DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATION AND MAINTENANCE

DIRECTION FINDER

GROUPS AN/APA-69

AND AN/APA-69A (U)

HEADQUARTERS, DEPARTMENT OF THE ARMY
SEPTEMBER 1958

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., 9 September 1958

TM 11-5826-203-15 (AN 16-30APA69-1, -2, -3, and -4) is published for the use of all concerned. [AG 413.44 (28 Jul 58)]

By Order of *Wilber M. Brucker,* Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:
HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

Distribution:
Active Army:

ASA (2)
CNGB (1)
Technical Stf, DA (1) except
CSigO (30)
Technical Stf Bd (1)
USA Arty Bd (1)
USA Armor Bd (1)
USA Inf Bd (1)
USA Air Def Bd (1)
USA Abn & Elct Bd (1)
USA Avn Bd (1)
USA Armor Bd Test Sec (1)
USA Air Def Bd Test Sec (1)
USA Arctic Test Bd (1)
USCONARC (5)
US ARADCOM (2)
US ARADCOM, Rgn (2)
OS Maj Comd (5)
Log Comd (5)
MDW (1)
Armies (5)
Corps (2)
Div (2)
USATC (2)
Instls (2)
Svc Colleges (5)
Br Svc Sch (5) except
USASCS (25)
Gen Depots (2) except Atlanta
Gen Depot (None)
Sig Sec, Gen Depots (10)
Sig Depots (17)
Fld Comd, AFSWP (5)
Engr Maint Cen (1)
Army Pictorial Cen (2)
WRAMC (1)
AFIP (1)
AMS (1)
Port of Emb (OS) (2)
Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agcy (2)
USA Sig Pub Agcy (8)
USA Sig Engr Agcy (1)
USA Comm Agcy (2)
TASSA (13), Mid-Western Rgn
Ofc
USA Sig Eqp Spt Agcy (2)
USA White Sands Sig Agcy (13)
Yuma Test Sta (2)
USA Elct PG (1)
Sig Fid Maint Shops (3)
Sig Lab (5)
Mil Dist (1)
Sectors, USA Corps (Res) (1)
USA Corps (Res) (1)
JBUSMC (2)
Units organized under following
TOE's:
11-7 (2)
11-16 (2)
11-57 (2)
11-127 (2)
11-128 (2)
11-500 (AA-AE) (2)
11-557 (2)
11-587 (2)
11-592 (2)
11-597 (2)
(TASSA) (1)

NG: State AG (6); units--same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

CHANGE
NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 3 January 1984

**OPERATION AND MAINTENANCE
DIRECTION FINDER GROUPS
ANIAPA-69 (NSN 5826-00-076-7254) AND
AN/APA-69A (NSN 5841-00-714-7962)**

TM 11-5826-203-15, 9 September 1958, is changed as follows:
Cover. The title is superseded as shown above.

Page 1, Chapter 1, Redesignate existing section 1 as section 1.1
Insert section 1 before section 1.1.

Section I. INTRODUCTION

1-1. General
This manual describes Direction Finder Groups AN/APA-69 and AN/APA-69A and covers their operation, operator and organizational maintenance, and field and depot maintenance. The manual also includes information pertaining to cleaning and inspection of the equipment.

1-2. Consolidated Index of Army Publications and Blank Forms
Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

1-3. Maintenance Forms, Records, and Reports
a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.
b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 73511-2/DLAR 4140.55/NAVMATINST 4355.73A/ AFR 400-54/MCO 4430.3F.
c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed : in AR 55-38/NAVSUPINST 461033C/AFR 7518/MCO P4610.19D/DLAR 4500.15.

1-4. Reporting Errors and Recommending Improvements
You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSELME-MP, Fort Monmouth, New Jersey 07703.

In either case, a reply will be furnished direct to you.

1-5. Reporting Equipment Improvement Recommendations (EIR)
If your direction finder needs improvement, let us know. Send us an EIR. You, the user are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. Well send you a reply.

1-6. Administrative Storage
Administrative Storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from

*This change supersedes C1, 18 December 1963.

administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 740-90-1.

1-7. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

Page 18, chapter 1. Add chapter 1.1 after figure 4-2.

CHAPTER 1.1

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

1.1-1. General

This chapter covers the scope of operator and organizational maintenance; the tools, test equipment, and materials required; and the preventive maintenance checks and services that are necessary to effectively maintain the equipment; Included also are instructions for cleaning and touchup painting of the equipment as required during the performance of the preventive maintenance checks and services.

1.1-2. Scope of Maintenance

The maintenance duties assigned to the operator of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions. The tools and test equipment required are listed in paragraph 1.1-3 of this chapter.

a. Operator/crew preventive maintenance checks and services chart (par. 1.1-6).

b. Organizational preventive maintenance checks and services chart (par. 1.1-7).

c. Touchup painting (par. 1.1-8).

1.1-3. Tools, Test Equipment, and Materials

a. Tools and Test Equipment. The tools and test equipment required are those available due to the assigned mission of the using organization.

b. Materials.

(1) Fine sandpaper, No. 000.
(2) A clean, dry, lint-free cloth.
(3) A soft-bristled brush.
(4) Trichlorotrifluoroethane (NSN 6850-00-105-3084).

1.1-4. Preventive Maintenance

NOTE

Refer to TM 750-244-2 for proper procedures for destruction of this equipment to prevent enemy use.

a. Operator/crew preventive maintenance is the systematic care, servicing and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to maintain equipment in serviceable condition. To be sure that your direction finder is always ready for your mission, you must do scheduled preventive maintenance checks and services (PMCS).

(1) BEFORE OPERATION, perform your B PMCS to be sure that your equipment is ready to go.

(2) When an item of equipment is reinstalled after removal, for any reason, perform the necessary B PMCS to be sure the item meets the readiness reporting criteria.

(3) Use the ITEM NO. column in the PMCS table to get the number to be used in the TM ITEM NO. column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) when you fill out the form.

(4) Organizational preventive maintenance procedures are designed to help maintain equipment in serviceable condition. They include items to be checked and how to check them. These checks and services, described in paragraph 1.1-7 outline inspections that are to be made at specific MONTHLY (M) and QUARTERLY (Q) intervals.

b. Routine checks like CLEANING, DUSTING, WASHING, CHECKING FOR FRAYED CABLES, STOWING ITEMS NOT IN USE, COVERING UNUSED RECEPTACLES, CHECKING FOR LOOSE NUTS AND BOLTS AND CHECKING FOR COMPLETENESS are not listed as PMCS checks. They are things that you should do any time you see thay must be done. If you find a routine check like one of those listed in your PMCS, it is because other operators reported problems with this item.

NOTE

When you are doing any PMCS or routine

checks, keep in mind the warnings and cautions.

WARNINGS

- **Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.**
- **Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent a chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel. Goggles must be worn at all times while cleaning with compressed air. Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch gage (psig) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when trichlorotrifluoroethane has been used.**

NOTES

The PROCEDURES column in your PMCS charts instruct how to perform the required checks and services. Carefully follow these instructions and, if tools are needed or the chart so instructs, get organizational maintenance to do the necessary work.

If your equipment must be in operation all the time, check those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

c. Deficiencies that cannot be corrected must be reported to higher category maintenance personnel. Records and reports of preventive maintenance must be made in accordance with procedures given in TM 38-750.

1.1-5. Operator/Crew Preventive Maintenance Checks and Services

Perform before operation PMCS if you are operating the item for the first time.

NOTE

The checks in the interval column are to be performed in the order listed.

1.1-6. Operator/Crew Preventive Maintenance Checks and Services Chart

B -- Before

Item No.	Interval B	Item to be Inspected	Procedures -- Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
1	*	Mission Essential Equipment	Check for completeness and satisfactory condition of the equipment. Report missing items.	Available equipment is insufficient to support the combat mission.
2	*	Direction Finder	Perform operational checks as described in paragraphs 2-1 through 2-25 (AN/APA-69), and 2-3 through 2-25 (AN/APA-69A).	

*Do this check before each deployment to a mission location. This will permit any existing problems to be corrected before the mission starts. The check does not need to be done again until redeployment.

1.1-7. Organizational Preventive Maintenance Checks and Services Chart

M -- Monthly Q - Quarterly

Item No.	Interval M	Interval Q	Item to be Inspected	Procedures
1	*	*	Direction Finder AN/APA-69 or AN/APA-69A	Perform organizational checks as described in Chapter 2.
2		*	Amplifier Power Supply AM-256/APA-69 and Azimuth Indicator IP-36/APA-69	Remove and replace with bench tested units.
3		*	Azimuth Panoramic Indicator IP-81 ( )/APA-69A	Remove and replace with bench tested units.

1.1-8. Touchup Painting Instructions
Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 43-0139.

Page 54. Add appendix I, reference after chapter 3.

APPENDIX I
REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 43-0139	Painting Instructions for Field Use.
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use.

By Order of the Secretary of the Army:

JOHN A. WICKHAM JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-36, Organizational Maintenance requirements for AN/APA-69.

DIRECTION FINDER GROUPS AN/APA-69 AND AN /APA-692 (U)

CHAPTER 1. OPERATING INSTRUCTIONS

SECTION I. GENERAL DESCRIPTION

SECTION II. OPERATING PROCEDURES

SECTION III. OPERATING CHECKS AND ADJUSTMENTS

SECTION IV. EMERGENCY OPERATION AND REPAIRS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (cont)

LIST OF TABLES

SAFETY NOTICE

HIGH VOLTAGES DANGEROUS TO LIFE ARE EMPLOYED IN THIS EQUIPMENT AND MAY BE FATAL IF CONTACTED BY OPERATING PERSONNEL ALL SAFETY PRECAUTIONS MUST BE EXERCISED WHEN WORKING WITH THE EQUIPMENT.

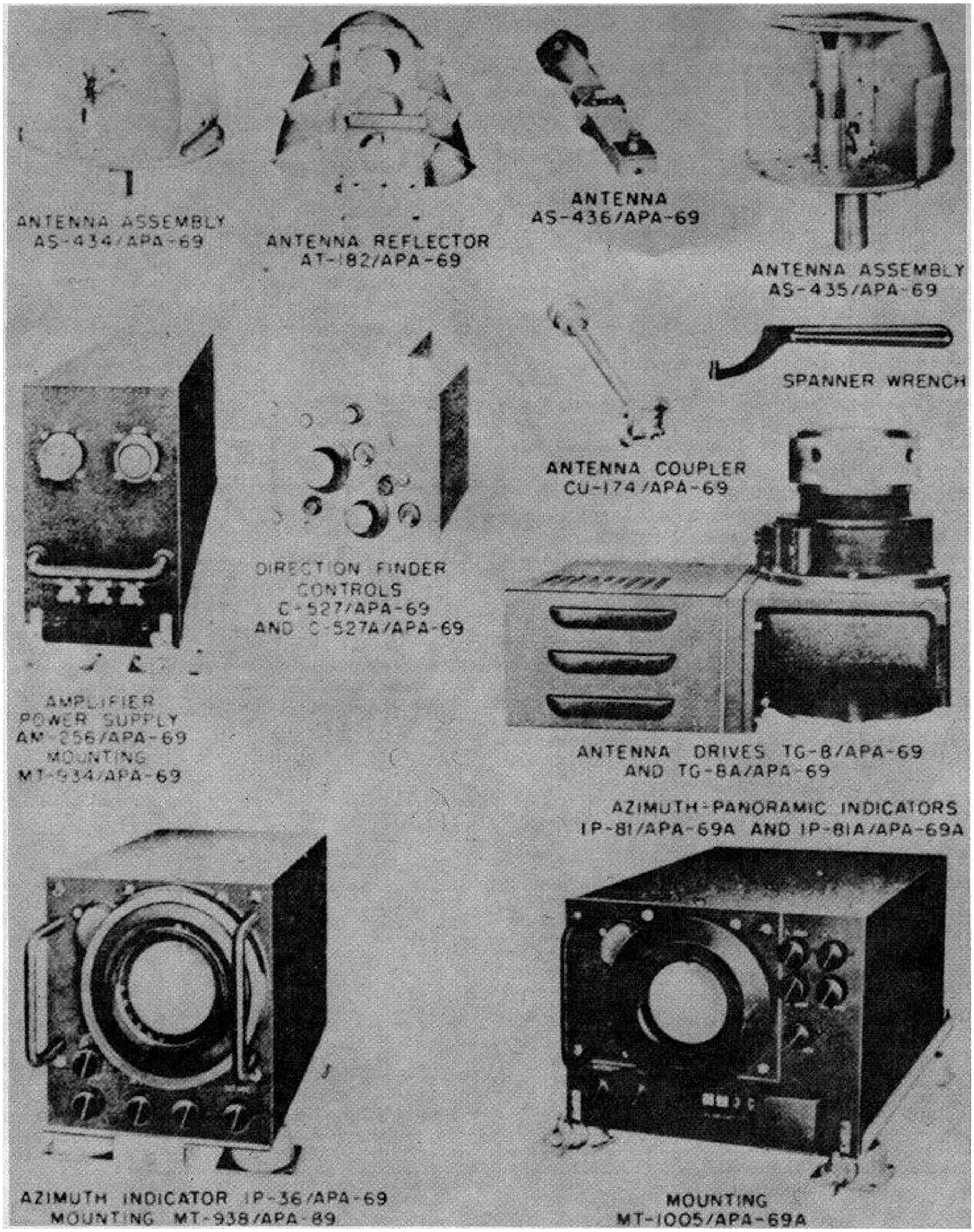


Figure 1-1. Direction Finder Group AN/APA-69 and AN/APA-69A Equipment Supplied

SECTION I
GENERAL DESCRIPTION

1-1. GENERAL.

1-2. Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A (figure 1-1), when used with a suitable radio or radar receiving set, provide visual indication on a cathode-ray screen of the true bearing of received radio and radar signals within the frequency range of the receiver. The directional indication is converted to true bearing by an azimuth scale rotating around the outer rim of the cathode-ray tube. This azimuth scale is driven by a Flux Gate compass not otherwise associated with the direction finder group.

1-3. The signal picture affords other information as well, including approximate pulse repetition frequency (prf), relative signal amplitude, modulation characteristics and polarization of the received signal. Direction Finder Group AN/APA-69A provides, in addition, a panoramic sweep signal 20 kilocycles wide which may be driven over the entire band of the receiver which operates with this equipment, to survey the band for signal isolation and identification. The sweep may be stopped to determine the exact frequency of any signal so isolated. A remote counter, synchronized with the scanning drive, indicates on a dial on the panoramic azimuth indicator the exact frequency being scanned.

1-3A. Direction Finder Group AN/APA-69 is designed for airborne service and covers the range of 180-10,750 megacycles. Direction Finder Group AN/ APA-69A is designed for airborne service and covers the range of 1000-10,750 megacycles.

1-4. Equipment listed in table 1-1 is supplied as part of the installation indicated. Elements of both equipments are the same except that Azimuth-Panoramic Indicator IP-81/APA-69A and its mounting and associated plugs are substituted for Amplifier Power Supply AM-256/APA-69 and Azimuth Indicator IP-36/APA-69 and their mountings and associated plugs.

1-5. Equipment listed in table 1-2 is required but not supplied as part of each installation.

TABLE 1-1. DIRECTION FINDER GROUP AN/APA69 AND DIRECTION FINDER GROUP AN/APA-69A, EQUIPMENT SUPPLIED

Quantity	*Name*	*Type Designation*	*Dimensions (Inches)*			*Weight (lbs)*	*Reference Symbol Series*
			Length	*Width*	*Height*		
EQUIPMENT COMMON TO BOTH DIRECTION FINDER GROUPS							
*1	Direction Finder Control	C-527/APA-69 or C-527A/APA-69	7.35	5.75	4.50	2.38	301-399
**1	Antenna Drive	TG-8/APA-69 or TG-8A/APA-69	11.2	8.2	7.4	13.5	401-499
1	Antenna Assembly	AS-435/APA-69	--	16.12	17.14	12.63	501-599
1	Antenna Assembly	AS-434/APA-69	--	20.0	18.3	14.7	601-699
1	Antenna Coupler	CU-174/APA-69	8.26	2.30	--	12.0	1301-1399
1	Antenna Reflector	AT-182/APA-69	11.5	9.38	10.88	0.625	1101-1199
1	Antenna	AS436/APA-69	13.13	2.485	--	2.5	1201-1299
1	Coaxial Plug	UG-21B/U	1.88	0.81	--	1.0	P405
1	Coaxial Plugs	UG-260/U	1.0	0.5	--	0.12	P402-3-4
1	Plug	AN3106-18-8S	2.0	1.31	--	0.06	P401
1	Plug	AN3106-24-7S	2.25	1.72	--	0.10	P301
1	Cable Clamp	AN3057-10	1.42	1.12	--	0.20	--
1	Cable Clamp	AN3057-16	1.87	1.32	--	0.05	--
1	Spanner Wrench		9.0		--	0.09	0428
EQUIPMENT COMPLETING DIRECTION FINDER GROUP AN/APA-69							
1	Amplifier-Power Supply	AM-256/APA-69	23.38	5.88	9.38	16.0	101-199
1	Mounting	MT-934/APA-69	23.8	8.132	1.625	2.25	701-799
1	Azimuth Indicator	IP-36/APA-69	16.18	5.94	7.8	19.0	201-299
1	Mounting	MT-938/APA-69	13.62	7.32	1.625	1.3	801-899
6	Coaxial Plugs	UG-260/U	.0	0.5	--	0.06	P101-2-3 P201-2-3

TABLE 1-1. DIRECTION FINDER GROUP AN/APA69 AND DIRECTION FINDER GROUP AN/APA-69A, EQUIPMENT SUPPLIED (cont)

Quantity	*Name*	*Type Designation*	*Dimensions (Inches)*			*Weight (lbs)*	*Reference Symbol Series*
			Length	*Width*	*Height*		
EQUIPMENT COMPLETING DIRECTION FINDER GROUP AN/APA-69 (cont)							
1	Plug	AN3106-14S-1S	1.44	1.13	--	0.05	P205
1	Plug	AN3106-14S-5S	1.44	1.13	--	0.05	P206
1	Plug	AN3106-20-7P	2.19	1.46	--	0.15	P105
1	Plug	AN3106-20-7S	2.19	1.46	--	0.15	P204
1	Plug	AB3106-20-9S	2.19	1.46	--	0.15	P104
3	Cable Clamps	AN3057-12	1.63	1.18	--	0.06	E133, E133, E248
2	Cable Clamps	AN3057-6	1.08	1.12	--	0.003	E249, E249
EQUIPMENT COMPLETING DIRECTION FINDER GROUP AN/APA-69A							
1	Azimuth-Panoramic	IP-8/APA-69A or	--	--	--	27.42	1001-1009
	Indicator	IP-81A/APA-69A	--	--	--	27.42	1001-1009
1	Mounting	MT-1005/APA-69A	--	--	--	2.5	901-999
5	Coaxial Plugs	UG-260/U	1.0	0.5	--	0.06	P510/ APR9 P1002-3-4-8
1	Plug	AN3106-14-2S	1.83	1.13	--	0.05	P1007
1	Plug	AN3106-14-5S	1.83	1.13	--	0.05	P1006
1	Plug	AN3106-14S-2P	1.83	1.13	--	0.05	P515/ APR9
1	Plug	AN3106-20-7S	2.19	1.46	--	0.15	P1001
2	Plugs (shell)	AN3106-36	2.35	2.46	--	--	P903/ APR9 P1005
1	Plug insert	Winchester 202B	--	--	--	--	--
1	Plug insert	Winchester 201B	--	--	--	--	--
3	Cable Clamps	AB3057-6	1.08	1.30	--	0.03	--
1	Cable Clamps	AN3057-12	1.18	1.37	--	0.06	E1023
2	Cable Clamps	AN3057-24	1.56	2.18	--	0.18	--

TABLE 1-2. DIRECTION FINDER GROUP AN/APA-69 AND DIRECTION FINDER GROUP AN/APA-69A, EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity	*Name*	*Type Designation*	*Required Characteristics*
1	Intercept Receiver	AN/APR-9	For Direction Finder Group AN/APA-69: covering 180 to 10,750 megacycles with provision for video output. For Direction Finder Group AN/APA-69A: covering 1000-10,750 megacycles, providing partial power requirements, video signal and panoramic sweep output.
1	Radome		Suitable to type of aircraft.
1	Gyro Flux Gate Compass		Sufficient output voltage to drive the torque unit in either direction finder group.
	Power and Coaxial Cables		Quantity and type required for specific installation.

*Direction Finder Control C-527A/APA-69 and Direction Finder Control C-527/APA-69 are identical in function. The only difference between the two controls is that the former has a stainless steel mounting, while the latter has a mounting fabricated of aluminum. In the text, the two controls are considered to be interchangeable.

**Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 are interchangeable mechanically and electrically, except that Antenna Drive TG-8A/APA69 is explosion proof and does not include the automatic speed changing device. In the text, the two antenna drives are considered to be interchangeable except as specifically stated otherwise.

1-6. DESCRIPTION OF EQUIPMENT.

1-7. GENERAL ELECTRICAL CHARACTERISTICS. The r-f range of the Direction Finder Group AN/ APA-69 is 180 to 10,750 megacycles, using three broad-banded antennas. Its power requirements are 115 volts (320-1760 cycles per second), approximately 64 volt-amperes; 115 volts (380-420 cycles per second), approximately 19 volt-amperes; and 26.5 volts dc, approximately 3 amperes. The r-f range of the Direction Finder Group AN/APA-69A is 1000 to 10,750 megacycles, using the same antennas. Its power requirements, exclusive of power drawn from Radar Set AN/APR-9, are 115 volts (380-420 cycles per

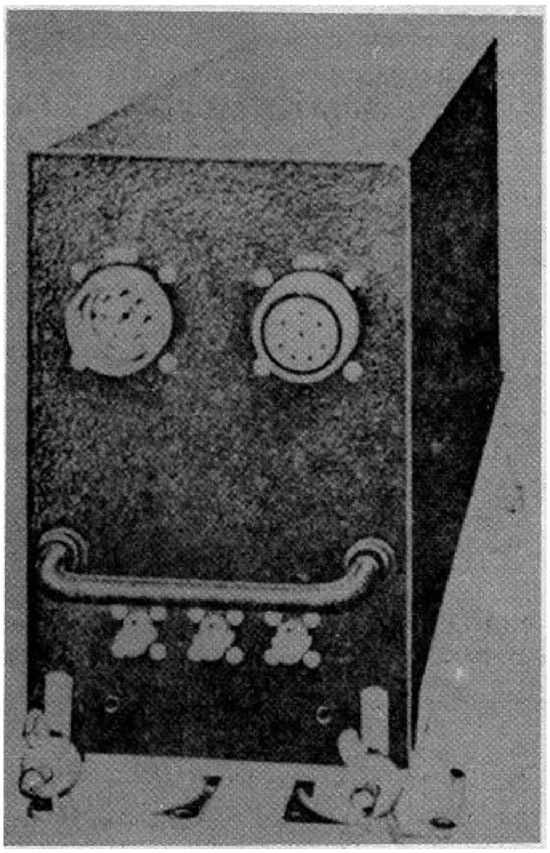


Figure 1-2. Amplifier Power Supply AM-256/APA-69

second) approximately 19 volt-amperes; and 26.5 volts dc, approximately 3 amperes. Owing to power supplied to Direction Finder Group AN/APA-69A by Radar Set AN/APR-9, the 115-volt (320-1760 cycle per second) requirement is only 18 volt-amperes to supply the high voltage circuits of the panoramic azimuth indicator. Power supplied by Radar Set AN/APR-9 when the "PAN-DF"-switch is in the PAN position is 300 volts at 43.5 milliamperes and

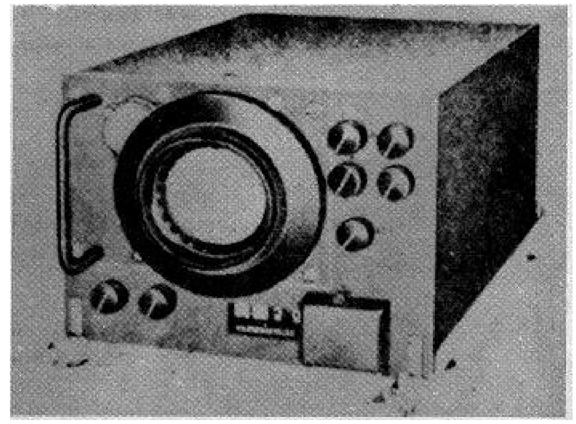


Figure 1-2A. Azimuth-Panoramic Indicator IP-81/APA-69A

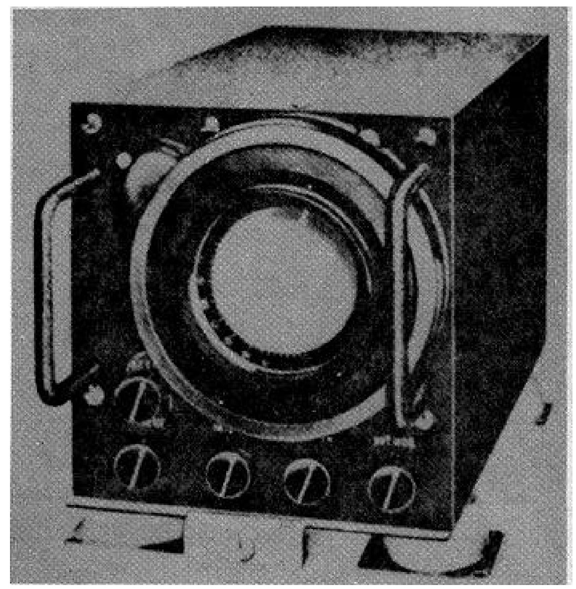


Figure 1-3. Azimuth Indicator IP-36/APA-69

150 volts at 5.7 milliamperes; in DF position, 300 volts at 42 milliamperes and 150 volts at 5.6 milliamperes.

1-8. AMPLIFIER POWER SUPPLY AM-256/APA69. (*See figure 1-2*.) The amplifier power supply comprises a video amplifier designed for amplifying input signals of either positive or negative polarity and a power supply providing one negative and two positive d-c outputs. The positive supplies provide 250 volts for the video amplifier and 350 volts for the azimuth indicator. The negative supply provides -150 volts dc for both video amplifier and cathode-ray tube. A two-pole, two-position switch located on the chassis is used for the selection of positive or negative input signals. No other adjustments or controls appear in this unit. The entire chassis and cover are fabricated from aluminum and finished in black wrinkle. The unit is mounted on Mounting MT-934/APA-69 which includes shockmounts to the aircraft.

1-8A. AZIMUTH-PANORAMIC INDICATOR IPX1( )/APA-69A. (*See figure 1-2A*.) Azimuth-Panoramic Indicator IP-81( )/APA-69A consists of a three-inch cathode-ray tube indicator, a video amplifier section, a pair of deflection amplifiers, an intensifier section, and a high voltage power supply. External adjustments are provided for "V(ertical)" and "H(orizontal) CENT(ering)", "FOCUS", "INTENSITY", intensifier bias ("INT. MOD."), "HOR. GAIN" and pilot light "DIMMER". The panoramic scanning voltage is separately introduced and switched through the horizontal and vertical deflection amplifiers by means of the "PAN-DF" switch in the direction finder control. Also part of the indicator are a torque unit and gear train which rotate the moving scale and an electron tube amplifier to supply driving voltage for the torque unit motor. Another part of the indicator is a self-synchronous motor driven from Radar Set AN/APR-9 to move the direct-reading frequency dial, and reset circuits attached thereto. The combined function of these components is to deliver a cathode-ray tube pattern of the received radio or radar signal in such a manner as to indicate either its frequency (panoramic function) or the direction from which it is being transmitted (azimuth function). This directional information is further converted into a true bearing by means of a rotating azimuth scale actuated from a compass repeater. If the compass is not operating, the cathode-ray tube will still deliver relative bearings; the azimuth scale must be zeroed against the fiducial mark for direct reading.

1-8B. Azimuth-Panoramic Indicator IP-81( )/APA69A is finished in black wrinkle to match the other components and is installed on Mounting MT-1005/ APA-i9A which includes shockmounts to the aircraft.

1-9. AZIMUTH INDICATOR IP-36/APA-69. (See figure 1-3.) The azimuth indicator consists of a three-inch cathode-ray tube indicator, a pair of deflection amplifiers, an intensifier tube, and high voltage and filament power supplies. External adjustments are provided for "V(ertical)" and "H(orizontal CENT (ering)", "FOCUS", "INTENSITY" and intensifier bias ("INT. MOD."). Also part of : the indicator are a torque unit and gear train which rotate the moving scale and a vacuum tube amplifier to supply driving voltage for the torque unit motor. The combined function of these components is to deliver a cathoderay tube pattern of the received radio or radar signal in such a manner as to indicate the direction from which it is being received and then to convert that direction indication into a true bearing by means of a rotating azimuth scale, actuated from a Flux Gate compass. If the compass is not operating, the cathoderay tube will still deliver relative bearings; the azimuth scale must be zeroed against the fiducial mark for direct reading.

1-10. The case is finished in black wrinkle to match the other components and is mounted on Mounting MT-938/APA-69 which includes shockmounts to the aircraft.

1-11. DIRECTION FINDER CONTROL C-527/APA-59. (*See figure 1-4.*) The director finder control is located at the operating position and provides means for (1) varying the rotating speed of the antenna, (2) switching oppositely polarized signals from the two lower frequency antenna units, (3) varying the gain of the video amplifier and (4) turning the primary power on and off. In installations using the Azimuth Indicator IP-36/APA-69 the "PAN-DF" switch is not used.

1-12. ANTENNA DRIVE TG-8/APA-69. (*See figure 1-5.*) The antenna drive comprises a d-c motor and gear train, a video resolver and a polarization on-off switch. This unit supports and rotates the antenna or reflector and, by means of the resolver, supplies sine and cosine voltages to the azimuth indicator. Polarity reversing and automatic speed-changing devices are included in this assembly.

1-12A. ANTENNA DRIVE TG-8A/APA-69. *(See figure 1-5.*) This antenna drive is the same as the TG-8/APA-69 except the antenna rotation speed is controlled only by the "ANT SPEED" knob (figure 1-4) on

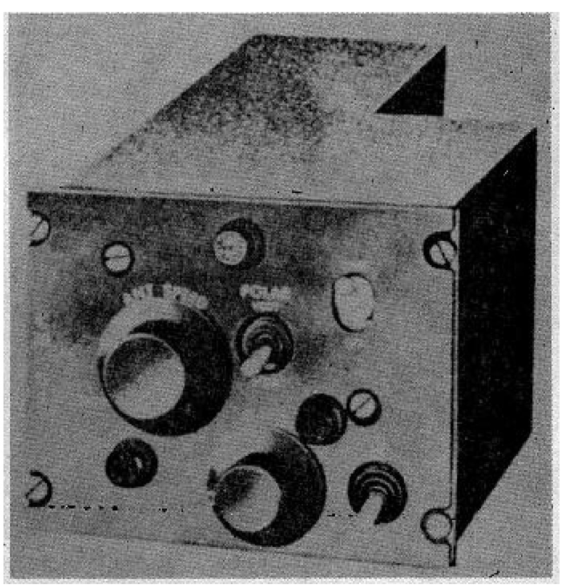


Figure 1-4. Direction Finder Control C-S27/APA-69

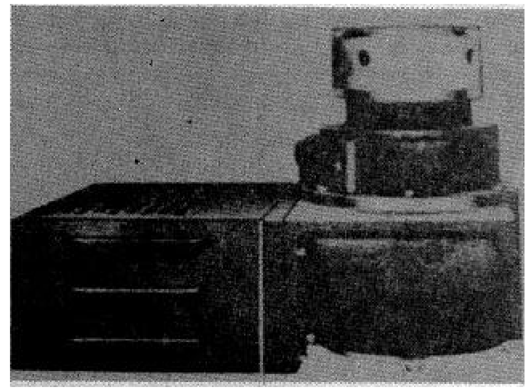


Figure 1-5. Antenna Drive TG-S8)/APA69

Direction Finder Control C-527/APA-69. The automatic antenna rotation speed varying device found on TG-8/APA-69 has been omitted from this model. The TG-8A/APA-69 has been constructed to be explosion proof.

1-13. ANTENNA ASSEMBLY AS435/APA-69. (*See figure 1-6.*) This antenna assembly operates in the frequency range between 140 and 1800 megacycles.

1-14. It consists essentially of a combination vertical-horizontal corner reflector spinner having two sheet reflectors mounted on a common circular base. Each antenna section has its own collector elements backed by a suitable reflector. The entire assembly is driven by a motor gear train in Antenna Drive TG-8( )/APA-69.

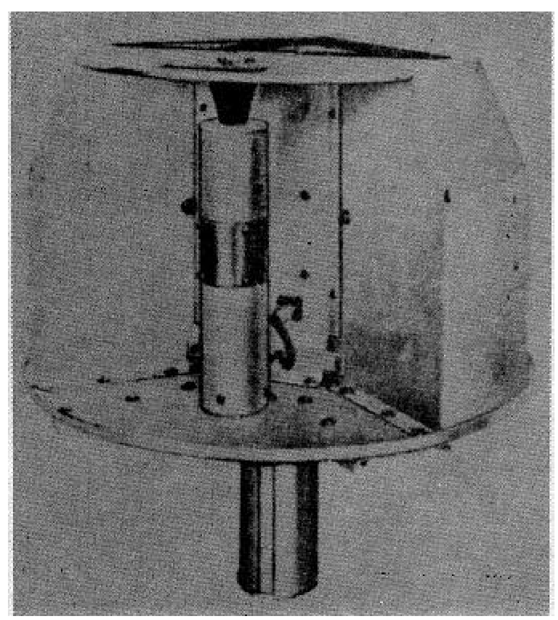


Figure 1-6. Antenna Assembly AS-435/APA-69

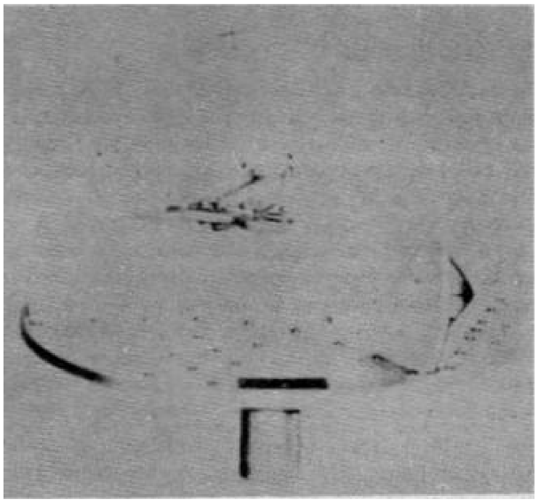


Figure 1-7. Antenna Assembly AS-434/APA-69

Connection to the receiver input is completed through a rotating coaxial joint, Antenna Coupler CU-174/APA-69. Since the vertical and horizontal antennas are pointed in opposite directions, a selector relay switch is provided in the antenna drive assembly to switch the indicator pattern 180 degrees when changing the antenna polarization so that the presentation on the screen is always correct for the antenna in use. This relay is operated by the same switch in Direction Finder Control C-527/APA-69 that is used to operate the coaxial relay which selects either the horizontal or vertical antenna.

1-15. ANTENNA ASSEMBLY AS-434/APA-69. (*See figure 1-7.*) This antenna assembly operates in the frequency range between 1000 and 5000 megacycles.

1-16. It consists of two balanced sleeve dipoles, one horizontal and the other vertical. Each dipole is mounted at the focus of a paraboloid reflector. The reflectors are back to back. In addition, a reflector dipole element is placed in front of each sleeve dipole to increase the response of the sleeve to energy reflected from the paraboloid. At high frequencies, the current flow on the end cylinders of the sleeve element is suppressed by small side stubs perpendicular to the end cylinders near each end of the sleeve cylinders. This type of antenna has been called a "double parabolic spinner" or "combination vertical-horizontal parabolic reflector spinner".

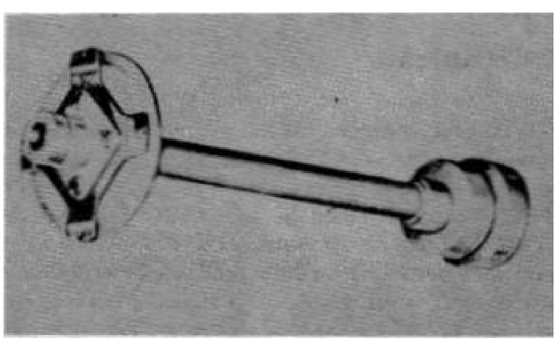


Figure 1-8. Antenna Coupler CU-174/APA-69

1-17. The assembly is mounted on a flat disc which serves as its base and is rotated by the same drive unit and in the same manner as Antenna Assembly AS-435/APA-69.

1-18. ANTENNA COUPLER CU-174/APA-69. (*See figure 1-8.*) This antenna coupler is used with the two lower frequency antenna assemblies and couples them to the coaxial line feeding the intercept receiver. It is not used with the high frequency antenna system. The coupler passes through the drive unit and provides continuous contact between 'the rotating elements of the antennas and the transmission line. Contact between the moving and stationary parts of the inner conductor is provided by a silver graphite alloy brush which maintains contact with a beryllium copper collector ring. The outer conductor is also a silver graphite alloy brush assembly rotating in a ball-bearing housing which makes continuous contact with a silver plated beryllium copper ring collector.

1-19. ANTENNA AS-436/APA-69. (*See figure 1-9.*) This antenna covers the frequency range between 5000 and 10,750 megacycles. It requires the use of Antenna Reflector AT-182/APA-69 which is separately described in paragraph 1-21 of this section.

1-20. The primary element is a circularly polarized horn mounted with its axis in the vertical plane. This element is stationary, with its aperture pointed into the inclined reflector. The antenna has nearly

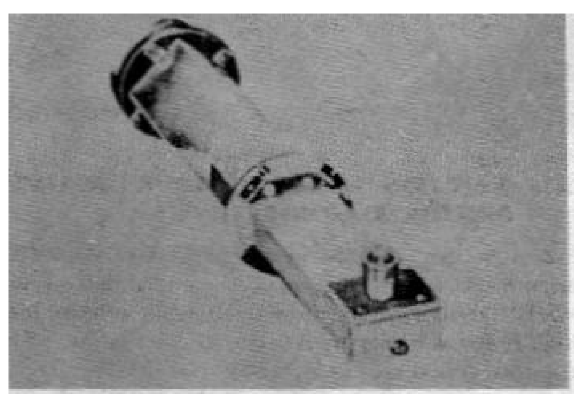


Figure 1-9. Antenna AS-436/APA-69

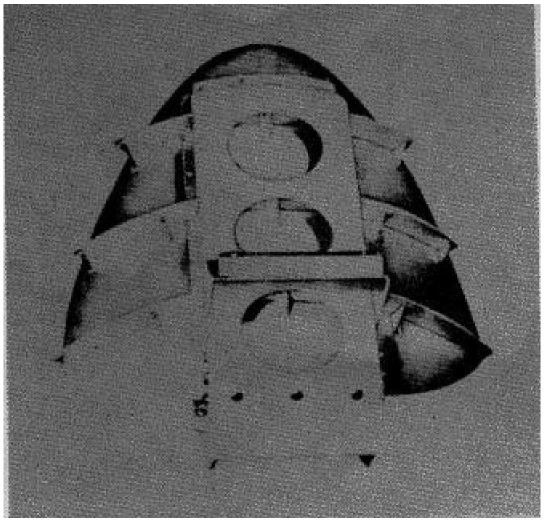


Figure 1-10. Antenna Reflector AT-182/APA-69

the same response to incoming waves at all bearing angles and all angles of polarization. It is also responsive to circularly polarized waves having the proper rotational direction. Its mounting structure permits interchanging with the medium and low frequency units.

1-21. ANTENNA REFLECTOR AT-182/APA-69. (See figure 1-10.) This reflector is used only with Antenna AS-436/APA-69. The reflector is shaped to form a section of a parabolic cylinder (spade) and is mounted at an angle of 45 degrees to the axis of the horn. It is driven by the antenna drive used with the other antennas and rotates at speeds up to 300 rpm. Thus the antenna pattern is rotated by causing the antenna reflector to turn about the horn axis while the horn itself remains stationary. This eliminates the rotating joint used with the other antenna assemblies.

1-22. METHOD OF OPERATION.

1-23. Direction Finder Group AN/APA-69 employs a conventional radio and radar intercept receiver to receive and indicate visually on a cathode-ray tube the direction of the transmitting station and certain other information relating to the signal received. In order to accomplish this, the video signal from the intercept receiver is amplified, then passed through a resolving circuit geared to the antenna drive shaft. This resolver delivers a sine and cosine voltage through suitable amplifiers to the plates of the cathode-ray tube and thus impresses on the tube a signal which is a radius vector rotating about the center of the tube at the same speed as the antenna rotation.

1-24. The Flux Gate compass, an independent navigational instrument, controls the azimuth scale torque unit by synchro transmitter and keeps the movable azimuth scale in coordination with the compass heading. This corrects the directional indication to a true bearing read against the cathode-ray tube trace. (The fiducial mark reads aircraft heading.)

1-25. Among signal characteristics which create a distinctive pattern on the cathode-ray tube are radar pulse repetition rate, relative amplitude and modulation characteristics and polarization. The best way to become familiar with the variety and interpretation of patterns on the cathode-ray tube is by observation, (sketching if necessary), of signals of known characteristics and reference to the signal analyzer charts if available. A certain amount of deduction will inevitably be necessary, however, since the possible combinations of factors are almost infinitely numerous. The accuracy of direction data depends on installation and varies from craft to craft, but error should be not more than six degrees while the Flux Gate compass synchro is operating.

SECTION II
OPERATING PROCEDURES

2-1. DIRECTION FINDER GROUP AN/APA-69. OPERATING PROCEDURE.

2-2. A switch on Antenna Drive TG-8/APA-69, marked "ON-OFF" (figure 2-1), should be set at "OFF" position before the aircraft is airborne if the high frequency Antenna AS-436/APA-69 is installed. Check this switch. If either of the other antenna assemblies is installed, set this switch to "ON". (Refer to paragraph 3-5.)

2-3. As soon as the craft is airborne, perform the following operations: Turn on the equipment by throwing the "POWER" switch on the direction finder control panel to "POWER". The "ANT. SPEED" control should be on "ZERO". Rotate the "ANT. SPEED" control until the rotator begins to spin; then advance it to full speed. Be sure the intercept receiver is turned on. As a signal is received, adjust the "GAIN" control for a trace about one inch long. Set the "POLAR" control. to the desired position, "HOR" or "VERT", as needed. The equipment is now ready for analysis of a desired signal.

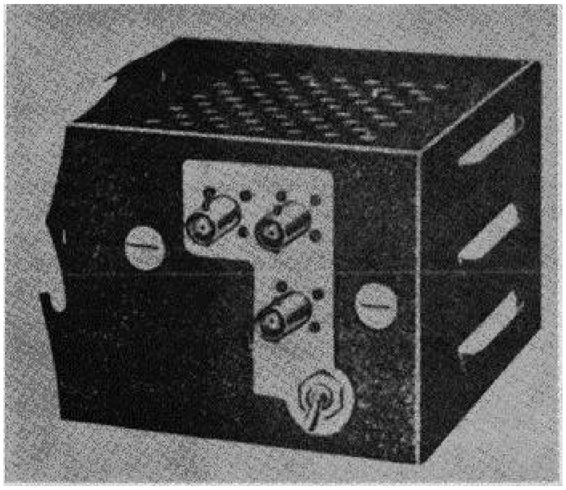


Figure 2-1. Antenna Drive TG-8/APA-69, "ON-OFF" Switch

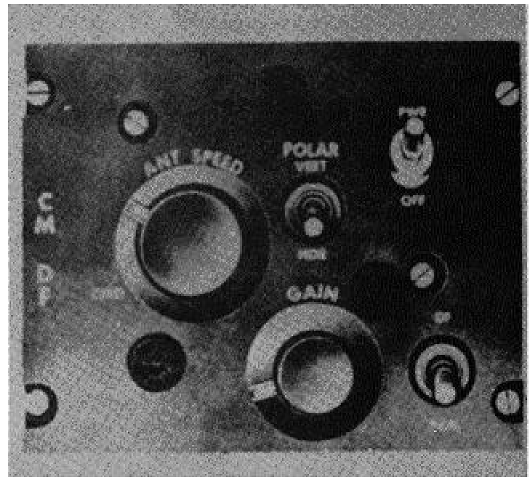


Figure 2-2. Direction Finder Control C-527/APA-69 Panel

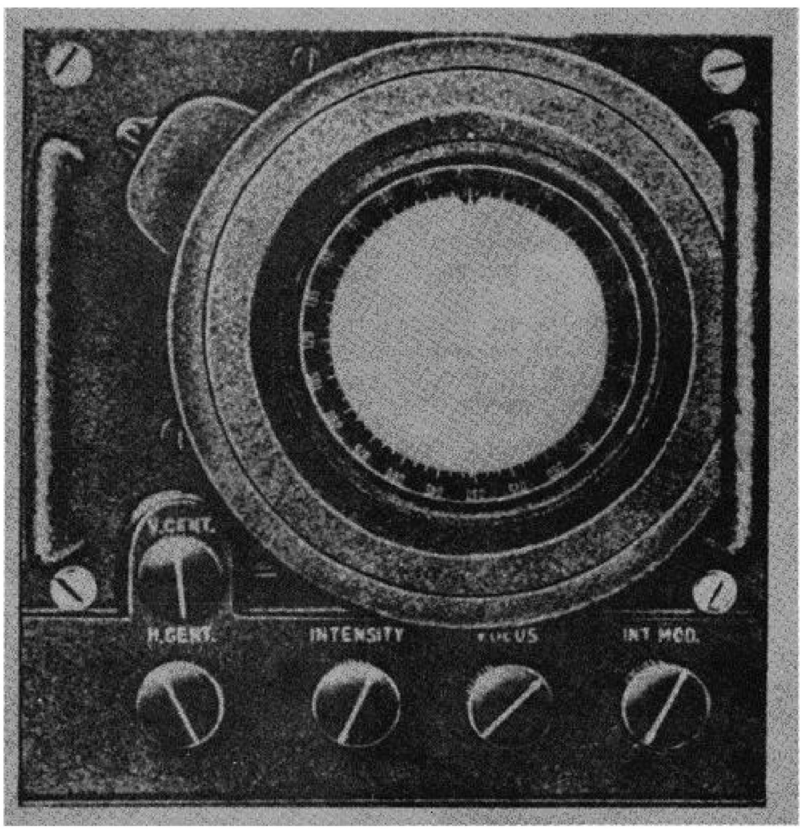


Figure 2-3. Azimuth Indicator IP-36APA-69, Panel

2-4. No further adjustments should be necessary in normal operation, except adjustment of the trace location on the scope face if it is not centered. Avoid premature readjustment of the "INTENSITY" control on the azimuth indicator when a bright trace occurs, since comparative brilliance of signal traces is a characteristic involved in signal analysis.

2-5. The pattern which appears on the cathode-ray tube screen when a signal is intercepted depends on the characteristics of the antenna, polarization of the signal, frequency, type of modulation and signal strength.

2-6. CONTROLS.

2-7. Once the equipment has been installed in the aircraft, operation is entirely remote. The operating controls which are on the panel of Direction Finder Control C-527/APA-69 are the "POWER" switch which controls the primary power supply to the equipment; the "ANT. SPEED" control, which adjusts the speed of antenna rotation; the "POLAR" switch, which selects antenna polarization (horizontal, vertical) when either of the two lower frequency antennas is used; the "GAIN" control, which varies the length of the sweep on the cathode-ray tube; and a "PAN-DF" selector which is not connected in this installation. (See figure 2-2.)

2-8. There ate additional controls on the front of Azimuth Indicator IP-36/APA-69 which may require adjustment from time to time. These are "V CENT" and "H CENT", which shift the location of the trace on the scope face as indicated; "INT. MOD.", which raises or lowers the level of the signal needed to produce a trace; "INTENSITY" and "FOCUS" which control the brilliance and focus of the trace. (See figure 2-3.)

2-9. To secure the equipment, turn the "ANT. SPEED" control on the direction finder control panel to extreme counterclockwise position, or "ZERO". Then turn the "POWER" switch to "OFF". In emergencies, all power circuits may be opened by removing the Direction Finder Control C-527/APA-69.

2-10. CALIBRATION CHARTS. Calibration charts may be provided for each installation. These charts are accurate only near the frequencies at which they were made. If the Direction Finder Group AN/APA69 has not been calibrated at or near the frequencies on which analyses will be conducted, see the Handbook of Service Instructions for calibration procedures.

2-11. TUNING PATTERNS.

2-12. Figure 2-4 illustrates the effect of various types of signal which may be encountered during search with the Direction Finder Group AN/APA-69. These patterns are interpretations of signal effect and generally over-emphasize the characteristic or identifying effect. Figures 2-5 through 2-7 show how frequency and polarization may affect appearance of the same type of signal. Experience-and reference to Signal Analyzer Charts, where available-will help afford a further competency of interpretation.

2-13. DIRECTION FINDER GROUP AN/APA-69A, OPERATING PROCEDURE.

2-14. Direction Finder Group AN/APA-69A, in which Azimuth-Panoramic Indicator IP-81/APA-69A is substituted for the Amplifier Power Supply AM256/APA-69 and Azimuth Indicator IP-36/APA-69, employs only Radar Set AN/APR-9 as a radar receiver. This radar receiver includes a number of separate equipment's and must be put into operation according to instructions included in its own Handhook of Operating Instructions.

2-15. Before the aircraft takes off, it must be determined which antenna is installed in the antenna drive. Check the setting of the "ON-OFF" switch on the antenna drive panel. If high frequency Antenna AS-436/APA-69 is in use, set this switch to "OFF". If either of the lower frequency antennas is in use, set it to "ON". (Refer to paragraph 3-5.)

2-16. As soon as the craft is airborne, perform the following operations:

a. Put Radar Set AN/APR-9 into operation according to instructions incorporated in its own Handbook of Operating Instructions. This includes setting of the frequency indicator.

b. Turn on the direction finder equipment by throwing the "POWER-OFF" switch on the control panel up. Set the "PAN-DF" switch for "DF".

c. The "ANT. SPEED" control on Direction Finder Control C-527/APA-69 should be at "ZERO". Advance this control clockwise slowly so that the antenna begins to rotate. Then advance it fully clockwise to bring the antenna to full speed.

CAUTION

In extreme cold, the advance to full speed should not be performed for thirty seconds or so after the antenna starts rotating.

d. As a signal is received, adjust the "GAIN" control on the control panel for a trace about one inch long.

e. Set the "POLAR" switch to the desired position, "HOR" or "VERT", as needed. The equipment is now ready for directional analysis of a received signal. (Refer to paragraph 2-11.)

f. No further adjustments should be necessary in normal D/F operation, except adjustment of the trace location on the scope face if it is not centered. Avoid premature readjustment of the "INTENSITY" control on the panoramic azimuth indicator, since comparative brilliance of the signal trace is a characteristic involved in signal analysis.

2-17. PANORAMIC RECEPTION, OPERATING PROCEDURE.

2-18. After having established the necessary "GAIN" level of the direction finder equipment as in paragraph 2-15 above, perform the following operations to change to panoramic operation of the set:

a. Make such changes in equipment adjustment as are indicated for the Radar Set AN/APR-9 by its Handbook of Operating- Instructions.

b. Throw the "PAN-DF" switch on the control panel to "PAN" position.

c. Adjust the "INTENSITY" and "INT. MOD." controls to give a bright trace, but one with more intensity at the top than along the base line.

d. The equipment is now ready for sector sweeping in search of a signal and for stopping to analyze any signal found. Instructions for performing this function are incorporated in the Handbook of Operating Instructions for Radar Set AN/APR-9 and will be restated here only briefly.

2-19. SECTOR SWEEPING. Figure 2-3B illustrates various types of signal response which may be encountered with the azimuth panoramic indicator in use for panoramic signal detection. When adjusted for "sector sweep", the receiver is driven over a band 20 kilocycles wide and delivers to the cathode-ray tube a vertical voltage which in effect pictures the amplitude of the received signal. Figures 2-3B (A), (B) and (C) illustrate, respectively, intercepted signals of low, medium, and high repetition rate. Figure 2-3B (G) illustrates relative levels of random noise and an intercepted radar signal. Figure 2-3B (I) illustrates a sweep picture of a sector containing three radar signals, each of a different repetition rate. Figure 2-3B (H) is an interpretation of the appearance of an intercepted cw or mcw signal.

2-20. FIXED OSCILLATOR OPERATION. When a radar signal has been intercepted, the "sector sweep" operation may be discontinued and the receiver tuned manually to the frequency of the suspected signal. A fixed oscillator is used to determine its exact frequency. Figure 2-3B (D) and (F) illustrate the appearance of a signal on the cathode-ray tube when the receiver is just off the signal frequency. When tuned exactly to the signal frequency, the fixed oscillator (in Radar Set AN/APR-9) causes the entire screen to "bloom" up, as in figure 2-3B (E), thus identifying the signal frequency. Read and record the frequency on the frequency indicator.

2-21. In addition to determination of signal frequency and visual interpretation of repetition rate, the panoramic signal output may be monitored with headphones. A low tone heard in the headphones indicates a low pulse repetition frequency, a higher one indicates a higher prf. A "warble" note indicates a lobe-switching radar such as a fire-control system. A sweeping radar will appear and disappear, both visually and aurally. The sweep rate may be determined by counting the number of appearances per minute.

2-22. DIRECTION-FINDING, OPERATING PROCEDURE.

2-23. The direction-finding operation of the Direction Finder Group AN/APA-69A is identical with that of Direction Finder Group AN/APA-69. Refer to the Handbook of Operating Instructions for Radar Set AN/APR-9 for operating procedure, and to paragraph 2-11 of this handbook for a short analysis of observed signal characteristics .

2-24. DIRECTION FINDER GROUP AN/APA-69A, CONTROLS.

2-25. Controls on the Antenna Drive TD-8/APA-69 and Direction Finder Control C-527/APA-69 are used similarly in both installations. The controls of Azimuth-Panoramic Indicator IP-81/APA-69A (figure 2-3A) are as follows: "V CENT"' and "H CENT", which shift the location of the trace on the scope face as indicated; "INT. MOD.", which raises or lowers the level of the signal needed to produce a trace; "INTENSITY" and "FOCUS" which control the brilliance and focus of the trace; "HOR. GAIN", which increases the height of the panoramic signal on the scope; and a "DIMMER" control for varying panel lamp intensity.

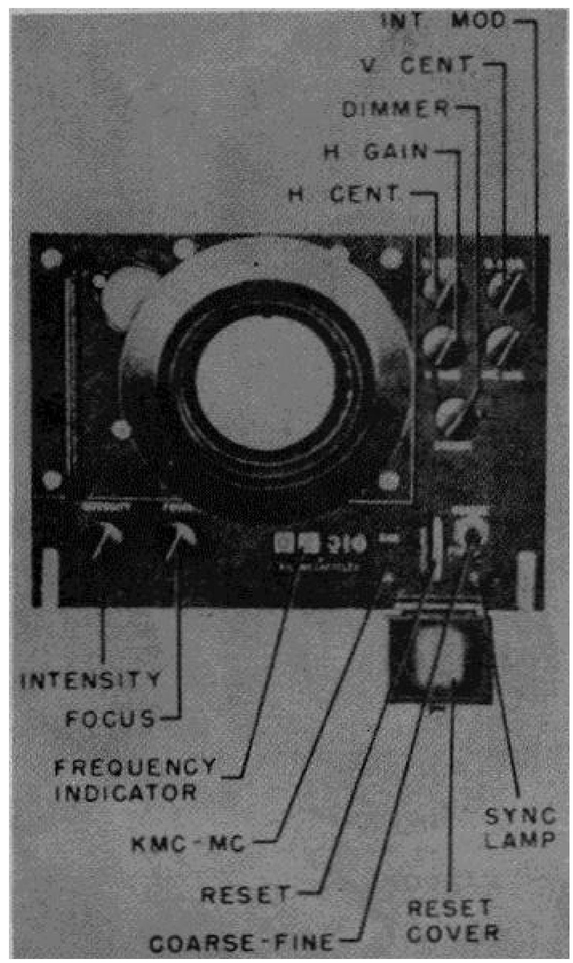


Figure 2-3A. Azimuth-Panoramic Indicator IP-81 APA-69A, Panel

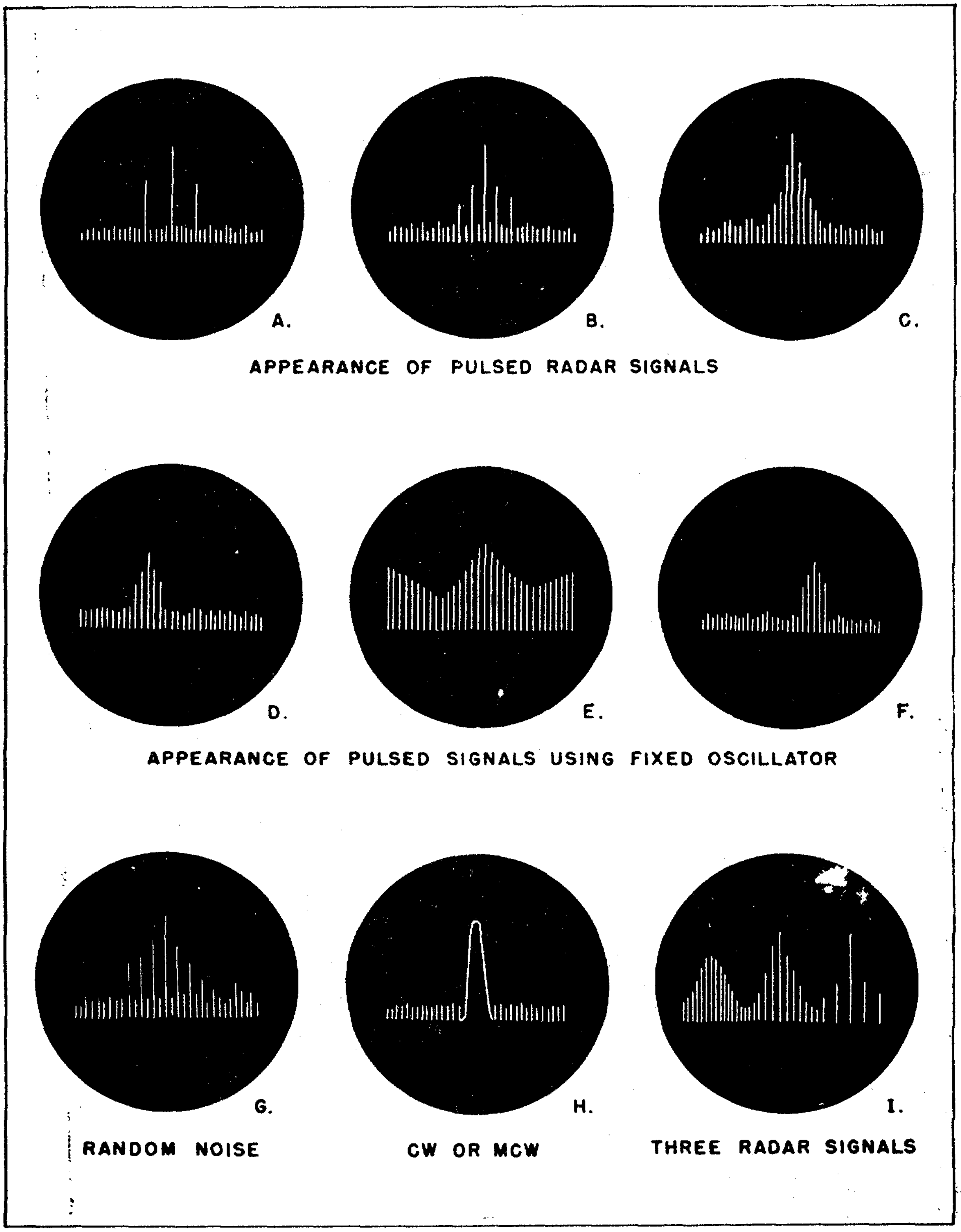
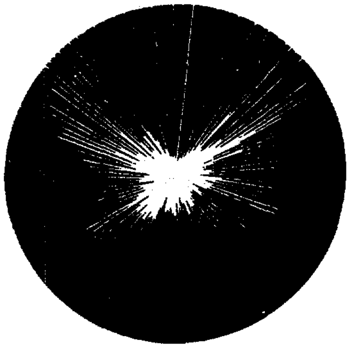


Figure 2-3B. Direction Finder Group AN/APA-69A, Panoramic Signal Patterns

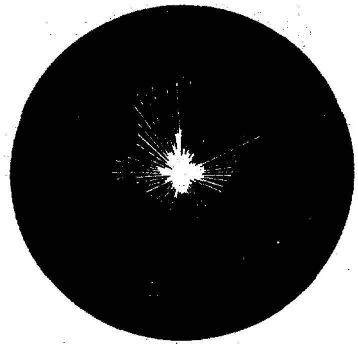


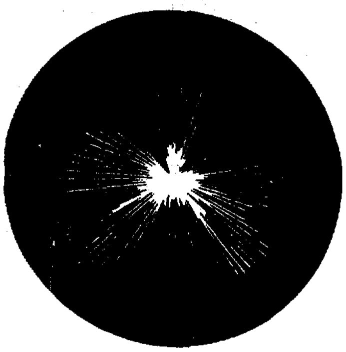
PATTERN A

Too strong a signal will obscure a large part of the screen, making bearing or characteristics analysis impossible. Turn "GAIN" control back to a level which will give a sweep an inch long and a lobe of practical size and shape for analysis.

PATTERN B

When the signal level is properly established, a signal trace like this may appear. This particular amorphous or asymmetrical signal is typical of noise, voice modulation or severe reflection from nearby objects. Despite asymmetry, bearings of a signal of this type may be roughly determined.



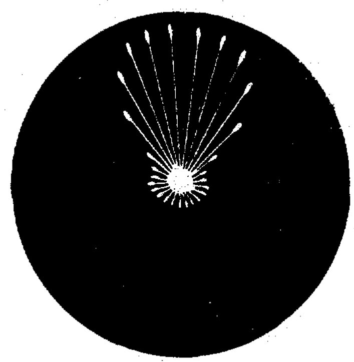


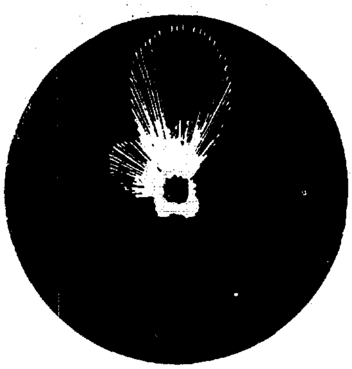
PATTERN C

Generally speaking, the major lobe will dominate in a properly polarized signal. However, pattern C, which portrays an exception, demonstrates that bearing determination is still easy, since the bearing line is the center of symmetry and bisects the small major lobe.

PATTERN D

The spacing of the individual traces is an indication of relative pulse repetition frequency (prf), the bright tips at the end of each trace suggest pulse modulation (the relative width of pulse accounts for the brightness of the tip). This pattern is of a low prf radar, assuming normal antenna speed settings.

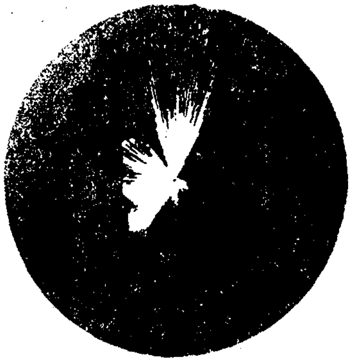




PATTERN E

Two signals are involved here. Each has a complete and symmetrical lobe which retains its identity where they overlap. They may be of the same type or of different types, as indicated by the different prf's pictured here.

Figure 2-4. (Sheet 1 of 2 Sheets) Direction Finder Group AN/APA-69, Signal interpretation



PATTERN F

Here is one signal and its reflection from the left of the major signal. This is evident from the irregularity of the side lobe, the lack of definite overlap. This type of signal can also indicate radar polarized at 45 degrees, and in such a case the minor lobe will swing from left to right while the shape, but not the direction, of the major lobe varies with rotation of the transmitting antenna.

PATTERN G

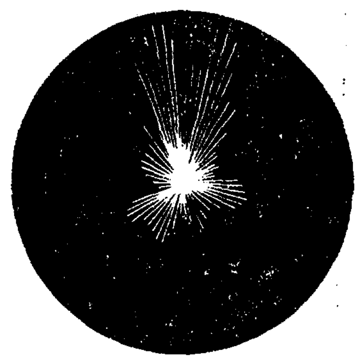
A fingered pattern like this one indicates a lobe-switching radar. The length of the traces varies with the lobe-switching action of the radar. When the short-fingered lobes extend and smooth out with the long ones to form a normal radar pattern, the radar is aimed at the intercept receiver.

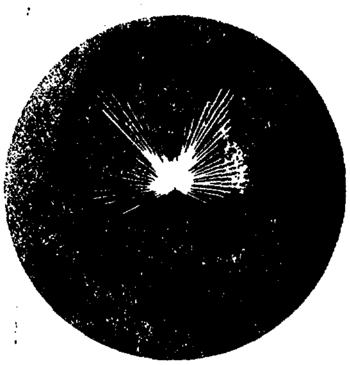
PATTERN H

A sinewave modulated communications signal often presents such a pattern as this. This is the brightest pattern encountered in intercept use, showing heavy lines close together without excessively bright tips.

'PATTERN I

Phone modulation in communications service gives a rough signal varying from shapeless as in Pattern B to identifiable as in Pattern I. As modulation alters the cathode-ray speed and travel distance, a pattern emerges with uneven edges and irregularly spaced lines. Basic symmetry, however, is usually discernible.





PATTERN J

A small, indistinguishable signal like this one, with general symmetry and no definite lobe information is probably a wrong polarization The signal increases in size, when the "POLAR" switch is reversed on the direction finder control panel, and usually assumes some analyzable shape.

Figure 2-4. (Sheet 2 of 2 Sheets) Direction Finder Group AN/APA-69, Signal Interpretation

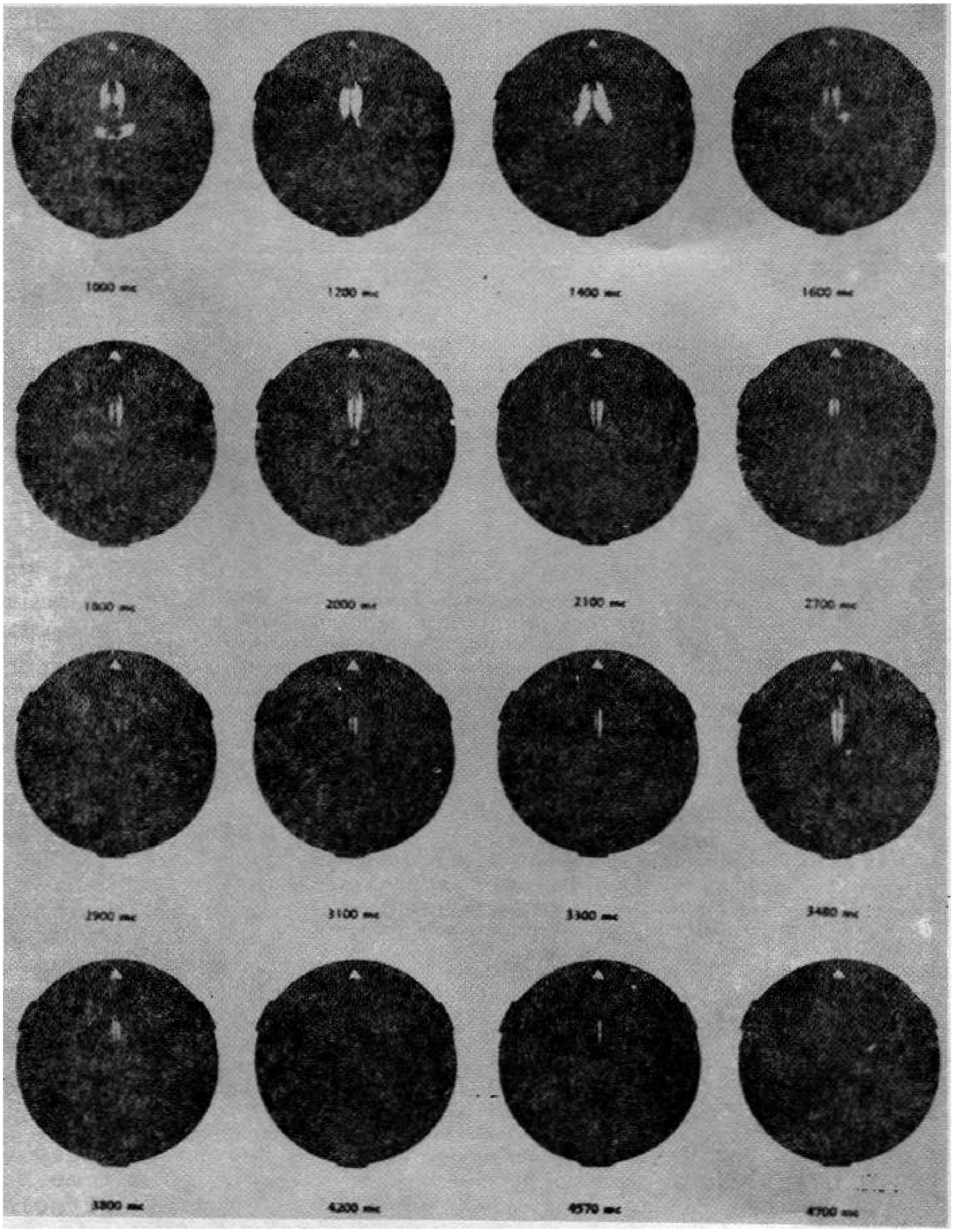


Figure 2-5. (Sheet 1 of 2 Sheets) Antenna Assembly AS-43S/APA-69, Operating Patterns

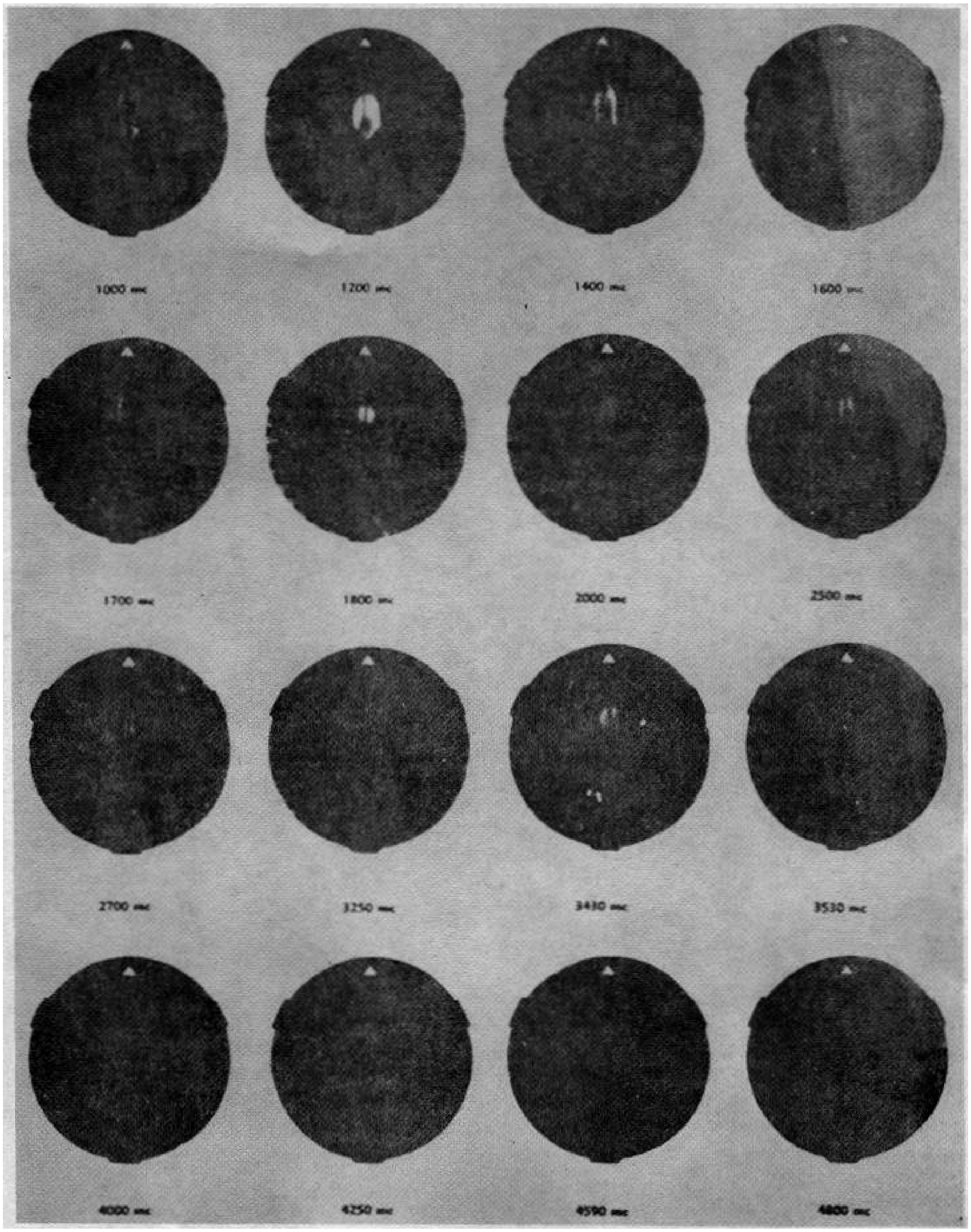


Figure 2-5. (Sheet 2 of 2 Sheets) Antenna Assembly AS-435/APA-69, Operating Patterns

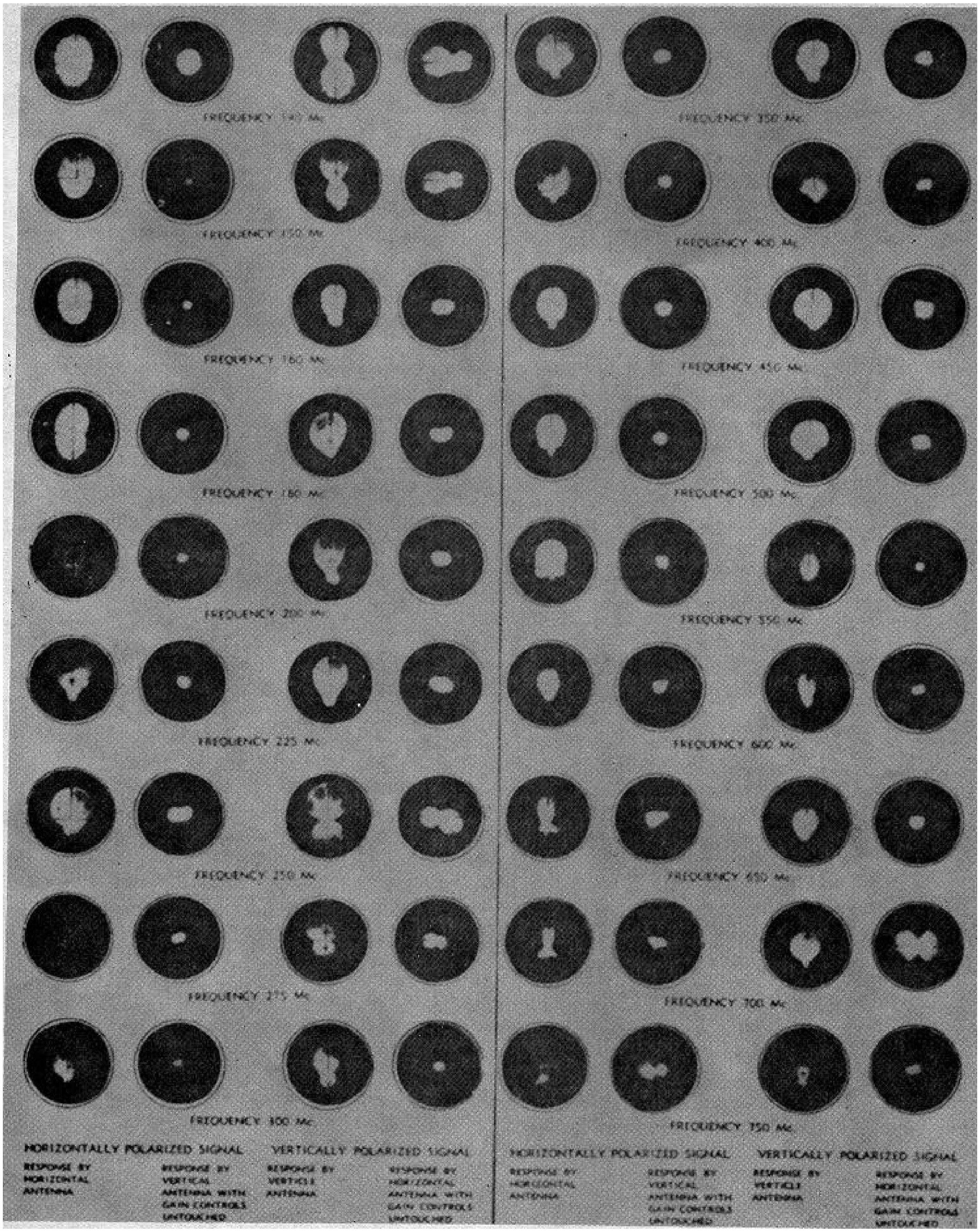


Figure 2-6. Antenna Assembly AS434/APA-69, Operating Patterns, Horizontally Polarized Signals

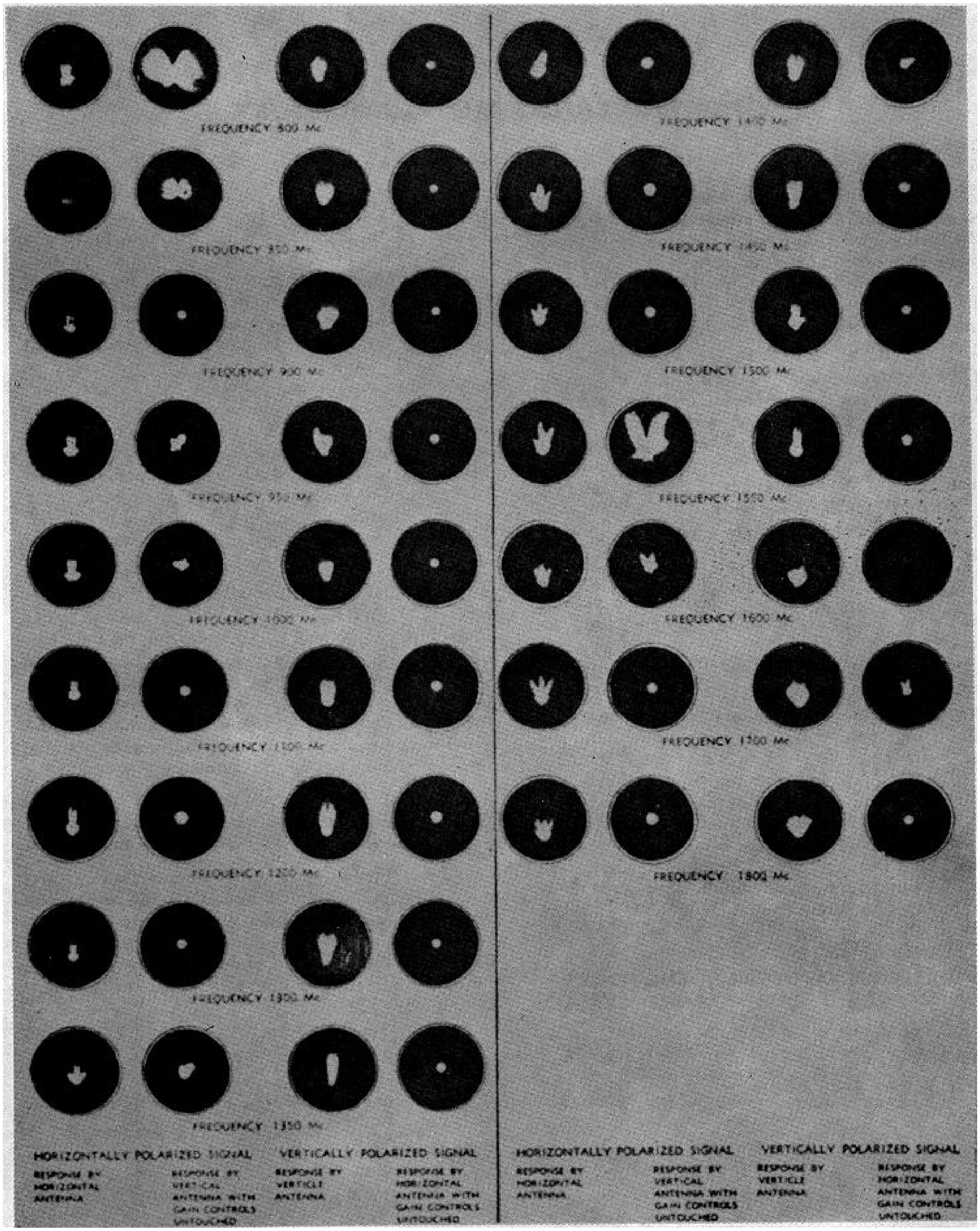


Figure 2-7. Antenna Assembly AS-434/APA-69, Operating Patterns, Vertically Polarized Signals

SECTION III
OPERATING CHECKS AND ADJUSTMENTS

3-1. GENERAL.

3-2. The efficient operation of Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA69A depends on the alertness of the operator as much as upon the condition and constants of the equipment itself. Continuous attention to the following common faults in operation can result in far more efficient and satisfactory performance of the direction finder.

3-3. IS "POLAR" SWITCH IN PROPER POSITION? Failure. to assure that this switch is properly positioned can result in erroneous interpretation of a signal or dismissal of a signal which should be examine and evaluated. For horizontally polarized signals, set the switch to "HOR"; for vertically polarized signals, set it to "VERT". If the polarity is unknown, both polarization's should be tried.

3-4. IS "GAIN" CONTROL TOO FAR ADVANCED? This will result in a broader and less definable signal. The original proper setting gives a trace about one inch long, and this is the average to which it should be corrected if the signal level becomes too high.

3-5. IS "ON-OFF" SWITCH ON ANTENNA DRIVE "OFF" WHEN ANTENNA AS-436/APA-69 IS IN USE This antenna does not have polarized sections. If the polarization selection circuit were left in operation there is a 50-50 chance that the "POLAR"' switch might be wrongly set, and thus deliver a signal 180 degrees in error to the azimuth indicator. This "ON-OFF" switch opens the line to the relay contacts which choose one or the other side of the antenna signal line, and when the high frequency antenna is in use, the switch should be open (or "OFF") and the "POLAR"' switch set at "HOR". At all other times, it should be closed (or "ON";) rendering the "POLAR" switch- operative.

3-6. IS RECEIVER ON THE FUNDAMENTAL FREQUENCY OF THE QUESTIONABLE SIGNAL? Tuning to a harmonic or image frequency is a relatively easy error to commit, but may result in erroneous interpretations. However, under certain other circumstances, it may even be desirable to tune i harmonic instead of a fundamental signal. In general, a harmonic affords a sharper signal for determining bearings; and harmonic tuning effectively increases the frequency range of the intercept receiver.

3-7. Since it is not easy to determine whether a signal is a true harmonic of the transmitting frequency or is a higher one of the intercept receiver oscillator, harmonic tuning is recommended only to thoroughly experienced operators. A stronger signal should be sought, usually at a fractional value of the frequency of the intercepted signal. If one is; found, it is the fundamental or a lower harmonic of the signal. If the original signal is not an even multiple of one found lower, the stronger is the signal, the weaker one an image.

3-7A. IS THE PANORAMIC FUNCTION OF DIRECTION FINDER GROUP AN/APA-69A USED PROPERLY? With a signal appearing on the cathode-ray screen of the Azimuth-Panoramic Indicator IP-81/APA-69A the equipment should be switched to "PAN" function. The receiver may then be tuned manually to the signal frequency. Tuning to the fundamental signal frequency will give the brightest response (bloom-up) on the cathode-ray screen.

3-8. IS THE PROPER ANTENNA IN USE? No reasonable results can be expected unless the antenna designed for the bands desired is in operation.

3-9. From time to time, or when any bearings are questioned, the azimuth indicator should be checked against the reading indicator of the master Flux Gate compass. It is not within the field of the operator to correct this condition, but compensation may be made for observed error, or the validity of the bearings discounted.

SECTION IV
EMERGENCY OPERATION AND REPAIRS

4-1. GENERAL.

4-2. This section covers emergency operating conditions and repairs possible in flight or without recourse to squadron maintenance location or equipment.

4-3. The following table (4-1) does not exhaust possible causes for the conditions enumerated. In event that checking the listed possible cause does not correct the defective operation, it should be referred to squadron maintenance facilities.

Note

There are no fuses in either of the direction finder groups. All power lines are protected by external power supply circuit breakers.

4-4. TUBE REPLACEMENT.

WARNING

There is high voltage present in the circuits associated with the cathode-ray tube. Use extreme care when replacing tubes in the azimuth indicator.

4-5. Figure 4-1 indicates location of all tubes in the Direction Finder Group AN/APA-69 and figure 4-2 that of all tubes in the Direction Finder Group AN/ APA-69A. If spares are available, any of these may be replaced except the cathode-ray tubes V205 (or V1009). Tube V204 (or V1008), located on the bottom of the chassis, is packed in Dow-Corning DC-4 compound which must fill the bottom half of the cups surrounding the socket without air space before the tube is reinstalled. This grease prevents corona at high altitudes.)

CAUTION

Changing the cathode-ray tube, or even removing and reinstalling the same tube, entails extensive readjustment of the azimuth indicator controls. It should never be attempted as an emergency repair.

TABLE 4-1. SHORT TROUBLE-SHOOTING CHART FOR EMERGENCY REPAIRS

Symptom	*Probable Cause*	*Remedy*
Lamps on Direction Finder Control C-527/APA-69 not lit	Bulbs burned out	Replace bulb
	Disconnected power cable	Check cable connections
Indicator lamps operating intermittently	Loose power cable	Check cable and tighten plug
No spot on CRT	Faulty socket connection	Tighten or reconnect
	Burned out H.V. rectifier	Replace tube V204
CRT spot but no sweep	Cable open from antenna drive to indicator	Tighten or reconnect cable
Antenna does not rotate	No 28-volt input	Check input connections to C-527/ APA-69 and TG-8/APA-69
	"POWER" switch "OFF"	
	"ANT. SPEED" control not on	Check switches and speed control
"INT. MOD." control ineffective	Faulty tube V201 (V1004)	Replace tube V201 (V1004)
	Cable from amplifier to azimuth indicator loose or disconnected	Tighten or connect cables
Azimuth dial not following master indicator	Faulty tube V206 (V1010)	Replace tube V206 (V1010)
	Cable from compass to indicator loose or disconnected	Check cable
Uncontrolled oscillation of azimuth scale	Faulty tube V206 (V1010)	Replace tube V206 (V1010)
Azimuth scale lamps not lit	Burned out or loose lamps	Tighten or replace
No Pan signal	"PAN-DF" switch incorrectly set or inoperative	Correct setting or repair
	Cable from Radar Set AN/APR-9 loose or disconnected	Connect cable
	Relay K1001 or K1002 inoperative	Check relay wiring (emergency closure possible)

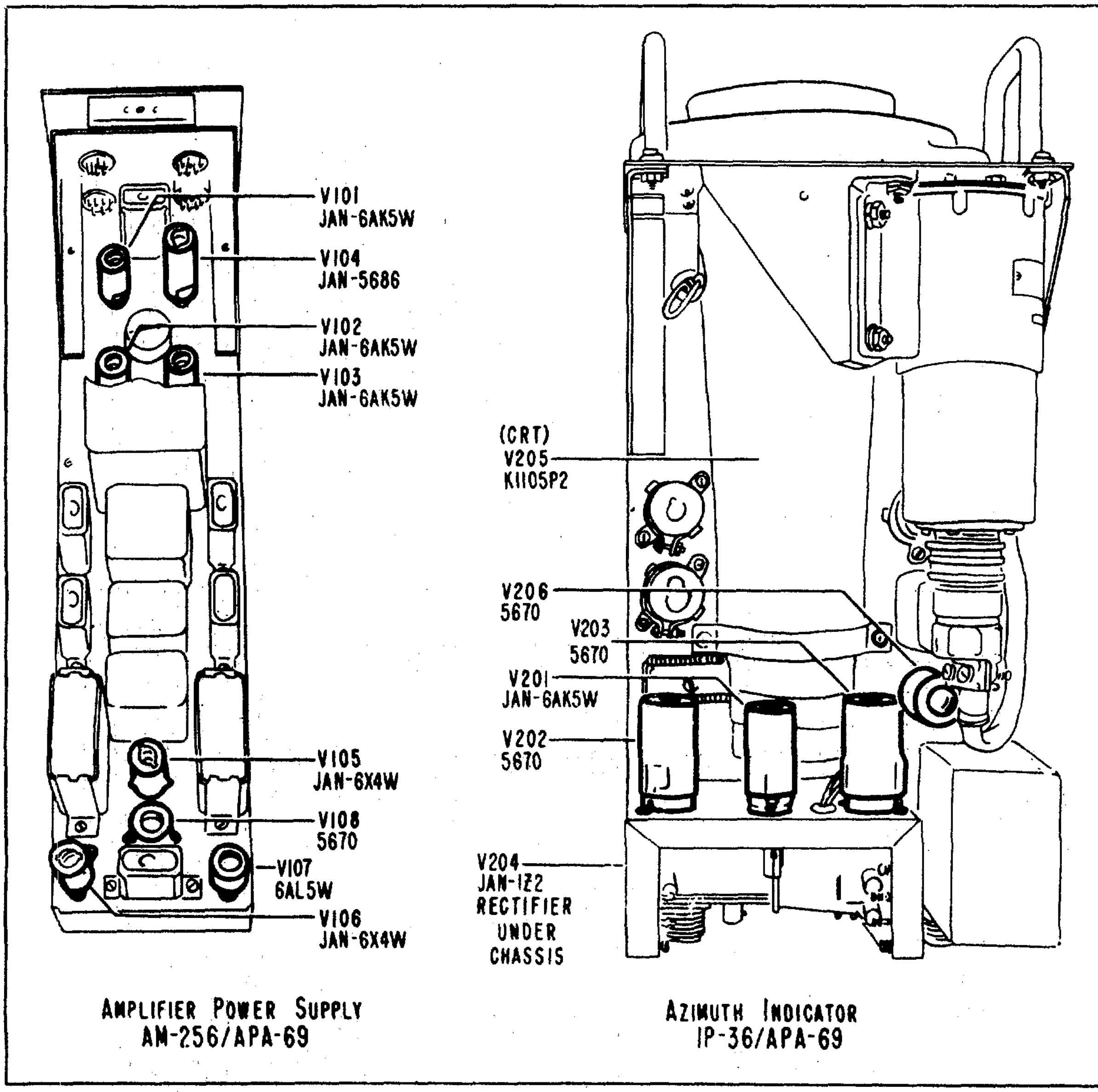


Figure 4-1. Direction Finder Group AN/APA-69, Tube Layout for Replacement.

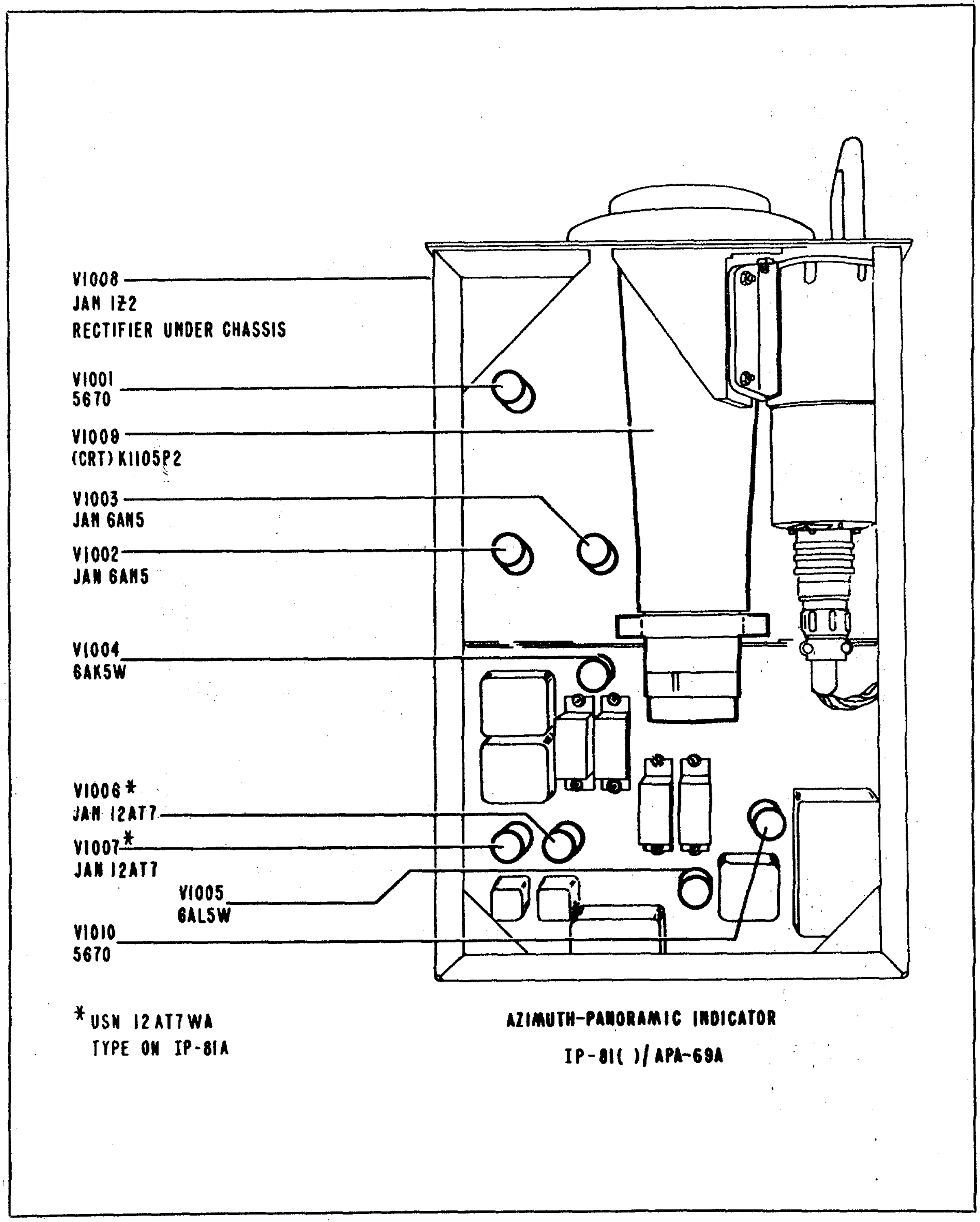


Figure 4-2. Direction Finder Group AN/APA-9A, Tube Locations for Replacement.

CHAPTER 2. SERVICE INSTRUCTIONS

TABLE OF CONTENTS

SECTION I. DESCRIPTION AND LEADING PARTICULARS

SECTION II. SPECIAL TEST EQUIPMENT AND SPECIAL TOOLS

SECTION III. PREPARATION FOR USE AND RESHIPMENT

SECTION IV. THEORY OF OPERATION

SECTION V. ORGANIZATIONAL AND SQUADRON MAINTENANCE

TABLE OF CONTENTS (Continued)

SECTION V. ORGANIZATIONAL AND SQUADRON MAINTENANCE (Continued)

SECTION VI. FIELD AND FASRON MAINTENANCE

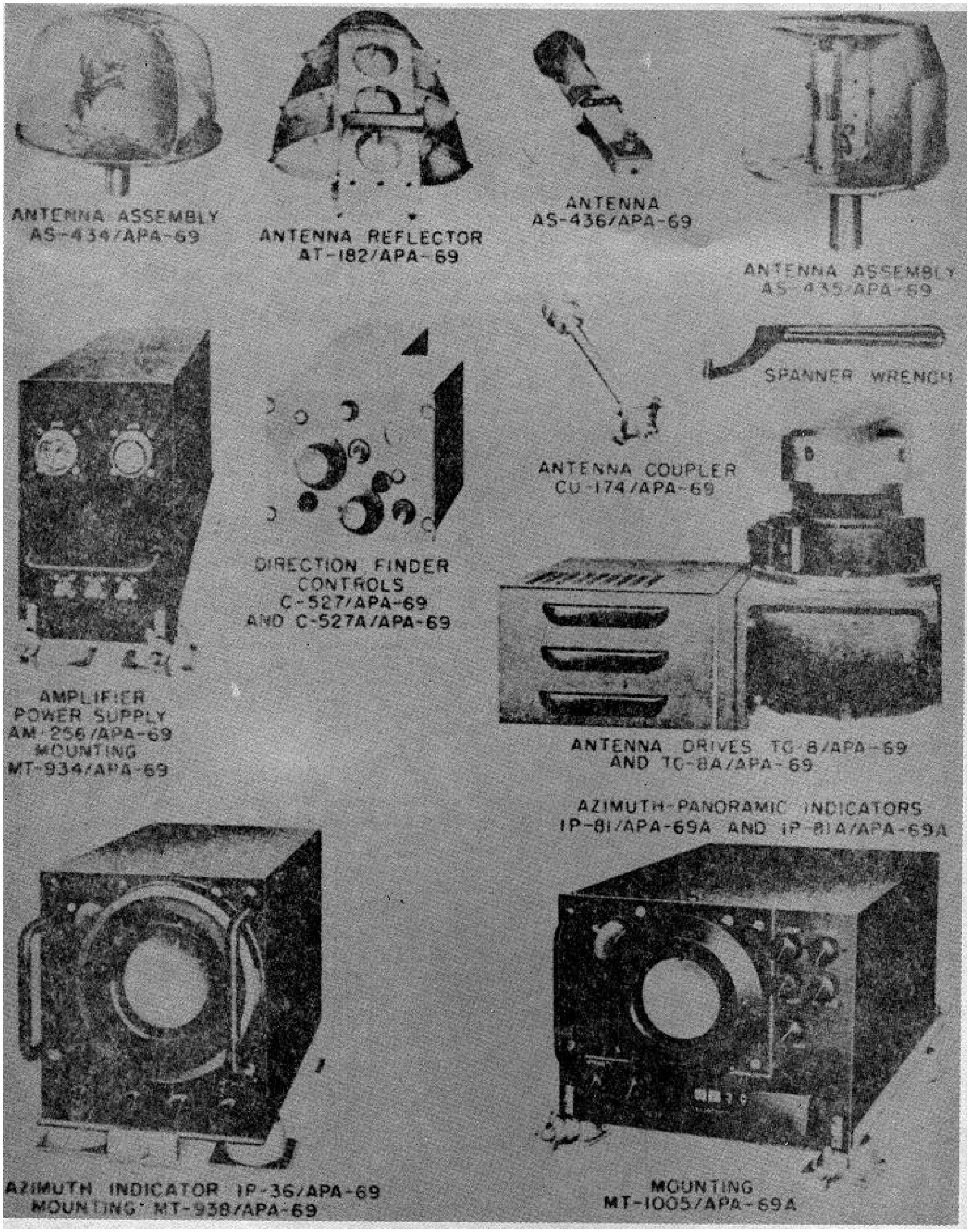
SECTION VII. DRAWINGS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES



*Refer to paragraph 1-4.

Figure 1-1. Direction Finder Group AN/APA-69 and AN/APA-69A, Equipment Supplied.

SECTION I
DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A (figure 1-1), when .used with a suitable radio or radar receiving set, provides visual indication on a cathode-ray screen of the true bearing of received radio and radar signals within the frequency range of the receiver. The directional indication is converted to true bearing by an azimuth scale rotating around the outer rim of the cathode-ray tube. This azimuth scale is driven by a Flux Gate compass not otherwise associated with the-direction finder group.

1-3. The signal picture affords other information as well, including approximate prf (pulse repetition frequency), relative signal amplitude, modulation characteristics and polarization of the received signal. Direction Finder Group AN/APA-69A provides, in addition, a panoramic sweep signal 20 megacycles wide which may be driven over the entire band of the receiver which operates with this equipment to survey the band for signal isolation and identification. The sweep may be stopped to determine the exact frequency of any signal so isolated. A remote counter, .synchronized with the scanning drive, indicates on a dial on the panoramic azimuth indicator the exact frequency being scanned.

1-3A. Direction Finder Group AN/APA-69 is designed for airborne service and covers the range of 180-10,750 megacycles. Direction Finder Group AN/APA-69A is designed for airborne service and covers the range of 1000-10,750 megacycles.

1-4. Table 1-1 lists the equipment supplied as part of Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A. Both direction finder groups use the same equipment except that, in Direction Finder Group AN/APA-69A, Azimuth-Panoramic Indicator IP-81/APA-69A (or IP-81A/APA69A) and its mounting replaces Amplifier Power Supply AM-256/APA-69 and Azimuth Indicator IP-36/APA-69 and their mountings, the latter equipments being used in Direction Finder Group AN/APA-69. The two azimuth-panoramic indicators are identical except for a few circuit changes in the deflection amplifier circuits. These changes are discussed in paragraph 4-39. For purposes of simplification, when the text refers to an azimuth-panoramic indicator and it is not necessary to distinguish between the two types (IP-81/APA--9A or IP-81A/APA-69A), the name will be written, "Azimuth-Panoramic Indicator IP-81( )/APA-69A".

TABLE 1-1. DIRECTION FINDER GROUP AN/APA-69 AND DIRECTION FINDER GROUP AN/APA-69A, EQUIPMENT SUPPLIED

Quantity	Name	Type Designation	Dimensions (Inches)			Weight (lbs)	Reference Symbol Series
			Length	Width	Height		
EQUIPMENT COMMON TO BOTH DIRECTION FINDER GROUPS							
*1	Direction Finder Control	C-527/APA-69 or	7.35	5.75	4.50	2.38	301-399
		C-527A/APA-69	7.35	5.75	4.50	3.625	301-399
1	Antenna Drive	TG-8AIPA-69	11.2	8.2	7.4	13.5	401-499
**1	Antenna Drive	TG-8A/APA-69	11.2	8.2	7.4	12.6	401-499
1	Antenna Assembly	AS435/APA-69	-	16.12	17.14	14.7	501-599
1	Antenna Assembly	AS-434/APA-69	-	20.0	18.3	12.0	601-699
1	Antenna Coupler	CU-174/APA-69	8.26	2.30	-	0.625	1301-1399
1	Antenna Reflector	AT-182/APA-69	11.5	9.38	10.88	2.5	1101-1199
1	Antenna	AS-436/APA-69	13.13	2.485	-	1.0	1201-1299
1	Coaxial Plug	UJG-21B/Ut	1.88	0.81	-	0.12	P405
3	Coaxial Plugs	UG-260/U	1.0	0.5	-	0.06	P402-3-4
1	Plug	AN3106-18-8S	2.0	1.31	-	0.10	P401
1	Plug	AN3106-24-7S	2.25	1.72	-	0.20	P301

* Direction Finder Control C-527A/APA-69 and Direction Finder Control C-527/APA-69 are identical in function. The only difference between the two controls is that the former has a stainless steel mounting, while the mounting in the latter is fabricated of aluminum. In the text, the two controls are considered to be interchangeable.

** Antenna Drives TG-8/APA-69 and TG-8A/APA-69 are interchangeable mechanically and electrically, except Antenna Drive TG-8A/APA-69 is explosion proof and does not include the automatic speed changing device. In the text, they are considered interchangeable except as specifically stated otherwise.

TABLE 1-1. DIRECTION FINDER GROUP AN/APA-69 AND DIRECTION FINDER GROUP AN/APA-69A, EQUIPMENT SUPPLIED (cont)

Quantity	Name	Type Designation	Dimensions (Inches)			Weight (lbs)	Reference Symbol Series
			Length	Width	Height		
1	Cable Clamp	AN3057-10	1.42	1.12	-	0.05	-
1	Cable Clamp	AN3057-16	1.87	1.32	-	0.09	-
1	Spanner Wrench		9.0	-	-	0.75	O428
EQUIPMENT COMPLETING DIRECTION FINDER GROUP AN/APA-69							
1	Amplifier-Power Supply	AM-256/APA-69	23.38	5.88	9.38	16.0	101-199
1	Mounting	MT-934/APA-69	23.8	5.94	1.625	2.25	701-799
1	Azimuth Indicator	IP-36/APA-69	16.18	7.32	7.8	19.0	201-299
1	Mounting	MT-938/APA-69	13.62	8.132	1.625	1.3	801-899
6	Coaxial Plugs	UG-260/U	1.0	0.5	-	0.06	P101-2-3 P201-2-3
1	Plug	AN3106-14S-1S	1.44	1.13	-	0.05	P205
1	Plug	AN3106-14S-5S	1.44	1.13	-	0.05	P206
1	Plug	AN3106-20-7P	2.19	1.46	-	0.15	P105
1	Plug	AN3106-20-7S	2.19	1.46	-	0.15	P204
1	Plug	AN3106-20-9S	2.19	1.46	-	0.15	P104
3	Cable Clamps	AN3057-12	1.63	1.18	-	0.06	E133, E133, E248
2	Cable Clamps	AN3057-6	1.08	1.12	-	0.03	E249, E249
EQUIPMENT COMPLETING DIRECTION FINDER GROUP AN/APA-69A							
1	Azimuth-Panoramic Indicator	IP-81( )/APA-69A	-	-	-	27.42	1001-1099
1	Mounting	MT-1005/APA-69A	-	-	-	2.5	901-999
5	Coaxial Plugs	UG-260/U	1.0	0.5	-	0.06	P510/APR9 P1002-3-4-8
1	Plug	AN3106-14-2S	1.83	1.13	-	0.05	P1007
1	Plug	AN3106-G14-5S	1.83	1.13	-	0.05	P106
1	Plug	AN3106-14S-2P	1.83	1.13	-	0.05	P515/APR9
1	Plug	AN3106-20-7S	2.19	1.46	-	0.15	P1001
2	Plugs (shell)	AN3106-36	2.35	2.46	-	-	P903/APR9 P1005
1	Plug insert	Winchester 202B	-	-	-	-	-
1	Plug insert	Winchester 20B1B	-	-	-	-	-
3	Cable Clamps	AN3057-6	1.08	1.30	-	0.03	-
1	Cable Clamp	AN3057-12	1.18	1.37	-	0.06	E1023
2	Cable Clamps	AN3057-24	1.56	2.18	-	0.18	-

1-5. Equipment listed in table 1-2 is required but not supplied as part of each installation.

1-6. DESCRIPTION OF EQUIPMENT.

1-7. A description of the physical and basic electrical characteristics of the components of the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A follows. (Since intercept receiver components are separately supplied, no data on this equipment will be provided in these handbooks and reference is made herewith to publications covering the intercept receiver equipment for any information needed about it.)

1-8. AMPLIFIER POWER SUPPLY AM-256/APA-69. (See figure 1-2.) The amplifier power supply comprises a video amplifier designed for amplifying input signals of either positive or negative polarity and a power supply providing one negative and two positive outputs. The positive supplies provide 250 volts dc for the video amplifier and 350 volts dc for

TABLE 1-2. DIRECTION FINDER GROUP AN/APA-69 AND DIRECTION FINDER GROUP AN/APA-69A, EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity	Name	Type Designation	Required Characteristics
1	Intercept Receiver		For Direction Finder Group AN/APA-69: covering 180 to 10,750 megacycles with provision for video output.
1	Radar Set	AN/APR-9	For Direction Finder Group AN/APA-69A: covering 1000-10,750 megacycles, providing partial power requirements, video signal and panoramic sweep output.
1	Radome		Suitable to type of aircraft.
1	Gyro Flux Gate Compass		Sufficient output voltage to drive the torque unit in either direction finder group.
	Power and Coaxial Cables		Quantity and type required for specific installation.

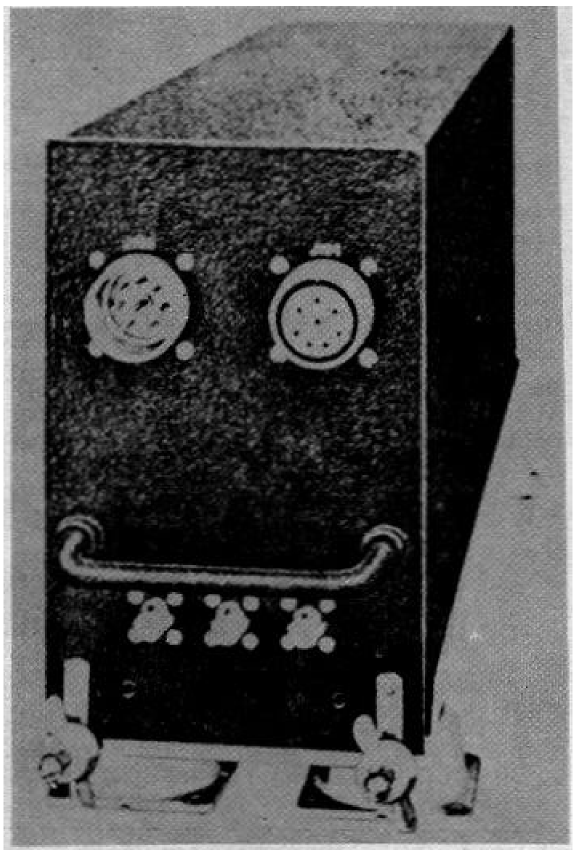


Figure 1-2. Amplifier Power Supply AM-256/APA-69.

the azimuth indicator. The negative supply provides -150 volts dc for both video amplifier and indicator. A two-pole, two-position switch, located on the chassis, is used for the selection of positive or negative input signals. No other adjustments or controls appear in this unit. The entire chassis and cover are fabricated from aluminum and finished in black wrinkle. The unit is mounted on Mounting MT-934/APA-69 which is a shockmount to the aircraft.

1-9. AZIMUTH INDICATOR IP-36/APA-69. (See figure 1-3.) The azimuth indicator consists of a three inch cathode-ray tube indicator, a pair of deflection amplifiers, an intensifier tube, and high voltage and filament power supplies. External adjustments are provided for "V(ertical)" and "H(orizontal) CENT(ering)", "FOCUS", "INTENSITY" and intensifier bias ("INT. MOD."). Also part of the indicator are a torque unit and gear train which rotate the moving

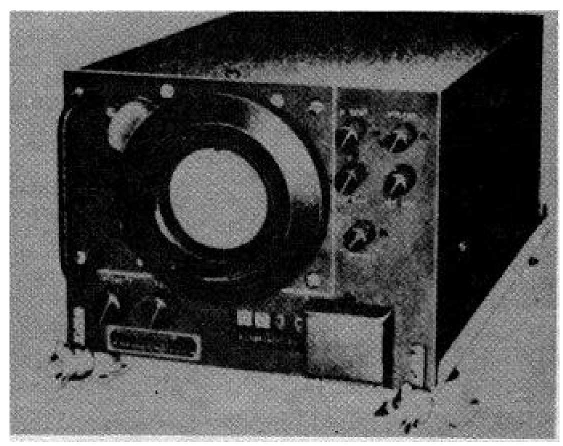


Figure 1-3. Azimuth Indicator IP-36/APA-69.

scale, and a vacuum tube amplifier to supply driving voltage for the torque unit motor. The combined function of these components is to deliver a cathode-ray tube pattern of the received radio or radar signal in such a manner as to indicate the direction from which it is being received and then to convert that direction indication into a true bearing by means of a rotating azimuth scale, actuated from a Flux Gate compass. If the compass is not operating, the cathode-ray tube will still deliver relative bearings; the azimuth scale must be zeroed against the fiducial mark for direct reading.

1-10. The case is finished in black wrinkle to match the other components and is mounted on Mounting MT-938/APA-69 which is a shockmount to the air, craft.

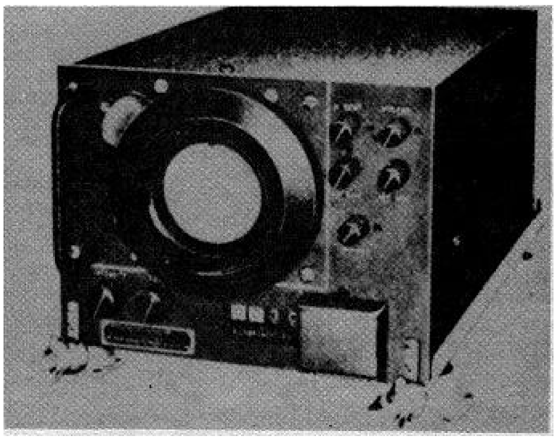


Figure 1-3A. Azimuth-Panoramic Indicator IP-81( )/APA-69A.

1-10A. AZIMUTH-PANORAMIC INDICATOR IP81( ) /APA-69A. (See figure 1-3A.) Azimuth-Panoramic Indicator IP-81( )/APA-69A consists of a three inch cathode-ray tube indicator, a video amplifier section, a pair of deflection amplifiers, an intensifier section, and a high voltage power supply. External adjustments are provided for "V.CENT." (vertical centering) and "H.CENT." (horizontal centering), "FOCUS", "INTENSITY", "INT. MOD." "H. GAIN" and pilot light "DIMMER". The panoramic scanning voltage is separately introduced and switched through the horizontal and vertical deflection amplifiers by means of the "PAN-DF" switch in the direction finder control. Also part of the indicator are a torque unit and gear train which rotate the moving scale, and a vacuum tube amplifier to supply driving voltage for the torque unit motor. Another part of the indicator is a self-synchronous motor driven from Radar Set AN/APjR-9- to move the direct-reading frequency dial, and reset circuits attached thereto. The combined function of these components is to deliver a cathode-ray tube pattern of the received radio or radar signal in such a manner as to indicate either its frequency ,(panoramic function) or the direction from which it is being transmitted (DF function). This directional information is further converted into a true bearing by means of a rotating azimuth scale actuated from a Flux Gate compass. If the compass is not operating, the cathode-ray tube will still deliver relative bearings,

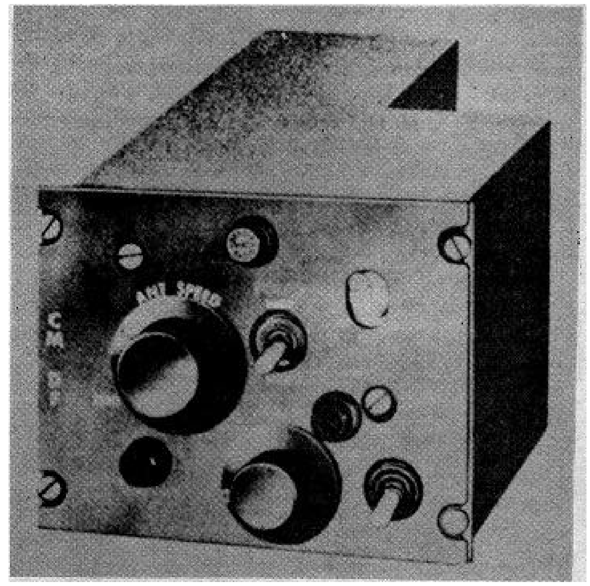


Figure 1-4. Direction Finder Control C-527/APA-69.

the azimuth scale must be zeroed against the fiducial mark-for direct reading.

1-10B. Azimuth-Panoramic Indicator IP-81( )/APA69A is finished in black wrinkle and is installed on Mounting MT-1005/APA-69A which includes shockmounts to the aircraft.

1-11. DIRECTION FINDER CONTROL C-527/APA-69. (See figure 1-4.) The direction finder control is located at the operating position and provides

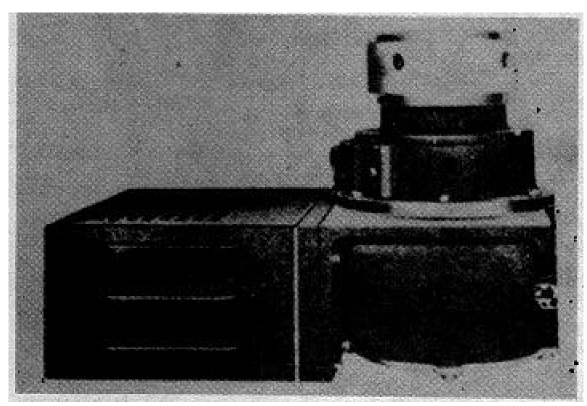


Figure 1-5. Antenna Drive TG-8/APA-69.

means for (1) varying the rotating speed of the antenna, (2) switching oppositely polarized signals from the two lower frequency antenna units, (3) varying the gain of the video amplifier and (4) turning the primary power on and off. In installations using the Azimuth Indicator IP-36/APA-69, the "PAN-DF" switch is not used.

1-12. ANTENNA DRIVE TG-8/APA-69. (See figure 1-5.) The antenna drive comprises a d-c motor and gear train, a video resolver polarization relay and a polarization on-off switch. This unit supports and rotates the antenna or reflector and, by means of the resolver, supplies sine and cosine voltages to the azimuth indicator. Polarity reversing and automatic speed-changing devices are included in this assembly.

1-12A. ANTENNA DRIVE TG-8A/APA-69. (See figure 1-5.) This antenna drive is similar to Antenna Drive TG-8/APA-69. It performs the same function, except TG-8A/APA-69 is not equipped with an automatic speed changing device. This unit is also explosion proof; otherwise, the units are interchangeable mechanically and electrically.

1-13. ANTENNA ASSEMBLY AS-435/APA-69. (See figure 1-6) This antenna assembly operates in the frequency range between 140 and 1800 megacycles.

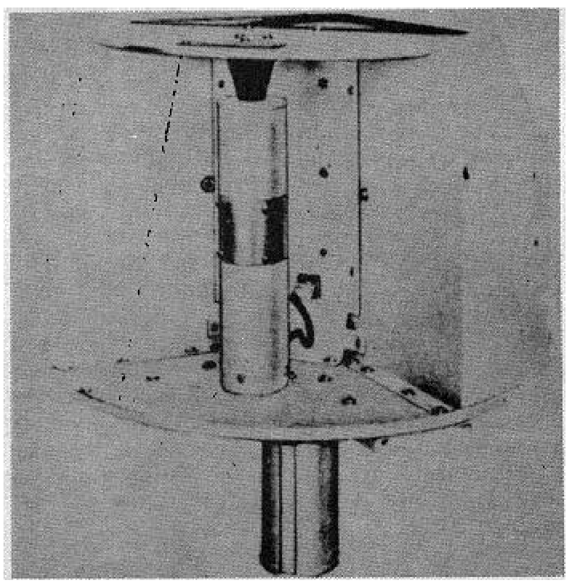


Figure 1-6. Antenna Assembly A-435/APA-69

1-14. It consists essentially of a combination vertical-horizontal corner reflector spinner having two sheet reflectors mounted on a common circular base. Each antenna section has its own collector elements backed by a suitable reflector. The entire assembly is driven by a motor gear train in Antenna Drive TG-8/APA-69. Connection to the receiver input is completed through a rotating coaxial joint, Antenna Coupler CU-174/APA-69. Since the vertical and horizontal antennas are pointed in opposite directions, a selector relay switch is provided in the antenna drive assembly to switch the indicator pattern 180 degrees when changing the antenna polarization so that the presentation on the screen is always correct for the antenna in use. This relay is operated by the same switch in Direction Finder Control C-527/APA-69 that is used to operate the coaxial relay which selects either the horizontal or vertical antenna.

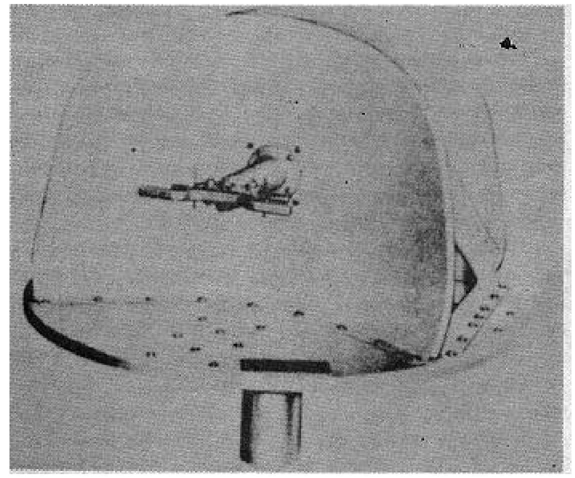


Figure 1-7. Antenna Assembly AS-434/APA-69

1-15. ANTENNA ASSEMBLY AS-434/APA-69. (See figure 1-7.) This antenna assembly operates in the frequency range between 1000 and 5000 megacycles.

1-16. It consists of two balanced sleeve dipoles, one horizontal and the other vertical. Each dipole is mounted at the focus of a paraboloid reflector. The reflectors are back to back. In addition, a reflector dipole element is placed in front of each sleeve dipole to increase the response of the sleeve to energy reflected from the paraboloid. At high frequencies, the current flow on the end cylinders of the sleeve element is suppressed by small side stubs perpendicular to the end cylinders near each end of the sleeve cylinders. This type of antenna has been called a "double parabolic spinner" or "combination vertical-horizontal parabolic reflector spinner".

1-17. The assembly is mounted on a flat disc which serves as its base and is rotated by the same drive unit

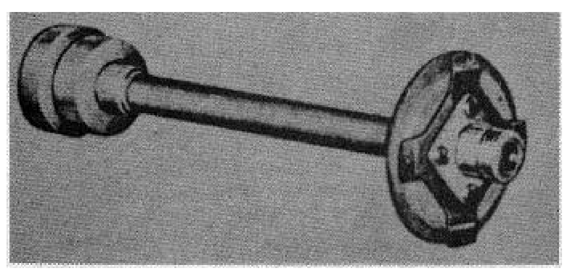


Figure 1-8. Antenna Coupler CU-174/APA-69

and in the same manner as Antenna Assembly AS-435/APA-69.

1-18. ANTENNA COUPLER CU-174/APA-69. (See figure 1-8.) This antenna coupler is used with the two lower frequency antenna assemblies and couples them to the coaxial line feeding the intercept receiver. It is not used with the high frequency antenna system. The coupler passes through the drive unit and provides continuous contact between the rotating elements of the antennas and the transmission line. Contact between the moving and stationary parts of the inner conductor is provided by a silver graphite alloy brush which maintains contact with a beryllium copper collector ring. The outer conductor is also a silver graphite alloy brush assembly rotating in a ball-bearing housing which makes continuous contact with a silver plated beryllium copper ring collector.

1-19. ANTENNA AS-436/APA-69. (See figure 1-9.) This antenna covers the frequency range between 5000 and 10,750 megacycles. It requires the use of Antenna Reflector AT-182/APA-69 which is separately described in paragraph 1-21 of this section.

1-20. The primary element is a circularly polarized horn mounted with its axis in the vertical plane. This element is stationary, with its aperture pointed into

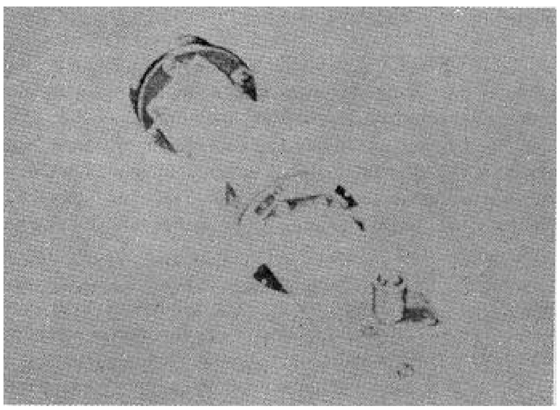


Figure 1-9. Antenna AS-436/APA-69.

the inclined reflector. The antenna has nearly the same response to incoming waves at all bearing angles and all angles of polarization. It is also responsive to circularly polarized waves having the proper rotational direction. Its mounting structure permits interchanging with the medium and low frequency units.

1-21. ANTENNA REFLECTOR AT-182/APA-69. (See figure 1-10.) This reflector is used only with Antenna AS-436/APA-69. The reflector is shaped to form a section of a parabolic cylinder (spade) and is mounted at an angle of -45 degrees to the axis of the horn. It is driven by the antenna drive used with the other antennas and rotates at speeds up to 300 rpm. Thus the antenna pattern is rotated by causing the antenna reflector to turn about the horn axis while the horn itself remains stationary. This eliminates the rotating joint used with the other antenna assemblies.

1-22. METHOD OF OPERATION.

1-23. Direction Finder Group AN/APA-69 employs a conventional radio and radar intercept receiver to receive and indicate visually on a cathode-ray tube the direction of the transmitting station and certain other

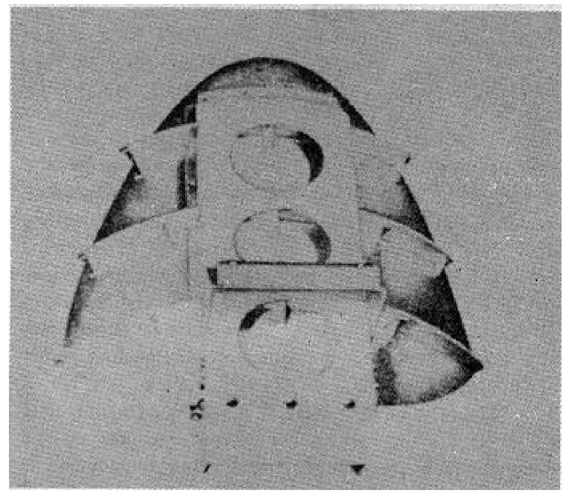


Figure 1-10. Antenna Reflector AT-182/APA-69.

information relating to the signal received. Due to the increased functions of the Direction Finder Group AN/APA-69A, only Radar Set AN/APR-9 is used to supply video as well as some of the power requirements of Indicator IP-81( )/APA-69. This radar receiver supplies the necessary information for the "PAN" circuits. In Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A, when operated in "DF" function, the video signal from the intercept receiver is amplified, then passed through a resolving circuit geared to the antenna drive shaft. This resolver delivers a sine and cosine voltage through suitable amplifiers to the plates of the cathode-ray tube and thus impresses on the tube a signal which is a radius vector rotating about the center of the tube at the same speed as the antenna rotation.

1-24. The Flux Gate compass, an independent navigational instrument, controls the azimuth indicator torque unit by synchro transmitter and keeps the movable azimuth scale in coordination with the compass heading. This corrects the directional indication to a true bearing read against the cathode-ray tube trace. (The fiducial mark reads aircraft heading.)

1-25. Among signal characteristics which create a distinctive pattern on the cathode-ray tube are radar pulse repetition frequency, relative amplitude and modulation characteristics anti polarization. The best way to become familiar with the variety and interpretation of patterns on the cathode-ray tube is by observation, (sketching if necessary), of signals of known characteristics and reference to signal analyzer charts if available. A certain amount of deduction will inevitably be necessary, however, since the possible combinations of factors are almost infinitely numerous. The accuracy of direction data depends on installation and varies from craft to craft.

1-26. TUBE COMPLEMENT.

1-27. Electron tubes listed in tables 1-3 and 1-4 are used in Direction Finder Group AN/APA-69. Table 1-5 lists the electron tubes used in Direction Finder Group AN/APA-69A.

TABLE 1-3. AMPLIFIER POWER SUPPLY AM-256/APA-69 TUBE COMPLEMENT

Symbol	*Type*	*Function*
V101	JAN-6AK5W	Video Amplifier
V102	JAN-6AK5W	Polarity Reverser
V103	JAN-AK5SW	Video Amplifier
V104	JAN-5686	Cathode Follower
V105	JAN-6X4W	Rectifier, 350 plus
V106	JAN-6X4W	Rectifier, 250 plus
V107	BuShips-6AL5W	Rectifier, Bias
V108	5670 (1/2)	Pulse Stretcher

TABLE 1-4. AZIMUTH INDICATOR IP-36/APA-69 TUBE COMPLEMENT

Symbol	*Type*	*Function*
V201	JAN-6AK5W	Intensifier
V202	5670	Vertical Deflection Amplifier
V203	5670	Horizontal Deflection Amplifier
V204	JAN-IZ2	HV Rectifier
V205	K1105P2 (Dumont)	Cathode-Ray Indicator
V206	5670	Servo Amplifier

TABLE 1-5. AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A TUBE COMPLEMENT

Symbol	*Type*	*Function*
V1001	JAN-5670	Pulse Stretcher/Video Amplifier
V1002	JAN-6AN5	Video Amplifier
V1003	JAN-6AN5	Cathode Follower
V1004	JAN-6AK5W	Intensity Modulation Amplifier
V1005	JAN-6ALSW	Panoramic Pulse Stretcher/Base Line Stabilizer
V1006	JAN-12A17	Vertical Deflection Amplifier IP-81/
V1007	JAN-12AT7	Horizontal Deflection Amplifier APA-69A
V1006	USN-12AT7WA	Vertical Deflection Amplifier IP-81A/
V1007	USN-12AT7WA	Horizontal Deflection Amplifier APA-69A

TABLE 1-5. AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A TUBE COMPLEMENT (cont.)

Symbol	*Type*	*Function*
V1008	JAN-1Z2	H. V. Rectifier
V1009	K105P2 (Dumont)	Cathode-Ray Indicator
V1010	JAN-5670	Servo Amplifier

1-28. CONTROLS, LOCATION AND FUNCTION.

1-29. Once the equipment has been installed in the aircraft, operation is entirely remote. The operating controls, which are on the Direction Finder Control C-527/APA-69 panel, are "POWER OFF", which controls the primary power supply to the equipment; the "ANT. SPEED" control, which adjust the speed of antenna rotation; the "POLAR" switch, which selects antenna polarization (horizontal, vertical) when either of the two lower frequency antennas are used; the "GAIN" control, which controls the length of the sweep on the cathode-ray tube. Also included is the "PAN-DF" selector, which is not connected in the Direction Finder Group AN/APA-69 installation, but is used in the Direction Finder Group AN/APA-69A installation to select either the PAN or DF function of Azimuth-Panoramic Indicator IP-81( )/APA-69A.

1-30. There are additional controls on the front of the azimuth indicator which may require adjustment from time to time. These are "V CENT", "H CENT" "INTENSITY", "FOCUS" and "INT. MOD.". Azimuth-Panoramic Indicator IP-81( )/APA-69A also provides on the front panel, "H. GAIN" and "DIMMER" controls and the necessary selector and set knobs for the frequency indicator.

1-31. Other adjustments, not used in operations, are found inside the chassis of the Azimuth Indicator IP36/APA-69. These controls are the circularity control (potentiometer R242A and R242B), phase correcting controls (capacitors C213 and C214), and torque unit gain control (potentiometer R248) and balance control (potentiometer R249).

1-31A. Azimuth-Panoramic Indicator IP-81( )/APA69A provides like adjustments. These are: circularity control (potentiometers R1031A and R1031B), phase correcting controls (capacitors C1018 and C1019), servo gain control (potentiometer R1058), and servo balance control (potentiometer R1060).

1-32. GENERAL INFORMATION.

1-33. (Deleted).

1-33A. The response curve for Direction Finder Group AN/APA-69 (with a pulse width over the range of 0.5 to 25 μsec) is not more than 6 db down from the response at 3 μsec with a prf of 1000. Over a range of 50 to 10,000 prf, with a pulse width of 3 A sec, the response is not more than 3 db down from the response at a prf of 1000.

1-33B. When operating in its "DF" function, the response curve of Direction Finder Group AN/APA69A (with a pulse over the range of 0.5 to 50 μsec) is not more than 6 db down from the response at 10 μsec with a prf of 500. Over a range of 50 to 5000 prf, with a positive pulse of 10-*u*sec pulse width, the response is flat within ±2 db. When operating in "PAN" function the vertical response from 0.5 to 50 *µsec* is not more than 6 db down from the response at 10 *µsec* with a prf of 500. Over a range of 50 to 2000 prf, with a 10-*usec*sec pulse width of negative polarity, tile response is not down more than 4 db from the response at 500 prf.

1-34. VIDEO INPUT VOLTAGE. Direction Finder Group AN/APA-69 with a 3-*usec* pulse of 0.12 volt (peak) from the intercept receiver produces a deflection of at least 1.2 inches on the cathode-ray tube.

1-34A. Direction Finder Group AN/APA-69A in "DF" operation provides a one-inch deflection on the cathode-ray scope with a 10-µsec positive pulse of one volt peak from the intercept receiver. When used in "PAN" operation the vertical amplifier requires a three-volt negative pulse of 10 *µsec*, with a prf of 500 to produce a one inch deflection.

1-35. CURRENT DEMANDS FOR DIRECTION FINDER GROUP AN/APA-69. Direction Finder Group AN/APA-69 requires a power input of 115volt ac, 400 cps nominal (320-1760), 64 volt-amperes. Regulated a-c input is 115-volt ac, 400 cps (±20 cycles), 25 volt-amperes with the dial at rest and 32 volt-amperes with the dial in motion. D-c input is 26.5 volts, three amperes. (In extreme cold it may require a starting maximum of 15 amperes.)

1-35A. CURRENT DEMANDS FOR DIRECTION FINDER GROUP AN/APA-69A. Direction Finder Group AN/APA-69A requires a power input of 37.4 volt-amperes at 115V, 380-420 cps, with the servo rotating. A-c power required is 17.3 volt-amperes at 115V, 320-1760 cps (400 cps nominal). D-c power required is 3.1 amperes at 26.5 volts, using Antenna AS-434/APA-69 (which draws maximum power). Power required from Radar Set AN/APR-9 is 5.7 ma at 150V dc; 43.5 ma at 300V dc; and 6.3V ac at 1.6 amperes, 400 cps.

1-36. ANTENNA DRIVE MOTOR DATA. The d-c antenna drive motor is a compound type 4800 rpm, 1/20 horsepower, 26-volt dc at 1.6 amperes. The ambient temperature is –55°C (-67°F) to 71°C (160°F) with 40°C (104°F) temperature rise, maximum altitude 50,000 feet.

1-37. Maximum current required for the antenna drive motor at 26.5V dc is two amperes and for the drive motor relays -0.4 ampere. This makes a total current for the drive motor (when rotating Antenna AS-434/APA-69) of three amperes.

SECTION II
SPECIAL TEST EQUIPMENT AND SPECIAL TOOLS

2-1. GENERAL.

2-2. Certain test equipment, signal generators and power supplies are required for bench testing and maintenance work on the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA- 69A.

2-3. SPECIAL TEST EQUIPMENT. Table 2-1 lists test equipment required.

TABLE 2-1. SPECIAL TEST EQUIPMENT REQUIRED FOR MAINTENANCE

Figure and Index No.	*Name*	*AN Type Designation*	*Alternate*	*Application*
	35-440 mc signal generator	TS-510/U	TS497/URR	Test signal generator
	400-1000 mc signal generator	TS-418/U		Test signal generator
	900-2100 mc signal generator	TS-419/U		Test signal generator
	1800-4000 mc signal generator	TS-403/U		Test signal generator
	3650-7300 mc signal generator	TS-621/U		Test signal generator
	6800-10900 mc signal generator	TS-622/U		Test signal generator
	Intercept receiver	Type AN/APR-9	As used in installa. tion	Test bench for performance tests
	Multimeter 20,000 ohms/volt	TS-352/U	Simpson 260	Voltage, current, continuity checks

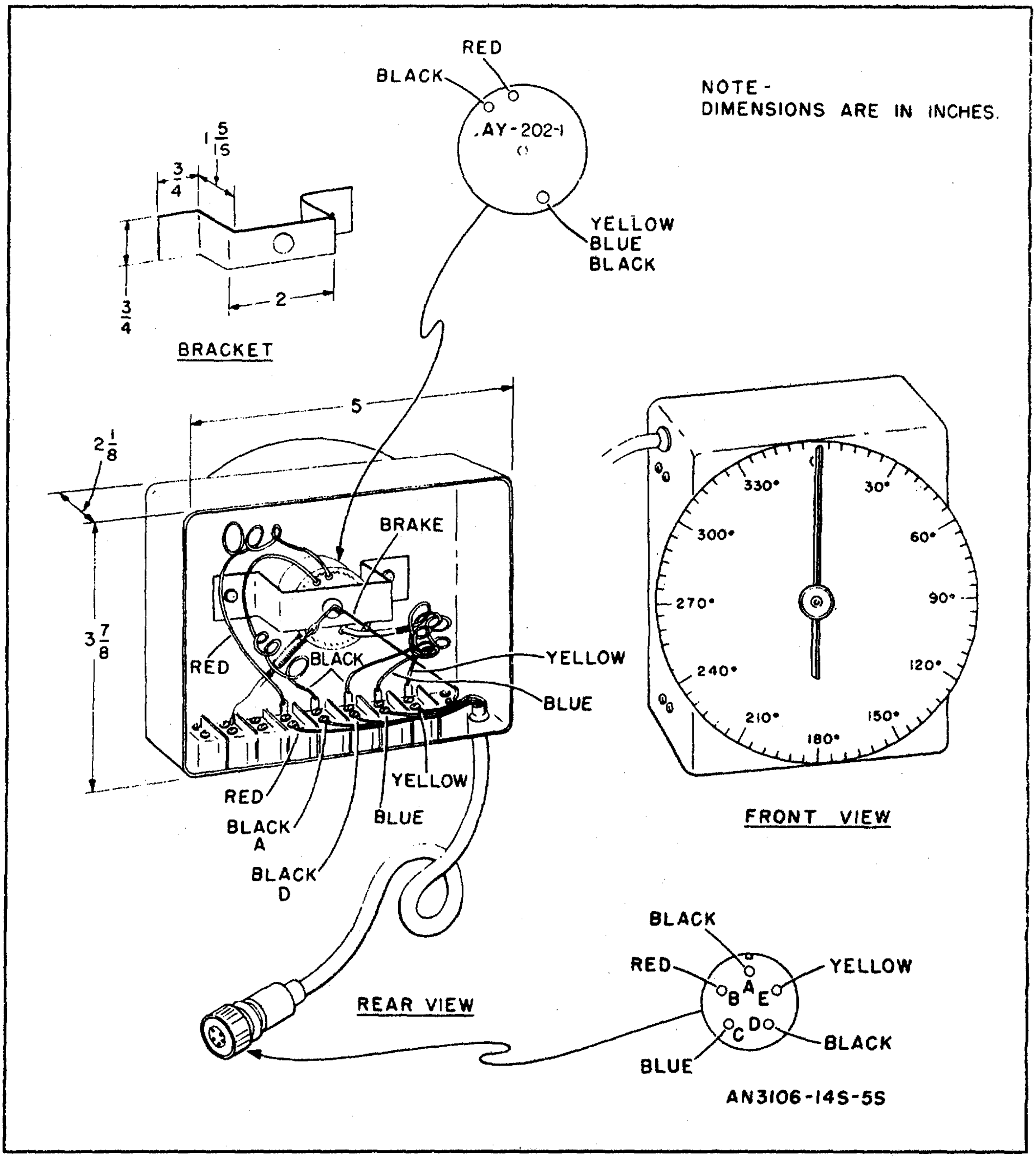


Figure 2-1. Autosyn Test Unit for Simulating Flux Gate Compass Bearings

TABLE 2-1. SPECIAL TEST EQUIPMENT REQUIRED FOR MAINTENANCE (Continued)

Figure and Index No.	*Name*	*AN Type Designation*	*Alternate*	*Application*
	Vacuum tube voltmeter		Ballantine 300, Hewlett-Packard 400	RMS voltages and with oscilloscope to read signal levels
	Tube tester	I-177A	Hickok 540, 547	Tube testing
	Oscilloscope	TS-239/UP	TS-35/AP (or) Dumont No. 241	Waveforms (Note: Only TS-239/UP may be used in bench tests described in Section VI.)
	Audio oscillator	TS-382A/U	Hewlett-Packard 200C, 205AG	Indicator tube tests
	Pulse generator	Measurements 79-B		Bench tests for waveform analysis (Section VI.)
2-1	Autosyn test unit	Fabricated		Test for torque unit following Flux Gate transmitter synchro
2-2	Antenna test stand	Fabricated		Mounting Antenna Drive TG-8/APA-69 for bench tests

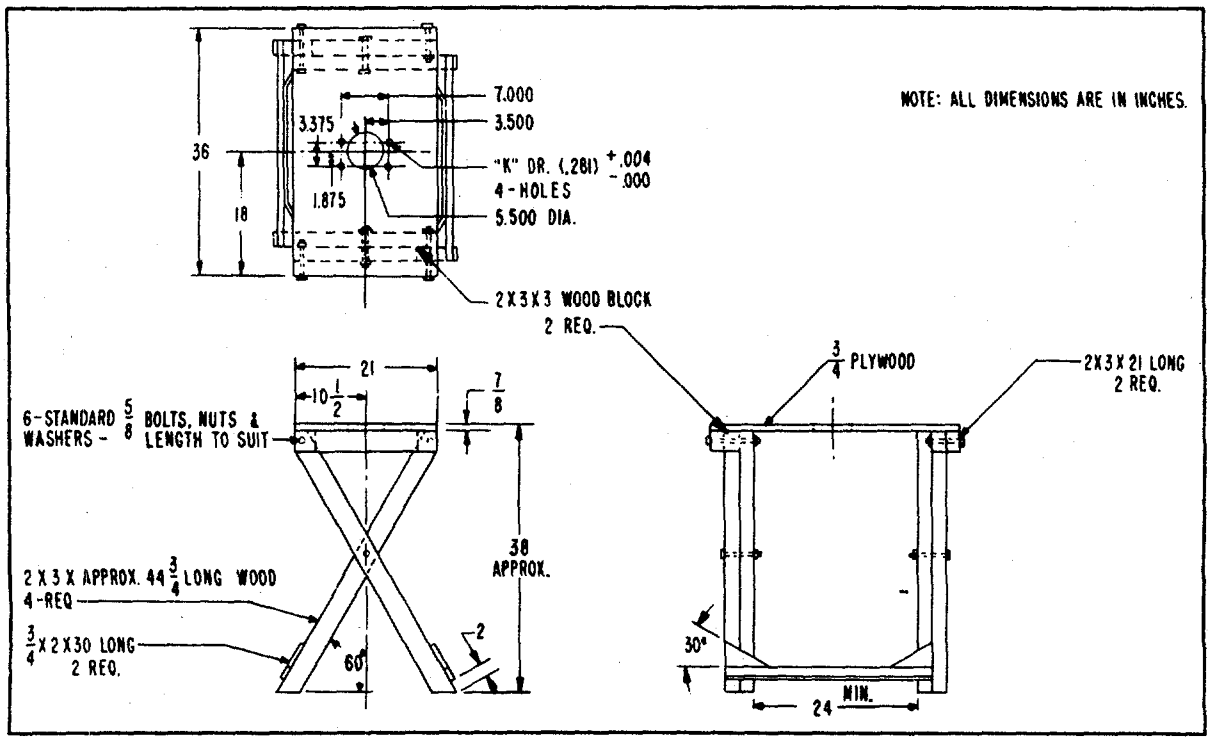


Figure 2-2. Antenna Stand for Test Bench

SECTION III
PREPARATION FOR USE AND RESHIPMENT

3-1. GENERAL.

3-2. This section describes the handling precautions and installation of the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A.

3-3. UNPACKING.

3-4. Unpack the equipment carefully and check each component for possible damage during shipment. Be particularly careful in handling the antennas. Do not use the elements as handles for lifting or carrying them. Use caution in handling the indicator which contains the cathode-ray tube.

3-5. INSTALLATION.

3-6. The exact locations of the components (except the antenna drive) of the direction finder groups are not important providing the maximum lengths specified on the interconnection cabling diagram (figure 7-17 or 7-17A as applicable) are not exceeded. Note also that cables for North-South and East-West plates must be the same length. The azimuth indicators should be installed so that the operator will have an unobstructed view of the cathode-ray tube screen. Direction Finder Control C-527/APA-69 should be mounted so that all controls are easily accessible.

3-7. INSTALLATION OF AZIMUTH INDICATOR IP-36/APA-69. Mounting dimensions are given in figure 7-9, which includes Mounting MT-938/APA69. Drill 16 No. 9 holes for the shockmount feet. Attach the mounts and grounding straps with No. 8 x 32 machine screws, nuts and lock washers. (Note that this unit should not be located more than 35 feet from the antenna drive.) Then install the azimuth indicator in the mount.

3-7A. INSTALLATION OF AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A. Mounting dimensions, which include Mounting MT-1005/APA69A are given in figure 7-9A. Drill 16 No. 9 holes for the shockmount feet. Attach the mounts and grounding straps with No. 8-32 machine screws, nuts and lock washers. Secure the azimuth indicator in its shockmount.

3-8. INSTALLATION OF DIRECTION FINDER CONTROL C-527/APA-69. The Direction Finder Control C-527/APA-69 should be located near the azimuth indicator so that it can be operated while viewing the screen. Refer to figure 7-11 for mounting dimensions. Note that space is required at the rear for the power plug connector.

3-9. INSTALLATION OF AMPLIFIER POWER SUPPLY AM-256/APA-69. Since the amplifier power supply has no operating controls, it may be located at some distance from the azimuth indicator, direction finder control, and antenna drive, up to the limit of its specified cable lengths.

3-10. Refer to the dimensions in figure 7-8. including Mounting MT-934/APA-69 which holds the amplifier power supply. Drill 16 No. 9 holes for the shockmount feet. Attach the mount with No. 8 x 32 screws using suitable nuts and lock washers. Bend the ground straps and fasten them under one of the screws, allowing sufficient slack for excursion of the shockmounts. Then install the amplifier power supply in the mount as indicated.

3-11. INSTALLATION OF ANTENNA DRIVE TG8/APA-69. Before installation of antenna drive, the resolver must be zeroed in accordance with procedure outlined in paragraphs 5-50 through 5-53. Installation of the antenna drive requires extreme care and planning. The antenna drive may be mounted on top or below, but belly mounting is preferable and in some cases absolutely necessary. It should be mounted as far forward as possible and on the centerline of the aircraft. Consideration should be given to possible obstructions such as protruding members and to the possibility of interference from other radio or radar equipment.

3-12. When the approximate location for the antenna drive has been determined, refer to the recommended mounting layout on the lower left-hard corner of the outline drawing (figure 7-10). Note that, in addition to the mounting holes, it is necessary to cut out a circle five and one-half inches in diameter to clear the-rotating shaft. Provision must be made inside the aircraft to clear the drive housing plus three coaxial cable leads and a power cable and the projecting end of Antenna AS-436/APA-69. The antenna will normally be protected on the outside by a radome (not supplied). The radome should be solidly mounted to the skin and carefully gasketed. When installing the drive unit, note that the exact front center of the collar is engraved with a vertical arrow to aid in aligning the unit.

3-13. Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 are supplied wired for belly mounting. Should it be desired to top-mount the antennas, refer to wiring changes shown. For Antenna Drive TG-8/APA-69 see figure 5-7; for Antenna Drive TG-8A/APA-69, see figure 5-7A.

3-14. INSTALLATION OF ANTENNAS.

3-15. ANTENNA COUPLER CU-174/APA-69. (See figure 7-16.) The antenna coupler is used with either Antenna Assembly AS-435/APA-69 or Antenna Assembly AS-434/APA-69. Insert the end with the largest diameter down through the top of the drive unit until the contact springs clear the flanges. Push it down firmly and then rotate it one quarter turn to lock it in place. Now the desired antenna may be installed.

3-16. ANTENNA ASSEMBLY AS-435/APA-69. (See figure 7-12.) Loosen the large knurled nut on the antenna drive by turning it counterclockwise, then carefully place the antenna assembly on the antenna drive shaft. Orient it by the keyways. Press the antenna down gently until the two small contacts are completely engaged. Do not work the antenna assembly around when installing or removing it. It should be pushed straight down or pulled straight up. Rough handling during this process may damage the contacts which feed power to the polarization relay. Tighten the knurled nut carefully with the spanner wrench.

3-17. ANTENNA ASSEMBLY AS-434/APA-69. (See figure 7-13.) This antenna is installed in exactly the same manner as described in paragraph 3-15, above, for Antenna Assembly AS-435/APA-69.

3-18. ANTENNA AS-436/APA-69. (See figure 7-14.)

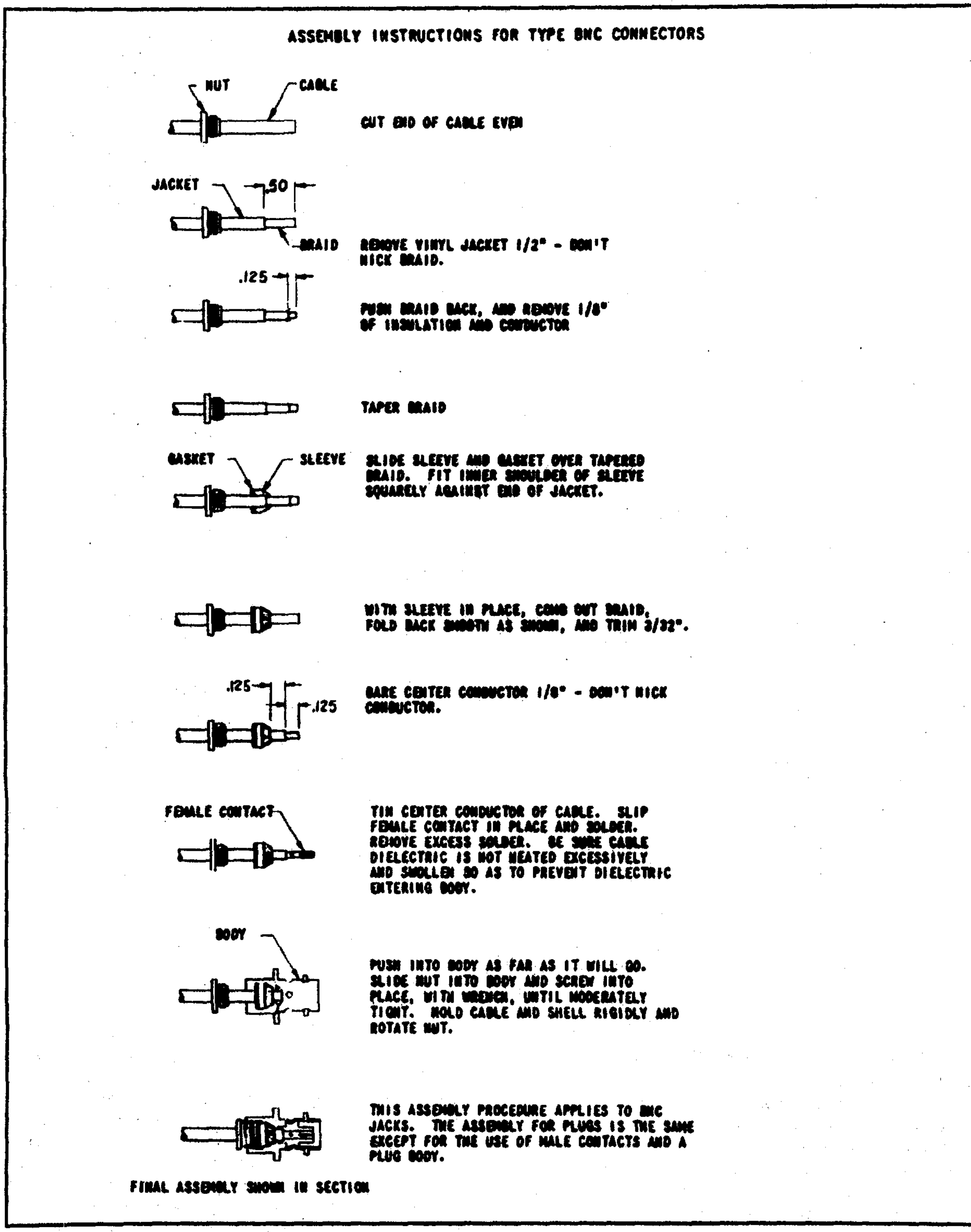


Figure 3-1. Type BNC Coaxial Connector Assembly Detail

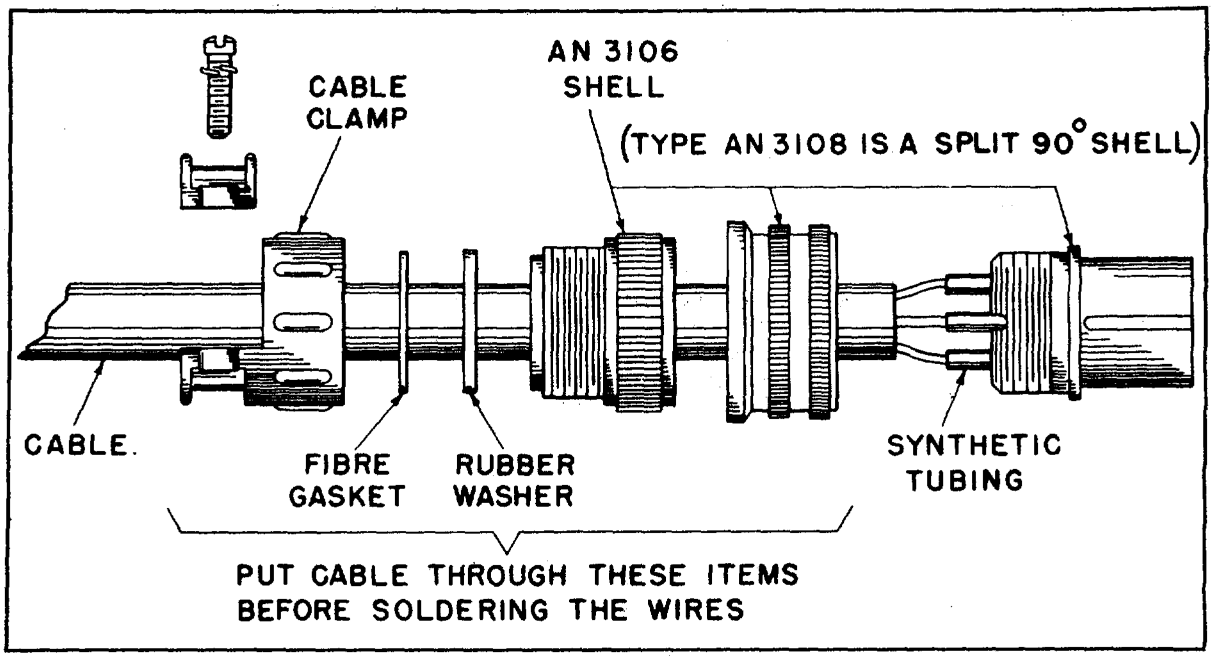


Figure 3-2. Type AN-3106 Connector Assembly Detail

Unlike the lower frequency antennas discussed immediately above, Antenna AS-436/A: PA-69 does not itself rotate. It is inserted closed end first down through the top of the antenna drive unit, pushed down firmly, and rotated one quarter turn to lock it in place.

