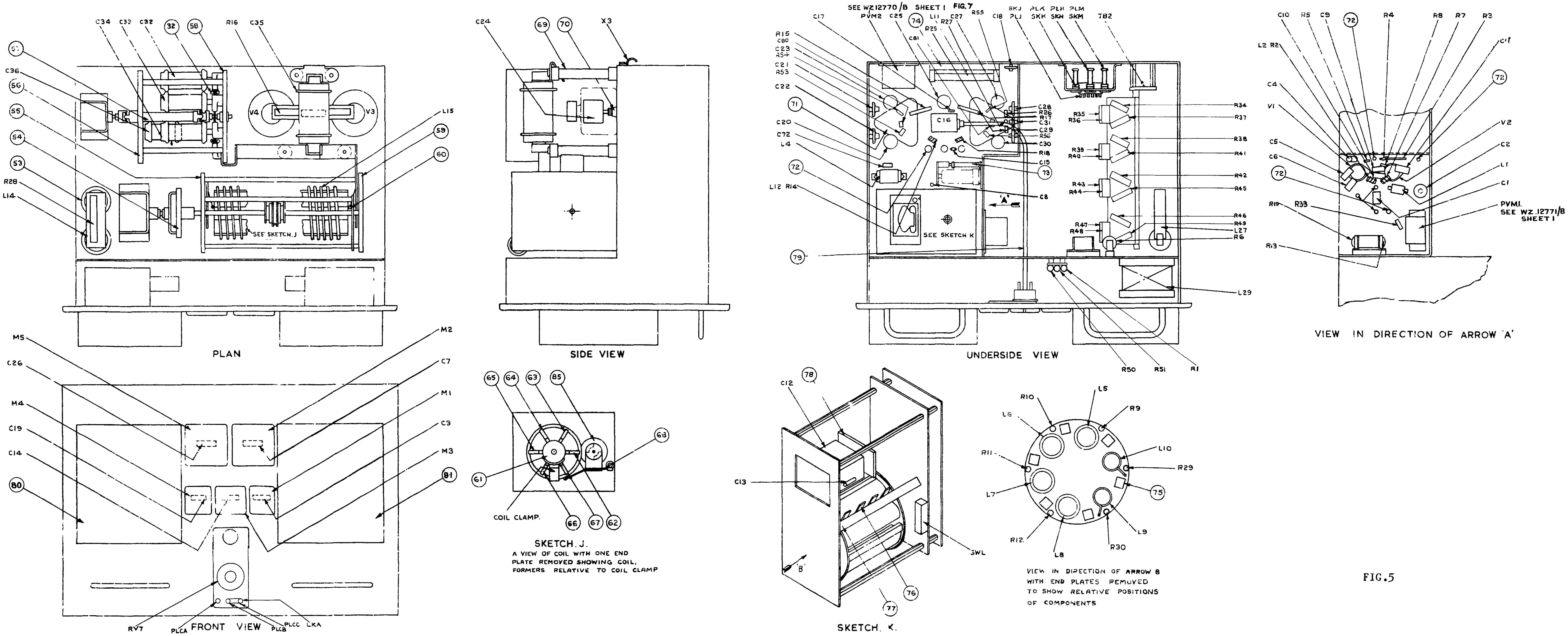


FIG.5

AP.2922D
Vol.1
April 1965

COMPONENT LAYOUT
RADIO FREQUENCY UNIT, SHEET 3
WZ.17589/D Sh.3 Iss.4

R.F. UNIT 3.5kW ISB TRANSMITTER TYPE HS.31A
(WQ.12610 Ed.A & W.37907 Ed.C)

Cross Reference List
for WZ.17365/D Sh.3

Ref.32	Ball Contact Assembly	No.416
Ref.53	Insulator Conical Porcelain	No.450
Ref.56	Support Plate Mycalex	No.490
Ref.57	Coupling Bar Mycalex	No.437
Ref.58	Mounting Plate Mycalex	No.464
Ref.59	Spring Assembly	No.472
Ref.60	Spring Assembly	No.473
Ref.61	Spring Assembly	No.474
Ref.68	Contact Assembly	No.429
Ref.69	Insulating Rod	No.453
Ref.70	Conical Insulator	No.435
Ref.71	Valveholder Ceramic	No.496
Ref.72	Insulator Stand-Off	No.454
Ref.73	Insulator Stand-Off	No.449
Ref.74	Base Mycalex	No.418
Ref.75	Terminal Block Mycalex	No.494
Ref.76	Spring Contact	No.475
Ref.77	Spring Contact Plate Mycalex	No.489
Ref.78	Condenser Plate Mycalex	No.434
Ref.79	Flexible Drive Assembly	No.443
Ref.81	Manual Drive Assembly	No.459
Ref.85	Spring	No.469

T.4260
1736
CP

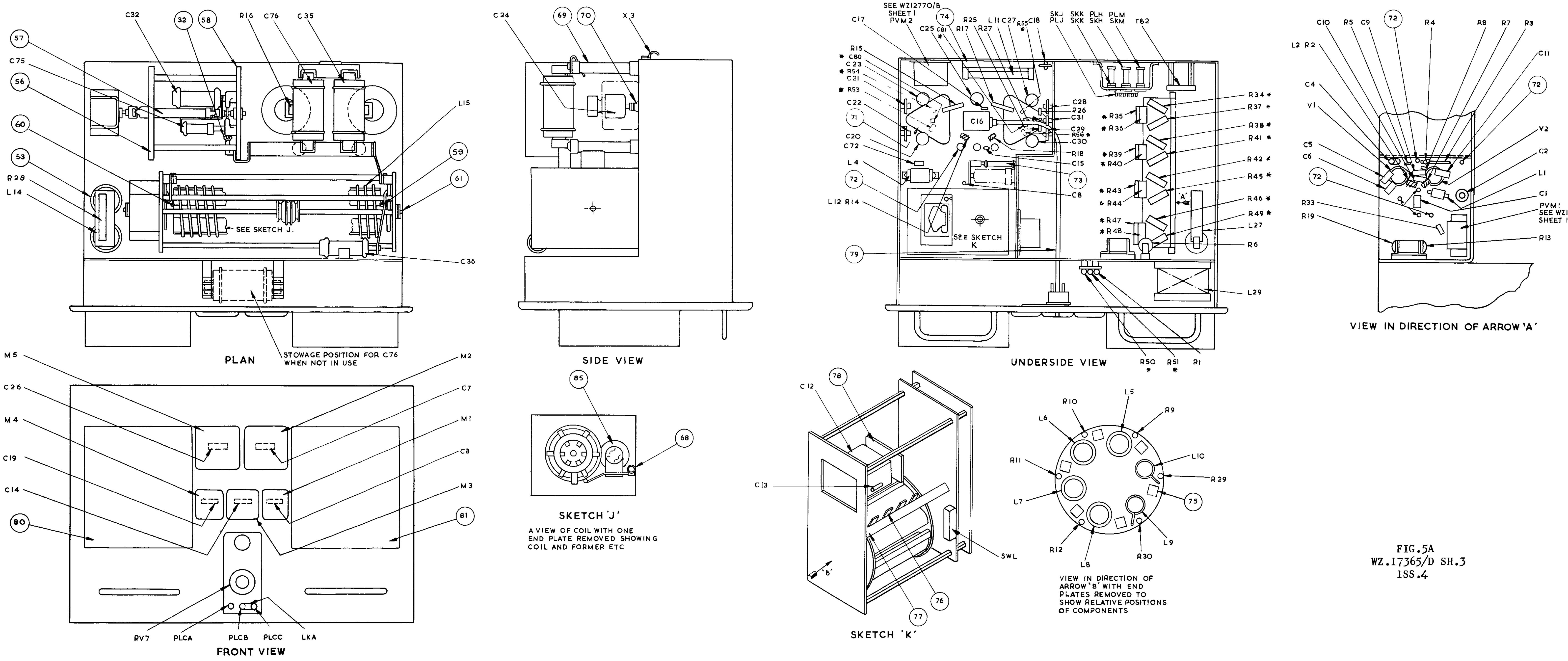
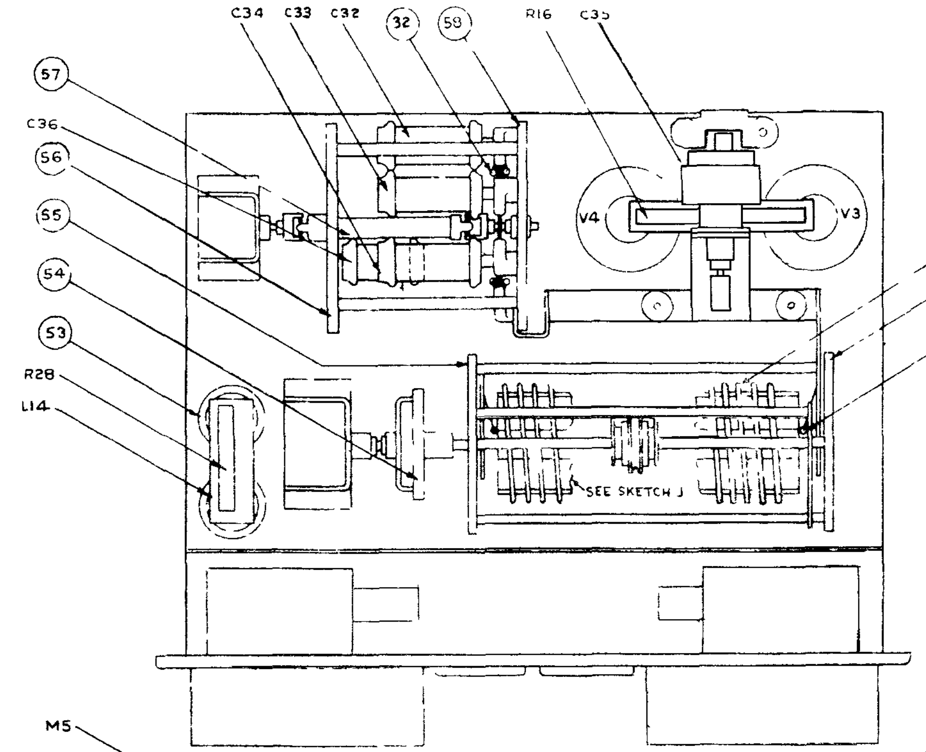
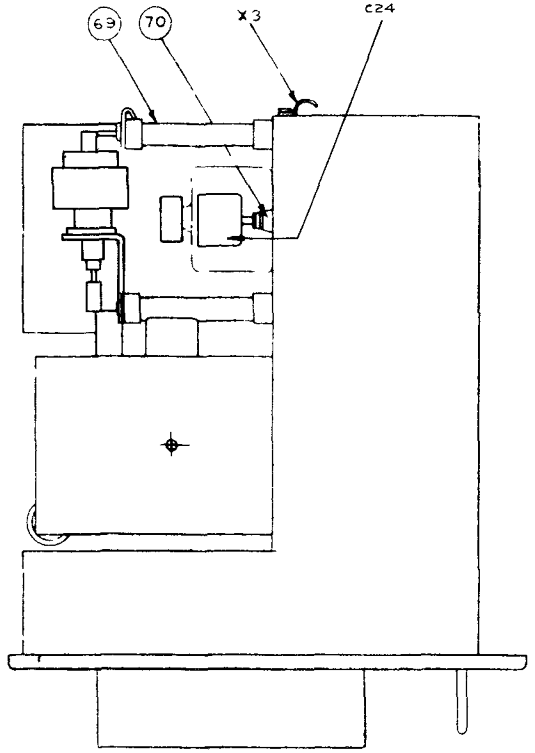


FIG.5A
WZ.17365/D SH.3
ISS.4

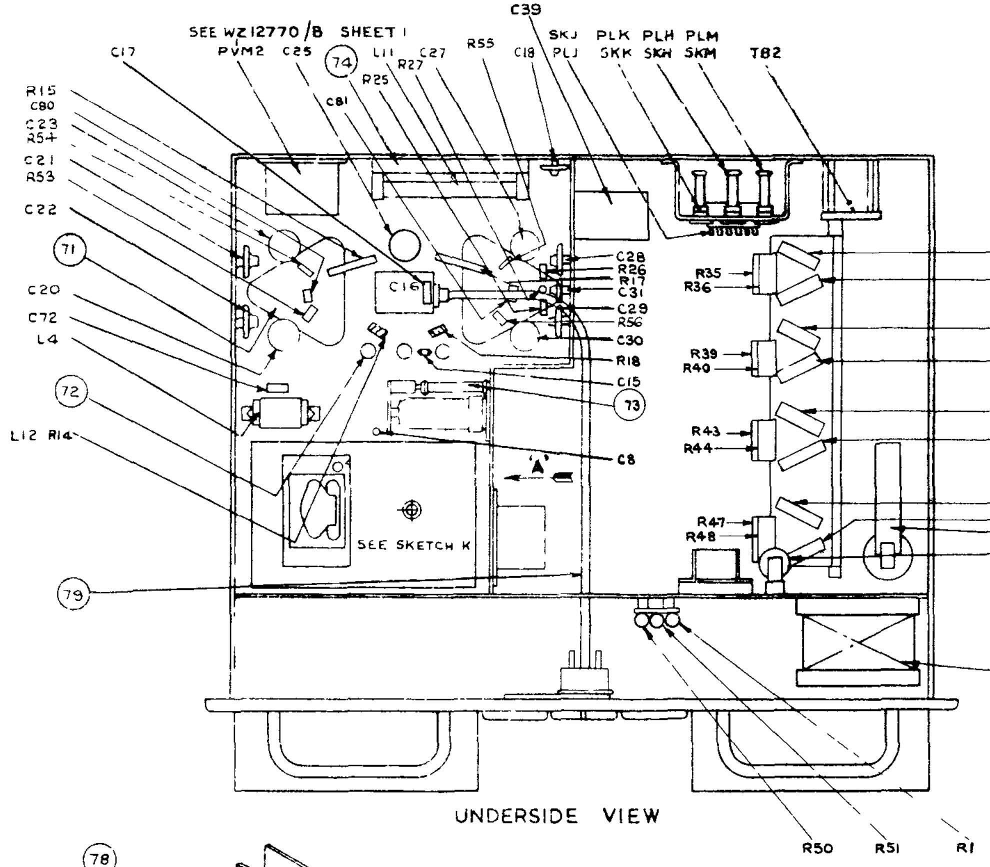
COMPONENT LAYOUT
R.F. UNIT, PART 3
HS31A



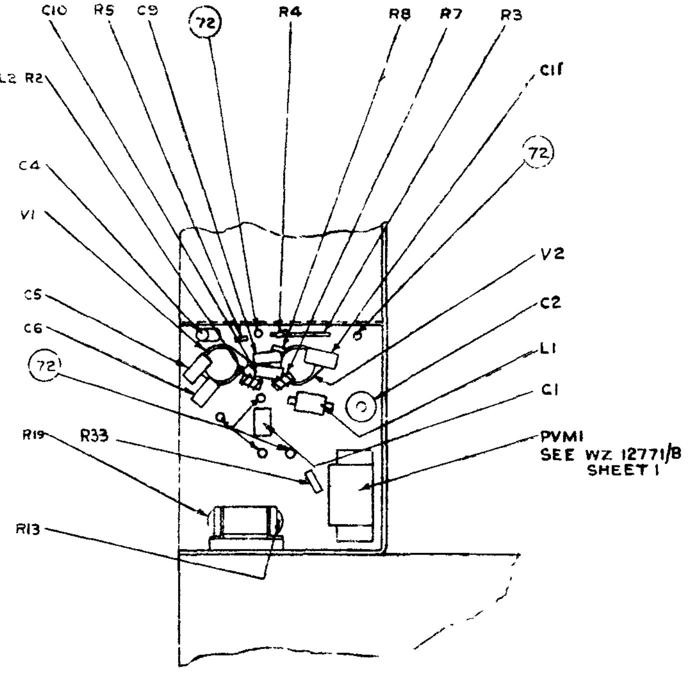
PLAN



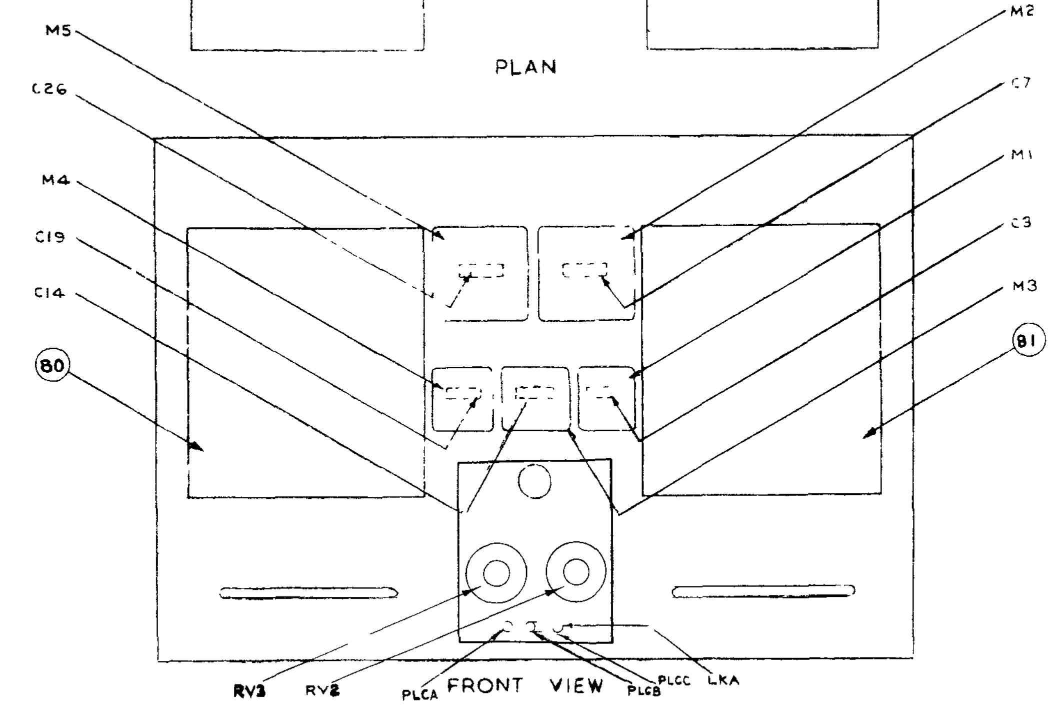
SIDE VIEW



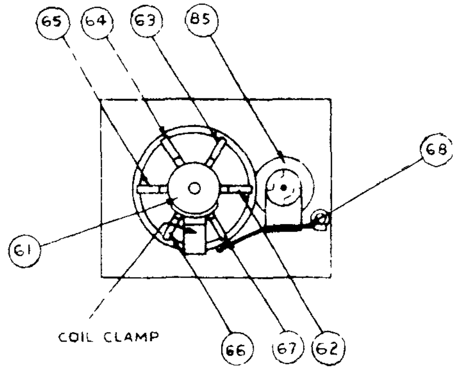
UNDERSIDE VIEW



VIEW IN DIRECTION OF ARROW A

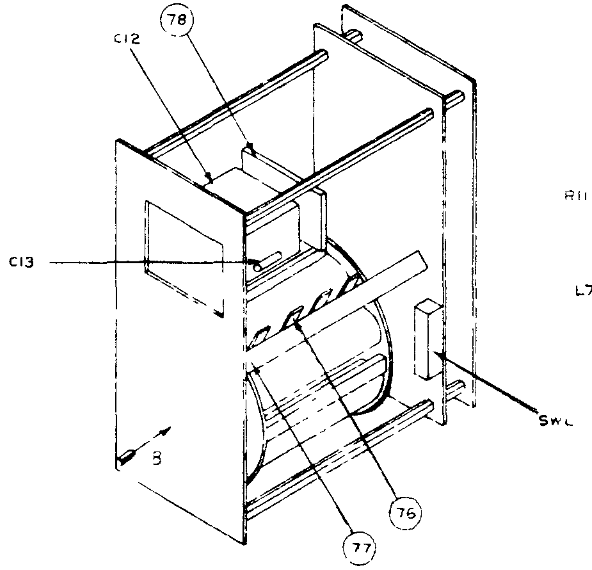


FRONT VIEW

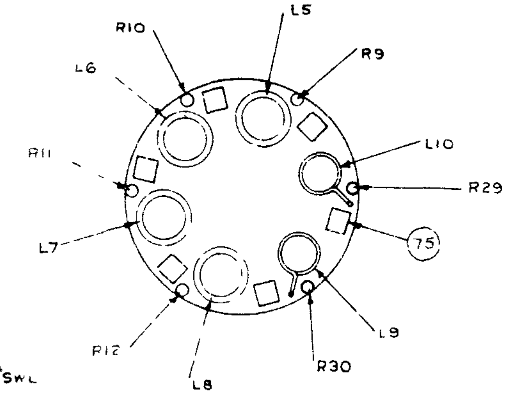


SKETCH J

A VIEW OF COIL WITH ONE END PLATE REMOVED SHOWING COIL FORMERS RELATIVE TO COIL CLAMP



SKETCH K



VIEW IN DIRECTION OF ARROW B WITH END PLATES REMOVED TO SHOW RELATIVE POSITIONS OF COMPONENTS

FIG.5B
WZ.26510/D SH.3
ISS.2

COMPONENT LAYOUT
R.F. UNIT, PART 3
HS31/1

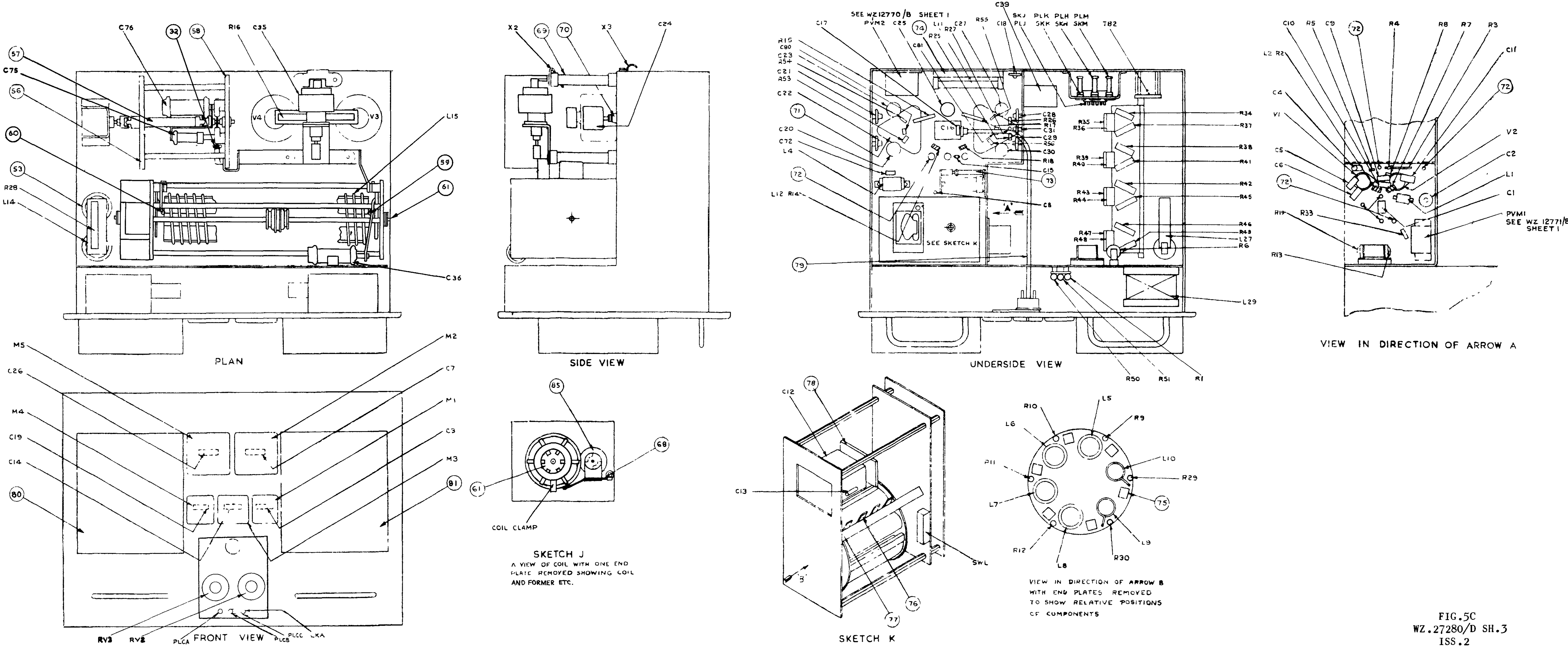
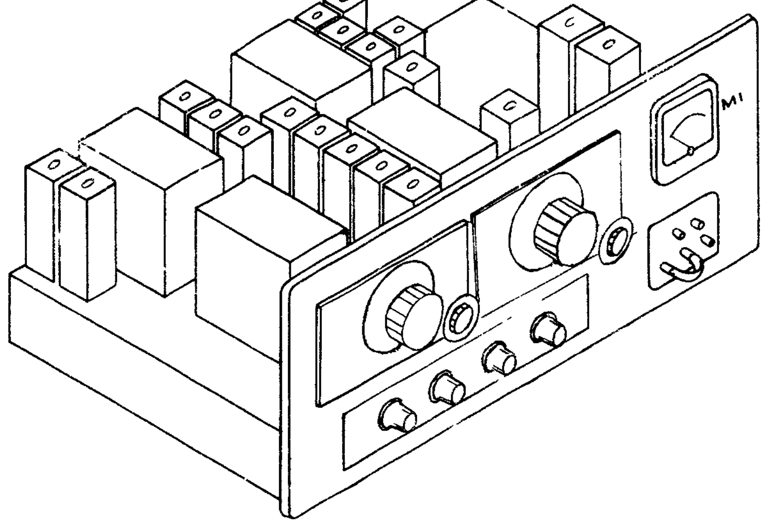
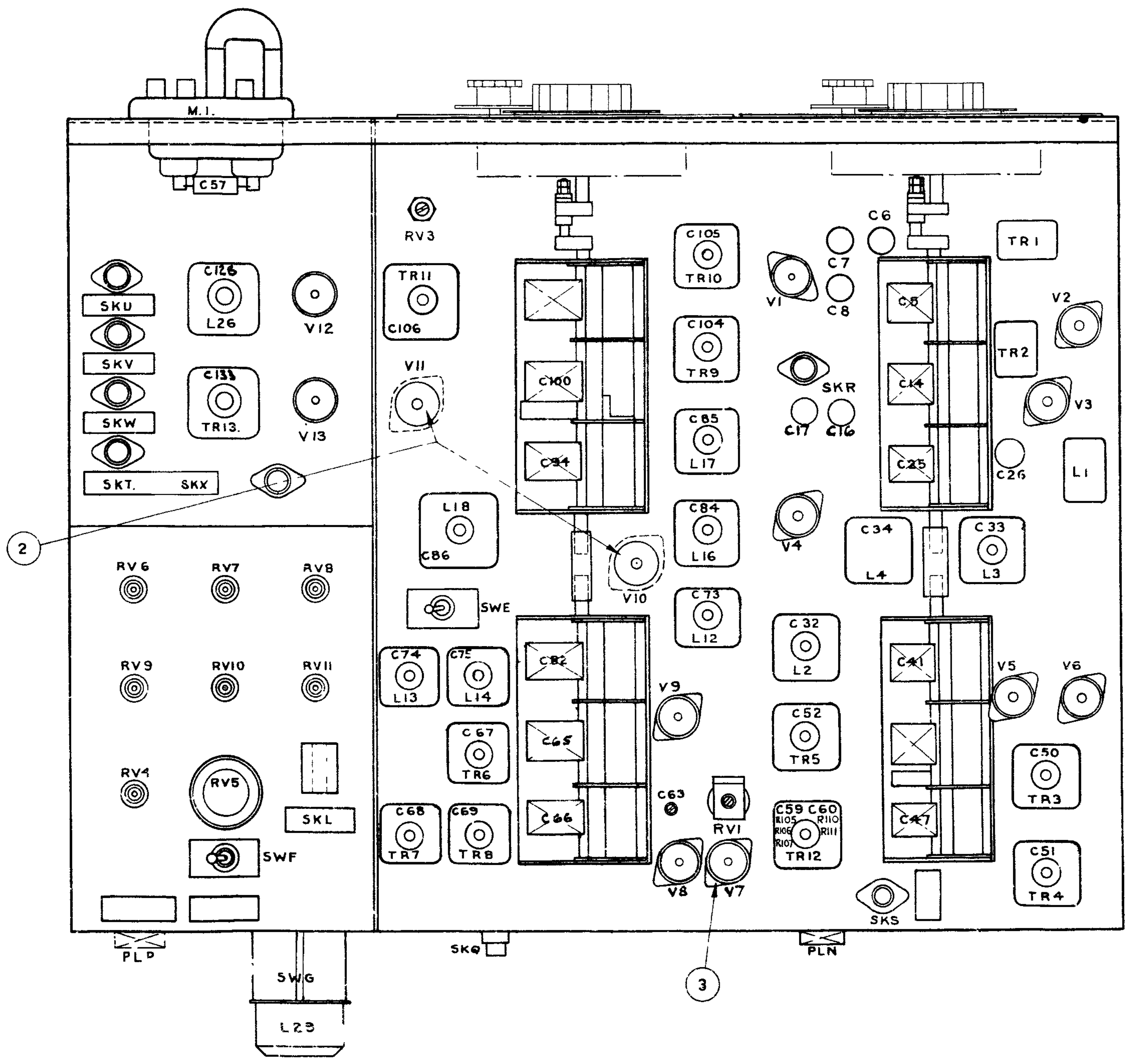


FIG.5C
WZ.27280/D SH.3
ISS.2

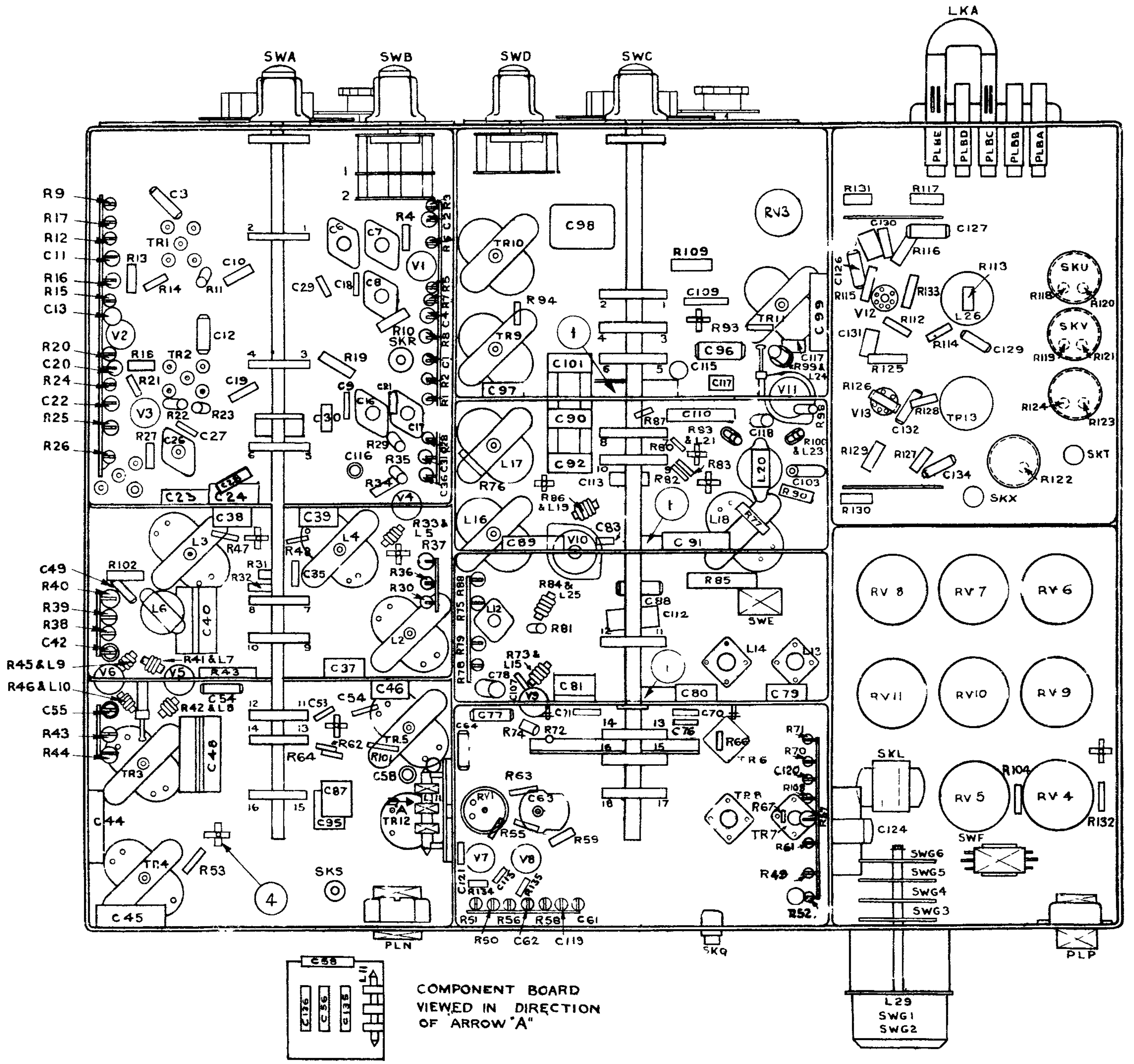
COMPONENT LAYOUT
R.F. UNIT, PART 3
HS31A/1



PLAN VIEW

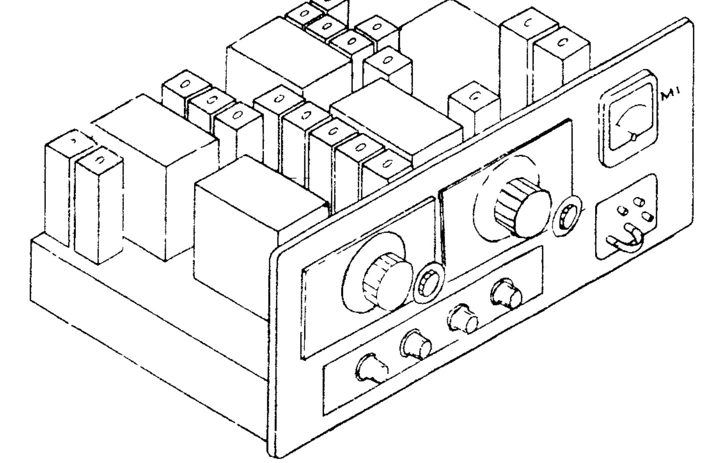


UNDERSIDE VIEW

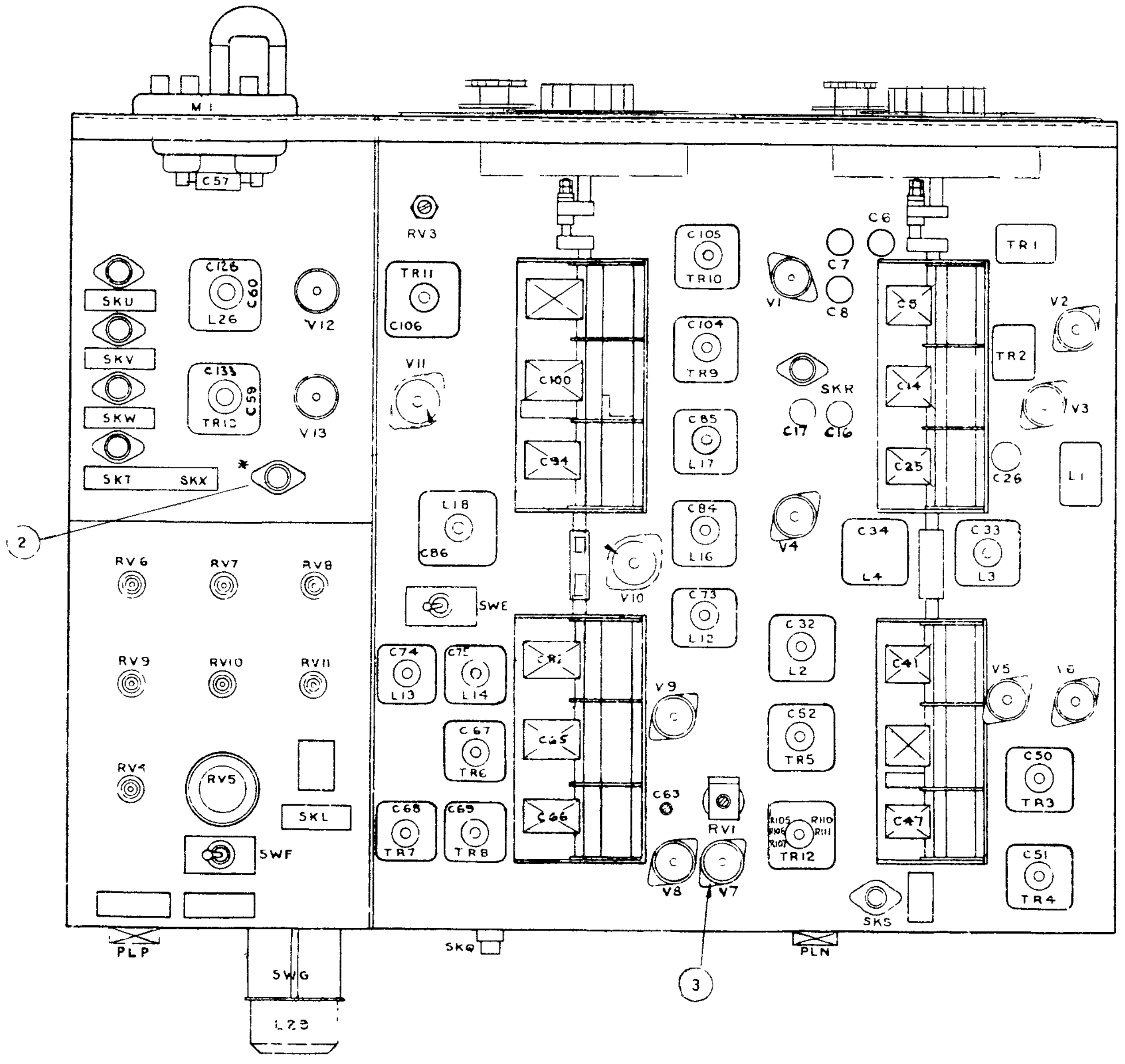


COMPONENT LAYOUT
MIXER UNIT
WZ.17591/D Sh.1 Iss.2

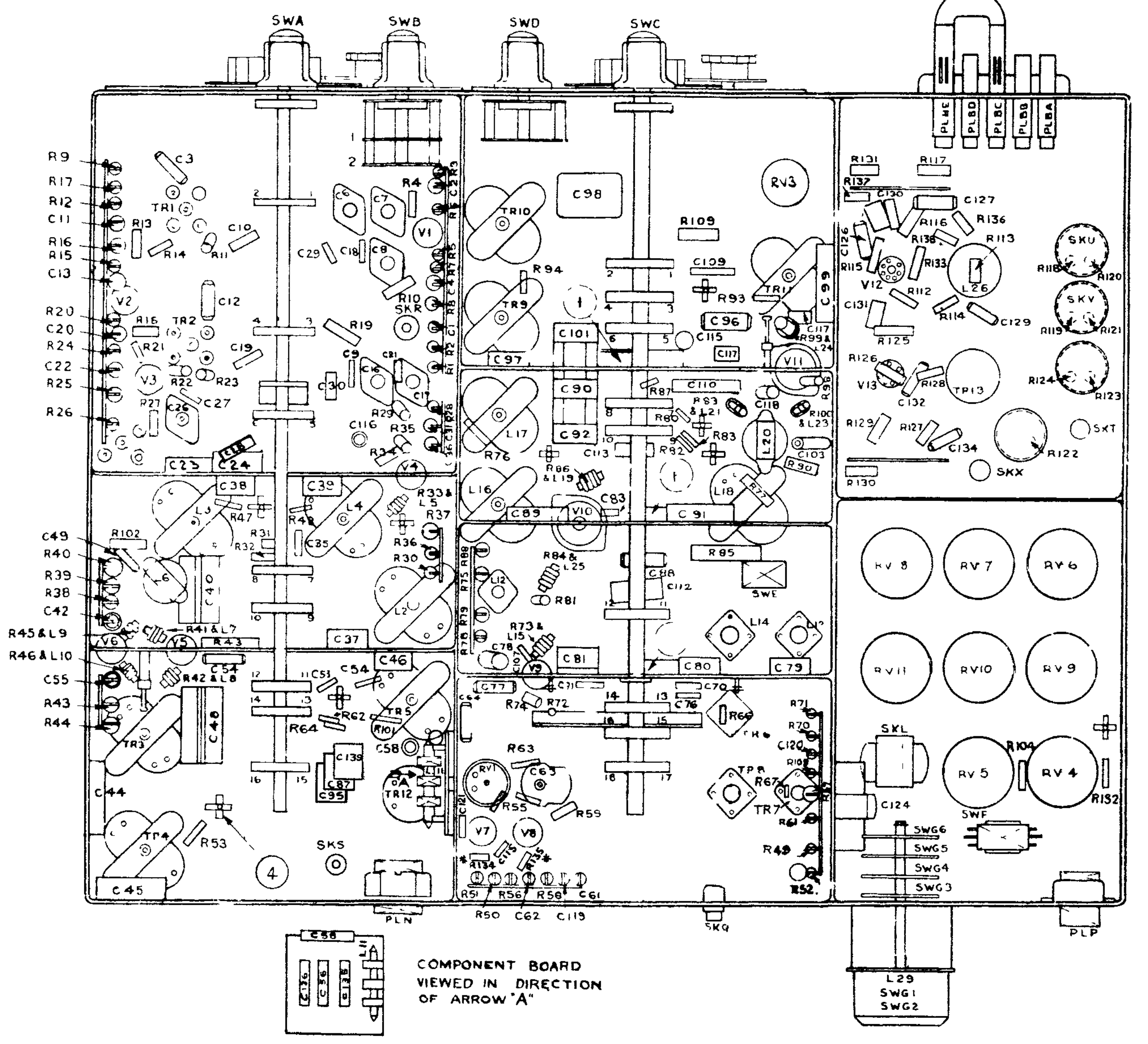
FIG.6



PLAN VIEW



UNDERSIDE VIEW



A.P.116E-0231-1
2nd Edn. Oct. '67

COMPONENT LAYOUT
MIXER UNIT, HS31A

FIG.6A
WZ.24355 SH.1
ISS.2

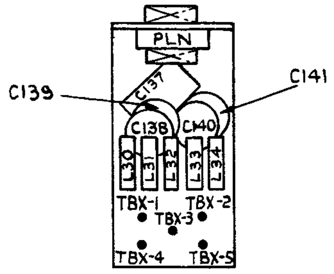
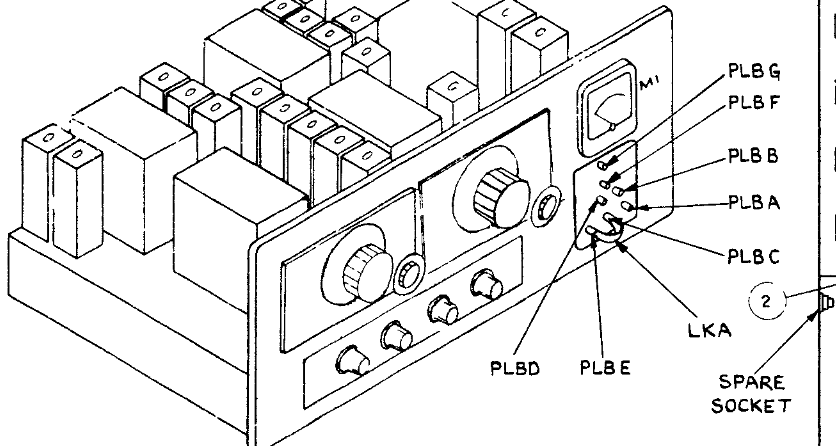
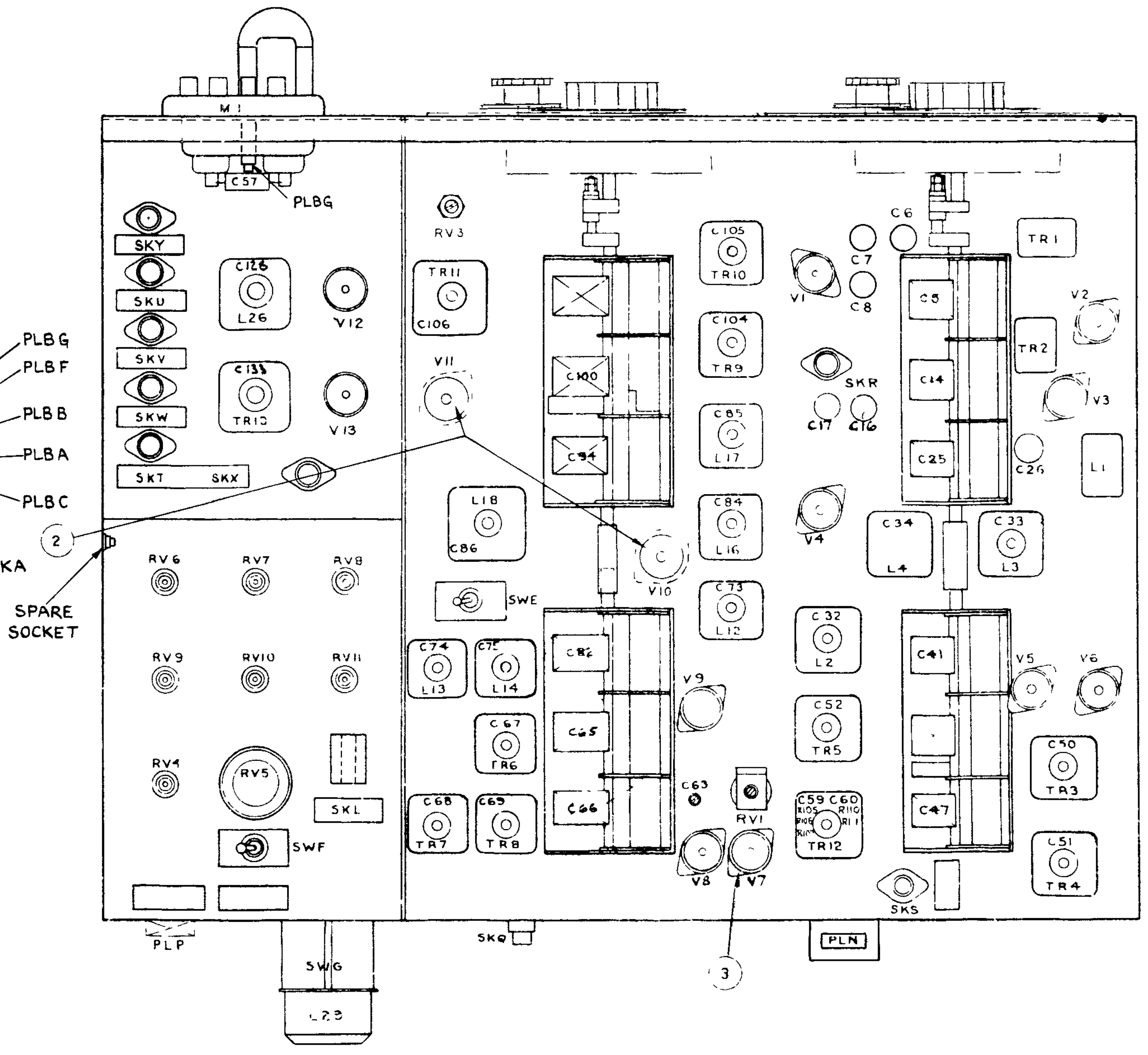