3-19. ANTENNA REFLECTOR AT-182/APA-69.
(See figure 7-15.) This reflector is used in conjunction with Antenna AS-436/APA-69. It is installed according to instructions outlined in paragraph 3-15 for the rotating antenna elements. Do not forget to tighten the knurled nut after installation.

3-20. CABLES. Cables are required as outlined in table 1-2. For wiring of the plugs of both control and coaxial cables, see figures 3-1, 3-2, 7-17, and 7-17A.

3-21. PREPARATION FOR RESHIPMENT.

3-22. Removal of equipment from aircraft is essentially the reverse of installation procedure. The same precautions and care in handling apply during removal. If the original packing boxes are available, they should be used. Otherwise, pack the equipment securely, paying particular attention to bracing the antenna assemblies so that no damage can occur to the antenna elements.

SECTION IV
THEORY OF OPERATION

4-1. DIRECTION FINDER GROUP AN/APA-69.

4-1A. GENERAL.

4-2. Direction Finder Group AN/APA-69 (block diagram, figure 4-1) operates from an intercept receiver with a range of 180 to 10,750 megacycles. It is contemplated that, by use of harmonics of the signals, the equipment may be used to intercept and analyze signals in bands considerably lower than its band of fundamental coverage.

4-3. ANTENNAS.

4-4. In order to cover this range of frequencies efficiently, three antenna units are used. Antenna Assembly AS-435/APA-69 is a broad-band antenna covering 140 to 1800 megacycles. It is a corner reflector spinner having one vertical and one horizontal section. Only one section at a time may be used, and relay K501 is employed to apply the signal from the selected section to the coupler which conveys it toward the intercept receiver. Because this switching relay is not used with the highest frequency-antenna, there is provided in the antenna drive assembly a switch for opening the relay circuit and preventing accidental mis-setting of the polarization controls.

4-5. Antenna Assembly AS-434/APA-69 is a double

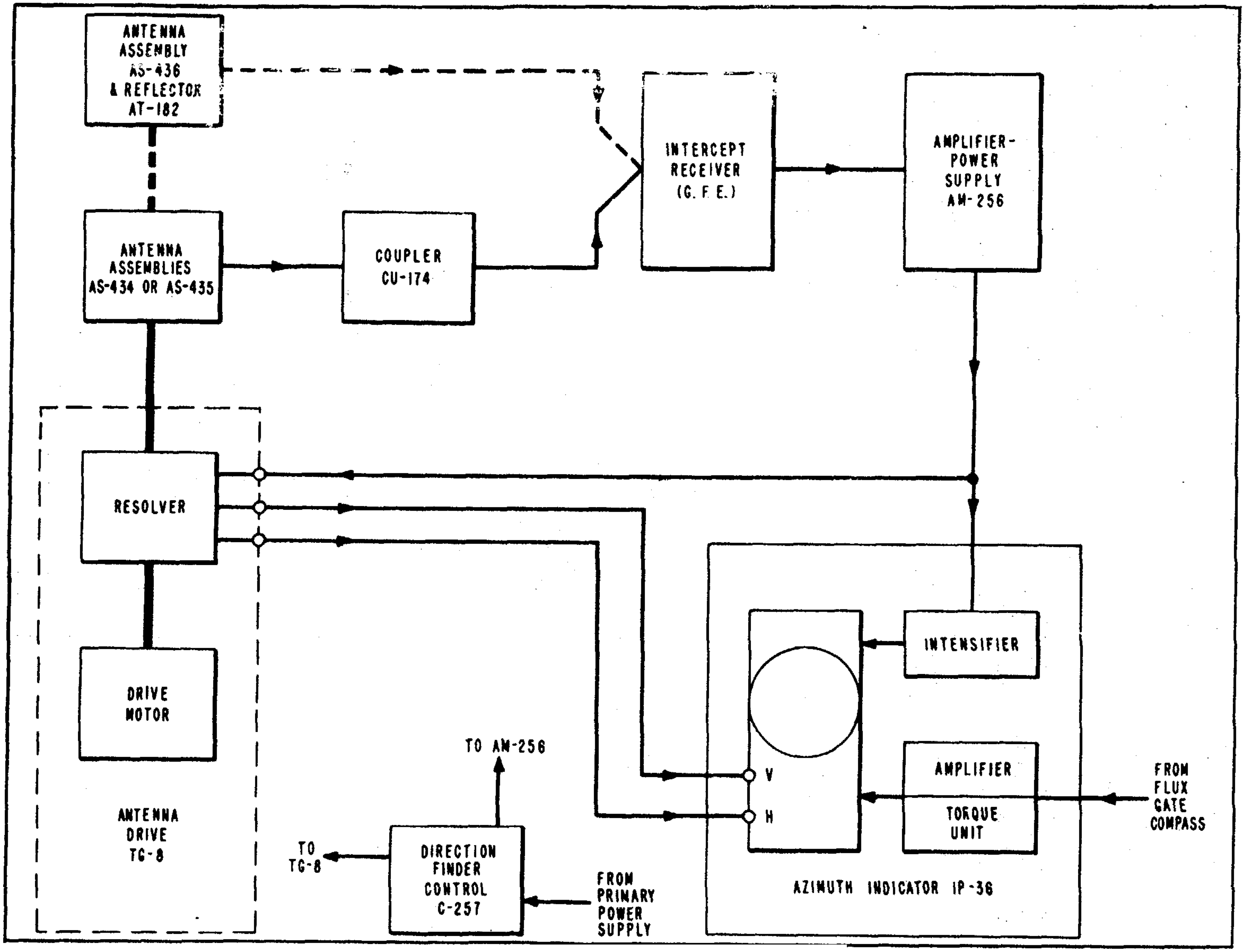


Figure 4-1. Direction Finder Group AN/APA-69, Block Diagram

parabolic spinner broad-banded to cover the frequencies from 1000 to 5000 megacycles. It has a horizontally and a vertically polarized section, like the lower frequency antenna, and is switched by relay K601 which performs a counterpart of the functions of K501, discussed above.

4-5A. Antenna Coupler CU-174/APA-69 is used with the two lower frequency antenna assemblies and couples them to the coaxial line feeding the intercept receivers. The coupler passes through the antenna drive unit and maintains continuous contact between the rotating antenna and the stationary transmission line. A coaxial connector is supplied on one end of the coupler for the transmission line. Contact to the inner conductor is made by a silver graphite alloy brush which rotates with the antenna while maintaining contact with a beryllium copper collector ring. Contact with the outer conductor is made in a similar manner with a silver graphite alloy brush assembly rotating on a ball bearing housing and contacting a beryllium copper collector ring.

4-6. Antenna AS436/APA-69 and Antenna Reflector AT-182/APA-69 cover the range from 5000 to 10,750 megacycles. In this assembly, the antenna is a circularly polarized horn mounted with its axis in the vertical plane. The reflector rotates about it at a declination of 45 degrees. This gives a coverage of both vertical and horizontal polarizations and of circularly polarized waves which are rotating in the proper direction.

4-7. The Antenna Drive TG-8/APA-69 (figure 4-2) rotates the antennas at speeds up to 300 revolutions per minute, with a fixed resistor which is periodically cut into the drive motor circuit to drop

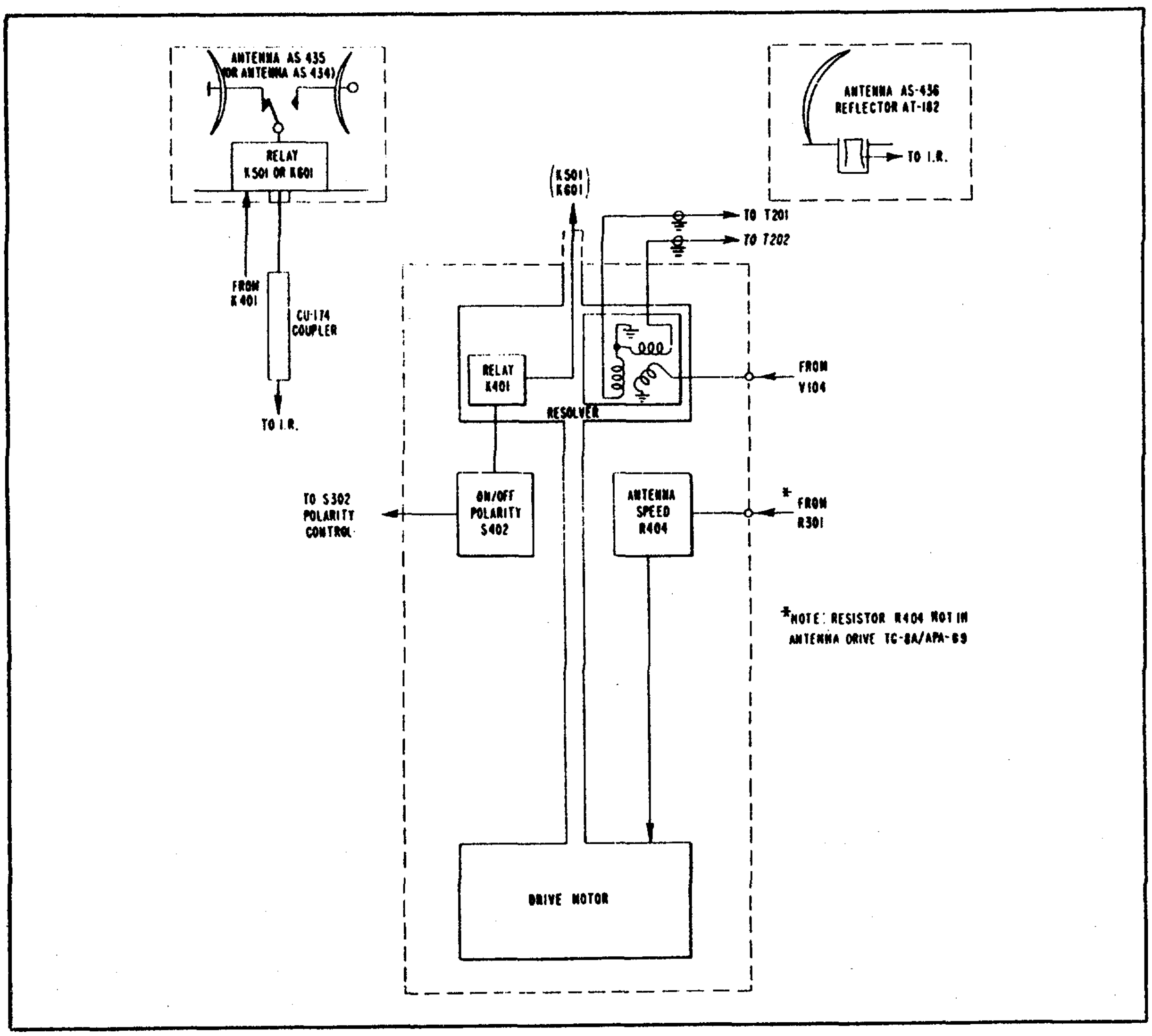


Figure 4-2. Antenna Drive TG-/APA-69, Block Diagram

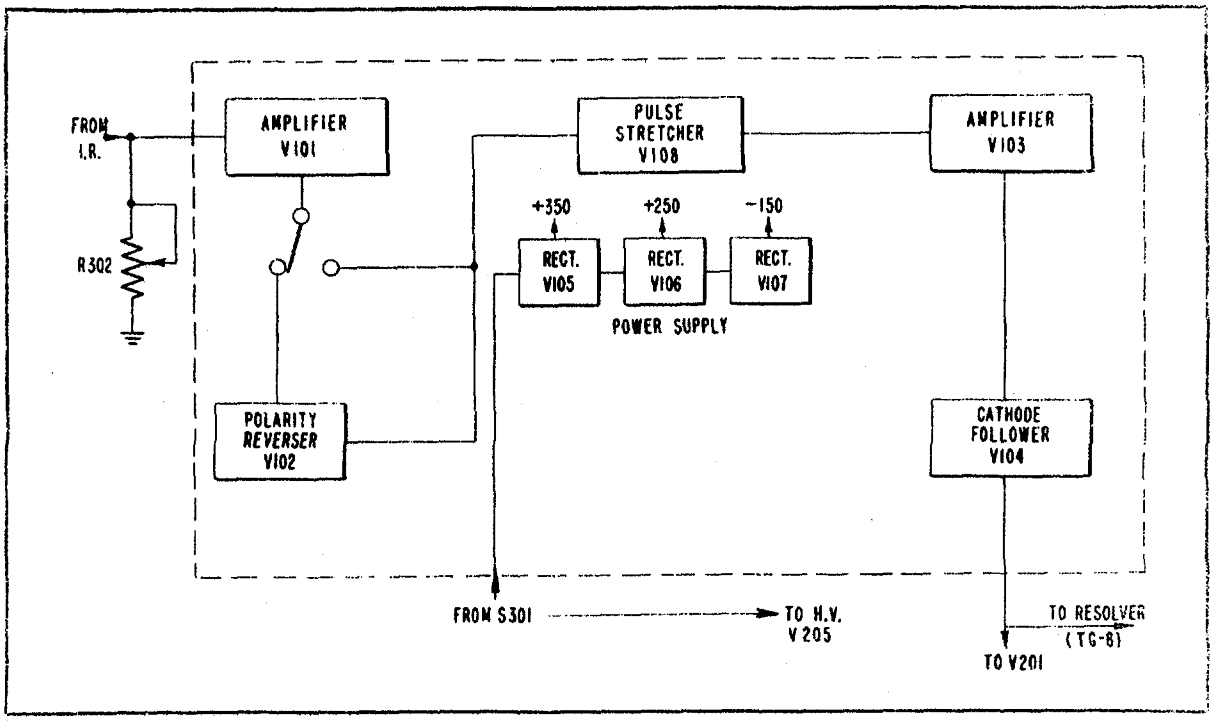


Figure 4-3. Amplifier Power Supply AM-256/APA-69, Block Diagram

the speed of rotation approximately ten per cent. This is a device to eliminate the possibility of "locking in" with a transmitted signal: i.e., of scanning with an antenna speed equal to that of the transmitter and so directed that the receiving antenna is pointed away each time the transmitter is directed at the direction finder. Antenna Drive TG-8A/APA-69 does not have this speed changing feature. The

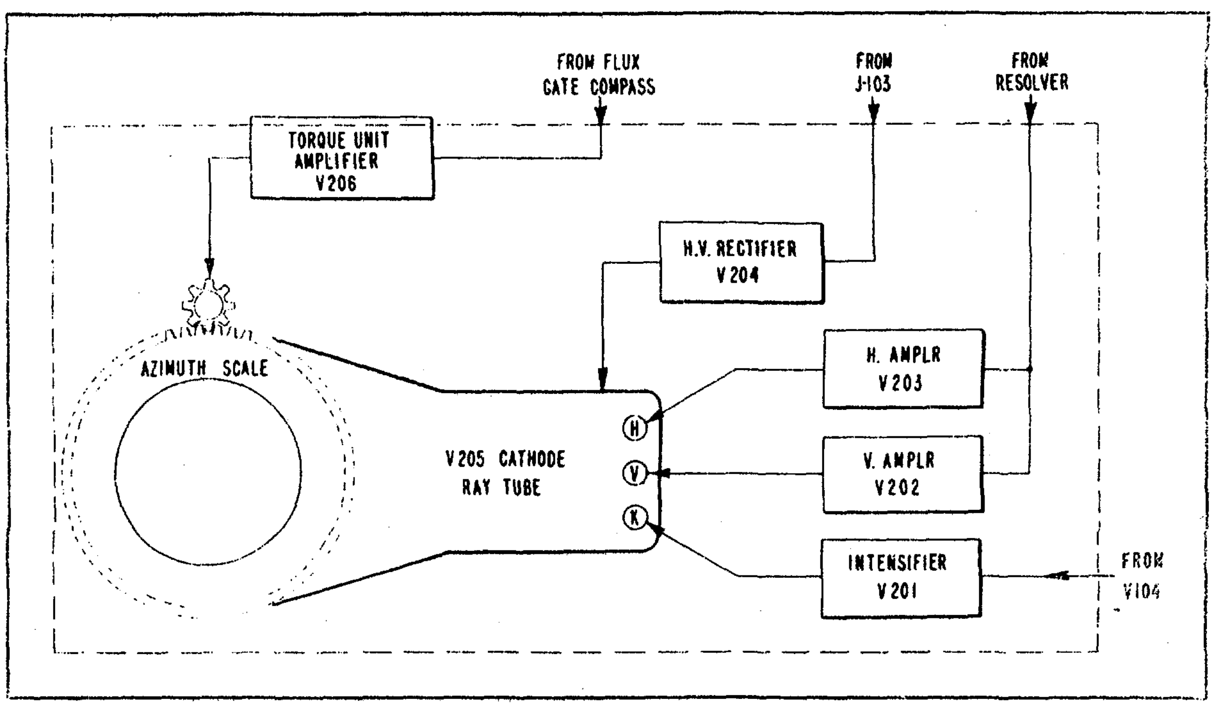


Figure 4-4. Azimuth Indicator IP36/APA-69, Block Diagram

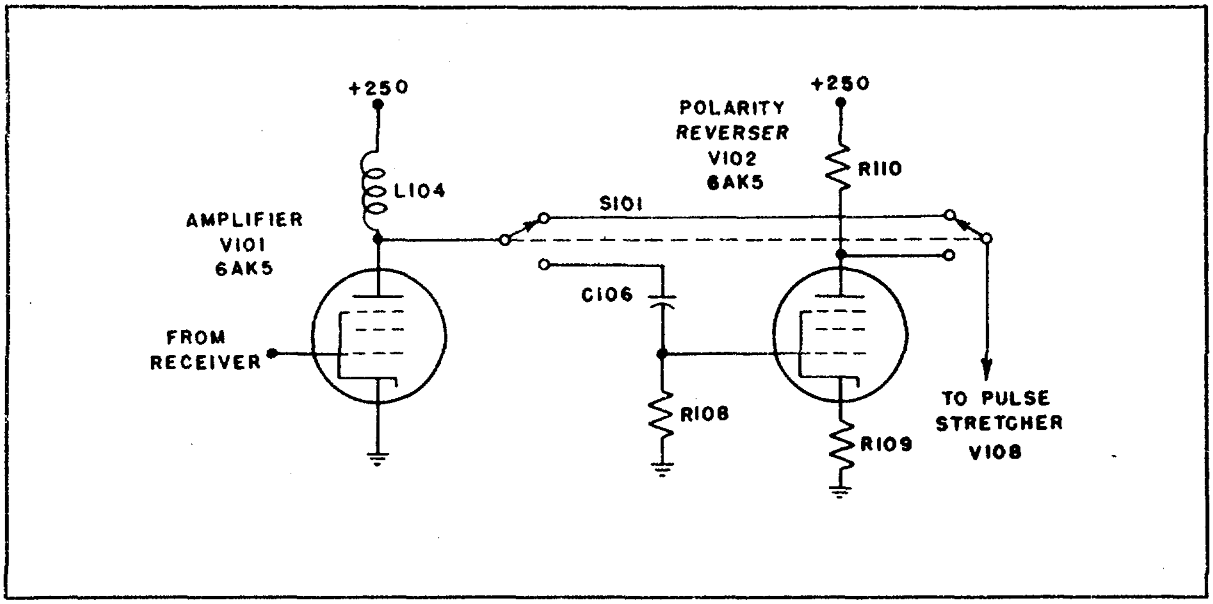


Figure 4-5. Polarity Reversing Circuit in Amplifier Power Supply AM-256/APA-69, Simplified Schematic Diagram

resolver circuit discussed below is also a part of the antenna drive unit and is geared to the shaft.

4-7A. Direction Finder Control C-527A/APA-69 provides controls for varying the antenna rotation speed and selection of the properly polarized element of the two lower frequency antenna units. The gain of the

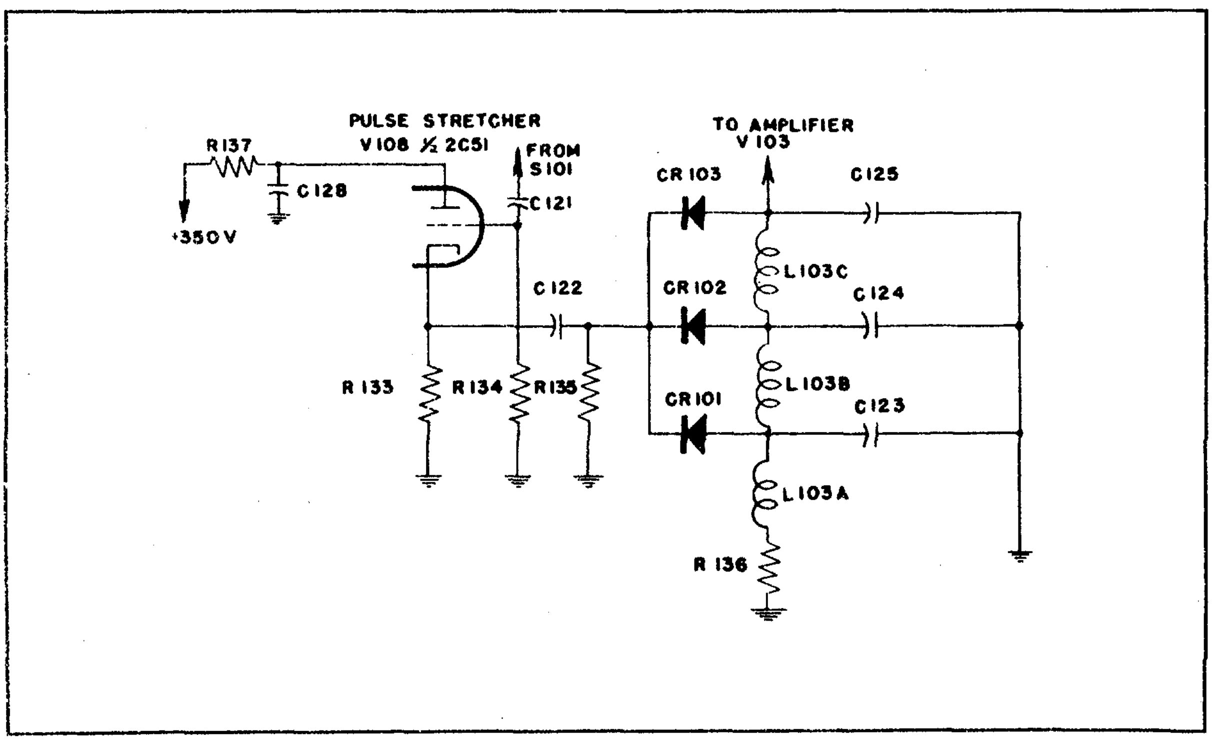


Figure 4-6. Pulse Stretching Circuit in Amplifier Power Supply AM-256/APA-69, Simplified Schematic Diagram

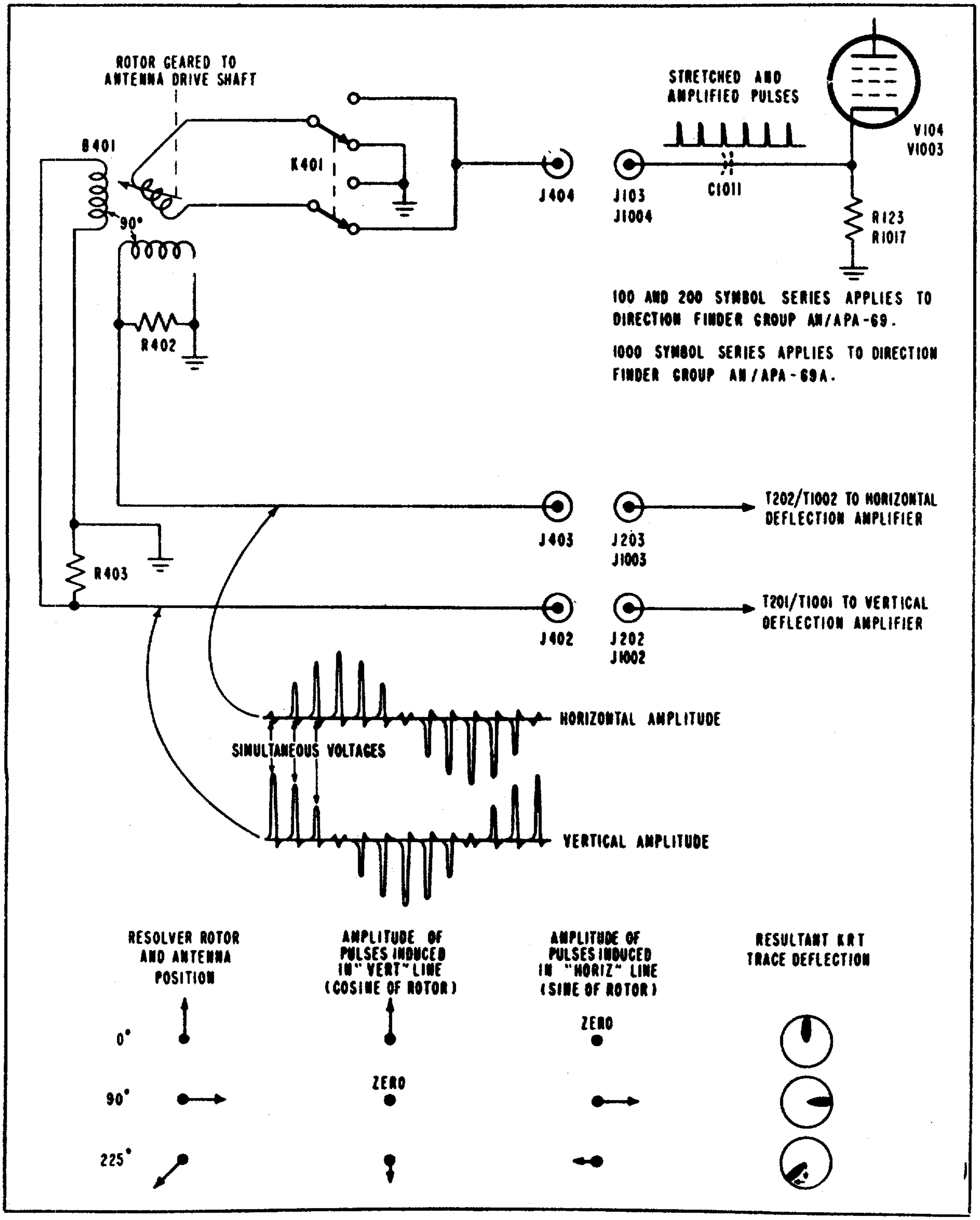


Figure 4-7. Resolver Circuit Operation and Simplified Schematic Diagram

video amplifier circuits may be varied and the primary power turned on and off. The "PAN-DF" switch is not used in Direction Finder Group AN/APA-69 installations. Direction Finder Control C-527A/APA69 is identical to Direction Finder Control C-527/ APA-69 in all its functions. The only difference between the two controls is that the former has a stainless steel mounting panel whereas the latter is fabricated from aluminum.

4-8. INVERTER AND PULSE STRETCHER CIRCUITS.

4-9. To accommodate either positive or negative video signals from the intercept receiver, the Amplifier Power Supply AM-256/APA-09 (figure 4-3) is provided with a polarity-reversing circuit (figure 4-5) which functions to include or short out the inverter stage (V102 and its associated components). If the signal is negatively polarized, the reversing switch should be set to include the inverter; therefore, in all cases the signal on the grid and the output from cathode follower V104 is positive.

4-10. Since some video pulses may be too short to he handled effectively in the final amplifiers, the circuit including pulse stretcher V108 and its associated components is inserted as a pulse stretcher between the first and second video amplifier stages. (See figure 4-6.) The three capacitors C123, C124 and C125 are negatively charged through the three germanium diodes which then, because of their unidirectional properties, block the discharge back along the same paths and force them to discharge through chokes L103A, B, and C. This effectively lengthens the pulse which is fed onto the grid of video amplifier V103. The result is to interpret on the cathode-ray tube screen pulses of extremely short duration which might not otherwise be visible.

4-11. RESOLVER CIRCUIT. (See figure 4-7.)

4-12. A portion of the cathode voltage of cathode follower V104 is fed from J103 via coaxial cable into 1404 on the Antenna Drive TG-8/APA-69. This signal passes through the polarity-reversing contacts of relay K401 and is impressed across the rotor of B401, a miniature two-phase synchro resolver. The rotor is geared to the rotating antenna and is driven at the came speed as the antenna in use. There are two stators. oriented at right angles to one another. The voltages induced across each of them simultaneously by the pulses passing through the rotor section vary in amplitude and polarity according to the angular relationship of rotor and stator. During a full (360 degree) revolution of the resolver the variation of pulse amplitude and polarity across one stator will create a pattern which is that of the sine of the rotating antenna angle; simultaneously, the variation of pulse amplitude and polarity across the other stator will create the cosine pattern. Stopped at any point in its rotation, the rotor will induce onto the stators the pulse amplitude of the sine and cosine component, respectively, of the signal for the angle at which it is stopped.

4-13. The two induced voltages from the resolver stators are impressed across the primaries of two separate video transformers (T201 and T202) whose secondaries feed two dual triodes (V202 and V203) in push-pull. One of the push-pull amplifiers (V202) is connected to the vertical deflection plates (N and S) of the scope tube (V205). The other is connected to the horizontal plates (E and W). The voltages on the two vertical plates are thus 180 degrees out of phase with each other and, similarly, those on the horizontal plates are 180 degrees out of phase. With this arrangement, the resulting sweep of the cathode-ray tube beam, owing to the vertical and horizontal components, is a radius vector of the signal voltage which rotates about the center of the tube at the same speed as the antenna. To prevent low frequency discrimination, the deflection plates are connected directly to the plates of the push-pull amplifiers. Capacitors C213 and C214 are used to correct phase shifts which tend to occur for the higher frequency components.

4-14. VIDEO TUBE CIRCUITS. (See figure 4-4.)

4-15. The cathode-ray tube used in the Azimuth Indicator IP-36/APA-69 is a flat-faced Dumont type K1105P2. This tube is designed for video service and has a long persistence screen.

4-16. Power for the cathode-ray tube is provided from a self-contained supply built into the azimuth indicator. A voltage divider is connected across the negative high potential supply. This divider includes the "INTENSITY" and "FOCUS" controls.

4-17. Under no-signal conditions, the cathode-ray tube is biased to cutoff by means of the "INTENSITY" control (R230) in order to provide better contrast when a signal is received. The intensifier screen and the deflector plates are maintained at approximately the same d-c potential to prevent distortion of the beam pattern which would result from different potentials on these elements. The cathode bias voltage is fixed by a tap on the divider. The cathode is also connected to the intensifier tube plate through blocking capacitor C204.

4-18. Horizontal and vertical centering is effected by means of potentiometers R223 and R216, respectively. These adjustments are located in the grid returns of the two push-pull deflection amplifiers and effect control by varying the bias on these grids. Potentiometer R242 is the circularity control which tends to reduce the gain of the vertical amplifier, which is higher than that of the horizontal amplifier.

4-19. A portion of the positive signal appearing across the cathode load (R123) of cathode follower V104 in the amplifier-power supply is applied to the grid of intensifier V201 in the azimuth indicator through J201. A limiter circuit, comprising two germanium rectifiers (CR201 and C(R202) and their associated circuits, is connected across the input of the intensifier tube (V201). This limiter is designed to maintain a constant positive voltage level on the intensifier grid during the pulse. The limiter threshold is adjustable by potentiometer R205. Since the intensifier tube is an amplifier, only a small signal is required on its grid to produce sufficient negative voltage on the cathode-ray tube cathode to unblank the screen. This system of blanking the cathode-ray tube screen, except in the presence of a signal, prevents varying intensities of the pattern as long as the input voltage at J201 does not fall below a preset minimum level. It also increases brightness of the signals, especially those with a low pulse repetition frequency, which normally are dimmer than those with higher frequencies.

4-20. TORQUE UNIT.

4-21. Azimuth Indicator IP-36/APA-69 also provides true bearing information by means of a rotating azimuth scale which moves around the circumference of the cathode-ray tube screen. The azimuth scale is driven by a torque unit and gear train which receives power from a single electron tube servo amplifier V206. The amplifier is fed with azimuth information from a Flux Gate compass which is normally employed on the aircraft. It controls distribution of power to the torque unit when a signal is generated as a result of a difference in position between the transmitting synchro in the Flux Gate compass and the receiver synchro in the torque unit.

4-22. The torque unit includes a synchro control transformer, a low-inertia motor, and a gear train for torque amplification and speed reduction. The servo amplifier comprises a single-stage push-pull amplifier employing a type 5670 dual triode miniature tube with signal input and power output transformers. The output transformer is made up of an autotransformer and two cores with three windings on each core, a primary, a secondary, and a third winding known as the control winding. Each plate of the tube is connected through a control winding to the 115-volt a-c supply. The primaries on each core are connected in series aiding, the secondaries in series opposed.

4-23. With no signal on the grids of the tube, and with equal rectified a-c plate currents flowing through each control winding, the voltages induced in each secondary are equal and opposite and thus balance out. When signals opposite in polarity are placed on the grids, causing the plate current to increase through one control winding and to decrease in equal amount through the other, the situation changes. Increasing current in one control winding increases the magnetic flux in the core and lowers inductive coupling between the other primary and secondary. The secondary balance is consequently upset and the voltage difference provides excitation to the induction motor variable phase. Direction or phase, differing 180 degrees, is determined by which of the two secondary windings is supplying the voltage.

4-24. The transmitting synchro rotor and the fixed phase of the induction motor are driven by a 26-volt a-c, 400-cycle excitation tapped off the autotransformer. The primaries of the amplifier transformer require 115 volts ac from the same supply. In installations where this power supply is obtained from other than the direction finder control source, this source must supply the entire amplifier power since, otherwise, disturbing phase differences are apt to occur in the synchro transmitter circuits.

4-25. SUMMARY.

4-26. In summary, signals picked up by the rotating antenna are fed to an intercept receiver from which video signals are supplied to the video amplifier which is designed to supply a positive signal at its output. The video output is fed to a video resolver rotating at the same rate as the antenna. Two signals from the resolver are fed to a pair of push-pull amplifiers which drive the deflection plates of the cathode-ray tube. The video signal from the amplifier also drives the intensity modulator which unblanks the cathode-ray tube. Owing to the unidirectional properties of the rotating antennas, the cathode-ray tube beam is swept by the video voltages in a manner that produces a pattern on the screen which is essentially the radiation pattern of the antenna being used. The relative bearing indications thus created are converted to true bearings on an azimuth indicator ring which is synchronized with the Flux Gate compass installation in the aircraft.

4-27. DIRECTION FINDER GROUP AN/APA-69A.

4-28. Direction Finder Group AN/APA-69A employs the same antennas, antenna drive, and control components as Direction Finder Group AN/APA-69. These components, the operation of which has been discussed in the preceding paragraphs are:

a. Antenna Assembly AS-435/APA-69 (paragraph 4-4.

b. Antenna Assembly AS434/APA-69 (paragraph 4-5).

c. Antenna Coupler CU-174/APA-69 (paragraph 4-5A).

d. Antenna AS-436/APA-69 (paragraph 4-6).

e. Antenna Reflector AT-182/APA-69 (paragraph 4-4).

f. Antenna Drive TG-8/APA-69 (paragraph 4-7).

g. Direction Finder Control C-527A/APA-69 (paragraph 4-7A).

Owing to an increase in the number of functions the equipment performs, only Radar Set AN/APR-9 is used to provide video signals. This radar receiving set, in addition, supplies filament and plate power for some of the tubes in the amplifier section of Direction Finder Group AN/APA-69A and signal and sweep voltages to its PAN circuits. The theory of operation of this equipment is not discussed here, and reference should be made to the Handbook Service Instructions Radar Set AN/APR-9 whenever information on it is needed.

4-29. GENERAL THEORY OF OPERATION.

4-30. The general theory of operation of Direction Finder Group AN/APA-69A is based on the simplified block diagram, figure 4-8. Direction Finder Control C-527A/APA-69 provides switches and controls for remote operation of Direction Finder Group AN/APA-69A. The "PAN-DF" switch on the control box is used with Direction Finder Group AN/APA-69A. With the equipment set to operate in its "DF" function, the signals picked up by the antenna (driven by the Antenna Drive TG-8/APA69-9) are fed to the intercept receiver. Video signals from the intercept receiver are supplied to the amplifier circuits of the Azimuth Panoramic Indicator IP-81( )/APA-69A. From the video amplifiers, the signal is fed to a video resolver in Antenna Drive TG-8/APA69. The resolver rotates at antenna speed. Two signals from the resolver are applied to a pair of push-pull amplifiers which drive the deflection plates of the cathode-ray tube. A portion of the signal from the video amplifiers also drives the intensity modulator circuit which unblanks the cathode-ray tube. The relative bearing indications created by the pattern on the screen of the cathode-ray tube are converted to true hearings on the azimuth indicator ring through a torque unit which is synchronized with the Flux Gate compass installation in the aircraft.

4-31. With the equipment set to operate in "PAN" function, Azimuth Panoramic Indicator IP-81( )/ APA-69A receives. from the intercept receiver, a scanning panoramic voltage which is presented upon the screen of the cathode-ray tube so as to indicate frequency, type of signal, relative amplitude, and type of modulation, if any. A remote counter, synchronized with the scanning drive, indicates on the dial of the indicator the exact frequency in kilomegacycles.

4-32. FUNCTIONAL OPERATION OF ELE(: TRONIC COMPONENTS.

4-33. GENERAL. Azimuth Panoramic Indicator IP81( )/APA-9A (see figure 4-9) is used to complete the equipment comprising Direction Finder Group AN/APA-69A. This indicator performs all functions of the amplifier and indicator sections of Direction Finder Group AN/APA-69 and also incorporates a new function, the provision of a panoramic signal picture on the cathode-ray indicator tube. It includes the same torque unit and amplifier driven from the Flux Gate compass and a new remote frequency indicator driven from the scanning control circuits of the intercept receiver.

4-34. AMPLIFICATION AND PULSE STRETCHING. When operated in "DF" function the amplifier section. (see figure 4-10), comprising tubes V1001, V1002 and V1003 and their associated circuits, functions in the same manner as the amplifier section of Amplifier Power Supply AM-256/APA-69. (Refer to paragraphs 4-8 through 4-10.) Since the output of the intercept receiver, Radar Set AN/APR-9. is positive, no polarity-reversing circuit is needed. The pulse stretching circuit is connected between the cathode follower and the video amplifying sections of the first tube, V1001, and includes capacitors C1003, C1004 and C1005; inductors L1001-A, L1001-B and L1001C; and germanium diodes CR1001, CR002 and CR1003. As in the other pulse stretcher circuits, these diodes pass current in only one direction, so that the capacitors must discharge through the inductances and resistor R1004, the delay of which effectively lengthens the shorter pulses applied to the grid of the video amplifier section of tube V1001. Other elements of the amplifier section are conventional, ending with a cathode follower tube (V1003) whose output is applied to the intensity modulation tube V1004 and to the resolver in Antenna Drive TG-8/APA-9.

4-35. INTENSITY MODULATION. The operation of relay K1003, when the "PAN-DF" switch S303 is in "DF" position, places the output from cathode follower tube V1003 on the grid of tube V1004, the intensity modulation tube. (See figure 4-11.) Though the blanking action of the intensity modulation circuit is similar to that discussed in paragraph 4-19, the circuits of tube V1004 are arranged somewhat differently. Two germanium diodes, CR1004 and CR1005, function as limiters to maintain a constant positive voltage on the grid of the intensity modulation tube during the pulse. A portion of the negative going plate voltage is taken off through variable resistor R1020, the "INT. MOD." control to unblank the screen of the cathode-ray tube. In "PAN" position, the relays feed part of the plate signal from the vertical deflection amplifier to the "INT. MOD." limiter circuit, where it is similarly effective in maintaining a variable unblanking voltage.

4-36. RESOLVER CIRCUIT. The resolver circuit and vertical and horizontal deflection amplifier circuits for Direction Finder Group AN/APA-69A, when operated in "DF" function, are similar to Direction Finder Group AN/APA-69. A portion of the output signal of cathode follower tube V1003 is fed, via coaxial cable, to the polarity-switching relay K401 and, hence, to the rotor of the miniature, two-phase synchro resolver B401. (See figure 4-7.) When either of the lower frequency antennas is in use, the relay K401 operation is controlled by the position of the antenna-polarization switch S302. Relay K401 is unenergized when S302 is in its horizontal position and energized when S302 is in its vertical position. When the high frequency antenna is in use switch S402 is opened, assuring that relay K401 is unenergized. The relay K401, operated in this manner, provides that the signal through the rotor of resolver B401 is in the proper direction. This properly polarized signal

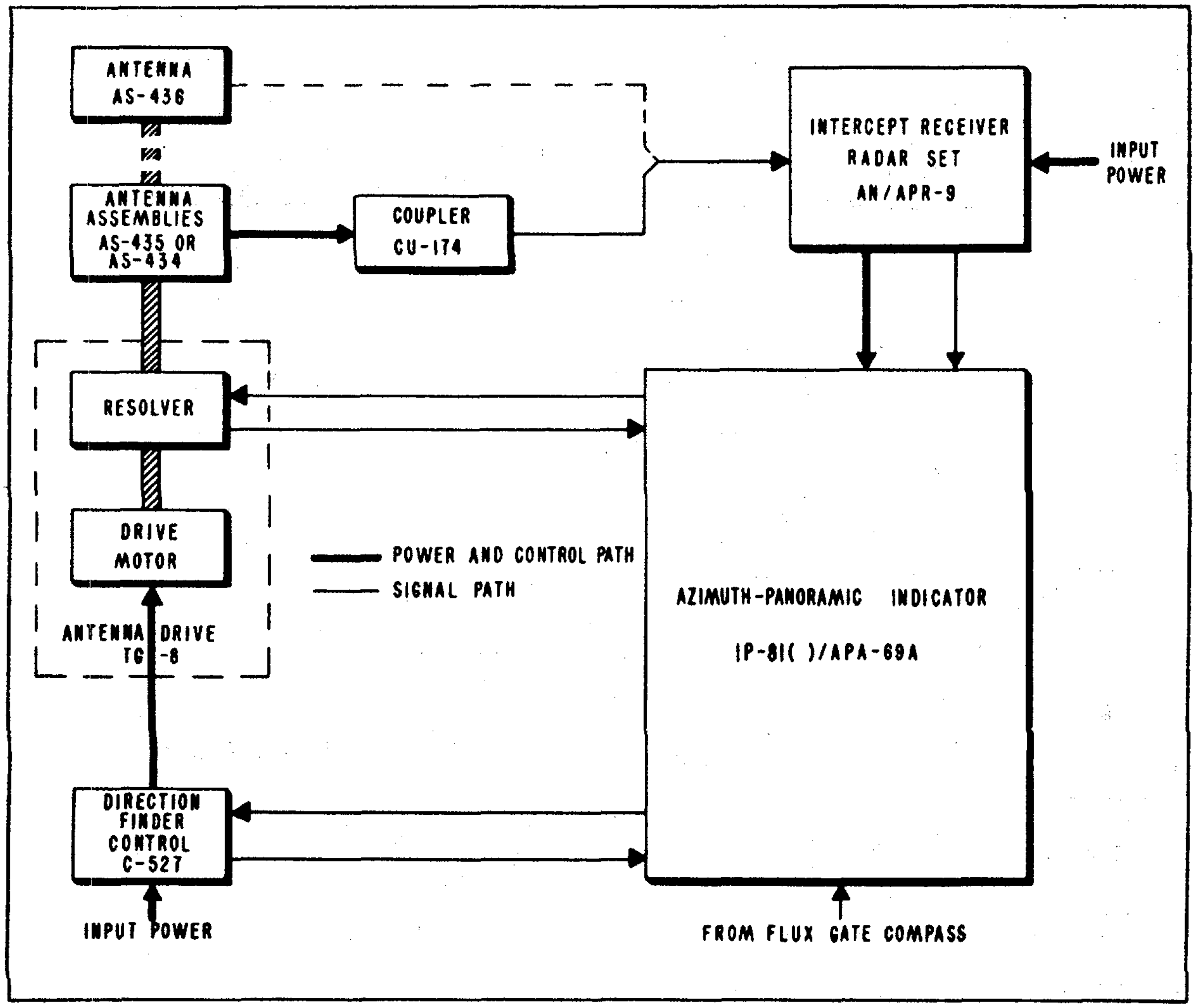


Figure 4-8. Direction Finder Group AN/APA-69A, Simplified Block Diagram

voltage is induced into the two stator windings of resolver B401. These two stator windings are positioned at right angles to one another. The voltages induced across each of them varies in amplitude and polarity according to their position relative to the rotor. Since the rotor is geared to the antenna, a full revolution of the resolver will create in one stator a voltage which can be represented as the sine of the rotating antenna angle. Simultaneously, the voltage developed in the other stator winding can be represented as the cosine of the rotating antenna angle. At any point in its rotation, the rotor induces onto the stators the sine and .cosine component of the signal voltage of the angular position of the antenna.

4-37. The two induced voltages from the resolver stators are impressed across the primaries of two separate video transformers (T1001 and T1002) whose secondaries feed two dual triodes (V1006 and V1007) operated in push-pull. One of the push-pull amplifiers (V1006) is connected to the vertical deflection plates (N and S) of the cathode-ray tube (V1009). The other push-pull amplifier (V1007) is connected to the horizontal (E. and W) plates of the tube. Thus the voltages on the vertical plates are 180 degrees out of phase with each other, and, similarly, the horizontal plates are 180 degrees out of phase. The resulting sweep rotating about the center of the cathode-ray tube at antenna speed is a radius vector of the signal voltage. To prevent low frequency discrimination, the deflection plates are connected directly to the plates of the push-pull amplifiers. Capacitors C1018 and C1019 are used to correct phase shifts which may occur at frequencies above 70 kilocycles.

4-38. PANORAMIC INDICATOR. The Direction Finder Group AN/APA-9A performs an entirely new function as-well. It receives from the radar receiver and presents on the screen of the cathode-ray indicator tube a 20 megacycle wide display of the signals

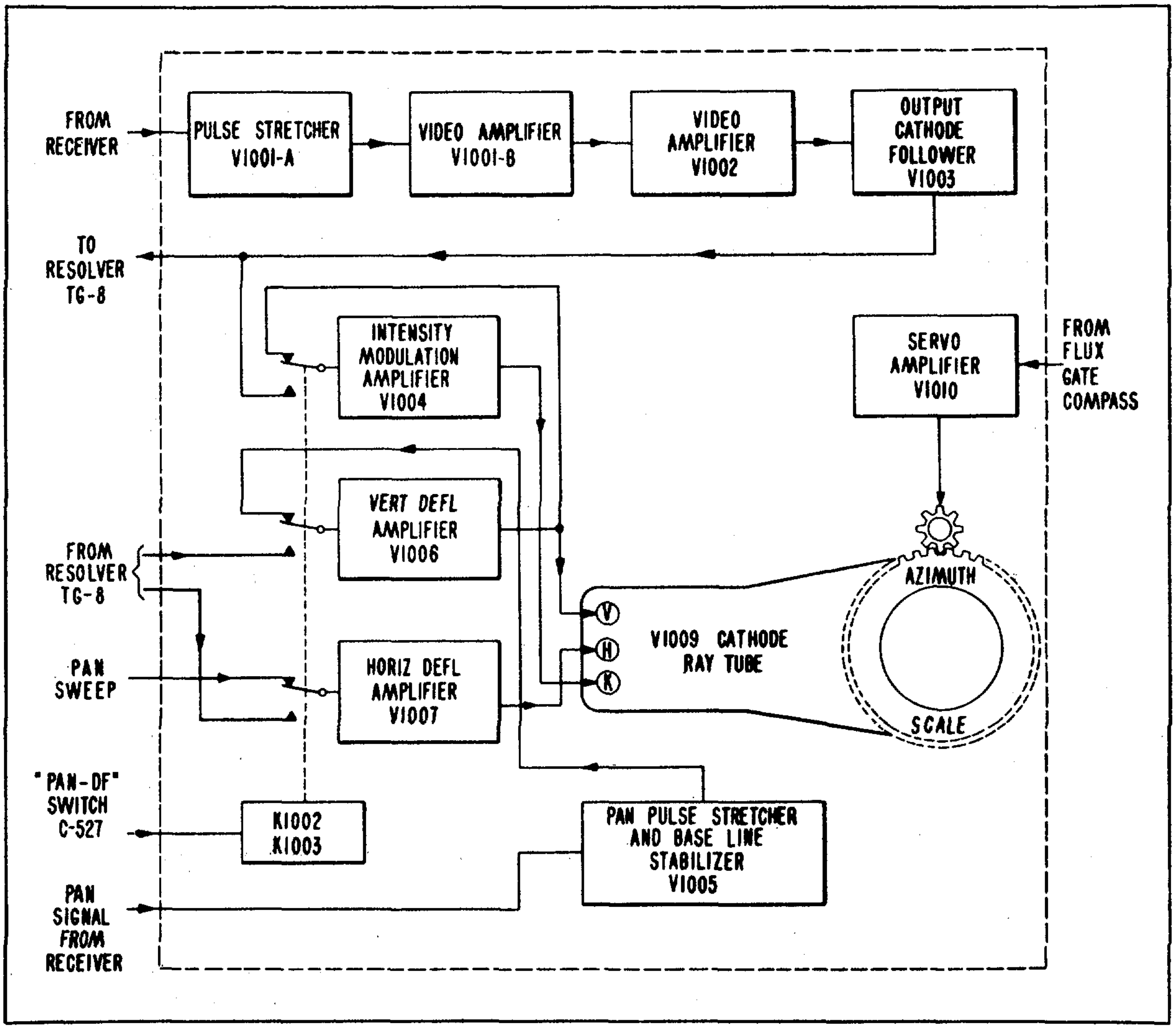


Figure 4-9. Azimuth-Panoramic Indicator IP-81( )/APA-69A, Block Diagram

on each side of the receiver frequency. From terminal A of J1007, the negative video output of Radar Set AN/APR-9 (see figure 4-12 for IP-81/APA-69A or figure 4-13 for IP-81A/APA-69A) is fed to the cathode of tube V1005-B whose plate is connected in parallel with the plate of tube V1005-A, serving as a baseline stabilizer. Tube V(005-B prevents positive going signals from appearing on the grid of the vertical deflection amplifier, while tube V1005-A is, in effect, a clamping circuit which prevents the trace from jumping with sudden large signals. Since, with the relays in "PAN" position, the amplifier is fed with a single-ended signal, resistors R1026 and R1027 function as a phase inverting device so that tube V1006 operates in push-pull. A voltage approximately midway between the plate voltages of the two sections of tube V1006 is applied from the junction of these resistors to the grid of the no-signal section, and thus causes a nearly balanced and self-correcting push-pull output. The "PAN" sweep, which is delivered to the horizontal deflection amplifier from the intercept receiver, has a frequency of about 12.5 cycles per second. The "H. GAIN" control, R1041, is a dual potentiometer which varies the input voltage simultaneously applied to the control grids of the two sections of tube V1007.

4-39. REMOTE FREQUENCY INDICATOR. The frequency of the r-f tuner is indicated by a synchro motor and counter (see figure 7-1A) driven by a synchro mechanism in the intercept receiver equipment. Since the same counter in the indicator must be used to show the frequencies of any of the four r-f tuners which may be used, it is necessary to provide a method of resetting the counter for each r-f tuner. The synchro motor is connected through a friction clutch to

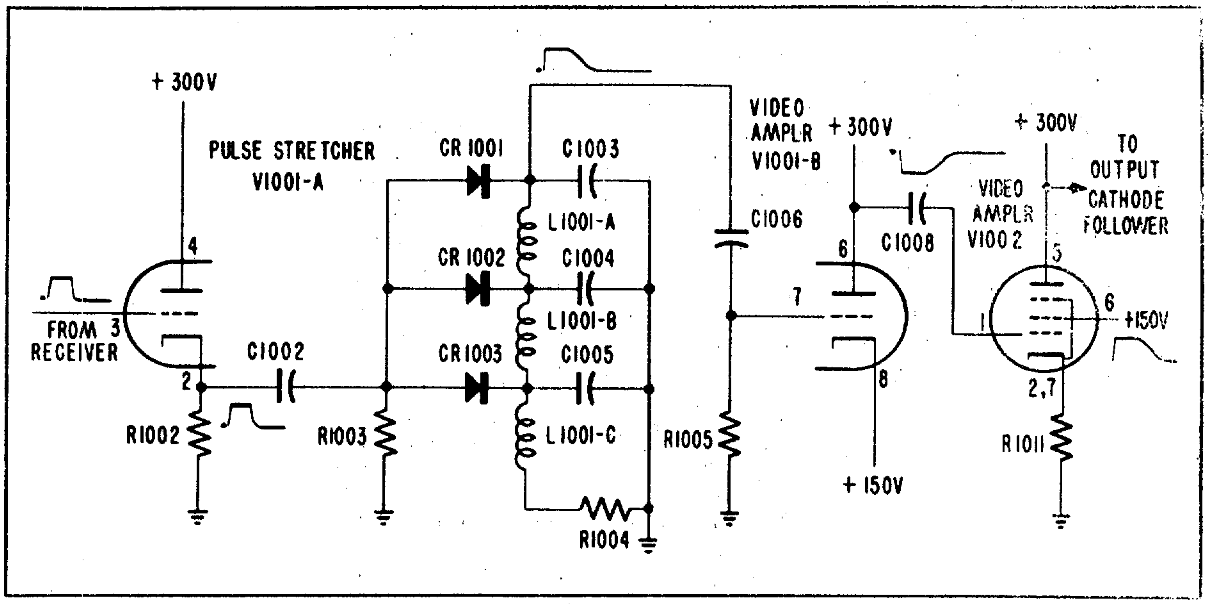


Figure 4-10. Azimuth-Panoramic Indicator IP-81( )/APA-69A, Amplifier and Pulse-Stretching Circuits

the counter. The gear ratio between the synchro and the counter is 1:1. A locking relay is arranged so that the synchro is locked in position whenever the relay is not energized and is free to turn whenever the relay coil is energized. There are three positions for the spring return counter reset switch. In the normal position, the relay is energized and the synchro is free to follow the remote synchro generator. In the "COARSE" reset position, the relay is still energized, but the rotor circuit of B1002 is opened and this allows the synchro and counter to be spun manually by the "RESET" control, thus quickly resetting the counter to a widely different reading. In switching S1001, the "COUNTER RESET" switch, from "COARSE" to "FINE" it is necessary to pass through the neutral position and in this brief interval the synchros become electrically aligned or synchronized. The counters are still not exactly aligned, however, and the final alignment is accomplished with S1001 in the "FINE" position. In this position, the relay is not energized and B1002 is in electrical synchronization with the r-f tuner synchro generator. The friction clutch then permits the counter to be set wherever desired while the synchro is locked, thus completing the exact alignment of the synchro and counter. The synchronizing lamp in the indicator lights up at the lower limit of each r-f tuner, indicating a known frequency on which counters can be synchronized or synchronization checked. Full details on this procedure, which involves several controls in the intercept receiver circuit, may be found in the Handbook Service Instructions, Radar Set AN/APR-9.

4-40. TORQUE UNIT AND AMPLIFIER. No changes in the torque unit and amplifier driven by the Flux Gate compass are involved in Direction Finder Group AN/APA-09A. Refer to paragraphs 4-20 through 4-24 for a full discussion of this circuit.

4-41. AZIMUTH-PANORAMIC INDIC: ATOR IP-81A/APA-69A. Horizontal and vertical centering is accomplished with potentiometers R1037 and R1028 which vary the positive bias on the grids of the deflection amplifier tubes, whereas in the IP-81, these controls were located in the cathode circuits. Values of these controls were changed. The positive bias applied to these controls is derived from the +150V supply through six bleeder resistors (R1069, R1070, R1071, R1072, R1073, and R1074). The cathodes; of the deflection amplifier tubes are positive-bias by resistors R1036, R1031, and R1075. The above circuit constants are so selected that, although the grids are positive with respect to ground, they are negative with respect to their respective cathodes. With this circuit change it is possible to obtain more centering range than was possible with the original cathode circuits of IP-81.

4-42. The 150 volts on contact 13 of K1003 is switched from bleeders R1069 and R1070 in the "PAN" position to R1071 and R1072 in the "DF" position. Cathode resistor R1030, the vertical deflection amplifier tube, is shunted by R1075 in the "PAN" position through the action of contacts 12 and 5 of relay K1002. This change in the bias of the constants of the vertical amplifier circuit in the "PAN" position causes the trace to shift below center, thus making it possible to utilize a greater portion of the tube surface for panoramic presentation.

4-43. Contacts 14 and 8 of K1003 and 12 and 4 of K1002 are used to ground both sides of the horizontal panoramic sweep output in the "DF" position, thus

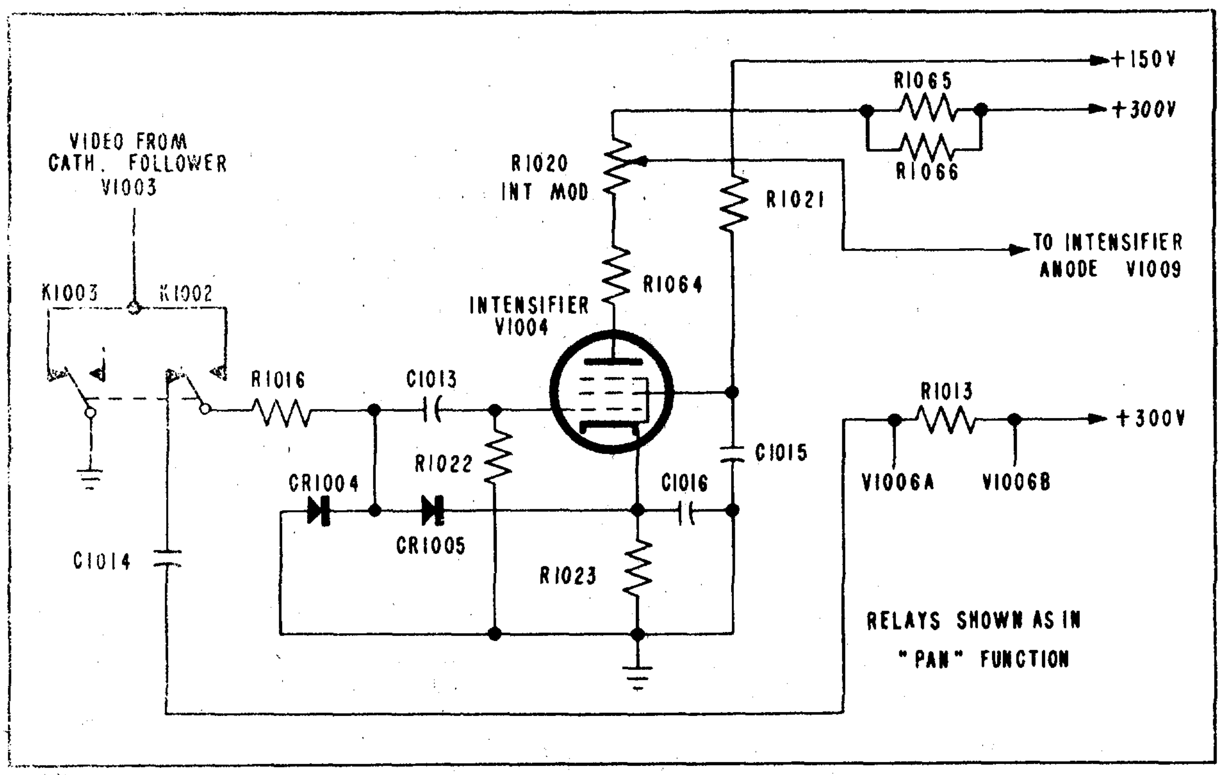


Figure 4-11. Azimuth-Panoramic Indicator IP-81( )/APA-69A, Intensity Modulator Amplifier Circuits

preventing 12-1/2-cps ripple voltage from getting into the horizontal deflection amplifier grids.

4-44. DETAILIED SYSTEM OPERATION.

4-45. The discussion of detailed system operation of Direction Finder Group AN/APA4-69A, is based on detailed block diagram, figure 4-14. Signals picked up by the antenna in use are fed to the intercept receiver of Radar Set AN/APR-9. With the high frequency Antenna AS-436/APA-69 in use, the signals are fed directly to the intercept receiver. With either of the lower frequency Antenna Assemblies, AS-434/APA-69 or AS-436/APA-69, the signal is fed through sliding contacts to Antenna Coupler CU-174/APA-69 and hence to the intercept receiver. The video output of the intercept receiver is fed to one half of the amplifier tube V1001. This section of the tube operates as a cathode follower. The signal picked off the cathode is fed to the pulse-stretching network. The time constant of the pulse-stretching network is designed to lengthen pulses that would be toot short to be handled effectively in the final amplifiers. The output of the pulse-stretching network is fed into the grid of the second half of the video amplifier tube V1001 and hence to video amplifier tube V1002. Since the output signals of Radar Set AN/APR-9 are always of positive polarity, the video amplifier tube V1002 will always deliver a positive signal to the grid of output cathode follower tube V1003. The output of the cathode follower is impressed across the rotor of a miniature two-phase synchro resolver. The rotor is geared to the rotating antenna and is driven at the same speed as the antenna in use. There are two stators oriented at right angles to one another. The voltage induced across each of them simultaneously by the pulses passing through the rotor section are impressed across the primaries of two separate video transformers T1001 and T1002. The secondaries of these transformers feed two pairs of dual triode tubes V1006 and V1007. The dual triodes are operated in push-pull, one pair connected to the vertical deflection plates and the other pair connected to the horizontal deflection plates of the cathode-ray tube. The voltages on the two vertical plates are thus 180 degrees out of phase with each other and, similarily, those on the horizontal plates are 180 degrees out of phase. As a result of the phase relationship of the vertical and horizontal components, a radius vector of the signal voltage rotates on the face of the cathode-ray tube at the same speed as the antenna.

4-46. A portion of the output of cathode follower tube V1003 is fed to the intensity modulation- amplifier tube V1004. The output level of the intensity modulation amplifier is varied by the "INT. MOD." potentiometer R1020. This output is fed to the cathode of the cathode-ray tube where it unblanks the screen of the cathode-ray tube in the presence of a signal. This unblanking voltage prevents varying intensities of the pattern as long as the input voltage does not fall below a preset minimum level.

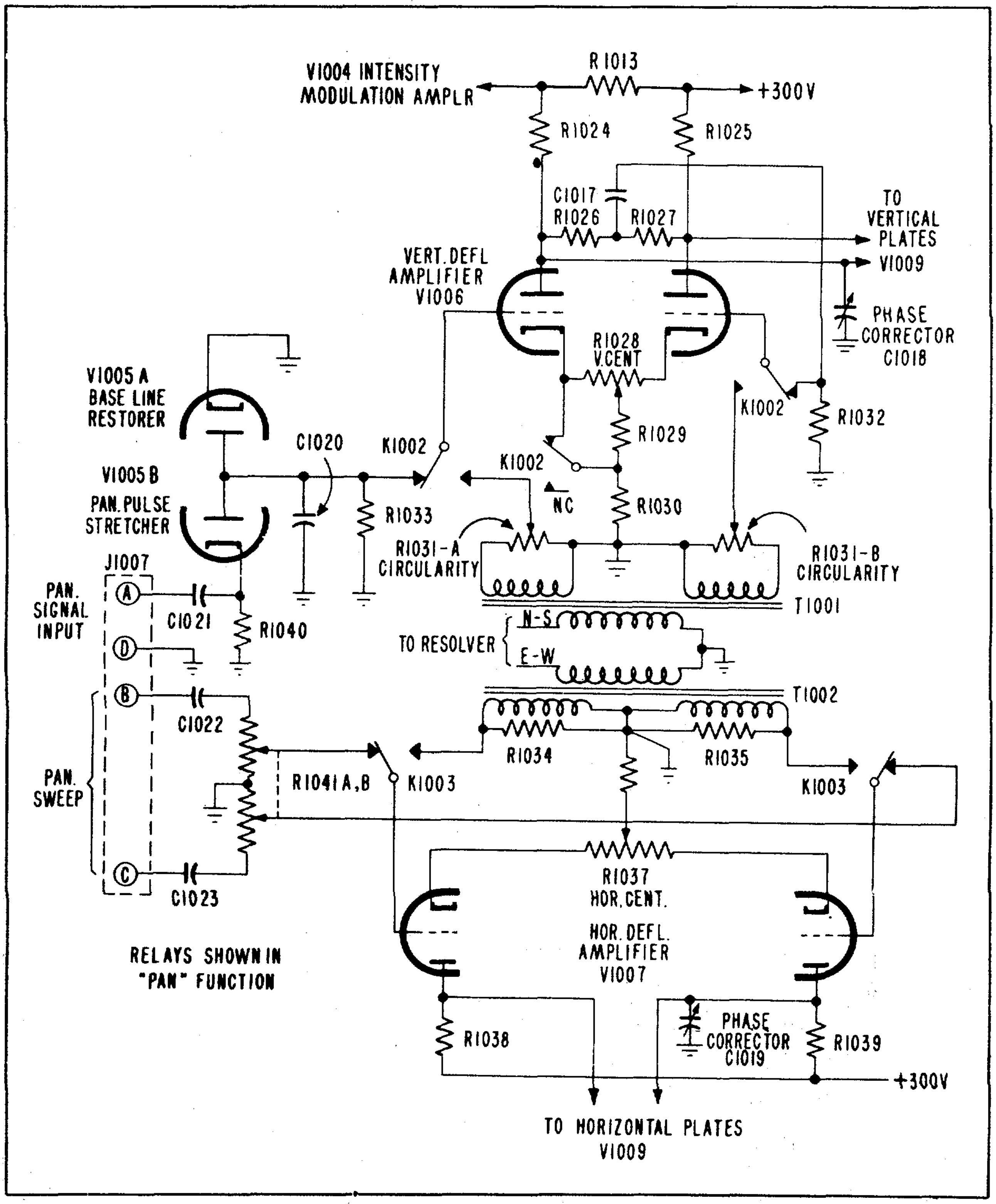


Figure 4-12. Azimuth-Panoramic Indicator IP-81/APA-69A, Horizontal- and Vertical-Deflection Amplifier Circuits

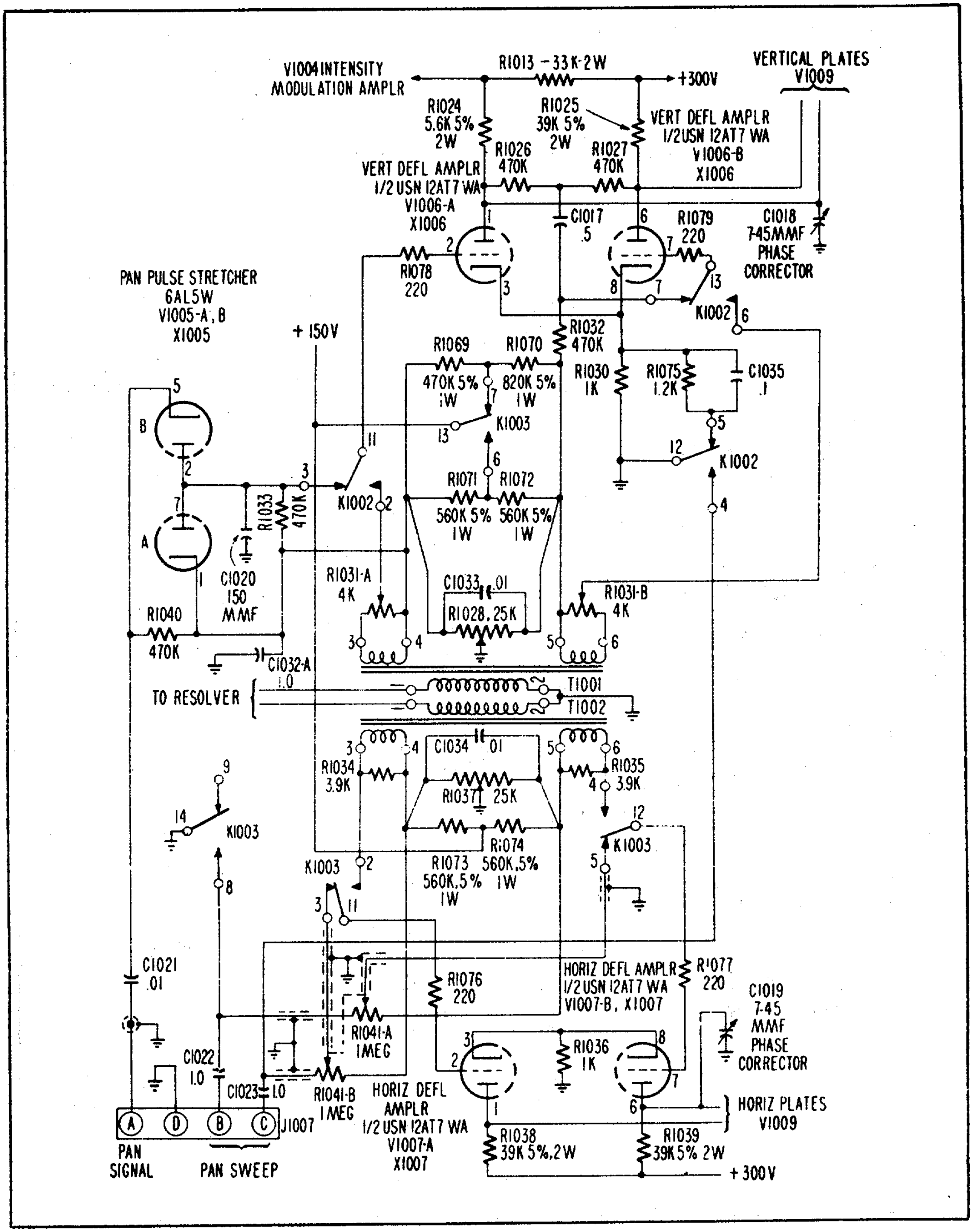


Figure 4-13. Azimuth-Panoramic Indicator IP-81A/APA-69A, Horizontal-and Vertical-Deflection Amplifier Circuits

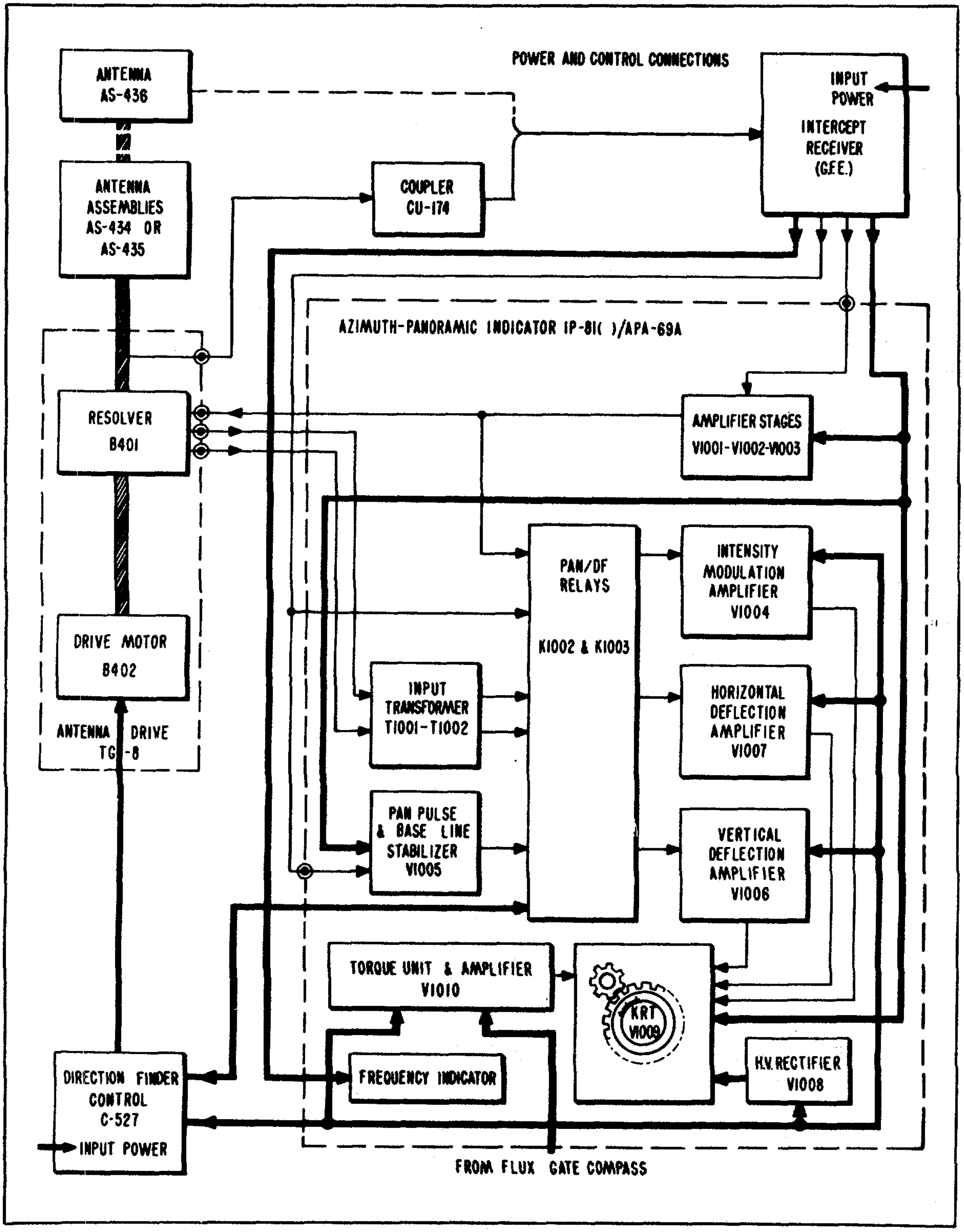


Figure 4-14. Direction Finder Group AN/APA-69A, Detailed Block Diagram

4-47. With Direction Finder Group AN/APA-69A operating in its "PAN" function the i-f video output of Radar Set AN/APR-9 is fed to the cathode of one-half of a dual diode tube V1005. The two halves of this dual diode are connected plate-to-plate, with the second half serving as a base line stabilizer or d-c restorer. The output of this tube is fed through an r-c circuit, (the time constant of which is such that it has a pulse-stretching effect on the signal) to vertical deflection amplifier tube V1006. Since the amplifier is fed with a single-ended signal, resistors R1026 and R1027 must act as a phase inverting device to keep the two halves of amplifier tube V1006 out of phase so that they will operate in push-pull. The output of the two halves of tube V1006 is fed directly to the vertical plates of the cathode-ray tube.

4-48. The relative bearing indications created by the pattern on the screen of the cathode-ray tube are converted to true bearing by means of an azimuth indicator which moves around the circumference of the cathode-ray tubes screen. The azimuth scale is driven by a torque unit which receives power from a servo amplifier tube V1010. The amplifier is fed with azimuth information from a Flux Gate compass which is normally employed in the aircraft. With the rotor of the receiving synchro in the torque unit in the same position as the rotor of the transmitting synchro in the Flux Gate compass, there is no signal impressed on the grids of the servo amplifier. Subsequently voltages induced in the control transformer balance out and there is no driving voltage impressed on the torque unit. When the rotor of the transmitting synchro of the Flux Gate compass changes its position with relation to the rotor of the receiving synchro, there is an out-of-phase voltage induced on the grids of servo amplifier tube V1010. The resulting output of the servo amplifier upsets the balance in the control transformer. This condition produces a driving voltage which causes the azimuth indicator ring to rotate on the face of the cathode-ray tube. This driving voltage will continue until the rotors of the two servos are in the same relative position, thus causing the azimuth indicator ring to indicate the same bearing as the Flux Gate compass. The transmitting synchro rotor and the fixed phase of the induction motor are driven by a 26-volt a-c 400-cycles per second excitation tapped off the autotransformer T1005. The primaries of the amplifier transformer require 115 volts ac from the same supply. In installations where the power is obtained from other than the direction finder control source, this source must supply the entire amplifier power since otherwise disturbing phase differences are apt to occur in the synchro transmitter circuits.

4-49. The remote frequency indicator found on Azimuth Panoramic Indicator IP-81( )/APA-69A is operated by a synchro motor and counter, which is driven by a synchro mechanism in the intercept-receiver equipment. Since the same counter in the indicator must be used to show the frequencies of the four r-f tuners (part of the intercept-receiver equipment) which may be used, there are provisions for resetting the counter manually. Refer to paragraph 4-39 for more detailed information on this unit.

4-50. The 28-volt d-c power input is used to operate the antenna drive motor and the antenna polarity switching relay. The regulated 115-volt 380- to 420cycles per second input supplies the necessary voltage to the servo amplifying network. The 115-volt a-c 320- to 1760-cycles per second input is fed to the primary of the power transformer T1003. Filament voltage is tapped off of this power transformer for operation of the filaments of tubes V1004, V1006 and V1007 and the filaments of the lamps 11002, 11003, 11004 and 11005. Filament voltage is also tapped off of the secondary of the power transformer for operation of the cathode-ray indicator tube V1009. The high voltage necessary for operation of the cathode-ray indicator is tapped off of the secondary of this power transformer and fed through the high-voltage rectifier tube V1008. The intercept receiver of Radar Set AN/APR-9 supplies filament voltage for vacuum tubes V1001, V1002, V1003 and V1005. The intercept receiver also supplies the 150-volt and 300-volt d-c plate and control voltage necessary for operation of the vacuum tubes V1001 through V1007 inclusive.

SECTION V
ORGANIZATIONAL AND OPERATIONAL MAINTENANCE

5-1. GENERAL.

5-2. This section covers maintenance, inspection, and minor repairs to Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A at the organizational or squadron level. Its purpose is to facilitate rapid and efficient isolation of trouble within a single component. For further checks, reference is made herewith to Section VI on Field and FASRON Maintenance.

5-3. Extensive checking or maintenance of the direction finder groups depends on generation of signals by one or more of the signal generators listed in table 2-1. Any one of these may be used for the general operational tests which follow, providing the antenna in use covers the band of frequencies sup plied by the generator.

5-4. OPERATIONAL TESTS.

5-5. Before making operational tests, a visual inspection should be made to determine that all plugs are tight, all mounting screws are secure, cables are clamped where necessary, plugs are safety-wired if necessary, and the primary power is turned on.

5-6. If the antenna is top mounted, make sure that wiring changes required were made in the antenna drive unit. (See figure 5-7.)

5-7. Make the following operational checks:

a. Turn on the equipment with the "POWER" switch (S301) on the direction finder control. Rotate the "ANT. SPEED" control fully clockwise and observe the antenna to see that it is rotating and that the speed changing switch on the TG-8/APA-69 is operating. Antenna Drive TG-8A/APA-69 does not have this speed changing switch. Place the PAN-DF switch in "DF" position.

b. Set up the signal generator corresponding to one of the frequencies covered by the antenna in use. It should be established about 100 feet away from the aircraft directly in front of the nose of the aircraft and on a line which is an extension of the longitudinal center (lubber) line. There should be no obstructions between the transmitter and the antenna and a space having a minimum radius of 100 feet should be clear to minimize reflections. The transmitting antenna should be horizontally polarized and the polarization switch on the Direction Finder Control C-527A/APA69 should be set on "HORIZONTAL". For convenience, harmonics of the transmitter input signal may he used, if desired.

c. Permit both receiver and signal generator to warm up for about ten minutes. Observe the pattern on the cathode-ray tube. The center of the pattern should fall close to the fiducial mark on the azimuth indicators. It is extremely difficult to reach the resolver for adjustment in place, if a larger error is noted; and it is recommended that the antenna drive be removed from the aircraft and zeroed on a test bench, as described in paragraph 5-50 and following. There is also a possibility of serious distortion of a received signal pattern owing to reflections; and it should be assumed, barring further counter-indications, that, if the resolver was properly adjusted before installation and has not been moved or damaged, its directional indications are still satisfactory.

d. It may be necessary to adjust the balance and gain controls of the azimuth indicator, particularly if any tendency to hunt is observed. In Direction Finder Group AN/APA-69 installations neither of these controls is accessible from the outside. The azimuth indicator should be removed by unfastening the two screws which secure it in the shockmount, removing the cover, and sliding out the front. Balance control R249 is the upper screwdriver adjustment on the left-hand side of the chassis. (See figure 5-9.) It is used to compensate for unequal cathode currents in the torque amplifier tube V206 which would tend to cause the azimuth dial to pull in one direction or the other. Gain control R248 is just below the balance control. It reduces any tendency toward hunting by the torque unit. These controls should be adjusted only with a signal being received from the Flux Gate compass. With the aircraft headed north so that the compass master indicator dial reads zero degrees, adjust resistor R249 so that the azimuth dial reads zero degrees. Adjust resistor R248 for minimum hunting. Do not reduce the gain control too far, as it will reduce the sensitivity of the servo amplifier. In Direction Finder Group AN/APA-69A installations, these adjustments may also be necessary. The "SERVO BALANCE" control (R1060) and the "SERVO GAIN" control (R1058) are located on the top of the Azimuth-Panoramic Indicator IP-81( )/APA-69A. (See figure 5-9A.) Remove the indicator and adjust these controls in the manner prescribed for Direction Finder Group AN/APA-69.

e. Check the reading of the azimuth scale on the azimuth indicator to he sure it coincides with the reading of the master indicator of the Flux Gate compass. Generally, the master indicator will have been checked against a standard and compensated where necessary. Electrical zeroing of the azimuth indicator was performed at the factory, but procedure for checking and zeroing this unit are included in paragraphs 6-25 through 6-35 on Field and FASRON Maintenance.

5-7A. Make the following operational checks for Direction Finder Group AN/APA-69A.

a. Same as step a. of paragraph 5-7.

b. Same as step b. of paragraph 5-7.

c. Same as step c. of paragraph 5-7.

d. It may be necessary to adjust the "SERVO BALANCE" and "SERVO GAIN" controls of Azimuth-Panoramic Indicator IP-81( )/APA-69A. Remove the dust cover from the indicator by removing the screw and lock washer on the top of the unit. These controls should only be adjusted with a signal being received from the Flux Gate compass. With the aircraft headed north so that the compass master indicator reads zero degrees, adjust the "SERVO BALANCE" control R1060 so that the azimuth dial reads zero degrees. Adjust resistor R1058, the "SERVO GAIN" control, for minimum hunting. Do not reduce the gain control too far, as it will reduce the sensitivity of the servo amplifier.

e. Check the reading of the azimuth scale on the azimuth indicator to be sure it coincides with the reading of the master indicator of the Flux Gate compass. Generally the master indicator will have been checked against a standard and compensated where necessary. Electrical zeroing of the azimuth indicator was performed at the factory, but procedures for checking and zeroing this unit are included in paragraphs 6-25 through 6-35 on Field and FASRON Maintenance.

5-8. FLIGHT TESTS AND CALIBRATION.

5-9. While bench and ground rests may show the equipment to be consistently accurate within its specifications, it may be found that corrections are necessary for readings taken during flights. This is due to the fact that the field pattern is distorted by the various aircraft members such as fuselage, wings, propellers, etc. For accurate bearings to be taken, it then becomes necessary to make calibration charts for the various frequencies and polarizations at which the equipment is to be used. These charts should include corrections at intervals of at least 15 degrees with respect to the fore and aft axis of the plane. The charts should be compiled while the aircraft is flying over reasonably smooth terrain with winds not exceeding ten miles per hour. Three methods of making flight calibrations will be described in the following para.
graphs. While the basic principles are similar, the accessory equipment is different in each case. It must be recognized that such calibrations may not be accurate on frequencies much removed from the calibration frequency.

5-10. LOCKING THE AZIMUTH SCALE.

5-11. It is necessary to hold the rotating scale on zero (360 degrees) at the fiducial mark. This is accomplished in the following manner:

a. Remove the plug from the Flux Gate compass connected to J206 (Azimuth Indicator IP-36/APA-69) or J1006 (Azimuth-Panoramic Indicator IP-81( )/ APA-69A). Procure a blank plug of the same type (AN-3106-145-5S) and wire as follows: Short a jumper between terminal A and C and terminal E. (This connects two stators of the synchro control transformer to ground.) (See figure 5-1.)

b. On Direction Finder Group AN/APA-69, remove the 115-volt a-c power plug that is connected to J205. This plug has an unused terminal B. (Terminal B on J205 is internally connected to terminal 3 of transformer T205 which is the 6.3-volt a-c winding.) Solder a wire to terminal B of the power plug and connect the other end of this wire to terminal D on the blank plug which is associated with J206. (This connection will apply 6.3 volts ac to the third stator winding of the synchro in the torque unit.) With Direction Finder Group AN/APA-69A, the 6.3 volts ac is obtained in a similar manner. Remove the plug which is connected to J1001 on the Azimuth-Panoramic Indicator IP-81( )/APA-69A. This plug has an unused terminal E which is connected, through E of J1001, to the 6.3-volt a-c tap of transformer T1005. Solder a wire to terminal E of this plug and connect the other end of the wire to terminal D of the test plug which is associated with J1006. Refer to figure 5-1 for these connections.

c. Connect these two plugs to their associated receptacles and turn on the 115-volt a-c, 400-cycle power. The azimuth scale will go to zero and will be held there by the 6.3-volt a-c potential. The azimuth scale will now read the relative bearing only.

d. Flight calibration procedure may then be carried out as described in the following paragraphs.

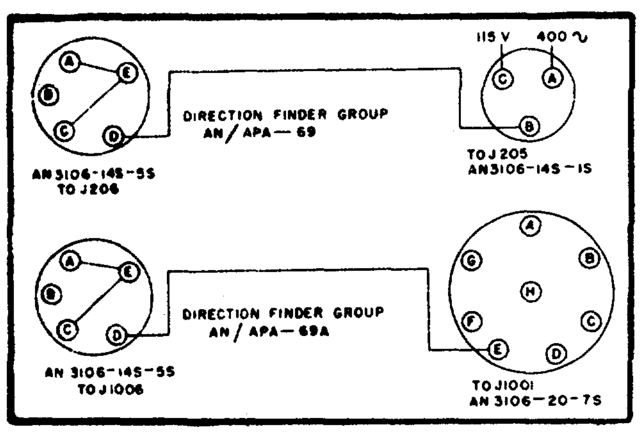


Figure 5-1. Plug Wiring and Connections for Zeroing Azimuth Indicator

Intended Radio Compass Bearing	*Actual Radio Compass Bearing**	*Observed Azimuth Indicator Bearing*	*Bearing Correction (Actual Minus Observed)*
Degrees	Degrees	Degrees	Degrees
15			
30			
45			
60			
75			
90			
105			
120			
135			
150			
165			
180			
195			
210			
225			
240			
255			
270			
285			
300			
315			
330			
345			
0			

* It is necessary that the radio compass interval be exactly 15 degrees.

Figure 5-2. Data Chart, Radio Compass Method of Calibration

("Actual Radio Bearing" should be within two degrees of the "Intended Radio Compass Bearing")

Note

Be sure to remove jumpers and test plug after flight calibration is completed. For maximum accuracy, calibration should be made at the frequencies at which most intercepts are made.

5-12. RADIO COMPASS METHOD OF CALIBRATION.

5-13. While this method is simple, it is the least accurate. It requires that the signal sources for the radio compass and the direction finder group be located within a few hundred yards of each other.

5-14. With the aircraft flying at a minimum distance of 15 miles from the transmitter, instantaneous readings are taken at "()" radio compass bearing and then at intervals of 15 degrees. These readings must be taken during level flight and never during a turn or bank. The observed data should be recorded on a chart such as that shown in figure 5-2.

5-15. GYRO COMPASS METHOD OF CALIBRATION.

5-16. When using the gyro compass method, all turns made during the calibration procedure should be gradual and uniform so that the gyro compass will not be disturbed any more than is necessary.

5-!7. Select a series of landmarks, fifteen or more miles away, that will provide a direct line to the signal source. If distortions occur in the shape or direction of the received pattern as the aircraft is flown along or across the reference line, it will be necessary to climb to a higher altitude or use another approach.

5-18. Head the aircraft toward the transmitter while flying directly along the reference line. Fly low enough to avoid sighting errors and keep the plane in level flight. Set the gyro compass to zero and release the caging knob so that the gyro compass reads zero when. the heading of the aircraft coincides with the reference line. Note the relative bearing indication of the signal source as read on the direction finder group. This reading should also be zero degrees if there is no wind drift. Refer to figure 5-3 for an illustration of the flight pattern to be followed. After the initial reading at zero degrees, turn the aircraft to the left and fly far enough from the reference line so that the aircraft can be turned to the right and a gyro compass heading of 15 degrees established before the reference line is crossed. While holding the aircraft on a level course with a steady gyro compass heading of 15 degrees. determine the relative bearing of the transmitter when the plane is exactly over the reference line. Record this reading on a chart similar to that shown in figure 5-4. Now fly to the right of the reference line far enough so that a left turn may be made and a gyro compass heading of 345 degrees established before recrossing the reference line. Determine the relative bearing of the signal source when the aircraft is exactly over the reference line in level flight and on a steady gyro compass heading of 345 degrees.

5-19. Repeat the above procedure for gyro compass headings of 30 degrees and 330 degrees. After the relative bearing is obtained at 330 degrees gyro compass heading, execute a right turn so that the aircraft is flying directly over the reference line. Check the gyro compass heading with the reference line while flying away from the signal source. If all turns were made carefully, the gyro compass should read within a few degrees of 180 degrees. If the gyro compass has varied more than a few degrees, the procedure must be repeated after it is rechecked. Small differences, not exceeding plus or minus three degrees over the 15degree interval, may be proportioned to the individual readings.

5-20. Repeat the gyro compass to 18(0 degrees while the aircraft heading coincides with the reference line, release the caging knob, and record the relative bearing for the 180-degree heading while the aircraft is flying a steady course.

5-21. Following the above procedure, obtain relative bearings of 210, 195, 165, and 150 degrees. Head the aircraft toward the transmitter along the reference line, establish a zero-degree heading with respect to the reference line, check the gyro compass reading, and recage to zero degrees. Obtain bearing readings for every 15-degree change in heading of the aircraft as indicated in figure 5-3. Do not make more than four alternate bearing checks between any two zero-degree or 180-degree gyro compass checks as excessive error may be introduced.

5-22. If the reference line is too short, or if there is difficulty in checking the zero and 180-degree gyro compass headings of the aircraft against the reference line after a series of turns, reduce the number of alternate right and left headings of the aircraft, as required.

5-23. MAGNETIC AND GYRO COMPASS METHOD OF CALIBRATION.

5-24. If it is impossible to locate a series of landmarks to provide a reference line, a third method may be used. Choose a prominent landmark (designated point A) at least 15 miles away from the transmitter Using an accurate detail map, determine the true bearing of the transmitter with respect to point A and convert this bearing to a magnetic bearing.

5-25. Using the magnetic compass, fly the magnetic bearing and with the aircraft in level flight, cage the gyro compass to the same bearing. Cross point A with the aircraft headed on this bearing and determine the relative bearing of the signal source at the instant the reference point is crossed. The reading on the azimuth indicator should be zero degrees if there is no wind drift and the antenna was properly aligned. (See figure 5-5.)

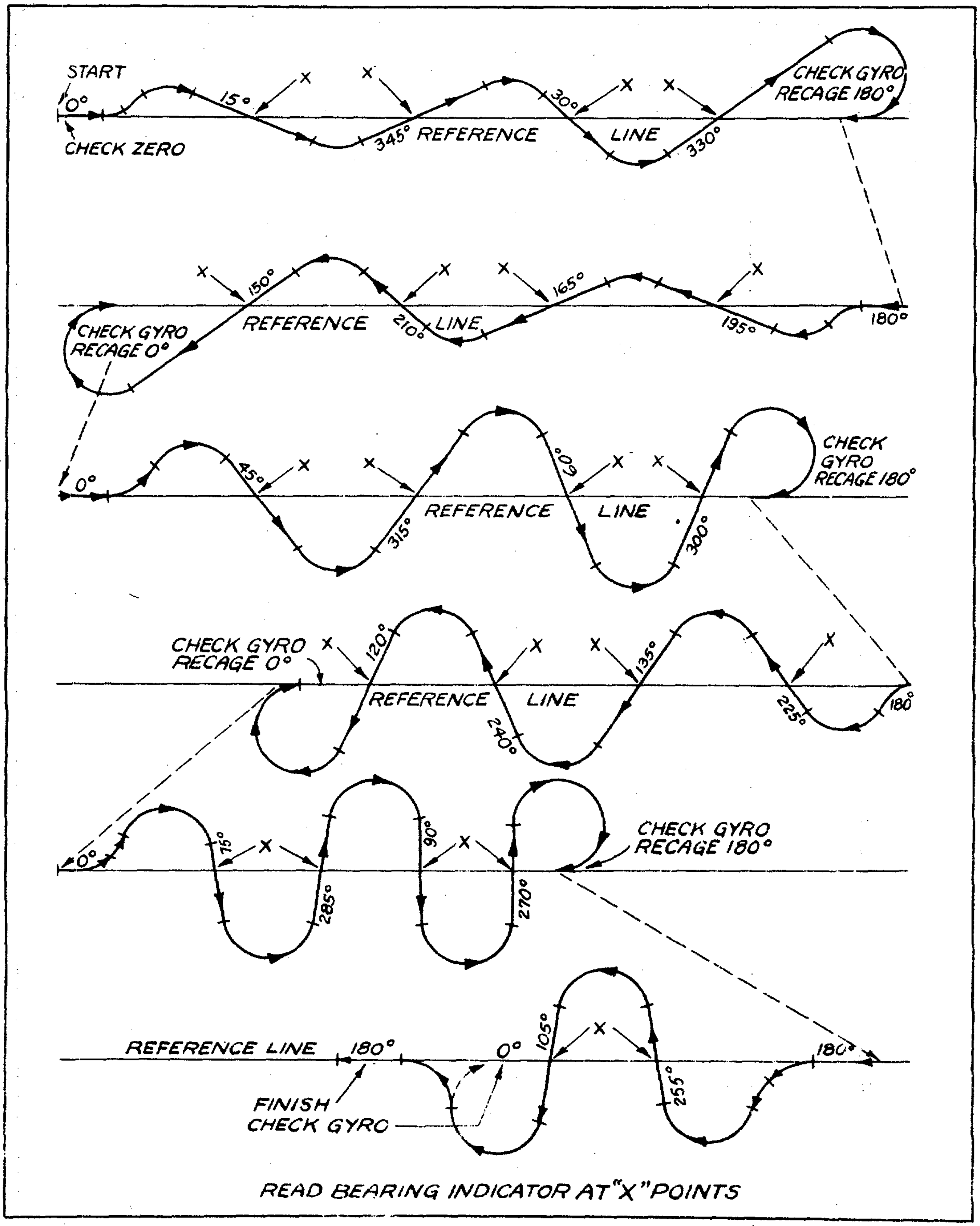


Figure 5-3. Flight Courses for Airborne Calibration of Azimuth Indicator

Gyro Heading	*Actual Relative Bearing*	*Observed Azimuth Indicator Relative Bearing*	*Bearing Correction (True Minus Observed)*
Degrees	*Degrees*	*Degrees*	*Degrees*
15	345		
345	15		
30	330		
330	30		
180	180		
195	165		
165	195		
210	150		
150	210		
◦	◦		
45	315		
315	45		
60	300		
300	60		
180	180		
225	135		
135	225		
240	120		
120	240		
◦	◦		
75	285		
285	75		
90	270		
270	90		
180	180		
255	105		
105	255		
180	180		

Figure 5-4. Data Chart, Gyro Compass Method of Calibration
CONFIDENTIAL

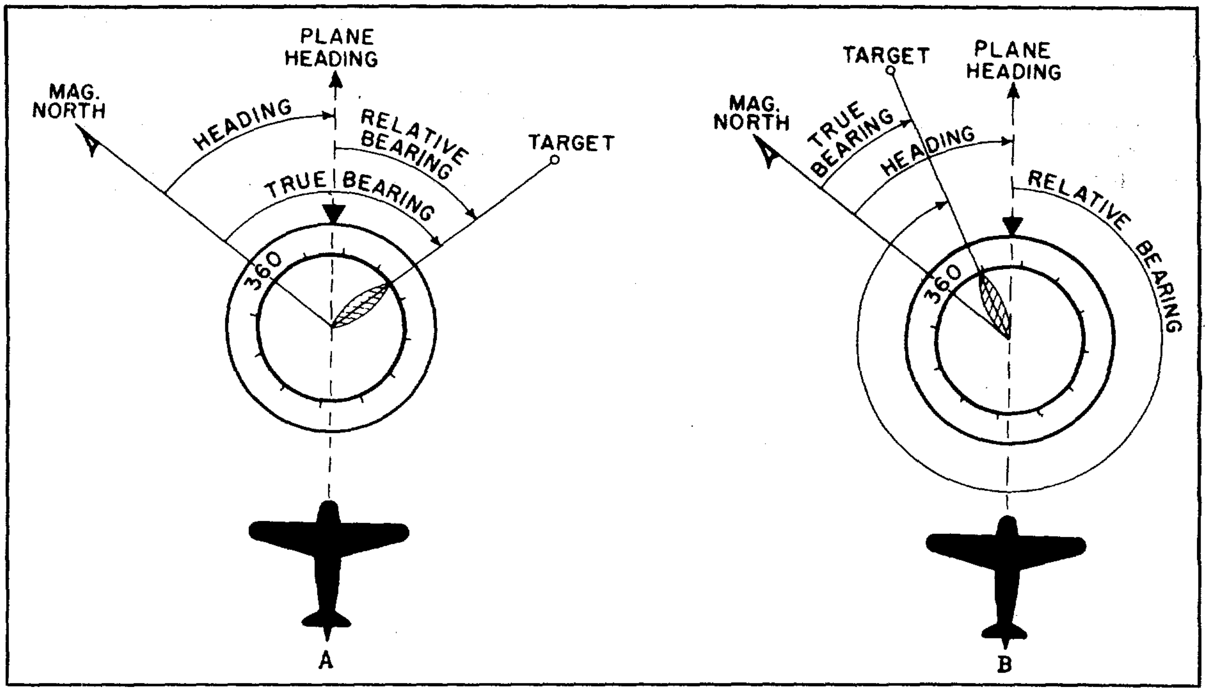


Figure 5-5. Typical Readings of Azimuth Indicator Illustrating Conversion of True Bearings to Relative Bearings

5-26. Turn the aircraft to the left and fly far enough from the reference point to enable the aircraft to be headed with a gyro compass reading that will pass over point A at an actual relative bearing of 270 degrees. While holding the aircraft in level flight, determine the relative bearing of the signal source at the instant the plane is directly over the reference point. Record the reading on a form such as is shown in figure 5-6.

5-27. Now, turn the aircraft to the right and fly far enough away from the signal source so that it may be headed with a gyro compass reading that will pass over point A at an actual relative bearing of 15 degrees. Again holding the aircraft in level flight, determine the relative bearing of the signal source at the instant the plane is directly over the reference point and record the reading on the chart.

5-28. Continue the above procedure until observations have been made for each "Actual Relative Bearing" heading in the chart. Check and recage the gyro compass before each run with 180-degree true relative bearing and recage before the next run. Record all readings on the chart for a permanent calibration record.

5-29. BENCH TESTS.

5-30. PRIMARY POWER REQUIREMENTS. Primary power requirements for Direction Finder Group AN/APA-69 are 26.5-volt dc at approximately three amperes and 115-volt ac, 400 cycles nominal at 64 volt-amperes (320-1760 cps). The torque unit of the azimuth indicator requires an additional source of 115volts ac, 380 to 420 cps at 32 volt-amperes.

5-30A. Direction Finder Group AN/APA-69A, due to power taken from the intercept receiver Radar Set AN/APR-9, requires only 173 volt-amperes at 115 volts (320-1760 cycles per second) from an external source. The 115-volt a-c 400-cycle nominal requirement is 37.4 volt-amperes (with servo rotating). The d-c requirement is 26.5 volts at approximately three amperes.

5-31. TEST EQUIPMENT REQUIRED.

5-32. The Audio Oscillator TS382A/U and the pulse generator Measurements type 79-B listed in table 2-1 are required. The test bench setup, figure 5-8 for Direction Finder Group AN/APA-69 and figure 5-8A for Direction Finder Group AN/APA-69A, is also required, modified as indicated. The autosyn test unit called for in each of the test benches is listed in table 2-1 and the fabrication instructions are given in paragraph 6-25.

5-33. BENCH TEST SETUP.

5-34. For bench testing the equipment, the antenna drive may be top or belly mounted. The antenna should be mounted in the same attitude in the test setup as in the aircraft installation where it will be used.

5-35. A suggested antenna test stand for mounting the may be fabricated from commonly available materials. The cutout in the top is the same as that shown in figure 7-10. It is important that the stand be level and provide clearance for the rotating antennas.

5-36. Mount the drive unit with four 1/4-inch bolts or screws to the test stand or jig, with the knurled collar up or down, as desired. Allow clearance for antenna drive unit is shown in figure 2-2. This stand power cables and coaxial cable leads. Be sure there is sufficient space around the rotating antenna. The antenna should be located about 15 feet minimum from the signal source with no intervening obstructions.

5-37. Connect the three coaxial cable plugs P402, P403, and P404 to their respective receptacles in the

24B

Gyro Heading	*Actual Relative Bearing*	*Azimuth Indicator Bearing*	*Bearing** Correction*
Degrees	Degrees	Degrees	Degrees
X	0		
X-270	270		
X-15	15		
X-285	285		
X-30	30		
X-300	300		
X-45	45		
X-315	315		
X-60	60		
X-330	330		
X-75	75		
X-345	345		
X-90	90		
X-180	180		
X-105	105		
X-195	195		
X-120	120		
X-210	210		
X-135	135		
X-225	225		
X-150	150		
X-240	240		
X-165	165		
X-255	255		
X	0		

*-X should be the magnetic heading of the signal source from Point A.
**-"Actual Relative Bearing" minus "Azimuth Indicator Bearing"

Figure 5-6. Data Chart, Magnetic and Gyro Compass Method of Calibration

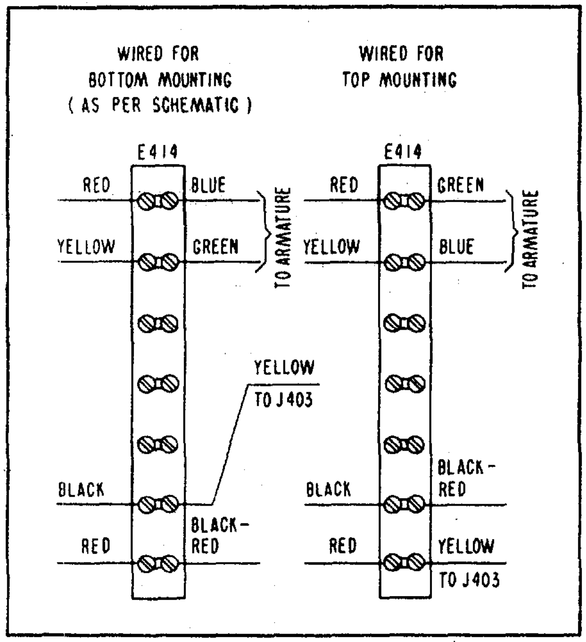


Figure 5-7. Wiring Changes Required for Top Mounting of Antenna Drive TG-8/APA-69

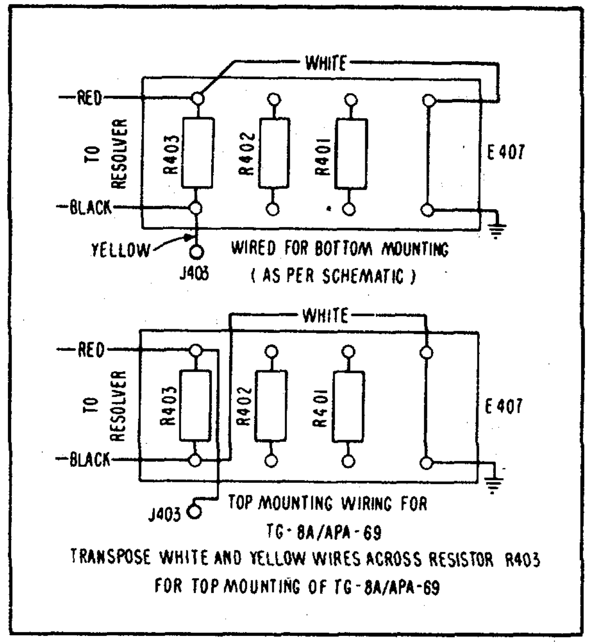


Figure 5-7A. Wiring Changes Required for Top Mounting of Antenna Drive TG-SA/APA-69

drive unit (J402, J403, and J404).. If Antenna Assembly AS-434/APA-69 or AS-435/APA-69 is to be used, set the toggle switch S402 on the drive unit to the "ON" position. If Antenna AS-436/APA-69 is to be used, set switch S402 in the "OFF" position. This insures that there will not be a 180-degree error in the pattern presentation on the indicator even if the polarization switch on Direction Finder Control C527/APA-69 is set in the "VERTICAL" position.

5-38. INTERCONNECTION AND INSTALLATION OF COMPONENTS.

5-39. The Antenna Coupler CU-174/APA-69 is used with either of the lower frequency antennas. Insert the largest (diameter) end through the top of the drive unit until the contact springs clear the flanges. Then push it down firmly and rotate one-quarter turn to lock it in place. With Antenna AS-436/APA-69, the coupler is nor used, and the antenna horn is installed in the same fashion as described above for the coupler.

5-40. Antenna Assembly AS-435/APA-69 or AS-434/APA-69, which cover the frequencies 140-1800 and 1000-5000 megacycles, respectively, are installed as follows: Loosen the knurled nut on the drive shaft by turning it counterclockwise, then carefully place the assembly on the antenna drive so that the keyways on the antenna are aligned with the keys on the drive. Be especially careful not to strike the two-contact relay connector in the drive with the end of the antenna collar when the later is inserted in the drive. Press the antenna down gently until fully engaged. Tighten the knurled nut carefully with the spanner wrench.

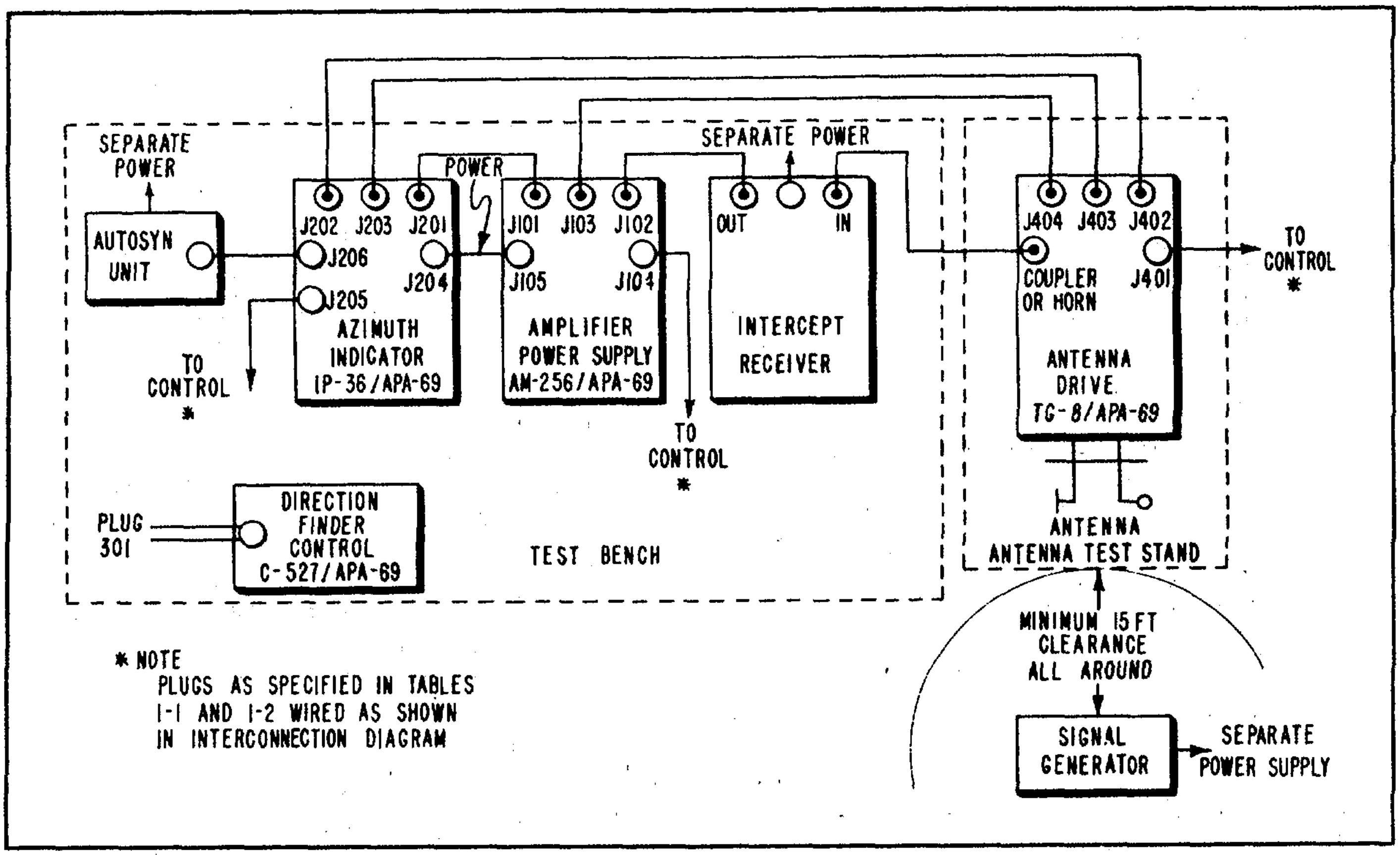


Figure 5-8. Direction Finder Group AN/APA-69, Test Bench for Squadron Maintenance

Revised 15 April 1955

Do not work the antenna assembly around when installing or removing it. It should be pushed straight down or pulled straight up. Rough handling during this process may damage the contacts which feed power to the polarization relay. Do not lift them or turn them by pressure against the antenna elements.

5-41. Antenna Reflector AT-182/APA-69 is used only with Antenna AS-436/APA-69. It is installed in the same manner as the two lower frequency antenna assemblies.

5-42. The Amplifier Power Supply AM-256/APA-69 may be installed at any convenient location near the azimuth indicator. Note that polarity switch S101, located on the amplifier power supply, must be in the correct position depending on the polarity of the video signals from the intercept receiver. Do not connect the video amplifier cable to the intercept receiver.

5-43. Azimuth Indicator IP-36/APA-69 may be installed at any point convenient to the operator. Select a point where the indicator scope tube face is easily visible. The interconnecting cables plug into the rear of the unit.

5-43A. Since Azimuth-Panoramic Indicator IP-81( )/APA-69A includes, among other things, the functions of both Azimuth Indicator IP-36/APA-69 and Amplifier Power Supply AM-256/APA-69, it should be installed at a point convenient to the operator. Select a point where the scope face is visible to the operator and clearance is available for connection of the interconnecting cables. Do not connect the video amplifier cable to the intercept receiver.

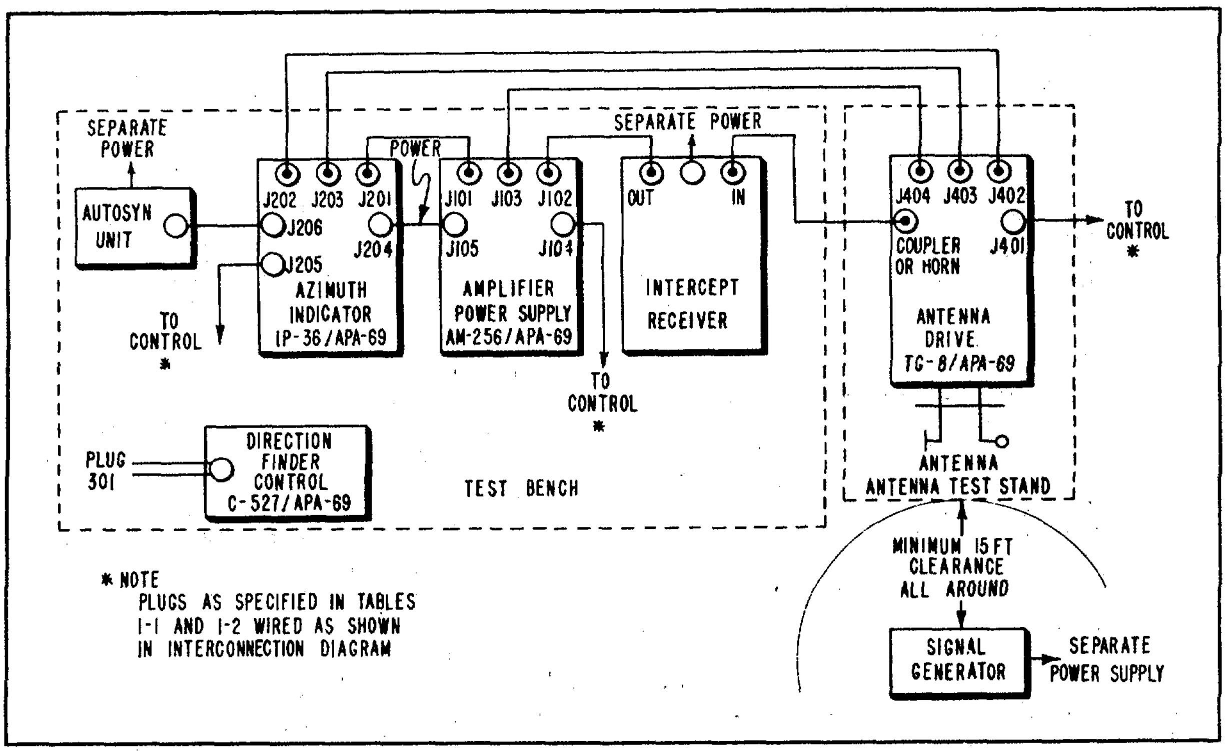


Figure 5-8A. Direction Finder Group AN/APA-69A, rest Bench for Squadron Maintenance

5-44. Direction Finder Control C-527A/APA-69 may be mounted at any convenient point near the azimuth indicator. Only a single multi-contact cable connection is required.

5-45. ADJUSTMENT AND TEST PROCEDURE.

5-46. The pulse generator, Measurements type 79-B specified in table 2-1 of this handbook, must be connected into the test bench. Connect it through the cable left unattached in the test setup (J102 for Direction Finder Group AN/APA-69 or J1008 for Direction Finder Group AN/APA-69A.) Adjust the pulse generator output for a 3-t*usec* pulse with an 800 prf.

5-47. Turn on the equipment with the "POWER" switch on the control panel. Check that the "PAN

DF" switch is in "DF" position. Now turn the "ANTSPEED" control knob fully clockwise so that the rotator will start and spin the antenna.

5-48. The pulse generator will cause a circular or elliptical pattern on the scope. Adjust the level of the generator so as not to overload the amplifier. A radius

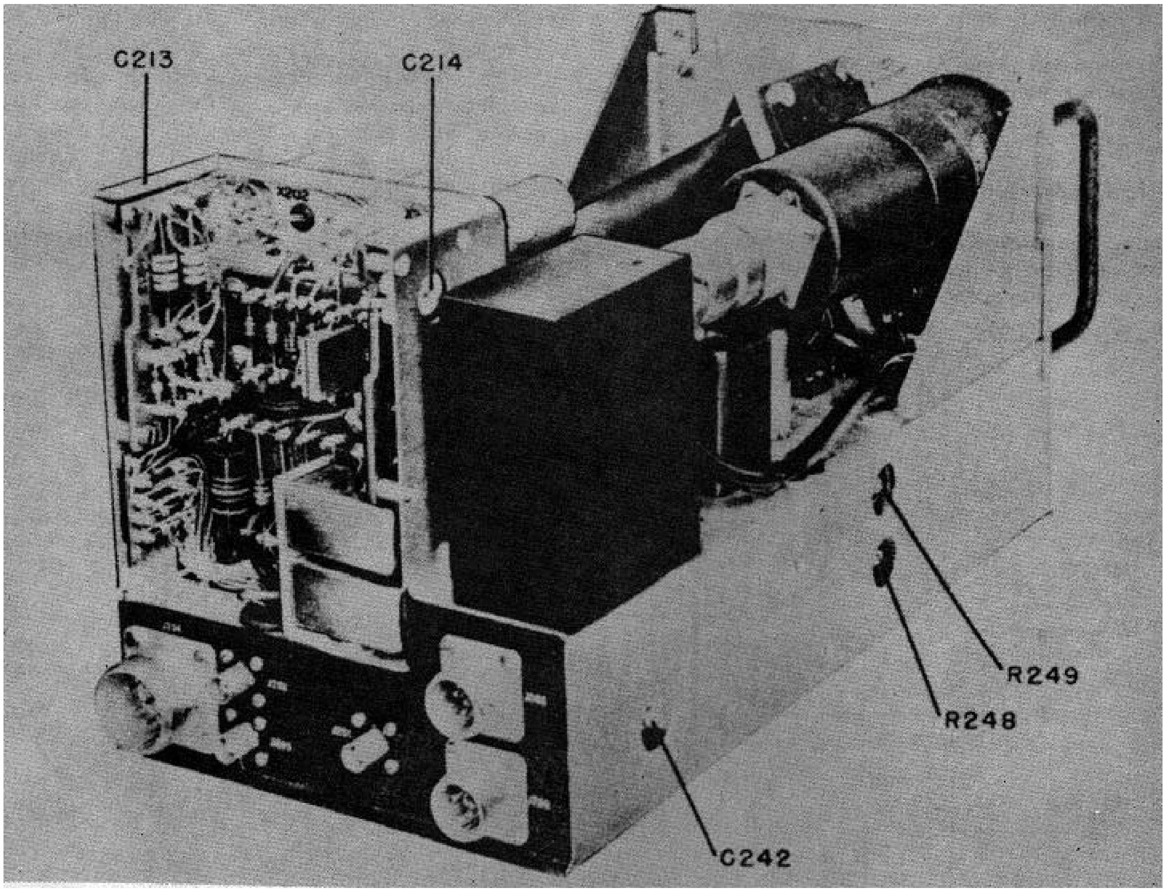


Figure 5-9. Azimuth Indicator IP36/APA69, Interior Control Locations

of about one inch is. a satisfactory deflection. For optimum circularity, it will then be necessary to adjust the "H CENT" and the interacting "V CENT" and "CIRCULARITY" controls found on the indicator in use. Proper adjustment of these controls is evidenced by a full circular sweep with the antenna rotating.

5-49. Now turn the "ANT-SPEED" control on the control panel fully counterclockwise so that the antenna stops rotating. Rotate the antenna by hand to 45, 135, 225, and 315-degree positions, where the presence of phase distortion will be evidenced by a narrow ellipse instead of a straight line. To correct any noticeable phase distortion, the phasing capacitors on the azimuth indicator must be adjusted. These capacitors (C213 and C214) are found on the rear of the Azimuth Indicator IP-36/APA-69. (See figure 5-9.) The corresponding capacitors (C1018 and C1019) for Direction Finder Group AN/APA-69A are found on the top of the Azimuth-Panoramic Indicator IP-81( )/APA-69A. (See figure 5-9A.)

5-50. MECHANICAL ZEROING OF RESOLVER.

5-50A. Disconnect the pulse generator and connect the audio oscillator into the test setup. Use the same cable that was used with the pulse generator. Adjust the audio oscillator for a ten-kilocycle sine-wave output.

5-51. Before zeroing the resolver it will be necessary to know how the Antenna Drive TG-8/APA-69 is to be oriented when mounted in the aircraft in which it is to be installed. Determine which of the engraved marks on the rotating collar will fall opposite the engraved arrow on the fixed collar when the drive is mounted in the aircraft and the horizontal dipole

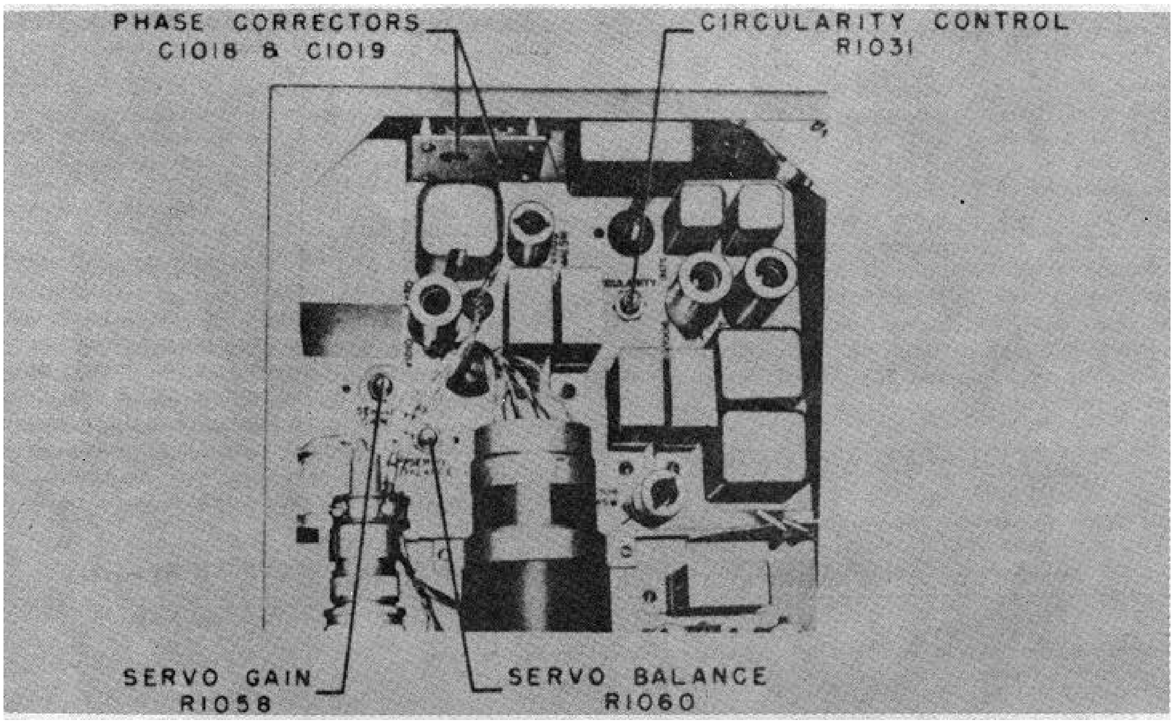


Figure 5-9A. Azimuth-Panoramic Indicator IP-81( )/APA-69A, Interior Control Locations

of the lower frequency antennas or the antenna reflector of the higher frequency antenna is facing forward along the center line (lubber line) of the aircraft. This mark hereafter will be referred to as the zero bearing mark. It should be noted that the two-contact relay connector in the antenna drive is on the rear side of the spindle when the horizontal dipole (or antenna reflector) is facing forward. Rotate the antenna several times by hand in its normal rotational direction and bring it to rest with the zero bearing mark exactly opposite the engraved arrow. This is to eliminate any possible effect of backlash on the alignment. (Since the antenna is driven in one direction only, backlash is no problem after the resolver is properly aligned and locked.) If the antenna is turned too far, do not turn it back, but make another revolution before lining the marks up. (See figure 5-10.)

5-52. With this setting of the drive spindle, the trace on the scope of the azimuth indicator must fall! at the fiducial mark. If the trace does not fall at this mark the following adjustment must be made:

5-53. Remove the cover from Antenna Drive TG-8/ APA-69 by releasing the two Dzus fasteners on the side panel and loosen carefully the three square clamping screws which hold the resolver (B401). Rotate the resolver so that the trace on the indicator points exactly to the fiducial mark on the scope face. Now clamp the resolver carefully back into place and check

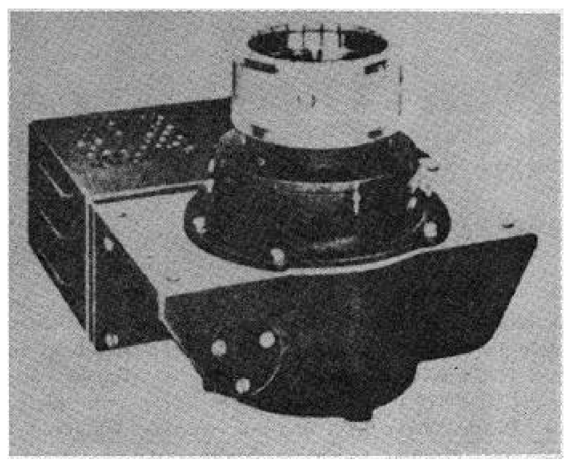


Figure 5-10. Antenna Drive TG-8/APA-69, Collar Marking for Antenna Orientation

the trace again to make sure the adjustment has not slipped. Also check that the drive spindle mark still coincides with the arrow mark. It is more practicable to adjust the resolver mechanically in this manner than by the use of signal generators while the antenna is rotating because of the considerable distortion introduced by reflections in any test bench setup.

5-54. Disconnect the audio oscillator and plug the video input cable from the indicator into the intercept receiver output jack. For Direction Finder Group AN/APA-69 this is the cable from]102. In Direction Finder Group AN/APA-69A tests, this is the cable from J1008 on the indicator. Also connect the "PAN" input cable (J1007) to the receiver. One of the r-f signal generators (suitable to the antenna installed) specified in table 2-1 may be set up as in the test bench (figure 5-8 or figure 5-8A, as applicable), and operation of all components involved checked by switching from horizontal to vertical signals, by changing antennas (and their corresponding test signal generators), and by manipulation of the circuit controls. Normal performance is described in the paragraphs preceding and in table 5-1, preceding the trouble-shooting charts.

5-55. TEST POINT COMPONENT TROUBLE SHOOTING.

5-56. The step-by-step procedure that follows is planned to enable organizational level maintenance technicians to determine that equipment is operating properly after the adjustments covered above, or to isolate a faulty component in its operating position or on a test bench. They require that the components be normally interconnected and supplied with power. For location of test point, see the schematic diagrams, figure 7-1, figure 7-3A, or figure 7-3B, as applicable.

5-57. Table 5-1 shows normal operating performance of Direction Finder Group AN/APA-69. Direction Finder Group AN/APA-69A minimum performance standards are given in table 5-1A.

5-58. If the equipment under test meets the standards set forth in the minimum performance checks it may be assumed that it is satisfactory for service. If the operation is faulty or the equipment has failed, proceed with the test point procedure outlined in table 5-2 or table 5-2A, which will isolate the faulty component. This component may then be removed and replaced with a component known to be in operating condition.

TABLE 5-1. PERFORMANCE STANDARDS (DIRECTION FINDER GROUP AN/APA-69)

Operating Step	*Normal Response*	*Abnormal Response*
All equipment on and in operating position. Incoming signal normal (or provided by signal generator). Compass or autosyn unit connected to azimuth indicator.	Sweep should appear rotating about the center of the scope.	No CRT pattern-refer to steps 2-6 in table 5-2. Spot but no sweep-refer to steps 9-12. Noise flashes, no CRT pattern-antenna contacts not making properly. Intermittent CRT pattern-table 5-2, entire check. Panel lamps not lit-no power to console bus.
Control Panel:		
1. Advance "GAIN"	Trace lengthens, trace over one inch possible, (reset to one inch).	
2. Throw "POLAR" switch	Pattern changes shape.	
3. Advance "ANT SPEED" control	Antenna rotates faster.	
Indicator:		
4. Turn "FOCUS" control	Traces focus and blur.	
5. Turn "INTENSITY" control	Traces brighten.	
6. Operate "H CENT" and "V CENT" knobs	Pattern shifts horizontally and vertically, adjust to start trace at center of scope.	
7. Turn "INT MOD" control	Trace brightens.	
8. Turn autosyn indicators* to 30° positions	Azimuth scale should follow within 1.5 degrees with minimum hunting	Refer to steps 13-15.

*See table 2-1.

TABLE 5-1A. PERFORMANCE STANDARDS (DIRECTION FINDER GROUP AN/APA-69A)

Operating Step	*Normal Response*	*Abnormal Response*
All equipment on and in operating position. Incoming signal normal (or provided by signal generator). Compass or autosyn unit* connected to azimuth indicator.	Sweep should appear rotating about the center of the scope.	No CRT pattern-refer to steps 2-6 in table 5-2A. Spot but no sweep-refer to steps 9-2. Noise flashes, no CRT pattern-antenna contacts not making properly.

*See table 2-1.

TABLE 5-1. PERFORMANCE STANDARDS (DIRECTION FINDER GROUP AN/APA-69A) (Continued)

Operating Step	*Normal Response*	*Abnormal Response*
		Intermittent CRT pattern-table 5-2A, entire check. Panel lamps not lit-no power to console bus.
	D-F OPERATION	
Control Panel: 1. Advance "GAIN"	Trace lengthens, trace over one inch possible (reset to one inch).	
2. Throw "POLAR" switch	Pattern changes shape.	
3. Advance "ANT SPEED" control	Antenna rotates faster.	
Indicator: 4. Turn "FOCUS" control	Traces focus and blur.	
5. Turn "INTENSITY" control	Traces brighten.	
6. Operate "H CENT" and "V CENT" knobs	Pattern shifts horizontally and vertically-adjust to start trace at center of scope.	
7. Turn "INT MOD" control	Trace brightens.	
8. Turn autosyn unit* to 30° positions	Azimuth scale should follow with 1-1/2 degrees with minimum hunting.	Refer to steps 14 and 15 in table 5-2A.
	"PAN" OPERATION	
9. Turn off signal generator. Make necessary adjustments for Radar Set AN/APR-9 as per its handbook of operating instructions. Set "PAN-DF" switch to "PAN". Adjust the "INTENSITY" and "INT. MOD." controls on the indicator.	A horizontal sweep should appear. Adjustment should allow a bright trace with more intensity along the top than along the base line.	Steps 16, 17, and 18 of table 5-2A.
10. Set equipment for sector sweep as per handbook of operating instructions for Radar Set AN/APR-9. Turn signal generator on (allow for warm up).	As the sector sweeping covers the signal generator frequency a signal should appear on the scope face.	Steps 15, 16, and 17 of table 5-2A.
11. Discontinue the sector sweeping and adjust the receiver manually to the signal generator frequency.	The entire scope face should bloom up.	Steps 15, 16, and 17 of table 5-2A.

* See table 2-1

Note

Test points are not provided generally for cable continuity checks. Where any test point procedure indicates a component should be removed, cables involved in the input and output circuits of the components should be checked for good connection and continuity before the component itself is removed.

TABLE 5-2. STEP-BY-STEP PROCEDURE FOR ISOLATING FAULTY COMPONENTS IN OPERATING POSITION (DIRECTION FINDER GROUP AN/APA-69)

Step	Test Point	Test Equipment Control Positions	Direction Finder Group AN/APA-69 Controls	Normal Response	Interpretation of Abnormal Response
			POWER CIRCUITS		
1	14*-pin P of J301	D-c voltmeter 150V scale	All operating equipment	28V dc	Power supply failure to antenna drive.

TABLE 5-2. STEP-BY-STEP PROCEDURE FOR ISOLATING FAULTY COMPONENTS IN OPERATING POSITION (DIRECTION FINDER GROUP AN/APA-69) (Continued)

Step	Test Point	Test Equip-ment Control Positions	Direction Finder Group AN/APA-69 Controls	Normal Response	Interpretation of Abnormal Response
2	1*-pin L of J301	A-c voltmeter 300V scale	All equipment operating	115V ac	Power supply failure to amplifier and indicator.
3	2*-pin C of J104	A-c voltmeter 300V scale	All equipment operating	115V ac	Switch failure-remove Direction Finder Control C-527/APA-69.
4	3*-pin C of J105	A-c voltmeter 300V scale	All equipment operating	115V ac	Open line-remove Amplifier Power -Supply AM-256/APA-69.
5	4*-pin H of J105	D-c voltmeter HV scale	All equipment operating	Positive 350V dc	Faulty indicator plate supply-remove Amplifier Power Supply AM-256/APA-69.
6	5*-pin A of J104	D-c voltmeter 300V scale POS to gnd	All equipment operating	Negative	Faulty bias supply-remove Amplifier Power Supply AM-256/APA-69.
	IF THESE TESTS DO NOT IDENTITY THE FAULTY COMPONENT, PROCEED WITH THE FOLLOWING SIGNAL CIRCUIT TESTS.				
	SIGNAL CIRCUITS				
7	—	Headphones at intercepteceiver	All equipment operating	Audible signal	Intercept receiver failure-(consult service manual for this equipment).
8	6*-J101	Ballentine VTVM #300	All equipment operating. "GAIN" control fully advanced	About 15V to ground	Faulty amplifier section-remove Amplifier Power Supply AM-256/APA-69.
9	7*-J402	Ballentine VTVM #300	All equipment operating. "GAIN" control fully advanced	Minimum 1.5V to ground	Resolver failure (check cables)-remove Antenna Drive TG-8/APA-69.
10	8*-J403	Ballentine VTVM #300	All equipment operating. "GAIN" control fully advanced	Minimum 1.5V to ground	Resolver failure (check cables)-remove Antenna Drive TG-8/APA-69.
11	9*-J202	Ballentine VTVM #300	All equipment operating. "GAIN" control fully advanced	Minimum 1.5V to ground	Faulty coaxial connection to Azimuth Indicator IP-36/APA-69.
12	10*-J203	Ballentine VTVM #300	All equipment operating. "GAIN" control fully advanced	Minimum 1.5V to ground	Faulty coaxial connection to Azimuth Indicator IP-36/APA-69.
	IF THE STEPS FROM 1 TO 12 HAVE NOT INDICATED ANY FAULT, REMOVE THE AZIMUTH INDICATOR IP-36/APA-09. THE ONLY CIRCUITS REMAINING UNCHECKED ARE LOCATED THERE.				
	AZIMUTH INDICATOR CIRCUITS				
13	11*-pin M of-J3l0	A-c voltmeter 300V scale	All equipment operating	115V ac to ground	Power supply failure to torque unit.
14	12*-pin C of J205	A-c voltmeter 300V scale	All equipment operating	115V ac to ground	Switch failure-remove Direction Finder Control C-527/APA-69.
15	13*-pin B of J206	D-c voltmeter 150V scale	All equipment operating	26V ac to ground	Transformer failure-remove Azimuth Indicator IP-36/APA-69.
	IF STEPS 13 TO 15 DO NOT IDENTIFY THE FAULT AFFECTING AZIMUTH DIAL ROTATION, REMOVE THE AZIMUTH INDICATOR IP-36/APA-69 FOR REPAIRS TO THE TORQUE UNIT LOCATED THEREIN.				
16	Substitution of the coupler and cable is the best way to check these components and the only way to check the antennas and antenna reflector. Substitute one antenna for another to determine whether an antenna is at fault (changing signal generators).				

TABLE -2A. STEP-BY-STEP PROCEDURE FOR ISOLATING FAULTY COMPONENTS IN OPERATING POSITION (DIRECTION FINDER GROUP AN/APA-69A).

Step	Test Point	Test Equipment Control Positions	Direction Finder Group AN/APA-69 Controls	Normal Response	Interpretation of Abnormal Response
			POWER CIRCUITS		
1	7 - pins H & J of J 1005	A-c voltmeter 1.5V scale	Equipment on normal control settings	6.3V ac	Intercept receiver failure (consult applicable H.S.I.)
2	1 - pin E of J301	A-c voltmeter 150V scale	Equipment on normal control settings	115V ac	Power supply faulty.
3	2 - pin F of J1001	A-c voltmeter 150V scale	Equipment on normal control settings	115V ac	Remove Direction Finder Control S-527A/APA-69 (check cable to panoramic-azimuth indicator first).
4	3 - pin P of J301	D-c voltmeter	"ANT. SPEED" fully clockwise	28V dc antenna rotates	Power supply faulty.
5	4* - pin H of J401	D-c voltmeter	"AN'. SPEED" fully clockwise	28V dc antenna rotates	If antenna not rotating, but voltage satisfactory, remove Antenna Drive TG-8/APA-69 - if no voltage remove Direction Finder Control C-527A/APA-69.
6	5 - pin K of J1005	D-c voltmeter HV scale	Equipment on normal control settings	300V dc	Failure in plate power from intercept receiver Radar Set AN/APR-9 (see applicable H.S.I.).
7	6 - pin F of J1005	D-c voltmeter 300V scale	Equipment on normal control settings	150V dc	Failure in 150V dc from intercept receiver Radar Ste AN/APR-9 (see applicable H.S.I.).
8	7 - pin M of J301	A-c voltmeter 300V scale	Equipment on normal control settings	115V ac	Power supply failure to torque units. Check 115V 380-420 input.
9	8 -pin C of J1001	A-c voltmeter300V scale	Equipment on normal control settings	115V ac	Switch failure. Remove Direction Finder Control C-527A/APA-69.
10	15*	D-c voltmeter	Operate "PAN DF switch	26.5V dc on DF, no voltage on "PAN"	Open or shorted (as indicated) S303. Remove Direction Finder Control C-527A/APA-69.
	IF THESE TESTS DO NOT IDENTIFY THE FAULTY COMPONENT, PROCEED WITH THE FOLLOWING SIGNAL CIRCUIT TESTS.				
			SIGNAL CIRCUITS		
11		Headphones in jack of intercept receiver -	Equipment operating incoming signal	Audible signal in headphones	Intercept receiver at fault.
12	9 - pin of J1008 output of intercept receiver	VTVM	"GAIN" control on Control Panel C-527A/APA-69 fully clockwise. Signal generator adjusted for 1-in. trace on Azimuth-Panoramic Indicator IP-81( )/APA-69A.	0.3V peak to peak	Intercept receiver at fault (see applicable H.S.I.).

TABLE 5-2A. STEP-BY-STEP PROCEDURE FOR ISOLATING FAULTY COMPONENTS IN OPERATING POSITION (DIRECTION FINDER GROUP AN/APA-69A) (Continued)

Step	Test Point	Test Equipment Control Positions	Direction Finder Group AN/APA-69 Controls	Normal Response	Interpretation of Abnormal Response
			SIGNAL CIRCUITS (Continued)		
13	10 -pin of J1004 input to resolver circuits	VTVM	"GAIN" control on Control Panel C-527A/APA-69 fully clockwise. Signal generator adjusted with 1 -in. trace on Azimuth-Panoramic Indicator IP-81( )/APA-69A.	10V peak to peak	Faulty amplifier section. Remove Azimuth- Panoramic Indicator IP-81( )/APA-69A.
14	1 - pin of J1002 N-S resolver out put	VTVM	Turn antenna to get trace 45° to distribute voltage equally to both stator windings.	0.8V peak to peak	Faulty resolver circuit. Remove Antenna Drive TG-8/APA-69.
15	12 -pin of J1003 E-W	VTVM	Turn antenna to get trace 45° to distribute voltage equally to both stator windings.	0.8V peak to peak	Faulty resolver circuit. Remove Antenna Drive TG-8/APA-69.
			SIGNAL CIRCUITS PANORAMIC SWEEP OPERATION SET "PAN/DF" SWITCH ON PAN		
16	13 - terminal A of J1007	VTVM	All equipment operating - Control Panel C-527A/APA-69 in "PAN" function - Interept receier set to center frequency and switched to narrow band.	2.5V peak to peak	Faulty intercept receiver (see applicable H.S.I.)
17	14 - pin B of J1006	A-c voltmeter	All equipment operating - Control Panel C-527A/APA-69 in "PAN" function - Intercept receiver set to center frequency and switched to narrow band.	26.5V dc nominal	Transformer failure. Remove Azimuth-Panoramic Indicator IP-81( )/APA-69A.
18	16 - pins B and C of J1007	VTVM	All equipment operating - Control Panel C-527A/APA-69 in "PAN" function - Intercept receiver set to center frequency and switched to narrow band.	5V ac and 13V dc respectively	Intercept receiver failure (see applicable H.S.I.).

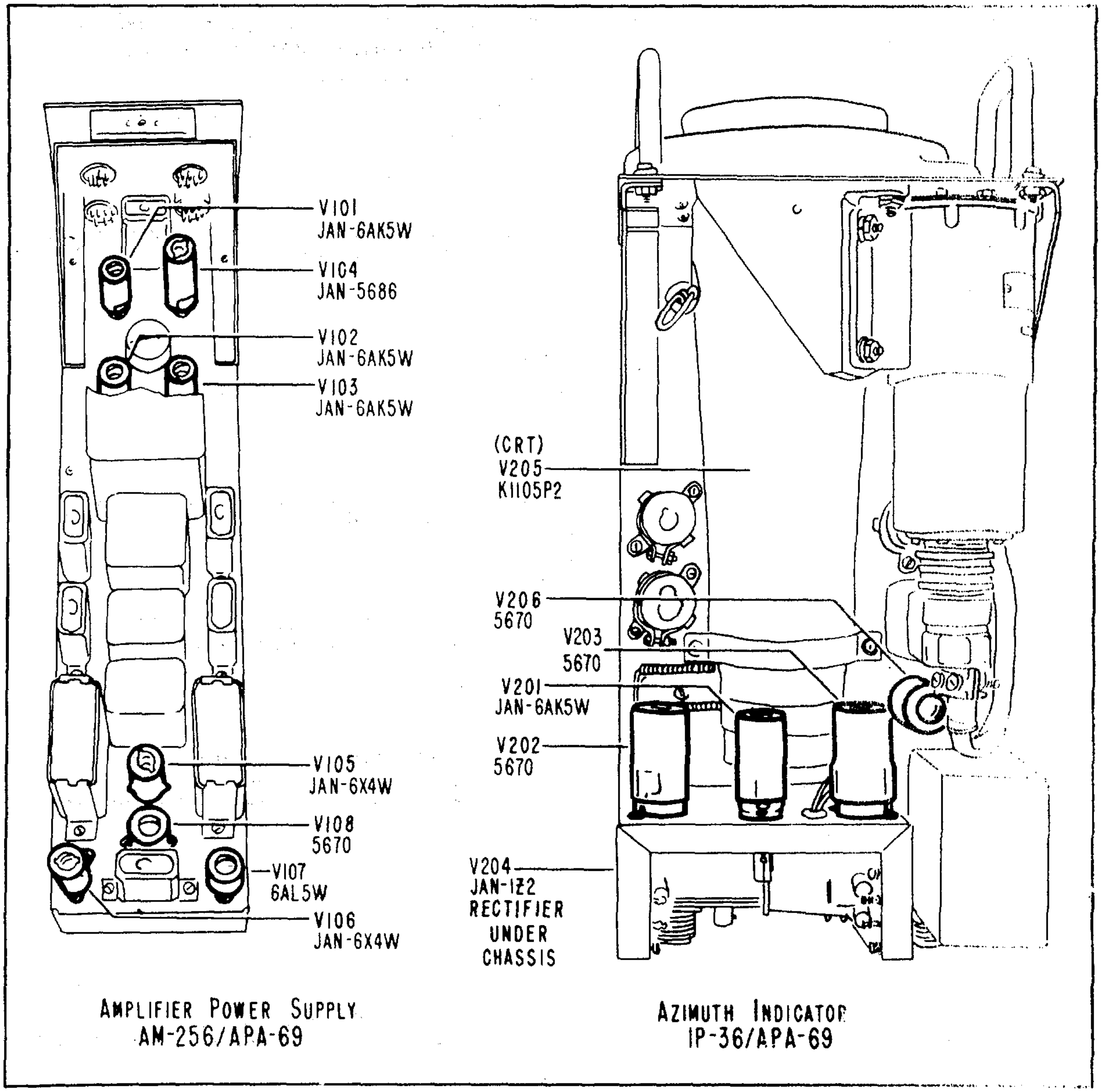


Figure 5-11. Direction Finder Group AN/APA-69, Tube Location Detail

5-59. REPAIRS AND REPLACEMENT.

WARNING

There are potentials of the order of 3000 volts present in this equipment. Use extreme caution when testing or aligning circuits with primary power turned on.

5-60. PILOT LAMPS AND ELECTRON TUBES. If any of the pilot lamps are burned out they may be replaced in the normal manner. The test equipment is available and the capabilities of organizational and operational maintenance personnel are somewhat limited. Therefore, tube replacement is limited to correcting obvious faults, as replacing tubes with burned filaments. If more than one tube is out the fault probably lies in the filament lighting circuits and the component should be turned over to Field and FASRON maintenance personnel.

5-61. Replacement of the high voltage rectifier tube or the cathode-ray tube should not be attempted by

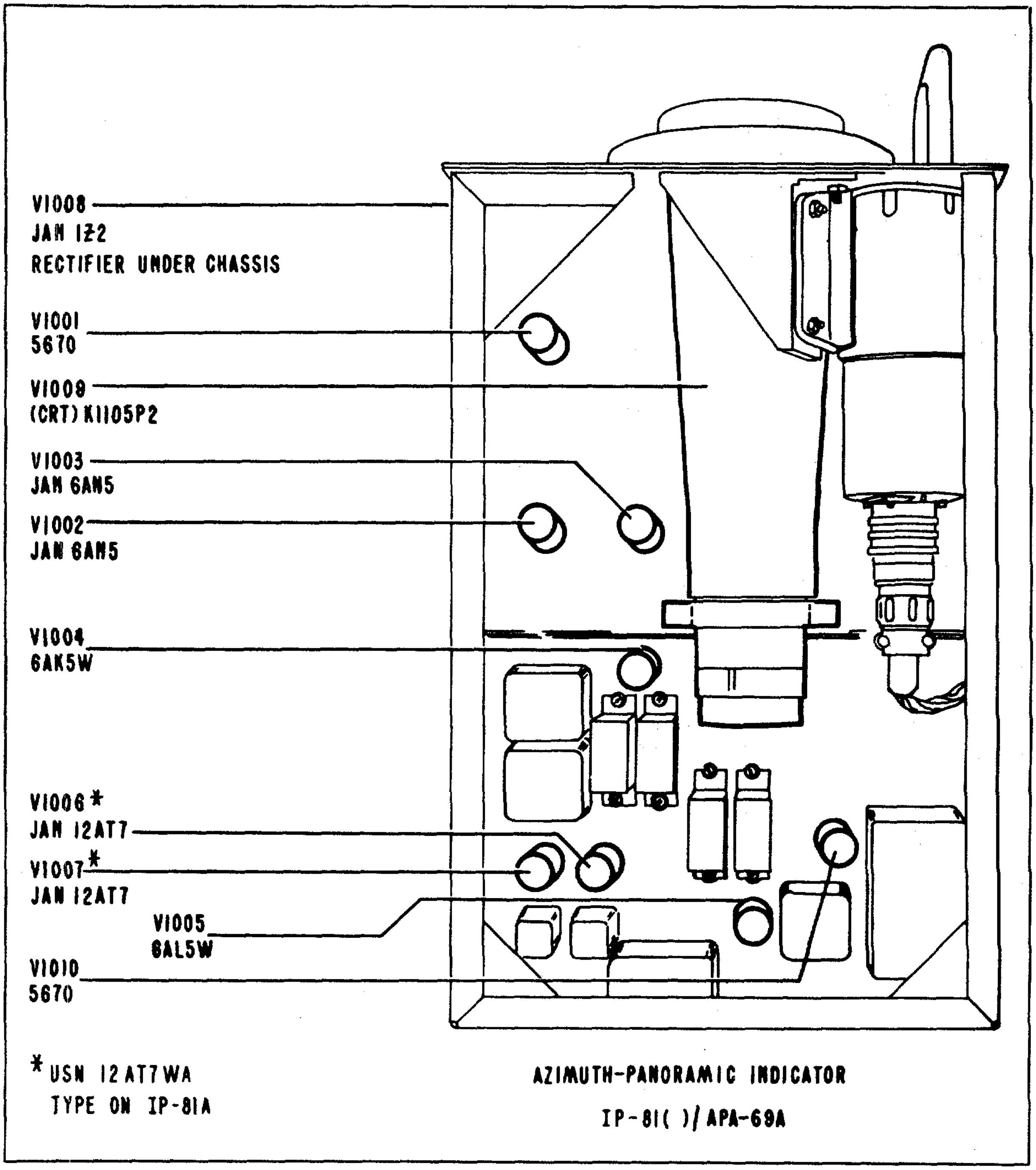


Figure 5-11A. Direction Finder Group AN/APA-69A, Tube Location Detail

squadron personnel. The rest of the tubes are replaced in a normal manner. Figure 5-11 shows tube location for Direction Finder Group AN/APA-69. Tube location for Direction Finder Group AN/APA-69A is shown in figure 5-11A.

5-62. The vertical deflection amplifier tubes and the horizontal deflection amplifier tubes (V202 and V203, respectively, on Azimuth Indicator IP-36/APA-69 and V1006 and V1007, respectively, on Azimuth-Panoramic Indicator IP-81/APA-69A) are dual triode (JAN 12AT7) type. When replacing one of these tubes it may be found that adjustment of the corresponding centering control, on the front panel, will not bring the start of the trace to the center of the cathode-ray tube face. This may be due to the wide differential of plate current in the two triode sections of the tube. If such is the case other 12AT7 tubes should be tried to find one where the plate current in the two halves of the tube is balanced enough to allow the trace to be centered on the cathode-ray tube. Azimuth-Panoramic Indicator IP-81A/APA-69A uses USN 12AT7 WA type tubes in the horizontal and vertical deflection amplifier circuits. These tubes have closer balance between the two sections. For this reason and because of some changes in the balance circuits, it is unnecessary to select tubes. Any USN 12AT7 WA type tube should function satisfactorily.

5-63. TABLE OF INSPECTIONS.

5-64. Periodic inspection schedules given in table 5-3 are arranged for maintaining the equipment mechanically during periods between major (200-hour) inspections and for the interception of mechanical faults before they reach breakdown proportions. After 2000 hours, overhaul is imperative on all components.

5-65. LUBRICATION CHART.

5-66. Table 5-4 indicates the extent of Squadron and FASRON lubrication service on the components of the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A.

TABLE 5-3. INSPECTIONS

	Squadron		*FASRON*
Unit	*Preflight Inspection*	*Daily Inspection*	*200-Hour Inspection*
Azimuth Indicator IP-36/APA-69	Check all plugs and cables. Check mounting screws. Check all clamps and safety wire.	Check knobs and dials for looseness.	Check all tubes except cathode-ray tube. Check cathode-ray tube socket, clamp and anode connector Check chassis for loose nuts, frayed wire or evidence of arcing or overheating.- Blow out dust.
Amplifier Power Supply AM-256/ APA-69	Check all plugs and cables. Check mounting screws. Check all clamps and safety wire.	Check switch S101 for proper polarity setting.	Check all tubes. Check chassis for loose nuts, frayed wire or evidence of overheating or arcing. Blow out dust.
Azimuth-Panoramic Indicator IP-I( )/ APA-69A	Check all external connections, clamps and mountings.	Check for visual damage to all components.	Check all tubes except cathode-ray tube. Check cathode-ray tube socket, clamp, and anode connection. Check chassis for loose nuts, frayed wire or evidence of arcing or overheating. Blow out all dust.
Direction Finder Control C-527A/ APA-69	Check all plugs and cables. Check mounting screws. Check panel lamps. Check position of switch S302.	Check switches for looseness.	Check for overheating. Check for loose nuts, frayed wire. Check panel lights and sockets. Blow out dust.
Antenna Drive TG-8/APA-69	Check all plugs and cables. Check mounting screws.		Check resolver (B401). Check motor brushes. Blow out dust.
Antenna Assemblies AS-434/APA-69 and AS-435/APA-69	Check for loose screws and locking collar.		Inspect for mechanical damage. Check cables and plugs. Check power receptacles.
Antenna AS-436/ APA-69 and Reflector AT-182/ APA-69	Check switch S402 position (on Antenna Drive TG-8/APA-69) (should be "OFF"). Check locking collar.		Inspect for mechanical damage.
Cables and Plugs			Examine both ends for worn or frayed wires. Check coaxial cable for sharp ends.

32B

TABLE 5-4. LUBRICATION CHART

Component	*Part*	*Type of Lubricant*	*Procedure*	*Period of Lubrication*
Antenna Drive TG-8/APA-69	Gears on gear plate, worn and spindle gears	Dow-Corning DC-33 medium grade	Place grease around gears, worm gear and phenolic gear. Do not fill container box. Do not pack.	600 hours
	Worn gear and spindle bearings	DC-33	Grease lightly. Do not pack.	600 hours
	*B402 motor bearings	AN-G-25	Remove end bell and bearing plate and gaskets. Place enough grease on the bearings to cover them. Do not pack the bearings. Keep grease off the commutators.	200 hours
	* Resolver B401	Pioneer #10 oil	Place a few drops on the hearing.	600 hours

* Antenna Drive TG-SA/APA-69 drive motor B402 and resolver B401 both contain sealed bearings that require no lubrication.

SECTION VI
FIELD AND FASRON MAINTENANCE

6-1. GENERAL.
6-2. This section outlines the extent of maintenance and repair permitted to field or FASRON maintenance units, test procedure for isolating faults within a component, and schedules for equipment overhaul.

6-3. BENCH TEST SETUP.
6-4. If the system to be tested is a Direction Finder Group AN/APA-69, set up the test bench shown in figure 6-1. Direction Finder Group AN/APA-69A requires test benches as shown in figures 6-1A and 6-1B for direction finding and panoramic functions respectively.

WARNING

There are potentials of the order of 3000 volts present in this equipment. Use extreme caution when testing or aligning units with the primary power turned on.

6-5. TEST POINT TROUBLE-SHOOTING PROCEDURE.
6-6. TEST BENCH SETUP FOR DIRECTION FINDER GROUP AN/APA-69. The test bench for point-to-point trouble shooting (figure 6-1) requires an oscilloscope type TS-239/U-P, a pulse generator Measurements type 79-B and a fabricated attenuator for attenuation of the signal input level to the generator.
6-7. First fabricate the attenuator from a 1000-ohm carbon resistor and a 100-ohm carbon potentiometer (Allen-Bradley type J or equivalent) to ground. From the arm of the potentiometer, connect a bridge-tested 10: 1 attenuator comprising two carbon resistors with a nominal value of 270 and 30 ohms as shown in the test bench figure. Return both grounds to the outer conductor of a section of type RG-59/U coaxial cable connecting the 1000-ohm resistor to the signal output terminal of the pulse generator. This cable must be less than one foot long and terminated with a BNC plug type UG-260/U to fit the type UG-273/U adapters which are provided with the pulse generator or oscilloscope. From the attenuator, wire another section of type RG-59/U cable not more than six feet long and terminated with a type UG-260/U plug for connecting the attenuated signal into J102 of the amplifier power supply under test. Wire another coaxial lead from the potentiometer arm, terminated with a type UG-260/U plug, for use in the initial pulse lineup and for checking the generator output later as necessary. Keep all wiring in the test jig extremely short. The attenuator may be fixed, as convenient, near the pulse generator.
6-8. INITIAL ADJUSTMENTS. In order to establish the output from the attenuator at 0.1 volt, connect the cable from the potentiometer arm to the signal input terminal of the oscilloscope. If the more conveniently measured level of one volt is established here, then the output through the 10:1 attenuator section will be 0.1 volt as desired.

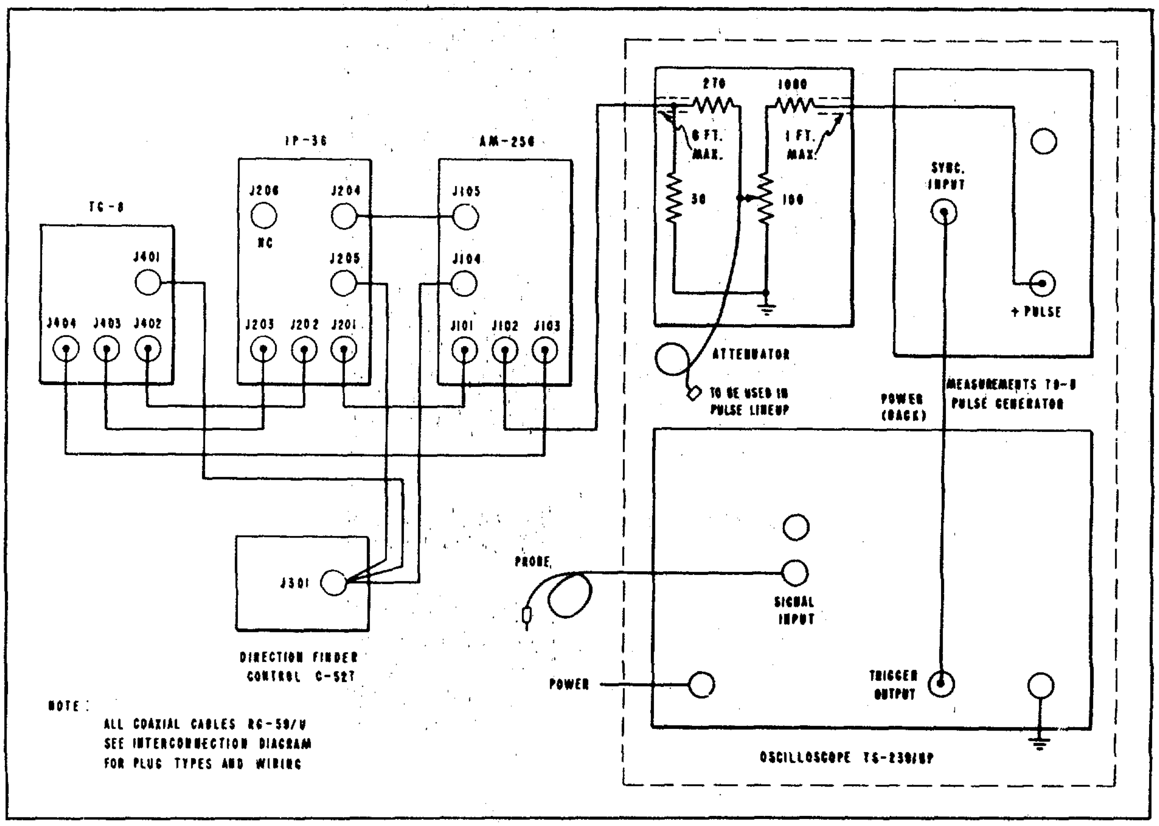


Figure 6-1. Direction Finder Group AN/APA69, Test Bench for Waveform Test Point Trouble Shooting

a. Connect the oscilloscope "TRIGGER OUTPUT" to the pulse generator "SYNC INPUT".

b. Set "TRIGGER RATE" to 800 on the oscilloscope.

c. Set "SYNC" switch (lower right) to "INTERNAL TRIGGER".

d. Adjust the "FREQUENCY" dial on the pulse generator to give the best pulse trace on the oscilloscope screen (this has been found to vary, often, from the expected 800 prf setting).

e. Set the "PULSE WIDTH" dial on the pulse generator to three microseconds.

f. Adjust the oscilloscope scale illumination to readable brilliance on the scope glass.

g. Set the "MARKER INTERVALS" switch to one microsecond by the upper right control on the oscilloscope.

h. Set the "SWEEP" rate at 10 microseconds.

i. Set "SWEEP DELAY" at "OUT".

i. Bring the trace onto the horizontal line with the "VERTICAL POSITIONING" control.

k. Adjust the "FINE SWEEP" control until ten microsecond marks exactly cover one large section of the scale between the vertical lines. This makes each scale division a half-microsecond unit. (If this adjustment is not possible while the pulse is on the screen, disconnect temporarily the line from the attenuator potentiometer.) The pulse may now be adjusted to exactly three microseconds at 90 per cent amplitude by varying the "PULSE WIDTH" control of the generator while watching the scope trace.

l. Now adjust the potentiometer on the test jig to deliver a calibrated one-volt signal to the oscilloscope. Calibration procedure will be found in the manual on operation of the Oscilloscope TS-239/UP.

m. After this calibration, disconnect the lead from the arm of the 100-ohm potentiometer to the oscilloscope. This lead will not be used again except to check the voltage calibration and generator output whenever it becomes necessary.

6-9. The oscilloscope test bench is now ready to use in test point checking of the Direction Finder Group

AN/APA-69 as assembled in operating order. Components should be connected and supplied with power as in the test bench figure (figure 6-1).: Turn on the equipment except for the antenna drive, which should be turned off by rotating the "ANT. SPEED" control fully counterclockwise. Set switch S101 for positive pulse input. Connect the pulse generator output (through the attenuator) into J102 of the amplifier power supply and adjust the "GAIN" control of the Direction Finder Control C-527/APAA69 to give a calibrated pulse of 0.5 volt through a probe on the plate of video amplifier V101. (This is the "GAIN" level normally required to cause a trace one inch long on the azimuth indicator dial.. Since this bench is established for maintenance work, it is to be assumed that a fault in the circuits between these points will have affected this normally expected result.)

6-10. After the adjustment of the direction finder "GAIN" control, place the probe on the grid of V101 to read the input pulse (which has been established as 0.1 volt) and move the leading edge of the pulse by means of the "HORIZONTAL POSITIONING" control over to the first large mark to the left of the left vertical line. Once set, this control should not be used again and internal delay may then be read on the horizontal scale at one-half microsecond per scale unit.

6-11. TEST POINT WAVEFORM AND VOLTAGE LEVEL ANALYSIS. Waveforms and voltage levels may now be compared with normal by reference to tables 6-1 and 6-2.

Note

Do not use the attenuating probe for these tests. Use an ordinary oscilloscope probe.

TABLE 6-1. WAVEFORM TESTS ON AMPLIFIER POWER SUPPLY AM-256/APA-69

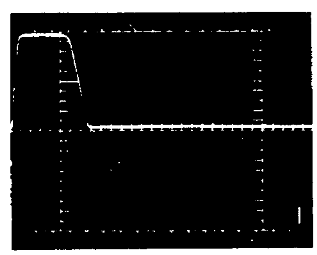
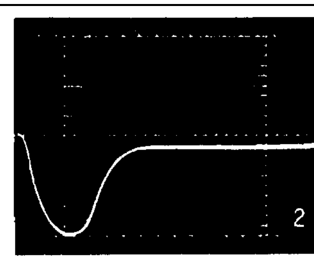
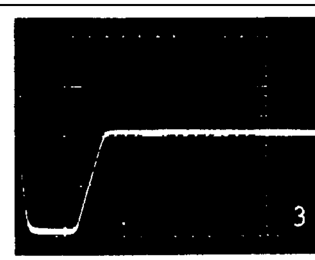
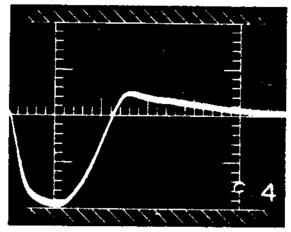
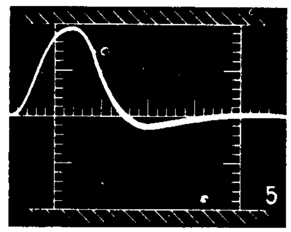
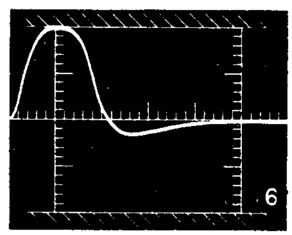
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/ APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
1	A-J102	Oscilloscope type TS-239/UP and pulse generator Measurement type 79-B: 800 prf trigger 3 microseconds "MULTIPLIER" x 3 "SWEEP" 10 micro-seconds Scale bright "MARKER INT." off.	"GAIN" as in para-graph 6-9		Calibrated voltage 0.1 volt input - error in setting up equipment or proper connections will cause variations - recheck.
2	B-plate pin of 5 video amplifier V101	Same as 1	Same as 1		Calibrated voltage 0.5 volt.
3	C-cathode pin 8 of pulse stretcher V108	Same as 1	Same as 1		Calibrated voltage about 0.45 volt - variation indicates failure of cathode follower V108 circuits, including bias resistors R134 and R133.

TABLE 6-1. WAVEFORM TESTS ON AMPLIFIER POWER SUPPLY AM-256/APA-69 (Continued)

Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/ APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
4	D-input end of capacitor C109	Same as 1	Same as 1		Calibrated voltage about 0.4 volt - elongated pulse with recovery as shown - variation indicates faulty pulse stretcher components.
5	E-plate pin of 5 video amplifier V103	Same as 1 except "MULTIPLIER" x 100	Same as 1		Calibrated voltage 15 volts ±30 percent - variation indicates faulty V103 circuits, including bias circuit.
6	F-J101 or cathode pin of cathode follower V104	Same as 5	Same as 1		Calibrated voltage 10 volts ±30 percent - variation indicates faulty V104 circuits, including bias circuit.

6-11A. TEST BENCH SETUP FOR DIRECTION FINDER GROUP AN/APA-69A. This test setup requires two slightly different arrangements in order to test both the direction finding and panoramic functions. The DF test bench is shown in figure 6-1A. The PAN setup is as shown in figure 6-1B.

6-11B. The DF test bench requires an oscilloscope, type TS-238/UP, a pulse generator, Measurements Corp. type 79B and a 100-ohm potentiometer connected as shown. If power is taken from an external source instead of the AN/APR-9, wire a blank plug and cable to replace plug P1005 from the intercept receiver.

6-11C. The PAN test bench requires the same type TS-239/UP oscilloscope, a type T3-382A/U audio oscillator and the AN/APR-9 set. If power is taken from an external source instead of the AN/APR-9, wire up a blank plug to replace plug P1005 from the intercept receiver.

6-11D. Use a paper blocking capacitor of 0.1 mf or more between the test probe and test points. This applies both to the calibrated oscilloscope probe and the standard probe. The capacitor prevents the d-c resistance of the oscilloscope input circuits from disturbing the bias of the indicator under test.

6-11E. DF TEST. In order to establish a one-volt input level to J1008 of Azimuth-Panoramic Indicator IP-81( )/APA-69A, connect a cable from the variable arm of the potentiometer to the "SIGNAL INPUT" terminal of the oscilloscope and proceed as follows:

a. Connect oscilloscope "TRIGGER OUTPUT" to pulse generator "SYNC. INPUT".

b. Set "TRIGGER RATE" to 800 on oscilloscope.

c. Set "SYNCH." (lower right) to "INTERNAL TRIGGER"

d. Adjust "FREQUENCY" dial on pulse generator to give best pulse trace on oscilloscope. (This may vary from the expected 800 prf setting.)

e. Set the "PULSE WIDTH" dial on the pulse generator to three microseconds.

f. Adjust oscilloscope scale illumination to readable brilliance on face of the glass.

g. Set the "MARKER INTERVALS" switch to one microsecond using the upper right-hand control on the oscilloscope.

h. Set the "SWEEP" rate to 10 microseconds.

i. Set "SWEEP DELAY" on "OUT".

j. Adjust the trace on the horizontal line with the "VERTICAL POSITIONING" control.

k. Adjust "FINE SWEEP" control until ten microsecond marks exactly cover one large section of the scale between the vertical lines. This makes each scale division equal a half-microsecond unit. (If this adjustment is not possible while the pulse is on the screen, disconnect temporarily the lead from the attenuator potentiometer.) The pulse may now be adjusted to exactly three microseconds at 90 percent amplitude by varying the "PULSE WIDTH" control of the generator while watching the scope trace.

l. Now, adjust the potentiometer on the test jig to deliver a calibrated one-volt signal on the oscilloscope. Calibration procedure will be found in the handbook of operation of Oscilloscope *TS-238/UP.*

m. After this calibration, disconnect the lead from the arm of the 100-ohm potentiometer to the oscilloscope. This lead will not be used again except to check the voltage calibration and generator output whenever it becomes necessary.

n. Turn on the equipment making sure that the antenna drive is off with "ANT. SPEED" control fully counterclockwise. Connect pulse generator output through the 100-ohm potentiometer into J1008 of the indicator and adjust "GAIN" of Control C-527A/APA-69A to give a one-inch trace on the indicator tube face. Place probe of oscilloscope on J1008 (test point A) which was established as one volt. Move leading edge of the pulse, by means of the "HORIZONTAL POSITIONING" control of the oscilloscope, over to the first large mark to the left of the left-hand vertical line. Once set, this control

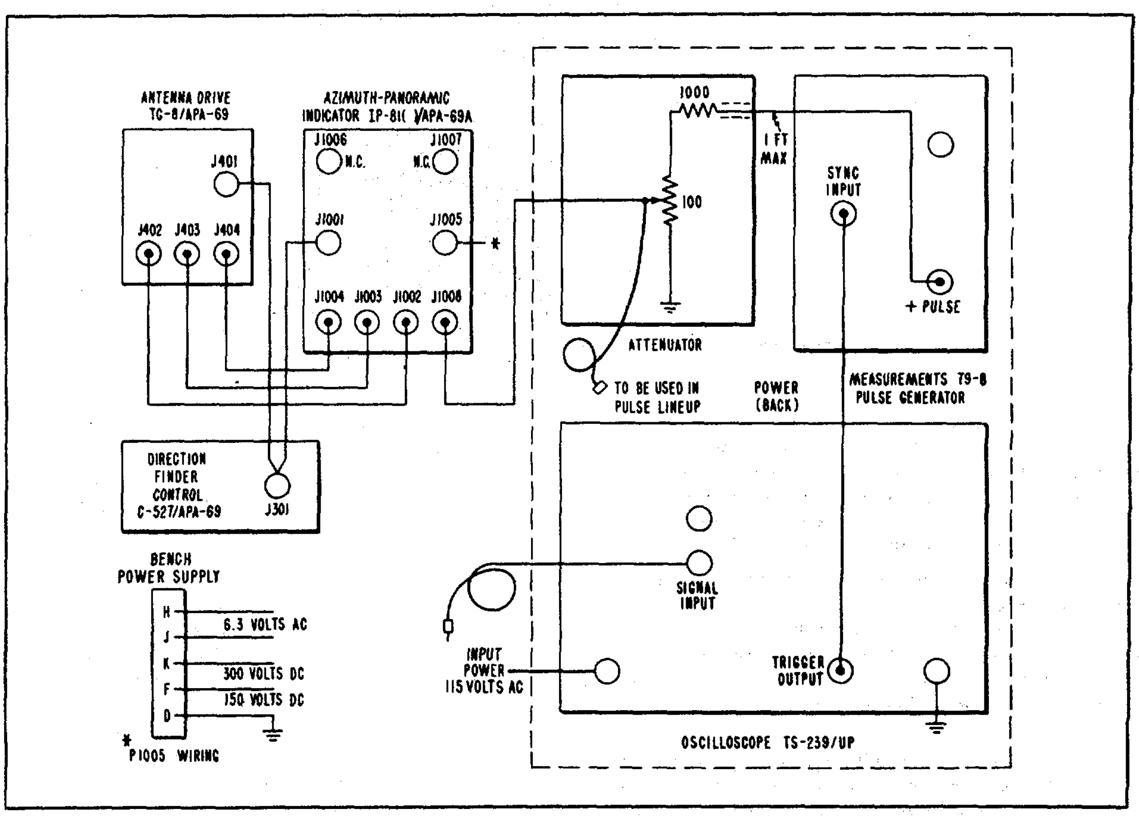


Figure 6-1A. Direction Finder Group AN/APA-69A, Test Bench for Waveform Test Point Trouble Shooting in DF Position

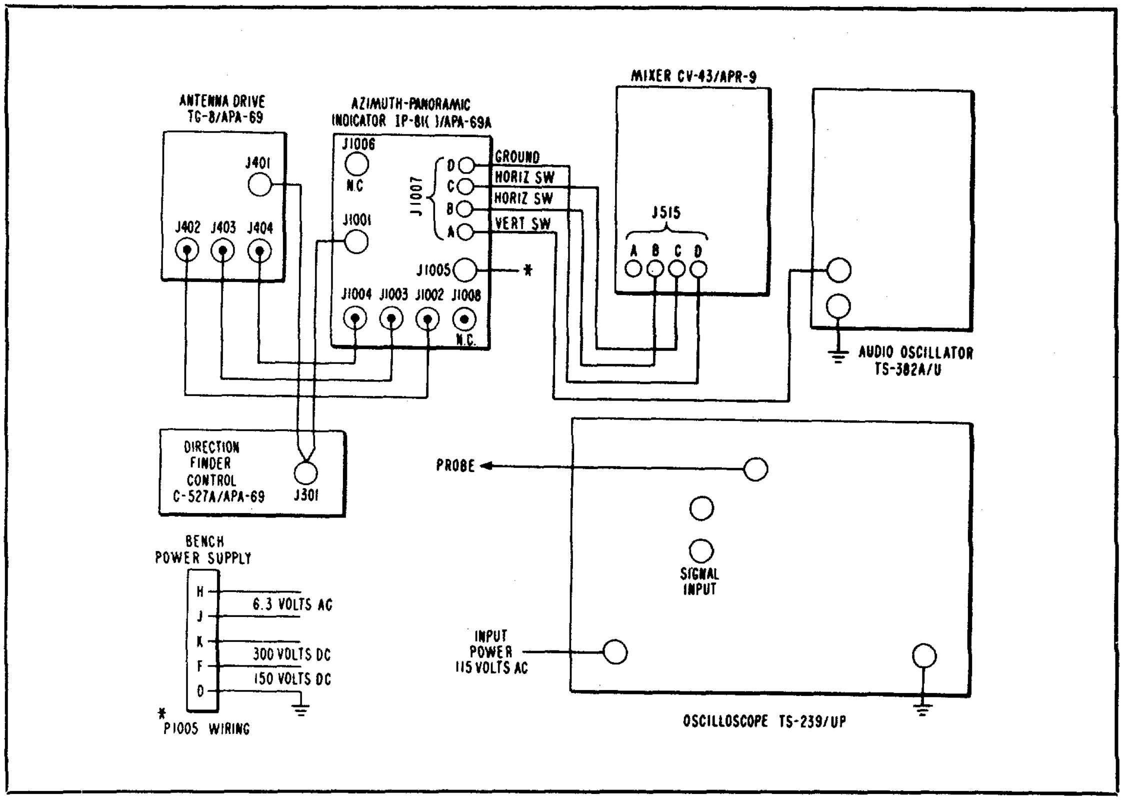


Figure 6-1B. Direction Finder Group AN/APA69A, Test Bench for Waveform Test Point Trouble Shooting in PAN Position

should not be disturbed and internal delay may then be read on She horizontal scale at one-half micro-second per scale unit.

Note

Do not use the attenuating probe supplied with the Oscilloscope TS-239/UP in making test steps 1 through 11. Use an ordinary probe for these tests.

6-11F. TEST POINT WAVEFORM AND VOLTAGE LEVEL ANALYSIS. For DF operation, compare the waveforms and voltage levels given in Table 6-3, steps 1 through 11 inclusive.

6-11G. PAN TESTS. The tests for the "PAN" functions are divided into vertical and horizontal measurements. Use the test bench setup as shown in figure 6-1B.

6-11H. For the vertical tests perform the following:

a. Connect output of audio oscillator TS-382A/U to pin A of J1007.

b. Set frequency of audio oscillator to 5 kc and adjust its output to give a one-inch vertical trace on Azimuth-Panoramic Indicator IP-81( )/APA-69A.

c. Set controls of oscilloscope as follows:

1. "TRIGGER"-any position.
2. "SWEEP TIME (COARSE)"-100 microseconds.
3. "SYNCH. SELECTOR"-signal position.
4. "MARKER INTERVALS"-OFF.
5. "MULTIPLIER"-30 for first step.
6. "SYNCH. VOLTAGE"-Adjust for stable pattern.

d. Calibrate the oscilloscope and measure peak-to peak voltages using the procedure described in the operating handbook for the oscilloscope. Waveforms and voltages may then be compared with those shown in Table 6-3, steps 12 through 16.

6-11I. For the horizontal tests, use the following procedure and use the probe calibrated for 10:1 attenuation ratio which is supplied with Oscilloscope TS-239/U. Be sure probe is calibrated for 10:1 ratio and correct measurements as read to include this attenuation. Measure peak-to-peak voltage at test points S and R to compare with those taken in steps 17 and 18 of Table 6-3.

a. Set "SWEEP TIME" to 10,000 micro-seconds.

b. Set "SYNCH. SELECTOR" to signal position.

c. "TRIGGER RATE"-any position.

d. "MULTIPLIER"-as required to measure voltage.

6-12. CIRCUIT BREAKDOWN OF DIRECTION FINDER GROUP AN/APA-69.

6-13. For trouble-shooting continuity checks and for signal and voltage tracing, Direction Finder Group AN/APA-69 may be broken down into a number of separate circuits. The following power circuits may be isolated: azimuth indicator plate power supply, amplifier plate power supply, indicator tube HV power supply, and grid bias voltage. Signal voltage

TABLE 6-2. WAVEFORM TESTS ON AZIMUTH INDICATOR IP-36/APA-69

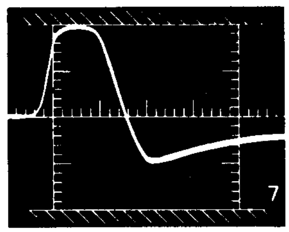
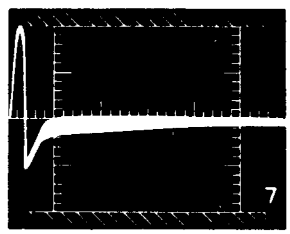
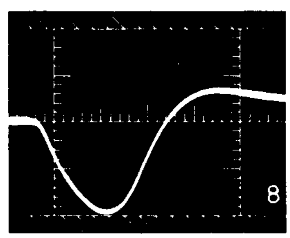
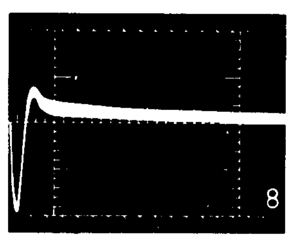
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
7	G-grid pin 1 of intensifier V201	Same as 1 except "SWEEP" switched from 10 to 100 for second picture and "MULTIPLIER" x 1	Same as 1 Also "INT. MOD." Set fully counter clockwise	 	Calibrated voltage less than 0.2 volts - variation indicates faulty "INT. MOD." circuit or component connections - vary "INT. MOD." carefully to observe increasing signal, which should rise sharply - 100 µsec (lower) picture shows sharp pulse with long recovery.
8	M-plate pin 5 of intensifier V201	Same as 7 except "MULTIPLIER" x 30	Same as 7	 	Calibrated voltage about 7 volts - variation indicates failure of V201 circuits - vary "INT. MOD." as in preceding step - 100 µsec (lower) picture shows sharp pulse with long recovery.

TABLE 6-2. WAVEFORM TESTS ON AZIMUTH INDICATOR IP-36/APA-69 (Continued)

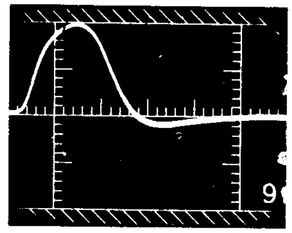
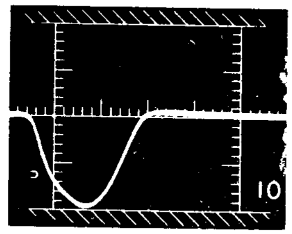
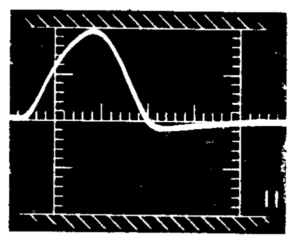
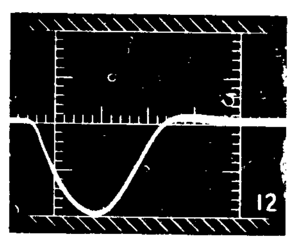
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
9	H-plate end of resistor R213	Same as 7 except "MULTIPLIER" x 100	Same as 7 Rotate antenna drive by hand to give highest scope trace		Calibrated voltage 24-45 volts - variation indicates failure of coupling cables, resolver, or one side of V202 (narrow fault by applying test step 10).
10	J-plate end of resistor R 214	Same as 9	Same as 9. Do not move antenna drive		Calibrated voltage 24-45 volts. If both sides are faulty, check resolver and T-201 - if only one side is faulty, check indicated circuits and tube V202.
NOTE Observe that one or the other side of both the horizontal and vertical deflections amplifiers will give a higher reading than the other half. This is inherent in the tube and does not indicate a faulty circuit. The voltages of the horizontal deflection amplifier will also be observed to have a higher range in value than the vertical deflection amplifier, owing to the fact that the deflection sensitivity is less for the horizontal than for the vertical plates of V205.					
11	K-plate end of resistor R225	Same as 9	Same as 7 Rotate antenna drive 90° degrees by hand to give highest scope trace		Calibrated voltage 30-55 volts - variation indicates faulty resolver, coupling cables, or one side of V203 - (as above, narrow fault by applying test step 12).
12	L-plate end of resistor R226	Same as 9	Same as 11 Do not move antenna drive		Calibrated voltage 30-55 volts - notes and interpretations of step 10 apply here to T202 and V203 circuits.

TABLE 63. WAVEFORM TEST ON AZIMUTH PANORAMIC INDICATOR IP-81( )/APA-69A

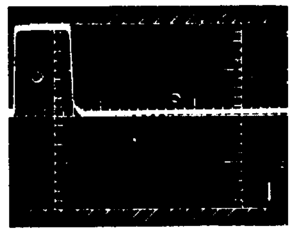
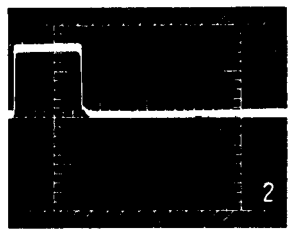
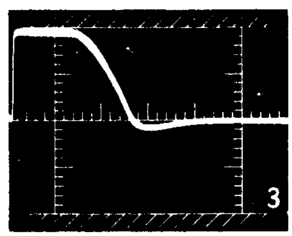
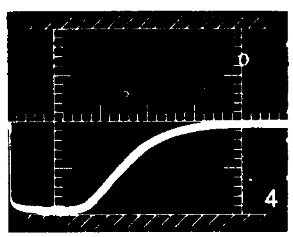
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/ APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
1	A-J1008 video input	Oscilloscope type TS-239/UP and pulse generator Measurements type 7-B:800 prf trigger 3 micro-second pulse width "MULTIPLIER" x 10 µsec. - Scale bright "MARKER INT" off.	"GAIN" as in para-graph 6-9		Calibrated voltage 1.0 volt - error in setting up. Equipment will cause variations - recheck.
2	B-CR1002 Input to pulse stretcher	Same as 1 except x 3 multiplier	Same as 1		Calibrated voltage 0.8 volts peak.
3	C-C1006 output of pulse stretcher	Same as 1 except x 3 multiplier	Same as 1		Calibrated voltage 0.78 volts peak 4 µsec pulse. Variation indicates faulty pulse stretcher.
4	D-V1001B plate	Same as 1	Same as 1		Calibrated voltage 2.5 volts - 4-2 µsec pulse - Variation indicates faulty amplifier circuit.

TABLE 6-3. WAVE-FORM TEST ON AZIMUTH PANORAMIC INDICATOR IP-I1( )/APA-69A (Continued)

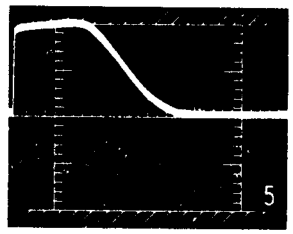
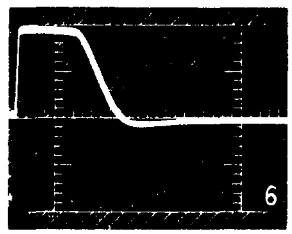
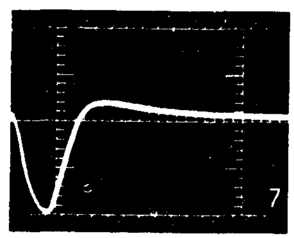
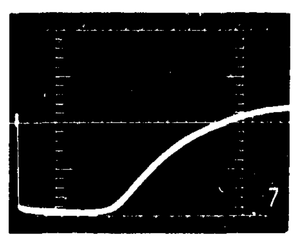
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/ APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
5	E-V1002 plate, taken at high side of C1010	Same as 1 except x 100 multiplier	Same as 1		Calibrated voltage 14.5 volts peak 4.5 µsec. Pulse. Variation indicates faulty amplifier circuitry.-
6	F-J1004 Output of cathode follower	Same as 1 except x 100 multiplier	Same as 1		Calibrated voltage 12.0 volts peak - 4 µsec. Pulse. Variation indicates V1003 circuitry.
7	G-R1020 variable tap - taken at low side of C1031	Same as 1 except "SWEEP" switched from 10 to 100 for second picture - x 300 multiplier	Same as 1 "INT MOD" set fully clockwis e	 	Calibrated voltage 57.0 volts peak - 6 µsec. Pulse. Variation indicates faulty "INT MOD" circuit or connections. Vary "INT MOD" carefully, signal should rise and fall sharply - 100 µsec. (lower) picture shows sharp pulse with long recovery.

TABLE 6-3. WAVEFORM TEST ON AZIMUTH PANORAMIC INDICATOR IP-81( )/APA-69A (Continued)

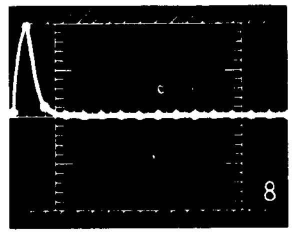
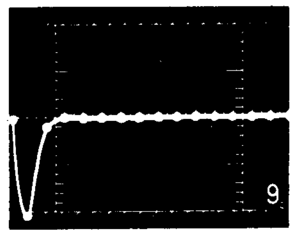
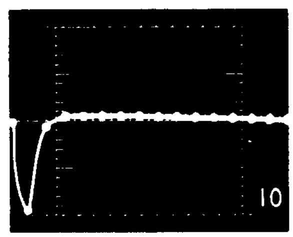
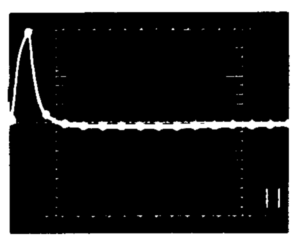
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/ APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
8	H-V1006A plate vertical deflection amplifier	Same as 1 except marker interval on 10-"SWEEP" on 100. Each interval equals 10 µsec. X 300 multipler.	Same as 1 except antenna drive adjusted for maximum output.		Calibrated voltage 33.0 volts peak - 5 µsec pulse. Variation indicates faulty resolver, cabling, or V1006A. See step 9.
9	J-V1006B plate of vertical deflection amplifier	Same as 8	Same as 8		Calibrated voltage 39.0 volts peak - 5 µsec pulse. If both sides are faulty, check resolver and T1001. If only one side is faulty, check indicated circuits and tube V1006.
10	K-V1007A plate horizontal deflection amplifier	Same as 8	Same as 1 except antenna drive adjusted for maximum output		Calibrated voltage 45 volts peak - 5 µsec pulse. Variation indicates faulty resolver, cabling, or V1007A. See step 11.
11	L-V1007B plate horizontal deflection amplifier	Same as 8	Same as 10		Calibrated voltage 48.0 volts peak - 5 µsec pulse. If both sides are faulty, check resolver and T1002. If only one side is faulty, check indicated circuits and tube V1007.

TABLE 6-3. WAVEFORM TEST ON AZIMUTH PANORAMIC INDICATOR IP-81( )/APA-69A (Continued)

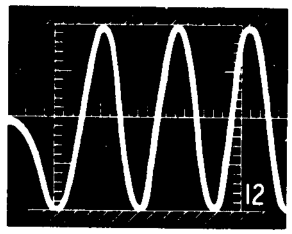
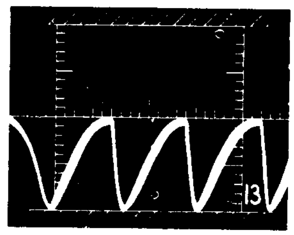
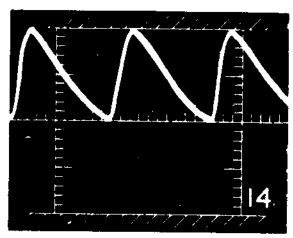
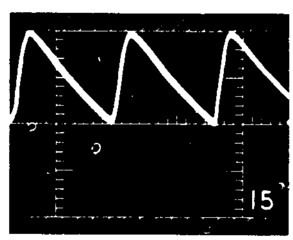
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
12	M-term. A of J1007 PAN input	Signal generator adjusted for 5 kc output at a voltage level necessary to give a 1 inch vertical Panoramic trae on the IP-81( )/APA-69A scope. Intercept receiver tuned to center frequency and switched to a narrow band.	Control Panel C527A/APA-69 in "PAN" function.		Calibrated voltage 2.3 volts peak to peak.
13	N-V1005B plate	Same as 12	Same as 12		Calibrated voltage 1.63 volts peak. Variation indicates faulty base line stabilizer or pulse stretcher, V1005 and associated components.
14	H-V1006A plate of VERT, DEFL, AMP.	Same as 12	Same as 12		Calibrated voltage 46 volts peak. Variation indicates faulty V1006A.
15	P-V1006B Grid of VERT, DEFL, AMP.	Same as 12	Same as 12		Calibrated voltage 1.65 volts peak. Variation may indicate faulty relay K1002.

TABLE 63. WAVEFORM TEST ON AZIMUTH PANORAMIC INDICATOR IP-81)/APA-69A (Continued)

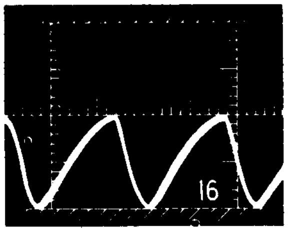
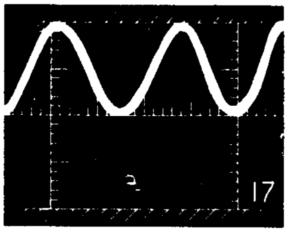
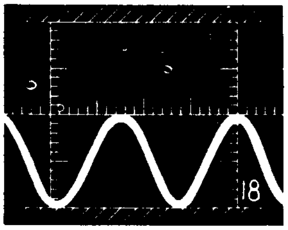
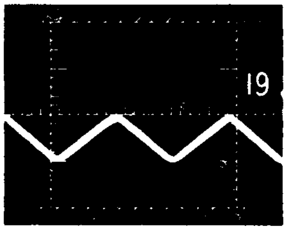
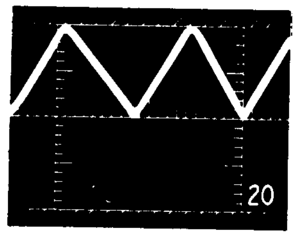
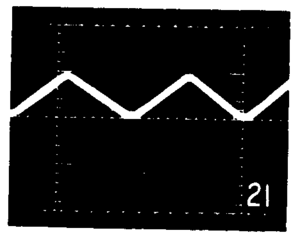
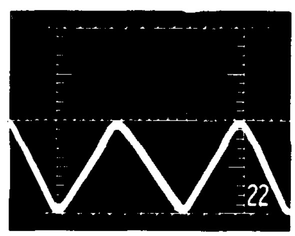
Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/ APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
16	J-V1006B plate of VERT, DEFL, AMP.	Same as 12	Same as 12		Calibrated voltage 48 volts peak. Variation indicates faulty V1006B.
17	S-R1041A sweep input	Use calibrated 10:1 attenuating probe with TS-239/UP oscilloscope.	Same as 12		Calibrated voltage 7.5 volts peak to peak. Variation indicates intercept receiver is faulty or out of adjustment.
18	R-R1041B sweep input	Same as 17	Same as 12		Calibrated voltage 7.5 volts peak to peak. Variation indicates intercept receiver is faulty or out of adjustment.
19	Pin #7, grid of V1007B	Same as 17	Same as 12		Calibrated voltage 2.5 volts peak to peak. Variation indicates intercept receiver is faulty or out of adjustment. C1022 may be open.

TABLE 6-3. WAVEFORM TEST ON AZIMUTH PANORAMIC INDICATOR IP-81'( )/APA-69A (Continued)

Step	Test Point	Test Equipment Control Position	Direction Finder Group AN/APA-69 Controls	Observed Waveform Normal Response	Interpretation of Abnormal Response (Voltage levels are Typical)
20	L-V1007B plate hor. DEFL., AMP. Pin #6	Same as 17	Same as 12		Calibrated voltage 100 volts peak to peak. Variation indicates faulty tube V1007B
21	Pin #2, grid of V1007A	Same as 17	Same as 12		Calibrated 2.5 volts peak to peak. Variation indicates intercept receiver is faulty or out of adjustment; C1023 may be open.
22	K-V1007A, plate-Hor-DEFL., AMP. Pin #1	Same as 17	Same as 12		Calibrated voltage 100 volts peak to peak. Variation indicates faulty tube V1007A.

circuits may be differentiated as follows: input and amplifier, intensifier, resolver, horizontal deflection amplifier, and vertical deflection amplifier. Independent of the electronic equipment is the antenna power circuit. Also independent of the remainder of the equipment is the torque unit power supply circuit.

6-14. AZIMUTH INDICATOR PLATE POWER SUPPLY. (See wiring diagrams, figures 7-2, 7-3 and 7-5.) The 115-volt a-c supply from pin L of J301 passes through switch S301 ("ON-OFF") to pin J of J301, pin C of J104, and primary terminal 1 of transformer T101. T101 is the power transformer; the other end of the primary is returned from terminal 2 to pin H of J204 to ground. The plates of rectifier tube V105 connect to terminals 3 and 5 of the transformer secondary which is center-grounded at terminal 4. Plate power for the azimuth indicator tubes is developed across bleeder resistors R124, R125, and R126 connected in series at the output end of the filter reactor L101. C115, the main filter capacitor, is connected to ground from this point. Power is delivered to plate pin 5 of V201, the intensifier tube, via pin H of J105, pin H of J204, the parallel dropping resistors R209 and R210, and load resistor R207. From pin H of J204, power is distributed to the horizontal and vertical amplifier plates through their load resistors R213, R214, R225, and R226 and from each plate to the corresponding deflector plate of the cathode-ray tube. Through bleeder resistor R211, voltage is applied to pin 9 (grid No. 3) of the cathode-ray tube. Through resistor R204 and variable potentiometer R205 ("INT. MOD."), back bias is applied to germanium diode CR201 to set the clipping level for the pulse applied to the grid of intensifier V201.

6-15. AMPLIFIER PLATE POWER SUPPLY. (See wiring diagram, figure 7-2.) The plates of rectifier tube V106 are connected to terminals 6 and 9 of the other secondary winding of the power transformer T101, which is tapped to ground at terminal 7. Bleeder resistors R127, R128, and R129, and filter

38H

capacitor C116 are connected to the output end of filter reactor L102. Screen voltage for tube V101 is taken from the bleeder train between R129 and R128 and is passed through screen resistor R107. Voltage to the plate of the pulse stretcher tube, V108, passes through load resistor R137. The plate and screen voltages for the remaining tubes of the amplifier are distributed through their respective load resistors; to plate pin 5 of tube V101 through load resistors R105 and R106 and a peaking choke inductance L104; to plate pin 5 of tube V102 through load resistors R110 and R111 to screen grid pin 6 of tube V102 through resistor R 112; to plate pin 5 of tube V103 through resistors R117 and R118; to screen grid pin 6 of tube V103 through resistors R119; and to plate pin 5 and screen grid pin 6 of tube V104 through resistor R130. The plate filter and screen bypass capacitors which serve the circuit are C103, C104, C107, C108, C110, C112, C118, C119, C126, C127, C128, and C129.

6-16. INDICATOR TUBE HV POWER SUPPLY. (See wiring diagram, figure 7-3.) The 115-volt a-c supply is fed from pin C of J104, to pin C of J105, to pin C of J204, to terminal I of T203, one end of the HV transformer primary, and returned from terminal 2 of T20.3 to pin D of J204 and ground. The filament of HV rectifier V204 is connected to terminals 6 and 7 of one of the secondaries. Positive HV plate power is developed across bleeders R244, R245, R246, and R247, and the HV cap of the cathode-ray tube is connected at the top of this bleeder train. Negative cathode and control voltages are developed across a bleeder train from ground to the plate of the HV rectifier. It begins with resistors R237, R236. R235, R234, and series potentiometer R233 ("FOCUS"), from which the focusing voltage is drawn; R232, at the lower end of which cathode voltage is taken off and applied through resistor R227 to the cathode; R231, series potentiometer R230 ("INTENSITY"), from which intensity control grid voltage is taken; and resistors R229 and R228. The train is connected to terminal 10 of the HV secondary, and terminal II of this secondary is connected to the HV rectifier plate. The rectifier voltage is filtered by capacitors C205, C206, and C210.

6-17. GRID BIAS VOLTAGE. Bias voltage is developed by V107, a rectifier with both cathodes tied together to terminal 8 on the amplifier power supply secondary, the ends of which are connected to the plates of rectifier V106. Bias voltage is applied to the grid of V101 through resistors R101, R102, R103, and R132; the "GAIN" control potentiometer (R302) is in series with resistors R102 and R103 and ground. Bias voltage is applied to the grid of tube V103 through resistors R114, RI 15, and R116; resistor R113 is in series with resistors R114 and R15 and ground. Bias voltage is applied to the grid of the tube V104 through resistors R122 and R121; resistor R120 is in series with resistor R122 and ground. Through pin A of J105 and pin A of J204 this bias voltage is also applied to the grids of the horizontal and vertical amplifiers. in the indicator, through resistor networks R218-R219 and R220-R221, the horizontal and vertical amplifier bridge networks attached to the cathode ends of the amplifier secondaries. The filter capacitors in the bias circuit are C117, C113, C111, C105, C120, and C102.

6-18. SIGNAL INPUT AND AMPLIFIER CIRCUIT. The signal voltage is introduced from the intercept receiver at J102 to the grid of tube V101 through coupling capacitor C101 and grid resistor R132. Resistor R131 functions as a terminating resistor. If the polarity reverser is not connected into the signal circuit by switch S101, the output from tube V101 is conveyed directly to the grid of tube V108, the pulse stretching circuit, through coupling capacitor C121. If switch S101 connects the polarity reverser to the tube V101 signal output, the signal is applied instead to the grid of tube V102 through coupling capacitor C106. This stage is self-biased by grid resistor R108 and cathode resistor R109 independent of the bias voltage circuit described above. Output from tube V102 is then applied through capacitor C121 to the control grid of tube V108. Tube V108 is self-biased by resistors R133 and R134. The action of the pulse stretching circuit (described in paragraph 4-10) delivers a pulse voltage to the grid of tube V103 through coupling capacitors C109 and C122 and the pulse stretching circuit comprising crystal diodes CR101, CR102, and CR103; capacitors C123, C124, and C125; the three sections of inductor L103; and resistor R136. The output of tube V103 is applied to the grid of tube V104 through coupling capacitor C114. Cathode follower V104 delivers the signal to the resolver and intensifier input lines.

6-19. INTENSIFIER CIRCUIT. The output of tune V104 is applied through J101 and J201 to the grid of intensifier V201 via resistor R202 and coupling capacitor C201. Resistor R201 functions as a terminating resistor. The stage is self-biased through grid resistor R203 and cathode resistor R206. Modulation level is controlled by varying the voltage level from B+ applied to crystal diode clipper CR201 through the "INT. MOD." control circuit. Output from the intensifier stage is applied to the cathode of the cathode-ray tube through coupling capacitor C204.

6-20. RESOLVER CIRCUIT. (See wiring diagram, figure 7-4.) The output of tube V104 is also applied to the resolver circuit through J103 and J404 to the resolver (described in paragraph 4-12) through the contacts of relay K401. The operation of this relay is dependent upon the power and switching circuits described in paragraph 6-23, following. R401, R402, and R403 are loading resistors across the rotor and stators of the resolver motor. Output from the two stators of the resolver is applied to the horizontal and vertical amplifier transformer primaries through coaxial cables connected to J402 and J403.

6-21. HORIZONTAL DEFLECTION AMPLIFIER CIRCUIT. The horizontal deflection amplifier signal input is applied to terminal 1 of transformer T202 from J203. The other end of this transformer is grounded from terminal 2. The balanced secondaries of transformer T202 are tied directly to the grids of V203, the horizontal amplifier. Through resistors R222 and R224 at opposite ends of potentiometer R223 ("H. CENT.",) they are also connected to the grounded cathodes of the same tube in a balanced bias network incorporating resistors R240 and R241, the transformer loading resistors, and R220 and R221, bias resistors connected into the bias voltage circuit. The output of tube V203 is applied directly to the horizontal deflection plates of the cathode-ray tube. Capacitor C214 is a phase correcting capacitor.

6-22. VERTICAL DEFLECTION AMPLIFIER CIRCUIT. The vertical deflection amplifier signal input is applied to terminal i of transformer T201 from J202. The other end of this transformer primary is grounded from terminal 2. Transformer loading resistors R242-A and R242-B are dual sections of a potentiometer ("circularity" control) bridging the balanced secondaries, with taps connected directly to the grids of V202, the vertical amplifier. As in the horizontal amplifier circuit above, resistors R215 and R217 are tied to opposite ends of potentiometer R216 ("V. CENT.")' and are connected to the grounded cathodes of the same tube in a balanced bias network incorporating R218 and R219, bias resistors connected into the bias voltage circuit. The output of tube V202 is applied directly to the vertical deflection plates of the cathode-ray tube. Capacitor C213 is a phase correcting capacitor.

6-23. ANTENNA DRIVE POWER SUPPLY. The 28-volt d-c power input is applied to the drive motor from pin P of J301 through switch S301 ("ON-OFF"), rheostat R301 ("ANT. SPEED"), pin C of J301, and pin H of J401. Resistor R404 is cut in and out of operation in a series connection with the shunt field winding of drive, motor B402 by the action of a cam switch S401, to alter the speed of antenna rotation. Antenna Drive TG-8A/APA-69 does not have resistor R404 or switch S401, since this unit does not have the automatic speed changing device. A part of the 28-volt antenna drive voltage is applied through switch S302 ("ANT. POLARIZATION") when it. is in "VERTICAL" position to operate relay K501 or K601, depending on the antenna in use. This voltage through switch S302 is also applied to relay K401 when S402, the "ON-OFF" switch on the antenna drive panel is closed. (See antenna wiring diagrams, figures 7-6 and 7-7.)

6-24. TORQUE UNIT POWER SUPPLY. The 115-volt a-c 400-cycle supply for the torque unit passes from pin M of J301 through switch S301 ("ON-OFF") to pin F of J301, pin C of J205, and terminal 7 on transformer T205. This voltage is coupled to the plates of tube V206 from terminals 1 and 5 of transformer T205. The tube is self-biased through a balanced cathode network including potentiometer R249 and bias resistors R252 and R253. The signal voltage to these grids is provided by the synchro control transformer connections from the Flux Gate compass, through servo gain control R248 to the primary of T204 and from the secondary terminals 3 and 5 to grids 7 and 3 of tube V206 through resistors R250 and R251. (Refer to paragraph 4-22 for the analysis of the operation of the amplifier section, including notes on power connections when it is supplied from other than Direction Finder Group AN/APA-69 sources.)

6-24A. CIRCUIT BREAKDOWN OF DIRECTION FINDER GROUP AN/APA-69A.

6-24B. Since the antennas, antenna drive and control box used in this group are the same as those used with Direction Finder Group AN/APA-69, it will be only necessary to describe the circuit breakdown of Azimuth-Panoramic Indicator IP-81(()/APA-69A.

6-24C. Basically, these indicators replace both the amplifier-power supply and indicator used in Direction Finder Group AN/APA-69. However they are limited to use only with the AN/APR-9 intercept equipment since the latter supplies some of the power requirements. These indicators also have no provision for reversing polarity of the input signal from the receiver, being designed for a positive video signal only.

6-24D. Referring to the schematic diagrams (figures 7-3A and 7-3B) it will be seen that the video amplifier is essentially the same as that used in Amplifier-Power Supply AM-256/APA-69 except that the polarity reversing circuit is eliminated and different tube types are employed. It should also be noted that the intensity modulation control is in the plate load of INT. MOD. tube V1004 for better control of this function.

6-24E. The low and medium power supply circuit is no longer employed since the intercept power supply furnishes, through connector J1005, +150V and + 300V power for the indicator as well as filament power for the video amplifier tubes and the Base Line Stabilizer-Pan Pulse Stretcher. The cathode-ray tube high voltage and filament supplies are the same.

6-24F. Pan and sweep signals are fed into the 'indicator at connector J1007. Tube V1005A and B is a dual diode operated as a base line stabilizer (section A) and a pulse stretcher (section B). The resistance capacitance network comprising R1033 and C1020 is used to provide a signal of longer duration to the grids of the vertical deflection amplifiers.

624G. Circuit details of the deflection amplifiers were given in paragraphs 4-41, 4-41A, and 4-41B. It should be noted that the method of controlling horizontal and vertical centering is different between Azimuth-Panoramic Indicators IP-81/APA-69A and IP-81( )/APA-69A. Also note that in the Azimuth-Panoramic Indicator IP-81A/APA-69A, both sides of the horizontal panoramic sweep output are grounded in the DF function to prevent 12-1/2 cps interference from getting into the horizontal amplifier grids.

6-25. AUTOSYN TEST FOR AZIMUTH INDICATOR.

6-26. FABRICATION OF AUTOSYN TEST UNIT. The fabrication of the autosyn test unit requires the following parts:

a. One type AY-202-1 autosyn transmitter.

b. One metal (or plastic) dial approximately 4-1/2 inches in diameter, graduated in five-degree steps and marked at thirty-degree intervals.

c. One pointer, with setscrew, for the dial above.

d. One aluminum box five inches long, 3-7/8 inches wide, 2-1/8 inches deep.

e. One type AN-3106-14S-5S plug.

f. One barrier-type terminal strip with six screw terminals.

g. A length of five-wire cable, No. 20 wires or larger, about five feet long.

h. One rubber grommet for cable entrance.

i. One aluminum (or steel) strip, 6-1/2 inches long by 3/4 inch wide and 1/16 inch thick for fabrication of mounting bracket.

j. One small spring about one inch long.

k. Three No. 6 lugs (one used on brake).

l. Six No. 6 machine screws.

m. Six No. 6 lock washers.

n. Six No. 6 hex nuts.

o. Approximately eight inches of solid No. 20 wire for brake.

p. Suitable mounting screws for dial.

6-27. Fabrication is self evident from figure 2-1. Attach the dial with three screws and nuts. Mount the autosyn with the U-bracket, using the No. 6 screws, nuts, and washers. Mount the terminal strip and place two of the solder lugs under the mounting screws. The brake is made from a small spring, a long shank solder lug, and two pieces of No. 20 solid wire. Adjust the tension on the spring to permit easy rotation of the autosyn shaft. Connect the wires from the autosyn as shown and then connect the cable wires after passing them through the grommet. Attach the pointer to the shaft at the front and be sure that it does not touch the dial face at any point. The unit is now ready for use.

6-28. AUTOSYN TEST OF AZIMUTH INDICATOR. The purpose of this test is to determine that the azimuth scale is zeroed and is properly following the Flux Gate compass synchro.

6-29. ZEROING AZIMUTH INDICATOR IP-36/ APA-69. First connect a Ballantine type 300 voltmeter across terminals 2 and 4 of power transformer T205 with ground terminal of meter to terminal 2 of transformer T205. Use the lowest meter scale that will give a reading near center of its scale. Set gain control R248 for minimum gain. Apply 115-volts, 400-cps power across terminals A and C of J205 (Terminal A is grounded and must be connected to ground side of 115V line). Adjust balance control R249 for minimum reading. Use the lowest meter scale that permits a reading and set the balance control again to the point that gives minimum reading. Leave it on this setting. Turn off power.

6-30. Electrically zero the azimuth scale as follows: Remove the plug which connects J206 of Azimuth Indicator IP-36/APA-69 to the Flux Gate compass and disconnect the a-c power plug which is connected to J205 on this unit. In place of the plug which was connected to J206, use a blank type AN-3106-14S: -5S plug and wire a jumper between terminals A, C and E. Now, connect a wire lead from the unused B terminal of the a-c power plug (which was connected to J205) to pin D on the blank plug associated with J206. This arrangement connects two stators of the synchro control transformer to ground and applies 6.3 volts ac from the filament lead of J205 to the third stator. (Note that this procedure is similar to that used in paragraph 5-11 for locking the azimuth scale for calibration purposes. See figure 5-1 for plug connections.)

6-31. Now, attach the two plugs to their respective receptacles J205 and J206 and turn on the 115-volt a-c (400-cycles per second) power. The azimuth indicator, if is does not need mechanical correction, will zero itself in the fiducial mark.

6-32. MECHANICALLY ZEROING AZIMUTH INDICATOR IP-36/APA-69.-If the azimuth indicator scale does not zero, perform the following adjustment:

6-33. Remove the four nickel-plated screws on the front panel and withdraw the panel, using care not to break the two wire leads to the panel lamps. Loosen the three screws in the rear which hold the torque unit on the casting. (If desired, the gear mask can be removed from the front panel by removing the two black screws and the right-hand handle which hold the mounting flanges of the mask in place. This permits the gears to be viewed from the outside while adjustments are being made.) Slide the torque unit upward until the gears disengage. Turn the azimuth dial until 360 degrees on the scale is exactly opposite the fiducial mark. Now, carefully re-engage the gears by slowly sliding the torque unit downward. It may require several attempts to get proper alignment. It also may be necessary to change by one gear tooth the engagement of the dial and the torque unit in order to secure the proper setting. Do not set too tightly since undesirable drag may result. Slide the torque unit upward slightly until there is a very small amount of backlash. While holding the torque unit in place, tighten the three mounting screws into the casting. Replace the outside gear mask. Turn off the power. Disconnect the plugs, unsolder the connection from terminal B of the plug to J205, and re-connect the autosyn and power plugs. The azimuth indicator should now follow.

6-34. Rotate the autosyn test unit by hand until the azimuth scale reads zero. The pointer setscrew on the autosyn pointer must be loosened and the pointer set to read zero (if it does not already do so) by holding the autosyn shaft stationary and tightening the pointer while set at zero. Rotate the needle by hand thereby moving the autosyn which, in turn, drives the azimuth indicator. Compare the readings with those of the azimuth indicator at intervals of 30 degrees. If the azimuth indicator does not follow the autosyn test unit readings at the 30-degree check points, the mechanical adjustment procedure must be performed again.

6-34A. ZEROING AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A. First connect a Ballantine type 300 voltmeter across terminals 2 and 4 of power transformer T1005 with ground terminal of meter to terminal 2 of transformer T1005. Use the lowest meter scale that will give a reading near center of its scale. Set gain control R1058 for minimum gain. Apply 115-volts, 400-cps power across terminals H and C of J1001 (Terminal H is grounded and must be connected to ground side of 115V line). Adjust balance-control R249 for minimum reading. Use the lowest meter scale that permits a reading and set the balance- control again to the point that gives minimum reading. Leave it on this setting. Turn off the power.

6-34B. Electrically zero the azimuth scale as follows: Remove the plug which connects J1006 of Azimuth-Panoramic indicator IP-81( )/APA-69A to the Flux Gate compass and disconnect the a-c power plug which is connected to J1001 on this unit. In place of the plug which was connected to J1006, use a blank type AN-310614S-5S plug and wire a jumper between terminals A, C and E. Now, connect a wire lead from the unused E terminal of the a-c power plug (which was connected to J1001) to pin D on the blank plug associated with J 1006. This arrangement connects two stators of the synchro control transformer to ground and applies 6.3 volts ac from the filament lead of J1001 to the third stator. (Note that this procedure is similar to that used in paragraph 5-11 for locking the azimuth scale for calibration purposes. See figure 5-1 for plug connections.)

6-34C. Now, attach the two plugs to their respective receptacles; J1001 and J1006 and turn on the 115-volt a-c (400-cycles per second) power. The azimuth indicator, if it does not need mechanical correction, will zero itself on the fiducial mark.

6-34D. MECHANICALLY ZEROING AZIMUTH. PANORAMIC INDICATOR IP-81( )/APA-69A. If the azimuth indicator scale does not zero, perform the following adjustment:

6-34E. Remove the four nickel-plated screws on the front panel and withdraw the panel, using care not to break the two wire leads to the panel lamps. Loosen the three screws in the rear which hold the torque unit on the casting. (If desired, the gear mask can be removed from the front panel by removing the three black screws which hold the mounting flanges of the mask in place. This permits the gears to be viewed from the outside while adjustments are being made.) Slide the torque unit upward until the gears disengage. Turn the azimuth dial until 360 degrees on the scale is exactly opposite the fiducial mark.. Now, carefully re-engage the gears by slowly sliding the torque unit downward. It may require several. attempts to get proper alignment. It also may be necessary to change by one gear tooth the engagement. of the dial and the torque unit in order to secure the proper setting. Do not set too tightly since undesirable drag may result. Slide the torque unit upward slightly until there is a very small amount of backlash. While holding the torque unit in place, tighten the three mounting screws into the casting. Replace the outside gear mask. Turn off the power. Disconnect the plugs, unsolder the connection from terminal E of the plug to J1001, and re-connect the autosyn and power plugs. The azimuth indicator could now follow.

6-34F. Rotate the autosyn test unit by hand until the azimuth scale reads zero. The pointer setscrew on the autosyn pointer must be loosened and the pointer set to read zero (if it does not already do so) by holding the autosyn shaft stationary and tightening the pointer while set at zero. Rotate the needle by hand thereby moving the autosyn which, in turn, drives the azimuth indicator. Compare the readings with those of the azimuth indicator at intervals of 30 degrees. If the azimuth indicator does not follow the autosyn test unit readings at the 30-degree check points, the mechanical adjustment procedure must be performed again.

6-35. HUNTING. If there is a tendency to hunt, reduce the gain control R248 in Azimuth Indicator IP-36/APA-69 or R1058 in Azimuth-Panoramic Indicator IP-81( )/APA-69A until the hunting ceases. It should not be set lower, since lower gain effects the accuracy of the system.

6-35A. REMOVAL AND REPLACEMENT OF CATHODE-RAY TUBE.

WARNING

There are potentials of the order of 3000 volts present in this equipment. Use extreme caution when testing or aligning units with the primary power turned on.

To remove the cathode-ray tube, disconnect the plug to the torque unit and remove the four nickel-plated screws on the front of the unit. The front panel assembly and the dial will come out the front. Use caution in this procedure not to break the leads which carry power to the dial lights. Loosen the cathode-ray tube clamp at the small end, disconnect the anode connections and remove the tube through the front opening.

6-35B. When the cathode-ray tube is removed and replaced, it will probably be necessary to align the tube physically so that the horizontal and vertical deflection plates are in the proper relationship to the fiducial mark. To make this adjustment, disconnect plug P403 from jack J403 on the antenna drive unit. When the power is turned on, and the antenna is rotating, a vertical line should appear on the cathode ray tube screen. With the cathode-ray tube clamp loosened, rotate the tube carefully until the vertical line is exactly on zero. Now, turn off the power, reconnect P403 and J403 and disconnect P402 and J402. With the power on and the antenna rotating, there should be a horizontal line on the cathode-ray tube screen. Check the position of the horizontal trace with the horizontal line on the dial face. The cathode ray tube should now be properly centered both vertically and horizontally.

6-35C. REPLACEMENT OF VACUUM TUBES. Vacuum tubes in the Direction Finder Group AN/ APA-09 are replaced normally with the exception of the HV rectifier tube V204, (V108 in Direction Finder Group AN/APA-69A) which is packed in Dow-Corning DC-4 compound to prevent corona at high altitudes. When this tube is removed, care must be exercised to push the grease back down into the cup so that, when it is replaced, no air pockets will exist around the tube cap. See figure 5-11 for location of all tubes in Direction Finder Group AN/APA-69. (For location of tubes in Direction Finder Group AN/APA-69A, see figure 5-11A.) Compensate for varying tube lengths with flat washers under socket X204 mounting screws.

6-36. (Deleted.)

6-37. RESISTANCE AND VOLTAGE CHECKS.

6-38. Figures 6-2, 6-3, 6-4 and 6-5 are appended to provide terminal resistance and voltage data for FASRON service.

6-39. OVERHAUL SCHEDULE.

6-40. After 2000 hours service, any component of Direction Finder Groups AN/APA-69 or AN/APA-69A should be removed from operation and returned for overhaul.

40D

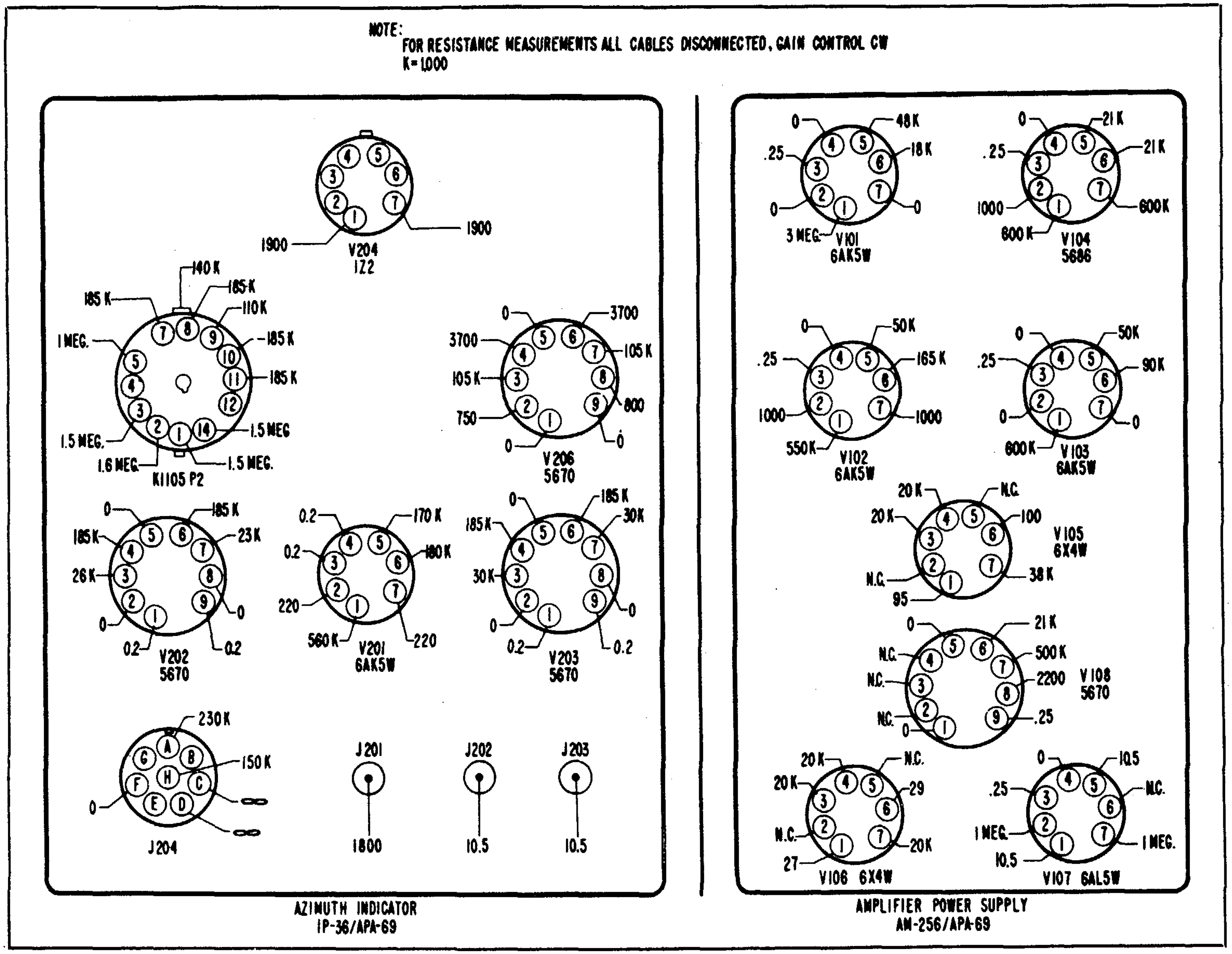


Figure 6-2. Direction Finder Group AN/APA-69, Terminal Resistance Chart

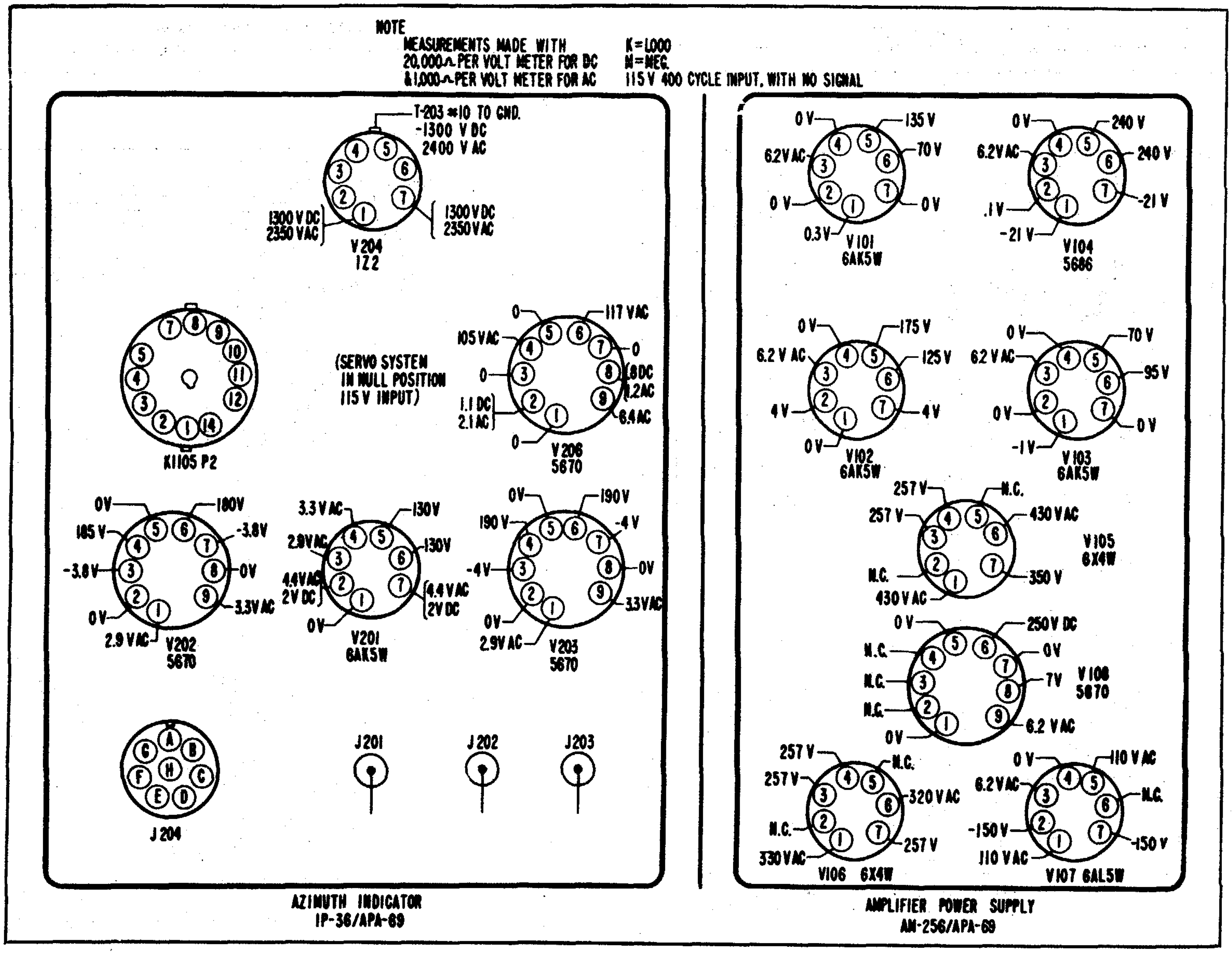


Figure 6-3. Direction Finder Group AN/APA-69, Terminal Voltage Chart

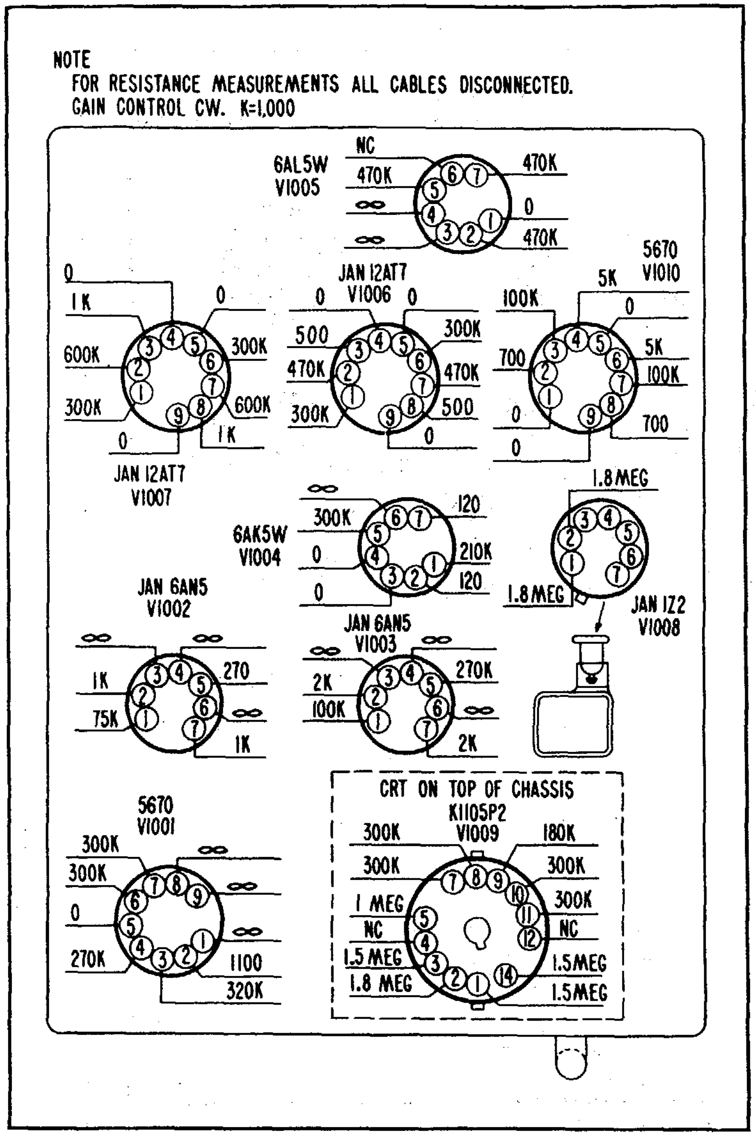


Figure 6-4. Azimuth-Panoramic Indicator IP-81/APA-69A, Terminal Resistance Diagram

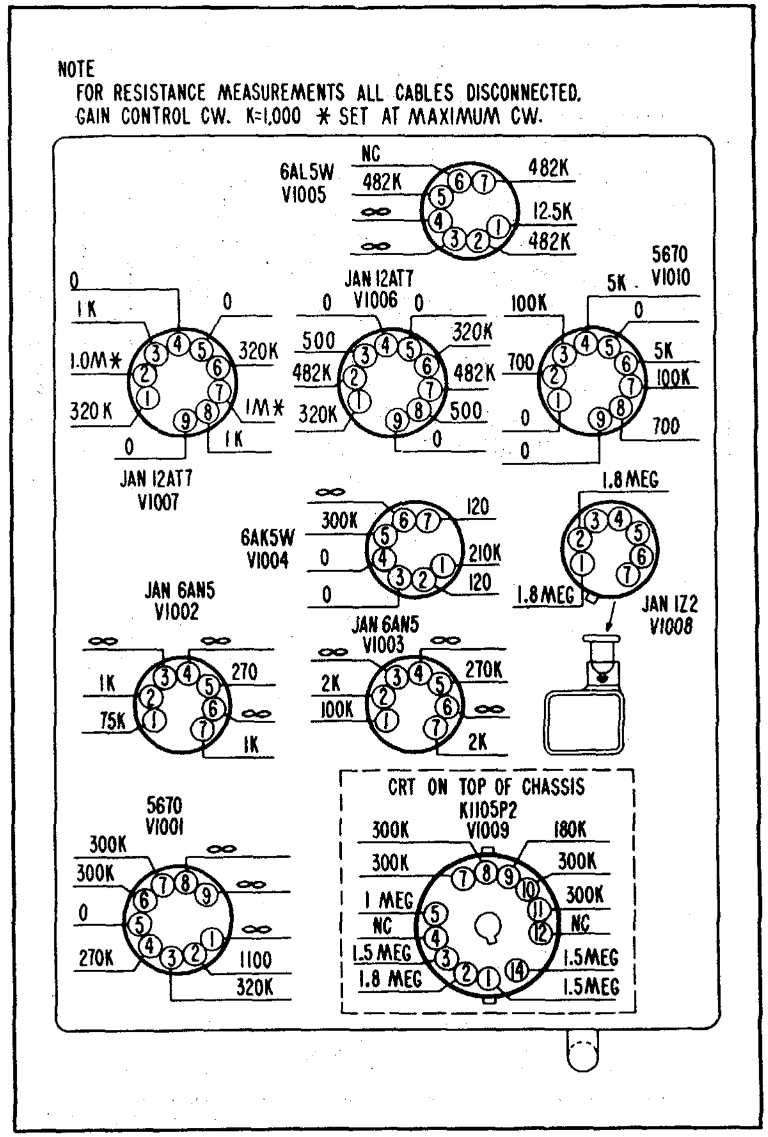


Figure 6-4A. Azimuth-Panoramic Indicator IP-81A/APA-69A, Terminal Resistance Diagram

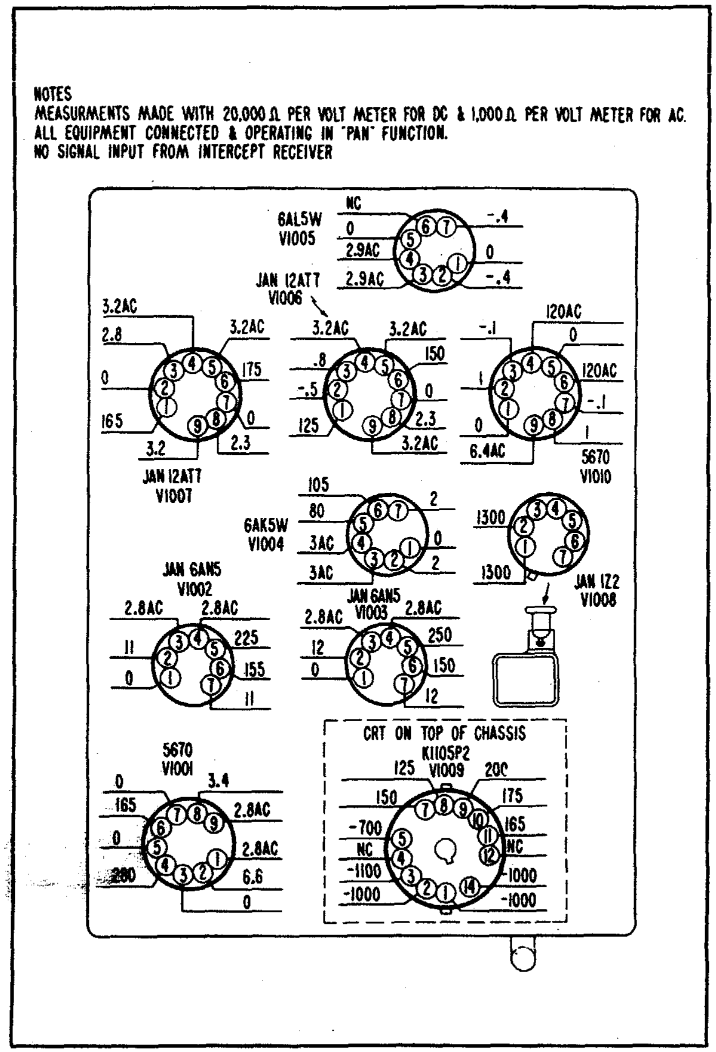


Figure 6-5. Azimuth-Panoramic Indicator IP-81/APA-69A Terminal Voltage Diagram

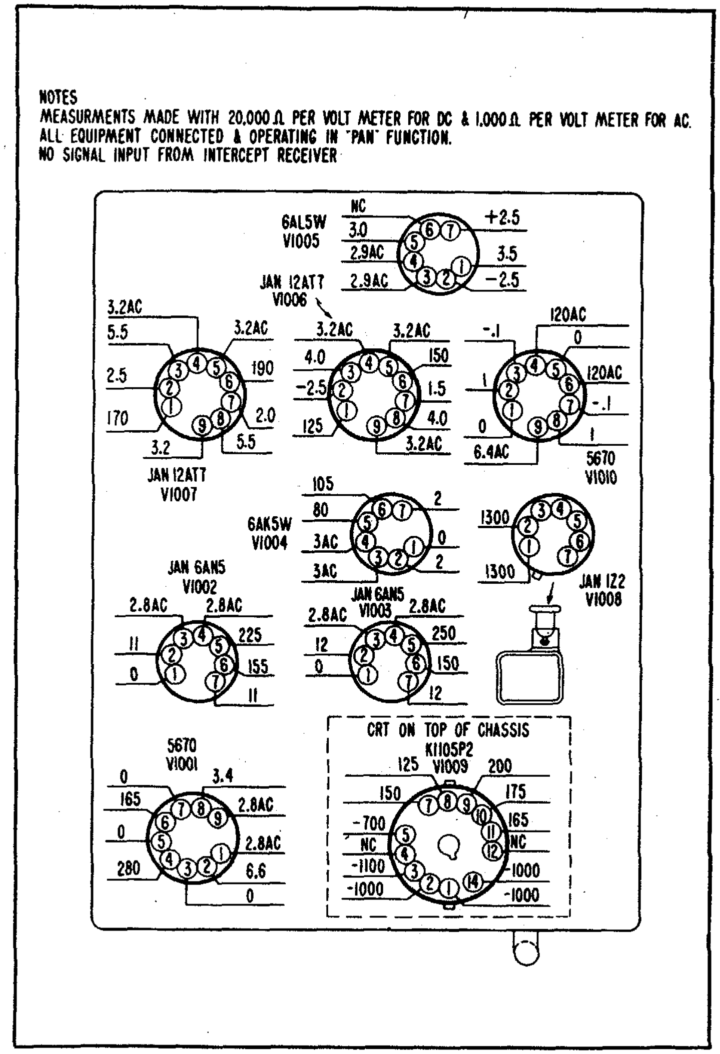


Figure 6-5A. Azimuth-Panoramic Indicator IP-81/APA-69A Terminal Voltage Diagram

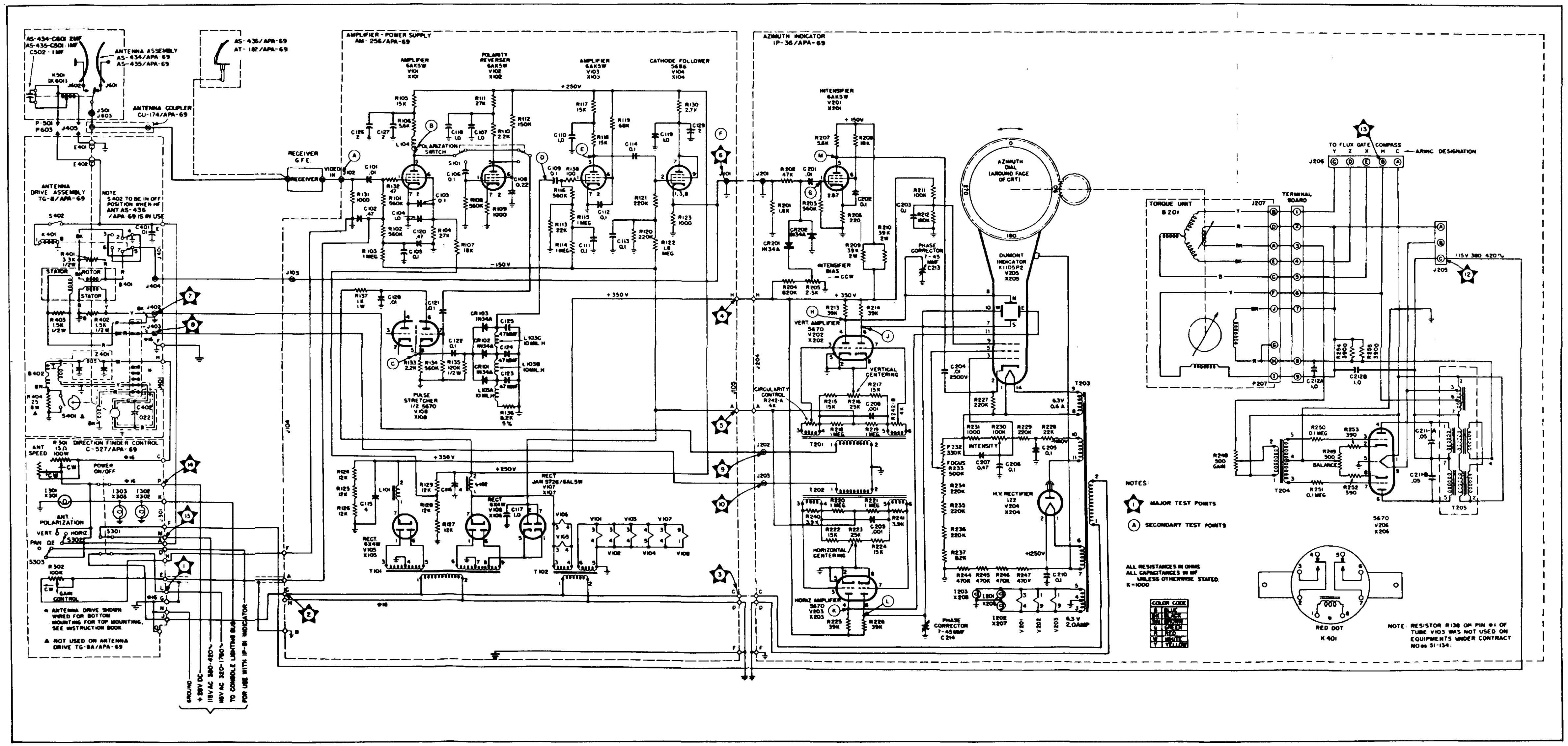


Figure 7-1. Direction Finder Group AN/APA-69, Schematic Diagram

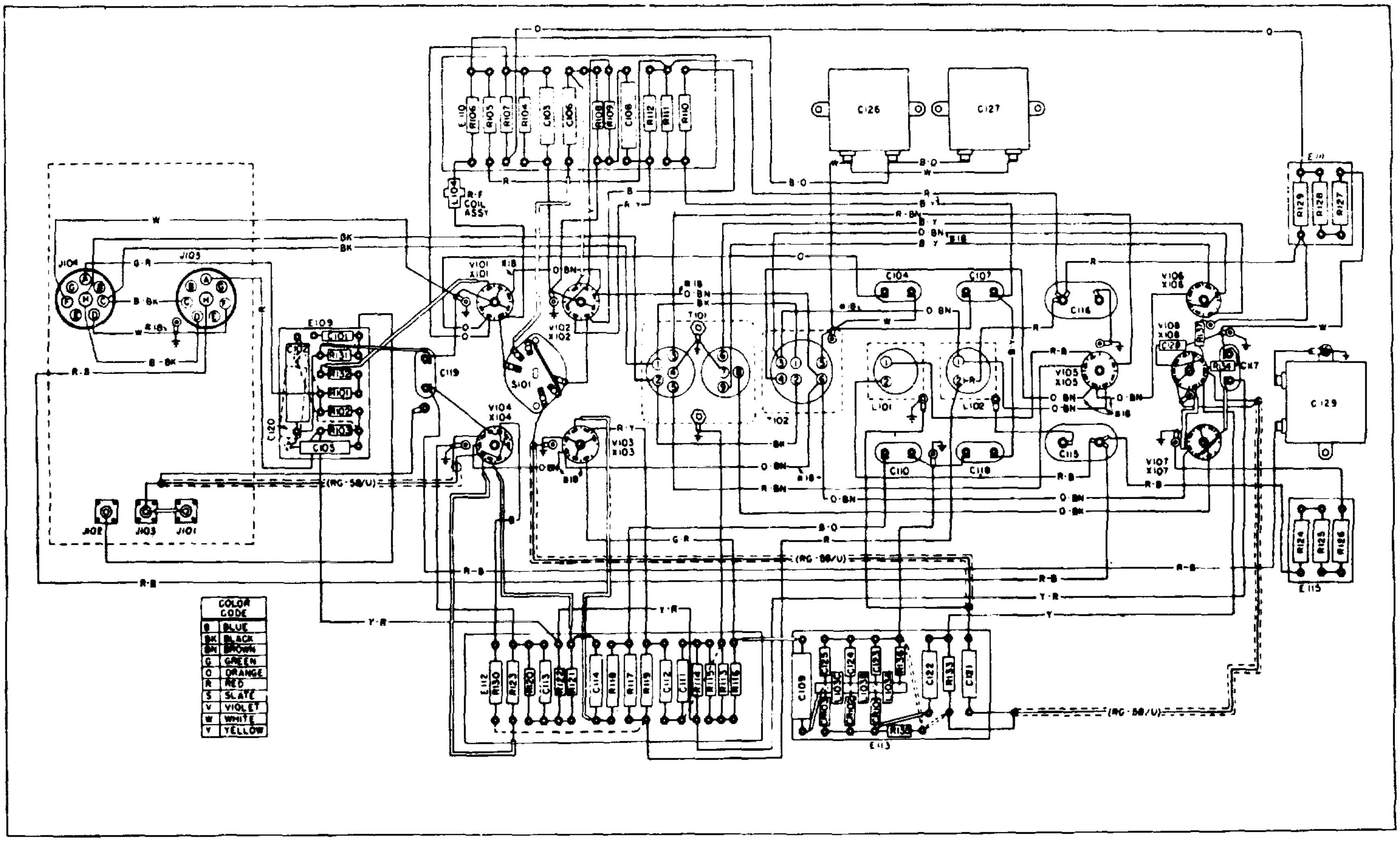


Figure 7-2. Amplifier Power Supply AM-256/APA-69, Wiring Diagram

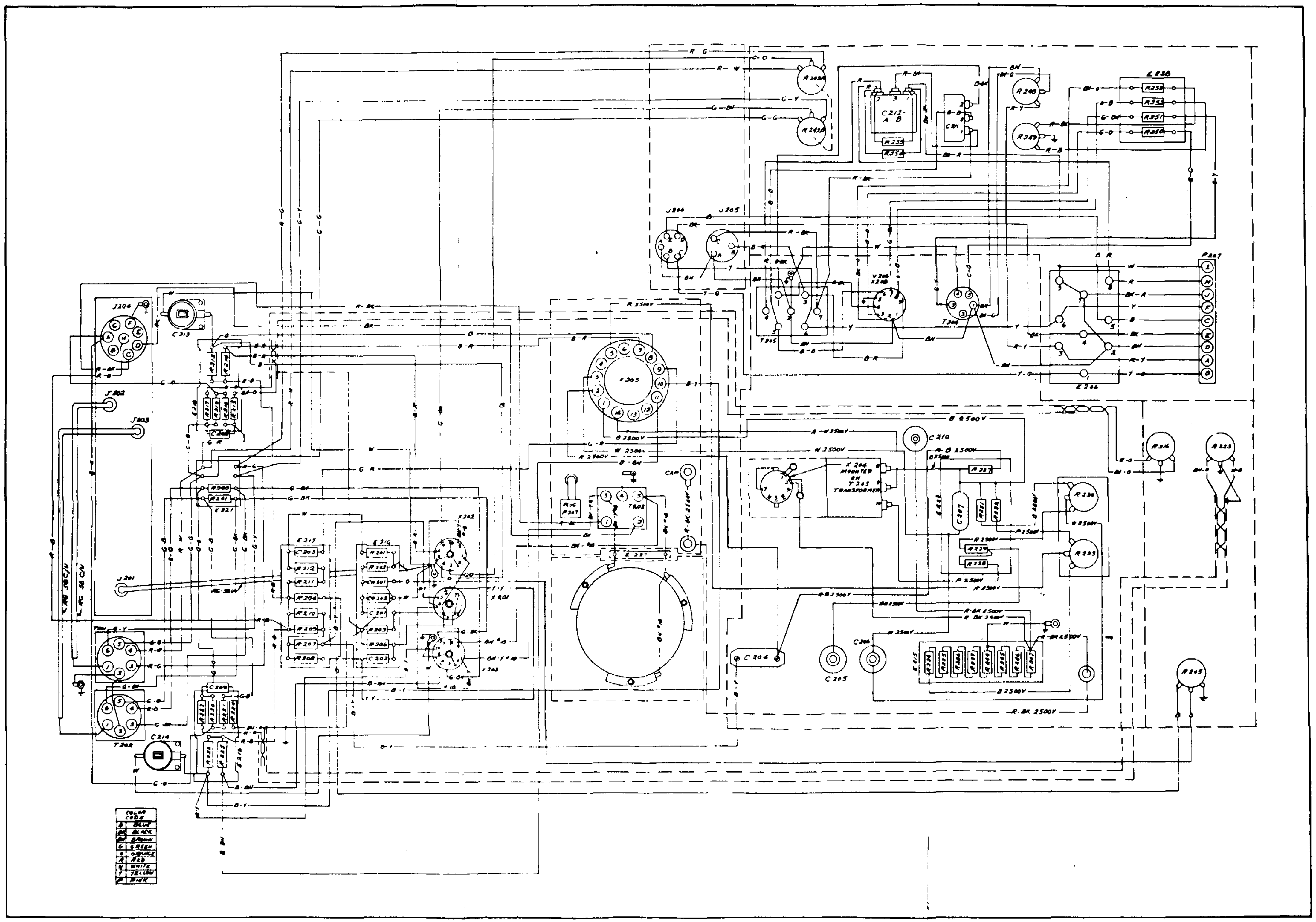


Figure 7-3. Azimuth Indicator IP-36/APA-69, Wiring Diagram

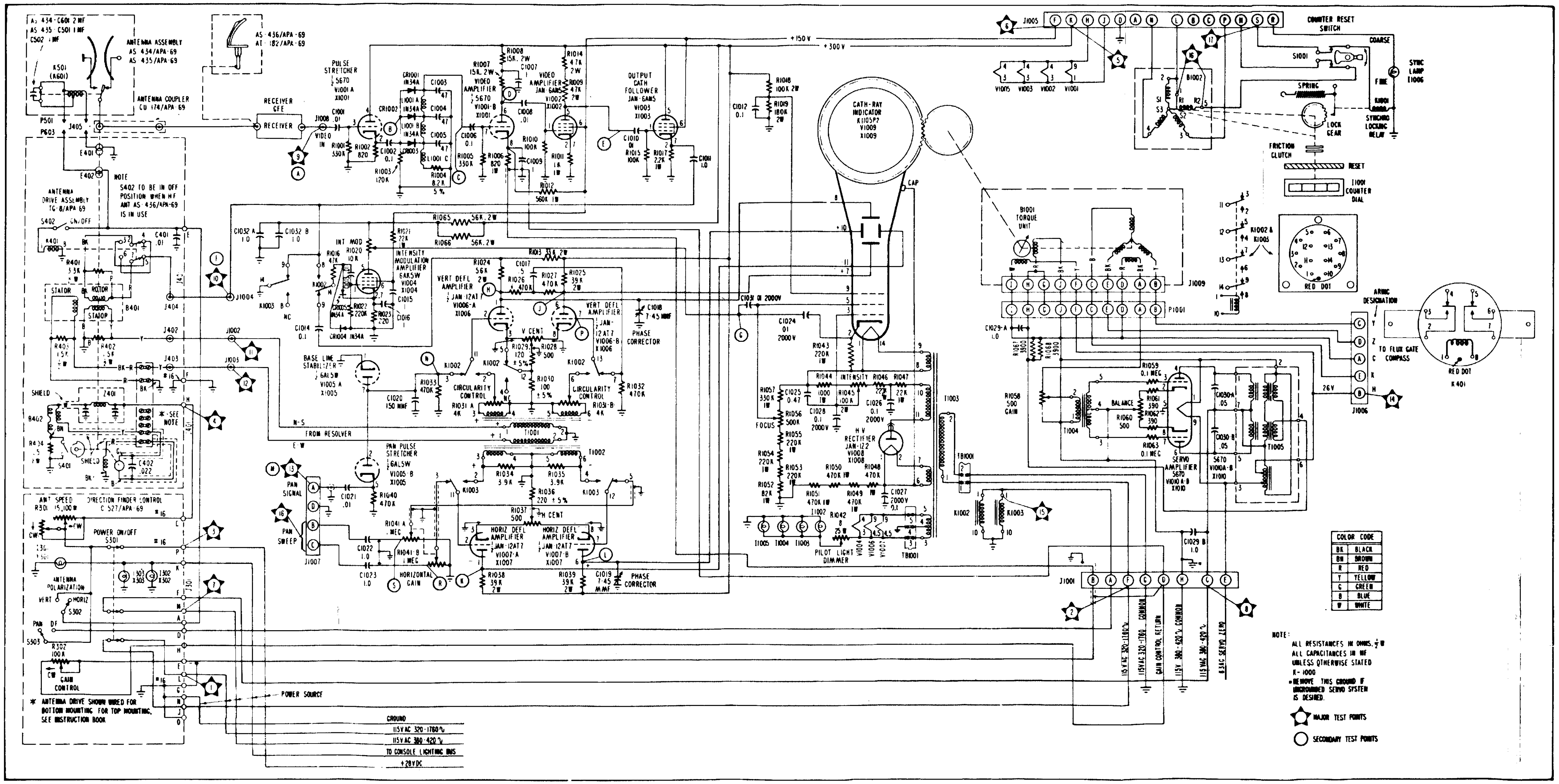


Figure 7-3A. Direction Finder Group AN/APA-69A, (IP-81/APA-69A), Schematic Diagram

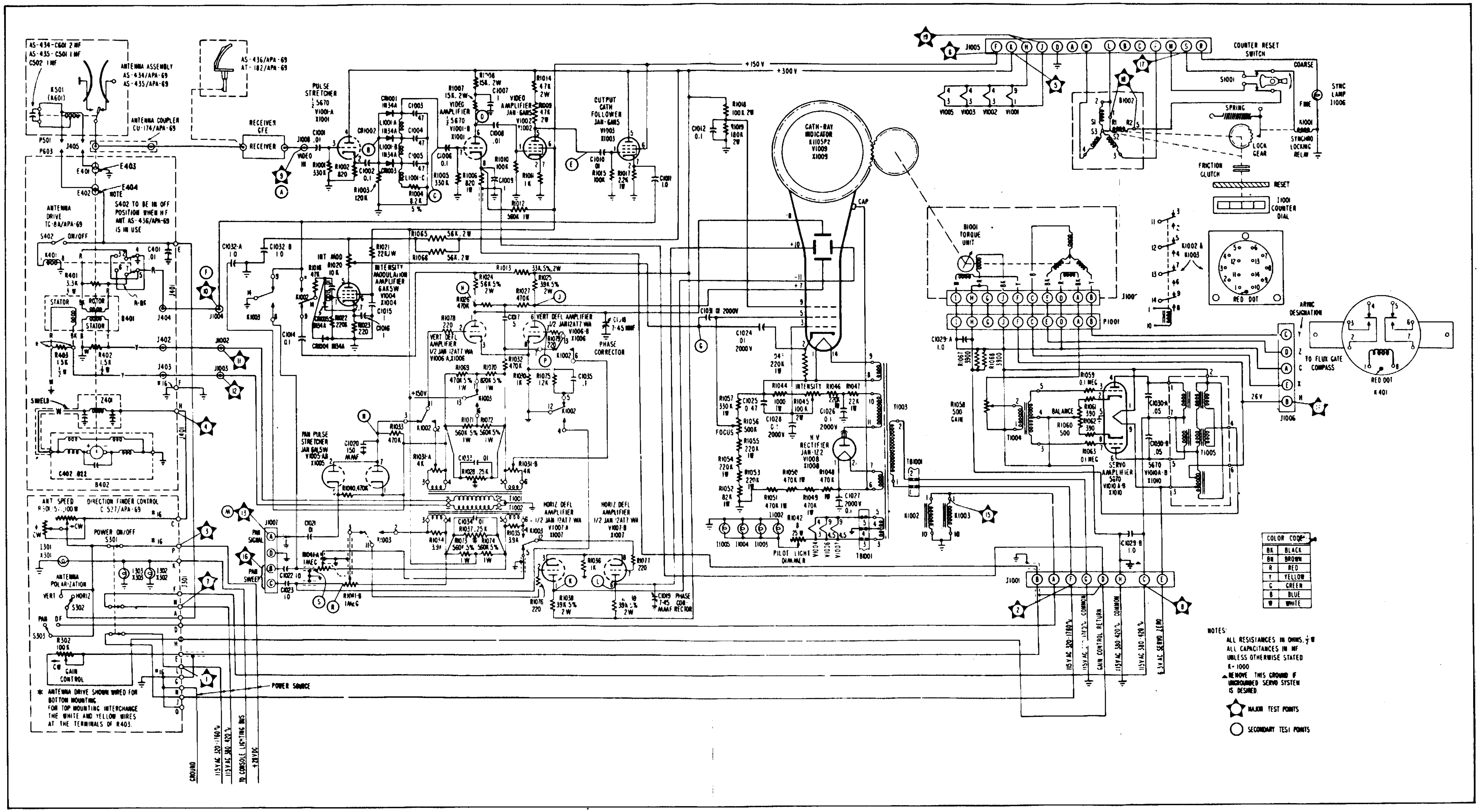


Figure 7-3B. Direction Finder Group AN/APA-69A, (IP-81A/APA-69A), Schematic Diagram

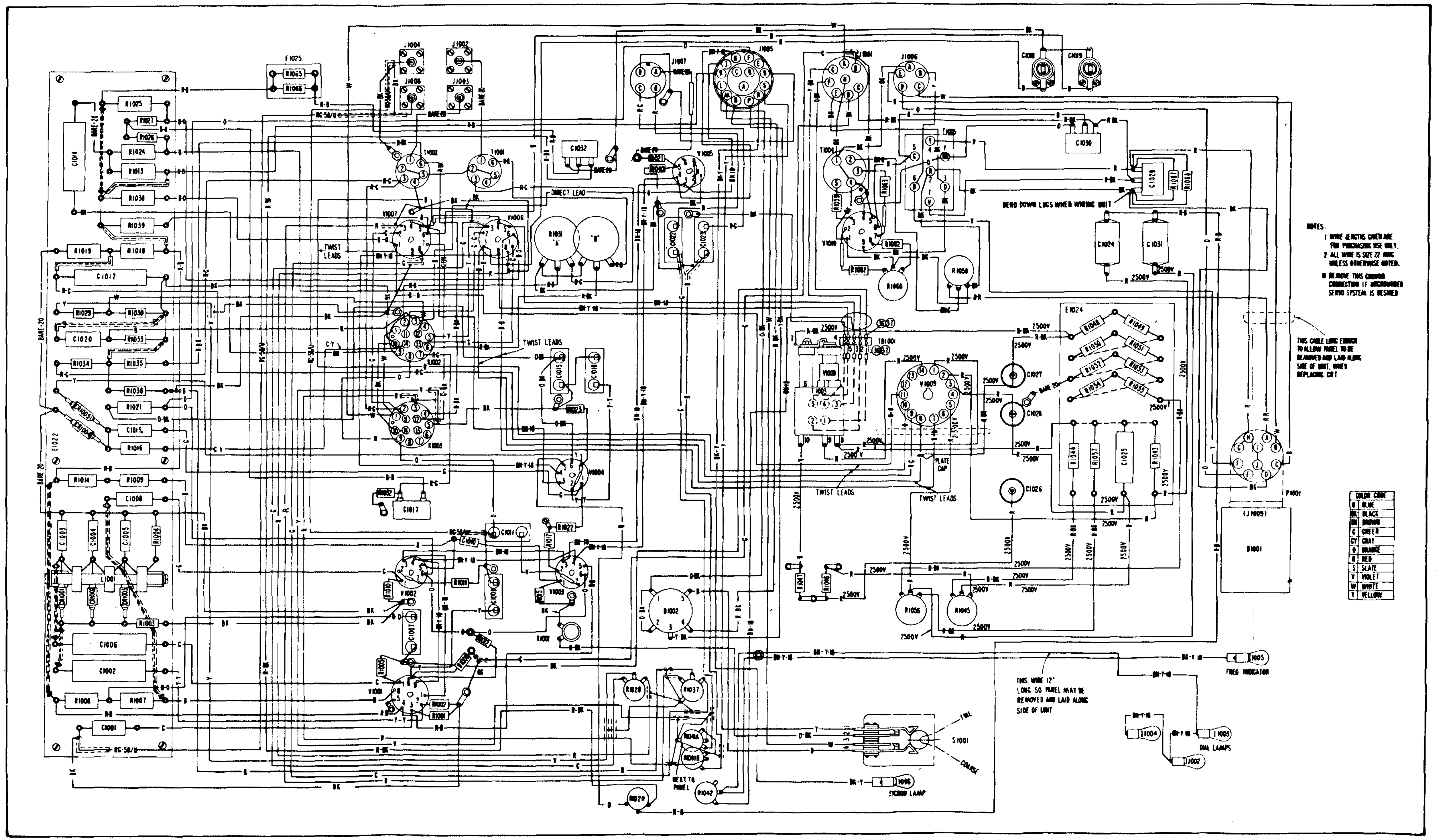


Figure 7-3C. Azimuth-Panoramic Indicator IP-81/APA-69A, Wiring Diagram

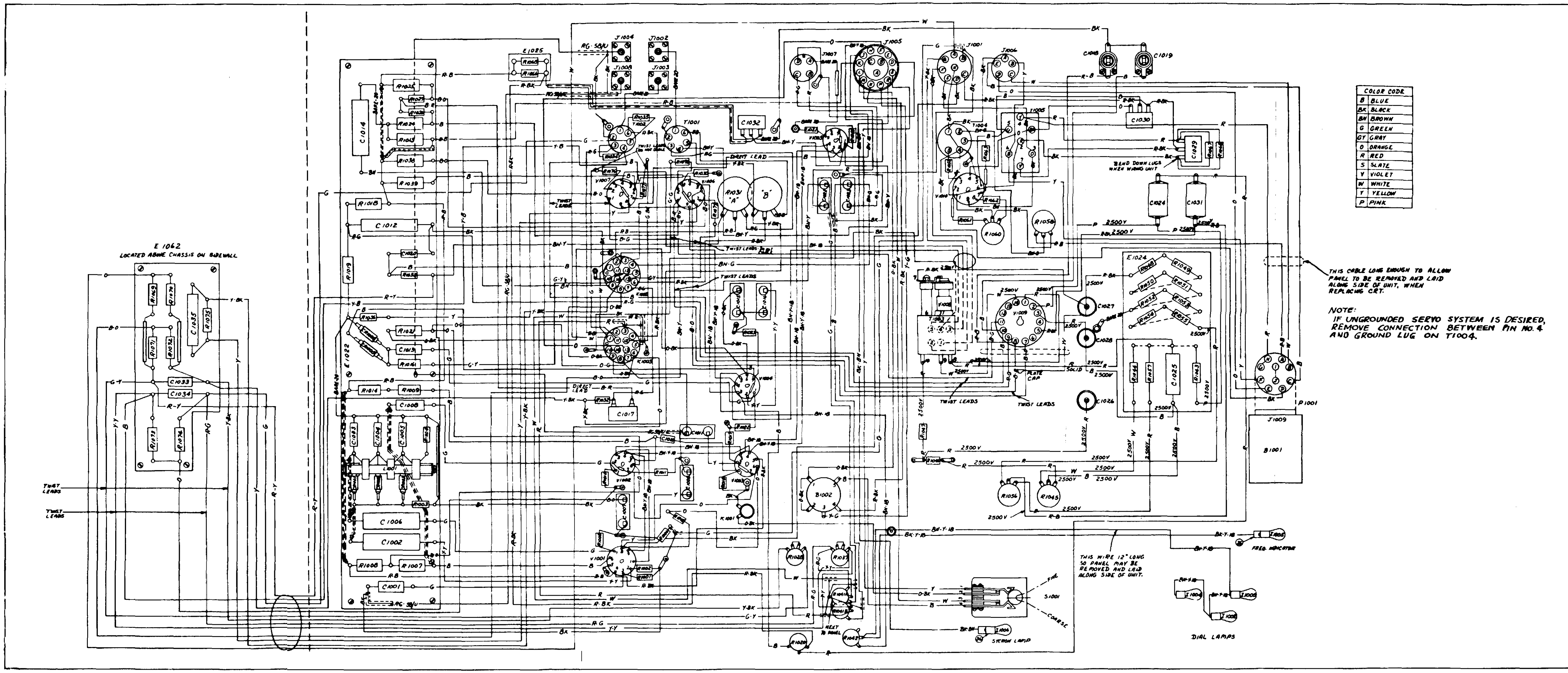


Figure 7-3D. Azimuth-Panoramic Indicator IP-81A/APA-69A, Wiring Diagram

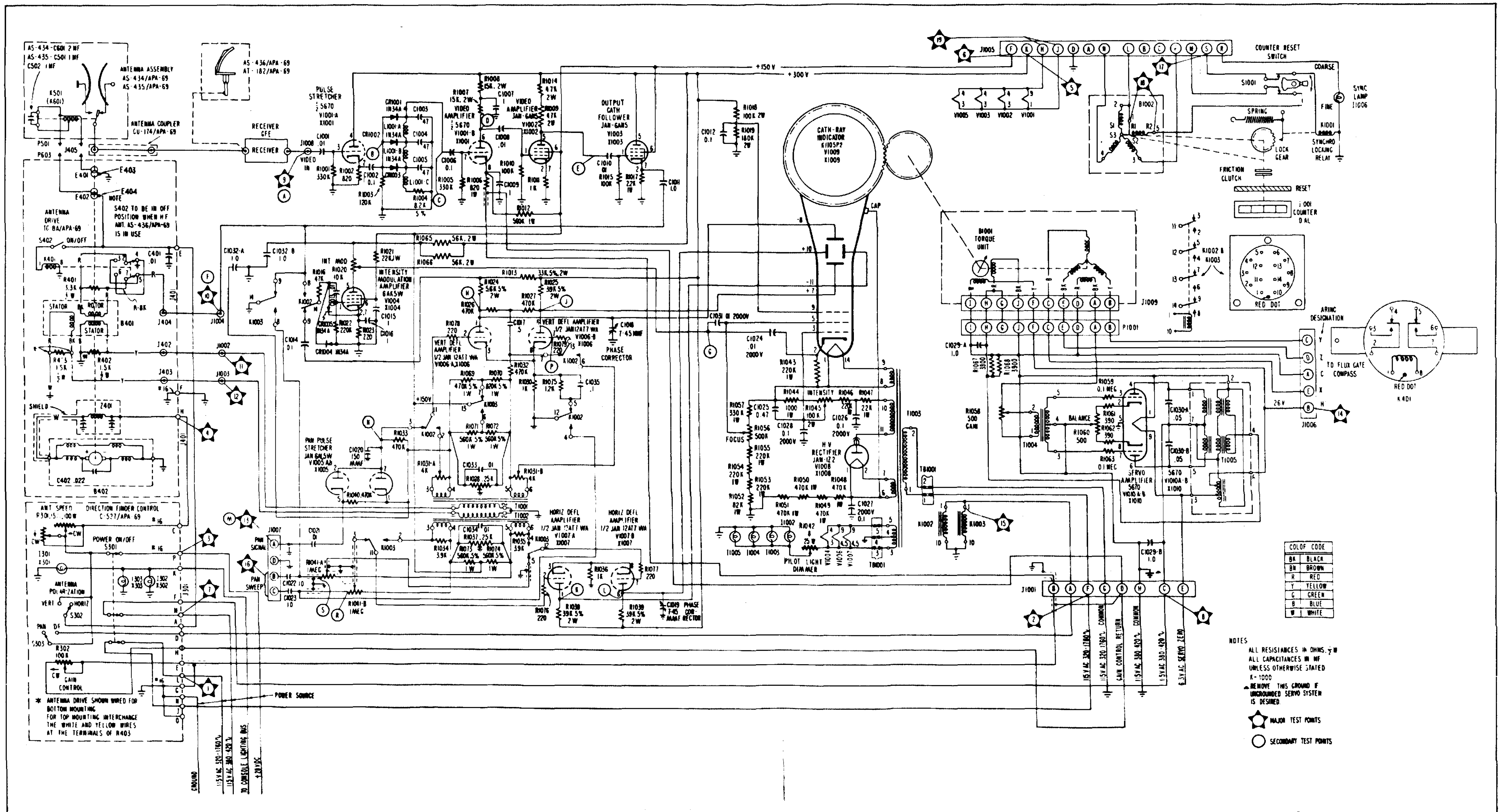


Figure 7-3E. Direction Finder Group AN/APA-69 (IP-81A/APA-69A and TG-8A/APA-69), Schematic Diagram

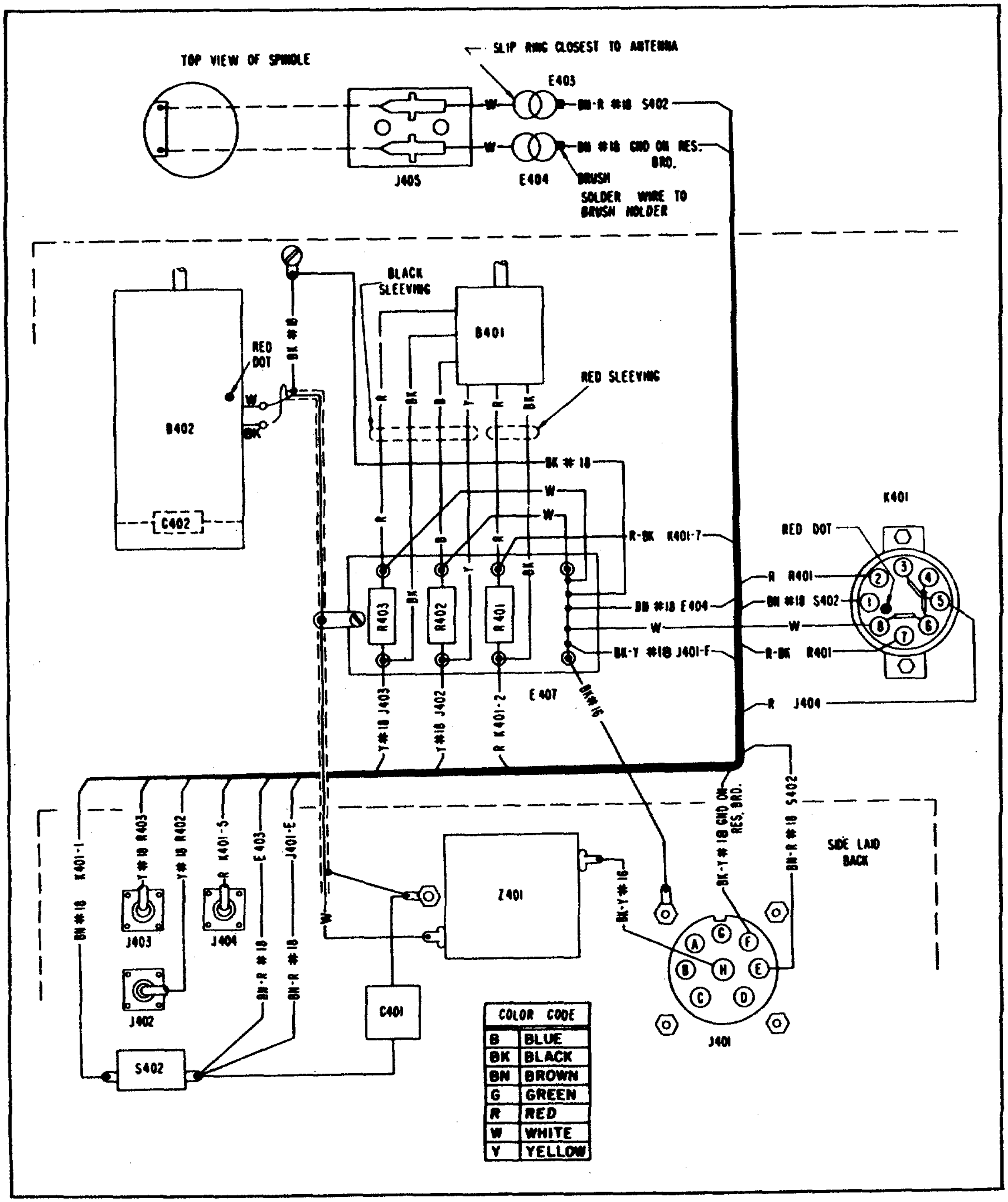


Figure 7-3F. Antenna Drive TG-SA/APA-69, Wiring Diagram

Revised 1 January 1956

50F

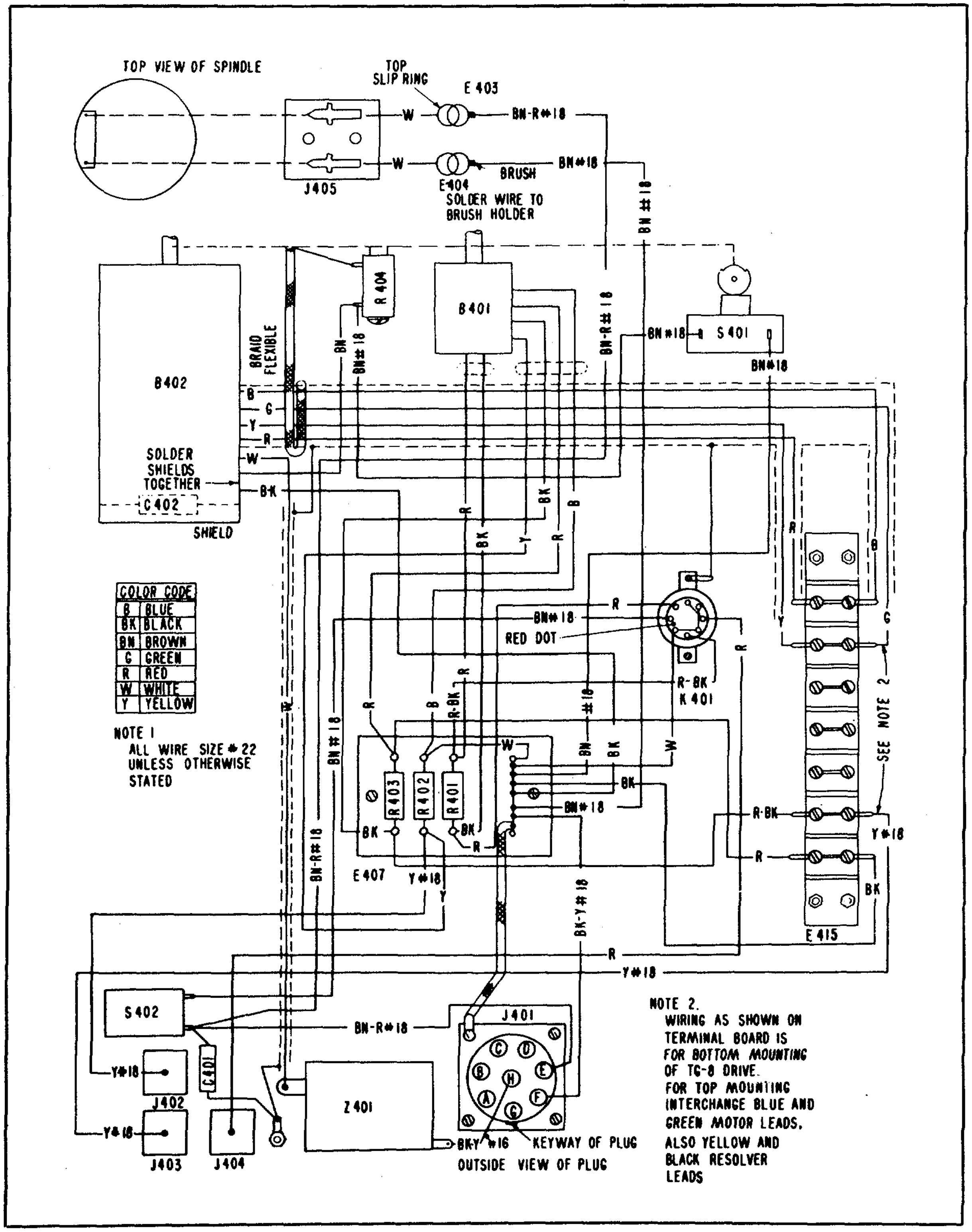


Figure 7-4. Antenna Drive TG-8/APA-69, Wiring Diagram

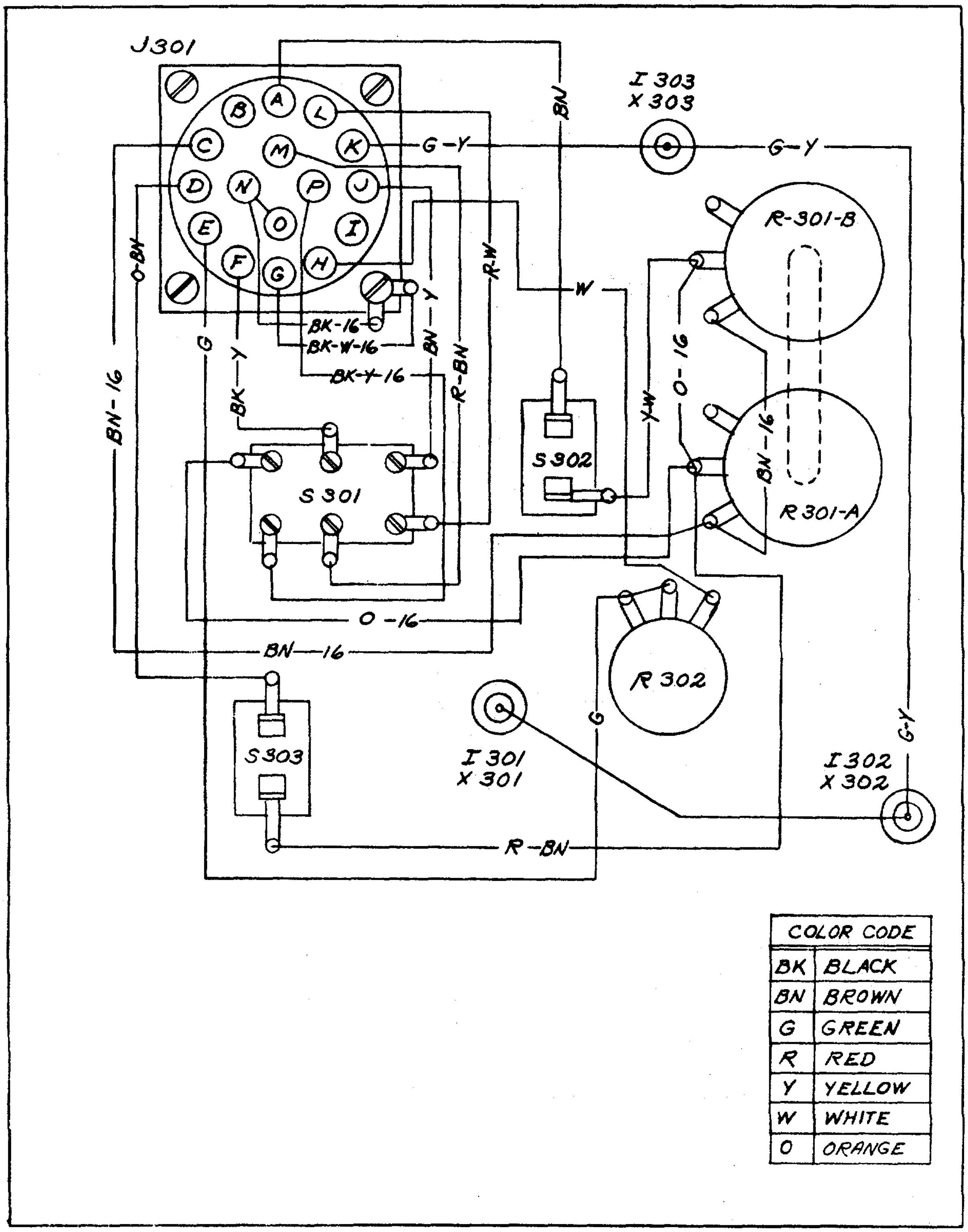


Figure 7-5. Direction Finder Control C-52/A/APA69, Wiring Diagram

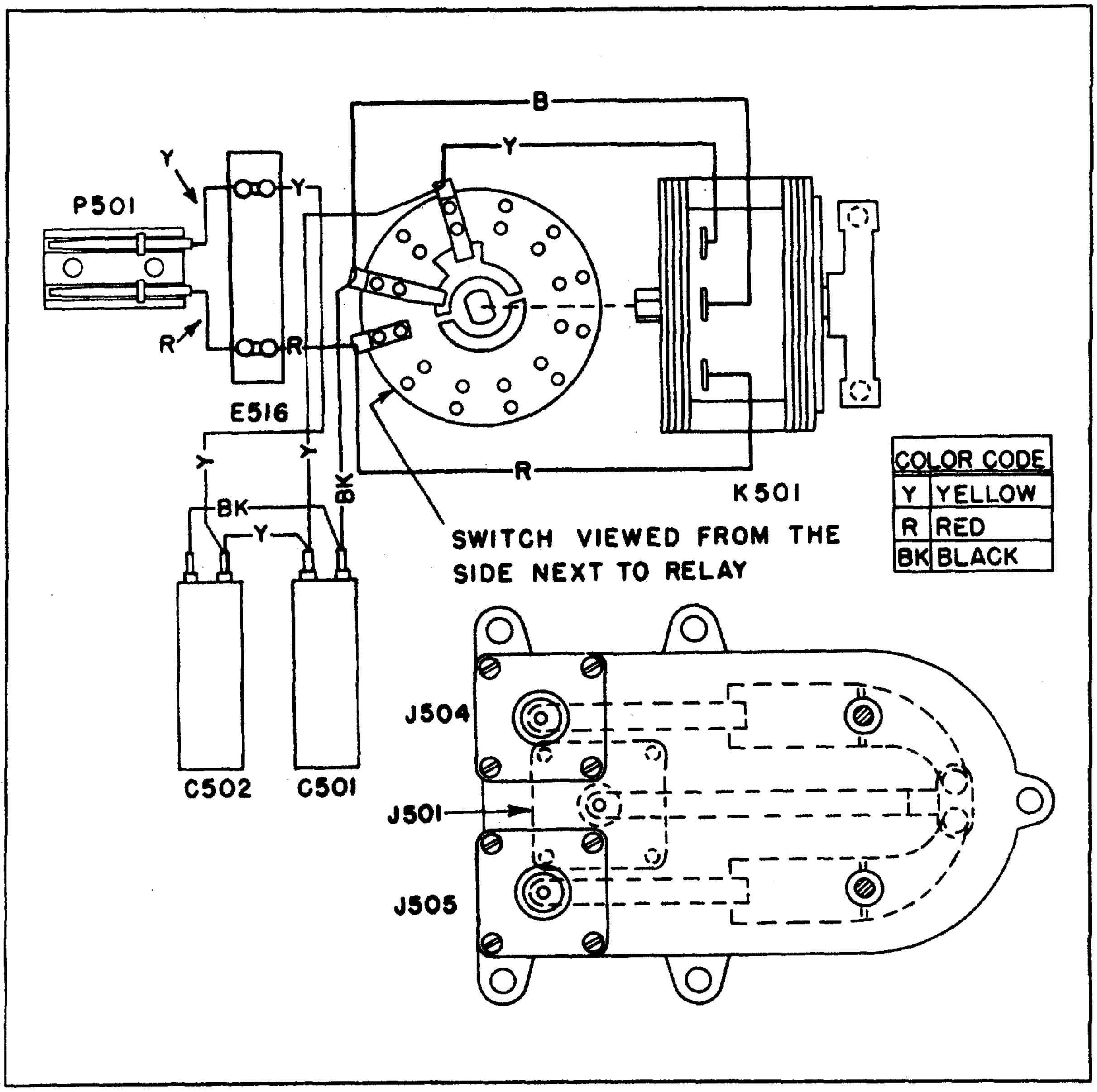


Figure 7-6. Antenna Assembly AS-435/APA-69, Wiring Diagram

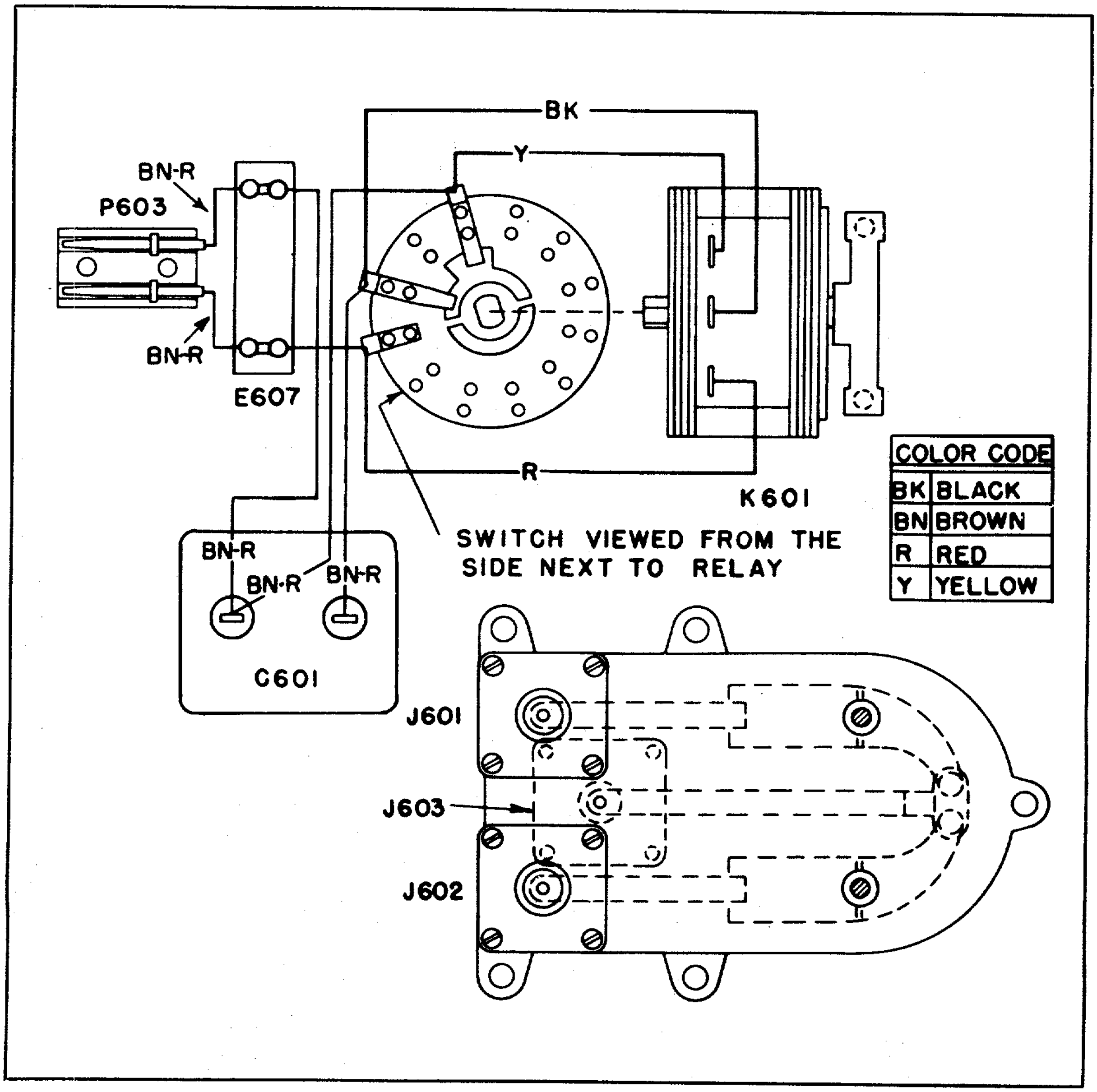


Figure 7-7. Antenna Assembly AS-434/APA69, Wiring Diagram

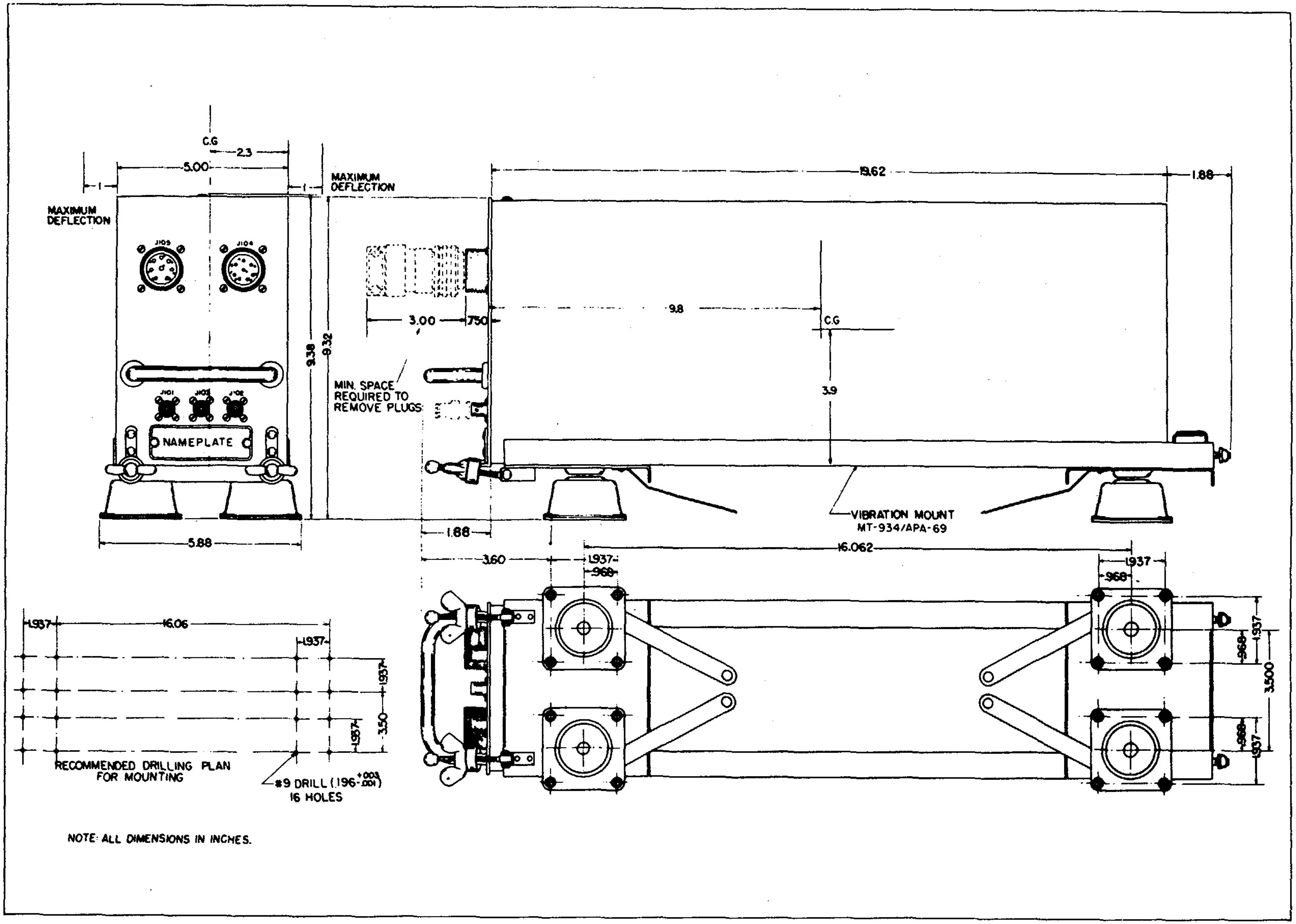


Figure 7-8. Amplifier Power Supply AM-256/APA-69 and Mounting MT-934/APA-69, Outline and Mounting Dimensions

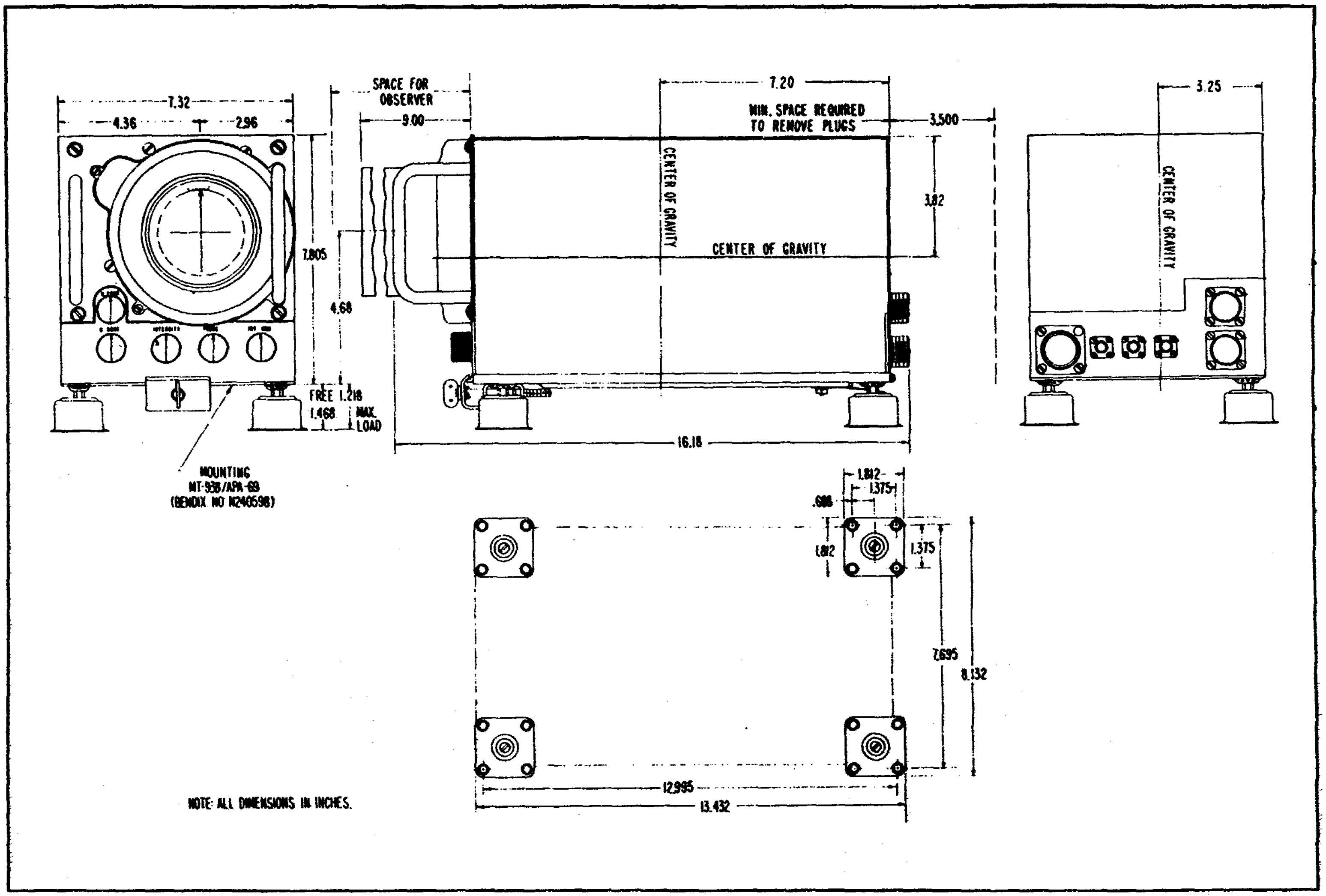


Figure 7-9. Azimuth Indicator IP-36/APA-69 and Mounting MT-938/APA-69, Outline and Mounting Dimensions

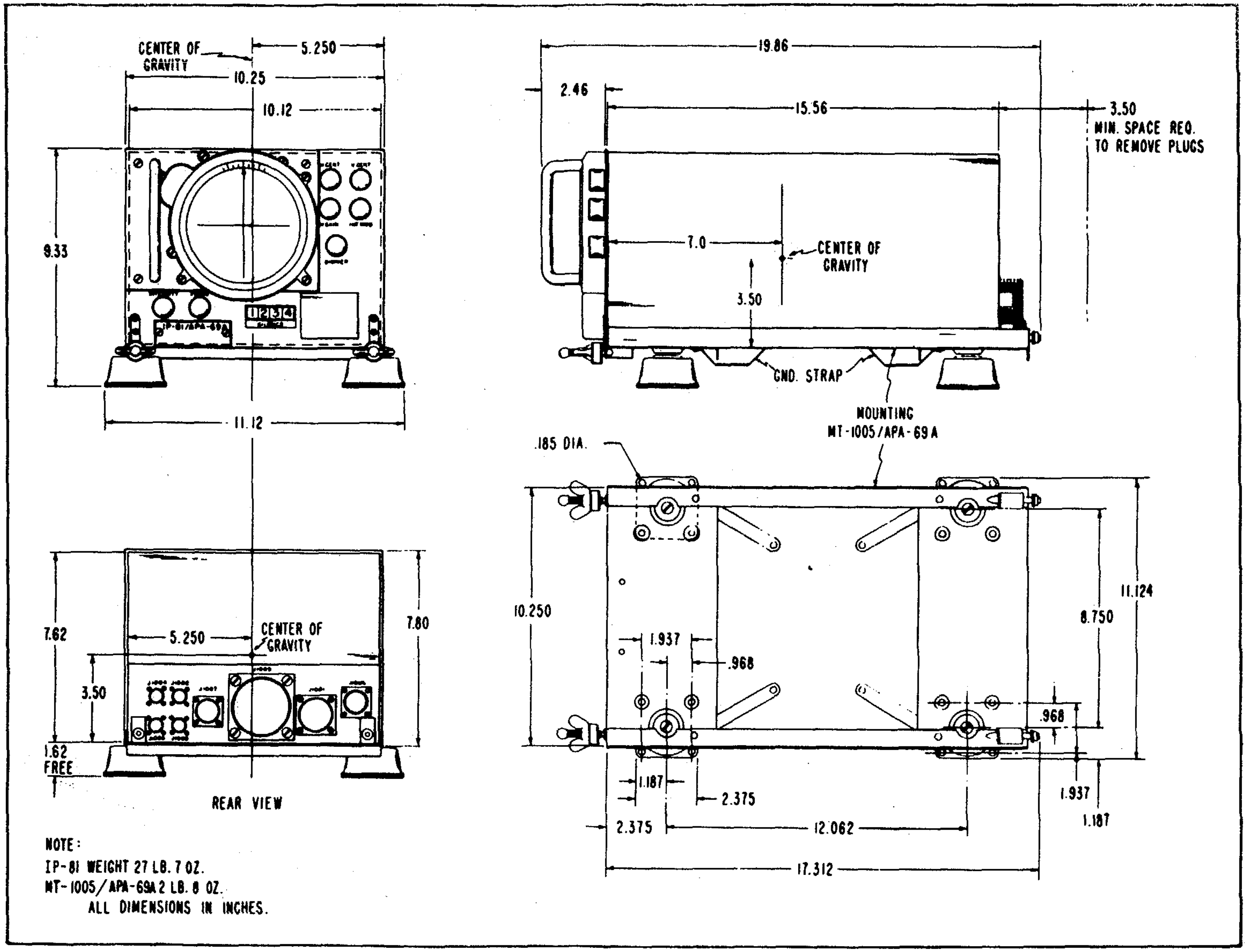


Figure 7-9A. Azimuth-Panoramic Indicator IP-81( )I/APA-69A and Mounting MT-1005/APA-69, Outline and Dimensions

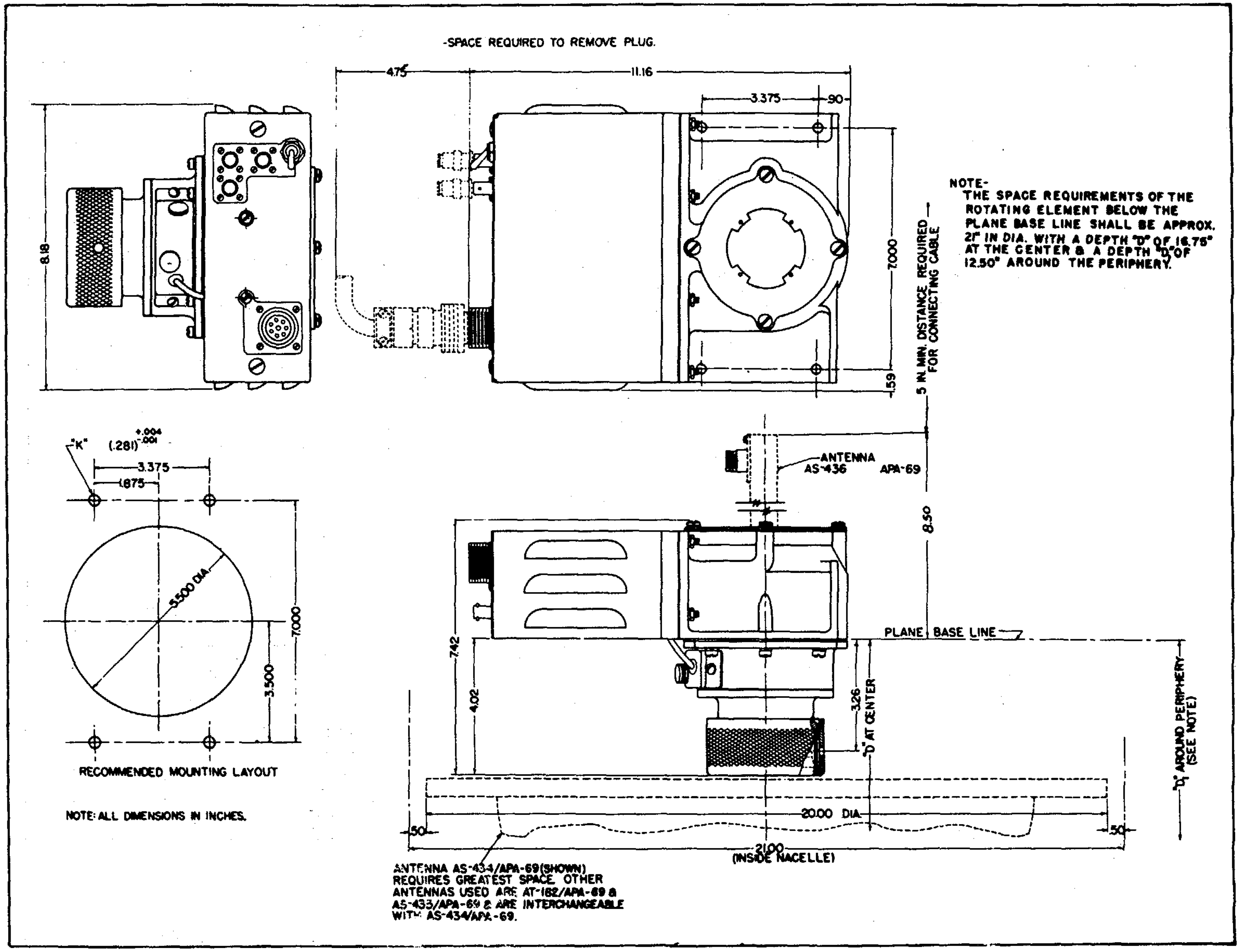


Figure 7-10. Antenna Drive TG-8/APA-69, Outline and Mounting Dimensions

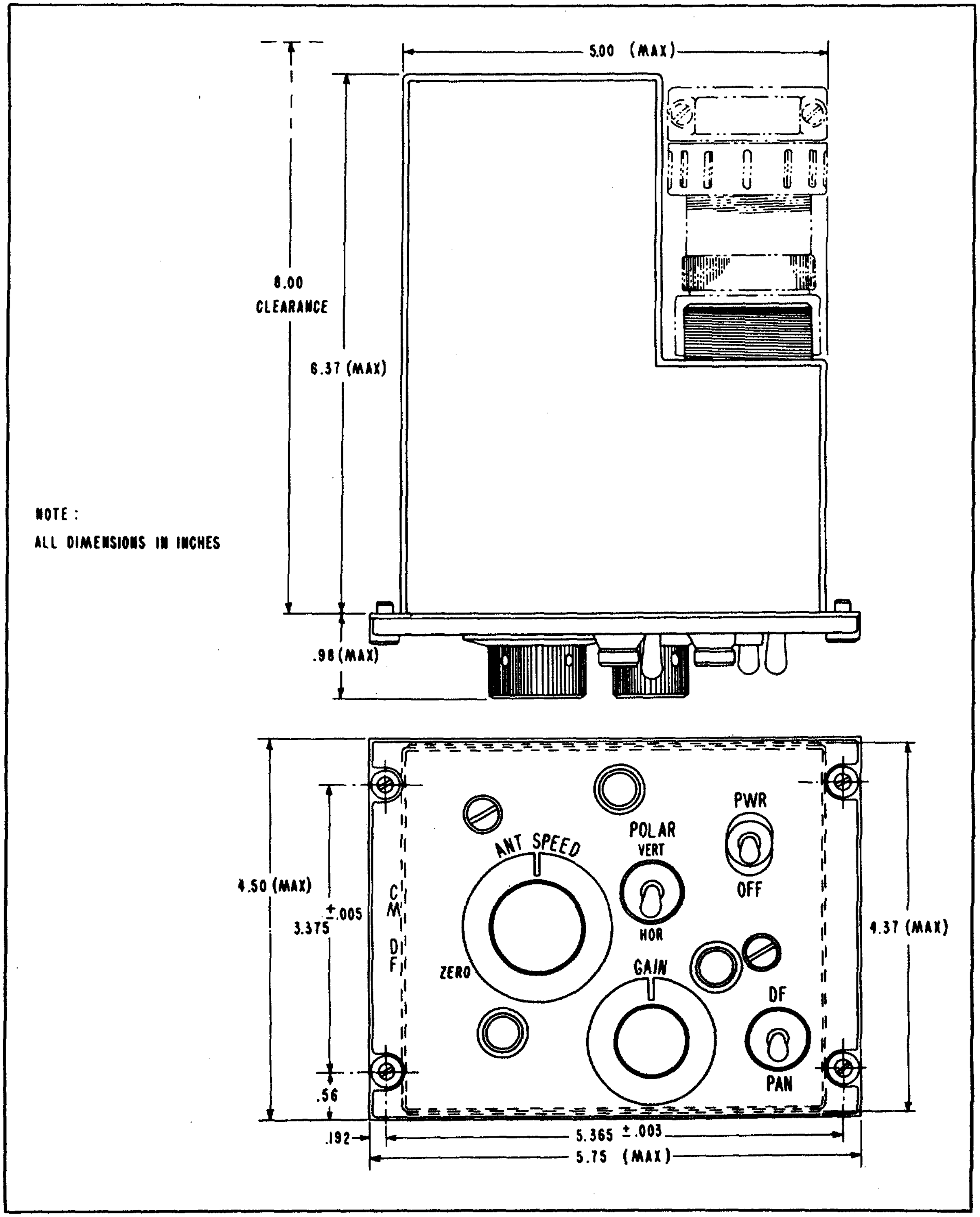


Figure 7-11. Direction Finder Control C-527/APA-69, Outline and Mounting Dimensions