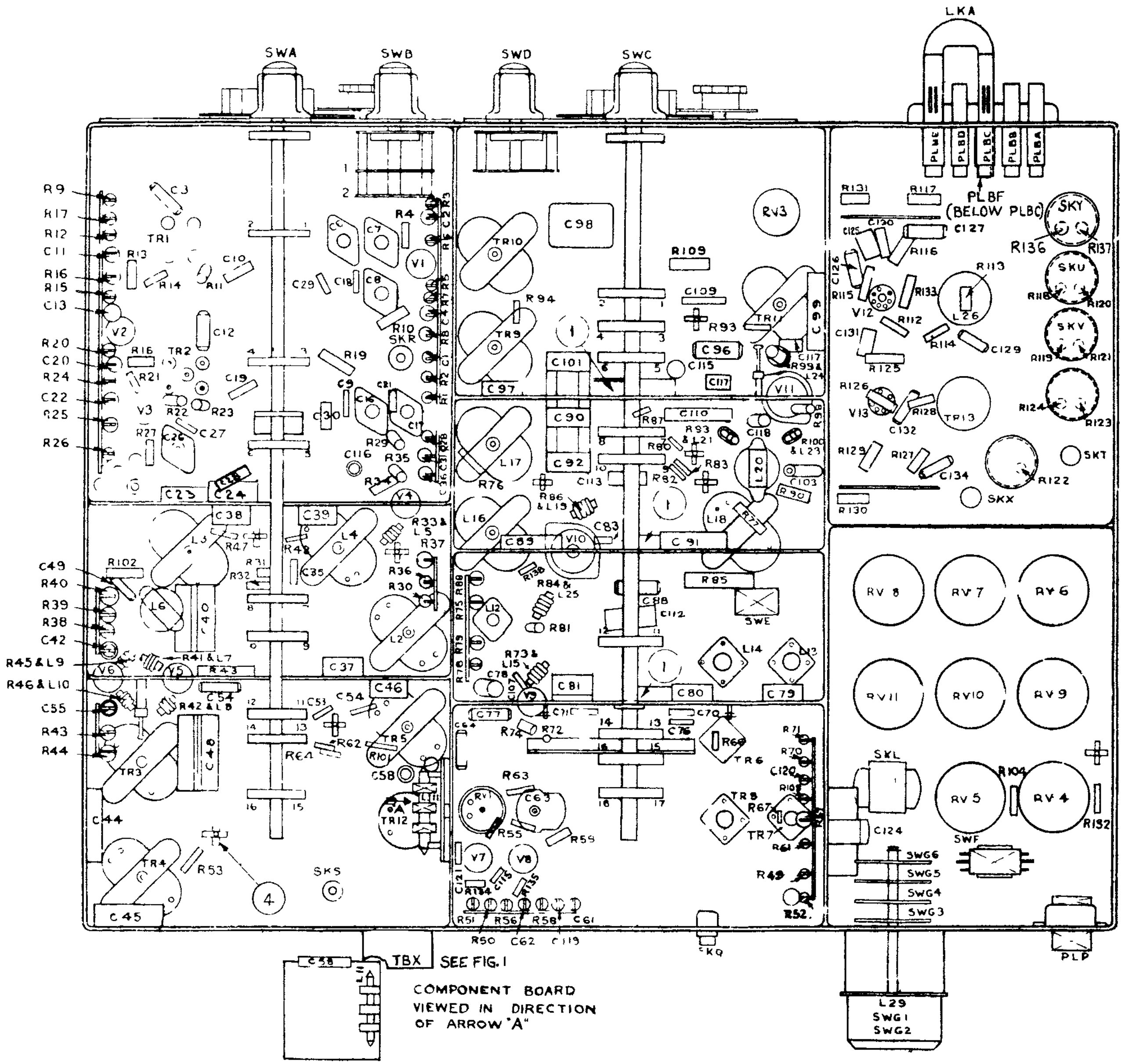
FIG. 1

PLAN VIEW

UNDERSIDE VIEW







COMPONENT LAYOUT
MIXER UNIT, HS31/1

FIG.6B
WZ.26512/D SH.1
ISS.1

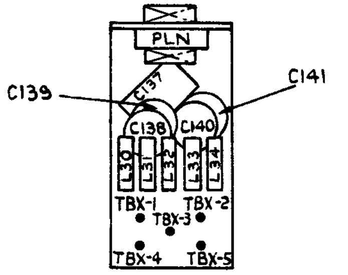
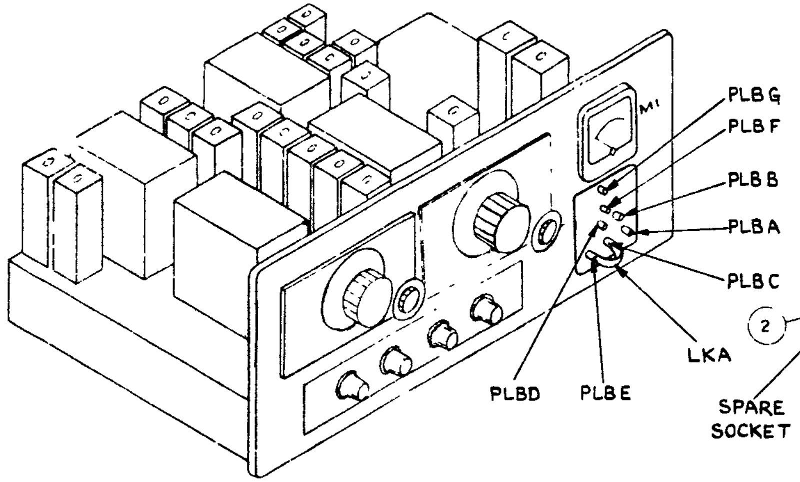
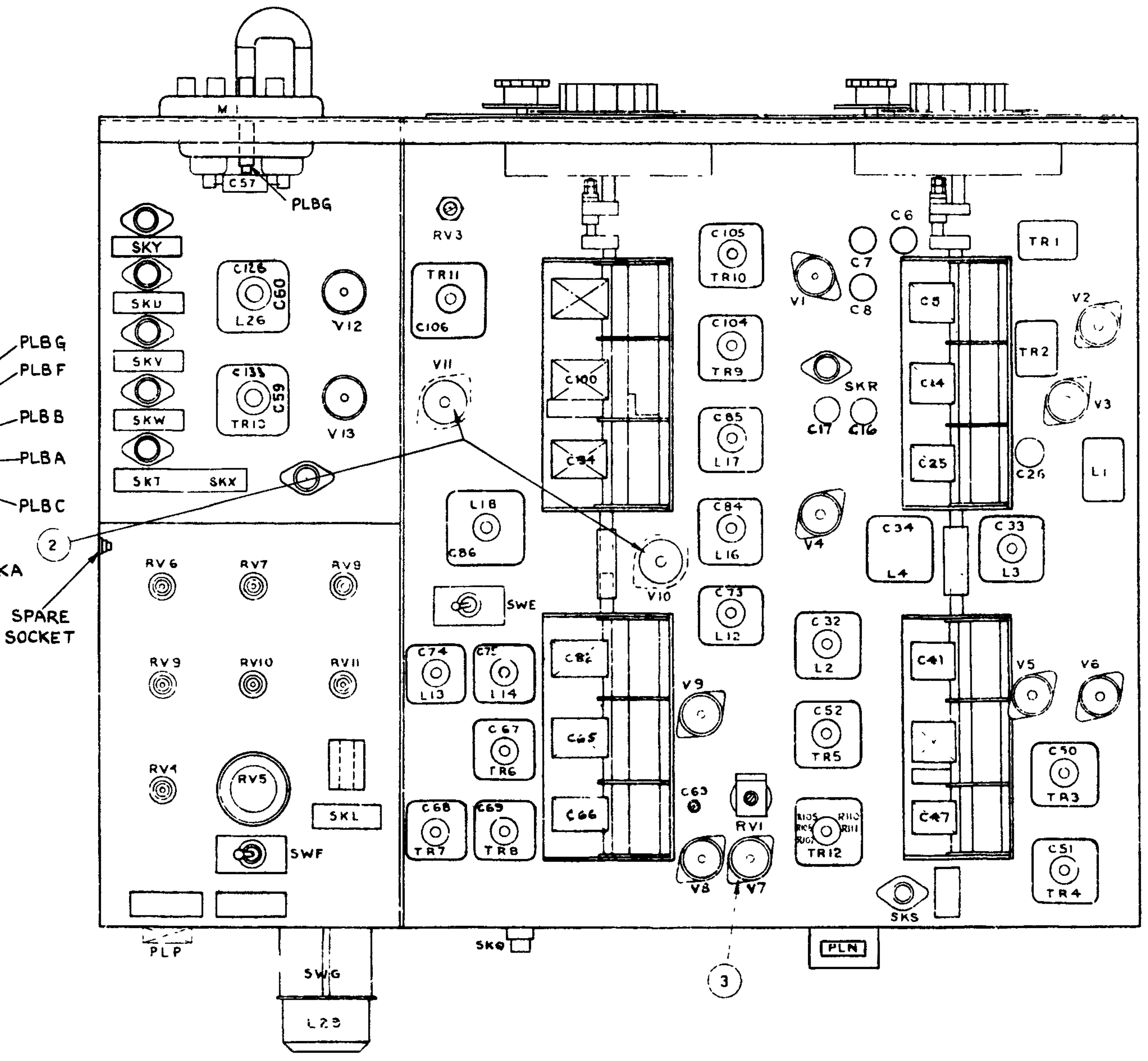


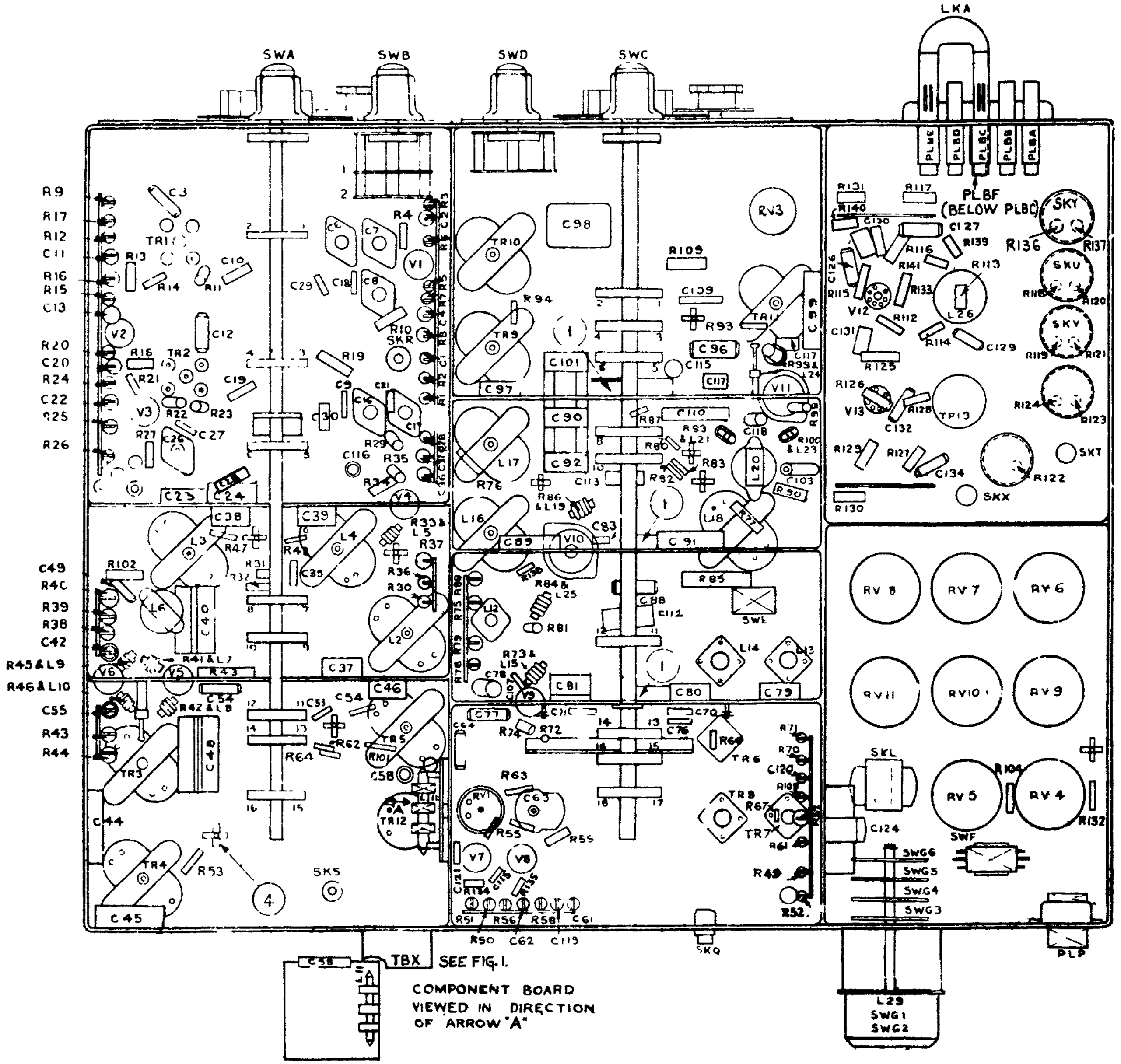
FIG. 1



PLAN VIEW

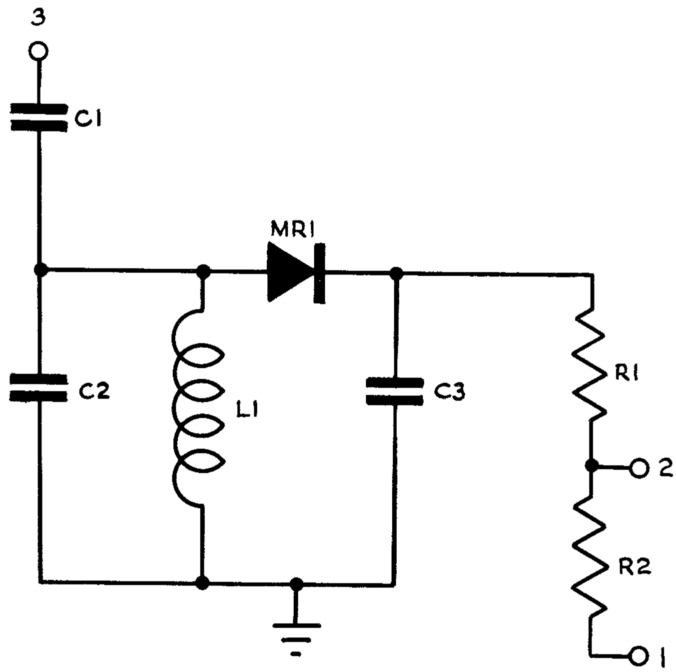


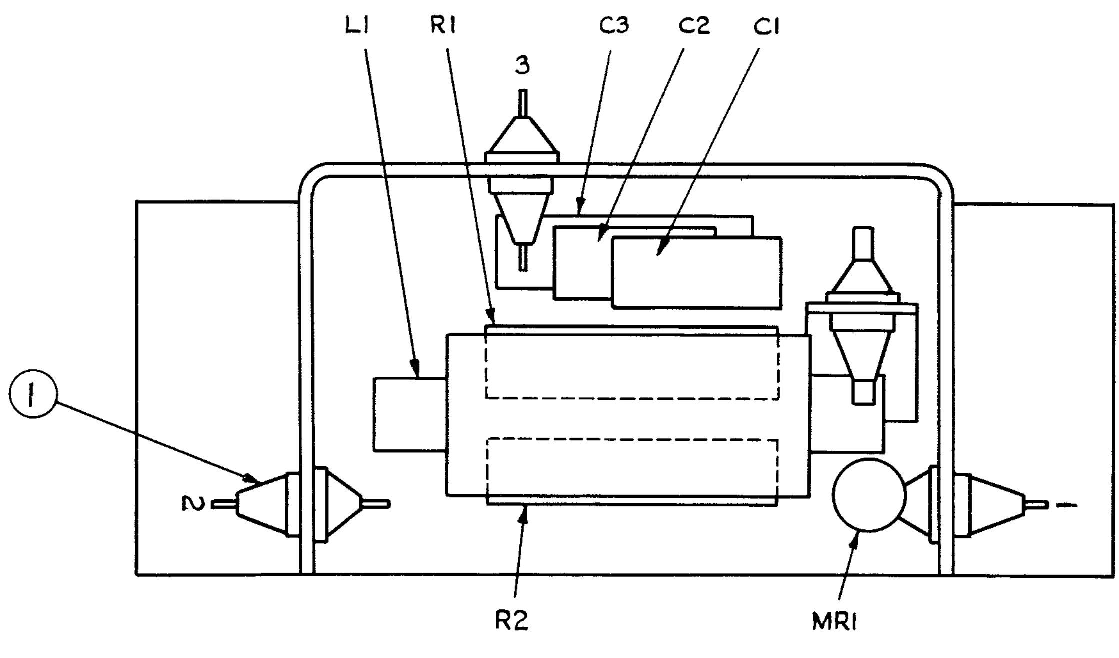
UNDERSIDE VIEW



COMPONENT LAYOUT
MIXER UNIT, HS31A/1

FIG.6C
WZ.27282/D SH.1
ISS.1





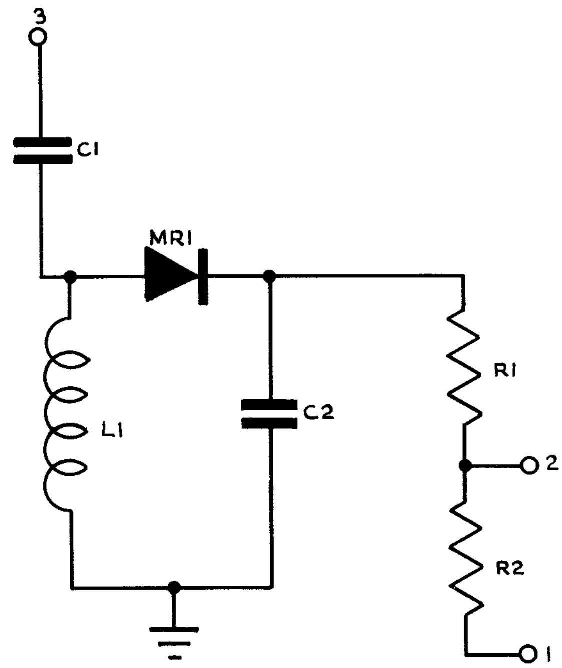
: 0-250 VOLTS WHEN CONNECTED TO TERMINAL 1 & EARTH.

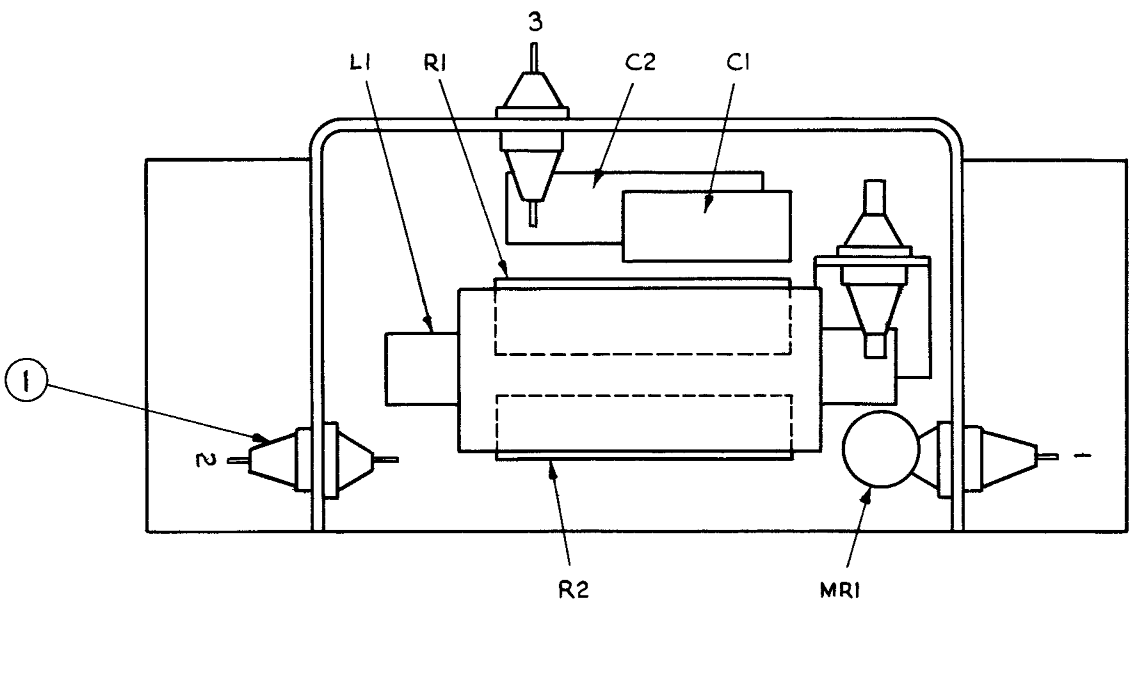
2D

CIRCUIT AND COMPONENT LAYOUT
PEAK VOLTMETER UNIT
WZ.12770/B Sh.1 Iss.1

1965

FIG.7





RANGE { 0-15 VOLTS WHEN CONNECTED TO TERMINAL 1 & EARTH
0- 5 VOLTS WHEN CONNECTED TO TERMINAL 2 & EARTH.

CIRCUIT AND COMPONENT LAYOUT
PEAK VOLTMETER UNIT
WZ.12771/B Sh.1 Iss.1

FIG.8

FIG. 9 BLOCK DIAGRAM

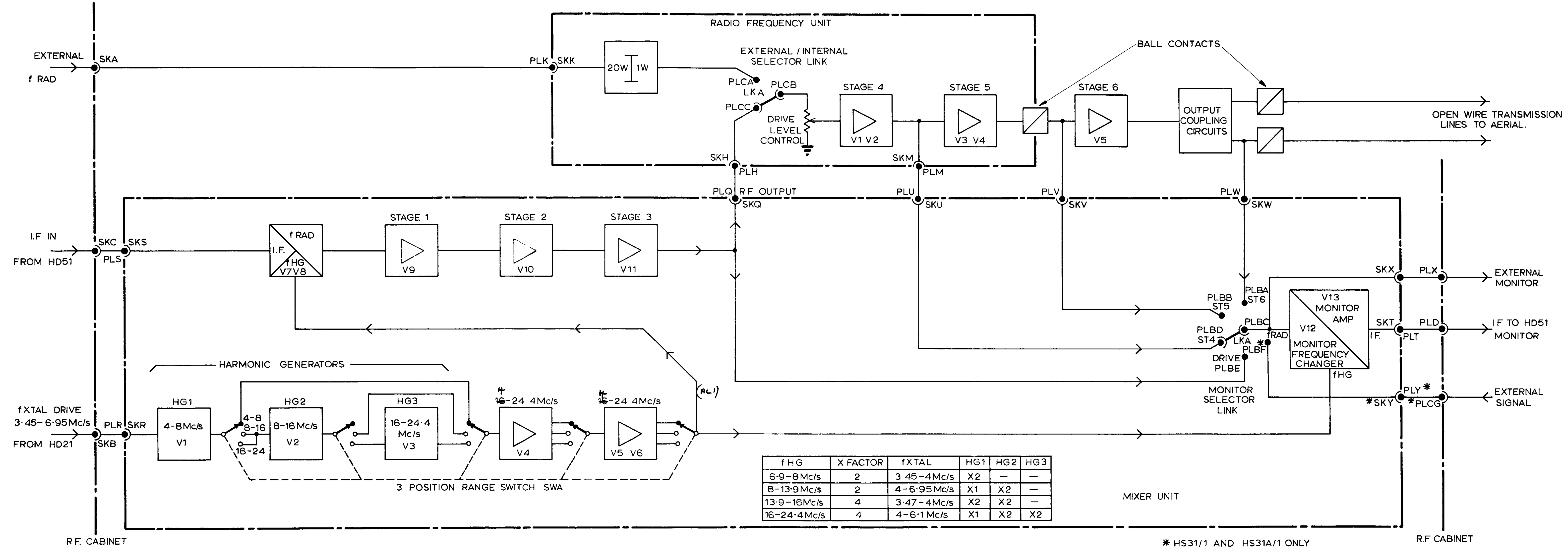
Changes arising from Modification 1312.

(Monitoring of Transmitter, Radio Type T.16719 when radiating on frequencies between 2.5 and 20 Mc/s).

The modification applies only to Transmitter, Radio, Type 16179 (HS31A) in the HS.31 series, and involves the use of an I.F. of 3.1 Mc/s throughout the fRAD range.

The fxtal/fHG conversion table on Fig. 9 applies to HS.31 and HS.31/1 (fRAD 4 - 27.5 Mc/s) when using an I.F. of 3.1 Mc/s. The conversion table relating to HS.31A when using an I.F. of 3.1 Mc/s to permit the use of Monitor, R.F., Type 10160 (Marconi HD.24) under Modification 1312 is given below. The fxtal DRIVE input to SKB will then range from 3.2 to 6.55 Mc/s.

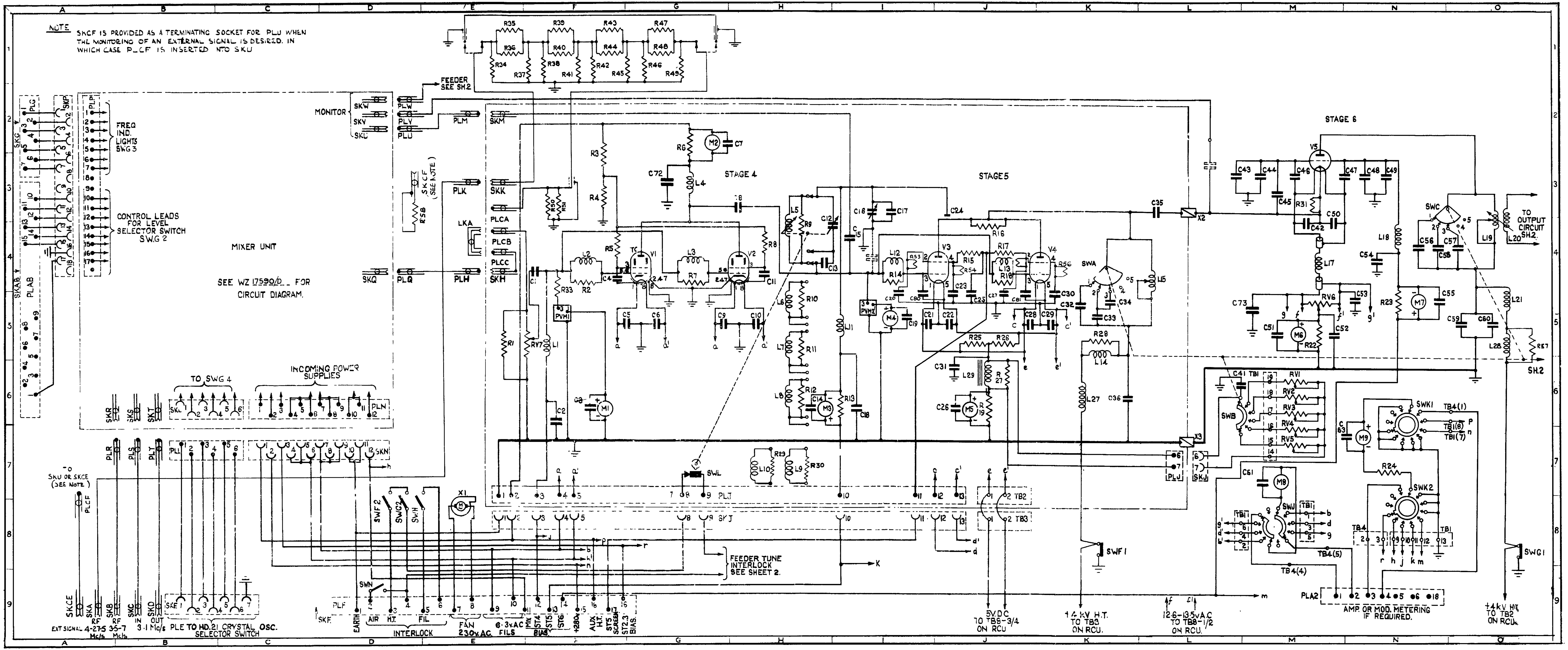
Transmitter, Radio, Type T.16719 (HS.31A) Using 3.1 Mc/s I.F.								
fRAD (Mc/s)	fRAD switch (SWC) setting	fHG (Mc/s)	Mult. Factor	fHG switch (SWA) setting	fxtal (Mc/s)	HG.1 (V1)	HG.2 (V2)	HG.3 (V3)
2.5-2.9	2.5-5	5.6-6.0	1	4 - 8	5.6-6.0	Amp.	-	-
3.3-4.9		6.4-8.0	2		3.2-4.0	X2	-	-
4.9-5.0		8.0-8.1	2	8 - 16	4.0-4.05	Amp.	X2	-
5.0-10.0	5-10	8.1-13.1	2		4.05-6.55	Amp.	X2	-
10.0-19.1	10-20	13.1-16.0	4		3.275-4.0	X2	X2	-
19.1-20.0		16.0-16.9	4	16 - 24.4	4.0-4.225	Amp.	X2	X2



f HG	X FACTOR	f XTAL	HG1	HG2	HG3
6·9–8 Mc/s	2	3·45–4 Mc/s	X2	—	—
8–13·9 Mc/s	2	4–6·95 Mc/s	X1	X2	—
13·9–16 Mc/s	4	3·47–4 Mc/s	X2	X2	—
16–24·4 Mc/s	4	4–6·1 Mc/s	X1	X2	X2

BLOCK DIAGRAM
R.F. CABINET
HS31 SERIES

FIG.9
WZ.31711/D SH.1
ISS.1



CIRCUIT
RADIO FREQUENCY UNIT, SHEET 1
WZ.17588/D Sh.1 Iss.7

R.F. UNIT 3.5kW ISB TRANSMITTER TYPE HS.31A
WQ.12610 Sh.1-6 Ed.A
W.37907 Sh.9 Ed.C

Cross Reference List
for WZ.17364/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	12	C41	26					PLCA	184	R25	229			SWF1	330
C2	13	C42	13					PLCB	184	R26	229			SWF2	331
C3	14	C43	27			M1	145	PLCC	184	R27	230			SWG1	332
C4	14	C44	27	L1	86	M2	146			R28	231			SWG2	333
C5	14	C45	28	L2	91	M3	147			R29	220	RV1	290	SWH	334
C6	14	C46	29	L3	91	M4	148			R30	220	RV2	290	SWJ	335
C7	14	C47	29	L4	92	M5	149			R31	231	RV3	290	SWK	336
C8	15	C48	27	L5	93	M6	150	PVM1	156	R33	232	RV4	290	SWL	331
C9	14	C49	27	L6	94	M7	151	PVM2	157	R34	233	RV5	290	SWN	331
C10	14	C50	13	L7	95	M8	152			R35	234	RV6	291		
C11	14	C51	14	L8	96	M9	153			R36	234	RV7	292		
C12	16	C52	13	L9	97					R37	233				
C13	17	C53	30	L10	98			R1	213	R38	235			TB1	356
C14	14	C54	13	L11	99	PLA	168	R2	214	R39	236	SKA	299	TB2	357
C15	18	C55	14	L12	91	PLB	169	R3	215	R40	236	SKB	299	TB3	358
C16	19	C56	31	L13	91	PLC	170	R4	216	R41	235	SKC	299	TB4	359
C17	20	C57	32	L14	100	PLD	171	R5	217	R42	237	SKD	299		
C18	21	C58	33	L15	101	PLE	172	R6	218	R43	238	SKE	301		
C19	14	C59	34	L18	102	PLF	173	R7	214	R44	238	SKF	300	V1	393
C20	13	C60	34	L19	103	PLG	173	R8	217	R45	239	SKG	302	V2	393
C21	13	C61	14	L20	(104A	PLH	170	R9	219	R46	239	SKH	299	V3	394
C22	13	C63	14		(104B	PLJ	173	R10	219	R47	240	SKJ	303	V4	394
C23	13	C72	38	L21	105	PLK	174	R11	219	R48	240	SKK	299	V5	395
		C73	30	L27	108	PLL	175	R12	220	R49	241	SKM	299		
C25	13	C75	40	L28	109	PLM	176	R13	221	R50	213	SKN	304		
C26	14	C76	24	L29	110	PLQ	177	R14	222	R51	213	SKP	305	X1	405
C27	13	C77	41	L30	111	PLR	178	R15	223	R53	242	SKAB	306	X2	406
C28	13	C80	43	L31	112	PLS	179	R16	224	R54	242	SKAZ	307	X3	407
C29	13	C81	43			PLT	180	R17	223	R55	242				
C30	13					PLU	181	R18	222	R56	242				
C31	13					PLV	182	R19	225	R57	243				
C32	23			LKA	137	PLW	183	R22	226			SWA	326		
C35	24			LKB	138	PLAB	173	R23	227			SWB	327		
C36	25			LKC	139	PLAZ	173	R24	228			SWC	328		

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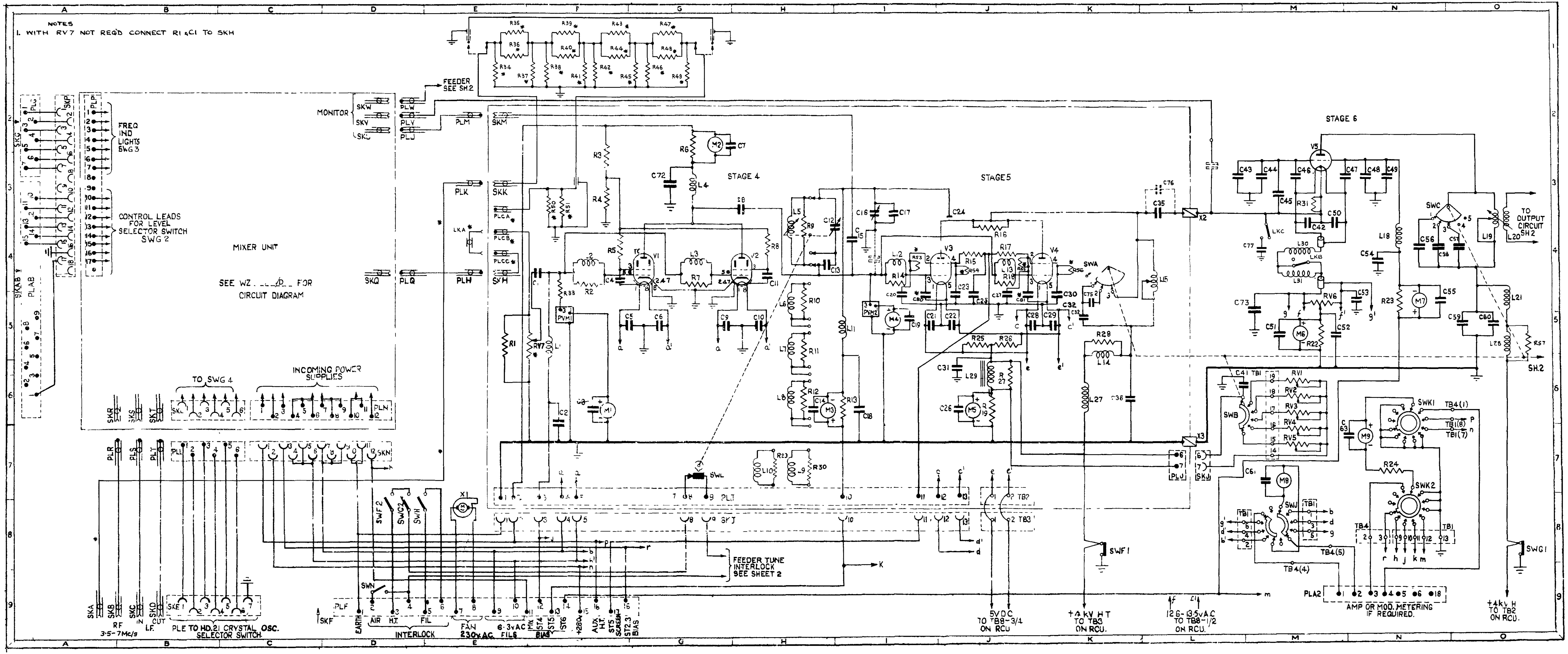


A.P.116E-0231-1
2nd Edn. Oct. '67

CIRCUIT DIAGRAM
R.F. UNIT, PART 1
HS31A

FIG.10A
WZ.17364/D SH.1
ISS.6

R.F. UNIT
(Refer to Master Components List T5553)

Cross Reference List
for WZ.26509/D Sh.1&2 (Fig.10&11)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	16	C38		C75		L23	170	PLL	268	R14	311	R51	317		
C2	17	C39	32	C76		L24		PLM	269	R15	326	R52		SWA	457
C3	18	C40	33	C77		L25		PLQ	270	R16	327	R53	346	SWB	458
C4	18	C41		C78		L26	171	PLR	271	R17	326	R54	346	SWC	459
C5	18	C42	17	C79		L27	172	PLS	272	R18	311	R55	346	SWF1	461
C6	18	C43	35	C80	45	L28	173	PLT	273	R19	328	R56	346	SWF2	460
C7	18	C44	35	C81	45	L29	174	PLU	274	R20		R57	347	SWG1	462
C8	19	C45	36	C82	11	L30	175	PLV	275	R21		R58	382	SWG2	413
C9	18	C46	37	C83	11	L31	175	PLW	276	R22	329			SWH	464
C10	18	C47	37	C84	73	L32	176	PLY	270	R23	330			SWJ	465
C11	18	C48	35	C85	73	L33	176	PLAB	265	R24	331			SWK	466
C12	20	C49	35					PLAZ	265	R25	332			SWL	460
C13	21	C50	17					PLCA	263	R26	332			SWM	460
C14	18	C51	18					PLBB	263	R27	333	RV1	393	SWN	467
C15	22	C52	17			LKA	214	PLCC	263	R28	334	RV2	392	SWP	468
C16	23	C53	34	L1	148			PLCG	263	R29	324	RV3	395		
C17	74	C54	17	L2	154	M1	220			R30	324	RV4		TB1	483
C18	25	C55	18	L3	154	M2	221			R31	334	RV5		TB2	484
C19	18	C56	27	L4	155	M3	222			R32	335	RV6		TB3	485
C20	17	C57	28	L5	156	M4	223	PVM1	216	R33	336	RV7		TB4	486
C21	17	C58	38	L6	157	M5	224	PVM2	231	R34	337				
C22	17	C59	39	L7	158	M6	225	PVM3		R35	338	SKA	406	V1	517
C23	17	C60	39	L8	159	M7	226	PVM4	231	R36	338	SKB	406	V2	517
C24	26	C61	18	L9	160	M8	227			R37	337	SKC	406	V3	518
C25	17	C62		L10	161	M9	228	R1	317	R38	339	SKD	406	V4	518
C26	18	C63	18	L11	162	M10	229	R2	318	R39	340	SKE	407	V5	519
C27	17	C64	40	L12	154			R3	319	R40	340	SKF	408		
C28	17	C65	41	L13	154	PLA	263	R4	320	R41	339	SKG	409	X1	428
C29	17	C66	41	L14	163	PLB	263	R5	321	R42	341	SKH	410	X2	113
C30	17	C67	18	L15	164	PLC	263	R6	322	R43	342	SKJ	411	X3	106
C31	17	C68	42	L16		PLD	263	R7	308	R44	342	SKK	410	X4	107
C32	27	C69	42	L17	165	PLE	264	R8	321	R45	343	SKM	410	X5	107
C33	28	C70	42	L18	166	PLF	265	R9	323	R46	343	SKN	412	X6	108
C34	29	C71	42	L19	167	PLG	265	R10	323	R47	344	SKP	413	X7	108
C35	30	C72	43	L20	168	PLH	266	R11	323	R48	344	SKAB	415	X8	108
C36	31	C73	34	L21	169	PLJ	265	R12	324	R49	345	SKAZ	414	X9	108
C37		C74	44	L22	170	PLK	267	R13	325	R50	317	SKCG	405	X10	108

R.F. UNIT
(Refer to Master Components List T5553)

Cross Reference List
for WZ.26509/D Sh.1&2 (Fig.10&11)

MISCELLANEOUS MECHANICAL ITEMS

Ref. 1	Insulator Ceramic	No.198
Ref. 2	Air Filter	No.119
Ref. 3		
Ref. 4	Mounting Board Mycalex	No.236
Ref. 5	Mounting Board Mycalex	No.237
Ref. 6	Insulator	No.199
Ref. 7		
Ref. 8		
Ref. 9		
Ref.10		
Ref.11	Coil Mounting Plate Mycalex	No.238
Ref.12	Top Panel Mycalex	No.251
Ref.13	Contact Mounting Mycalex	No.239
Ref.14	End Cheek Mycalex	No. 81
Ref.15	Contact Mounting Mycalex	No.240
Ref.16	Rotor Mounting Mycalex	No.241
Ref.17	Contact Assembly	No. 87
Ref.18	Contact Assembly	No. 88
Ref.19		
Ref.20	Spring Contact	No. 89
Ref.21	Stand-Off Insulator	No.200
Ref.22	Mounting Board Mycalex	No.242
Ref.23	Spring Contact	No. 90
Ref.24	Grid Contact Spring	No. 91
Ref.25	Stand-Off Insulator	No.201
Ref.26	Ball Contact Assembly	No. 88
Ref.27	Spring	No.419
Ref.28	Switch Blade Assembly	No.472
Ref.29	Contact Panel Mycalex	No.252
Ref.30	Insulating Pillar	No.202
Ref.31	Mounting Plate Mycalex	No.243
Ref.32	Ball Contact Assembly	No. 93
Ref.33	End Plate Mycalex	No.257
Ref.34	Bearing Plate Mycalex	No.254
Ref.35	Spring Contact Assembly	No. 94
Ref.36	End Plate Mycalex	No.255
Ref.37	Spring Contact Assembly	No. 95
Ref.38	Spring Contact Assembly	No. 96
Ref.39		
Ref.40	Spring Contact Assembly	No. 97
Ref.41	Spring Flat	No.420
Ref.42	Coupling Coil Mounting Plate Mycalex	No.244
Ref.43	Spring Contact Assembly	No. 98
Ref.44	Spring Contact Assembly	No. 99
Ref.45	Spring Contact	No.100

R.F. UNIT
(Refer to Master Components List T5553)

Cross Reference List

for WZ.26509/D Sh.1&2 (Fig.10&11)

MISCELLANEOUS MECHANICAL ITEMS CONTD:

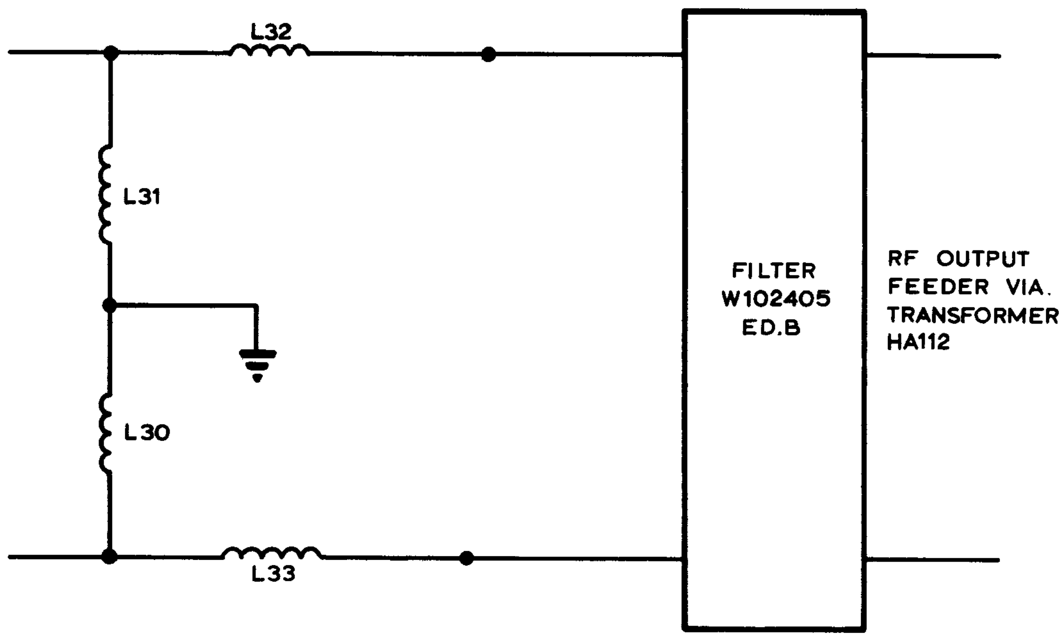
Ref.46	Spindle Assembly	No.424
Ref.47	Coil Support Mycalex	No.430
Ref.48	Coil Support Mycalex	No.431
Ref.49	Coil Support Mycalex	No.432
Ref.50	Coil Support Mycalex	No.433
Ref.51	Coil Support Mycalex	No.434
Ref.52	Coil Support Mycalex	No.435
Ref.53	Insulator Conical Porcelain	No.199
Ref.54	Insulating Piece Mycalex	No.203
Ref.55	Mounting Board Mycalex	No.245
Ref.56	Support Plate Mycalex	No.256
Ref.57	Coupling Bar Mycalex	No.116
Ref.58	Mounting Plate Mycalex	No.246
Ref.59	Mounting Board Mycalex	No.247
Ref.60	Spring Assembly	No.421
Ref.61	Shaft Assembly	No.403
Ref.62	Former Mycalex	No.127
Ref.63	Former Mycalex	No.128
Ref.64	Former Mycalex	No.129
Ref.65	Former Mycalex	No.130
Ref.66	Former Mycalex	No.131
Ref.67	Former Mycalex	No.132
Ref.68	Contact Assembly	No.101
Ref.69	Insulating Rod	No.204
Ref.70	Conical Insulator	No.205
Ref.71	Valveholder Ceramic 5 Pin	No.530
Ref.72	Insulator Stand-Off	No.201
Ref.73	Insulator Stand-Off	No.207
Ref.74	Base Mycalex	No. 1
Ref.75	Terminal Block Mycalex	No.487
Ref.76	Spring Contact	No.102
Ref.77	Spring Contact Plate Mycalex	No.259
Ref.78	Condenser Plate Mycalex	No.258
Ref.79	Flexible Drive Assembly	No.118
Ref.80	Manual Drive Assembly	No.119
Ref.81	Manual Drive Assembly	No.120
Ref.82	Manual Drive Assembly	No.121
Ref.83		
Ref.84	Spring Contact Assembly	No.103
Ref.85	Spring	No.422
Ref.86	Contact Mounting Mycalex	No.248
Ref.87	Contact Assembly	No. 88
Ref.88	End Cheek Mycalex	No. 82
Ref.89	Contact Assembly	No.105
Ref.90	Coupling Mycalex	No.115

NOTE: *The preceding Cross Reference List for T5553 identified 'for WZ.26509/D Sh.1 & 2 (Figs.10 & 11)' applies only to Fig.10B (WZ.26509/D Sh.1) following for identities of components in Fig.11 (WZ.17568/D Sh.2) refer to Components List No.1, R.F. Unit.*

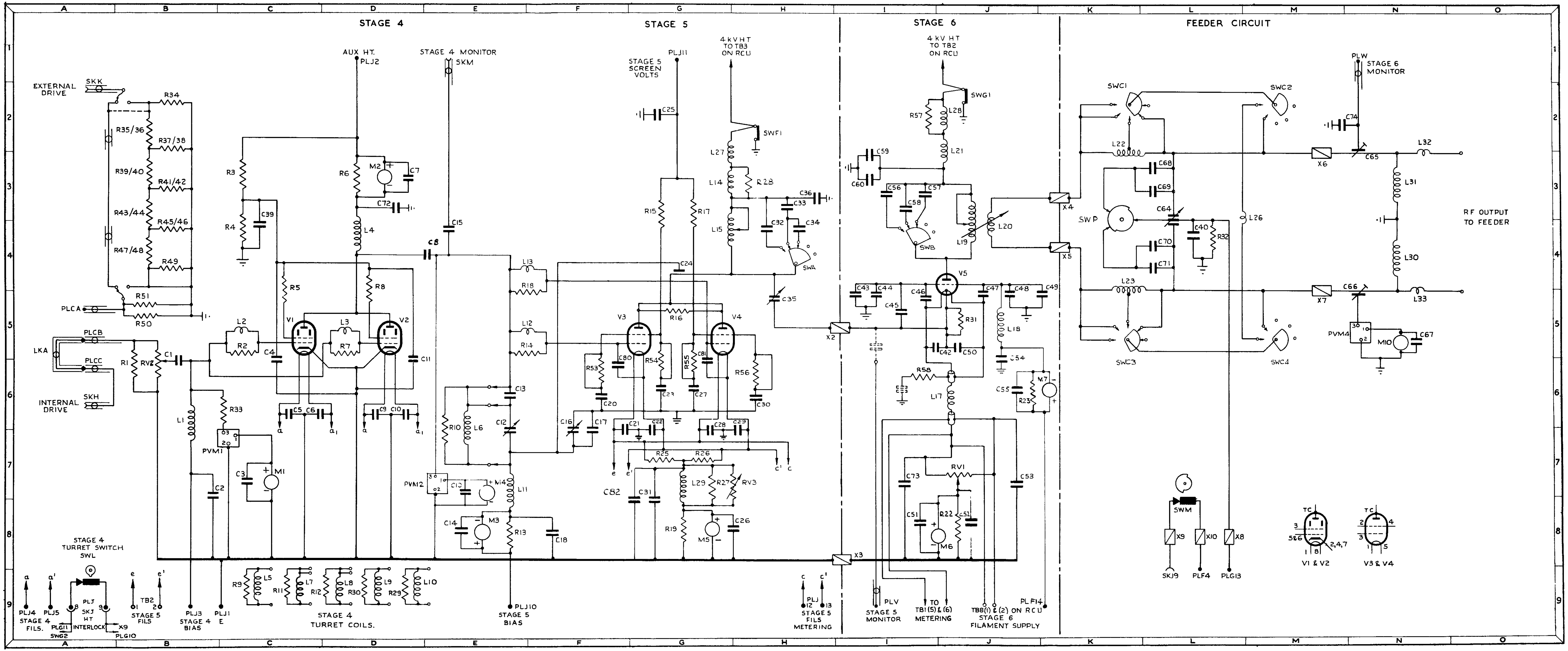
(To prec
Fig.10B

R.F. Unit of Transmitter HS31/1
(WZ.26509/D Sh.1)

Modification No.1785



Modification No.1785 entails the provision of Filter Type W.10240! Ed.B at the output of HS31/1 when 50 ohms output impedance is provided by Transformer Type HA112.