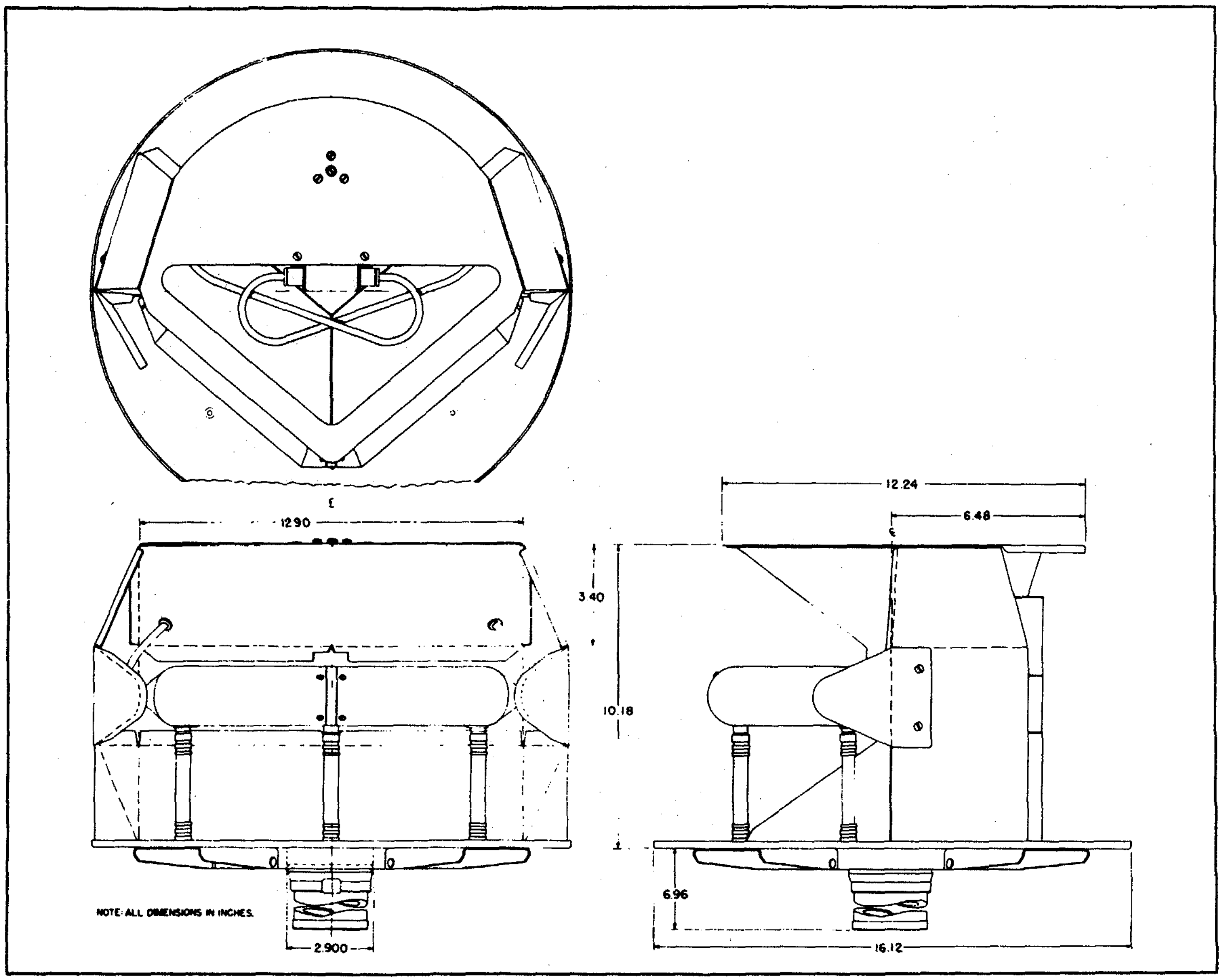


Figure 7-12. Antenna Assembly AS-435/APA-69, Outline and Mounting Dimensions

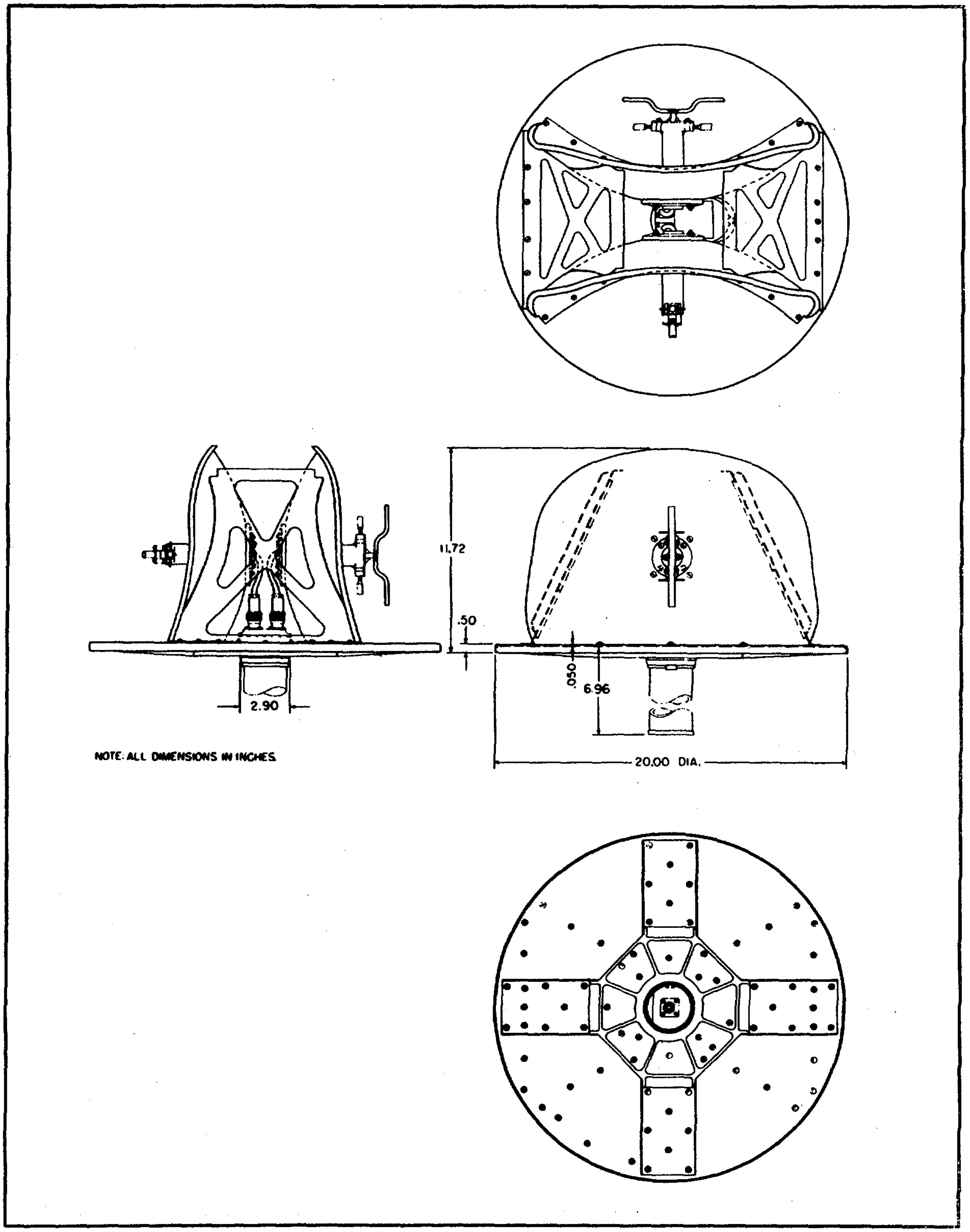


Figure 7-13. Antenna Assembly AS434/APA-9, Outline and Mounting Dimensions

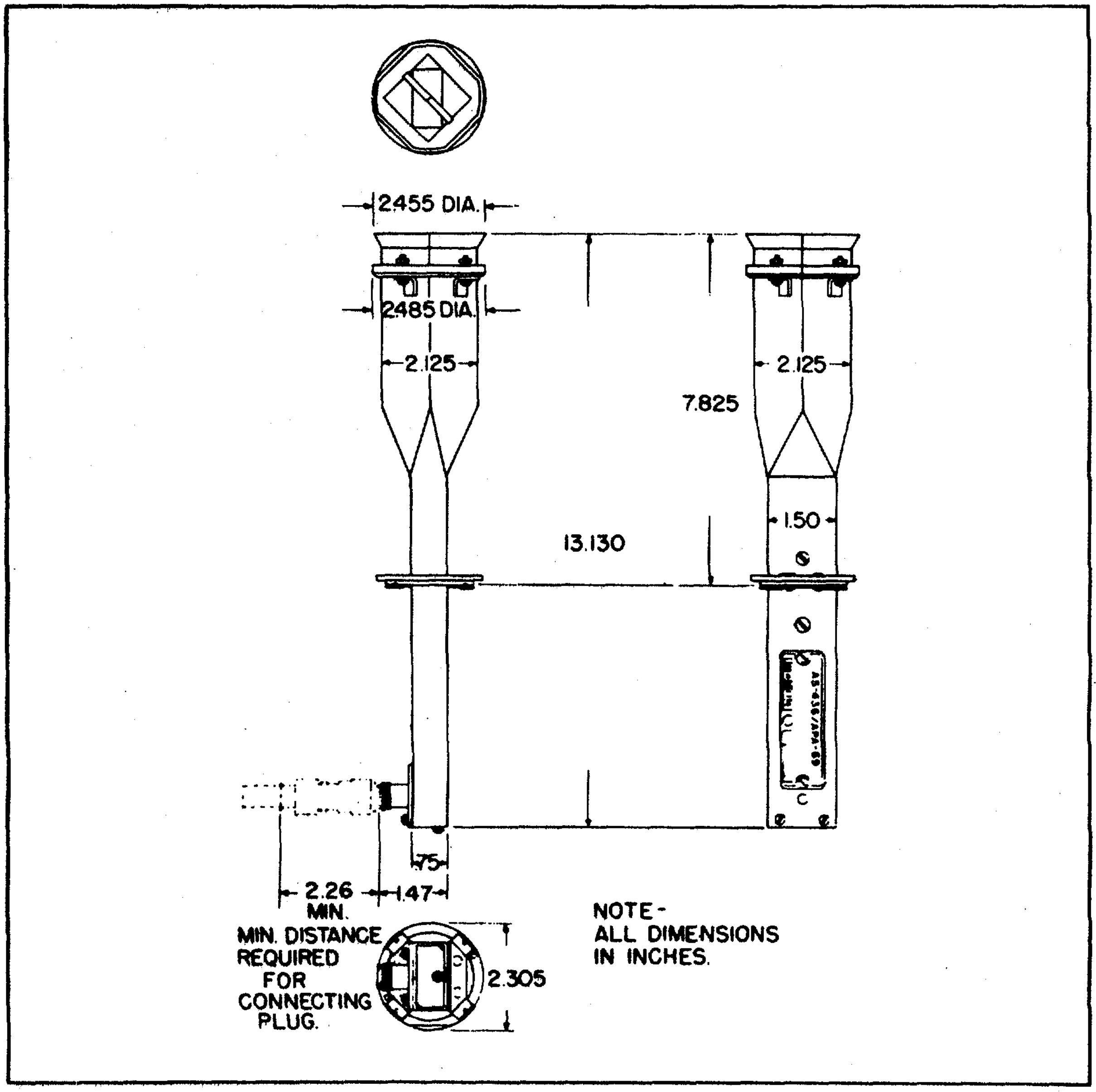


Figure 7-14. Antenna AS-436/APA-69, Outline and Mounting Dimensions

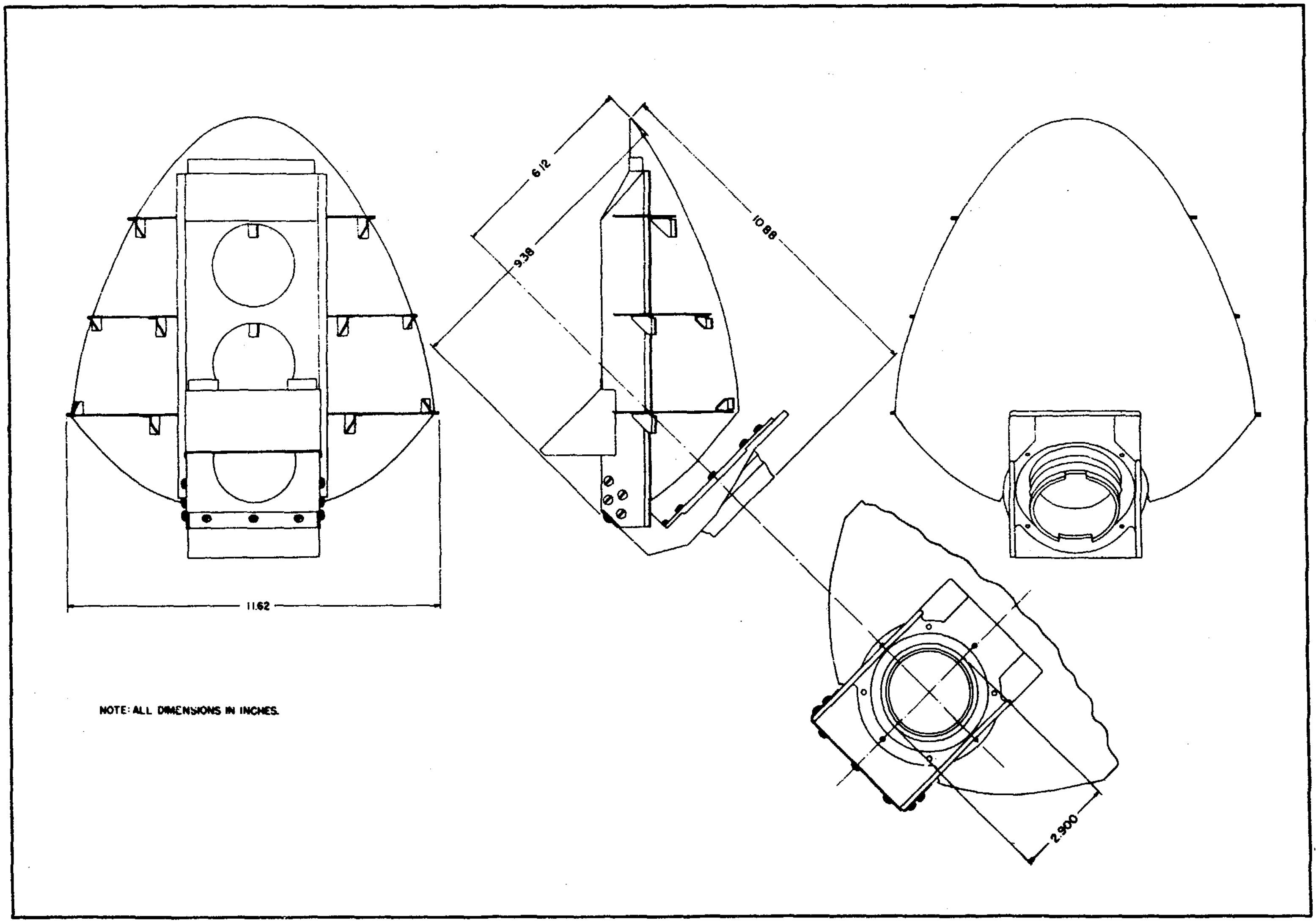


Figure 7-15. Antenna Reflector AT-182/APA-69, Outline and Mounting Dimensions

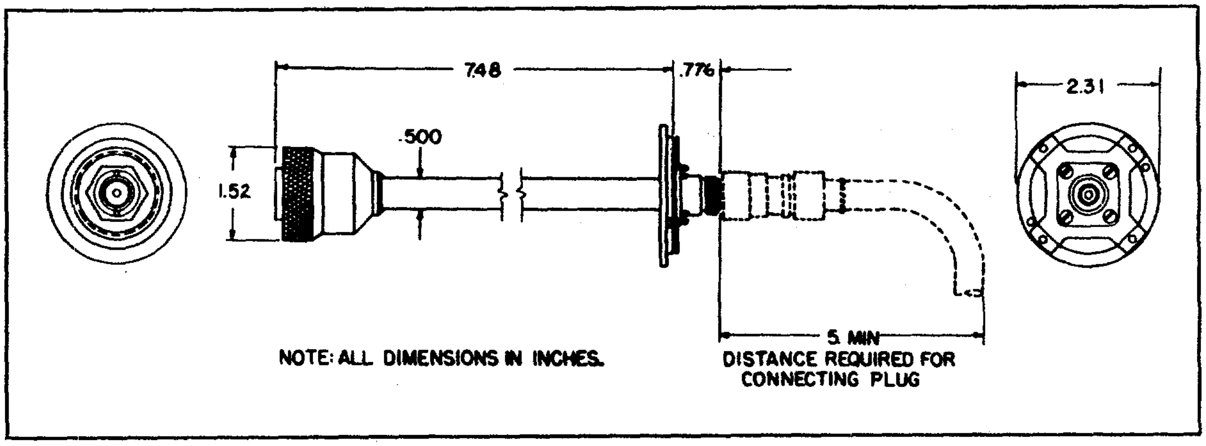


Figure 7-16. Antenna Coupler CU-174/APA-69, Outline and Mounting Dimensions

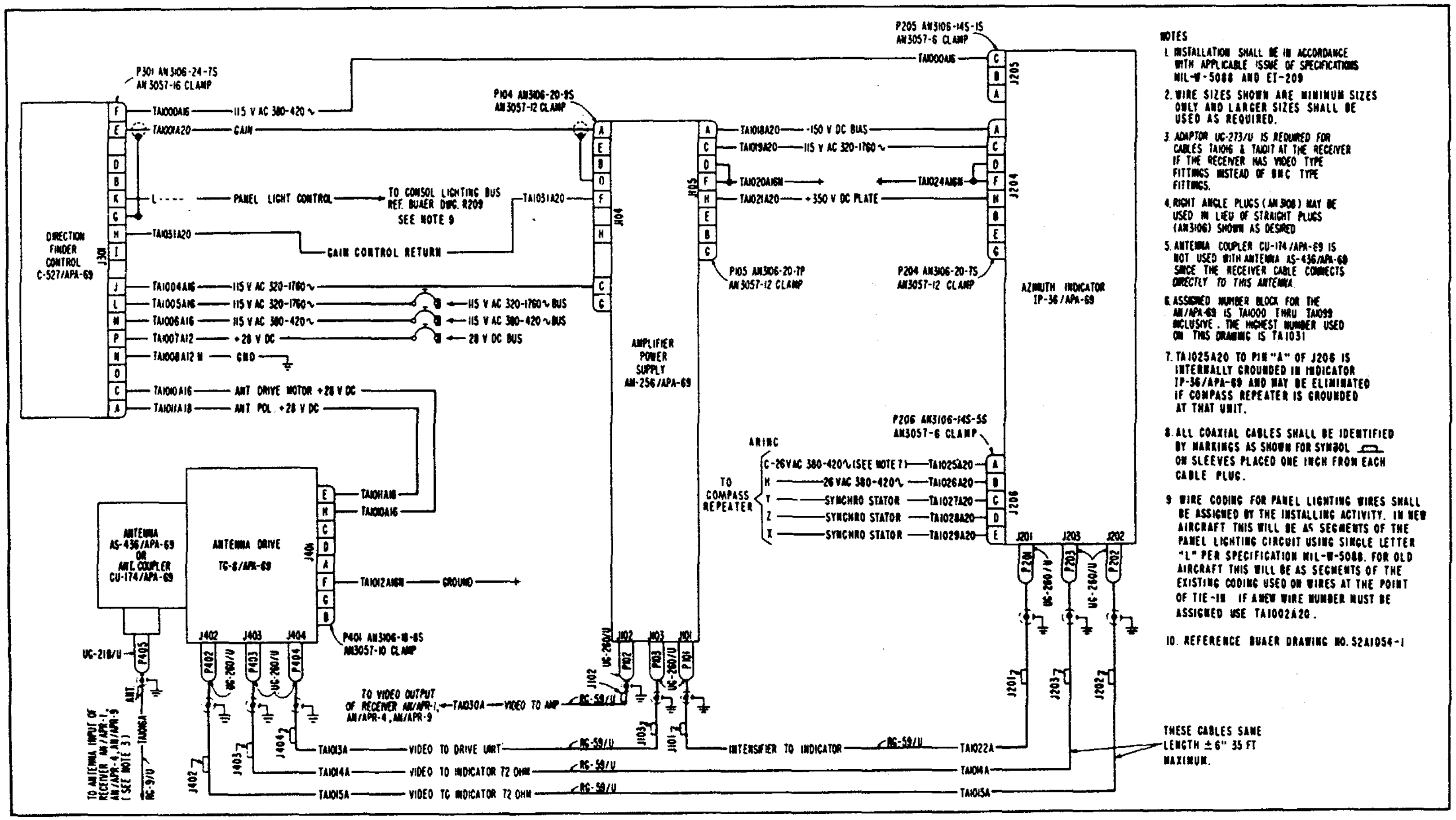


Figure 7-17. Direction Finder Group AN/APA-69, Interconnection Cabling Diagram

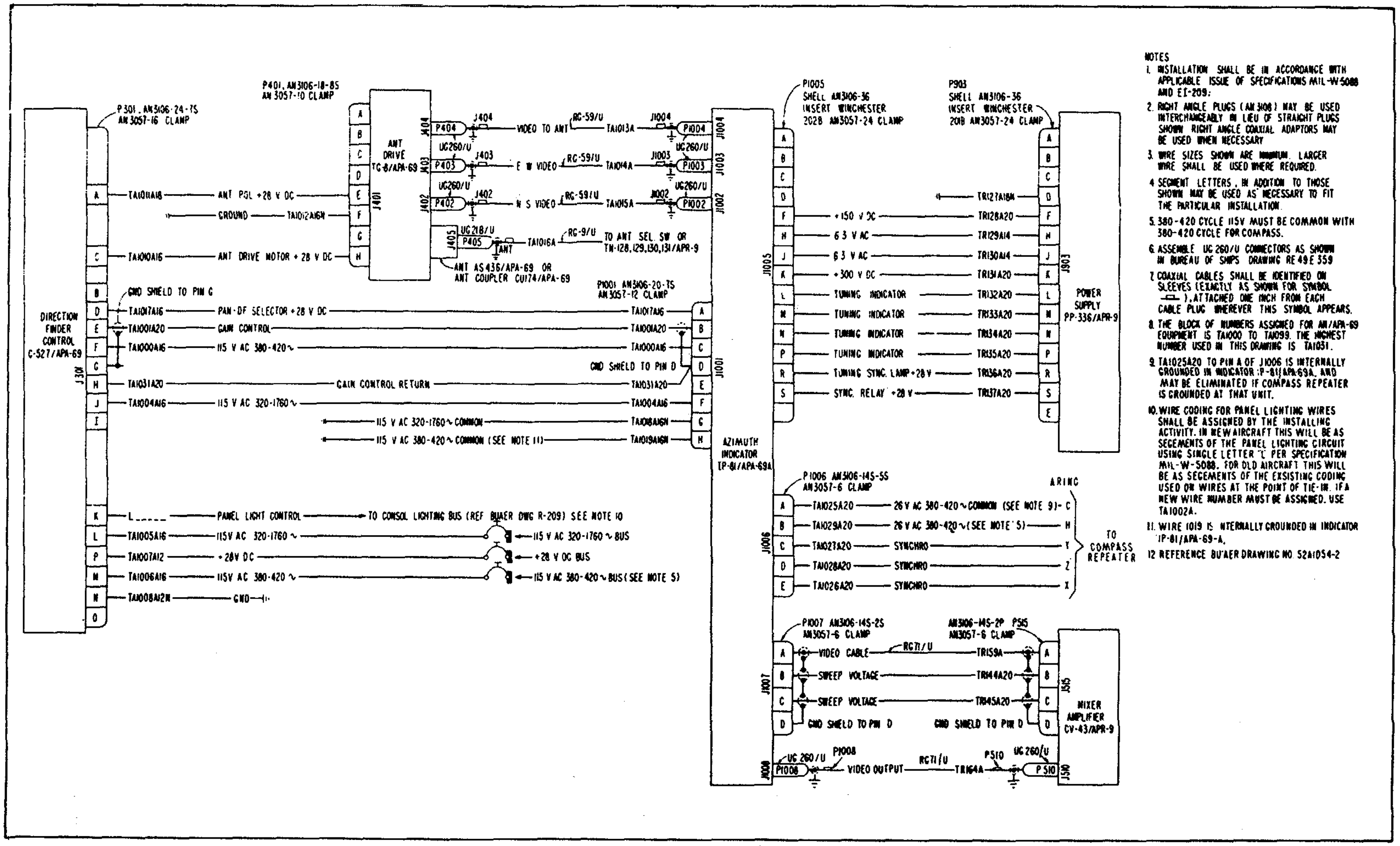


Figure 7-17A. Direction Finder Group AN/APA-69A, Interconnection Cabling Diagram

INDEX

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

INDEX (Continued)

CHAPTER 3. OVERHAUL INSTRUCTION

TABLE OF CONTENTS

SECTION I. DESCRIPTION AND LEADING PARTICULARS

TABLE OF CONTENTS (cont)

SECTION VIII. ASSEMBLY AND TESTING OF SUBASSEMBLIES AND ASSEMBLIES

SECTION IX. REASSEMBLY AND TESTING OF COMPONENTS

SECTION X. FINAL REASSEMBLY

SECTION XI. INSPECTION AND TESTING

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION I
DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL

1-2. This publication comprises overhaul instructions for the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A manufactured by Bendix Radio Division, Bendix Aviation Corporation, Baltimore 4, Maryland.

1-3. It covers the equipment components listed in table 1-1.

1-4. This publication does not cover the intercept equipment from which the direction finder groups receive a video output and, in the case of Direction Finder Group AN/APA-69A, some of its power.

1-5. DESCRIPTION.

1-6. Full description of equipment components, power requirements and theory and method of operation will be found in Sections I and IV of the Handbook Service Instructions for Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA69A.

1-7. Information on "test point" trouble shooting and circuit analysis is contained in Section VI of the Service Handbook.

TABLE 1-1. DIRECTION FINDER GROUP AN/APA-69, AND DIRECTION FINDER GROUP AN/APA-69A, MAJOR COMPONENTS

Nomenclature	Common Name
Amplifier Power Supply AM-256/APA-69	Amplifier power supply
Direction Finder Control C-527/APA-69 or C-527A/APA-69*	Control unit
Azimuth Indicator IP-36/APA-69	Azimuth indicator
Azimuth-Panoramic Indicator IP-81 ( )/APA-69A**	Azimuth-panoramic indicator
Antenna Drive TG-8 ( )/APA-69***	Antenna drive
Antenna Coupler CU-t 74/APA.69	Coupler
Antenna Reflector AT-182/APA*69	Reflector
Antenna AS-436/APA-69	Waveguide horn
Antenna Assembly AS-435/APA-69	Low frequency antenna
Antenna Assembly AS-434/APA-69	Medium frequency antenna
Mounting MT-934/APA-69 (for Amplifier Power Supply AM-256/APA-69)	Mounting
Mounting MT-938/APA-69 (for Azimuth Indicator IP-36/APA-69)	Mounting
Mounting MT-i005/APA-69A [for Azimuth-Panoramic Indicator	Mounting

* Direction Finder Control C.527A/APA-69 and Direction Finder Control C-527/APA69 are identical in function. The only different between the two controls is that the former has a stainless steel mounting while the mounting for the latter is fabricated of aluminum. In the text, the two controls are considered to be interchangeable.

** For purposes of simplification, when the text refers to an azimuth-panoramic indicator and it is not necessary to distinguish between the two types (IPF-81/APA-69A or IP.81A/APA-69A) the name will be written "Azimuth-Panoramic Indication IP.81( )/APA-69A. (or with the common name as indicated.)

*** Antenna Drives TG-8/APA-69 and TG-8A/APA-69 are interchangeable mechanically and electrically, except that Antenna Drive TG-8A/APA-69 is explosion proof and does not include the automatic speed changing device. In the text, they are considered interchangeable except as specifically stated otherwise.

Revised 28 March 1955

SECTION II
SPECIAL OVERHAUL TOOLS AND TEST EQUIPMENT

2-1. GENERAL.

2-2. This section covers special tools and test equipment required for overhaul and associated tests of Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A.

2-3. The test equipment specified in Section II of the Handbook of Service Instructions for Direction Finder Group AN/APA-69-Direction Finder Group AN/ APA-69A, in whole or in part is required as indicated throughout the text of this overhaul handbook. Reference is made herewith to this list.

2-4. The spanner wrench supplied with the equipment is also required for each operation involving installation or removal of an antenna assembly.

2-5. TEST EQUIPMENT.

2-6. In addition to the special test equipment listed in Section II of the Handbook of Service Instructions, the test equipment listed in table 2-1 is required.

2-.7. The attenuator and phase inverter unit specified in the test jig, figure 9-4A, for the Azimuth-Panoramic Indicator IP-81( )/APA-69A must be fabricated in the shop. A drawing of the parts and chassis arrangement is shown in figure 2-3. Layout and wiring is not especially critical although short leads are desirable. The components specified in the parts list (table 2-2) are those used in the original model. Other parts of equal electrical and physical characteristics may be substituted, if necessary. It is not recommended, however, that the two potentiometers specified be changed.

2-8. The two flashlight cells must be wired in series to give three volts and mounted by means of insulated cable clamps. The two coaxial leads, which enter the chassis through rubber grommets, should continue around the chassis and be fed to the center contact of potentiometer R2, in the case of the positive pulse lead, and to the stand-off insulator and one end of resistor R1, in the case of the lead to the pulse generator. Both cables should be secured by insulated clamps inside the chassis to relieve strain on the soldered connections. The shield of the pulse generator lead can be soldered to the grounded tip jack J5 (which serves as the common ground point), and the shield of the positive pulse lead is connected to the grounded terminal of potentiometer R2. The power input cable

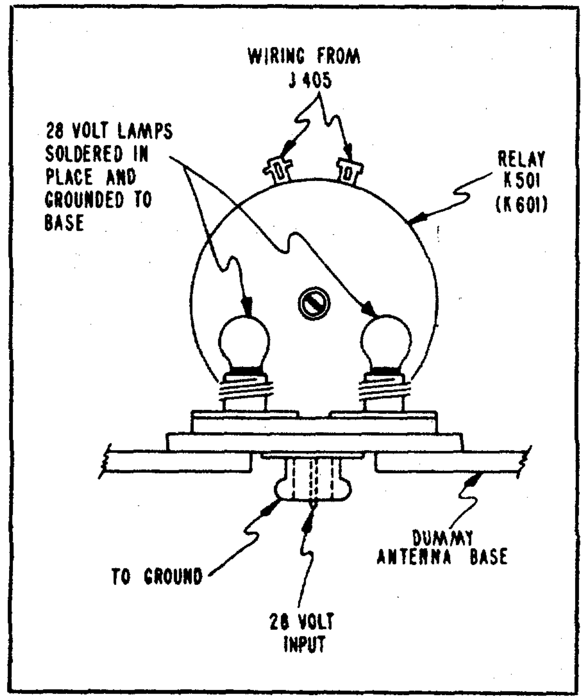


Figure 2-1. Antenna Drive TG-B/APA-69, Dummy Antenna

leads can be terminated on the six-terminal strip which has two of its mounting lugs grounded. The tip jacks provide convenient test points. Controls, test jacks, and cables should be identified with typewritten labels pasted on or lettered directly on the chassis with India ink.

2-9. Power is taken from a separate source of + 150 volts at approximately 25 ma which should be regulated and well filtered. The heater requirement is 0.45 amp at 6.3 volts.

2-10. Note that all cable and coaxial leads enter the chassis on one side through rubber grommets and terminate either at the six-terminal strip, the pin jacks, the small stand-off insulator or the potentiometer R2. It will facilitate wiring if the two potentiometers and the switch are not mounted permanently until the other wiring is completed. Be sure to use serrated washers under all controls. Observe polarity of electrolytic capacitor and dry cell batteries. Check circuits for continuity before using.

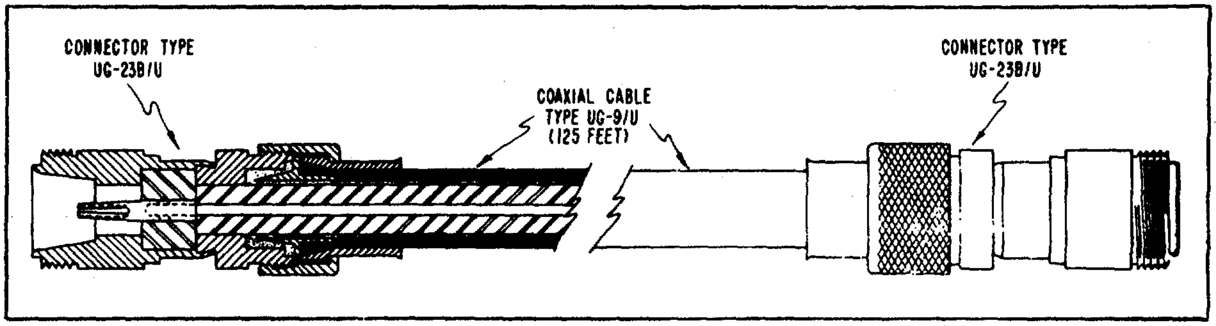


Figure 2-2. Antenna Coupler CU-174/APA-69, Long Line Load

TABLE 2-1. DIRECTION FINDER GROUP AN/APA-69, AND DIRECTION FINDER GROUP AN/APA-69A, SPECIAL TEST EQUIPMENT REQUIRED FOR OVERHAUL

Name	*AN Type Designation*	*Alternate*	*Applications*
Tachometer (100-400 rpm)			Overhaul test, Antenna Drive TG8-/APA-69
Dummy antenna	Fabricated (figure 2-1)		Overhaul test, Antenna Drive TG-8/APA-69
Attenuator and phase inverter unit	Fabricated (figures 2-3 and 9-4A)		Overhaul test, Azimuth-Panoramic Indicator IP-81( )/APA-69A
Coaxial slotted line		Hewlett-Packard Type 805-A	VSWR measurement on antenna elements
Coaxial slotted line		Polytechnic Research and Development (PR&D) Type 205-A	VSWR measurement on antenna elements
Slotted line probe		PR&D Type 250-A	VSWR measurement on antenna elements
"S"-band crystal mount		PR&D Type 613-M	VSWR measurement on antenna elements
50-ohm termination		PR&D Type 102	VSWR measurement on antenna elements
Signal Generator		Hewlett-Packard Type 608-A	VSWR measurement on antenna elements
Signal Generator		Hewlett-Packard Type 616-A	VSWR measurement on antenna elements
Signal Generator		PR&D Type 902	VSWR measurement on antenna elements
Signal Generator		PR&D Type 903	VSWR measurement on antenna elements
Signal Generator		Aircraft Radio Corp Type H. 12	VSWR measurement on antenna elements
SWR indicator		Hewlett-Packard Type 415-A	VSWR measurement on antenna elements
Long-line load	Fabricated (figure 2-2)		VSWR measurement on antenna elements
R-F adaptor fitting	Fabricated (figure 9-6)		VSWR measurement on antenna elements
Coaxial cable 2 ft ± 1 in.	Fabricated (Paragraph 9-49)		VSWR measurement on antenna elements
Right angle connector	UG-27B U		VSWR measurement on antenna elements
Crystal (1)	JAN IN21 or JAN 1N23		VSWR measurement on antenna elements

TABLE 2-1. DIRECTION FINDER GROUP AN/APA-69, AND DIRECTION FINDER GROUP AN/APA-69A. SPECIAL TEST EQUIPMENT REQUIRED FOR OVERHAUL (cont)

Name	*AN Type Designation*	*Alternate*	*Applications*
0-15/30 DC Voltmeter			VSWR measurement on antenna elements
Torque wrench 0-10 inch-ozs.			Measuring torque of Antenna Coupler CU- 174/APA-69
Noise Meter		Ferris Model 32-A or 32-B	Noise interference tests
Dummy Antenna for Noise Meter		Ferris Model 324A2	Noise interference tests
T-connector	UG-274/U		Noise interference tests
Loop Prober for Noise Meter		Ferris Model 324A8	Noise interference test
Noise Meter	Measurements Model 58	Noise interference test	
Noise Test Set	AN/URM-28		Noise interference test
Tuning Heads for Noise Test Set	TN-16 and TN-17		Noise interference test
600-ohm Headset	HS-33		Noise interference test
Audio Voltmeter		Weston Model 571	Noise interference test

TABLE 2-2. PARTS LIST FOR ATTENUATOR AND PHASE INVERTER UNIT

Symbol Designation	*Function*	*Name of Part and Description*	*AN or Manufacturer's Part No.*
		BATTERY	
BA1, 2	Bias	1-1/2V pen light	Burgess, Cat. Type Z
		CAPACITORS	
C1	Grid Coupler	0.1 mf, paper, 400V dcw	
C2	Plate Coupler	0.1 mf, paper, 400V dcw	
C3	High Voltage Filter	20 mf, 450V dcw, electrolytic, tubular type, 2 in. lg. by 7/8 in. o.d.	Cornell-Dubilier Cat. No. BR2045A
		JACKS	
J1	Positive Pulse Output	Insulated tip jack, red	Birnbach Cat. No. 407'
J2	Negative Pulse Output	Insulated tip jack, green	Birnbach Cat. No. 407
33	Horiz. Sweep Output (B)	Insulated tip jack, red	Birnbach Cat. No. 407
J4	Horiz. Sweep Output (C)	Insulated tip jack, red	Birnbach Cat. No. 407
J5	Ground to Indicator (D)	Tip jack, less insulator, black	Birnbach Cat. N0. 407
		CONNECTORS	
P1	To Mixer Amplifier (B, C, D)	4-contacts	AN3106-14S-2P
P2	To Indicator (A, B, C, D) J1007	4-contacts	AN3106-14S-2S

TABLE 2.2. PARTS- LIST FOR ATTENUATOR AND PHASE INVERTER UNIT (cont)

Symbol Designation	*Function*	*Name of Part and Description*	*AN or Manufacturer's Part No.*
		RESISTORS	
R1	Pulse Input Divider	1,000 ohms, ±10 %, 2w, carbon	Allen-Bradley Type HB
R2	Pulse Input Gain Control	100 ohms, Standard "U" curve, molded element, potentiometer with washer and nut	Allen-Bradley JU101-2/P.2056
R3	Grid Resistor	100,000 ohms, ± 10;%, 1/2w, comp	Allen-Bradley Type HB
R4	Cathode Bias	330 ohms, ±:10%,1/2w, comp	Allen-Bradley Type HB
R5	Plate Load	470 ohms, ± 10%, 2w, comp	Allen-Bradley Type HB
R6	Horiz. Sweep Attenuator	25,000 ohms per section, linear, potentiometer, dual, with washer and nut	Allen-Bradley JJ/SD3108/U2531
		SWITCH	
S1	Function Switch	Double pole, three position wafer type	Mallory Cat. No. 3223J
		TUBES	
V1	Inverter	7-pin miniature pentode	JAN-6AN5
		SOCKETS	
X1	Socket for VI	7-pin miniature type	Amphenol No. 147-925
-	Tube Shield for X1	1-3/4 in. miniature tube shield	Amphenol No. 5-402
		MISCELLANEOUS	
-	Mounting for Batteries	Cable clamps, insulated (2)	Adel Type 754-8-2-8
-	Hold Down for Coaxial Cables	Cable clamps, insulated (2)	Adel Type 754-4-2-8
-	Output from Pulse Generator and Input to Indicator from Positive Pulse Jack J I	Coaxial connectors (2)	UG-260/U
-	Pulse Generator Output to Input Cable	Coaxial adaptor	UG-273/U
-	Anchor Points, Power Input Cable	Terminal strip, 6 terminals	Birnbach Cat. No. 1386
-	Chassis for Test Unit	Aluminum chassis, 6 in. long x 4 in. wide x 3 in. deep	Bud Cat. No. 430
-	Two Signal Leads, 3 ft. Long each	7 ft. (approx.) coaxial cable	RG-59/U
-	Two horiz. Sweep Leads, 3 ft. long each	7 ft. (approx.) shielded, twisted pair	-
-	Circuit Wiring and Cables	Hook up wire No. 18 stranded, misc. colors.	-
-	For Mounting components	Misc. nuts, screws, washers, n.p.	-
-	Coaxial and Cable Leads from Test Unit	Grommets (4), 5/16 in. i.d. hole 7/8 in. o.d. rubber	AN931-5-9
-	Protects Three Cable Leads	Cable sheaths (3), black Vinyl plastic spaghetti	Turbotherm No. 105 or equivalent
-	Junction of RI and Pulse Generator Input Coaxial Lead	Insulated stand-off 7/8 in. Long	-
-	Horiz. Sweep Amp. and Pulse Amp. Control Knobs	Round knobs with arrow (2) for potentiometers R2 and R6, approx. 1-3/16" o.d.	-
-	Function Switch Selector Knob	Pointed switch knob for S1, approx. 1-1/4" long	Supplied with Switch

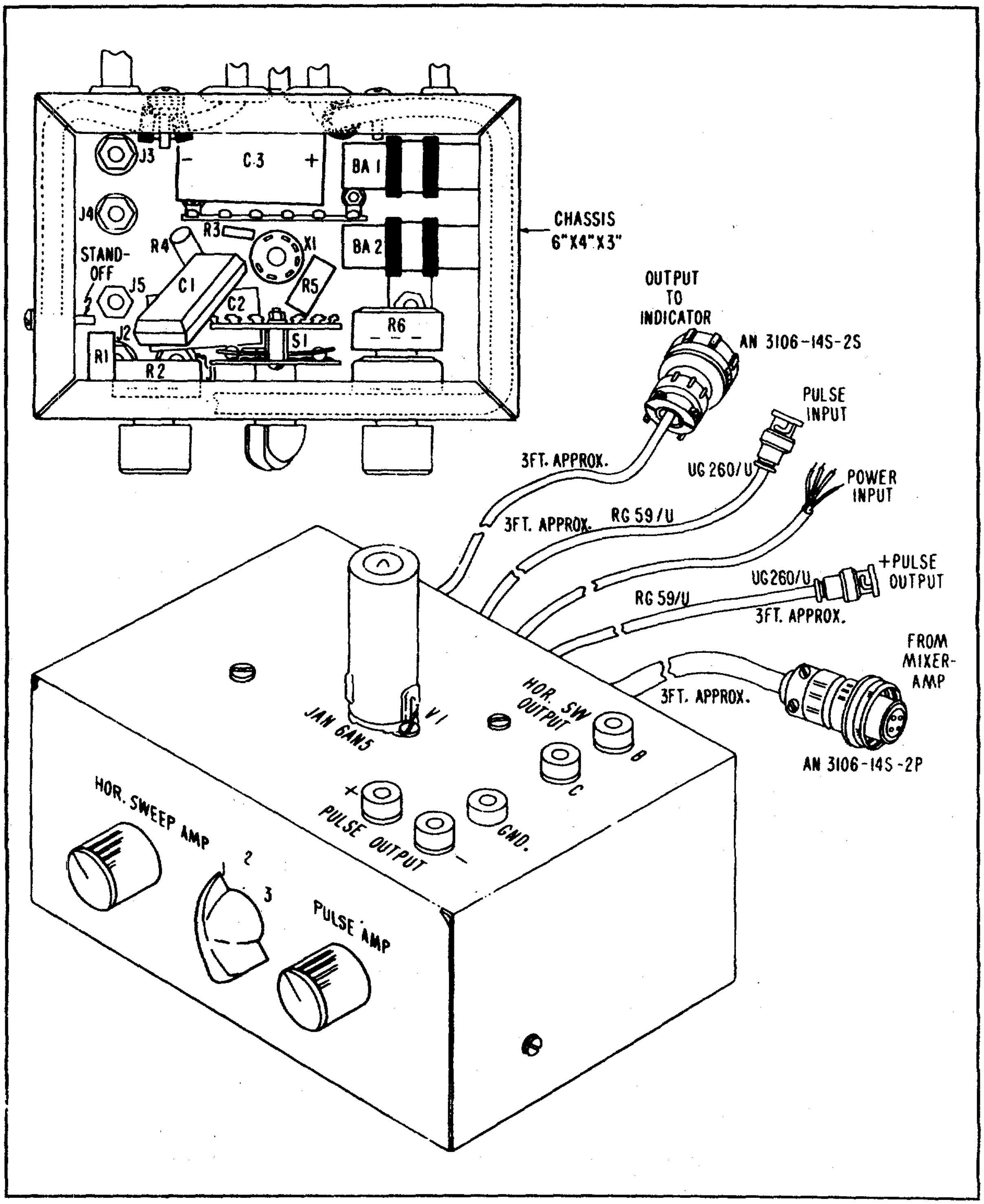
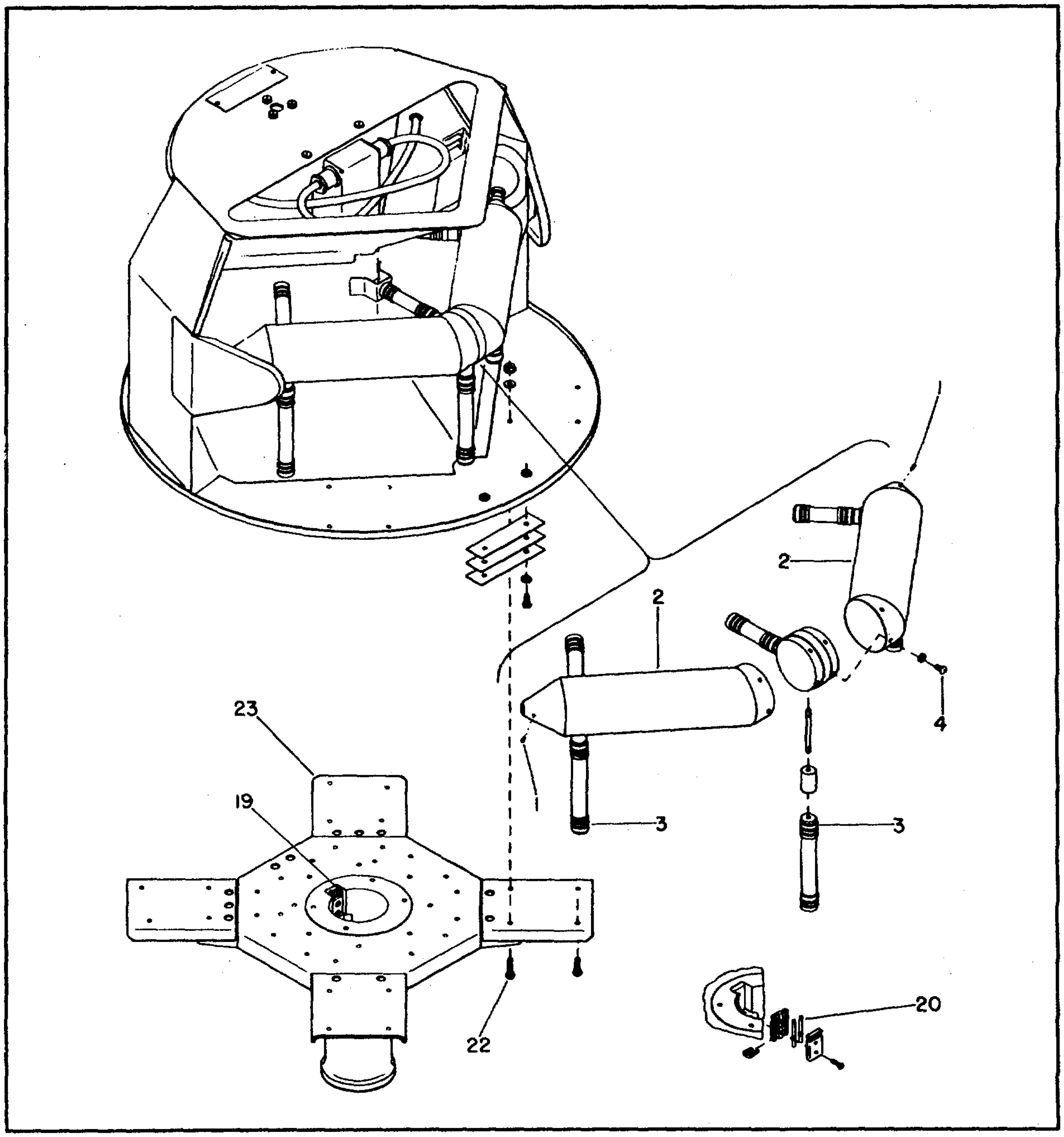
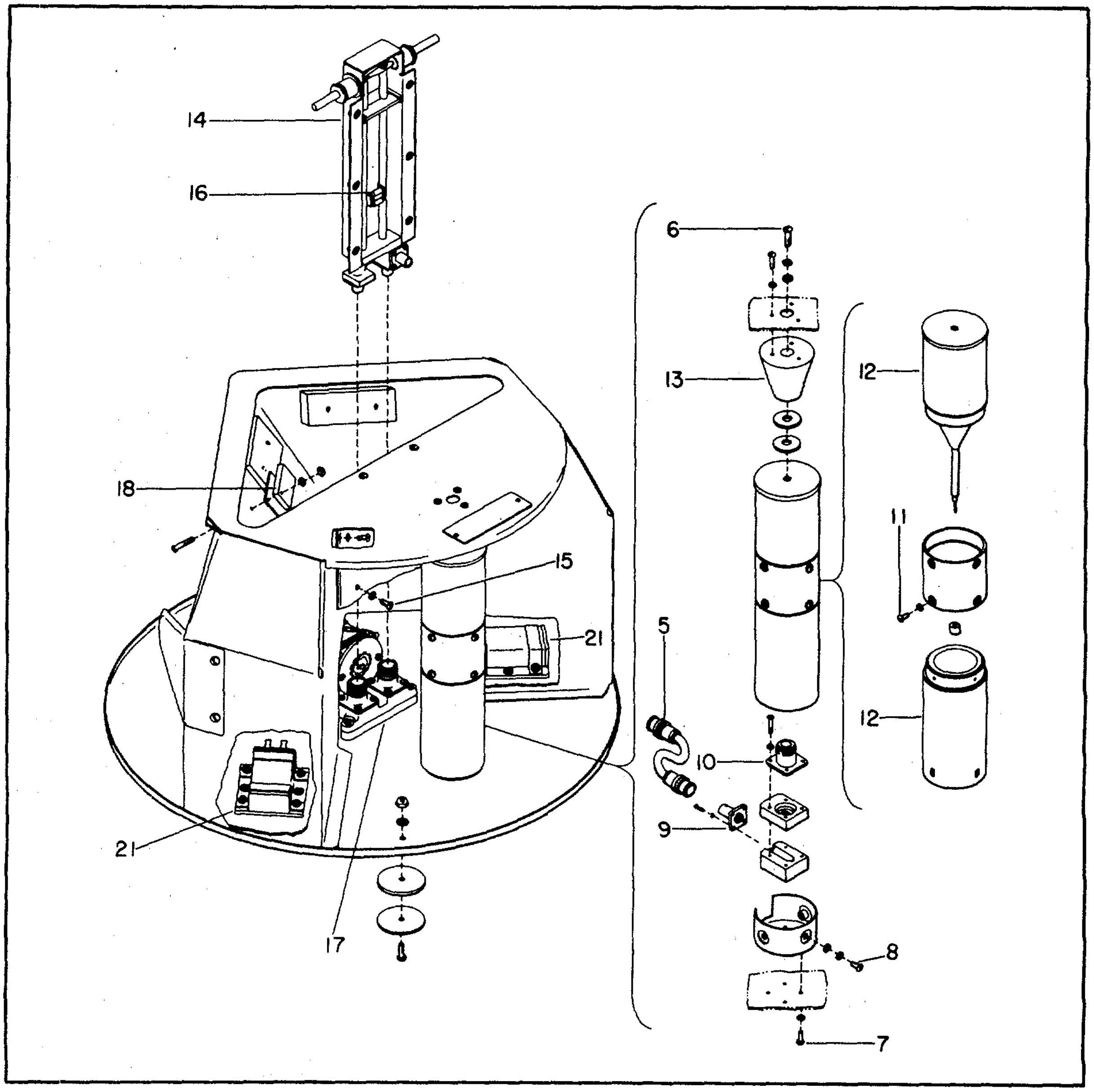


Figure 2-3. Attenuator and Phase Inverter Unit



1	Screw	7	Screw
2	Vertical antenna	8	Screw
3	Standoff insulator	9	Plug
4	Screw	10	Connector
5	Plug connector	11	Screw
6	Screw	12	Horizontal antenna

Figure 3-1. Antenna Assembly AS-435/APA-69, Disassembly (Sheet 1 of 2 Sheets)



13	Insulator	19	Power connector
14	Matching unit (bazooka)	20	Terminal contacts
15	Plate	21	Capacitor
16	Resistors	22	Screw
17	Rotary coaxial relay	23	Base mounting plate
18	Terminal board		

Figure 3-1. Antenna Assembly AS-435/APA-69, Disassembly (Sheet 2 of 2 Sheets)

SECTION III
SPECIALIZED MAINTENANCE AND REPAIR

3-1. GENERAL.

3-2. This section covers the performance of specialized maintenance (as differentiated from overhaul) which, because it is outside the range of FASRON maintenance activities, must be performed by Overhaul and Repair facilities.

3-3. In some instances, because this maintenance requires cleaning and inspections not in accord with those employed during normal overhaul activities, the entire disassembly, repair or maintenance, cleaning, inspection and reassembly of the unit involved will be covered in this section. Where this is true, the same information will be referenced in subsequent sections on cleaning, inspection and reassembly.

3-4. MAINTENANCE AND REPAIR, TORQUE UNIT. AND AMPLIFIER [AZIMUTH INDICATOR IP-36/APA-69 AND AZIMUTHPANORAMIC INDICATOR IP-81( )/APA-69A].

3-5. VISUAL INSPECTION AND REPAIR. In general, FASRON maintenance will not attempt repairs on the elements of the torque unit and amplifier sections of the Azimuth Indicator IP-36/APA-69, and Azimuth-Panoramic Indicator IP-81 ( )/APA-69A. In maintenance and repair work at overhaul facilities, the following precautions are to be observed:

a. Inspect all soldered joints and repair weakened connections.

b. Inspect all wires and replace those found in poor condition.

c. Exercise care to replace wire with new wire of the same gauge and tracer color.

d. Locate new wires in the same position as those replaced.

e. Clean new soldered joints with alcohol to remove all traces of flux.

f. Replace any insulating sleeves removed for repairs.

3-6. Test the amplifier tube V206 of the Azimuth Indicator IP-36/APA-69 and replace it if it shows signs of deterioration. (Replacement of this tube may affect balance and sensitivity of the amplifier, and these checks should be performed carefully again after reassembly. Refer to paragraphs 6-29 and 6-35 of the Handbook of Service Instructions.)

3-6A. Test the amplifier tube V1010 of the azimuthpanoramic indicator and replace it if it shows signs of deterioration. (Replacement of this tube may affect balance and sensitivity of amplifier, and these checks should be performed carefully again after reassembly. Refer to paragraphs 6-34A and 6-35 of the Handbook Service Instructions.)

3-7. VOLTAGE CHECKS. The torque unit and amplifier in the Azimuth Indicator IP-36/APA-69 must be tested in place. Connect the Autosyn Test Unit (as fabricated in paragraphs 6-26 and 6-27 of the Service Handbook) to J206 on the Azimuth Indicator IP36/APA-69. Connect a source of 115-volt a-c power (380-420 cps) to J205. It is not necessary that the cathode-ray tube or signal circuits of the azimuth indicator be connected, since this test is only for voltages within the torque unit amplifier section.

<u>CAUTION</u>

Do not apply power until it is assured that all plug contacts, etc., are "making" normally.

3-7A. VOLTAGE CHECKS. The torque unit and amplifier in the azimuth-panoramic indicator must be tested in place. Connect the autosyn test unit (as fabricated in paragraphs 6-26 and 6-27 of the service handbook) to J1006 on the azimuth-panoramic indicator. Connect a source of 115-volt a-c power (380420 cps) toJ1001. It is not necessary that the cathode-ray tube or signal circuits of the azimuth-panoramic indicator be connected, since this test is only for voltages within the torque unit amplifier section.

3-8. With these test connections, rotor excitation, fixed phase excitation and variable phase excitation may be checked as follows:

a. Using A-C Multimeter TS-352/U (or equivalent, from table 2-1, Handbook of Service Instructions), read rotor excitation from terminal B of J206 (the Flux Gate compass line) to ground. It should be 26volts ac plus or minus 10 per cent.

b. With the same multimeter, read fixed phase excitation between terminals F and I of J207, the plug at the rear of the torque unit. This voltage should be 26-volts ac plus or minus t10 per cent.

c. Read variable phase excitation between terminals H and J of J207. Connect a Ballentine type 300 vacuum-tube voltmeter (or equivalent, from table 2-1, Handbook of Service Instructions) across these terminals. After permitting the azimuth indicator ring to go to null, turn off the power and shift the autosyn pointer needle by hand 180 degrees. Turn the power back on and read the voltage as the torque unit is driven back to null. The maximum voltage should read between 75 and 120 volts.

3-9. One of the common causes of erratic operation of the torque unit and amplifier is unbalance, which causes the azimuth indicator to turn slowly and continuously. Balancing instructions are given in paragraph 6-29 of the Handbook Service Instructions.

3-10. If the amplifier has been balanced and the gain control adjusted after changing the amplifier tube, all corrections of visible faults made, the equipment cleaned and the voltage checks made satisfactorily, the torque unit and amplifier may be considered in satisfactory operating condition.

3-11. MAINTENANCE AND REPAIR, ANTENNA ASSEMBLY AS-435/APA-69.

3-12. To disassemble the Antenna Assembly AS435/APA-69 (for maintenance and repair only) proceed as follows (see figure 3-1):

3-13. REMOVAL OF HORIZONTAL ANTENNA ELEMENTS.

a. Remove the two setscrews (reference l).at the ends of the horizontal antenna elements (reference 2).

b. Remove the six screws at the ends of the standoff insulators (reference 3). Removal of these screws frees the entire horizontal antenna assembly.

c. Standoff insulators may be replaced by unscrewing them from the studs attached to the antenna elements. The two insulators at the center of the horizontal antenna screw into threaded bolts which also may be removed.

d. To replace either horizontal antenna element, remove the screws (reference 4) which attach the element to the central coupling spacer.

3-14. REMOVAL OF VERTICAL ANTENNA ELEMENTS.

a. Disconnect the coaxial plug connector .(reference 5) at the bottom of the vertical antenna assembly.

b. Using a long handled screwdriver, remove the screw (reference 6) at the top of the antenna assembly.

c. Now remove the four screws (reference 7) from the bottom of the assembly. The entire antenna assembly will come out.

d. To repair the connector at the base of the vertical antenna assembly, remove the screws (reference 8) which secure it to the base. Now it may be disassembled by removing the screws which hold the plug (reference 9) and the interior connector (reference 10) on the assembly.

e. To separate the upper and lower antenna elements, remove the screws (reference 11) which hold them together. The elements (reference 12) may now be replaced individually.

CAUTION

Do not attempt further disassembly on these elements, and handle them with care. Damage to any antenna element will incapacitate the entire assembly.

f. The insulator (reference 13) at the top of the vertical assembly may be replaced by removing the screws which hold it on the reflector cover.

3-15. REMOVAL OF MATCHING UNIT (BAZOOKA).

a. To remove the matching unit (commonly called the bazooka) (reference 14), first remove the vertical antenna assembly as instructed in the preceding paragraph 3-14, steps a through c.

b. Now take out the screws (reference 15) which hold the plate behind the antenna. The bazooka is attached to this plate by six more screws which may be removed to permit access to the interior of the matching unit.

c. Pull the bazooka up to disengage it from the connectors into the rotary coaxial switch.

d. The matching resistors (reference 16) are removable by unsoldering.

3-16. REMOVAL OF ROTARY COAXIAL SWITCH.

a. After removal of the bazooka as described in paragraph 3-15, use a straight or, where necessary, a right-angle screwdriver to remove the screws which hold the coaxial switch (reference 17) on the base plate.

b. This switch may be replaced in its entirety, or the relay coil may be removed and replaced separately. Should it be necessary to replace the spring conductors inside the switch body (usually because of trouble with the contact points or pressure), the switch body may be opened and these elements replaced by unsoldering them from the connector wires and installing new ones. Exercise caution not to bend the replacement connectors since any bending may result in their failure subsequently to make proper contact.

3-17. REMOVAL OF POWER CONNECTOR.

a. In order to remove the power connector (reference 19), remove the screws from the terminal board (reference 18) at the top of the antenna assembly and attach a string or light wire to it. (This will enable the power connector to be dropped down through the shaft and subsequently to be drawn back into place. Extra length of wiring is provided for this purpose.)

b. Now insert a thin, long-handled screwdriver through the hole in the shaft opposite the power connector (reference 19.) and remove the screws which secure it. Lower it through the shaft where the terminal contacts (reference 20) may be unsoldered and replaced. (These terminal contacts are easily damaged and will probably account for a large proportion of maintenance on this antenna assembly.)

3-18. REMOVAL OF CAPACITORS. The capacitors (reference 21) are designed to suppress sparks during the operation of the coaxial switch. Their failure is not immediately noticeable; since the circuit is protected by circuit breakers instead of fuses and must have an initial overload tolerance of several hundred per cent, shorting of these capacitors may not incapacitate the circuit. In the event of repeated overload kickout, however, it is suggested that a d-c voltmeter be connected in series with one of the terminals of the terminal board (reference 18) to measure the current drawn through the relay while the equipment is on and the "POLAR" switch operated. If the capacitors are not shorted, current will be approximately one volt after an initial surge; if they are shorted, it will continue at a higher level, approximately five volts. ("ANT. SPEED" should be ZERO, of course.)

3-19. If removal is required, the vertical antenna assembly, bazooka, and coaxial switch must be removed first. (Refer to paragraphs 3-14, 3-15 and 3-16.) The capacitors are released by removing the screws which hold their mounting plates to the base mounting plate. These screws are accessible from the underside of the antenna base mounting plate.

3-20. REMOVAL OF BASE MOUNTING PLATE.

a. Insert a long-handled screwdriver as in paragraph 3-17b and remove the screws which hold the connector (reference 19) on the shaft.

b. Now remove the sixteen screws (reference 22) which hold the antenna assembly on the base mounting plate (reference 23). This frees the base mounting plate.

3-21. BALANCING WEIGHTS. Each antenna is balanced before shipment by the addition of washers where necessary about the underside of the base. This balancing minimizes vibration and the excessive wear which would result from it. Every attempt should be made after maintenance work to return cables and other non-fixed weight to the same location as before. If removed, these weighting washers must be returned to their places before release of the assembly for use.

3-22. CLEANING. During maintenance, the chassis of the antenna assembly may be blown out with clean compressed air at a pressure of 20 to 30 pounds.

3-23. INSPECTION. After maintenance, a thorough inspection should be made of all soldered joints, all screws checked for tightness and replacement of washers, etc., and the entire assembly checked out for bench damage.

3-24. TESTS. After reassembly, the tests outlined in Section IX must be applied before release of the antenna assembly for use.

3-25. MAINTENANCE AND REPAIR, ANTENNA ASSEMBLY AS-434/APA-69.

3-26. The relay and antenna elements of Antenna Assembly AS-434/APA-69 may be replaced if necessary. No special procedural instructions are necessary for this operation.

SECTION IV
DISMANTLING AND DISASSEMBLY

4-1. GENERAL.

4-2. This section describes the separation for purposes, of overhaul of the Direction Finder Group AN,APA-69 and Direction Finder Group AN/APA69A into components and the disassembly of those components. Detailed instructions have been omitted where the procedure is entirely obvious.

4-3. PRELIMINARY SEPARATION OF COMPONENTS.

4-4. If it is desired to remove a component for replacement, disconnect the cables and follow the instructions in the paragraphs below which apply to the particular unit. Removal and disassembly of parts of a component, except vacuum tubes or dial lamps, should not be attempted in an aircraft. Remove the entire component to a service bench before proceeding further with disassembly.

4-5. In instances where the equipment has been disassembled into its components and shipped individually, carefully remove each component from its packing box and place on a repair bench before further disassembly.

CAUTION

In handling Antenna Assemblies AS-435/APA-69 and AS-434/APA-69, do not lift or move these antennas by means of the antenna elements. In handling the azimuth indicators exercise caution not to damage the cathode-ray tubes, as a dangerous explosion may result.

4-6. Disassembly of Antenna Assembly AS-435/ APA-69 and AS-434/APA-69 for maintenance or repair only is covered in Section III preceding.

4-7. REMOVAL OF AMPLIFIER POWER SUPPLY AM-256/APA-69. If this component is still mounted, loosen the wingnuts until they permit the removal of the amplifier power supply from the mount. Then remove the screw at the top of the case and slide the chassis out forward. No further disassembly is required for inspection, cleaning or test. All plugs disconnect from the front.

4-8. REMOVAL OF DIRECTION FINDER CONTROL C-527/APA-69. Release the Dzus-type fasteners at the side and take out the component. Remove the two spring-lock fasteners at the back of the dust cover and take off the dust cover. No further disassembly is required for inspection, cleaning or test.

4-9. REMOVAL OF AZIMUTH INDICATOR IP36/APA-69 and AZIMUTH-PANORAMIC INDICATOR IP-81/APA-69A. If this component is still mounted, loosen the wingnuts to permit the removal of the azimuth indicator from the mount. Disconnect all plugs at the rear of the chassis, remove the single screw at the top and slide the chassis out forward. Further disassembly which follows (paragraphs 4-11 and 4-11A) should be performed on a service bench.

4-10. REMOVAL OF ANTENNA DRIVE TG-8/ APA-69. It is recommended that the antenna drive not be removed from the aircraft unless absolutely necessary. In this case, follow the procedure below:

a. Remove the radome.

b. Remove the antenna and coupler or horn, whichever is being used.

c. Uncouple all cables.

d. Remove the four mounting bolts.

e. Remove the antenna drive from inside the plane.

4-11. DISASSEMBLY OF AZIMUTH INDICATOR IP-36/APA-69, AND AZIMUTH PANORAMIC INDICATOR IP-81( )/APA-69A.

4-11A. Disassembly of the azimuth indicators is similar since the azimuth dial drive chassis, the cathode-ray tubes, and the torque unit are the same in both indicators. In Azimuth Indicator IP-36/APA-69 the azimuth dial drive subassembly makes up the indicator front panel. This same subassembly in the azimuthpanoramic indicator is mounted onto and makes up part of the indicator front panel. Figure 4-1 shows the disassembly of the azimuth indicator dial drive subassembly. Only one handle is used on azimuthpanoramic indicator units.

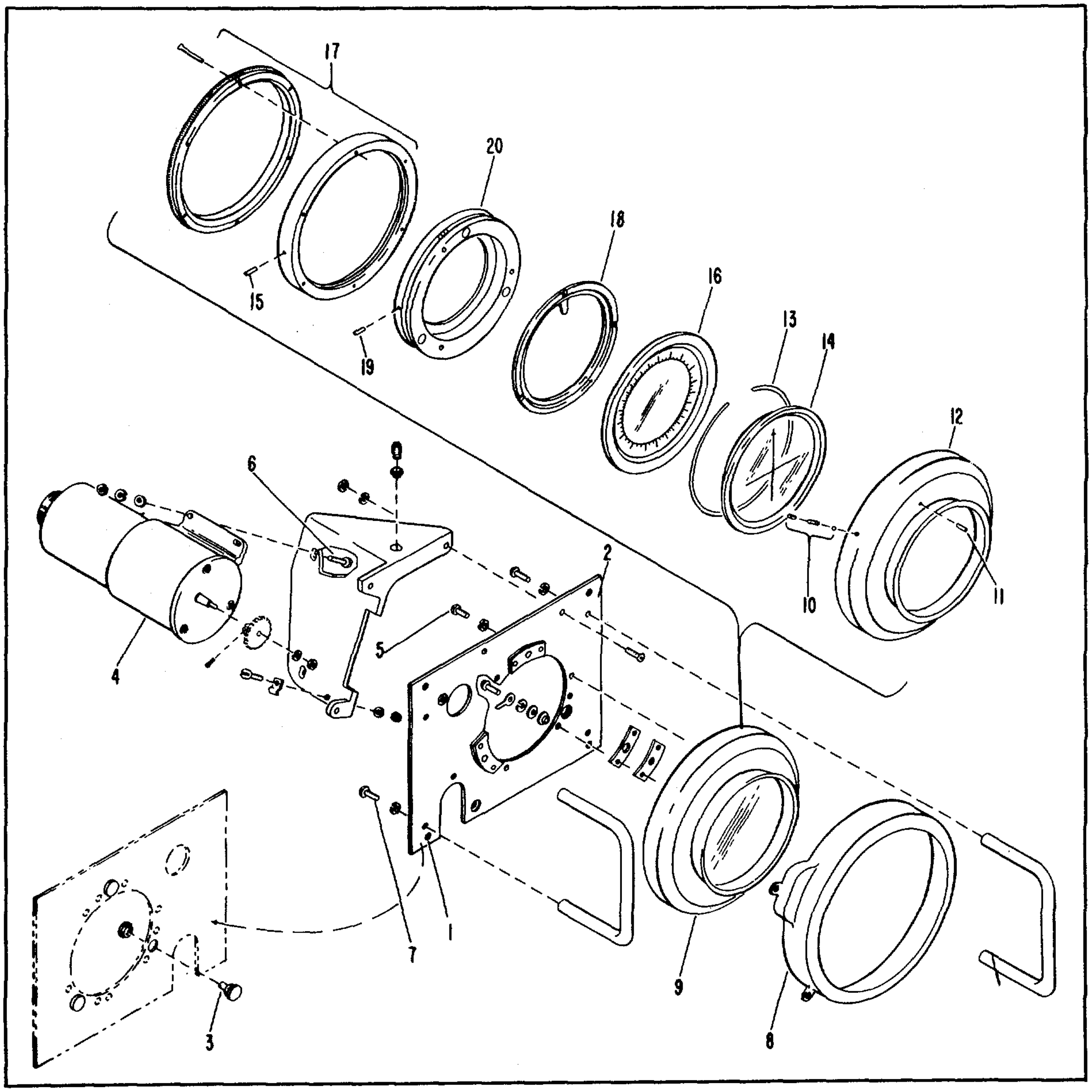
4-12. CATHODE-RAY TUBE. (*See figure 4-1*.) To remove the cathode-ray tube, remove the four nickel plated screws (reference 1) on the front of the unit. The front panel assembly (reference 2) will come off the frame. Use caution in this procedure not to damage the leads which carry power to the dial lamps (reference 3). The ends of these wires may be freed by unscrewing the machine screws on the terminal block to which they are attached. Loosen the cathode-ray tube clamp at the small end, remove the socket and disconnect the anode connection and withdraw the tube through the front opening.

CAUTION

Be extremely careful while handling the cathode-ray tubes. Breakage of these tubes may result in a dangerous explosion with flying glass.

4-13. TORQUE UNIT. (*See figure 4-1*.) The torque unit (reference 4) may be removed by taking out the strap screws (reference 6) which hold it on the oblique plate beside the dial drive subassembly. Withdraw the torque unit carefully so as not to damage the gear. The dial drive subassembly should be taken off as described in steps a. and b. of paragraph 4-14 following.

4-14. DIAL DRIVE SUBASSEMBLY. The disassembly of the dial drive subassembly is performed as follows (figure 4-1):



1	Screw	11	Pin
2	Front panel assembly	12	Outer race assembly
3	Dial lamp	13	Retainer ring
4	Torque unit	14	Indicator pointer dial
5	Screw	15	Pin
6	Strap screw	16	Scale
7	Screw	17	Cone bearing assembly
8	Dial drive cover	18	Dial
9	Dial drive subassembly	19	Pin
10	Setscrew, spring and ball bearing	20	Inner cone bearing

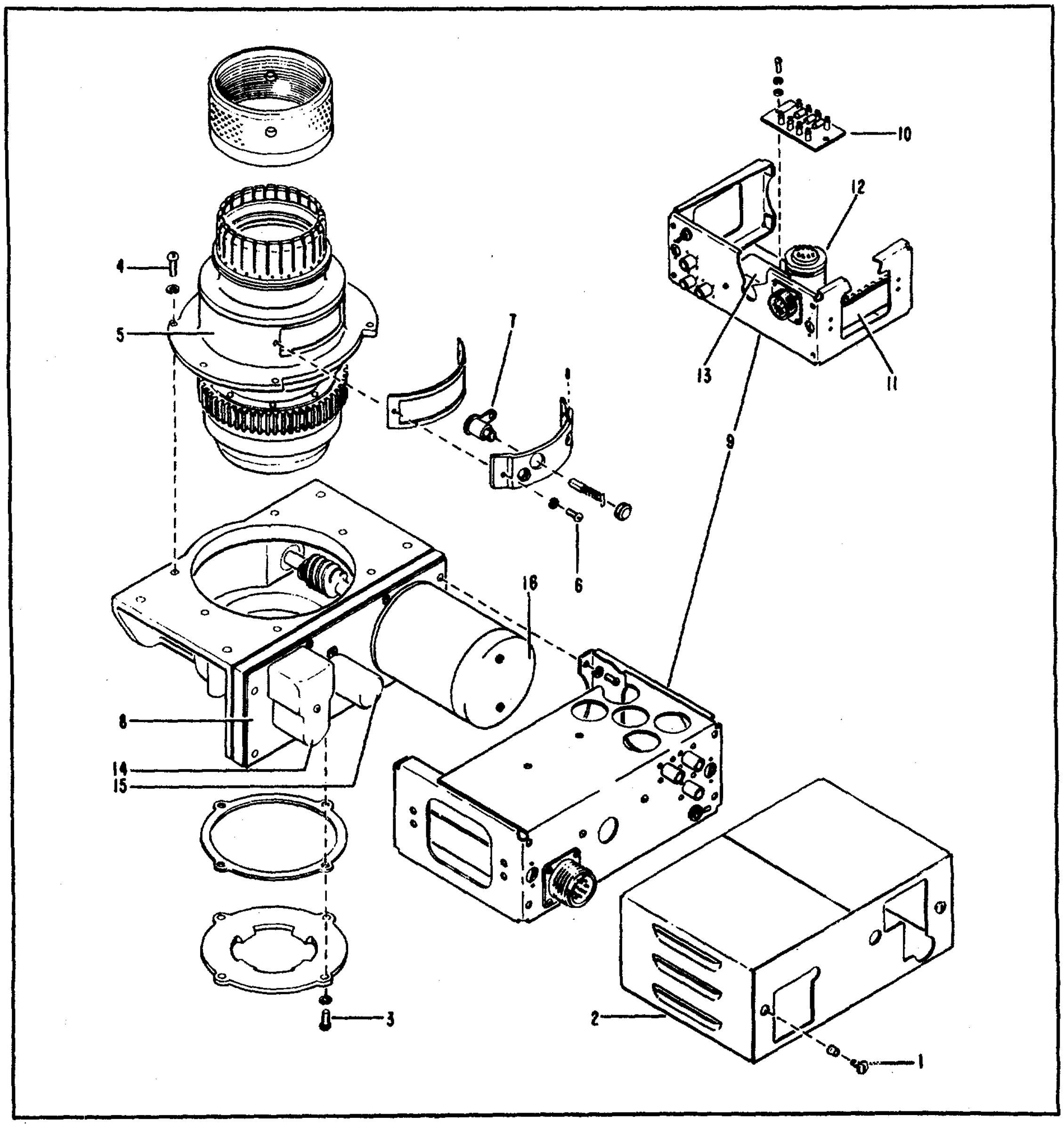
Figure 4-1. Azimuth Indicator Dial Drive Subassembly, Disassembly

a. First, remove the handles (one handle and two screws on the azimuth-panoramic indicator by taking out the four screws (reference 7) which hold them on the panel. Remove the attaching screws and take off the dial drive cover (reference 8).

b. Now remove the three screws (reference 5), lift off the dial drive subassembly (reference 9) and lay it on a clean bench for further disassembly.

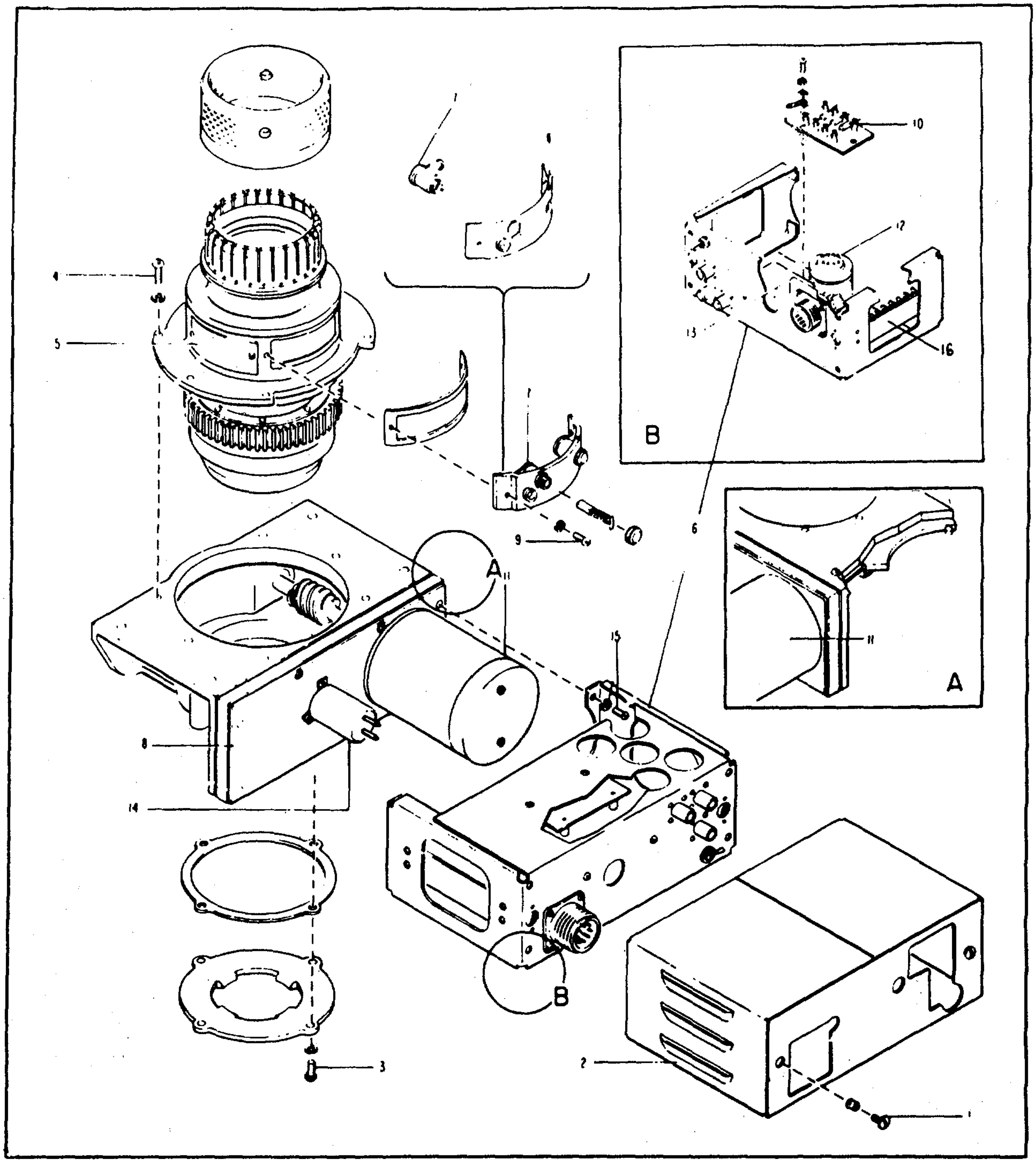
Note

This disassembly involves glass ball bearings. Before proceeding, provide a means of catching and storing the balls.



1 Cover plate screw	5 Antenna spindle and gear assembly	9 Cover plate support	13 Noise suppresser Z401
2 Cover plate	6 Brush holder screw	10 Resistor board	14 Switch S401
3 Lock plate screw	7 Brush holder	11 Terminal board	15 Resolver B401
4 Spindle assembly collar screw	8 Gear plate	12 Relay K401	16 Drive motor B402

Figure 4-2. Antenna Drive TG-8/APA-69, Preliminary Disassembly



1 Cover plate screw
2 Cover plate
3 Lock plate screw
4 Spindle assembly collar screw
5 Antenna spindle and gear assembly
6 Cover plate support
7 Brush holder
8 Gear plate
9 Brush holder cover screw
10 Resistor board
11 Drive motor B402
12 Relay K401
13 Noise suppressor Z401
14 Resolver B401
15 Cover plate support screw
16 Terminal board

Figure 4-2A. Antenna Drive TG-8A/APA-69, Preliminary Disassembly

c. Remove the three setscrews, springs and ball bearings (reference 10) on which they ride.

d. Lift up the black cover and outer race assembly (reference 12), exercising care not to lose any glass balls which may cling to the inner section.

e. Empty the ball bearings into a clean receptacle. There are approximately 183.

f. Remove the retainer ring (reference 13) and free the indicator pointer dial (reference 14).

CAUTION

Removal of pins (references 11, 15 and 19) will result in destruction of the plastic parts which they secure and should not be performed except for replacement.

g. Now lift off the race assembly (cone bearing) being careful again with the balls, which may scatter, and disassemble it into its component parts by removing the three pins (reference 15) which hold the scale (reference 16) on the cone bearing assembly (reference 17). This assembly may be taken apart by removing the six screws and two pins which hold it together, but parts are not interchangeable and no substitutions should be made.

h. Remove the dial (reference 18), when necessary, by taking out the three pins (reference 19) which hold it to the inner cone bearing (reference 20). (See "CAUTION" above.)

4-15. DISASSEMBLY OF ANTENNA DRIVE TG-8/APA-69.

4-16. PRELIMINARY DISASSEMBLY OF ANTENNA DRIVE. The disassembly of the antenna drive into its major assemblies and parts is performed as follows (figure 4-2):

a. Remove the two cover-plate screws (reference 1) and slide the cover plate (reference 2) off the coverplate support.

b. Remove the four lock-plate screws (reference 3) and take off the lock plate and shim at the bottom of the spindle and gear assembly.

c. Remove the brush caps from the cover plate supports (reference 7) and lift out brushes. Remove the two screws (reference 6) from the brush holder cover and lift off the cover and gasket.

d. Remove the six spindle collar screws (reference 4) and carefully lift out the spindle and gear assembly (reference 5). Disassembly procedure accompanies figure 4-3 (paragraph 4-17).

e. See figure 4-4 and paragraph 4-18 for procedure to be followed in removal of the gear plate (reference 8) and disassembly of the gear train.

f. All electrical components may be tested on the cover-plate support (reference 9) without further disassembly. Remove the resistor board (reference 10) and terminal board (reference 11), when necessary, by unsoldering the leads (being careful to mark or otherwise note the proper connections for rewiring) and taking out the screws which hold the boards on the support. Remove hermetically-sealed relay K401 (reference 12) by unsoldering the leads and taking out the screws at each end of the mount.

Note

For easier access to these components, use a long-handled screwdriver inserted through the holes at the side of the cover-plate support to release it by removing the screws which secure it to the gear plate assembly.

g. Remove the noise suppressor Z401 (reference 13) by unsoldering the wiring and taking out the mounting screws.

h. See figure 4-4 and paragraph 4-18 for procedure to be followed in removal of switch S401 (reference 14), resolver B401 (reference 15) and drive motor B402 (reference 16). See figure 4-5 and paragraph 4-19 for procedure to be followed in disassembly of the drive motor.

4-16A. PRELIMINARY DISASSEMBLY OF ANTENNA DRIVE TG-8A/APA-69. (See figure 4-2A.) Disassemble the antenna drive into its major assemblies and parts as follows:

a. Remove the two cover-plate screws (reference 1) and slide the cover plate (reference 2) off the cover plate support (reference 6).

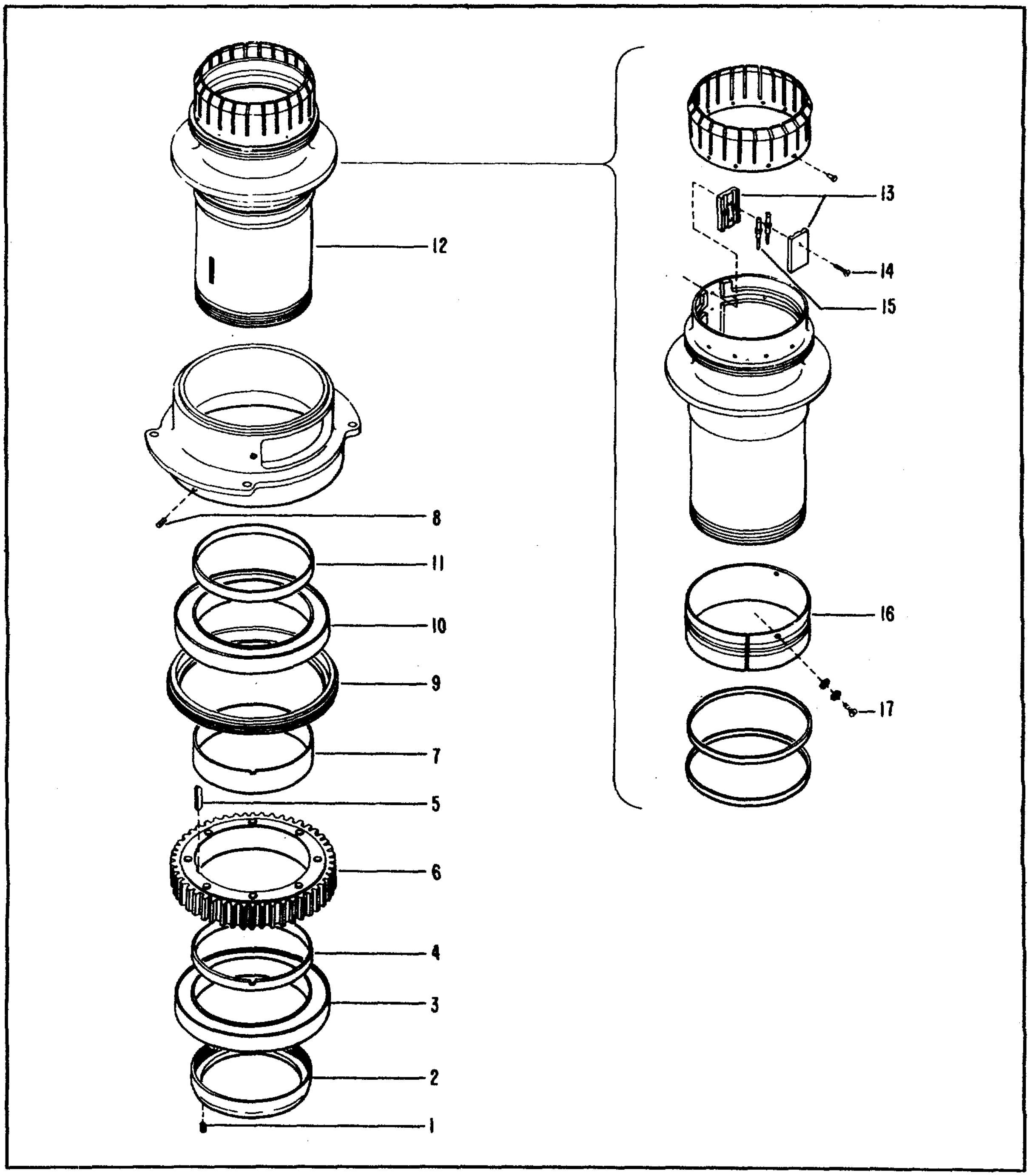
b. Remove the four lock-plate screws (reference 3) and take off the lock-plate and shim at the bottom of the spindle gear assembly.

c. Remove the brush caps from the holders (reference 7) and lift out the brushes. Remove the two screws (reference 9) from the brush holder and lift the cover and gasket for access to the holder. In removing and replacing these brush holders, exercise care not to damage the leads.

d. After removing the brush holders, remove the six collar screws (reference 4) and carefully lift out the spindle and gear assembly (reference 5). Disassembly procedure is shown in figure 4-3 and described in paragraph 4-17.

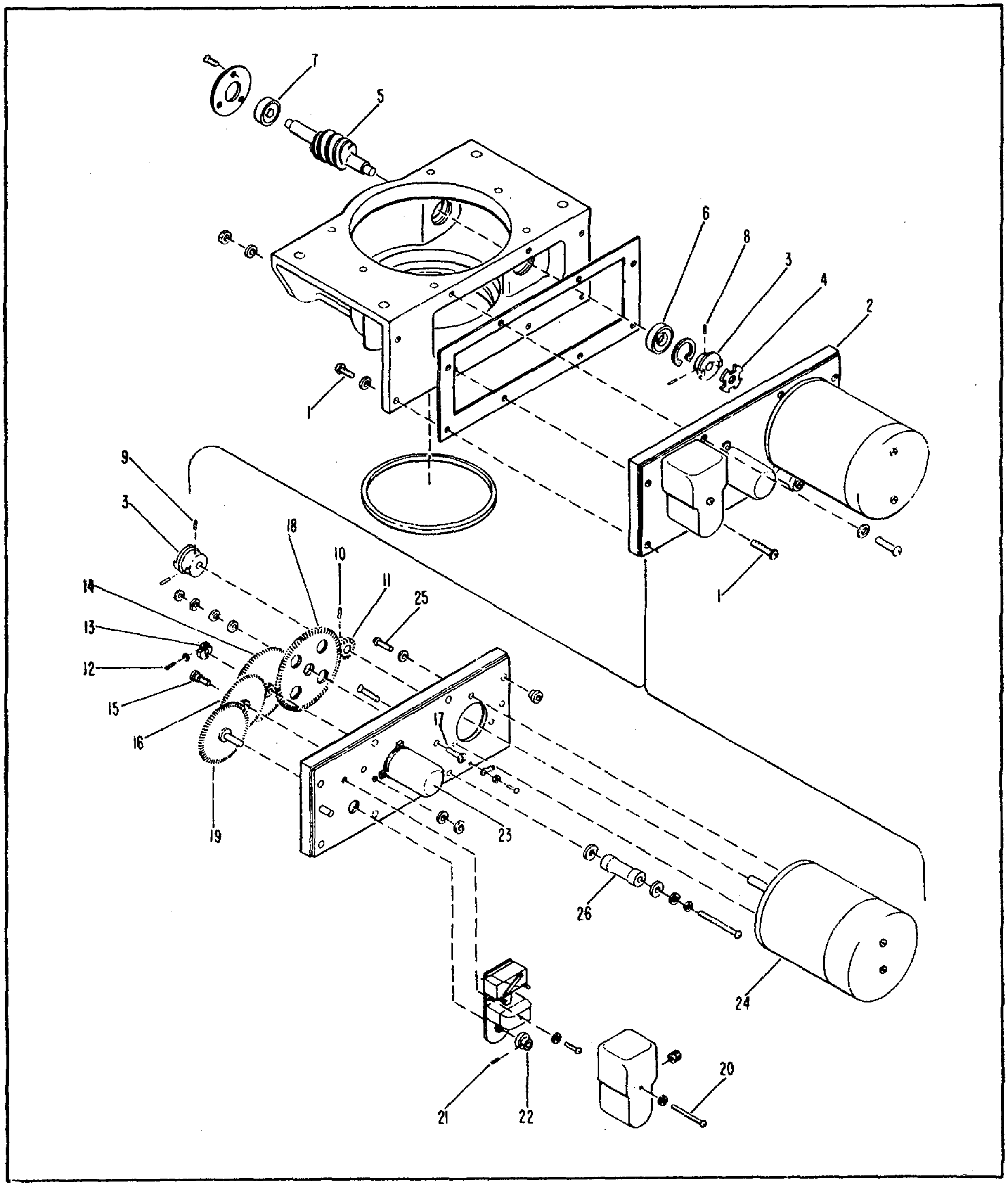
e. See figure 4-4 and refer to paragraph 4-18 for procedure to be followed in removal of the gear plate (reference 8) and disassembly of the gear train.

f. All electrical components may be tested without further disassembly from the cover plate support (reference 6). Remove the resistor board (reference 10), when necessary, by unsoldering the leads (being careful to mark or otherwise note the proper connections for rewiring) and take out the screws which



1 Spindle nut screw
2 Spindle nut
3 Ball bearing
4 Sleeve
5 Gear key
6 Gear assembly
7 Sleeve
8 Spindle collar setscrew
9 Bearing retainer ring
10 Ball bearing
11 Oil ring
12 Spindle assembly
13 Connector mount
14 Connector mount screw
15 Connector contact
16 Insulator ring
17 Insulator ring screw

Figure 4-3. Antenna Drive Spindle and Gear Assembly, Disassembly



1 Gear plate screw	7 Worm gear bearing	12 Screw	17 Threaded shaft	22 Cam
2 Gear plate	8 Setscrew	13 Collar clamp	18 Gear	23 Resolver
3 Flexible coupling	9 Setscrew	14 Resolver gear	19 Switch gear	24 Motor 1B402
4 Spider	10 Setscrew	15 Threaded shaft	20 Screw	25 Motor base screw
5 Worm gear	11 Pinion gear	16 Gear	21 Setscrew	26 Resistor R404
6 Worm gear bearing				

Figure 4-4. Antenna Drive TG-8/APA-69, Disassembly of Gear Plate Assembly

hold the board to the support. Remove the hermetically-sealed relay K401 (reference 12) by unsoldering the leads and taking out the screws at each end of the mount.

Note

For easier access to these components, use a long handle screwdriver inserted through the side of the cover plate support. Release it by removing the screws (reference 15) which secure it to the gear plate assembly.

g. Removal of the noise suppressor Z401 (reference 13) is accomplished by unsoldering the wiring and taking out the mounting screws.

h. See figure 4-4A and paragraph 4-18A for the procedure to be followed in removal of the resolver B401 (reference 14) and drive motor (reference 11). See figure 4-5A and paragraph 4-19A for the procedure to be followed in disassembly of the drive motor B402.

4-17. DISASSEMBLY OF ANTENNA DRIVE SPINDLE AND GEAR ASSEMBLY. *(See figure 4-3.)* The disassembly of the spindle and gear assembly of Antenna Drive TG-8/APA-69 is performed as follows:

a. Remove the two set screws (reference 1) and unscrew the spindle nut (reference 2). The ball bearing (reference 3) and sleeve (reference 4) will slide off the spindle shaft.

b. Tap out the key (reference 5) from the keyway which holds the gear assembly (reference 6) to the spindle. The gear assembly and sleeve (reference 7) will now slide off the spindle shaft.

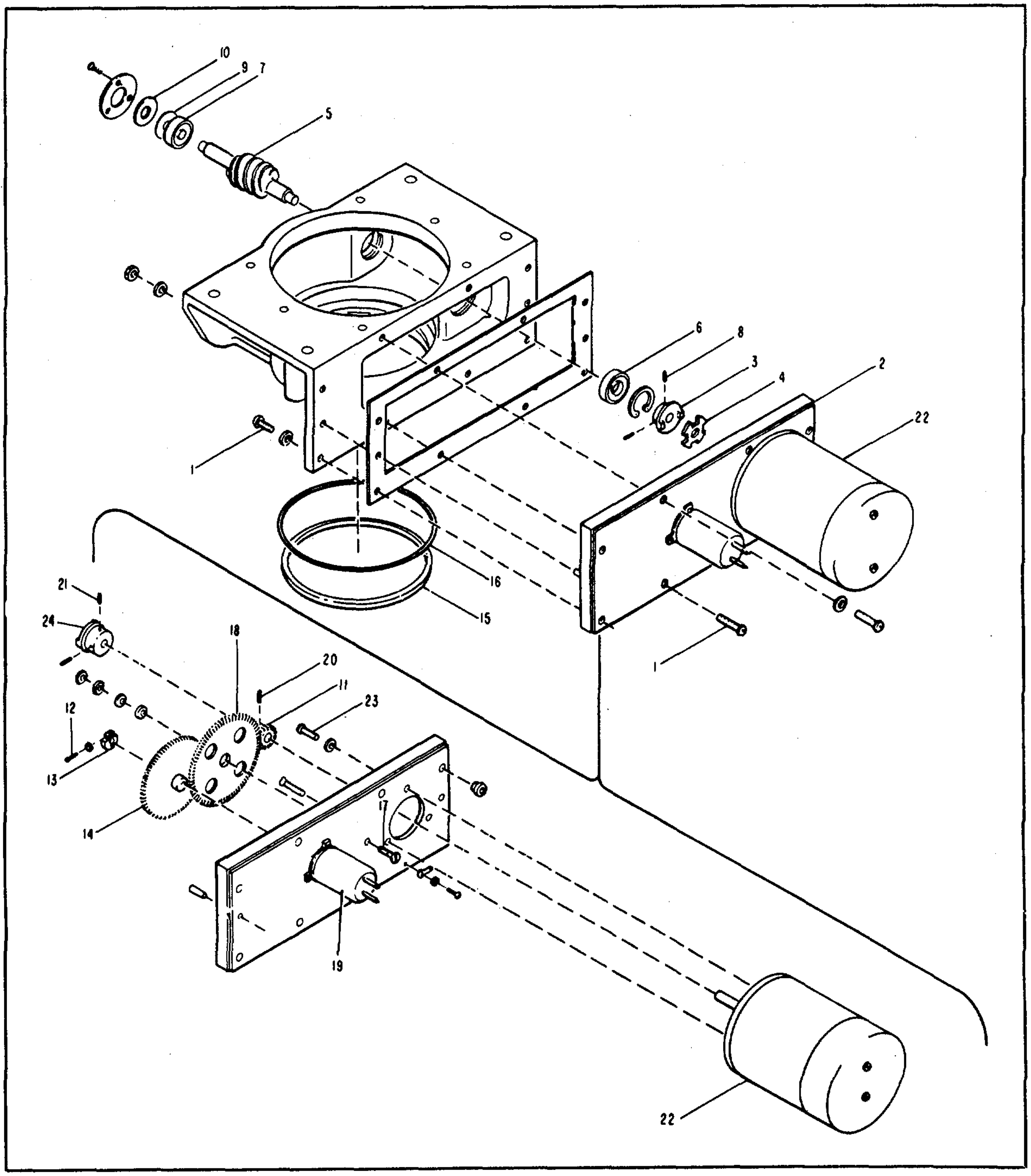
c. The spindle (collar) assembly will now slide off and may be disassembled as follows: Remove the setscrews (reference 8), unscrew the bearing retainer ring (reference 9) and remove the ball bearing (reference 10) and grease seal (reference 11).

Note

A spacer below this seal is not illustrated and must be noted for correct reassembly.

d. The antenna spindle assembly (reference 12) remains. To remove the connector mounts (reference 13), remove the two screws (reference 14), take out the mounts, and the male contacts (reference 15) which ride in them are accessible. Use care in handling the leads from these contacts to the slip rings.

e. To remove the insulator ring (reference 16) which holds the slip rings, remove the three screws (reference 17) and slide the ring off the spindle.



1	Gear plate screw	9	Shim	17	Threaded shaft
2	Gear plate	10	Rubber washer	18	Gear
3	Flexible coupling	11	Pinion gear	19	Resolver
4	Spider	12	Screw	20	Setscrew
5	Worm gear	13	Collar clamp	21	Setscrew
6	Worm gear bearing	14	Resolver gear	22	Drive motor B402
7	Worm gear bearing	15	Oil seal	23	Motor base screw
8	Setscrew	16	Gasket O ring	24	Flexible coupling

Figure 4-4A. Antenna Drive TG-8A/APA-69, Disassembly of Gear Plate Assembly

4-18. DISASSEMBLY OF ANTENNA DRIVE GEAR PLATIE ASSEMBLY. *(See figure 4-4.)* The disassembly of the gear plate assembly of Antenna Drive TG8/APA-69 is performed as follows:

a. Remove the eight gear plate screws (reference 1).

b. Carefully lift off the gear plate (reference 2). The flexible coupling (reference 3) will come apart and the spider (reference 4) will fall out. Put the spider aside safely until reassembly. Do not damage the gasket.

c. To complete disassembly of the worm gear shaft, extract the worm gear (reference 5), take off the bearing (reference 7), remove the setscrews (reference 8) and pull off the gear end of the flexible coupling and the washer to free the other bearing (reference 6).

d. To disassemble the gears, remove the two setscrews (reference 9) and take off the motor end of the flexible coupling (reference 3). Remove the setscrew (reference 10) and take off the pinion gear (reference 11).

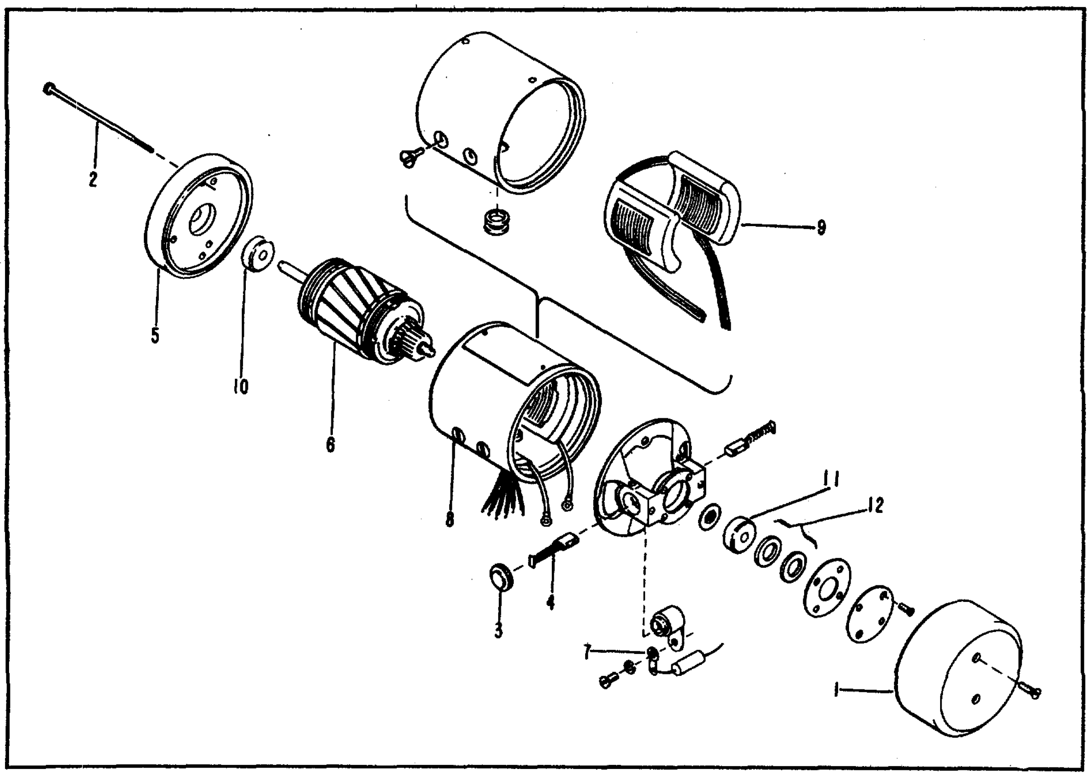
e. Now remove the screw (reference 12) holding the collar clamp (reference 13) and take this piece off. Now pull off the resolver gear (reference 14).

f. Unscrew the threaded shaft (reference 15) and take out the gear (reference 16).

g. Next unscrew the threaded shaft (reference 17) and take off the gear (reference 18). This leaves only the switch gear on the gear plate assembly.

h. To remove the switch gear (reference 19), take out the screw (reference 20), lift off the cover, remove the setscrew (reference 21), lift off the cam (reference 22), and the gear is freed. The switch S401 may be removed by taking out the screws which secure it to the gear plate.', i. To remove the resolver B401 (reference 23), loosen the three square clamping screws about its base and lift it out.

j. To remove the drive motor B402 (reference 24), take out the three motor-base screws (reference 25) and lift it off. See figure 4-5 and paragraph 4-19 for disassembly procedure.



1	End bell	7	Brush holder screw
2	Through bolt	8	Yoke screw
3	Brush cap	9	Field winding
4	Brush	10	Drive bearing
5	Drive head	11	Commutator bearing
6	Armature	12	Gasket

Figure 4-5. Antenna Drive Motor B402, Disassembly

PAGE DELETED

Revised 1 January 1956

k. To remove the resistor R404 (reference 26), take out the screw which passes through it.

4-18A. DISASSEMBLY OF ANTENNA DRIVE TG8A/APA-69, GEAR PLATE ASSEMBLY. (See figure 4-4A.) Disassemble the gear plate assembly of the antenna drive as follows:

a. Remove the eight gear plate screws (reference 1).

b. Carefully lift off the gear plate (reference 2). The flexible coupling (reference 3) will come apart and the spider (reference 4) will fall out. Put the spider aside in a safe place until reassembly. Do not damage the gasket.

c. To complete disassembly of the worm gear shaft, extract the worm gear (reference 5), take off the bearing (reference 7), the shim (reference 9) and the rubber washer (reference 10). Remove the set screws (reference 8) and pull off the gear end of the flexible coupling and the washer to free the other bearing.

d. To disassemble the gears, remove the two set screws (reference 21) and take off the motor end of the flexible coupling (reference 24). Remove the set screw (reference 20) and take off the pinion gear (reference 11).

e. Remove the screw (reference 12) holding the collar clamp (reference 13) and take the clamp off. Pull off the resolver gear (reference 14).

f. Next, unscrew the threaded shaft (reference 17) and take off the gear (reference 18).

g. To remove the resolver (reference 19), loosen the three square clamping screws about its base and lift out.

h. To remove drive motor B402 (reference 22), take out the three motor base screws (reference 23) and lift the motor off. See figure 4-5 and paragraph 4-19A for disassembly procedure of drive motor B402.

4-19. DISASSEMBLY OF ANTENNA DRIVE MOTOR B402. (See figure 4-5.) The disassembly of drive motor B402 of Antenna Drive TG-8/APA-69 is performed as follows:

a. Remove the end bell (reference 1). Unscrew and withdraw the two counter sunk through-bolts (reference 2) from the drive end of the motor.

b. Remove the brush caps (reference 3) and brushes (reference 4) from both sides of the commutator head.

c. Carefully pry off the head (reference 5) on the drive end of the motor and withdraw the armature (reference 6) through the case. Bearings should remain on the armature shaft.

CAUTION

Be careful while prying off the drive head. Uneven pressure may damage the bearing.

d. Remove the screws (reference 7) from the brush holder, disconnect the wiring from the field windings (reference 9) and pry off the head on the commutator end of the motor. Remove the locking screws and take out the brush holders.

e. Remove the four screws (reference 8) which hold the field windings in place. The field windings may now be removed. [The screws (reference 8) are lacquered into place, and they must be turned carefully to avoid burring their countersunk heads.

f. The bearings (references 10 and 11) must be removed with a bearing puller. Do not exert undue or uneven pressure in attempting to remove them by hand.

g. To replace the bearing gaskets (reference 12), remove the four screws and cover from the outer end of the commutator head.

SECTION V
CLEANING

5-1. GENERAL

5-2. This section outlines cleaning procedures for the disassembled components of Direction Finder Group AN/APA-69 and Direction Finder Group AN,/APA69A.

5-3. CLEANING MATERIALS.

5-4. For general cleaning blowing out the equipment with compressed air is the most satisfactory. Electrical parts should not be dipped, or liberally coated with any cleaning liquid including water. Cleaners, if used, should always be applied with a cloth. For the removal of dust, a damp cloth is recommended. Water, when applied in this manner, will do no permanent damage, but should be permitted to dry off after cleaning. When a solvent must be used for general cleaning purposes, the following chemical mixtures are recommended:

Dry Cleaning Solvent-Federal specification P.-S-661 (General Stores Stock No. 51-C-1326-75, 55-gallon drum, and 5 I-C-1 326-67, 5-gallon container)- 70% by volume

Perchlorethylene-Federal Specification O-T-236 (General Stores Stock No. 51-T-4459-200, 55gallon drum)- 5% by volume

Methylene Chloride-Air Force-Navy Aeronautical Specification AN-M-3 7, (ASO Stock No. R51-M950-10, 1-gallon container, and R5 -M-950-20, 5-gallon container)- 25% by volume

WARNING

The materials noted above are miscible in all proportions, and mixing difficulties should not be encountered. This chemical mixture, although considerably less toxic than carbon tetrachloride, should not be used in closed spaces without adequate ventilation. To insure against corrosion, contact with moisture or water should be avoided, since the chlorinated solvents present in the chemical mixture may hydrolyze to form hydrochloric acid under these conditions, as has been experienced with carbon tetrachloride.

5-5. CLEANING PROCEDURES.

5-6. AMPLIFIER POWER SUPPLY AM-256/APA-69. Remove the tubes from their sockets and blow out the chassis with clean compressed air.

5-7. DIRECTION FINDER (: ONTROL (C-527 APA69. Blow out the chassis with clean compressed air. The control panel may be wiped off with a clean. lint-free cloth dampened, if necessary, with cleaning solvent (paragraph 5-4). Do not use alcohol in wiping off this panel.

5-8. AZIMUTH INDICATOR IP-36 APA-69. Remove the tubes and blow out the chassis with clean compressed air. If disassembly has included the dial drive assembly, wash the balls and race with cleaning solvent and relubricate them during reassembly. Be careful not to lose any of these glass balls. (An approximate, count of them is included in disassembly instructions, paragraph 4-14.) If necessary, change, the Dow-(Corning type DC-4 anti-corona compound in the H.V. rectifier V204 cup.

5-8A. AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A. Remove the tubes and blow out with clean compressed air. If disassembly has included the dial drive assembly, wash the balls and race with cleaning fluid (paragraph 5-4) and relubricate them during reassembly. Be careful not to lose any of these glass balls. (An approximate count of them is included in disassembly instructions, paragraph 4-14.) If necessary, change the Dow-Corning type DC-4 anti-corona compound in the high voltage rectifier tube V1008 cup.

5-9. ANTENNA DRIVE TG-8/APA-69. Wash the antenna spindle and gear parts with cleaning solvent. Wash the gear train and bearings with cleaning solvent. Wash the motor bearings and armature with cleaning solvent. Blow out the chassis, gear box, and field windings of the drive motor with clean compressed air.

5-10. ANTENNA COUPLER CU-174 APA-69. Do not attempt to clean or lubricate the contacts of this coupler. They are made of silver graphalloy and supply their own lubrication.

5-11. ANTENNA ASSEMBLIES. Do not attempt to disassemble the antenna assemblies for cleaning. Instructions for disassembly, for maintenance, or repair only of Antenna Assembly AS-435 APA-69 are given in paragraph 3-11. During this process the assembly may be cleaned by being blown out with clean compressed air.

SECTION VI
INSPECTION

6-1. GENERAL

6-2. This section outlines inspection routine for the disassembled components of Direction Finder Group AN/APA-69. Full inspection schedules for the assembled equipment will be found in Section V of the Handbook Service Instructions, paragraph 5-64.

6-3. Vacuum tubes should be tested with a type 1177A tube tester or the alternate Hickok types 540 or 547. Any substandard tubes should be replaced with new ones drawn from stock.

6-4. INSPECTION PROCEDURES.

6-5. AMPLIFIER POWER SUPPLY AM-256/APA 69. Remove and test all vacuum tubes. Examine the unit for loose nuts, frayed wire or any evidence of overheating of components such as resistors. Check state of all connector pins.

6-6. DIRECTION FINDER CONTROL C-527/APA 69. After removing the cover, examine all components for signs of overheating or excessive wear. Be sure the panel lamps are secure in their sockets.

6-7. AZIMUTH INDICATOR IP-36/APA-69. Remove all tubes except the cathode-ray tube and test them. Check the chassis for loose nuts, frayed wire or evidence of overheating or arcing. After reassembly of the dial drive subassembly, adjust the tension on the three ball bearings to give a smooth, even friction. Assure that no air pockets exist about the plate contact of the H.V. rectifier tube V204 which should be completely surrounded by Dow-Corning type DC 4 compound to prevent corona. Check the state of all connector pins, including those of J207, which connects to the torque unit.

6-7A. AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A. Remove all tubes except the cathoderay tube and test them. Check the chassis for loose nuts, frayed wire, or evidence of overheating or arcing. After reassembly of the dial drive subassembly, adjust the tension on the three ball bearings to give a smooth even friction. Assure that no air pockets exist about the plate contact of the high voltage rectifier tube V1008 which should be completely surrounded by Dow-Corning Type DC-4 compound to prevent corona. Check the state of all connector pins, including those of J1009, which connects to the torque unit.

6-8. ANTENNA DRIVE TG-8/APA-69. Inspect the gears for wear. Inspect the d-c relay input brushes and motor brushes for wear. Inspect the armature and commutator of drive motor B402; if the commutator is pitted or grooved, it must be turned down on a lathe. Check the mica insulation between the commutator segments. It should be tight and undercut to specifications found in paragraph 7-11. Assure that no grease has worked onto the commutator from the bearings. Check the fit of bearings at each end of the armature of the drive motor. Slight lateral play is permitted on the drive bearing; no play is permitted on the commutator bearing. Lateral play is not critical on the worm gear and antenna spindle assembly bearings, though faulty bearings whose excess of normal tolerance is obvious, should be replaced.

6-9. ANTENNA COUPLER CU-174/APA-69. Inspect the coupler for possible mechanical damage or undue wear on the contacts. Make no attempt to disassemble the coupler for further inspection or repair. In case of damage, replace it with a spare coupler.

6-10. ANTENNA ASSEMBLIES AND REFLECTOR. Inspect the antenna reflector and Antenna Assembly AS-434/APA-69 for mechanical damage or undue wear. Tighten any screws that may be loosened. Make sure the coaxial cables are tight. Do not attempt further disassembly on this unit. In case of damage, replace it with a new unit.

6-11. Antenna Assembly AS-435/APA-69 may be repaired if it has been found faulty by inspection or substitution. Disassembly instructions for maintenance and repair are given in paragraph 3-11. Disassembly solely for inspection should not be attempted. Instructions in paragraph 6-10 apply.

6-12. Both antenna assemblies are provided with distributed weights for balance. Do not permit these to be removed without noting their location for reinstallation, lest the antenna be returned to service unbalanced.

6-13. CABLES AND WIRING. Inspect all connectors for loose pins, bent pins, or other source of faulty contact. Inspect cable connections for open lines, frayed ends which will lead to shorts, or wear at points of friction or excursion.

SECTION VII
REPAIR AND REPLACEMENT

WARNING

There are potentials of the order of 3,000 volts present in this equipment. Use extreme caution when testing or aligning units with the primary power turned on.

7-1. GENERAL

7-2. This section deals with the repair and replacement of parts of Direction Finder Group AN/APA-69 and Direction Finder Group AN/APIA-69A. Where parts cannot economically he repaired or overhauled, they should be replaced as a unit, and repair instructions will not, be included here. Resistors, capacitors, transformers, chokes and tubes should be replaced after determination of failure by normal trouble.
shooting operations.

7-3. AMPLIFIER POWER SUPPLY AM-256/APA-69 REPAIRS.

7-4. No repairs are practicable on the amplifier power supply. Switch S I 101 is a simple two-pole wafer switch and is more economically replaced than repaired.
After replacement of any parts, be sure to clean any new soldered joints and replace all insulating sleeves as before.

7-5. DIRECTION FINDER CONTROL C-527/APA-69 REPAIRS.

7-6. For repairs to the control unit, remove the two spring-lock fasteners at the back of the dust cover and take off the dust cover. The resistor bracket is secured to the mounting plate by four screws threading into the spacers, and the resistor is detached from the bracket by removing four more screws into the spacing blocks. Resistor R301 should be replaced rather than repaired. 'in event of damage to the plexiglas panel, it may he removed from the mounting plate and replaced by taking off the control knobs and taking out the two screws which secure it on the mounting plate.

7-7. AZIMUTH INDICATOR IP-36/APA-69, AND AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A.

7-8. The torque unit. dial drive subassembly, and all other 1parts of the azimuth indicator must be replaced upon failure. Refer to paragraphs 4-11 through 4-14 for disassembly procedure. Replace all insulating sleeves. Refer to paragraphs 3-7 through 3-10 for tests which should follow replacement of any part associated with the torque unit and amplifier circuits in the azimuth indicators.

7-9. ANTENNA DRIVE TG-8/APA-69 AND TG-8A/APA-69, REPAIRS.

7-10. Resolver B401, switch S401 (not part of Antenna Drive TG-8A/APA-69), noise suppressor Z401 and hermetically-sealed relay K401 in the antenna drive must be replaced when defective. individual gear elements on the gear plate, in the antenna drive spindle, and gear assembly may be replaced where replacement parts are available. For Antenna Drive TG-8/APA-69, refer to paragraphs 4-15 through 4-19 and see figures 4-2, 4-3, 4-4, and 4-5 for disassembly and replacement of those parts. For Antenna Drive TG-8A/APA-69, refer to paragraphs 4-15, 4-16A, 4-17, and 4-18A and see the accompanying figures 4-2A, 4-3, and 4-4A, for disassembly and replacement of those parts. In general replace gears and bearings by selective fitting. Backlash, though not critical, should be kept to a minimum as far ;is practicable.

SECTION VIII
ASSEMBLY AND TESTING OF SUBASSEMBLIES AND ASSEMBLIES

8-1. GENERAL

8-2. This section deals with the reassembly of subassemblies and component equipment of the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A. Since testing of assemblies of this equipment is not practicable except as installed in their respective components, production type test data will be included in Section IX. Adjustments and checks of newly reassembled components will be described or referenced here.

8-3. AZIMUTH INDICATOR IP-36/APA-69 AND AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A REASSEMBLY.

8-4. DIAL DRIVE SUBASSEMBLY. After inspection or indicated maintenance, reassemble the dial drive subassembly of the Azimuth Indicator IP-36/APA-69 and Azimuth-Panoramic Indicator IP-81( )/APA69A by reversing the procedure of disassembly contained in paragraph 4-14 and illustrated in figure 4-1. At this time, lubrication should be applied to both ball bearing races. A few drops of Pioneer No. 10 instrument oil spaced about each race are sufficient.

8-5. TORQUE UNIT. After reassembly of the dial drive subassembly, re-install the torque unit on its mounting plate, reversing the procedure for its removal therefrom, contained in paragraph 4-13.

8-6. Return the tubes, including the cathode-ray tube, to their proper sockets. Check cathode-ray tube seating and supports carefully, and assure that the anode cap is connected at its side.

8-7. The following adjustments will be necessary and may be performed on a component test and adjustment bench similar to that illustrated by figure 5-8, Handbook Service Instructions.

8-8. AZIMUTH INDICATOR IP-36/APA-69 ADJUSTMENTS AFTER REASSEMBLY.

8-9. Set up the test bench as in the figure 5-8 of the Handbook of Service Instructions, install any antenna, being sure to use a signal generator which produces signals within its receiving range, and follow the instructions contained in paragraph 5-68 of the Handbook Service Instructions. Make the following adjustments:

a. Check the azimuth indicator for following and zero it if necessary as directed in paragraphs 6-26 to 6-34 inclusive of the Service Handbook.

b. Align the cathode-ray tube as in paragraph 6-35B of the Service Handbook.

c. Adjust the scope circularity as in paragraph 5-48 of the Service Handbook.

d. Adjust for phase distortion, if necessary, as in paragraph 5-49 of the Service Handbook.

e. Check performance against operating performance standards contained in table 5-1 of the Service Handbook.

8-10. If the reassembled azimuth indicator has been adjusted and checked as instructed above, it is ready for the production type tests included in Section IX.

8-10A. AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A ADJUSTMENTS AFTER REASSEMBLY.

8-10B. Set up the test bench as in figure 5-8A of the Handbook Service Instructions. Install any antenna, being sure to use a signal generator which produces signals within its receiving range. Make the following adjustments:

a. Check the azimuth-panoramic indicator for following and zero it if necessary, as directed in paragraphs 6-34A to 6-34F, inclusive, of the Service Handbook.

b. Align the cathode-ray tube as in paragraph 6-35B of the Service Handbook.

c. Adjust the scope circularity as in paragraph 5-48 of the Service Handbook.

d. Adjust for phase distortion, if necessary, as in paragraph 5-49 of the Service Handbook.

e. Check performance against operating performance standards contained in table 5-1A of the Service Handbook.

8-10C. If the reassembled azimuth-panoramic indicator has been adjusted and checked as instructed above, it is ready for the production type tests included in section IX of this publication.

8-11. ANTENNA DRIVE TG-8/APA-69 REASSEMBLY.

8-12. DRIVE MOTOR B402. Reassemble the drive motor B402 of the Antenna Drive TG-8/APA-;69 by reversing the procedure contained in paragraph 4-19 illustrated by figure 4-5. Check brush lengths and seat. Assure that repair tolerances contained in paragraphs 7-11 and 7-12 have been met. Check staking lacquer application on through bolts (reference 2) and yoke screws (reference 8). Lubricate with type AN-G-25 grease by placing enough grease on the bearings to cover them, but do not pack them, and keep grease off the commutators.

8-13. GEAR PLATE ASSEMBLY. After inspection or indicated maintenance, reassemble the gear plate assembly of the Antenna Drive TG-8 APA-69 by reversing the procedure of disassembly contained in paragraph 4-18 illustrated by figure 4-4. Apply lubrication at this time to the gears, hearings and motors of the assembly as indicated in table 8-1.

8-1 3A. For gear plate assembly in Antenna Drive TG8A/APA-69, refer to paragraph 4-18A and figure 4-4A.

8-14. SPINDLE AND GEAR ASSEMBLY. Reassemble the spindle and gear assembly of Antenna Drive TG-8 AP'A-69 by reversing the procedure of disassembly contained in paragraph 4-17 illustrated by figure 4-3. Lubricate the bearings with Dow-Corning DC-33 grease. Handle the wiring from the slip rings to the plug carefully.

8-15. Now reassemble the subassemblies carefully, following procedure which is the reverse of that contained in paragraph 4-16 illustrated by figure 4-2. Make sure that all wiring is returned to the proper terminals as marked during disassembly. Lubricate the spindle gear with enough Dow-Corning D(-33 medium grade grease to provide adequate lubrication but do not pack the gear.

8-15A. For reassembly of the subassemblies of Antenna Drive TG-8A/APA-69, see figure 4-2A and follow a procedure the reverse of that given in paragraph 4-16A.

8-16. ANTENNA DRIVE TG-B/APA-69 TESTS AFTER REASSEMBLY.

8-17. Manually test the rotation backlash of the antenna drive spindle. While this backlash is not critical, it should be minimal.

8-18. Set up the test bench described in paragraph 5-38 and following of the Handbook Service Instructions and illustrated by figure 5-8 or 5-8A of the Service Handbook. Check the controls against the performance standards in table 5-1 of the Service Handbook. Zero the resolver, if the aircraft installation position is known, by following procedure in paragraph 5-50 of the Service Handbook.

8-19. After the reassembled antenna drive has been adjusted and checked as instructed above, it is ready for the production type tests included in Section IX.

8-20. AMPLIFIER POWER SUPPLY AM-256/APA-69 REASSEMBLY.

8-21. No assemblies of the amplifier power supply are normally removed during overhaul except for repair or replacement, and therefore no reassembly procedure is necessary. There are no moving parts, and no lubrication instructions are needed. Since the polarity switch is the only control in this unit, no tests are needed to prepare it for the production type tests which follow in Section IX.

8-22. DIRECTION FINDER CONTROL C-527/APA49 REASSEMILY.

8-23. No parts of this component are normally removed during overhaul except for repair or replacement. Refer to paragraph 7-5 for disassembly procedure, which should be reversed for reassembly if necessary. A continuity check of all switches and resistance reading of resistor R302 are the only tests required before the component is ready for the production type tests included in Section IX.

8-24. ANTENNA ASSEMBLY AS-435/APA-69 REASSEMBLY.

8-25. Antenna Assembly AS-435/APA-69 is not disassembled except for specialized maintenance and repair, and reference is made herewith to paragraph 3-11 illustrated by figure 3-1 for any reassembly. No preliminary tests are required. No lubrication is necessary.

TABLE 8-1. LUBRICATION OF ANTENNA DRIVE BEARINGS AND SEARS

Part	Type of Lubrication	Quantity Procedure
*Resolver 11401	Pioneer No. to10 oil	Place a few drops on the bearing.
*Drive motor 1B402 bearings	AN.G-25	Remove end bell and gaskets. Place enough grease on the bearings to cover them. Do not pack the bearings. Keep grease off the commutators. Check only if this motor has been lubricated after its own reassembly. (Paragraph 8-12.)-
Spindle and worm gear bearings	Dow-Corning DC-33 medium grade	Grease these bearings lightly. Do not pack them.
Gear plate and worm gears	Dow-.Corning DC-33 medium grade	Place grease around these gears evenly. Do not fill the container box. Do not pack -

*On Antenna Drive TG-BA/APA.69. drive motor B402 and resolver B401 contain sealed bearings that require no lubrication.

8-26. ANTENNA ASSEMBLY AS434/APA69 REASSEMBLY.

8-27. Antenna Assembly AS-434/APA-69 is not disassembled, except for maintenance or repair, and no reassembly instructions or tests are necessary. No lubrication is required.

8-28. ANTENNA AS436/APA-69 REASSEMBLY.

8-29. Antenna AS-436/APA-69 is not disassembled, and no reassembly instructions or tests are necessary.

8-30. ANTENNA COUPLER CU.174/APA-69 REASSEMBLY.

8-31. Antenna Coupler CU-174/APA-69 is not disassembled, and no reassembly instructions or tests are necessary.

8-32. ANTENNA REFLECTOR AT-182/APA-69 REASSEMBLY.

8-33. Antenna Reflector AT-182/APA-69 is not disassembled, and no reassembly instructions or tests are necessary.

SECTION IX
REASSEMBLY AND TESTING OF COMPONENTS

9-1. GENERAL.

9-2. This section deals with reassembly of components of Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A and production type tests which will assure that a component unit is acceptable for interchange with a newly produced component. Since reassembly has been largely incorporated in Section VIII, only such additional assembly information as may be needed before production type tests will be included here.

9-3. Lubrication of all components has been included in Section VIII as the assemblies were put together.

9-4. USE OF ASSOCIATED COMPONENTS IN TESTING.

9-5. While it is generally desirable to test each component separately from its associated equipment, the nature of the Direction Finder Group AN/APA-69 components is such as to require loading and supply of power from other components of the group, which are to be considered as test equipment. Any component unit used in a test bench for a different component of the equipment (i.e., an amplifier power supply used in a bench for testing azimuth indicators) must be fully operative and in perfect condition.

9-6. ANTENNA DRIVE TG-8/APA-69 FINAL TESTS.

9-7. The final tests of the Antenna Drive TG-8/APA69 require the following test equipment:

a. A Simpson Model 260 volt-ohm-milliammeter or equivalent 20,000 ohm-to-volt d-c voltmeter.

b. A d-c ammeter, 0-30 ampere range.

c. A rheostat, 0-50 ohms, 200 watts.

d. A d-c power source, 18-30 volts, 20 amperes.

e. A dummy antenna equivalent in weight and balance to Antenna Assembly AS-435/APA-69, containing relay and switch assembly K501 and two 28V lamps, connected as in figure 2-1. (See applicable Illustrated Parts Breakdown, Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA69A.)

f. A tachometer, 100-400 rpm range, instantaneous.

9-8. This equipment must be assembled into a test jig as illustrated in figure 9-1.

9-9. FINAL TEST PROCEDURE.

9-10. VISUAL CHECK. A visual check of the Antenna Drive TG-8/APA-69 must precede the electrical test. Check all wiring against the wiring diagram, Handbook of Service Instructions, figure 7-4. Rotate the spindle by hand to determine that a minimum of backlash exists. Assure that lubrication has been applied to parts indicated in table 8-1. Now install the dummy antenna and connections as indicated in the test jig figure.

9-11. SPEED TEST. Set the input voltage at 26.5 volts to the rheostat, and adjust the rheostat for full antenna speed. Note that a slight speed change occurs every 15 revolutions.

a. Using the tachometer attached as necessary, determine and record the speed during the fast cycle.

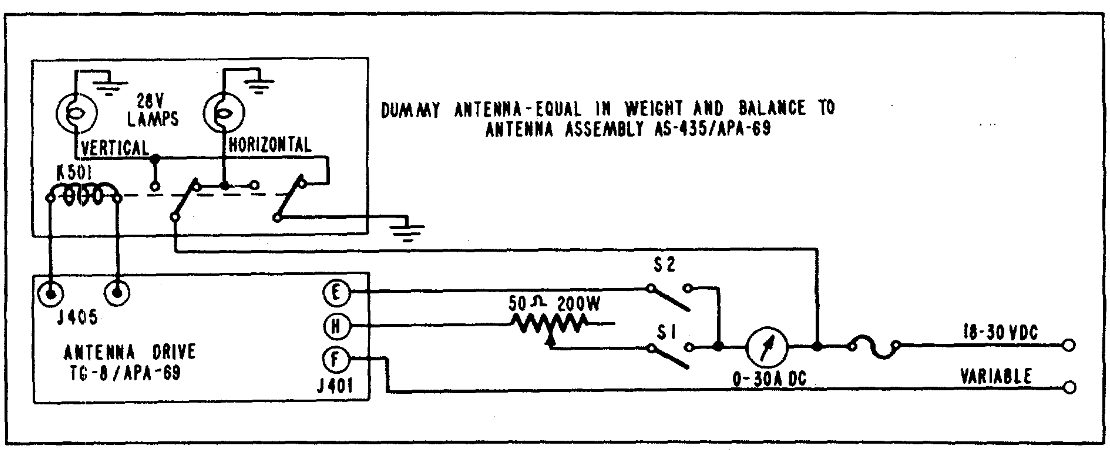


Figure 9-1. Antenna Drive TG-8/APA-69, Reassembly Test Jig

b. Similarly determine and record the speed during the slow cycle.

c. Record the input current during the fast cycle.

9-1 A. Speed test given in paragraph 9-11, with the exception of step b, also applies to Antenna Drive TG8A/APA-69.

9-12. The rollowing results are minimum normal operating standards:

a. Minimum full speed must be approximately 300 rpm.

b. The percentage of variation in the slow cycle must be between 8 and 12 percent as determined by the formula:

$$\% \text{ variation} = \frac{\text{fast speed - slow speed (rpm)}}{\text{fast speed}} \times 100$$

c. Input current at the fastest speed should not exceed two amperes.

9-12A. The information given in paragraph 9-12, with the exception of step b, also applies to Antenna Drive TG-8A/APA-69.

9-13. RELAY CHECK. Set the input voltage for 20 volts dc. Turn off the ANT, SPEED control and close switch S2 (figure 9-1). The antenna relay should close, extinguishing the HORIZONTAL lamp and lighting the VERTICAL lamp. At all times when S2 is open, the HORIZONTAL lamp should remain lit. With S2 closed, close switch S402 on the antenna drive panel. The antenna drive relay will now be energized. Continuity will exist between J404 and the black rotor lead on resolver B401, and between ground and the red rotor lead on resolver B40 1. (These readings are made with a Simpson Model 260 volt-ohm-milliampere meter.) With SZ open, continuity will exist between ground and the black rotor lead on resolver B401 and betweenJ404 and the red rotor lead on resolver B401.

Note

On Antenna Drive TG-8A/APA-69 the rotor leads can be identified by referring to figure 4-2A. The resistor board (reference 10), containing resistor R401, illustrates the rotor leads connected across the resistor.

9-14. AMPLIFIER POWER SUPPLY AM-256,APA-69 FINAL TESTS.

9-15. The final tests of the Amplifier Power Supply AM-256/APA-69requirethe following test equipment:

a. A simulated Direction Finder Control C-527/ APA-69.

b. An Azimuth Indicator IP-36/APA-69.

c. An Antenna Drive TG-8/APA-69.

d. A Measurements Pulse Generator type 79-B with 110 attenuator (refer to paragraph,6-7, Handbook of Service Instructions, Direction Finder Group AN/ APA-69 for instructions on fabrication of this attenuator).

e. An Oscilloscope type TS-239/UP.

f. A Hewlett-Packard Audio Oscillator type 200-C.

g. A Variac, 5-ampere capacity, General Radio type V5M or equivalent.

h. Sources of power: 115-volt 400-cycle ac for equipment under test and 115-volt 60-cycle ac for test equipment.

9-16. This equipment must be assembled into a test jig as illustrated in figure 9-2.

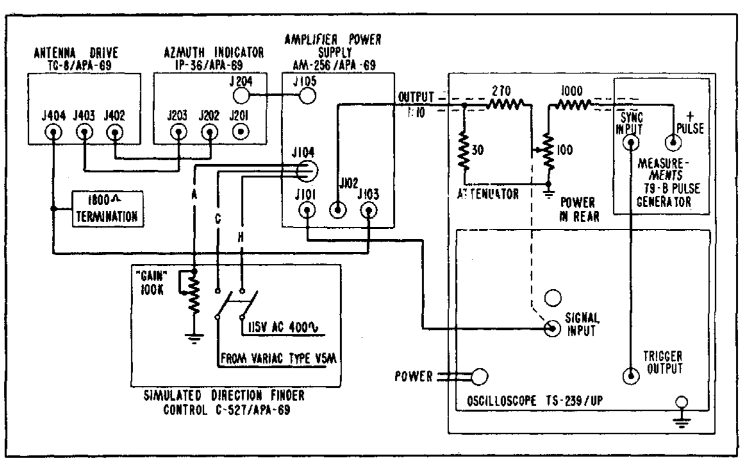


Figure 9-2. Amplifier Power Supply AM-256/APA-69, Reassembly Test Jig

9-17. FINAL TEST PROCEDURE

9-18. VISUAL CHECK. A visual check of the amplifier power supply is required before initiating the electrical tests.

9-19. OSCILLOSCOPE SETUP. The oscilloscope connection shown with dotted lines in figure 9-2 is used in establishing the output of the Measurements Pulse Generator type 79-B. An examination of the test jig figure and accompanying text, paragraphs 6-5 through 6-8, Handbook of Service Instructions, will show the similarity between this test and the troubleshooting procedure. Using cables and connections as indicated therein, fabricate and connect the 1: 10 attenuator required.

9-20. To provide an input level of 0.12 volt as required by the test steps in paragraph 9-22, proceed as follows:

a. Connect the Oscilloscope type TS-239/UP "SIGNAL INPUT" to the attenuator 100-ohmpotentiometer arm. (This is the dotted line connection.)

b. Set the "TRIGGER RATE" to "OFF."

c. Set the "SYNC SELECTOR" switch to "SIGNAL" on the oscilloscope.

d. Adjust the "FREQUENCY" dial on the pulse generator to "800" and the "MULTIPLY FREQUENCY BY" switch to "X 1." e. Set the "PULSE WIDTH" dial on the pulse generator to three microseconds.

f. Adjust the oscilloscope scale illumination to readable brilliance on the scope glass.

g. Set the "MARKER INTERVALS" switch to one microsecond by the upper right control on the oscilloscope.

h. Set the "SWEEP" rate at ten microsecond.

i. Set the "SWEEP DELAY" at "OUT".

j. Bring the trace onto the horizontal line by adjusting the "VERTICAL POSITIONING" control.

k. Adjust the "FINE SWEEP" control until ten one microsecond marks exactly cover one large section of the scale between the vertical lines. This makes each scale division a half-microsecond unit.

l. Now adjust the potentiometer on the test jig to deliver a calibrated 1.2 volt signal to the oscilloscope. Calibration procedure will be found in the Manual of Operation of Oscilloscope TS-239/UP.

m. After this calibration, disconnect the lead from the oscilloscope. (Since the attenuator ratio is 1: 10, the input connection to the amplifier power supply will deliver a 0.12-volt peak signal to J102.)

9-21. 'To provide an input level of 1.0 volt as required by the test steps in paragraph 9-22, proceed as follows:

a. Perform steps a. through k. as in paragraph 9-20.

b. Adjust the potentiometer on the test jig to deliver a calibrated 1.0-volt signal to the oscilloscope.

c. Now instead of the attenuator output line connect the potentiometer line (the dotted line on figure 9-2) to J102. This connects the pulse generator peak output of 1.0 volt into the amplifier power supply.

9-22. OUTPUT TEST PROCEDURE. To test the amplifier power supply for output amplitude and pulse width, proceed as follows:

a. Connect the components required by figure 9-2. Make the necessary power connections and interconnections (figure 7-17, Handbook Service Instructions) and check all wiring.

b. Turn the amplifier power supply on by closing the switch in the simulated control box. Set the line voltage at 11 5-volts ac with the Variac.

c. Now, by varying the pulse width and repetition frequency, and by changing the pulse voltage output as instructed in paragraphs 9-20 and 9-21, perform the test checks tabulated in table 9-1. Voltages are read by calibration on the oscilloscope.

d. If necessary (that is, if unable to secure a satisfactory pulse from the unsynchronized pulse generator), in order to obtain a repetition rate of 80 pps, disconnect the oscilloscope "TRIGGER OUTPUT" and connect the output of the Hewlett-Packard Audio Oscillator type 200-C to the "SYNC INPUT" terminal of the pulse generator. Set the audio generator to deliver 80 cps to the pulse generator as a triggering signal. Then adjust the oscilloscope and the pulse generator output voltage as instructed in paragraph 9-20.

e. Test signals and acceptable responses are given in table 9-1.

9-23. Since no available pulse generator will deliver the required range of negative pulses, it is necessary to test the amplifier power supply for positive pulse output and then apply a sine wave to test operation of the polarity-reversing stage. Tube V102, the reversing circuit, is a no-gain stage and maximum variation from the positive output readings should not exceed plus or minus 10 per cent. Proceed as follows:

a. Disconnect all pulse generator connections.

b. Connect the output of the Hewlett-Packard Audio Oscillator type 200-C to the "SIGNAL INPUT" terminal of the oscilloscope and adjust the audio generator to deliver a 0.1-volt rms sine wave of 5,000 cycles per second.

c. Now connect the output of the audio generator to connector J 102 of the amplifier power supply and the output of the amplifier power supply (from J 103) to the "SIGNAL INPUT" terminal of the oscilloscope.

d. With switch S101 in positive position, read the voltage of the signal output as calibrated on the oscilloscope.

e. Throw switch 5101 to negative position and read the voltage again. There should be no more than a plus or minus 10 per cent variation.

TABLE 9-1. AMPLIFIER POWER SUPPLY AM-256/APA-69 OUTPUT TESTS

Positive Input at J102					
Pulse Width (in microseconds)	*Peak Hght.*	*Rep. Rate*	*"GAIN" Position*	*Meaning*	*Output Limits at J103*
3	0.12	800	Full ON	Amplitude	Min: 35 volts (A)
3	0.12	80	Full ON	Amplitude	A' plus/minus 10%
3	0.12	8,000	Full ON	Amplitude	A' plus/minus 10%
3	1.0	800	Full OFF	Amplitude	Max: 5.0 volts
0.5	0.12	800	Full ON	Amplitude	Min: 60% of A'
0.5	0.12	800	Full ON	Pulse width	Min: 3, sec
25	0.12	800	Full ON	Amplitude	Min: 90% of A'
25	0.12	800	Full ON	End Ampi.	Min: 80% of full amplitude

A'-Actual reading of first amplitude test.

9-24. END DROOP MEASUREMENT. Measurement of "end droop" (table9- 2) is accomplished by adjusting the leading edge of the pulse to a standard amplitude on the vertical scale by means of the oscilloscope "GAIN" control, then shifting the end of the pulse by means of the "HORIZONTAL POSITIONING" control to the same vertical scale for comparison.

9-25. AZIMUTH INDICATOR IP-36/APA-69 FINAL TESTS.

9-26. The final tests of the Azimuth Indicator IP36/APA-69 require the following test equipment:

a. An Amplifier Power Supply AM-256/APA-69.

b. An Antenna Drive TG-8/APA-69.

c. A Direction kinder Control C-527/APA-69.

d. A Variac, General Radio type V5M or equivalent.

e. An a-c voltmeter, 0-150-volts ac, two per cent accuracy.

f. An Oscilloscope TS-239/UP.

g. A Measurements Pulse Generator type 79-B, with attenuator.

h. An autosyn test unit, fabricated according to instructions contained in paragraphs 6-26 and 6-27 of the Handbook Service Instructions.

i. A transparent graticule calibrated with engraved lines at 0.1-inch intervals to 1.4 inches and engraved circles with radii of 0.5, 1.14, 1.2 and 1.26 inches, to fit over the face of the cathode-ray tube of the Azimuth Indicator IP-36/APA-69.

j. A source of 115-volt 400-cycle-per-second ac for components of the Direction Finder Group AN/APA69.

k. A source of 115-volt 60-cycle-per-second ac for test equipment. A source of 28-volts dc for the Antenna Drive TG-8/APA-69.

9-27. This equipment must be assembled into a test jig as illustrated in figure 9-3. In order to make the

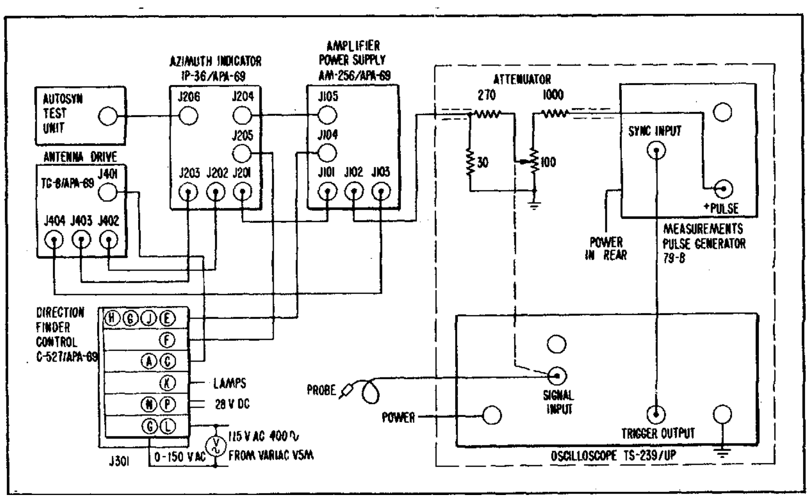


Figure 9-3. Azimuth Indicator IP-6 / APA-6Y, Reassembly Test Jig

test described in paragraph 9-35c it will be necessary to zero the resolver in the antenna drive used in test jig, figure 9-3. This may be done as follows:

a. Set "GAIN" control R302 on Direction Finder Control C-527/APA-69 full "ON" (clockwise), the "POI.ARITY REVERSING" switch SI01 on Amplifier Power Supply AM-256/APA-69 to "POSITIVE", the "ANT. SPEED" control on the direction finder control to "ZERO", the "POWER" switch on the direction finder control to "ON", and the "POLAR." switch on the direction finder control to "HORIZ."

b. Following instructions in paragraph 9-20, establish ;a positive output pulse of 800 repetition rate, three microseconds wide from the pulse generator. The voltage of this pulse should be adjusted to give a pulse (voltage) at J404 on the antenna drive of 20 to 30 volts peak.

c. Select one of the eight engraved marks (spaced 45 degrees) on the rotating collar of the antenna drive and mark it with a piece of tape for future reference. This mark will hereafter be referred to as the "zero bearing mark".

d. Remove the cover from the antenna drive by releasing the two Dzus fasteners on the side panel and carefully loosen the three square clamping screws which hold the resolver (B401).

e. Rotate the antenna drive spindle several turns by hand in a counterclockwise direction as viewed from the antenna mounting side and stop with the zero bearing mark mentioned above exactly in alignment with the arrow on the fixed collar. l-his is to eliminate any possible effect. of backlash on the alignment.

CAUTION

If the spindle is turned too far, do not turn it back, but make another revolution before lining the marks up.

f. By use of a T-fitting, connect the Oscilloscope TS-239/UPI signal input directly (do not use Attenuator Probe MX.607/AP) to J202 on the Azimuth Indicator IP1-36/AP'A-69. (Be sure that the opposite end of the coaxial cable to J202 is connected to J402 on the antenna drive.)

g. With the zero bearing mark on the drive spindle set as in e. above, rotate the resolver to give a negative pulse at J202 as indicated by downward deflection on Oscilloscope TS-239/'UP. Set the resolver for maximum deflection on the oscilloscope, using suitable settings of "GAIN" and "MULTIPLIER" controls to prevent saturation of the oscilloscope amplifier.

h. Transfer the oscilloscope input to J203 on Azimuth Indicator IP-36/APA-69. With the oscilloscope "MULTIPLIER" on "1" and "GAIN" at maximum, carefully rotate the resolver back and forth over a small angle to obtain a minimum (or null) response. Disregard the residual overshoot at the beginning and end of the pulse and bring the center to the pulse to the base line.

i. Now clamp the resolver carefully back into place, tighten the three square screws, and check again to see that it has not slipped off the null position.

9-28. FINAL TEST PROCEDURES

9-29. VISUAL CHECK. A visual check of the azimuth indicator IP-36/AIA-69 must be made before initiating the final tests.

9-30. CONTROL POSITIONS. Initially, set "GAIN" control R302 on the Direction Finder Control C527/APA-69 full ON (clockwise), the "POLARITY REVERSING" switch S101 on Amplifier Power Supply AM-256/APA-69 to "POSITIVE", the "POWER" switch on the Direction Finder Control to OFF and the "ANT. SPEED" control on the direction finder control to "ZERO". Maintain the input voltage at 115 volts ac by means of the Variac.

9-31. Following instructions in paragraph 9-20, establish an output pulse of 800 repetition rate three microseconds wide from the pulse generator. The voltage value of this pulse is not important, and will subsequently be adjusted by varying the 100-ohm attenuator potentiometer. When the pulse width and repetition rate have been adjusted, disconnect the (dotted line) connection from the attenuator potentiometer to oscilloscope signal input.

9-32. CONTROL CHECK. Now, turn the "ON-OFF" switch on the Direction Finder Control C-527/APA69 ON. Adjust the attenuator potentiometer to deliver a trace on the azimuth indicator cathode-ray tube face approximately one inch long.

a. Rotate the azimuth indicator "FOCUS" control through its range and note that there is a setting near the center of its range where the sharpest focus is obtained. The trace should be fuzzy at settings on both sides of this optimum setting. Leave the "FOCUS" control at its best setting.

b. Rotate the "INTENSITY" control on the azimuth indicator through its range. At extreme counterclockwise setting, the trace on the cathode-ray tube should be extinguished. Near the mid-range, the trace should be of brightness adapted to viewing in normal room light. At extreme clockwise setting, the trace should be overbright and halated. Leave the "INTENSITY" control at its optimum setting.

c. Rotate the "INT. MOD." control on the azimuth indicator through its range. The cathode-ray tube trace should intensify as the control is rotated clockwise.

d. Rotate the "H. CENT." control on the azimuth indicator through its range. As the control moves clockwise, the start of the trace should move laterally from at least 1/4 inch to the left of center to at least 1/4 inch to the right of center. Set the control to center the start of the trace.

e. Rotate the "V. CENT." control on the azimuth indicator through its range. As the control moves clockwise, the start of the trace should move vertically from at least 1/4 inch below the center to at least 1/4 inch above the center. Set the control to center the start of the trace.

f. Check the azimuth dial lighting for uniformity of illumination around the outside of the cathode-ray tube face and for freedom from light leakage into the face of the tube.

g. Check the azimuth indicator cursor dial. This dial should turn by hand without moving the azimuth dial, but should be snug enough not to be rotated by vibration.

9-33. DEFLECTION AMPLIFIER GAIN CHECK. Set the azimuth dial with 360 degrees at the top (on the fiducial mark). Place the calibrated test dial over the face of the cathode-ray tube.

a. Turn the antenna drive spindle until the trace is horizontal and pointing to the 90 degree.-azimuth mark. With the "GAIN" control R302 fully clockwise and the start of the trace centered adjust the output level of the pulse generator (by using the attenuator potentiometer) until the trace length on the cathoderay tube of the azimuth indicator is 1.2 inches long.

b. Connect the probe from the "SIGNAL INPUT" terminal of the Oscilloscope TS-239/UP to J203, the horizontal deflection input jack of the azimuth indicator, and read the voltage of the signal input at this point. It should be no more than 3.5-volts peak. (Procedure for reading calibrated voltage with the Oscilloscope will be found in the Handbook of Operating Instructions on the Oscilloscope TS-239/UP.) Now disconnect the oscilloscope connections.

9-34. INTERIOR CONTROLS CHECK AND ADJUSTMENT. After the trace length has been set to 1.2 inches as in paragraph 9-33a above, perform the following operations:

a. Rotate the Antenna Drive TG-8/APA-69 spindle until the trace is at 270 degrees azimuth. Without disturbing the pulse generator output level as set, measure the trace length against the calibration graticule. It should be between 1.1 and 1.3 inches long.

b. Rotate the spindle until the trace is vertical at 3('0 degrees azimuth. Without changing the output level of the pulse generator, adjust the "circularity" potentiometer R242 (see figure 9-4) to reset the trace length to 1.2 inches.

c. Rotate the spindle until the trace points to 180 degrees azimuth. Without changing the output level of the pulse generator or the setting of the "circularity" potentiometer, measure the trace length against the calibration graticule. It should be between 1.1 and 1.3 inches long.

d. Turn the "ANT. SPEED" control on the antenna drive clockwise, so that the spindle rotates. The trace on. the cathode-ray tube should rotate and create a circle on the dial. Adjust the "H. CENT." and "V. CENT." controls to center the start of the trace. Adjust the "circularity" control R242 for the best circular pattern of 1.2 inches radius. The maximum deviation from circularity may not exceed 0.06 inch. (That is, the circle should fall between the maximum and minimum limits of circularity engraved on the graticule.) If there is noticeable ripple modulation present, consider only the locus of the peaks of the ripple deflection in checking circularity. Reduce the signal level until a circle of 1-inch radius is obtained and determine the total excursion of the end of the trace in inches due to ripple voltage. This should not exceed 0.1 inch.

e. Turn the "ANT. SPEED" control counterclockwise to "OFF". With the trace length 1.2 inches, rotate the spindle by hand to observe the trace for a loop at 45, 135, 225 and 315 degrees azimuth. If any loop is observed, set the trace at the point of maximum loop and adjust the "phase corrector" trimmer capacitors C213 and C214 (see figure 9-4) until a loop of minimum width (or a straight line) is obtained. Continue to check and adjust until all disphase is minimized. Maximum loop must not exceed 1/16 inch.

f. The antenna drive is normally wired for belly mounting. To check the proper wiring of this unit, observe that the cathode-ray tube trace rotates in a clockwise direction. The antenna drive spindle should rotate in a counterclockwise direction when viewed from the antenna mounting end.

9-35. TORQUE UNIT AND AMPLIFIER CHECK. Following the procedure outlined in the Handbook Service Instructions, paragraphs 6-29 through 6-31, zero and adjust 'the balance control of the torque unit amplifier. Remove the special plugs when this operation is done, and restore the test connections as in figure 9-3.

a. Check the azimuth dial operation by rotating the test autosyn needle by hand clockwise. If the indicator dial oscillates more than two or three times before stabilizing reduce the torque unit gain control R248 (see figure 9-4) slightly. If the dial is sluggish, advance this gain control slightly.

b. Now calibrate the azimuth indicator dial by comparing its readings every fifteen degrees with the hand-set autosyn test unit reading. Differences must not exceed 1.5 degrees.

c. Use Antenna Drive TG-8/APA-69 with there. solver zeroed, as described in paragraph 9-27. With the pulse input to J102 of Amplifier-Power Supply AM-256/APA-69 set at approximately 0.1 volt peak, adjust "GAIN" control on Direction Finder Control C-527/APA-69 to give a trace deflection approximately one inch long on the azimuth indicator. Turn the azimuth dial so that the 360-degree mark is opposite the fiducial mark. Carefully center the beginning of the trace at the intersection of the cursor cross marks. Rotate the antenna drive spindle in the counter clockwise direction as viewed from the antenna mounting side and stop with the zero bearing mark (established by procedure of paragraph 9-27) in exact alignment with the arrow on the fixed collar. Rotate the cursor arrow (on the azimuth indicator) until it falls over the trace. Note that the reading of the azimuth scale opposite the end of the cursor arrow is 360 degrees. Turn the antenna drive spindle in the counterclockwise direction until the next engraved mark is lined up with the arrow on the drive collar. Rotate the cursor arrow until it again falls over the trace and note the corresponding reading of the azimuth scale which should be approximately 45 degrees. Continue checking the trace follow-up accuracy for all of the 45-degree points of the antenna drive. The difference between the trace azimuth scale reading and the angular displacement of the antenna drive spindle (accumulating 45 degrees per mark from the zero bearing mark) should not exceed ± 2.5 degrees at any point.

Note

In order to prevent errors due to parallax, it is important to use the following procedure for each of the above settings: Close one eye and move the head until the spot at the beginning of the trace falls under the intersection of the cursor cross marks. Without moving head, follow trace outward to the end and adjust cursor line so that it appears to exactly bisect trace.

9-35A. AZIMUTH-PANORAMIC INDICATOR IP-81( )/APA-69A, FINAL TEST PROCEDURES.

9-35B. VISUAL CHECK. A visual check of the azimuth-panoramic indicator must be made before initiating the final tests.

9-35C. The azimuth-panoramic indicator has two modes of operation corresponding to its dual functions of direction finding and panoramic indication.

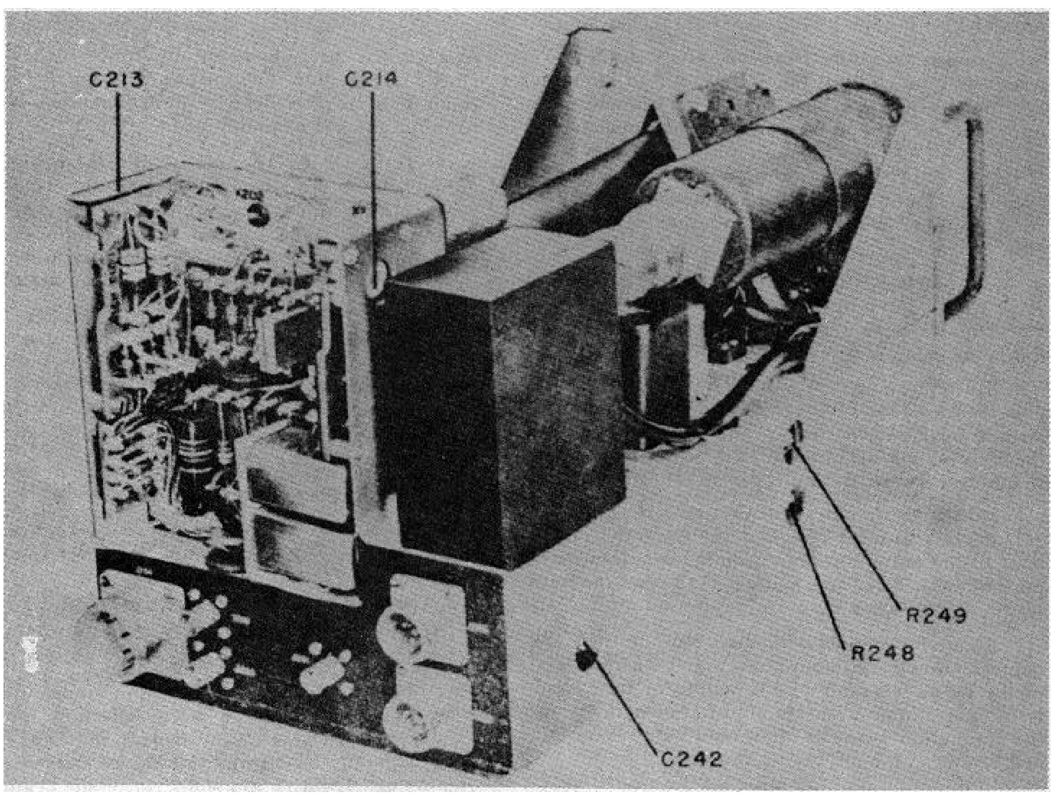


Figure 9-4. Azimuth Indicator IP-36/APA-69, Internal Controls

TABLE 9-1A. TEST EQUIPMENT FOR FINAL TESTS. AZIMUTH-PANORAMIC INDICATOR IP-41( )/APA69A

Radar Set AN/APR-9
Source of 26.5 volts dc for antenna drive motor and Radar Set AN/APR-9
Source of 118 volts 60 cps for operation of test equipment
Source of 115 volts 400 cps for operation of indicator and Radar Set AN/APR-9
Multimeter, Simpson Model 260, or equivalent
Pulse generator, Measurements Type 79-B
Oscilloscope TS-239/U
Peak-reading a-c VTVM TS-487/U or Ballantine Model 305, or equivalent
Antenna Drive TG-8/APA-69
Direction Finder Control C-527/APA-69
Transparent graticule calibrated with engraved lines at O.1-inch intervals to 1.4-inch and engraved circles with radii of 0.5-inch, 1.14-inch, 1.2-inch, and 1.26-inch, to fit over face of KRT
Synchro test unit, fabricated according to instructions contained in paragraphs 6-26 and 6-27 of the Handbook Service Instructions
AN connectors (one each) as follows:

1. AN-3106-14S-5S with pins C, E, and A jumpered and pin D connected to pin E of item 3 below (AN-3106-20-7S)
2. AN-3106.14S-2S for input to azimuth-panoramic indicator jack 31007
3. AN-3106-20-7S
4. AN-3106 shell with Winchester Type 202-B insert

Attenuator and phase inverter unit. (Refer to paragraph 2-7.)

The test setup. (figure 9-4A) is used for checking the unit when used either for direction finder or panoramic operation.

9-35D. The final tests of the azimuth-panoramic indicator require the following test equipment listed in table 9-1A, above.

9-35E. This equipment must be assembled into a test jig as illustrated by figure 9-4A. In order to make the test described in paragraph 9-35AK, j. it will be necessary to zero the resolver in the antenna drive used in the test jig shown in figure 9-4A. This may be done either by the method described in paragraph 9-27, using the setup shown in figure 9-3, or by the method described in paragraph 9-35AK (a. thru i.) using the setup shown in figure 9-4A.

9-35F. The attenuator and phase inverter unit in the test jig shown in figure 9-4A is necessary to provide a means of varying the pulse output amplitude and to furnish the negative pulse required for testing the vertical amplifier in panoramic operation. (The Measurements Type 79-B pulse generator furnishes only a positive pulse of fixed amplitude.) This unit also provides a means of varying the amplitude of the horizontal sweep voltage from Mixer-Amplifier CV43/APR-9 when testing the horizontal amplifier of the azimuth-panoramic indicator in panoramic operation. The switch S1 (positions I and 2) in the attenuator and phase inverter unit, is necessary to check proper phasing of the horizontal amplifier circuits in panoramic operation. See paragraph 2-7 for fabrication of this unit.

9-35G. OSCILLOSCOPE SETUP. Oscilloscope TS239/UP is used in the test setup shown in figure 9-4A to determine the pulse input at J1008, J1002, J1003 for direction finder operation and at pin A of J1007 for panoramic operation. It is also used to measure the pulse output at J1004 for direction finder operation.

Since the various pulse repetition frequencies used in the tests cannot be obtained with the internal trigger generator of the Oscilloscope TS-239/UP, it is necessary to use the Measurements Type 79-B pulse generator as the source of pulse repetition frequency and synchronize the Oscilloscope TS-239/UP sweep with this source. More satisfactory operation in this case is obtained by synchronizing the oscilloscope sweep internally by the signal rather than through the use of the "EXTERNAL SYNC" jack. The Oscilloscope TS239/UP controls listed below should, therefore, be set as indicated.

"TRIGGER RATE" -"OFF"
"SWEEP DELAY" -"OUT"
"SYNC SELECTOR"-"SIGNAL"
"SYNC VOLTAGE"-Maximum and plus or minus, depending upon whether unknown signal pulse is thought to be plus or minus To obtain a signal of specified polarity, pulse repetition frequency pulse width, and pulse amplitude, proceed as follows:

a. Connect the Oscilloscope TS-239/UP "SIGNAL INPUT" to the proper test point (J1008 for positive pulse used in direction-finder operation and pin A of 1007 for negative pulse used in panoramic operation).

b. Set the "FREQUENCY" dial and "MULTIPLY FREQUENCY BY" switch on the pulse generator in combination to give the required repetition frequency.

c. Set the "PULSE WIDTH" dial on the pulse generator to the required pulse width.

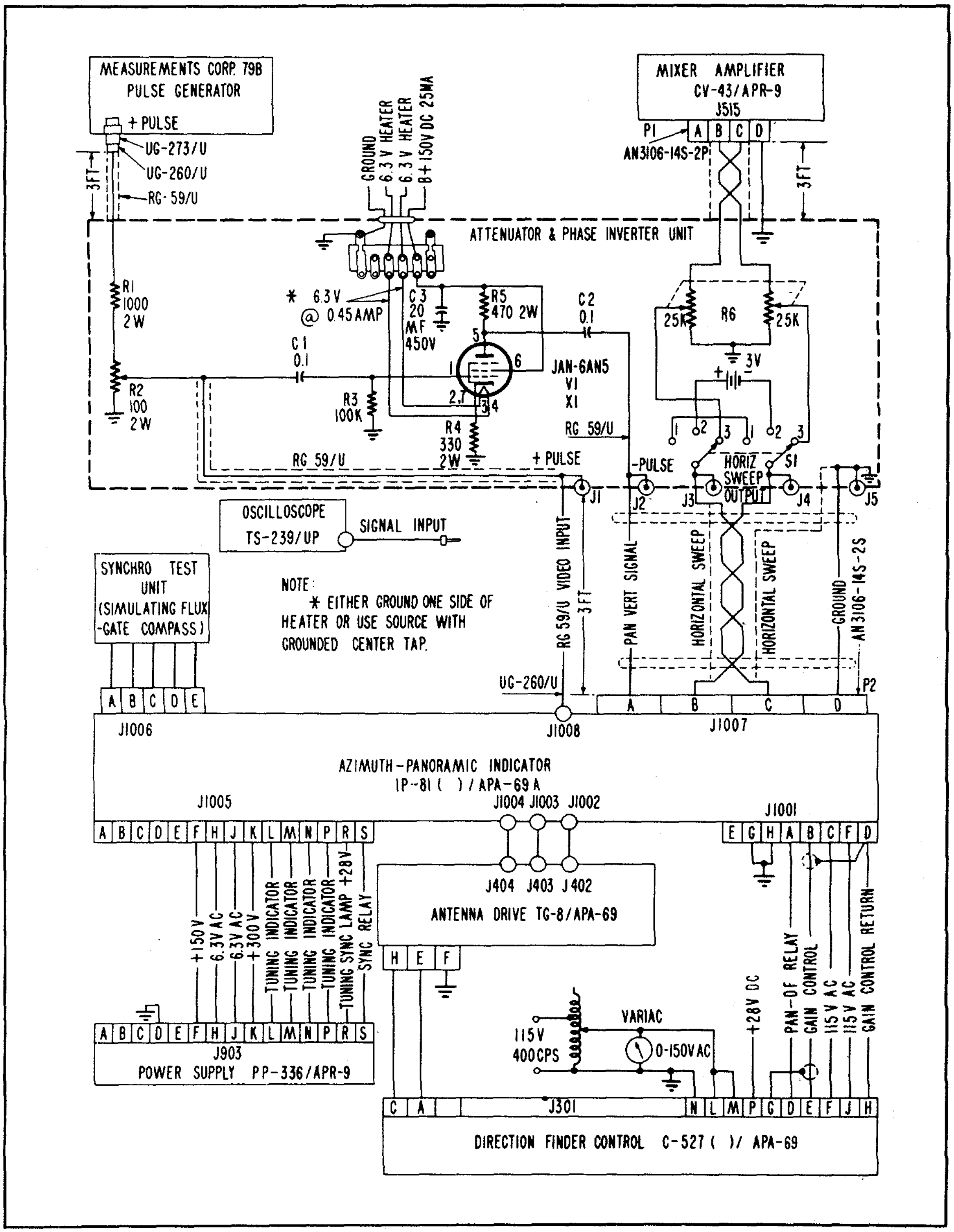


Figure 9-4A. Direction Finder Operation of Azimuth-Panoramic Indicator IP-811)/APA-69A Reassembly Test Jig

d. Adjust the oscilloscope scale illumination to readable brilliance on the scope glass.

e. Set the "MARKER INTERVALS" switch to "1" when measuring 0.5-microsecond pulse and to "10" when measuring 10-microsecond or 50-microsecond pulse.

f. Set the "SWEEP TIME COARSE" switch to "1" for 0.5-microsecond pulse, to "10" for 10-microsecond pulse, and to "100" for 50-microsecond pulse.

g. Bring the trace onto the horizontal line by adjusting the "VERTICAL POSITIONING" control.

h. Adjust the "FINE SWEEP" control until the scale distance between vertical lines is as follows:

Spacing between adjacent one-microsecond markers for 0.5-microsecond pulse measurements

Spacing between adjacent 10-microsecond markers for 10-microsecond pulse measurements

Spacing of five 10-microsecond intervals for 50microsecond pulse measurements

i. Now adjust the potentiometer in the test jig to deliver the specified pulse amplitude as measured by the calibration procedure found in the manual of operation of Oscilloscope TS-239, UP.

j. Readjust the "PULSE WIDTH" dial on the pulse generator slightly so that the width at 90 per cent of maximum amplitude is exactly the specified value as determined by the calibrated sweep. (See step h., above.)

9-35H. DIRECTION-FINDER OPERATION.

9-35I. TEST SETUP.

9-35K. The test setup shown in figure 9-4A is used for the direction finder test. Place the "PAN-D.F." switch S303 on the control box in the "D.F." position.

Turn on the power by actuating the "POWER ONOFF" switch S301 on the control box. Be sure the input power is maintained at 115 volts 400 cps during the test.

9-35L. SERVO SYSTEM CHECK.

9-35M. To check the servo system, follow the procedure given below.

9-35N. ADJUSTMENT OF BALANCE CONTROL R 1060. To adjust balance control R1060, proceed as follows:

a. Make connections to J1001 andJo1006 as shown in figure 9-4B. Then connect jumpers at plug forJ1006 between pins A, C, and E. Connect jumper plug for J1001 pin E to pin D of plug at JlO06. Connect 115 volts 400 cps to Jl00l between pin C (hot) and pin H (common).

b. Connect a VT'VM (TS-487/'U or Ballantine Model 300 or 305) across terminals 2 and 4 of transformer T1005 (connect VTVM "GND" terminal to terminal 2 of T1005).

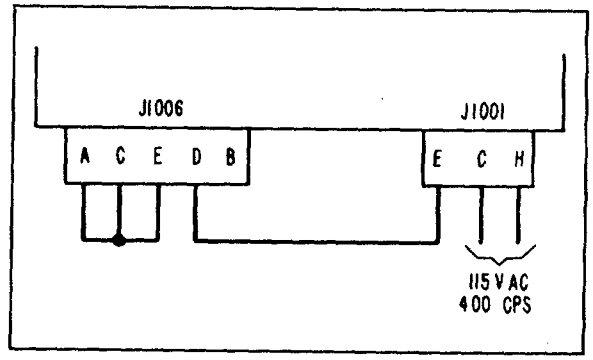


Figure 9-4B. Connector Circuits, Servo Test

c. Turn the a-c power on atJ00o1. The torque unit will rotate to a certain position and stop.

d. Set the "SERVO GAIN" control R1058 (figure 9-4C) full counterclockwise for minimum gain.

e. Adjust the "BALANCE" control R1060 for a minimum reading on the VTVM. Use the lowest VTVM scale consistent with obtaining a mid-scale reading.

f. Lock the "BALANCE" control at the point of minimum reading.

g. Set the "SERVO GAIN" control R1058 for maximum gain. If dial hunts, reduce gain slightly until hunting just stops.

9-35P. ZEROING TORQUE UNIT BI001. To zero torque unit B1001:

a. Remove the top section of the front panel from the unit by taking out the four screws in the corners.

b. Loosen the three screws holding the base of the torque unit to the inclined frame on the back of the front panel. Slide the torque unit upwards until the gears unmesh.

c. Turn the azimuth dial until the 360-degree mark is opposite the fiducial mark at the top of the KRT face.

d. Carefully engage the gears by sliding the torque unit downward, while its shaft is held in the electrical zero position, without disturbing the position of the azimuth dial. It may be necessary to make several attempts at this procedure in order to get proper alignment.

e. Slide the torque unit into place for minimum gear backlash, but do not mesh gears so tightly as to introduce appreciable drag. Tighten the torque unit mounting screws.

f. Test the zero position as follows: 1. Turn the voltage to J1001 off. 2. Rotate the azimuth dial off 360 degrees. 3. Turn the voltage to JI001 on again.

The azimuth dial should rotate and stop with the 360degree mark in line with the fiducial mark. If the dial does not zero properly, repeat the alignment previously described.

g. Replace the panel section on the indicator unit.

Remove the plugs and jumpers from J1001 and J1006.

9-35Q. ADJUSTING SERVO GAIN CONTROL R1058: To adjust the servo gain control R1058:

a. Connect the synchro test jig (simulating a Flux Gate compass) to J1006. Apply 115 volts 400 cps to J 1001 between pins C (hot) and H (common).

b. Place the "SERVO GAIN" control in the 3/4 clockwise position.

c. Rotate the test synchro in the direction of increasing azimuth (clockwise) and note that the azimuth dial on the indicator follows. If the indicator dial oscillates more than two or three times when coming to rest, reduce the "SERVO GAIN" slightly (counterclockwise rotation). If the dial is sluggish, increase the "SER'VO GAIN" slightly (clockwise rotation).

9-35R. CHECKING AZIMUTH DIAL ACCURACY. To check azimuth dial accuracy, make sure that the test synchro has been accurately calibrated and zeroed at the 360-degree azimuth. (See paragraphs 6-34 through 6-34F of the Handbook Service Instructions.) Set the test synchro dial so as to bring the indicator azimuth dial to each 15-degree position. Read and record the test synchro dial reading, estimating to tenths of a degree. Subtract the indicator azimuth dial setting from the test synchro dial reading and record the difference. This difference should be within 4 1.5 degrees.

9-35S. CONTROLS OPERATION.

9-35T. Using procedure described in paragraph 9-35G, apply a positive pulse of 10-microsecond width, PRF of 500, at one-volt amplitude to video input jack J1008. Adjust R302 "GAIN" control on the control box to produce a trace of about 1.0-inch length on the indicator tube.

9-35U. FOCUS CONTROL R1056. Rotate the "FOCUS" control through its range and note that there is a setting near the center of the range at which the sharpest focus is obtained. The trace should be fuzzy on either side of the correct position; that is, the best focus must not occur at either extreme of the range. Set the "FOCUS" control for sharpest focus.

9-35V. INTENSITY CONTROL R1045. Rotate the "INTENSITY" control through its range from full counterclockwise to full clockwise. In the extreme counterclockwise position, the trace should be extinguished. Near mid range the trace should be of a brightness adapted to viewing in normal room light. In the extreme clockwise position the trace should be overbright and halated. Set the "INTENSITY" control for optimum brightness.

9-35W. INTENSITY MODULATION CONTROL R1020. Rotate the "INTENSITY MODULATION" control through its range in the clockwise direction. The trace should be intensified.

9-35X. HORIZONTAL CENTERING CONTROL R1037. Rotate the "HORIZONTAL" "CENTERING control through its range in the clockwise direction. The start of the trace should be moved from at least 1/4inch to the left of center to at least 1/4-inch to the right of center. Set the control to place the start of the trace at the center of the tube.

9-35Y. VERTICAL CENTERING" CONTROL R1028. Rotate the "VERTICAL "CENTERING" control through its range in the clockwise direction. The start of the trace should move from at least 1/4-inch below the center of the KRT to at least 1/4-inch above the center. Set the control to place the start of the trace at the center of the tube.

9-35Z. DIAL LIGHTING AND DIMMER CONTROL R1042. Check the azimuth dial lighting for uniformity of illumination around the outside of the KRT and for freedom from light leakage onto the face of the KRT. Rotate dimmer control R1042 through its range and check that clockwise rotation increases brightness of the dial lighting.

9-35AA. CURSOR DIAL FRICTION. The cursor dial in front of the KRT should be adjusted so that it can be turned by hand without moving the azimuth dial, but should be snug enough so as not to be rotated by vibration.

9-35AB. DEFLECTION PLATE ALIGNMENT. Set the azimuth dial around the KRT so that the 360degree mark is at the top fiducial mark. Start the antenna drive rotating by turning the "ANT. SPEED" control clockwise. Pull off the coax plug at one end of the line that carries horizontal deflection voltage from the antenna drive to the indicator. A vertical trace should remain on the KRT. Loosen the clamp at the socket end of the KRT. With the cursor arrow set to the 360-degree mark on the scale, center the trace and rotate the KRT until the trace falls exactly along the cursor arrow. Push the KRT so as to seat it tightly in the panel and tighten the clamp at the socket end. Recheck trace alignment. Replace the horizontal deflection coax and pull off the vertical deflection coax. Turn the cursor arrow to line up with the horizontal trace. Check that the horizontal trace is within two degrees of perpendicularity with the vertical trace. Replace the vertical deflection coax. Turn "ANT. SPEED" control to "ZERO".

9-35AC. CHECKING VIDEO AMPLIFIER.

9-35AD. GAIN. To check video amplifier gain:

a. Apply a positive pulse of 10-microsecond width, PRF of 500, and one-volt amplitude to video input jack J 1008.

b. Measure the amplitude of the output at J1004 on the test scope as follows: 1. With the "GAIN" control R302 on the control box fully on, observe the video output atJ1004 on the test oscilloscope by connecting to the signal input of the scope. 2. Determine the pulse voltage by the calibration procedure found in the manual of operation of Oscilloscope TS-2 39/UP. This voltage should not be less than 25 volts.

9-35AE. HIGH FREQUENCY RESPONSE. Apply a positive pulse of 0.5-microsecond width, PRF of 500, and set the amplitude at one volt as in paragraph 9-35ADa. Measure the output as viewed on the test scope at J1004 in the manner outlined in paragraph 9-35ADb. This output should not be less than 1/2 the output measured in paragraph 9-35ADb.

9-35AF. LOW FREQUENCY RESPONSE. Apply a positive pulse of 50-microsecond, 500-PRF, one-volt amplitude at J1008. Observe the output at J1004 on the test scope.

a. Measure the amplitude of the start of the output pulse by comparison with the vertical deflection calibration of the test scope.

b. Measure the amplitude at the end of the output pulse. This amplitude must be at least 50 per cent-of the amplitude measured in a., above.

9-35AG. HORIZONTAL DEFLECTION AMPLIFIER. Set the azimuth dial around the KRT of the indicator so that the 360-degree mark is at the top fiducial mark. Place the calibrated test dial over the face of the KRT to measure trace length. With no signal applied, center the start of the trace by means of the "HORIZONTAL and "VERTICAL "CENTERING" controls. Apply a 10-microsecond, 500-PRF positive pulse of one-volt amplitude to J1008. Turn the antenna drive spindle until the trace is horizontal and pointing to the 270-degree azimuth mark. Connect the test scope to monitor the input level at the horizontal amplifier input jack J1003. Adjust the "GAIN" control R3E2 on Direction Finder Control C-527/APA-69 so that a trace length of 1.0 inch is obtained on the KRT. Measure the input pulse voltage level at J1003. This pulse should be positive and of amplitude not exceeding 2.5 volts. Rotate the antenna drive spindle until the trace is at 90-degree azimuth. Set the level of the pulse at J1003 (which should now be negative) to the same amplitude as measured above. Measure the trace length in inches which should be within the limits of 0.9 to 1.1 inches.

9-35AH. VERTICAL DEFLECTION AMPLIFIER. Check the vertical deflection amplifier as follows:

a. Rotate the antenna drive spindle until the trace is at 180 degrees. Connect the test scope to J1002.
Set the level of the pulse at J1002, (which should be positive) to the same value as measured in paragraph 9-35AG, above. Adjust "CIRCULARITY" control R1031 until a trace length of 1.0-inch is obtained.

b. Rotate the antenna drive spindle until the trace is at 0 degree. Set the level of the pulse at J1002 (which should now be negative) to the same amplitude as in a., above. Measure the trace length in inches; it should be within the limits of 0.9 to 1.1 inches.

9-35AJ. ROTATION CHECK. Set the "GAIN" control R302 on the control box to full clockwise position and apply a 10-microsecond pulse at 500 PRF to the video input jack J1008. Adjust amplitude of pulse to give approximately 1.2-inch deflection on KRT.

a. Start the antenna drive motor rotating by means of the antenna speed control on Direction Finder Control C-527/APA-69. Check that the trace on the KRT rotates clockwise as the antenna drive shaft rotates counterclockwise, as viewed from the antenna end of the shaft.

b. For circularity test, set "GAIN" control R302 on the control box to full clockwise position. With the calibrated test dial over the KRT face and the antenna drive motor rotating, set the sweep trace circle to an average radius of 1.2 inches. Touch up "CIRCULARITY" control R1031, if necessary, to bring the trace locus within the area outlined by the 1.14-inch and 1.26-inch circles on the calibrated graticule. If there is noticeable ripple modulation present, consider only the locus of the peaks of the ripple deflection in checking circularity. Maximum deviation from 1.2inch circle should not exceed ± 0.06 inch.

c. Using a 1.0-inch deflection, determine the total excursion of the end of the trace in inches due to ripple voltage. This should not exceed 0.1 inch.

d. To make the phase corrector capacitor adjustment, turn off the antenna drive motor and rotate the drive slowly by hand. Determine whether or not the trace exhibits a loop in positions near 45, 135, 225, and 315 degrees of azimuth. If a loop is anywhere observed, return the trace to the position of maximum loop and adjust "PHASE CORRECTOR" capacitor C1018 and C1019 for a loop of minimum width. Again check for a loop in other sweep positions and touch up C1018 and C1019 for minimum or no loop in all positions. Loop width should not exceed 1/16inch.

9-35AK. TRACE AZIMUTH ACCURACY. In order to make the trace azimuth accuracy test, it will be necessary to zero the resolver in the antenna drive used in the test jig shown in figure 9-4A. This may be done as described in paragraph 9-27, or, as described below (a. through i.), using the test setup shown in figure 9-4A.

a. Set the "POWER" switch on Direction Finder Control C-527/APA-69 to "ON", the "PAN-DF" switch to "DF", the "POLAR" switch to "HORIZ", and the "ANT. SPEED" control to "ZERO".

b. Following the instructions in paragraph 9-35G, establish a positive, 500-repetition frequency, 10microsecond ,wide pulse of one-volt amplitude at video input terminaljoo008 of the indicator. Adjust the "GAIN" control R302 on the direction finder control to give approximately a one-inch trace deflection on the indicator KRT.

c. Select one of the eight engraved marks (spaced 45 degrees) on the rotating collar of the antenna drive and mark it with a piece of tape for future reference.
This mark will hereafter be referred to as the "zero bearing mark".

d. Remove the cover from the antenna drive by releasing the two Dzus fasteners on the side panel and loosen carefully the three square clamping screws which hold the resolver (B401).

e. Rotate the antenna drive spindle several turns by hand in a counterclockwise direction as viewed from the antenna mounting side and stop with the zero bearing mark exactly in alignment with the arrow on the fixed collar. This is to eliminate any possible effect of backlash on the alignment. If the spindle is turned too far, do not turn it back, but make another revolution before lining the marks up.

f. By using a T-fitting connect Oscilloscope TS239/UF signal input directly (do not use MX-607/AP attenuator probe) toJ1002 on the azimuth-panoramic indicator. (Be sure the opposite end of the coaxial cable to J1002 is connected to J402 on the antenna drive.)

g. With the zero bearing mark on the antenna drive spindle set as in e., above, rotate resolver to give negative pulse at J1002 as indicated by downward deflection on Oscilloscope TS-239/UP. Set resolver for maximum deflection on oscilloscope, using suitable settings of "GAIN" and "MULTIPLIER" controls to prevent saturation of the oscilloscope amplifier.

h. Transfer. oscilloscope input to J1003 on the azimuth-panoramic indicator. With oscilloscope "MULTIPLIER" on "1" and "GAIN" at maximum, carefully rotate the resolver back and forth over a small angle to obtain a minimum (or null) response. Disregard the residual overshoot at the beginning and at the end of the pulse and bring the center of the pulse to the base line.

i. Now clamp the resolver carefully back into place and check again to see that it has not slipped off the null position.

j. Using the antenna drive with the resolver zeroed as described above, set the pulse input and gain to obtain a trace approximately one-inch long on the indicator. Turn the azimuth dial so that the 360-degree mark is opposite the fiducial mark. Carefully center the beginning of the trace at the intersection of the cursor cross marks. Rotate the antenna drive spindle in the counterclockwise direction as viewed from the antenna mounting side and stop with the zero bearing mark (established by the procedure given above or in paragraph 9-27) in exact alignment with the arrow on the fixed collar. Rotate the cursor arrow on the azimuth-panoramic indicator until it falls over the trace. Note that the reading of the azimuth scale opposite the end of the cursor arrow is 360 degrees. Turn the antenna drive spindle in the counterclockwise direction until the next engraved mark is lined up with the arrow on the antenna drive collar. Rotate the cursor arrow until it again falls over the trace and note the corresponding reading of the azimuth scale, which should be approximately 45 degrees. Continue checking the trace follow-up accuracy for all of the 45-degree points of the antenna drive. The difference between the trace azimuth scale reading and the angular displacement of the antenna drive spindle (accumulating 45 degrees per mark from the zero bearing mark) should not exceed 42.5 degrees at any point.

Note

In order to prevent errors due to parallax, it is important to use the following procedure for each of the above settings: Close one eye and move the head until the spot at the beginning of the trace falls under the intersection of the cursor cross marks. Without moving head follow trace outward to the end and adjust cursor line so that it appears to exactly bisect trace.

9-35AL. PANORAMIC OPERATION.

9-35AM. TEST SETUP.

9-35AN. The test setup shown in figure 9-4A is used for testing the indicator in panoramic operation.

9-35AP. CONTROL POSITIONS. Place the "PANDF" switch on Direction Finder Control C-527/APA69 in the "PAN" position. Place switch S1 in the attenuator and phase inverter unit in position 3, and adjust the dual 25,000-ohm potentiometer for maximum horizontal sweep output from the Mixer-Amplifier CV-43/APR-9. Set the Measurements Type 79-B Pulse Generator 't give a 10-microsecond wide, 500-PRF pulse output. Adjust the 100-ohm potentiometer in the attenuator and phase inverter unit to give a one-inch vertical deflection on the indicator.

9-35AQ. OPERATION OF CONTROLS. Procedure for operating controls follows:

a. Focus Control R1056-Rotate the "FOCUS" control through its range and note that there is a setting near midrange at which the sharpest focus is obtained. The trace should be fuzzy on either side of the optimum position.

b. Intensity Control R1045-Rotate the "INTENSITY" control through its range. Near midrange the trace should be of a brightness adapted to viewing-in normal room light. Set the "INTENSITY" control for optimum brightness.

c. Intensity Modulation Control R1020-Rotate the "INTENSITY MODULATION" control through its range in the clockwise direction. The trace should be intensified.

d. Horizontal Gain Control R1041-Rotate the "HORIZONTAL GAIN" control R1041 through its range. At the extreme counterclockwise position the sweep should be collapsed in the horizontal direction. In the extreme clockwise direction the sweep should be expanded off the KRT in both directions. Set the control for edge-to-edge expansion across the tube.

e. Vertical Centering Control R1028-Without changing the setting of the "VERTICAL" "CENTERNG" control made in the direction finder test, the horizontal trace on the KRT should be below the center of the KRT by an amount not exceeding 0.7 inch.

9-35AR. VERTICAL AMPLIFIER. Connect the test oscilloscope to monitor the pulse input level atJ1007 pin A. The scope can be connected to the "-PULSE" output terminal of the attenuator and phase inverter unit. Set the dual 25,000-ohm potentiometer in the attenuator and phase inverter unit to produce a horizontal trace approximately 2.5 inches long.

a. Set the negative pulse atJ1007 pin A to 10-microsecond width at 500 PRF. Adjust the level to give a one-inch maximum deflection on the KRT. Measure the input level on the test scope in the manner previously described. This input should not exceed 3.0 volts.

Note

Pulse width is to be measured at 90 per cent of maximum amplitude.

b. With the input to J1007 pin A set the same as that established in a., above, measure the minimum deflection on the indicator KRT. This should not be less than 0.8 inch.

c. Apply a 0.5-microsecond pulse of 500 PRF at the same level set in a., above. Again measure the maximum deflection on the indicator KRT. This should not be less than 0.5 inch.

d. Apply a 50-microsecond pulse at 500 PRF at the same input level set in a., above. Measure the deflection in inches on the indicator KRT. This should not be less than 0.5 inch.

e. Apply a 10-microsecond pulse at PRF of 60 at the same input level set in a., above, to check variation with PRF. Measure the KRT deflection in inches. This should not be less than 0.63 inch.

f. Apply a 10-microsecond pulse at PRF of 2000 at the same input level set in a., above, to check variation with PRF. Measure the KRT deflection in inches. This should not be less than 0.63 inch.

9-35AS. HORIZONTAL AMPLIFIER. Place the "HORIZONTAL GAIN" control R1041 in the full clockwise position.

a. Starting with the KRT trace centered in the horizontal direction and switch S1 (figure 9-4A) in position 1, note the momentary deflection of the trace when S1 is thrown to position 2. [This removes the short across pins B and C of J1007 and connects the three-volt battery in its place with the (+) terminal connected to pin B.] The trace should instantly jump toward the right side of the tube, and then return more slowly to its original position.

b. Place switch S1 in position 3. This applies the low-frequency sweep voltage from the Mixer-Amplifier CV-43/APR-9 through the dual 25,000ohm potentiometer to pins B and C of J1007. Connect the TS-487/U or Ballantine Model 305 peak-reading VTVM across the "HORIZONTAL SWEEP OUTPUT" terminals of the attenuator and phase inverter unit. Do not ground the case or ground terminal of the VTVM since, in this test, it is being used to measure across a balanced voltage source. Due to the extremely low frequency being measured and the low capacitance between the "GND" side of the VTVM and the a-c power line in the instruments mentioned above, the error caused by this type of operation is negligible. Adjust the dual 25,000-ohm potentiometer in the attenuator and phase inverter unit so as to give a horizontal deflection of 2.5 inches on the indicator KRT. Read the peak-to-peak voltage on the VTVM which should be less than 20 volts.

c. Reduce the horizontal sweep voltage with the dual 25,000-ohm potentiometer until a one-inch horizontal deflection is obtained on the indicator KRT. Read the peak-to-peak voltage on the VTVM for this deflection.

d. Calculate the linearity ratio of the horizontal amplifier by dividing the input to produce a 2.5-inch deflection by the input required to produce a one-inch deflection. This ratio should be within the limits of 2.3 to 2.8.

9-35AT. REMOTE FREQUENCY INDICATOR. Procedure for checking the remote frequency indicator follows:

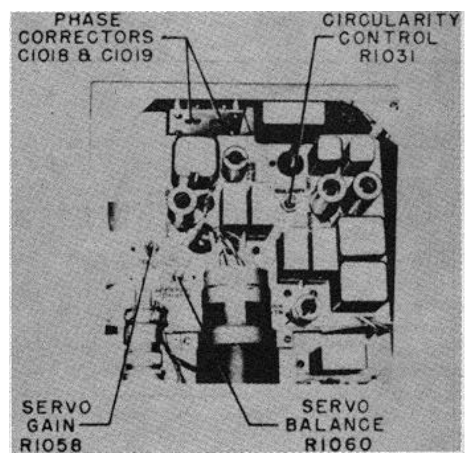


Figure 9-4C. Azimuth-Panoramic Indicator IP-81 ( )I/APA-69A, Internal Controls

a. The panoramic-azimuth indicator must be connected to Radar Set AN/APR-9 at J1005 and the receiver must be turned on for this test.

b. Set the "RANGE" switch on the receiver for the frequency range of the r-f tuner being used (TN-128, TN-129, TN-130, or TN-131). Place the "SECTOR SWEEP/MANUAL" switch, on the control box of

Radar Set AN/APR-9, in the "MANUAL" position and hold the "MANUAL TUNE" switch in the "LOWER" position.

c. open the switch cover located in the lower right hand corner of the azimuth-panoramic indicator.

When the limit of travel of the receiver dial is reached, the pilot lamp next to the "COUNTER RESET" switch S1001 should light up.

d. Hold the "COARSE-FINE" switch S1001 in the "COARSE" position. Move the knurled wheel until the dial indicator on the azimuth-panoramic indicator reads one of the lock-in frequencies listed below, depending on the tuner being used with Radar Set AN/APR-9.

Tuner TN	Kilomegacycles
128	01.00
129	02.30
130	04.30
131	07.05

e. Release the "COARSE-FINE" switch to allow the indicator dial to move from its position set in step d.

f. Move the "COARSE-FINE" switch to the "FINE" position and carefully turn the knurled wheel until the indicator shows the exact frequency listed in step d.

The arm of relay K1001 must lock the gear on B1002 synchro shaft when the knurled wheel is turned in either direction.

g. Release the "COARSE-FINE" switch and move the "MANUAL TUNE" switch on the receiver control box to the "RAISE" position. As the tuner changes frequency, compare the reading of the frequency indicator on the tuner with that of the indicator dial. Both indicators should agree within : 5 megacycles of each other throughout the tuning range.

9-36. ANTENNA COUPLER CU-174/APA-69 PRODUCTION TESTS.

9-37. The antenna coupler must not be disassembled for overhaul, nor is maintenance or repair practicable on it. However, for purposes of determining the condition of an individual coupler, the following production test procedure is appended. Tests of Antenna Coupler CU-174/APA-69 require the following test equipment:

a. A coaxial slotted line, Polytechnic Research and Development Company Type 205-A.

b. A slotted line probe, Polytechnic Research and Development Company Type 250-A.

c. A 50-ohm termination, Polytechnic Research and Development Company Type 102.

d. An "S" band crystal mount, Polytechnic Research and Development Company Type 613-M, including d-c ground return.

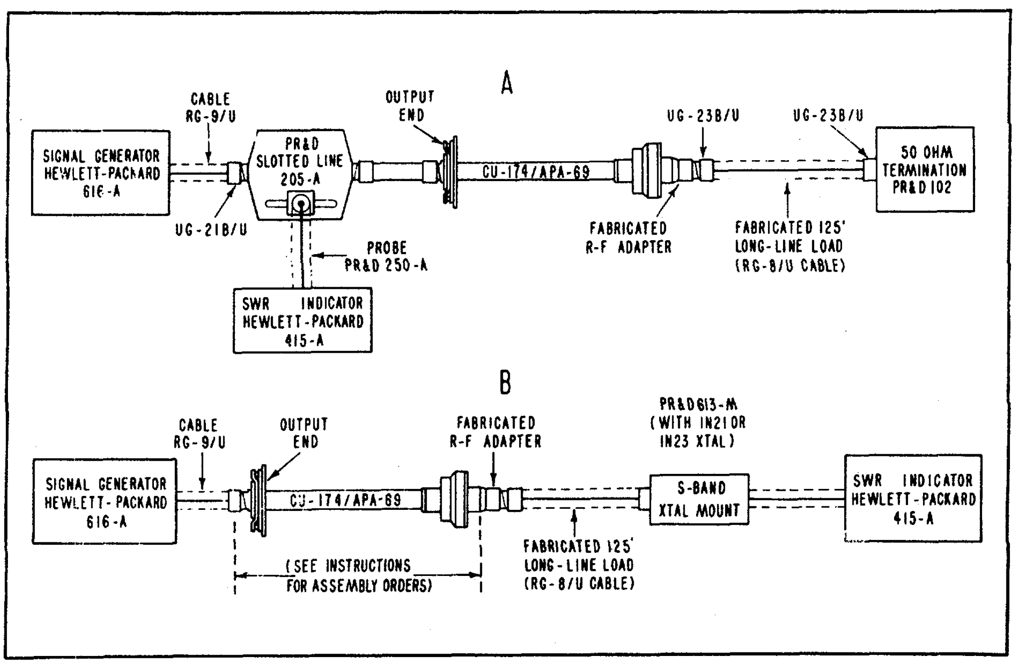


Figure 9-5. Antenna Coupler CU-174/APA-69, Production Test Jigs

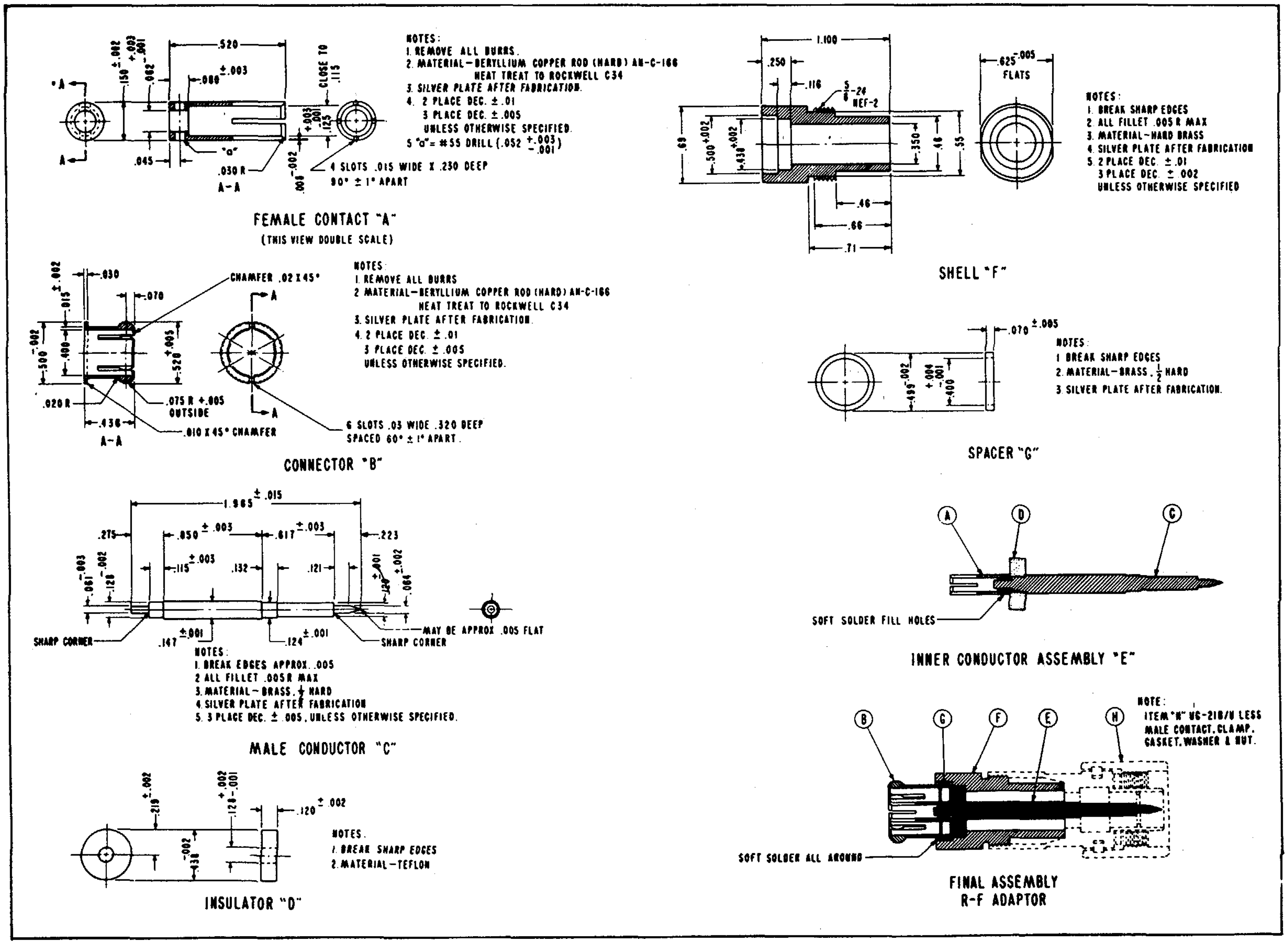


Figure 9-6. Fabricated R-F Adaptor for Antenna Coupler CU-1 74/APA-69

e. A signal generator with pulse modulation, Hewlett-Packard Model 616-A.

f. An SWR indicator, Hewlett-Packard Type 415-A.

g. A matched long-line load (figure 2-2) consisting of about 125 feet of type RG-8/U cable terminated at each end with a type UG-23B/U connector. This load must have a VSWR no greater than 1.1 at 2,000 to 4,000 mc.

h. An r-f adaptor fitting fabricated according to figure 9-6.

i. J.AN 1N21 or JAN 1N23 crystals selected for good square-law response as outlined in paragraph 9-46.

j. A torque wrench for measuring 0 to 10 inch-ounces of torque.

9-38. FABRICATION INSTRUCTIONS FOR R-F ADAPTOR.

9-39. In order to couple the components used in testing the Antenna Coupler CU-174/APA-69 to the rotating joint or input end of the coupler, it is necessary to have an r-f adaptor which will make the connection without adding to the VSWR of the assembled unit. Fabrication instructions for such an adaptor follow. (See figure 9-6 for complete machining and assembly instructions.) a. Fabricate female contact "A" and connector "B" from hard beryllium copper rod AN-C-166, heat treated to Rockwell C-34 hardness. After machining these parts, silver plate them.

b. Fabricate male conductor "C" from half-hard brass and silver plate it.

c. Fabricate insulator "D" from Teflon. Now assemble items "A", "C" and "D" as shown, into inner conductor assembly "E", soft soldering as indicated.

d. From hard brass stock, mill shell "F" and silver plate it. From half-hard brass, fabricate spacer "G" and silver plate it.

e. Strip an r-f connector type UG-21B/U of its male contact, clamp, gasket, washer and nut. The remaining portion will be item "H" as shown in dotted lines in the final assembly drawing.

f. Make the final assembly by inserting items "B", "E", "F" and "G" into item "H" and soft soldering as indicated. The completed plug is the fabricated r-f adaptor required in paragraph 9-37h.

9-40. TEST PROCEDURE.

9.41. Before testing, check the coupler visually for damage or fault. Check freedom of the rotating element. Then proceed as follows:

9-42. VOLTAGE STANDING-WAVE RATIO MEASUREMENT. Set up the test jig shown in figure 9-5A, for measuring VSWR (Voltage Standing-Wave Ratio). (Note that the VSWR will include the mismatch of the coupler, adaptor fitting and long-line load.) Insert the adaptor fitting for maximum penetration into the antenna end of the coupler. Keep these units in line and support them rigidly to prevent movement during the test. Set the controls of the signal generator for maximum attenuation of a signal of 3,000 megacycles, internally ("INT") synchronized with a modulating pulse of 1,000 prf, 10-microseconds wide.

a. With the JAN lN21 or JAN 1N23 crystal installed in the probe, turn the SWR indicator ON and set the switch in the upper left of the front panel in the CRYSTAL position. Tune the slotted line for maximum up. scale reading on the SWR indicator by moving the probe carriage for support to one of the stops and then alternately adjusting the tunable slide and the side knob until maximum output is obtained. Adjust signal generator pulse rate for maximum indication. It may be necessary at this point to readjust the OUTPUT ATTEN control on the signal generator to keep the reading on scale.

b. Now move the carriage along the slotted line to a position of maximum response. Set the switch on the SWR indicator on "40 DB" and turn the GAIN control full clockwise. Adjust the OUTPUT ATTEN control of the signal generator so the indicator meter reading stands at "1.0" on the VSWR (top) scale.

c. Now move the pick-up probe along the slotted line carriage to a trough in the standing wave pattern (minimum reading on the SWR meter in the down-scale direction). The SWR meter now indicates the standing-wave ratio directly, either in VSWR (top scale) or in DB (lower scale).

d. Repeat the procedure in paragraphs 9-42a through 9-42c with a signal of 2,600 and 3,700 megacycles and record each result. The maximum permissible VSWR of production units is 1.7 on any frequency.

9-43. ATTENUATION MEASUREMENT. Before inserting the antenna coupler in the-test jig, figure 9-5B, it is necessary to make the original adjustments of the signal generator and SWR indicator. Assemble the test jig (without the coupler). Proceed as follows:

a. Adjust the signal generator controls as for VSWR measurement (paragraph 9-42).

b. Place the CRYSTAL/BOLOMETER switch on the SWR indicator in the CRYSTAL position. Place the DB control on "40 DB" and the GAIN control fully clockwise.

c. Adjust the OUTPUT ATTEN control on the signal generator so that the SWR indicator reads "O DB".

d. Now without disturbing the control settings just made, disconnect the long-line load from the signal generator and insert the antenna coupler between them, thus completing the test jig shown in figure 9-5B.

e. Read the SWR meter setting in DB. This is the attenuation of the antenna coupler with its adaptor.

f. Repeat the procedure above with signal frequencies of 2,600 megacycles and 3,700 megacycles and record the results. The maximum permissible attenuation on any frequency is 1.0 db.

9-44. VSWR DURING ROTATION. To measure relative change in VSWR during rotation of the antenna coupler, set up the test jig shown in figure 9-5A.

Now, remove the long-line load and connect the 50ohm termination directly to the adaptor fitting. Set up all controls as in paragraph 9-42 except for signal frequency, which should be 3,700 megacycles. Following the procedure in paragraphs 9-42a through 9-42c, determine the VSWR. Observe that this VSWR will not be the same as that read earlier in the VSWR measurement. This makes no difference, since the purpose of this test is to determine a relative change only between stationary and rotational VSWR. Now set the slotted-line probe at a wave node and rotate the adaptor fitting. Check that the reading of the SWR indicator does not vary appreciably during rotation. Maximum permissible change is 0.25 db.

9-45. TORQUE MEASUREMENT. Only the antenna coupler and its adaptor fitting are required for this measurement. Stand the coupler on end, receiver (output) end down, and apply the torque wrench to the adaptor fitting. Then hold the torque wrench stationary and rotate the body of the coupler. Note the maximum torque reading. Maximum permissible torque is 5.0 inch-ounces.

9-46. PROCEDURE FOR CHECKING CRYSTAL SQUARE-LAW RESPONSE.

9-47. The setup for checking the square-law response of crystals uses the same test jig shown in figure 9-5A.

Proceed as follows:

a. Insert a JAN 1N21 or JAN 1N23 crystal into the probe of the slotted line. Set up the signal generator as instructed in paragraph 9-42. (The crystals must be checked on each of the check frequencies, 2,600megacycles, 3,000 megacycles and 3,700 megacycles.)

b. Set the SWR indicator for crystal operation.

Turn the GAIN control fully clockwise and set the step DB switch at "40 DB".

c. Adjust the probe penetration for maximum pickup. Tune the stub for maximum reading on the SWR meter. Now move the probe carriage back and forth carefully along the standing-wave pattern until a point of maximum indication is located. It may be necessary to readjust the OUTPUT ATTEN control on the signal generator in order to remain on scale.

d. Set the SWR indicator meter to a reading of 0 DB" on the lower scale (after locating a peak) by .gain readjusting the OUTPUT ATTEN control on he signal generator.

e. Reduce the signal generator output level exactly 10 db from the setting established in step d preceding.

f. Change the DB switch on the SWR indicator to the "50" position.

g. Read the SWR meter on the DB scale. If the meter reads less than 0.8 db, the crystal being tested is satisfactory for use in making the VSWR measurements at the frequency being generated and at the output level ("40") required for the test.

9-48. ANTENNA ASSEMBLY AS-434/APA-69 FINAL TESTS.

9-49. The final tests of the Antenna Assembly AS434/APA-69 require the following test equipment:

a. A Signal Generator, Aircraft Radio Corporation type H-12.

b. A Signal Generator, Hewlett-Packard type 616A.

c. A Signal Generator, Polytechnic Research and Development Company type 902.

d. A coaxial slotted line, Hewlett-Packard type 805-A.

e. A coaxial slotted line, Polytechnic Research and Development Company type 205-A.

f. A slotted line probe, Polytechnic Research and Development Company type 250-A.

g. A Standing-Wave Ratio Indicator, Hewlett Packard type 415-A.

h. JAN lN21 or JAN 1N23 crystal diode detectors selected for square-law response (refer to paragraph 9-46), at frequencies to be used in this test.

i. Coaxial cable type RG-8/U, two feet plus or minus one inch in length, terminated at both ends by a connector type UG-21B/U. VSWR of this cable must not exceed 1.1 over a range of 1,500 to 4,000 megacycles.

j. An Antenna Coupler CU-174/APA-69.

k. An Antenna Drive TG-8/APA-69.

l. An antenna test stand fabricated as in figure 2-2, Handbook Service Instructions.

m. A 0-30-volt d-c meter, : 1% accuracy.

n. A right-angle connector, type UG-27B/U.

o. A connector type AN3106-18-8S to apply 28 volts dc to Antenna Drive TG-8/APA-69.

p. D-c voltage source variable from 18 to 30 volts for change-over relay.

9-50. FINAL TEST PROCEDURE.

9-51. Before testing, check the antenna assembly thoroughly for damage. Check the shaft for fit into the antenna drive.

9-52. Now set up the test jig as shown in figure 9-7. Select a test site clear of obstruction in order to prevent nearby objects from affecting the standing-wave ratio (SWR). Provide at least five feet clearance around the antenna generally and at least ten feet in the direction in which the antenna is to be pointed during measurement. Push the antenna coupler down firmly into the antenna drive and rotate it counterclockwise one-quarter turn to lock it into place. Then loosen the knurled nut at the top of the antenna drive and install the antenna assembly, exercising care to align the keyways accurately. Press the antenna assembly slowly into plate until it is firmly seated.

Tighten the knurled nut with the spanner wrench which accompanies the antenna drive unit. Set up the appropriate slotted line (and probe, if required), SWR indicator and signal generator according to instructions for the particular test. Connect the slotted line to the antenna coupler through the two-foot length of type RG-8/U cable and the angle connector type UG-27B/U. Connect the probe on the slotted line to the SWR indicator. Connect the signal generator to the slotted line. Connect the d-c source to pins E and F of J401 by means of the type AN 310618-8S connector with the meter and switch in place as illustrated. (When the switch is closed, it connects the vertical dipole to the coupler.) 9-53. VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 1,200 MEGACYCLES. To measure the VSWR (voltage standing-wave ratio) at 1,200 megacycles, the Aircraft Radio Company type H-12 Signal Generator and the Hewlett-Packard type 805-A Slotted Line are required.

a. Set the signal generator controls as follows:
SIGNAL FREQUENCY control, 1,200 MEGACYCLES; SELECTOR switch, RATE X10; PULSE RATE, 100; PULSE WIDTH, 10 MICROSECONDS; OUTPUT ATTENUATOR, maximum output.

b. Set the SWR indicator controls as follows:
CRYSTAL/BOLOMETER switch, crystal; DB switch, 40 DB; GAIN control, full ON.

c. Install the JAN 1N21 or JAN 1N23 crystal in the slotted line probe.

d. Tune the probe, by means of the knob on top, for maximum up-scale reading on the SWR meter.
Adjust the signal generator pulse rate for maximum indication. Several peak outputs may be obtained at different harmonics of the fundamental frequency. To ascertain that the probe is tuned to the fundamental frequency, measure the distance between successive minimum points as the probe is slid along the carriage. At 1,200 megacycles, the distance between successive minima is approximately 12-1/2 centimeters.

e. The application of 28-volt d-c power removes the horizontal antenna dipole from the coupler and connects the vertical dipole thereto. To check which dipole is energized, touch each with a finger. When the energized dipole is touched, the SWR meter reading changes.

Note

At this point, orient the antenna to be tested so that it points toward the least obstructed area of the test site. When the opposite element is to be tested, rotate the antenna.

f. Now slide the probe carriage along the slotted line to obtain a maximum indication on the SWR meter. Adjust the attenuator on the signal generator, if necessary, to keep the reading on scale.

g. When the maximum has been found, adjust the signal generator for a reading of 1.0 (VSWR) on the SWR meter.

h. Move the probe to a minimum on the slotted line. Read the SWR meter. The reading on the top scale is the desired VSWR. If the ratio exceeds 3.3, switch the DB switch to "50 DB" and read the next VSWR scale.

i. Repeat the VSWR measurement with the opposite dipole energized. Maximum permissible VSWR is 10: 1.

9-54. VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 3,100 MEGACYCLES. To measure the VSWR at 3,100 megacycles the Hewlett

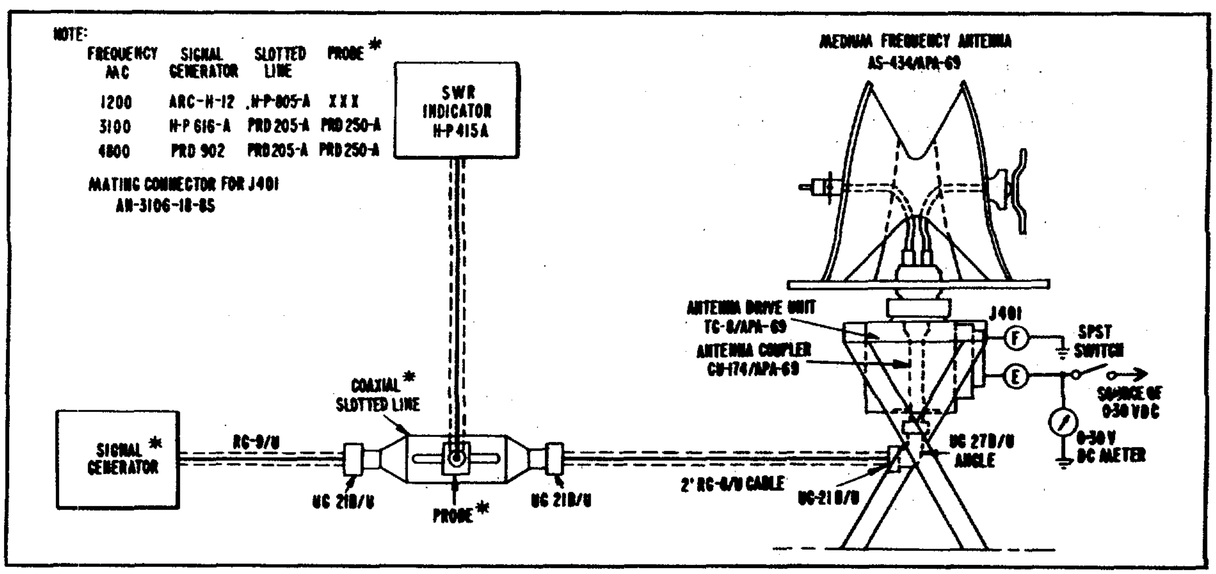


Figure 9-7. Antenna Assembly AS-434/APA-69, Reassembly Test Jig

Packard type 616-A Signal Generator and the Polytechnic Research and Development Company type 205-A Slotted Line with type 250-A Probe are required.

a. Set the signal generator controls as follows: FREQUENCY control, 3,100 MEGACYCLES; MODULATION, INTERNAL PULSE; SYNC SELECTOR, X1O; PULSE RATE, 100; PULSE WIDTH, 10 MICROSECONDS; ATTENUATOR, maximum output. Other controls are not used.

b. Set up the SWR indicator as in paragraph 9-53b above.

c. The type 250-A Probe is similar to that on the Hewlett-Packard 805-A Slotted Line and uses the same crystal detector, but two tuning adjustments are provided. These are the slide control and the tuning knob on the side near the base. Both of these controls must be adjusted together for proper tuning. It is recommended that the probe carriage be moved to one of the stops and tuned at this point by alternately adjusting the slider and the slide knob until maximum output is obtained on the SWR indicator. Now adjust the signal generator pulse rate for maximum indication.

d. Measure the VSWR on both horizontal and vertical dipoles by the procedure given in paragraphs 9-53d through 9-53i. Distance between minima at 3,100 megacycles is approximately five centimeters.

9-55. VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 4,800 MEGACYCLES. To measure the VSWR at 4,800 megacycles, the Polytechnic Research and Development Company type 902 Signal Generator, type 205-A Slotted Line and type 250-A Probe are required.

a. Set the signal generator controls as follows: FREQUENCY control, 4,800 MEGACYCLES; MODULATION, PULSE; SYNC SELECTOR, internal; RATE MULTIPLIER, X1O; PULSE RATE, 100; PULSE WIDTH, 10 MICROSECONDS; ATTENUATOR, maximum output; REFLECTOR, maximum upscale reading.

Note

When setting up the type 902 signal generator, set the MODULATION selector for CW operation first and adjust the REFLECTOR control for maximum reading on the generator meter. This control adjusts the reflector voltage of the klystron oscillator to set the proper mode of oscillation. After setting the REFLECTOR control, switch back to INTERNAL operation.

b. Set up the SWR indicator as in paragraph 9-53b above.

c. Tune the probe as in paragraph 9-53d above.

d. Measure the VSWR on both horizontal and vertical dipoles by the procedure in paragraphs 9-53d through 9-53i above. Distance between minima at 4,800 megacycles is approximately 3-1/8 centimeters.

9-56. VOLTAGE STANDING-WAVE RATIO MEASUREMENTS, ANTENNA RELAY ACTUATED BY 20 VOLTS DC. The same test setup is required as in paragraph 9-55 above. The signal generator type 902 is used. Lower the input voltage to the antenna change-over relay to 20 volts dc.

a. Now actuate the change-over relay at 20 volts dc to energize the vertical dipole and remeasure the - VSWR of the vertical dipole. This reading should be only one decibel off that obtained in the vertical dipole test. The relay should not chatter at this voltage setting.

9-57. ANTENNA ASSEMBLY AS-435/APA-69 FINAL TESTS.

9-58. The final tests of the Antenna Assembly AS435/APA-69 require the following test equipment:

a. A Signal Generator, Hewlett-Packard type 608-A.

b. A Signal Generator, Aircraft Radio Corporation type H-12.

c. A coaxial slotted line, Hewlett-Packard type 805-A.

d. A Standing-Wave Ratio Indicator, Hewlett Packard type 415-A.

e. JAN IN21 or JAN 1N23 crystal diode detectors selected for square-law response (refer to paragraph 9-46), at frequencies to be used in this test.

f. Coaxial cable type RG-8/U, two feet plus or minus one inch in length, terminated at both ends by a connector type UG-21B/U. VSWR of this cable must not exceed 1.1 over a range of 150 to 1,500 megacycles.

g. An Antenna Coupler CU-174/APA-69.

h. An Antenna Drive TG-8/APA-69.

i. An antenna test stand fabricated as in figure 2-2, Handbook of Service Instructions.

j. A 0-15/50-volt d-c meter, 1% accuracy.

k. A right-angle connector, type UG-27B/U.

l. A connector, type AN3106-18-8S to apply 28 volts dc to Antenna Drive TG-8/APA-69.

m. D-c voltage variable from 18 to 30 volts to energize the change-over relay.

9-59. FINAL TEST PROCEDURE.

9-60. Before testing, check the antenna assembly thoroughly for damage. Check the shaft for fit into the antenna drive.

9-61. Now set up the test jig as shown in figure 9-8. Select a test site clear of obstruction in order to prevent nearby objects from affecting the standing-wave ratio (SWR). Provide at least five feet clearance around the antenna generally and at least ten feet in the direction in which the antenna is to be pointed during measurement. Push the antenna coupler down firmly into the antenna drive and rotate it counterclockwise one-quarter turn to lock it into place. Then loosen the knurled nut at the top of the antenna drive and install the antenna assembly, exercising care to align the keyways accurately. Press the antenna assembly slowly into place until it is firmly seated. Tighten the knurled nut with the spanner wrench which accompanies the antenna drive unit. Set up slotted line, SWR indicator, and signal generator according to instructions for the particular test. Connect the slotted line to the antenna coupler through the two-foot length of type RG-8/U cable and the angle connector type UG-27B/U. Connect the probe on the slotted line to the SWR indicator. Connect the .signal generator to the slotted line. Connect the d-c source to pins E and F of J401 by means of the type AN3106-18-8S connector with the meter and switch in place as illustrated. (When the switch is closed, it connects the vertical dipole to the coupler.) 9-62. VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 500 MEGACYCLES. To measure the VSWR at 500 megacycles, the Hewlett Packard type 608-A Signal Generator is required.

a. Set the signal generator controls as follows: MODULATION switch, 1,000 CPS; MODULATION LEVEL, maximum; FREQUENCY, 500 MEGA(: YCLES; TRIMMER, tuned for maximum output; AT.-TENUATOR, maximum output.

b. Set the controls on the SWR indicator as follows: CRYSTAL BOLOMETER switch, CRYSTAL; DB switch, 40 DB; GAIN control, full ON.

c. Install the JAN IN21 or JAN 1N23 crystal in the slotted line probe.

d. Tune the probe by means of the knob on top for maximum up-scale reading on the SWR meter. Adjust signal generator pulse rate for maximum indication. Several peak outputs may he obtained at different harmonics of the fundamental frequency. To ascertain that the probe is tuned to the fundamental frequency, measure the distance between successive minimum points as the probe is slid along the carriage. At 500 megacycles, the distance between adjacent maxima and minima is approximately 15 centimeters.

e. The application of 28-volt d-c power removes the horizontal antenna dipole from the coupler and connects the vertical dipole thereto. To check which dipole is energized, touch each with a finger. When the energized dipole is touched, the SWR meter reading changes.

Note

At this point, orient the antenna to be tested so that it points toward the least obstructed area of the test site. When the opposite element is to be tested, rotate the antenna.

f. Now slide the probe carriage along the slotted line to obtain a maximum indication on the SWR meter. Adjust the attenuator on the signal generator, if necessary, to keep the reading on scale.

g. When the maximum has been found, adjust the signal generator for a reading of 1.0 (VSWR) on the SWR meter.

h. Move the probe to a minimum on the slotted line. Read the SWR meter. The reading on the top scale is the desired VSWR. If the ratio exceeds 3.3, switch the DB switch to 50 and read the next VSWR scale.

i. Repeat the VSWR measurement with the opposite dipole energized. Maximum permissible VSWR is 10: 1.

9-63. VOLTAGE STANDING-WAVE RATIO

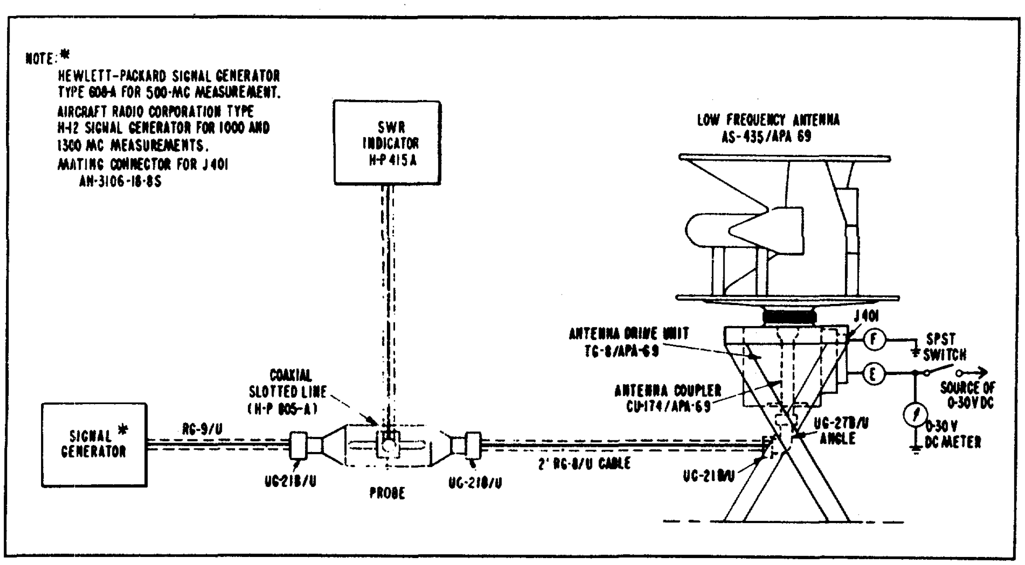


Figure 9-8. Antenna Assembly AS-435 ,'APA-69,. Reassem4ly Test Jig

MEASUREMENT AT 1,000 MEGACYCLES. To measure the VSWR at 1,000 megacycles, the Aircraft Radio Corporation type H12 Signal Generator is required.

a. Set the signal generator controls as follows: SIGNAL FREQUENCY control, 1,000 MEGACYCLES; SELECTOR switch, RATE X10; PULSE RATE, 100; PULSE WIDTH, 10 MICROSECONDS; OUTPUT ATTENUATOR, maximum output.

b. Proceed with the tests as instructed for 500 megacycles in paragraphs 9-62b through 9-62i above. For 1,000 megacycles, the distance between successive minima of the standing-wave (as may be required to tune to the fundamental frequency) is 15 centimeters approximately.

9-64. VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 1,300 MEGACYCLES. To measure the VSWR at 1,300 megacycles, the Aircraft Radio Corporation type H-12 Signal Generator is required.

a. Set the signal generator as instructed in paragraph 9-63a above.

b. Proceed with tests as instructed in paragraphs 9-62b through 9-62i above, For 1,300 megacycles, the distance between successive minima of the standing wave (as may be required to tune to the fundamental frequency) is approximately 11 -1/2 centimeters.

9-65. VOLTAGE STANDING-WAVE RATIO MEASUREMENT, ANTENNA RELAY ACTUATED BY 20 VOLTS DC. The same test set is used as in paragraph 9-64 above. Lower the input voltage to the antenna change-over relay to 20 volts dc.

a. Now actuate the change-over relay at 20 volts dc to energize the vertical dipole and remeasure the VSWR of the vertical dipole. This reading should be only one decibel off that obtained in the vertical dipole test. The relay should not chatter at this voltage setting.

9-66. ANTENNA AS-436/APA-69 PRODUCTION TESTS.

9-67. The Antenna AS-436/APA-69 is not disassembled for overhaul, nor is maintenance practicable on it. However, for purposes of determining the condition of an individual antenna horn, the following production test procedure is appended.

9-68. Tests of the antenna horn require the following equipment:

a. A Signal Generator, Polytechnic Research and Development type 902.

b. A Signal Generator, Polytechnic Research and Development type 903.

c. A coaxial slotted line, Polytechnic Research and Development type 205-A.

d. A slotted line probe, Polytechnic Research and Development type 250-A.

e. JAN IN21 or JAN 1N23 crystal diode detectors selected for square-law response (refer to paragraph) 9-46), at the frequencies to be used in this test.

f. A Standing-Wave Indicator, Hewlett Packard type 415-A.

g. Coaxial cable type RG-8/'.I, two feet plus or' minus one inch in length, terminated at both ends by a, connector type UG-2 IB/U.

h. An Antenna Drive TG-8/APA-69.

i. An Antenna Reflector AT.182./APA-69.

j. An antenna test stand fabricated as in figure 2-2, Handbook Service Instructions.

9-69. TEST PROCEDURE.

9-70. Before testing, check the antenna thoroughly for damage. Now set up the test jig .is shown in figure 9-9. Select a test site clear of obstruction.: in order, to prevent nearby objects from affecting the standing. wave ratio. Provide at least five feet clearance around. the antenna generally and at least ten feet in the ,direction in which the antenna is to be pointed during measurement. Insert the horn into the top of the antenna drive, closed end down, until tile mounting springs clear the drive flanges. Push down firmly on the horn and rotate it clockwise one-quarter turn to lock it into place. Loosen the large knurled nut on the drive by turning it counterclockwise. Install the. reflector into the drive being careful to align the key ? in the reflector with the key in the drive unit. Press the reflector slowly into place until it is firmly seated. Then tighten the knurled nut carefully with the spanner wrench which is provided as part of the ,antenna drive equipment. Set up the slotted line, SWR indicator, signal generator as required for the individual test. Connect the slotted line to the horn through the.? foot coaxial cable type RG-8/U. Connect the probe on the slotted line to the SWR indicator. Connect the signal generator to the slotted line.

9-71. VOLTAGE STANDING-WAVI: RATIO MEASUREMENT AT 4,500 MEGACYCLES. To measure the VSWR at 4,500 megacycles, the Polytechnic Research and Development type 902 Signal Generator is required.

a. Set the signal generator controls as follows:. SIGNAL FREQUENCY, 4,500 MEGACYCLES POWER SET, fully clockwise; ZERO SET, for zero reading on meter; MODULATION selector TERNAL; SYNC SELECTOR, INTERNAI.; PULSE WIDTH, fully clockwise; PULSE DELAY, fully clock wise; PULSE RATE, 100; RATE MULTIPLIER, X 10, OUTPUT ATTENUATOR, maximum output; REFLECTOR, maximum up-scale reading.

b. Set the controls of the SWR indicator as follows CRYSTAL/BOLOMETER switch, CRYSTAL switch, 40 DB; GAIN control, full ON.

c. Install the JAN 1N21 or JAN IN23 crystal ill 11islotted line probe.

d. Tune the probe by means of the knob and slider. The small coupling adjustment on top of the probe may have to be screwed all the way down to produce a reading on the SWR indicator. Adjust the large knob near the base of the probe and slide the probe along the slotted line until a maximum up-scale reading is obtained on the SWR indicator. Rock the tuning knob back and forth slowly and at the same time move the probe about on the carriage in the region of maximum indication until it is certain that the greatest maximum has been obtained.

Note

A reading near the center of the slotted line should be used so that it is certain to be a true maximum and also so that the adjacent minimum will be sufficiently displaced from the end of the carriage.

e. Reduce the gain of the SWR indicator by reducing the setting of the DB switch (with GAIN control fully clockwise). But do not reduce the DB setting below 40 DB. If the meter reading is off scale, reduce the insertion depth of the probe by turning outward the small knob on its top.

f. Readjust the PULSE RATE and REFLECTOR controls on the signal generator for maximum SWR indication.

g. Recheck the probe location for maximum of the standing-wave pattern.

h. Adjust the SWR indicator for a reading of 1.0 on the VSWR scale with the DB switch and GAIN control. The DB switch should be in the 40 DB or 50 DB position and the GAIN control as far clockwise as practicable. Do not disturb these adjustments again during the measurement.

i. Move the probe along the carriage to a minimum, as read on the SWR meter. Read the VSWR directly from the SWR meter. If it exceeds 3.3, change the DB switch one 10 DB step counterclockwise and read the VSWR directly from the middle scale. Maximum VSWR permissible is 5:1.

9-72 VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 7,000 MEGACYCLES. To measure the VSWR at 7,000 megacycles, the Polytechnic Research and Development type 903 signal generator is required.

a. Set all controls and run the test as instructed in paragraph 9-69 above. The controls of the Polytechnic Research and Development type 903 signal generator are identical with those of the type 902.

b. Maximum permissible VSWR for this frequency is 4:1.

9-73 VOLTAGE STANDING-WAVE RATIO MEASUREMENT AT 9,500 MEGACYCLES. To

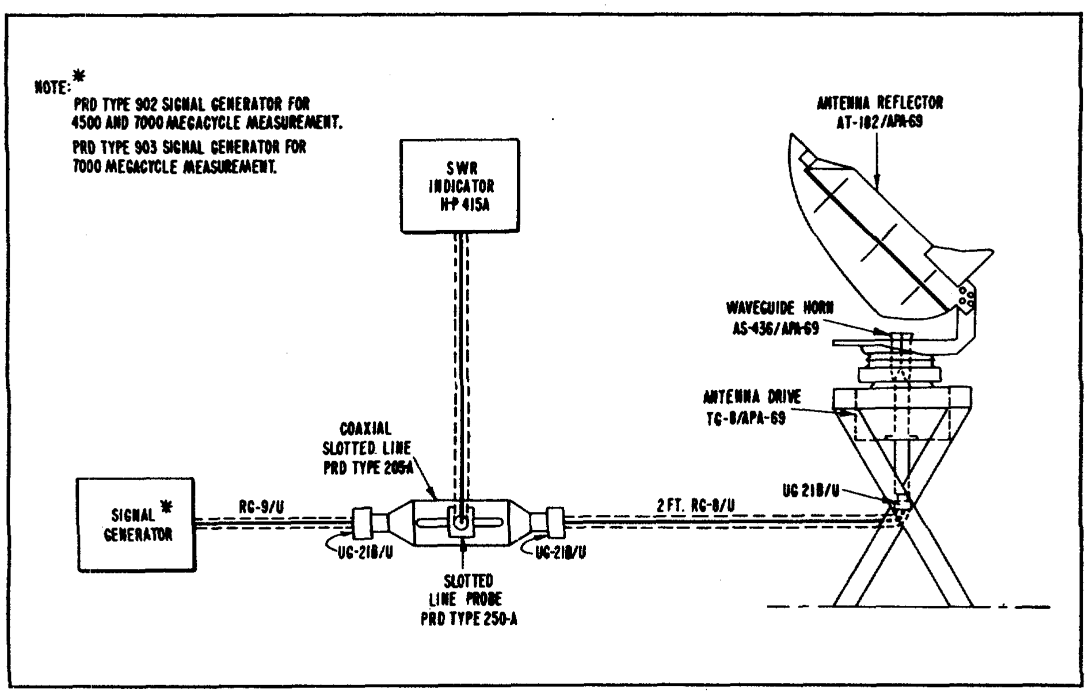


Figure 9-9. Antenna AS-436/APA-69, Production Test Jig

measure the VSWR at 9,500 megacycles, the Polytechnic Research and Development type 903 signal generator is required.

a. Set all controls and run the test as instructed in paragraph 9-69 above. The controls of the Polytechnic Research and Development type 903 signal generator are identical with those of the type 902.

b. Maximum permissible VSWR for this frequency is 4: 1.

9-74. ANTENNA REC AT-182/APA69 FINAL INSPECTION.

9-75. No tests are required for the antenna reflector other than its performance with the Antenna AS436/APA-69 which is covered in paragraphs 9-66 through 9-73. Before being included in an installation, it should be inspected for damage and wiped clean, etc.

9-76. SUMMARY.

9-77. This section has covered detailed test information for all components of the Direction Finder Group AN/APA-69. After conforming to the requirements of these tests, a component need only perform as required by the field performance tests of Section XI to be considered an equal substitute for newly manufactured equipment.

SECTION X
FINAL REASSEMBLY

10-1. GENERAL 10-2. This section deals with the final reassembly of the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A components into a complete equipment, ready for inspection and final test.

10-3. REASSEMBLY OF COMPONENTS.
10-4. Each component of Direction Finder Group AN/APA-69, and Direction Finder Group AN/APA69A as reassembled for its individual component tests, is complete and requires only cable connections to the other components to form a complete operating equipment.
10-5. Connect the units with the required cabling (figure 7-17, Handbook Service Instructions). Assure that the Azimuth Indicator IP-36/APA-69 or IP-8 I1A( )/APA-69A and the Direction Finder Control C-527/APA-69 are accessible for observation and operation of the controls. The equipment is now ready for its final operating and accuracy checks.

SECTION XI
INSPECTION AND TESTING

11-1. GENERAL
11-2. This section covers final inspection and type and field performance tests on Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA69A as reassembled following overhaul. Marking of equipments required by Government T.O.'s or other instructions, to indicate overhaul or the incorporation of changes, shall be applied during these inspections or tests (if not previously applied to subassemblies, assemblies or components during overhaul and assembly).

11-3. EXCERPTS FROM TYPE TESTS.
11-4. Type test procedure for this equipment includes the following tests: Video Response, Antenna Speed, Conducted Noise Interference and Radiated Noise Interference.
11-5. VIDEO RESPONSE. Tests for video response are included in the reassembly test procedure for the Amplifier Power Supply AM-256/APA-69. If it becomes necessary to perform these tests again, refer to paragraphs 9-14 through 9-24 and figure 9-2 for instructions on setting up the test jig and obtaining the required information.
11-6. ANTENNA SPEED. Antenna speed tests are included in the reassembly test procedure for the Antenna Drive TG.8/APA-69. If it becomes necessary to perform these tests again, refer to paragraphs 9-6 and 9-13 and figure 9-1 for instructions on setting up the test jig and obtaining the required information.
11-7. CONDUCTED NOISE INTERFERENCE TEST. This test must be conducted in a screen room to eliminate outside interference. It requires a composite equipment setup similar to that illustrated in figure 9-3, except that the autosyn test unit need not be included in the setup. The antenna drive should be installed in the antenna test stand shown in table 2-1 of the Handbook Service Instructions. In addition to the equipment shown in the test jig setup, there will also be required a Ferris Model 32-A or 32-B Noise Meter, a dummy antenna for this noise meter (Ferris Model 32XA2), with twisted pair coaxial leads 24 inches plus or minus one inch in length, and UG-274/U T-connectors as required.
11-8. Calibrate the noise meter at each frequency of measurement as follows:

a. Connect the dummy antenna to the antenna jack on the noise meter.

b. Place the "RADIO NOISE/FIELD STRENGTH" switch in the "RADIO NOISE" position.

c. With the master selector switch at "A BAT" and "B BAT" positions, the output meter should read above the "BAT LOW LIMIT" mark. Full-scale deflection indicates voltages of 3.0 and 135.0 for the A and B batteries respectively.

d. Set the selector switch on "INT ADJ" and adjust the knob marked "INT ADJ" to make the meter read near the "INT ADJ" mark on the scale. If the meter reads between "BAT LOW LIMIT" and "INT ADJ", the instrument will be satisfactorily standardized.

e. Advance the selector knob to "INT CAL" and press the center button on the knob marked "ZERO SET PRESS AND TURN". Holding this button depressed, turn the knob to make the meter read at the scale mark "ZERO SET".

f. Refer to the calibration curve on the panel cover of the instrument, and determine the value of calibrating voltage to be used at the particular frequency of measurement. By adjusting the knob marked "CALIBRATE", make sure that the meter indicates this value of microvolts.

g. To measure noise microvolts, advance the master selector to "BLACK" position. Voltages applied to the input at the tuned frequency now reads on the black, or one to 1,000-microvolts, scale.

h. If the meter reads off-scale, the input voltage exceeds 1,000 microvolts, and the selector switch should be advanced to "RED". This cuts in an attenuator which multiplies the meter readings by 100 to make the range 100 to 100,000 microvolts.

11-9. Connect the equipment as shown in figure 7-17, Handbook Service Instructions. Remove the cable clamps from plug P401 on the antenna drive so as to lexpose the contacts. Now install Antenna Assembly AS-435/APA-69 in the antenna drive unit. Start the equipment and advance the "ANT. SPEED" control fully clockwise.

a. Connect the dummy antenna leads to pin H of plug P401 and tune the Ferris Noise Meter over the band from 0.15 to 20 megacycles. Watch for peak microvoltage readings on the noise meter. Whenever a peak is located, record the frequency and voltage level. (In order to get an accurate noise voltage reading, the instrument must be recalibrated at each frequency examined. Refer to paragraph 11-8, steps f. through h.) Conducted noise voltage limits are shown in figure 11-1. If no peaks are discovered in the initial sweep, note the noise voltages at the test frequencies of 0.2, 10 and 20 megacycles.

b. Disconnect the noise meter from pin H and connect it to pin E of plug P401. Repeat the procedure from step a.

c. Using a UG-274/U T-connector to make contact to the noise meter leads repeat the procedure from step a. to read noise voltages at jacks J402, J403 and J404. Noise voltage limit values are shown in figure 11-1.

11-10. RADIATED NOISE INTERFERENCE TEST. This test must be conducted in a screen room to eliminate outside interference. It requires a composite setup similar to that illustrated in figure 9-3, except that the autosyn test unit need not be included in the setup. The antenna should be installed in the antenna test stand shown in table 2-1 of the Handbook of Service Instructions. In addition to the equipment shown in the test jig setup, there will also be required a Ferris Model 32-A or 32-B Noise Meter, a loop probe for the noise meter (Ferris Model 32XA8), a Measurements Model 58 Noise Meter, and a Noise Test Set Type AN/URM-28 with Tuning Heads TN-17 and TN-18.

11-11. Assemble the equipment into the setup illustrated in figure 9-3. (If the cable clamp has been removed from plug P401 for the preceding test, replace it.) Calibrate the Ferris Noise Meter as instructed in paragraph 11-8 preceding, using the hand loop and probe Model 32XA8. Put the equipment into operation as before.

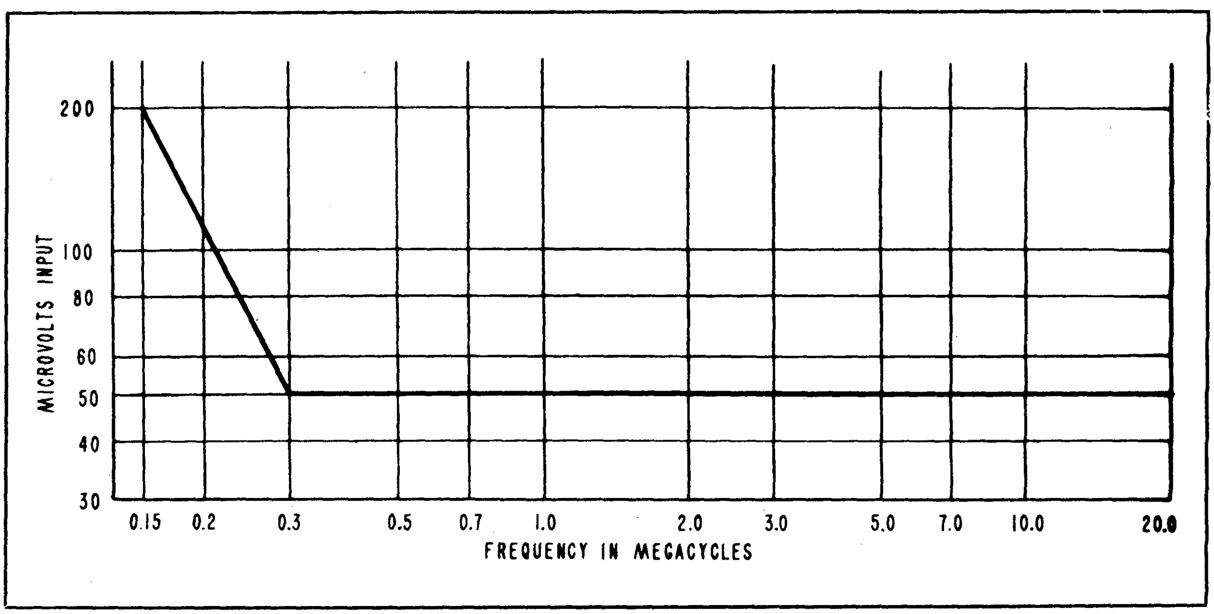


Figure 11-1. Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A, Conducted Noise Interference Limits

a. To measure radiated noise voltage in the band 0.15 to 20 megacycles, run the loop probe around the Antenna Drive -TG-8/APA-69 case and the leads leaving plug P401. If any peaks are found while the noise meter is tuned over its range, orient the hand loop for maximum indication, calibrate the meter for accurate reading of this voltage, and record its frequency and value.

b. If no peaks are found, read the noise voltage at 0.2, 10 and 20 megacycles and record them. The value of this noise should not exceed 2.5 microvolts.

11-12. Remove the Ferris Noise Meter, and set up the Measurements Model 58 Noise Meter as follows:

a. Connect the capacity probe to the antenna receptacle on the meter by means of the antenna cable furnished with the instrument.

b. Depress the required frequency range button.

c. Depress the "ZERO" button to turn the noise meter on. Allow about fifteen minutes for warm up.

During the warm-up period, move the probe around the Antenna Drive TG-8/APA-69 case and the leads leaving it, to check for interference peaks.

d. Turn the "ZERO" knob clockwise. The "MICROVOLT" meter will read up-scale, indicating proper connection to the a-c power source.

e. Turn the megacycle scale pointer, by means of the knob below the scale, to the required frequency.

(Refer to table 11-1.) Note the calibration number which appears on the "CALIBRATION" number scale nearest the letter corresponding to the operating frequency voltage.

Note

The next three steps should be performed as rapidly as possible to prevent damage to the shot-noise calibrating tube.

f. Set the "PEAK AVERAGE" switch to "AVERAGE" position and turn the "ZERO" knob to set the "MICROVOLT" meter pointer to zero.

g. Depress the "ADJUST" button and operate the "ADJUST" knob to set the "MICROVOLT" meter pointer to lie within the black scale segment marked "ADJUST".

h. Depress the "CALIBRATE" button and operate the "CALIBRATE" knob to bring the "MICROVOLT" meter pointer to the calibration number observed in step e. above.

i. Depress the "ZERO" button, and turn the "ZERO" knob to reset the "MICROVOLT" meter pointer to zero. Repeat the above steps, as necessary, to be sure that the instrument is properly calibrated at the frequency of measurement.

j. Place the toggle switch in the "PEAK" position for measurements.

11-13. To test for noise voltage level, tune the Measurements Model 58 Noise Meter to the first frequency band on which it will be used. Run the probe around the case of the Antenna Drive TG-8/APA-69, plug P401 and the leads leaving this plug. If interference peaks are found, record them carefully, orienting the loop for maximum indication at each peak. If no peaks are found, record the noise voltage encountered at each check frequency given in table 11-1. This level

TABLE 11-1. FREQUENCIES OF RADIATED NOISE TESTS

Frequency Range	Check Frequencies	Noise Meter Used
0.15-20 mc	0.2, 10 and 20 mc	Ferris Model 32-A
21-38 mc	25, 30 and 35 mc	Measurements Model 58
39-65 mc	40, 50 and 60 mc	Measurements Model 58 or Noise Test Set AN/URN-28
78-100	80, 90 and 100 mc	Measurements Model 58 or Noise Test Set AN/URM-28
101-150 mc	300, 600 and 900 mc	Noise Test AN/URM-28

should not exceed the level indicated in figure 11-2.

11-14. Remove the Measurements Model 58 Noise Meter and set up the Noise Test Set AN/URM-28 as follows:

a. Connect a 600-ohm headset to one of the phone jacks.

b. To the other phone jack, connect a 1,000-ohmsper-volt audio-frequency voltmeter such as a Weston Model 571.

c. Connect the loop probe MX-936/URM to the antenna jack by means of the 20-foot length of type RG-8/U coaxial cable.

d. Slide the required tuning unit into position on the tracks provided in the large rectangular hole in the panel of Receiver R-54/APR-4, engaging the plugs and jacks. Swing the right-hand knurled nut on the mounting base over the hold-down lug and tighten it, to lock the tuning unit in the receiver.

e. Connect the receiver to the 60-cps a-c line through the main power line and a Variac (General Radio type V5M or equivalent). Maintain the voltage supply at 115 volts plus or minus one volt during the measurement.

f. Turn the equipment on. The pilot lamp should light and the diode meter read 20 microamperes or more. Place the automatic sweep switch on the tuner in the "MANUAL" position.

g. Place the "HETERODYNE" switch in the "OFF" position, the "WIDE-NARROW" switch in the "NARROW" position, and the "VOLUME" control fully clockwise.

11-15. Check the background noise level with the Direction Finder Group AN/APA-69 equipment turned off. This noise level, as determined from the diode meter reading or the output voltmeter, should be within 25 per cent of the limit on the graph accompanying the Noise Test Set AN/URM-28. Turn the "IF GAIN" switch to the minimum db setting which gives an on-scale diode meter reading.

11-16. Now turn the Direction Finder Group AN/ APA-69 on. Tune the test set successively through each range given in table 11-1, running the loop around the Antenna Drive TG-8/APA-69 case, plug P401 and its leads. Listen in the headset and observe the output meter readings for interference peaks. If any peaks are located, orient the loop for maximum indication and read the output meter. Convert this reading to equivalent microvolts by using the charts furnished with the Noise Test Set AN/URM-28.

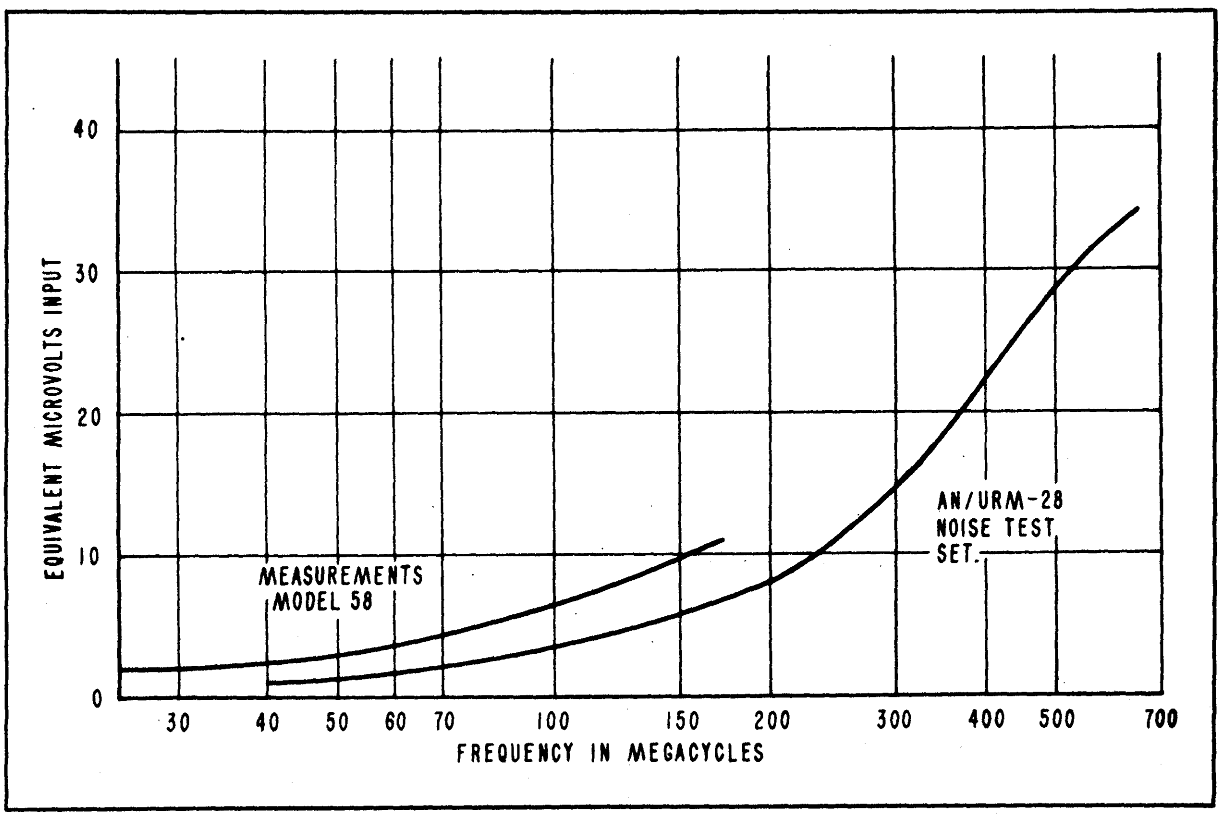


Figure 11-2. Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A, Radiated Noise Intereference Limits

Note

Since the test set uses an if. of 30 megacycles, a strong image signal may appear at several places on the frequency dial. To determine the true frequency of a suspected image, note the "IF GAIN" switch setting and the diode meter reading, then retune 60 megacycles below (with the TN-17) or above (with the TN-18) and read again. The : stronger signal is the true frequency.

11-17. The noise voltage limits over the range of 40 to 700 megacycles are shown on the graph in figure 11-2.

11-18. FIELD PERFORMANCE TESTS. Tests provided for field performance of the Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A are covered in the components tests of Section IX. Therefore, after being checked for radiated noise, the Direction' Finder Group AN/APA69 and Direction Finder Group AN/APA-69A may be considered ready for return to service as a fully operating equipment.

ALPHABETICAL INDEX

ALPHABETICAL INDEX (cont)

ALPHABETICAL INDEX (cont)

ALPHABETICAL INDEX (cont)

ALPHABETICAL INDEX (cont)

CHAPTER 4. ILLUSTRATED PARTS BREAKDOWN

TABLE OF CONTENTS

Revised 1 February 1956

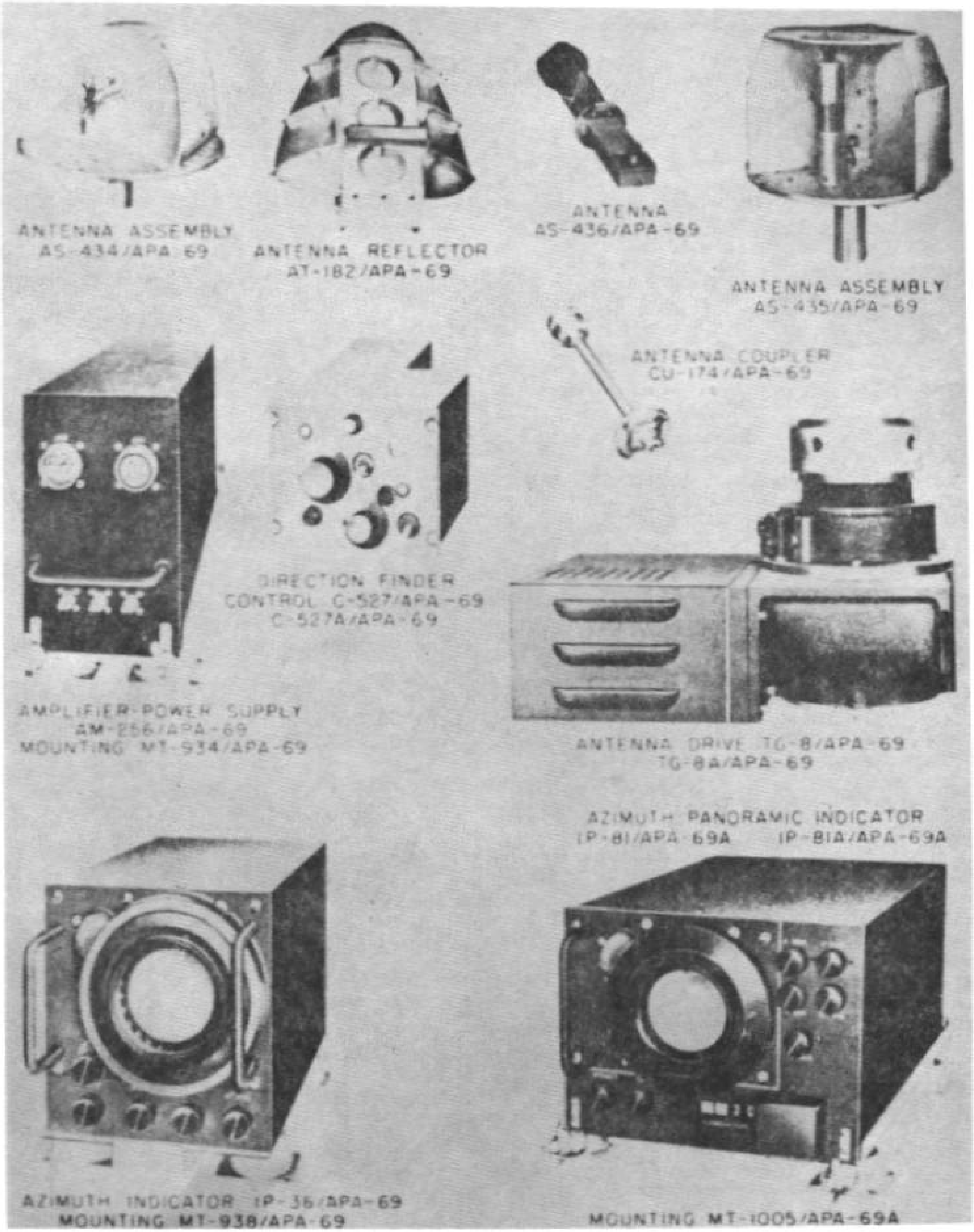


Figure 1. Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A

SECTION I
INTRODUCTION

1-1. GENERAL.

1-2. This illustrated Parts Breakdown lists and describes each detail part of all components of Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A which are manufactured by Bendix Radio Division of Bendix Aviation Corporation, Baltimore 4, Maryland and the Presto Recording Corporation, Paramus, N. J.

1-3. An exploded view drawing, which is cross-refeneced to the Components Parts List by means of reference symbols, is provided to show -the physical shape of the detail parts' and the location of the parts in the component. Insofar as practicable the illustrations show the disassembly relationships of the various parts.

1-4. EQUIPMENT SUPPLIED.

1-5. The components supplied with Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A are show in Figure 1 and listed in Table 1-1.

1-6. EXPLANATION OF REFERENCE SYMBOLS.

1-7. The reference symbols appearing in the illustrations and associated Components Parts Lists correspond to those used in all other applicable publications for Direction Finder Group AN/APA-69 and Direction Finder Group AN/APA-69A.

1-8. Each reference symbol consists of one or two capital letters followed by a number. The alphabetical portion of the symbol denotes the type of part, classified in accordance with Table 1-2.

1-9. The numerical portion of the symbol is assigned in groups to each component as listed in Table 1-1.

1-10. STOCK NUMBER COLUMN.

1-11. The symbol * appearing in the Stock Number column indicates a part which is not subject to failure or wear and is not normally intended for replacement.

1-12. The symbol # appearing in the Stock Number column indicates a part which cannot be successfully replaced or is a member of a matched or selected set. Such parts are only replaceable by the next higher assembly. The next higher assembly is identified in the Description Column.

1-13. One or more numbers may appear in the Stock Number column for a single part. Those numbers beginning with the letter R or the prefix 16T refer to

TABLE 1-1. EQUIPMENT SUPPLIED

Quantity per equipment	Name of unit	AN type designation	Overall dimensions (inches)			Weight (lbs.)	Numerical series of reference symbols
			Length	Width	Height		
1	Amplifier Power Supply	AM-256/APA-69	23.38	5.88	9.38	16.0	101 to 199
1	Antenna Assembly	AS-434/APA-69	--------	20.0	18.3	12.0	601 to 699
1	Antenna Assembly	AS-435/APA-69	--------	16.12	17.14	14.7	501 to 599
1	Antenna	AS-436/APA-69	13.130	2.485	--------	1.00	1201 to 1299
1	Antenna Coupler	C7-174/APA-69	8.26	- 2.30	--------	0.625	1301 to 1399
1	Antenna Drive	TG-8A/APA-69	11.2	8.2	7.4	13.2	401 to 499
1	Antenna Drive	TG-8A/APA-69					401 to 499
1	Antenna Reflector	AT-182/APA-69	11.5	9.38	10.88	2.5	1101 to 1199
1	Antenna Indicator	1P-36/APA-69	16.18	7.32	7.8	19.0	201 to 299
1	Azimuth Panoramic Indicator	IP-81/APA-69A				27.42	1001 to 1099
1	Azimuth Panoramic Indicator	IP-81A/APA-69A				27.42	1001 to 1099
1	Direction Finder Control	C-527/APA-69					301 to 399
1	Direction Finder Control	C-527A/APA-69					301 to 399
1	Mount	MT-934/APA-69	23.8	5.94	1.625	2.25	701 to 799
1	Mount	MT-938/APA-69	13.62	8.132	1.625	1.3	801 to 899
1	Installation Components						(see

TABLE 1-2. REFERENCE SYMBOL DESIGNATIONS

Alphabetical Portion of Reference Symbol	*Component*
A	Structural parts
B	Motors
C	Capacitors
D	Dynamotors
E	Miscellaneous electrical parts
F	Fuses
G	Generation
H	Hardware
I	Indicating devices
J	Jacks and receptacles
K	Contactors
L	Inductors
M	Meters
N	Nameplates
O	Plugs
P	Switches T
R	Resistors
S	Switches
T	Wires X
V	Sockets Y
W	Vacuum tubes
X	Wires
Y	Sockets
Z	Impedances
CR	Rectifying crystals

ASO stock numbers; those beginning with numbers 3300, 6500, 8800, 8950, are Air Force stock numbers, those prefixed with numbers 1 thru 8 are Signal Corps stock numbers.

1-14. DESCRIPTION COLUMN.

1-15 'Where applicable, Government standard part numbers are given following the description of each part.

1-16. Commercial hardware items not listed in Government publications are identified as "Commercial." Such items are procurable from normal commercial sources by the use of their full description.

1-17. Vendors of commercial items are identified by code abbreviations shown in parentheses before the part number.

1-18. All drawing numbers listed are those of Bendix Aviation Division of Bendix Aviation Corporation except where a manufacturer is identified by name or code abbreviation in parentheses following the description of the part.

1-19. The names and addresses of manufacturers of replaceable parts are listed in Table 1-3 together with the code abbreviation for each manufacturer.

LIST OF MANUFACTURERS

Code Symbol	*Name and Address*
AB	Allen-Bradley Co. 118 W. Greenfield Ave. Milwaukee 4, Wisconsin
ADE	Advance Electric and Relay Co. W. 2nd and Bixel Sts. Los Angeles 26, California
AGX	Automatic Electric Mfg. Co. Mankato, Minn.
ARH	American Radio Hardware Co., Inc 476 Broadway, New York, N. Y.
ARP	Aircraft-Marine Products, Inc. 1523 N. Fourth St., Harrisburg, Pa.
BARB	Red Bank Division, Bendix Aviation Corp. Red Bank, N. J.
CAN	Canfield, H. O., Co. Bridgeport, Connecticut
CE	Continental Electric Co. 325 E. Ferry St. Newark, N. J.
CHG	Channon, J. H., Corp. 1455 W. Hubbard St., Chicago, Illinois
CHI	Chicago Rawhide Mfg. Co., The 1311 Elston Ave., Chicago 22, Illinois
CIN	Cinch Mfg. Co. 1026 S. Homan Ave., Chicago 24, Illinois
CLC	Camloc Fastener Co. 420 Lexington Ave., New York 17, N. Y.
DUM	DuMont, Allen B., Laboratories, Inc. Passaic, N. J.
DZ	Dzus Fastener Co., Inc. John St, Babylon, N. Y.
ECP	Eclipse-Pioneer Division Bendix Aviation Corp. 43 Williams Ave., Teterboro, N. J.
ELCN	Elcon Mfg. Co. 947-61st St., Brooklyn, N. Y.
EN	Elastic Stop Nut Corp. of America 2330 Vauxhall Rd., Union, N. J.
FAF	Fafnir Bearing Co., The New Britain, Connecticut
FHE	Fahnestock Electrical Co. Long Island City, N. Y.
GE	General Electric Co. Schenectady 5, N. Y.
GECO	General Control Co. Boston, Mass.

Code Symbol	*Name ad Address*
HPP	Huntington Precision Products Corp. 1444 Washington Ave. Huntington, W. Va.
IRC	International Resistance Co. 401 N. Broad St., Philadelphia, Pa
JNS	Jones, Howard B., Division Cinch Mfg. Co. 1026 S. Homan Ave., Chicago 24, 11.
KER	Kearfott Co., Inc 117 E. Liberty St., New York, N. Y.
KO	Kollsman Instrument wt Corp. 80-04 45th Ave. Elmhurst, N. Y.
LAV	Lavelle Rubber Co Hubbard and Wood Sts, Chicago 22, ill
MTM	Midwest Moking and Mfg. Co. Chicago, IIL
MTP	Miniature Precision Bearings, Inc. Keene, N. H.
ND	New Departure Division General Motors Corp. 1948 Thomas St., Bristol, Coin
PEN	Penn Engineering and Mfg. Corp. Doylestown, Pa.
RAI	Robinson Aviation, Inc Teterboro Air Terminal Teterboro, N. J.
RFA	Radio Frequency Laboratories Inc Boonton 2, N. J.
ROSN	Rosan, Inc. South Gate, California
SH	Shakeproof, Inc 2503 N. Keeler Ave., Chicago 39, IlL
SLE	Sylvania Electric Products, Inc New York, N. Y.
SPR	Sprague Electric Co. 201 Beaver St., North Adam, Mass
VEE	Veeder-Root, Inc Hartford, Conn.

Code Symbol	*Name and Address*
WIQ	Winchester Electronics Co. Glenbrook, Conn.
WKI	Waldes-Koh-I-Noor, Inc. Austel Place Long Island, N. Y.

1-20. RELATED HANDBOOKS

1-21. This Illustrated Parts Breakdown supplements information covered in applicable Handbook of Operating Instructions, Handbook of Service Instructions and Handbook of Overhaul Instructions for Direction Finder Group AN/APA-69.

1-22. HOW TO USE THIS CATALOG

1-23. When the reference symbol is known and it is desired to find the applicable stock number, description, or part number, refer to Table 1-1 to determine component in which the part is used. The listing of the part can then be located by reference to the Table of Contents.

1-24. When the part number is known and it is desired to find the applicable reference symbol, stock number, or description Table 3-1, Manufacturers Part Number Cross Index to Reference Symbol Number. The Part Numbers are arranged first in alphabetical order and secondly, in numerical order. When the reference symbol has been determined proceed as outlined in paragraph 1-23 to find the desired information.

1-25. When only the physical location of the part is known and it is desired to find the reference symbol, stock number, name or description, or the part number, refer to the List of Illustrations to find the page number of the illustration of the components in which the part is used. The listing for each component immediately follows the illustration and is arranged first in alphabetical order and secondly, in numerical order by reference symbols.

LIST OF ILLUSTRATIONS

SECTION II
ILLUSTRATIONS AND

COMPONENTS PARTS LIST

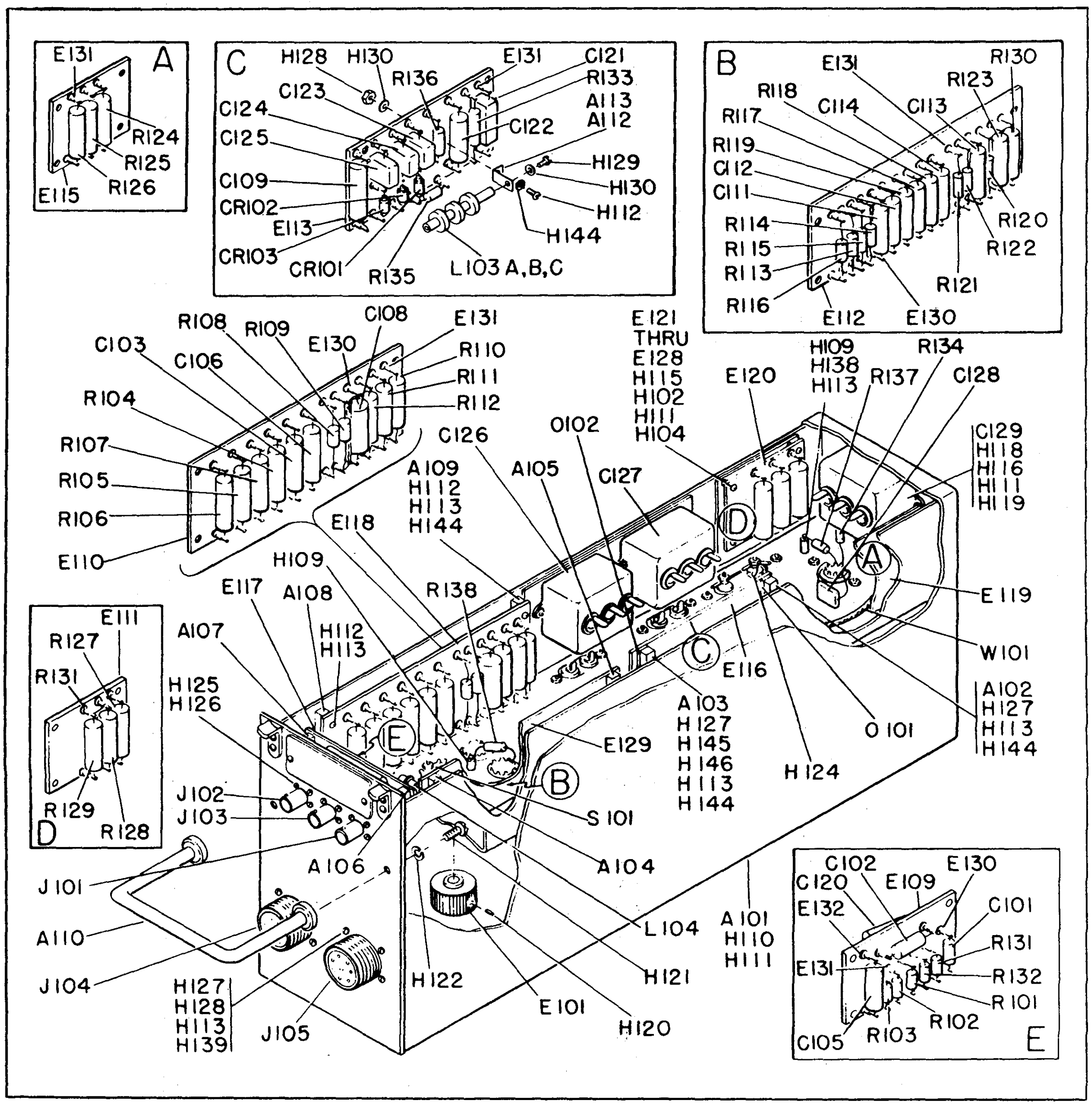


Figure 2. Amplifier-Power Supply AM-256/APA-69 (Sheet 1 of 2)

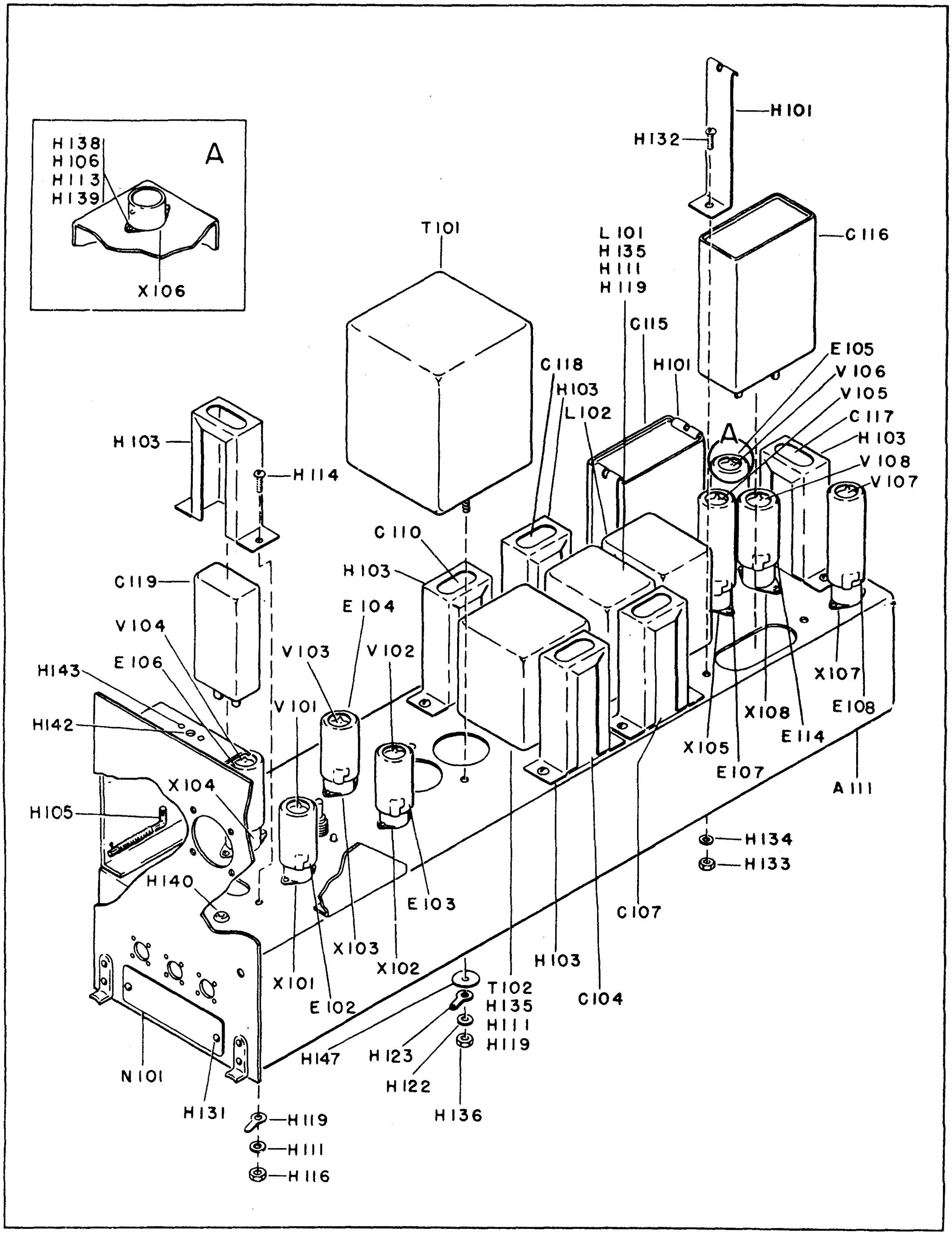


Figure 2. Amplifier-Power Supply AM-256/APA-69 (Sheet 2 of 2)

Amplifier Power Supply AM-256/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
101-199 series	R16AN-AM256APA69	AMPLIFIER POWER SUPPLY AM-256/APA-69 R200330-1	P1 MO/R
A101		CASE ASSY: spotwelded, 4.125 in x 4.83 in. X 19.75 in. R203340-1	M1
A012		BLOCK, mounting; brs, nickel pl: 2.85 in. x ¼ in. x ¼ in: I hole drilled 0.38 in. deep in one end and taped for No. 6-32 NC-2 screw: 2 holes drilled thru side for NO. 4-40 NC-2 screw. A232508-27	M1
A103		BLOCK, mounting; brs, nickel pl: 2.85 in. x ¼ in. 1 holed drilled 0.38 in. deep in one end and tapped for No. 6-32 NC-2 screw: 2 holes drilled thru side for No. 4-40 NC-2 screw. A232508-27	M1
A104		BLOCK, mounting; brs nickel pl: 2.88 in. x ¼ in. x ¼ in: 1 hole drilled 0.25 in. deep in one end and tapped for No. 4-40 NC-2 screw: 2 holes drilled thru side for No. 4-40 NC-2 screw. A232508-6	M1
A105		BLOCK, mounting: brs, nickel pl: 2.88 in. x ¼ in. x ¼ in.: 1 hole drilled 0.25 in. deep in one end and tapped for No. 4-40 NC-2 screw: 2 holes drilled thru side for No. 4-40 NC-screw. A232508-6	M1
A106		BLOCK, mounting: brs, nickel pl: 2.70 in. x ¼ in. x ¼ in. 1 hole drilled 0.25 in. deep in one end and tapped for No. 4-40 NC-2 screw; 2 holes drilled thru side for No. 4-40 NC-2 screw. A232508-5	M1
A107		Block, mounting: brs, nickel pl: 2.70 in. x ¼ in. x ¼ in. 1 hole drill 0.25 in. deep in one end and tapped for No. 4040 NC-2 screws; 2 holes drills thru side for No. 4-40 NC-2 screw. A232508-5	M1
A108		BLOCK, mounting; brs, nickel pl: 2.91 in. x ¼ in; 1 hole drilled 0.25 in. deep in one end and tapped for No. 4-40 NC-2 screw; 2 holes drilled thru side for No. 4-40 NC-2 screw. A232508-7	M1
A109		BLOCK, mounting: brs, nickel pl: 2.91 in. x ¼ in.: 1 hole drilled 0.25 in. deep in one end and taped for No. 4-40 NC-2 screw: 2 holes drilled thru side for No. 4-40 NC-2 screw. A232508-7	M1
A110		HANDLE, U-shaped; cres: approximately 5-3/8 in. lg: both ends tapped for No. 10-24 NC-2 screw.	M1
A111		CHASIS: A1, etched finish: 19.46 in. lg. X 4.75 in. wd x 3 in. deep: 80 holes of varying sizes drilled in bottom; 23 holes of varying sizes drilled in side; 2 gussets spotwelded on one end joining panel drilled with 27 holes of varying sizes: nameplate riveted on panel. R203573-1	M1
A112		BRACKET, “L” shaped: A1, etched finish: 0.62 in. lg x 0.26 in. wd: 2 holes 0.128 in. dia drilled in each end. A29231	M
A113		BRACKET, “L” shaped; A1, etched finish; 0.62 in. lg x 0.26 in. wd; 2 holes 0.128 in. dia drilled in each end. A229231	M
C101	R16C10492-56	CAPACITOR, fixed: mica: 0.01 of ±5%; 300 vdcw. CM35C103J	P1 MO/N
C102	R16C11339-99-450	CAPACITOR, fixed: paper: 0.47 uf ±20%; 200 vdcw. L220152-36 (SPR) 91P47402	P1 MO/N
C103	R16C44307-14	CAPACITOR, fixed: paper: 0.40 uf ±20%; 400 vdcw. L220152-36 (SPR) 91P 10404	P1 MO/N P1MO/N
C104	R16CJAN-P61B1FF105V	CAPACITOR, fixed; paper; 1 uf ± CP61B1FF105V	P1 MO/N
C105	R46C44299-28	CAPACITOR, fixed: paper: 0.40 uf ±20%; 300 vdcw. L220152-51 (SPR) 91P0403	P1 MO/N P1 MO/N

Amplifier Power Supply AM-256/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
C106	R16C11307-14	CAPACITOR, fixed: paper; 0.10 uf ±20%; 400 vdcw. L220152-70 (SPR) 91P0404	P1 MO/N
C107	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper; 1 uf ±20% - 40%; 600 vdcw.	P1 MO/N
C108	R16C11707-100	CAPACITOR, fixed: paper; 0.22% 400 vdcw.	P1 MO/N
C109	R16C11307-14	CAPACITOR, fixed paper; 0.10 uf ±20% 400 vdcw	
C110	R16JAN-CP61BIFF105V	CAPACITOR, fixed: paper: 1 uf +20%--10%; 600 vdcw.	P1 MO/N
C111	R16C11307-14	CAPACITOR, fixed: paper: 0.10 uf ±20% 400 vdcw.	P1 MO/N
C112	R16C11307-14	CAPACITOR. fixed: paper; 0.10 uf ±20% ; 400 vdcw. L220152-70 (SPR) 94P10404	P1 MO/N
C113	R16C11307-14	CAPACITOR, fixed; Paper: 0.40 of ±20% 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C114	R16C11307-14	CAPACITOR, fixed: paper: 0.10 uf ±20%: 400 vdcw. L220152-70 (SPR) 91P10404	
C115	R16C11599 25 10	CAPACITOR, fixed: paper; 4 uf +20% - 10%: 600 vdcw CP70E1FF405V	P1 MO/N
C116	R16C11599 25 10	CAPACITOR, fixed: paper; 4 uf +20% -- 10%; 600 vdcw CP70E1FF405V	P1 MO/N
C117	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper, 1 uf +20% 10%; 600 vdcw. CP61B1FF105V	P1 MO/N
C118	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper; 1 uf +20% -- 10% 600 vdcw. CP61B1FF105V	P1 MO/N
C119	R16JAN-CP61U1FF105V	CAPACITOR, fixed: paper; 1 uf +20% -- 10% 600 vdcw. CP61B1FF105V	P1 MO/N
C120	R16C11339-99-450	CAPACITOR, fixed: paper; 0.47 uf +20% 200 vdcw. L220152-36 (SPR) 91PA7402	P1 MO/N
C120	R16C11339-99-450	CAPACITOR, fixed: paper; 0.47 uf +20% 200 vdcw.	P1 MO/N
C121	R16C10492-56	CAPACITOR, fixed: mica: 0.01 uf +5%; 300 vdcw. CM35C103J	P1 MO/N
C122	R16C11307-14	CAPACITOR, fixed; paper; 0.10 uf ±20%; 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C123	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf °5%; 500 vdcw. CM20C470J	P1 MO/N
C124	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf 500 vdcw. CM20C470J.	P1 MO/N
C125	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf 500 vdcw. CM20C470J	P1 MO/N
C126	R16C11176-254	CAPACITOR, fixed: mica; 2 uf -20% --10%; 600 vdcw. CP54B1EF20V	P1 MO/N
C127	R16C11176 254	CAPACITOR, fixed: paper; 2 uf +20% 10%; 600 vdcw. CP54B1EF205V	P1 MO/N
C128	R16C10492-56	CAPACITOR, fixed paper, mica: 0.01 uf ±; 300 vdcw. CM35C103J	P1 MO/N

Amplifier Power Supply,AM-256/APA-9 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
C129	R16C11176 254	CAPACITOR, fixed: paper; 2 uf +20% --10%; 600 vdcw. CP54B1EF205V	P1 MO/N
CR101	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) 1N34A	P1 MO/N
CR102	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) 1N34A	P1 MO/N
CR103	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal C221944-1 (SLE) 1N34A	P1 MO/N
E101	R16K3336-625	KNOB, control: molded black bakelite: 7/8 in. dia: marked with an arrow across knob. C60187-2	P1 MO/N
E102	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E103	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E104	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E105	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E106	R16JAN TS103U02	SHIELD, tube. TSF0T101	P1 MO/N
E107	R16JAN TS102U03	SHIELD, tube. TSF0T103	P1 MO/N
E108	T16JAN TS102U03	SHIELD, tube. TSF0T103	P1 MO/N
E109		BOARD, terminal: 17 terminals unevenly spaced. C203597-1	A1
E110		BOARD, terminal: 2 rows of 12 terminals each C203599-1	A1
E111		BOARD, terminal: 2 rows of 6 terminals each C204148-1	A1
E112		BOARD, terminal: 2 rows of 17 terminals each C204148-1	A1
E113		BOARD, terminal: 2 rows of 20 terminals each C203915-1	A1
E114	R16S3933	SHIELD, tube TSF0T104	P1 MO/N
E115		BOARD, terminal; 2 rows of 3 terminals each. C204148-2	A1
E116		RESISTOR AND CAPACITOR ASSY: consists of 4 capacitors and 5 resistors mounted on terminal board. C203921-1	A1
E117		RESISTOR AND CAPACITOR ASSY: consists of 4 capacitors and 5 resistors mounted on terminal board.	
E118		RESISTOR AND CAPACITOR ASSY: consists of 3 capacitors and 9 resistors mounted on terminal board. C203598-1	A1
E119		RESISTOR BOARD ASSY: consists of 3 resistors mounted on terminal board. C204149-2	A
E120		RESISTOR BOARD ASSY: consists of 3 resistors mounted on terminal board. C204149-1	A

Amplifier Power Supply,AM-256/APA-9 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E121		SPACER: Al, anodized; 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18064-6	
E122		SPACER: Al, anodized; 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054-6	
E123		SPACER: Al. anodized: 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054.6	
E124		SPACER: Al. anodized: 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054.6	
E125		SPACER: Al. anodized: 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054.6	
E126		SPACER: Al. anodized: 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054.6	
E127		SPACER: Al. anodized: 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054.6	
E128		SPACER: Al. anodized: 3/16 in. lg x 1/4 in. OD x 0.144 in. ID. A18054.6	
E129		CAPACITOR AND RESISTOR ASSY: consists of 4 capacitors and 12 resistors mounted on terminal board.	A1
E130		TERMINAL, lug: brs, hot tinned: 3/16 in. dia; 0.603 in. lg. (19 each used) B13021-4	
E131	R17BXR-B13020-4	TERMINAL, lug: brs, hot tinned; 3/16 in. dia, 0.400 in. lg. (86 each used) B13020-4	P1 O/N
E132	R17BXR-A15611-4	TERMINAL, lug: brs, hot tinned; ¼ in. dia: 0.700 in. lg. (2 each used) A15611-4	P MO/N
E133		ADAPTER, electrical accessory to cable: A1; 1-9/16 in. wd; 1-3/16 in. lg; threaded 1-3/16-18 NEF-2B. (2 each used) AN3057-12	
H101	R17BXRB13020-4	BRACKET, capacitor mounting. (4 each used) CP07FB3	P1 MO/N
H102		NUT, hex; brs, nickel pl; No. 6-32 NC-2; 0.250 in. wd; 3/32 in. thk (14 each used) HSN775B-18	
H103	R16JAN-CP06FA5	BRACKET, capacitor mounting. (6 each used) CP06FA5	P1 MO/N
H104		WASHER, flat; brs, nickel pl; No. 6 (10 each used)	
H105		WRENCH, Bristo: steel, Cd pl: L-shaped; size 03; short arm HC684H03-S	
H106		NUT, hex; brs, nickel pl: No. 4-40 NC-2 0.188 in. wd; 1/16 in. thk (16 each used) HSN 775B-18	
H107		NOT USED	
H108		NOT USED	
H109	R17BXR-C243900-3	TERMINAL, stud; solder type terminals; brs, hot tin dipped, OA length 0.844 in.; 20,000 vacw, (2 each used) C243000-3 (ELCN) TT-16	
H110	R43S117370	SCREW, mach; slot dr; Bind H; brs, nickel pl: no. 6-32 NC-2; 7/16 in. lg. Commercial	
H111		WASHER, lock: phosphor bronze, nickel pl; split; No. 6. (39 each used) AN935B6	
H112		SCREW, mach; slot dr: Bind H; brs, nickel pl; No. 4-40 NC-2; 5/16 in. lg. (22 each) used) Commercial	

Revised 1 February 1956

Amplifier Power Supply AM-256/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H113	R43W73510	WASHER, lock: phosphor bronze, nickel pl; split No. 4. (49 each used) AN935B4	
H114	R43S117365	SCREW, mach: pilot dr: Bind H; brs. nickel pi; No. 6-32 NC-2; 3/8 in. Ig. (12 each used) Commercial	
H115		SCREW, mach: slot dr; FH: brs, nickel pi; No. 6-32 NC-2; 5/8 in. Ig. (8 each used AN505B6-10	
H116	R43N40525	NUT, hex: brs, nickel pl; No. 6-32 NC-2. (16 each used) AN340B6	
H117		NOT USED	
H118	R43S135455	SCREW, mach: slot dr; FH; brs. nickel pl: No. 6-32 NC-2; 3/8 in. Ig. (6 each used) AN505B6-6	
H119	R17T4234	TERMINAL, lug: brs, hot tinned; 6/64 in. hole drilled in one end and 0.144 in. hole drilled in other end. (7 each used) Commercial	
H120		SCREW, set: Bristo dr; cup point; steel, chromated Cd pl; No. 6-32 NC-3; 3/16 in. IR. t2 each used) Commercial	
H121	R43S119455	SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 10-24 NC-2; 1/2 in. Ig. (2 each used) Commercial	
H122	R43W73540	WASHER, lock: phosphor bronze, nickel pl; split; No. 10. (4 each used) AN935110	
H123	R17T4410	TERMINAL, lug: soldering; 57/64 in. Ig; 0.350 in. OD one end for No. 10 screws; 0.165 in. OD other end with hole 0.093 in. dia A165-10	
H124		TERMINAL, lug; soldering; 57/64 in. lg; 0.350 in. OD one end for No. 10 screws; A4735-2	
H125	R43S135225	SCREW. mach: slot dr; Bind H; brs, nickel pl; No. 3-56 NF-2; 5/16 in. Ig. (12 each used) HSN950B-18	
H126	R43W73507	WASHER. lock: phosphor bronze, nickel pl; split;. No. 3. (12 each used) AN935B3	
H127	R43S117255	SCREW, mach: slot dr; Bind H; brs. nickel Pl: No. 4-40 NC-2; 3/8 in. Ig. (10 each used) Commercial	
H128	R43N40515	Nut, hex; brs, nickel 4-40 NC-2 (8 each used) AN340B4	
H129		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 4-40 NC-2; ¼ in. lg. (2 each used	
H130		WASHER, lock: phosphor bronze, nickel pl; split; 0.245 in. OD; 0.120 in. ID; 1/32 in. thk. (4 each used) A18037-3	
H131		RIVET, tubular: oval hd; brs, nickel pl; Oi121 in. dia; 15/16 in. Ig. (2 each used) Commercial	
H132	R435117485	SCREW. mach: slot dr; Bind H; brs, nickel pi; No. 8-32 NC-2; 1/2 in. Ig. (4 each used) Commercial	
H133	R43N40530	NUT, hex: bras, nickel pi; No. 8-32 NC-2. (4 each used) AN340B8	
H134	R43W73530	WASHER, lock: phosphor bronze, nickel pl: split; No. 8. (4 each used) AN935B8	

Amplifier Power Supply AM-256/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H135	R43S6898	SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 6-32; 5/16 in. lg. (12 each used)	
H136		NUT, hex; brs, nickel pl; No. 10-24 NC-2. (2 each used) AN340B10	
H137	R43N4053S	NOT USED	
H138	R43S117245	SCREW. mach: slot dr: rd hd; brs, nickel pl; No. 4-40 NC-2; 1/4 in. Ig. (18 each used) AN616B4-4	
H139	R17T4234-10	TERMINAL. lug: bra, hot tinned; S/64 in. hole drilled in one end and 0.121 hole drilled in other end. (8 each used) Commercial	
H140	R33GC10-251-05	GROMMET: black rubber; 9/32 in. ID; 9/16 in. OD; 1/4 in. thk. (2 each used) A18143-8 (LAV) 905	
H141		NOT USED	
H142	R43N92600	NUT, plate: self-locking; steel; No. 6-32 NC-2. AN366F632	P1 O/N
H143		RIVET, solid: crank; Al, anodize; 0.094 in. dil; 9/32 in. hr. (2 each used) Commercial	
H144	R43W42024	WASHER, flat: brs; No. 4. (16 each used) AN96OB4	
H1415		COLLAR, spacing: plastic; 0.120 in. ID; 1/4 in. OD; 0.32 in. h1. C282827-6	
H146	R43S117285	SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 4-10 NC-2; 3/4 in. Ig. Commercial	
H147		WASHER, flat: bra, nickel pl; No. 10. (2 each used) AN960B10	
J101	R16R2435	CONNECTOR, receptacle: one female contact UG-290/U	P1 MO/N
J102	R16R2435	CONNECTOR, receptacle: one female contact. UG-290/U	P1 MO/N
J103	R16R2435	CONNECTOR, receptacle: one female contact. UG-290/U	
J104	R17R1505-54	CONNECTOR. plug: 8 male contacts. AN3102A-20-9P	
J105	R17R1505 41	CONNECTOR. receptacle: 8 female contacts. AN3102A-20-7S	
L101	RS6BXR-A217114	REACTOR, filter: SH; 0.070 ma de; 200 ohms dc. A217114	P1 MO/N
L102	R16BXR-A217114	REACTOR. filter: SH; 0.070 ma de; 200 ohms dc A217114	P1 MO/N
L103 A, B, C,	R16BXIA20920M01	COIL, r-f: single pi; 1 mh. A209293-1	P1 MO/N
L104	R16BXR-A209294-1	COIL, r-f: single pi; 1 mh. A209293-1	P1 MO/N
N101		PLATE, identification. N246539-17	M1
0101		SHIM, plastic: 17/64 in. wd x 1/16 in. thk X 2.54 in. 15; 2 holes 0.128 in. dia drilled 2-1/8 in. c to c.	M1

Amplifier Power Supply AM-256/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
0102		SHIM. plastic: 17/64 in. wd x 1/16 in. thk x 2.54 in. lg: 2 holes 0.128 in. dia drilled 2-1/8 in. c to c. A236727	M1
P101		CONNECTOR, plug: single male contact. UC;-260/U	
P102		CONNECTOR, plug: single male contact. UG-260/U	
P103		CONNECTOR, plug: single male contact. UG-260/U	
P104		CONNECTOR. plug: 8 female contacts. AN3106-20-9S	
P105		CONNECTOR, plug: 8 male contacts. AN3106-20-7P	
R101		RESISTOR, fixed: comp; 560,000 ohms ±10%; 1/2w. RC20BF564K	P1 MO/N
R102	N16R050858 0811	RESISTOR. fixed: comp: 560,000 ohms +10%; 1/2w. RC20BF564K	P1 MO/N
R103	N16R050858 0811	RESISTOR. fixed: comp: 560.000 ohms -10%: 1/2w. RC20BF564K	P1 MO/N
R104	R16R17318-246	RESISTOR, fixed: comp; 27,000 ohms ±10%; 2w C220509-273 (AB) HB-2731	
R105	N16R050335 0940	RESISTOR. fixed: comp; 15.000 ohms ± 10%: 2wv	P1 MO/N
R106	R16R17291-74-11	RESISTOR, fixed: comp: 5,600 ohms +10% ; 2w. C220509-562 (AB) HB-5621	P1 MO/N
R107	R16R17310-97-500	RESISTOR. fixed: comp; 18,000 ohms +10%; 2w. C220509-183 (AB) HB-1831	P1MO/N
R108	R16JAN-RC20BF564K	RESISTOR, fixed: comp; 560,000 ohms ±10%; 1/2w. RC20BF564 K	P1I MO/N
R109	R16JAN-RC20BF102K	RESISTOR. fixed: comp; 1,000 ohms -10%; 1/2w. RC20BF102K	P1 MO/N
R110	R16R17274-36	RESISTOR, fixed: comp; 2,200 ohms +10%; 2w. C220509-222 (AB) HB-2221	P1 MO/N
R111	R16R17318-246	RESISTOR, fixed: comp: 27,000 ohms ±10%; 2w.	P1 MO/N
R112	R16R17319-25	RESISTOR, fixed: comp; 150,000 ohms +10%; 2w. C220509-154 (AB) HB-1541	P1 MO/N
R113	N16R050372 0811	RESISTOR, fixed: comp; 22.000 ohms +10%; 1/2w. RC20BF223K	P1 MO/N
R114	R16JAN-RC20BF105K	RESISTOR. fixed: comp; 1 meg +10%; 1/2w. RC20BF105K	P1 MO/N
R115	R16JAN-RC20BF105K	RESISTOR, fixed: con;p: 1 meg ±10% RC20BF105K	
R116	R16JAN-RC20BF564K	RESISTOR, fixed: comp; 560,000 ohms ±10%; 1/2w. RC20BF564K	P1 MO/N
R117	R1617310-63-500	RESISTOR, fixed: comp; 15,000 ohms ±10%; 2w. C220509-153 (AB) HB-1531	P1 MO/N

Amplifier Power Supply AM-256/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
R1118	R16R17310	RESISTOR, fixed: comp; 15,000 ohms ±10%; 2w. C220609-153 (AB) HB-1531	P1 MO/N
R119	R16R17339-9-13	RESISTOR, fixed: comp; 68,000 ohms ±10%; 1/2w. C220509-683 (AB) HB-6831	P1 MO/N
R120	R16JAN-RC20BF224K	RESISTOR, fixed; comp; 220,000 ohms ±10%; 1/2w. RC20BF224K	P1 MO/N
R121	R16JAN-RC20BF224K	RESISTOR, fixed; comp; 220,000 ohms ±10%; 1/2w. RC20BF224K	P1 MO/N
R122	R16JAN-RC20BF185K	RESISTOR, fixed; comp;1.8 meg ±10%; 1/2w RC20BF185K	P1 MO/N
R123	R16R17265-75	RESISTOR, fixed; comp;1,000 ohms ±10%; 2w. C220509-102 (AB) HB-1021	P1 MO/N
R124	N16R050310-0480	RESISTOR, fixed; comp; 12,000 ohms ±10%; 2w. C220509-123 (AB) HB-1021	P1 MO/N
R125	N16R050310-0480	RESISTOR, fixed; comp; 12,000 ohms ±10%; 2w. C220509-123 (AB) HB-1021	P1 MO/N
R126	N16R050310-0480	RESISTOR, fixed; comp; 12,000 ohms ±10%; 2w. C220509-123 (AB) HB-1021	P1 MO/N
R127	R16R17310-44-10	RESISTOR, fixed; comp; 12,000 ohms ±; 2w. C220509-123 (AB) HB-1021	P1 MO/N
R128	R16R17310-44-10	RESISTOR, fixed; comp; 12,000 ohms ±; 2w. C220509-123 (AB) HB-1021	P1 MO/N
R129	R16R17310-44-10	RESISTOR, fixed; comp; 12,000 ohms ±; 2w. C220509-123 (AB) HB-1021	P1 MO/N
R130	R16R17276-3-6	RESISTOR, fixed; comp; 2,700 ohms ±; 10% C220509-123 (AB) HB-1021	P1 MO/N
R131	N16R050310480	RESISTOR, fixed: comp: 1,000 ohms ±10%; RC20BF102K	
R132	R16JAN-RC20BF222K	RESISTOR, fixed: comp: 1,000 ohms ±10%; RC20BF222K	P1 MO/N
R133	R16JAN-RC30BF222K	RESISTOR, fixed: comp: 1,000 ohms ±10%; RC20BF222K	P1 MO/N
R134	R16JAN-RC20BF564K	RESISTOR, fixed: comp: 560,000 ohms ±10%; 1/2w. RC20BF564K	P1 MO/N
R135	N16R050651-0811	RESISTOR, fixed: comp: 120,000 ohms ±10%; 1/2w. RC20BF124K	P1 MO/N
R136	R16JAN-RC20BF102K	RESISTOR, fixed; comp; 8,200 ohms ±5 %; 1/2w RC20BF822J	P1 MO/N
R137	R16JAN-RC30BF102K	Resistor, FIXED: COMP; 1,000 ohms ±10%; 1/2w RC30BF102K	P1 MO/N
R138	R17S25091-28	RESISTOR, fixed: comp; 100 ohms ±10%, 1/2w RC20BF101K	
S101	R17S25091-28	SWITCH, rotary: 2 pole; 2 positions. C218145-81	P1 MO/N
T101	R17BXR-C217116	TRANSFORMER, power: fil and pl; input 115V, 400 to 1600 cyc, 38 volt amperes, 1 ph; 2 output wnd. C217116	P1 MO/N
T102	R17T7219-29	TRANSFORMER, power; fil and pl; input 115V, 400 to 1600 cyc, 14 volt amperes, 1 ph; 2 output wnd. A217118	P1 MO/N

Amplifier Power Supply AM-256/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
V101	N16T64191-50	TUBE, electors. JAN-6AK5W	P1 MO/N
V102	N16T66191-50	TUBE, electron. JAN-6AK5W	P1 MO/N
V103	N16T66191-50	TUBE, electron. JAN-6AK5W	P1 MO/N
V104	N16T75686	TUBE, electron. JAN-5686	P1 MO/N
V105	N16T56840-50	TUBE, electron. JAN-6X4W	P1 MO/N
V106	N16T66140-50	TUBE, electron. JAN-6AK5W	P1 MO/N
V107	N16T56195-50	TUBE, electron. JAN-6X4W	P1 MO/N
V108	N16T756670	TUBE, electron. JAN-5670	P1 MO/N
W101		CABLE, coaxial: single conductor. RG-58/U	M1
X101	N16S62603-6700	SOCKET, tube: 7 pin miniature C287037-2	P1 MO/N
X102	N16S62603-6700	SOCKET, tube: 7 pin miniature C287037-2	P1 MO/N
X103	N16S62603-6700	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X104	N16S62603-6714	SOCKET, tube: 7 pin miniature C287037-2	P1 MO/N
X105	N16S62603-6700	SOCKET, tube: 7 pin miniature C287037-2	P1 MO/N
X106	N16S62603-6700	SOCKET, tube: 7 pin miniature C287037-2	P1 MO/N
X107	N16S62603-6700	SOCKET, tube: 7 pin miniature C287037-2	P1 MO/N
X108	N16S62603-6714	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N

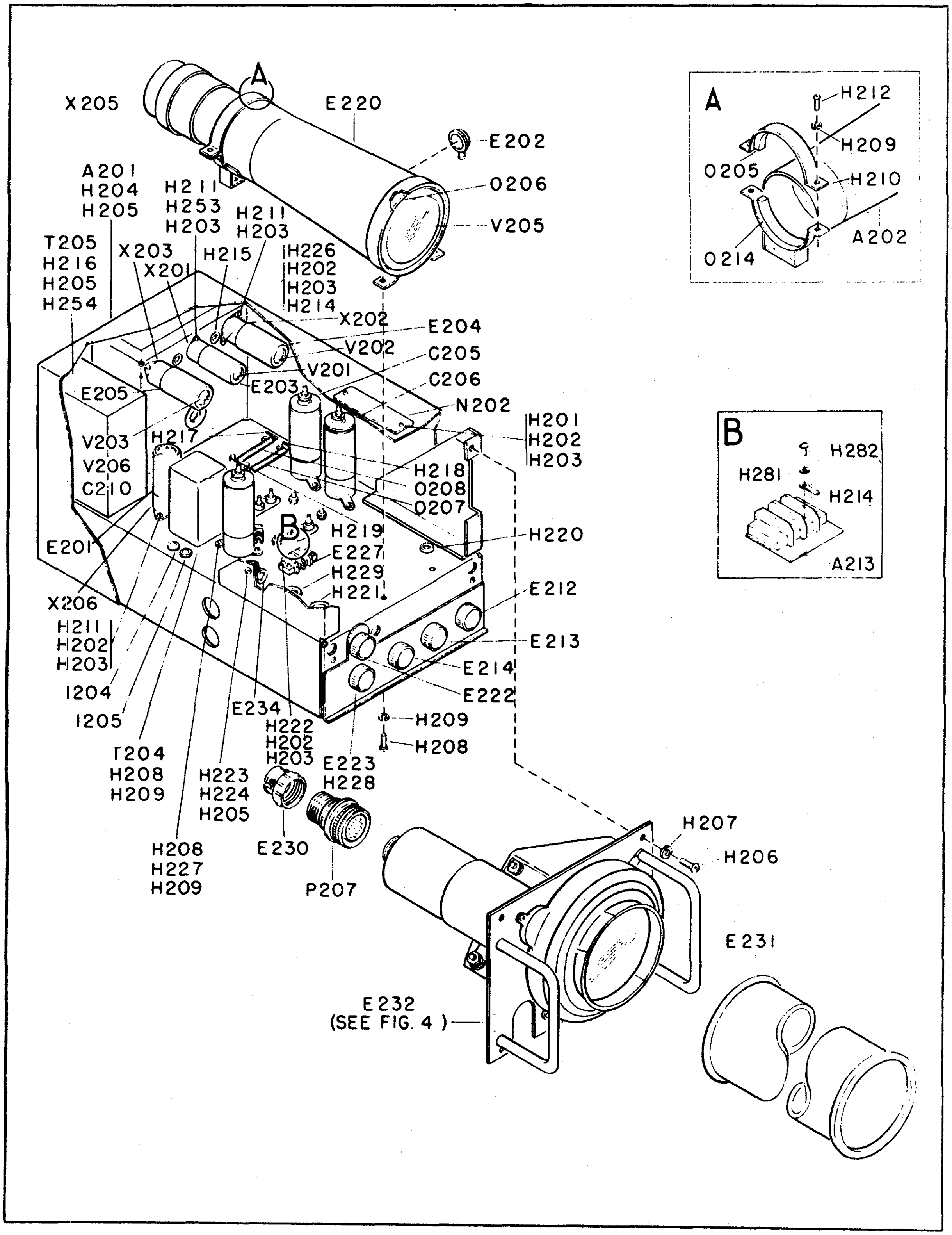


Figure 3. Azimuth Indicator IP-36/APA-69 (Sheet 1 of 2)

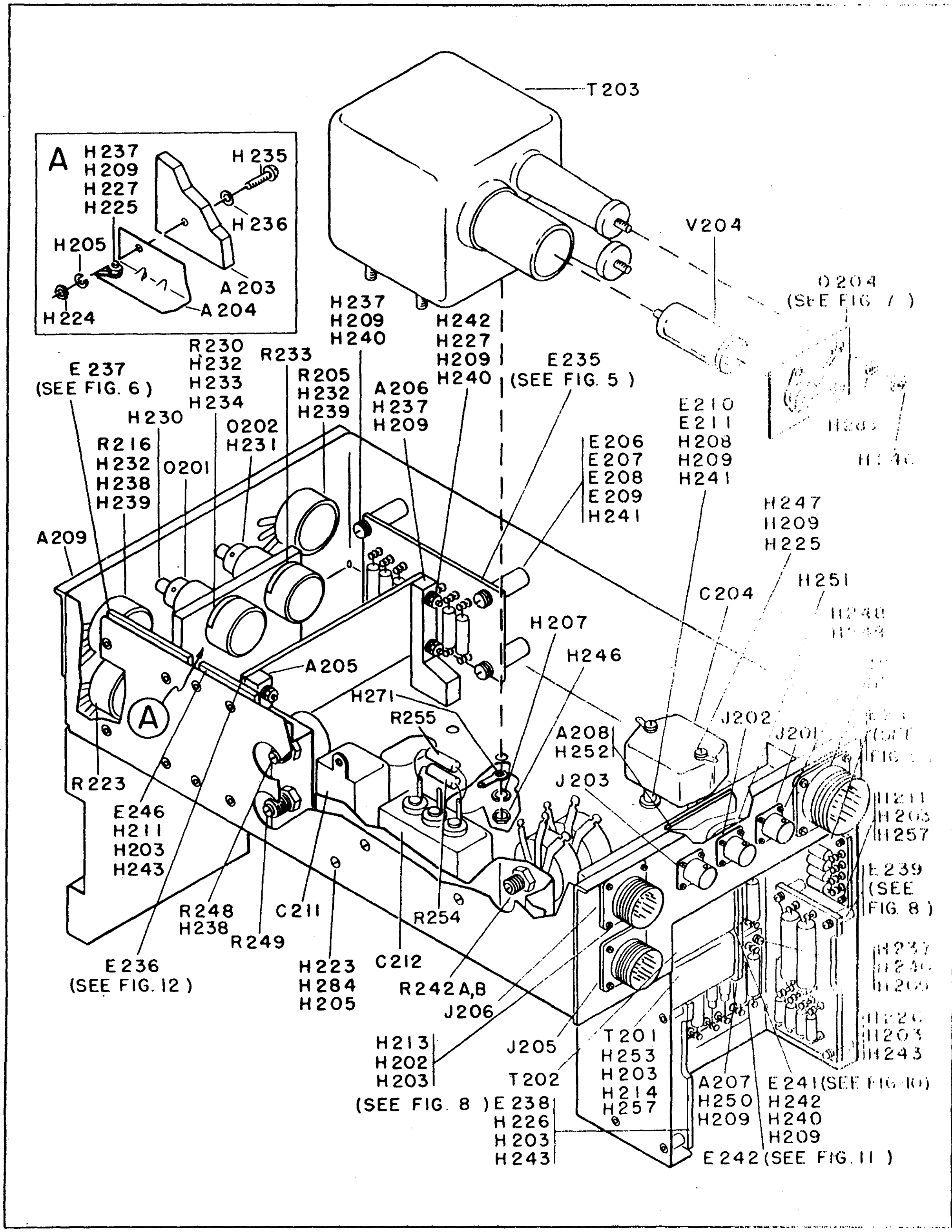


Figure 3. Azimuth Indicator IP-36/APA69 (Sheet 2 of 2)