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2nd Edn. Oct. '67

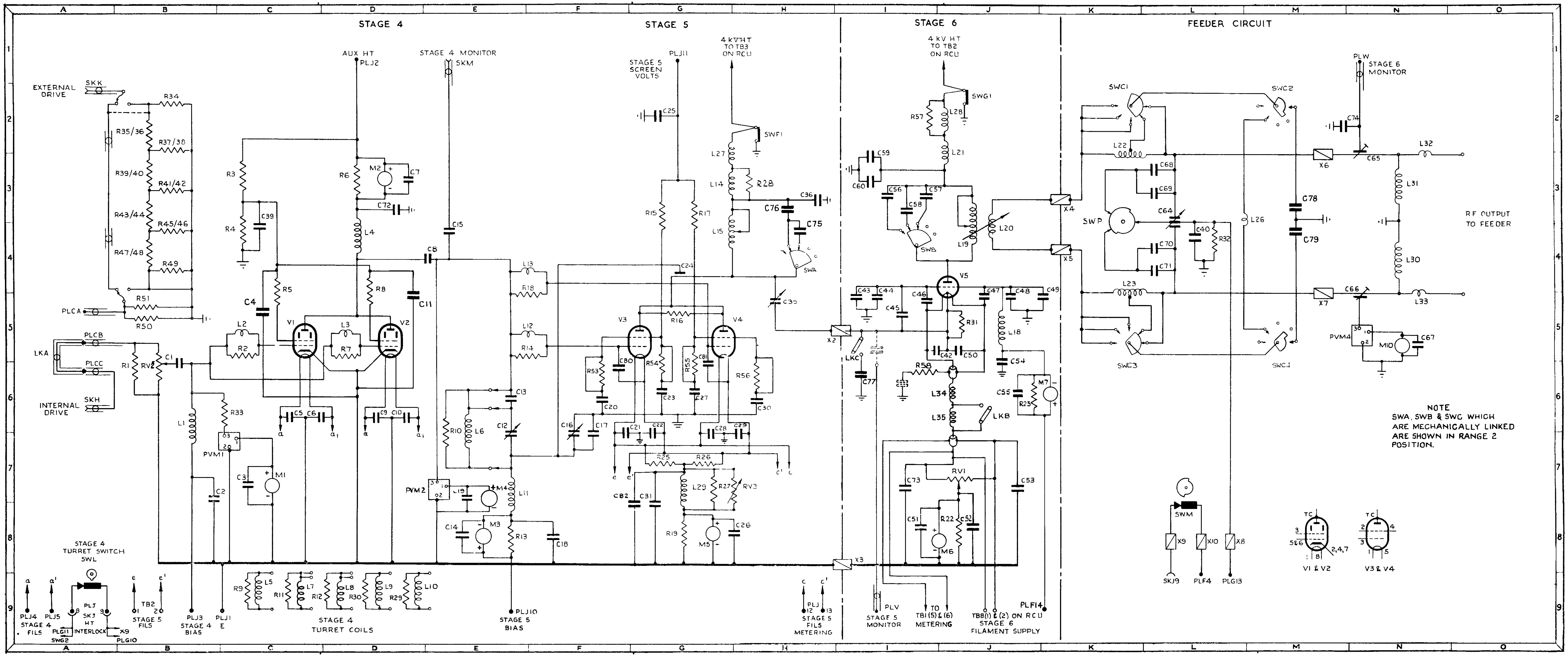
CIRCUIT DIAGRAM
R.F. UNIT, PART 1
HS31A

FIG.10B
WZ.26509/D SH.1
ISS.5

R.F. Unit of Transmitter HS31A/1
(WZ.27279/D Sh.1)

Modification No.1784

L30, L31, L32 and L33 are replaced by R.F. Filter Type W.102405 Ed.C when 50 ohms output impedance is provided by the use of Wideband Transformer Type HA112.



A.P.116E-1231-1
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CIRCUIT DIAGRAM
R.F. UNIT PART 1 (INCLUDING OUTPUT CIRCUIT)
HS31A

FIG.10C
WZ.27279/D SH.1
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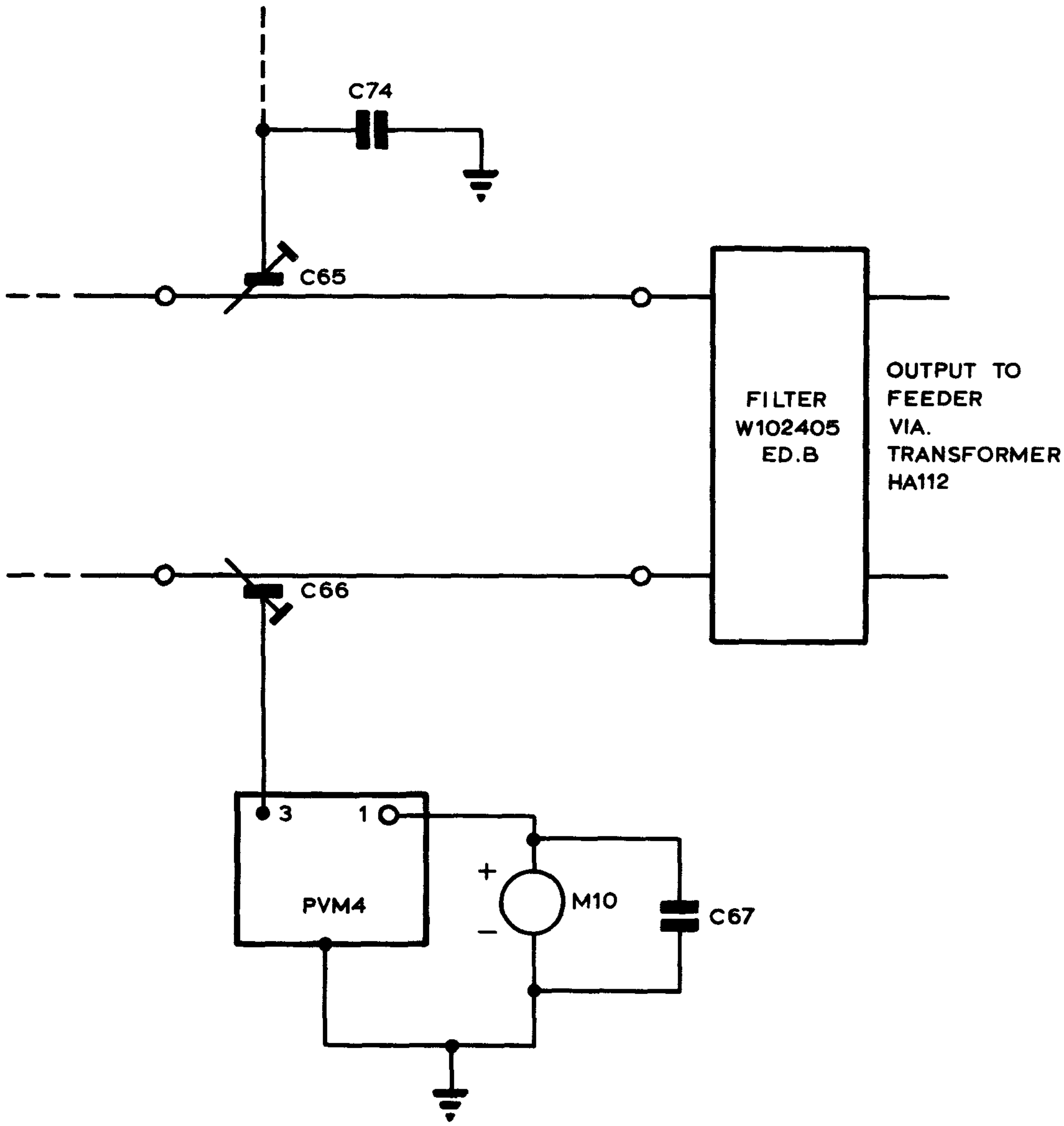
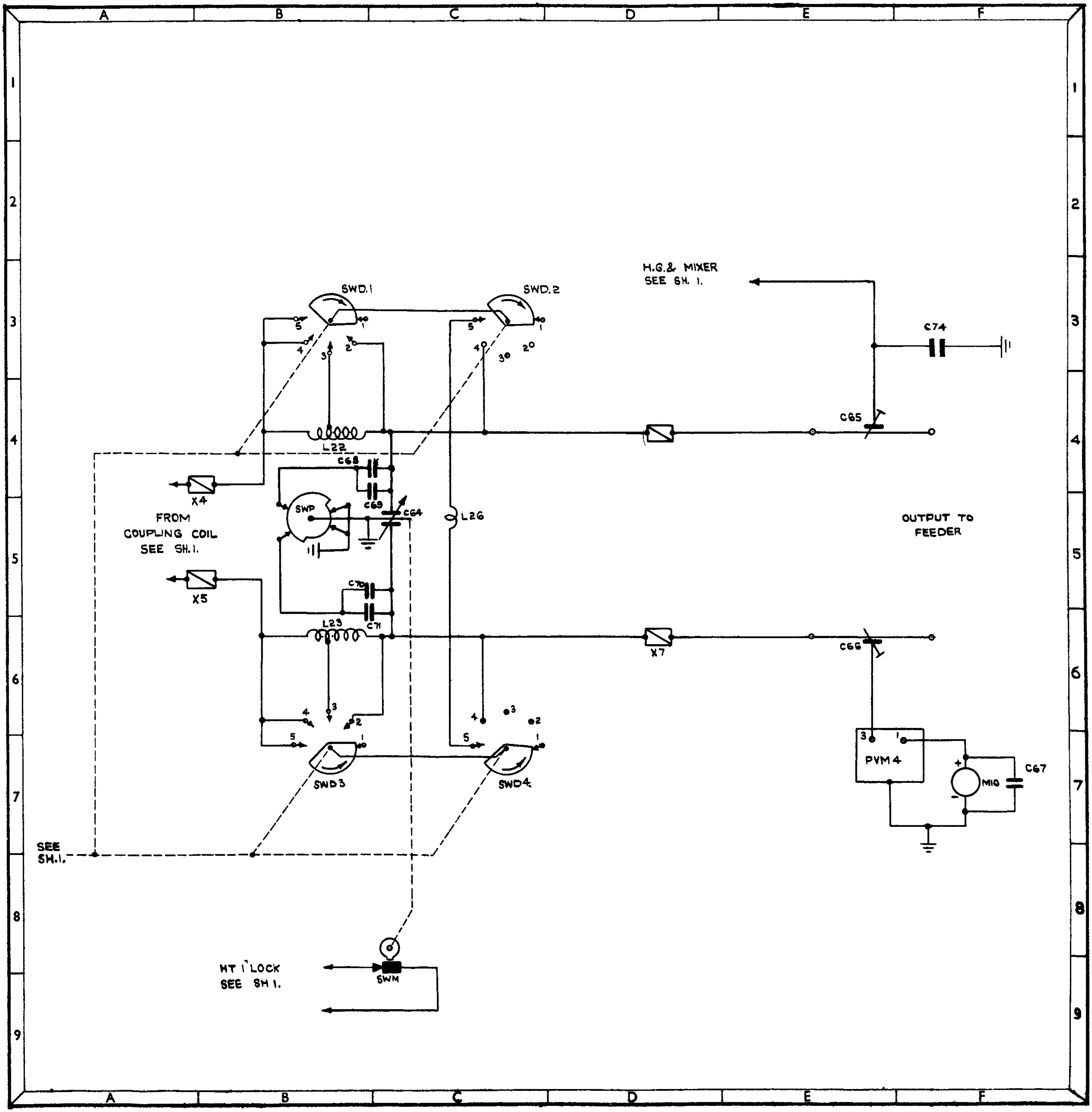
R.F. Unit of Transmitter HS31
(WZ.17588/D Sh.2)

Modification No.1785



Modification No.1785 entails the provision of Filter Type W.102405 Ed.B at the output of Transmitter HS31 when 50 ohms output impedance is provided by Transformer Type HA112.



CIRCUIT
RADIO FREQUENCY UNIT, SHEET 2
WZ.17588/D Sh.2 Iss.3

FIG.11

R.F. UNIT 3.5kW ISB TRANSMITTER TYPE HS.31A
WQ.12610 Sh.1-6 Ed.A
W.37907 Sh.9 Ed.C

Cross Reference List
for WZ.17364/D Sh.2

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C64	35	C69	37	C79	42	L23	106							X7	409
C65	36	C70	37			L26	107	M10	154						
C66	36	C71	37			L32	113			SWD	329	X4	408		
C67	14	C74	39			L33	113			SWM	331	X5	408		
C68	37	C78	42	L22	106			PVM4	157	SWP	35	X6	409		

NOTE: SWP is part of C64. See Item 427

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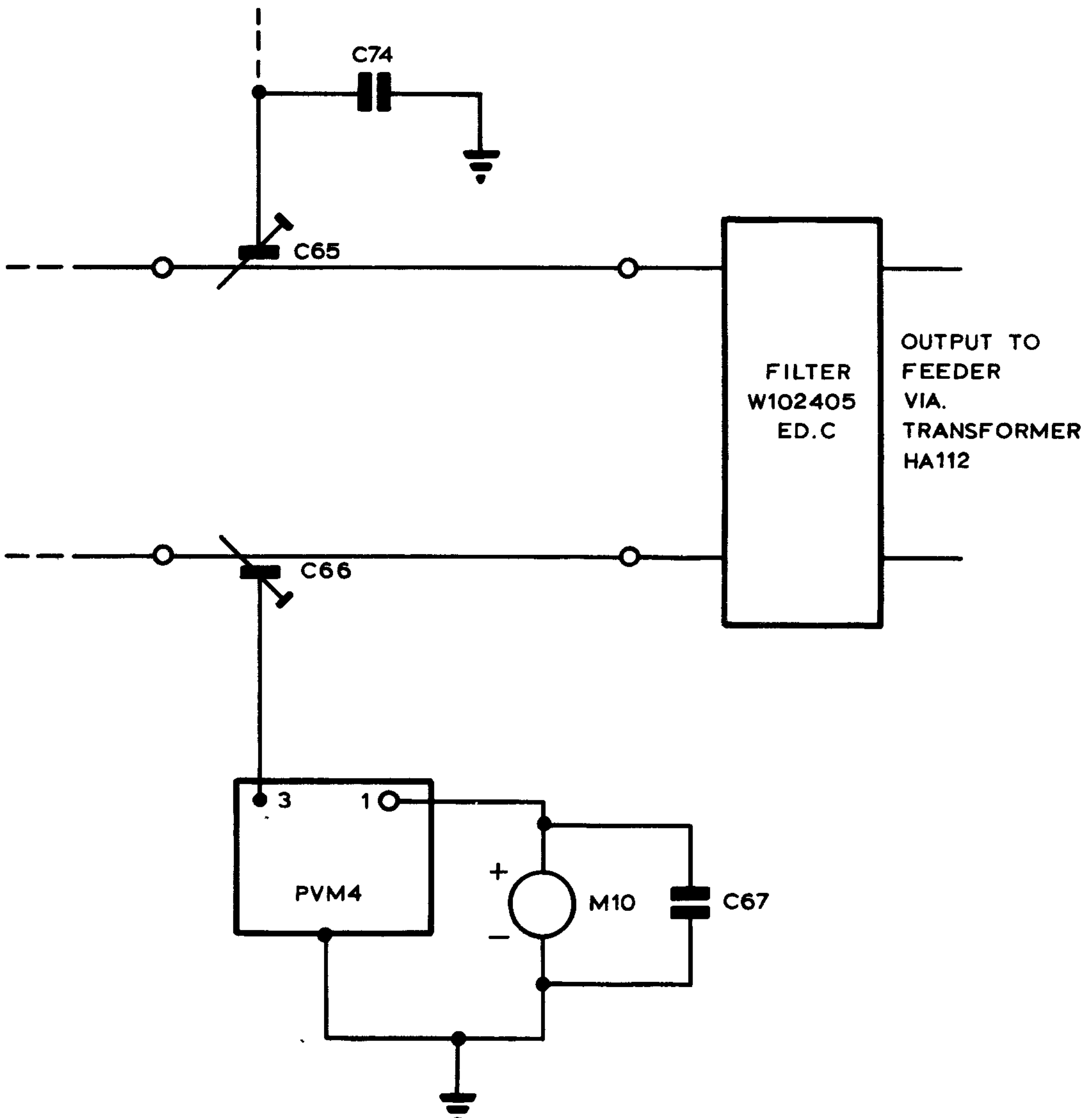
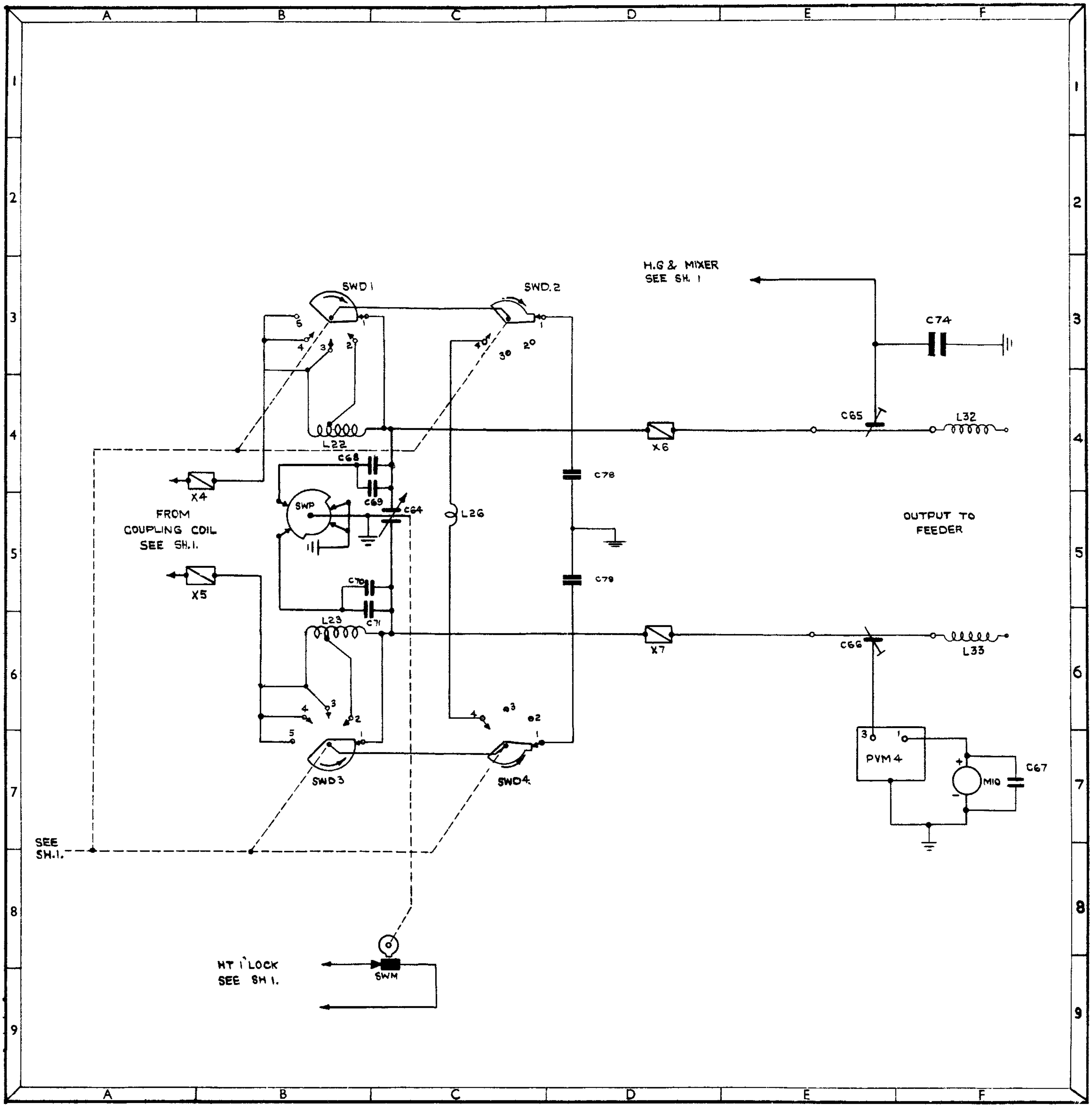
Circuit Diagram R.F. Unit HS31A
(WZ.17364/D Sh.2)

Modification No.1784



Filter W.102405 Ed.C replaces L32 and L33 when 50 ohms output impedance is provided in Transmitter HS31A using Transformer Type HA11[illegible]

Fig.11A(a



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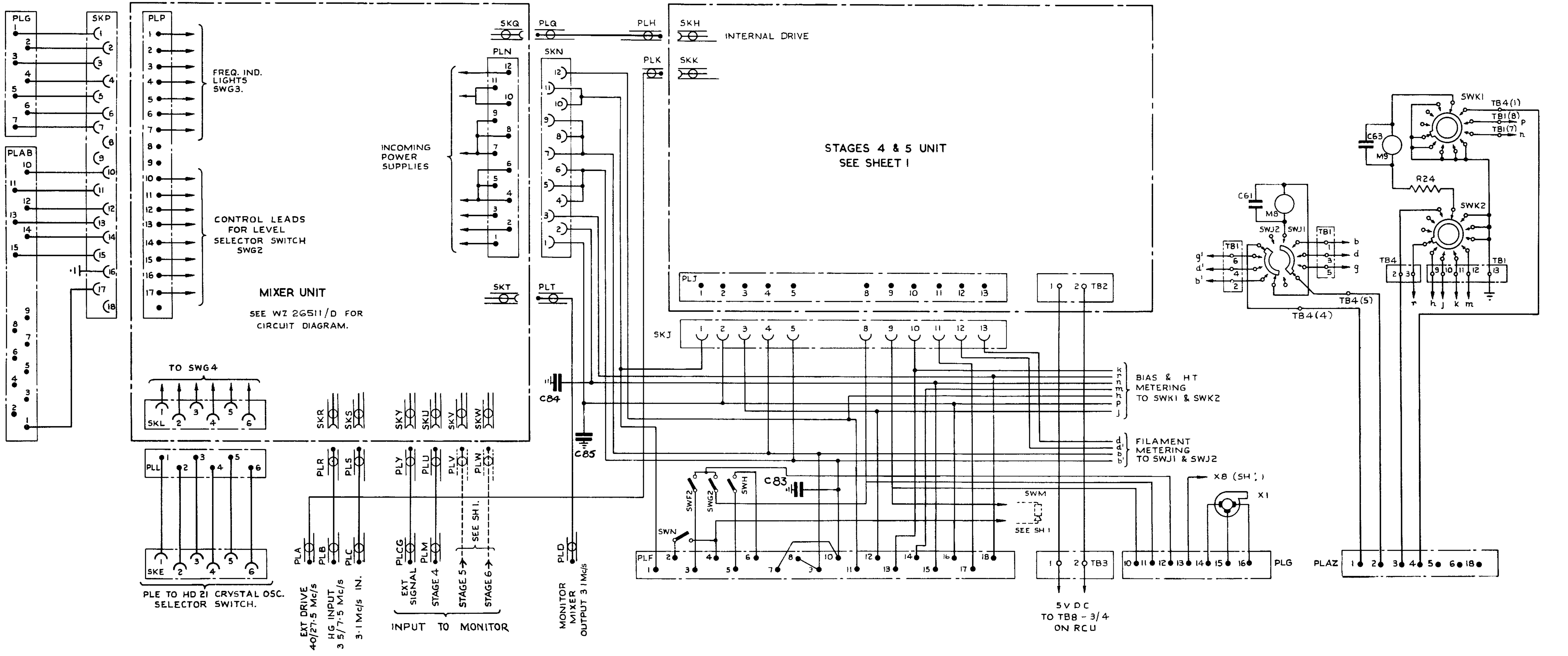
2nd Edn. Oct. '67

CIRCUIT DIAGRAM
R.F. UNIT, PART 2 (OUTPUT CIRCUIT)
HS31A

FIG.11A
WZ.17364/D SH.2
ISS.3



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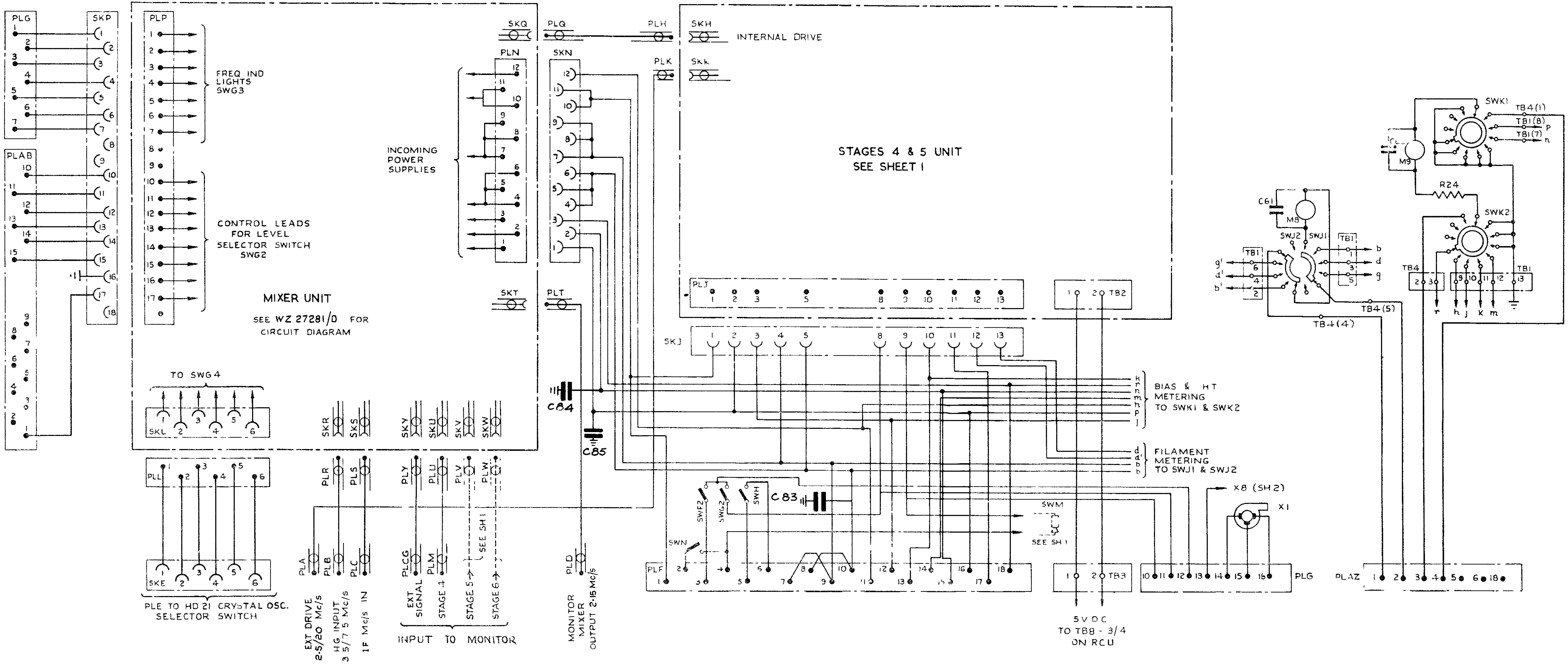
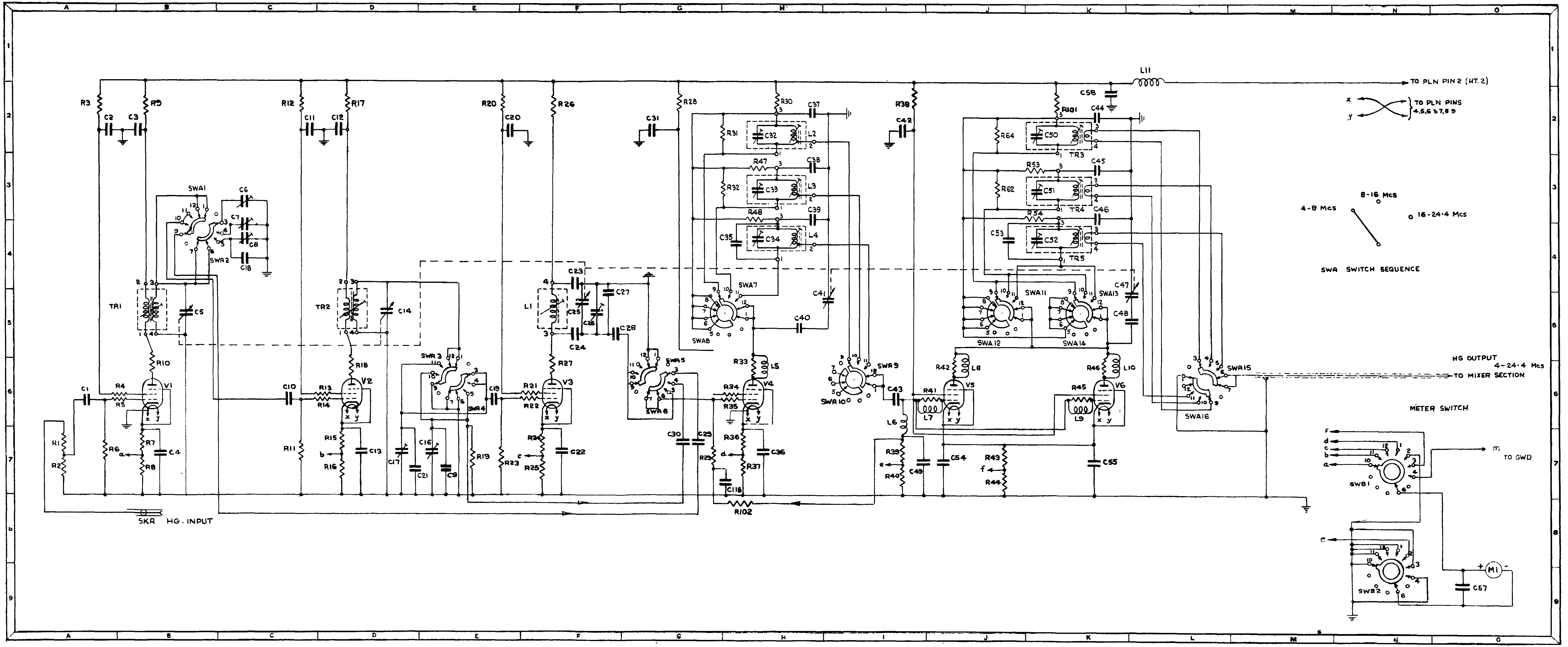
INTER-UNIT CONNECTIONS
R.F. UNIT
HS31/1

FIG.11B
WZ.26509/D SH.
ISS.2



INTER-UNIT CONNECTIONS
R.F. UNIT, HS31A/1



AP.2922D
Vol.1
April 1965

CIRCUIT
MIXER UNIT, SHEET 1
WZ.17590/D Sh.1 Iss.1

FIG.12

MIXER UNIT HS.31A
W.37920 Sh.7-9 Ed.D
WQ.12610 Sh.7 Ed.A

Cross Reference List
for WZ.24354/D Sh.1

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	44	C23	51	C44	51			R4	242	R25	251	R46	242		
C2	45	C24	51	C45	51	L1	114	R5	242	R26	252	R47	260		
C3	45	C25	46	C46	51	L2	115	R6	249	R27	242	R48	260	TR1	372
C4	45	C26	47	C47	46	L3	116	R7	250	R28	252	R53	260	TR2	373
C5	46	C27	50	C48	51	L4	117	R8	251	R29	254	R54	260	TR3	374
C6	47	C28	49	C49	45	L5	118	R9	252	R30	255	R62	256	TR4	375
C7	47	C29	44	C50	53	L6	119	R10	242	R31	252	R64	263	TR5	376
C8	47	C30	52	C51	53	L7	118	R11	249	R32	256	R101	255		
C9	48	C31	45	C52	53	L8	118	R12	248	R33	242	R102	248		
C10	49	C32	53	C53	50	L9	118	R13	242	R34	242			V1	396
C11	45	C33	53	C54	45	L10	118	R14	242	R35	242			V2	396
C12	45	C34	53	C55	45	L11	120	R15	250	R36	257			V3	396
C13	45	C35	50	C57	45			R16	251	R37	251			V4	396
C14	46	C36	45	C58	45			R17	252	R38	258			V5	396
C16	47	C37	51	C116	45			R18	242	R39	252			V6	396
C17	47	C38	51			M1	155	R19	253	R40	251				
C18	50	C39	51					R20	248	R41	242	SKR	308		
C19	49	C40	51					R21	242	R42	242				
C20	45	C41	46			R1	246	R22	242	R43	257				
C21	50	C42	45			R2	247	R23	249	R44	259	SWA	337		
C22	45	C43	51			R3	248	R24	250	R45	242	SWB	338		

MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Spring Contact	No.479
Ref.3	Valveholder for V1-V6	No.505
Ref.4	Insulator (Stand-Off)	No.448

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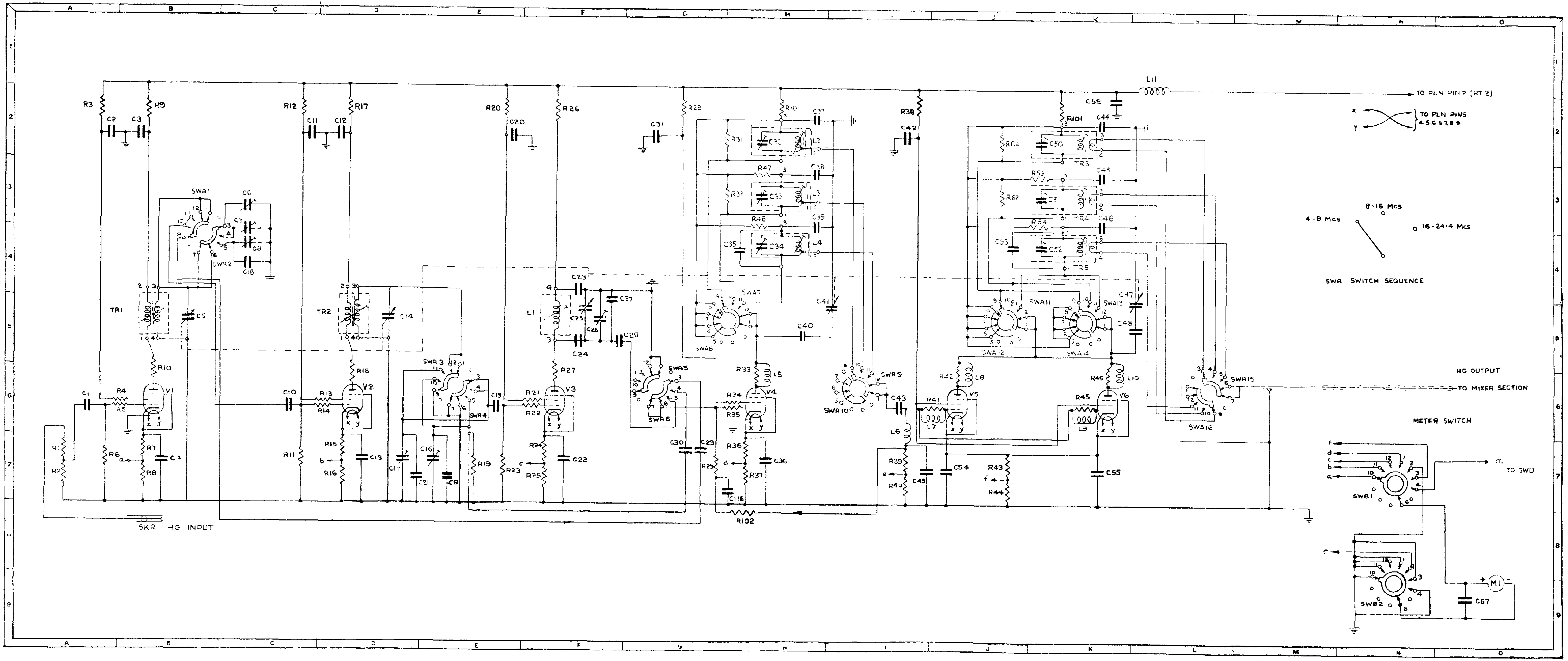
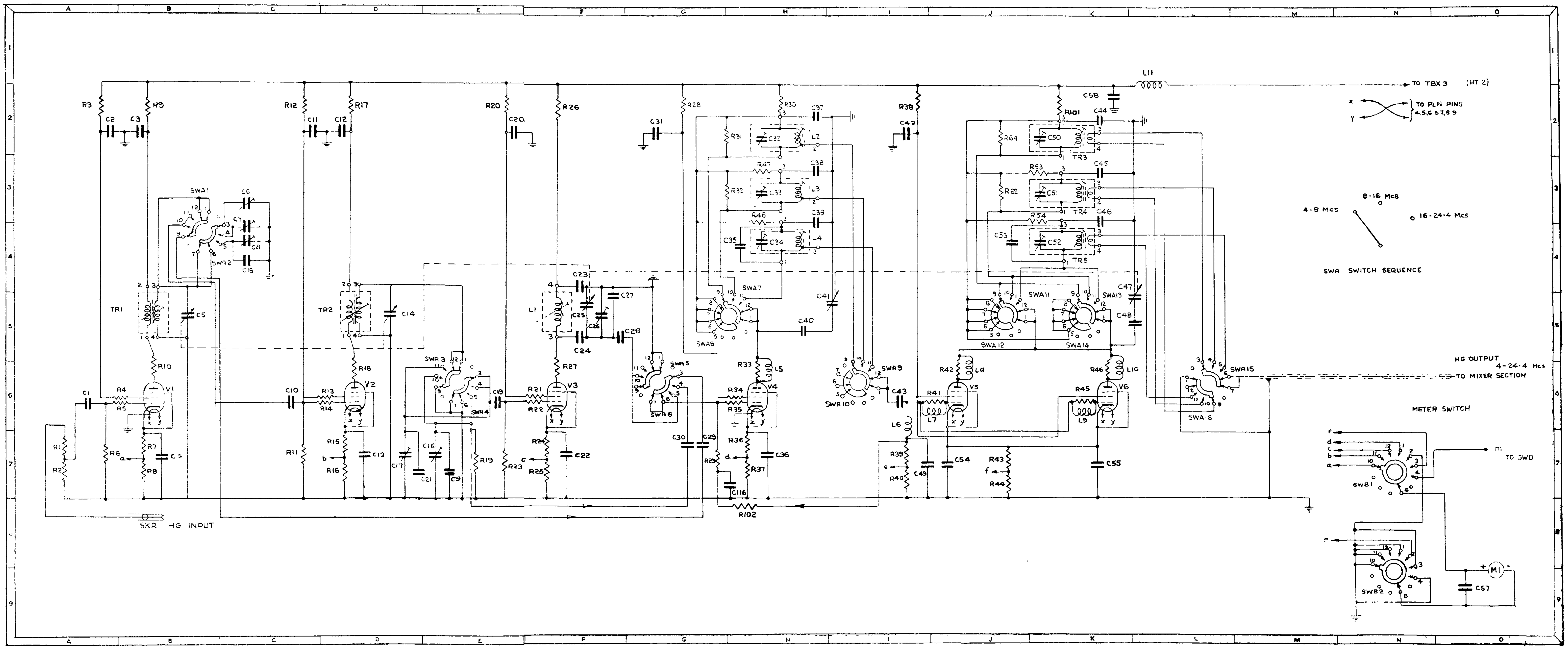


A.P.116E-0231-1
2nd Edn. Oct. '67

CIRCUIT DIAGRAM
MIXER UNIT, PART 1
HS31A

FIG.12A
WZ.24354/D SH.1
ISS.2



CIRCUIT DIAGRAM
MIXER UNIT, PART 1
HS31/1

FIG.12B
WZ.26511/D SH.1
ISS.1

MIXER UNIT
(Refer to Master Components List T5553)
Cross Reference List
for WZ.26511/D Sh.1&2 (Fig.12&13)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	46	C21	52	C41	48	C61	58	C81	53	C101	53	C121	65	C141	72
C2	47	C22	47	C42	47	C62	58	C82	48	C102		C122			
C3	47	C23	53	C43	53	C63	59	C83	47	C103	64	C123			
C4	47	C24	53	C44	53	C64	47	C84	55	C104	55	C124	67		
C5	48	C25	48	C45	53	C65	48	C85	55	C105	55	C125	68		
C6	49	C26	49	C46	53	C66	48	C86	55	C106	55	C126	47		
C7	49	C27	52	C47	48	C67	55	C87		C107	65	C127	47		
C8	49	C28	51	C48	53	C68	55	C88	47	C108		C128	55		
C9	50	C29	45	C49	47	C69	60	C89	53	C109	66	C129	47		
C10	51	C30	54	C50	55	C70	61	C90	53	C110	53	C130	69		
C11	47	C31	47	C51	55	C71	47	C91	53	C111		C131	70		
C12	47	C32	55	C52	55	C72		C92	53	C112	64	C132	47		
C13	47	C33	55	C53	52	C73	55	C93		C113		C133	55		
C14	48	C34	55	C54	47	C74	55	C94	48	C114		C134	47		
C15		C35	52	C55	47	C75	55	C95		C115	65	C135			
C16	49	C36	47	C56		C76	62	C96	47	C116	47	C136			
C17	49	C37	53	C57	47	C77	47	C97	53	C117	65	C137	71		
C18	52	C38	53	C58	47	C78	63	C98	53	C118	47	C138	72		
C19	51	C39	53	C59	56	C79	53	C99	53	C119	58	C139	72		
C20	47	C40	53	C60	57	C80	53	C100	48	C120	58	C140	72		
R1	348	R20	350	R39	355	R58	351	R77	362	R96		R115	369	R134	351
R2	349	R21	351	R40	354	R59	351	R78	360	R97		R116	353	R135	351
R3	350	R22	351	R41	351	R60		R79	354	R98	365	R117	365	R136	377
R4	351	R23	352	R42	351	R61	365	R80	367	R99	321	R118	377	R137	378
R5	351	R24	353	R43	360	R62	359	R81	356	R100	351	R119	377	R138	381
R6	352	R25	354	R44		R63	355	R82	355	R101	358	R120	378		
R7	353	R26	355	R45	351	R64	366	R83	359	R102	350	R121	378		
R8	354	R27	351	R46	351	R65	355	R84	351	R103		R122	379		
R9	355	R28	355	R47	362	R66	359	R85	368	R104	356	R123	378		
R10	351	R29	357	R48	362	R67	355	R86	351	R105	370	R124	377		
R11	352	R30	358	R49	363	R68		R87	369	R106	371	R125	352		
R12	350	R31	355	R50	364	R69		R88	365	R107	372	R126	351		
R13	351	R32	359	R51	364	R70	358	R89		R108	356	R127	358		
R14	351	R33	351	R52	352	R71	363	R90	356	R109	373	R128	369		
R15	353	R34	351	R53	362	R72	356	R91		R110	374	R129	373		
R16	354	R35	351	R54	362	R73	351	R92		R111	321	R130	365		
R17	355	R36	360	R55	351	R74	351	R93	362	R112	375	R131	362		
R18	351	R37	354	R56	351	R75	358	R94	362	R113	361	R132	380		
R19	356	R38	361	R57	360	R76	362	R95		R114	376	R133	350		

MIXER UNIT
(Refer to Master Components List T5553)
Cross Reference List
for WZ.26511/D Sh.1&2 (Fig.12&13)

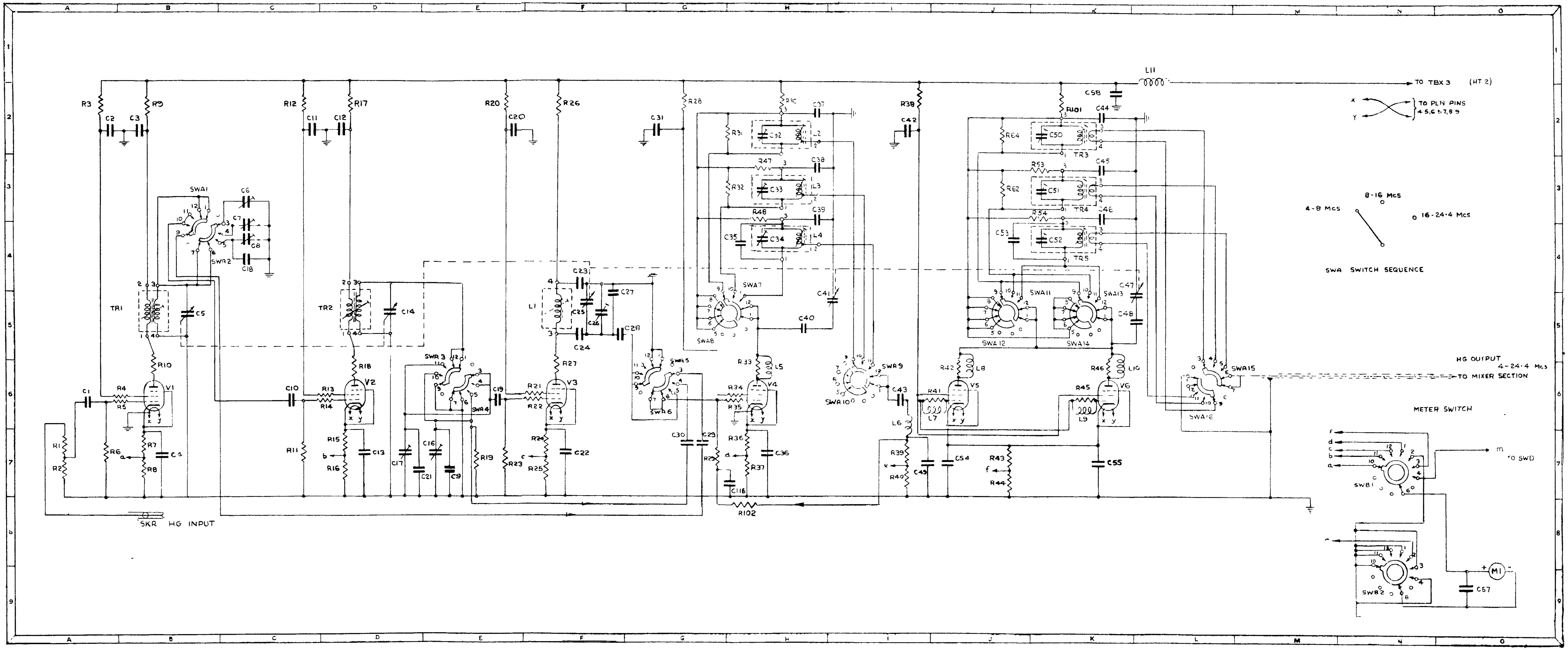
Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
L1	(177 (178	L15	182	L29	189	PLBB	263	RV6	397	SKX	405	TR3	502	V3	520
L2	179	L16	179	L30	190	PLBC	263	RV7	397	SKY	405	TR4	503	V4	520
L3	180	L17	180	L31	190	PLBD	263	RV8	397	SKZ	405	TR5	504	V5	520
L4	181	L18	181	L32	190	PLBE	263	RV9	397			TR6	505	V6	520
L5	182	L19	182	L33	190	PLBF	263	RV10	397	SWA	451	TR7	506	V7	521
L6	183	L20	183	L34	190	PLBG	263	RV11	397	SWB	452	TR8	507	V8	521
L7	182	L21				PLN				SWC	453	TR9	502	V9	522
L8	182	L22				PLP	265	SKQ	405	SWD	454	TR10	503	V10	522
L9	182	L23	182					SKR	405	SWE	455	TR11	508	V11	523
L10	182	L24	182	LKA	214	RV1	396	SKS	405	SWF	455	TR12	509	V13	523
L11	184	L25	182			RV2		SKT	405	SWG	456	TR13	510		
L12	185	L26	188	M1	230	RV3	397	SKU	405						
L13	186	L27				RV4	397	SKV	405	TR1	500	V1	520		
L14	187	L28		PLBA	263	RV5	397	SKW	405	TR2	501	V2	520		

MISCELLANEOUS MECHANICAL ITEMS

Ref.1	Spring Contact	No. 86
Ref.2	Valveholder B8G for V10 & V11	No.526
Ref.3	Valveholder B7G with Skirt for V1 to V9, V12 & V13	No.527
Ref.4	Insulator	No.208