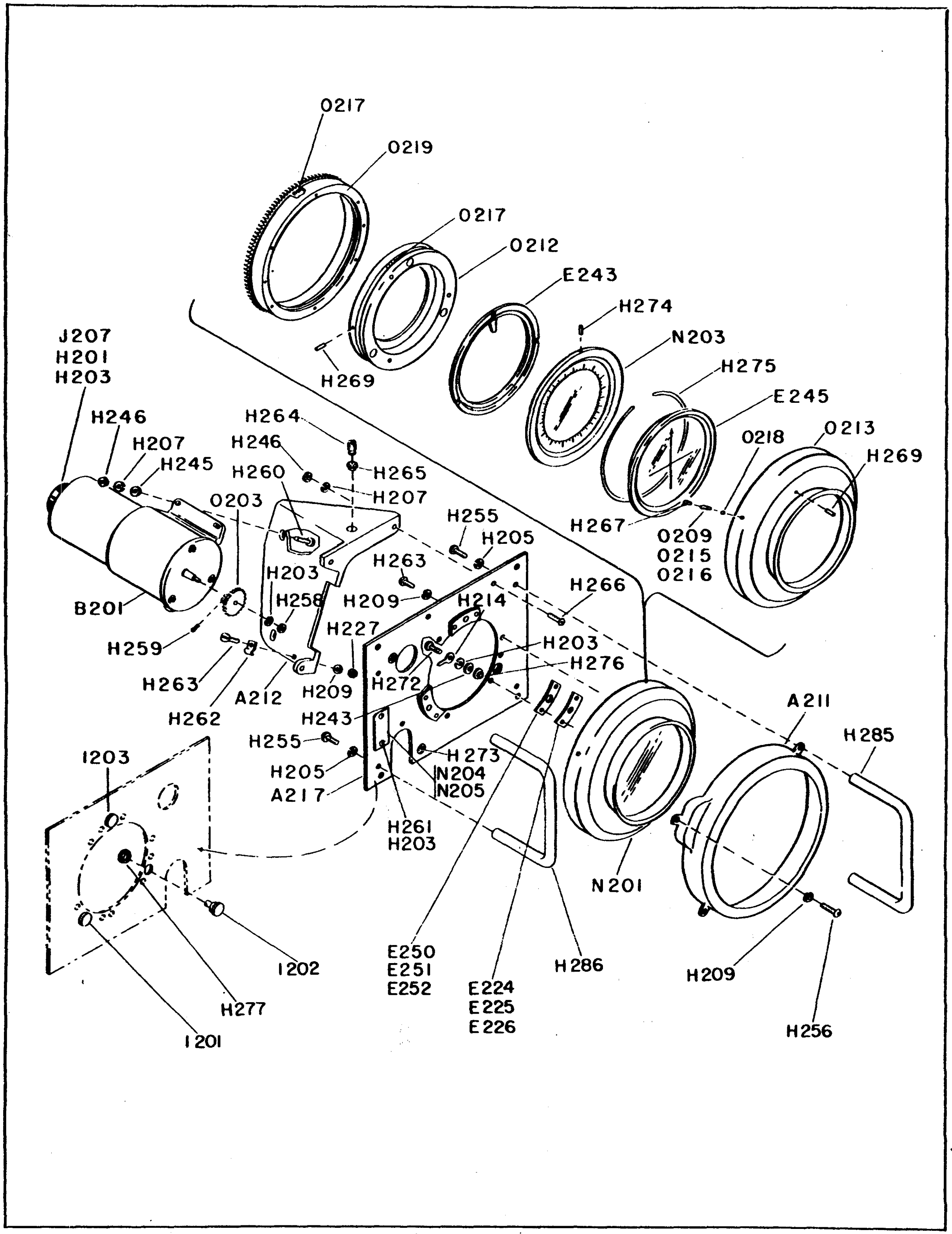


Figure 4. Dial Drive Assembly

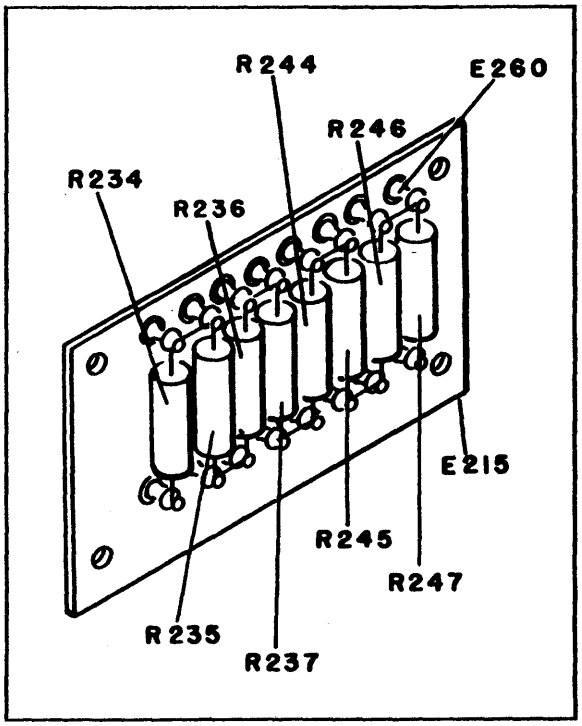


Figure 5. Resistor Assembly

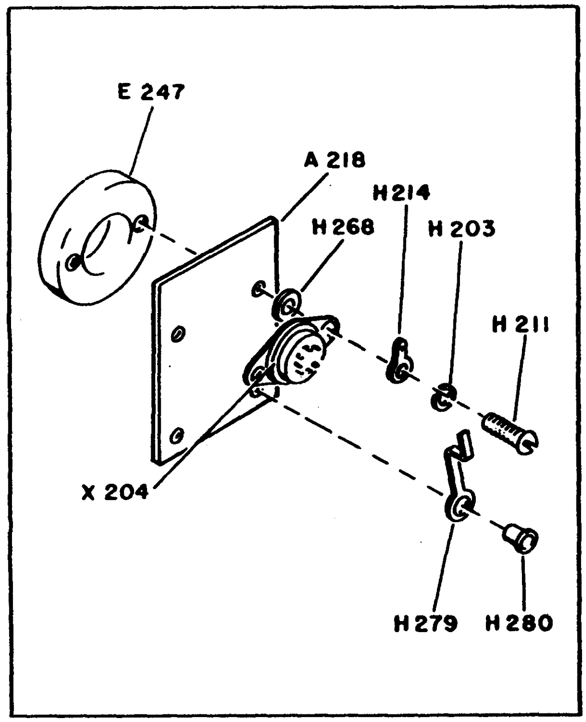


Figure 6. Resistor Assembly

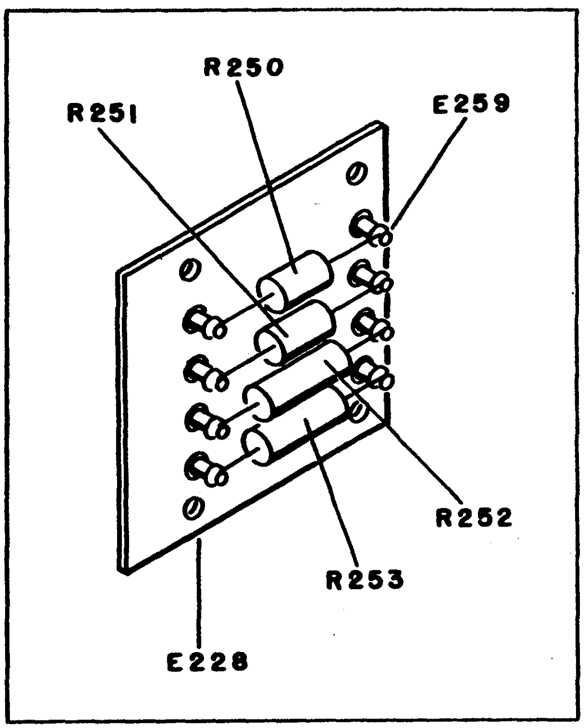


Figure 7. Rectifier Mounting Assembly

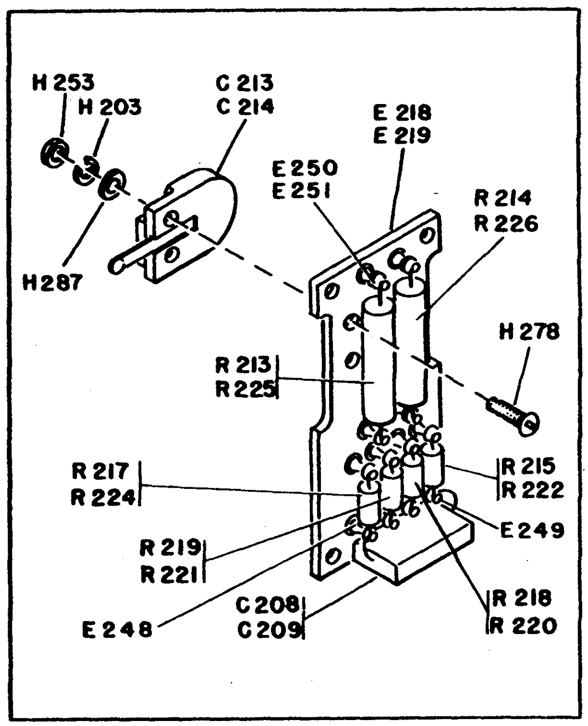


Figure 8. Resistor Assembly

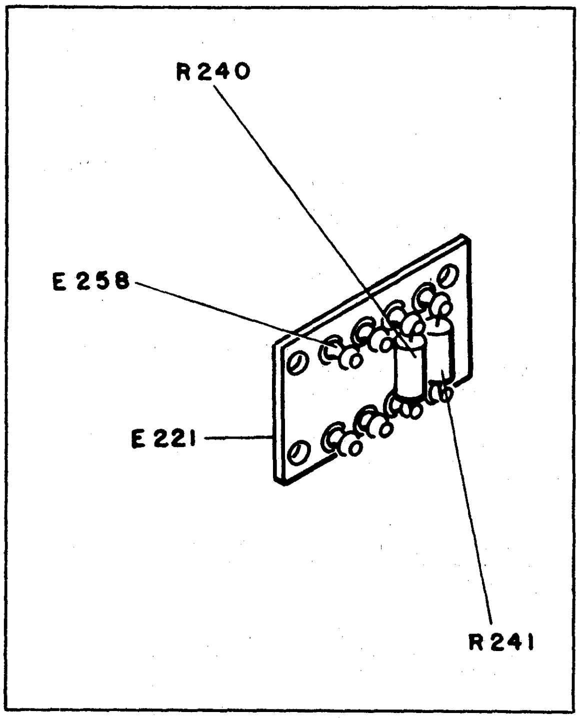


Figure 9. Resistor Assembly

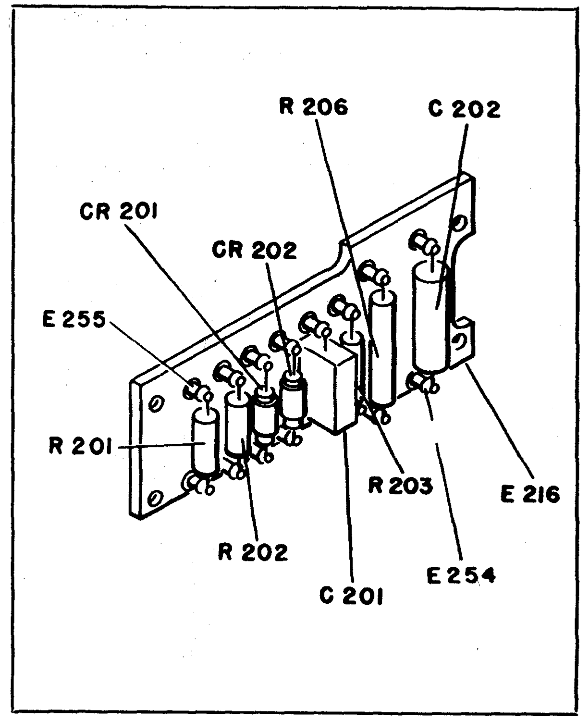


Figure 11. Capacitor and Resistor Assembly

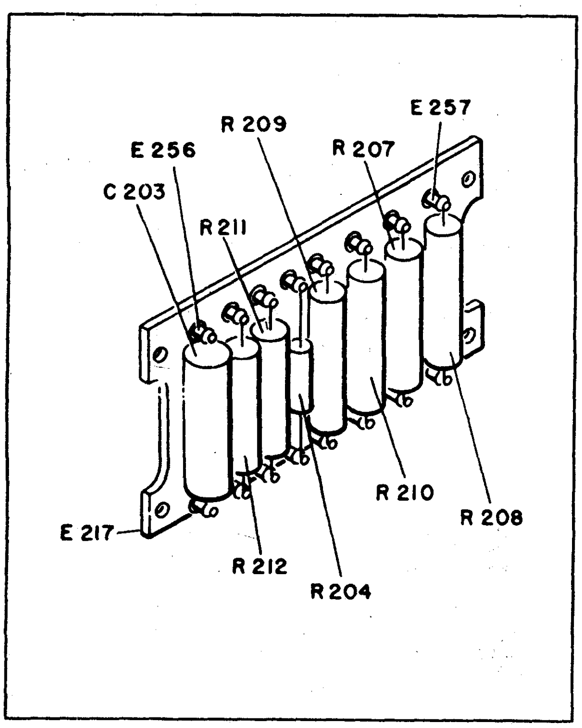


Figure 10. Capacitor and Resistor Assembly

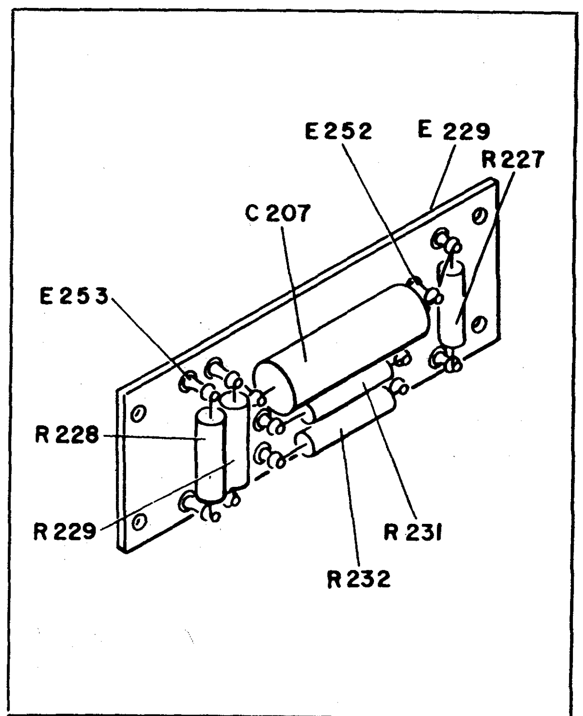


Figure 12. Capacitor and Resistor Assembly

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
201-209	R16AN-1P36APA-	AZIMUTH INDICATOR IP-36/APA-69 R200444-1	PA MO/R
A201		CABINET ASSY: 13.02 in. lg x 7.64 in. wd x 7.31 in. deep: spotwelded. L204578-1	M1
A202		SHIELD ASSY, tube: 3.20 in. dia tapering to 2.50 in. dia; clamp spotwelded to small end; 7.42 in. lg.	X1
A203		PLATE, resistor mounting: plastic; 2.94 in. lg x 2.18 in. wd x ¼ in. thk; two 0.140 in. dia holes 1-1/2 in c to c: two 0.386 in. dia holes 1/1-2 in. c to c; two 0.189 in. dia holes 2 in. c to c; stenciled R230 and R233 on one edge. A228772	M
A204		BRACKET, mounting: A1; etched finish: right angle: ¾ in. One width and 0.56 in. other width: 2.94 in. Lg; four cutouts on angle evenly spaced; three 0.161 in. dia holes in short side evenly spaced; two 0.189 in. Dia holes on other side 2 in. c to c. A2288771	
A205		SUPPORT, leg; plastic: L-shaped; long side 2.24 in. lg x 0.40 in. wd x 0.30 in. thk; short side 1 in. lg x 0.40 in. wd x 0.60 in. thk; two 6-32 NC-2 holes tapped 1/2 in. c to c on short side; two 0.161 in. dia holes on long side. C236230	M1
A206		SUPPORT, leg; plastic L-shaped; long side 2.24 in. lg x 0.40 in. wd x 0.30 in. thk; short side 1 in. lg x 0.40 in. wd x 0.60 in. thk; two 6-32 NC-2 holes tapped 1/2 in. c to c on short side; two 0	M1
A207		BRACKET ASSY: right angle; 2.24 in. lg one side; 1.24 in lg other side; 1 in. wd; four self-clinching inserts evenly spaced on short side. A203588-1	M1
A208		PLATE, insulation: plastic; 1.12 in. wd one end; 0.93 in. wd other end; 4.55 in. lg: 0.012 in. thk: cutout 0.26 in. radius on one side; 0.56 in. radius cutout on other side; five 0.063 in. dia holes. A228874	M1
A209		CHASSIS ASSY; spotwelded; OA dimensions 7.18 in. wd; 7-1/2 in. deep; 12.86 in. lg. R204563-1	M1
A210		NOT USED	
A211	R16BXRL2300499-1	GUARD: Al, black finish: circular; approximately 6 in. high; four mounting ears spaced around guard. L230499-1	P1 MO/N
A212		SUPPORT, dial drive: Al die casting, etched finish; OA dimensions 3-5/8 in. x 3-5/16 in. x 5-5/8 in. N229629	
A213		PLATE, insulation: plastic; 1.38 in. lg x 1.12 in. wd x 0.032 in thk; four 0.161 in. holes C243544-4	
A214		NOT USED	
A215		NOT USED	
A216		NOT USED	
A217		PANEL: Al, etched finish; 7.32 in. lg x 5.78 in. wd x 0.091 in. thk; 3.180 in. dia hole with three holes 0.386 in. dia and chore 7/16 in. dia x 0.048 in. deep evenly spaced around large hole; 1.060 in. dia hole near large hole; cutout 0.52 in. radius off one end. L230500	M1
A218		PLATE, mounting plastic; 1.50 in. wd x 1.96 in. lag x 0.062 in. thk; 5/8 in. dia hole flanked by two holes 0.128 in. dia; two holes 7/32 in. dia 0.880 in. c to c; one side stenciled 122; other side stenciled X204 and V204. A230243-1	
B201	R16B-L211728-1	DRIVE, dial; torque unit; 115V; 380 to 420 cyc; max operating alt 50,000 ft. L211728-1 (ECP) 12625-3	P1 MO/R

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
C201	R16C10492-56	CAPACITOR, fixed; mica; 0.01 uf ±5%; 300 vdcw. CM35C103J	P1 MO/N
C202	R16C11299-28	CAPACITOR, fixed; paper; 0.10 uf ±20%; 300 vdcw. L220152-51 (SPR) 91P10403	P1 MO/N
C203	R16C11307-14	CAPACITOR, fixed; paper; 0.10 uf ±20%; 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C204	R16C10513-530	CAPACITOR, fixed; mica; 0.01 uf ± +20%; 2,500 vdcw. CM60B103M	P1 MO/N
C205	R16BXR-C220114-1	CAPACITOR, fixed; mica; 0.01 uf ± +20%; 2,500 vdcw. C220114-1 (SPR) P12551	P1 MO/N
C206	R16BXR-C220114-1	CAPACITOR, fixed; mica; 0.01 uf ± +20%; 2,500 vdcw. C220114-1 (SPR) P12551	P1 MO/N
C207	R16C11339-99-450	CAPACITOR, fixed; mica; 0.47 uf ± +20%; 200 vdcw. L220152-36 (SPR) 91P47402	P1 MO/N
C208	R16C10084-1-100	CAPACITOR, fixed; mica; 1,000 uuf ± 10%; 500 vdcw. CM30B102K	P1 MO/N
C209	R16C10084-1-100	CAPACITOR, fixed; mica; 1,000 uuf ± 10%; 500 vdcw. CM30B102K	P1 MO/N
C210	R16BXR-C220114-1	CAPACITOR, fixed: paper: 0.1 of +20% --10%; 2,000 vdcw. C220114-1 (SPR) P12551	P1 MO/N
C211	R16C11688-733	CAPACITOR, fixed: paper: 2 x 0.05 uf ±10%, 600 vdcw. CP53B4EF503L	P1 MO/N
C212	R16C11437-925	CAPACITOR, fixed: paper; 2 x 1 uf ±15%; vdcw. CP53B4EF105L	P1 MO/N
C213	R16C11923	CAPACITOR, variable: ceramic; 7-45 uuf. C219043-2	P1 MO/N
C214	R16C11923	CAPACITOR, variable; ceramic; 7-45 uuf. C219043-2	P1 MO/N
CR201	N16T51734-10	CRYSTAL UNIT: rectifying: germanium crystal. C221944-1 (SLE) 1N34A	P1 MO/N
CR202	N16T51734	CRYSTAL UNIT: rectifying: germanium crystal. C221944-1 (SLE) 1N34A	P1 MO/N
E201	R16S3933-24	SHIELD, tube, TSF0T104	P1 MO/N
E202	R16C20181	CLIP, tube. A242240	
E203	R16S3933-24	SHIELD, tube TSF0T101	P1 MO/N
E204	R16S3933-24	SHIELD, tube TSF0T104	P1 MO/N
E205	R16S3933-24	SHIELD, tube TSF0T104	P1 MO/N
E206	R1614279-100	INSULATOR, standoff; white glazed glass. NS3W0105	P1 MO/N
E207	R1619867	INSULATOR, standoff: white glazed glass NS3W0105	P1 MO/N
E208	R1619867	INSULATOR, standoff, white glazed glass. NS3W0105	P1 MO/N

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E209	R1619867	INSULATOR. standoff: white glazed glass. NS3W0105	P1 MO/N
E210	R1619867	INSULATOR. standoff: white glazed glass. NS3W0105	P1 MO/N
E211	R1614279-100	INSULATOR, standoff; NS3W0105	P1 MO/N
E212	R16K3336-625	KNOB, round: black bakelite: 7/'8 in. dia: 19/32 in. thk; marked with arrow across front. C60187-2	P1 MO/N
E213	R16K3336-625	KNOB. round: black bakelite; 7/8 in. dia; 19/32 in. thk; marked with arrow across front. C60187-2	P1 MO/N
E214	R16K3336-625	KNOB. round: black bakelite; 7/8, in. dia: 19/32 in. thk; marked with arrow across front. C60187-2	P1 MO/N
E215		BOARD ASSY. Terminal: consists of sixteen small terminal lugs mounted on board. C204570-1	A1
E216		BOARD ASSY, terminal: consists of sixteen small terminal lugs mounted on board. C204570-1	Al
E217		BOARD ASSY, terminal: consists of fourteen small terminal lugs and two large terminal lugs mounted on board. C203569-1	Al
E218		BOARD ASSY, terminal: consists of ten small terminal :lugs and two large terminal lugs mounted on board C203570-1	Al
E219		BOARD ASSY. terminal: consists of ten small terminal lugs and two large terminal lugs mounted on board C203570-2	Al
E220	R16BXR-L204579-1	SHIELD ASSY, tube: consists of spotwelded tube shield with a clamp screwed to one end. L204579-1	P1 MO/N
E221		BOARD ASSY, terminal: consists of eight small terminal lugs mounted on board. C203604-1	Al
E222	R16K3336-625	KNOB, round: black bakelite; 7/8 in. dia; 19/32 in. thk; marked with arrow across front. C60187-2	P1 MO/N
E223	R16K3336-625	KNOB, round: black bakelite; 7/'8 in. dia:; 19/32 in. thk; marked with arrow across front. C60187-2	P1 MO/N
E224		PLATE, contact mounting: arc: brs, silver pl: 3/8 in. wd x 1.20 in. lg x 0.064 in. thk; 0.199 in. dia hole in center; two 4-40 NC-2 tapped holes 30° c to c. A243488	M1
E225		PLATE, contact mounting: are; brs. silver pl; 3/8 in. wd x 1.20 in. lg x 0.064 in. thk; 0.199 in. dia hole in center; two 4-40 NC-2 tapped holes 30° c to c. A243488	Ml
E226		PLATE, contact mounting: arc: brs. silver pl; 3/8 in. wd x 1.20 in. lg x 0.064 in. thk; 0.199 in. dia hole in center: two 4-40 NC-2 tapped holes 30° c to c. A243488	Ml
E227	R17S17020	STRIP, terminal: black plastic; 1-3/8 in. lg x 7/8 in. wd x 13/32 in. thk; two terminals; two 0.160 in. dia mtg holes on each end. C60854-2 (JNS) 2-140	P1 MO/N
E228		BOARD ASSY, terminal: consists of eight small terminal lugs mounted on board. C204572-1	Al
E229		BOARD ASSY, terminal: consists of ten small terminal lugs and two large terminal lugs mounted on board.	Al

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E230	R17A2299	ADAPTER, electrical accessory to cable: Al; 1-7/16 in. wd x 1-1/8 in. lg; threaded 1-20 UNEF-2B. AN3057-10	P1 MO/N
E231	R16BXR-C233623	TUBE. viewing: circular: black neoprene; 3-1/2 in. ID x 8 in. lg; 0.25 in. dia I beading on both ends. C233623	P1 MO/N
E232	R16BXR-N204568-1	DRIVE ASSY, dial: consists of dial drive and gear with guard mounted on panel; two U-shaped handles on panel. N204568-1	P1 MO/N
E233		NOT USED	
E234	R42C18200-115	CLIP, line support: Al with rubber cushion; 5/16 in. ID x 1/2 in. wd; 0.199 in. dia hole in ends. C63122-4 (HPP) 754-4-2-8	P1 MO/N
E235		RESISTOR ASSY: consists of eight resistors wired to board. C204574-1	A1
E236		CAPACITOR AND RESISTOR ASSY: consists of a capacitor and five resistors wired to board. C204575-1	A1
E237		RESISTOR ASSY: consists of four resistors wired to board. C204573-1	A1
E238		CAPACITOR AND RESISTOR ASSY: consists of six resistors and two capacitors wired to board. C203571-2	A1
E239		CAPACITOR AND RESISTOR ASSY: consists of six resistors and two capacitors wired to board. C203571-1	A1
E240		RESISTOR ASSY: consists of two resistors wired to board. A203605-1	A1
E241		CAPACITOR AND RESISTOR ASSY: consists of seven resistors and one capacitor wired to board. C203567-1	A1
E242		CAPACITOR AND RESISTOR ASSY: consists of four resistors, two capacitors and two crystals wired to board. C203566-1	A1
E243		DIAL: clear plastic; 4.057 in. OD x 3.24 in. ID x 0.188 in. thk; engraved pointer. C246626	X1
E244		NOT USED	
E245		POINTER, indicator: clear plastic: 3.857 in. dia x 0.278 in. thk; arrow engraved on face. C246656	X1
E246		BOARD ASSY, terminal: consists of nine small terminal lugs mounted on board. C204569-1	X1
E247		RING, electrode: 1.240 in. OD x 0.178 in. ID x 0.30 in. thk; two tapped holes 4-40 NC-2 x 0.25 in. deep 180° apart. A243445	X1
E248		ADAPTER, electrical accessory to cable: Al; 1-9/16 in. wd x 1-3/16 in. lg; threaded 1-3/16-18 NEF-2B. AN3057-12	P1 MO/N
E249		ADAPTER, electrical accessory to cable: Al; 1-1/4 in. wd x 1-5/64 in. lg; threaded 3/4-20 UNEF-2B. AN3057-6	P1 MO/N
E250		PLATE, spacer: arc; plastic; 1.20 in. lg x 7/8 in. wd x 0.062 in. thk; 0.323 in. dia hole in center and 0.128 in. dia hole on each side of center hole. A243487	M

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E261		PLATE, spacer: arc; plastic; 1.20 in. lg x 7/8 in. wd x 0.062 in. thk; 0.323 in. dia hole in center and 0.128 in. dia hole on each side of center hole. A243487	M
E252		PLATE, spacer: are: plastic; 1.20 in. lg x 7/8 in. wd x 0.062 in. thk: 0.323 in. dia hole in center and 0.128 in. dia hole on each side of center hole. A243487	M
H201		SCREW, mach: slot dr; Bind H; bras, nickel pl; No. 4-40 NC-2; 1/4 in. lg. (2 each used) Commercial	
H202	R43N40515	NUT, hex: bra, nickel pl; No. 4-40 NC-2. (20 each used) AN340B4	
H203	R43W73510	WASHER, lock: phosphor bronze, nickel pl; split; No. 4. (63 each used) AN935B4	
H204	R43S155396	SCREW. mach: slot dr; Bind H; bras, nickel pl; No. 8-32 NC-2; 1/2 in. lg. Commercial	
H205	R43W73530	WASHER, lock: phosphor bronze, nickel pl; split; No.. 8. (16 each used) AN936B8	
H206	G43S9053	SCREW. mach: slot dr; Bind H; brs, nickel pl; No. 10-24 NC-2; 7/16 in. lg. (4 each used) Commercial	
H207	R43S155308	WASHER. lock: phosphor bronze, nickel pl; split; No. 10. (14 each used) AN935B10	
H208		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2; 5/16 in. lg. (14 each used) AN515BG-5	
H209	R43W73520	WASHER, lock: phosphor bronze, nickel pl; split; No. 6. t47 each used) AN936B6	
H210		CLAMP, cold rolled steel, Cd pl; 3-1/2 in. lg x 1/2 in. wd; 0.161 in. dia hole drilled in each end. A241215-7	
H211	R43S155164	SCREW. mach: slot dr; rd hd; brs, nickel pl; No. 4-40 NC-2; 1/4 in. lg. (20 each used) AN616B4-4	
H212		SCREW. mach: slot dr; Bind H; brs, nickel pl; No. 6-32 NC-2; 9/16 in. lg. (2 each used) Commercial	
	R43S155176		
H213		SCREW, mach: slot dr; rd hd; bra, nickel pl; No. 4-40 NC-2; 7/16 in. lg. (12 each used) AN616B4-7	
	R17T4234-10		
H214		TERMINAL, lug: soldering: brs, hot tinned; one 6/64 in. dia hole and 0.121 in. dia-hole 7/16 in. c to c. (10 each used) Commercial	
	R3311702		
H215		GROMMET, vinyl resin: 5/16 in. ID; 7/16 in. OD; 3/16 in. thk. (3 each used) AN931-3-6	
	R43S155388		
H216		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 8-32 NC-2; 3/8 in. lg. (4 each used) AN516B8-6	
	R41W2466		
H217		WRENCH, Bristo: steel. Cd pl; L-shaped; size 04; short arm. HC648H04-S	
	R41W2466		
H218		WRENCH, Bristo: steel, Cd pl; L-shaped; size 03; short arm. HC648H03-S	
H219		RIVET. tubular: oval hd; brs, nickel pl; 0.098 in. dis; 9/64 in. lg. (4 each used)	
	R33G1905-215-50	Commercial	
H220		GROMMET, rubber: 3/16 in. ID; 9/16 in. OD; 3/8 in. thk. A18130-4 (ARH) 1103G	

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H221	R33G1710	GROMMET, rubber: 3/8 in. ID; 1-1/16 in. OD; ;3/8 in. thk. A18440-10 (ARH) 1109C	
H222	R43S155180	SCREW. mach: slot dr; rd hd; bra. nickel pi; No. 4-40 NC-2; 1/2 in. It. (4 each used) AN515B4-8	
H228	R43S135570	SCREW. much: slot dr; FH; bra, nickel pl; No. 8-32 NC-2: 3/8 in. Ig. (5 each used) AN606BS-6	
H224	R43N40530	NUT, hex: bra., nickel pl; No. 8-S2 NC-2. (7 each used) AN34088	
H225	R17T4234	TERMINAL, lug: soldering: bra, hot tinned; one 5/64 in. dia hole and 0.144 in. dia hole 7/16 in. c to c. (3 each used) Commercial	
H226	R43S155172	SCREW. mach: slot dr; rd hd: bra. nickel pl; No. 4-40 NC-2; 3/8 in. Ig. (10 -each used) AN51IB4-6	
H227	R43N40525	NUT. hex: bra, nickel pl; No. 6-32 NC-2. (14 each used) AN340B6	
H228	R43S436392	SCREW, set: Bristo dr: cup point; steel, Cd pl; No. 6-32 NC-; 3/16 in. Ig. (10 each used) Commercial	
H229	R33G1906-256-75	GROMMET, rubber: 7/16 in. ID; 3/4 in. OD; 1/4 in. thk. A18130-25 (ARH) 1124G	
H230		PIN, straight: SS, unfinished; 0.25 in. dia; 1-1/8 in. Ig. (2 each used) Commercial	
H231	R413S436398	SCREW. set: Bristo dr: cup point; steel, Cd pi; No. 8-32 NC-3; 3/16 in. lg. (8 each used) Commercial	
H232	R43N94610	NUT, hex: bra, nickel pl: No. 3/8-32. (5 each used) HSN776B-2	
H233	R43N20485	WASHER, lock: SS, passivated int tooth; 3/8 in, ID; 1/2 in. OD; 0.022 in. thk. J4 each used) A109842	
H234		WASHER, flat; copper; 0.380 in. ID; 0.687 in. OD; 0.020 in. thk. (2 each used) Commercial	
H235	R43S155400	SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 8-32 NC-2; 5/8 in. lg. (2 each used) AN515B8-10	
H236	R43S155400	SCREW. mach: slot dr; rd hd: bra, nickel pl: No. 8-32 NC-2; 6/8 in. Ig. (2 each used) ANISBS8-10	
H237	R43S155312	SCREW, mach: slot dr; r hd; brs, nickel pl; No. 6-32 NC-2; 3/8 in. lg. (13 each used) AN515B6-6	
H238	R17T5548-210	TERMINAL, lug: brs, hot tinned; 3/32 in. dia hole and 0.386 dia hole 5/8 in. c to c. (3 each used) Commercial	
H239		WASHER, lock: phosphor bronze. nickel pl; split; 3/8 in. (3 each used) AN936B616	
H240	R43W42028	WASHER, flat: brs, nickel pl; 0.147 in. ID; 5/16 in. OD; 0.028 in. thk. (20 each used) AN960B6	
H241		WASHER, flat: copper, nickel pl; 0.157 in. ID; 0.375 in. OD; 0.020 in. thk. (8 each used)	
H242	R43S155324	SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2; 5/8 in. lg. (8 each used) AN515B6-10	

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H243		WASHER, flat: bra, nickel pl; 0.119 in ID; 9/32 in. OD; 0.026 in. thk. (26 each used) AN960B4	
H244		NOT USED	
H245	R43W42036	WASHER, flat: brs, nickel pl; 0.200 in. ID; 7/16 in. OD; 0.036 in. thk. (5 each used) AN960B10	
H246	R43N40535	NUT, hex: brs, nickel pl; No. 10-24 NC-2. (12 each used) AN3401110	
H247	R43S155336	SCREW, mach: slot dr; rd hd; bra, nickel pl; No. 6-32 NC-2; 1 in. 11. (2 each used) AN5151L6-16	
H248	R43S117065	SCREW. mach: slot dr; Bind 11; brs, nickel pl; No. 3-56 NF-2; 5/16 in. i.e. (12 each (used) HSN950B-18	
H249	R43W73507	WASHER, lock: phosphor bronze, nickel pl; split; No. 3. (12 each used) AN935B3	
H250	R43S155304	SCREW, mach: slot dr: rd hd; brs, nickel pl No. 6-32 NC-2; 1/4 in. Ig. (4 each used) AN515B16-4	
H251	R33G1714	GROMMET, vinyl resin: 9/16 in. ID; 1-1/16 in. OD: 5/16 in. thk. (3 each used) AN931-9-13	
H252		RIVET. tubular: oval hd; brs, nickel pi; 0.059 in. dia; 1/8 in. Ig. (5 each used) Commercial	
H253		NUT, hex; brs, nickel pl; No. 4-40 NC-2; 0.1875 in. wd; 1/16 in. thk. (6 each used) HSN775B-18	
H254	R17T26653-4982N	TERMINAL, lug: soldering: bra, hot tinned; 5/64 in. dia hole and 0.170 in. dia hole 7/16 in. c to c.	
H255		SCREW, mach; slot dr; rd hd; brs, nickel pl; No. 8-32 NC-2; ½ in. lg. (4 each used)	
H256	R43S6898-24N	SCREW, mach: slot dr; rd hd: brs, nickel pi; No. 8-32 NC-2; 1/2 in. Ig. (4 each used) AN151118-8	
H257		WASHER, flat: CRS, Cd pl; 0.120 in. ID; 7/32 in. OD; 0.036 in, thk (8 each used) Commercial	
H258	R88PRPB21498	NUT, hex: brs,. nickel pl; No. 4-48 NF-2. Commercial	
H259	GM42P6573	PIN, cotter; SS, passivated; 1/32 in. dia; ½ in. lg.	
H260	G43S9056	SCREW, mach; slot dr; Bind H; brs, nickel pl; No. 10-24 NC-2; 5/8 in. lg. (3 each) used) Commercial	
H261		SCREW, mach; slot dr; Bind H; brs, nickel pl; No. 4-40 NC-2; 1/8 in. lg (2 each used)	
H262	R42GPS-28879	CLAMP, brs: nickel pl; 0.593 in. lg; 3/8 in. wd; 1/32 in. thk; hole 0.140 in. dia drilled one end. A6768	M
H263	R43S155316	SCREW, mach; slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2; 7/16 in. lg. (4 each used) AN515116-7	
H264	R43114500-5	INSERT, threaded: 0.375 in. lg; 0.245 in. OD; threaded ¼-20 NC-3 tapped 8-32 NC-3; tapped end serrated. C245605-3 (ROSN) R104SB-6	P1 O/N

Amplifier Power Supply IP-36/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H265	R43L11006	RING, retainer; steel Cd pl; 0.213 in. ID; 0.354 in. OD; 0.099 in. thk. C238655-3 (ROSN) RL21SB-6	P1 O/n
H266	R43S6898-42N	SCREW, mach; slot dr; Bind H; brs, chromated Cd pl; No. 10-24 NC-2; 5/8 in. lg. (3 each used) Commercial	
H267		SCREW, set; Bristo dr; half-dog point; steel, Cd pl; No. 6-32 NC-3; 1/8 in. g. (3 each used)	
H268		WASHER, flat; brs, nickel pl; No. 4. (2 each used) AN960B4	
H269		PIN, straight: brs, Cd pl; 0.063 in. dia; 0.156 in. lg. (4 each used) HSC838B-15.	
H270	R43S135250	SCREW, mach slot dr; FH; brs, nickel pl; No. 4-40 NC-2; 5/8 in. lg. (6 each used) AN505B4-10	
H271		TERMINAL, lug; brs, hot tinned; 0.196 in. hole other end A18169-1	
H272		SCREW, mach: slot dr: Bind H; brs, Cd pl; No. 4-40 NC-2; 3/8 in. lg. (6 each used) Commercial	
H273		INSERT, threaded; steel, chromated Cd pl: 5/16 in. knurled flange; 0.187 in. dia other end; 0.087 in. shank; tapped No. 6-32 NC-2 (2 each used) HK860H87-0632 (PEN) CL632-3	
H274		PIN, straight; brs, Cd pl: 0.063 in. lg. (3 each used)	
H275		RING, retainer; steel music wire, Cd pl; 4-1/4 in. OD; 0.0475 in. thk; 30°	
H276		WASHER, flanged: plastic; 0.128 in. ID; 0.32 in. OD one end; 0.184 in. OD other end; 0.086 in. thk. (6 each used) Commercial	
H277		INSERT, threaded: brs, silver pl; 0.445 in. knurled flange: 0.384 in. dia. other end; 0.090 in. thk; threaded 5/16-32 NEF-2. (3 each used) A241997	
H278	R43S135240	SCREW, mach; slot dr: FH; brs, nickel pl; No. 4-40 NC-2; 7/16 in. lg. (4 each used) AN505B4-7	
H279	R47T26654-1908N	TERMINAL, lug: soldering; 1/8 in. dia x 0.020 in. thk x 1-1/4 in. lg; for No. 10 screw. (2 each used) A17803-2	
H280	R42E4032-150	EYELET, brs: Cd pl; 3/8 in. flange; 0.247 in. OD other end; 0.209 in. ID; 0.178 in. lg; sink on small end. (2 each used) A112885-3	
H281		WASHER, lock; phosphor bronze, nickel pl; split; No. 5 (4 each used) AN935B5	
H282		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 5-40 NC-2; ¼ in. lg (4 each used)	
H283		WASHER, lock; phosphor bronze, nickel pl; int tooth; No. 10 (2 each used) A18041-10 (SH) 1910	
H284		NUT, hex: brs, nickel pl; No. 8-32 NC-2; 0.250 in. wd; 3/32 in. thk (4each used) HSN775B-17	
H285		HANDLE: cres, Cd pl; U-shaped; 4.04 in. lg; 2.08 in. wd; 3/8 in. thk; tapped 8-32 NC-2 each end.	
H286		HANDLE: cres, Cd pl: U-shaped 4.04 in. lg; 2.08 in. wd; 3/8 in. thk; tapped 8-32 NC-2 each end. A103650-57	
H287		WASHER, flat; soft copper; 0.120 in. ID; 0.188 in. OD; 0.015 in. thk (4 each used) Commercial	
H288	R17L6512	LAMP, incandescent: 3V; 0.19 amp; clear; No. 953 screw base. AN3136-323	P1 MO/N

Azimuth Indicator IP-36/APA- 69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
I202	R17L6512	LAMP, incandescent: 3V;0.19 amp: clear: No. 953 screw base AN3136-323	P1 MO/N
I203	R17L6512	LAMP, incandescent: 3V;0.19 amp: clear: No. 953 screw base AN 3136-323	P1 MO/N
I204	N16S62303-6700	LAMP, incandescent: 3V;0.19 amp: clear: No. 953 screw base AN 3136-323	P1 MO/N
I205	R17L6512	LAMP, incandescent: 3V;0.19 amp: clear: No. 953 screw base AN 3136-323	P1 MO/N
J201	R16R2435-1	CONNECTOR, receptacle: single female contact UG-291/U	P1 MO/N
J202	R16R2435-1	CONNECTOR receptacle: single female contact UG-291/U	P1 MO/N
J203	R16R2435-1	CONNECTOR receptacle: single female contact UG-291/U	P1 MO/N
J204	R17R1505-80	CONNECTOR, plug: eight male contacts AN3102A-20-7P	P1 MO/N
J205	R17R1480	CONNECTOR, plug: three male contacts AN3102A-14S-1P	P1 MO/N
J206	R17R1480-40	CONNECTOR, plug: five male contacts AN3102A-14S-5P	P1 MO/N
J207	R17R4426-110	CONNECTOR, receptacle: ten female contacts. AN3106-18-1S	P1 MO/N
N201	R16BXR-N204604-1	DIAL ASSY, drive: consists of a dial, pointer indicator, scale, housing and bearings N204604-1	P1 MO/S
N202		PLATE, identification. N246539-18	M1
N203		SCALE: amber plastic; 4.22 in. OD x 3.360 in. ID x ¼ in. thk: numerals engraved on face. C246660	X1
N204		PLATE, identification (used on Contract Noas 51-134) N246667-36	
N205		PLATE, identification (used on Contract Noas 52-435) L247420-3	
O201	R16C36002-250	COUPLING, rigid: sleeve type A239254	P1 MO/N
O202	R16C36002-150	COUPLING, rigid: sleeve type. A239254	P1MO/N
O203	R16BXR-A238336	GEAR, spur: 48 teeth, 20° involute: 1.038 in. OD: gear hub 0.30 in OD x 0.265 in. lg A238336	P1 MO/N
O204	R16BXR-C204436-1	MOUNTING, rectifier. C204436-1	P1 MO/N
O205		STRIP, gasket: sponge rubber: ½ in. wd x 3 in. lg x 3/16 in. thk A233212-3	M
O206	R16BXR-C240575	MOUNT, vibration: natural rubber: 2.32 in. dia x 0.60 in. thk C240575	P1 MO/N
O207		SPRING, wrench holder: 0.031 in. dia phosphor bronze wire, nickel pl: for size 03 Bristo wrench: 1-5/8 in. in lg. x 0.082 in. dia: loop on each end for mounting spring. A110694-9	M1
O208		SPRING, wrench holder: 0.031 in. dia phosphor bronze wire, nickel pl: for size 04 Bristo wrench: 1-5/8 in. in lg. x 0.076 in. dia: loop on each end for mounting spring. A110694-3	M1
O209		SPRING, compression: steel music wire, Cd pl: 0.012 in. dia wire: 0.090 in. OD x 0.18 in. lg: seven turns: ends closed and ground. C239080-38	M1
O210		NOT USED	
O211		NOT USED	

Azimuth Indicator IP-36/APA- 69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
O212		CONE, bearing: A1, anodize; 4.200 in. OD x 2.800 in. ID one side, 3.180 in. ID other end x 0.560 in. thk; indentation for ball around outside of cone: three holes 0.302 in. dia evenly spaced near edge; six holes 0.221 in. dia x 0.06 in. deep drilled on opposite side from 0.302 in. dia holes evenly spaced L234068	X1 '
O213		CONE, bearing: 0.600 in. . OD one side, 3-54 in. OD other end x 3.360 in. ID one side, 5 in. ID other end x 1.33 in. thk; indention for ball race just inside largest dia; three holes 0.098 in. dia and tapped 6-22 NC-2 evenly spaced around rim. L234072	X1
O214		STRIP, gasket: sponge rubber; 1/2 in. wd x 3 in. lg ·8/16 in. thk. A233212-3	M
O215		SPRING. compression: steel music wire, Cd pl; 0.012 in. dia wire; 0.09M in OD x 0.18 in. lg; seven turns; ends closed and ground. C2398080-38	M1
O216		SPRING. compression: steel music wire, Cd pl: 0.012 in. dia wire; 0.090 in. OD x 0.18 in. lg: seven turns; ends closed and ground.	M1
O217	847 to C177-1-7	BALL, pyrex glass: 0.1562 in. dia. (183 each used) HSC801X-3	P1 O/N
O218	847 to C177-1-7	BALL, pyrex glass: 0.0.37 in. dia. (3 each used) HSC801X-4	P1 O/N
0219		BEARING ASSEMBLY: consists of 2 spur gears assembled with 6 screws and 2 straight pins. N207892-1	X1
O220		NOT USED	
P201		CONNECTOR. plug: single male contact UG-260/U	
P202		CONNECTOR, plug: single male contact UG-260/U	
P,203		CONNECTOR. plug: single male contact UG-260/U	
P204		CONNECTOR, plug: 8 female contact AN3106-20-7S	
P205		CONNECTOR. plug: 3 female contacts. AN3106-14S-1S	
P206		CONNECTOR. plug: 6 female contacts. AN3106-14S-5S	
P207	R17P4433-599-2	CONNECTOR. receptacle: ten female contact AN3106A-18-1S	P1 MO/N
R201	N16R049985-0811	RESISTOR, fixed: comp; 1.800 ohms ±10%; 1/2 w. RC20BF182K	P1 MO/N
R202	R16JAN-RC20BF473K	RESISTOR. fixed: comp; 47.000 ohms ±.10%; 1/2w. RC20BF473K	P1 MO/N
R203	N16R050858-0811	RESISTOR, fixed: comp; K60,000 ohms ±10%; 1/2w. RC20BF564K	P1 MO/N
R204	N16R050931-0510	RESISTOR. fixed: comp; 820.000 ohms ±10%; 2w. C220509-824 (AB) HB-8241	P1 MO/N
R205	R16P5582-341-50	RESISTOR, variable: carbon; 2.6500 ohms :±20%; supplied with nut ad lock washer. A114344-252 (AB) JU2522/P3048	P1 NO/N
R206	R16MIL-RC42GF221K	RESISTOR, fixed: comp; 220 ohms ±10%; 2w. C220509-221 (AB) HB-2211	P1 MO/N
R207	R16R17291-74-11	RESISTOR, fixed: comp; 5,600 ohms ±10%; 2w. C2200509-562 (AB) HB-5621	P1 MO/N

Azimuth Indicator IP-36/APA- 69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
R208	R16JAN-RC42GP183K	RESISTOR, fixed: comp; 18,000 ohms ±10%; 2w. C220509-183 (AB) HB-1831	P1 MO/N
R209	R1l6R17328-234	RESISTOR. fixed: comp; 39,000 ohms ±10%; 2w. C220509-393 (AB) HB3931	P1 MO/N
R210	R16R17328-234	RESISTOR. fixed: comp; 39,000 ohms ±10%: 2w. C220509-393 (AB) HR3931	P1 MO/N
R211	R16JAN-RC30BF104K	RESISTOR. fixed: comp; 100,000 ohms ±10%.; 1w. RC30BF104K	P1 MO/N
R212	N16R050697-0508	RESISTOR. fixed: comp; 180,000. ohms ±10%; 2w. C220509-184 (AB) HB-1841	P1 MO/N
R213	N16R050445-0503	RESISTOR. fixed: comp;: 39,000 ohms ±10%; 2w. C220509-393 (AB) HB3931	P1 MO/N
R214	N16R0504450-0503	RESISTOR. fixed: comp; 39,000 ohms ±10%; 2w. C220509-393 (AB) HB-3931	P1 MO/N
R.215	N16R050336-0811	RESISTOR, fixed: comp: 16,000 ohms ±10%; 1/2w. RC20BF153K	P MO/N
R216	R16P5586-288	RESISTOR. variable: carbon; 256,000 ohms ±20%; with nut and A113434-253 (AB) JU2532/P3048	P1 MO/N
R217	N16R050336-0811	RESISTOR. fixed: comp; 16.000 ohms ±10%; 1/2w. RC20BF153K	P1 MO/N
R218	N16R050975-0811	RESISTOR, fixed: comp; I meg ±10%: 1/2w. RC20BF105K	P1 MO/N
R219	N16R050975-0811	RESISTOR. fixed: comp; 1 meg ±10%; 1/2w. RC20BF105K	P1 MO/N
R220	R16JAN-RC20B105K	RESISTOR. fixed: comp; 1 meg ±10%; 1/2w. RC20BF105K	P1 MO/N
R221	R16JAN-RC20BF105K	RESISTOR. fixed: comp; 1 meg ±10%: 1/2w. RC20BF105K	P1 MO/N
R222	R16JAN-RC20BF153K	RESISTOR, fixed: comp; 16,000 ohms ±10%; 1/2w. RC20BF153K	P1 MO/N
R223	R16P5586-288	RESISTOR. variable: carbon; 25,000 ohms ±:20%; with nut and lock wer. A113434-253 (AB) JU2532/P3048	P1 MO/N
R224	R16JAN-RC20BF153K	RESISTOR, fixed: comp; 15,000 ohms :±10%; 1/2w. RC20BF153K	P1 MO/N
R225	R16R17328-234	RESISTOR, fixed: comp; 39,000 ohms ±10%; 2w. C220509-393 (AB) HB3931	P1 MO/N
R226	R16R17328-234	RESISTOR, fixed: comp; 39,000 ohms :±10%; 2w. C220509-393 (AB) HB3931	P1 MO/N
R227	R16JAN-RC30BF224K	RESISTOR, fixed: comp; 220,000 ohms ±10%; 1w. RCSOBF224K	P1 MO/N
R228	R16JAN-RC30BF223K	RESISTOR, fixed: comp; 22,000 ohms ±10%; 1w. RC30BF223K	P1 MO/N
R229	R16JAN-RC30BF224K	RESISTOR. fixed: comp; 220,000 ohms ±10%: 1w. RC30BF224K	P1 MO/N

Azimuth Indicator IP-36/APA- 69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
R230	R16P5590-120-725	RESISTOR. variable: carbon; 100,000 ohms ±20%; 2w. A219520-26	P1 MO/N
R231	R16JAN-RC30BF102K	RESISTOR. fixed: comp; 1,000 ohms ±10%: 1w. RC30BF102K	P1 MO/N
R232	R16JAN-RC30BF334K	RESISTOR, fixed: comp; 330,000 ohms ±10%: 1w. RC30BF334K	P1 MO/N
R233	R16P5595-46-500	RESISTOR. variable: carbon; 500,000 ohms ±20% ; 2w. A219520-27	P1 MO/N
R234	R16JAN-RC30BF224K	RESISTOR. fixed: comp: 220,000 ohms ±10%; 1w. RC30BF224K	P1 MO/N
R235	R16JAN-RC30BF224K	RESISTOR. fixed: comp: 220,000 ohms ±10%: 1w. RC30BF224K	P1 MO/N
R236	R16JAN-RC30BF224K	RESISTOR. fixed: comp; 220,000 ohms ±10%; 1w. RC30BF224K	P1 MO/N
R237	R16JAN-RC30BF823K	RESISTOR. fixed: comp; 82,000 ohms ±10%:; 1w. RC30BF823K	P1 MO/N
R238	NOT USED		
R239	NOT USED		
R240	R16JAN-RC20BF392K	RESISTOR, fixed: comp: 3,900 ohms ±10%; 1/2w. RC20BF392K	P1 MO/N
R241	R16JAN-RC20BF392k	RESISTOR. fixed: comp: 3,900 ohms ±10%:; 1/2 w. RC20BF392K	P1 MO/N
R242A, B	N16R092531-3293	RESISTOR, variable: WW; dual sect.: 4,000 ohms ±5%; 2w each sect: supplied with nut and lock washer. L219576-1 (IRC) 34-1420-3528	P1 MO/N
R243	NOT USED.		
R244	R16JAN-RC30BF474K	RESISTOR, fixed: comp; 470,000 ohms ±10%: 1w. RC30BF474K	P1 MO/N
R245	R16JAN-RC30BF474K	RESISTOR, fixed: comp: 470,000 ohms ±10%; 1w. RC30BF474K	P1 MO/N
R246	R16JAN-RC30BF474K	RESISTOR, fixed: comp: 470,000 ohms +10%: 1w. RC30BF474K	P1 MO/N
R247	R16JAN-RC30BF474K	RESISTOR. fixed: comp; 470,000 ohms ±10%; 1w. RC30BF474K	P1 MO/N
R248	R16P5581-246-525	RESISTOR, variable: carbon; 600 ohms ±20%; supplied with mounting nut, lock nut and lock washer. A109267-45 (AB) JU5012/SD4040L	P1 MO/N
R249	R16P5581-246-526	RESISTOR.' variable: carbon; 600 ohms +20%S; supplied with mounting nut, lock nut. and lock washer. A109267-46 (AB) JU5012/SD4040L	PI MO/N
R250	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms +10%; 1/2 w. RC20BF104K	P1 MO/N
R251	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1/2 w. RC20BF104K	P1 MO/N
R252	R16JAN-RC30BF391K	RESISTOR. fixed: comp; 390 ohms ±10%; 1w. RC30BF391K	P1 MO/N
R253	R16JAN-RC30BF391K	RESISTOR, fixed: comp; 390 ohms ±10%;1w. RC30BF391K	P1 MO/N

Azimuth Indicator IP-36/APA- 69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
R254	R16MILRC42GF392K	RESISTOR. fixed: comp; 3,900 ohms ±10%: 2w. C220509-392 (AB) HB-3921	
R255	R16MILRC42GF392K	RESISTOR. fixed: comp: 3,900 ohms ±10%, 2w C2205609-392 (AB) HB-3921	
T201	R16BXR-C-217098	TRANSFORMER, a-f; plate coupling; pri 625 ohms impedance; 10.5 ohms d-c resistance. C217098-1	P1 MO/N
T202	R16BXR-C-217098	TRANSFORMER. a-f; plate coupling; pri 625 ohms impedance: 10.5 ohms dc resistance. C217098-1	P1 MO/N
T203	R17T7218-125	TRANSFORMER. power: fil and pl type; 115 V, 380/1760 cyc, 1 ph, 22 volt amperes; 4 output wnd. L217258-1	P1 MO/N
T204	R16BXR-C217197	TRANSFORMER. input C217197	P1 MO/N
T205	R17R583-48	TRANSFORMER, power. C217199	P1 MO/N
V201	N16T75654	TUBE. electron. JAN-6AK5W	P1 MO/N
V202	N16T75670	TUBE, electron. JAN-5670	P1 MO/N
V203	N16T75670	TUBE. electron. JAN-5670	P1 MO/N
V204	N16T51990	TUBE. electron. JAN-1Z2	P1 MO/N
V205	N16T70129-5	TUBE. electron: electrostatic deflection and focus KRT. (DUM) K1105P2	P1 MO/N
V206	N16S64063-6714	TUBE. electron. JAN-5670	P1 MO/N
X201	R16BXR-C287037-2	SOCKET, tube: seven pin miniature. C287037-2	P1 MO/N
X202	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature. C287037-4	P1 MO/N
X203	R16BXR-C287037-4	SOCKET. tube: 9 pin miniature. C287037-4	P1 MO/N
X204	N16S062603-6926	SOCKET, tube: ceramic; 7 pin miniature. C287019-1 (CIN) 53C14810	P1 MO/N
X205	R1656189-220	SOCKET. tube: 14 pin. C66510 (CIN) 9463-1FV	P1 MO/N
X206	R16BXR-C287037-4	SOCKET. tube: 9 pin miniature. C287037-4	P1 MO/N

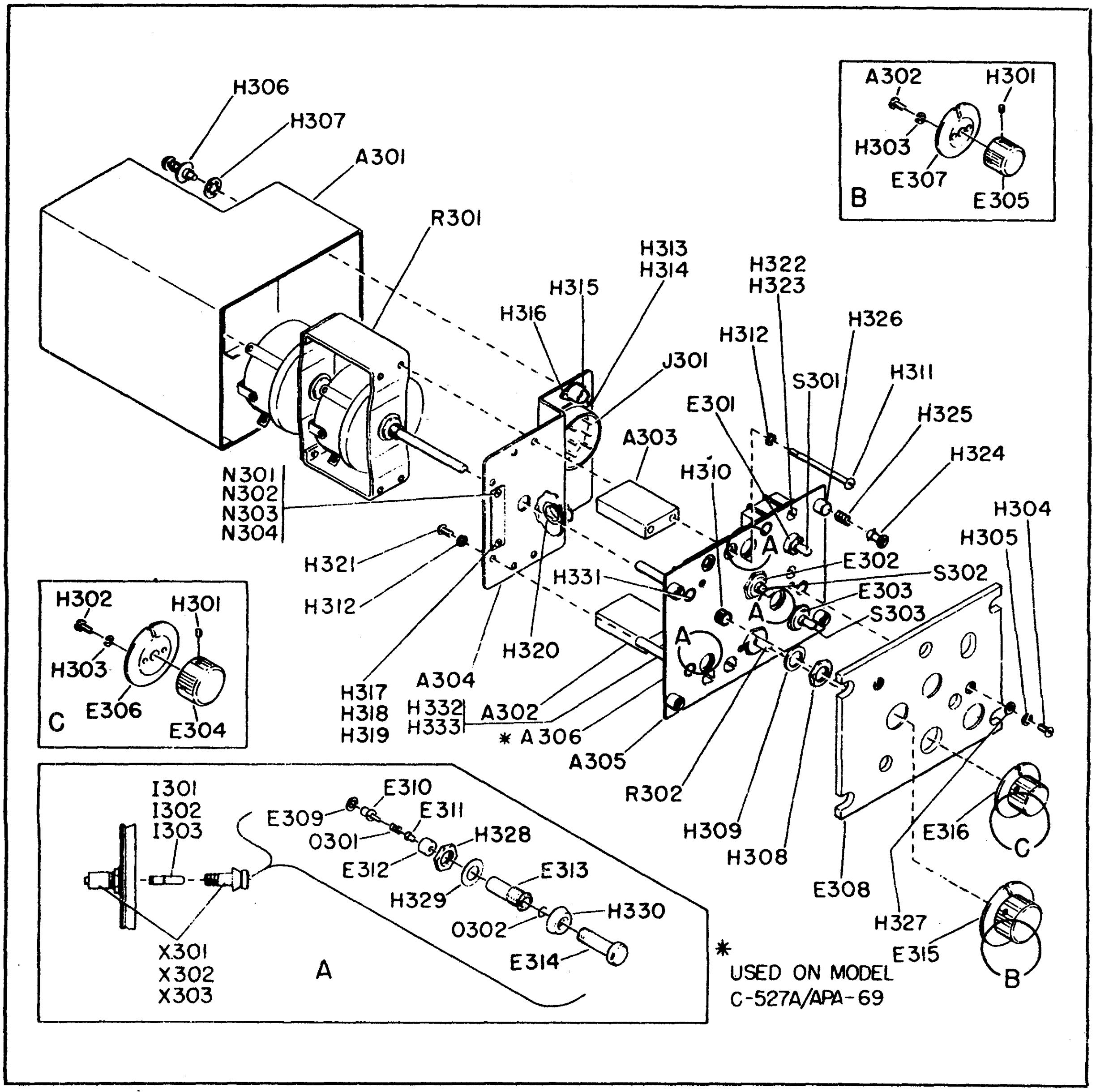


Figure 13. Direction Finder Control C-527/APA-69 and Direction Finder Control C-527A/APA-69

Direction Finder Control C-527/APA-69 and Direction Finder Control C-527A/APA-69

Ref. Symbol Code	Stock No.	Description	Source
301-499 series 301-399 series	R16AN-C527APA-69 (BXR)	DIRECTION FINDER CONTROL C-527/APA-69 N200692-1 DIRECTION FINDER CONTROL C-527A/APA-69 N200692-2	P MO/R
A301	I	COVER ASSY: consists of an L-shaped Al cover 6.34 in. x 4.90 in. x 4.30 in. with two springlock fasteners and lock spring L207771-1	A1

Direction Finder Control C-572/APA-69 and direction Finder Control C-527A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
A302		BLOCK. spacing: A1. etched finish: rectangular: 1.660 in. lg x 1.20 in. wd x 0.3756 in. thk; two 0.204 in. dia holes spaced 0.688 in. c to c. C235898	M1
A303		BLOCK. spacing: A1. etched finish; rectangular: 1.660 in. lg x 1.20 in. wd x 0.3765 in. thk; two 0.204 in. dia holes spaced 0.688 in. c to c. C235898	M1
A304		BRACKET ASSY: consists of offset bracket with two springlock receptacles riveted to offset L207834-1	A1
A305		PLATE ASSY. mounting: consists of A1 plate 5.76 in. lg x 4.50 in. wd: two Dzus offset, on each end of plate. N207776-1	M1
A306		PLATE ASSEMBLY: mounting: consists of A1 plate 5.75 in. lg x 4.50 in. wd; two Dzus fasteners on each end of plate N207776-2	P1 MO/N
E301	R17B23289	BOOT. toggle switch: cylindrical with two diameters; one end 0.156 in. ID, other end 0.412 in. ID; flange on large end 0.720 in. OD. AN32242	
E302		BOOT. toggle switch: hex:; 0.750 in. OD one end with 15/32-32 nut; 0.312 in. OA thickness; 0.080 in. ID other end. C230744-1 (RFA) H1267	
E303		BOOT, toggle switch: hex; 0.750 in. OD one end with 15/32-32 nut; 0.312 in. OA thickness; 0.080 in. ID other end. C230744-1 (RFA) H1267	
E304		KNOB: A1, black alumilite; knurled; 0.88 in. dia; 0.59 in. thk; hole 0.32 in. deep and 0251 in. dia drilled in center of knob; two holes drilled 0.1495 in. x 0.16 in. deep and tapped 6-32 NC-2 on side 90° apart; two holes tapped 2-56 NC-2 0.562 in. c to c near center hole. C243581-2	
E305		KNOB: A1, black alumilite; knurled: 1.12 in. dia: 0.59 in. thk; one hole 0.28 in. deep and 0.261 in. dia drilled in center of knob; two holes drilled 0.1495 in. x 0.16 in. deep and tapped 6-32 NC-2 on side 90° apart; two holes tapped 2-56 NC-2 spaced 0.562 in. c to c near center hole. C245381-1	
E306		DIAL: A1. black alumilite; 1.50 in. OD; 0.88 in. ID one end; 0.257 in. ID other end: 0.12 in. thk; one side chamfered; with flat surface on chamfered side 0.88 in. dia; slot 0.28 in. lg x 0.08 in. wd. C247114-2	
E307		DIAL: A1. black alumilite; 1.75 in. OD: 0.88 in. ID one end; 0.257 in. ID other end; 0.12 in thk: one end chamfered; with flat surface on chamfered aide 1.12 in. dia; slot 0.28 in. lg x 0.08 in. wd. C247114-1	
E308	R16BXR-N290904	PANEL: clear plastic; 5.69 in. lg x 4.44 in. wd x 0.187 in. thk; four cutouts two on each side: one elongated hole stenciled PWR and OFF; two holes 0.750 in. dia and ebore opposite side 0.922 in. dia; one stenciled DF and PAN, other stenciled POLAR VERT and HOR; two holes ebore on opposite side 0.375 in. dia x 0.06 in. deep. 1.812 in. c to c; two holes 0.296 in. dia and ebore 0.437 in. dia; three holes drilled 0.437 in. dia: four holes ebore opposite side 0.437 in. dia; 0.688 in. c to c; hole 0.718 in. dia with area 1.68 in. dia painted white and stenciled ANT SPEED and ZERO; hole 0.718 in. dia with area 1.44 in. dia painted white and stenciled GAIN; CM and DF stenciled vertically on left side of panel. N290904	P1 O/N
E309		WASHER, insulating: flat; phenolic; 0.204 in. ID x 0.380 in. OD x 0.032 in. thk. A17023-151	
E310		CONTACT. lampholder: male; brs, tin pl; 1/4 in. OA dia x 0.410 in. OA lg. C293278	
E311 A293277		CONTACT. lampholder: female; brs, nickel pl; 0.150 in. OA dia x 0.170 in. OA lg.	
E312		INSULATOR. bushing: plastic: 0.380 in. OA dia x 0.232 in. thk; 0.254 in. ID one end, 0.112 in. ID other end and chamfered. C293279	
E313		BASE. lampholder: A1; O.562 in. OA dia x 0.338 in. lg; portion threaded 15/32-32 NEF-2. L290559	

Direction Finder Control C-572/APA-69 and direction Finder Control C-527A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
E314	R17BXR-C23554-1	CAP. lampholder: black plexiglas with red plexiglas top; 1/2 in. OA dia; 0.770 in. OA lg; portion threaded 3/8-12 NEF-2. C23566U4-1	P MO/N
E315	R16BXR-C20635671	KNOB ASSY: consists of knob, dial and attaching hardware C206357-1	P MO/N
E316	R16BXR-C20661-4	KNOB ASSY: consists of knob, dial and attaching hardware. C206S67-2	P MO/N
E317		ADAPTER, electrical accessory to cable: A1; 1-7/8 in. wd; 1-6/16 in. lg; threaded 1-7/16-18 NEF-2B. AN3057-16	
H301		SCREW, set: Bristo dr; cup point; steel, Cd pl: No. 6. NC-3; 3/16 in. lg. (4 each used) Commercial	
H302		SCREW. mach: slot dr; Bind H; bra, nickel pl; No. 2 NC-2; 3/16 in. lg. (4 each used) Commercial	
H303		WASHER, lock: phosphor bronze, nickel pl; split; No. 2. (2 each used) AN935B2	
H304		SCREW. mach: slot dr: fil b; SS. black oxidixed; No. 6-32 NC-2; 0.340 in. lg threaded 0.226 in. (2 each used) C245580-10	M1
H305		WASHER, spring: are; phosphor bronze, nickel pl: 0.375 in. OD; 0.260 in. ID; 0.013 in. thk; washer bent across grain. (2 each used) A17027-74	M1
H306	R42F70820	FASTENER, springlock: slotted hd; steel, Cd pl; 1/2 in. OA dia; 0.825 in. lg. (2 each used) A241787-1 (CLC) 2600-4	PI O/N
H307		WASHER, lock: spring cup; steel, Cd pl; int tooth; 0.450 in. OD; 1/4 in. ID; 0.15 in. thk. (2 each used) C241777-4 (CLC) YS-2600.LW	
H308		NUT, hex: bra, nickel pl; 3/8-32 NEF-2; 0.06 in. thk. HSN775B-42	
H309		WASHER, lock: phosphor bronze; nickel pl; int tooth; 3/8 in. ID; 11/16 in. OD; 0.016 in. thk. A18041-20 (SH) 1920	
H310	R16B15005	BUSHING, threaded: hex flange; bra, dull nickel; 1/2 in. wd flange; 5/16 in. lg; 0.251 in. ID; 3/8-32 NEF-2 thread. A103894-10	P1 O/N
H311		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 10-32 NF-2; 2-1/8 in. lg. (4 each used) HSN950B-29	
H312		WASHER, lock: phosphor bronze,. nickel pl; split; No. 10. (8 each used) AN935B10	
H313		SCREW, mach: slot dr; FH; bra, nickel pl; No. 6-32 NC-2; 7/16 in. lg. (4 each used) AN505B6-7	
H314		NUT, hex: bra, nickel pl; No. 6-32 NC-2 (4 each used) AN340B6	
H315	R42F24490-20	FASTENER. springlock receptacle: silicon bronze, Cd pl; flange on one end 1 in. x 1/2 in.; 0.438 in. ID; 1/2 in. lg. (2 each used) A233481-1 (CLC) 212-12	P1 O/N
H316		RIVET, solid: csink hd; A1, anodize; 0.094 in. dia; 1/4 in. lg. (4 each used) AN426AD3-4	

Direction Finder Control C-572/APA-69 and direction Finder Control C-527A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H317		SCREW, mach: slot dr; rd hd; brs. nickel pl; No. 4-40 NC-2; 5/16 in. Ig. (2 each used) AN515B4-5	
H318		NUT, hex: brs, nickel pl; No. 4-40 NC-2. (2 each used) AN340B4	
H319		WASHER: lock: phosphor bronze, nickel pl; split; No. 4. (2 each used) AN935B4	
H320		GROMMET, rubber: 3/8 in. ID: 5/8 in. OD; 6/16 in. thk. A18130-8 (ARH) 1107C	
H321		SCREW: mach: slot dr; rd hd; brs, nickel pl; No. 10-24 NC-2; 1/2 in. Ig. (4 each used) AN515B10-8	
H322		SCREW, mach: slot dr; Bind H; bra. nickel pl; No. 6-32 NC-2; 3/8 in. Ig. (2 each used) Commercial	
H323		WASHER, lock: phosphor bronze, nickel pi; split; No. 6. (6 each used) AN935B6	
H324	847 to C1 42 1-6	FASTENER, Dzus: slotted; steel, Cd pl; 0.335 in. hd dia; 0.213 in. shaft dia; approximately 1 in. Ig. (4 each used) A241961-1 (DZ) PF 3-1/2-38	P1 O/N
H326	847 to C1 42 1-	SPRING, steel: Cd pl; 0.281 in. Ig; 0.328 in. OD; 0.060 in. thk wire: 2-1/2 turns. (4 each used) A238542-1 (DZ) PS 3-1/2	P1 O/N
H326	847 to C1 42 14	RETAINER, fastener stud: steel. Cd pl; 0.373 in. dia one end; 0.255 in. dia other end; 3/8 in. Ig. (4 each used) A233970-1 (DZ) PC 3-1/2	P1 O/N
H327		WASHER, flat: brs, nickel pl; 0.261 in. ID; 3/8 in. OD; 0.020 in. thk. (2 each used) Commercial	
H328		NUT. hex: brs, nickel pl; 15/32-32 NEF-2 HSN775B-8	
H329		WASHER. lock: steel, Cd pl; int tooth; 15/32 in. ID; 19/32 in. OD; 0.026 in. thk. A18039-42	
H330	R17BXR-C293276	GROMMET, rubber: tapered edge; 0.600 in. OD one end, 1/2 in. OD other end: 0.370 in. ID. C293276	P MO/N
H331		POST. spacing: brs, nickel pl; 2.78 in. Ig x 0.312 in. dia; int threaded No. 10-24 NC-2 both ends. C234831-1	
H332		POST: spacing: brs, nickel pl; 1.66 in. Ig x 0.312 in. dia; int threaded No. 10-24 NC-2 both ends. (2 each used) C234831-2	
H333		SCREW, mach: slot dr; FH; brs. nickel pl; No. 10-24 NC-2; 1/2 in. Ig. (3 each used) AN505B10-8	
1301	R17L2126	LAMP. incandescent: 28V; 0.04 amp; T-1-3/4 bulb. AN3140-327	P1 MO/N
1302	R17L2126	LAMP, incandescent: 28V; 0.04 amp; T-1-3/4 bulb. AN3140-327	P1 MO/N
1303	R17L2126	LAMP, incandescent: 28V; 0.04 amp: T-1-3/4 bulb. AN3140-327	P1 MO/N
J301	R17R1727-60	CONNECTOR, plug: 16 male contacts, AN3102A-24-7P	P1 MO/N
N301		PLATE, identification. (used on C-527/APA-69; Contract NOas 51-134) N246667-34	

Direction Finder Control C-572/APA-69 and direction Finder Control C-527A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
N302		PLATE. identification. (used on C-527A/APA-69; Contract Noas 62-435)	
L247420-4			
N:803		PLATE. identification. (used on C-527A/APA-69; Contract NOas 51-134) (spare major units only) N246667-38	
N:104		PLATE, identification. (used on C-627A/APA-69; Contract NOas 54-359) L247420-6	
0301		SPRING, compression: steel music wire. Cd pl; 0.08 in, ID x 0.24 in. lg; closed ends. C239080-59	
0302		SPRING. ring: steel music wire, Cd pl; 0.248 in. ID; 0.066 in. opening. A249633	
P301		CONNECTOR. plug: 16 female contacts. AN3106-24-7S	
R301	R17P7470-50	VARIABLE RESISTOR ASSY: consists of two model G rheostats, each 635 ohms 75w in tandem connected by a universal coupling; OA dimensions 6.8556 in. x 2.875 in. x 4.25 in. L222974-1	P1 MO/N
R302	R16P5690-123-260	RESISTOR, variable: carbon; 100,000 ohms -20%. ERV30CR1U-104	P1 MO/N
S301	R17S28288	SWITCH, toggle: 3 pole; single throw. AN3226-2	P1 MO/N
S302	R17S28256-10	SWITCH, toggle: spdt. AN3021-2	P1 MO/N
S303	R17S28256-10	SWITCH. toggle: spdt. AN3021-2	P1 MO/N
X301	PANEL LIGHT ASSY:	1.25 in. lg x 9/16 in. dia; consists of base and cap with contact one end; nut and lock washer. MS25010-2	P1 MO./N
X302		PANEL LIG(HT ASSY: 1.25 in. lg x 9/16 in. dia; consists of base and cap with contact one end; nut and lock washer.	P1 MO/N
X303	MS25010-2	PANEL, LIGHT ASSY: 1.25 in. lg x 9/16 in. dia; consists of base and cap with contact one end: nut and lock washer. M S25010-2	P1 MO/N

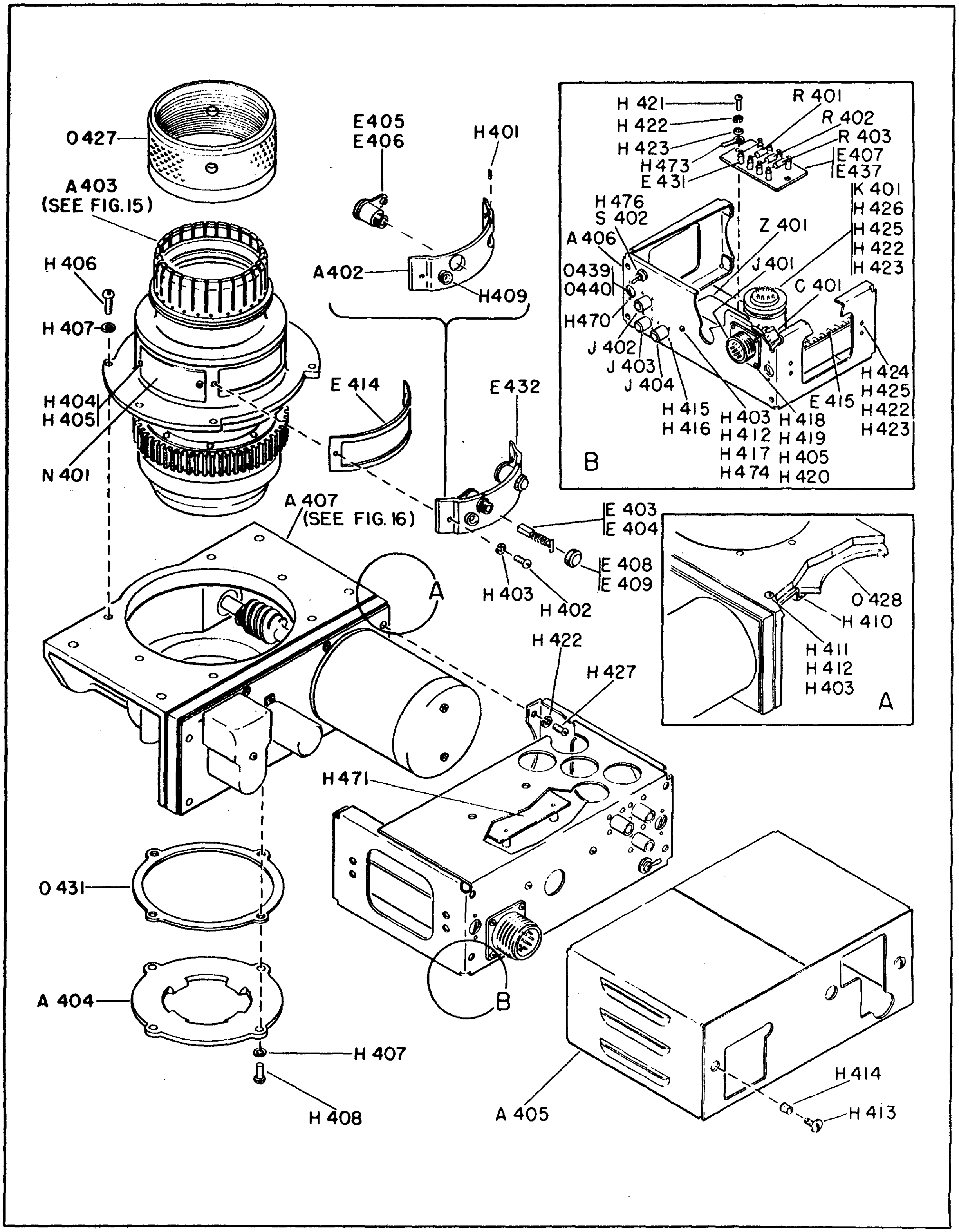


Figure 14. Antenna Drive TG-8/APA-69

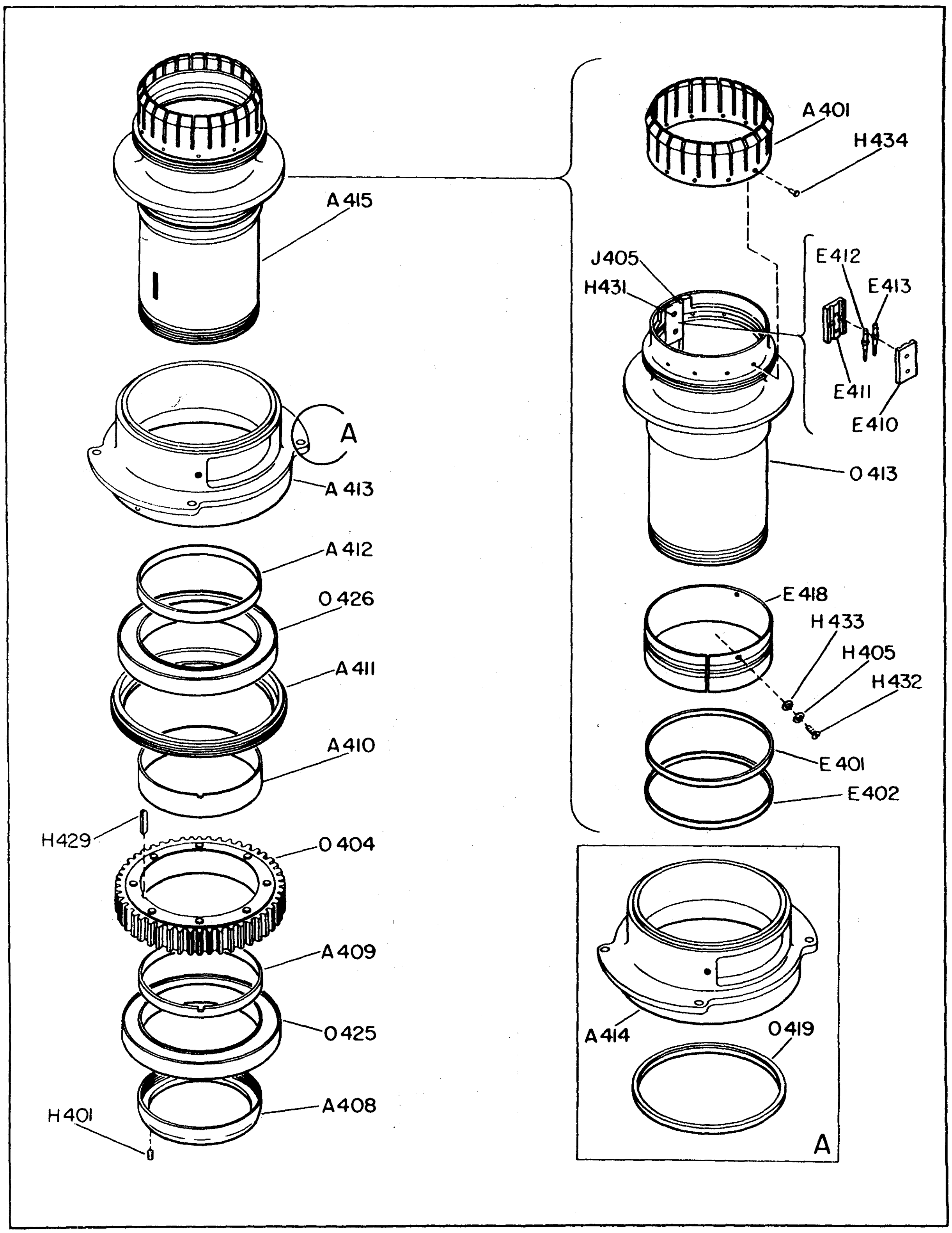


Figure 15. Spindle and Bearing Assembly

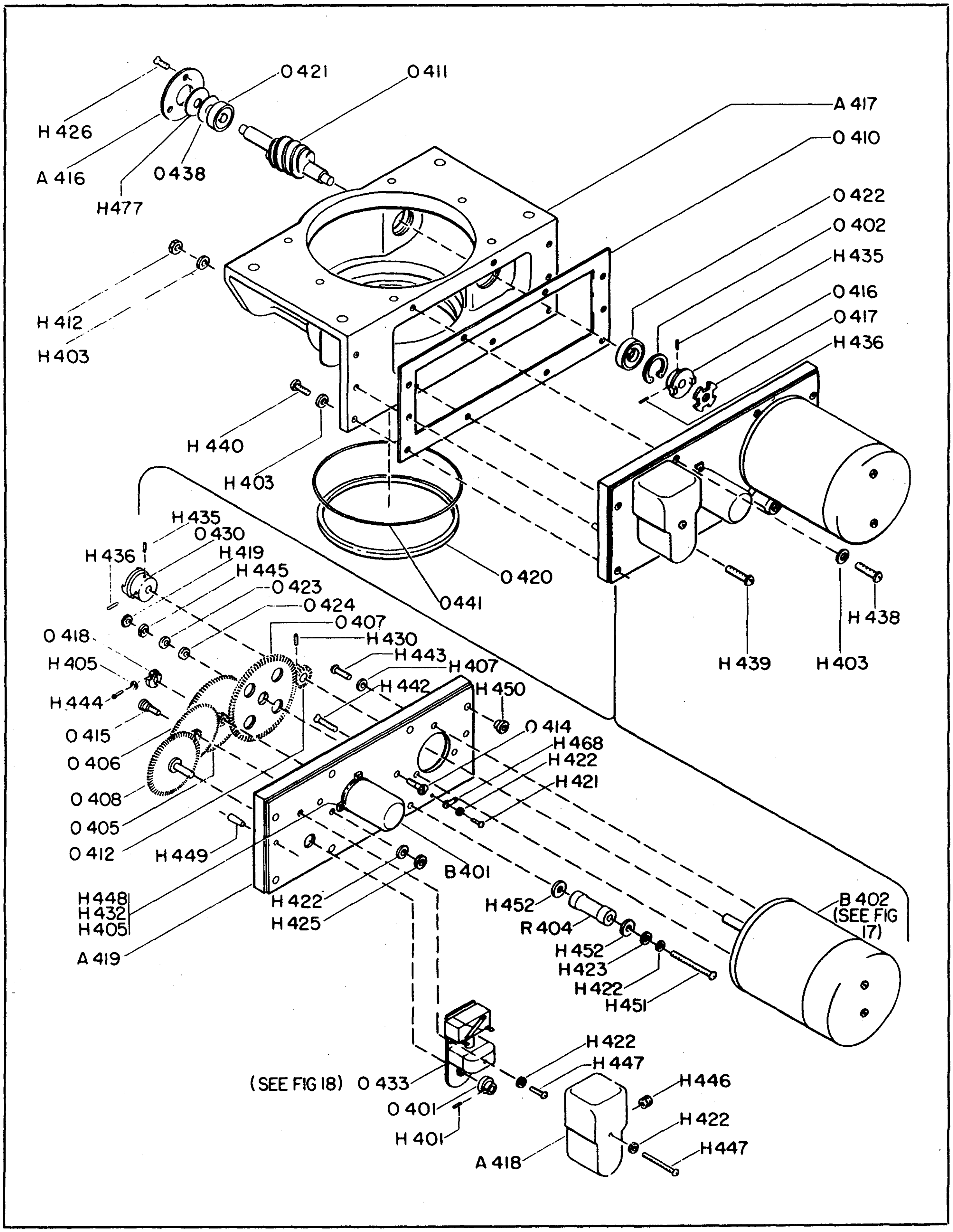


Figure 16. Housing Assembly

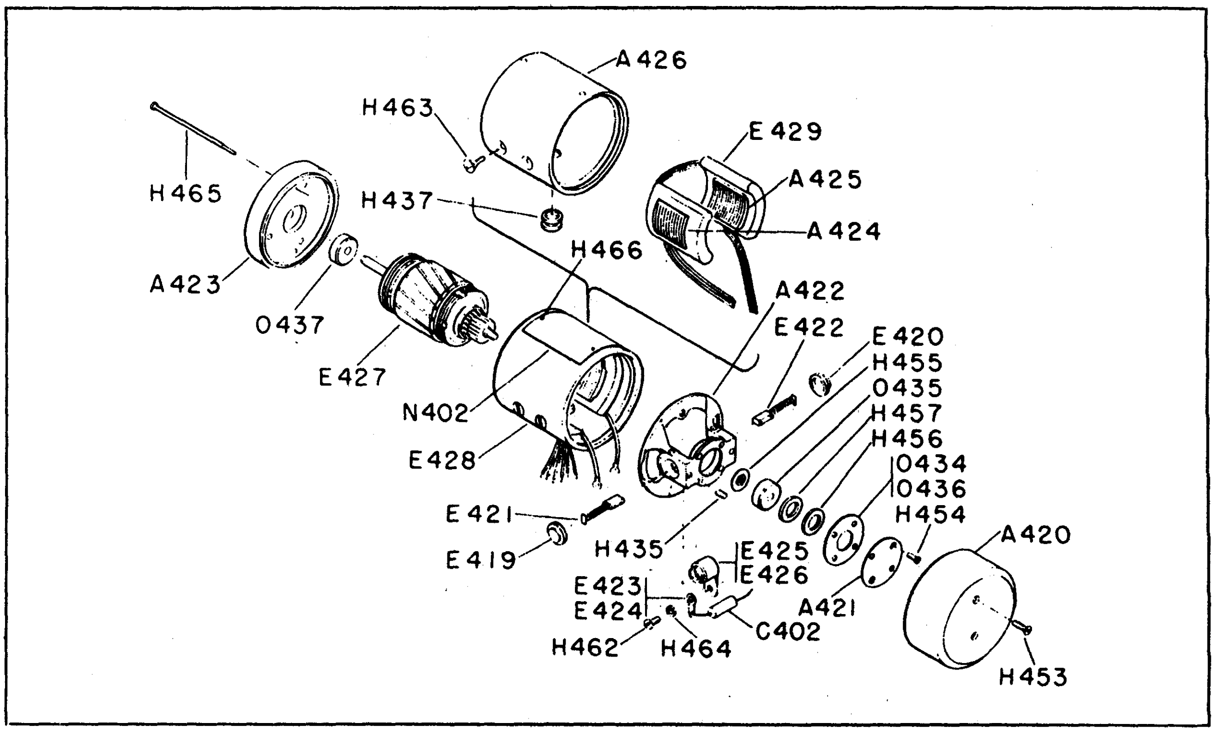


Figure 17. DC Motor

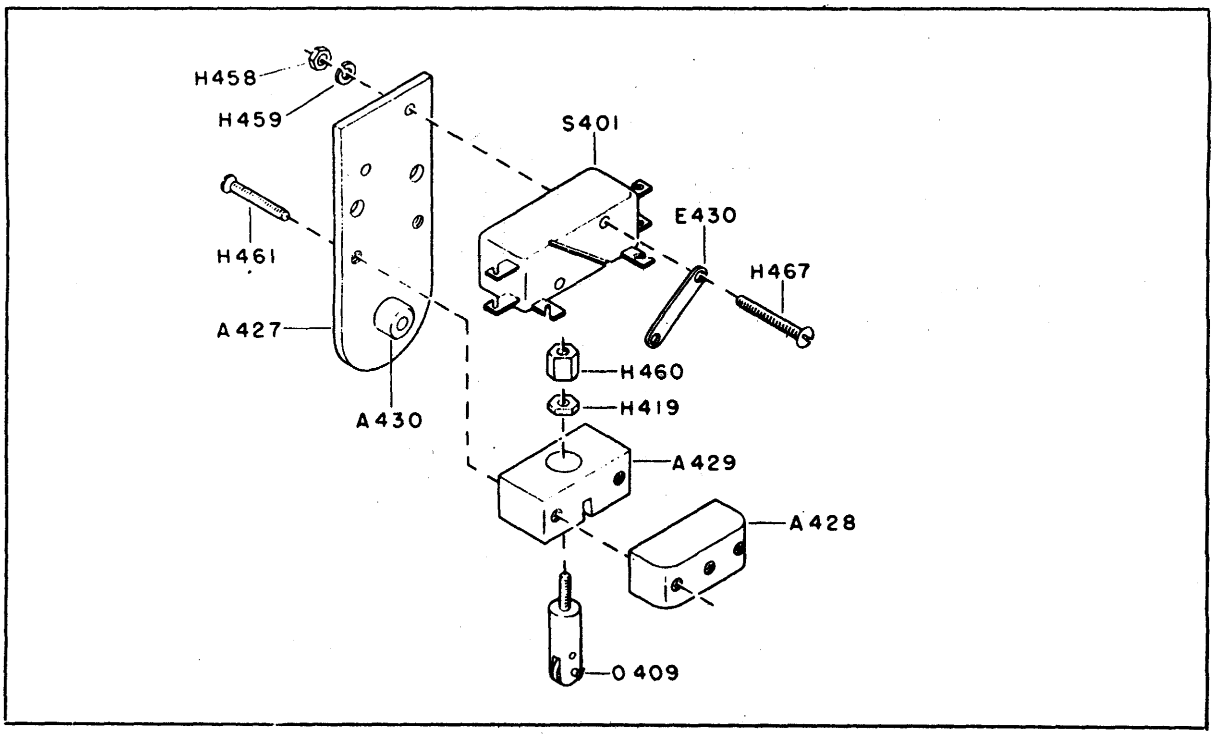


Figure 18. Switch and Plunger Assembly

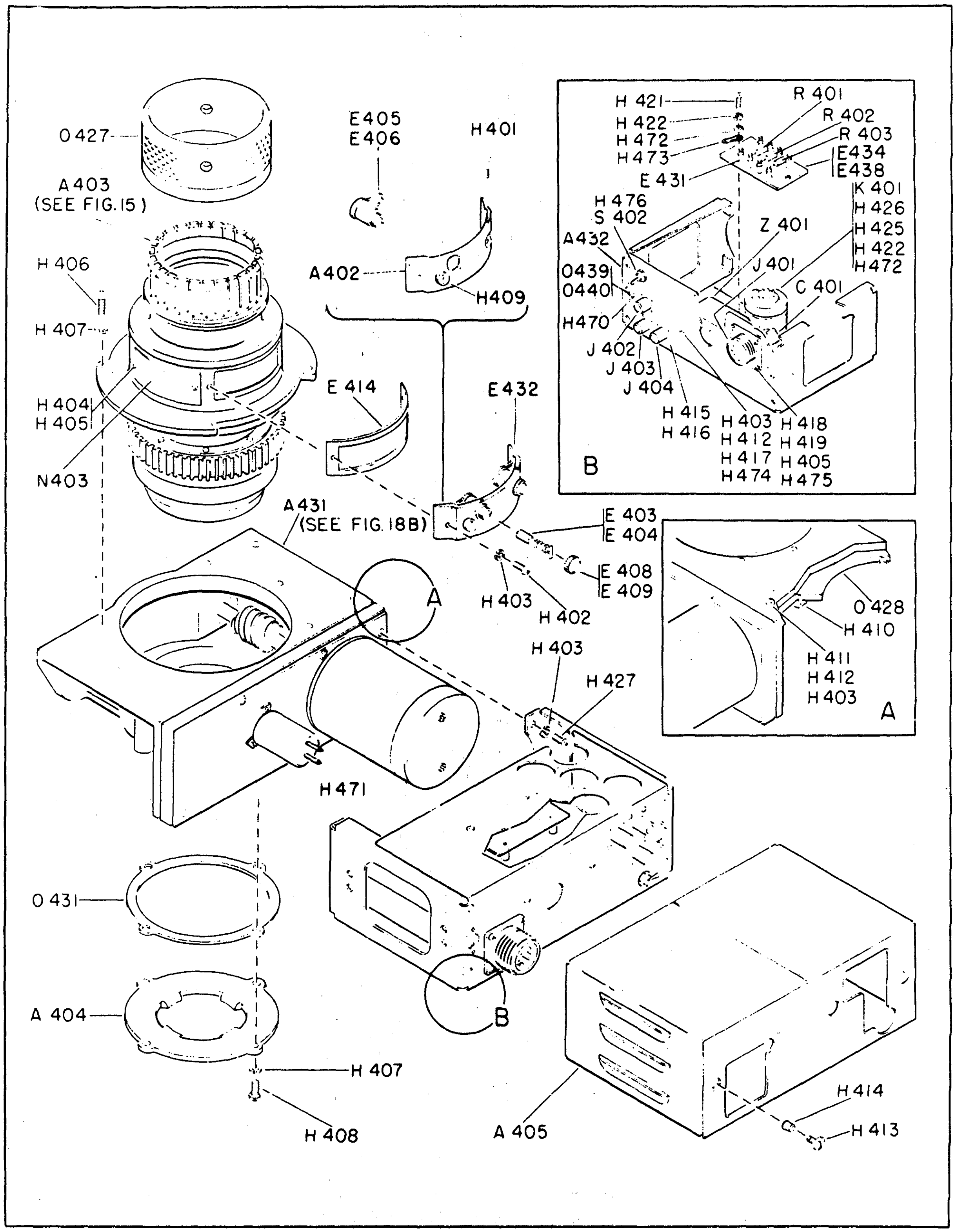


Figure 18A. Antenna Drive TG-8A APA-69

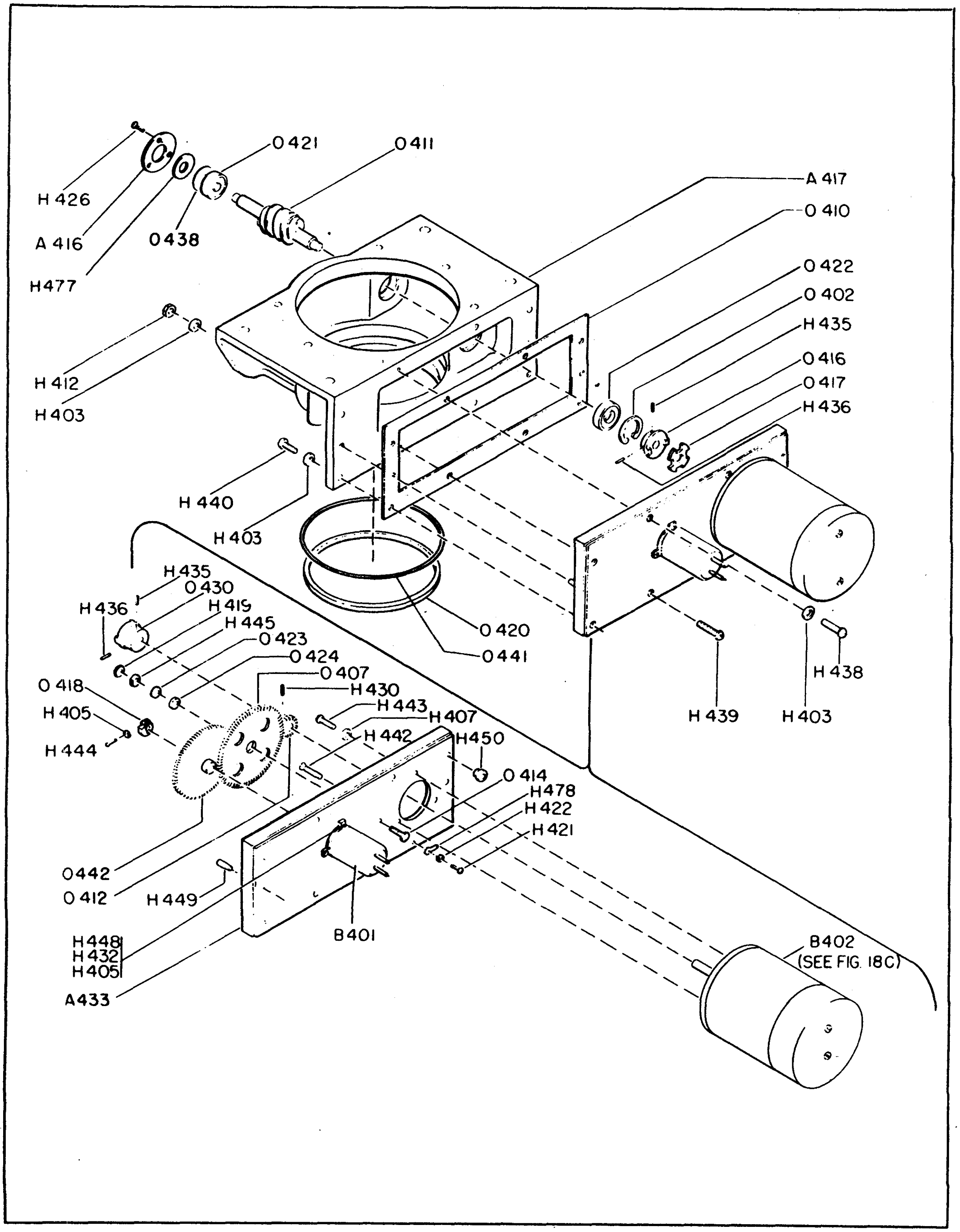


Figure 18B. Housing Assembly

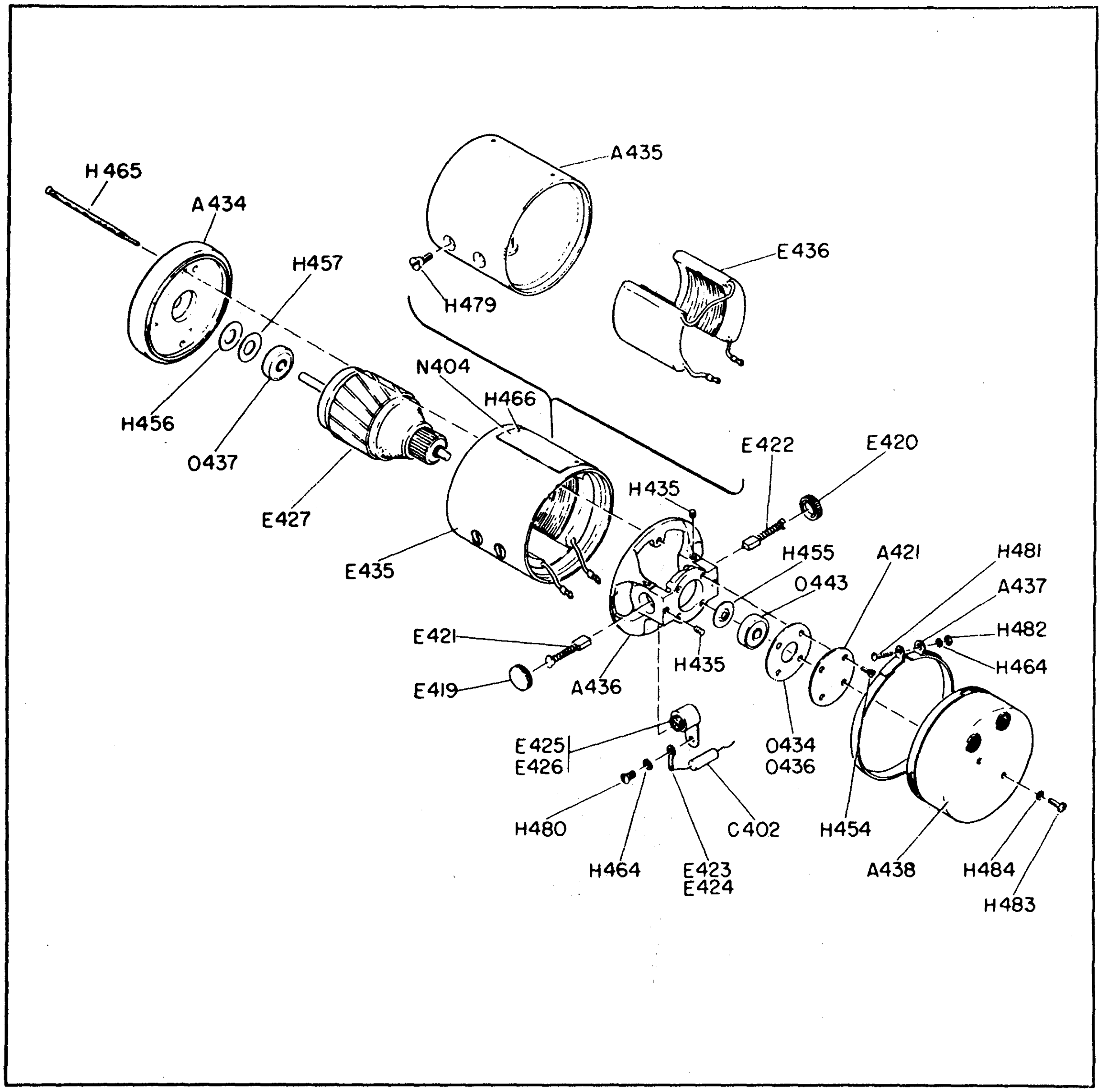


Figure 18C. DC Motor

42D

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69

Ref Symbol No.	Stock no.	Description	Source Code
401-499 series	R16AN-TC.-RAPA-69 (BXR)	ANTENNA DRIVE TG-R/APA-69 R200331-I	P1 MO/R
401-499 series		ANTENNA DRIVE TG-XA./APA-f,9	R650263-1
A401	R16BXR-C239699	COLLAR. spring,: SS. passivated; 3 in. OD; 1.245 in. Ig: 24 slots 1 in. deep evenly spaced around collar. C239699	P1 O/N
A402	R16BXR-C22F28C	BRACKET. brush: die east A1. black wrinkle enamel: 102° arc; 1.08 in. wd x 9/32 in. thk: approximately 4-1/2 in. Ig. C22R2F6	P1 O/N
A403	R16BXR-N203288-1	SPINDLE AND BEARING ASSY: consists of cylinder 6-:1/4 in. lg mounted with gear and ball .bearings. N203288-1	P1 O/N
A404	R16BXR-C22R470	PLATE Iock: SS. passivated; 4.781 in. OD x 1/8 in. thk x 1.937 in. ID: four P1 O/N protrusions evenly spaced around edge drilled with 0.213 in. hole, in each; four protrusions from center drilled with 0.03112 in. csink hole in each. C228470	
A405		COVER ASSY: A1. black wrinkle finish: 7.74 in. Ig: 5.06 in. wd: :3.06 in. deep: three louvers on each end spotwelded: 2 irregular shaped cutouts, in side. I.203245-1	M1
A406		COVER SUPPORT ASSY: A1. etched finish: 7.70 in. Ig x : 3.00 in. wd x 3.80 in. deep. Bracket mounted on each end of cover extending 1.14 in. outside of cover. Five holes drilled in cover for four jacks and one switch. Symbol numbers stenciled on top. N203251-1	M1
A407		HOUSING ASSY: consists of a rectangular housing 7.80 in. lg x 4.60 in. wd x 3.13 in. thk; oil seal pressed in center; with generator: motor: switch and plunger. R203323-1	
A408	R16BXR-A241629	NUT, spindle: SS. passivated: 2.500 in. ID one end: 2-7/8-16 thread class 2 fit on other end: 0.460 in. thk; two No. 4-40 NC-2 holes tapped on opposite sides. A241629	P1 O/N
A409		SLEEVE: SS. passivated; 2.940 in. ID; 3.06 in. OD; 0.276 in. wd: slotted 0.14 in. deep x 0.14 in. wd in one end. A233305-1	M1
A410		SLEEVE: SS. passivated; 2.940 in. ID x 3.060 in. OD x 0.64X in. wd; slotted 0.14 in. deep x 0.14 in. wdt in one end. A 233305-2	M1
A411	R161XR-A239707	RING, retainer: bearing; A1, anodized: 3.882 in. ID on one side: 3.80 in. ID on other side; 4.130 in. OD on one side; other side threaded for 4-1/4-16 class 2 fit; 2 Slots. 1 in. wd. cut on inside of ring opposite one another. A239707	P1 O/N
A412		SLEEVE: SS, passivated; 2.940 in. ID x 3.060 in. OD x 0.280 in. wd. A233336	M1
A413		FLANGE RING ASSY: consists of a flange ring and oil seal. C203416-1	A
A414	R16BXR-N239649	RING A1, black wrinkle enamel; 3.60 in. ID one end; 4-1/4-16 thread class 2 fit on other end; OA OD 5.34 in.; 2.12 in. thk: flange on opposite sides of ring: three 0.213 in. holes drilled in each flange; two No. 8-32 NC-2 holes tapped thru threaded portion 90° apart, rectangular cutout in side of ring. N239649	P1 O/N
A415	R16BXR-N203290-1	SPINDLE ASSY, cylindrical: 6-3/4 in. Ig; 4 in. OA dia. N203290- 1	F1 MO/N
A416		PLATE. Bearing: A1, black alumilite; 1.480 in. OD; 0.091 in. thk; 0.68 in. csink hole 0.0:3 in. deep in center: three 0.159 in. csink holes drilled 120° apart. A228393	M1
A417	R16BXR-OR228330	HOUSING, rectangular: A1, black wrinkle enamel; 7.80 in. Ig x 4.60 in. wd x 3.13 in. thk; 4.40 in. hole thru center of housing; 0.281 in. hole in each corner ebore 1/2 in. dia x 0.04 in. deep. R228330	P1 O/S
A418		COVER. switch: A1. etched; 2.50 in. lg x 1.38 in. wd tapering to 1.04 in. wd about center rounding at that end: 1.02 in. deep; 0.161 in. hole drilled in center; cutout on one side. L228438	M1

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
A419		PLATE, gear: A1. black wrinkle enamel: rectangular: 7.80 in. lg x 3.10 in. wd x 0.500 in. thk; 27 hole of varying sizes drilled unevenly thru rectangle. N228336	M1
A420		COVER end: steel; 2.709 in. ID x 1.036 in. thk: two hole. 0.125 in. dia drilled 1.086 in. c to c. (BARB) RB-2788-3	
A421		PLATE, hearing retainer: steel: 1-23/64 in. dia: 0.031 in. thk: two 0.120 in. dia holes equally spaced near edge: two 0.230 in. clink holes equally spaced near edge. (BARB) RB-2768-1	
A422		HEAD: A1 die casting : bell shaped 2.707 in. dia large end. 1-11/16 in. dia small end 1.093 in. lg; 0.747 in. hole in small end : two 1/2 in. holes for brushes in arms. (BARB) RD-3648-1	
A423		HEAD, shaft end: A1: 2.750 in. dia : 0.686 in. thk: hole 0.296 in. ebore 0.7477 in. ; two, 0.140 in. csink holes drilled on 1.958 in. dia: three No. 10-24 holes tapped 11/32 in. spaced on 1.750 in. dia; 3/32 in. sq slot cut in ebore side. (BARB) RB4270-1	
A424		POLE SHORE ASSY: laminated steel. dull black laquer: 1-5/8 in. lg x 1-1/4 in. wd x 7 x in. thk: curved : laminated steel riveted: two No. 8-32 csink holes tapped 7/32 in. deep on unpainted surface. (BARB) RB-5316-1	
A425		POLE SHORE ASSY: laminated steel dull black laquer: 1-5/8 in lg x x1-1/4 in . wd x 7/32 in. thk: curved: laminated section riveted: two No. 8-32 csink holes tapped 7/32 in. deep on unpainted surface (BARB) RB-5316-1	
A426		YOKE cylinder: seamless, tubing black ,wrinkle enamel: 2.750 in. OD: 2.375 in. lg: both ends ebore 0.437 in. hole drilled in center of side 5/8 X 14 in. dia ebore: two sets of two 0.169 in. thru 0.375 in. apart on opposite sides of cylinder. (BARB) RC4284-1	
A427		SWITCH PLATE ASSY: consists of A1 plate 2.44 in. lg x 0.96 in. wd x 0.091 in. thk rounded on one, end: two 0.128 in. csink holes 1.13 in. from, rounded end, one on either side, a bearing sleeve pressed in center of rounded end: five various size holes drill in plate. C205673-1	
A428		SUPPORT, cover: A1. etched finish: 0.96 in. lg x 0.400 in. wd x 0.400 in. thk; corners rounded on one side: No. 4-40 NC-2 tapped hole in center: No. 4-40 NC 2 tapped hole in center: No. 4-40 NC-2 tapped hole 0.350 in. each side of center. A228437	M1
A429		BLOCK, guide: brs, nickel pl: 0.96 in. lg x 0.500 in. wd x 0.400 in. thk: 0.281 in. hole in center: 0.080 in. wd slot width of block across center hole: two 0.128 in. holes drilled thru width of block one on each side of slot. A233393	M1
A430		BEARING. sleeve, phosphor bronze: 0.406 in. dia head : 0.370 in. OA length: length of shaft 0.270 in.: straight knurled band on shaft directly below head; 0.125 in. hole in center thru head and shaft csink both ends. A240265	M1
A431		HOUSING ASSY: consists of rectangular housing with 2 gear assemblies. DC Motor (B402) and AC Generator (B402). R283044-1	
A432		COVER SUPPORT ASSY: A1, etched finish: 7.75 in. lg x 3.00 in. wd x 5.00 in. deep. Five holes drilled in cover for four jacks and one switch. Symbol numbers stenciled on top. N283042-1	
A433		PLATE, gear: die cast. A1, black wrinkle enamel: 7.80 in. lg x 3.10 in. wd x 0.50 in. thick: 27 holes of varying sizes drilled unevenly through rectangle: stenciled on outer side. N685562-1	
A434		HEAD, shaft end: A1. (BARB) RC6510-1	
A435		YOKE, cylinder: seamless tubing, black wrinkle enamel. (BARB). RC-6493-1	
A436		HEAD. brush end :A1 die casting: bell shaped. (BARB) RB-2785-4	
A437		CLAMP ASSY. (BARB) RB-4606-1	

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
A438		COVER. end: steel. (BARB) RB-6501-1	
B401	R17BXR-L224270-1	GENERATOR. ac: rotor input 26V: 0.1 amp; 2 ph stator; 1 ph rotor: 1.734 in. lg x 1.062 in. dia: shaft 0.453 in. lg: six leads on motor (used on TG-8/APA.-69). L224270-1 (KER) R230-2-A	P1 MO/N
B401		in. lg x 1.062 in. dia: shaft 0.453 in. lg; six lead (used on TG-8A/APA-69) L224486-1	
B402	R17BXR-L222802	MOTOR. dc: 27.5V: 4.800 to 5.200 rpm: 10 oz.-in. nominal load; 3.625 in. lg x 2.75 in. dia: shaft 0.812 in. lg; seven leads (used on TG-8/APA-69) L222802 (BARB) RC-4285-1	P1 MO/N
B402		MOTOR. dc: explosion proof: 27.5V: 4.800 to 5.200 rpm; 10 oz-in. nominal head: 4.032 in. lg x 2.88 in. dia; shaft 0.937 in. lg: 2 leads (used on TG-8A/APA-69) N221111-1 (BARB)-RC-6498-1	
C401	R16C10492-56	CAPACITOR, fixed: mien; 0.01 uf ±5%; 300 vdcw. CM35C103J	P1 MO/N
C402	R16C11262-700	CAPACITOR. fixed: paper: 0.022 uf ±10%; 600 vdcw. L220221-1 (SPR),96P22396S4	P1 MO/N
E401	R17BXR-A239682	RING,. collector: coin silver laminated brass; 3.160 in. ID: wall .040 in. thk: ring : 0.125 in. thk. A239682	P1 MO/N
E402	R17BXR-A239682	RING. collector: coin silver laminated brass; 3.160 in. ID: wall 0.040 in. thk: ring 0.125 in. thk. A239682	P1 MO/N
E403	R16B12200-10	BRUSH. output: HV: electrical contact: 7/16 in. lg x 1/4 in. wd x 0.093 in. thk brush: 0.688 in. lg copper wire spring on brush with brs, silver plate cap on other end of spring; positive brush. A118521-1 (BARB) RC-226-13	P1 MO/N
E404	R16B12200-10	BRUSH. output: HV: electrical contact: 7/16 in. lg x ¼ in. wd x 0.093 in. thk brush 0.688 in. lg copper wire spring on brush with bra. silver plate cap on other end of spring; positive brush. A1621-1 (BARB) RC-226-13	P1 MO/N
E405		HOLDER. brush: insulated; L-.shaped: one end 0.765 in. lg x 0.499 in. OD: 0.500 in. OA dia; 0.193 in. tapped 3/8-32 NEF-2 : double key way to 0.252 in. lg x 0.196 in. wd in center: arm extending 0.875 in. front center of key way 0.375 in. wd: rounded end with 6-32 tap. (BARB)-RB-4111-1	
E406		HOLDER. brush: insulated L-shaped: one end 0.765 in. lg x 0.499 in. OD: 0.500 in. OA dia: one end threaded :3/8-32 NEF-2; double key way 0.252 in. lg x 0.196 in. wd in center: arm extending 0.875 in. from center of key way 0.375 in. wd: rounded end with 6-32 tap. (BARB) RB-4111-1	
E407		BOARD ASSY. terminal: consists of eight terminal lugs mounted on terminal board. C203634-1	
E408	R17C2952	CAP. brush holder: black bakelite top; 9/16 in. OD: brs, insert thread 3/8-32 NEF-2; knurled band. (MTM) 682S (BARB) RH-3142-1	P1 MO/N
E409	R17C2952	CAP. brush holder: black bakelite top: 9/16 in. OD; brs insert threaded 3/8-32 NEF-2; knurled band. (MTM) 682S (BARB) RB-3142-1	P1 MO/N
E410		BLOCK. connector: black plastic: in. lg x 0.58 in. wd: 0.12 in. thk: two semi. circular slots 0.094 in. radius 0.070 in. wd in center of mount: two 0.062 in. radius semi-circular grooves the length of mount: two 0.128 in. csink holes evenly spaced at right angles to the grooves. A228415-1	X1
E411		BLOCK. connector: black plastic; 1 in. lg x 0.58 in. wd: 0.12 in. thk: two semi-circular slots 0.094 in. radius 0.070 in. wd in center of mount; two 0.062 in. radius semi-circular groove. the length of mount; two 0.12i8 in. holes evenly spaced at right angles to the grooves. A228415-2	X1

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
E412		CONTACT, male: brs, silver pl: 0.92 in. OA lg: 0.160 in. OA dia: 0.110 in. dia one end with 0.59 in. hole drilled 0.26 in. deep: 0.047 in. hole drilled thru shaft at right angle to 0.059 in. hole 0.12 in. from end; other end is pointed male contact A243003	X1
E413		CONTACT. male: brs. silver pl: 0.92 in. OA dia: 0.160 in. OA din: 0.110 in. dia one end with 0.0559 in. hole drilled 0.26 in. deep: 0.047 in. hole drilled thru shaft at right angle to 0.059 in. hole 11.12 in. from end; other end is pointed male contact. A243003	X1
E414		GASKET, rectangular, neoprene 40-50 diameter: 3.64 in. lg x 1.08 in. wd x 0.031 in. thk: centered cutout 2.80 in. lg x 0.88 in. wd: 0.189 in. hole centered on each end. A23348	
E415	R1711211PS3-84	BOARD, terminal: black plastic: 3-13, 16 in. lg x 1-1/8 in. wd x ½ in. OA thickness: seven terminals equally spaced at 7/16 in.: two 0.175 in. holes evenly spaced on both ends: furnished with 6-32 x ¼ in. brs , nickel pl screws. C5995-6 (JNS) 7-141A	P1 O/N
E416		NOT USED	
E417		NOT USED	
E418	R16BXR-C242999	INSULATOR, ring: natural plastic: 3.20 in. OD: 3.060 in. ID: 1.04 in. wd: two grooves 0.125 in. wd around ring: three 0.128 in. holes evenly spared around rim of ring. C242999	P1 O/N
E419	R17C2952	CAP. brush retaining: HV: moulded bakelite: 0.563 in. dia: 1/4 in. ; brs insert; tapped 3 8/32 NEF-2: edge of cap is knurled. (MTM) 682S (BARB)-RB-3142-1	P1 O/N
E420	R17C2952	CAP, brush retaining: HV: moulded bakelite: 0.563 in. dia: 1/4 in. lg; brs insert; tapped 3/8-32 NEF-2: edge of caps is knurled. (MTM) 682S (BARB) RB-3142-1	P1 MO/N
E421		BRUSH ASSY: carbon: 17/32 in. lg x 0.250 in. wd x 0.156 in. thk: spring on brush lead held on by metal cap: stamped negative. (BARB) RC-226-12	
E422		BRUSH ASSY: carbon: 17/32 in. lg x 0.250 in. wd x 0.156 in. thk: spring on brush lead held on by metal cap: stamped positive. (BARB) RC-226-11	
E423		TERMINAL, lug: solderless: 0.593 in. lg: 0.203 in. wd; 0.018 in. thk: for stud No. 6. C92650-23 (ARP) 31681	
E424		TERMINAL. lug: solderless; 0.593 in. lg; 0.203 in. wd; 0.018 in. thk: for stud No. 6 C92650-23 (ARP) 31681	
E425		BRUSH HOLDER AND INSULATOR ASSY: consists of a brs holder 0.756 in. lg x 0.382 in. OD: threaded on one end 3/8-32 NEF-2: an arm 1.062 in. lg x 1/2 in. wd OA soldered to holder; insulator 1/2 in. OD x 15/32 in. lg slipped cover holder. (BARB) RB-197-2	
E426		BRUSH HOLDER AND INSULATOR ASSY: consists of a brs holder 0.75 in. lg x 0.382 in. OD; threaded on one end 3/8-32 NEF-2; an arm 1.062 in. lg x 1/2 in. wd OA soldered to holder; insulator 1/2 in. OD a 15/32 in. lg slipped over holder. (BARB) RB-1987-2	
E427		ARMATURE ASSY: 4-1/2 in. lg; approximately 1-/8 in. dia (BARB) RC-4290-1	
E428		YOKE AND FIELD COIL ASSY: 2 in. lg; 2-3/4 in. dia; seven leads.: lugs on blue and green leads only. (BARB) RB-4282-1	
E429		FIELD COIL ASSY: consists of two coils wound on square curved coil forms; coils are connected in both shunt and series. (BARB) RC-4279-1	
E430		STRAP: steel, Cd pl: 0.75 in. lg; 0.16 in. wd; 0.030 in. thk; ends rounded; 0.101 in. hole in each end. C24746-8	M1
E431	R17BXR-B13020-4	TERMINAL. lug: brs, hot tinned: 3/16 in. dia: 0.400 in. lg. (8 each used) B13020-4	P1 O/N
E432	R16BXR-C206352-1	BRUSH HOLDER ASSEMBLY: consists of a bracket, 2 brushes, 2 brush holders. with 2 caps. C206352-1	P1 MO/N
E433	R17A2299	ADAPTER, electrical accessory to cable: A1: 1-7/16 in. wd; 1-1/8 in. lg; threaded 1-20 UNEF-2B. AN3057-10	

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
E434		BOARD ASSY. terminal: consists eight terminal lugs mounted ,on terminal board. C203634-3	
E435		YOKE AND FIELD COIL ASSY: consists of yoke with field coil pressed inside 2 leads. on field coil. (BARB) RB-6492-1	
E436 .		FIELD COIL ASSY: consist of two coils wound on square curved coil forms: coils are connected in both shunt and series	
E437		RESISTOR ASSY: consists of terminal board (E407) and 3 resistors (R401), R402, R403). C203634-2	
E438		RESISTOR ASSY: consists of terminal board (E434) and 3 resistors (R401, R402, R403). C203634-4	
H401		SCREW. set: Bistro dr: cup point: steel, cd pl: No. 4-40 NC-3: 1.8 in. lg (6 each used) Commercial	
H402		SCREW. mach: slot dr: Bind H brs, nickel pl: No. 8-32 NC-2: 7/16 in lg.(2 each used) Commercial	
H403		WASHER. lock: phosphor bronze, nickel pl: split: No. 8 (3 each used) AN935B8	
H404		SCREW. mach: slot: dr, Bind H: brs, nickel pl: No. 4-40 No.-2 : ¼ in. lg (2 each used) Commercial	
H405		WASHER. lock: phosphor, bronze. nickel pl: split; No. 4. (13 each each used) AN935B4	
H406		SCREW. mach: slot dr: fil h: brs. nickel pl: No.. 10-24 NC-2: 5/8 in lg (6 each used) AN500B10-10	
H407		WASHER. lock: phosphor bronze. nickel pl: split; No. 10. (12 each used) AN935B10	
H408		SCREW. mach: slot dr: Bind H: brs. nickel pl: No. 10-24 NC-2; 1.2 in. lg. (4 each used) Commercial	
H409		GROMMET: black rubber: 3/16 in. ID: 7/16 in. OD: 7/32 in. thk. A18143-6 (LAV) 903	
H410		CLAMP: A1: 0.040 in. thk: etched: irregular shape: 0.60 in. wd: approximately 1.08 in. lg: hole 0.1819 in. in one end. A295114	
H411		SCREW, cab: slot dr; Bind H: brs. nickel pl: No. 8-32 NC-2: 1/2 in. Ig. Commercial	
H412		NUT. hex: brs. nickel pl; No. 8-32 NC-2, (5 each used) AN340B8	
H413	R42F36080	FASTENER. Dzus: carbon steel. Cd pl: 0.300 in. Ig: 7/16 in. dia of head: slotted: irregular cutout at end of shaft , fit into spring. (2 each used A18366-1 (DZ) AJ4-30	P1 O/N
M414	847-2859- to CL 42 1-5	GROMMET. Dzus: A1; 0.025 in. wall: 0.250 in. lg: 5/16 in. OD one end; other end flared. (2 each used) A18132-5 (DZ) GA4-250	P1 O/N
H415		SCREW. mach: slot dr: rd bd: bra. nickel pl; No. 3-56 NF-2; 3/16 in. Ig. (12 each used) HSN949B-14	
H416		WASHER. lock: phosphor bronze, nickel pl: split: No. 3. (12 each used) AN935B3	
H417		SCREW. mach: slot dr: rd hd: brs. nickel ,No. 8-32 NC-2: 5/16 (2 each used) AN515B8-5	
H418		SCREW. mach: slot dr: Bind H: brs. nickel pl: No. 4.40 NC-2: 3/8 in. lg. (4 each used) Commercial	
H419		NUT. hex: brs, nickel pl: No. 4-40 NC-2. (6 each used) AN340B4	
H420		TERMINAL lug: brs. hot tinned: 0121 in. hole drilled in one end 5/64 in. hole drilled in other end. Commercial	
H421		SCREW. mach: slot dr,: rd: hd: brs nickel pl: No. 6-32 NC-2: 5/16 in. lg. (3 each used) AN515B6-5	

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H422		WASHER. lock: phosphor bronze. nickel pl: split; No. 6.-32 each used on TG-8/APA-69 (9 each used on TG-8A/APA-69) AN935B6	
H423		WASHER, flat: brs. nickel pl; 5/16 in. OD: 0.147 in. ID; 0.028 in. thk: for No. 6 screw. (9 each used) AN960B6	
H424		SCREW. mach: slot dr; FH; bra. nickel pl: No. 6-32 NC-2; 5/8 in. lg (4 each used) AN505B6-10	
H425		NUT. hex: brs, nickel pl: No. 6-32 NC-2. (7 each used on TG-8-/APA-69) (2 each used on TG-8A/APA-69) AN340B6	
H426		SCREW. mach: slot dr: FH; brs, nickel pl; No. 6-32 NC-2: 3/8 in. lg. (5 each used) AN505B-6	
H427		SCREW. mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2: 1/2 in. Ig. (4 each used) AN515B6-8	
H429		NOT USED	
H429		KEY, rectangular: steel bar: 3/4 in. Ig; 0.125 in. wd; 0.125 in. thk. A241178-1	M1
H430		SCREW. set: Bristo; cup point; steel. Cd pl; No. 6-32 NC-3: 1/8 in. Ig. (2 each used) Commercial	
H431		SCREW, mach: slot dr: FH; bra. nickel pl: No. 4-40 NC-2; 3/8 in. lg. (2 each used) AN505B4-6	
H432		SCREW, mach: slot dr; rd hd: brs. nickel pl: No. 4-40 NC-2: 1/4 in. lg (6 each used) AN515B4-4	
H433		WASHER. flat: brs, nickel pl; 9/32 in. OD; 0.119 in. ID: 0.025 in. thk; for No. 4 screw. (3 each used) AN960B4	
H434		RIVET, solid- FH; A1. anodized: 0.094 in. dia: 5/16 in. lg ,(10 each used) AN442AD3-5	
H435		SCREW, set: Bristo dr; cup point; steel, Cd pl; No. 6-32 NC-3; 3/16 in lg. (6 each used) Commercial	
H436		PIN, taper: SS, passivated; No. 6/0; 9/16 in. lg. (2 each used) Commercial	
H437		GROMMET: rubber; round edge; 19/64 in. ID: 39/64 in. OD: 0.235 in. thk. (BARB) RB-198-2 (CAN) 8677	
H438		SCREW, mach: slot dr; fil h; brs. nickel pl; No. 8-32 NC-2; 5/8 in. Ig. (2 each used) AN500B8-10	
H439		SCREW, mach: slot dr; rd hd; brs. nickel pl; No. 8-32 NC-2; 7/8 in. Ig. (2 each used) AN515B8-14	
H440		SCREW. mach: slot dr; rd bd; brs, nickel pl; No. 8-32 NC-2; 5/8 in. Ig. (4 each used) AN515B8-10	
H441		NOT USED	
H442		SCREW. mach: slot dr; FH; brs, nickel pl; No. 10-24 NC-2; 3/8 in. lg. AN505B10-6	
H443		SCREW. mach: slot dr; rd bd; brs. nickel pl; No. 1-24 NC-2; 1/2 in. lg. (2 each used) AN515B10-8	
H444		SCREW, mach: slot dr; fil h; brs, nickel pl; No. 4-40 NC-2; 3/8 in. lg. AN500B4-6	
H445		NUT. shoulder: SS, passivated; circular with opposite sides cut off; 0.340 in. across flats x 0.400 in. dia; 0.090 in OA thickness; tapped 4-40 NC-2 in center. A241669	M1
H446		GROMMET. black rubber: 1/4 in. ID; 1/2 in. OD; 5/32 in. thk. A18131-23 (ARH) 1122	
H447		SCREW. mach: slot dr; rd bd; brs, nickel pl; No. 6-32 NC-2; 1/4 in. Ig. (3 each used) AN515B6-4	
H448		LUG. clamp: A1. etched; 0.36 in. lg x 0.30 in. wd x 0.110 in. thk; one side concave; hole 0.128 in. drilled in center (3 each used) A243083	M1

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H449		PIN. straight: steel drill rod, Cd pl: 0.125 in. Ig. (2 each used) Commercial	
H450		INSERT. offset: brs. nickel pl: in. Ig: one end 0.383. in. dia knurled 0.22 in.; 0.248 in. OD other end: tapped 8-32 NC-2 center of insert. (4 each used) A245713	
H451		SCREW. mach: slot dr brs, nickel pl; No. 6-32 NC-2; 1-1/4 in. Ig. AN245713	
H452		WASHER: insulating natural phenolic in. OD; 0.157 in. ID: 0.0312 in. thk. (2 each used) Commercial	
H453		SCREW. mach: slot dr: Bind H: steel, Cc pl: No. 4-40 NC-2: 5/16 in. lg. (2 each used) Commercial	
H454		SCREW. mach. slot dr: FH: steel. Cd pl: No. 4-40 NC-2; 1/4 in. Ig. (2 each used) AN505-4-4	
H455		SLINGER oil: steel: 5/8 in dia: 0.020 in. thk; 0.312 in. offset in center: 0.1989 in. hole drilled in offset. (BARB) RB-2770-1	
H456		WASHER. flat: fish paper: 47/64 in. OD: 7/16 in. ID; 0.005 in. thk. (As required) (BARB) RB-102-3	
H457		WASHER. flat: fish paper: 47/64 in. OD; 716 in. ID: 0.010 in. thk. (As required) (BARB) RB-102-4	
H458		NUT. hex: brs. nickel pl; No. 2-56 NC-2. (2 each used) AN340B2	
H459		WASHER. lock: phosphor bronze. nickel pl: split; No. 2. (2 each used) AN935B2	
H460		SPACER, hex: cres; 0.200 in. lg 1/4 in. across flats; tap thru 4-40 NC-2. A18100-37	
H461		SCREW. mach: slot dr: FH; brs. nickel pl; No. 4-40 NC-2; 3/4 in. Ig. (2 each used) AN505B4-12	
H462		SCREW. mach: slot dr; rd hd; brs. tinned; No. 6-32 NC-2; 3/8 in. Ig. (2 each used) Commercial	
H463		SCREW. math: slot dr: FH; steel. Cd pl; 1/4-20 NC-2: 5/8 in. lg (4 each used) AN505-416-10	
H464		WASHER, lock: steel, tin pl: split; No. 6. (2 each used) Commercial	
H465		SCREW. mach: slot dr: FH; steel. Cd pl; No. 6-32 NC-2; 3-1/4 in. Ig. (2 each used) Commercial	
H466		SCREW. drive: rd hd; steel. Cd pl; No. 2; 1/8 in. Ig. (2 each used) Commercial	
H467		SCREW. mach: slot dr; rd hd; bras. nickel pI; No. 2-56 NC-2; 3/4 in. Ig. (2 each used) AN515B2-12	
H468		TERMINAL, lug: brs, hot tinned; 5/64 in. hole one end; 0.144 in. hole other end. Commercial	
H469		NOT USED	
H470		RIVET, tubular: oval hd; brs, nickel pl; 0.088 in. dia; 3/16 in. Ig. (4 each used) AN4450C6-6	
H471	47 to CL 43 1-7	INSERT. A1: 6/16 in. dia one end, 0.248 in. dia other end; 0.327 in. Ig; threaded No. 6.32 NC-2. (3 each used) A1811-25	P1 O/N
H472		WASHER, flat: brs, nickel pl; 0.147 in. ID; 0.312 in. OD; 0.029 in. thk. (4 each used) Commercial	
H473		TERMINAL, lug: brs, hot tinned; 0.169 in. hole one end; 1/8 in. die pin other end. Commercial	
H474		TERMINAL, lug: brs, hot tinned; 0.196 in. hole one end; 0.080 in. hole other end. Commercial	
H475		TERMINAL. lug: brs, hot tinned; 5/64 in. hole one end; 0.121 In. hole other end. Commercial	
H476		WASHER, lock: steel, Cd pl; int tooth; 15/32 in. ID; 19/32 in. OD; 0.026 in. thk. Commercial	
H477		WASHER, flat: neoprene; 0.626 in. ID; 1.31 in. OD; 0.125 in. thk. Commercial	
H478		TERMINAL, lug: brs,. hot tinned; 5/64 in. hole one end; 0.144 in. hole other end. A291	
H479		SCREW, mach: slot- dr; FH; steel, tin plate; No. 8-32 NC-2; 3/8 in. Ig. (4 each used) AN505-8-6	

Antenna Drive TG-8-/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H480		SCREW. mach: slot dr: rd hd: brs. tin plate; No. 6-32 NC-2: 1/4 in lg. (2 each used) Commercial	
H481		SCREW, mach: slot dr: rd hd: steel. Cd pl; No. 6-32 NC-2: 3/4 in. lg. AN515-6-12	
H482		NUT. hex: steel. Cd pl: No. 6-32 NC-2. AN340-6	
H483:		SCREW. mach: slot dr: Bind H: steel. Cd pl: No. 4-40 NC-2; 5/16 in. lg. (2 each used) Commercial	
J401	R17AN-3102A-18-8P	CONNECTOR. plug: 8 female contacts. AN3102A-18-8P	P1 MO/N
J402	R16R2435	CONNECTOR. receptacle: single female contact. UG-290/U	P1 MO/N
J403	R16R2435	CONNECTOR. receptacle: single female contact. UG-290/U	P1 MO/N
J404	R16R2435	CONNECTOR. receptacle: single female contact. UG-290/U	P 1 MO/N
J405	R16BXR-C203905	PLUG: consists of E410. E411. E412. E413. C203905	P1 MO/N
K401	R17R5884-16	RELAY. armature: steel case. tin pl: dpdt: operating voltage 22-29V dc: connects rated 3 amps; resistance of coil 200 ohms. C218441-1 (ADE) TC6D24B2	P1 MO/N
N401		PLATE. identification. N246539-12	
N402		PLATE, identification. (BARB) RC-300-2	
N403		PLATE. identification. L247419-12	
N404		PLATE. identification. (BARB) C-818011-1	
O401	R17BXR-A234696	CAM: SS. passivated: front part circular with a radius of 0.36 in.: cam portion flares from 0.36 in. dia. to 0.48 in. dia; 0.30 in. lg; shaft hole 1/8 in. dia; two 4-40 NC-2 tapped holes for setscrews at right angles to shaft hole. A239696	P1 O/N
O402	R42R2893	RING. retainer: int ; steel Cd pl housing dia 0.875 in. free dia 0.944 in.; 0.55 in. clearance. HC847G875 (WKI) 5000-87	P1 O/N
O403		NOT USED	
O404	R16BXR-C203212-1	GEAR ASSY: consists of a worm wheel gear and two side gear plate riveted together; 2.938 in. ID; 4-1, 4 in. OD; 5/8 in. thk. C203212-1	P1 O/N
O405	R16BXR-C203253-1	GEAR ASSY: consists of a gear blank and a pinion gear; blank is bra with 2.300 in. dia and 0.060 in. thk; SS, passivated pinion. C203253-1	P1 O/N
O406	R16BXR-A203254-1	GEAR ASSY: consists of a brs gear blank 1.760 in. dia and 0.030 in. thk; with SS, passivated pinion. A203254-1	P1 O/N
O407	R16BXR-C203255-1	GEAR ASSY: consists of a brs gear blank 2.300 in. dia and 0.060 in. thk with three 0.437 in. holes evenly spaced around pinion; one SS, passivated gear pinion. C203255-1	P1 O/N
O408	R16BXR-C203256-1	GEAR ASSY: consists of brs spur gear 1.7485 in. dia and 0.030 in. thk; with SS, passivated cam shaft 0.81 in. lg. C203255-1	P1 O/N
O409	R17BXR-A203265-1	PLUNGER ASSY: consists of SS. passivated plunger 1 in. lg with a roller cam mounted with straight pin. A203265-1	P1 O/N
O410		GASKET. rectangular: vellumoid; 0.031 in. thk; 7.80 in. lg x 3.10 in. wd; 2.10 in. x 6.60 in. cut out in center; ten 0.189 in. holes around edge. C233487	M
O411	R16BXR-C238146	GEAR. worm: four threads; lead is 0.7854 in.; 20° in. volute; 0.8036 in. OD; shaft is SS. passivated: single piece of metal with five off sets of the following diameters 0.44 in.; 0.375 in.; 0.31 in.; 0.250 in.; 0.2496 in. C238146	P1 O/N
O412	R16BXR-A238234-1	GEAR. pinion: SS. passivated: 20° involute: 27 teeth; 0.6027 in. OD: hub is 0.500 in. dia: OA thickness 0.500 in.: shaft hole 0.2500 in. dia; two 6-32 NC-2 tapped holes at right angles to shaft hole. A238234	P1 O/N

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
0113		SPINDLE. antenna: A1 casting, portion black wrinkle enamel: cylindrical; 2.500 in. ID: OA OD 4.09 in.: 6.200 in. lg: one end threaded 2-7/8-16 NC-2; flange 0.20 in. thk: extending 0.52 in.: three 4-40 NC-2 holes tapped 0.140 in. below flange spaced 120° apart; ten 0.096 in. holes spaced 36° apart 0.600 in. from one end; 0.25 in. threaded 3-1/4-16 NC-2 0.700 in. from one end; one 0.625 in. hole drilled below flange. N239680	
O414	R16BXR-A239686-1	SHAFT. threaded: SS, passivated ; 0.65 in. OA length; FH: slotted: 0.320 in. dia; 0.070 in. thk; 0.29 in. of shaft threaded 4-40 NC-2; dia of shaft 0.1248 in. A2391686-1	P1 O/N
O415	R16BXR-A239689	SHAFT. threaded: SS, passivated; 0.480 in. OA length: 0.30 in. of shaft threaded 6-32 NC-2; head 0.24 in. dia. A239689	P1 O/N
O416		COUPLING. flexible: SS. passivated: 0.800 in. dia flange: 0.60 in. dia hub: two bosses on front of flange 0.210 in. x 0.12 in. opposite one another: shaft hole 1/4 in. dia and one hole in hub 0.067 in. dia and one 6-32 NC-2 tapped hole in hub at right angles to each other and to shaft hole: 0.360 in. OA thickness. A239693	M1
O417	R16BXR-A239694	SPIDER. coupling: natural plastic: 0.800 in. dia: 0.100 in. thk: four 0.215 in. x 0.15 in. cutouts evenly spaced; 0.281 in. hole in center. A239694	P1 MO/N
O418	R16BXR-A241668	CLAMP. collar: SS, passivated; 0.600 in. dia: 0.180 in. thk: 3/16 in. hole in center; 0.03 in. slot running 0.44 in. across dia; two right angle cutouts 0.040 in. adjacent to slot: hole 0.128 in. drilled from cutout thru to slot; hole tapped 4-40 NC-2 from cutout to slot on other end. A241668	P1 O/N
O419	847 to CL 33 1-7	SEAL, oil: 3.756 in. OD; 1/4 in. thk; for 3-1/8 in. dia shaft. C219823-1 (CHI) 375G34	P1 MO/N
O420	847 to CL 33 1-7	SEAL. oil: 3.756 in. OD; 1/4 in. thk; for 3-1/8 in. dia shaft. C239823-1 (CHI) 375G34	P1 MO/N
O421	R77B115-00402-0000	BEARING. ball: 0.750 in. OD: 0.250 in. ID; 0.2188 in. thk: six balls: with shields C240043-9 (FAF) S1K	P1 O/N
O422	R77B115-00609-0000	BEARING, ball: 0.375 in. ID; 0.875 in. OD; 0.2188 in. thk: seven balls; with shields. C240043-10 (FAF) S3K	P1 O/N
O423	847 CL 77 1-4	BEARING;. ball: light duty; chrome steel; 0.3125 in. OD; 0.1250 in. ID; 0.1094 in. thk; 11 balls; no shields. A240129-5 (MTP) 518	P1 O/N
0424	847 CL 77 1-4	BEARING, ball: light duty: chrome steel; 0.3125 in. OD; 0.12650 in. ID; 0.1094 in. thk; 11 balls; no shields. A240129-6 (MTP) 518	P1 O/N
0425	R77B511-04700-0504	BEARING: ball: 3.875 in. OD; 2.938 in. ID; 0.531 in. thk-; twenty-six 7/32 in. balls without shields. C240156-9 (FAF) K47BK	P1 O/N
O426	R77B5L1-04700-0504	BEARING. ball: 3.875 in. OD; 2.938 in. ID; 0.631 in. thk; twenty-six 7/32 in. balls without shields. C240156-9 (FAF) K47BK	P1 O/N
O427	R16BXR-C241630	NUT, mounting: SS, passivated; 3.42 In. OD: 3-1/4-16 NC-2 tapped 1/2 in. on end: 1.64 in. thk; 3 in. ID other end: four 3/8 in. holes evenly spaced around nut: diamond knurl band. C241630	P1 MO/N
O428	SUB G41W3255-220	WRENCH. spanner: 9 in. lg; 3/16 in. hole drilled in handle ¼ in. from end; 11/32 in. sq tooth extending from. spanner which is on 1-3/4 in. radius. A245950-11 (CHG) P462AZO	P1 MO/N
O429		NOT USED	
O430		COUPLING flexible: SS. passivated; 0.800 in. dia flange; 0.60 in. dia hub; two bosses on front of flange 0.210 in. x 0.12 in. opposite one another; shaft hole 1/4 in. dia and one hole in hub 0.067 in. dia and one 6-32 NC-2 tapped hole in hub at right angles to each other and to shaft hole; 0.360 in. OA thickness. A239693	M1
O431		SHIM. laminated brs: 3.50 in. ID; 4 in. OD; 0.063 in. thk: four rounded protrusions evenly spaced around shim with 0.213 in. hole drilled in center of each. C234890	M1
O482		NOT USED	

Revised 1 May 1955

Antenna Drive TG-8/APA-69 and Antenna Drive TG-8A/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
O433		SWITCH AND PLUNGER ASSY: consists of plate to which is mounted a switchette, a plunger and a cover support; approximately 2-1/2 in. x 1-1/4 in. C203294-1	A1
O434		GASKET, fibre: 17/32 in. ID; 1-5/16 in. OD: 0.005 in. thk; four 0.156 in. holes equally spaced around gasket 1.086 in. c to c on diameter (BARB) RB-2769-1	
O435		BEARING. ball: single row radial; 0.748 in. OD: 0.1969 in. bore; 0.2362 in. width: single shield. (BARB) RC-214-2 (ND) 7035	
O436		GASKET, fibre: 17/32 in. ID: 1-5/16 in. OD; 0.005 in. thk; four 0.156 in. holes equally spaced around gasket 1.086 in. c to c on diameters. (BARB) RB-2769-1	
O437		BEARING, ball: single row radial; 0.748 in. OD; 0.250 in. bore; 0.2362 in. width; double shield. (BARB) RC-211-1 (ND) 77111L1254E	
O438		SHIM: brs: 25/32 in. ID x 1.48 in. OD x 0.030 in. thk; three holes 0.161 in. dia spaced 120° apart. C236999-1	
O439	R42F28000	SPRING Dzus fastener: steel music wire. Cd pl; S-shaped; ¾ in. lg between mounting holes. A18377-2 (DZ) S4-225	P1 O/N
O440	R42F28000	SPRING. Dzus fastener: steel music wire, Cd pl; S-shaped; 3/4 in. lg between mounting holes. A18377-2	P1 O/N
(DZ)	S4-225	(DZ) S4-225	
O441		GASKET, "O" ring: hydraulic; fibre; 3-7/8 in. ID; 4-1/8 in. OD; 1/8 in. thk. AN6230-19	
O442		GEAR ASSY: consists of a gear blank and hub; blank is brs with 2.30 in. dia and 0.060 in. thk. C203253-2	
O443		BEARING, ball: single row radial. (BARB) RC-214-11 (ND) 77035X1254E	
P401		CONNECTOR, plug: 8 female contacts. AN3106-18-8S	
P402		CONNECTOR, plug: single male contact. UG-260/U	
P403		CONNECTOR, plug: single male contact. UG-260/U	
P404		CONNECTOR, plug: single male contact. UG-260/U	
P405		CONNECTOR. plug: single female contact UG-21B/U	
R401	R16R17279-0-925	RESISTOR. fixed: comp; 3.300 ohms ± 10%; 1/2w. RC20BF332K	P1 MO/N
R402	R16R17268-22	RESISTOR. fixed: comp: 1,500 ohms ± 10%; 1/2w. RC20BF152K	P1 MO/N
R403	R16R17268-22	RESISTOR, fixed: comp; 1,500 ohms ±10%; 1/2w. RC20BF152K	P1 MO/N
R404	R16JAN-RW30G310	RESISTOR. fixed: WW; 31 ohms; 8w. RW30G310	P1 MO/N
S401	R17S35799	SWITCH, sensitive: spst; double break. C218135-3 (GE) CR1070-C103E3	P1 MO/N
S402	R17S28225-110	SWITCH. toggle: spst; 3 amp; 125V ac. ST17A	P1 MO/N
Z401	R17S18900-90	SUPPRESSOR, electrical noise. L220222-1 (SPR) JX51V	P1 MO/N

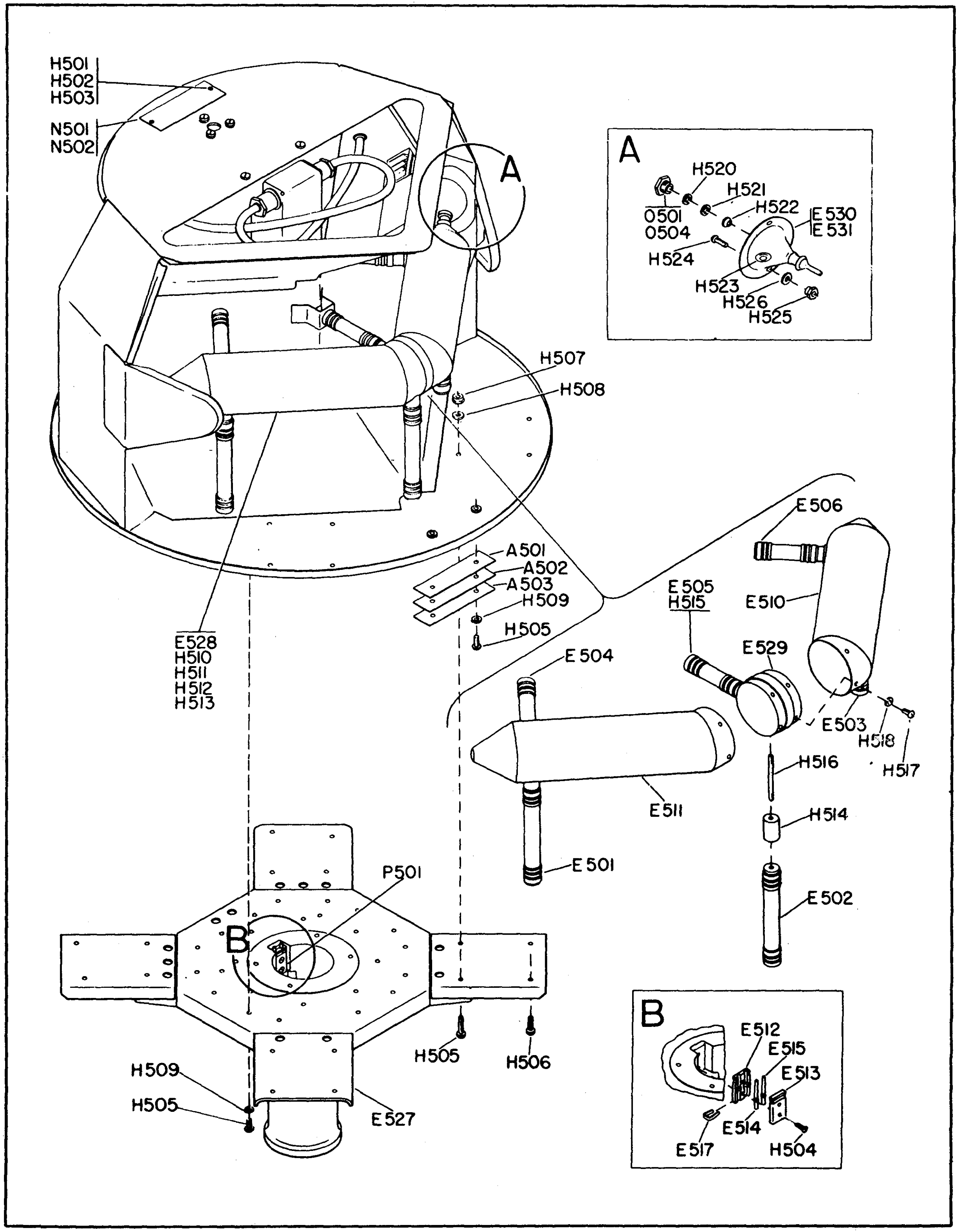


Figure 19. Antenna Assembly AS-435/APA-69 (Sheet 1 of 2)

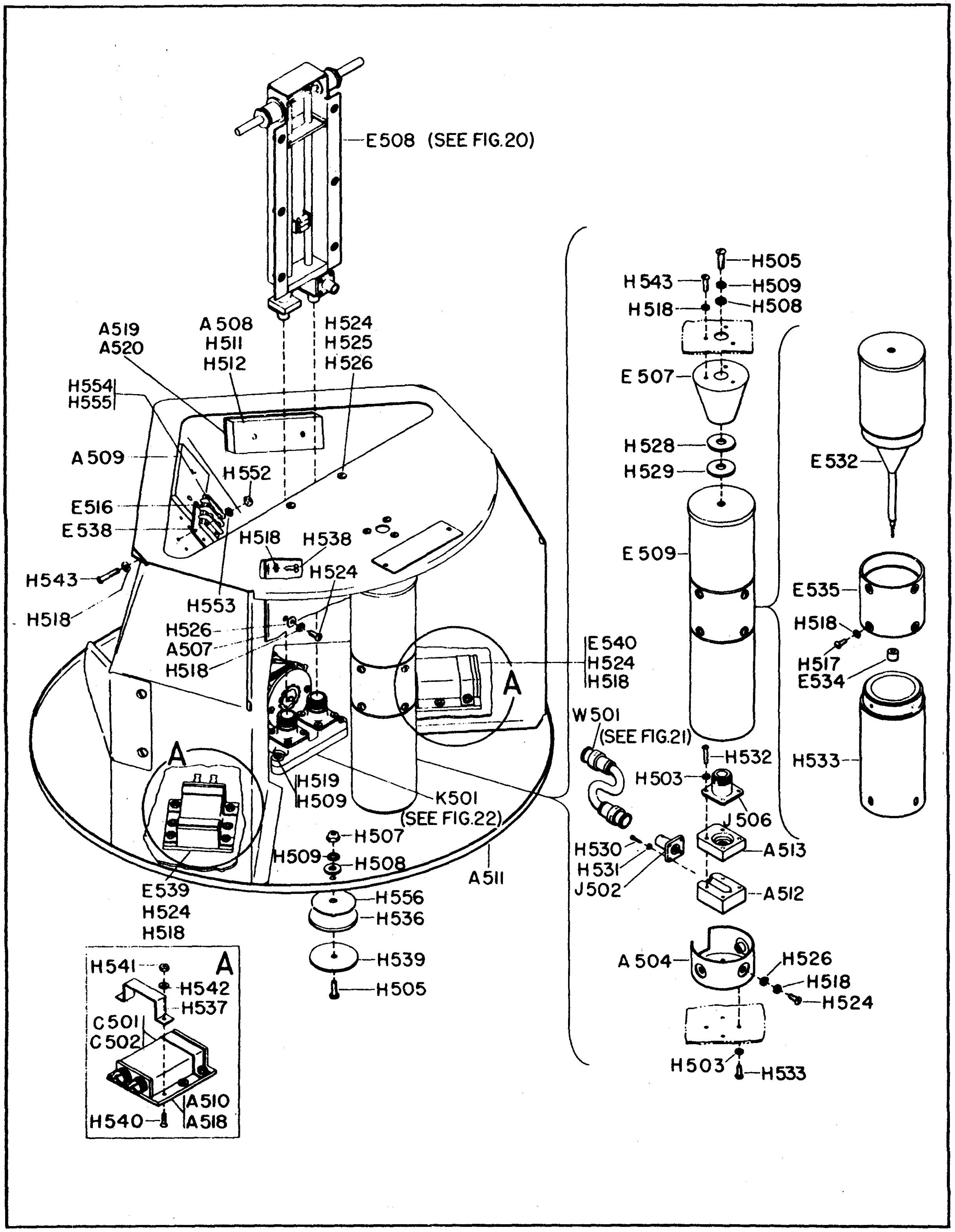


Figure 19. Antenna Assembly AS-435/APA-69 (Sheet 2 of 2)