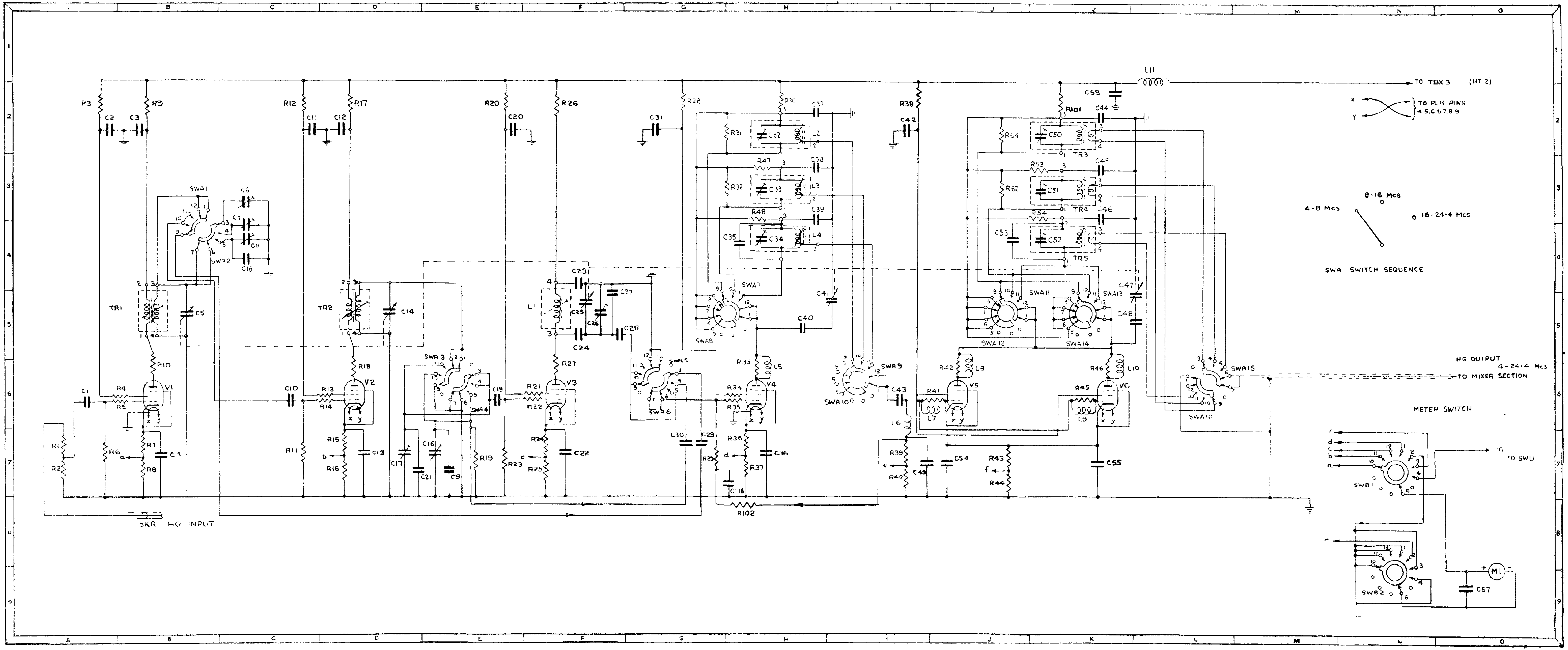
NOTE: *The preceding Cross Reference List for T5553 identified 'for WZ.26511/D Sh.1 & 2 (Figs.12 & 13)' applies only to Fig.12B (WZ.26511/D Sh.1). For identities of components in Fig.13 (WZ.17590/D Sh.2), refer to Components List No.1, Mixer Unit.*

(To prec
Fig.12B



CIRCUIT DIAGRAM
MIXER UNIT, PART 1
HS31A/1

FIG.12C
WZ.27281/D SH.1
ISS.1



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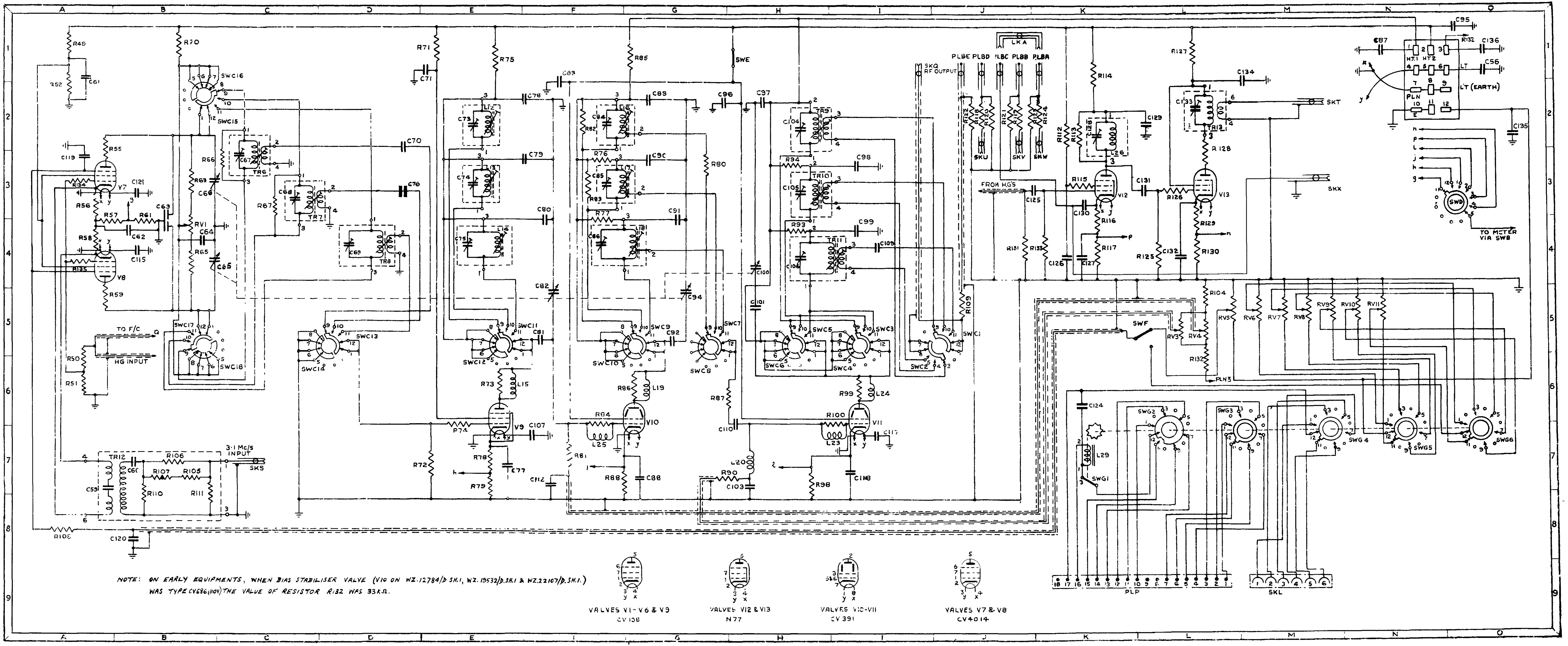
2nd Edn. Oct. '67

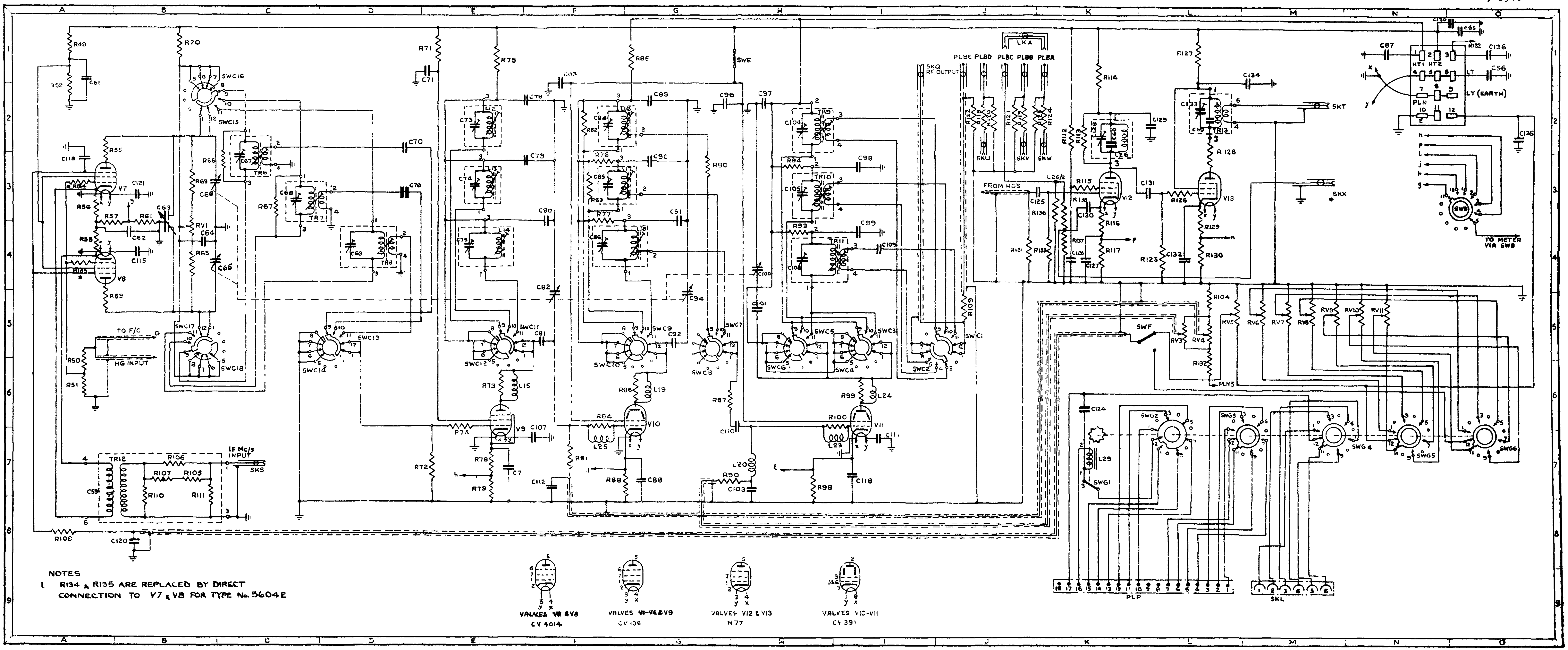
CIRCUIT DIAGRAM
MIXER UNIT, PART 1
HS31A/1

FIG.12C
WZ.27281/D SH.1
ISS.1



CIRCUIT
MIXER UNIT, SHEET 2
WZ.17590/D Sh.2 Iss.4

FIG.13

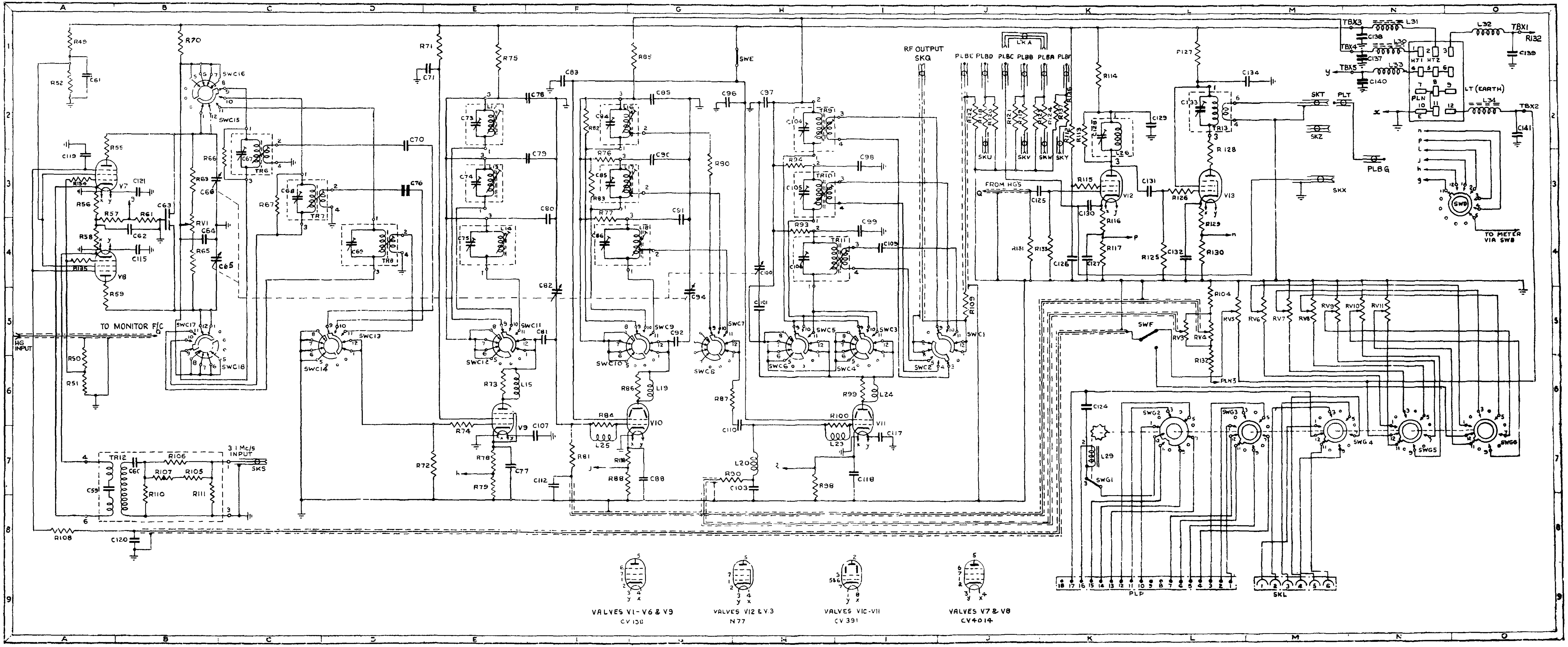


NOTES
1. R134 & R135 ARE REPLACED BY DIRECT CONNECTION TO V7 & V8 FOR TYPE No. 5604E

WZ.24354/D SH.2
ISSUE 2

CIRCUIT DIAGRAM
MIXER UNIT, PART 2
HS31A

FIG.13A



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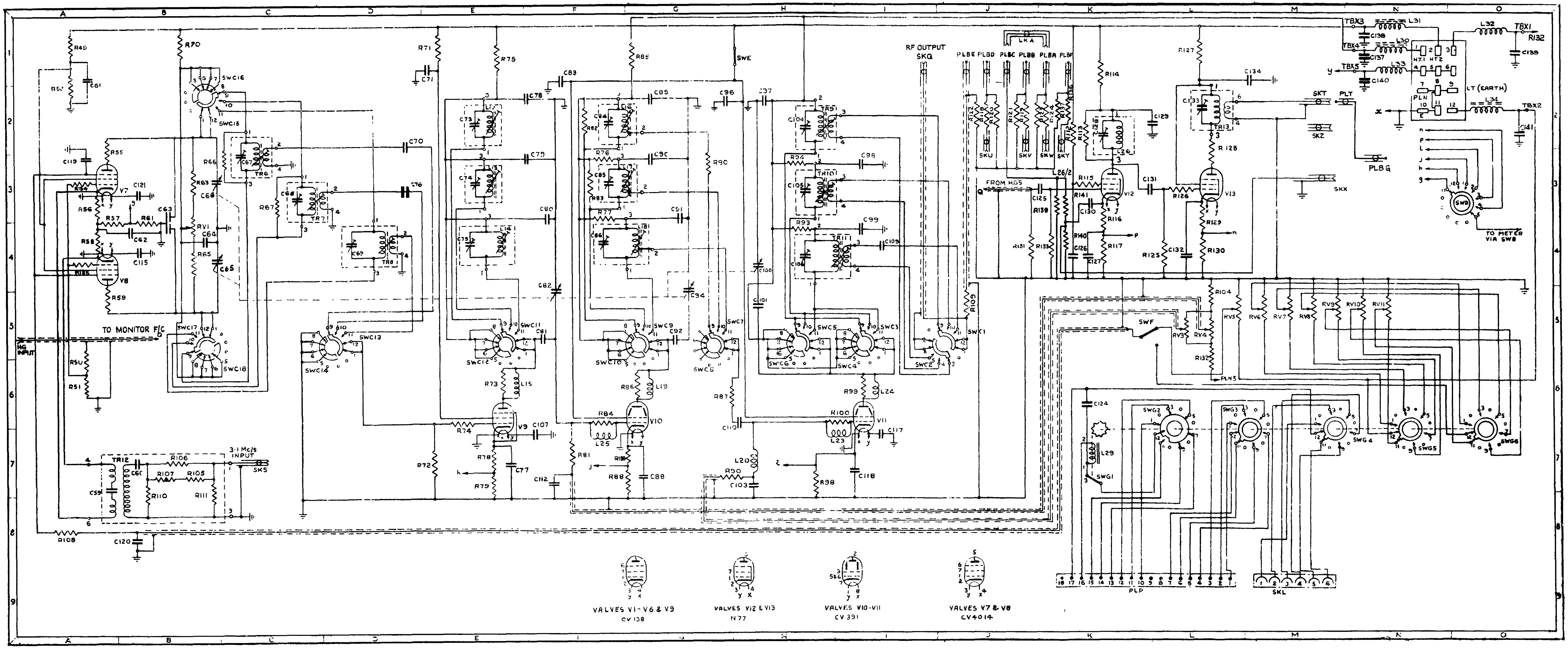
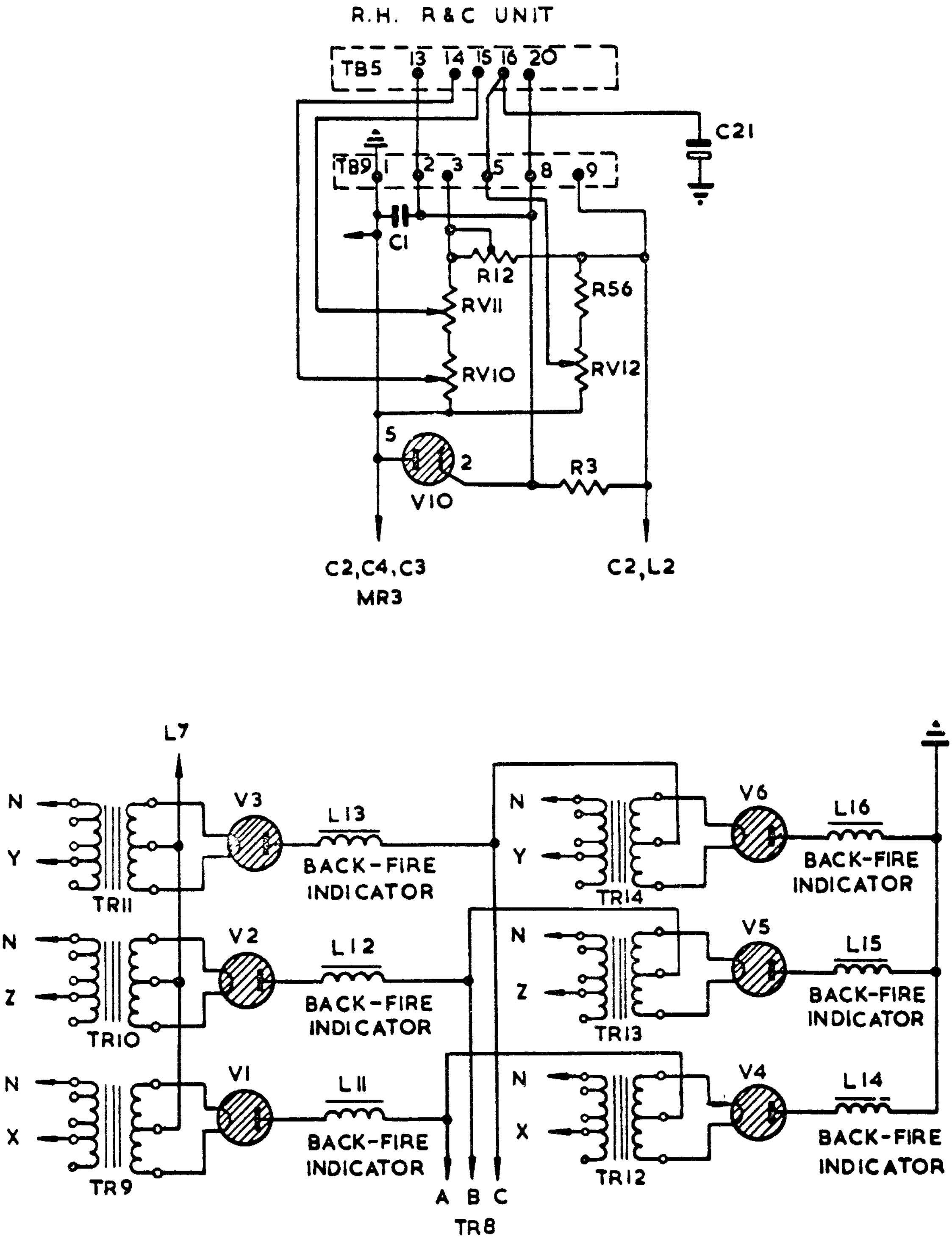
2nd Edn. Oct. '67

CIRCUIT DIAGRAM
MIXER UNIT, PART 2
~~HS31A/1~~
HS31/1 (AL1)

(AL1)
FIG. ~~13A~~ 13B
WZ.26511/D SH.2
ISS.1

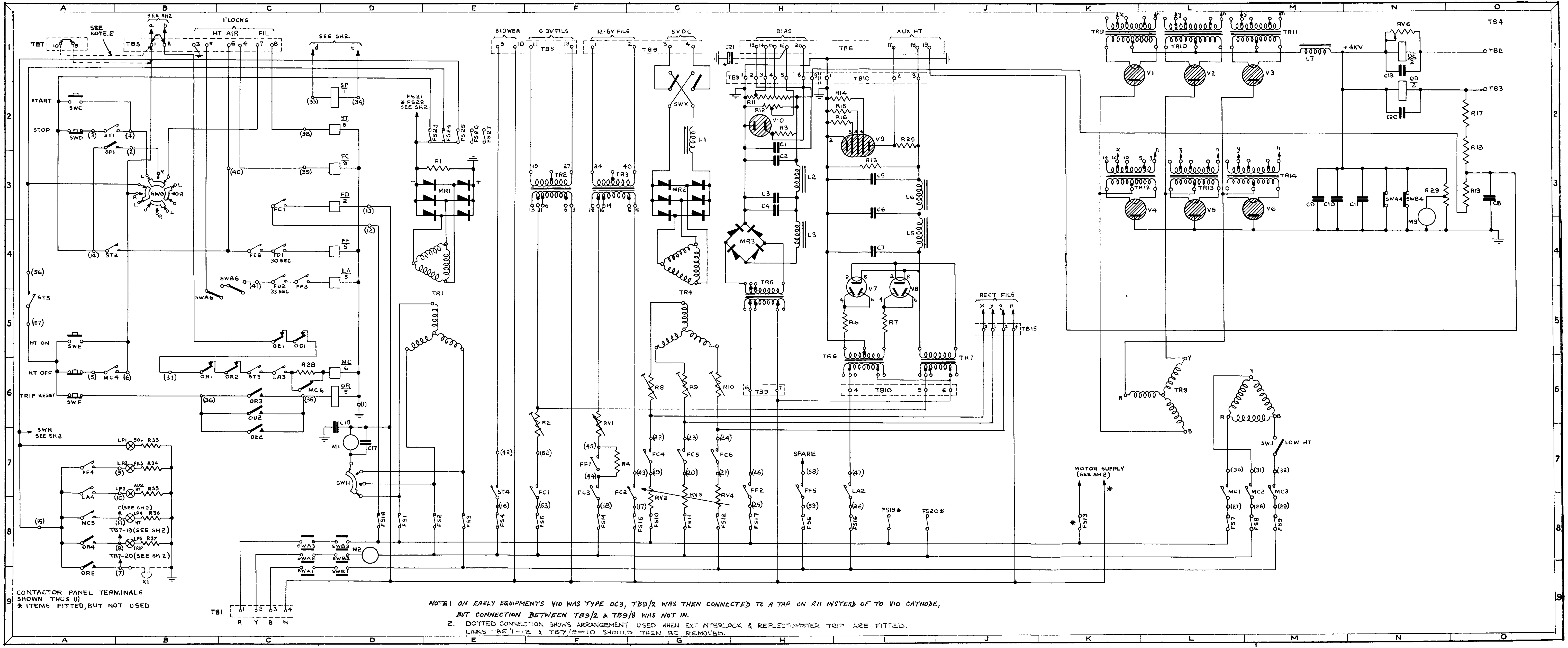


CIRCUIT DIAGRAM
MIXER UNIT, PART 2
HS31A/1



CIRCUIT CHANGES ARISING FROM
MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)

To face
Fig. 14)



CIRCUIT
RECTIFIER AND CONTROL UNIT, PART 1
WZ.12784/D Sh.1 Iss.13

RECTIFIER & CONTROL UNIT
W.37908 Sh.3 Ed.B

Cross Reference List for WZ.17361/D Sh.1 (Fig.14A)

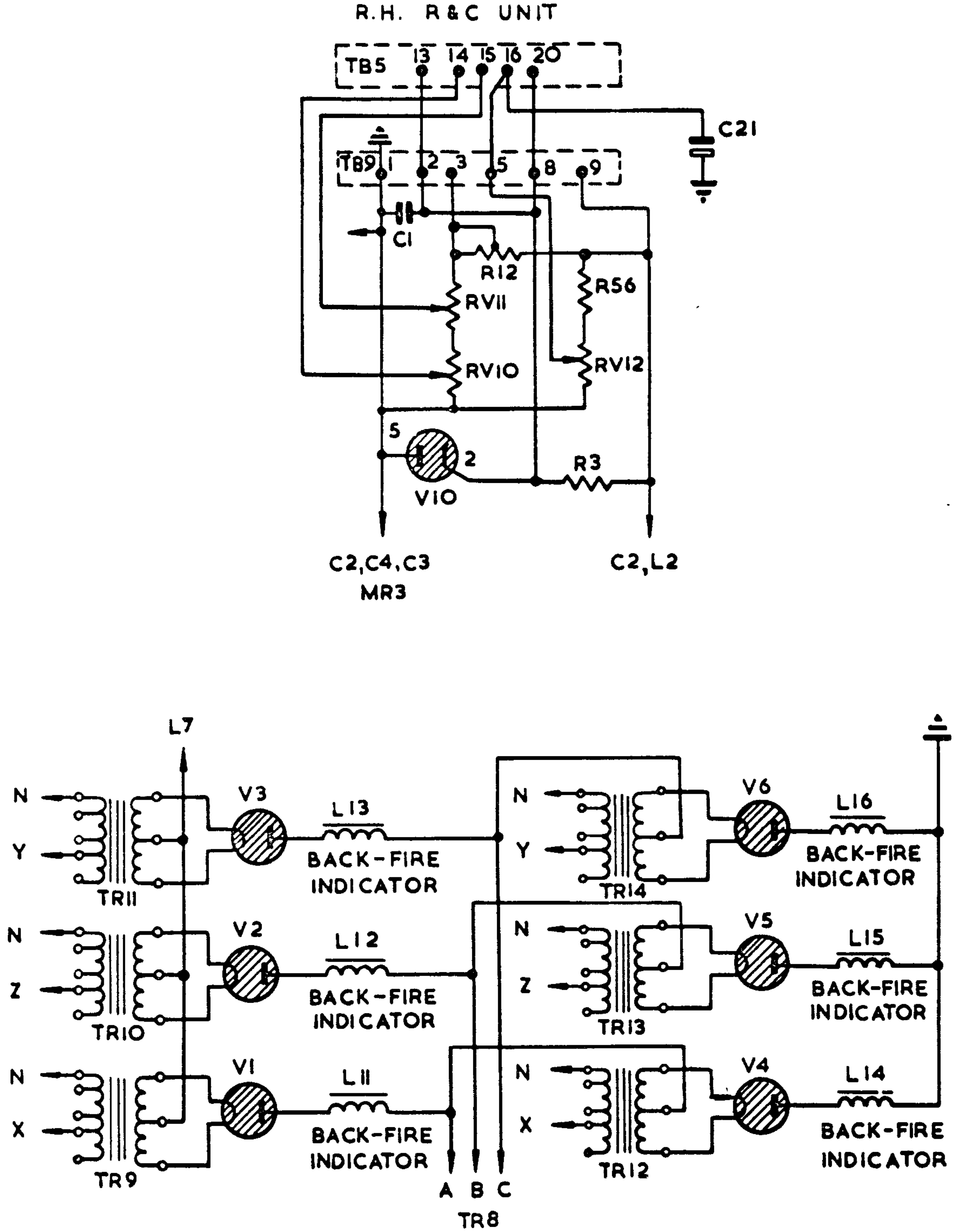
Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	5	FS5	75	L5	89	ST	190	R13	206	RV6	289	TB8	352	V1	389
C2	5	FS7	77	L6	89	FF	190	R14	207			TB9	353	V2	389
C3	5	FS8	77	L7	90	LA	190	R15	207			TB10	354	V3	389
C4	5	FS9	77			MC *	189	R16	207	SWA	313	TB15	355	V4	389
C5	6	FS10	75			OR	192	R17	208	SWA-6	314			V5	389
C6	6	FS11	75	LP1	134	SP	193	R18	208	SWB	315			V6	389
C7	6	FS12	75	LP2	134	FD	194	R19	209	SWB-6	316	TR1	363	V7	390
C8	7	FS14	78	LP3	134	OD	195	R25	210	SWC	317	TR2	364	V8	390
C9	8	FS15	78	LP4	134	OE	195	(Part	of	SWD	317	TR3	365	V9	391
C10	8	FS16	79	LP5	134			R28-189)		SWE	317	TR4	366	V10	392
C11	8	FS17	79					R29	211	SWF	318	TR5	367		
C17	9	FS18	80					R33	212	SWG	319	TR6	368		
C18	9	FS20	80	M1	142	R1	198	R34	212	SWH	320	TR7	369		
C19	10	FS23	82	M2	143	R2	199	R35	212	SWJ	321	TR8	370	X1	403
C20	10	FS24	83	M3	144	R3	200	R36	212	SWK	322	TR9	371		
C21	11	FS25	81			R4	201	R37	212	SWL	323	TR10	371	X3	411
						R6	202			SWM	324	TR11	371		
				MR1	164	R7	202			SWN	325	TR12	371		
				MR2	161	R8	203			TB1	349	TR13	371		
FS1	75			MR3	162	R9	203	RV1	287	TB2	350	TR14	371		
FS2	75	L1	87			R10	203	RV2	288	TB3	350				
FS3	75	L2	88			R11	204	RV3	288	TB4	350				
FS4	76	L3	88	FC	191	R12	205	RV4	288	TB5	351				

NOTE: MR2 comprises 2 units (No.161) in parallel.
SWL & SWM are combined in one assembly.
X1 Fitted externally.

* Wotsac replacement for item 189: CC 270003 (Type UCA7) (Mod.A.4745).

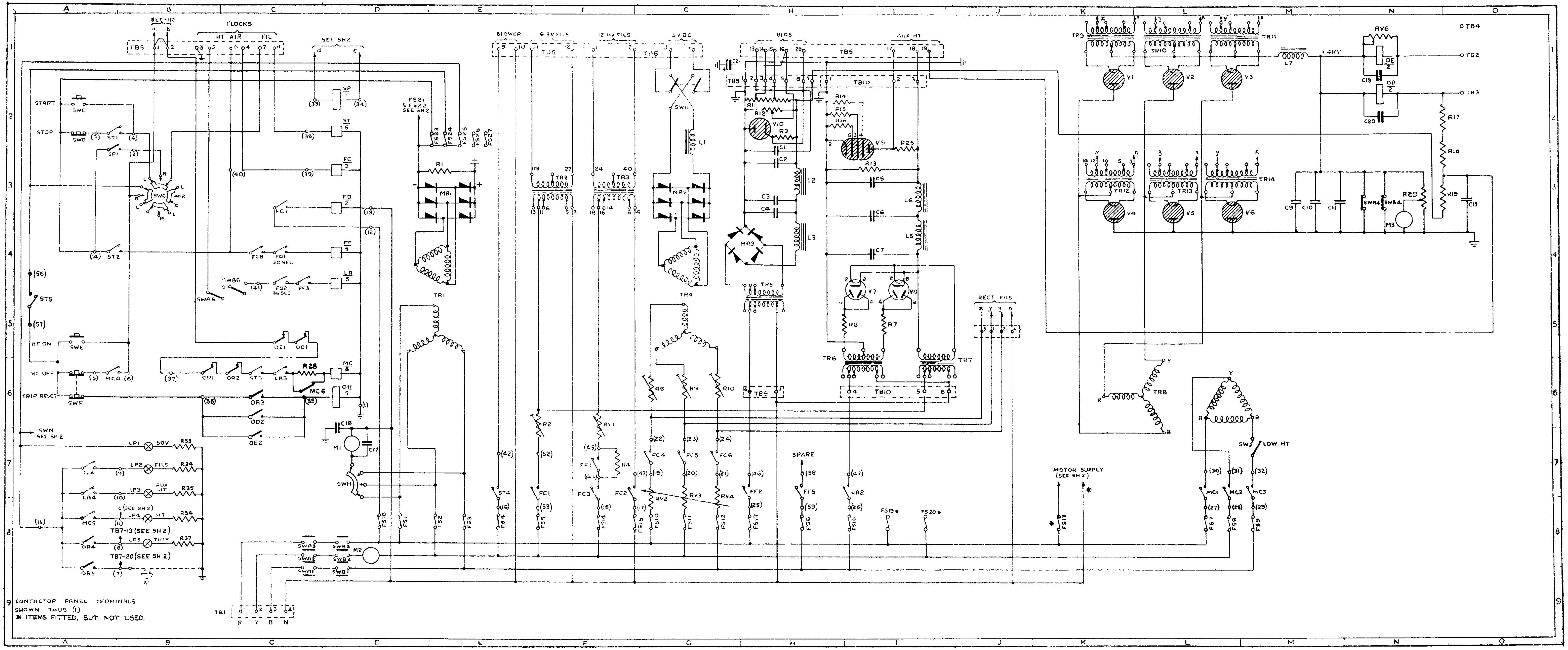
MISCELLANEOUS MECHANICAL ITEMS

Ref. 1	Fuseholder (For FS7-9)	No.446
Ref. 2	Fuseholder (For FS1-5,10-12,14-15)	No.444
Ref. 3	Fuseholder (For FS16-18,20,22-25)	No.445
Ref. 4	Valveholder (For V7 & V8)	No.497
Ref. 5	Valveholder (For V9)	No.498
Ref. 6	Lamp Jack (For LP1-11)	No.455
Ref. 7	Resistor Mounting (For R1 & R2)	No.465
Ref. 8	Resistor Mounting (For R17-19)	No.466
Ref. 9	Anode Clip	No.414
Ref.10	Resistor for Mounting(For R13 & R25)	No.467
Ref.11	Valve Retainer (For V9)	No.499
Ref.12	Valve Retainer (For V7 & V8)	No.500
Ref.15	Stand-Off Insulator	No.449
Ref.16	Valve Retainer (For V10)	No.501
	Socket for Relays OR & SP	No.503



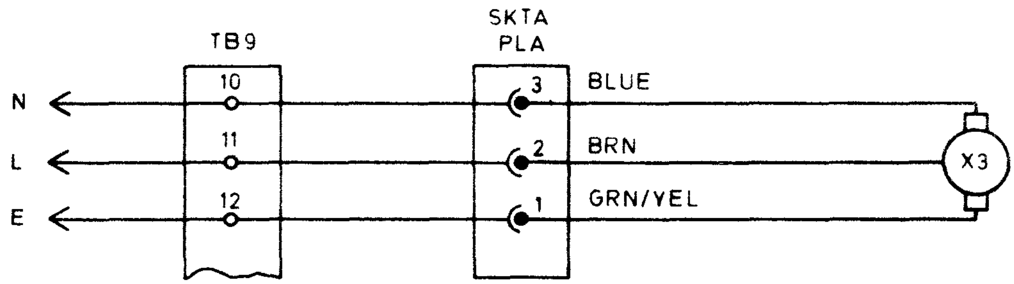
CIRCUIT CHANGES ARISING FROM
MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)

To face
Fig. 14A)



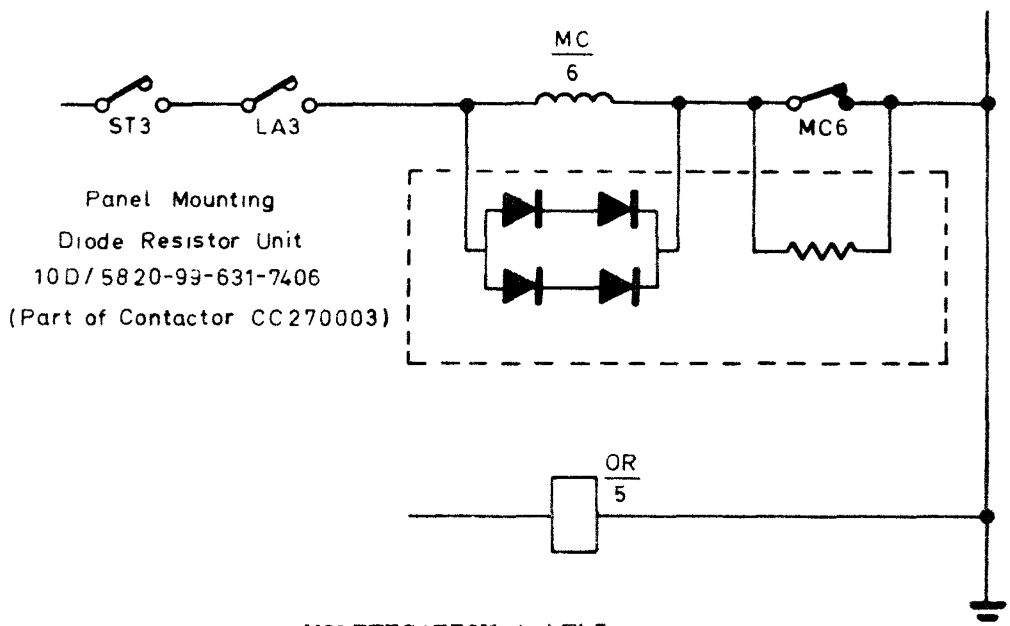
CIRCUIT DIAGRAM
RECTIFIER AND CONTROL UNIT, PART 1
HS31A

FIG.14A
WZ.17361/D SH.1
ISS.4



FAN

Fitted to all Rectifier and Control Units
Refer to Figs. 14, 14A and 14B



MODIFICATION A.4745
Contactor replacement

Applicable to all Rectifier and Control Units
Refer to Figs. 14, 14A and 14B

Fig.14C

RECTIFIER & CONTROL UNIT
Refer to Master Components List T5553 Issue

Cross Reference List
for WZ.26506/D Sh.1 & WZ.26506/B Sh.2 (Fig. 14B & 15A)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
C1	7	FS11	134					R31		RV3	390	SWG	443	TR5	494
C2	7	FS12	134			PLAJ	262	R32		RV4	390	SWH	444	TR6	495
C3	7	FS13						R33	306	RV5		SWJ	445	TR7	496
C4	7	FS14	137			R1	291	R34	306	RV6	391	SWK	446	TR8	497
C5	8	FS15	137	L1	149	R2	292	R35	306	RV7	392	SWL	447	TR9	498
C6	8	FS16	138	L2	150	R3	293	R36	306	RV8		SWM	448	TR10	498
C7	3	FS17	138	L3	150	R4	294	R37	306			SWN	449	TR11	498
C8	9	FS18	139	L4		R5		R38	306	RELAYS &		SWP		TR12	498
										CONTACTORS					
C9	10	FS19		L5	151	R6	295	R39	306	FC)		SWQ		TR13	498
C10	10	FS20	139	L6	151	R7	295	R40	306	ST)		SWR	450	TR14	498
C11	10	FS21		L7	152	R8	296	R41	306	FF)	111				
C12		FS22	140	L8		R9	296	R42	306	LA)		TB1	475	V1	513
C13		FS23	141	L9		R10	296	R43	306	MC)*		TB2	476	V2	513
C14		FS24	142	L10	153	R11	297	R44	307	OR	284	TB3	476	V3	513
C15	11	FS25	140			R12	298	R45	307	SP	285	TB4	476	V4	513
C16	12	FS26		LP1)		R13	299	R46	307	FD	469	TB5	477	V5	513
C17	13	FS27		LP2)		R14	300	R47	308	OD	288	TB6	477	V6	513
C18	13	FS28		LP3)		R15	300	R48	309	OE	288	TB7	477	V7	514
C19	14	FS29		LP4)		R16	300	R49	310	OG	286	TB8	478	V8	514
C20	14	FS30		LP5)		R17	301	R50	311	OJ	287	TB9	479	V9	515
C21	15	FS31		LP6)	213	R18	301	R51	312	ILR	112	TB10	480	V10	516
		FS32		LP7)		R19	302	R52	313			TB11			
		FS33		LP8)		R20		R53	314			TB12		X1	196
FS1	134	FS34		LP9)		R21		R54	315	SKAJ	416	TB13		X2	488
FS2	134	FS35		LP10)		R22		R55	316			TB14		X3	123
FS3	134	FS36		LP11)		R23				SWA	437	TB15	481	X4	532
FS4	135	FS37		M1	217	R24				SWA6	438	TB16			
FS5	134	FS38		M2	218	R25	303			SWB	439	TB17)	482		
FS6		FS39		M3	219	R26				SWB6	440	)	482A		
FS7	136	FS40				R27				SWC	441	TR1	499		
FS8	136	FS41	137	MR1	280	R28	304			SWD	441	TR2	491		
FS9	136	FS42	137	MR2	281	R29	305	RV1	389	SWE	441	TR3	492		
FS10	134	FS43	137	MR3	282	R30		RV2	390	SWF	442	TR4	493		

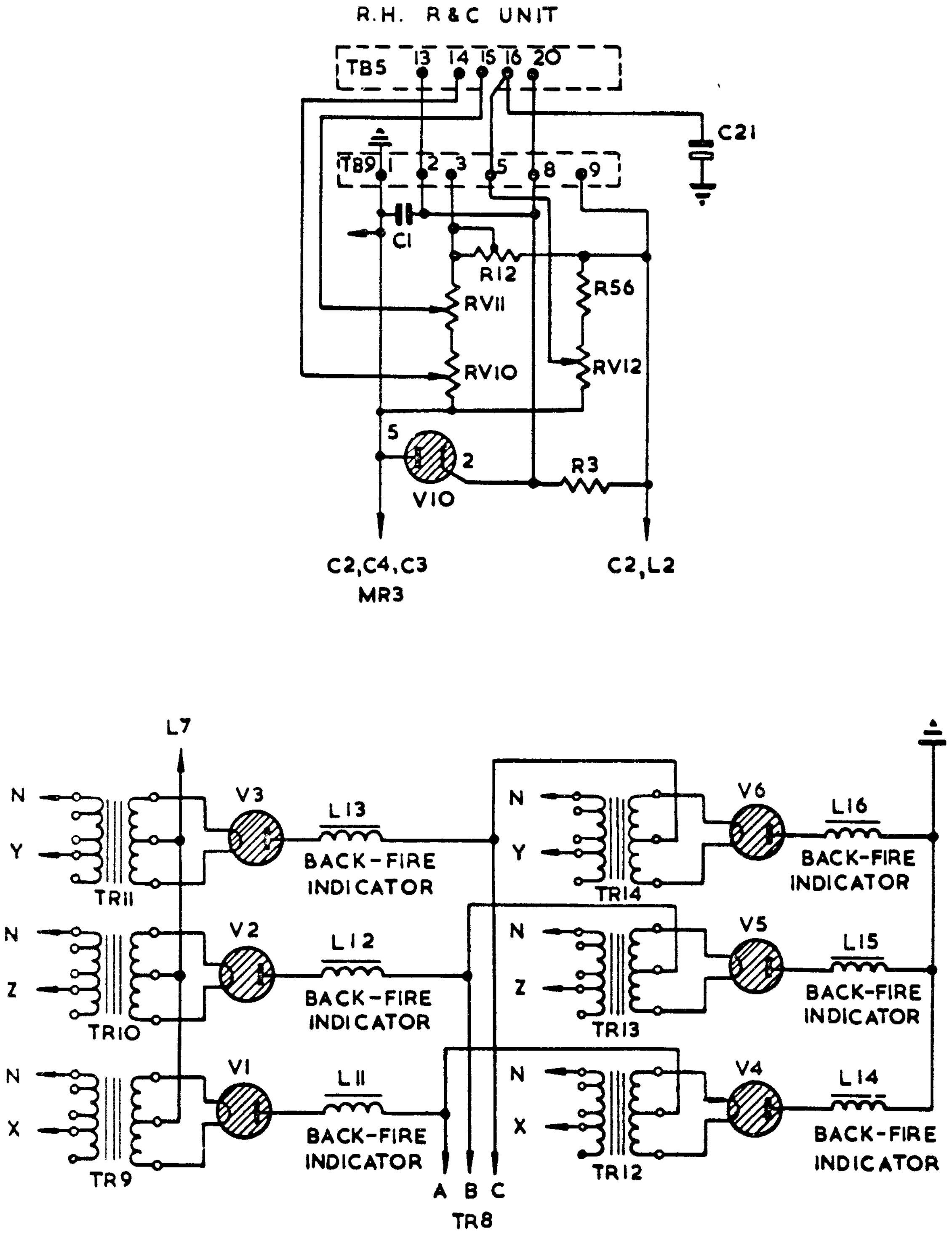
* Wotsac replacement for item Ref: MC: CC 270003 (Type UCA7) (Mod. A.4745)

RECTIFIER & CONTROL UNIT

Refer to Master Components List T3 Issue
Cross Reference List
for WZ.26506/D Sh.1 & WZ.26506/B Sh.2 (Fig.14B & 15A)

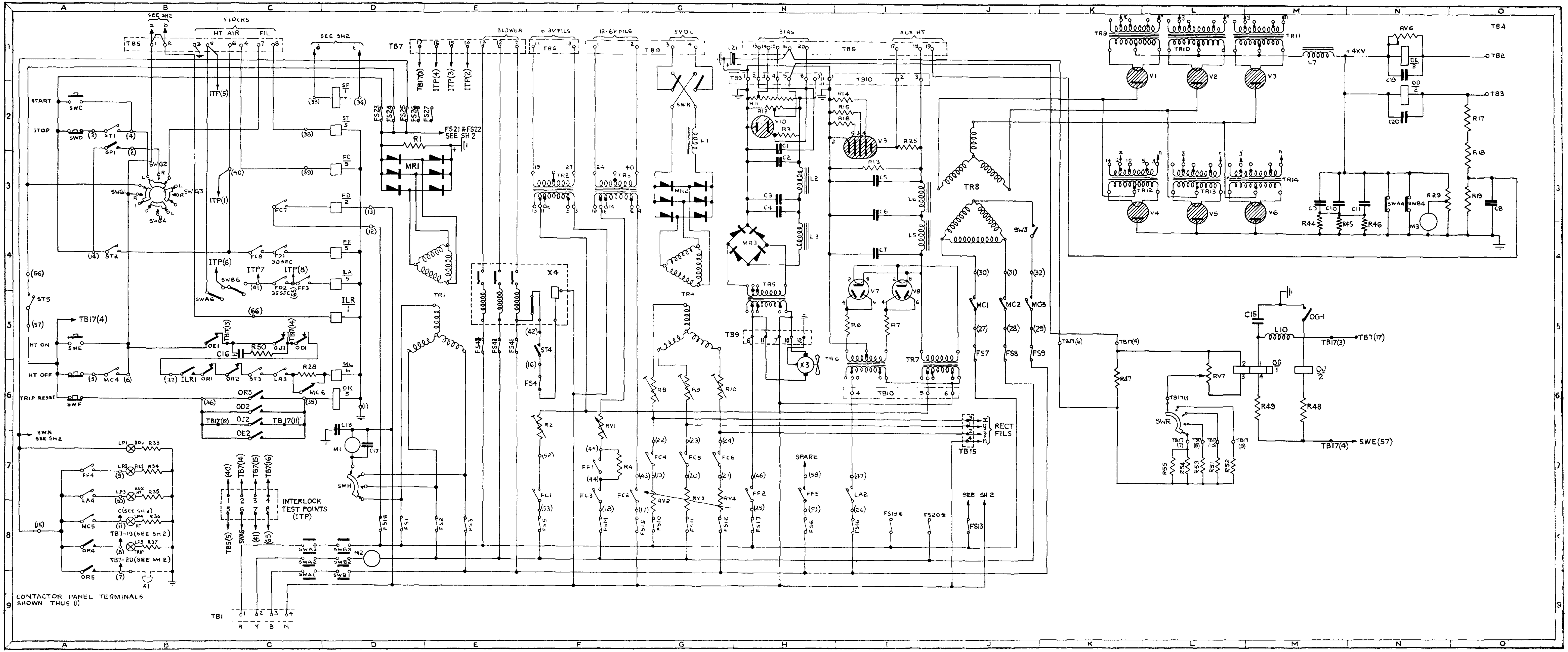
MISCELLANEOUS MECHANICAL ITEMS

Ref. 1	Fuseholder	No.144
Ref. 2	Fuseholder	No.145
Ref. 3	Fuseholder	No.146
Ref. 4	Valveholder I.O.	No.528
Ref. 5	Valveholder B5	No.529
Ref. 6	Lamp Jack	No.210
Ref. 7	Resistor Mounting	No.233
Ref. 8	Resistor Mounting	No.234
Ref. 9	Anode Clip	No. 84
Ref.10	Resistor Mounting	No.235
Ref.11	Valve Retainer	No.399
Ref.12	Valve Retainer	No.400
Ref.13		
Ref.14		
Ref.15	Stand-Off Insulator	No.207
Ref.16	Valve Retainer	No.401
	Contactor Panel WIS.9273-1-1	No.111



CIRCUIT CHANGES ARISING FROM
MODIFICATION NO.9785
(Fitting of Back-fire Indicators
and Remote Bias Control)

(To face
Fig. 14B)



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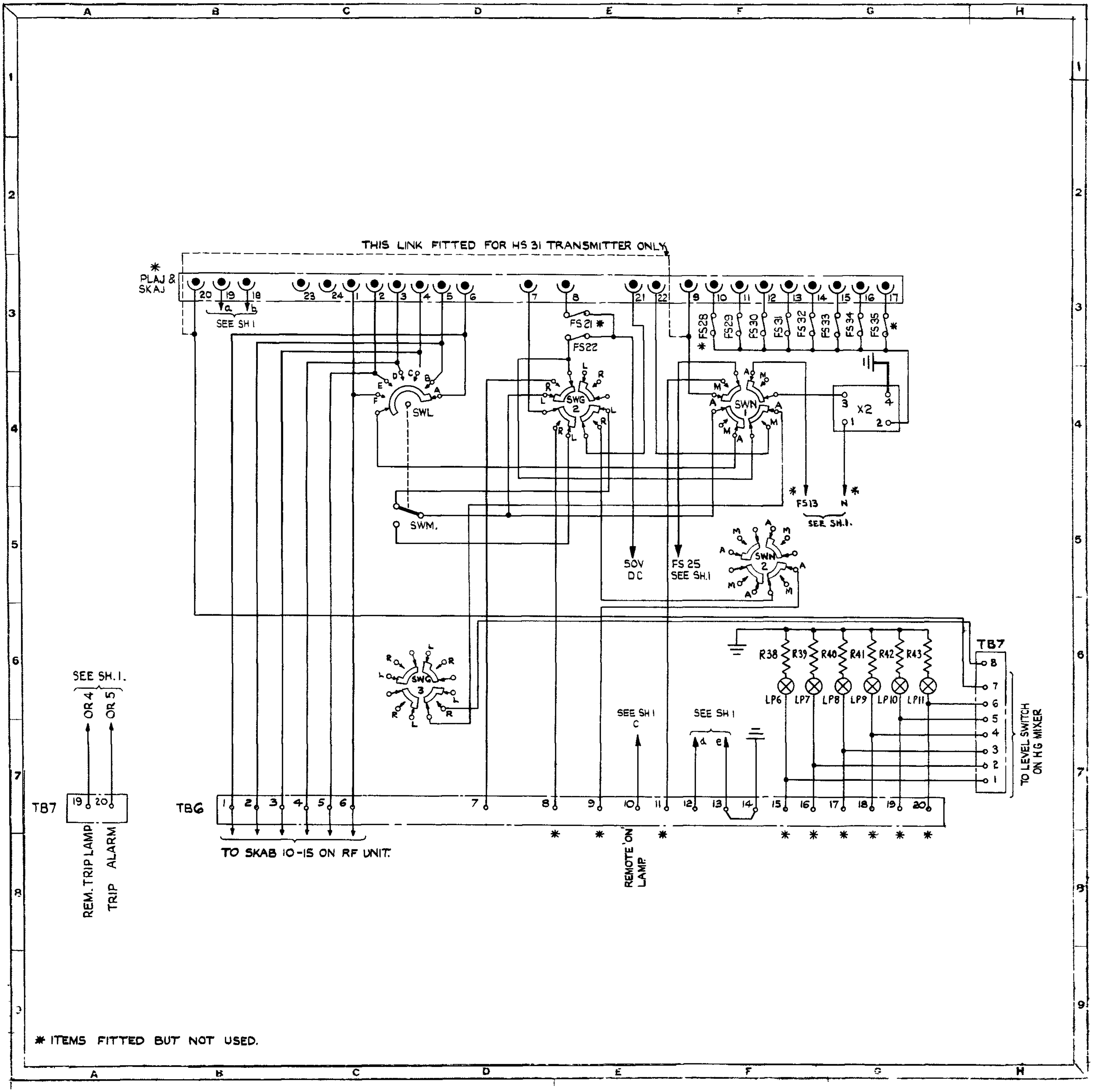
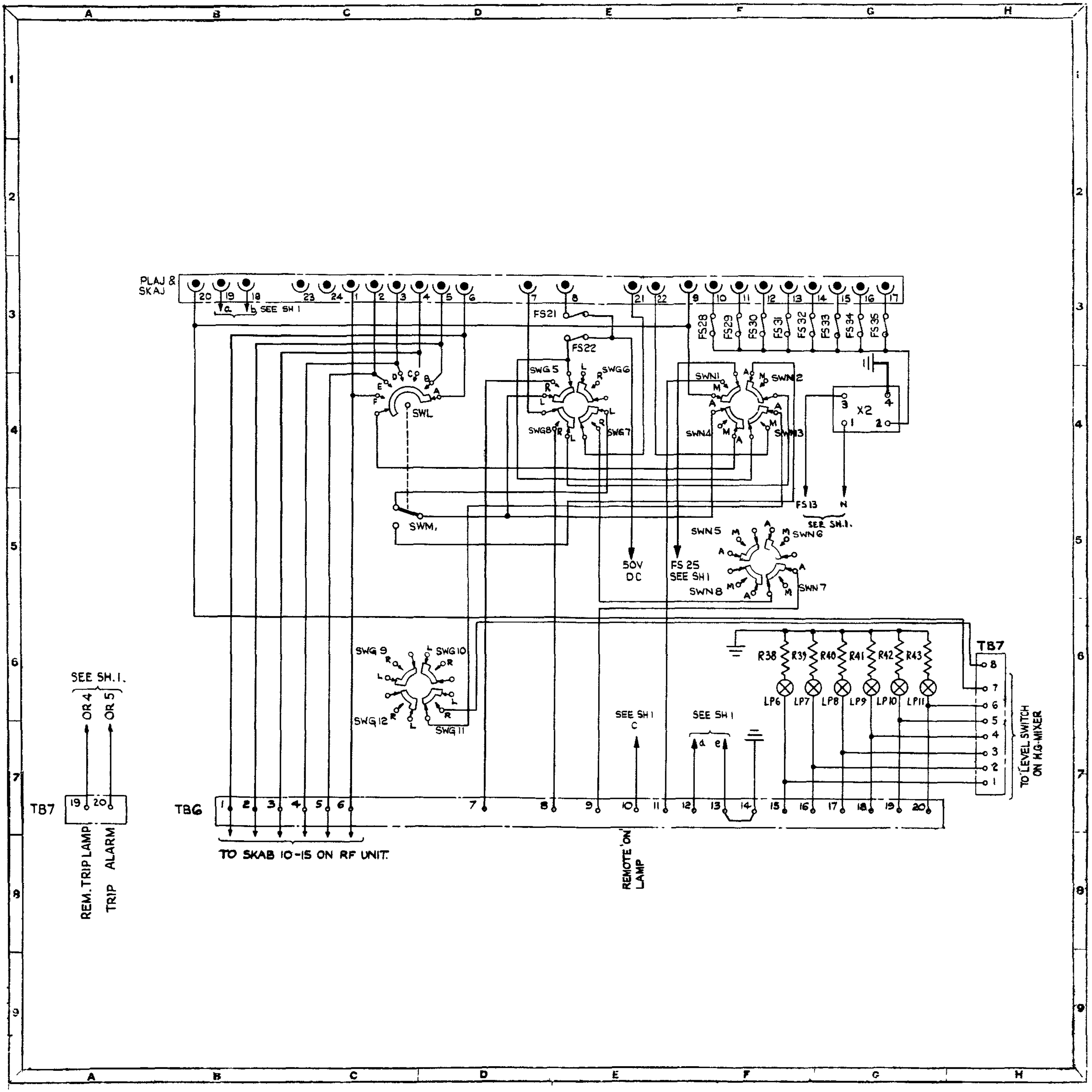
CIRCUIT DIAGRAM
RECTIFIER AND CONTROL UNIT, PART 1
HS31/1 AND HS31A/1

FIG.14B
WZ.26506/D SH.1
ISS.2



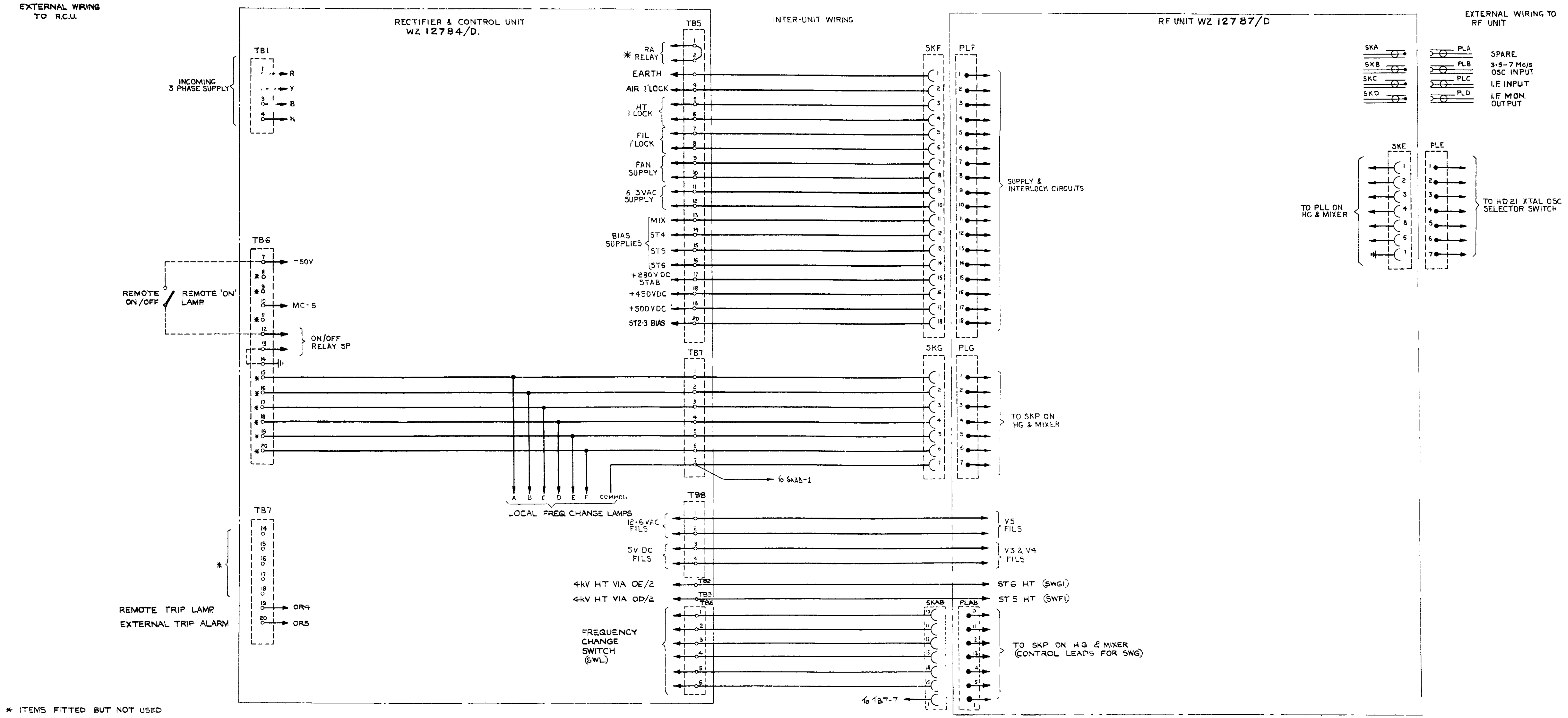
CIRCUIT
RECTIFIER AND CONTROL UNIT, SHEET 2
WZ.12784/B Sh.2 Iss.6

FIG.15



CIRCUIT DIAGRAM
RECTIFIER AND CONTROL UNIT, PART 2
HS31/1 AND HS31A/1

FIG.15A
WZ.26506/B SH.2
ISS.1



INTER-UNIT CONNECTION DIAGRAM
HS31 AND HS31A

FIG.16
WZ.17363/D SH.1
ISS.1

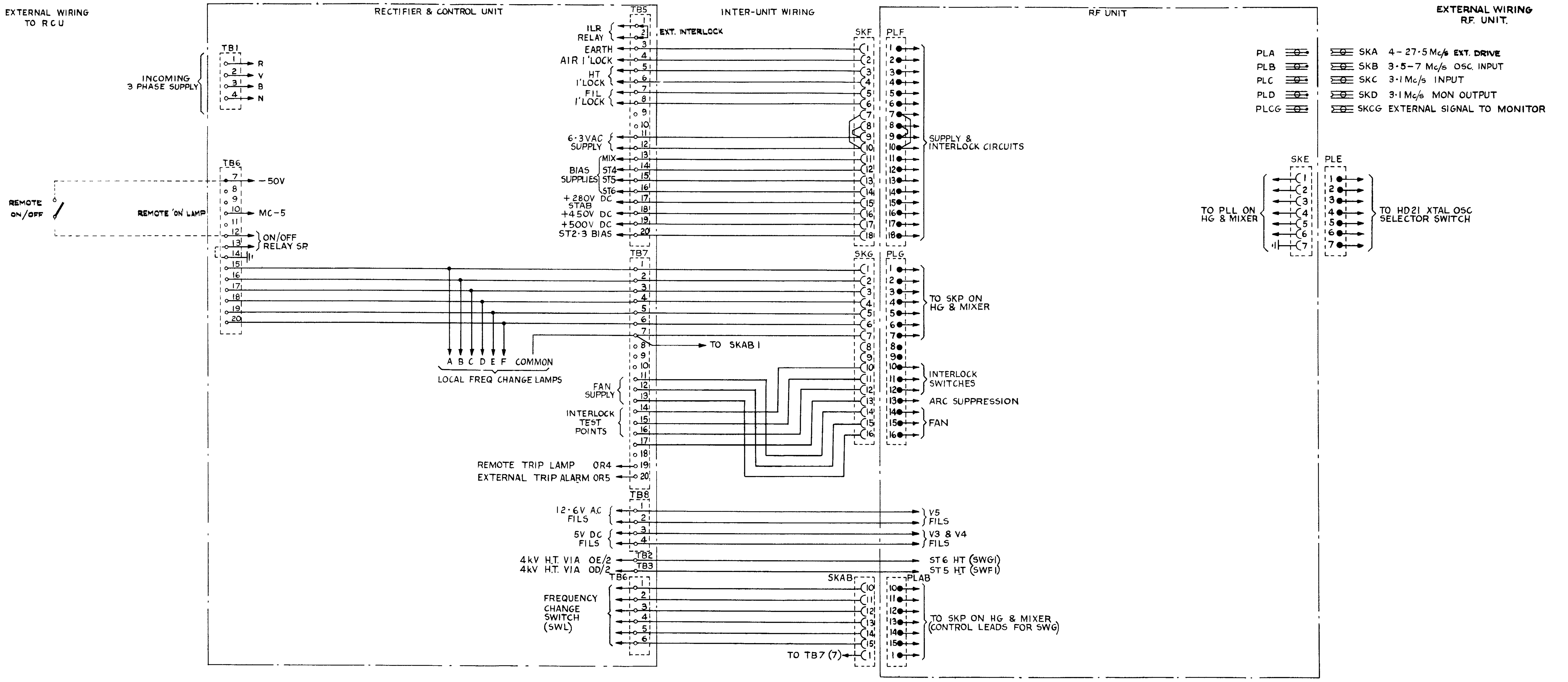
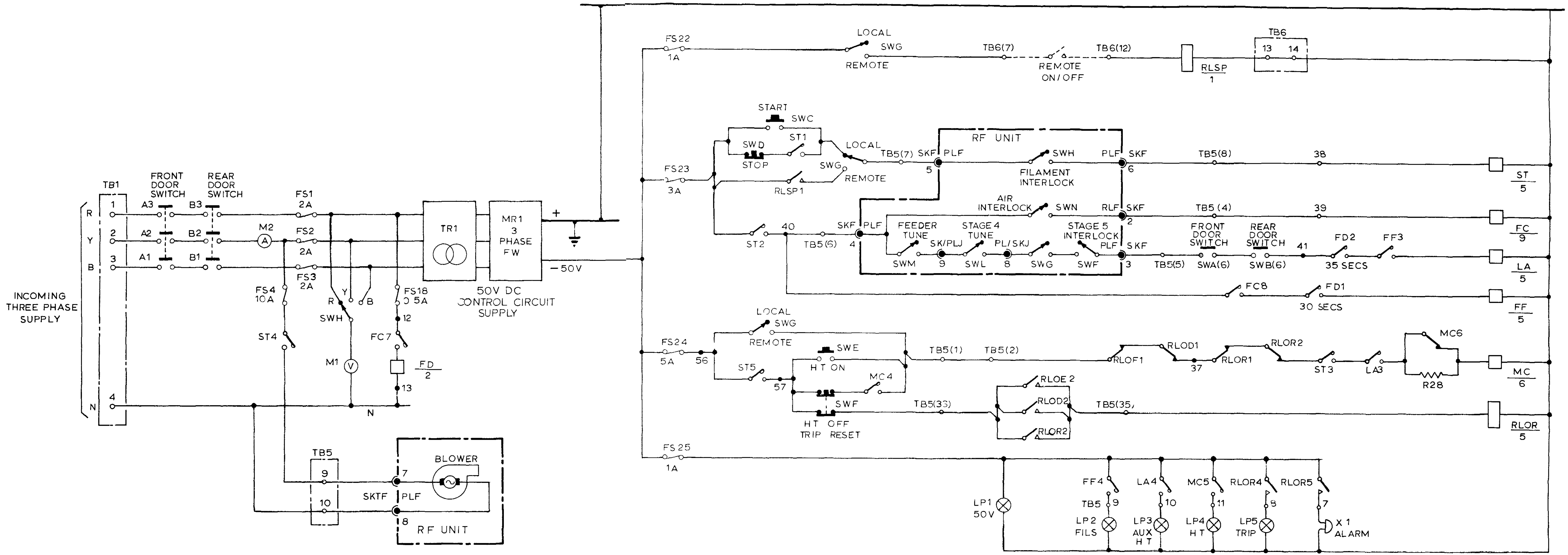


FIG.16A
WZ.26508/D Sh.1

A.P.116E-0231-1
Oct. '67.

INTER-UNIT CONNECTIONS
HS31/1 AND HS31A/1 TRANSMITTERS



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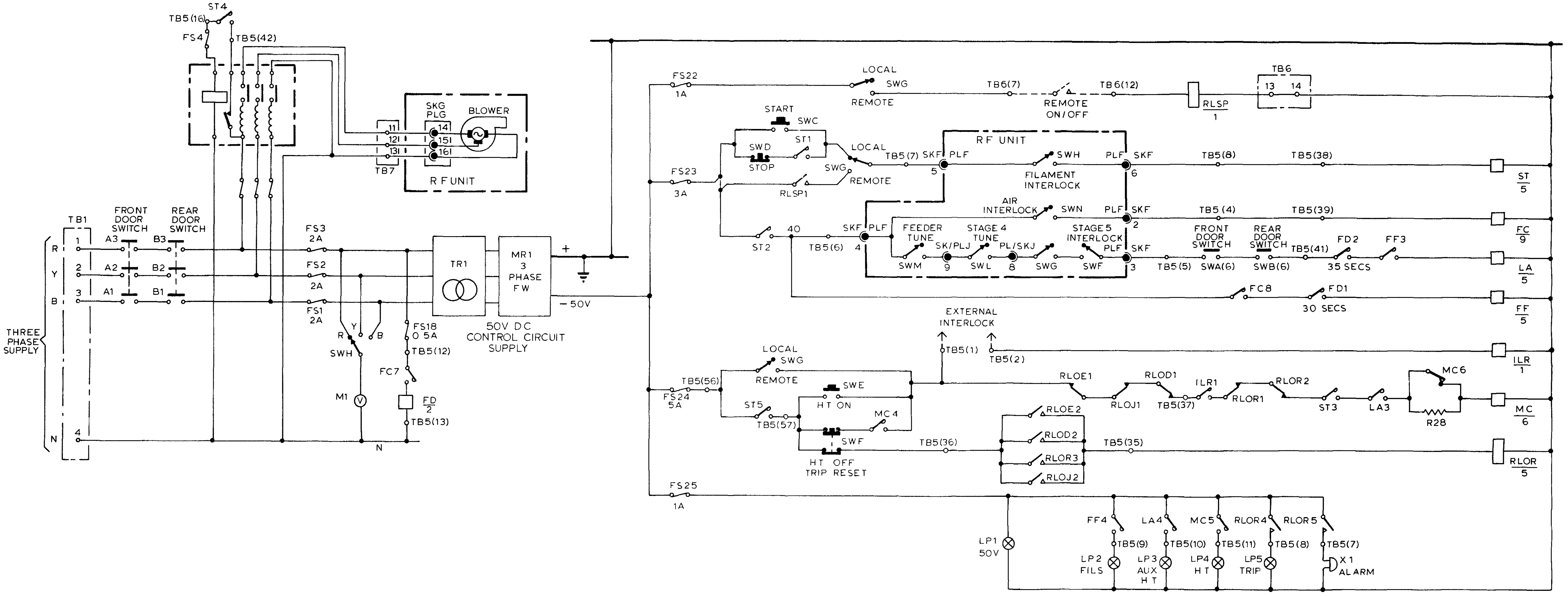
FUNCTIONAL DIAGRAM
CONTROL CIRCUITS
HS31 AND HS31A

FIG.17
WZ.31712/D SH.1
ISS.1



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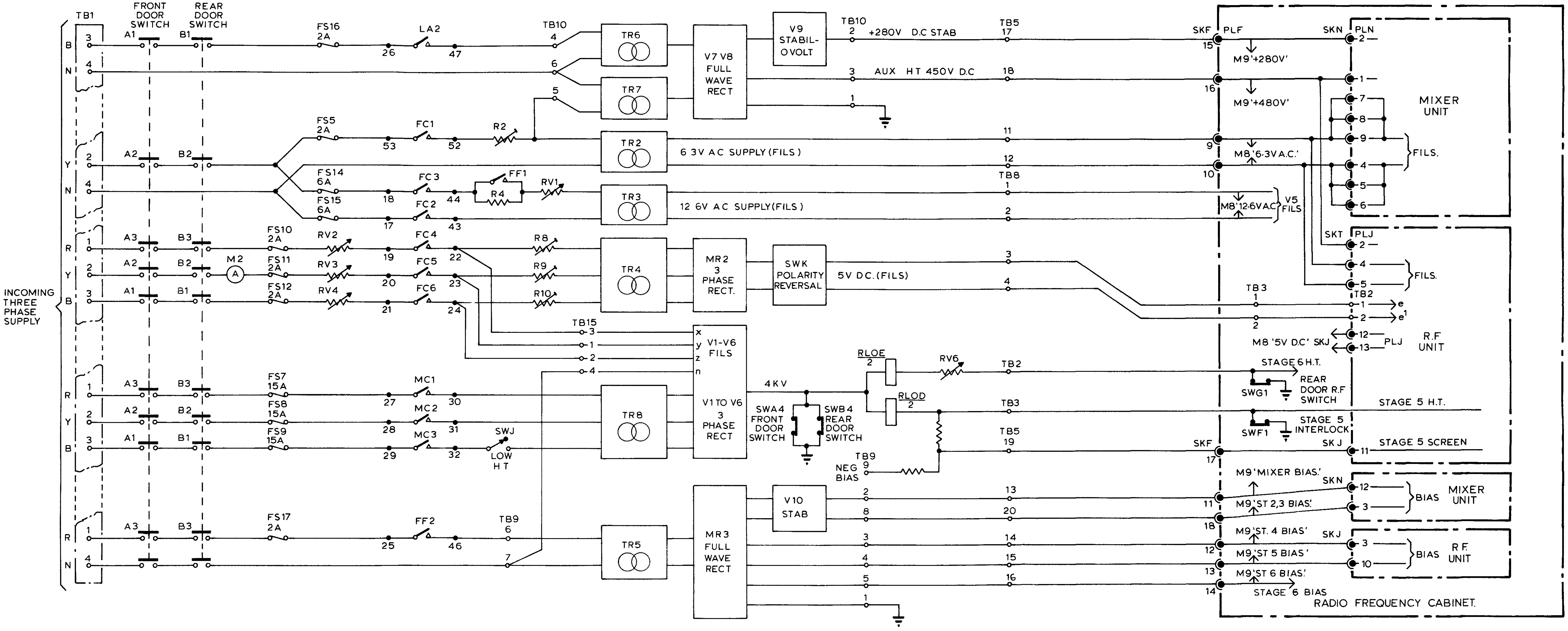
FUNCTIONAL DIAGRAM
CONTROL CIRCUITS
HS31A AND HS31A/1

FIG.17A
WZ.31712/D SH.2
ISS.1



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FUNCTIONAL DIAGRAM
POWER SUPPLY CIRCUITS
HS31 SERIES

FIG.17B
WZ.31713/D SH.1
ISS.1

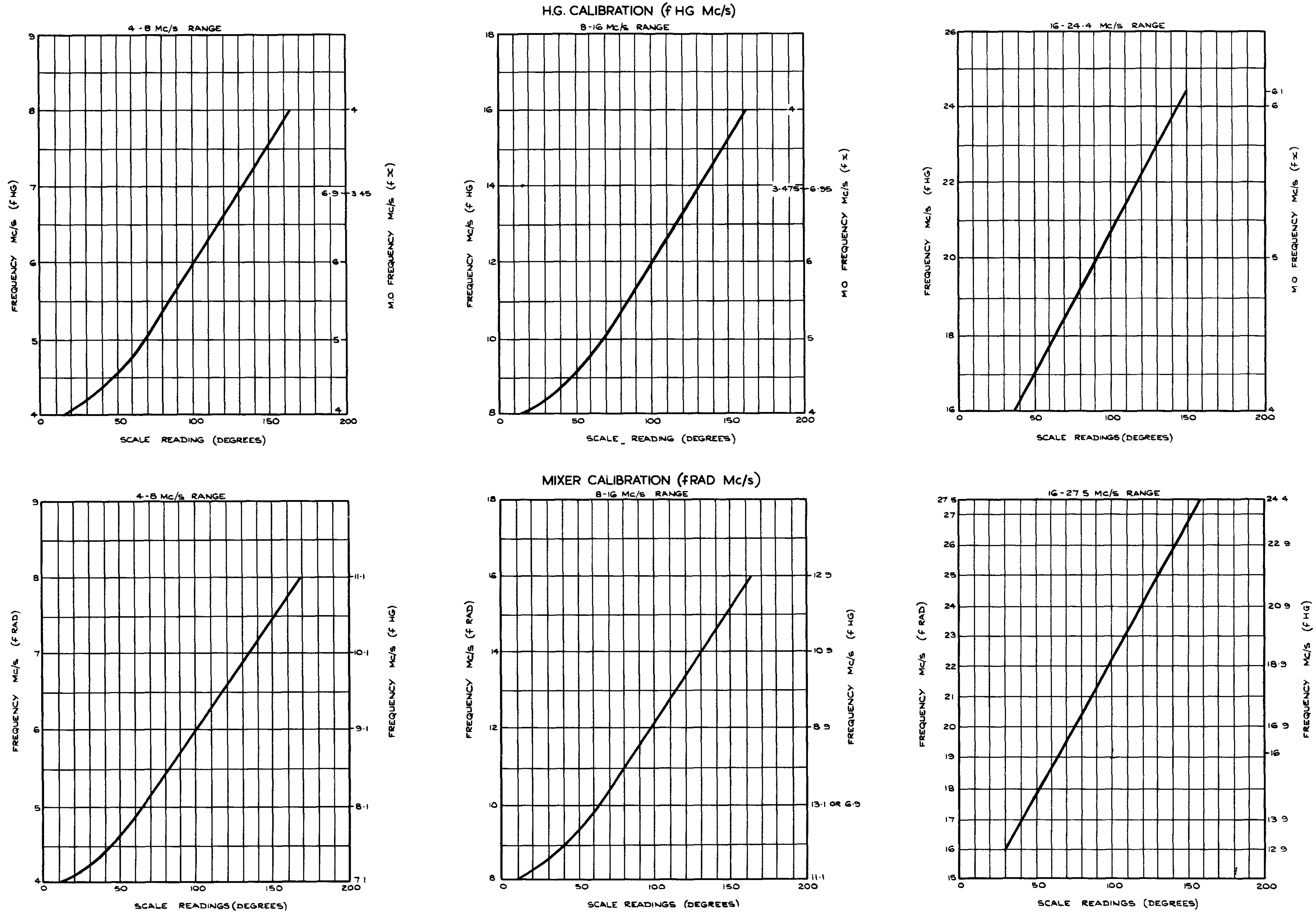
TYPE OF EMISSION	RADIATED FREQ. Mc/s	OSC FREQ. Mc/s	HG1 (V1) Ic mA	HG2 (V2) Ic mA	HG3 (V3) Ic mA	AMP (V4) Ic mA	AMP (V5/6) Ig mA	AMP (V5/6) Ic mA	MONITOR V12. Ic mA	MONITOR V13. Ic mA	MIXER (V7/8) Ic mA	ST1 (V9) Ic mA	ST2 (V10) Ic mA	ST3 (V11) Ic mA	ST4 Eg V	ST4 Ia mA	ST5 Eg V	ST5 Ic mA	ST6 Ig mA	ST6 Ic A	H.T KV	A.C CURRENT A	MEAN P/O KW	P.E.P. KW.
2 T	4·0	3·55	2·8	2·0	1·75	4·7	1·0	18	8	19	12	8·6	41	25	4·5	92	65	149	80	1·06	4·1	13·0	1·8	3·6
C W	4·0	3·55	2·8	2·0	1·8	4·7	1·0	18	8	19	12	8·5	41	27	10·5	90	110	210	240	1·6	4·05	15·7	3·6	
2 T	6·0	4·55	2·6	5·4	1·8	3·0	0·6	16	8	19	12	8·5	40	25	4·0	92	70	139	75	1·0	4·1	13·2	1·8	3·6
C W	6·0	4·55	2·6	5·5	1·8	3·1	0·6	15	8	19	12	8·5	40	25	9·5	91	109	200	220	1·55	4·05	15·1	3·6	
2 T	8·5	5·8	2·6	5·4	1·8	3·0	0·6	16	8	19	12	8·5	40	25	4·8	92	65	143	68	1·01	4·1	12·1	1·8	3·6
C W	8·5	5·8	2·6	5·5	1·8	3·1	0·6	15	8	19	12	8·5	40	25	8·0	92	100	220	215	1·51	4·05	15·0	3·6	
2 T	10·0	6·55	2·6	5·4	1·8	3·0	0·6	16	8	19	12	8·5	40	25	4·4	91	59	139	81	1·05	4·1	13·2	1·8	3·6
C W	10·0	6·55	2·6	5·5	1·8	3·1	0·6	15	8	19	12	8·5	40	25	7·0	88	90	175	205	1·45	4·0	15·0	3·6	
2 T	15·0	5·95	2·6	5·4	1·8	3·0	0·6	16	8	19	12	8·5	40	25	4·0	94	55	141	70	1·05	4·1	13·3	1·8	3·6
C W	15·0	5·95	2·6	5·5	1·8	3·1	0·6	15	8	19	12	8·5	40	25	7·9	90	106	200	240	1·52	4·05	15·2	3·6	
2 T	18·0	3·725	2·6	5·4	1·8	3·0	0·6	16	8	19	12	8·5	40	25	3·9	92	59	130	60	0·98	4·05	13·0	1·8	3·6
C W	18·0	3·725	2·6	5·5	1·8	3·1	0·6	15	8	19	12	8·5	40	25	8·0	89	104	209	220	1·51	4·0	15·4	3·6	
2 T	22·0	4·725	2·4	5·6	4·9	4·7	1·2	18	9	19	12	8·5	41	24	3·6	90	50	133	31	0·75	4·0	12·5	1·4	2·8
C W	22·0	4·725	2·3	5·6	4·9	4·7	1·2	18	8·5	19	12	8·4	40	25	6·6	88	88	205	110	1·25	3·95	14·9	2·8	
2 T	27·5	6·1	2·4	5·6	4·9	4·7	1·2	18	9	19	12	8·5	41	24	3·8	94	49	130	50	0·78	4·05	12·4	1·4	2·8
C W	27·5	6·1	2·3	5·6	4·9	4·7	1·2	18	8·5	19	12	8·4	40	25	7·6	91	92	220	150	1·25	4·0	14·3	2·8	

TYPICAL POWER FIGURES
WZ.12791/D Sh.1 Iss.3

FIG.18

TYPE OF EMISSION	RADIATED FREQ Mc/s		HG1 (V1) Ic mA	HG2 (V2) Ic mA	HG3 (V3) Ic mA	AMP (V4) Ic mA	AMP (V5/6)		MONITOR		MIXER (V7/8) Ic mA	ST1 (V9) Ic mA	ST2 (V10) Ic mA	ST3 (V11) Ic mA	ST4 Eg V	ST4 Ia mA	ST5 Eg V	ST5 Ic mA	ST6 Ig mA	ST6 Ic A	HT KV	A.C. CURRENT A	MEAN P/O kW	P.E.P. kW
							Ia mA	Ic mA	V12, Ic mA	V13 Ic mA														
2 T	2·5	—	2·8	4·1	1·5	6·2	0·2	13	8	16	10	8·6	38	25	3·5	92	65	149	98	1·06	4·1	13·0	1·8	3·6
CW	2·5	—	2·8	4·1	1·5	6·2	0·2	13	8	16	10	8·5	37	24	6	90	100	210	255	1·6	4·05	15·7	3·6	
D.S.B (CARRIER)	2·5	—	2·8	4·9	1·6	3·8	0·5	17	8	18	13	8	40	28	2·2	94	61	129	65	0·85	4·05	11·6	1·5	
2 T	4·0	—	2·6	2·4	1·8	4·3	1·0	20	8	16	9	8·5	38	25	3·0	92	70	139	107	1·1	4·1	13·2	1·75	3·5
CW	4·0	—	2·6	2·4	1·8	4·3	1·0	20	8	16	9	8·5	38	25	4·8	85	100	185	260	1·55	4·05	15·1	3·5	
D.S.B (CARRIER)	4·0	—	2·6	2·8	1·9	3·7	1·0	22	8	17	11	8·3	39	27	2·8	91	69	135	73	0·9	4·05	12·5	1·5	
2 T	4·9	—	2·6	2·6	1·8	8·4	0·1	12	8	16	9	8·5	38	25	2·5	87	65	143	93	1·06	4·1	12·8	1·75	3·6
CW	4·9	—	2·6	2·6	1·8	8·4	0·1	12	8	16	9	8·5	38	25	4·2	82	100	200	265	1·57	4·05	15·0	3·5	
B.S.B. (CARRIER)	4·9	—	2·6	3·3	1·9	8·2	0·1	13	8	18	11	8·4	38	28	2·4	87	65	140	66	0·86	4·05	12	1·5	
2T	8·0	—	2·6	3·2	1·4	8·6	0·1	12	8	16	8	8·5	40	25	2·5	88	50	115	91	1·05	4·1	12·0	1·75	3·6
CW	8·0	—	2·6	3·2	1·4	8·6	0·1	12	8	16	8	8·5	40	25	5·4	80	96	165	255	1·55	4·0	15·0	3·5	
D.S.B. (CARRIER)	8·0	—	2·6	3·5	1·5	8·4	·05	13	8	17	9	8·4	40	27	2·5	88	50	115	65	·9	4·05	12·0	1·5	
2T	10·2	—	2·6	1·8	1·6	4·8	1·0	20	8	16	12	8·5	40	25	3·5	90	65	130	105	1·05	4·1	13·3	1·75	3·6
CW	10·2	—	2·6	1·8	1·6	4·8	1·0	20	8	16	12	8·5	40	25	7·9	81	115	170	250	1·52	4·05	15·2	3·5	
D.S.B. (CARRIER)	10·2	—	2·6	2·1	1·7	4·5	0·9	22	8	17	15	8·3	39	27	3·5	90	64	129	74	·9	4·05	12·5	1·5	
2T	11·1	—	2·6	3·2	1·5	8·7	0·1	11	8	16	8	8·5	40	25	3	86	59	120	90	1·02	4·05	12·5	1·75	3·6
CW	11·1	—	2·6	3·2	1·5	8·7	0·1	11	8	16	8	8·5	40	25	6·5	80	104	166	250	1·5	4·0	14·5	3·5	
D.S.B. (CARRIER)	11·1	—	2·6	3·5	1·6	8·4	0·1	12	8	17	9	8·4	39	27	2·9	86	59	118	61	·85	4·05	11·5	1·5	
2T	13·1	—	2·6	4·6	1·8	3·4	0·5	16	9	16	11	8·5	41	30	2·8	86	55	140	90	1·1	4·1	12·5	1·75	3·6
CW	13·1	—	2·6	4·6	1·8	3·4	0·5	16	8·5	16	11	8·4	40	29	6·8	76	108	180	260	1·5	4·05	14·9	3·5	
D.S.B. (CARRIER)	13·1	—	2·6	5·1	1·9	3·1	0·4	18	8	18	13	8·4	40	33	2·8	85	55	138	60	0·92	4·05	11·5	1·5	
2T	20	—	2·8	5·0	4·9	7·3	0·3	18	7	16	12	8·5	38	24	3·3	91	68	155	105	1·05	4·05	12·4	1·75	3·6
CW	20	—	2·8	5·0	4·9	7·3	0·3	18	7	16	12	8·4	37	25	6·8	85	110	210	250	1·6	4·0	15·5	3·5	
D.SB. (CARRIER)	20	—	2·8	5·6	5	7·0	0·5	20	7	17	14	8·3	37	27	3·3	90	67	153	70	0·87	4	11·4	1·5	

TYPICAL POWER FIGURES
HS31A AND HS31A/1

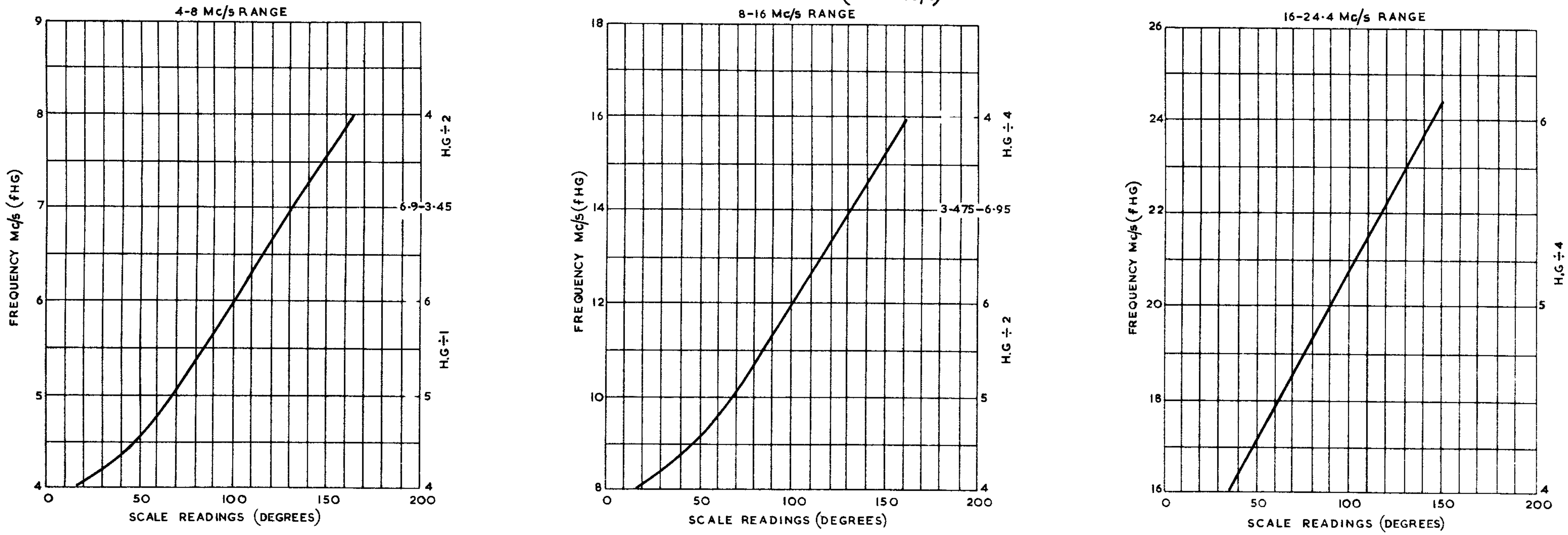


CALIBRATION CURVES

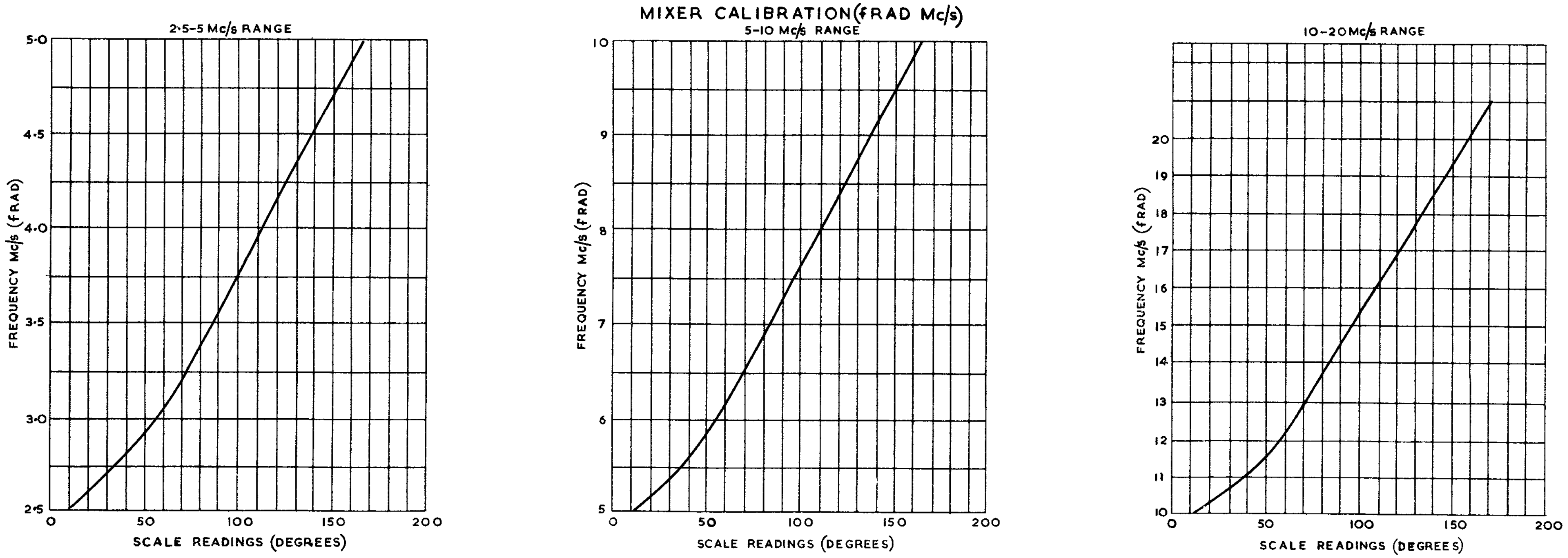
SHEET 1

WZ.12792/D Sh.1 Iss.2

H.G. CALIBRATION (fHG Mc/s)

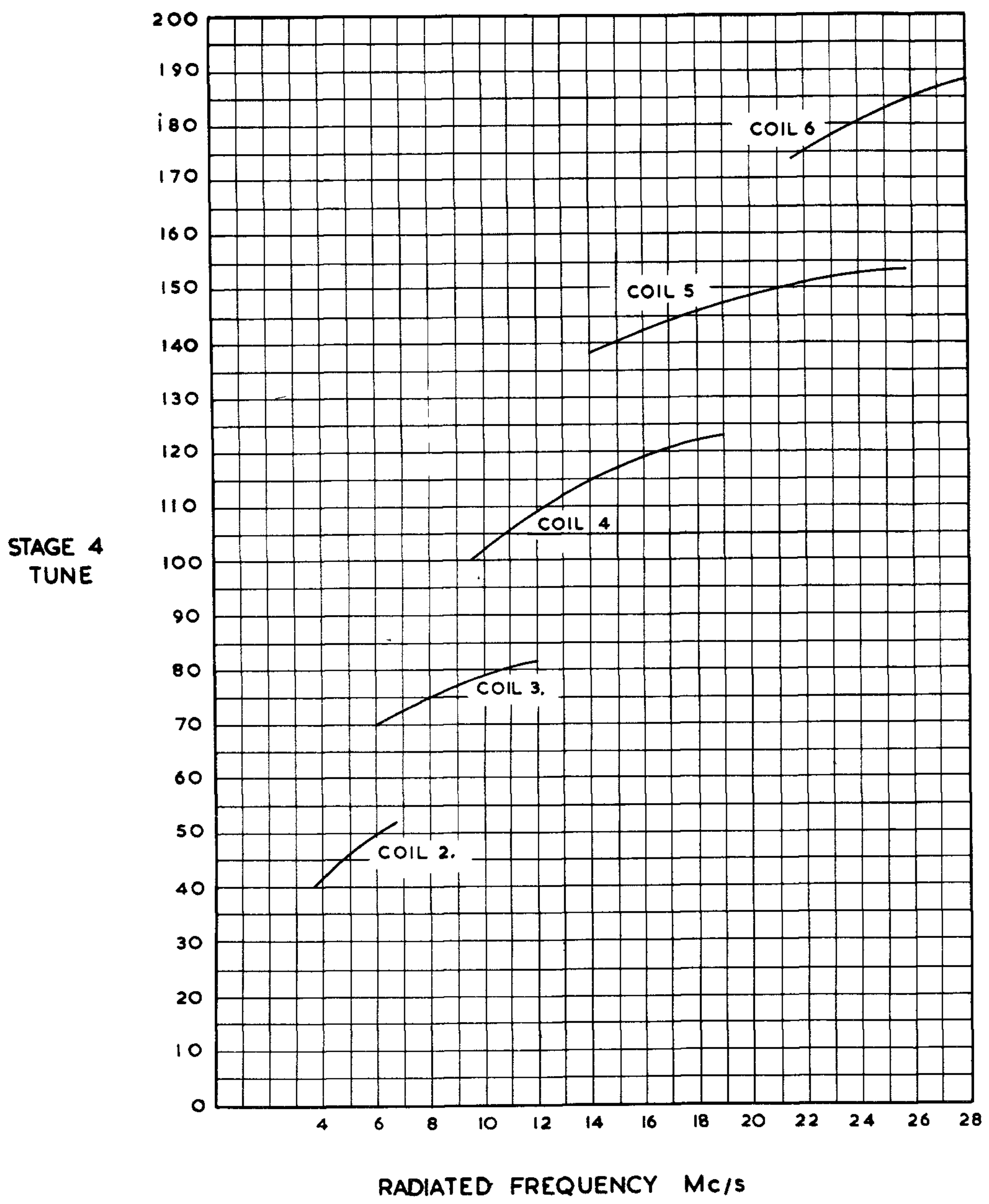


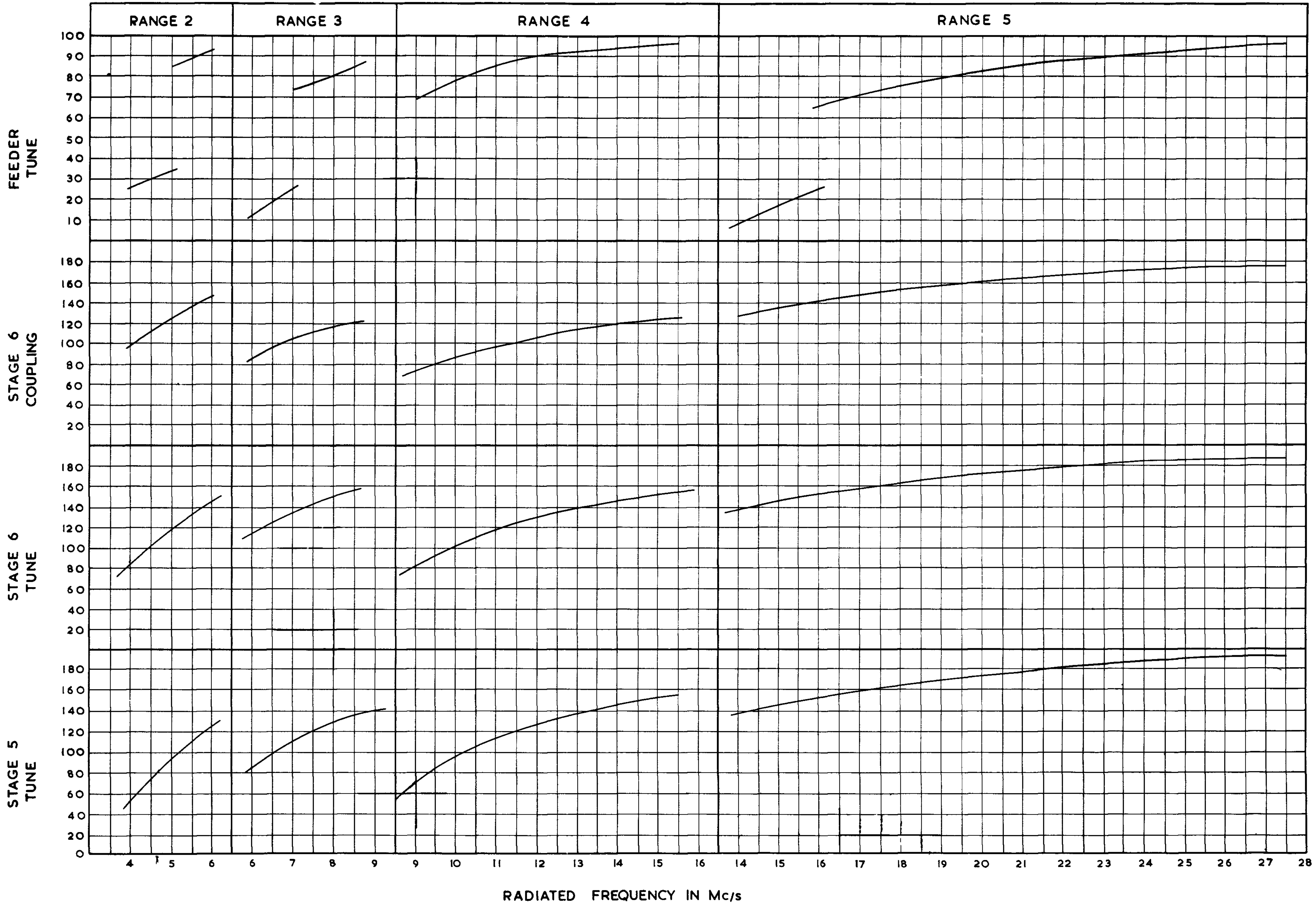
MIXER CALIBRATION (fRAD Mc/s)