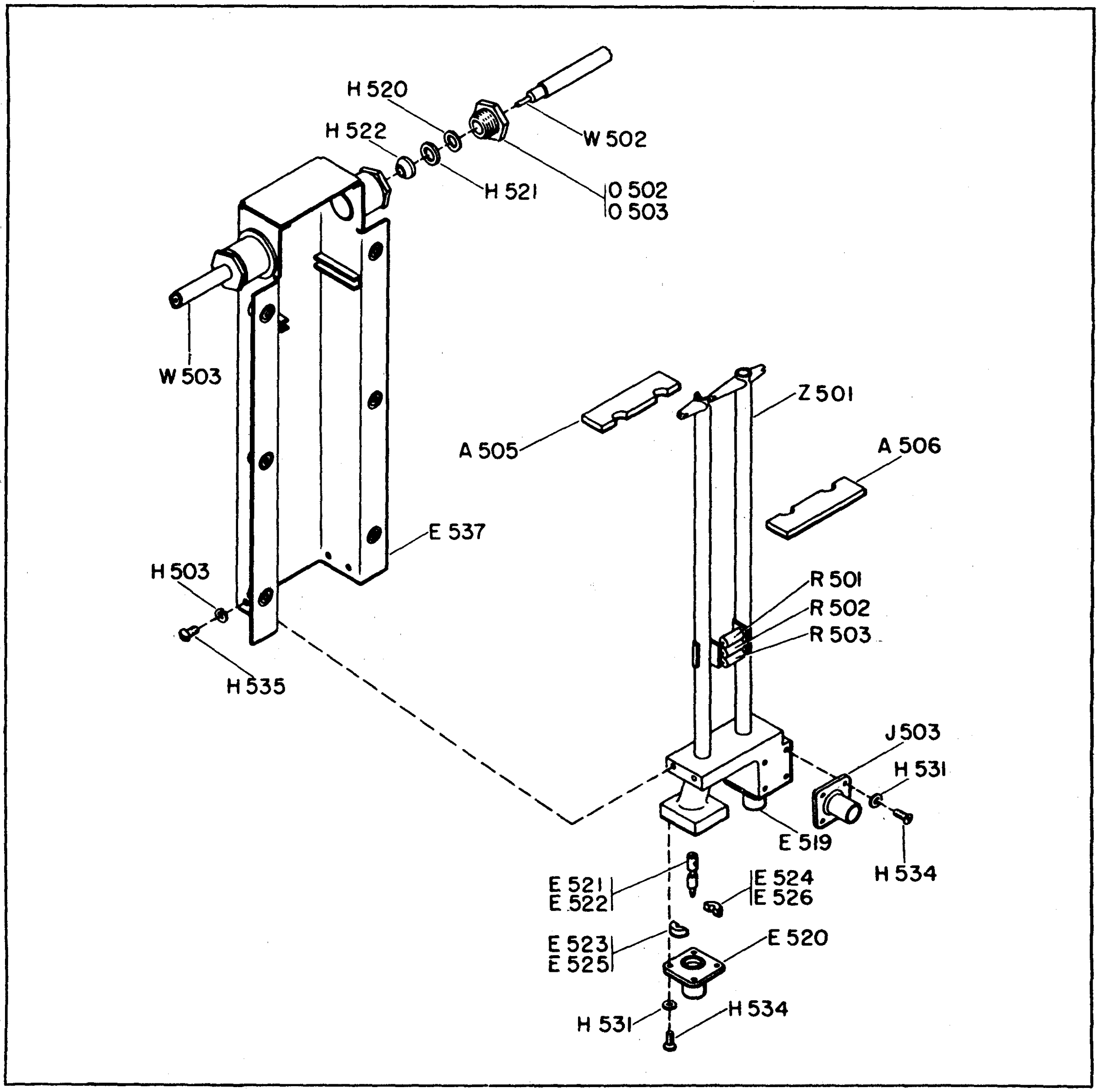


Figure 20. Matching Unit Assembly

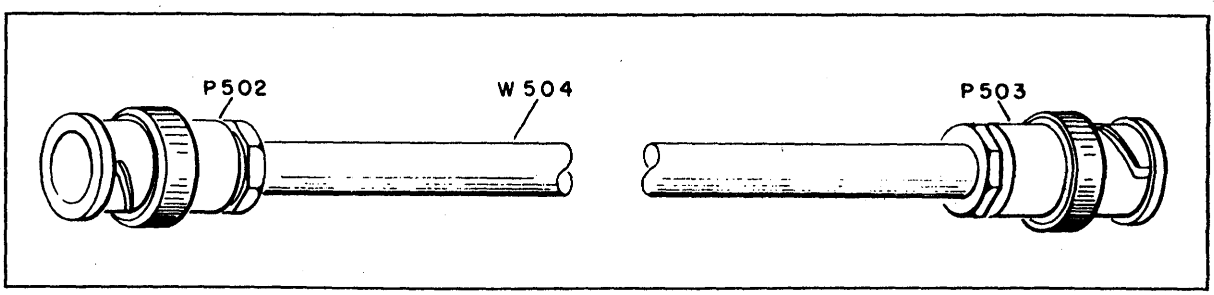


Figure 21. Cable Assembly

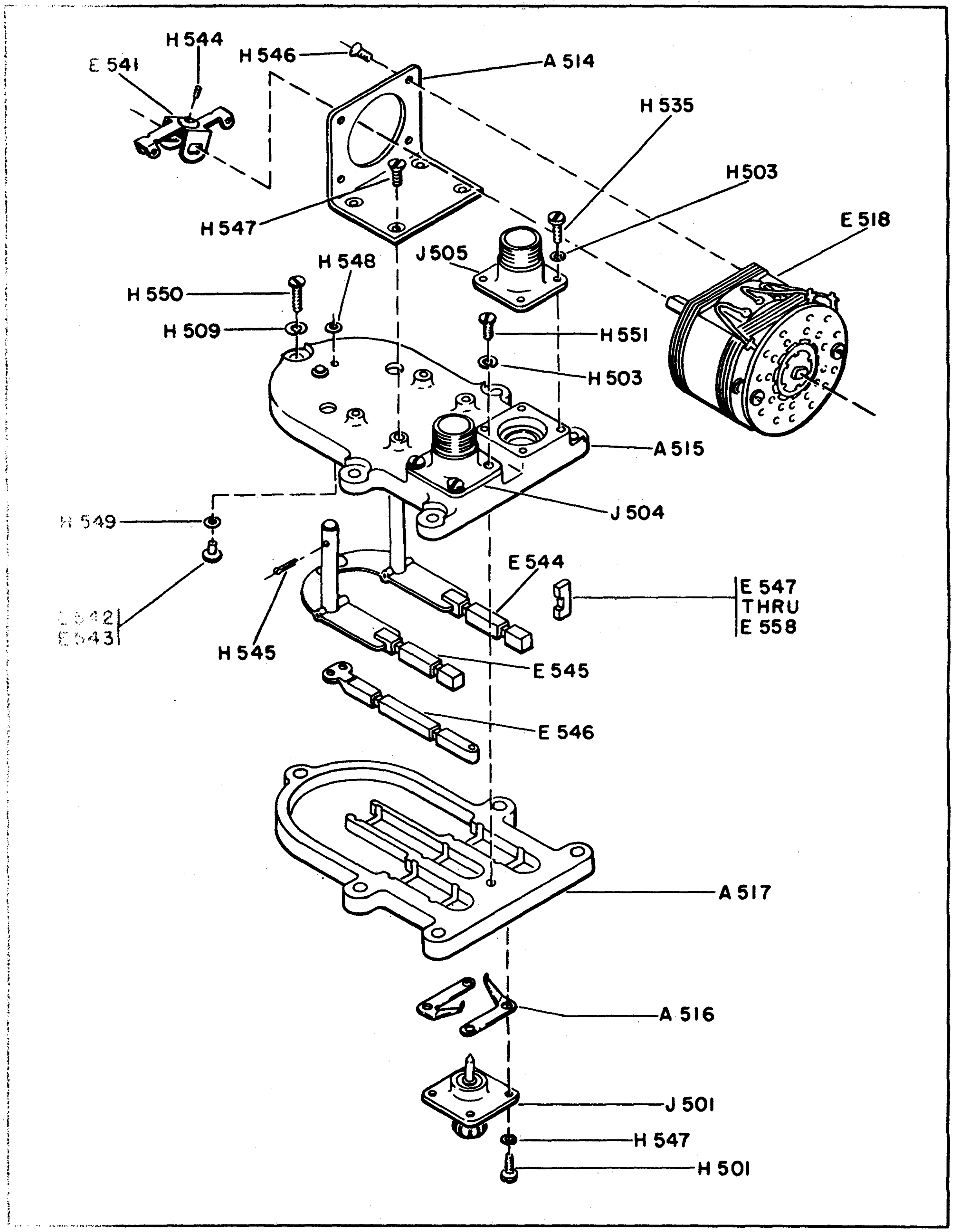


Figure 22. Switch Mounting Assembly

Antenna Assembly AS-435/APA-69

Ref Symbol No.	Stock no.	Description	Source Code
501-659 series	R16AN-AS435APA-49 (BXR)	ANTENNA ASSEMBLY AS-435/APA-69 R200310-1	P1 MO/R
A501		STRAP. brs. nickel pl: 3 in. Ig x ¾ in. wd x 0.187 In. thk; 0.218 in. die hole in each end. A232764-7	M1
A502		STRAP: brs. nickel pl: 3 in. Ig x 3/4 in. wd x 0.062 in. thk: 0.218 in. dia hole in each end. A232764-B	M1
A503		STRAP: brs. nickel pl: 3 in. Ig x 8/4 in. wd x 0.031 in. thk; 0.2181 in. dia bole in each end. A232764-9	M1
A504	R16BXR-A203371	FLANGE ASSY. mounting: consists of A1 mounting flange 1.934 in. dia x 1 in. thk with three inserts. A203371-1	P1 O/N
A505		INSULATOR. plate: plastic: 1.680 in. Ig x 0.437 in. wd x 0.126 in. thk: two semi-circular cutouts of 0.125 in. radius 7/8 in. c to c. A2430807	M1
A506		INSULATOR. plate: plastic: 1.680 in. Ig x 0.437 in. wd x 0.125 in. thk: two semi-circular cutouts of 0.125 in. radius 7/11 in. c to c. A243087	M1
A507		PLATE. mounting: A1, etched finish: 10.08 in. lg x 4 in. wd: flange turned down on each side: cutout 3/4 in. sq at one end; two rows of 0.180 in. dia holes. three in each row. in top: three 0.10P in. dia holes in each long flange and two in each short flange. N228506	M1
A508		PLATE, tapping: cres, Cd pl: 1/4 in. wd x 2 in. Ig x 0.090 in. thk: two holes tapped 6-32 NC-2 1-1/2 in. c to c. A226831-3	M1
A509		PLATE, tapping: cres, Cd pl: ¼ in. wd x 2 in. Ig x 0.090 in. thk: two holes tapped 6-.32 NC-2 1-½ in. c to c. A226831-3	M1
A510		MOUNTING ASSY, plate: A1. etched finish: consists of plate 2-1/2 in. 1t x 2.16 in. wd with 1 in. hole in center and two inserts on opposite sides of hole. C207818-1	A1
A511		SPOTWELD ASSY. reflector: low frequency antenna consists of reflectors and disk mounting assembly. R203367-1	X2
A512		MOUNTING. connector bottom: A1. etched finish: 1.24 in. lg x 1 in. wd x ½ in. thk; two corners at one end cut off at 45°: two rows of holes tapped 4.40 NC-2 0.718 in. c to c on top: two holes tapped 3-48 NC-2 x 0.25 in. deep in cut-off side 1/2 in. c to c: semi-circular groove 5/16 x 0.92 in. deep and ebore 0.376 in. dia x 0.10 in. deep on bottom side. C228594	M1
A513		MOUNTING, connector top: A1. etched finish: 1.24 in. Ig X 1 In. wd x 0.375 in. thk; two corners at one end cut off at 45°: two rows of holes 0.128 in. dia drilled 0.718 in. c to c thru mounting: two holes tapped 3-48 NC.-2 x 0.25 in. deep in cut-off side 1/2 in. c to c: semicircular groove 5/16 x 0.92 in. deep and ebore 0.375 in. x 0.10 in. deep on bottom side: hole 5/16 in. and ebore 17/32 in. dia x 0.188 in. deep and csink 0.618 in. dia x 82° on top side at right angle to semi-circular groove. C228593	M1
A514		MOUNTING, relay: L-shaped: one arm 1.48 in. lg; other arm 1.30 in. Ig; 1.72 in. wd; four holes 0.128 in. dia and csink In each arm; hole 1.125 in. in 1.48 in. Ig arm. A228485	M1
A515		BODY, switch: A1 dia casting. etched finish: one end rounded; 4-1/2 in. 1 x 2-6/16 in. wd; 0.49 in. OA thickness: five protrusions extending two from each side and one from rounded end. each drilled 3/16 in. dia and ebore: four holes tapped 4-40 NC-2 x 0.20 in. deep: double row 1.33 in. c to c; two holes 7/16 in. and ebore 33/64 in. dia x 0.18 in. deep and csink 1.32 in. c to c with four holes tapped 4-40 NC-2 x 0.25 in. deep around each hole; two 0.064 in. holes drilled 0.28 in. c to C on rounded end: two holes 0.281 in. dia 1.32 in. c to c. N243032	X2
A516	R16BXR-C228504	PLATE. lock: beryllium copper, silver pl: 1 in. lg x 0.015 in. thk; bent arm extending out; two 0.116 in. holes one in each end. (2 each used) C228504	P1 O/N
A517		BODY, switch: A1 dia casting: etched finish: one end rounded: 4-1/2 in. lg x 2-6/16 in. wd x 0.312 in. thk; five protrusions extending two from each side and one from rounded end; the four side protrusions drilled with 3/16 in. dia holes; hole in protrusion on rounded end tapped 8-32 NC-2: 7/16 in. hole drilled near flat end and chore 33/64 in. dia x 0.180 in. deep x csink 0.670 in. dia: four 4-40 NC-2 x 0.24 in. deep tapped holes around ebore: one 4-40 NC-2 tapped hole thru at ebore: one 1/16 in. hole drilled near tap on rounded end. N2403031	X1

Antenna Assembly AS-435/APA-69 (con't)

Ref Symbol No.	Stock no.	Description	Source Code
A518		MOUNTING ASSY. plate: A1. etched finish: consists of plate 2-1/2 in. lg x 2.16 in. wd with 1 in. hole in center and two inserts on opposite ides of hole. C207818-1	A1
A519		STRAP. brs: nickel pl: 2.184 in. lg x 1.25 in. wd x 0.064 in. thk: 0.191 in. dia hole in each end. A232764-34	
A520		STRAP. brs: nickel pl: 2.84 in. lg x 1.25. in. wd x 0.032 in. thk; 0.191 in. dia hole in each end. A232764-35	
C501	R16JAN-CP16B1FF4105V	CAPACITOR. fixed: paper; 1 uf + 20 -10%.: 600 vdcw. CP61BFF105V	P1 MO/N
C502	R16JAN-CP61BFF105V	CAPACITOR. fixed: paper: 1 uf +20% -10%; 60 vdcw. CP61B1FF105V	P1 MO/N
E501	R17BXR-A203378-2	STANDOFF ASSY. insulator: consists of an insulator with two caps, one on each end. A203378-2	P1 O/S
E502	R17BXR-A203378-2	STANDOFF ASSY,. insulator: consists of an insulator with two caps on each end. A203378-2	P1 O/S
E503	R17BXR-A203378-2	STANDOFF ASSY, insulator: consists of an insulator with two cap one each end. A203378-1	P1 O/S
E504	R17BXR-A203378-1	STANDOFF ASSY. insulator: consists of. an insulator with-two caps one on each end A23378-1	P1 O/S
E505	R17BXR-A203378-1	STANDOFF ASSY. insulator: consists of an insulator with two caps. one on each A20337X-1	P1 O/S
E506	R17XR-A203378-1	STANDOFF ASSY. insulator: consists of an insulator with two caps. one on each end A203378-1	P1 O/S
E507		INSULATOR. standoff: plastic: truncated cone; 1.56 in. lg 1-4/4 in. dia one end: 0.88 in. dia other end: hole drilled in center 0.193 in. dia and ebore 0.406 in. dia leaving 0.160 in. material; three holes tapped 6-32 NC-2 x 0.600 is. deep evenly spaced around center hole. A243093	M1
E508	R16BXR-L203388-1	MATCHING UNIT ASSY: consists of a matching section and a matching line; two r-f connectors on one end of unit and two coaxial cables on other end L203388-1	P1 MO/S
E509	R16BXR-C203353-1	ANTENNA ASSY. vertical: consists of an inner and outer vertical antenna with a ring insulator screwed on near center. C203353-1	P1 MO/S
E510		RIGHT ANTENNA ASSY. horizontal: consists of a brs tube approximately -7-1/2 in. lg and 2 in. dia to which two thread rods are soldered at right angles to each is soldered L203376-1	X1
E511		LEFT ANTENNA ASSY. horizontal: consists of a brs tube approximately 7-1/2 in. lg and 2 in. dia to which two threaded rods are soldered at right angles to each other and to tube: one end is truncated cone into which a female connector is soldered. L203375-1	X1
E512		BLOCK. connector: black plastic: 1 in. lg x 0.580 in. wd x 0.130 is. thk two semi-circular slots 0.094 in. radius 0.070 in. wd, in center of mount; 0.062 in. radius semi-circular grooves the length of mount; two 0.128 in. dia holes evenly spaced at right angles to the grooves. A235876-1	X1
E513		BLOCK. connector: black plastic; 1 in. lg: 0.580 in. wd: 0.130 in. thk: two semi-circular slots 0.094 in. radius 0.070 in. wd in center of mount; 0.062 in. radius semi-circular grooves the length of mount; two 0.128 in. dia csink holes evenly spaced at right angles to the grooves. A235876-2	X1
E514		CONTACT, connector: female: beryllium copper rod, silver pl: 1.120 in. lg. A243004	X1
E515		CONTACT. connector: female: beryllium copper rod. silver pl. 1.120 in. lg. A243004	X1

Antenna Assembly AS--435/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
E516	R17S17020	BOARD. terminal: black plastic 1-3/8 in. lg 7/8 in. wd x 13/32 in. thk; two terminals: two 0.160 in. dia mtg holes on each end C60854-2 (JNS) 2-140	P1 O/N
E517		SPRING. contact: beryllium copper, Cd. pl U-shaped 1/2 in. lg x 0.240 in. wd. A249620	M1
E518	R17BXR-C218248	COIL. relay: 28V dc nominal; 50,000 ft max alt: 1.906 in. dia: 2.230 in. OA length. C218248	P1 MO/N
E519	R16HXR-A203391-1	FITTING ASSY: consists of a male fitting mounted on a plate 0.688 in. sq. A203391-1	P1 O/N
E520	R16BXR-A203391-1	FITTING ASSY: consists of a male fitting mounted on a plate 0.688 in. sq. A203391-1	P1 O/N
E521		CONTACT, male: brs, silver pl 0.080 in. lg x 0.120 in. OA dia: contact end 0.065 in. dia; hole 0.078 in. dia x 0.200 in. deep drilled in one end with hole 0.059 in. dia. drilled thru shaft at right angle. A243050	M1
E522		CONTACT, male: brs. silver pl 0.080 in. Ig 0.120 in. OA dia; contact end 0.065 in. dia; hole 0.078 in. dia x 0.200 in deep drilled in one end with hole 0.059 in. dia drilled thru shaft at right angle . A243050	M1
E523		INSULATOR. head: textolite; semi-circular: 0.156 in. semi-circular cutout 0.020 in. radius bisecting the face horizontally; 0.100 in. thk. A243049	M1
E524		INSULATOR, head: textolite: semi-circular: 0.156 in. radius: semi-circular cutout 0.020 in. radius bisecting the face horizontally; 0.100 in. thk. A243049	M1
E525		INSULATOR. head: textolite: semi- circular: 0.156 in. radius; semi-circular cutout 0.020 in. radius bisecting the face horizontally 0.100 in. thk. A243049	M1
E526		INSULATOR, head: textolite: semi- circular: 0.16 in. radius: semi-circular cutout 0.020 in. radius bisecting the face horizontally; 0.100 in. thk. A243049	M1
E527		MOUNTING, antenna: octagon shaped with four brackets riveted to mounting equally spaced at 90°. N204897-1	X2
E528	R16BXR-N203400	ANTENNA ASSY horizontal: consists of two horizontal antennas joined at 45°: angle with six standoff insulators; three on inside of angle and three on right angle to inside insulators; female contact on each end of antenna. N203400-1	P1 MO/S
E529		COUPLING: natural plastic; 2 in. dia x 1 in. thk: two holes tapped 10-24 NC-2 to CL of part and ebore 0.5:31 in. dia tot within 1/2 in. of CL. holes to be at right angles of each other; eight holes tapped 6-32 NC-2 x 0.30 in. deep around coupling in pairs 0.640 in. c to c. C239738	M1
E530	R16BXR-C203412-1	TERMINAL ASSY. cable: consists of a cable termination shield with a female fitting to which a bushing assembly is soldered. C203412-1	P1 O/N
E531	R16BXR-C203412-1	TERMINAL ASSY, cable: consists of a cable termination shield with a female fitting to which a bushing assembly is soldered. C203412-1	P1 O/N
E532	R16BXR-C203351-1	ANTENNA ASSY. inner vertical: consists of a cylindrical antenna section with an insert on one end; cone with male contact on small end soldered to other end. C203351-1	P1 O/N
E533	R16BXR-C203352-1	ANTENNA ASSY, outer vertical: consists of a cylindrical antenna section with a cone soldered in cylinder;: male fitting on small end of cone. C203352-1	P1 O/N
E534		INSULATOR, bead: plastic; 3/8 in. dia x 0.240 in. thk; 0.136 in. dia hole thru center. A2433082	M1
E535		RING. insulator. natural plastic: 1.840 in. Ig x 2 in. OD x 1.843 in. ID; four pairs of holes 0.169 in. dia and spotfaced 0.:32 in, dia. A243079	M1

Antenna Assembly AS-435/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
E366		NOT USED	
E537		MATCHING SECTION ASSY consists of box with flange on each side and two female fittings soldered to box, one on each side near end; three inserts evenly spaced on each flange. L203380-1	X1
E538		INSULATOR. plate: plastic: 1.76 in. In x 1.19 in. wd x 0.032 in. thk: numbers and 2 stenciled on plate. C243544-4	M
E539		CAPACITOR ASSY: consists of a capacitor held to a mounting plate by two brackets C207817-1	A1
E540		CAPACITOR ASSY: consists of a capacitor held to a mounting plate by two brackets. C207817-1	A1
E541	R17BXR-C207717	ARM ASSY: consists of an arm into which a threaded square insert has been rolled over. C207717-1	P1 O/N
E542		CONTACT: coin sliver: 0.24 in. dia head; shaft 0.062 in. dia x 0.110 in. lg. C43043-6	X1
E543		CONTACT: coin silver; 0.24 in. dia. head; shaft 0.062 in. dia x 0.110 in. lg. C243043-6	X1
E544	R16BXR-C203341-1-	CONDUCTOR ASSY,. spring: RH: consists of a spring conductor to the end of which is riveted two contacts: a shaft Is also clamped on at right angle. C203341-1	P1 O/N
E545	R16BXR-C203341-2	CONDUCTOR ASSY. spring: LH; consists of a spring conductor to the end of which is riveted two contacts; a shaft is also clamped on at right angle. C203941-2	P1 O/N
E546	R16BXR-A203339	CONDUCTOR ASSY. center: consists of a center conductor with two contacts riveted to one end. A203339-1	P1 O/N
E547		INSULATOR. bead: plastic; U-shaped; 1/2 in. lg x ¼ in. wd x 0.12 in. thk. A242781	M1
E548		INSULATOR. bead: plastic; U-shaped: 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E549		INSULATOR. bead: plastic; U-shaped; 1/2 in. lg x 1/4 In. wd x 0.12 in. thk. A242781	M1
E550		INSULATOR. bead: plastic: U-shaped; 1/2 in. lg x ¼ in. wd x 0.12 in. thk. A242781	M1
E551		INSULATOR. bead: plastic;: U-shaped: 1/2 In. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E552		INSULATOR. bead: plastic: U-shaped; 1/2 In. In x 1/4 in. wd x 0.12 in. thk. A242781	M1
E553		INSULATOR. bead: plastic: U-shaped: 1/2 In. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E554		INSULATOR. bead: plastic; U-shaped; 1/2 In. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E555		INSULATOR. bead: plastic;: U-shaped: 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E556		INSULATOR. bead: plastic: U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242731	M1
E557		INSULATOR. bead: plastic; U-shaped: 1/2 in. lg x ¼ in. wd x 0.12 in. thk. A242781	M1
E558		INSULATOR. bead: plastic: U-shaped; 1/2 in. lg x ¼ in. wd x 0.12 in. thk. A242781	M1

Antenna Assembly AS-435/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H501		SCREW, mach: slot dr; Bind H: brs, nickel pl: No. 4-40 NC-2: 1/4 in. lg. (6 each used) Commercial	
H502		NUT, hex: brs, nickel pl; No. 4-40 NC-2. (2 each used) AN340B4	
H503		WASHER, lock: phosphor bronze. nickel pl; split; No. 4. (23 each used) AN935B4	
H504		SCREW. mach: slot dr; FH; brs, nickel pl: No. 4-40 NC-2; 3/8 in. lg. (2 each used) AN505B4-6	
H505		SCREW, mach: slot dr; Bind H: brs. nickel pl; No. 8-32 NC-2:; 9/16 in. Ig. (31 each used) Commercial	
H506		SCREW. mach: slot dr; Bind H; brs. nickel pl; No. 8-32 NC-2; 7/16 in. Ig. (8 each used) Commercial	
H507		NUT. elastic stop: brs, nickel pl: 11/32 in. wd: 11/64 in. thk: No. 8-32 NC-2. (29 each used) A12522-15 (EN) 92TM-82	
H508		WASHER, flat: brs, nickel pl; 0.172 in. lg; 5/16 in. OD; 0.036 in. thk. (30 each used) AN960B8	
H509		WASHER, lock: phosphor bronze. nickel pl;: split; No. 8. (20 each used) AN935B8	
H510		SCREW, set: Allen dr; cup point; steel, Cd pl; No. 6-32 NC-3; 1/4 in. Ig. (2 each used) AN565D6H4	
H511		SCREW, mach: slot dr; Bind H; brs, nickel pl: No. 10-24 NC-2; 1/2 in. lg. (10 each used) Commercial	
H512		WASHER, lock: phosphor bronze, nickel pl: split; No. 10. (10 each used) AN935B10	
H513		WASHER. flat: brs, nickel pl; 0.201 in. ID; 1/2 in. OD; 0.040 in. thk. (6 each used) AN960B10	
H514		SPACER: natural plastic; 0.213 in. ID; 1/2 in. OD; 0.744 in. lg. Commercial	
H515		SPACER: natural plastic; 0.213 in. ID; 1/2 in. OD; 0.660 in. lg. Commercial	
H516		ROD, threaded: brs, nickel pl; 1.70 in. lg; threaded 10-24 NC-2. (2 each used) Commercial	
H517		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 1-32 NC-2; 1/4 in. lg. (16 each used) Commercial	
H518		WASHER, lock: phosphor bronze, nickel pl; split: No. C. (38 each used) AN935B6	
H519		SCREW. mach: slot dr; Bind H; brs, nickel pl; No. 8-32 NC-2;3/4 in. lg. (4 each used) Commercial	
H520		WASHER, flat: brs, nickel pl; 1/4 in. ID; 0.369 in. OD; 0.032 in. thk. (4 each each) Commercial	
H521		WASHER, flat: neoprene; 0.245 in. ID; 3/8 in. OD; 0.062 in. thk. (4 each used) Commercial	
H522		SLEEVE, clamping: brs, silver pl; 0.350 in. OD one end with 1/4 in. ID; other end tapered with 0.199 in. ID; 0.160 in. thk. (4 each used) A233438	M1

Antenna Assembly AS-435/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H523		GROMMET: vinyl rain; 1/4 in. ID; 5/8 in. OD: 3/16 in. thk. (4 each used) AN931-4-7	
H524		SCREW. mach: slot dr; Bind H; bra nickel pl; No. 6-32 NC-2; 3/8 in. Ig. (21 each used) Commercial	
H525		NUT. elastic stop: brs nickel pl: 5/16 in. wd; 11/64 in thk: No. 6-32 NC-2. (10 each used) A12522-5 (EN) 99M62	
H526		WASHER, flat: brs, nickel pl: 0.147 in. ID; 3/8 in. OD; 0.032 in. thk. (17 each used) AN960B6	
H527		SCREW, mach: slot dr; Bind H; brs. nickel pl: No. 6-32 NC-2; ½ in. Ig. (3 each used) Commercial	
H528		WASHER, flat: natural plastic; 0.193 in. ID; 0.58. in. OD: 0.032 in. thk. (3 each used) Commercial	
H529		WASHER, flat: natural plastic; 0.193 in. ID; 0.88 in. OD: 0.016 in. thk. (4 each used) Commercial	
H530		SCREW. mach: slot dr; rd hd: brs, nickel pl: No. 3-48 NC-2; 5/16 in. thk. (4 each used) AN515B3-5	
H531		WASHER, lock: phosphor bronze. nickel pl; split; No. 3 (16 each used) AN935B3	
H532		SCREW. mach: slot dr: rd hd; brs. nickel pl; No. 4-40 NC-2; 5/8 in. lg. (4 each used) AN515B4-10	
H533		SCREW, mach: slot dr; Bind H; ,brs. nickel pl; No. 4-40 NC-2; 3/8 in. Ig. (4 each used) Commercial	
H534		SCREW, mach: slot dr; rd hd: brs, nickel pl; No. 4 NC-2; ¼ in. thk. (12 each used) AN515B3-4	
H535		SCREW, mach: slot dr; rd bd; brs, nickel pl; No. 4-40 NC-2; ¼ in. thk. (16 each used) AN151B4-4	
H536		WASHER. flat: brs, nickel pl: 0.218 in. ID; 1-1/2 in. OD; 0.093 in. thk. Commercial	
H537		BRACKET: U-shaped with mounting foot on each side; brs Cd pl; 2.16 in. Ig x 0.40 in. wd x 0.65 in. high; 0.136 in. hole in each foot. (4 each used) A290946	M1
H538		SCREW, mach: slot dr; Bind H: brs nickel pl; No. 6-32 NC-2; 5/16 in. lg. (6 each used) Commercial	
H539		WASHER, flat: brs, nickel pl, 0.218 in. ID; 1-1/2 in. OD; 0.031 in. thk (3 each used) Commercial	
H540		SCREW. mach: slot dr; FH; brs. nickel pI; No. 4-40 NC-2; 7/16 in. Ig. (8 each used) AN505B4-7	
H541		NUT. elastic ,stop: brs. nickel pl: 1/4 in. wd; 9/64 in. thk; No. 4-40 NC-2. (8 each used) A12522-7 (EN) 99M40	
H542		WASHER, flat: brs, nickel pl: 0.119 in. ID; 1/32 in. OD; 0.025 in. thk. (8 each used) AN960B4	

Antenna Assembly AS-435/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
H543		SCREW. mach: slot dr; Bind H; brs. nickel pl; No. 6-:12 NC-2; 1/2 in. It. (7 each used) Commercial	
H544		SCREW, set: Bristo dr: cup point; steel. Cd pl; No. 6. NC-3: 3/16 in. lg. Commercial	
H545		PIN. cotter: steel. Cd pl; 1/14 in. dia; 1/2 in. lg. (2 each used) AN380-2-2	
H546		SCREW, mach: slot dr; FH; brs,. nickel pl; No. 4-40 NC-2: 5/8 in. lg. (4 each used) AN505B4-10	
H547		WASHER. lock: phosphor bronze, nickel pl: split; No. 4: light. AN935B4L	
H548		WASHER. flat: brs Cd pl: 0.064 in. ID; 0.18 in. OD; 0.010 in. thk. (2 each used) Commercial	
H549		WASHER. flat: brs Cd pl;: 0.064 in. ID; 0.240 in. OD; 0.004 in. thk. (2 each used) Commercial	
H550		SCREW. mach: slot dr; rd bd: brs nickel pl; No. 2 NC-2: 1/2 in. lg. AN515B8-8	
H551		SCREW. mach: slot dr: rd hd; brs, nickel pl; No. 4-40 NC-: 1/2 in. lg. AN515B4-8	
H552		NUT. hex: brs. nickel pl: No. 6-32 No. 2: 0.250 in wd; 3/32 in. thk. (4 each used) HSN775B-4	
H553		WASHER flat: brs. nickel pl: 0.147 in. ID: 5/16 in. OD: 0.0214 in. thk. (4 each used) Commercial	
H554		SCREW. mach: slot dr: Bind H: brs nickel pl: No. 5-40 NC-2: 1/4 in. lg. (4 each used) Commercial	
H555		WASHER. lock: slot phosphor bronze,. nickel pl: split; No. 5. (4 each used) AN935B6	
H556		WASHER. flat: brs. nickel pl: 0.218 in. ID; 1.00 in. OD: 0.032 in. thk. (3 each used) Commercial	
J501	R16BXR-C203327-1	CONNECTOR ASSY. receptacle: consists of single contact female connector attached to a contact assembly. C203327-1	P1 MO/N
J502	SUB R16R2435	CONNECTOR. receptacle: single female contact. C223390-8	P1 MO/N
J503	SUB R16R2435	CONNECTOR. receptacle: single female contact C223390-8	P1 MO/N
J504	R16AN-UG55AU	CONNECTOR. receptacle: single female contact UG-58A/U	P1 MO/N
J505	R16AN-UG58AU	CONNECTOR. receptacle single female contact. UG-58UA/U	P1 MO/N
J506	R16AN-UG58AU	CONNECTOR receptacle: single female contact UG-58A/U	P1 MO/N
K501	R17BXR-L203572-1	SWITCH MOUNTING ASSY: consists of relay attached to a mounting and two connectors on end; three conductors mounted under relay. L203572-1	P1 MO/S
N501		PLATE identification (used on contract Noas 51-134). N246539-14	M1
N502		PLATE. identification (used on Contract NOas ,52-435). L247419-3	
O501		BUSHING. hex: brs Cd pl; flange one end 0.60 in. wd: .320 in. thk: threaded 7/16-28 NEF-2 other end: ID tapers from 0.34 in. flange end to 1/4 in. other end. A241707	M1
O502		BUSHING. hex: brs,. Cd pl; flange one end 0.60 in. wd; 0.320 in. thk; threaded 7/15-28 NEF-.2 other end; ID tapers from 0.34 in. flange end to 1/4 in. other end. A241707	M1
O503		BUSHING. hex: brs,. Cd pl: flange one end 0.60 in. wd: 0.320 in. thk: threaded 7/16-28 NEF-2 other end: ID taper from 0.34 in. flange end to 1/4 in. other end. A241707	M1

Antenna Assembly AS-435/APA-69 (cont)

Ref Symbol No.	Stock no.	Description	Source Code
O504		BUSHING, hex: bra. Cd pl: flange one end 0.60 in. wd; 0.320 in. thk :threaded 7/16-28 NEF-2 other end; ID tapers from 0.34 in. flange end to 1/4 in. other end. A241707	M1
P501	R16BXR-C203906-1	PLUG: consists of E512. E513, E514. E515, and E516. C203906-1	P1 MO/N
P502	R16P3627-375	CONNECTOR. plug: single male contact. UG-88/U	P1 MO/N
P503	R16P3627-375	CONNECTOR. plug: single male contact UG-88/U	P1 MO/N
R501	R16JAN-RC20BF471J	RESISTOR. fixed: comp; 470 ohms ±5%; 1/2w. RC20BF471J	P1 MO/N
R502	R16JAN-RC20BF471J	RESISTOR. fixed: comp; 470 ohms ±5%; 1/2w. RC20BF471J	P1 MO/N
R503	R16JAN-RC20BF471J	RESISTOR, fixed: comp; 470 ohms ±5%: 1/2w. RC20BF471J	P1 MO/N
W501		CABLE ASSY: consists of a coaxial cable and two r-f connectors; 7 in. lg. L212614-1	M
W502		CABLE. coaxial: tinned ends; 20 in. OA length. RG-100/U	M1
W503		CABLE. coaxial: tinned ends; 20 in. OA length. RG-100/U	M1
W504		CABLE.- coaxial: single conductor; 1 in. Ig. RG-58/U	M1
Z501		LINE ASSY: matching; consists of two tube and sleeve assemblies soldered to a connector adapter one end. C203383-1	

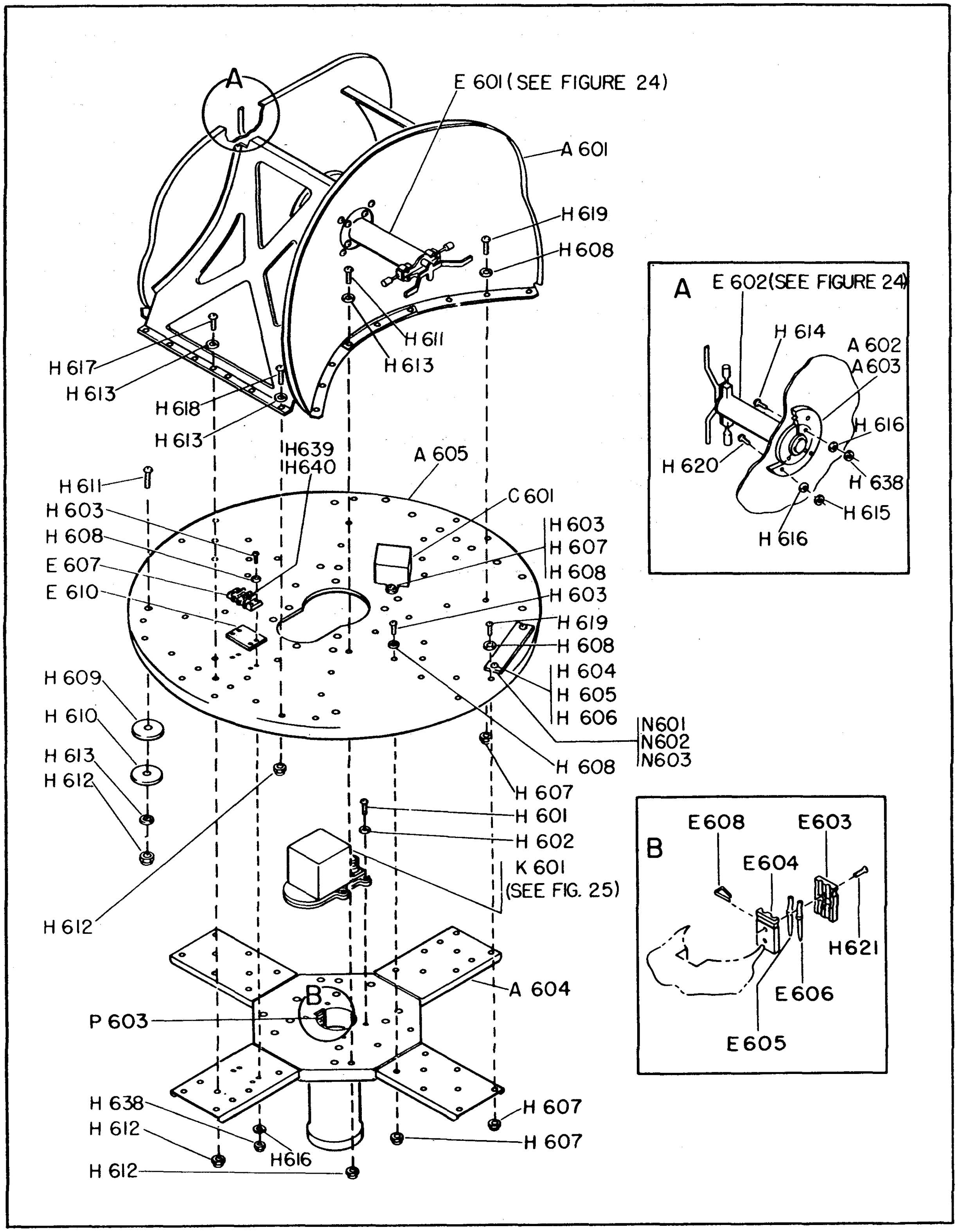


Figure 23. Antenna Assembly AS-434/APA-69

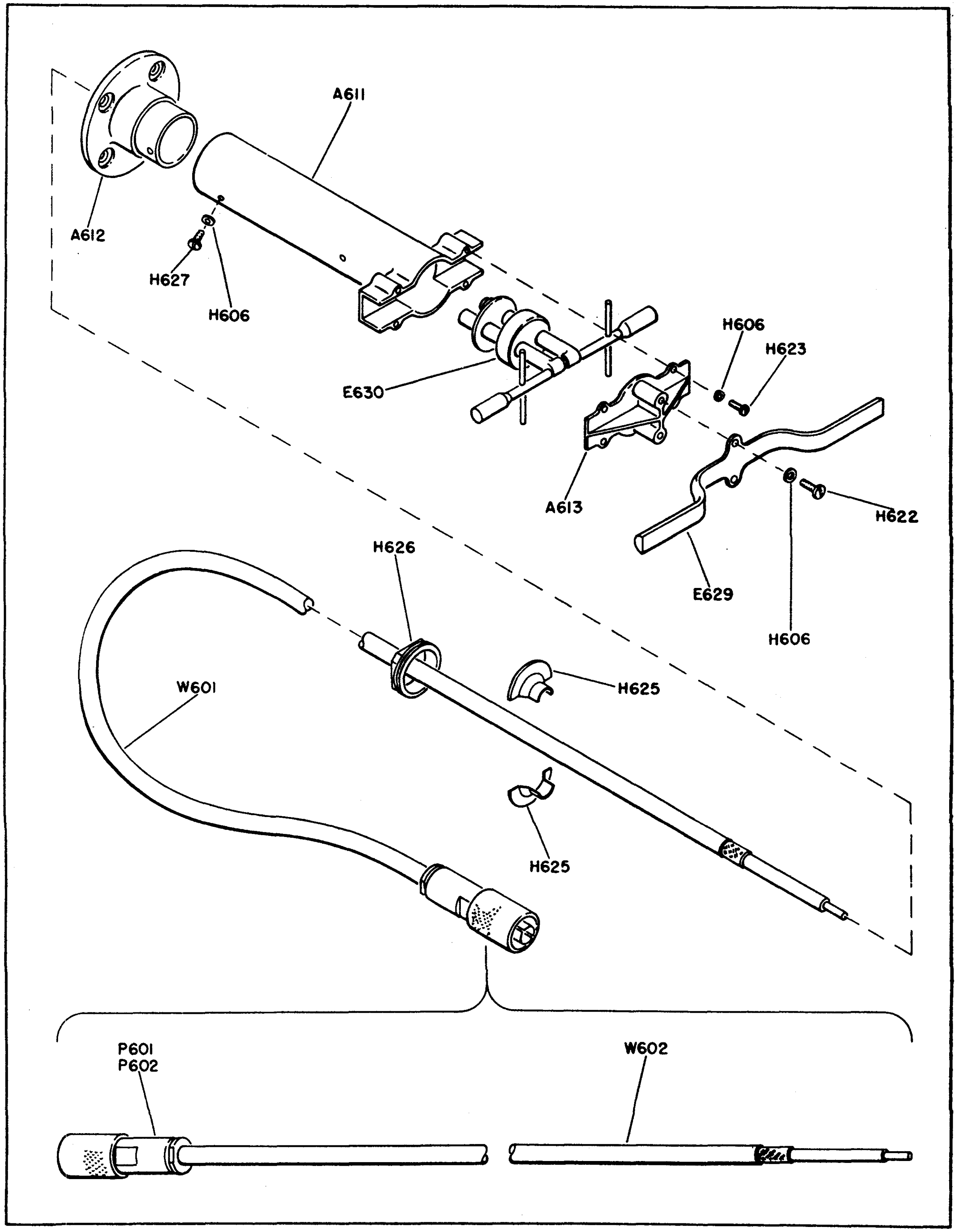


Figure 24. MF Antenna Assembly

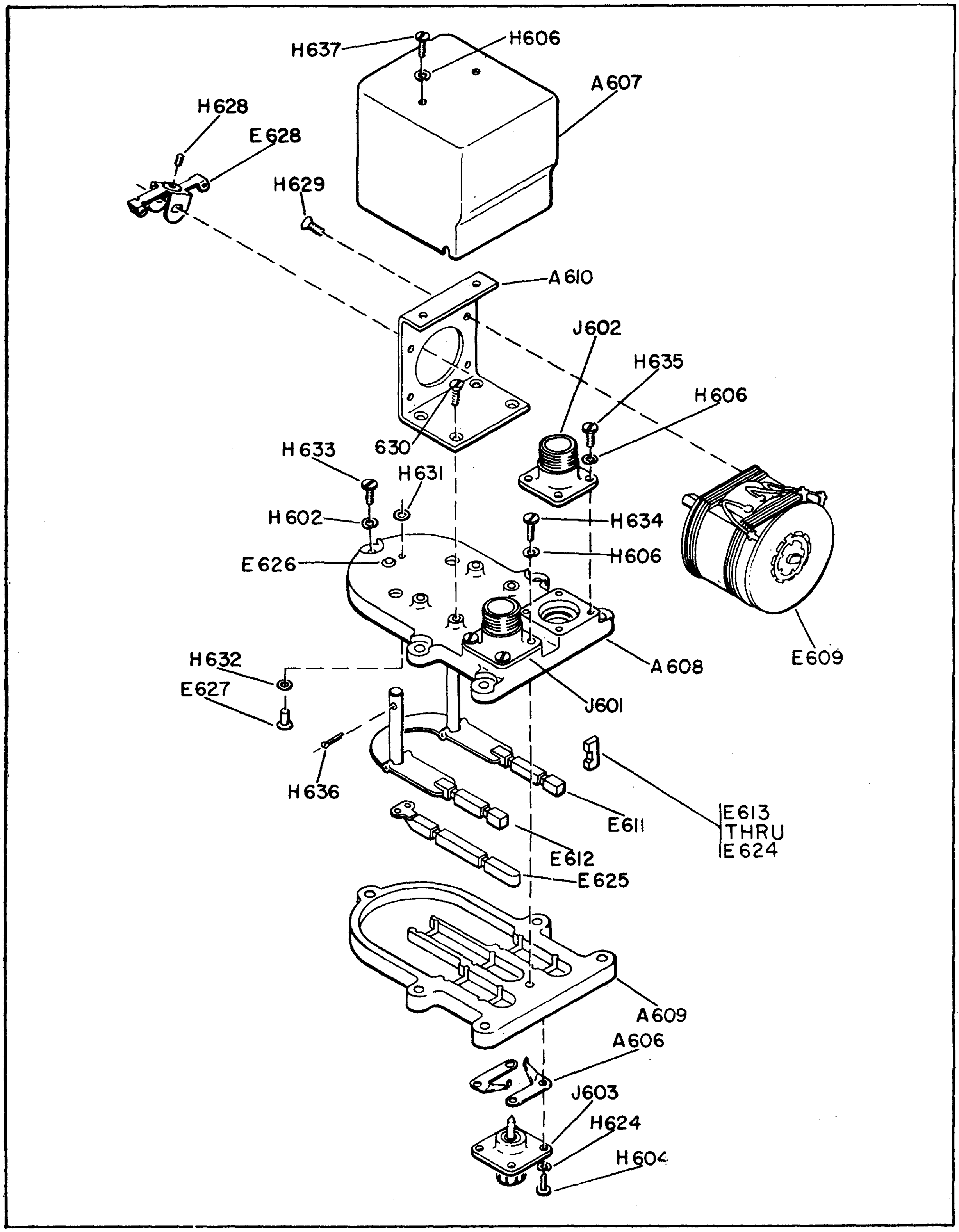


Figure 25. Switch Mounting Assembly

Antenna Assembly AS-434/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
601-699 series.	R16AN-AS434APA-69 (BxR)	ANTENNA ASSEMBLY AS-434/APA-69 R20031 1-1	P1 MO R
A601	R16BXR-N205164	ANTENNA SUBASSEMBLY: consists of two antenna rejectors. two antenna braces, and two reinforcing plates spotwelded together. N205164-1	P1 MO N
A602		FLANGE ASSY, mounting: consists of a die cast mounting flange 3.5 in. dia into which . straight locating pin is pressed. A203403.-1	A1
A603		FLANGE ASSY, mounting: consists of a die cast mounting flange 3.5 in. dia into which a straight locating pin is pressed. A203403-1l	A1
A604		MOUNTING ASSY, antenna: consists of a mounting collar to which for brackets are riveted. N205165-1	X2
A605		DISC, mounting: A1, etched finish: 20 in. dia with key shape cutout in center. N23467	X2
A606	R16BxR-C228504	PLATE, lock: beryllium copper. silver : 1 in. lg x 0.015 in. thk: bent arm extending out: two 0.116 in. holes. one in each end, (2 each used) C228504	P1 O N
A607		COVER, relay: A1, etched finish: 2.33 in. x 2.20 in. x 2.5x in.: two holes 0.128 in. drilled 1.250 in. c to c: two 0.203 in. cutout off side on opposite sides; cutout 0.24 in. wd: 0.08 in. deep off another side. C281536-1	M1
A608		BODY, switch: A1 die casting; etched finish: one end rounded: 4-1,2 in. lg: 2-5/16 in. wd: 0.49 in. OA thickness: five protrusions extending two from each side and one from rounded end each drilled 3/16 in. dia. and chore: four holes tapped 4-401 NC-2 x 0.20 in. deep: Double row 1.33 in. c to c: two holes 7/16 in. And cbore 3:3/64 in. dia x 0.18 in. deep, and csink 1.32 in. c to c with four holes tapped 4-40 NC-2 x 0.25 in. deep around each hole: two 0.064 in. holes drilled 0.28 in. c to c on rounded end: two holes 0.281 in dia 1.32 in. c to c. N243032	X2
A609		BODY. switch: A1 die casting. etched finish: one end rounded: 4-1/2 in. lg x 2-5/16 in. wd: 0.312 in. thk; five protrusions extending two from each side and one from rounded end: the four side protrusions drilled with 3/16 in. dia holes: hole in protrusion on rounded end tapped 8-32 NC-2; 7/16 in. hole drilled near flat end ann cbore 33/64 in, dia x 0.180 in. deep x csink 0.670 in. dia: four 4-40 NC-2 x 0.24 in. deep tapped holes around cbore: one 4-40 NC-2 tapped hole thru at cbore : one 1/16 in. hole drilled near tap on rounded end. N243031	X2
A610		MOUNTING ASSY, relay: consists of bracket into which two inserts are pressed. A203456-1	A1
A611		SUPPORT, antenna tube: A1 die casting, etched finish; tube 4.156 in. lg; 1.187 in. OD: I in. 1D: four 0.128 in. Holes drilled in tube: arms extending from other end OA 2.38 in. lg: 5/8 in. wd: four protrusions two on each arm tapped 4-40 NC-2; cutout 0.43:t in. wd complete length of arms. L225855	X1
A612		FLANGE, antenna mounting: A1 die casting. etched finish: 1.25 in. lg: flange dia 2.245 in. tapped 1-1/8-28 NEF-2 center of flange: 0.812 in. 1D other end; OD 1.060 in. on end: 1.1/7 in. OD 1/2 in. from end: three evenly spaced holes tapped 4-40 NC-2 around end: four holes 0.154 in. and chore 0.31 in. evenly spaced on flange: one 0.067 in. hole in flange. C233459	X1
A613		COVER. antenna support. A1 die casting. etched finish: angular: 2.3R in. lg: 0.562 in. thk; :0.60 in. wd: rib 0.12 in. thk runs length of cover; three protrusions on each side. one small on each end and large one in center: No. 4-40 NC-2 tapped hole x 10.34 in. deep in each large protrusion; 0.128 in. hole drilled in each small protrusion. C228554	X1
C601	R16C11491-355	CAPACITOR, fixed: paper: 2 uf -20. -10% 600 vdcw. C P54B1EF205V	P1 MO/N
E601	R16BXR-L203330-1	ANTENNA, dipole array: medium frequency. L203330-1	P1 MO/S
E602	R16BXR-L203330-X	ANTENNA, dipole array: medium frequency. L203330-1	P1 MO/S

Antenna Assembly AS-434/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
E.603		BLOCK, connector: black Plastic; 1 in. lg; 0.580 in. wd; 0.130 in. thk: two semi-circular slots 0.094 in. radius 0.070 in. wd in center of mount: 0.062 in. radius semi-circular grooves the length of mount; two 0.128 in. dia holes evenly spaced at right angles to the grooves. A235876-1	X1
E604		BLOCK, connector: black Plastic; 1 in. lg; 0.580 in. wd; 0.130 in. thk: two semi-circular slots 0.094 in. radius 0.070 in. wd in center of mount; 0.062 in. radius semi -circular grooves the length of mount; two 0.128 in. dia. csink holes evenly spaced at right angles to the grooves. A235876-2	X1
E605		CONTACT, connector: female: beryllium copper rod: silver P1 : 1.120 in. lg. A243004	X1
E606		CONTACT, connector: female; beryllium copper rod: silver P1 : 1.120 in. lg. A243004	X1
E607	R17S17020	STRIP, terminal: black Plastic: 1-3/8 in. lg; 7/8 in. wd; 13/32 in. thk; two terminals; two 0.160 in. dia holes on each end, C60854-2 (JNS) 2-140	P1 O/N
E608		SPRING, contact: beryllium copper. Cd pl : U-shaped: 1/2 in. lg x 0.240 in. wd. A249620	M1
E609	R17BXR-C218248	COIL, relay: 28V dc nominal; 50,000 ft max alt; 1.906 in. dia: 2.230 in OA length. C218248	P1 MO/N
E610		INSULATOR, Plate: naturA1 Plastic; 1.76 in. lg x 1.19 in. wd x 0.032 in. thk. C243544-4	M
E611	R16BXR-C203341-1	CONDUCTOR ASSY, spring: RH; consists of a spring conductor to the end of which in riveted 2 contacts; a shaft is also clamped on at right angle. C203341-1	P1 O/N
E612	R16BXR-C203341-2	CONDUCTOR ASSY, spring: LH; consists of a spring conductor to the end of which is riveted 2 contacts; shaft is also clamped on at right angle. C203341-2	P1 O/N
E613		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E614		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E615		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E616		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E617		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg. x 1/4 in. wd x 0.12 in. thk. A242781	M1
E618		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E619		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E620		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E621		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E622		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg. x 1/4 in. wd x 0.12 in. thk. A242781	M1
E623		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg x 1/4 in. wd x 0.12 in. thk. A242781	M1
E624		INSULATOR, bead: Plastic; U-shaped; 1/2 in. lg. x 1/4 in. wd x 0.12 in. thk. A242781	M1
E625	R16BXR-A20339	CONDUCTOR ASSY, center: consists of a center conductor with 2 contacts riveted A203339-1	P1 O/N

Antenna Assembly AS-434/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
E626		CONTACT: coin silver: 0.24 in. dia of head: shaft 0.052 in. dia: 0.114 in. lg. C243043.	X1
E627		CONTACT: coin silver: 0.24 in. dia of head: shaft 0.062 in. dia: 0.110 in. 14. C2430436	X1
E628	R17BXR-C207717	ARM ASSY: consists of an arm into which a threaded square insert has been rolled over. C207717-1	P1 O/N
E629	R16BXR-C222326	ELEMENT, antenna reflector: die cast, etched finish: 5.76 in. Ig bar: 0.36 in. wd. C222326	P1 MO/S
E630		ANTENNA ASSY: consists of two antennas mounted on two supports spaced by a centering Plate. The antennas are in the same Plane and spaced 180° apart C203299-1	X1
H601		SCREW, Mach : slot dr : Bind H brs. nickel pl : No. 8-32 NC-2: 3/4 in. Ig. (4 each used) Commercial	
H602		WASHER, lock: phosphor bronze, nickel pl : split: No. 8. (5 each used) AN935B8	
H601		SCREW, mach: slot dr: Bind H: brs,. nickel pl : No. 6-32 NC-2: 5/8 in. lg (13 each used) Commercial	
H604		SCREW, mach: slot dr: Bind H: brs, nickel pl: No. 4-40 NC-2: 1/4 in. lg. (6 each used) Commercial	
H605		NUT, hex: brs. nickel pl: No. 4-40 NC-2. (2 each used) AN340B4	
H606		WASHER, lock: phosphor bronze. nickel pl : split; No. 4. (25 each used) AN935B4	
H607		NUT, stop: hex; brs. nickel pl ; No. 6-32 NC-2. (50 each used) A12612-5 (EN) 99M622	
H608		WASHER, flat: brs, No. 6. (45 each used) AN601B6	
H609		WASHER, flat: brs: 0.166 in. ID: 1-1/2 in. OD; .0093 in. thk. Commercial	
H610		WASHER, flat: brs; 0.166 in. ID; 1-1 2 in. OD; 0.031 in. thk. (3 each used) Commercial	
H611		SCREW, mach: slot dr: Bind H: brs. nickel pl : No. 8-32 NC-2; 5/8 Ig. (26 each used) Commercial	
H612		NUT, stop: hex: brs; No. 1-32 NC-2. (31 each used) A12622-15 (EN) 92TM-82	
H613		WASHER, fit. brs: No. 8. (31 each used) AN960B8	
H614		SCREW, math: slot dr; Bind H; brs, nickel pl : No. 6-32 NC-2; 7/16 in, lg. (8 each used) Commercial	
H615		NUT, hex: brs, nickel pl; No. 6-32 NC-2. (8 each used) AN340B6	
H616		WASHER, lock: phosphor bronze. nickel pl : split: No. 6-32. (20 each used) AN935B6	
H617		SCREW, mach: slot dr: Bind H; brs nickel pl; No. 8-2 NC-2; 1/2 in lg. (6 each used) Commercial	
H618		SCREW, mach: slot dr; Bind H; bran,. nickel pl ; No. 8-32 NC-2; 7/16 in. (8 each used) Commercial	

Antenna Assembly AS-434/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
H619		SCREW, mach: slot dr; Bind H brs, nickel pl ; No. 6-32 NC-2: 3/8 in. Ig. (33 each used) Commercial	
H620		SCREW, mach: slot dr; Bind H; brs, nickel pl ; No. 6-32 NC-2: 1/2 in. Ig. (8 each used) Commercial	
H621		SCREW, mach: slot dr; FH; brs, nickel pl : No. 4-40 NC-2: 3./8 in. lg. (2 each used) AN505B4-6	
H622		SCREW, mach: slot dr; rd hd: steel, Cd pl : No. 4-40 NC-2: 7/16 in. Ig. (2 each used) AN616-4-7	
H623		SCREW, mach: slot dr: rd hd: steel, Cd pl : No. 4-40 NC-2: 5/16 in. lg. (4 each used) AN515-4-5	
H624		WASHER, lock: phosphor bronze, nickel pl : split: No. 4: light. (4 each used) AN936B4L	
H625		CLAMP, cable: A1, etched finish; flanged end 1.056 in. OD: 0.330 in. ID: 1/2 in. Ig. A241712	M1
H626		NUT, clamping: brs, Cd pl; threaded 1-1/1-28. A241713	M1
H627		SCREW, mach: slot dr; rd hd: steel. Cd PL : No. 4-40 NC-2: 1/4 in. lg. (6 each used) AN515-4-4	
H628		SCREW, set: Bristo dr; cup point; steel, Cd PL ; No. 6-32 NC-3 : 3/16 in. lg. Commercial	
H629		SCREW, mach: slot dr; FH: brs, nickel pl; No. 4-40 NC-2; 6/8 in. lg. (4 each used) AN505B4-10	
H630		SCREW, mach : slot dr: FH: brs, nickel pl; No. 4-40 NC-2: 1/4 in. Is. t4 each used) AN505B4-4	
H631		SHIM, bearing: brs. Cd PL : 0.064 in. ID: 0.18 in. OD: 0.010 in. thk. 42 each used) A113111-27	M1
H632		SHIM, bearing: bra, Cd PL ; 0.064 in. ID; 0.240 in. OD: 0.004 in. thk. (2 each used) A113111-26	M1
H633		SCREW, mach: slot dr; rd hd; brs. nickel pl ; No. 8-32 NC-2: 1/2 in. Ig. AN515B8-8	
H634		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 4-40 NC-2; 1/2 in. Ig. AN515B4-8	
H635		SCREW, mach: slot dr; rd hd: bra. nickel pl; No. 4-40 NC-2: 1/4 in. Ig. (8 each used) AN515B4-4	
H636		PIN, cotter: steel, Cd pl; 1/16 in. din; 1/2 in. Ig. (2 each used) A32276-14	
H637		SCREW, mach: slot dr; rd bd; br., nickel pl ; No. 4-40 NC-2: 5/16 in. Ig. (2 each used) AN515B4-5	
H638		NUT, hex: brs, nickel pl : No. 6-32 NC-2; 0.250 in. wd: 3/32 in. thk. (12 each used) HSN775B-4	
H639		SCREW, mach: slot dr: Bind H; bra. nickel pl; No. 6-40 NC-2; 1/4 in. Ig. 44 each Commercial	
H640		WASHER, lock: phosphor bronze. nickel pl; split; No 5. (4 each used) AN936B5	
J601	R16AN-UG58AU	CONNECTOR, receptacle: one female contact. UG-58A/U	P1 MO/N
J602	R16AN-UG58AU	CONNECTOR, receptacle: one female contact. UG-58A/U	P1 MO/N

Antenna Assembly AS-434/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
J603	R16BXR-C203327-1	CONNECTOR ASSY, receptacle: consists of single contact female connector attached to a contact assembly. C203327-1	P1 MO/N
K601	R17BXR-N203225-1	SWITCH MOUNTING ASSY: collar mounting: dpdt N203225-1	P1 MO/S
N601		PLATE, identification. (used on Contract NOas 15-134) N246539-13	
N602		PLATE, identification. (used on Contract NOas 52-435) L247419-2	
N603		PLATE, identification. (used on Contract NOas 54-539) L247419-3	
P601	R16P3626-220	CONNECTOR, receptacle: one female contact. UG-18/U	P1 MO/N
P602	R16P3626-220	CONNECTOR, receptacle: one female contact UG-18S/U	P1 MO/N
P603	R16BXR-C203906-1	PLUG : consists of E603, E604, E605, E606, E608 C203906-1	P1 MO/N
W601		CABLE ASSY: consists of 16 inches of cable RG-6/U and 1 connector UG-18/U. L212612-1	M
W602		CABLE coax : 16 in. lg. RG-5/U	M1

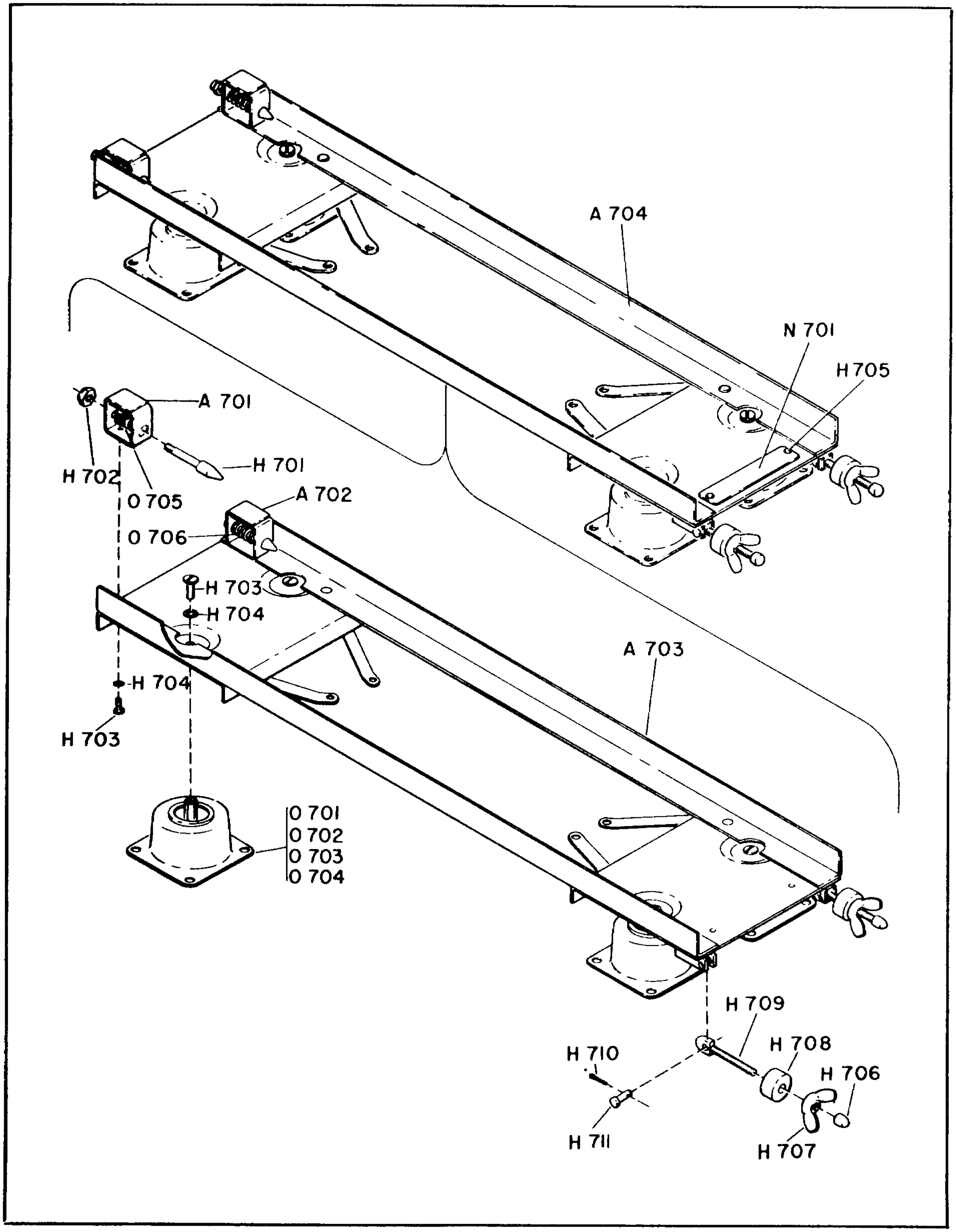


Figure 26. Mount MT-934/APA-69

Mount MT-934/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
701-799 series	R16AN-MT934APA-69 (BXR)	MOUNT MT-934/APA-69 N240594-1	P1 MO/R
A701		BRACKET, mounting. (RAI) 1210A-1	
A702		BRACKET, mounting. (RAI) 1210A-1	
A703		MOUNTING, amplifier. (RAI) R5259-D	
A704		MOUNT, vibration: same as MT-934/APA69. less name plate. N240567-1	X1
H701		PIN, locating. (2 each Used) (RAI) 1212A-1	
H702		NUT, elastic stop : steel, Cd pl: No. 10-32 NF-2. (2 each used) (EN) 99M02	
H703		SCREW, mach : slot dr ; Bind H ; steel, Cd pl ; No. C2 NC-2 ; 3/8 in. Ig. (6 each used) Commercial	
H704		WASHER, flat : steel, Cd pl : No. 6. (6 each used) AN960-6	
H705		RIVET, solid : A1, anodize ; FH; 0.094 in. dia; 1/4 in. Ig. (2 each used) AN442AD3-4	
H706		NUT, round : brs. Cd pl ; 3/8-16 NC-2. (2 each used) (RAI) 1507A-2	
H707		NUT, wing : brs. Cd pl : 3/8-16 NC-2. (12 each used) (RAI) R-1642A-1	
H708		BUSHING, mounting : SS ; 11/16 in. Ig: 1 in. OD; 7/16 in. ID. (RAI) 1488A-1	
H704		ROD, threaded : SS : 3/8 in. dia; 2-7/16 in. lg. (2 each used) (RAI) 1486A-1	
H710		PIN, cotter : cres ; 1/32 in. dia ; 3/8 in. Ig. (2 each used) AN380C1-1	
H711		PIN, SS: 9/16 in. Ig. (2 each used) (RAI) 1358A-3	
N701		PLATE, identification. N246667-33	M1
O701	R421402-12	MOUNT, vibration. C240618-1 (RAI) 7002-H	R O/N
O702:	R421402-12	MOUNT, vibration. C240618-1 (RAI) 7002-H	R O/N
O703	R421402-12	MOUNT, vibration. C240618-1 (RAI) 7002-H	R O/N
O704	R421402-12	MOUNT, vibration. C240618-1 (RAI) 7002-H	R O/N
O705		SPRING, compression: steel, tinned or Cd pl . (RAI) 1211A-1	
O706		SPRING, compression: steel, tinned or Cd pl . (RAI) 1211A-1	

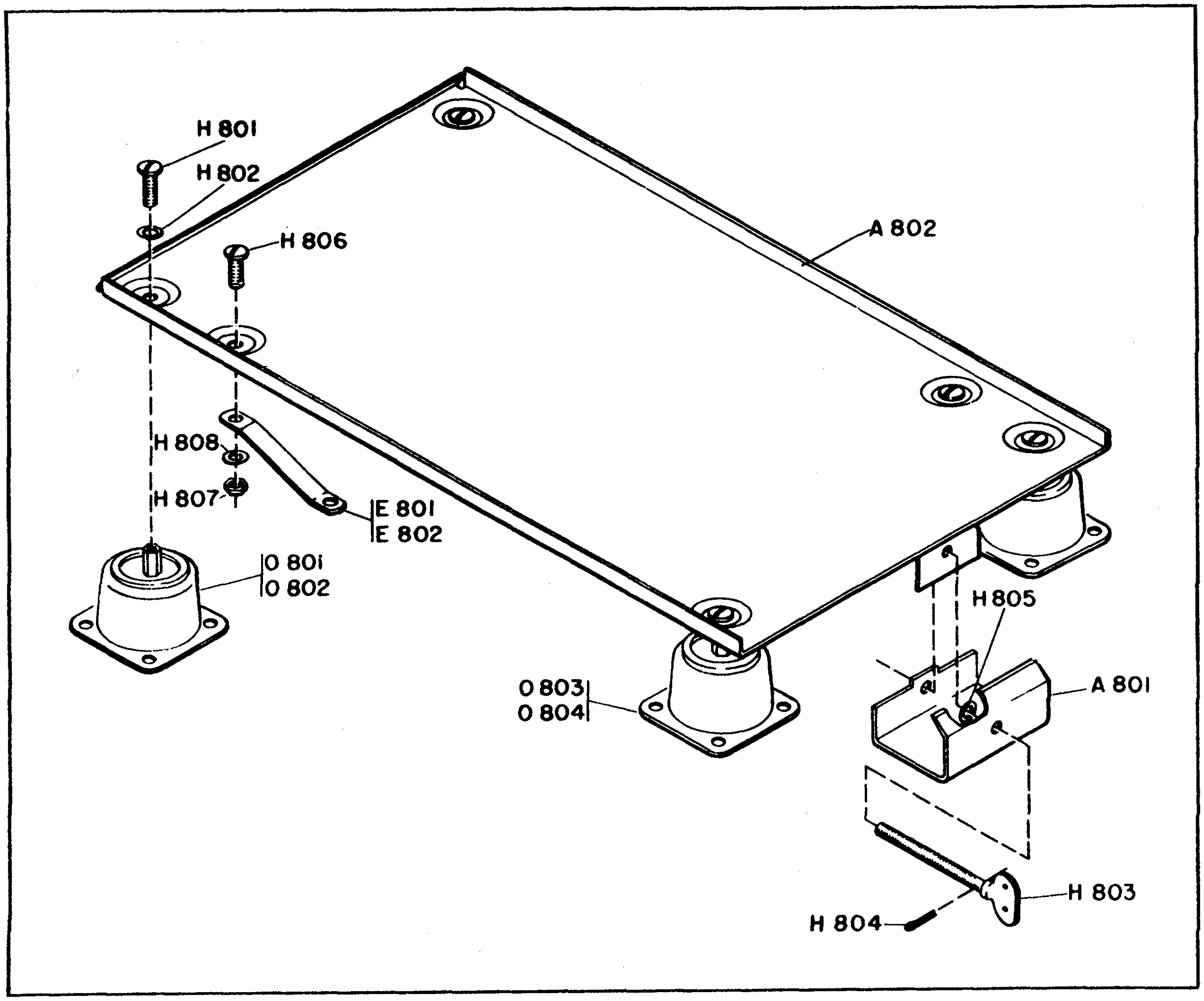


Figure 27. Mount MT-938/APA-69

Mount MT-938/APA-69

Ref. Symbol No.	Stock No.	Description		Source Code
801-899 series		MOUNT MT-938/APA-69	N240598	P1 MO/R
A80		MOUNTING, amplifier	(RAI) R-3104A	
A802		MOUNTING, indicator.	(RAI) R-S304D	
E801		STRAP, grounding.	(RAI) 14476	
E802		STRAP, grounding.	(RAI) 1447-6	

Mount MT-938/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H801		SCREW, mach : slot dr : Bind H : cres, Cd pl : No. 8-32 NC-2 : 3/8 in. lg. (4 each used) (RAI) 1503-1	
H802		WASHER, lock : steel, Cd pl : split: No. 8 (4 each used) AN935-8	
H803		SCREW, thumb: cres, Cd pl. (RAI) R-3123A-1	
H804		PIN, roll : steel, Cd pl. (EN) 52-018-078-0375	
H805		WASHER, flat: cres : 1/4 in. Commercial	
H806		SCREW, mach : slot dr : rd hd : brs, Cd pl : No. 6-32 NC-2: 1/4 in. lg. (2 each used) AN515B6-4	
H807		NUT, hex: steel, Cd pl : No. 6-32 NC-2: 5/64 in. thk. (2 each used) Commercial	
H808		WASHER, lock: steel, Cd Pl : int tooth : No 6 (2 each used) AN936A6	
O801	R421402-11	MOUNT, vibration. C240617-1 (RAI) 7001-L	P1 O/N
O802	R421402-11	MOUNT, vibration. C240617-2 (RAI) 7001-L	P1 O/N
O803	R421402-11-20	MOUNT, vibration. C240617-2 (RAI) 7001-M	P1 O/N
O804	R421402-11-20	MOUNT, vibration. C240617-2 (RAI) 7001-M	P1 O/N

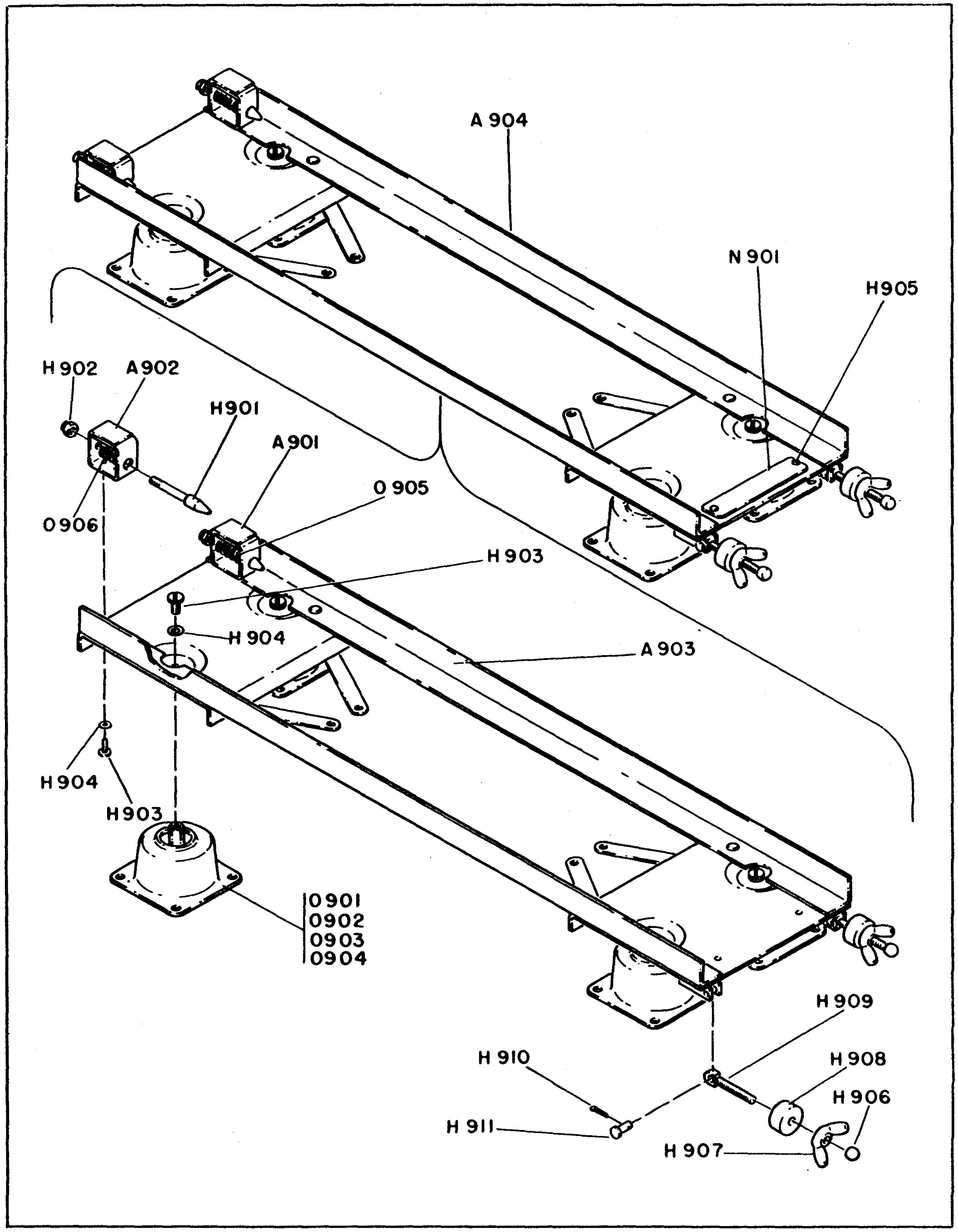


Figure 28. Mount MT-1005/APA-69A

Mount MT-1005/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
901-999 series	R16AN-MT-I005APA-69A (BXR)	MOUNT MT-1005/APA-69A. N240594-2	P1 MO/R
A901		BRACKET, mounting. (RAI) 1210A-1	
A902		BRACKET, mounting. (RAI) 1210A-1	
A903		MOUNTING. amplifier. (RAI) R-5259-D	
A904		MOUNT, vibration: same as MT-1005/APA49A Mount less nameplate N240567-2	X1
H901		PIN, locating. (2 each used) (RAI) 1212A-1	
H902		NUT, elastic stop : steel, Cd pl : No. 10-32 NF-2. (2 each used) Commercial	
H903		SCREW, Mach : slot dr; Bind H : steel, Cd pl : No. 6-32 NC-2 ;3/8 in. lg. (6 each used) Commercial	
H904		WASHER, flat : steel, Cd pl ; No. 6. (6 each used) AN960-6	
H906		RIVET, solid : FH: A1, Anodize : 0.094 in. dia : 1/4 in. lg. (2 each used) AN442AD3-4	
H906		NUT, round: brs, Cd pl ; 3/8-16 NC-2. (2 each used) (RAI) 1507A-2	
H907		NUT, wing : brs, Cd pl ; 3/8-16 NC-2. (2 each used) (RAI) R-1642A-1	
H908		BUSHING, mounting : SS : 7/16 in. ID ; 1 in. OD; 11/16 in. lg. (2 each used) (RAI) 1488A-1	
H909		ROD, threaded : SS : 3/8 in. dia : 2-7/16 in. lg. (2 each used) (RAI) 1486A-1	
H910		PIN, cotter : steel : 1/32 in dia : 3/8 in. lg. (2 each used) AN380C1-1	
H911		PIN : SS ; 9/16 in. lg. (2 each used) (RAI) 1358A-3	
N901		PLATE, identification. N246667-35	
O901	R421402-13	MOUNT, vibration. C240618-2 (RAI) 7002-J	P1 O/N
O902	R421402-13	MOUNT, vibration. C2240618-2 (RAI) 7002-J	P1 O/N
O903	R421402-13	MOUNT, vibration. C240618-2 (RAI) 7002-J	P1 O/N
O904	R421402-13	MOUNT, vibration. C240618-2 (RAI) 7002-J	P1 O/N
O905		SPRING, compression : steel, tinned or Cd pl. (RAI) 1211A-1	
0906		SPRING, compression : steel, tinned or Cd pl. (RAI) 1211A-1	

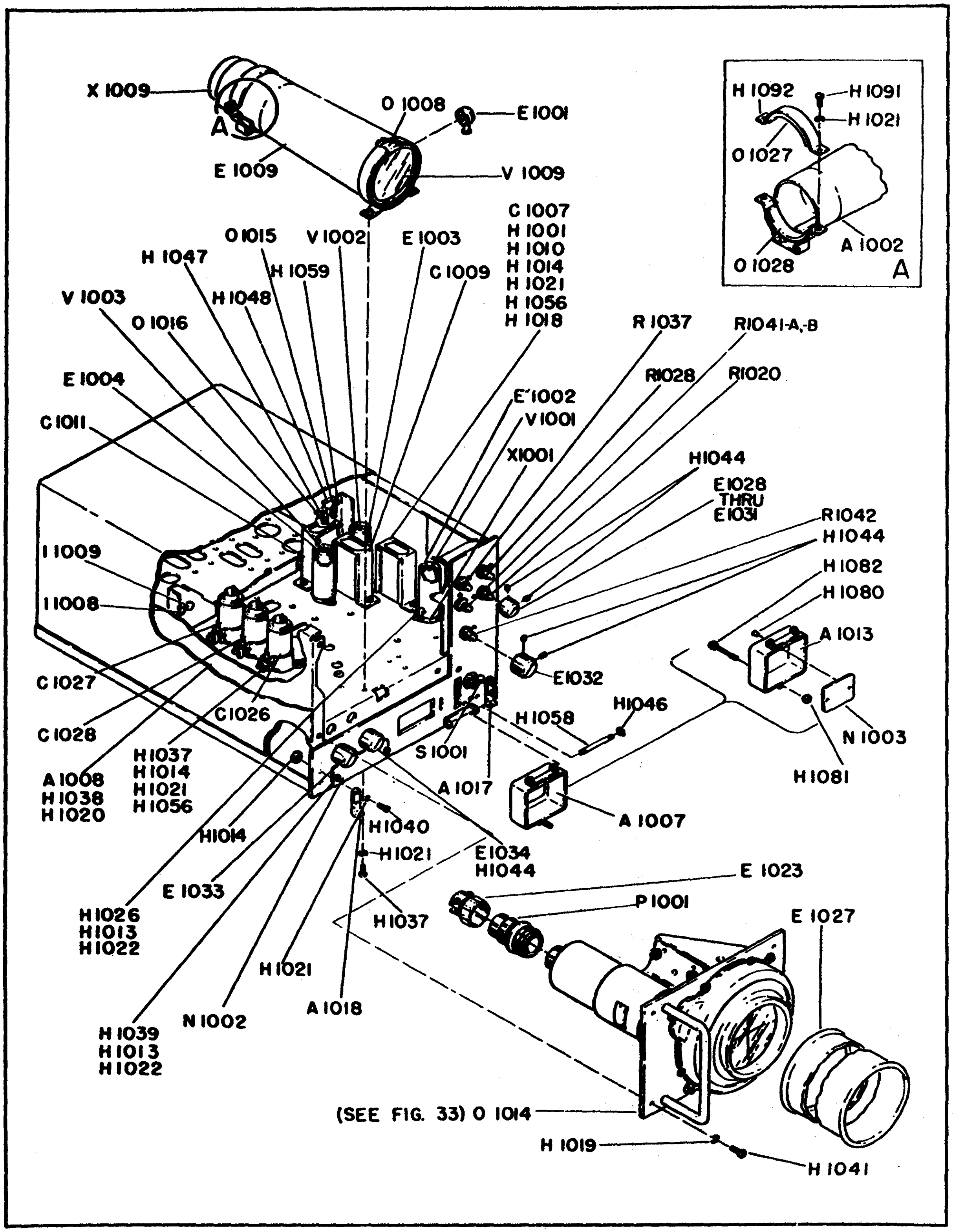


Figure 29. Azimuth Panoramic Indicator IP-81/APA-69A (Sheet 1 of 4)

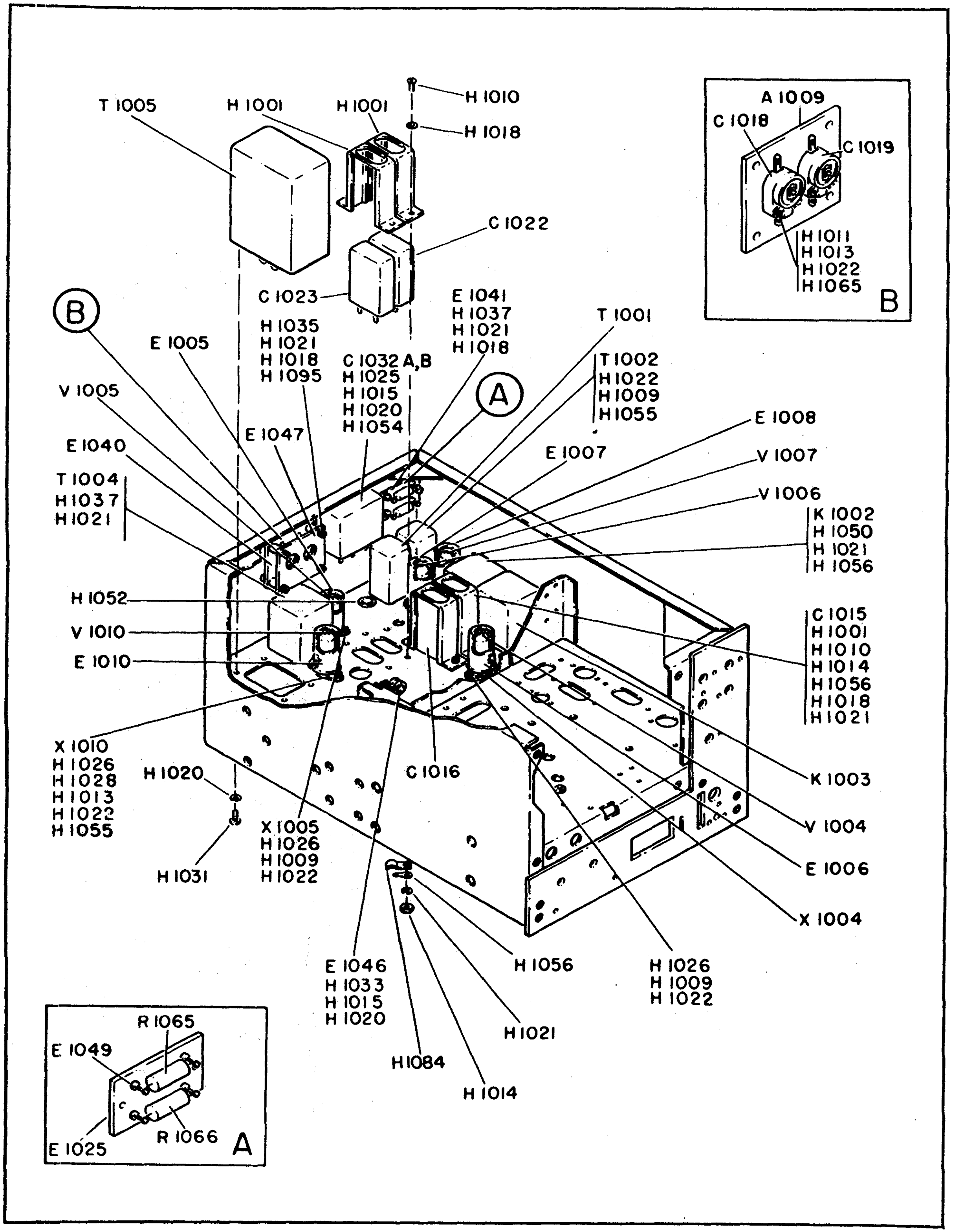


Figure 29. Azimuth Panoramic Indicator IP-81/APA-69A (Sheet 2 of 4)

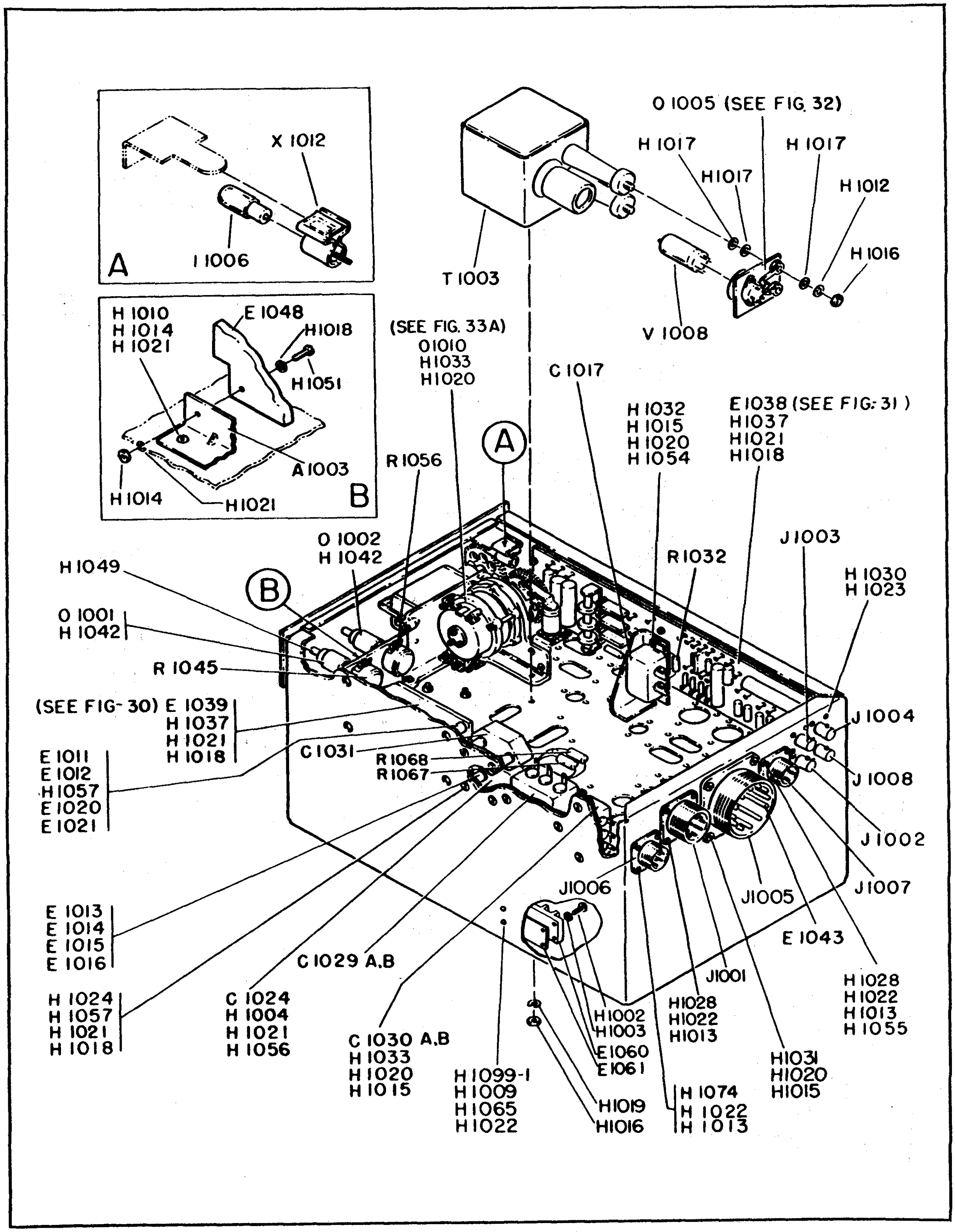


Figure 29. Azimuth Panoramic Indicator IP-81/APA-69A (Sheet 3 of 4)

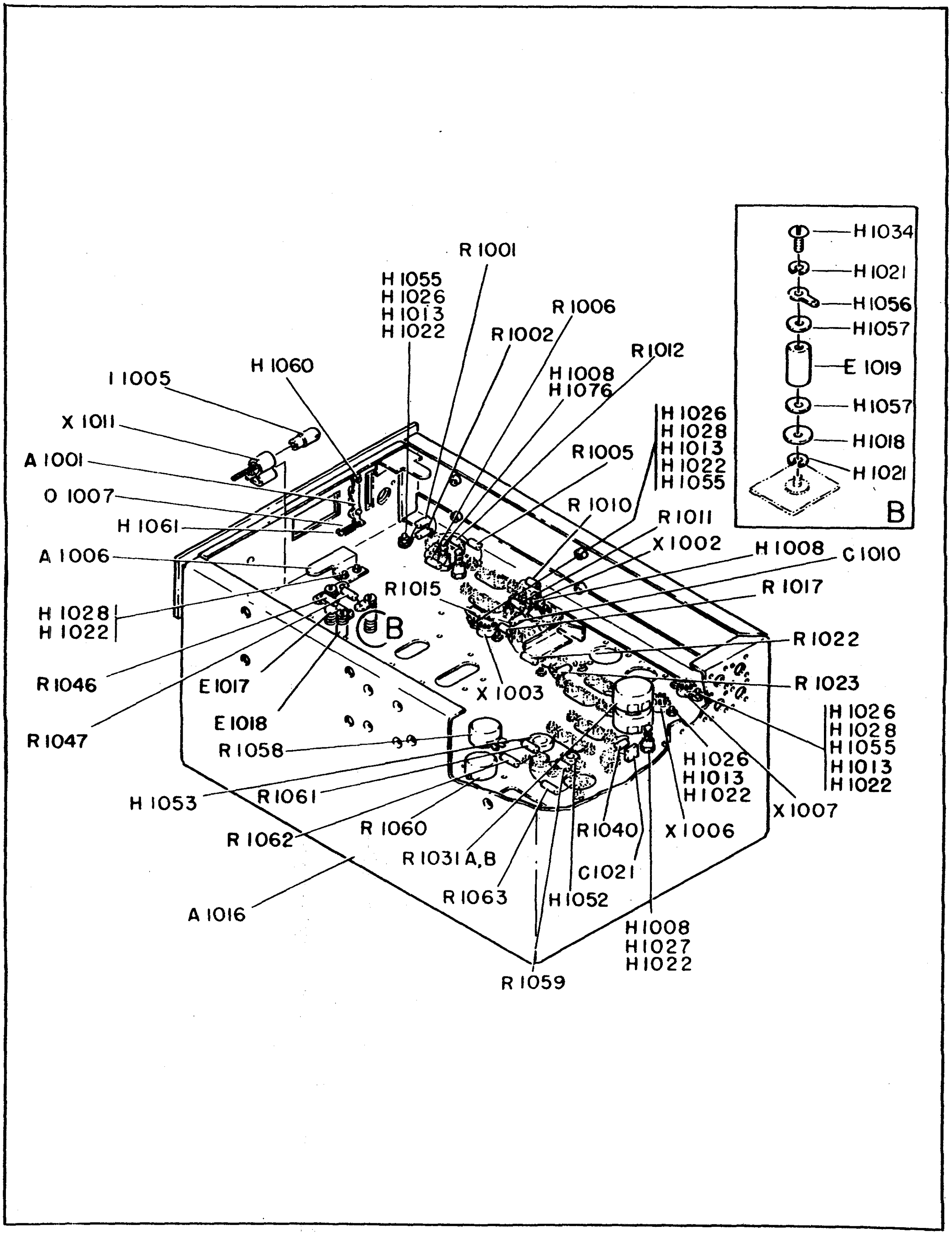


Figure 29. Azimuth Panoramic Indicator IP-81/APA-69A (Sheet 4 of 4)

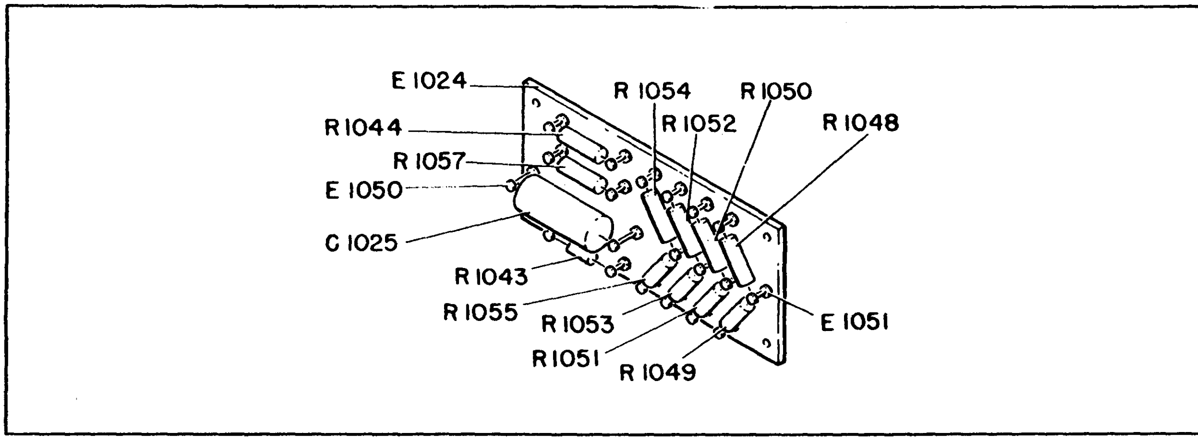


Figure 30. Capacitor and Resistor Assembly

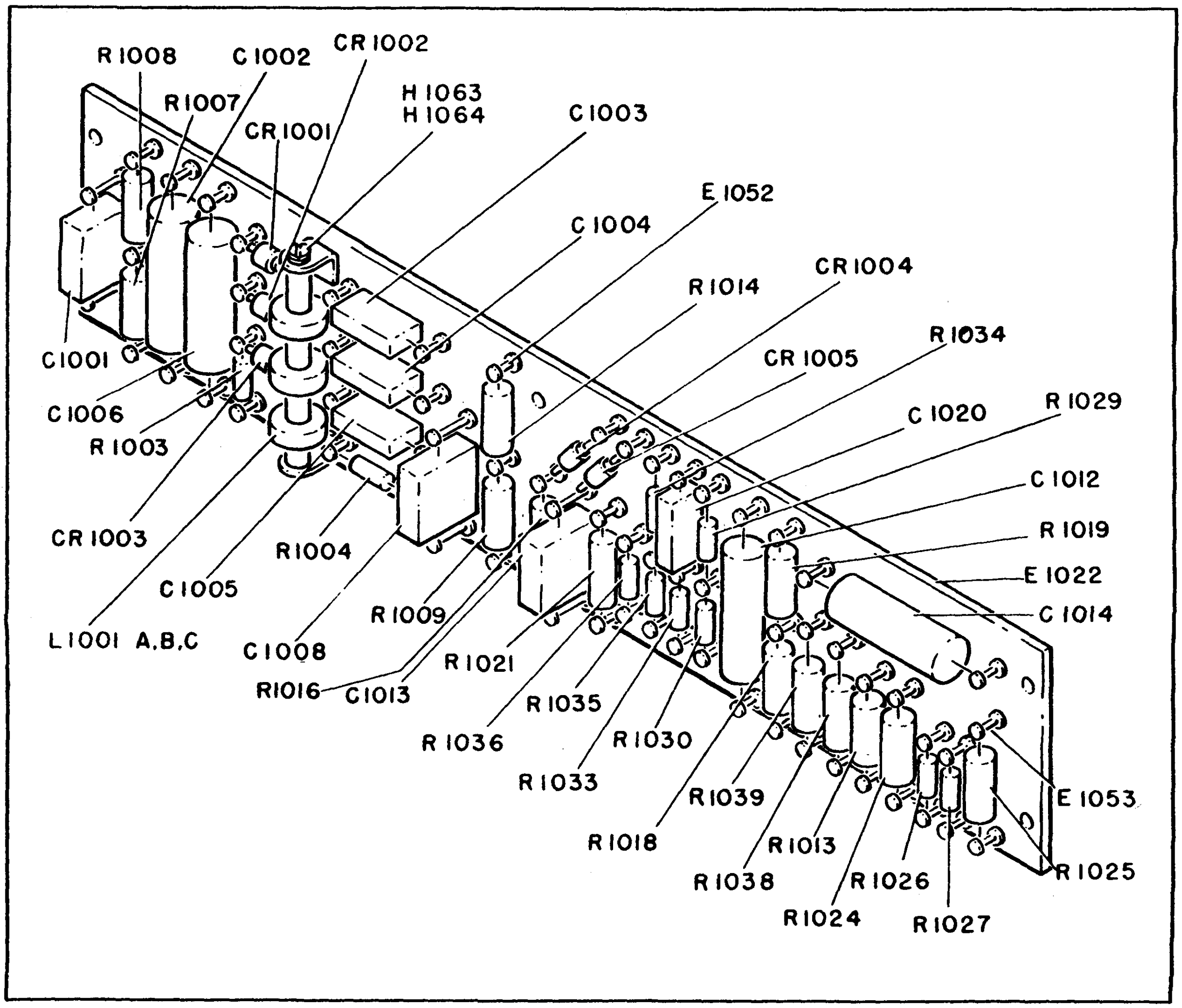


Figure 31. Capacitor and Resistor Assembly

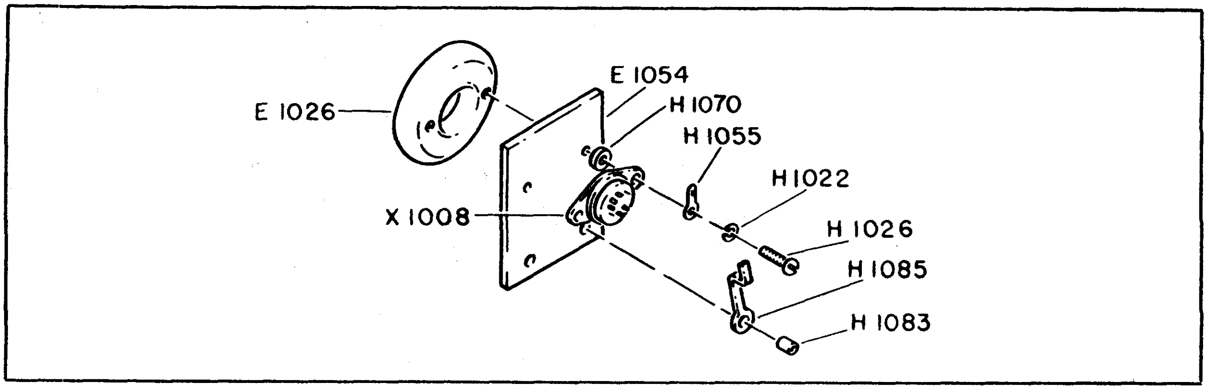


Figure 32. Rectifier Mounting Assembly

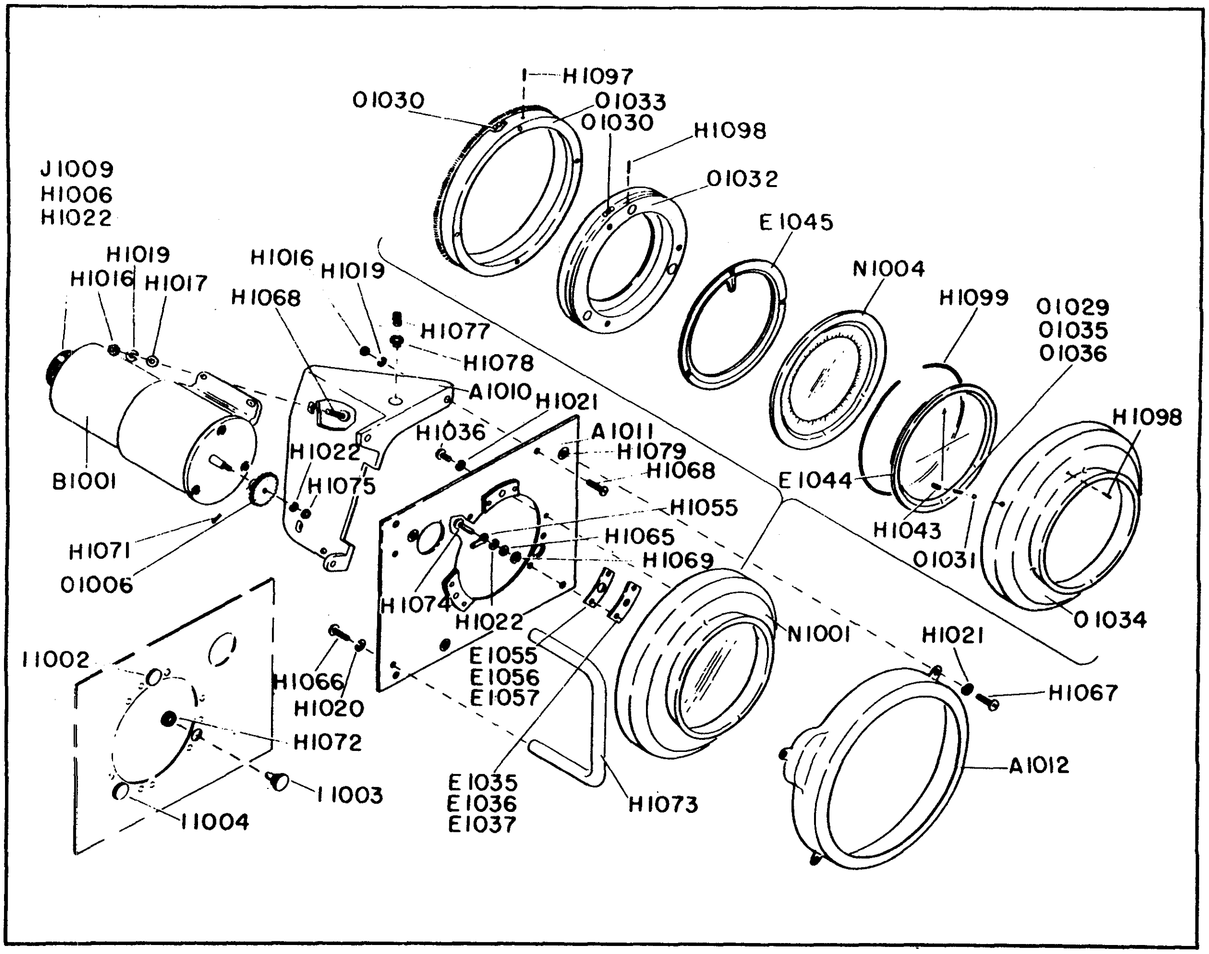


Figure 33. Dia1 Drive Assembly

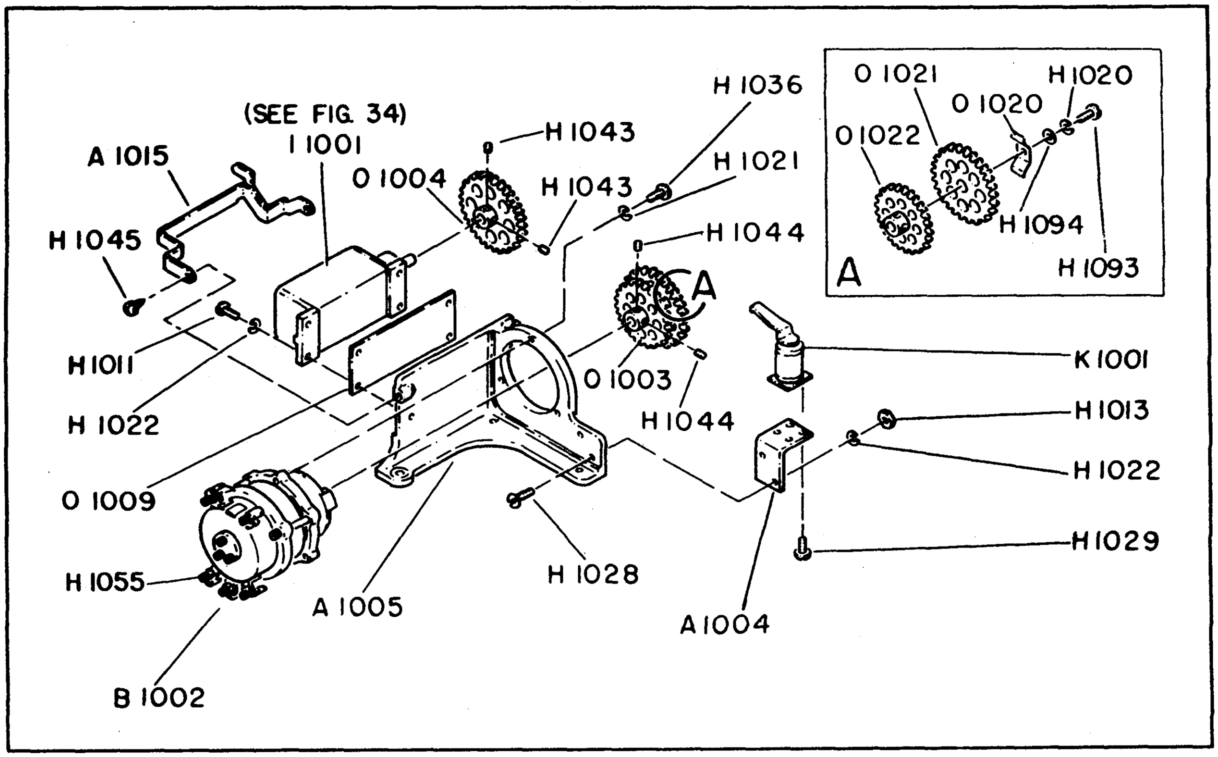


Figure 33A. Electrical Counter Assembly

84B

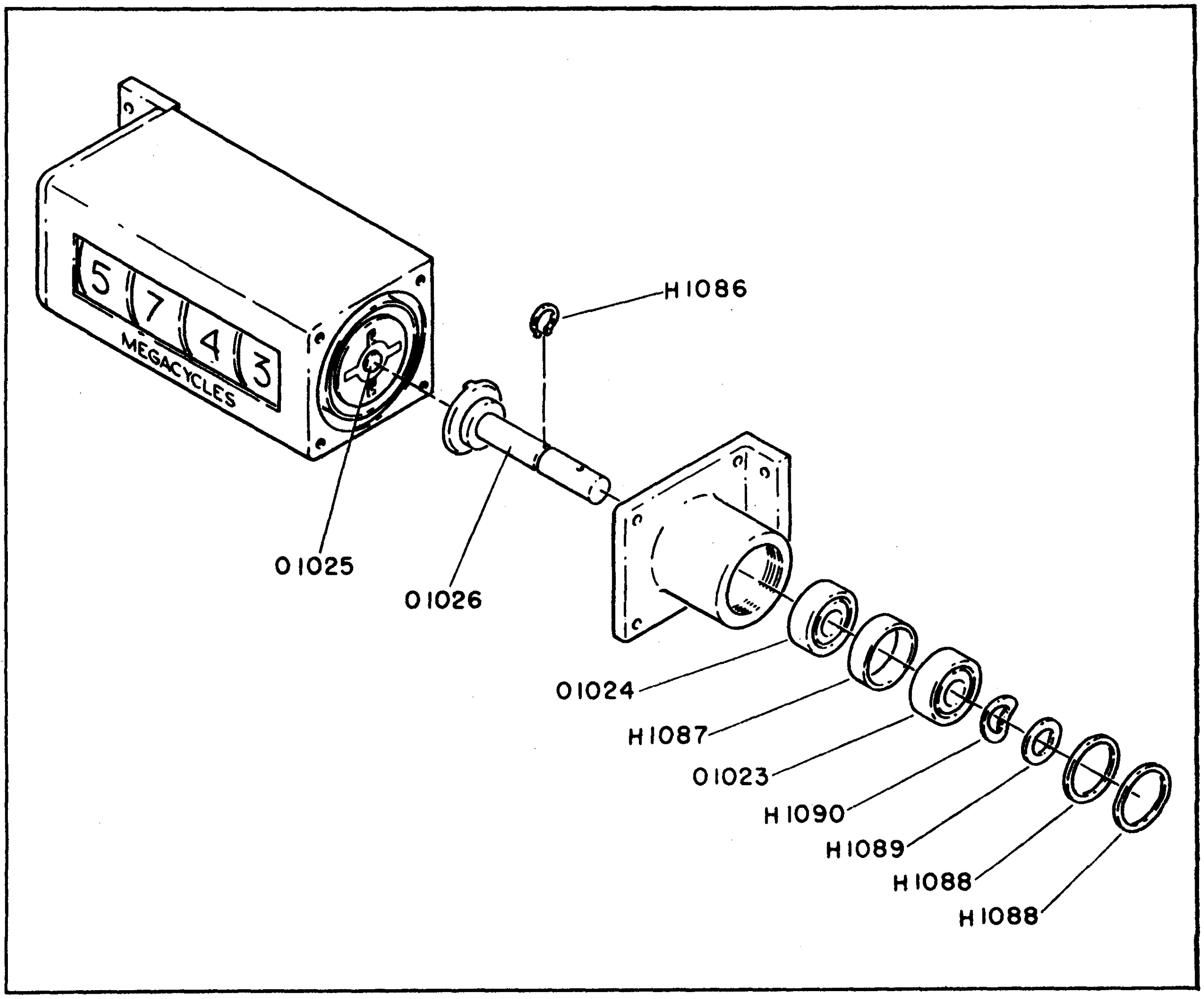


Figure 34. Counter Assembly

Azimuth-Panoramic Indicator IP-81/APA-69A

Ref. Symbol No.	Stock No.	Description	Source Code
1001-1099 series	R16AN-IP81APA-69A (BXR)	AZIMUTH-PANORAMIC INDICATOR IP-81/APA-69A R200727	P1 MO/H
A1001		LATCH, lever: brs, Cd pl; irregular shape ; elongated hole one end ; 0.106 in. dia hole other end; approximately 1-5/8 in lg. C245494	M1
A1002		TUBE SHIELD ASSY: consists of a bracket., rim, and clamp spotwelded to a tube shield. L204580-2	X1
A1003		BRACKET: A1, etch finish; angular; 2-1/4 in. Ig: each side 0.68 in. wd ; hole 0.161 in. dia drilled two on each side; three dimple on angle. A296571	M1
A104		BRACKET: A1, etch finish; L-shaped; 0.76 in. wd: one end 1.16 in. Ig with two holes drilled 0.136: in. dia ; other end 0.98 in. Ig with four holes drilled 0.116 in. dia evenly spaced ; dimple on angle. C296582	M1

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
A1005		BRACKET: A1, etch finish; 3.60 in. x 2.44 in. 3.68 in.; hole 1.876 in. dia in one side with three holes 0.161 in. dia and spotfaced 3/8 in. x approximately 0.02 in. deep evenly spaced around hole. N296572	
A1006		BRACKET ASSY: consists of an irregular shaped bracket with two inserts. C208455-1	A1
A1007		COVER ASSY: consists of a cover with captivated screw in bracket and identification plate riveted to cover. L208376-2	X2
A1008		COVER ASSY: spotfaced: 10.12 in. lg x 7.62 in. wd. N208392-1	A1
A1009		PLATE, mounting: natural plastic; 2.25 in. lg x 2 in. wd x 0.091 in. thk: hole drilled 0.161 in. dia one in each corner: four holes 0.120 in. dia drilled 0.445 in. c to c; stenciled C1018 on one end and C1019 on other end. A296596	M1
A1010		SUPPORT, dial drive: A1 die casting; irregular shaped; 3.26 in. x 3-5/8 in. x 4.718 in.; 5-5/8 in. lg. N229629	
A1911		PANEL: A1, etch finish with front painted black; 7.63 in. lg x 5-1/2 in. wd; cutout 3.180 in. dia in panel with three holes 0.386 in. dia and chore 0.438 in. dia. x 0.048 in. deep evenly spaced around cutout; hole 1.060 in. dia near one corner: hole 0.218 in. dia in each corner; two holes 0.218 in. dia and chore 3/8 in. dia x 0.043 in. deep drilled 5.660 in. c to c. L296633	M1
A1912	R16BXR-L230499-2	GUARD: circular; A1 : 5.09 in. dia one side; 6-3/8 in, dia other side; 7-3/8 in. OA OD; four protrusions evenly spaced around edge. L230499-2	P1 MO/N
A1013		COVER ASSY: consists of two brackets and a cover. L208376-1	X2
A1014		NOT USED	
A1015		RANGE INDICATOR ASSY: consists of a range indicator to which a lever is spot-welded. C208375-1	M1
A1016		AZIMUTH-PANORAMIC INDICATOR ASSY: consists of frame to which brackets, gussets and Plates are riveted or welded. R208446-1	X1
A1017		HOOK: SS, passivate: 0.32 in. wd: 0.094 in. thk: approximately 1-1/8 in. lg; 2 holes 0.149 in. dia drilled 1/2 in. c to c. A245234	M1
A1018		HOOK: SS, passivate; 0.32 in. wd: 0.094 in. thk; approximately 1-1/8 in. lg; 2 holes 0.149 in. dia drilled 1/2 in. c to c. A245234	M1
B1001	R16BXR-L	DRIVE, dial: torque unit; 115V; 380 to 420 cyc; max oper alt 50,000 ft. L211728-1 (ECP) 12625-3	P1 MO/R
B1002	R17M3010	MOTOR, self-synchronous: 47.5V; 400 cyc; 100 ma at 1 watt: second output 22V max. L221051-2 (KO) 1339-0430-0	P1 MO/S
C1001	R16C10492-56	CAPACITOR, fixed- mica; 10,000 uuf ±5%; 300 vdcw. CM35C103J	P1 MO/N'
C1002	R16C11307-14	CAPACITOR. fixed: paper; 0.1 uf ±20%; 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C1003	R16C9843-3-100	CAPACITOR, fixed: mica; 47 uuf ±5%; 500 vdcw. CM20C470J	P1 MO/N
C1004	R16C9843-36-100	CAPACITOR, fixed: mica; 47 uuf ±5%; 500 vdcw. CM20C470J	P1 MO/N
C1005	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf ±5%; 500 vdcw. CM20C470J	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
C1006	R16C11307-14	CAPACITOR, fixed: paper; 0.1 uf ±20%; 400 vdcw. L220152-70 (SPR) 91P10401	P1 MO/N
C1007	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10%: 600 vdcw. CP61B1FF105V	Pt MO/N
C1008	R16C10492-56	CAPACITOR, fixed: mica: 10,000 uuf ±5%; 300 vdcw. CM35C103J	P1 MO/N
C1009	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10%; 600 vdcw. CP61B1FF105V	P1 MO/N
C1010	R16C10492-56	CAPACITOR, fixed: mica; 10,000 uuf ±5%: 300 vdcw. CM36C103J	P1 MO/N
C1011	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper; 1 uf +20 -10%: 300 vdcw. CP61B1FF105V	P1 MO/N
C1012	R15C11307-14	CAPACITOR, fixed: paper: 0.1 uf ±20%: 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C1013	R16C10492-56	CAPACITOR, fixed: mica; 0.01 uf ±5%; 300 vdcw. CM35C103J	P1 MO/N
C1014	R16C11307-14	CAPACITOR, fixed: paper; 0.1 uf ±20%: 400 vdcw. L220132-70 (SPR) 91P10404	P1 MO/N
C1015	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1016	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% - 10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1017	R16C11354-24	CAPACITOR, fixed: paper: 0.5 uf ±10%:600 vdcw. CP53B1FF504K	P1 MO/N
C1018	R16C11923	CAPACITOR, variable: ceramic: 7-45 uuf. C219043-2	P1 MO/N
C1019	R16C11923	CAPACITOR, variable: ceramic: 7-46 uuf. C219043-2	P1 MO/N
C1020	R16C9097-36	CAPACITOR, fixed: mica; 150 uuf ±10%: 500 vdcw. CM20C151K	P1 MO/N
C1021	R16C10492-56	CAPACITOR, fixed: mica; 0.01 uf ±5%: 300 vdcw.	P1 MO/N'
C1022	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper; 1 uf +20% -10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1023	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper; 1 uf +20% -10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1024	R16C10513-530	CAPACITOR, fixed: mica; 0.01 uf ±20%; 2,500 vdcw, CM60B103M	P1 MO/N
C1025	R16C11339-99-450	CAPACITOR, fixed: paper; 0.47 uf ±20%: 200 vdcw, L220152-36 (SPR) 91P47402	P1 MO/N
C1026	R16BXR-C220114-1	CAPACITOR, fixed: paper; 0.1 uf +20% -10%; 2,000 vdcw. C220114-1 (SPR) P12551	P1 MO/N
C1027	R16BXR-C220114-1-	CAPACITOR, fixed: paper; 0.1 uf +20% -10%: 2,000 vdcw. C220114-1 (SPR) P12551	P1 MO/N
C1028	R16BXR-C220114-1	CAPACITOR, fixed: paper; 0.1 uf +20% -10%; 2,000 vdcw. C220114-1 (SPR) P12551	P1 MO/N
C1029A, B	R16JAN-CP53B4EF105L	CAPACITOR, fixed: paper; 2 x 1 uf :±15%: 600 vdcw. CP53B4EF105L	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
C1030A,B.	R16C11292-R9-8	CAPACITOR, fixed: paper; 2 x 0.05 uf ±15%; 600 vdcw. CP53B4EF503L	P1 MO/N
C1031	R16C10513-530	CAPACITOR, fixed: mica: 0.01 uf ±20%; 2,500 vdcw. CM60B103M	P1 MO/N
C1032A, B	R16JAN-CP53B4EF105L	CAPACITOR, fixed: paper: 2 x 1 uf ±15%; 600 vdcw. CP53B4EF105L	P1 MO/N
CR1001	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1002	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1003	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C2211944-1 (SLE) IN34A	P1 MO/N
CR1004	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1005	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
E1001	R16C20181	CLIP, tube: rubber: 47/64 in. OA width: 1-13/64 in. lg; 26/64 in. OA thickness; metal contact enclosed. A242240	P1 MO/N
E1002	R16S3933-24	SHIELD, tube. TSF0T104	P1 MO/N
E1003	R16S3933-10	SHIELD, tube. TSF0T102	P1 MO/N
E1004	R16S3933-10	SHIELD, tube. TSF0T102	P1 MO/N
E1005	R16S3937-6	SHIELD, tube. TSF0T101	P1 MO/N
E1006	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E1007	R16S3933-25	SHIELD, tube. TSF0T105	P1 MO/N
E1008	R16S3933-25	SHIELD, tube. TSF0T105	P1 MO/N
E1009	R16BXR-L204579-2	TUBE SHIELD ASSY: consists of a tube shield to which gasket strips are cemented and a clamp screwed to one end. L204579-2	P1 O/S
E1010	R16S3933-24	SHIELD, tube. TSF0T104	P1 MO/N
E1011	R1619867	INSULATOR, post. NS3WO106	P1 MO/N
E1012	R1619867	INSULATOR, post. NS3WO106	P1 MO/N
E1013	R1619867	INSULATOR post. NS3WO105	P1 MO/N
E1014	R1619867	INSULATOR, post. NS3WO105	P1 MO/N
E1015	R1619867	INSULATOR, post. NS3WO105	P1 O/N
E1016	R1619867	INSULATOR, post. NS3WO105	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1017	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1018	R1619867	INSULATOR, post. NS3WO105	P1 MO/N
E1019	R1619867	INSUI.ATOR, post. NS3W0105	P1 MO/N
E1020	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1021	R1619867	INSULATOR, post. NS3WO105	P1 MO/N
E1022		TERMINAL BOARD ASSY: consists of two brackets and sixty-six terminal posts mounted on board. N208390-1	A1
E1023	R17A2299	ADAPTER, electrical accessory to cable: A1; 1-7/16 in. OD: 1-1/8 in. Ig: threaded 1-20 UNEF-211. AN3057-10	P1 MO/N
E1024		TERMINAL, BOARD ASSY: consists of twenty terminals mounted on board. L208382-1	A1
E1025		TERMINAL BOARD ASSY: consists of four terminal lugs mounted on board. C208425-1	A1
E1026		RING, electrode: brs, nickel pl : 0.718 in. ID: 1.240 in. OD: 0.30 in. thk; two holes tapped No. 4-40 NC-2 x 0.18 in. deep 7/8 in. c to c. A243445	X1
E1027	R16BXR-C233623	TUBE, viewing: black neoprene; 3-1/2 in. ID: 8 in. IR; 1/8 in. wall thickness; beaded edge both ends. C233623	P1 MO/N
E1028		KNOB: aluminum: 0.580 in. dia; 0.59 in. thk: marked with an arrow across front of knob. C2451 82-2	P1 MO/N
E1029		KNOB: aluminum: 0.580 in. dia; 0.59 in. thk: marked with an arrow across front of knob. C245152-2	P1 MO/N
E1030		KNOB: aluminum: 0.580 in. dia; 0.59 in. thk: marked with an arrow across front of knob. C245182-2	P1 MO/N
E1031		KNOB: aluminum; 0.580 in. dia; 0.59 in. thk: marked with an arrow across front of knob. C245182-2	P1 MO/N
E1032	R16K3336-625	KNOB: molded black bakelite: 7/8 in. dia: 19/32 in. thk: marked with an arrow across front of knob. C60187-2	P1 MO/N
E1033	R16K3336-625	KNOB: molded black bakelite; 7/8 in. dia; 19/32 in. thk: marked with an arrow across front of knob. C60187-2	P1 MO/N
E1034	R16K3336-625	KNOB: molded black bakelite; 7/8 in. dia: 19/32 in. thk: marked with an arrow across front of knob. C60187-2	P1 MO/N
E1035		PLATE, contact mounting: brs, silver pl ; arc: 1.20 in. IR: hole 0.199 in. dia drilled in center of plate; two holes tapped No. 4-40 NC-2 30 c to c. A243488	M1
E1036		PLATE, contact mounting: bra. silver P1 ; arc: 1.20 in. Ig: hole 0.199 in. dia drilled in center of Plate: two holes tapped No. 4-40 NC-2 30 c to c. A243488	M1
E1037		PLATE, contact mounting: brs, silver pl : are; 1.20 in. IR; hole 0.199 in. dia drilled in center of Plate; two holes tapped No. 4-40 NC-2 30 c to c. A243488	M1
E1038		CAPACITOR AND RESISTOR ASSY :-consists of five crystal units, eleven capacitors. twenty-three resistors and a coil assembly wired to terminal board. N208390-2	A1

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1039		CAPACITOR AND RESISTOR ASSY: consists of eleven resistors and one capacitor wired to terminal board. L208382-2	A1
E1040		CAPACITOR ASSY: consists of two capacitors mounted on plate. C208386-1	A1
E1041		RESISTOR ASSY: consists of two resistors wired to terminal board. C208425-2	A1
E1042		ADAPTER, electrical accessory to cable: A1; 1-1/4 in. wd x 1-5/64 in. Ig; threaded 3/4-20 UNEF-2B. (2 each used) AN3057-6	P1 MO/N
E1043		INSERT, electrical connector: 16 round male contacts. C295532-1 (WIQ) 201-B	X1
E1044		POINTER, indicator: clear Plastic: 3.857 in. dia x 0.278 in. thk; arrow engraved on face. C246656	X1
E1045		DIAL: clear plastic; 4.067 in. OD x 3.24 in. ID x 0.188 in. thk; engraved pointer C246626	X1
E1046		CLIP, line support: 6/16 in. ID; 1/2 in. wd. C63122-6 (HPP) 754-62-28	P1 MO/N
E1047		PLATE. mounting: natural plastic; 2-1/4 in. Ig x 2 in. wd x 0.091 in. thk; hole 0.061 in. dia drilled in each corner; two holes .1/2 in. dia drilled 0.8 in. c to c under which is stenciled C1018 and C1019. A296597	M
E1048		PLATE, mounting: natural plastic; 2 in. OA width: 2.94 in. lg; 1/4 in. thk; cutout 0.64 in. x 0.36 in. on two opposite ends two o.386 in. holes drilled 1.42 in. c to c; two 0.136 in. holes drilled in line with previous described holes; two 0.161 in. holes drilled 1.64 in. c to c at cutout end; symbol numbers R1056 and R1045 stenciled on one side A296624	M
E1049	R17BXR-Bl3020-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia; 0.437 in. lg (4 each used) B13020-10	P1 O/N
E1050	R17BXR-BI3021-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia.; 0.640 in. Ig. (2 each used) B13021-10	P1 O/N
E1051	R17BXR-BI3020-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia; 0.437 in. Ig. (18 each used) B13020-10	P1 O/N
E1052	RI7BXR-BI3020-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia; 0.437 in. Ig. (60 each used) B13020-10	P1 O/N
E1053	RI7BXR-Bl3021-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia; 0.640 in. Ig. (6 each used) B13021-10	P1 O/N
E1054		PLATE, mounting: natural plastic; 1.96 in. lg x 1-1/2 in. wd x 0.062 in. thk; 5/8 in. hole drilled in plate; two holes 0.118 in. dia drilled 7/8 in. c to c; two holes 1/4 in. drilled 0.880 in. c to c; stenciled 1Z2 on one side and V1008 and X1008 on other side. A230243-2	
E1055		PLATE, spacer: arc; plastic; 1.20 in. lg. x 7/8 in. wd x 0.062 in. thk; 0.323 in. din hole in center and 0.128 in. dia bole on each side of center hole. A243487	Y
E1056		PLATE, spacer: arc: plastic; 1.20 in. Ig x 7/8 in. wd x 0.062 in. thk; 0.323 in. dia hole in center and 0.128 in. dia hole on each side of center hole. A243487	
E1057		PLATE. spacer: arc; Plastic; 1.20 in. lg. x 7/8 in. wd x 0.062 in. thk; 0.33 in. din bole in center and 0.128 in. dia bole on both side of center hole. A243487	M
E1058		ADAPTER, electrical accessory to cable: A1; 2-3/4 in. wd x 1-6/8 in. Ig; threaded 2-18 NS-2B. AN3057-24	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1069		ADAPTER, electrical accessory to cable: A1; 1-9/16 in. wd x 1-3/16 in. lg; threaded 1-3/16-18 NEF-2B. AN3067-12	P1 MO/N
E1060		BOARD terminal; 5 contacts. C60854-5 (JNS) 5-140	
E1061		PLATE, insulator C243544-18	
H1001	R16JAN-CP06FA5	BRACKET: mounting. (7 each used) CP06FA5	P1 MO/N
H1002		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 5-40 NC-2; 1/4 in. lg. (10 each) Commercial	
H1003		WASHER, lock: phosphor bronze, nickel pl ; split; No. 5. (10 each used) AN936BS	
H1004		SCREW, mach: slot dr; rd hd; brs, nickel pl ; No. 6-32 NC-2; 1 in. lg. (4 each used) AN515B6-16	
H 1005		NOT USED	
H 1006		NOT USED	
H 1007		NOT USED	
H1008	R17BXR-C243900-3	TERMINAL, stud: 1/2 in. OA dia; 0.844 in. lg; one end tapped 4-40 NC-2. (4 each used) C243900-3 (ELCN) TT-16	P1 MO/N
H1009		NUT, hex: brs, nickel pl ; No. 4-40 NC-2; 0.1875 in. wd; 1/16 in. thk. (16 each used) HSN775B-18	
H1010		SCREW, mach: slot dr; rd bd; brs, nickel pl ; No. 6-32 NC-2; 3/8 in. lg. (16 each used) AN515B6-6	
H1011		SCREW, mach: slot dr; rd hd; brs, nickel pl ; No. 4-40 NC-2; 7/16 in. lg. (8 each used) AN515B4-7	
H1012		WASHER, lock: phosphor bronze, nickel pl ; int tooth; No. 10. (2 each used) A18041-10 (SH) 1910	
H1013		NUT, hex: brs, nickel pl ; No. 4-40 NC-2. (29 each used) AN340B4	
H1014		NUT, hex: brs, nickel pl ; No. 6-32 NC-2. (35 each used) AN340B6	
H1015		NUT, hex: ,brs, nickel pl ; No. 8-32 NC-2. (13 each used) AN340B8	
H1016		NUT, hex: brs, nickel pl ; No. 10-24 NC-2. (10 each used) AN340B10	
H1017		WASHER, flat: brs, nickel pl ; No. 10. (6 each used) AN960B10	
H1018		WASHER, flat: brs, nickel pl ; No. 6. (37 each used) AN960B6	
H1019		WASHER, lock: phosphor bronze, nickel pl ; split; No. 10. (1 each used) AN935B10	
H1020		WASHER, lock: phosphor bronze, nickel pl ; split; No. 8. (24 each used) AN935B8	
H1021		WASHER, lock: phosphor bronze, nickel pl ; split; No 6. (82 each used) AN935B6	

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1022		WASHER, lock: phosphor bronze, nickel spl ; split; No. 4. (69 each used) AN935B4	
H1023		WASHER, lock: phosphor bronze, nickel pl ; split; No. 3. (20 each used) AN935B3	
H1024		SCREW, mach: slot dr; FH; brs, nickel pl ; No. 6-32 NC-2; 5/16 in. lg. (4 each used) AN505B6-6	
H1025		SCREW, mach: slot dr; FH: brs, nickel pl; No. 8-32 NC-2; 3/8 in. lg. (6 each used) AN505B8-6	
H1026		SCREW, mach: slot dr; rd hd; brs, nickel pl ; No. 4-40 NC-2; 1/4 in. lg. (16 each used) AN515B4-4	
H1027		SCREW, mach: slot dr: rd hd: brs, nickel pl; No. 4-40 NC-2: 3/16 in. lg. (5 each used) AN515B4-3	
H1028		SCREW, mach: slot dr: rd hd: brs, nickel pl ; No. 4-40 NC-2; 6/16 in. lg. (19 each used) AN515B4-5	
H1029		SCREW, mach: slot dr: rd hd: brs, nickel pl; No. 3-48 NC-2; 1/8 in. lg. (4 each used) AN515B3-2	
H1030		SCREW, mach: slot dr: rd hd: brs, nickel pl : No. 3-56 NF-2; 1/4 in. lg. (16 each used) AN520B3-4	
H1031		SCREW, mach: slot dr; rd hd: brs, nickel pl : No. 8-32 NC-2: 7/16 in. lg. (8 each used) AN515B8-7	
H1032		SCREW, mach: slot dr: rd hd: brs,, nickel pl; No. 8-2 NC-2: 5/16 in. lg. (2 each used) AN515B8-5	
H1033		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 12 NC-2; 3/8 in. lg. (4 each used) AN515B8-6	
H1034		SCREW, mach: slot dr: rd hd: brs, nickel pl; No. 6-32 NC-2: 3/16 in. lg. (3 each used) AN515B6-3	
H1035		SCREW, mach: slot dr: rd hd: brs, nickel pl; No. 6-32 NC-2; 3/4 in. lg. (8 each used) AN515B6-12	
H1036		SCREW, mach: slot dr; rd hd: brs, nickel pl; No. 6-32 NC-2; 7/16 in. lg. (9 each used) AN515B6-7	
H1037		SCREW, mach: slot dr: rd hd: brs. nickel pl; No. 6-32 NC-2 /16 in. lg. (26 each used) AN1515B6-5	
H1038		SCREW, mach: slot dr; Bind H; brs, nickel pl ; No. 8-32 NC-2; 1/2 in. lg. Commercial	
H1039		SCREW, mach: slot dr; Bind H: brs, nickel pl ; No. 4-40 NC-2: 3/8 in. lg. (2 each used) Commercial	
H1040		SCREW, mach: slot dr; Bind H: bran, nickel pl : No. 6-32 NC-2; 7/16 in. lg. (4 each used) Commercial	
H1041		SCREW, mach: slot dr: Bind H; brs, nickel pl : No. 10-24 NC-2: 3/8 in. lg. (4 each used) Commercial	
H1042		SCREW, set: Bristo dr; cup point steel, Cd pl ; No. 8-32 NC-3; 1/8 in. lg. (8 each used) Commercial	

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1043		SCREW, set: Bristo dr; cup point; steel, Cd pl; No. 6-32 NC-3; 1/8 in. lg. (5 each) Commercial	
H1044		SCREW, set: Bristo dr: cup point: steel, Cd pl ; No. 6-32 NC-3; 3/16 in. lg. (16 each) Commercial	
H1045		SCREW, drive: rd hd; steel; Cd pl; No. 2: 1/4 in. Ig. (2 each used) Commercial	
H1046		RING, retaining: external: steel, Cd pl : 0.230 in. OD x 0.094 in. ID x 0.015 in. thk. (2 each used) HC846G-125 (WKI) 5133-12	
H1047	R41W2468	WRENCH, Bristo: steel, Cd pl; size 04; L-shaped; short arm. HC684H03-S	P1 MO/N
H1048	R41W2462	WRENCH, Brlsto: steel, Cd pl : size 03: L-shaped; short arm. HC684H03-S	P1 MO/N
H1049		PIN, straight: SS, unfinished; 1-1/8 in. lg x 0.25 in. dia. (2 each used) Commercial	
H1050		NUT, hex: brs, nickel pl : No. 6-32 NC-2; 0.250 in. wd: 3/32 in. thk. (6 each used) HSN776B-4	
H1051		SCREW, mach: slot dr: rd hd: brs, nickel pl; No. 6-32 NC2: 1/2 in. Ig. (2 each used) AN616B6-8	
H1052		GROMMET, rubber: 17/64 in. ID: 9/16 in. OD: 1/4 in. thk. (3 each used) A11426-4 (ARH) 1119	
H1053		GROMMET: black rubber: 1/8 in. ID x 11/32 in. OD x 3/16 in. thk. (2 each used) A18143-13 (LAV) 901	
H1054		TERMINAL, lug: soldering; brs, hot tinned; 5/64 in. dia hole in one end; 0.170 in. dia hole drilled in other end; holes 7/16 in. c to c; 0.020 in. thk. (2 each used) Commercial	
H1055		TERMINAL, lug: soldering; brs, hot tinned; 5/64 in. dia hole in one end; 0.121 in. dia hole drilled in other end; holes 7/16 in. c to c; 0.020 in. thk. (11 each used) Commercial	
H1056		TERMINAL, lug: soldering: brs, hot tinned; 5/64 in. dia hole in one end; 0.144 In. dia hole drilled in other end; holes 7/16 in. c to c;.0.020 in. thk. (16 each used) Commercial	
H1057		WASHER, flat: soft copper, nickel pl : 0.167 in. ID x 3/8 in. OD x 0.020 in. thk. (18 each used) Commercial	
H1058		PIN, binge: brs, Cd pl : 1/8 in. dia; 1.74 in. lg. A245495	M1
H1059		RIVET, tubular: oval hd: brs, nickel pl : 0.098 in. dia: 9/64 in. Ig. (4 each used) Commercial	
H1060		STUD: brs, Cd pl : 1/8 in. OA dia; one end 0.060 in. thk with hole drilled 0.052 in. dia: other end 1/16 in. dia; 0.380 in. lg. A295168	M1
H1061		STUD, flanged: brs, Cd pl ; 1/4 in. dia flanged end; 1/16 in. dia other end; 0.260 in. lg. (2 each used) A295167	M1
H1062		NOT USED	
H1063		SCREW, mach: slot dr; Bind H: brs, nickel pl ; No 4-40 NC-2: 3/16 in. lg. (2 each used) Commercial	

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1064		WASHER, lock: steel, nickel pl: split; No. 4. (2 each used) AN935-4	
H1065		WASHER, flat: brs, nickel; pl; No. 4. (14 each used) AN960B4	
H1066		SCREW, mach: slot dr; rd hd: brs, nickel pl : No. 8-32 NC-2; 1/2 in. lg. (2 each used) AN515B8-8	
H1067		SCREW, mach: slot dr; Bind H; brs, chromated Cd pl ; No. 6-42 NC-2: 5/16 in. lg. (3 each used) Commercial	
H1068		SCREW, mach: slot dr: Bind H; brs, nickel pl; No. 10-24 NC-2: 5/8 in. lg. (6 each used) Commercial	
H1069		WASHER, flanged: plastic: 0.128 in. ID; 0.32 in. OD flanged end; 0.184 in. OD other end; 0.14 in. thk. (6 each used) A17029-89	
H1070		WASHER, flat: brs, nickel pl; No. 4. (2 each used) AN960B4	
H1071		PIN, cotter: SS, passivate: 1/32 in. dia: 1/2 in, lg. Commercial	
H1072		INSERT, threaded: brs rod, silver pl ; tapped 5/16-32 NEF-2; 0.445 in. OD and knurled one end; 0.384 in. OD other end; 0.090 in. thk. (3 each used) A241997	M1
H1073		HANDLE: steel, Cd pl; U-shaped; 4.46 in. Ig; each end 2.08 in. Ig; each end tapped 8-32 NC-2. A103650-39	M1
H1074		SCREW, mach: slot dr: rd hd: brs, Cd pl; No. 4-40 NC-2: 3/8 in. Ig. (6 each used) AN615B4-6	
H1075		NUT, hex: brs, nickel pl ; No. 4-48 NF-2. Commercial	
H1076		CLAMP, cable: brs, nickel pl : approx 9/16 in. lg x 5/16 in. wd x 1/32 in. thk: 0.144 in. dia hole in one end. A18362-3	
H1077	R43114500-5	INSERT, threaded: steel, Cd pl; tapped 8-32 NC-S; threaded 1/4-20 NC-2: 3/8 in. lg. C246605-3 (ROSN) R104SB-6	P1 O/N
H1078	R43L11006	RING, retainer: steel, Cd pl; 0.364 in. OD: 0.213 in. ID; 0.099 in. thk. C238665-3 (ROSN) RL21SB-6	P1 O/N
H1079		INSERT, threaded: steel, chromated Cd pl : 6/16 in. knurled flange: 0.187 in. dia other end; 0.087 in. shank; tapped No. 6-32 NC-2. (3 each used) HK860H87-0632 (PEN) CL632-83	
H1080		RIVET, tubular: oval hd; brs, Cd pl; 0.088 in. dia; 1/4 in. lg. (2 each used) AN450C6B8	
H1081		INSERT, self-clinching: steel, Cd pl; No. 6-32. HC860H38-0632 (PEN) CL632-1	M1
H1082		SCREW, captive: SS, black oxide; 1.34 in. Ig; portion 0.26 in. threaded 6-32 NC-2; head 0.312 in. dia. A2965155	M1
H1083		EYELET, flanged: brs, Cd pl; 0.209 in. ID; 0.247 in. OD one end; 3/8 in. ID flanged end; 0.178 in. Ig. (2 each used) A112886-5	
H1084		CLAMP, cable: brs, nickel pl : approx 3/4 in. Ig x 7/16 in. wd x 1/32 in. thk; 0.173 in. dia hole in one end. A18362-20	
H1085		TERMINAL, lug: soldering: brs, hot tinned; 1/8 in. din one end; 0.38 in. dia other end drilled 1/4 in. dia hole; 1.32 in. lg. (2 each used) A17803-2	

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1086		RING, retainer: external; steel, Cd pl: 1/4 in. ID: 0.025 in. thk. HC848G250 (WKI) 5100-25	
H1087		RING, retainer: brs, nickel pl : 0.53 in. ID; 0.623 in. OD; 0.158 in. thk. C239634-6	M1
H1088		WASHER, flat: SS; 1/2 in. ID; 6/8 in. OD; 1/32 in. thk. (2 each used) A17006-153	M1
H1089		WASHER, flat: SS; 0.251 in. ID; 0.406 in. OD; 0.027 in. thk. A17006-152	M1
H1090		WASHER, spring: phosphor bronze; 0.265 in. ID; 0.406 in. OD; 0.009 in. thk. A17027-83	M1
H1091		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 6-32 NC-2; 9/16 in. Ig. (2 each used) Commercial	
H1092		CLAMP: CRS, Cd pl ; U-shaped; 3-1/2 in. Ig; 1/2 in. wd; 0.062 in. thk material; bole drilled 0.161 in. dia on each end. A241215-7	
H1093		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 8-32 NC-2; 1/4 in. Ig. AN516B-4	
H1094		WASHER flat: brs, nickel pl; No. 8. AN960B8	
H1095		COLLAR, spacing: A1; 0.164 in. ID; 1/4 in. OD; 3/8 in. Ig. (4 each used) A12008-10	M1
H1096		SCREW, mach: slot dr; Bind H; brs, nickel pl ; No. 4-40 NC-2; 1/4 in. lg. (4 each used) Commercial	
H1097		PIN: brs, Cd pl; 6/16 in. Ig; 0.063 in. dia. (3 each used) HSC838B-14	
H1098		PIN: brs, Cd pl ; 0.156 in. lg; 0.630 in. dia. (4 each used) HSC838B-15	
H1099		RING, retainer: steel spring wire, Cd pl; 4.25 in. OD; 30° section cut from ring. C238572	M1
H1099-1		SCREW, mach: slot dr; FH; brs, nickel pl ; No. 4-40 NC-2; 5/8 in. lg. (4 each used) AN606B4-10	
I1001	R16BXR-N208412-1	COUNTER ASSY: consists of two shafts., two retainer rings; two ball bearings and one counter. N208412-1	P1 MO/S
I1002	R17L6i12	LAMP, incandescent: 3V: 0.19 amp; clear; No. 953 screw base. AN3136-23	P1 MO/N
I1003	R17L6612	LAMP, incandescent: 3V; 0.19 amp; clear; No. 953 screw base. AN3134Sl2	P1 MO/N
I1004	R17L6512	LAMP, incandescent: 3V; 0.19 amp; clear; No. 953 screw base. AN3136-323	P1 MO/N
I1005	R17L6536-700	LAMP, incandescent: 2.9V; 0.17 amp; clear. A93206 (GE) 291	P1 MO/N
I1006	R17L6682	LAMP, incandescent: 28V; 0.17 amp; clear. A9320-8 (GE) 313	P1 MO/N
I1007		COUNTER, mechanical: 3.94 in. lg; 1.234 in. wd; 1.297 in. high; four figure counter. C222454-1 (VEE) CK-110234	
I1008	R17L6612	LAMP. incandescent: 3V; 0.19 amp; clear; No. 953 screw base (spare). AN3136-323	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
I1009	R17L6512	LAMP, incandescent: 3V; 0.19 amp; clear: No. 953 screw base (spare). AN3136-323	P1 MO/N
J1001	R17R1706	CONNECTOR, receptacle: eight male contacts. AN3102A-20-7P	P1 MO/N
J1002	R16R2435	CONNECTOR, receptacle: one female contact. UG-290/U	P1 MO/N
J1003	R16R2435	CONNECTOR, receptacle: one female contact. UG-290/U .	P1 MO/N
J1004	R16R2436	CONNECTOR, receptacle: one female contact. UG-290/U	P1 MO/N
J1005	R17WIQ-201BAN3102ABC	CONNECTOR, receptacle: 15 male contacts. C208361-1	P1 MO/N
J1006	R17R1701-130	CONNECTOR. receptacle: 5 male contacts. AN3102A-14S-5P	P1 MO/N
J1007	R17R1701-100-10	CONNECTOR, receptacle: 4 male contacts. AN3102A-14S-2P	P1 MO/N
J1008	R16R2435	CONNECTOR, receptacle: one female contact. UG-290/U	P1 MO/N
J1009		CONNECTOR, receptacle: 10 female contacts. AN3106-18-IS	P1 MO/N
K1001	R17R5884-18	COIL, Relay, 28V oper: 300 ohms dc resistance. C216010-1 (AGC) R38-1185	P1 MO/N
K1002	R17R5884-17	RELAY, armature: 25V de; 4 pdt. C218451-1 (ADE) TC12D24PL -A3	P1 MO/N
K1003	R175884-17	RELAY, armature: 25V dc; 4 pdt. C218451-1 (ADE) TC12D24PL -A3	P1 MO/N
L1001 A, B, C	R16BXR-A209293-1	COIL, r-f:pi; 10 mh at 1000 cyc ea pi. A209293-1	P1 MO/N
N1001	R16BXR-N204604-1	DIAL DRIVE ASSY: consists of dial, scale, pointer, housing and bearings. N204604-1	P1 MO/S
N1002		PLATE, identification N246539-19	
N1003		PLATE, identification C247115	M1
N1004		SCALE: amber Plastic: 4.22 in. OD x 3.360 in. ID x 1/4 in. thk; numerals engraved on face. C246660	X1
O1001	R16BXR-A239254	COUPLING, insulated: brs, Cd pl ; with glazed ceramic outside surface; 11/16 in. OA dia; 1-1/4 in. lg: two tapped holes 8-32 90° apart on each end. A239254	P1 MO/N
O1002	R16BXR-A239254	COUPLING, insulated: brs, Cd pl : with glazed ceramic outside surface; 11/16 in. OA dia: 1-1/4 in. lg: two tapped holes 8-32 90° apart on each end. A239254	P1 MO/N
O1003	R16BXR-C208363-1	GEAR ASSY: 2 spur type. C208363-1	P1 MO/S
O1004	R16BXR-C248568	GEAR, spur: A1, anodize. 128 teeth: 20° involute; 2.0284 in. OD; 1/4 in. ID: eight 3/8 in. dia holes spaced 45° apart: two 6-32 NC-2 tapped holes spaced 90° apart. C248568	P1 MO/N
O1005		BRACKET, rectifier: consists of a tube socket and electrode ring mounted on Plate. C204436-2	
O1006	R16BXR-A238336	GEAR, spur: A1, anodize: 48 teeth: 20° involute; 1.0388 in. OD; ID tapers from 0.18 in. max. A238336	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
O1007		SPRING, compression: steel music wire, Cd pl ; 3/16 in. dia; 1/2 in. lg. A239887-6	M1
O1008	R16BXR-C240687	MOUNT, vibration: natural rubber: black: 2.32 in. ID: 0.04 in. wall; 0.60 in. lg. C240575	P1 MO/N
O1009		SHIM, rectangular: laminated brs; 1.26 in. wd x 3.20 in. lg x 0.033 in. thk; hole 0.161 in. dia drilled in each corner. A236337	M1
O1010		ELECTRICAL COUNTER ASSY: consists of motor LIt0021, gear assy (O1003), and counter assy (I1001) L2R0384-1	
O1011		NOT USED	
O1012		NOT USED	
O1013		NOT USED	
O1014	R16BXR-OR208448-1	DIAL DRIVE ASSY: consists of dial drive assy. torque unit and gear. R20R448-1	P1 O/R
O1015		SPRING, wrench holder: 0.131 in. phosphor bronze wire, nickel pl: 1-5/8 in. lg; mounting loop for Bristo size 03 wrench on each end: 0.100 in. ID of loop. A110694-9	M1
O1016		SPRING, wrench holder: 0.031 in. phosphor bronze wire, nickel pl: 1-5/8 in. lg: mounting loop for Bristo size 04 wrench on each end: 0.076 in. ID of loop. A110694-3	M1
O1017		NOT USED	
O1018		NOT USED	
O1019		NOT USED	
O1020		SPRING: beryllium copper, Cd pl : 0.94 in. lg x 0.36 in. wd; hole 0.170 in. dia drilled in center; crimp 0.020 in radius in each end. A249702	M1
O1021	R16BXR-C248569	GEAR, spur: A1, anodize: 128 teeth; 20^{o} involute: 2.02x4 in. OD; 8 holes 3/8 in. dia spaced 45^{o} apart. C248569	P1 O/S
O1022	R16BXR-C248570	GEAR, spur: A1, anodize: 112 teeth; 20^{o} involute: 1.7784 in. OD; 8 holes 6/16 in. dia spaced 45^{o} apart; two holes tapped 6-32 NC-2 120^{o} apart. C248570	P1O/S
O1023	R77B115-00409-0000	BEARING, ball: 5/8 in. OD; 1/4 in. ID; 0.1969 in. thk; 8 balls. C240043-11 (FAF) S1K7	P1 O/N
O1024	R77B115-00409-0000	BEARING, ball: 5/8 in. OD: 1/4 in. ID: 0.1969 in. thk; 8 balls. C240043-11 (FAF) SIK7	P1 O/N
O1025		SHAFT: steel, chrome plate; 0.154 in. dia; 2.03 in. lg. A249709	M1
O1026		SHAFT: steel, Cd pl, 0.618 in. dia one end; 0.2493 in dia other end; 1.405 in. OA lg. C249706	M1
O1027		GASKET, strip: sponge rubber; 1/2 in. wd x 3/16 in. thk x 3 in. lg. A233212-3	M
O1028		GASKET, strip: sponge rubber: 1/2 in. wd x 3/16 in. thk x 3 in. lg. A233212-3	M
O1029		SPRING, compression steel spring wire, Cd pl ; 7 turns: 0.09 in. OD; 0.18 in. lg. C239080-38	M1