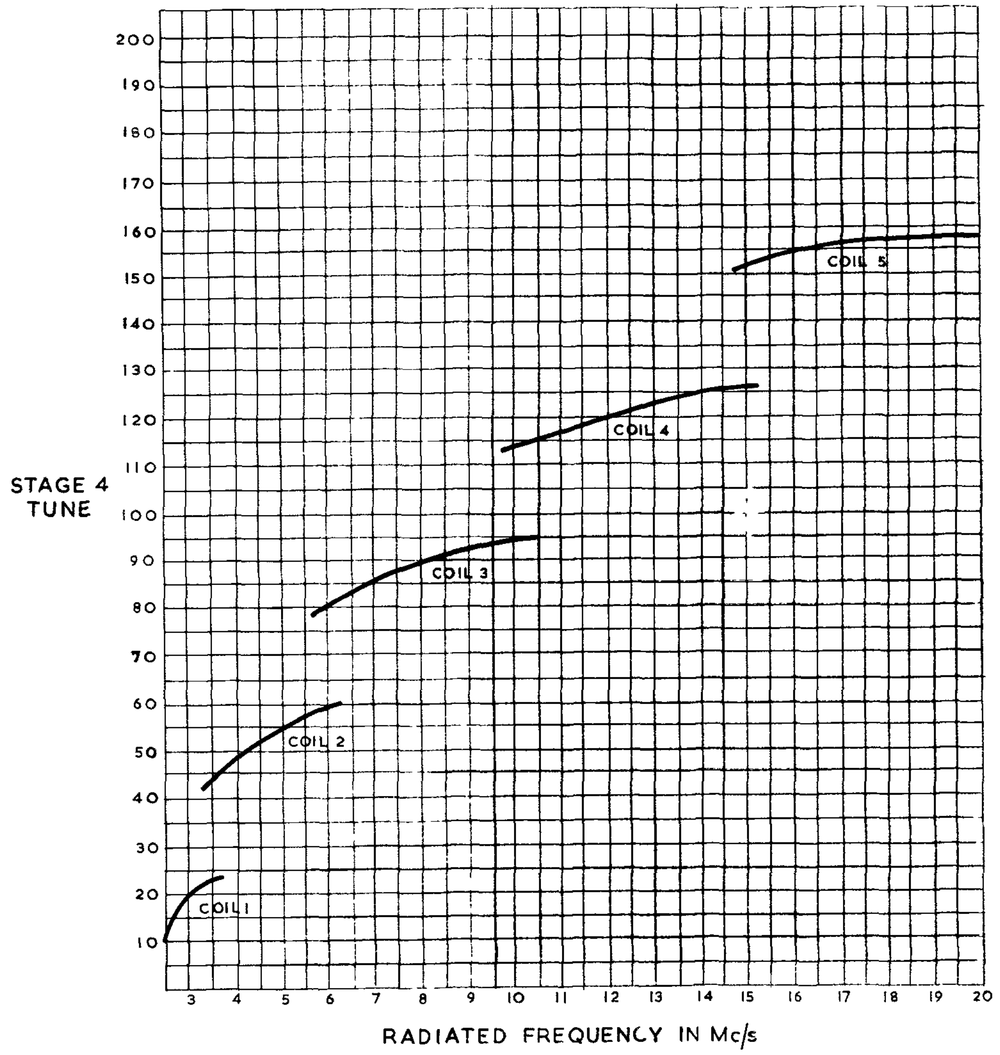
CALIBRATION CURVES, PART 1
HS31A AND HS31A/1

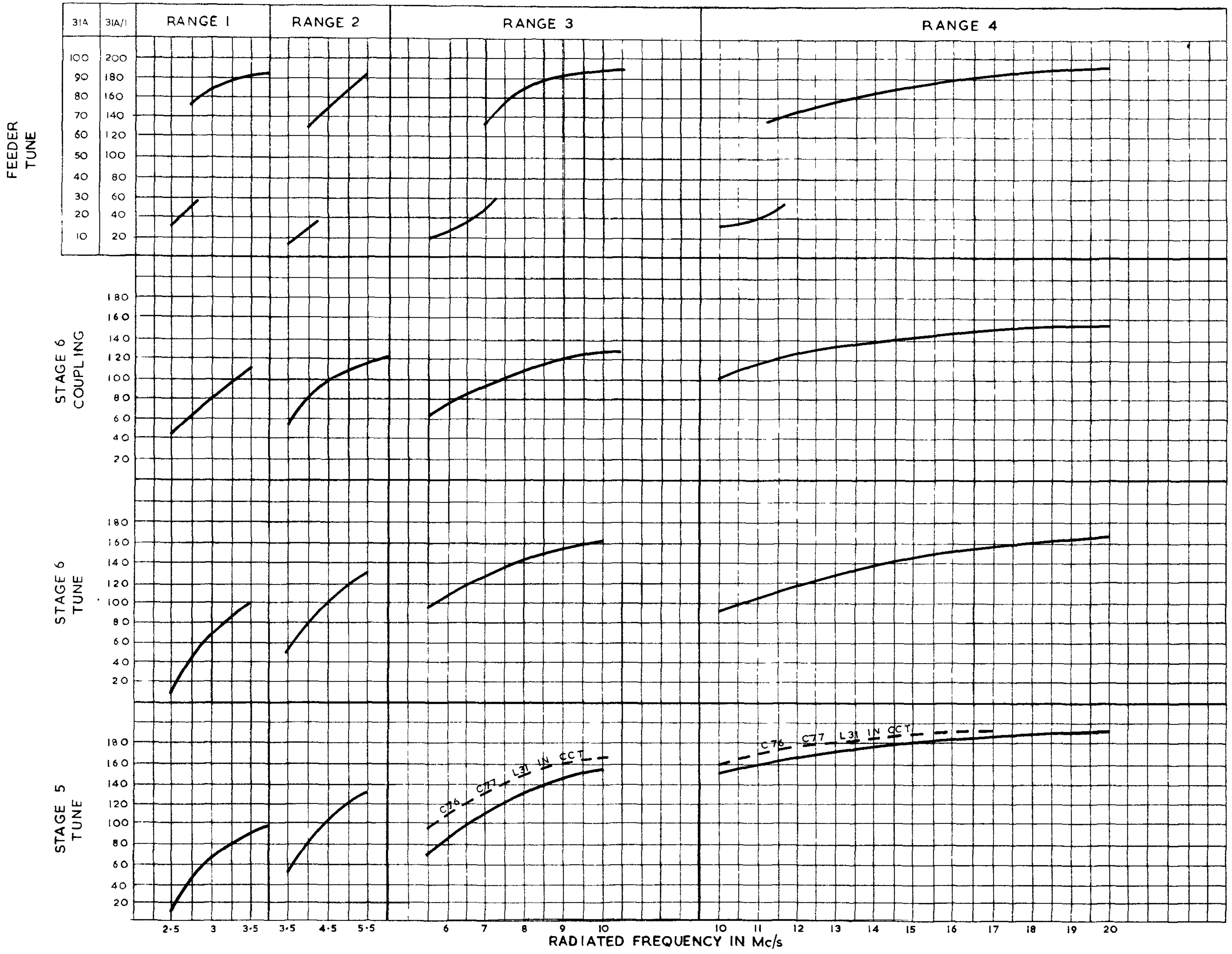
FIG.19A
WZ.17367/D SH.1
ISS.2





CALIBRATION CURVES
SHEET 2
WZ.12792/D Sh.2 Iss.2





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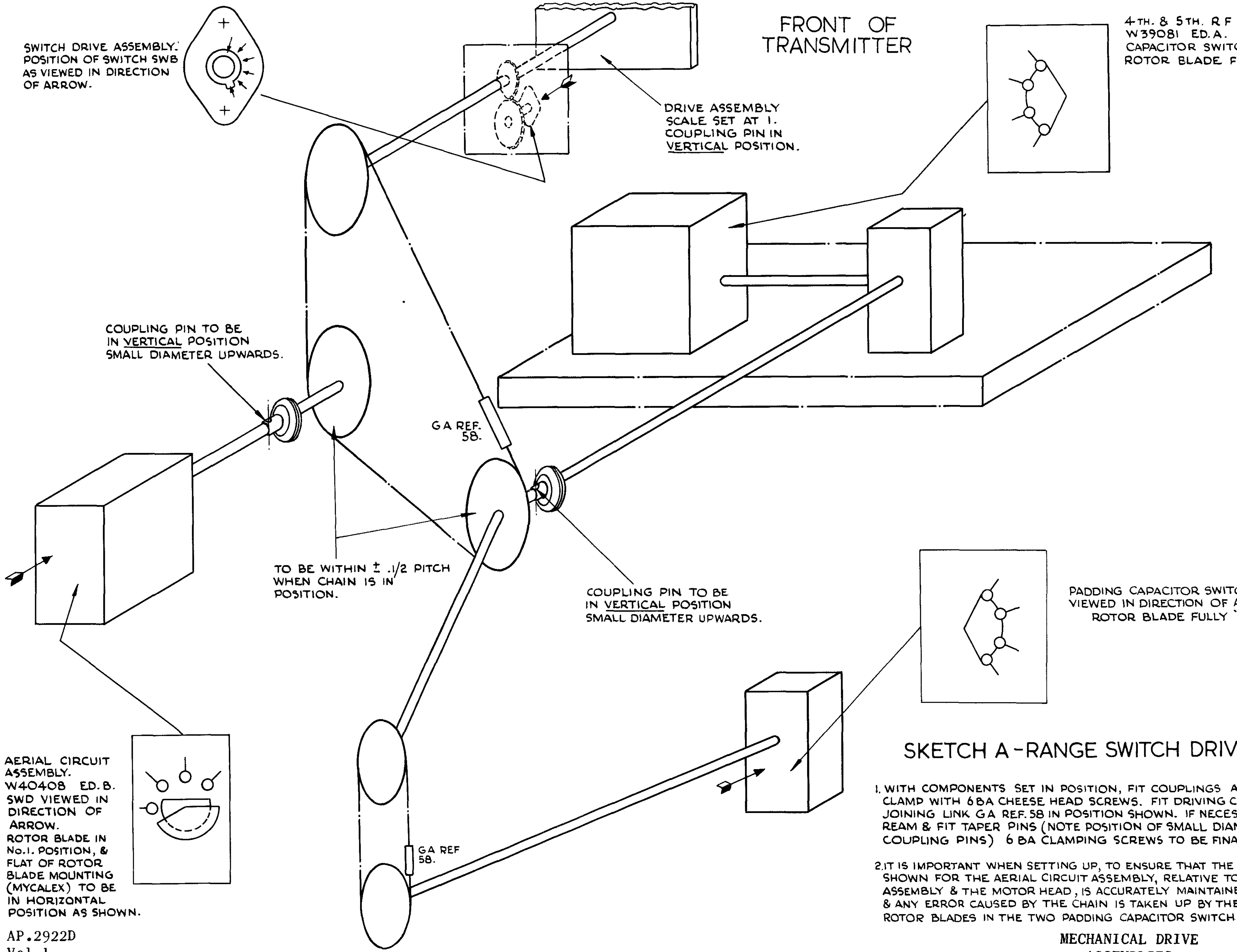
2nd Edn. Oct. '67

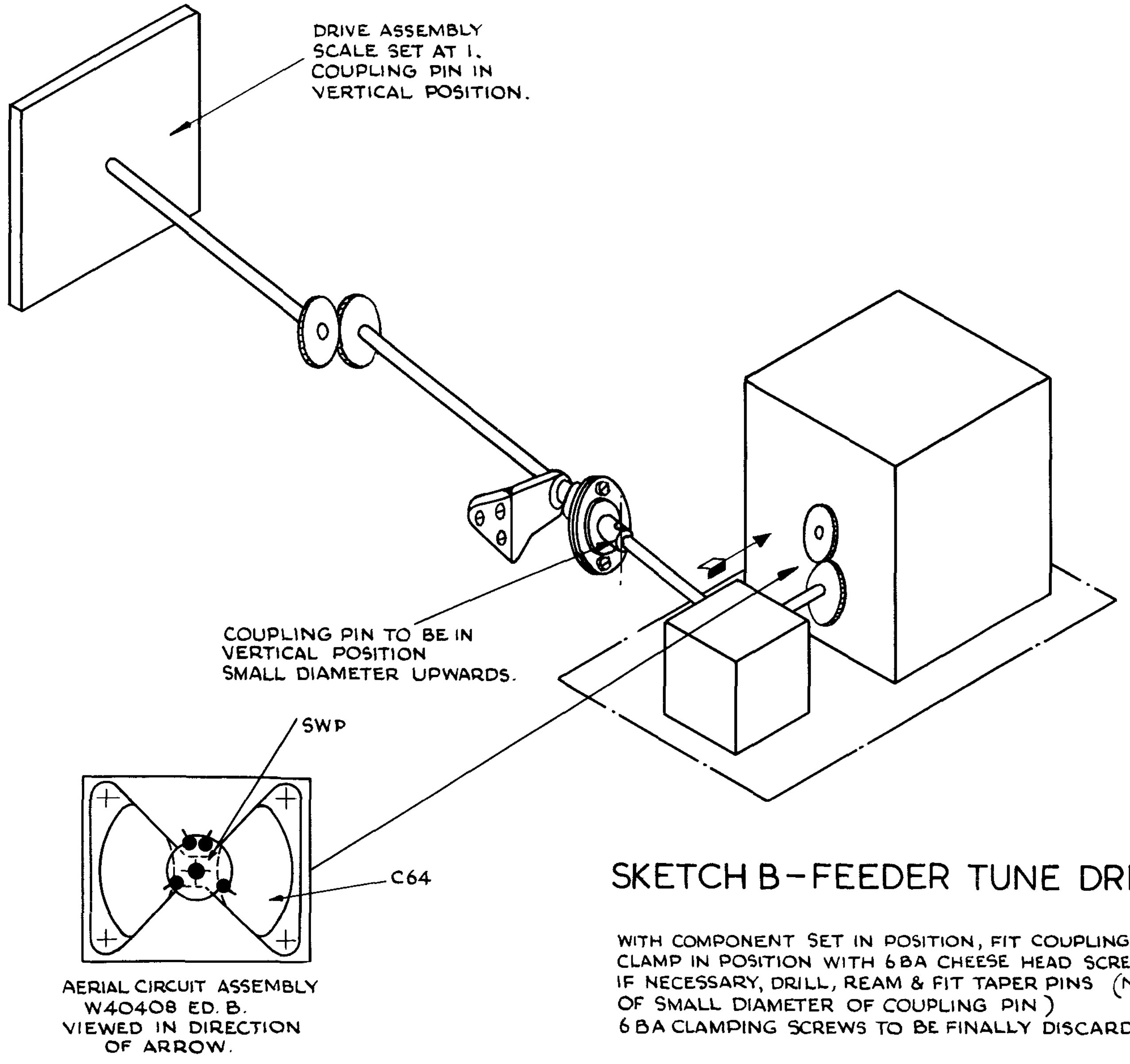
CALIBRATION CURVES, PART 2
HS31A AND HS31A/1

FIG.20A
WZ.17367/D SH.2
ISS.2



SKETCH A-RANGE SWITCH DRIVES.

1. WITH COMPONENTS SET IN POSITION, FIT COUPLINGS AS SHOWN. CLAMP WITH 6BA CHEESE HEAD SCREWS. FIT DRIVING CHAINS WITH JOINING LINK GA REF. 58 IN POSITION SHOWN. IF NECESSARY, DRILL REAM & FIT TAPER PINS (NOTE POSITION OF SMALL DIAMETER OF COUPLING PINS) 6 BA CLAMPING SCREWS TO BE FINALLY DISCARDED.
2. IT IS IMPORTANT WHEN SETTING UP, TO ENSURE THAT THE SETTING POSITION SHOWN FOR THE AERIAL CIRCUIT ASSEMBLY, RELATIVE TO THE SWITCH DRIVE ASSEMBLY & THE MOTOR HEAD, IS ACCURATELY MAINTAINED & SET UP FIRST, & ANY ERROR CAUSED BY THE CHAIN IS TAKEN UP BY THE OVERLAP OF THE ROTOR BLADES IN THE TWO PADDING CAPACITOR SWITCH ASSEMBLIES.

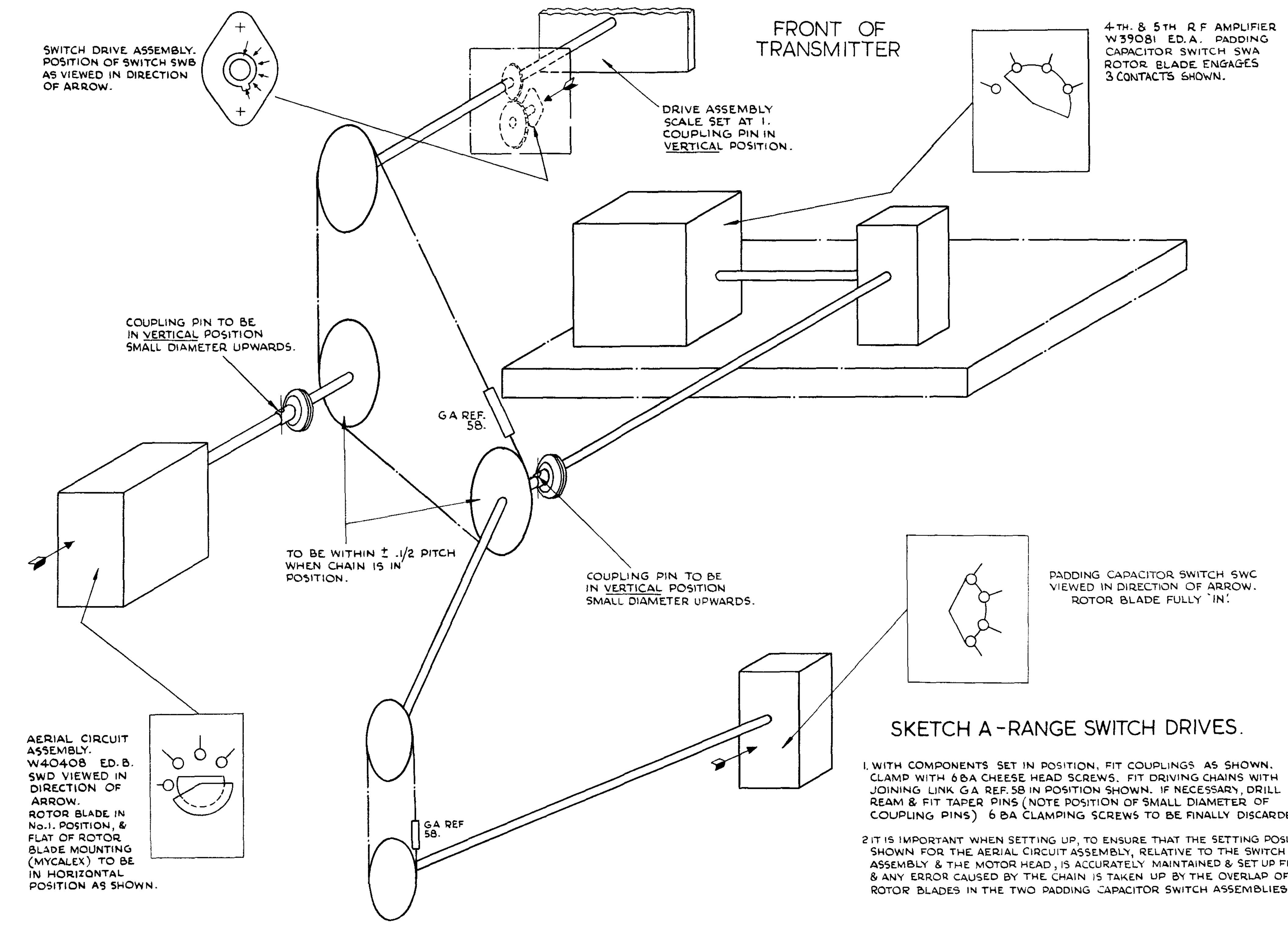


SKETCH B-FEEDER TUNE DRIVE.

WITH COMPONENT SET IN POSITION, FIT COUPLING AS SHOWN. CLAMP IN POSITION WITH 6BA CHEESE HEAD SCREWS. IF NECESSARY, DRILL, REAM & FIT TAPER PINS (NOTE POSITION OF SMALL DIAMETER OF COUPLING PIN) 6BA CLAMPING SCREWS TO BE FINALLY DISCARDED.

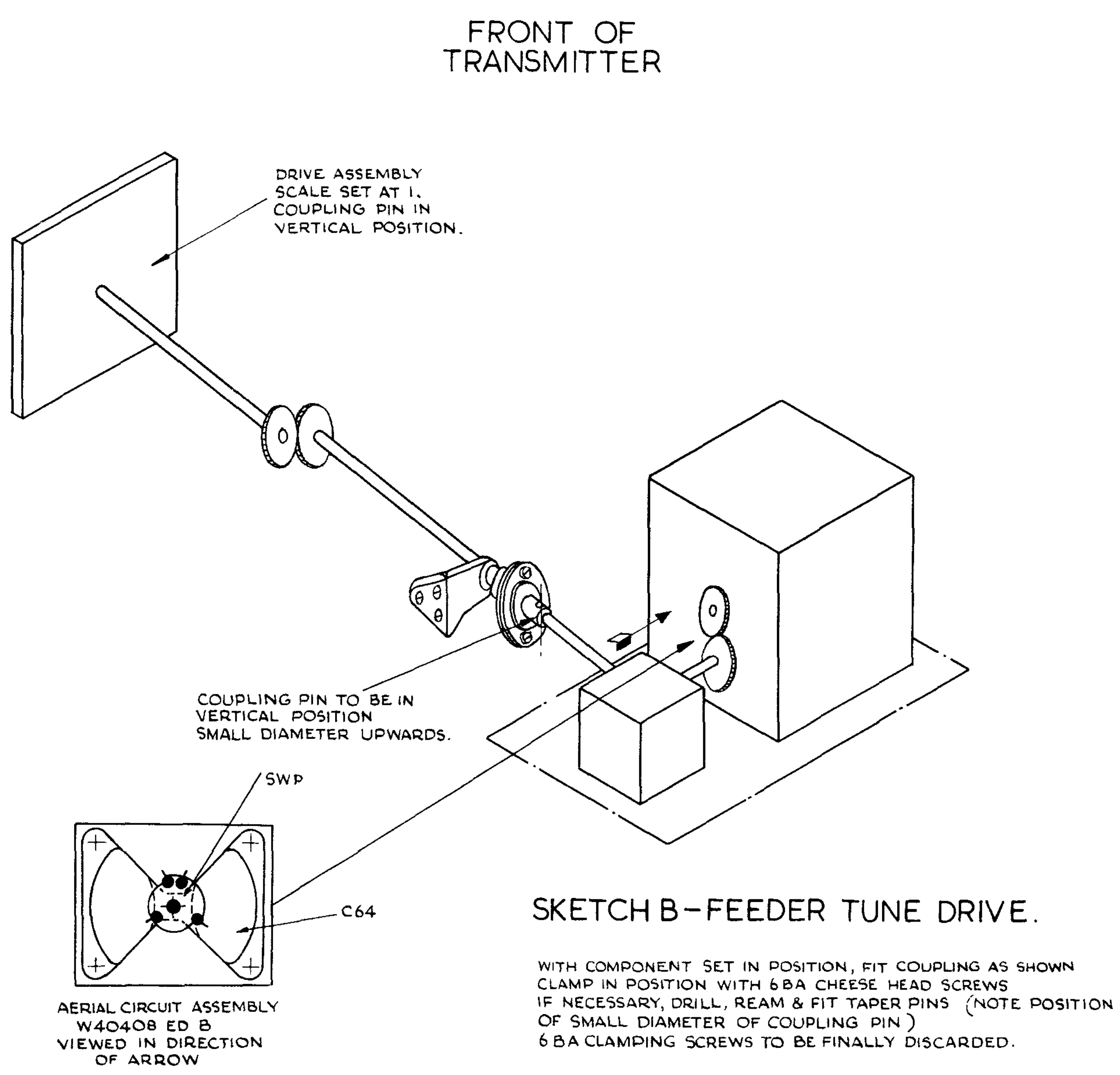
MECHANICAL DRIVE
ASSEMBLIES
WZ.16303/D Sh.1 Iss.1

FIG.21



SKETCH A - RANGE SWITCH DRIVES.

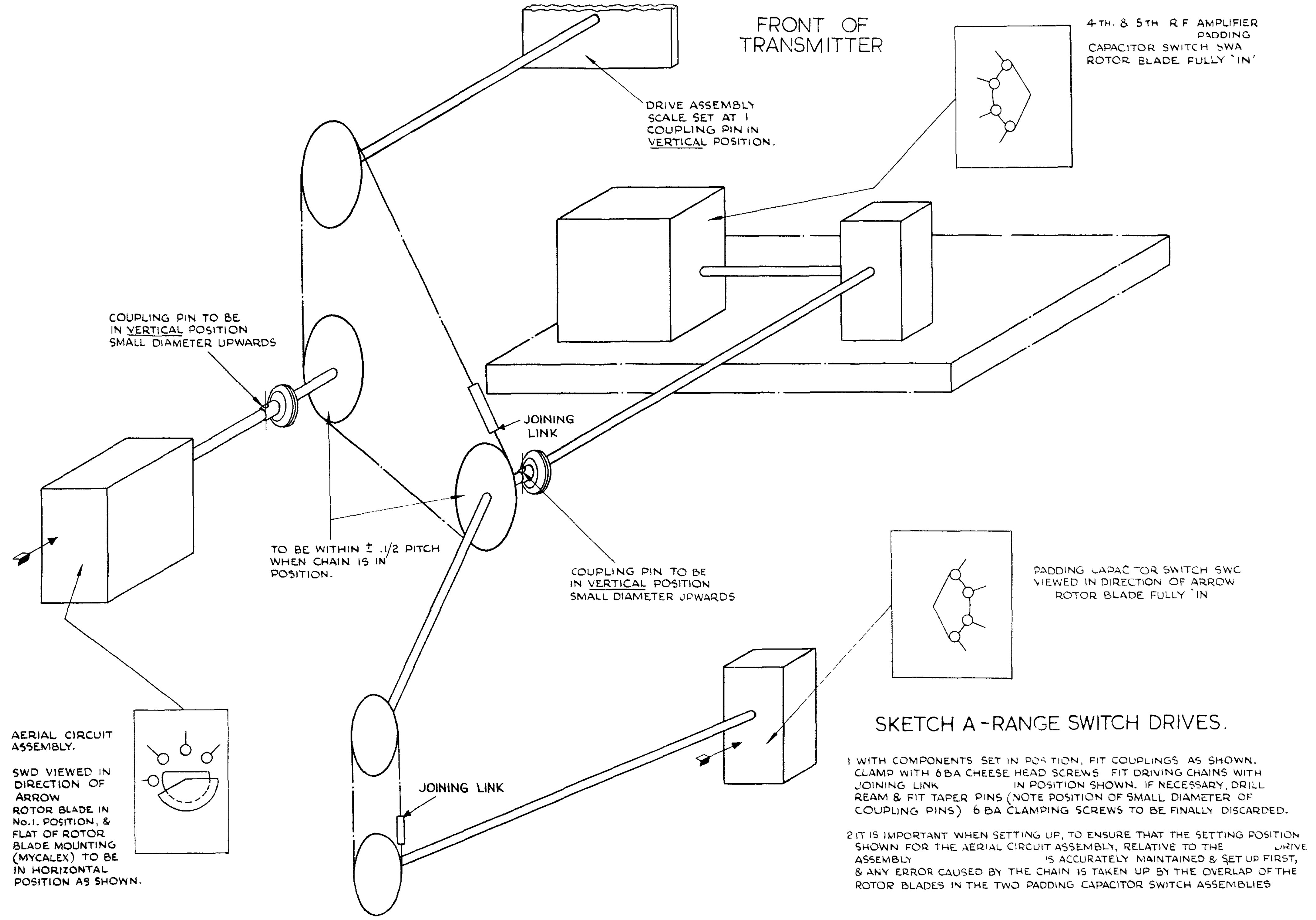
1. WITH COMPONENTS SET IN POSITION, FIT COUPLINGS AS SHOWN. CLAMP WITH 6BA CHEESE HEAD SCREWS. FIT DRIVING CHAINS WITH JOINING LINK GA REF. 58 IN POSITION SHOWN. IF NECESSARY, DRILL REAM & FIT TAPER PINS (NOTE POSITION OF SMALL DIAMETER OF COUPLING PINS) 6 BA CLAMPING SCREWS TO BE FINALLY DISCARDED.
2. IT IS IMPORTANT WHEN SETTING UP, TO ENSURE THAT THE SETTING POSITION SHOWN FOR THE AERIAL CIRCUIT ASSEMBLY, RELATIVE TO THE SWITCH DRIVE ASSEMBLY & THE MOTOR HEAD, IS ACCURATELY MAINTAINED & SET UP FIRST, & ANY ERROR CAUSED BY THE CHAIN IS TAKEN UP BY THE OVERLAP OF THE ROTOR BLADES IN THE TWO PADDING CAPACITOR SWITCH ASSEMBLIES.



SKETCH B - FEEDER TUNE DRIVE.

WITH COMPONENT SET IN POSITION, FIT COUPLING AS SHOWN CLAMP IN POSITION WITH 6BA CHEESE HEAD SCREWS IF NECESSARY, DRILL, REAM & FIT TAPER PINS (NOTE POSITION OF SMALL DIAMETER OF COUPLING PIN) 6BA CLAMPING SCREWS TO BE FINALLY DISCARDED.

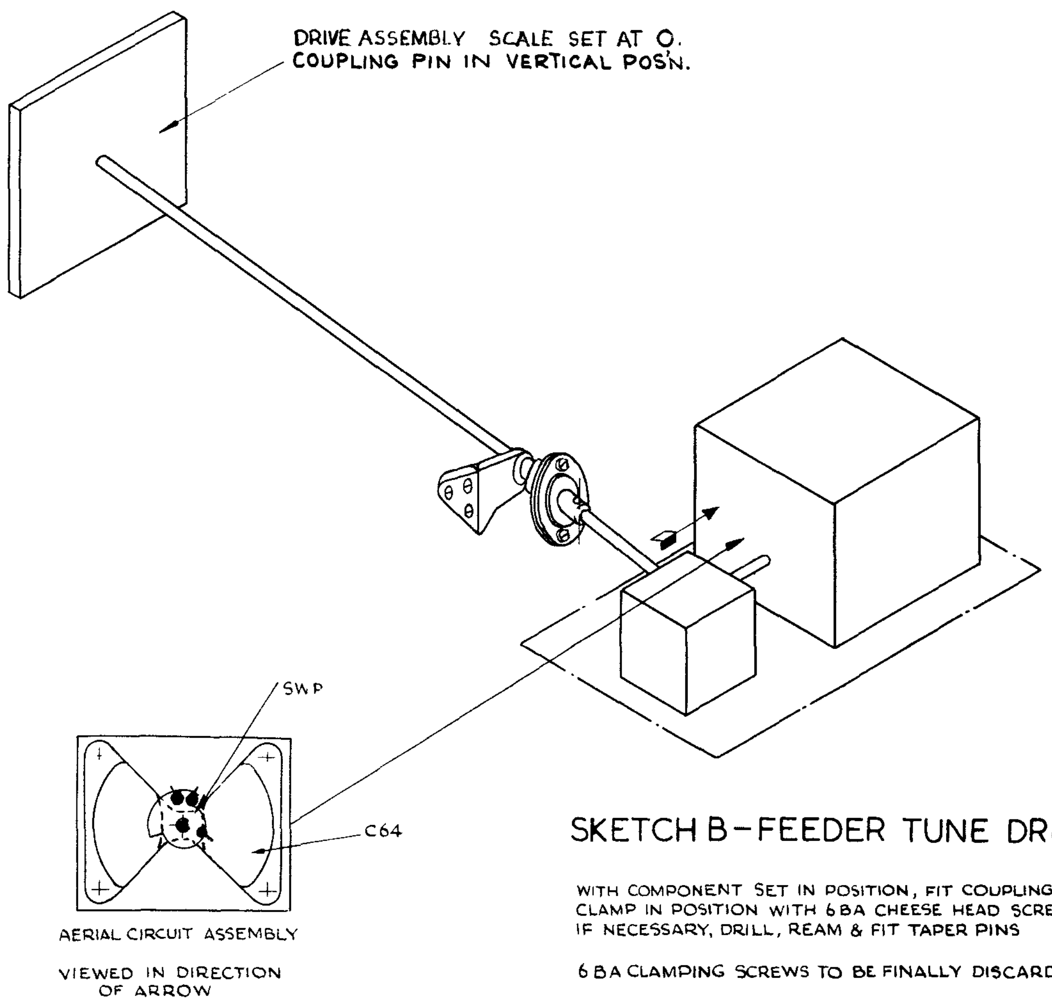
FIG.21A
WZ.17369/D SH.1
ISS.1



SKETCH A - RANGE SWITCH DRIVES.

1 WITH COMPONENTS SET IN POSITION, FIT COUPLINGS AS SHOWN. CLAMP WITH 6BA CHEESE HEAD SCREWS FIT DRIVING CHAINS WITH JOINING LINK IN POSITION SHOWN. IF NECESSARY, DRILL REAM & FIT TAPER PINS (NOTE POSITION OF SMALL DIAMETER OF COUPLING PINS) 6 BA CLAMPING SCREWS TO BE FINALLY DISCARDED.

2 IT IS IMPORTANT WHEN SETTING UP, TO ENSURE THAT THE SETTING POSITION SHOWN FOR THE AERIAL CIRCUIT ASSEMBLY, RELATIVE TO THE DRIVE ASSEMBLY IS ACCURATELY MAINTAINED & SET UP FIRST, & ANY ERROR CAUSED BY THE CHAIN IS TAKEN UP BY THE OVERLAP OF THE ROTOR BLADES IN THE TWO PADDING CAPACITOR SWITCH ASSEMBLIES



SKETCH B - FEEDER TUNE DRIVE.

WITH COMPONENT SET IN POSITION, FIT COUPLING AS SHOWN. CLAMP IN POSITION WITH 6BA CHEESE HEAD SCREWS. IF NECESSARY, DRILL, REAM & FIT TAPER PINS

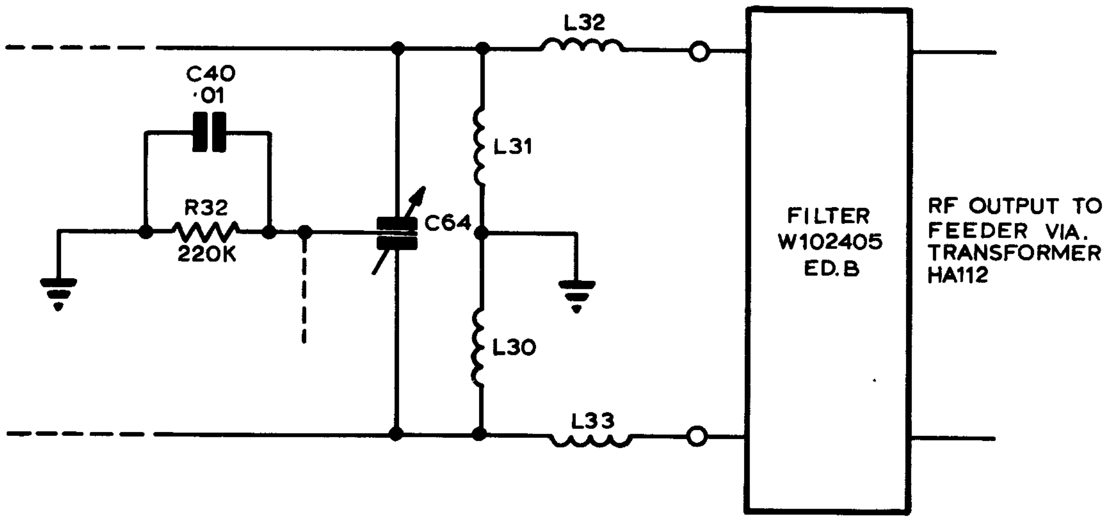
6 BA CLAMPING SCREWS TO BE FINALLY DISCARDED.

MECHANICAL DRIVE ASSEMBLIES
HS31/1 AND HS31A/1

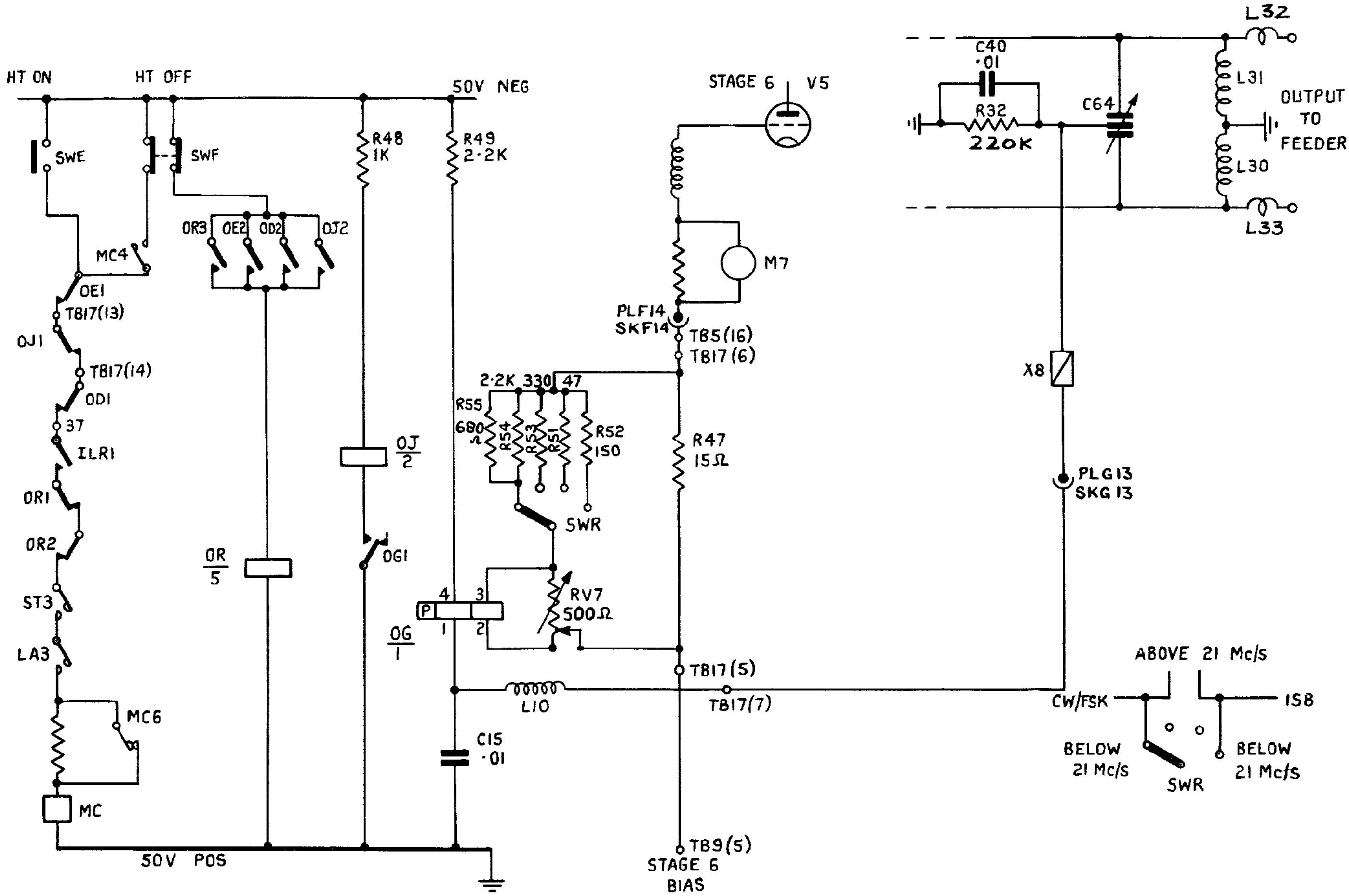
FIG.21B
WZ.26516/D SH.1
ISS.3

Feeder Capacitor Arc and Stage 6 Grid Current Trip Circuit, HS31/1
(WZ.26146/B Sh.1)

Modification No.1785



Modification No.1785 entails the provision of Filter W.102405 Ed.B at the output of HS31/1 when 50 ohms output impedance is provided by use of Transformer HA112.



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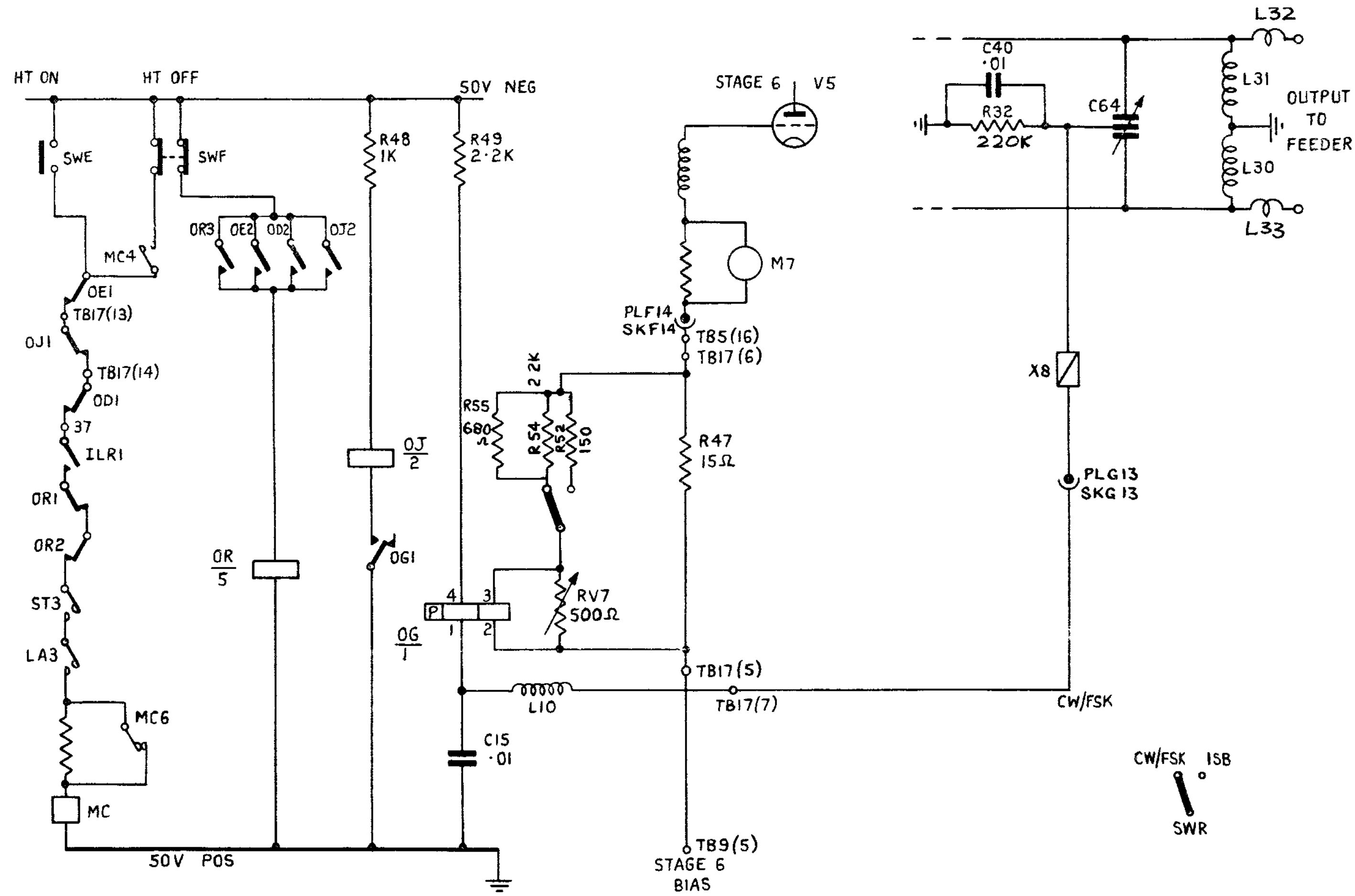
FUNCTIONAL DIAGRAM
FEEDER CAPACITOR ARC AND STAGE 6
GRID CURRENT TRIP CIRCUIT HS31/1

FIG.22
WZ.26146/B SH.
ISS.2

Feeder Capacitor Arc and Stage 6 Grid Current Trip Circuit of HS31A/1
(WZ.27283/B Sh.1)

Modification No.1784

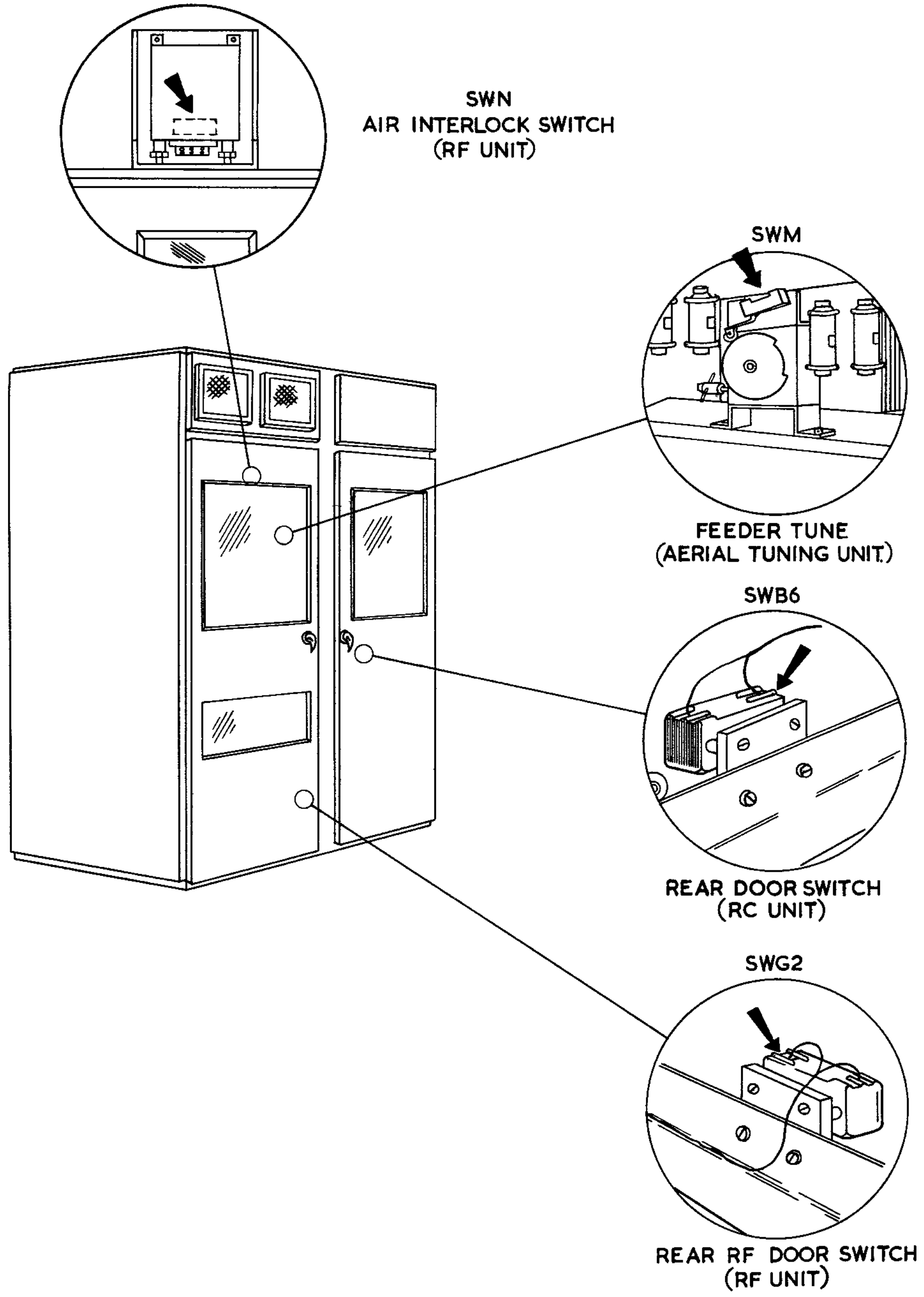
L30, L31, L32 and L33 are replaced by Filter W.102405 Ed.C when 50 ohms output impedance is provided by use of Transformer Type HA112.



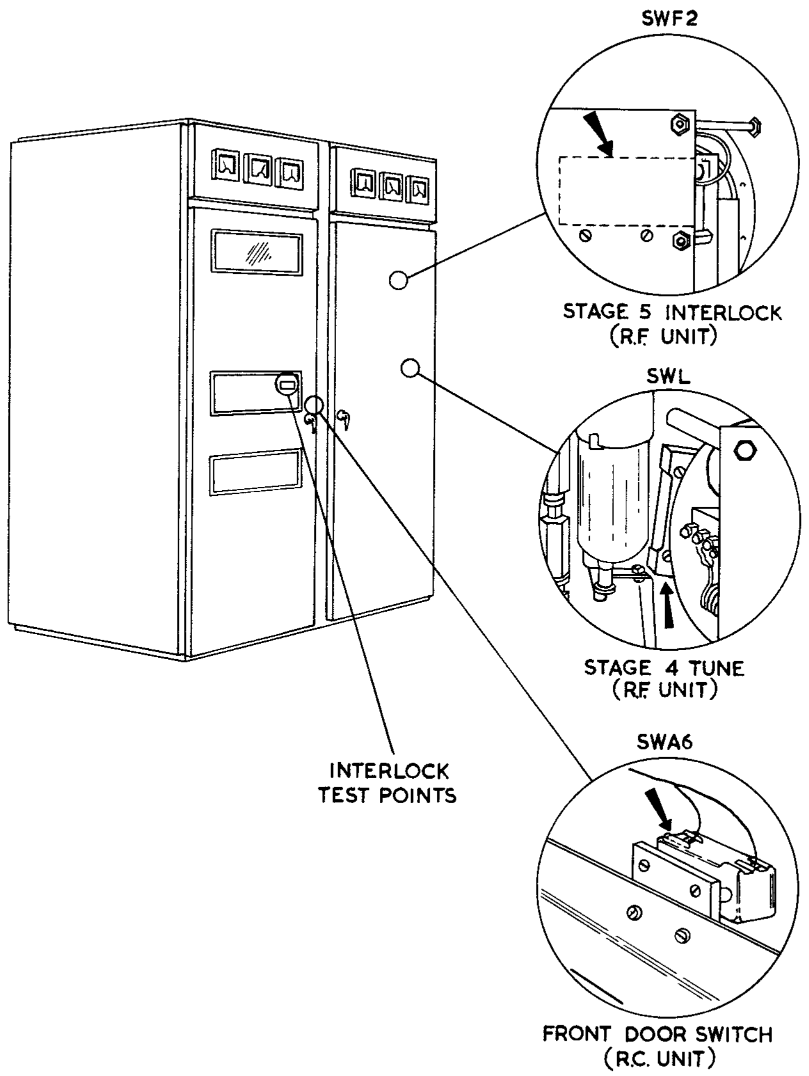
116E-0231-1
Edn. Oct. '67

FEEDER CAPACITOR ARC & STAGE 6
GRID CURRENT TRIP CIRCUIT
HS31A/1

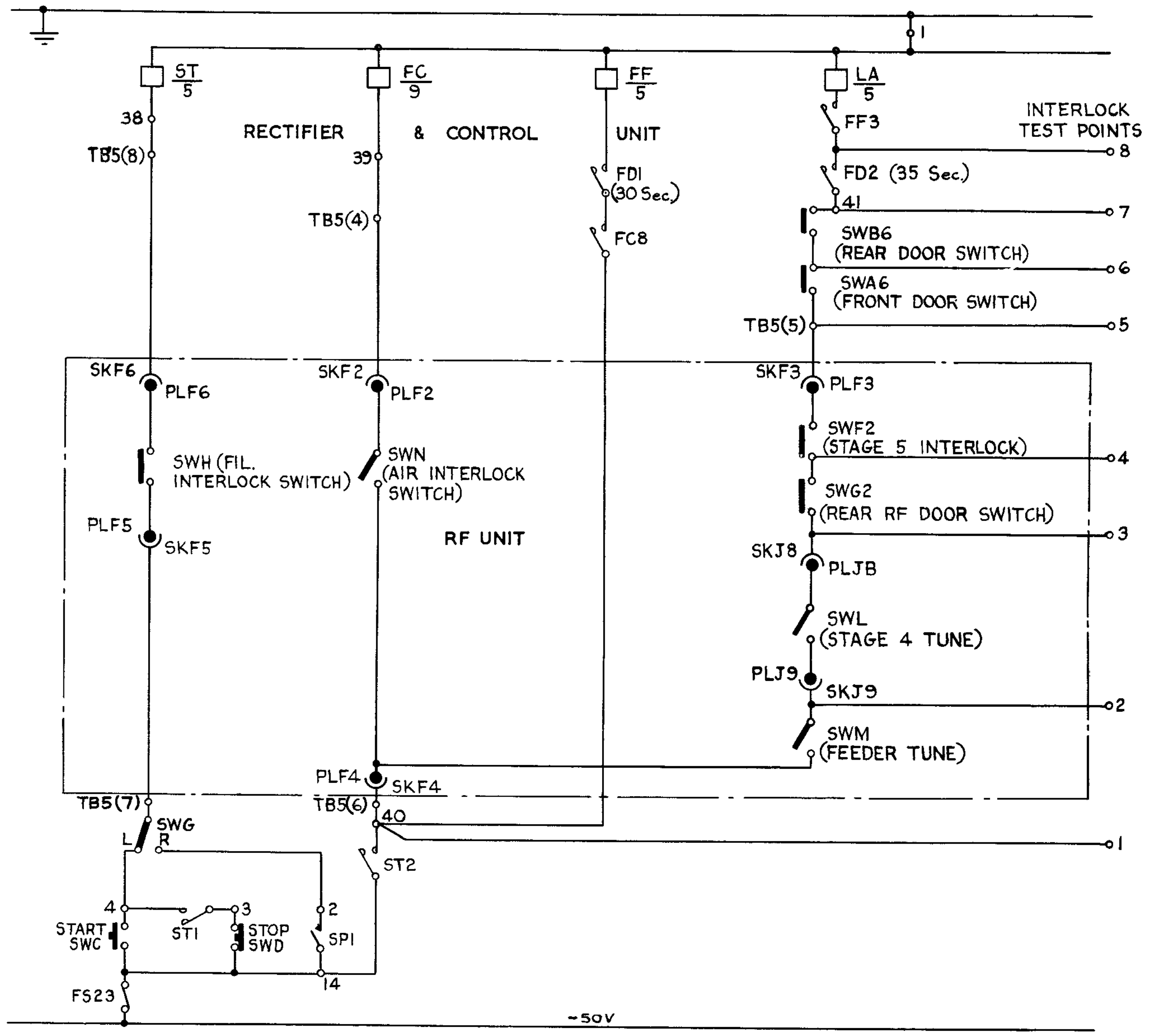
FIG.22A
WZ.27283/B SH.1 ISS.2



REAR VIEW

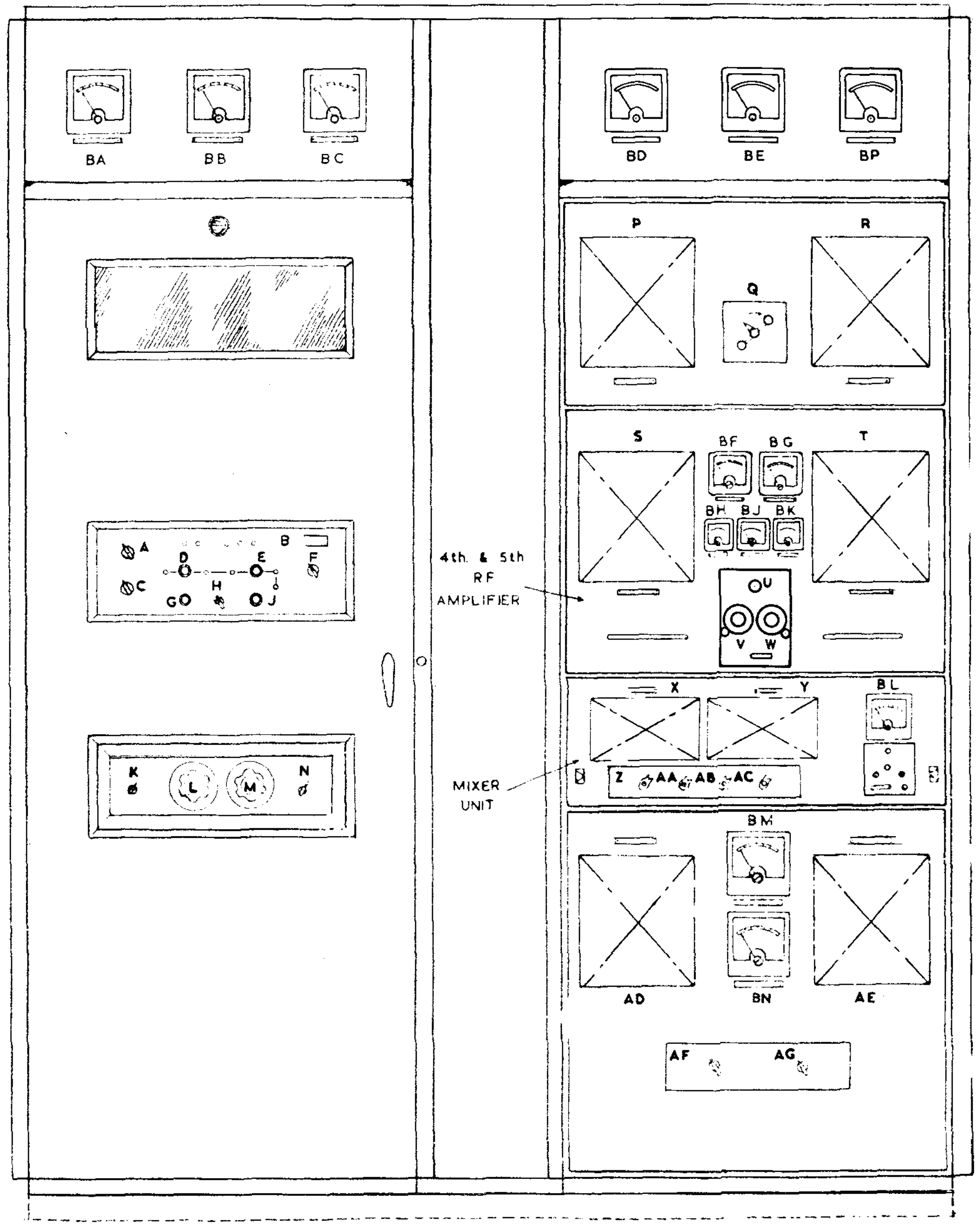


FRONT VIEW



CIRCUIT DIAGRAM

LOCATION AND FUNCTIONS
OF INTERLOCK SWITCHES
HS31 SERIES



RECTIFIER & CONTROL UNIT

RADIO FREQUENCY UNIT

CONTROLS		METERS	
REF	TITLE	REF	TITLE
A	GRID CURRENT TRIP LEVEL CONTROL	BA	AC VOLTS
B	INTERLOCK TEST POINTS	BB	AC AMPS
C	AUTO-MANUAL switch	BC	HT. VOLTS
D	START switch	BD	STAGE 6 GRID CURRENT
E	HT ON switch	BE	STAGE 6 CATHODE CURRENT
F	FREQUENCY switch	BF	ST 5 CATHODE CURRENT
G	STOP switch	BG	ST. 4 ANODE CURRENT
H	LOCAL/REMOTE switch	BH	ST. 5 GRID PEAK VOLTS
J	OFF & ON switch	BJ	ST. 5 GRID CURRENT
K	AC. VOLTMETER switch	BK	ST. 4 GRID PEAK VOLTS
L	STAGE 5, & RECT. FILS rheostat	BL	MIXER METERING
M	STAGE 6 FILS rheostat	BM	FIL VOLTMETER
N	HT VOLTS switch	BN	AUX VOLTMETER
P	RANGE control	BP	FEEDER INDICATOR
Q	ST.5 HT INTERLOCK switch		
R	OUTPUT TUNE control		
S	ST. 5 TUNE control		
T	ST.4 TUNE control		
U	NEUTRALISING		
V	FEEDBACK control		
W	DRIVE LEVEL control		
X	HG TUNE control		
Y	MIXER TUNE control		
Z	fHG Mc/s range switch		
AA	HG METERING switch		
AB	MIXER & MONITOR METERING switch		
AC	fRAD Mc/s range switch		
AD	ST. 6 COUPLING control		
AE	ST. 6 TUNE control		
AF	FIL. VOLTMETER switch		
AG	AUX. VOLTMETER switch		

CONTROL LAYOUT
HS31/1 AND HS31A/1

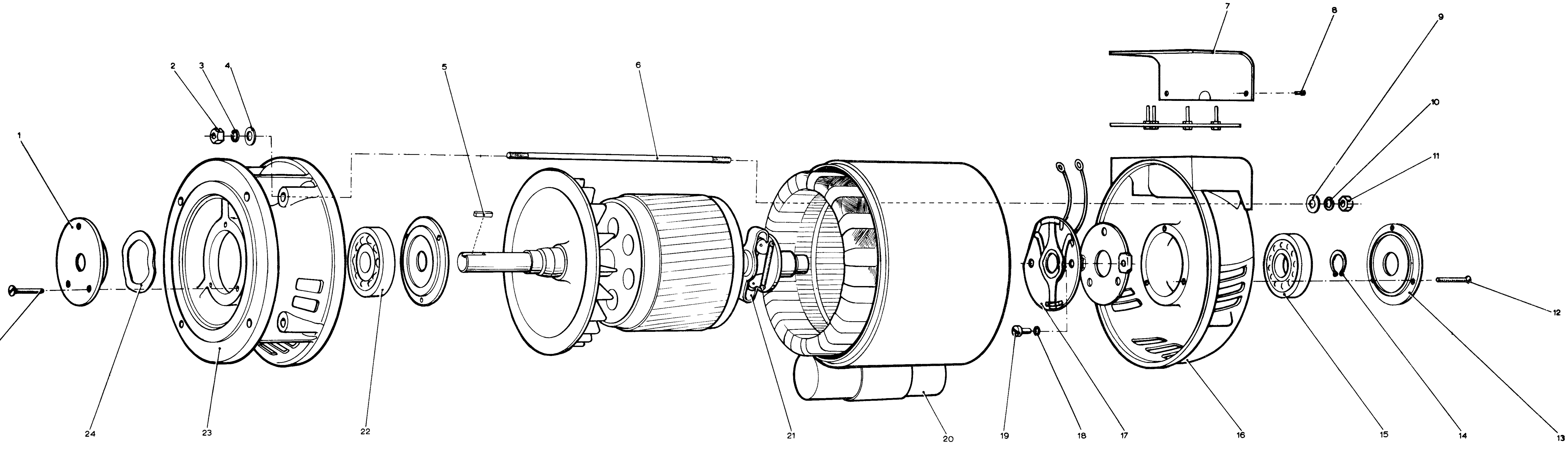
FIG.24
WZ.29754/D SH.1
ISS.3

SUCTION FAN ASSEMBLY
6105-99-622-3206

Cross Reference List for Fig.25

(Refer to Components List No.1 - page 100)

Dwg. Ref.	No.	Dwg. Ref.	No.	Dwg. Ref.	No.	Dwg. Ref.	No.
14	98	17	95	21	94	24	97
15	92	20	96	22	93		



SUCTION FAN MOTOR
EXPLODED VIEW FIG. 25

TRANSMITTERS, RADIO
TYPES T.10158, T.10158A, T.16719
T.10158A, T.16719A
(Marconi HS31, HS31 modified, HS31A
HS31/1 and HS31A/1

Supplement 1

to

A.P.116E-0231-1

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CONTENTS LIST

NOTE: *The Section titles in this Contents List are the same as those bearing the same Section numbers in the main book (A.P.116E-0231-1).*

3.5 kW H.F. I.S.B. TRANSMITTERS
Types HS31, HS31/1, HS31A and HS31A/1

1 INTRODUCTION

The Types HS31, HS31/1, HS31A, HS31A/1 are general purpose transmitters for use in the frequency range 2.5 to 27 Mc/s, HS31A and HS31A/1, covering the band 2.5 to 20 Mc/s, and the HS31 and HS31/1 the Band 4 to 27.5 Mc/s. The four transmitters are similar, but in the HS31 and HS31/1 the frequency range is covered without external changes of coils, whereas the HS31A and HS31A/1 have internal links which, set in one position, cover the band 2.5 - 17 Mc/s, and, in the other, the Band 6 - (R 20 Mc/s. External units are used to provide the drive and the type of service required. Drive frequencies are normally supplied by Type HD21 Crystal Drive Units. The type of service is supplied by various units at different intermediate frequencies depending on the service and type of transmitter. The i.f. may also be dependent on the required radiated frequency i.e. above or below 4 Mc/s.

2 TRANSMITTER DIFFERENCES

The variations in frequency range between the HS31 and HS31A and between HS31/1 and HS31A/1 transmitters cause three main differences:

(a) in the unit identities,

(b) in the intermediate frequencies,

(c) in the r.f. tuning and loading circuit components.

The differences in the unit identities used in the four transmitters are clearly shown in List 2 at the front of the handbook and Table 1 following gives the differences in intermediate frequencies. The variations in r.f. tuning and loading components are covered in Section 4 (Description of Equipment).

Table 1

List of Ancillary Units and Intermediate Frequencies

HS31 and HS31/1			HS31A and HS31A/1		
Type of Service	Aux. Unit	I.F. (Mc/s)	Aux. Unit	I.F. (Mc/s) (Above 4 Mc/s f RAD)	I.F. (Mc/s) (Below 4 Mc/s f RAD)
FSK	HD22	3.1	HD22 (Modified)	3.1	6.2
FSK Diplex	HD22	3.1	HD22 (Modified)	3.1	6.2
I.S.B.	HD61B HD51 SSD2	- 3.1 3.1	HD51 (Modified)	2.15	2.15

Table 1 (Contd.)

HS31 and HS31/1			HS31A and HS31A/1		
Type of Service	Aux. Unit	I.F. (Mc/s)	Aux. Unit	I.F. (Mc/s) (Above 4 Mc/s f RAD)	I.F. (Mc/s) (Below 4 Mc/s f RAD)
D.S.B.	HD51	-	HD51 (Modified)	2.15	2.15
C.W.	HD22		HD22 (Modified)	3.1	6.2

4.1 GENERAL

The information given in the main book (A.P.116E-0231-1), together with this Supplement, provides a complete manual on the Marconi Transmitter Types HS31, HS31/1, HS31A and HS31A/1. Where desirable, the main book has been amended, but where repeated references would cause complicated notes to be added this supplement has been referred to. For ease of comparison between the Supplement and A.P.116E-0231-1, the paragraph headings and numbers are the same in the Supplement as those in the main book in which the transmitter differences occur.

4.2.5 Fuse Panel

The change from a single phase r.f. unit blower in the HS31 and HS31A to a 3-phase blower in the HS31/1 and HS31A/1 causes FS4 to have a different function, and three additional fuses (FS41-43) to be needed. The table in A.P.116E-0231-1 covers the HS31 and HS31A, whilst the additional fuses for the HS31/1 and HS31A/1 are listed in Table 2, with the 2 amp. FS4 substituted for the 10 amp. fuse in HS31 and HS31A.

Table 2

Fuse	Location	Rating
FS4	Blower Starter Supply	2A
FS41	Blue Phase R.F. Unit Blower	6A
FS42	Yellow " " " "	6A
FS43	Red " " " "	6A

4.2.8 4th and 5th R.F. Amplifier

In the HS31/1 and HS31A/1 transmitters, the Stage 5 Feedback control RV3 is situated on the 4th and 5th R.F. Amplifier Panel, and provides, by means of a.f. feedback, adjustment of the envelope correction circuit in Stage 5, to minimize I.S.B. distortion.

4.3.1 Rectifier and Control Unit

In the HS31/1 and HS31A/1 are two additional overload relays OG and OJ, mounted on a separate sub-unit at the top of the right-hand wall of the cubicle, viewed from the rear, near the rear door. These relays are operated by excess currents in the Stage 6 grid circuit or when an arc develops across the feeder capacitor (C64 in the r.f. unit).

The three-phase r.f. unit blower in the HS31/1 and HS31A/1 has a starter unit, and this, with its associated fuses FS41, 42 and 43, is mounted in front of the bias unit, immediately accessible inside the front door. This starter incorporates its own trip reset circuit operated by buttons on its front panel.

Standing on the floor of the HS31/1 and HS31A/1 cubicles are the main h.t. discharge surge limiting resistors R44-R46.

4.3.2.1 Mixer Unit

In the HS31/1 and HS31A/1 sub-units, above the Monitor Frequency Changer U-link selector sockets, is a single co-axial socket labelled MONITOR OUTPUT 3.1 Mc/s (HS31/1) 2.15 Mc/s (HS31A/1). This is an alternative outlet for the 3.1 Mc/s HS31/1 2.15 Mc/s (HS31A/1) monitoring signal for use when a Spectrum Analyser tuned to 3.1 Mc/s (HS31/1) 2.15 Mc/s (HS31A/1) is placed beside the transmitter. The roof outlet is for the cable which passes 3.1 Mc/s (HS31/1) 2.15 Mc/s (HS31A/1) to the monitoring rack in the Drive Room. To use this facility the socket must be connected to SKT on the mixer chassis when it is desired to monitor the 3.1 Mc/s (HS31/1) 2.15 Mc/s (HS31A/1) signal at the transmitter. A dummy socket SKZ is fixed to the chassis to anchor the unused plug PLT on either output.

4.3.2.2 4th and 5th R.F. Amplifier

In the HS31/1 and HS31A/1, the adjustment of an envelope correction circuit to minimize I.S.B. distortion is provided by a feedback potentiometer RV3, which is situated on the front panel.

The required tuning capacitance, which is switched into circuit with the anode tuning coil by SWA, differs in the HS31A and HS31A/1 from the HS31 and HS31/1.

In the HS31A, the tuning capacitors switched by SWA are C32 and C75, whilst in the HS31A/1 they are C75 and C76.

Storage clips are provided behind the front panel in the HS31A for storing the capacitor C76 when the transmitter is operating in the range 6.0 to 20.0 Mc/s (see Section 9.1 of this supplement).

4.3.2.3 Amplifier Stage 6

To cover the lower frequencies of the HS31A and HS31A/1 the

Capacitors are switched across the anode tuning coil to cover the tuning range of the transmitter. In the HS31/1 and HS31A/1 the capacitors are on the switch assembly, SWB, which is mounted in the lower compartment of Stage 6 circuit in the top right-hand corner, and is ganged with SWA already mentioned in the description of Stage 5, Section 4.3.3.2, and with the output circuit range switch SWC, described below; SWC is shown in more detail in Sketch 'F' in Fig.4.

5.2 POWER SUPPLIES

The cooling fan in the HS31/1 and HS31A/1 differs from that in the HS31 and HS31A in that it is 3-phase and is supplied via a starter which incorporates phase failure and overload protection. Its operating coil is controlled via FS4 and ST4 relay contact.

5.2.1 Harmonic Generator

The HS31, HS31/1, HS31A and HS31A/1 transmitters have different intermediate frequencies, the HS31 and HS31/1 being 3.1 Mc/s and the HS31A and HS31A/1 2.15, 3.1 or 6.2 Mc/s. The use of 2.15 Mc/s is necessary to avoid the i.f. lying within the 2.5 - 4 Mc/s frequency band.

To allow the use of 3.1 Mc/s drive units (for economy reasons) with an HS31A or HS31A/1, the fundamental 3.1 Mc/s drive is used above 4 Mc/s radiated frequency, doubling to 6.2 Mc/s for radiated frequencies below 4 Mc/s. When this system is used monitoring exists only at radiated frequency, but equipment modified to RMC Mod. 1312, and using an I.F. of 3.1 Mc/s, will give an output at I.F. for external monitoring. Radiated frequencies between 2.9 and 3.3 Mc/s cannot, however, then be used. A crystal frequency table, to replace Table 3 below, faces Fig.9 in the main book.

The basic crystal formula of the transmitters is the same, but the primary crystal frequency range differs in each case. Table 3 shows the HS31A and HS31A/1 crystal frequency range (the range for HS31 and HS31/1 is given in Section 6.2.1 in the main book.

Table 3

Crystal Frequency Table

SWA Range Mc/s	f xtal. Mc/s	Function			f HG Mc/s	Mult. Factor m
		V1	V2	V3		
4 - 8	4.65 - 7.15 3.575 - 4	Ampl. Doubler	- -	- -	4.65-7.15 7.15 - 8	1 2
8 - 16	4 - 6.425 3.2125-4	Ampl. Doubler	Doubler Doubler	- -	8 - 12.85 12.85-16	2 4
16 - 24.4	4-4.4625	Ampl.	Doubler	Doubler	16-17.85	4

6.2.4 Stages 4 and 5

The Stage 5 anode tuned circuit differs in the various transmitters and Section 6.2.4 in the main book covers the HS31 and HS31/1. The following covers the HS31A and HS31A/1.

The anode tuned circuit consists of L15 and the two ceramic capacitors C32 (HS31A) C76 (HS31A/1) and C75, switched by the range switch SWA. On the lowest frequency range C32 (HS31A) C76 (HS31A/1) is connected in parallel with L15. On the next range C32 (HS31A) C76 (HS31A/1) in series with C75 is in circuit and on the other ranges, the self capacities of the valve and circuit tune the inductance.

To provide adjustment of the envelope correction circuit in the HS31/1 and HS31A/1, R27 is shunted by RV3.

In the HS31A, the output to Stage 6 is via C35 or C35 and C76 in parallel. In the HS31/1 and HS31A/1 the output to Stage 6 is via a variable vacuum capacitor (35) that is set to give the correct loading of V3 and V4; it is set up when the valves are first used and should not require resetting.

6.2.5 Stage 6

To cover the lower frequencies of the HS31A and HS31A/1, the filament chokes differ from those of the HS31 and HS31/1 already described in the main book. The following describes the HS31A and HS31A/1.

The filament chokes L30 and L31 (L34 and L35 in HS31A/1) are wound from concentric cable. One leg of V5 filament is connected to the inner conductor, the other leg to the outer conductor and the filament supply is applied to the other end. Thus the supply circuit is isolated from r.f. The cathode circuit is grounded via the centre tap of RV6 (RV1 in HS31A/1) connected between inner and outer of L31 (L35 in HS31A/1), and the meter shunt R22. Link LKB is used to short L31 (L35 in HS31A/1) out of circuit on the 6.0 to 20 Mc/s range.

In the HS31/1 and HS31A/1, the grid current flows through one winding of relay OG and excessive current will operate the trip circuits. Excessive grid current may result from feeder faults many of which cause the valve to unload with low anode current and consequently high grid current and grid dissipation.

6.2.6 Output Circuit

The HS31/1 and HS31A/1 transmitters have a suppressor circuit incorporated to suppress any arc which may occur across C64. This circuit comprises R32, C40 and relay OG in the RCU. An r.f. arc will produce a d.c. path to earth for the 50V d.c. via relay OG. OG will be energized and its contact OG1 will cause OJ to be energized. The contacts of OJ de-energize the main contactor MC and lockout the transmitter via relay OR.

In the HS31/1 and HS31A/1, feeder static leak chokes are situated in the roof of the cubicle. In the HS31A/1 these will be replaced by Filter W.102405 Ed.C when 50 ohms output impedance is provided.

6.2.7 Monitor Frequency Changer

The HS31/1 and HS31A/1 have an external monitoring point PLBF which is used when the transmitter is driving a power amplifier, thus allowing points in the power amplifier to be monitored in the same manner as described in Section 6.2.7 in the main book. Also incorporated in the HS31/1 and HS31A/1 is PLBG, which, in conjunction with PLT, SKT and SKZ, permits the use of a Spectrum Analyser tuned to 3.1 Mc/s (HS31/1) 2.15 Mc/s (HS31A/1) to be used in the transmitter hall.

6.3.1 Main H.T. Rectifier

In the HS31 and HS31A the smoothing capacitors are earthed direct whereas in the HS31/1 and HS31A/1 they are earthed via three resistors R44, 45 and 46.

6.3.5 Control Circuit Supplies

The HS31/1 and HS31A/1 cooling fans are supplied, via a starter which incorporates phase failure and overload protection, from the 3-phase a.c. input.

6.4.1 Switching-on Sequence

5(g) When, in the HS31/1 and HS31A/1, the H.T. ON button SWE is pressed, the interlock pilot relay ILR will close and the main h.t. contactor MC, will 'make', energized via OD1, OE1 and OJ1, which are contacts of the overload relays and are normally closed, OR1 and OR2, which are contacts of the overload reset relay and are normally closed, ST3 and LA3, which are contacts of the START relay and the auxiliary h.t. relay, and ILR1, which is a contact of the external circuit interlock pilot relay.

The remainder of the switching-on sequence is the same as that for the HS31 and HS31A described in Section 6.4.1 in the main book.

In the HS31/1 and HS31A/1 the external interlock circuit is incorporated in the control circuit, whereas in the HS31 and HS31A facilities exist for making it available as described in the main book.

6.4.2 H.T. OFF and Trip Reset

When SWF, the H.T. OFF and RESET button is pressed the interlock pilot relay ILR in the HS31/1 and HS31A/1 is released, with the main h.t. contactor, MC, switching off the high voltage rectifier only.

6.4.4 Overload Circuits

In the HS31/1 and HS31A/1 transmitters there are two additional overload circuits to those described in the main book, as follows:

1. Stage 6 Grid Circuit

To protect the Stage 6 valve from grid overloads a circuit, comprising SWR, R47, RV7, R51 - R55 and a coil of relay OG, is included in the grid supply line. In the HS31A/1 the grid current varies with the service and two trip settings, C.W./F.S.K. and I.S.B., are required; these are set by R52, R54 and R55 selected by SWR. In the HS31/1, the grid current varies with the service and frequency and so various trip settings are required; these are set by R51 - R55 selected by SWR.

When an overload occurs, excessive grid current through OG operates it, closing contact OG1 which causes relay OJ to be energized. This relay has two contacts which are connected as the contacts of OD and OE are, and they function in a similar manner, see Section 6.4.4 in the main book.

2. Arc Protection Circuit

An arc across the Feeder Tune Capacitor completes the 50V d.c. circuit of relay OJ, which operates via relay OG to remove the h.t., as described in Section 6.4.4 in the main book.

Reset nu STOP button.

8.7 SETTING-UP THE OVERLOAD RELAYS

The HS31/1 and HS31A/1 transmitters have additional overload relays to those described in the main book, and the following is the information necessary for the setting-up of these additional relays.

8.7.1 Stage 6 Grid Current

(a) Set up the transmitter as described in Sections 9.1.1 - 9.1.4

(b) Reduce the drive level and Stage 6 coupling, maintaining the stage 6 grid current at about 200 mA.

(c) Turn the drive level to zero.

(d) Turn the Stage 6 grid current trip switch to 'I.S.B. ABOVE 21 Mc/s' (HS31/1) 'I.S.B.' (HS31A/1). Increase the drive level to 100 mA (HS31/1), 150 mA (HS31A/1) Stage 6 grid current or until the trip operates, whichever is the lower.

(e) Adjust the trip setting control RV7 until the relay operates with the grid current of 100 mA (HS31/1) 150 mA (HS31A/1).

This must be done in steps, the transmitter being switched off each time to gain access to RV7, situated at the rear of the R.F. Unit.

(f) In the HS31/1, check that the current at which the relay operates on the other switch position is as follows:

C.W.	above 21 Mc/s	-	200 - 250 mA
I.S.B.	below 21 Mc/s	-	150 - 200 mA
C.W.	below 21 Mc/s	-	280 - 350 mA

For the HS31A/1, the current at which the relay operates on the other switch position should be approximately 300 mA.

I.S.B.	-	150 - 200 mA
C.W.	-	280 - 350 mA

8.7.2 Arc Suppression

To check the arc suppression circuits, connect a short circuit across one half of the Output Tuning Capacitor, press the START button and check that the AUX. H.T. is switched on.

Press the H.T. ON button - the OVERLOAD lamp should light immediately and it should be impossible to bring on the Main H.T. (supply path to MC open-circuit by relay contacts of OR).

8.7.3 Suction Unit and Starter

(a) Remove the starter cover and set the overload pointer at 100% overload. The adjustment is made by a pointer situated at the left-hand side of the mechanism.

(b) Remove all the fuses from the transmitter except FS1 - 4, FS23-25 and FS41-43 inclusive.

(c) Close and lock the transmitter doors, close the main supply switch and press the START button. The suction unit should now start to run.

(d) Press the STOP button and as the fan runs down check that the direction of rotation agrees with the arrow on the motor casing. If rotation is incorrect, reverse any two of the three motor connections; refer to the instructions on the motor terminal box.

(e) Remove <u>one</u> of the three fuses FS41, 42 and 43, close the doors and press the START button. The motor should not start and will indicate overload by a clearly audible hum; <u>within 12 seconds</u> the starter overload should drop out, but <u>do not keep the mains applied to</u>

the suction unit for longer than 12 seconds under this condition otherwise damage due to overheating may occur.

If the trip out does not occur, check the wiring and, in the absence of fault, the starter should be returned to the factory. To reset the starter press the red button, after allowing approximately 5 minutes for the starter heater elements to cool down.

NOTE: *Normal line current motor running 1.0 amp.*
2 phases only - running, approximately 2.2 amp.
2 phases only - stalled on starting, approximately 7.0 amp.

8.11 STAGE 5-6 PRESET COUPLING CAPACITOR ADJUSTMENT

In the HS31/1 and HS31A/1, the output of Stage 5 enters Stage 6 via C35, a variable vacuum capacitor that is set to give the correct loading of V3 and V4.

The following describes the setting of C35.

(a) Set the transmitter up for single tone operation at 21 Mc/s (HS31/1) 16 Mc/s (HS31A/1) as described in Sections 9.1.1 to 9.1.4 in the main book.

(b) Reduce the drive level to zero and switch the I.F. Drive to 2 tone.

(c) Increase the drive level until Stage 6 grid current reads approximately 130 mA. Check the tune of Stage 6 and then increase the Stage 6 coupling until the drive of 100 mA Stage 6 grid current corresponds to 1.1A Stage 6 cathode current. Check the tune of the feeder circuit (FEEDER TUNE) and if necessary readjust as described in Section 9.1.2 (p) in the main book.

(d) Check and note the cathode current of Stage 5, it should be 160 mA. If not, it is necessary to adjust the variable coupling capacitor and retune to obtain the 160 mA with the Stage 6 drive at the level quoted in (c) above.

(e) The setting of Stage 5-6 coupling achieved under the above conditions in the HS31/1 should be adequate to cover the rest of the band on all services, but will probably require adjustment if Stage 5 valves are changed.

In the HS31A/1, the setting of Stage 5-6 coupling achieved under the above conditions should be adequate to cover the range 6 - 20 Mc/s on all services. To cover the low frequency range, the above procedure is repeated at 5.6 Mc/s.

11.4 Manual Drive Assemblies

All the variable tuning controls are driven by manual drive assemblies mounted on the front panel. There are basically two types of drive assembly used, these are the single turn type and the multi-turn type. The single turn types, the handles of which rotate less than 360°, are used for the RANGE switch and the FEEDER TUNE controls. The multi-turn types, the handles of which rotate a number of complete revolutions, are used for STAGE 4 TUNE, STAGE 5 TUNE, STAGE 6 TUNE and STAGE 6 COUPLING.

To set-up the manual drive assemblies it is necessary to check that:-

(a) the dial stops are correctly set.

(b) the components are set in the correct position.

(c) the dials are correctly set.

The correct positions of (a), (b) and (c) for HS31/1 and HS31A/1 are listed below under the control names.

RANGE switch

(a) Dial stops: 1, 2, 3, 4 and 5.

(b) Components: (i) Stage 5: Switch blade making on all contacts.

(ii) Stage 6: Switch blade making on all contacts.

(iii) Feeder circuit: The switch blade should be clear of all contacts. The contacts of range 1 are not fitted.

(c) Dial set to: 1.

FEEDER TUNE

(a) Dial stops: 0 and 210

(b) Components: Set the capacitor C64 to maximum capacity with padder capacitors C68-71 in circuit.

(c) Dial set to: 0

Check that the interlock micro-switch SWM mounted on the tuning capacitor assembly opens when the capacitor reaches minimum with the fixed padders still in circuit and that the switch makes again at the maximum capacity following, in which position the fixed padders are now

A.P.116E-0231-1
2nd Edn.
Supp.1 Oct. '67
IA

out of circuit. If necessary adjust the position of the micro-switch.

STAGE 4 TUNE

(a) Dial stops: 0 and 210.

(b) Components: Set the turret with the largest inductor (L5) connected across the capacitor C12. Set C12 to maximum capacity (ready to tune L5).

(c) Dial set to: 0.

STAGE 5 TUNE

(a) Dial stops: 0 and 210.

(b) Components: Set the inductor (L15) wiper contacts to within approximately 1/8 turn (2 ") from the right-hand end of inductor.

(c) Dial set to: 210.

STAGE 6 TUNE

(a) Dial stops: 0 and 210.

(b) Components: Set the inductor (L19) wiper contacts approximately 1/4 turn (3 ") from the top connection of the inductor.

(c) Dial set to: 210.

STAGE 6 COUPLING

(a) Dial stops: 0 and 210.

(b) Components: Lower the inductor to the full extent of the extension rod stops, and set the inductor by rotating the front driving shaft approximately ½ turn.

(c) Dial set to: 0.

STAGE 5-6 PRESET COUPLING

Adjust the variable capacitor 6 turns of the control from maximum capacity.

Slight adjustment may be required when fitting the assemblies to the couplings but the above settings allow for this. After fitting check the complete range coverage.

Supplement No.2

to

AP.116E–0231–1

2nd Edition

REMOTE (EXTENDED) CONTROL OF TRANSMITTER TYPE HS31 AT R.A.F. HITTADDU, GAN.

AP 116E–0231–1
2nd Edn.
AL.8 Oct 73

REMOTE (EXTENDED) CONTROL OF TRANSMITTER TYPE HS31 AT R.A.F., HITTADDU, GAN.

List of Contents

List of Illustrations

Master Components List

The Master Components List at the end of this supplement includes electrical components and selected mechanical components not covered in the mains manual AP 116E-0231-1, 2nd Edition.

INTRODUCTION

1. The Control Transmitter Unit provides remote operational switching of the HS31 transmitter when the transmitter is switched to remote control and lamp and meter indications of the state of the transmitter on both local and remote control.

2. As the HS31 is manually tuned, tuning must be completed on Local Control before switching to Remote Control.

3. This supplement outlines the changes incorporated by Modification Nos.A3785 and A4031 to the HS31 transmitter, and should be referred to in conjunction with the manual on Station Control, AP 116E-0244-1E, Supplement 1, Chapter 3.

TRANSMITTER MODIFICATION

NOTE: *The incorporation of this modification changes the reference identity numbers of the Transmitter HS31, and the Control Power Supply as follows:*

OLD	Nomenclature	NEW
Ref.No.5820-99-933-2182	Transmitter Radio HS31	Ref.No.5820-99-622-8256
Ref.No.5820-99-933-2183	Control Power Supply	Ref.No.5820-99-622-8255

4. To provide extended control facility to the Transmitter HS31 a tagstrip TB16 is added to the Control Power Supply and mounted beneath the existing tagstrip TB6, as shown in the Component Layout Change Diagram Fig.1.

5. Included in these changes is the addition of a Relay ILR to the Contactor Panel, and a 3-way terminal block fixed alongside the existing block TB2 in the Indicator Panel. The new terminals are numbered 13, 14 and 15.

6. Also included is the fitting of a Drive Muting Relay Unit H31-8827-01, Fig.3. This unit is external to the HS31 Transmitter and is operated by the Aerial Interlock line breaking the r.f. drive to the transmitter.

7. Refer to the Remote Control Functional Diagram Fig.2. The HS31 Transmitter Ref.No.5820-99-622-8256 when modified, is linked to the Control Transmitter Ref.No.5820-99-972-5345 as shown. The changes to the existing wiring, and new connections, are described in detail in the Modification Leaflets A3785 and A4031 but their function is described as follows:

TB16.1	Connects the 50V supply to energize RLA to light the AVAILABLE lamp and to be available for the START switch SA when the local/remote switch is at REMOTE.
TB16.2	Connects the supply to the remote start pilot relay SP when the START switch is closed.
TB16.3 & 4	Relays RLB and RLC are energized by the Auxiliary and Main H.T. contactors to light the READY and H.T. ON indicator lamps respectively.
TB16.7 & 8	Connect the 50V supply when on REMOTE to the H.T. START switch and to the drive mute relay coil via the aerial interlock contacts.
TB16.9	Connects the interlock relay ILR, fitted as part of the modification, which is energized via the H.T. START switch SC in the Control Transmitter, allowing the Main H.T. contactor MC to close.
TB16.10 & 11	On REMOTE these complete the overload trip relay circuit via the reset part of SD.

TB16.12 Not used.

TB16.13 Connects the transmitter trip relay RLF to light the TRANSMITTER TRIP lamp and initiate the alarm circuit.

TB16.14 Connects the aerial trip relay RLG to light the AERIAL TRIP lamps and initiate the alarm circuit.

Drive Muting Relay Unit (H31-8827Z)

8. Refer to Fig.3. The relay socket terminals SKA3 and SKA1 are connected to the tagstrip TB16-8 and 15. R.F. sockets SKC and SKB supplied are fitted to the r.f. line which allows the unit to be connected in series; the line for the drive connected to the INPUT plug PLB, and the line to the transmitter is connected to the OUTPUT plug.

OPERATION SUMMARY

Local

9. When the transmitter is operated locally all the indicators light with the exception of the AVAILABLE lamp. This shows the central operator that the equipment is in use but not available for service by him. It should be noted that the alarm circuit is inoperative.

EXTENDED

10. When the transmitter has been set up and tuned locally into the required aerial, control is passed to the extended point by switching the transmitter back to Mains ON (50V d.c. lamp on) and setting the Remote/LOCAL switch to REMOTE.

NOTE: *The aerial selection which took place as part of the tuning procedure must not be changed at this time as it will affect the loading of the transmitter. If either the frequency or the aerial is changed the transmitter must be returned to Local Control and retuned.*

11. At the control station the lamps AVAILABLE and AE INTERLOCK will show the station controller that the transmitter is under his control.

12. To switch on the transmitter press the START switch. Initially the START lamp will light and after approximately 35s will be extinguished and the READY lamp light.

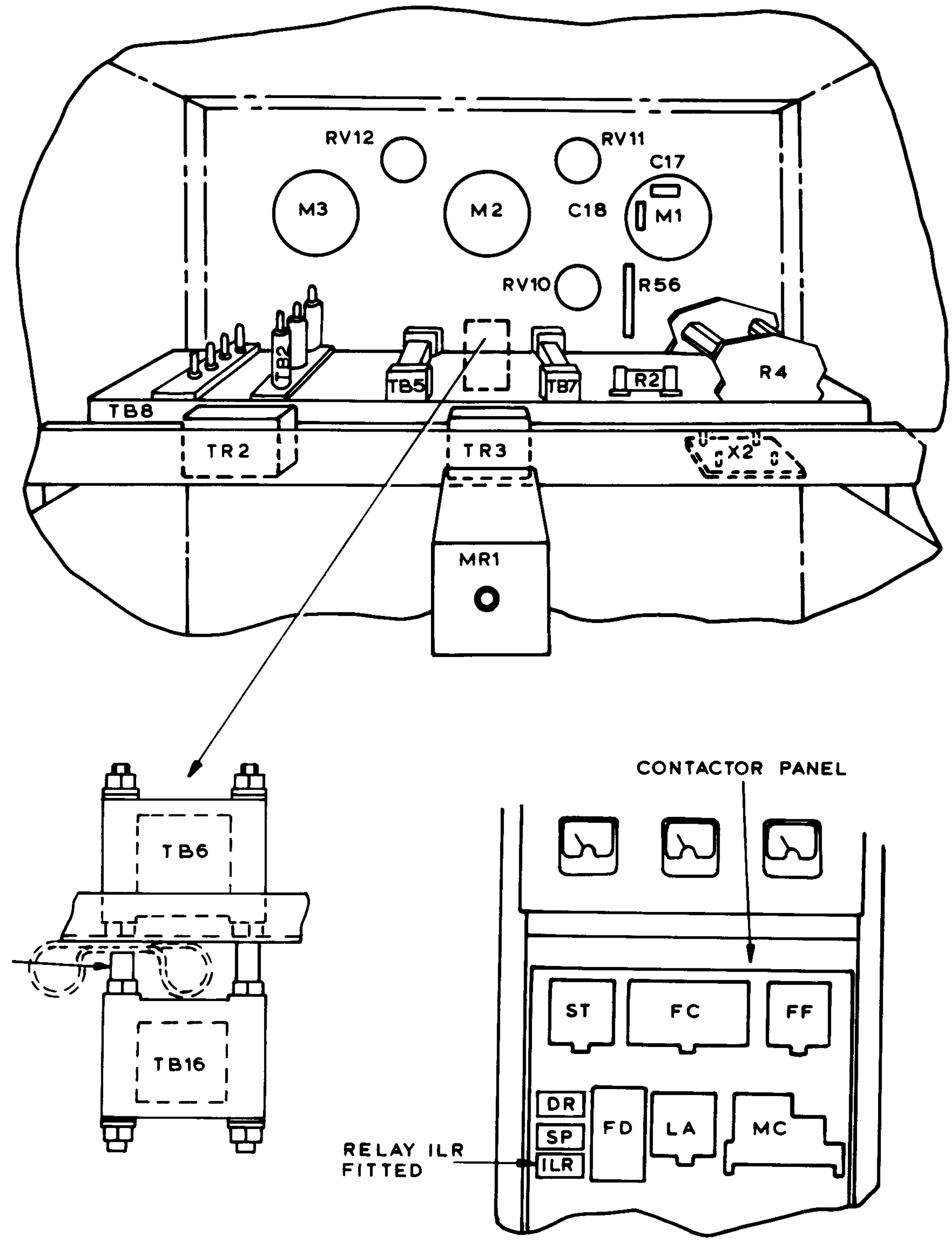
13. Press the H.T. START switch:, the H.T. ON lamps will light and the transmitter is ready for use.

14. To switch off the transmitter press the STOP/TRIP RESET switch and all circuits will return to the state described in Para.10.

MAINTENANCE

General

15. The Control Transmitter is fitted as an extension of the transmitter control circuits. Thus it can be proved to be faulty or not by returning to Local Control and switching on. If the transmitter becomes operative on Local Control and not on Extended Control the fault lies in the extension circuit, if it remains inoperative on both, the fault is in the transmitter.



COMPONENT LAYOUT CHANGES ARISING
FROM MODIFICATIONS A8785 & A4031
REMOTE (EXTENDED) CONTROL

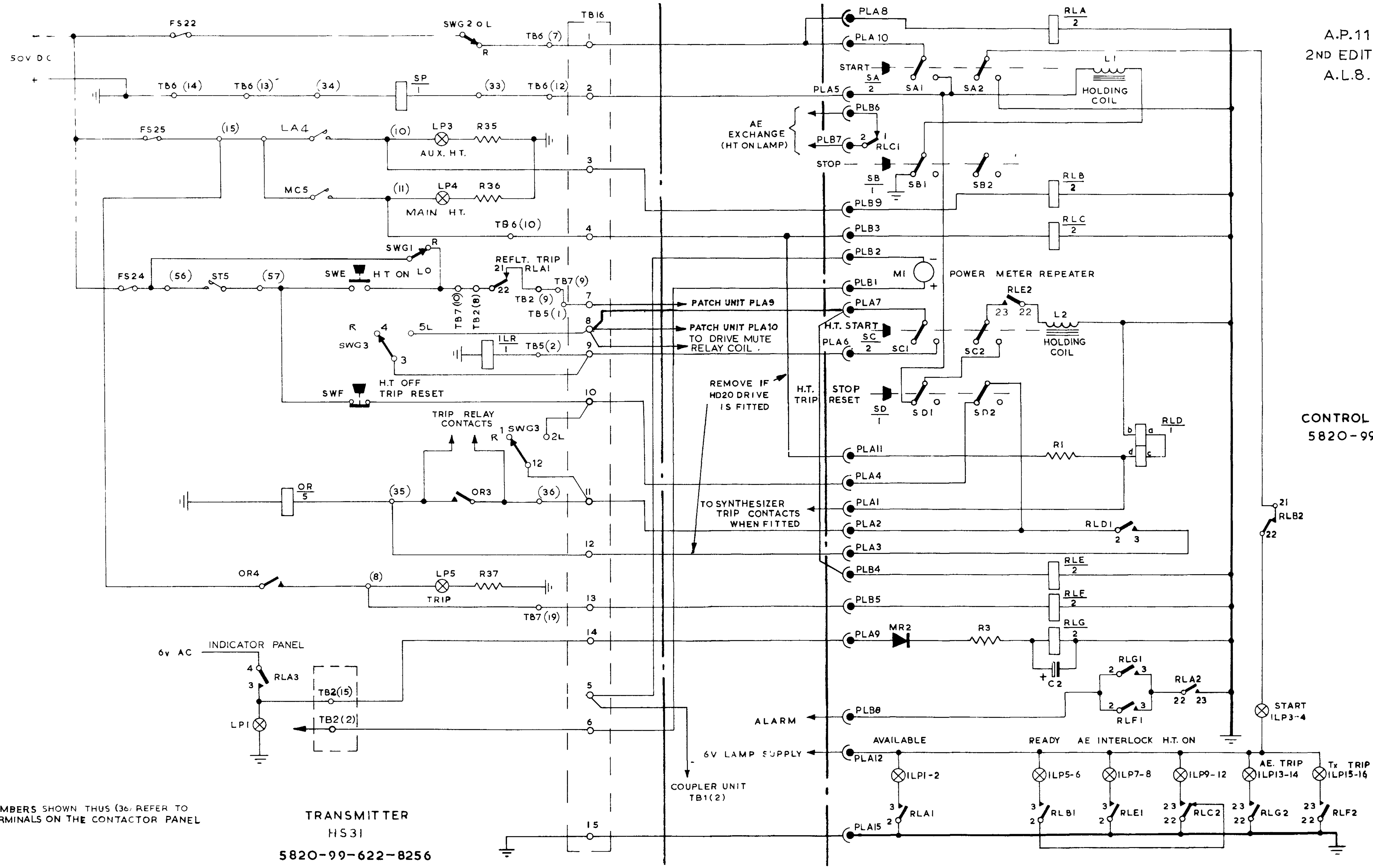
FIG.1

FUNCTIONAL DIAGRAM REMOTE CONTROL HS31 TRANSMITTER
(Refer to Master Components List AP 116E-0231-1)
Supplement No.2
Cross Reference List for WZ.31065/D (Fig.2)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
ILR	2	TB16	3												

MISCELLANEOUS ITEMS

Socket for ILR	No. 9
End Moulding for TB16	No.13
STUD for TB16 assy.	No.18
3-way Terminal Block (Part of TB2)	No.12



CONTROL TRANSMITTER
5820-99-972-5345

TRANSMITTER
HS31
5820-99-622-8256

NOTE
NUMBERS SHOWN THUS (36) REFER TO TERMINALS ON THE CONTACTOR PANEL

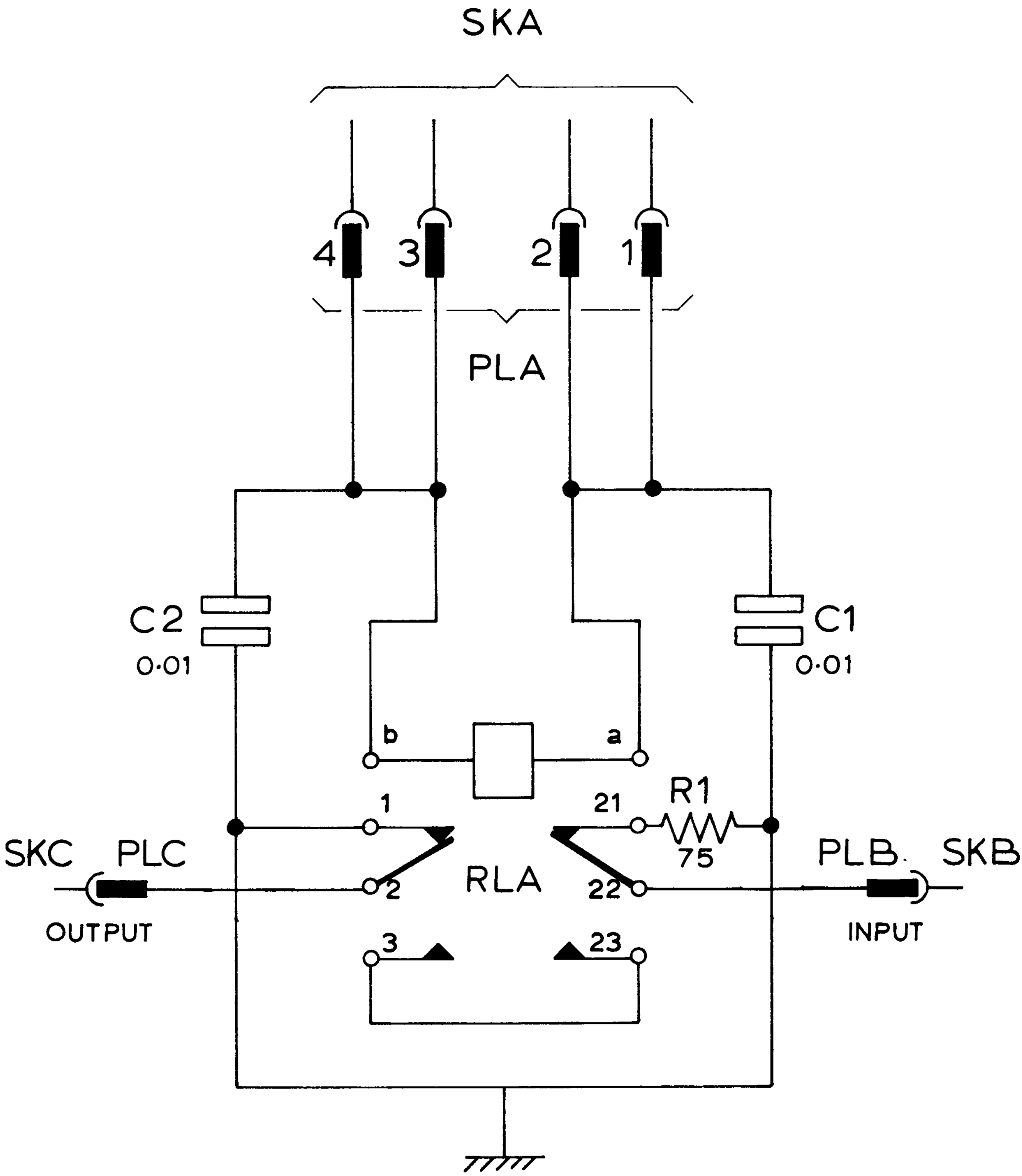
FIG.2

DRIVE MUTING RELAY UNIT
(Refer to Master Components List AP 116E-0231-1)
Supplement No.2
Cross Reference List for H31-8827Z (Fig.3)

Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.	Ref.	No.
RLA	6	C1	4	R1	5	PLA	7								
		C2	4			PLB	8								
						PLC	8								

MISCELLANEOUS ITEMS

Socket for PLA	No.11
Socket for PLB	No.10
Socket for PLC	No.10



H-31-8827Z SH.1.
ISSUE. 1.

DRIVE MUTING RELAY UNIT
H-31-8827-01

FIG. 3

MASTER COMPONENTS LIST
FOR
TRANSMITTER (HS31) REMOTE (EXTENDED) CONTROL

No.	Description and Identity	Qty.	
1	Drive Muting Relay Unit H31-8827-01 *	1	
2	Relay Assembly WQ.8740 Sh.1 Ed.P *	1	
3	Terminal Block Assembly WZ.2489/B Ed.U *	1	
	Capacitors		
4	Ceramic, 0.01 µF +80-20% 500V d.c. PC.18207/7 5910-99-580-7490	2	
	Resistors		
5	Fixed Metal Oxide 75Ω ±2% ½W PC.66641/96	1	
	Relays		
6	2 Changeover PC.65408/5 5945-99-011-9882	1	
	Plugs		
7	4-pole 5A PC.57014/1 5935-99-580-2867	1	
8	R.F. Coaxial PC.60207/1 5935-99-054-0201	2	
	Sockets		
9	Heavy Duty Relay WIS.4048/B Sh.1 Ref.13	1	
10	R.F. Coaxial PC.68208/1 5935-99-580-6609	2	
11	4-pole 5A PC.57016/1	1	
	Terminal Blocks		
12	3-way WIS.1631 Sh.1 Ref.3 5820-99-900-9915	1	
13	End Moulding WIS.4412/C Ref.1	2	
14	Clamp Strip 97/W379087C	1	
	Labels		
15	Mod. Record H31-8808-50	1	
16	Plate Marking Blank 10AM/9905-99-913-6858	2	
17	Mod. Record 10AM/9905-99-942-9495	1	
18	STUD 4⅛ in lg W7415/C Sh.1 Ed.28BH	4	
19	STUD 2BA x 2 in lg W7415/C Sh.1 Ed.11AC	1	

* ITEMS INCLUDED IN LIST

FEEDER MONITORING EQUIPMENT
FOR
TRANSMITTER
TYPE T.10158
(Marconi Type HS31)

Technical Appendix No.1
to
A.P.2922D Vol.1

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THE MARCONI COMPANY LIMITED
CHELMSFORD
Printed in Great Britain

1964

CONTENTS

CONTENTS (contd.)

Illustrations

COMPONENTS LISTS

Feeder Monitoring Equipment
for
Transmitter Type HS31

1 INTRODUCTION

The feeder monitoring system described herein provides visual indication of transmitted power and standing wave ratio (s.w.r.) in output feeder systems and is intended for use with a transmitter fitted with coaxial output feeders of 50 ohms characteristic impedance.

Forward and reflected waves in the feeder are sampled by directional couplers inserted at a convenient point near the feeder outlet on the transmitter roof and the coupler outputs are connected to a P.O. jack socket for use with a portable plug-in reflectometer panel. The coupler outputs can also be switched to provide duplicate readings at a common meter panel located in a central position.

In the event of the s.w.r. in any output feeder exceeding a predetermined level, the h.t. of the transmitter concerned is tripped and cannot be reinstated until the cause of the abnormal level is removed.

2 EQUIPMENT LIST

2.1 Coupler Assembly

Feeder Type	Type No.	Drg. No.
Telecon HM9 *	2865N	W.53928 Sh.6 Ed.N

* Requires 2 in/HM9 adaptors, Drg. No. T80-0249 Sh.1

2.2 Portable Reflectometer Panel (Type S1/1 Ref. No. 6625-99-993-1343)

Type No.	Drg. No.
2959G	W.55604 Sh.1 Ed.G

2.3 Indicator Panel Assembly

Type No.	Drg. No.
4768A	W.68874 Sh.1 Ed.A

2.4 Remote Metering Equipment

	Drg. No.
Meter, Power	WIS.9288/B Sh.1 Ref.1
Meter, SWR	WIS.4235 Sh.16 Ref.252
Relays K.300 2C, ±10%, 100V	PC.64901/12

3 DESCRIPTION

3.1 General

The forward and reflected waves on the aerial feeders are sampled at convenient points by directional couplers. Each coupler consists of a small coil supported in the space between the inner and outer conductor of a rigid coaxial feeder. One end of the coil is earthed via a resistive load and the other is brought out via an insulated bush to the external circuits. The coil is coupled both inductively and capacitively to the transmission line and the mutual inductance between the line and the coil can be varied both in magnitude and sign by rotation of the coil but the capacity is not altered to the same extent. This makes it possible to adjust the coil so that the inductive and capacitive pick-up voltages cancel, and there is no output from a wave travelling in one direction in the transmission line. For a wave in the opposite direction in which the phase relationship is reversed, the inductive and capacitive voltages will be additive and there will be a voltage output. Two couplers therefore are employed, one set to respond to the forward wave and the other to the reflected wave. The two couplers are arranged close together in a short length of transmission line, referred to as a coupler assembly, and their outputs are fed to circuits mounted on a platform forming part of the assembly, and enclosed by a metal cover. For brevity the directional coupler responding to the forward wave and that to the reflected wave are referred to as forward and backward couplers respectively, and their outputs are called forward and backward signals, the last designations bearing no relation to the direction of flow of these outputs in subsequent rectifying and indicating circuits.

The outputs from both couplers after passing through equalising networks which provide frequency compensation, are then rectified. The resulting currents are then fed via output terminals TB1(1) and TB1(3) to the Indicator Panel Assembly which is mounted on the transmitter front near the feeder outlet. Inside the unit the backward line current is connected to one pole (SWA1) of a TEST TRIP key switch SWA, the forward line current is similarly connected to another pole SWA2. Pole SWA3 is connected to a d.c. supply for testing and setting the h.t. trip circuit. With switch SWA in the normal position, both forward and backward line currents are fed back to the coupler via terminals TB1(4) and TB1(2) respectively, where they pass through variable resistors providing a fine sensitivity control and then through the coils of a sensitive dual wound trip relay. The latter is thereby operated at a predetermined current difference giving a trip level reasonable independent of power. The relay contacts RLA1 when closed cause relay RLA3 to operate and break the transmitter interlock circuit and trip the transmitter off.

The monitoring circuit is terminated on the frame of the coupler unit via the frame and two auxiliary contacts on a P.O. type jack. Inserting the plug attached to a portable reflectometer panel breaks the two auxiliary contacts and the circuits to earth is then completed via the portable unit and the plug sleeve.

Remote indication of transmitted power and s.w.r. is provided by a metering panel mounted in the Test Equipment Rack. A two pair cable is fed from each transmitter monitoring point to the banks of a uniselector contained in the Power and Frequency Monitor Rack. When a transmitter is selected by a key switch on the control desk the lines from the selected transmitter are connected via the uniselector to the power and s.w.r. meters located in the Test Equipment Rack.

In order to maintain the local metering and trip levels independent of the remote meters when they are switched out of circuit, an equivalent resistance is inserted in each line by means of a relay fitted with two sets of changeover contacts. One relay is provided for each transmitter to be monitored.

To cater for the different power output levels of the types of transmitter to be monitored a special triple scale power meter is used on both the portable and remote metering panels.

3.2 Coupler Assembly

3.2.1 Mechanical

The unit consists of a short cylindrical aluminium casting machined internally and fitted with a concentric inner conductor terminated in the appropriate coaxial connectors. The casting is extended to form a platform through which two directional couplers are let into holes in the platform and project into the space between inner and outer conductors. Depth of penetration is determined by a collar held by grub screws: after setting to the correct depth and rotating to the correct position the two couplers are locked in position by grub screws in bosses on the casting. On no account should their position be altered. Three potentiometers are supported by a bracket at one side: their spindles are locked and RV2 and RV3 which affect the meter calibration should not be disturbed. A P.O. type jack is mounted at one end of the platform and a dual wound trip relay at the other. Connections are made to a terminal block and are taken out through a hole in the platform. A rectangular cover fits over the assembly and is held in position by a single screw at the front. A hole is provided in the cover to enable the portable meter unit to be plugged into the P.O. type jack. Each end of the cylindrical casting is split and provided with a nut and bolt for clamping in position on the feeder.

NOTE: The arrow on the coupler body must agree with the direction of transmission.

3.2.2 Electrical

Circuit Diagrams Fig.1

In the coupler unit the forward signal is picked up by coil X2 and rectified by the germanium crystal rectifier MR2 and smoothed by the resistance-capacity network R4, C5 and C6. An identical coil X1 picks up the backward signal which is rectified and doubled by MR1, MR4, C2 and C8. The rectified output is smoothed by R3. C2 and C3. The identical coils X1 and X2 have a rising frequency output characteristic and to compensate for this the filters C1, R1 and C4, R2 have been inserted to give a substantially flat response. The components MR3, C7 and R5 are also compensating elements to counteract the effect of nonlinear rectification at low levels.

The rectified outputs of X1 and X2 representing the backward and forward line voltages respectively, are taken to the output terminals TB1(1) and TB1(3) respectively and thence to terminals TB2(1) and TB2(3) on the Indicator Panel Assembly. Inside this unit the backward line voltage (TB2(1)) is connected to a pole of the TEST TRIP switch SWA and then via the moving contact to terminal TB2(4). The forward line voltage (TB2(3)) is connected to another pole of SWA and then via the moving contact to terminal TB2(2). Both TB2(4) and TB2(2) are connected back to the coupler assembly via terminals TB1(4) and TB1(2) respectively These terminals are connected to variable resistors RV3 and RV2 which are the fine sensitivity controls for the backward and forward currents. Coarse control is afforded by the penetration of the couplers as previously described. RV3 and RV2 are connected to a dual wound moving coil trip relay RLA. The polarities of the coils are such that the currents work in opposition, the backward current seeking to close contact RLA1 and thereby furnish a trip, and the forward current tending to hold this contact open. The forward coil of RLA is shunted by a variable resistor RV1 which is used to set the trip level at which the relay will operate. The backward and forward lines from the relay coils are terminated to earth via the auxiliary contacts of jack JKA and the remote meters or via the jack ring when the portable meter is plugged in.

3.3 Indicator Panel Assembly

Circuit Diagram Fig.2

3.3.1 Mechanical

The unit consists of a chassis on which various components are mounted and a rectangular metal cover secured by four screws. The unit is fixed in position by four screws through the rear panel. An indicator lamp and key switch project through the front face of the cover and two holes are provided for adjusting two preset potentiometers mounted on the chassis. The two position key switch is non-locking in the test position.

3.3.2 Electrical

The Indicator Panel has the following functions:-

(a) To lock out the transmitter on a fault condition and to indicate that tripping has occurred.

(b) To generate and apply test signals for checking the trip operation.

When the s.w.r. on the lines rises above the predetermined limit, RLA in the Coupler Unit operates and contact RLA1 connects a 50V negative control voltage to relay RLA in the Indicator Panel, causing it to operate, with rectifier MR1 acting as a spark quench. Contact RLA1 in the Indicator Panel breaks the transmitter interlock circuit, tripping the transmitter off. This results in the release of the trip relay RLA in the Coupler Unit and the breaking of contact RLA1 but contact RLA2 holds on relay RLA and prevents the transmitter being restarted. Contact RLA3 completes the circuit of the fault indicator lamp LP1.

A 6.3V a.c. supply, derived from the transmitter, enters the unit via terminals TB2(10) and (11), is rectified by MR2, smoothed by C1 and connected to potentiometers RV1 and RV2, the circuit being completed through one pole of the TEST TRIP switch SWA when switched to the test position. The potentiometers RV1 and RV2 are adjusted to simulate the d.c. voltages obtained from couplers X1 and X2 and are used to check visually the response of the trip circuit in the Coupler Unit. The TEST TRIP switch normally passes signals from X1 and X2 to the monitoring circuits via poles SWA1 and SWA2. Potentiometer RV1 and RV2 can be adjusted with a screwdriver through the two holes provided in the front panel, and in conjunction with the portable meter unit, the response of the trip circuit over the power range may be observed.

3.4 Portable Reflectometer Unit

Circuit Diagram Fig.3

3.4.1 Mechanical

The portable reflectometer is built into a small metal box with a sloping front. It can be stood on a convenient support or may be hung on the feeder near a coupler assembly, two hooks at the back being provided for this purpose. A carrying handle is also fitted.

On the front panel are two large square faced meters, one calibrated to read power and the other to read standing wave ratio. The power meter is provided with a triple scale to cater for the different power outputs of the transmitters on the station. The scale ranges are as follows:-

Scale	Transmitter	Range kW
Top	HS.51	0-42
Middle	HS.71	0-14
Bottom	HS.31	0-4.2

The power output from each type of transmitter is read directly on the scale without switching at the panel, the outputs from the various couplers being adjusted by the maker to suit the type of transmitter to which they are to be fitted.

All components are mounted behind the front panel and the cable which is connected to the coupler assemblies by means of a jack plug, leaves the instrument through a bushed hole in the side.

3.4.2 Electrical

Circuit Diagram Fig.3

The forward signal is applied firstly to a power indicator M1 the scale being calibrated to read outgoing power in the feeder. The scale used is determined by the response of the directional coupler circuits. The signal is then passed to the control coil of ratiometer M2 and then to earth via the case of the unit and the sleeve of plug PL. The backward signal is applied to the deflection coil of M2 and then to earth. The meter M2 indicates the ratio between the current flowing in the control coil and the current flowing in the deflector coil. The movement has no restoring spring, but any current (above a certain minimum) in the control coil will bring that coil into a neutral plane and the pointer to the zero mark. Deflection is then caused by current in the deflection coil and, by virtue of the specially shaped permanent magnet pole pieces, the deflection bears the required relationship to the current ratio. Full scale deflection is given when control and deflection currents are equal. The values of the components in the coupler circuits are so chosen that equal currents are produced when the s.w.r. in the feeder is infinite, the ratiometer scale is therefore calibrated 1 to infinity. All meter coils are bypassed by fairly large value mica capacitors C1, C2 and C3 to prevent erroneous readings due to stray r.f. fields.

3.5 Remote Reflectometer Panel

Circuit Diagram Fig.5

This comprises a panel on which are mounted two meters, one reading power and the other s.w.r. The Power meter is identical with that fitted on the Portable Reflectometer Unit but there is an extra scale added to the s.w.r. meter to read 'Power Factor'. This gives the ratio of transmitted power to the power indicated on the power meter.

To find the power transmitted to the load the power meter reading must be multiplied by the P.F. reading since the power meter indicates the power of the forward wave, a proportion of which is reflected at the load terminals.

The power and s.w.r. for any transmitter on the station will be indicated on this panel after selecting the desired transmitter by switching at the control desk. All lines not connected through to the meter panel via the uniselector are terminated with equivalent resistances switched into circuit by relays, one relay with two sets of changeover contacts is required for each transmitter to be monitored.

4 SETTING UP

4.1 General

The Coupler Assemblies and Indicator Panels are permanently connected in the feeders at points where monitoring facilities are required. The portable reflectometer panel is intended to be carried around from one coupler to another as required. Duplicate readings are given at the remote metering panel by switching at the control desk.

4.2 Trip Levels

Proceed as follows:-

(a) Switch on the filament and control supplies of the transmitter.

(b) Set the POWER LEVEL and S.W.R. LEVEL controls RV1 and RV2 respectively, on the Indicator Panel Assembly to minimum output.

(c) Plug the portable reflectometer panel into the jack located in the Coupler Unit.

(d) Depress the TEST TRIP switch SWA in the Indicator Unit.

(e) Adjust the POWER LEVEL control until the reading on the portable meter corresponds to 3.5 kW.

(f) Increase S.W.R. LEVEL control slowly until the fault lamp on the Indicator Panel shows a trip, then turn the control back to minimum.

(g) On the Rectifier and Control Unit press the H.T. OFF and RESET button: the indicator lamp should be extinguished.

(h) Undo the locking device on potentiometer RV1 in the Coupler Unit and by successively increasing the S.W.R. LEVEL, adjusting RV1 and resetting the trip after each trial; continue until the trip occurs with a s.w.r. of 2 shown on the meter. Release the TEST TRIP switch and lock RV1 at this setting.

5 MAINTENANCE

5.1 Coupler Units

The setting of the directional couplers should in no circumstances be altered. They are locked in position, and cannot be reset without special equipment. They should be returned to The Marconi Company Limited for recalibration if they are disturbed or damaged.

5.2 Portable Reflectometer Panel

The panel should require little attention apart from the removal of the Cable Connections if these become worn from use.

5.3 Indicator Panel Assembly

This unit should require no attention apart from the replacement of an indicator lamp in the event of a failure.

COMPONENT LIST No.2
FOR
INDICATOR PANEL TYPE 4768A
(Drg. No. W.68874 Sh.1 Ed.A)

NOTES
1. When ordering spares quote identity only.
2. References in column 1 are normally shown on the circuit and component location diagram Fig.2.
3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol % ±	Rating	Identity	Qty
CAPACITORS						
C1	Electrolytic, Plain Foil, Tub.	50 μF	+100 -20	12V Peak Working	PC.18402/16	
RESISTORS (FIXED)						
R2	Composite Grade 2 Insulated	560Ω	±10	$\frac{3}{4}$W	PC.66612/16	
R3	Composite Grade 2 Insulated	8.2 kΩ	±10	$\frac{3}{4}$W	PC.66612/30	
R4	Composite Grade 2 Insulated	470k	±10	$\frac{1}{4}$W	PC.66610/57	
RESISTORS (VARIABLE)						
RV1	Wirewound Linear	5 kΩ	±10	$\frac{1}{2}$W	PC.67401/29	
RV2	Wirewound	5 kΩ	±10	$\frac{1}{2}$W	PC.67401/29	

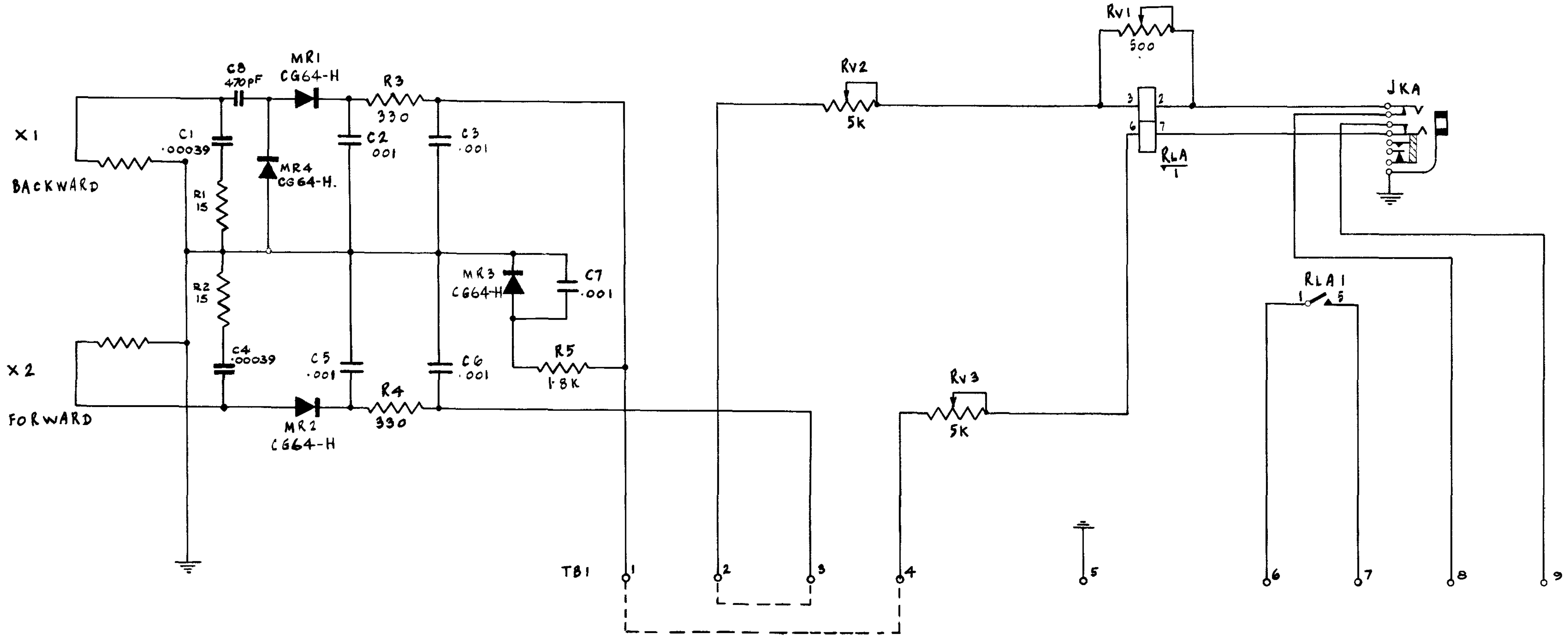
COMPONENT LIST No.2 (contd.)

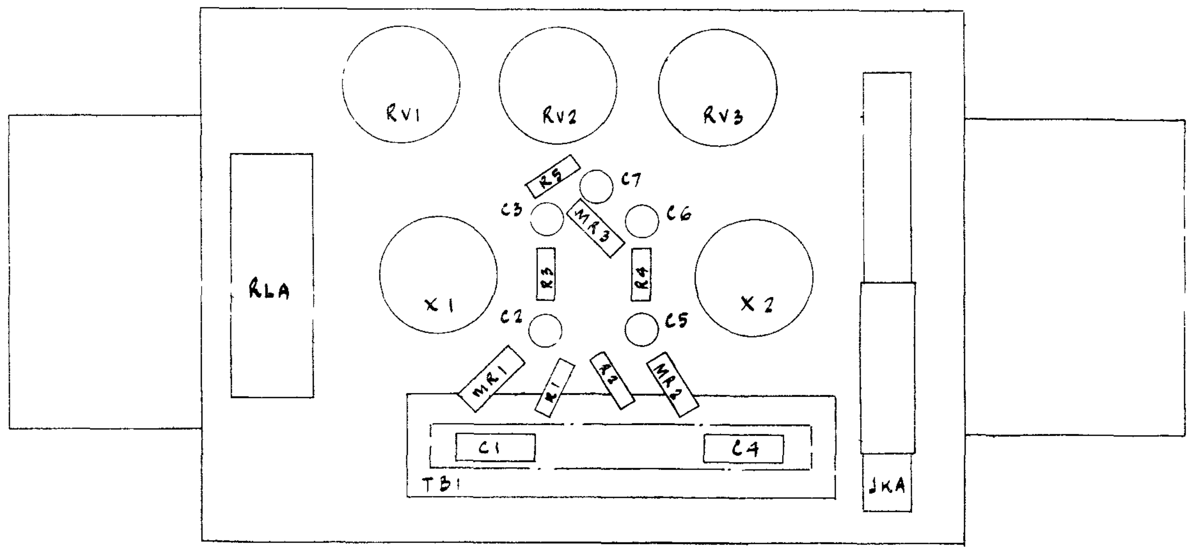
Ref.	Description	Value	Tol % ±	Rating	Identity	Qty
MISCELLANEOUS ELECTRICAL ITEMS						
LP1	Lamp E10 Clear 6.5V 2.3W				PC.48701/2	1
MR1	Rectifier Westinghouse T5D/19					1
MR2	Rectifier CG64H					1
SWA	Switch Lever 2 Position				PC.71202/2	1
RLA	Relay 2B 2M				PC.65406/15	1
TB1	Terminal Block 12 Way				WIS.1631/1/12	1

COMPONENT LIST No.3
FOR
PORTABLE REFLECTOMETER PANEL TYPE 2959G
(Drg. No. W.55604 Ed.G)

NOTES
1. When ordering spares quote identity only.
2. References in column 1 are normally shown on the circuit and component location diagram Fig.3.
3. For identical items the total quantity is given at the first entry.

Ref.	Description	Value	Tol % ±	Rating	Identity	Qty
CAPACITORS						
C1	Mica	0.01 μF	±20	350V	PC.18701/5	3
C2	Mica	0.01 μF	±20	350V	PC.18701/5	
C3	Mica	0.01 μF	±20	350V	PC.18701/5	
MISCELLANEOUS ELECTRICAL ITEMS						
PLA	Plug G.P.O. Type 316				WIS.2499/1	1
TB1	Terminal Block				W.21523/C/1/M	1
M1	Power Indicator Meter				WIS.9288/B/1/1	1
M2	Ratiometer				WIS.4235/16/253	1

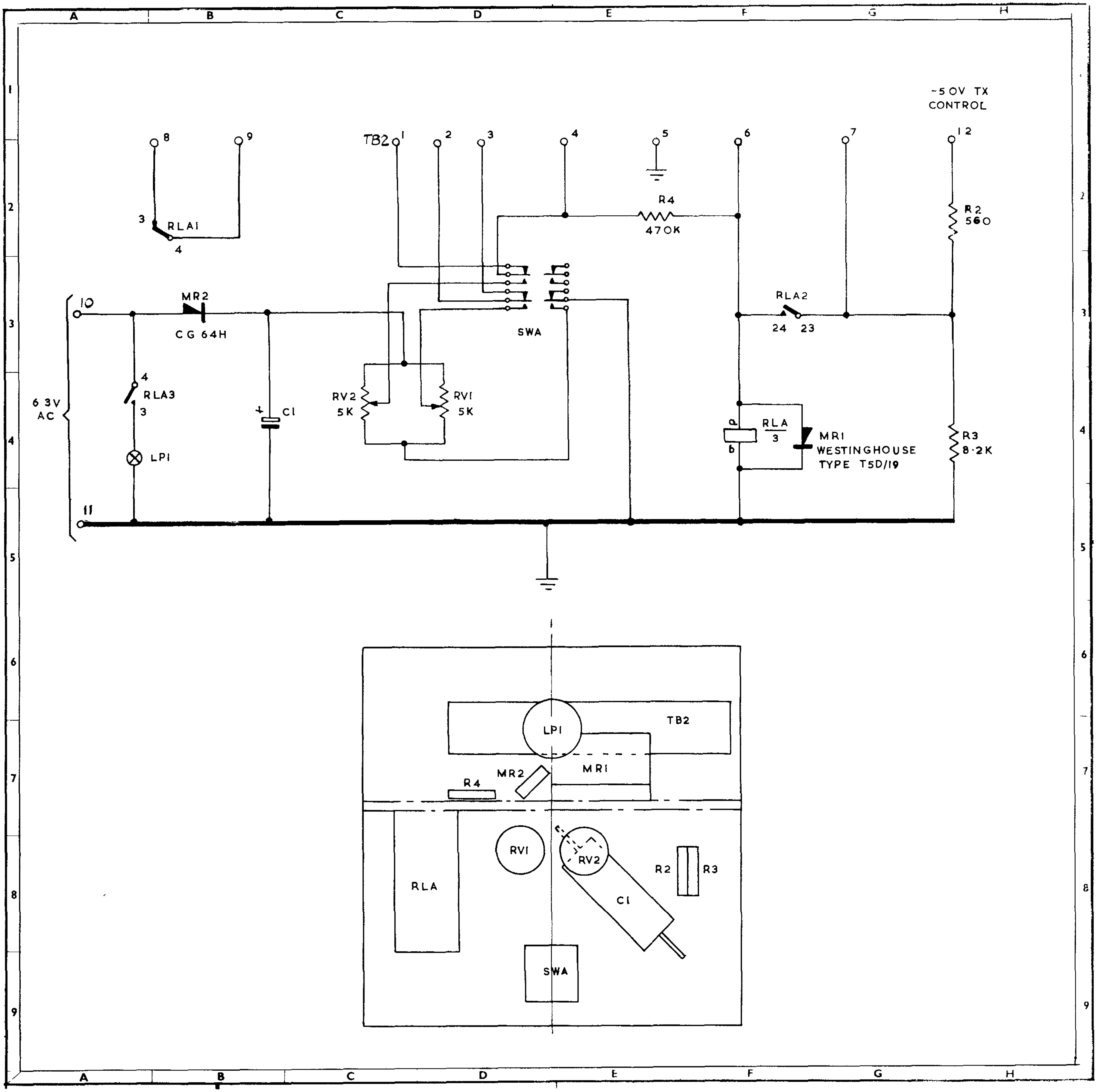




A.L.3 to
A.P.2922D
Feb. 1964

COUPLER ASSEMBLY (TYPE 2865N MODIFIED)
CIRCUIT DIAGRAM AND COMPONENT LAYOUT
HK/SK/52 Sh.2 Iss.1

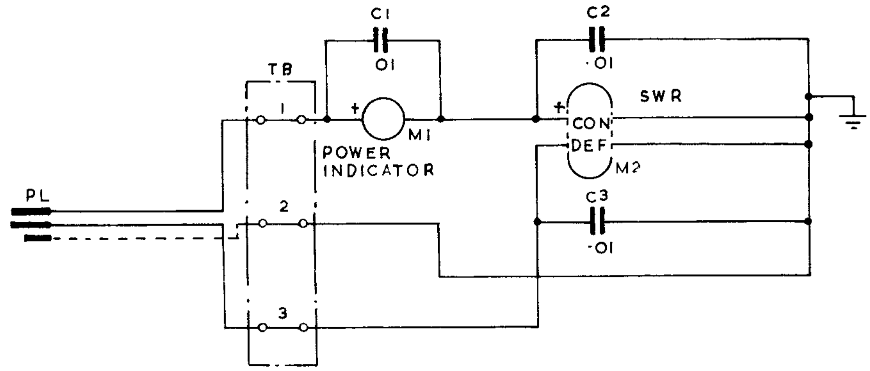
Fig.1

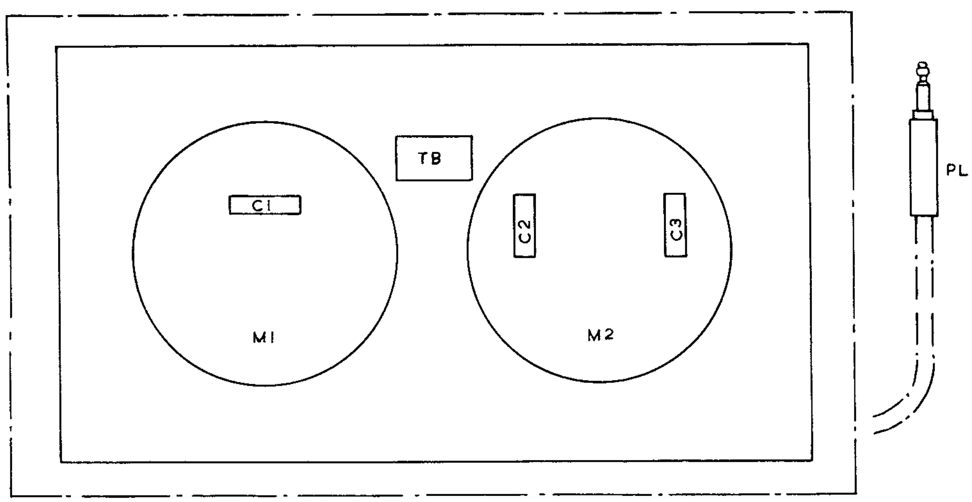


A.L.3 to
A.P.2922D
Feb. 1964

INDICATOR PANEL ASSEMBLY
CIRCUIT DIAGRAM AND COMPONENT LAYOUT
WZ.31015/B Sh.1 Iss.3

Fig.2

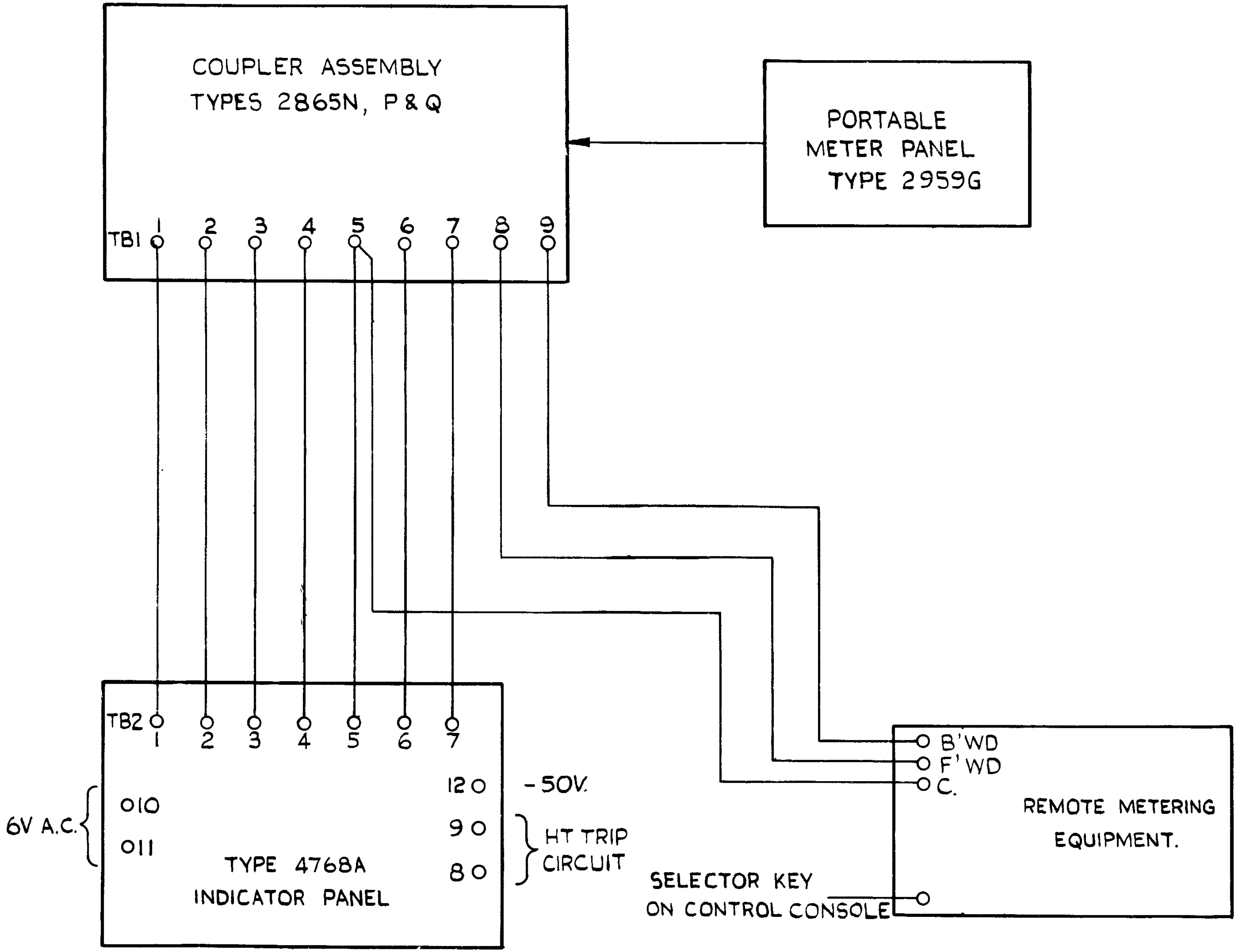




A.L.3 to
A.P.2922D
Feb. 1964

PORTABLE REFLECTOMETER PANEL
CIRCUIT DIAGRAM AND COMPONENT LAYOUT
WZ.16129/B Sh.2 Iss.1

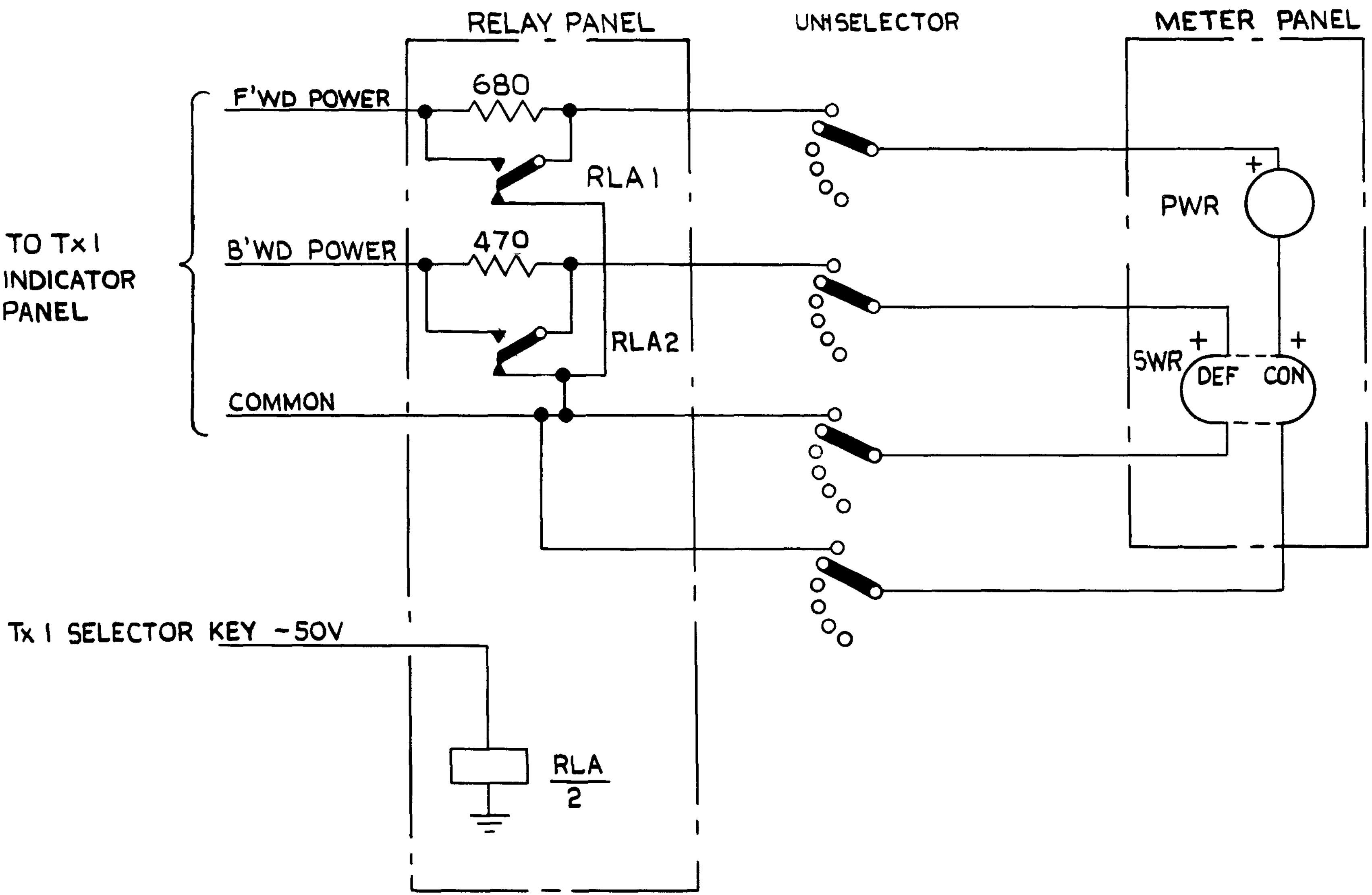
Fig.3



A.L.3 to
A.P.2922D
Feb. 1964

FEEDER MONITORING EQUIPMENT
BLOCK DIAGRAM
WZ.30872 Sh.1

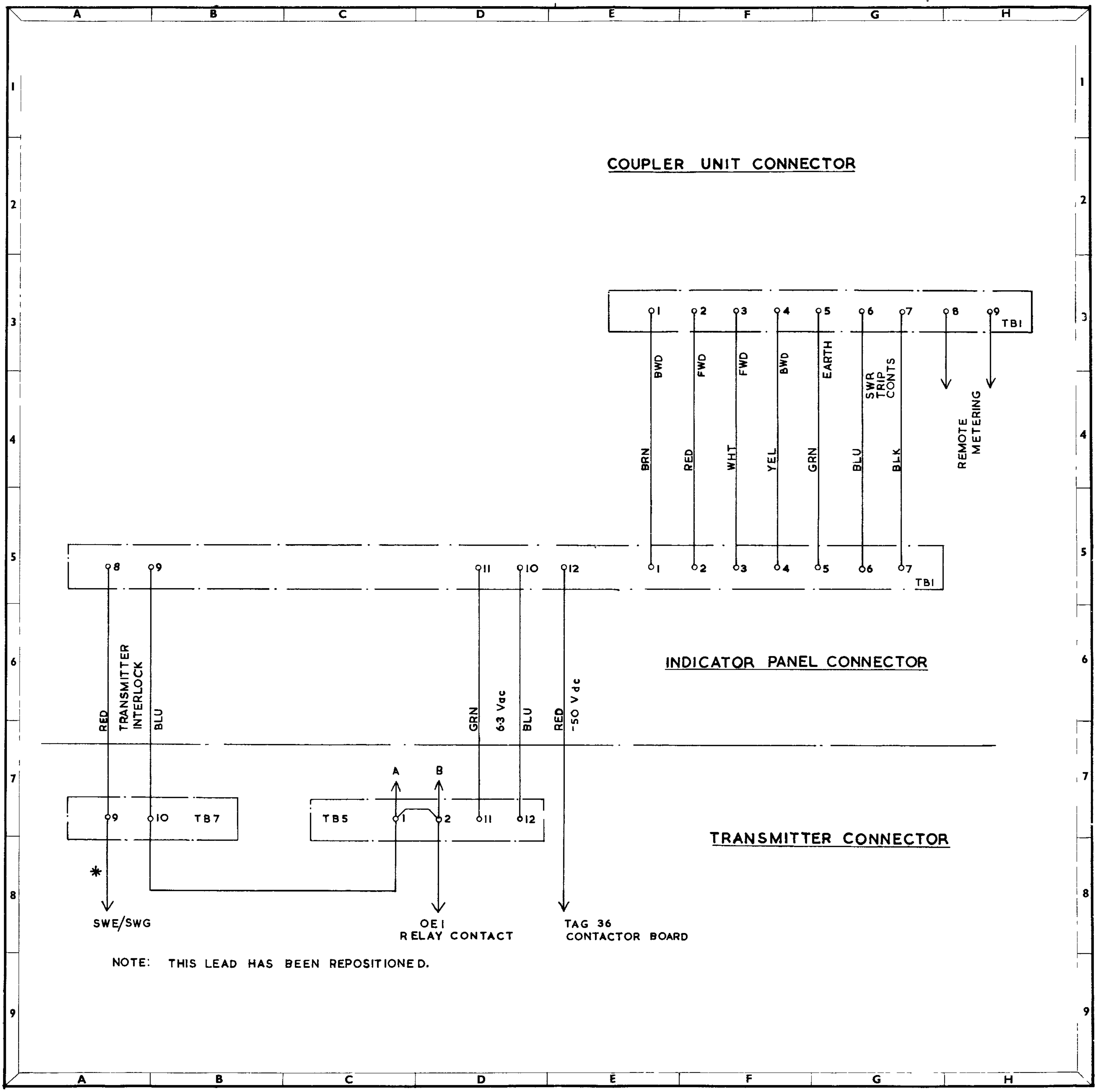
Fig.4



A.L.3 to
A.P.2922D
Feb. 1964

REMOTE METERING EQUIPMENT
SIMPLIFIED CIRCUIT
WZ.30871 Sh.1

Fig.5



A.L.3 to
A.P.2922D
Feb. 1964

REFLECTOMETER INTERCONNECTIONS
WZ.31158/B Sh.1 Iss.1

Fig.6