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
O1030	847 to C1 77-1-7	BALL, glass: 0.1562 in. dia. (183 each used) HSC810X-3	P1 O/N
O1031	847 to C1 77-1-7	BALL, glass: 0.0937 in. dia. (3 each used) HSC810 X-4	P1 O/N
O1032		CONE, bearing: A1, anodized: 4.2 in. OD: 3.66 in. ID: 0.560 in. thk. L234068	X1
O1033		BEARING ASSY: consists of two spur gears assembled with 6 screws, and two straight pins. N207892-1	X1
O1034		CONE, bearing: A1: 5.6 in, OD: 3.8 in. ID: 1.33 in. thk. L234072	X1
O1035		SPRING, compression: steel spring wire, Cd pl ; 7 turns; 0.09 in. OD. 0.18 in. lg. C239080-38	M1
O1036		SPRING, compression: steel spring wire, Cd pl; 7 turns; 0.09 in. OD: 0.18 in. Ig. C239080-38	M1
P1001	R17P4433-599-2	CONNECTOR, plug : 8 female contacts. AN3106A-18-1S	
P1002		CONNECTOR, plug : single male contact. UG-260/U	
P1003		CONNECTOR, plug : single male contact. UG-260/U	
P1004		CONNECTOR, plug : single male contact. UG-260/U	
P1005		CONNECTOR, plug : 15 female contacts. AN3106-36 shell (WIQ) 202-B insert	
P1006		CONNECTOR, plug : 5 female contact,. AN3106-14S-5S	
P1007		CONNECTOR, plug : 4 female contact. AN3106-14S-2S	
P1008		CONNECTOR, plug : single male contact. UG-260/U	
R1001	R16JAN-RC20BF334K	RESISTOR, fixed: comp: 330,000 ohms ±10%; 1/2w. RC20BF334 K	P1 MO/N
R1002	R16JAN-RC20BF821K	RESISTOR, fixed: comp: 820 ohms ±10%; 1/2w. RC20BF821K	P1 MO/N
R1003	R16JAN-RC20BF124K	RESISTOR, fixed: comp: 120,000 ohms ±10%: 1/2w. RC20BF124K	P1 MO/N
RI004	R16JAN-RC20BF822J	RESISTOR, fixed: comp:; 8.200 ohms ±15%; 1/2w. RC20BF822J	P I MO/N
R1005	R16JAN-RC20BF334K	RESISTOR, fixed: comp: 330,000 ohms ±10%; 1/2w. RC20BF334K	P1 MO/N
R1006	R16JAN-RC30BF821K	RESISTOR, fixed: comp; 820 ohms ±10% ; 1w. RC30BF821K	P1 MO/N
R1007	R16R17310-63-500	RESISTOR, fixed: comp: 15,000 ohms ±10%: 2w. C220509-1 53 (AB) HB-1531	P1 MO/N
R1008	R16R17310-63-600	RESISTOR, fixed: comp; 15,000 ohms ±10%: 2w. C220509-153 (AB) HB-1531	P1 MO/N
R1009	R16R17281-186	RESISTOR, fixed: comp; 4.700 ohms ±10%: 2w. C220509-472 (AB) HB-4721	P1 MO/N
R1010	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1/2w. RC20BF104K	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
R1011	R16JAN-RC20BF102K	RESISTOR, fixed: comp; 1,000 ohms ±10%; 1/2w. RC20BF102K	P1 MO/N
R1012	R16JAN-RC30BF564K	RESISTOR, fixed: comp; 560,000 ohms ±10%; 1w. RC30BF664K	P1 MO/N
R1013	R16R17291-74-11	RESISTOR, fixed: comp: 5,600 ohms ±10%: 2w. C220509-333 (AB) HB-5621	P1 MO/N
R1014	R16R17281-186	RESISTOR, fixed: comp: 4,700 ohms ±10%: 2w. C220509-472 (AB) HB-4721	P1 MO/N
R1015	R16JAN-RC20BF104K	RESISTOR, fixed: comp: 100,000 ohms ±10%: 1/2w. RC20BF104K	P1 MO/N
R1016	R16JAN-RC30BF473K	RESISTOR, fixed: comp: 47,000 ohms ±10%:; 1w. RC30BF473K	P1 MO/N
R1017	R16JAN-RC30BF222K	RFSISTOR, fixed: comp; 2,200 ohms ±10%; 1w. RC30BF222K	P1 MO/N
R1018	R16R17347-34	RESISTOR, fixed: comp; 100,000 ohms ±10%: 2w. C220509-104 (AB) HB-1041	P1 MO/N
R1019	R16R17350-12-18	RESISTOR, fixed: comp; 10,000 ohms ±10%: 2w. C220509-184 (AB) HB-1841	P1 MO/N
R1020	R16PSS83-34	RESISTOR, variable: carbon; 10,000 ohms ±20% (with nut and lock washer). A113434-103 (AB) JU1032/P3048	P1 MO/N
R1021	R16JAN-RC30BF223K	RESISTOR, fixed: comp; 22,000 ohms ±10%:; 1w. RC30BF223K	P1 MO/N
R1022	R16JAN-RC20BF224K	RESISTOR, fixed: comp; 220,000 ohms ±10%:; 1/2w. RC201BF224K	P1 MO/N
R1023	R16JAN-RC20BF221K	RESISTOR, fixed: comp; 220 ohms ±10%; 1/2w. RC20BF221K	P1 MO/N
R1024	R16R17327-58	RESISTOR, fixed: comp; 33,000 ohms ±10%; 2w. C220509-562 (AB) HB-3331	P1 MO/N
R1026	R16R17328-234	RESISTOR, fixed: comp: 39,000 ohms 4'±10%; 2w. C220509-393 (AB) HB-3931	P1 MO/N
R1027		RESISTOR, fixed: comp; 470,000 ohms ±10%; 1/2w. RC20BF474K	
R1027		RESISTOR, fixed: comp; 470,000 ohms ±10%; 1/2w. RC20BF474K	
R1028	R16PS681-24B-60	RESISTOR, variable: carbon; 00 ohms ±20% (with nut and locker washer). A113434-501 (AB) JU6012/P3048	P1 MO/N
R1029	R16JAN-RC20BF121J	RESISTOR, fixed: comp: 120 ohms ±5%; 1/2w. RC20BF121J	P1 MO/N
R1030	R16JAN-RC20BF101J	RESISTOR, fixed: comp; 100 ohms ±5%; 1/2w. RC20BF101J	P1 MO/N
R1031A,B	R16P6907	RESISTOR, variable: WW; dual section; 4,000 ohms :±5%; 2w both sections (with nut and lock washer). L219676-1 (IRC) 34-1420-3528	P1 MO/N
R1032		RESISTOR, fixed: comp; 470,000 ohms ±10%; 1/2w. RC20BF474K	
R1033		RESISTOR, fixed: comp; 470,000 ohms ±10%; 1/2w. RC20BF474K	

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
R1034	R16JAN-RC20BF392K	RESISTOR, fixed: comp: 3,900M ohms ±10%; 1/2w. RC20HP39SK	P1 MO/N
R1035	R16JAN-RC20BF392K	RESISTOR, fixed: comp: 3,900 ohms ±10%: 1/2w. RC2011F392K	P1 MO/N
R1036	R16JAN-RC20BF221J	RESISTOR, fixed: comp: 220 ohms ±5'%: 1/2w. RC20BF221J	P1 MO/N
R1037	R16P5581-24B-550	RESISTOR, variable: carbon: 500 ohms ±20% (with nut and lock washer). A113434-501 (AB) JU5012/P3048	P1 MO/N
R1038	R16R17328-234	RESISTOR, fixed: comp: 39,000 ohms ±10% : 2w. C220509-393 (AB) HB3931,	P1 MO/N
R1039	R16R17328-234	RESISTOR, fixed: comp: 39,000 ohms ±10%: 2w. C220509-393 (AB) HB-3931	P1 MO/N
R1040		RESISTOR, fixed: comp: 470,000 ohms ±10%:; 1/w. RC2011F474K	
R1041A,B	R16P5597-2-7500	RESISTOR, variable: comp: dual: 1 meg ±10%: 2-1/4w each section (with nut and lock washer) C59881-2 (AB) JJ/4/P3048/U1051	P1 MO/N
R1042		RHEOSTAT, WW: power type; 8.0 ohms ±10%: 25w (with nut and lock washer) RP101RD8ROKK	P1 MO/N
R1043	R16JANRC20BF224K	RESISTOR, fixed: comp, 220,000 .ohms ±10%: 1/2w. RC20BF224K	P1 MO/N
R1044	R16JAN-RC30BF102K	RESISTOR, fixed: comp: 1,000 ohms ±10%: 1w. RC30BF102K	P1 MO/N
R1045	R16P5590-120-725	RESISTOR, variable: carbon 100,000 ohms ±20%: 2w (with nut and lock washer). A219520-26	P1 MO/N
R1046	R16JAN-RC30BF224K	RESISTOR, fixed: comp : 220,000 ohms ±10%; 1w. RC30BF224K	P1 MO/N
R1047	R16JAN-RC30BF223K	RESISTOR, fixed: comp: : 2,000 ohms ±10%: 1w. RC30BF223K	P1 MO/N
R1048	R16JAN-RC30BF474K	RESISTOR, fixed: comp : 470,000 ohm. ±10%; 1w. RC30BF474K	P1 MO/N
R1049	R16JAN-RC30BF474K	RESISTOR, fixed: comp: 470,000 ohm. ±10%: w,. RC30BF474K	P1 MO/N
R1050	R16JAN-RC30BF474K	RESISTOR, fixed: comp: 470,000 ohms	
R1051	R16JAN-RC30BF474K	RESISTOR, fixed: comp: 470,000 ohms ±10%; 1w. RC30BF474K	P1 MO/N
R1052	R16JAN-RC30BF828K	RESISTOR, fixed: comp 142,000 ohms ±10:; 1w. RC30BF823K	P1 MO/N
R1053	R16JAN-RC30BF224K	RESISTOR, fixed: comp, 220,000 ohms ±10%: 1w. RC30BF224K	P1 MO/N
R1054	R16JAN-RC30BF224K	RESISTOR, fixed: comp: 220,000 ohms±10%; 1w. RC30BF224K	P1 MO/N
R1055	R16JAN-RC30BF224K	RESISTOR, fixed: comp : 220,000 ohms ±10%: 1w. RC30BF224K	P1 MO/N
R1056	R16P5595-46-500 R	RESISTOR, variable: carbon; 600,000 ohms ±20%; 2w (with nut and lock washer). A219520-27	P1 MO/N
R1057	R16JAN-RC30BF224K	RESISTOR, fixed: comp: 330,000 ohms -±10%: 1w. RC30BF334K	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
R1058	R16P5581-246-525	RESISTOR, variable: carbon: 500 ohms ±20% (with nut and lock washer). A109267-46 (AB) JU5012/SD4040L	P1 MO/N
R1059	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1/2w. RC20BF104K	P1 MO/N
R1060	R16P5581-246-525	RESISTOR, variable: carbon: 600 ohms ±20% (with nut and lock washer). A109267-46 (AB) JU5012/SD4040L	P1 MO/N
R1061	R16R17263-30-28	RESISTOR, fixed: comp: 390 ohms ±10% 1w. RC20BF391K	P1 MO/N
R1062	R16R17263-30-28	RESISTOR, fixed: comp: 390 ohms ±10%: 1/2w. RC20BF391K	P1 MO/N
R1063	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1/2w. RC20BF104K	P1 MO/N
R1064		NOT USED	
R1065	R16R17338-5-18	RESISTOR, fixed: comp; 56,000 ohms ± 10%; 2w. C220509-563 (AB) HB-5631	P1 MO/N
R1066		RESISTOR, fixed: comp: 60,000 ohms ±10%: 2w. C220509-563 (AB) HB-5631	P1 MO/N
R1067		RESISTOR, fixed comp; 3,900 ohms ±10%: 2w. C220059-392 (AB) HB-3921	
R1068		RESISTOR, fixed: comp 3,900 ohms ±10%; 2w. C220509-392 (AB) HB-3921	
S1001	R17S251091-29	SWITCH, lever: spdt. L218462-1 (GECO) MCT-1-T8	P1 MO/N
T1001	R16BXR-C217098	TRANSFORMER, a-f. C217098-1	P1 MO/N
T1002	R16BXR-C217098	TRANSFORMER, a-f. C217098-1	P1 MO/N
T1003	R17BXR-L217253	TRANSFORMER, power. L17268-1	P1 MO/N
T1004	R16BXRC217197	TRANSFORMER, input. C217197	P1 MO/N
T1005	R16BXR-C217129	TRANSFORMER, power. C217199	P1 MO/N
V1001	N16T75670	TUBE, electron. JAN-5670	P1 MO/N
V1002	N16T56196-50	TUBE, electron. JAN-6AN5	P1 MO/N
V1003	N16T56196-50	TUBE, electron. JAN-6AN5	P1 MO/N
V1004	N16T56191-50	TUBE, electron. JAN-6AK5W	P1 MO/N
V1005		TUBE, electron. JAN-5726/6AL5W	P1 MO/N
V1006	N16T58240-10	TUBE, electron. JAN-12ATTWA	P1 MO/N
V1007	N16T58240-10	TUBE, electron JAN-12AT7WA	P1 MO/N

Azimuth-Panoramic Indicator IP-81/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
V1008	N16T51990	TUBE, electron. JAN-1Z2	P1 MO/N
V1009		TUBE, electron (DUM) K1105P2	P1 MO/N
V1010	N16T75670	TUBE, electron. JAN-6670	P1 MO/N
X1001	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X1002	R16BXR-C287037-2	SOCKET. tube: 7 pin miniature. C287037-2	P1 MO/N
X1003	R16BXR-C287037-2	SOCKET, tube: 7 pin miniature. C2870S7-2	P1 MO/N
X1004	R16BXR-C287037-2	SOCKET, tube: 7 pin miniature. C287037-2	P1 MO/N
X1005	R16BXR-C287037-2	SOCKET, tube: 7 pin miniature. C287037-2	P1 MO/N
X1006	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature. C287037-4	P1 MO/N
X1007	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X1008	R16S6183-13-200	SOCKET, Lube: ceramic; 7 pin. C287019-1 (CIN) 53C14810	P1 MO/N
X1009	R16S6189-200	SOCKET, tube: 14 pin. C65510 (CIN) 9453-1FV	P1 MO/N
X1010	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X1011	R17BXR-C233379-12	LAMPHOLDER: bayonet type; to fit bayonet lamp No. 44; 5 in. lead. C23379-12	P1 MO/N
X1012	R17BXR-C233379-7	LAMPHOLDER: bayonet type; to fit bayonet lamp No. 44; 25 in. lead.	P1 MO/N

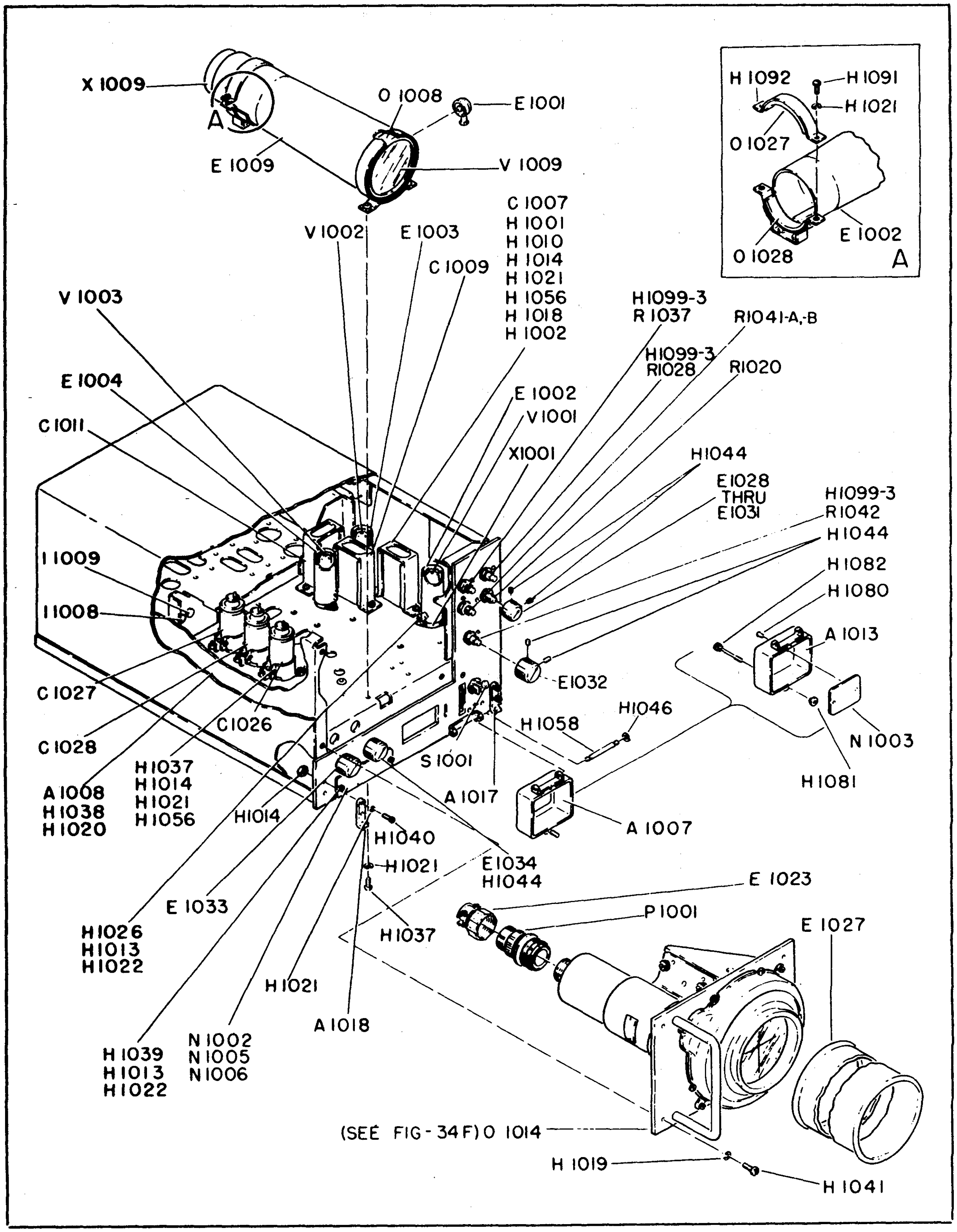


Figure 34A. Azimuth Panoramic Indicator IP-81A/APA-69A (Sheet 1 of 4)

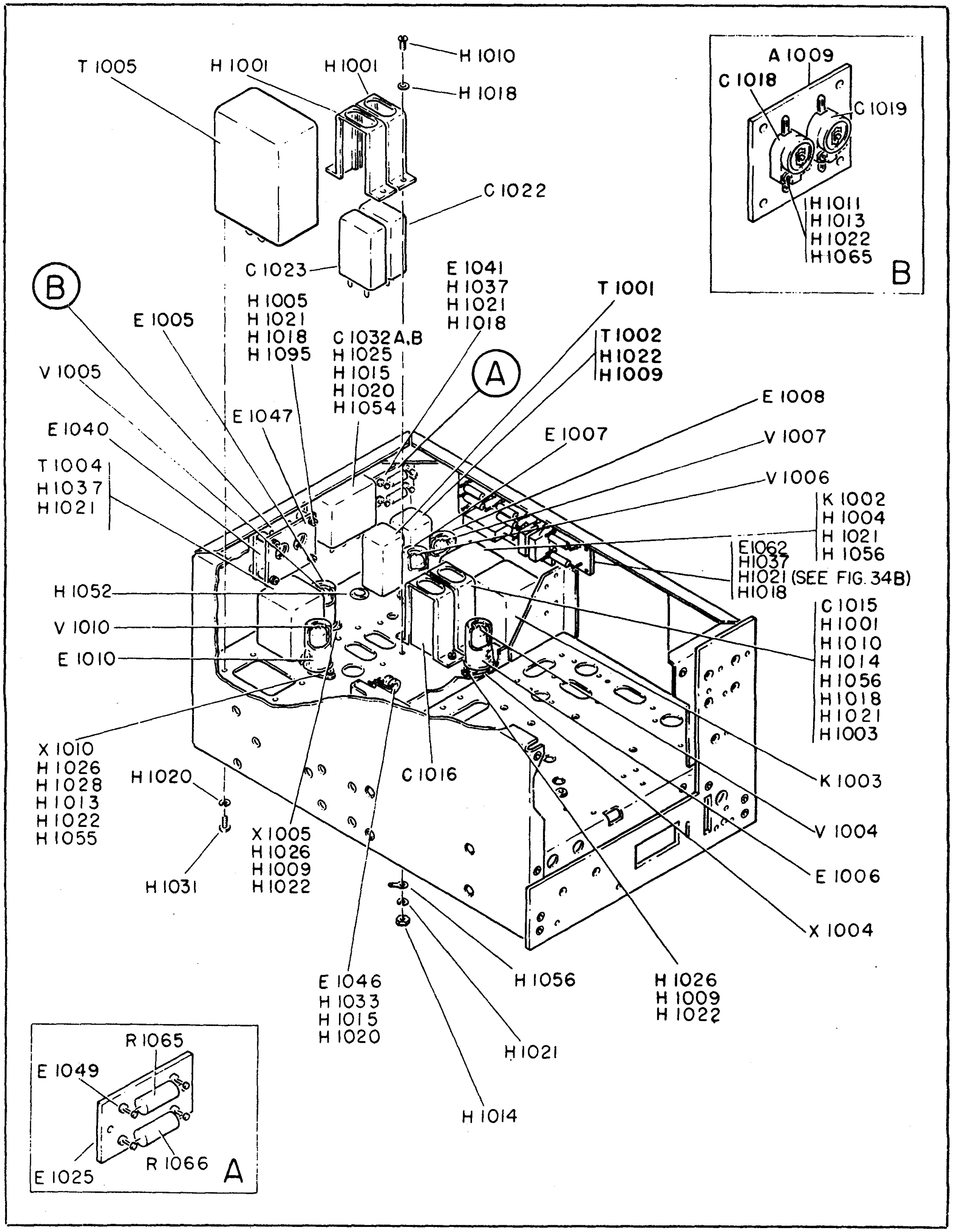


Figure 34A. Azimuth Panoramic Indicator IP-8IA/APA-69A (Sheet 2 of 4)

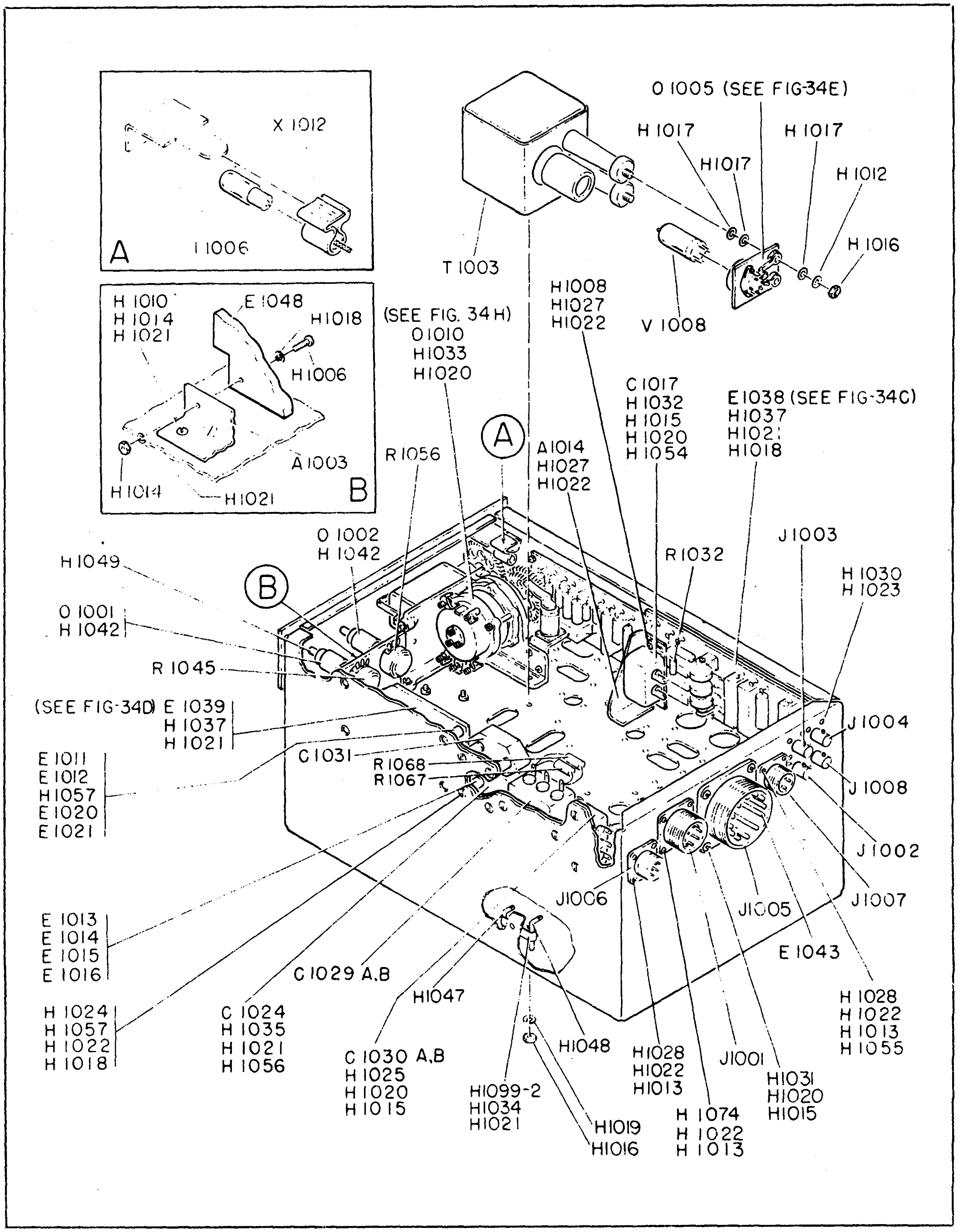


Figure 34A. Azimuth Panoramic Indicator IP-81A/APA-69A (Sheet 3 of 4)

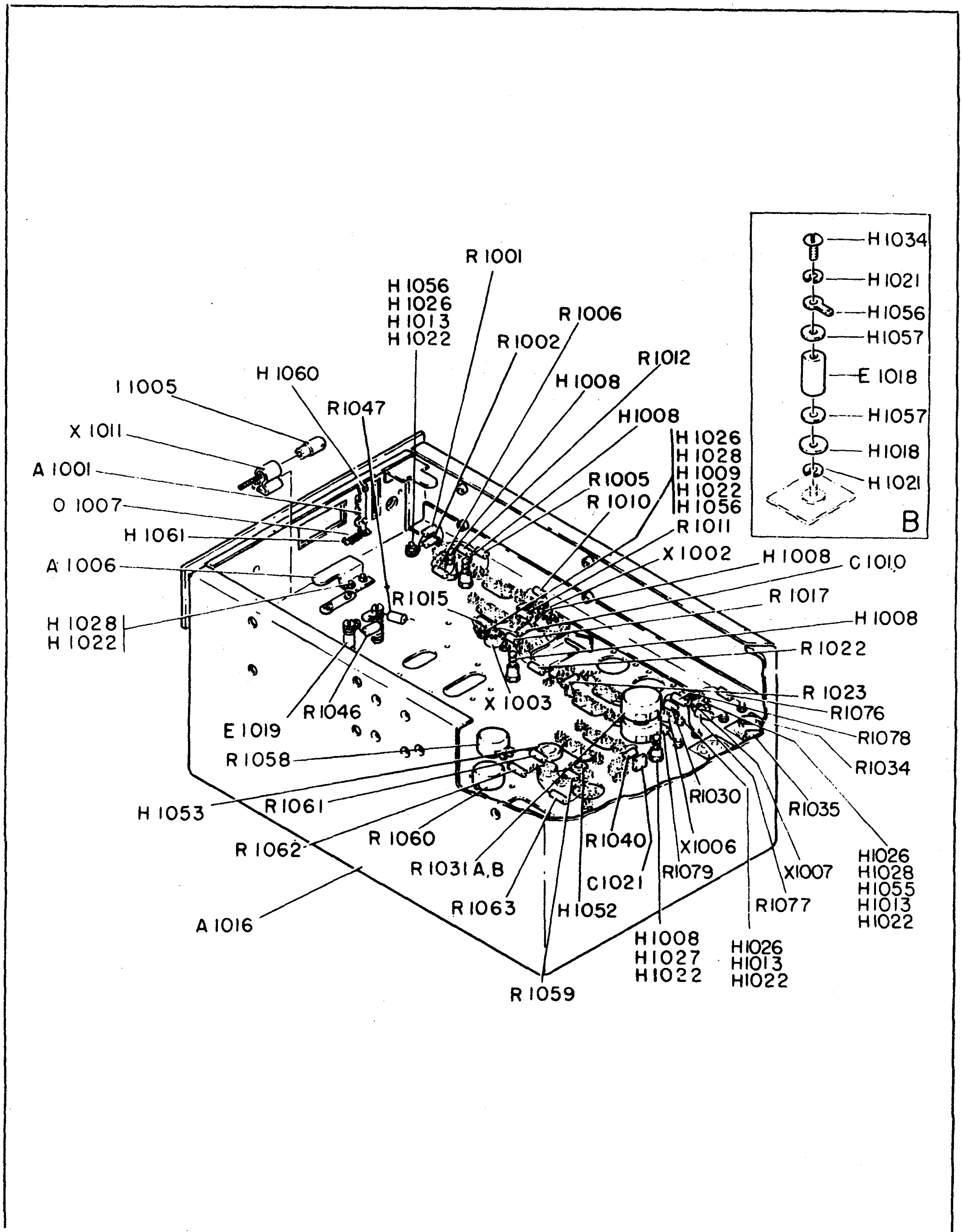


Figure 34A. Azimuth Panoramic Indicator IP81A/PA-69A (Sheet 4 of 4)

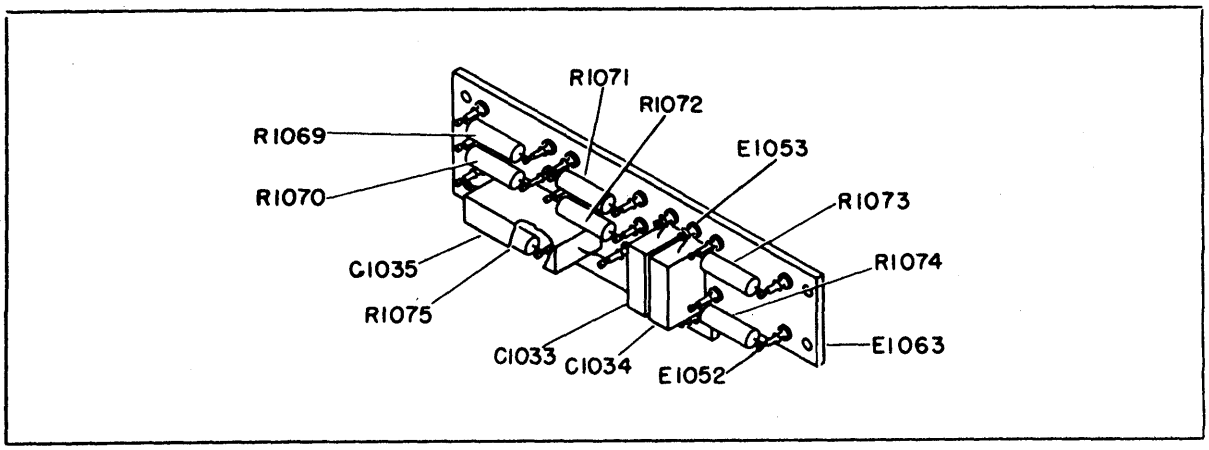


Figure 34B. Capacitor and Resistor Assembly

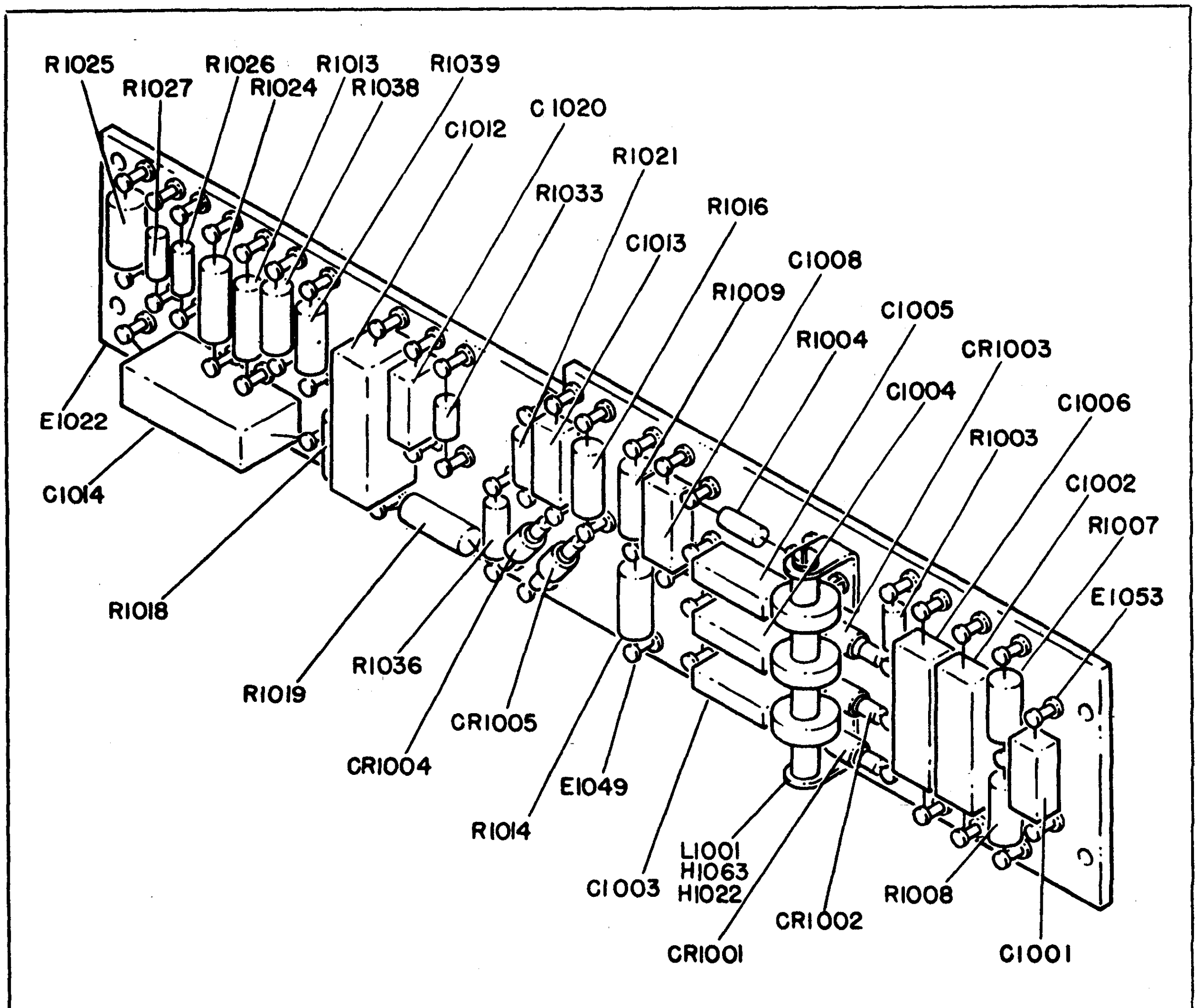


Figure 34C. Capacitor and Resistor Assembly

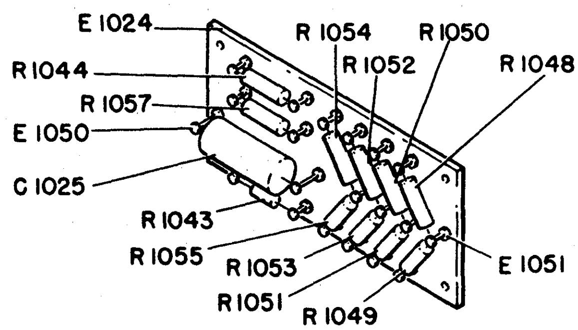


Figure 34D. Capacitor and Resistor Assembly

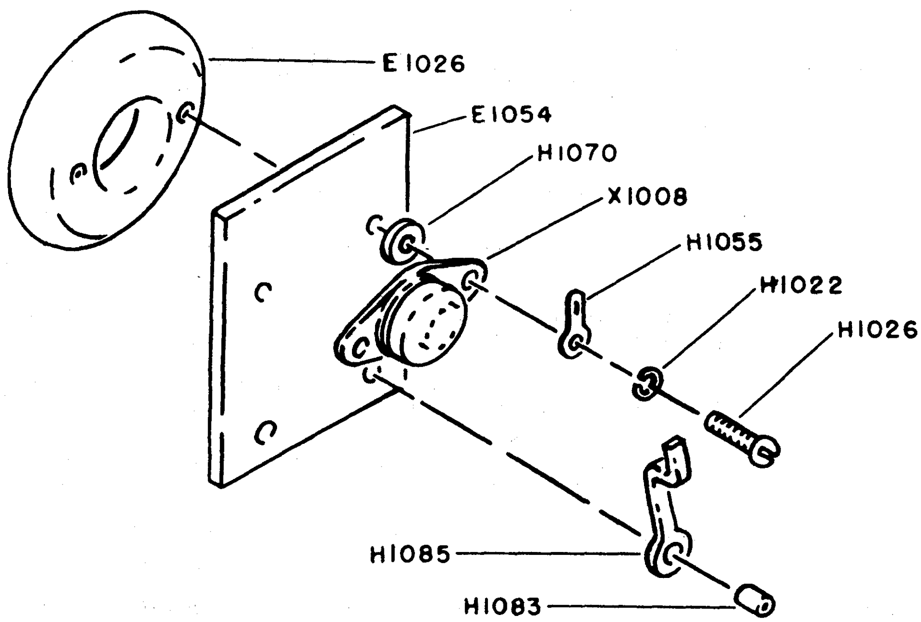


Figure 34E. Rectifier Mounting Assembly

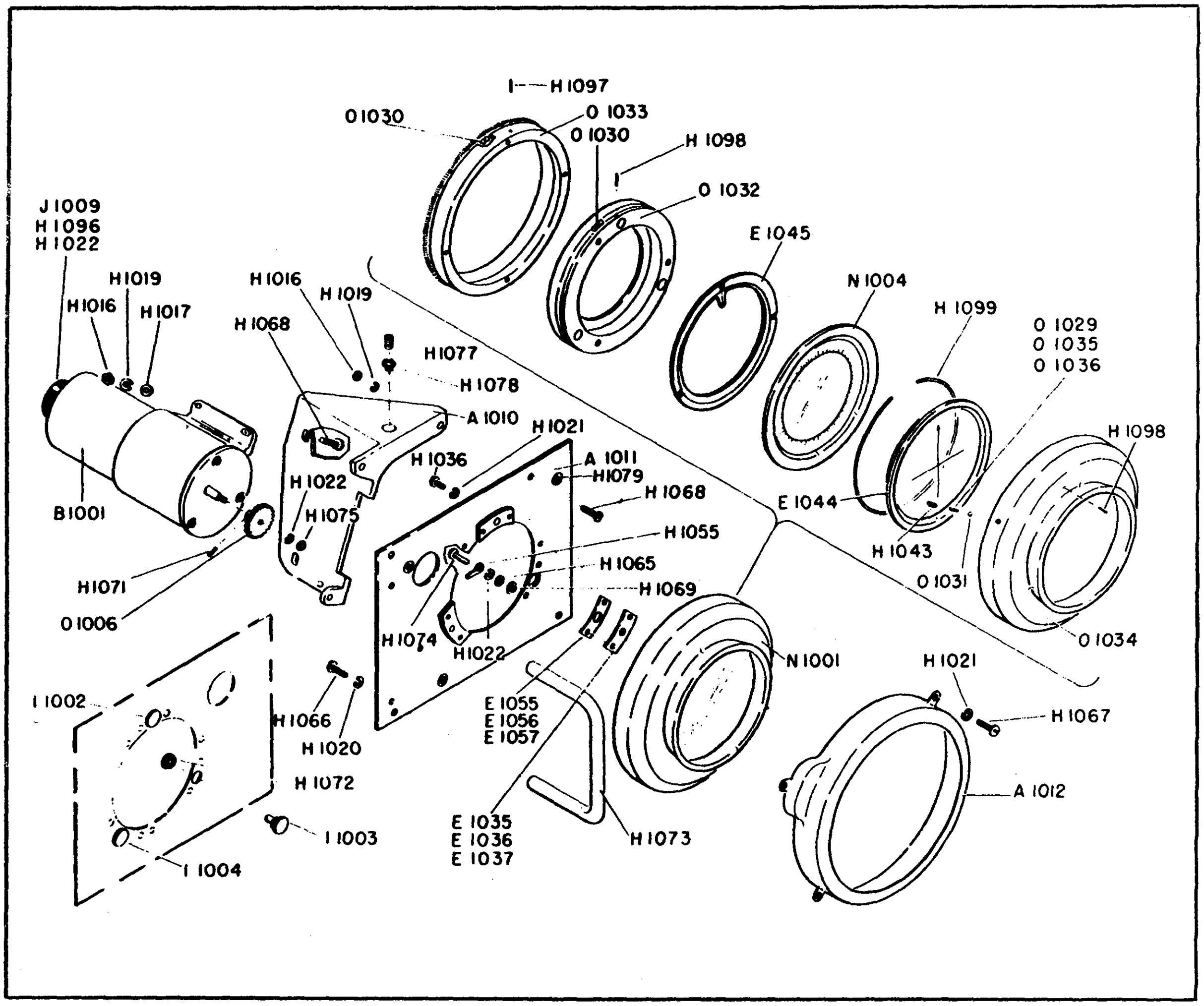


Figure 34F. Dial Drive Assembly

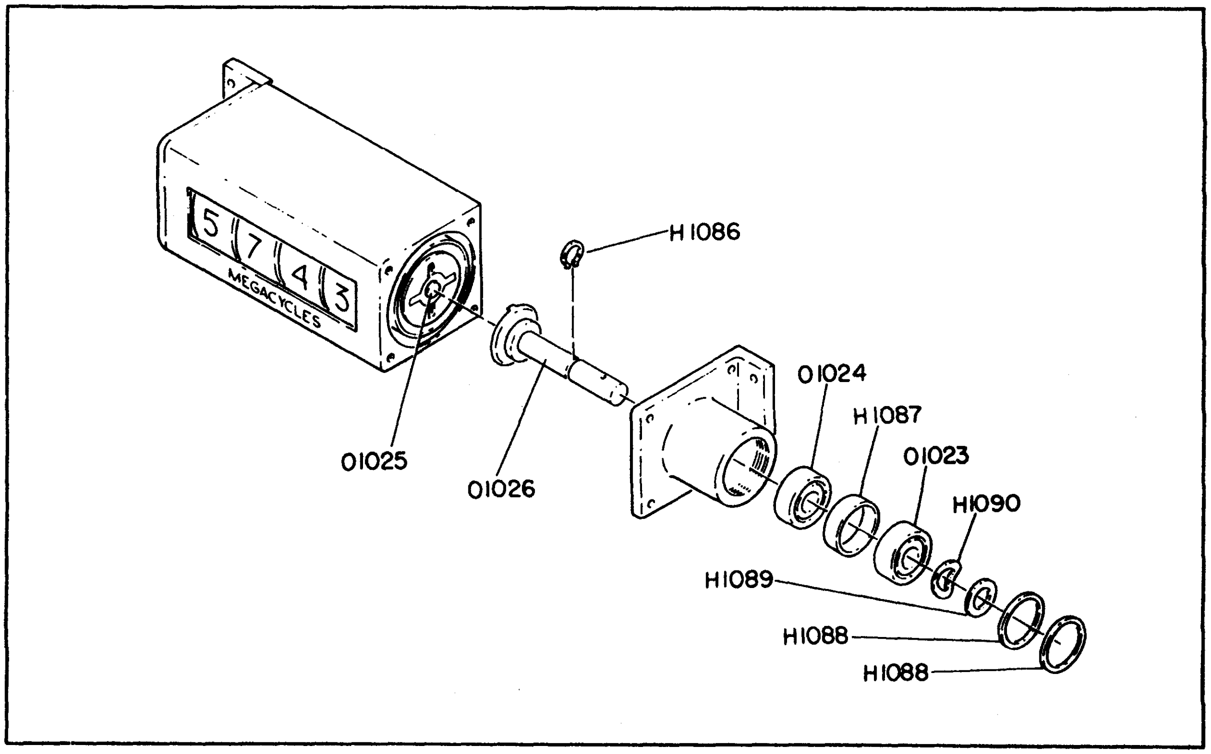


Figure 34G. Counter Assembly

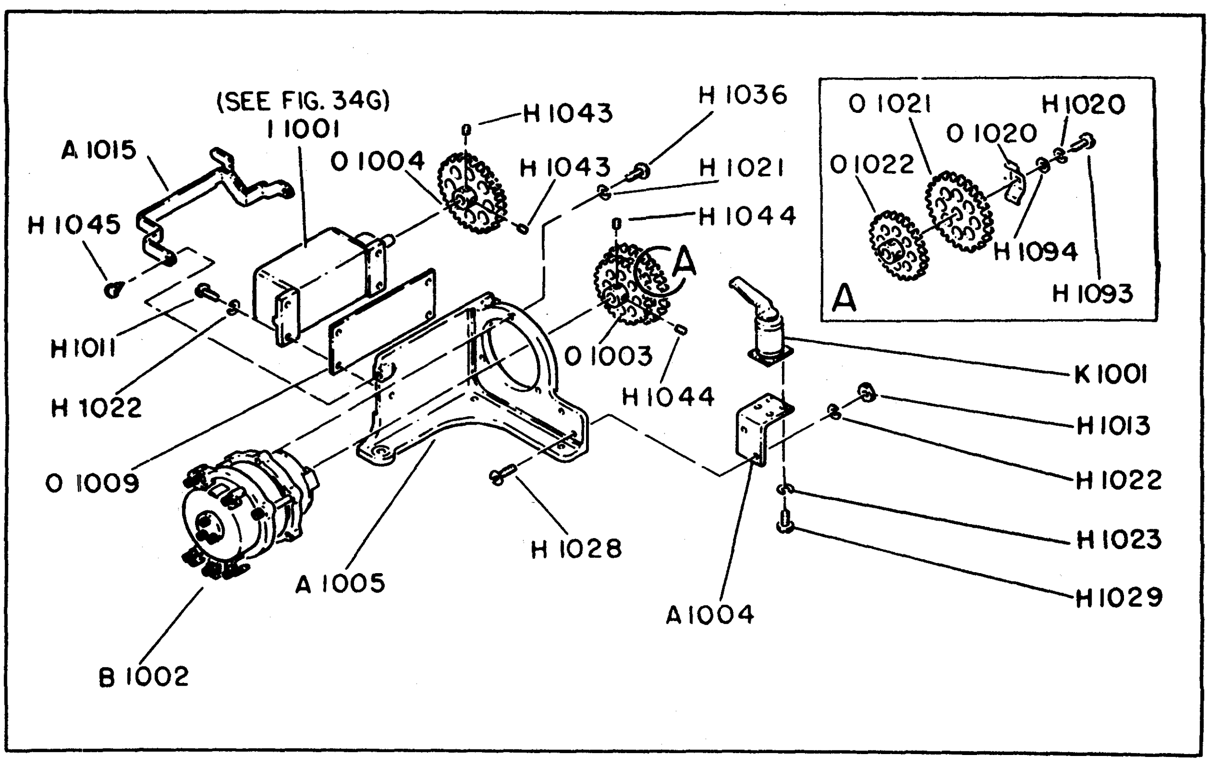


Figure 34H. Electrical Counter Assembly

Azimuth-Panoramic Indicator IP-81A/APA-69A

Ref. Symbol No.	Stock No.	Description	Source Code
1001-1099 series	R16AN-IP81APA-69A (BXR)	AZIMUTH-PANORAMIC INDICATOR IP-81A/APA-69A R650129	P1 MO/R
A1001		LATCH, lever: brs, Cd pl: irregular shape: elongated hole other end; 0.106 in. dia hole other end; approximately 1-5/8 in. lg. C245494	M1
A1002		TUBE SHIELD ASSY: consists of a bracket, rim, and clamp spotwelded to a tube shield. L204580-2	X1
A1003		BRACKET: A1, etch finish: angular: 2-1/4 in. lg: each side 0.68 in. A296571	M1
A1004		BRACKET: A1, etch finish: L-shaped: 0.76 in. wd; one end 1.16 in. lg with two holes drilled 0.136 in dia.; other end 0.98 in. lg with four holes drilled 0.116 in. dia evenly spaced: dimple on angle. C296582	M1

102H-2

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
A1005		BRACKET: A1, etch finish; 3.60 in. 2.44 in. 3.68 in.; dia in one side with three holes 0.161 in. dia and spotfaced 3/8 in. x approximately 0.02 in. deep evenly spaced around hole. N296572	
A1006		BRACKET ASSY: consists of an irregular shaped bracket with two inserts. C208466-1	A1
A1007		COVER ASSY: consists of a cover with captivated screw in bracket and identification plate riveted to cover. L208376-2	X2
A1008		COVER ASSY: spotfaced: 10.12 in. lg x 7.62 in. wd. N208392-1	A1
A1009		PLATE, mounting: natural plastic; 2.25 in. lg x 2 in. wd x 0.091 in. thk; hole drilled 0.161 in. dia one in each corner; four holes 0.120 in. dia drilled 0.446 in. c to c; stenciled C1018 on one end and C1019 on other end. A296596	M1
A1010		SUPPORT, dial drive: A1 dia casting: irregular shaped: 3.26 in. x 3-5/8 in. x 4.718 in.; 5-5/8 in. lg. N229629	
A1011		PANEL: A1, etch finish with front painted black; 7.63 in. lg x 5-1/2 in wd; cutout 3.180 in. dia in panel with three holes 0.386 in. dia and chore 0.438 in. dia x 0.048 in. deep evenly spaced around cutout; hole 1.060 in. dia near one corner; hole 0.218 in. dia in each corner; two holes 0.218 in. dia and chore 3/8 in. dia x 0.043 in. deep drilled 6.660 in. c to c. L296633	M1
A1012	R16BXR-L230499-2	GUARD: circular: A1; 5.09 in. dia one side; 6-3/8 in. dia other side; 7-3/8 in. OA OD; four protrusions evenly spaced around edge. L230499-2	P1 MO/N
A1013		COVER ASSY: consists of two brackets and a cover. L208376-1	X2
A1014		BRACKET ASSY: consists of an irregular shaped bracket with two inserts. C280643-1	
A1015		RANGE INDICATOR ASSY: consists of a range indicator to which a lever is spot-welded. C208375-1	M1
A1016		AZIMUTH-PANORAMIC INDICATOR ASSY: insists of frame to which brackets, gussets and plates are riveted or welded. R208446-1	X1
A1017		HOOK: SS. passivate; 0.32 in. wd: 0.094 in. thk; approximately 1-1/8 in. lg; 2 holes 0.149 in. dia drilled 1/2 in. c to c. A245234	M1
A1018		HOOK: SS. passivate; 0.32 in. wd; 0.094 in. thk; approximately 1-1/8 in. lg; 2 holes 0.149 in. dia drilled 1/2 in. c to c. A245234	M1
B1001	R16BXR-L	DRIVE, dial: torque unit; 116V; 380 to 420 cyc; max oper alt 60.000 ft.1 L211728-1 (ECP) 12626-3	P1 MO/R
B1002	R17M3010	MOTOR. self-synchronous: 47.6V; 400 cyc; 100 ma at 1 watt; second output 22V max. L221051-2 (KO) 1339-0430-0	P1 MO/S
C1001	R16C10492-56	CAPACITOR, fixed: mica; 10,000 uuf ±5:%; 300 vdcw CM35C103J	P1 MO/N
C1002	R16C11307-14	CAPACITOR, fixed: paper; 0.1 uf ±20%; 400 vdcw L220162-70 (SPR) 91P10404	P1 MO/N
C1003	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf ±5%; 600 vdcw. CM20C470J	Pf MO/N
C1004	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf ±6%; 600 vdcw. CM20C470J	P1 MO/N
C1005	R16C9843-35-100	CAPACITOR, fixed: mica; 47 uuf ±5%; 600 vdcw CM20C470J	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
C1006	R16C11307-14	CAPACITOR. fixed: paper; 0.1 uf ±20%; 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C1007	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper; 1 uf +20% -10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1008	R16C10492-56	CAPACITOR, fixed: mica; 10,000 uuf ±5%; 300 vdcw. CM35C103J	P1 MO/N
C1009	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10%; 600 vdcw. CP61B1FF106V	P1 MO/N
C1010	R16C10492-56	CAPACITOR, fixed: mica; 10,000 uuf +5%; 300 vdcw. CM36C103J	P1 MO/N
C1011	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10%; 600 vdcw. CP61H1FF105V	P1 MO/N
C1012	R16C11307-14	CAPACITOR, fixed: paper; 0.1 uf +20%; 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C1013	R16C10492-56	CAPACITOR, fixed: mica; 0.01 uf +6%; 300 vdcw. CM35C103J	P1 MO/N
C1014	RI6C11307-14	CAPACITOR, fixed: paper; 0.1 uf +20%; 400 vdcw. L220152-70 (SPR) 91P10404	P1 MO/N
C1015	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1uf +20% -10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1016	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10%: 600 vdcw. CP61B1FF105V	P1 MO/N
C1017	R16C11354-24	CAPACITOR, fixed: paper; 0.6 uf +10%; 600 vdcw. CP5341FF504K	P1 MO/N
C1018	R16C11923	CAPACITOR, variable: ceramic; 7-45 uuf. C219043-2	P1 MO/N
C1019	R16C11923	CAPACITOR, variable: ceramic: 7-45 uuf. C219043-2	P1 MO/N
C1020	R16C9097-36	CAPACITOR, fixed: mica; 150 uuf +10%; 500 vdcw. CM20C151K	P1 MO/N
C1021	R16C10492-56	CAPACITOR, fixed: mica; 0.01 uf ±5%; 300 vdcw. CM35C103J	P1 MO/N
C1022	R16JAN-CP61B1FF105V	CAPACITOR, fixed: paper: 1 uf +20% -10% ; 600 vdcw. CP61B1FF105V	P1 MO/N
C1023	R16JAN-CP61BFF105V	CAPACITOR, fixed: paper: 1 uf +20% -10% ; 600 vdcw. CP61B1FF105V	P1 MO/N
C1024	R16C10513-530	CAPACITOR, fixed: mica; 0.01 uf -±20% 2,600 vdcw. CM60B103M	P1 MO/N
C1025	R16C11339-99-450	CAPACITOR, fixed: paper: 0.47 uf ±20% ; 200 vdcw. L220162-36 (SPR) 91P47402	P1 MO/N
C1026	R16BXR-C220114-1	CAPACITOR, fixed: paper; 0.1 uf +20% -10%; 2,000 vdcw.C220114-1 (SPR) 912551	P1 MO/N
C1027	R16BXR-C220114-1	CAPACITOR, fixed: paler; 0.1 uf +20% -10%; 2,000 vdcw. C220114-1 (SPR) 912551	P1 MO/N
C1028	R16BXR-C220114-1	CAPACITOR. fixed: paper 0.1 uf +20%; -10% ; 2,000 vdcw. C220114-1 (SPR) 912551	P1 MO/N
C1029A, B	R16JAN-CP53B4EF105L	CAPACITOR, fixed: paper: 2 x 1 uf ±15%; 600 -vdcw. CP53B4EF105L	

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1036		PLATE. contact mounting: brs, silver pl: arc: 1.20 in. lg; hole 0.199 in. dia drilled in center of plate: two holes tapped No. 4-40 NC-2 30° c to c. A243488	M1
E1037		PLATE, contact mounting: brs, silver pl: arc: 1.20 in. lg; hole 0.199 in. dia drilled in center of plate: two holes tapped No. 4-40 NC-2 30° c to c. A243488	M1
E1038		CAPACITOR AND RESISTOR ASSY: consists of five crystal units, eleven capacitors, nineteen resistors and a coil assembly wired to terminal board. N282064-2	A1
E1039		CAPACITOR AND RESISTOR ASSY: consists of eleven resistors and one capacitor wired to terminal board. L208382-2	A1
E1040		CAPACITOR ASSY: consists of two capacitors mounted on plate. C208386-1	A1
E1041		RESISTOR ASSY: consists of two resistors wired to terminal board. C208425-2	A1
E1042		ADAPTER, electrical accessory to cable: A1: 1-1/4 in. wd x 1-5/64 in. lg: threaded 3/4-20 UNEF-2B. (2 each used). LN3057-6	P1 MO/N
E1043		INSERT, electrical connector: 15 round male contacts. C296632-1 (WIQ) 201-B	X1
E1044		POINTER, indicator: clear plastic: 3.857 in. die x 0.278 in. thk: arrow engraved on face. C246666	X1
E1045		DIAL: clear plastic: 4.057 in. OD x 3.24 in. ID x 0.188 in. thk: engraved pointer C246626	X1
E1046		CLIP, line support: 5/16 in. ID: 1/2 in. wd. C63122-4 (HPP) 754-4-2-8	P1 MO/N
E1047		PLATE, mounting: natural plastic; 2-1/4 in. lg x 2 in. wd x 0.091 in. thk: hole 0.061 in. dia drilled in each corner: two holes 1/2 in. dia drilled 0.8 in. c to c under which is stenciled C1018 and C1019. A296697	M
E1048		PLATE, mounting: natural plastic: 2 in. OA width: 2.94 in. 1/4; 1/4 in. thk: cutout 0.64 in. x 0.35 in. on two opposite ends: two 0.386 in. holes drilled 1.42 in. c to c: two 0.136 in. holes drilled in line with previous described holes; two 0.161 in. holes drilled 1.64 in. c to c at cutout end; symbol numbers R1056 and R10456 stenciled on one side. A296624	M
E1049	R17BXR-B13020-10	TERMINAL, lug: brs, hot tinned: 3/16 in. dia: 0.437 in. lg. (64 each used) B13020-10	P1 O/N
E1050	R17BXR-B13021-10	TERMINAL, lug: brs, hot tinned: 3/16 in. dia: 0.640 in. lg. (2 each used) B13021-10	P1 O/N
E1051	R17BXR-B13020-10	TERMINAL, lug: brs, hot tinned: 3/16 in. dia: 0.437 in. lg. (34 each used) B13020-10	P1 O/N
E1052	R17BXR-B13020-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia: 0.437 in. lg. (64 each used) B13020-10	P1 O/N
E1053	R17BXR-B13021-10	TERMINAL, lug: brs, hot tinned; 3/16 in. dia: 0.640 in. lg. (11 each used) B13021-10	P1 O/N
E1054		PLATE, mounting: natural plastic; 1.96 in. lg x 1-1/2 in. wd x 0.062 in. thk; 5/8 in. hole drilled in plate; two holes 0.128 in. dia drilled 7/8 in. c to c: two holes 1/4 in. dia drilled 0.880 in. c to c: stenciled 1Z2 on one side and V1008 and X1008 on other side. A230243-2	
E1055		PLATE, spacer: arc: plastic: 1.20 in. lg x 7/8 in. wd x 0.062 in. thk: 0.323 in. dia hole in center and 0.128 in. dia hole on each side of center hole. A243487	M
E1056		PLATE, spacer: arc: plastic: 1.20 in. lg x 7/8 in. wd x 0.062 in. thk; 0.323 in. dia hole in center and 0.128 in. dia hole on each side of center hole. A243487	M

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1057		PLATE, spacer: arc; plastic; 1.20 in. lg x 7/8 in. wd x 0.06 hole in center and 0.128 in. dia hole on each side of center hole. A243487	M
E1058		ADAPTER, electrical accessory to cable: A1; 24-/4 in. wd x 2-18 NS-2B. AN3057-24	P1 MO/N
E1069		ADAPTER, electrical accessory to cable: A1; 1-9/16 in. wd x 1-8/16-18 NEF-2B. AN3067-12	P1 MO/N
E1060		BOARD, terminal: 5 contacts. C60854-5 (JNS) 5-140	
E1061		PLATE, insulator C243544-18	
E1062		CAPACITOR AND RESISTOR ASSY: consists of seven resistors and three capacitors wired to terminal board. L280907-2	
E1063		TERMINAL BOARD ASSY: consists of twenty terminal lugs mounted on board. L280907-1	
H1001	R16JAN-CP06FAS5	BRACKET: mounting.(7 each used) CP06FA5	P1 MO/N
H1002		CLAMP, cable: brs, nickel pl; approx 9/16 in. x 5/16 in 0.144 in. dia hole in one end. (2 each used) A18362-3	
H103		CLAMP, cable: bra, nickel pl; approx 3/4 in. lg x 7/16 in. wd x 1/32 in. thk: 0.173 in. dia. Hole in one end. A18362-20	
H1004		NUT, hex: brs, nickel p1; No. 6-32 NC-2; 0.250 in. wd; 3/32 in. thk. (6 each used) HSN775B-4	
H1005		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2: ¾ in. lg. (4 each used) AN515B6-12	
H1006		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2; ½ in. lg. (2 each used) AN515B6-8	
H1007		NOT USED	
H1008	R17BXR-C243900	TERMINAL, stud: 1/2 in. OA dia; 0.844 in. Ig; one end tapped 4-40 NC-2. (9 each used) C243900-3 (ELCN)TT-16	P1 MO/N
H1009		NUT, hex: bra. nickel pl; No. 4-40 NC-2; 0.1875 in. wd; 1/16 in. thk. (16 each used) AN515B6-6	
H1010		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2: 3/8 in. lg. (20 each used) AN515B4-6	
H1011		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 4-40 NC-2; 7/16 in. lg. (8 each used) AN515B4-7	
H1012		WASHER, lock: phosphor bronze, nickel pl; int tooth; No. 10 (2 each used) A18041-10 (SH) 1910	
H1013		NUT, hex: brs, nickel pl; No. 4-40 NC-2. (29 each used) AN340B4	
H1014		NUT, hex: brs, nickel pl; No. 6-32 NC-2. (55 each used) AN340B6	
RH105		NUT, hex: brs, nickel pl; No. 8-32 NC-2. (13 each used) AN340B8	
H1016		NUT, hex: brs, nickel pl; No. 10-24 NC-2. (10 each used) AN340B10	

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
C1030A, B	R16C11292-89-N	CAPACITOR, fixed: paper; 2 x 0.05 uf ±15%: 600 vdcw. CP53B4EF503L	P1 MO/N
C1031	R16C10513-530	CAPACITOR, fixed: mica 0.01 uf ±20%: 2.500 vdcw. CM1160B103M	P1 MO/N
C1032A, B	R16JAN-CP53B4EF105L	CAPACITOR, fixed: paper; 2 x 1 uf ±15%: 600 vdcw. CP53B4EF105L	P1 MO/N
C1033	R16C10493-21	CAPACITOR, fixed: mica: 0.01 uf ±10%: 300 vdcw. CM315B103K	
C1034	R16C10493-21	CAPACITOR, fixed: mica: 0.01 uf ±10%: 300 vdcw. CM315B103K	
C1035	R16C11307-14	CAPACITOR, fixed: paper: 0.10 uf ±20%: 400 vdcw. L220152-70 (SPR) 91P10404	
CR1001	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1002	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1003	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1004	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
CR1005	N16T51735	CRYSTAL UNIT, rectifying: germanium crystal. C221944-1 (SLE) IN34A	P1 MO/N
E1001	R16C20181	CLIP, tube: rubber: 47/64 in. OA width: 1-13/64 in. lg: 25/64 in. OA thickness; metal contact enclosed. A242240	P1 MO/N
E1002	R16S3933-24	SHIELD, tube. TSF0T104	P1 MO/N
E1003	R16S3933-10	SHIELD, tube. TSF0T102	P1 MO/N
E1004	R16S3933-10	SHIELD, tube. TSF0T102	P1 MO/N
E1005	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E1006	R16S3937-5	SHIELD, tube. TSF0T101	P1 MO/N
E1007	R16S3933-25	SHIELD, tube. TSF0T105	P1 MO/N
E1008	R16S3933-25	SHIELD, tube. TSF0T105	P1 MO/N
E1009	R16BXR-L204579-2	TUBE SHIELD ASSY: consists of a tube shield to which gasket strips are cemented and a clamp screwed to one end. L204679-2	P1 O/S
E1010	R16S3933-24	SHIELD, tube. TSF0T104	P1 MO/N
E1011	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1012	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1013	R1619867	INSULATOR, post. NS3W0105	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1014	R1619867	INSULATOR, post. NS3W0100	P1 MO/N
E1015	R1619867	INSULATOR, post. NS3W0106	P1 MO/N
E1016	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1017		NOT USED	
E1018	R1619P67	INSULATOR, post. NS3W0105	P1 MO/N
El019	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1020	R1619S67	INSULATOR, post. NS3W0105	P1 MO/N
E1021	R1619867	INSULATOR, post. NS3W0105	P1 MO/N
E1022		TERMINAL BOARD ASSY: consists of sixty-five terminal posts mounted on board. N282054-1	A1
E1023	R17A2299	ADAPTER, electrical accessory to cable: A1; 1-7/18 in. OD; 1-1/8 in. lg; threaded 1-20 UNEF-2B. AN3057-10	P1 MO/N
E1024		TERMINAL BOARD ASSY: consists of twenty terminals mounted on board. L208382-1	A1
E1025		TERMINAL BOARD ASSY: consists of four terminal lugs mounted on board. C208425-1	A1
E1026		RING, electrode: bra, nickel pl: 0.718 in. ID: 1.240 in. OD: 0.3o in. thk: two holes tapped No. 4-40 NC-2 x 0.18 in. deep 7/8 in. c to c. A243445	X1
E1027	R16BXR-C233623	TUBE, viewing: black neoprene: 3-1/2 in. ID: 8 in. lg; 1/8 in. wall thickness; beaded edge both ends. C233623	P1 MO/N
E1028		KNOB: aluminum; 0.580 in. dia; 0.59 in. thk; marked with an arrow across front of knob. C245182-2	P1 MO/N
E1029		KNOB: aluminum; 0.580 in. dia; 0.59 in. thk; marked with an arrow across front of knob. C245182-2	P1 MO/N
E1030		KNOB: aluminum; 0.580 in. dia; 0.59 in. thk; marked with an arrow across front of knob. C245182-2	P1 MO/N
E1031		KNOB: aluminum; 0.580 in. dia; 0.59 in. thk; marked with an arrow across front of knob. C245182-2	P1 MO/N
E1032	R16K3336-625	KNOB: molded black bakelite: 7/8 in. dia; 19/32 in. thk: marked with an arrow across front of knob. C60187-2	P1 MO/N
E1033	R16K3336-625	KNOB: molded black bakelite: 7/8 in. dia; 19/32 in. thk: marked with an arrow across front of knob. C80187-2	P1 MO/N
E1034	R16K3336-625	KNOB: molded black bakelite; 7/8 in. dia; 19/32 in. thk; marked with an arrow across front of knob. C60187-2	P1 MO/N
E1035		PLATE, contact mounting: brs, silver pl; arc: 1.20 in. lg: hole 0.199 in. dia drilled in center of plate; two holes tapped No. 4-40 NC-2 30c to c. A243488	M1

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1061		STUD, flanged: brs, Cd pl: 1/4 in. dia flanged end; 1/16 in. dia other end; 0.260 in. lg. (2 each used) A296167	M1
H1062		NOT USED	
H1063		SCREW, mach: slot dr; Bind H: bran. nickel pl; No. 4-40 NC-2; 8/16 in. lg. (4 each used) Commercial	
H1064		WASHER, lock: steel, nickel pl: split; No. 4. (2 each used) AN935-4	
H1065		WASHER, fiat: brs, nickel pl; No. 4. (14 each used) AN960B4	
H1066		SCREW, mach: slot dr: rd hd; brs, nickel pl; No. 8-32 NC-2; 1/2 in. lg. (2 each used) AN515B8-8	
H1067		SCREW, mach: slot dr; Bind H; brs, chromated Cd pl No. 6-32 NC-2: 5/16 in. lg. (3 each used) Commercial	
H1068		SCREW, mach: slot dr; Bind H; brs,. nickel pl; No. 10-24 NC-2; 5/8 in. lg. (3 each used) Commercial	
H1069		WASHER, flanged: plastic: 0.128 in. ID; 0.32 in. OD flanged end; 0.184 in. OD other end; 0.14 in. thk. (6 each used) A17029-89	
H1070		WASHER, flat: bra. nickel pl; No. 4. (2 each used) AN960B4	
H1071		PIN, cotter: SS, passivate; 1/32 in. dia; 1/2 in. lg. Commercial	
H1072		INSERT, threaded: brs rod. silver pl; tapped 5/16-32 NEF-2; 0.446 in. OD and knurled one end; 0.384 in. OI other end; 0.090 in. thk. (3 each used) A241997	MI
H1073		HANDLE: steel, Cd pl; U-shaped; 4.46 in. lg; each end 2.08 in. lg; each end tapped 8-32 NC-2. A103650-39	MI
H1074		SCREW, mach: slot dr; rd hd; brs, Cd pl; No. 4-40 NC-2; 3/8 in. lg. (10 each used) AN615B4-6	
H1075		NUT, hex: brs. nickel pl; No. 4-48 NF-2. Commercial	
H1076		NOT USED	
H1077	R43I14500-5	INSERT, threaded: steel, Cd pl. tapped 8-32 NC-3; threaded 1/4-20 NC-2; 3/8 in. lg. C246606-3 (ROSN) R104SB-6	P1 O/N
H1078	R43L11006	RING, retainer: steel, Cd pl; 0.354 in. OD; 0.213 in. ID; 0.099 in. thk. C2386655-3 (ROSN) RL21SB-6	P1 O/N
H1079		INSERT, threaded: steel, chromated Cd pl: 5/16	M1
H1080		RIVET, tubular: oval hd; brs, Cd pl; 0.088 in. dia; ¼ in. lg. (2 each used) AN450C6B8	
H1081		INSERT, self-clinching: steel, Cd pl: No. 6-32 HC860H38-0632 (PEN) CL632-1	
H1082		SCREW, captive: SS, black oxide: 1.34 in. lg: portion 0.26 in. threaded 6-32 NC-2; head 0.312 in. dia. A295155	M1

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1083		EYELET. flanged: brs, Cd pl; 0.209 in. ID; 0.247 in. OD one end; 3/8 in. ID flanged end; 0.178 in. lg. (2 each used) A112885-3	
H1084		NOT USED	
H1085		TERMINAL. lug: soldering brs, hot tinned; 1/8 in. dia one end; 0.38 in. dia other end drilled ¼ in. dia hole; 1.32 in. lg. (2 each used) A17803-2	
H1086		RING, retainer: external steel Cd pl; ¼ in. ID; 0.025 in. thk. HC848G250 (WKI)5100-25	
H1087		RING, retainer: brs, nickel pl; 0.53 ID; 0.623 in. OD; 0.158 in. thk. C239634-6	M1
H1088		WASHER, flat: SS; 1/2 in. ID; 5/8 in. OD; 1/32 in. thk. (2 each used) A17005-153	M1
H1089		WASHER, flat: SS; 0.251 in. ID; 0.406 in. OD; 0.027 in. thk. A17005-152	M1
H1090		WASHER, spring; phosphor bronze; 0.265 in. ID; 0.406 in. OD; 0.009 in. thk. A170027-83	M1
H1091		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 6-32 NC-2; 9-16 in. lg. (2 each used) Commercial	
H1092		CLAMP: CRS, Cd pl; U-shaped; 3-1/2 in. lg; ½ in. lg: ½ in. wd; 0.062 in. thk material; hole drilled 0.161 in. dia on each end. A241215-7	
H1093		SCREW, mach; slot dr; rd hd; brs, nickel pl; No. 8-32 NC-2; ¼ in. lg. AN515B8-4	
H1094		WASHER, flat; brs, nickel pl; No. 8. AN9460B8	
H1095		COLLAR, spacing; A1; 0164 in. ID; ¼ in. OD; 3/8 in. lg. (4 each used) A12008-10	M1
H1096		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 4-40 NC-2: ¼ in. lg. (4 each used) Commercial	
H1097		PIN: brs, Cd pl; 5/16 in. lg: 0.063 in. dia. (3 each used) HSC838B-14	
H1098		PIN: brs, Cd pl; 0.156 in. lg: 0.630 in. dia. (3 each used) HSC838B-15	
H1099		RING, retainer steel spring wire, Cd pl; 4.25 in. OD; 30° section cur from ring. C238572	M1
H1099-1		SCREW, mach; slot dr: FH: brs, nickel pl; No. 4-40 NC-2; 5/8 in. lg. (4 each used) AN505B4-10	
H1099-2		CLIP, electrical: phosphor bronze; nickel pl; 1.885 in. lg: 0.375 in. wd; 0.688 in. thk material; hole drilled 0.182 in. dia in center. C294234-1 (FHE) 9C	
H1099-3		TERMINAL, lug: soldering: brs, hot tinned; 0.382 in. dia one end; other end drilled 3/32 in. dia hole; 5/8 in. lg. (5 each) A121259	
I1001	R16BXR-N208412-1	COUNTER ASSY: consists of two shafts, two retainer rings, two ball bearings and one counter. N208412-1	
I1002	R17L6512	LAMP, Incandescent; 3V: 0.19 amp; clear; No. 953 screw base. AN3136-323	P1 MO/N
I1003	R17L6512	LAMP, Incandescent; 3V: 0.19 amp; clear; No. 953 screw base. AN3136-323	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1017		WASHER, flat: brs, nickel pl; No. 10. (6 each used) AN960B10	
H101		WASHER, flat: brs. nickel pl; No. 6. (41 each used) AN960B6	
H1019		WASHER, lock: phosphor bronze, nickel pl: split; No. 10. (16 each used) AN936B10	
H1020		WASHER, lock: phosphor bronze, nickel pl; split; No. 8. (24 each used) AN935B8	
H1021		WASHER, lock: phosphor bronze, nickel pl; split; No. 6. (87 each used) AN935B6	
H1022		WASHER, lock: phosphor bronze, nickel pl split; No .4. (69 each used) AN93SB4	
H1023		WASHER, lock: phosphor bronze, nickel pl; split; No. 3. (20 each used) AN936B3	
H1024		SCREW, mach: slot dr; FH; brs, nickel pl; No. 6-32 NC-2; 5/16 in. Ig. (4 each used) AN605B6-6	
H1025		SCREW, mach: slot dr: FH; bra, nickel pl; No. 8-32 NC-2; 3/8 in. lg. (6 each used) AN505B8-6	
H1026		SCREW, mach: slot dr: rd hd; brs., nickel pl: No. 4-40 NC-2: 1/4 in. lg. (16 each used) AN515B4-4	
H1027		SCREW, mach: slot dr; rd hd: brs, nickel pi; No. 4-40 NC-2:; 3/16 in. Ig. (8 each used) AN515B4-3	
H1028		SCREW, mach: slot dr; rd hd: brs, nickel pi; No. 4-40 NC-2; 5/16 in. lg. (19 each used) AN516B4-6	
H1029		SCREW, mach: slot dr; rd hd: bra, nickel pl; No. 3-48 NC-2; 1/8 in. lg. (4 each used) AN516B3-2	
H1030		SCREW, mach: slot dr: rd hd; brs, nickel pl: No. 3-66 NF-2; 1/4 in. lg. (16 each used) AN520B3-4	
H1031		SCREW, mach: slot dr; rd hd; brs, nickel pi; No. 8-32 NC-2; 7/16 in. lg. (8 each used) AN615B8-7	
H1032		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 8-32 NC-2; 6/16 in. lg. (2 each used) AN616B8-5	
H1033		SCREW, mach: slot dr; rd hd; brs, nickel pl: No. 832 NC-2; 3/8 in. Ig. (4 each used) AN515B8-6	
H1034		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2; 3/16 in. lg. (4 each used) AN616B6-3	
H1036		SCREW, mach: slot dr; rd hd ;.brs, nickel pl; No. 6-32 NC-2; 1 in. Ig. (4 each used) AN516B6-16	
H1036		SCREW, mach: slot dr; rd hd; brs, nickel pl; No. 6432 NC-2; 7/16 in. Ig. (9 each used) AN515B6-7	
H1037		SCREW, match: slot dr; rd hd; brs, nickel pl; No. 6-32 NC-2; 5/16 in. lg. (30 each used) AN155B6-5	
H1038		SCREW, mach: slot dr; Bind H: brs, nickel pl; No. 8-32 NC-2; 1/2 in. lg. (2 each used) Commercial	
H1039		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 4-40 NC-2: 3/8 in. Ig. (2 each used) Commercial	

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1040		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 6-32 NC-2; 7/16 in. lg. (4 each used) Commercial	
H1041		SCREW, mach: slot dr: Bind H; brs, nickel pl; No. 10-24 NC-2; 3/8 in. lg. (4 each used) Commercial	
H1042		SCREW, set: Bristo dr; cup point; steel, Cd pl; No. 8-32 NC-3; 1/8 in. lg. (8 each used) Commercial	
H1043		SCREW, set: Bristo dr; cup point; steel, Cd pl; No. 6-32 NC-3; 1/8 in. lg. (5 each used) Commercial	
H1044		SCREW, set: Bristo dr; cup point; steel, Cd pl; No. 6-39 NC-3; 3/16 in. lg. (16 each used) Commercial	
H1045		SCREW, drive: rd hd; steel; Cd pl; No. 2; 1/4 in. lg. (2 each used) Commercial	
H1046		RING, retaining: external: steel, Cd pl; 0.230 in. OD x 0.094 in. ID x 0.016 in. thk. (2 each used) HCR846G-125 (WKI) 6133-12	
H1047	R41W2468	WRENCH, Bristo: steel, Cd pl; size 04; L-shaped; short arm. HC684H04-S	P1 MO/N
H1048	R41W2462	WRENCH, Bristo: steel, Cd pi; size 03; L-shaped: short arm. HC684H03-S	P1 MO/N
H1049		PIN, straight: SS, unfinished; 1-1/8 in. lg x 0.25 in. dia. (2 each used) Commercial	
H1050		NOT USED	
H1051		NOT USED	
H1052		GROMMET, rubber: 17/64 in. ID; 9/16 in. OD; 1/4 in. thk. (2 each used) A11426-4 (ARH) 1119	
H1053		GROMMET, black rubber; 1/8 in. ID x 11/32 in. OD x 3/16 in. thk. AA1143-13 (LAV) 901	
H1054		TERMINAL, lug: soldering; brs, hot tinned; 5/64 in. dia hole in one end; 0.170 in. dia hole drilled in other end; holes 7/16 in. c to c; 0.020 in. thk. (2 each used) Commercial	
H1055		TERMINAL, lug: soldering; brs. hot tinned; 5/64 in. die hole in one end; 0.121 in. dia hole drilled in other end; holes 7/16 in. c to c; 0.020 in. thk. (9 each used) Commercial	
H11056		TERMINAL, lug: soldering; bras, hot tinned; 5/64 in. dia hole in one end: 0.144 in. dia hole drilled in other end; holes 7/16 in. c to c; 0.020 in. thk. (16 each used) Commercial	
H11057		WASHER, flat: soft copper, nickel pl; 0.167 in. ID x 3/8 in. OD x 0.020 in. thk. (24 each used) Commercial	
H1058		PIN, hinge: brs, CdI pl; 1/8 in. dia: 1.74 in. lg. A245495	M1
H1059		NOT USED	
H1060		STUD: brs, Cd pi; 1/8 in. OA dia; one end 0.050 in. thk with hole drilled 0.052 in. dia; other end 1/16 in. dia; 0.380 in. lg. A296168	M1

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
I1004	R17L6512	LAMP, incandescent: 3V;: 0.19 amp; clear; No. 93 screw base. AN3136-323	P1 MO/N
I1005	R17L6536-700	LAMP, incandescent: 2.9V; 0.17 amp; clear. A9320-5 (GE) 291	P1 MO/N
I1006	R17L6682	LAMP, incandescent: 28V; 0.17 amp; clear. A9320-8 (GE) 313	P1 MO/N
I1007		COUNTER, mechanical: 3.94 in. lg; 1.234 in. wd; 1.297 in. high; four figure counter. C222464-1 (VEE) CK-110234	
I1008	R17L6512	LAMP, incandescent: 3V; 0.19 amp; clear; No. 953 screw base (spare). AN3136-323	P1 MO/N
I1009	R17L6512	LAMP, incandescent: 3V; 0.19 amp; clear; No. 953 screw base (spare). AN3136-323	P1 MO/N
J1001	R17R1706	CONNECTOR, receptacle: eight male contacts.AN3102A-20-7P	P1 MO/N
J1002	R16R2436	CONNECTOR, receptacle: one female contact UG-290/U	P1 MO/N
J1003	R16R2435	CONNECTOR, receptacle: one female contact. UG-290/U	P1 MO/N
J1004	R16R2486	CONNECTOR, receptacle: one female contact. UG-290/U	P1 MO/N
J1005	R17WIQ-201BAN3102A3C	CONNECTOR, receptacle: 15 male contacts. C208361-1	P1 MO/N
J1006	R17R1701-130	CONNECTOR, receptacle: 5 male contacts. AN3102A-14S-6P	P1 MO/N
J1007	R17R1701-100-10	CONNECTOR, receptacle: 4 male contacts. AN3102A-14S-2P	P1 MO/N
J1008	R16R2435	CONNECTOR, receptacle: one female contact. UJG-290/U	P1 MO/N
J1009		CONNECTOR, receptacle: 10 female contacts. AN3106-18-1S	P1 MO/N
K1001	R17R5884-18	COIL, relay: 28V oper; 300 ohms dc resistance. C216010-1 (AGC) R38-1186	P1 MO/N
K1002	R17R5884-17	RELAY, armature: 26V dc; 4 pdt. C218461-1 (ADE) TC12D24PL-A3	P1 MO/N
K1003	R17R5884-17	RELAY, armature: 25V dc; 4 pdt. C218461-1 (ADE) TC12D24PL-A3	P1 MO/N
L1001A, B, C	R16BXR-A209293-1	COIL, r-f: 3 pi; 10 mh at 1000 cyc ea pi. A209293-1	P1 MO/N
N1001	R16BXR-N204604-1	DIAL DRIVE ASSY: consists of dial, scale, pointer, housing and bearings. N204604-1	P1 MO/S
N1002		PLATE, identification (used on Contract NOas 52-435) L247419-7	
N1003		PLATE, identification. C247115	M1
N1004		SCALE: amber plastic; 4.22 in. OD x 3.360 in. 1D x 1/4 in. thk; numerals engraved on face. C246660	X1
N1005		PLATE, identification (used on Contract NOas 61-134) (spare major units only.) N246539-2	
N1006		PLATE, identification (used on Contract NOas 54-359) L247419-11	
01001	R16BXR-A239254	COUPLING, insulated: brs, Cd pl; with glazed ceramic outside surface; 11/16 in. OA dia; 1-1/4 in. lg; two tapped holes 8-32 90° apart on each end. A2392654	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
O1002	R16BXR-A239254	COUPLING, insulated: brs, Cd pl: with glazed ceramic outside surface: 11/16 in. OA dia; 1-1/4 in. lg: two tapped holes 8-32 90° apart on each end. A23925-4	P1 MO/N
O1003	R16BXR-C208363-1	GEAR ASSY: 2 spur type. C208363-1	P1 MO/S
O1004	R16BXR-C248568	GEAR, spur: A1, anodize; 128 teeth; 20° involute; 2.0284 in. OD: ¼ in. ID: eight 3/8 in. dia holes spaced 45° apart; two 6-32 NC-2 tapped holes spaced 90° apart. C248568	P1 MO/N
O1005		BRACKET, rectifier: consists of a tube socket and electrode ring mounted on plate. C204436-2	
O1006	R16BXR-A238336	GEAR; spur: A1,anodize; 4 teeth; 20° involute; 1.0388 in. OD; OD tapers from 0.188 in. max. A238336	P1 MO/N
O1007		SPRING, compression: steel music wire, Cd pl; 3/16 in. dia; ½ in. lg. A239887-6	M1
O1008	R16BXR-C240575	MOUNT, vibration: natural rubber; black; 2.32 in. ID: 0.04 in. wall; 0.60 in. lg. C240575	P1 MO/N
O1009		SHIM, rectangular: laminated brs; 1.26 in. wd x 3.20 in. lg. X 0.032 in. thk; hole 0.161 in. dia drilled in each corner. A236337	M1
O1010		ELECTRICAL COUNTER ASSY: consists of motor (B1002), gear assy (I1001) L230384-1	
O1011		NOT USED	
O1012		NOT USED	
O1013		NOT USED	
O1014	R16BXR-OR206448-1	DIAL DRIVE ASSY: consists of dial drive assy, torque unit and gear. R206448-1	
O1015		NOT USED	
O1016		NOT USED	
O1017		NOT USED	
O1018		NOT USED	
O1019		NOT USED	
O1020		SPRING: beryllium copper Cd pl: 0.94 in. lg x 0.36 in. wd; hole 0.170 in. dia drilled in center: crimp 0.020 in radius in each end. A249702	M1
O1021	R16BXR-C248569	GEAR, spur: A1, anodize; 128 teeth; 20° involute; 2.0284 in. OD; 8 holes 3/8 in. dia spaced 45° apart. C248569	P1 O/S
O1022	R16BXR-C248570	GEAR, spur: A1, anodize; 112 teeth; 20° involute; 1.7784 in. OD; 8 holes 5/16 in. dia spaced 45° apart; two holes tapped 6-32 NC-2 120° apart. C248569	P1 O/S
O1023	R77B115-00409-0000	BEARING, ball: 5/8 in. OD; ¼ in. ID; 0.1969 in. thk.; 8 balls. C240043-11 (FAF)S1K7	P1 O/N
O1024	R77B115-00409-0000	BEARING, ball 5/8 in. OD; ¼ in. ID; 0.1969 in. thk; 8 balls C240043-11 (FAF)S1K7	P1 O/N
O1025		SHAFT: steel, chrome plate; 0.154 in. dia; 2.03 in. lg. A249709	M1

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
O1026		SHAFT: steel. Cd pi; 0.618 in, dia one end: 0.249U in. dia other end; 1.403 in. OA lg. C249701	M1
O1027		GASKET, strip: sponge rubber; 1/2 in. wd x 3/16 in. thk x 3 in. lg. A233212-3	M
O1028		GASKET, strip: sponge rubber; 1/2 in. wd x 3/16 in. thk x 3 in. lg. A233212-3	M
O1029		SPRING, compression: steel spring wire, Cd pl; 7 turns; 0.09 in. OD; 0.18 in. lg. C239080-38	M1
O1030	347 to C1 77-1-7	BALL, glass: 0.1562 in. dia. (183 each used) HSC801X-3	P1 O/N
O1031	347 to C1 77-1-7	BALL, glass: 0.0937 in. dia (3 each used) HSC801X-4	P1 O/N
O1032		CONE, bearing: A1, anodized; 4.2 in. OD: 3.6 in. ID; 0.560 in. thk. L234068	X1
O1033		BEARING ASSY: consists of two spur gears assembled with 6 screws and two straight pins N207892-1	X1
O1034		CONE, bearing: A1; S.C in. OD; L1 in. ID: 1.33 in. thk. L234072	X1
O1035		SPRING, compression: steel spring wire, Cd p: 7 turns; 0.09 in. OD; 0.18 in. lg. C239080-38	M1
O1036		SPRING, compression: steel spring wire, Cd pl; 7 turns; 0.09 in. OD: 0.18 in. lg. C23908038	M1
P1001	R17P4433-599-2	CONNECTOR, plug: 8 female contacts. AN3106A-18-1S	
P1002		CONNECTOR, plug: single male contact. UG-260/U	
P1003		CONNECTOR, plug: single male contact. UG-260/U	
P1004		CONNECTOR, plug: single male contact. UG-260/U	
P1005		CONNECTOR, plug: 15 female contact. AN3106-36 shell (WIQ) 202-B insert	
P1006		CONNECTOR, plug: 5 female contacts. AN3106-14S-5S	
P1007		CONNECTOR, plug: 4 female contacts. AN3106-14S-2S	
P1008		CONNECTOR, plug: single male contact. UG-260/U	
R1001	R16JAN-RC20BF334K	RESISTOR, fixed: comp; 330,000 ohms ±10%; 1/2w. RC20BF334K	P1 MO/N
R1002	R16JAN-RC20BF321K	RESISTOR, fixed: comp; 820 ohms ±10%; 1/2w. RC20BF321K	P1 MO/N
R1003	R16JAN-RC20BF124K	RESISTOR, fixed: comp; 120,000 ohms ±10%; 1/2w. RC20BF124K	P1 MO/N
R1004	R16JAN-RC20BF822J	RESISTOR, fixed: comp; 8.200 ohms :±10%; 1/2w. RC20BF822J	P1 MO/N
R1005	R16JAN-RC20BF334K	RESISTOR, fixed: comp; 330.000 ohms ±10%; 1/2w. RC20BF334K	P1 MO/N
R1006	R16JAN-RC30BF821K	RESISTOR, fixed: comp; 820 ohm ±10%; 1w. RC30BF821K	P1 MO/N
R1007	R16R7310-63-500	RESISTOR, fixed: comp; 15.000 ohms ±108; 2w. C220509-153 (AB) HB-1531	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
R1008	R16R17310-63-500	RESISTOR, fixed: comp: 15,000 ohms ±10%; 2w. C220509-153 (AB) HB-1631	P1 YO/N
R10 09	R16R17281-186	RESISTOR, fixed: comp: 4,700 ohms ±10%; 2w. C220609-472 (AR) HB-4721	P1 MO/N
R1010	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1/2w. RC20BF104K	P1 MO/N
R1011	R16JAN-RC20BF102K	RESISTOR, fixed: comp; 1,000 ohms ±10%; 1/2w. RC20BF102K	P1MO/N
R1012	R16JAN-RC30BF564K	RESISTOR, fixed: comp; 560,000 ohms ±10%; 1w. RC30BF564K	P1 MO/N
R1013	R16R17327-63	RESISTOR, fixed: comp: 335,000 ohms ±5%: 2w. C220508-333 (AB) HB-3335	
R1014	R16R17281-186	RESISTOR, fixed: comp; 4,700 ohms ±10%; 2w C220609-472 (AB) H8-4721	P1 MO/N
R1015	R16JAN-RC20BF104K	RESISTOR, fixed: comp: 100,000 ohms ±10%; 1/2w. RC20BF104K	P1 MO/N
R1016	R16JAN-RC30BF473K	RESISTOR, fixed: comp: 47,000 ohms ±10%; 1w. RC30BF473K	P1 MO/N
R1017	R16JAN-RC30BF222K	RESISTOR, fixed: comp: 2,200 ohms ±10%; 1w. RC30BF222K	P1 MO/N
R1018	R16R17347-34	RESISTOR, fixed: comp: 100,000 ohms ±10%; 2w. C220609-104 (AB) HB-1041	P1 MO/N
R1019	R16R17350-12-18	RESISTOR, fixed: comp: 180,000 ohms ±10%; 2w.C220609-184 (AB) HB-1841	P1 MO/N
R1020	R16P5583-34	RESISTOR, variable: carbon; 10,000 ohms ± 20% (with nut and lock washer). A113434-103 (AB) JU1032/P3048	P1 MO/N
R1021	R16JAN-RC30BF223K	RESISTOR, fixed: comp: 22,000 ohms ±10%; 1w. RC30BF223K	P1 MO/N
R1022	R16JAN-RC20BF224K	RESISTOR, fixed: comp; 220.000 ohms ±10%; 1/2w. RC20BF224K	P1 MO/N
R1023	R16JAN-RC20BF221K	RESISTOR, fixed: comp: 220 ohms ±10%; 1/2w. RC20BF221K	P1 MO/N
R1024	R16R17291-74-2	RESISTOR, fixed: comp; 5,600 ohms ±5%; 2w. C22000-562 (AB) HB-6626	
R1025		RESISTOR, fixed: comp; 39,000 ohms ±5%; 2w. C220608-393 AB) HR-3955	P1 MO/N
R1026		RESISTOR, fixed: comp; 470.000 ohms ±10%; 1/2w. RC20BF474K	
R1027		RESISTOR, fixed: comp; 470,000 ohms ±10%; 1/2w. RC20BF474K	
R1028	R16P5586-288	RESISTOR, variable: comp; 2,.000 ohms ±20%. A113434-263 (AB) JU1632/P3048	P1 MO/N
R1029	R16JAN-RC20BF121J	RESISTOR, fixed: comp; 120 ohms ±5%; 1/2w. RC20BF121J	P1 MO/N
R1030	R16JAN-RC20BF102J	RESISTOR, fixed: comp; 1.000 ohms ±5%; 1/2w. RC20BF102J	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref Stocked No.	Stock No.	Description	Source Code
R1031A, B	R16P6907	RESISTOR. variable: WW; dual section; 4.000 ohms 65%; 2w both sections (with nut and lock washer). L219576.1 (IRC) 34-1420-3528	P1 MO/N
R1032		RESISTOR, fixed: comp: 470,000 ohms±10%; 1/2w. RC20BF474K	
R1034		RESISTOR, fixed: comp: 470,000 ohms±10%; 1/2w. RC20BF474K	
R1034	R16R17279-43	RESISTOR, fixed: comp; 3,900 ohms±10%; 1/2w. C60068-392 (AB) EB-3921	P1 MO/N
R1035	R16R17279-43	RESISTOR, fixed: comp: 3.900 ohms±10%; 1/2w. C60068-392 (AB) EB-3921	P1 MO/N
R1036	R16JAN- RC20BF102J	RESISTOR, fixed: comp; 1,000 ohms±5%: 1/2w.	P1 MO/N
R1037	R16P6686-288	RESISTOR, variable: comp; 25,000 ohms±20%. A113434-253 (AB) JU2532/P3048	P1 MO/N
R108	R16R17328-227	RESISTOR, fixed: comp: 39,000 ohms±:5%; 2w. C220608-393 (AB) HB-3935	P1 MO/N
R1039	R16R17328-227	RESISTOR, fixed: comp; 39,000 ohms±5%; 2w. C220608-393 (AB) HB-3935	P1 MO/N
R1040		RESISTOR, fixed: comp; 470,000 ohms ±10%; 1/2w. RC20BF474K	
R1041A, B	R16P5597-2-7500	RESISTOR, variable: comp; dual; 1 meg±10%; 2-1/4w each section (with nut and lock washer). C69881-2 (AB) JJ/4/P3048/U1051	P1 MO/N
R1042	R16R27240	RHEOSTAT, WW: power type; 256 ohms ±10%, 25w (with nut and lock washer). RP101RD250KK	P1 MO/N
R1045	R16JAN-RC20BF224K	RESISTOR, fixed: comp; 220,000 ohms ±10%; 1/2w. RC20BF224K	P1 MO/N
R1044	R16JAN-RC30BF102K	RESISTOR, fixed: comp; 1,000 ohms±10%; 1w. RC30BF102K	P1 MO/N
R1045	R16P6590-120-725	RESISTOR, variable: carbon; 100,000 ohms ±:20%; 2w (with nut and lock washer). A219520-26	P1 MO/N
R1046	R16JAN-RC30BF224K	RESISTOR, fixed: comp; 220,000 ohms±10%; 1w. RC30BF224K	P1 MO/N
R1047	R16JAN-RC30BF223K	RESISTOR, fixed: comp; 22,000 ohms±10%; 1w. RC30BF223K	P1MO/N
R1048	R16JAN-RC30BF474K	RESISTOR, fixed: comp; 470,000 ohms±10%; 1w. RC30BF474 K	P1 MO/N
R1049	R16JAN-RC30BF474K	RESISTOR, fixed: comp; 470,000 ohms±10%; 1w. RC30BF474K	P1 MO/N
R1050	RI6JAN-RC30BF474K	RESISTOR, fixed: comp; 470,000 ohms±10%; 1w. RC30BF474K	P1 MO/N
R1051	RI6JAN-RC30BF474K	RESISTOR, fixed: comp; 470,000 ohms±10%; 1w. RC30BF474K	P1 MO/N
R1052	R16JAN-RC30BF823K	RESISTOR, fixed: comp; 82,000 ohms±10%; 1w. RC30BF823K	P1 MO/N
R1053	R16JAN-RC30BF224K	RESISTOR, fixed: comp; 220,000 ohms±10%; 1w.	P1 MO/N
R1054	R16JAN-RC30BF224K	RESISTOR, fixed: comp; 220,000 ohms ±10%; 1w. RC30BF224K	P1 MO/N
R1055	R16JAN-RC30BF224K	RESISTOR, fixed: comp; 220,000 ohms±10%; 1w. RC30BF224K	P1 MO/N

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref Symbol No.	Stock No.	Description	Source Code
R1056	R16P5595-46-500	RESISTOR, variable: carbon; 500,000 ohms±20%: 2w (with nut and lock washer). A219520-27	P1 MO/N
R1057	R16JAN-RC30BF334K	RESISTOR, fixed: comp; 330,000 ohms±10%; 1w.	P1 MO/N
R1058	R16P5581-246-525	RESISTOR, variable: carbon; 500 ohms±20% (with nut and lock washer). A10926746 (AB) JU5012/SD4040L	P1 MO/N
R1059	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms±10%; 1/2w. RC20BF104K	P1 MO/N
R160	R16P5581-246-525	RESISTOR, variable: carbon; 500 ohms±20% (with nut and lock washer). A109267-46 (AB) JU5012/SD4040L	P1 MO/N
R1061	R16R17263-30-28	RESISTOR, fixed: comp: 390 ohms±10%; 1/2w. RC20BF391K	P1 MO/N
R1062	R16R17263-30-28	RESISTOR, fixed: comp; 390 ohms±10%; 1/2w. RC20BF391K	P1 MO/N
R1063	R16JAN-RC20BF104K	RESISTOR, fixed: comp; 100,000 ohms±10%; 1/2w. RC20BF104K	P1 MO/N
R1064		NOT USED	
R1065	R16R17338-5-18	RESISTOR, Fixed: comp; 56,000 ohms±10%;2w C220509-563 (AB) HB-5631	P1 MO/N
R1066	R16R17338-5-18	RESISTOR, fixed: comp; 56,000 ohms±10%; 2w. C220509-563 (AB) HB-5631	P1 MO/N
R1067		RESISTOR, fixed: comp; 3,900 ohms±10%; 2w. C220509-392 (AB) HB-3921	
R1068		RESISTOR, fixed: comp; 3,900 ohms±10%; 2w. C220509-392 (AB) HB-3921	
R1069	R16R17354-12-176	RESISTOR, fixed: comp; 390,000 ohms ±10%; 1/2w. C60069-394 (AB) EB-3941	
R1070	R16R17359-285-100	RESISTOR, fixed: comp; 820,000 ohms ±10%; 1/2w. C60069-824 (AB) EB-8241	
R1071	R16R17359-285-100	RESISTOR, fixed: comp; 560,000 ohm±10%; 1/2w. C60069-564 (AB) EB-5641	
R1072	R16R17359-285-100	RESISTOR, fixed: comp; 660,000 ohms±10%; 1/2w. C60069-564 (AB) EB-5641	
R1073	R16R17359-285-100	RESITOR, fixed: comp; 560,000 ohms±10%; 1/2w. C60069-564 (AB) EB-5641	
R1074	R16R17359-285-100	RESISTOR, fixed: comp; 560,000 ohms±10%; 1/2w. C60069-564 (AB) EB-5641	
R1075	R16JAN-RC20BF122J	RESISTOR, fixed: comp; 1,200 ohms±5%; 1/2w RC20BF122J	
R1076		RESISTOR, fixed: comp; 220 ohms±10%; 1/2w. RC20BF221K	
R1077		RESISTOR, fixed: comp; 220 ohms ±10%; 1/2w. RC20BF221K	
R1078		RESISTOR, fixed: comp; 220 ohms±10%; 1/2w. RC20BF221K	
R1079		RESISTOR, fixed: comp; 220 ohms±10%; 1/2w. RC20BF221K	

Azimuth-Panoramic Indicator IP-81A/APA-69A (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
S1001	R17S25091-29	SWITCH, lever: spdt. L218462-1 (GECO) MCT-1-TS	P1 MO/N
T1001	R16BXR-C217098	TRANSFORMER, a-f. C217098-1	P1 MO/N
T1002	R16BXR-C217098	TRANSFORMER, a-f. C217098-1	
T1003	R17BXR-L217258	TRANSFORMER, power L217258-1	P1 MO/N
T1004	R16BXR-C217197	TRANSFORMER, input C217197	P1 MO/N
T1005	R17BXR-C217199	TRANSFORMER, power. C217199	P1 MO/N
V1001	N16T75670	TUBE, electron. JAN-5670	P1 MO/N
V1002	N16T56196-50	TUBE, electron. JAN-6AN5	P1 MO/N
V1003	N16T56196-50	TUBE, electron. JAN-6AN5	P1 MO/N
V1004	N16T56191-50	TUBE, electron. JAN-6AK5W	P1 MO/N
V1005		TUBE, electron. JAN-5726/6AL5W	P1 MO/N
V1006	N16T58240-10	TUBE, electron JAN-12AT7WA	P1 MO/N
V1007	N16T58240-10	TUBE, electron. JAN-12AT7WA	P1 MO/N
V1008	N16T51990	TUBE, electron. JAN-1Z2	P1 MO/N
V1009	D	TUBE, electron. (DUM)K1105P2	P1 MO/N
V1010	N16T75670	TUBE, electron. JAN-5670	P1 MO/N
X1001	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X1002	R16BXR-C287037-2	SOCKET, tube: 7 pin miniature. C287037-2	P1 MO/N
X1003	R16BXR-C287037-2	SOCKET, tube: 7 pin miniature. C287037-2	P1 MO/N
X1004	R16BXR-C287037-2	SOCKET, tube: pin miniature. C287037-2	P1 MO/N
X1005	R16BXR-C287037-2	SOCKET, tube: 7 pin miniature. C287037-2	P1 MO/N
X1006	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature. C287037-4	P1 MO/N
X1007	R16BXR-C287037-4	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X1008	R16S6183-13-200	SOCKET, tube: ceramic; 7 pin C287019-1 (CIN) 53C14810	P1 MO/N
X1009	R16S6189-220	SOCKET, tube: 14 pin. C65510 (CIN) 9463-1FV	P1 MO/N
X1010	R16BXR-C287037-7	SOCKET, tube: 9 pin miniature C287037-4	P1 MO/N
X1011	R17BXR-C233379-12	LAMPHOLDER: bayonet type; to fit bayonet lamp No. 44; 6 in. lead. C233379-12	P1 MO/N
X1012	R17BXR-C233379-7	LAMPHOLDER: bayonet type; to fit bayonet lamp No. 44; 25 in. lead. C233379-7	P1 MO/N

102AB

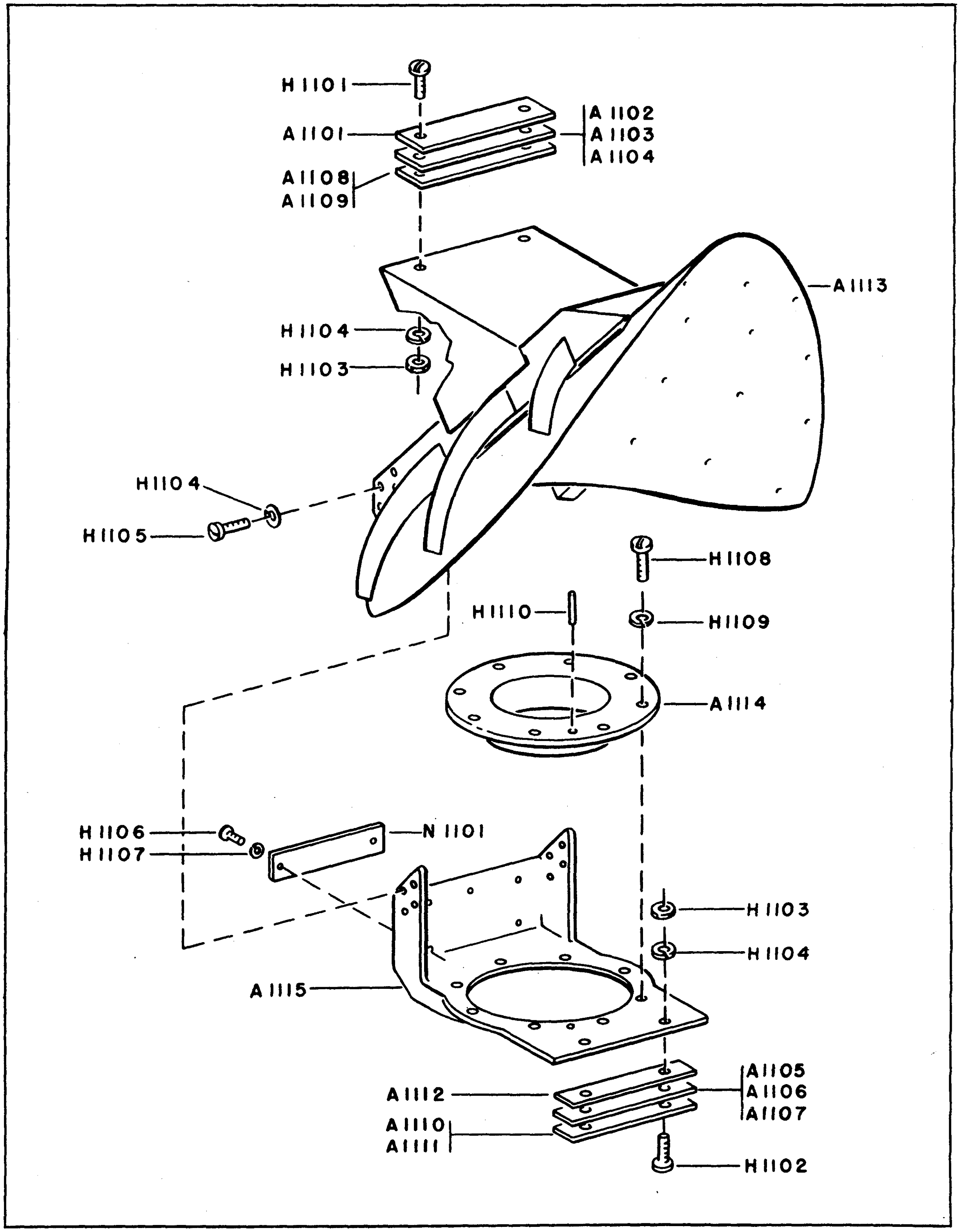


Figure 35. Antenna Reflector AT-182/APA-69

Antenna Reflector AT-182/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
1101-1199 series	R16AN-AT182APA-69 (BXR)	ANTENNA REFLECTOR AT-182/APA-69 L200312-1	P1 MO/R
A1101		STRAP: brs. nickel pl; 3.437 in. lg: 0.750 in. wd; 0.250 in. thk; 0.161 in. hole drilled in strap. one on each end. A232764-10	
A1102		STRAP: bra. nickel pl; 3,437 in. lg: 0.750 in. wd; 0.031 in. thk; 0.161 in. hole drilled in strap, one on each end. A232764-12	
A1103		STRAP: brs. nickel pl; 3,437 in. lg: 0.750 in. wd; 0.031 in. thk; 0.161 in. hole drilled in strap, one on each end. A232764-12	
A11041		STRAP: brs, nickel pl; 3,.437 in. lg: 0.750 in. wd; 0.031 in. thk; 0.161 in. hole drilled in strap, one on each end. A232764-12	
A1105		STRAP: brs, nickel pl; 3,437 in. lg: 0.750 in. wd; 0.031 in. thk; 0.161 in. hole drilled in strap, one on each end. A232764-12	
A1106		STRAP: brs, nickel pl; :3,437 in. lg: 0.750 in. wd; 0.031 in. thk: 0.161 in. hole drilled in strap, one on each end. A232764-12	
A1107		STRAP: brs, nickel pl; 3,437 in. lg: 0.750 in. wd; 0.031 in. thk; 0.161 in. hole drilled in strap, one on each end. A232764-12	
A1108		STRAP: brs. nickel pl; 3,437 in. lg: 0.750 in. wd; 0.015 in. thk: 0.161 in. hole drilled in strap, one on each end. A232764-13	
A1109		STRAP: brs. nickel pl; 3,437 in. lg: 0.750 in. wd; 0.015 in. thk: 0.161 in. hole drilled in strap, one on each end. A232764-13	
A1110		STRAP: brs. nickel pl: 3.437 in. lg: 0.750 in. wd: 0.015 in. thk: 0.161 in. hole drilled in strap, one on each end. A232764-13	
A1111		STRAP: brs. nickel pl; 3.437 in. lx: 0.750 in. wd; 0.015 in. thk; 0.161 in. hole drilled in strap, one on each end. A232764-13	
A1112		STRAP: brs. nickel pl;: 3.437 in. lg: 0.750 in. wd; 0.125 in. thk: 0.161 in. hole drilled in strap, one on each end. A232764-11	
A1113		REFLECTOR ASSY, paraboloid: 13.06 in. wd; spotwelded to bracket 11.30 in. lg with three 2.500 in. holes evenly spaced: three brace supports spotwelded flush against A1 paraboloid; bracket with two triangular sides spotwelded to other side of bracket. L203284-1	X1
A1114	R16BXR-L239653	COLLAR, mounting: Al die casting., etched finish: 4.40 in. die flange one end; 2.690 in. OD other end; 2.50 in. ID; 1.300 in. thk: nine 0.189 in. holes drilled in flange; slot 1,020 in. wd x 0.200 in. deep on smaller end; slot 0.620 in. wd x 0.200 in. deep opposite other slot. L239653	P1 MO/N
A1115	R16BXR-N228303	SUPPORT, antenna reflector: Al die casting, etched finish; 6.10 in. lg x 4 in. wd x 0.20 in. thk; 3.600 in. hole in center surrounded by eight holes tapped 8-32 NC-2 and one 0.086 in. hole; two 0.161 in. holes on one end; foot extended 1.760 in. at right angle with l in. wedge shaped ends tapped 6-32 NC-2 four places N228303	P1 MO/N
H1101		SCREW, mach: slot dr; Bind H; brs, nickel pi; No. 6-32 NC-2; 1 in. lg. (2 each used) Commercial	
H1102		SCREW. mach: slot dr; Bind H; brs, nickel pl; No. 6-32 NC-2; 3/4 in. lg. (2 each used) Commercial	
H1103		NUT, hex: brs, nickel pl; No. 6-32 NC-2. (4 each used) AN340B6	

Antenna Reflector AT-182/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1104		WASHER, lock: phosphor bronze, nickel pl; split; No. 6. (15 each used) AN935B6	
H1105		SCREW, mach: slot dr; Bind H: brs, nickel pl; No. 6-32 NC-2: 3/8 in. lg. (11 each used) Commercial	
H1106		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 4-40 NC-2: 1/4 in. lg. (2 each used) Commercial	
H1107		WASHER, lock: phosphor bronze, nickel pl;: split: No. 4. (2 each used) AN935B4	
H1108		SCREW, mach: slot dr; Bind H: brs, nickel pl; No. 8-32 NC-2; 7/16 in, lg. (8 each used) Commercial	
H1109		WASHER, lock: phosphor bronze, nickel pl; split; No. 8. (8 each used) AN935B9	
H1110		PIN, taper: SS, passivated: No. 5/0: 3/8 in. lg: 0.093 in. dia one end. Commercial	
N1101		PLATE, identification. N246539-16	M1

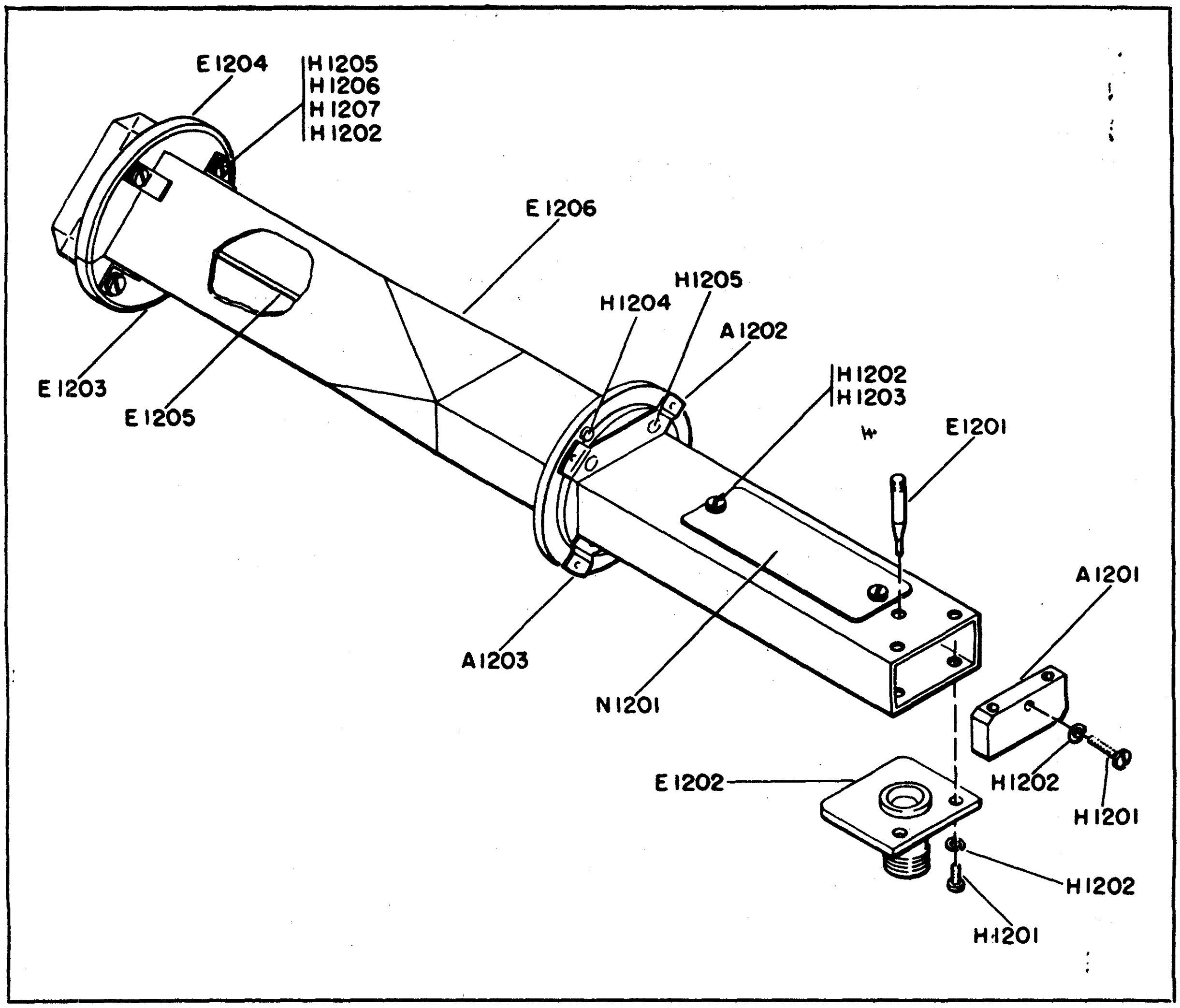


Figure 36. Antenna AS-436/APA-69

Antenna AS-436/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
1201-1299 series	R16AN-AS-436APA69 (BXR)	ANTENNA AS-436/APA-69 N200313-1	P1 MO/R
A1201		PLUG, waveguide end: brs. silver pl: 1.340 in. lg: x 0.600 in. wd x 0.250 in. thk: two opposite corners chamfered; two 4-40 NC-2 tapped holes 1 in. apart; one hole 0.128 in. in center at right angle to tapped holes. A244016	
A1202		SPRING, flat: phosphor bronze, nickel pl: 1-1/2 in. lg: 0.040 in. thk; approximately 1/2 in. wd: each end bent at 45° extending 5/16 in.; dimple in each end: two 0.128 in. holes 0.700 in. c to c. A239704	M1
A1203		SPRING, flat: phosphor bronze, nickel pl: 1-1/2 in. lg: 0.040 in. thk; approximately 1/2 in. wd: each end bent at 45° extending 5/16 in.; dimple in each end; two 0.128 in. holes 0.700 in. c to c. A239704	M1

Antenna AS-436/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
E1201		CONTACT, connector: beryllium copper wire, silver pi; 1.288 in. lg; diameters 0.120 in.; 0.1874 in.: 0.250 in.; female contact one end; threaded 1/4-28 NF-2 with 0.070 in. slot other end.A243824	
E1201		ADAPTER. coaxial to waveguide: bra casting. silver pi: 1.38 in. x 1.40 in. flange one end with two 0.128 in. holes spotfaced 0.31 in. dia x 0.02 in. deep; 1 in. c to c: adapters 0.783 in. lg OA x 0.630 in. OD: threaded 5/8-24 NEF-2 x 0.18 in. 1g; hole thru adapter is 0.271 in. dia and flared one end, 0.318 in. dia other end. A244084	
E1203		RING, guide: natural plastic; semicircular with 1.24 in. radius; triangular cutout; two holes 0.136 in. dia; one edge beveled. A239703	M1
E1204		RING, guide: natural plastic; semicircular with 1.24 in. radius; triangular cutout; two holes 0.136 in. dia; one edge beveled. A239703	M1
E1206		INSERT, phaser: plastic: 3.50 in. lg x 1.44 in. wd x 0.125 in. thk: two triangular cutouts at 45° one on each end. A295069	M1
E1206		ANTENNA ASSY: A1; 13.12 in. I1; 1.44 in. sq one section and flared at end, this is welded to rectangular tube 1.436 in. x 0.686 in.; 7.74 in. lg; mounting flange located on rectangular tube; strip and filler are brazed to inside of tube; four angles spotwelded one on each side on sq end. N203252-1	
H1201		SCREW, mach: slot dr; Bind H; brs, nickel pl; No. 4-40 NC-2; 3/8 in. lg. (5 each used) Commercial	
H1202		WASHER, lock: phosphor bronze, nickel pi: split: No. 4. (11 each used) AN935B4	
H1203		SCREW, mach: slot dr; Bind H; brs, nickel pl: No. 4-40 NC-2; 3/16 in. lg. (2 each used) Commercial	
H1204		STUD: SS. anodized; 0.199 in. die head; 0.10 in. thk; shaft 0.1654 in. dia x 0.147 in. lg; csink hole drilled 0.047 in. deep x 0.154 in. dia in end of shaft. A18082-12	
H1205		SCREW, mach: slot dr: Bind H brs, nickel pl; No. 4-40 NC-2; 9/16 in. lg. (4 each used) Commercial	
H1206		NUT, hex: brs, nickel pl; No. 4-40 NC-2. (4 each used) AN340B4	
H1207		WASHER, flat: brs, nickel pl; 0.119 in. ID; 9/32 in. OD; 0.025 in. thk; for site 4 screw. (4 each used) AN960B4	
H1208		RIVET, solid: Brazier hd; A1 anodized; 0.125 in. dia; 5/16 in. lg. (4 each used) AN455AD4-9	
N1201		PLATE, identificatior N246539-16	M1

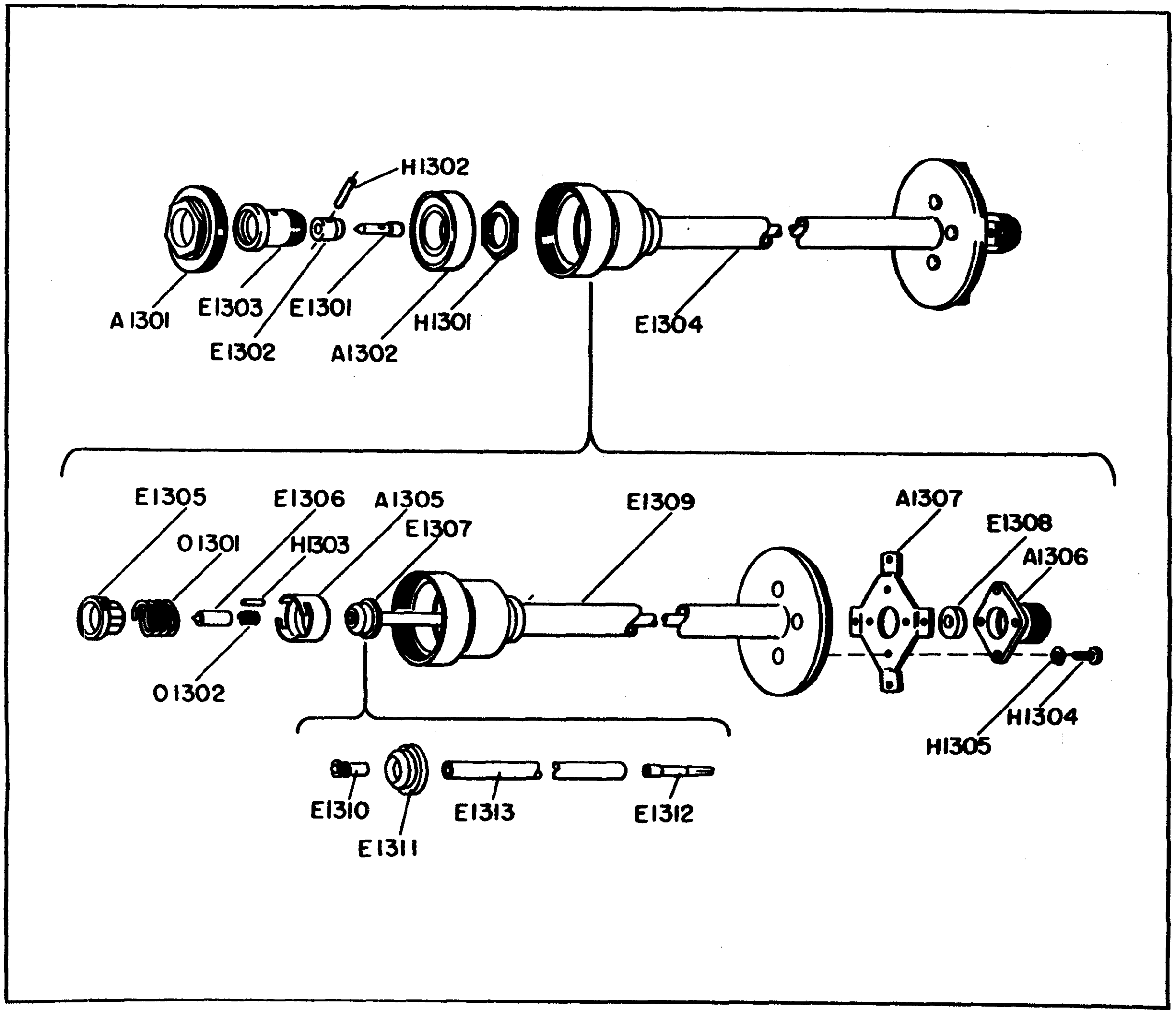


Figure 37. Antenna Coupler CU-174/APA-69

Antenna Coupler CU-174/APA-69

Ref. Symbol No.	Stock No.	Description	Source Code
1301-1399 series	R16AN-CU174APA-69 (BXR)	ANTENNA COUPLER CU-174/APA-69 L200327-1	P1 MO/R
A1301	R16BXR-A233421	RETAINER. bearing: brs, Cd pl: hex one end: 0.770 in. ID: ebore 1 in. other end; 0.30 in. thk; ebore end threaded 1-3/8-16 NC-2 0.12 in. deep. A233421	P1 MO/N
A1302		BEARING, ball: single row radical: bore 15 mm: 32 mm OD; 9 mm width; two shields. HCL302X015-032	
A1303		NOT USED	
A1304		NOT USED	

Antenna AS-436/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
A1305		SUPPORT, ring: brs. silver pi: 0.780 in. OD; 0.413 in. ID one end with hole 0.039 in. drilled next to center hole: 0.560 in. OA thickness: two fingers extending in opposite directions on opposite sides. C227768	X1
A1306	R16BXR-A243063	FITTING, female: brs, silver pl; in. sq flange one end: 0.128 in. holes drilled in each corner; 0.450 in. ID; center dia 0.271 in.: 0.19 in. threaded 5/8-24 NEF-2 on other end with dia 0.332 in. tapering to 0.318 in.: 0.731 in. OA thickness. A243063	P1 MO/N
A1307	R16BXR-A239728	SPRING: phosphor bronse, nickel pl: 1.40 in. sq with protrusion 1/2 in. wd from each corner; dimple in each protrusion: 1/2 in. dia hole in center: four 0.128 in. holes evenly spaced 0.720 in. c to c. A239728	P1 MO/N
E1301		PIN BRUSH ASSY: consists of silver graphalloy pin 0.20 in. Ig: 0.190 in. OD 0.0937 in. ID: soldered to brs, silver pl pin 0.702 in. Ig; hole 0.063 in. drilled in shaft: pointed end. C206338-1	
E1302		BUSHING. insulator: plastic, 0.420 in. OD: 0.125 in. ID; one end csink to 0.200 in. dia; same end beveled at 30°; hole 0.067 in. drilled at right angle to center hole. A243045	
E1303		BRUSH ELECTRICAL CONTACT ASSY: consists of silver graphalloy, copper pl brush 1/2 in. OD; 0.413 in. ID: 0.18 in. thk: soldered to brs. silver pl ring threaded 9/16-24 NEF-2; csink dia at other end 1/2 in.; 0.800 in. ;g: hole 0.063 in. drilled thru both sides of ring. A204014-1	
E1304		RF LINE ASSY: consists of an inner and an outer conductor assy:; housing on one end and a flange and female fitting on other end; approximately 8 in. Ig. L203332-1	
E1305		RING. collector: beryllium copper rod, silver pi; 0.66 in. dia flange on one end: 0.437 in. OD: 0.410 in. ID with eight slots 0.28 in. evenly spaced from other end; 0.430 in. OA thickness. C239880	
E1306C		RING. collector: beryllium copper rod. silver pl; 0.158 in. ID: 0.182 in. OD: 0.340 in. Ig; two slots 0.29 in. !i; 0.02 in. wd opposite one another: two irregularly shaped slots 0.29 in. Ig opposite one another and adjacent to previously described slots. A239879	
E1307		INNER CONDUCTOR ASSY, r-f line: consists of one female contact soldered to brs conductor 6.03 in. Ig x 0.187 in. OD; connected to plastic insulator bushing 0.625 in. OD: 0.20 in. thk: supporting post pressed into bushing. C203329-1	
E1308	R16BXR-OA243062-1	INSULATOR, bead: plastic; 0.446 in. OD; 0.120 in. thk; 0.126 in. ID. A243062-1	P1MO/N
E1309		OUTER CONDUCTOR ASSY, r-f line: consists of brs housing 1.580 in. Ig; 1.51 in. OD one end; 0.70 in. OD other end silver soldered to tube 4.69 in. Ig; flange 2.30 in. OD x 0.200 in. thk silver soldered to other end of tube. C203328-1	
E1310		POST, supporting: brs, silver pl; 9/16 in. Ig; 3/16 in. OA dia: with SS straight pin. A204039-1	
E1311		INSULATOR, bushing: plastic; 5/8 in. OD: 0.30 in. ID one end: 0.24 in. slot other end. A243044	
E1312	R16BXR-A243061	CONTACT, connector: female; copper rod. silver pl; 0.138 in. OD x 0.830 in. Ig. A243061	P1 MO/N
E1313		CONDUCTOR, inner: brs, tubing. silver pl; 0.141 in. ID; 3/16 in. OD; 6.07 in. Ig. A243084	
H1301		NUT, hex: brs, nickel pl; threaded 9/16-24. HSN775B-31	
H1302		PIN, straight: cylindrical; plastic; 0.58 in. Ig; 0.062 in. dia. A241690	
H1303		PIN, straight: cylindrical; steel, Cd pl; 0.040 in. dia; 1/8 in. Ig. Commercial	

Antenna Coupler CU-174/APA-69 (cont)

Ref. Symbol No.	Stock No.	Description	Source Code
H1304		SCREW. mach: slot dr: Bind H: brs, nickel pl: No. 4-40 NC-2:; 5/16 in. lg. (4 each used) Commercial	
H1305		WASHER. lock: phosphor bronze, nickel pl; split; No. 4. (4 each used) AN935B4	
O1301		SPRING, compression: music wire. Cd pl; 0.034 in. dia of wire: 1.030 in. lg; 0.485 in. ID: 0.553 in. OD: 5-1/2 turns; ends closed and ground sq. C239080-20	M1
O1302		SPRING, compression: steel music wire, Cd pl; 0.016 in. wire; 0.32 in. lg, 0.14 in. OD: 6-1/2 turns; ends closed and ground sq. C2539808-7	M1

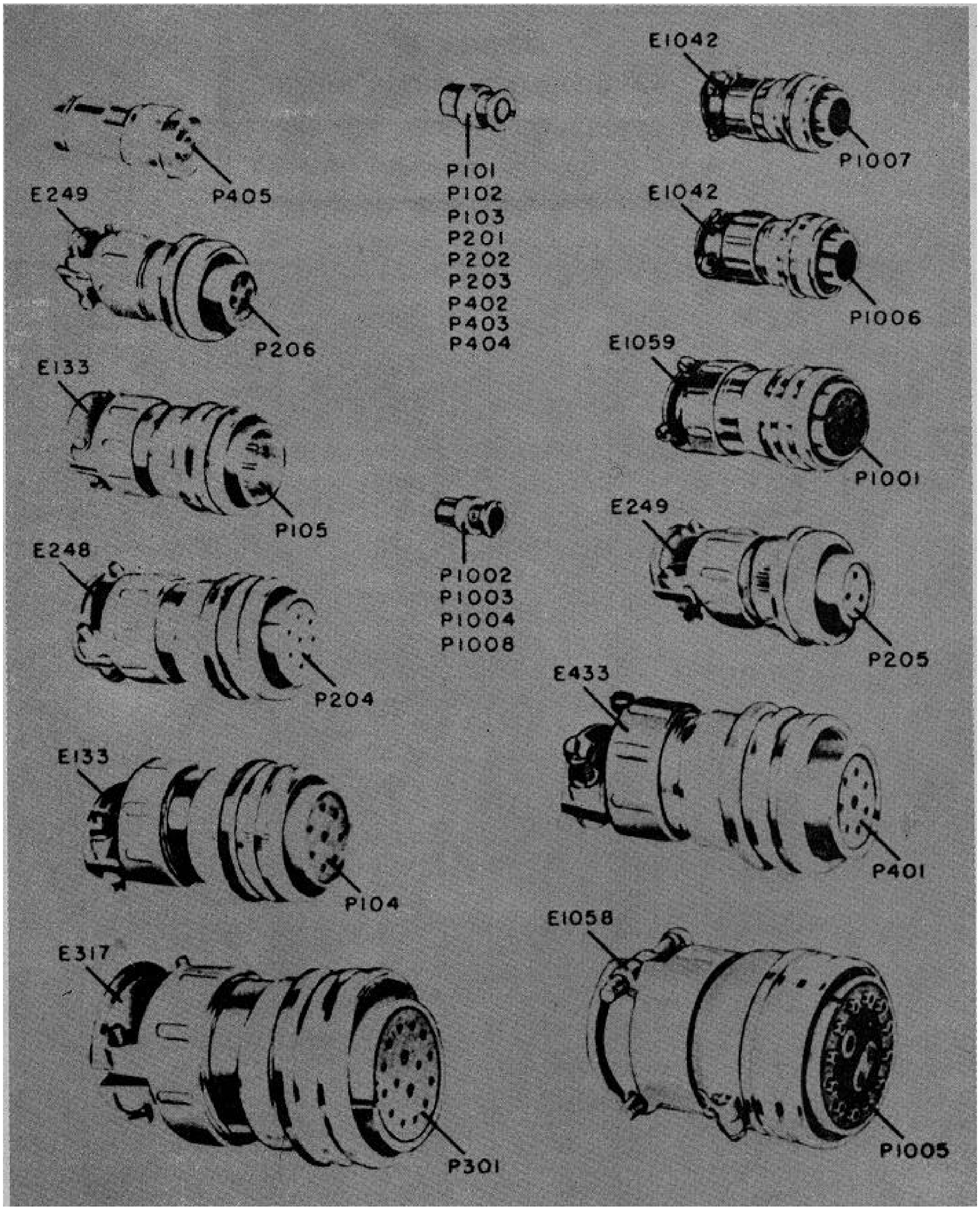


Figure 38. Installation Components

SECTION III
PART NUMBER CROSS INDEX
BENDIX TO PRESTO NUMBER TO REFERENCE SYMBOL NUMBER

Parts or Dwg. No		Ref.
Bendix No.	Presto No.	Symbol No.
A165-10	W105-408	H123
A291	W105-413	H119
		H225
		H472
		H1056
A291-1	W105-414	H124
		H238
		H468
		H1055
A291-2	W105-415	H254
		H1054
A4735-4	W105-728	H139
A5943-6	W105-594	H1045
A6768	W105-527	H262
A9320-5	W105-205	I1005
A9320-8	W105-204	I1006
A11426-4	W105-558	H1052
A12008-10	W105-560	H1095
A12522-5	W105-525	H607
A12522-15	W105-526	H612
A125611-4	W105-390	E132
A17803-1	W105-409	H473
		H474
		H475
A17803-2	W105-410	H214
		H279
		H1085
A18054-6	W105-559	E121
		E122
		E123
		E124
		E125
		E126
		E127
		E128
A18082-16	W105-546	H1204
A18130-4	W105-528	H220
A18130-8	W105-529	H320
A18130-25	W105-530	H229
A18143-6	W105-543	H409
A18143-8	W105-557	H140
A18143-13	W105-542	H1053
A18369-1	W105-411	H271
A18362-3	W105-604	H1002
A18377-2	W105-556	O439
		O440
A18440-2	W105-548	H251
A18440-10	W105-549	H221
A18440-13	W105-550	H215
A32276-14	W105-537	H636
A103650-39	W105-641	H1073
A103650-57	W105-639	H285
A103650-58	W105-640	H286
A112885-3	W105-540	H280
		H1083
A113055-13	W105-602	H236
A113055-19	W105-593	H234
		H1057
A113055-20	W105-603	H257
A118520	W105-696	E408
A118521-1	W105-217	E403
		E404
A121259	W105-412	H1099-3
A203333-1	W105-73P	E546
A203339	W105-69P	E625
A203402-1	W105-65P	A602
		A603
A203456	W105-782	A610
A203588	W105-506	A207
A203605-1	W105-3018	E240
A204014-1	W105-42P	E1303
A204039-1	W105-46P	E1310
A209293-1	W105-359	L1003A, B, C
		L1001A, B, C
A209294-1	W105-358	L104
A217114	W105-405	L101
		L102
A228393	W105-606	A416

Parts or Dwg. No		Ref.
Bendix No.	Presto No.	Symbol No.
	W105-471	E410
	W105-472	E411
	W105-503	A204
	W105-745	A203
	W105-797	A112
		A113
A230243-1	W105-741	A218
A230243-2	W105-742	E1054
A230243-3	W105-615	O205
		O214
		O1027
		O1028
A233305-1	W105-453	A409
A233305-2	W105-454	A410
A233336	W105-452	A412
A233337	W105-469	E405
		E406
A233421	W105-24P	A1301
A233484	W105-609	E414
A235876-1	W105-747	E512
		E603
A235876-2	W105-748	E513
		E604
A236337	W105-611	O1009
A236727	W105-744	0101
		O102
A238234	W105-448	O412
A238336	W105-447	O203
		O1006
A239254	W105-470	O201
		O202
		O1001
		O1002
A239682	W105-475	E401
		E402
A239686	W105-9P	O414
A239693	W105-8P	O416
		O430
A239694	W105-613	O417
A239704	W105-510	A1202
		A1303
A239707	W105-434	A411
A239728	W105-511	A1307
A239879	W105-522	E1306
A240129-5	W105-400	O423
		O424
A240265	W105-605	A430
A241113-8	W105-739	H259
		H1071
A241178-1	W105-32P	H429
A241629	W105-455	A408
A241668	W105-26P	O418
A241669	W105-12P	H445
A241690	W105-516	H1302
A241712	W105-519	H625
A241713	W105-35P	H626
A241854	W105-25P	H1303
A241997	W105-789	H277
		H1072
A242240-A	W105-354	E202
		E1001
A242781	W105-482	E547
		E613
		E614
		E615
		E616
		E617
		E618
		E619
		E620
		E621
		E622
		E623
		E624
A243003	W105-498	E412
		E413

Parts or Dwg. No		Ref.
Bendix No.	Presto No.	Symbol No.
A243004	W101-499	E514
		E605
		E606
A243044	W105-513	E1311
A243045	W105-517	E1302
A243061	W105-500	E1312
A243063	W105-589	A1306
A243083	W105-29P	H448
A243084	W105-21P	E1313
A243445	W105-15P	E247
		E1026
A243487	W105-770	E250
		E251
		E252
		E1055
		E1056
		E1057
A243488	W105-771	E224
		E225
		E226
		E1035
		E1036
		E1037
A243824	W105-501	E1201
A244084	W105-438	E1202
A245234	W105-781	A1017
		A1018
A245495	W105-16P	H1058
A245713	W105-13P	H450
A245950-11	W105-474	O428
A249620	W105-772	E517
		E608
A295114	W105-504	H410
A295155	W105-5P	H1082
A295167	W105-10P	H1061
A295168	W105-11P	H1060
A296571	W105-502	A1003
A296596	W105-379	A1009
A296597	W105-476	E1047
A296624	W105-478	E1048
AC62724-11	W105-751	A110
AN3021-2	W105-122	S302
		S303
AN3057-6	W105-230	E249
		E1042
AN3057-10	W105-231	E230
		E1023
AN3057-12	W105-232	E133
		E248
		E1059
AN3057-16	W105-233	E317
AN3057-24	W105-234	E1058
AN3102A-14S-1P	W105-235	J205
AN3102A-14S-2P	W105-236	J1007
AN3102A-14S-5P	W105-237	J206
		J1006
AN3102A-18-8P	W105-238	J401
AN3102A-20-7P	W105-239	J204
		J1001
AN3102A-20-7S	W105-240	J105
AN3102A-20-9P	W105-241	J104
AN3102A-24-7P	W105-242	J103
		J301
AN3102A-36-405P	W105-382	J1005
AN3106A-14S-1S	W105-244	P205
AN3106A-14S-2S	W105-245	P1007
AN3106A-14S-5S	W105-246	P206
		P1006
AN3106A-18-1S	W105-247	P207
		P1001
		P1009
AN3106A-18-8S	W105-248	P401
AN3106A-20-7P	W105-249	P105
AN3106A-20-7S	W105-250	P204
AN3106A-20-9S	W105-251	P104
AN3106A-24-7S	W105-252	P301
AN3106A-36	W105-253	P1005
AN3136-323	W105-203	I201
		I202
		I203
		I204
		I205
		I002
		I003
		I004
		I008
		I009
AN3140-327	W105-213	I301
		I302
		I303
AN3226-2	W105-121	S301
B13020-3	W105-386	H214
B13020-4	W105-385	E131
		E431

Parts or Dwg. No		Ref.
Bendix No.	Presto No.	Symbol No.
B13020-10	W105-383	E1049
		E1051
		E1052
B13021-4	W105-389	E130
B13021-10	W105-387	E1050
		E1053E
C59881-2	W105-137	R1041A&B
C59935-6	W105-211	E415
C60187-2	W105-743	E101
		E213
		E214
		E222
		E223
		E1032
		E1033
		E1034
C60854-2	W105-210	E227
		E607
C63122-4	W105-531	E1046
C63122-5	W105-532	E234
C65510	W105-212	X205
		X1009
C203212-1	W105-441	O404
C203253	W105-460	O442
C203255-1	W105-442	O407
C203299-1	W105-68P	E630
C203327-1	W105-70P	J501
		J601
C203328-1	W105-45P	E1309
C203329-1	W105-44P	E1307
C203341-1	W105-762	E544
		E611
C203341-2	W105-763	E545
		E612
C203341-2	W105-51P	A413
C203566-1	W105-3015	E242
C203567-1	W105-3014	E241
C203568-1	W105-3033	E216
C203569-1	W105-3034	E217
C203571-1	W105-3008	E239
C203571-2	W105-3009	E238
C203596-1	W105-3010	E117
C203597-1	W105-3029	E109
C203598-1	W105-3004	E118
C203599-1	W105-3041	E110
C203602-1	W105-3046	E112
C203634-1	W105-3031	E407
C203634-2	W105-3021	E437
C203915-1	W105-3042	E113
C203921-1	W105-3005	E116
C204148-1	W105-3047	E111
C204148-2	W105-3048	E115
C204149-1	W105-3002	E120
C204149-2	W105-3003	E119
C204436-1	W105-56P	O204
C204436-2	W105-57P	O1005
C204569-1	W105-3019	E246
C204570-1	W105-3037	E215
C204571-1	W105-3036	E229
C204572-1	W105-3035	E228
C204573-1	W105-3013	E237
C204574-1	W105-3012	E235
C204575-1	W105-3011	E236
C206338-1	W105-43P	E1301
C206352-1	W105-52P	E432
C206357-1	W105-76P	E315
C206357-2	W105-77P	E316
C207717-1	W105-512	E628
C208363-1	W105-443	O1003
C208375-1	W105-769	O1015
C208386-1	W105-3017	E1040
C208425-1	W105-3043	E1025
C208425-2	W105-3016	E1041
C208455-1	W105-505	A1006
C216010-1	W105-104	K1001
C217098-1	W105-406	T201
		T202
		T1001
		T1002
C217116	W105-401	T101
C217118	W105-402	T102
C217197	W105-404	T204
C218145-81	W105-100	S101
C218248	W105-225	E618
		E609
C218441-1	W105-215	K401
C218451-1	W105-105	K1002
		K1003
C219043-2	W105-226	C213
		C214
		C1018
		C1019
	W105-206	R242A & B
C219576-1		

Revised 1 February 1956

Parts or Dwg. No		Ref.
Bendix No.	Presto No.	Symbol No.
C220114-1	W105-130	C205
		C206
		C210
		C1026
		C1027
		C1028
C221944-1	W105-216	CR101
		CR102
		CR103
		CR201
		CR202
		CR1001
		CR1002
		CR1003
		CR1004
		CR1005
		E629
		A1305
		A402
		A404
		A516
		A606
		A613
		E302
		E303
		O441H145
		X1012
		X1011
		A612
		O410
		E231
		E1027
		O431
		A302
		A303
		A205
		A206
		O438
		O411
		H275
		H1099
		H265
		H1078
		O209
		O215
		O216
		01029
		O1035
		O1036
		A401
		O419
		O420
		E1305
		O421
		O422
		O425
		O426
		O206
		O1008
		O427
		E418
		E542
		E626
		E627
		A213
		E610
		H109
		H1008
		E1028
		E1029
		E1030
		E1031
		E305
		E304
		H264
		H1077
		E243
		E1045
		E245
		E1044
		N203
		N1004
		E307
		E306
		O1004
		O1026
		A1014
		A607
		X204
		X108

Parts or Dwg. No		Ref.
Bendix No.	Presto No.	Symbol No.
C287037-2	W105-207	X101
		X102
		X103
		X104
		X105
		X106
		X107
		X201
		X1002
		X1003
		X1004
		X1005
C287037-4	W105-208	X104
		X108
		X202
		X203
		X206
		X1001
		X1006
		X1007
		X1010
C293045	W105-793	E301
C294234-1	W105-799	H1099-2
C296582	W105-785	A1004
CM20C151K	W105-123	C1020
CM20C470J	W105-124	C123
		C124
		C125
		C1004
		C1005
CM30B102K	W105-125	C208
		C209
CM35B103K	W105-127	C1033
		C1034
CM35C103J	W105-126	C101
		C121
		C128
		C201
		C401
		C1008
		C1010
		C1013
		C1021
CM60B103M	W105-128	C204
		C1024
		C1031
CP06FA5	W105-587	H103
		H1001
CP07FB3	W105-588	H101
CP53B4EF105L	W105-219	C212
		C1029A&B
		C1032A&B
CP53B4EF503L	W105-220	C211
		C1030A&B
CP53B1FF504K	W105-221	C1017
CP54B1EF205V	W105-222	C126
		C127
		C129
		C601
CP61B1FF105V	W105-223	C104
		C107
		C110
		C117
		C118
		C119
		C1007
		C1009
		C1015
		C1016
		C1022
		C1023
CP70E1FF405V	W105-224	C115
		C116
		C1011
ERV30GR1U-104	W105-139	R302
HA991E16-094	W105-584	H316
HA993E20-094	W105-586	H434
HC838G08-040	W105-642	H1303
HC838G40-125	W105-643	H449
HC846G-125	W105-538	H1046
HC847G875	W105-539	O402
HC860H38-0632	W105-552	H1031
HC927H04-632	W105-618	H267
HC928H04-440	W105-619	H401
HC928H04-632	W105-620	H430
HC928H04-832	W105-621	H1042
		H1043
HC928H06-632	W105-623	H120
		H228
		H301
		H435
		H1044
HC928H06-832	W105-624	H281
HC949B10-632	W105-667	H1067
HC949S05-440	W105-668	H628
HC949S10-110	W105-669	H483
		H627
HC949S14-440	W105-670	H1074
HC950B12-440	W105-713	H272

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	Presto No.	
HCL802X015-032	W105-396	A1302
HK860H87-0632	W105-555	H273 H1079
HK950B10-632	W105-704	H135 H256
HK950B20-1024	W105-712	H266
HN775B04-40	W105-571	H128 H202 H318 H419 H605 H1013 H1206
HN775B04-48	W105-572	H258 H1075
HN77B06-32	W105-573	H116 H227 H314 H425 H615 H1014 H1103
HN775B08-32	W105-574	H133 H224 H412 H1015
HN775B10-24	W105-575	H136 H246 H1016
HN789R60-18	W105-567	H436 H1110
HN799P02-M	W105-595	H303
HN799P03-M	W105-596	H126 H416 H1023
HN799P04-M	W105-597	H113 H130 H203 H319 H405 H606 H1022 H1107 H1202 H1305
HN799P05-M	W105-598	H249 H281 H640
HN799P06-M	W105-599	H111 H209 H323 H422 H482 H616 H1018 H1021 H1104
HN799P08-M	W105-600	H134 H205 H403 H602 H1020 H1109
HN799P10-M	W105-601	H122 H207 H312 H407 H1017 H1019
HN947B12-440	W105-635	H444
HN947B20-832	W105-636	H438
HN947B20-1024	W105-637	H406
HN948B08-440	W105-625	H630
HN948B10-440	W105-626	H629
HN948B10-632	W105-627	H1024
HN194B12-440	W105-628	H431 H621
HN948B12-632	W105-629	H118 H426
HN948B12-832	W105-630	H223 H1025
HN948B12-1024	W105-631	H333 H442
HN948B14-440	W105-802	H278
HN948B14-632	W105-632	H313
HN948B20-440	W105-633	H270 H461 H1099-1
HN948B20-632	W105-634	H113 H424
HN949B04-348	W105-671	H1029
HN949B06-440	W105-672	H1027
HN949B06-632	W105-674	H1034
HN949B08-356	W105-675	H1030

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	Presto No.	
HN949B08-440	W105-673	H138 H211 H432 H635 H1026
HN949B08-632	W105-666	H250 H447 H451 H480
HN949B08-832	W105-676	H633 H1093
HN949B10-440	W105-677	H317 H623 H637 H1028
HN949B10-632	W105-678	H208 H421 H1037
HN949B10-832	W105-679	H417 H1032
HN949B12-440	W105-680	H226 H622
HN949B12-632	W105-681	H237 H462 H1010
HN949B12-832	W105-682	H216 H1033
HN949B14-440	W105-683	H213 H1011
HN949B14-632	W105-684	H263 H1036
HN949B14-832	W105-685	H1031
HN949B16-440	W105-687	H222 H634
HN949B16-632	W105-686	H427 H1006
HN949B16-832	W105-688	H255 H1066
HN949B16-1024	W105-689	H321 H443
HN949B20-632	W105-690	H242
HN949B20-832	W105-691	H235 H440
HN949B24-632	W105-692	H481 H1005
HN949B28-832	W105-693	H439
HN949B32-632	W105-694	H247 H1035
HN950B04-440	W105-697	H261
HN950B06-440	W105-698	H1203
HN950B06-256	W106-699	H302
HN950B08-440	W105-701	H129 H201 H404 H604 H1096 H1106
HN950B08-54	W105-702	H282 H639
HN950B10-440	W105-703	H112 H453 H1304
HN950B12-440	W105-705	H127 H418 H1039 H1201
HN950B12-632	W105-706	H114 H322 H619
HN950B12-832	W105-707	H132
HN950B12-1024	W105-708	H1041
HN950B14-632	W105-714	H110 H614 H1040
HN950B14-832	W105-715	H402 H618 H1108
HN950B14-1024	W105-716	H206
HN950B16-632	W105-717	H620
HN950B16-832	W105-718	H204 H411 H617 H1038
HN950B16-1024	W105-719	H121 H408
HN950B18-440	W105-720	H1205
HN950B18-632	W105-721	H212 H1091
HN950B20-632	W105-722	H603
HN950B020-832	W105-723	H611
HN950B20-1024	W105-724	H260 H1068
HN950B24-440	W105-725	H146
HN950B00-332	W105-726	H601
HN950B00-632	W105-727	H1101
HN999B00-088	W105-653	H470
HN999B00-001	W105-655	H131
HP789R50-012	W105-566	H1110

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
HSC838B-14	W105-644	H274 H1097
HSC838B-15	W105-645	H269 H1098
HSD801X-3	W105-393	O217 O1030
HSD801X-4	W105-394	O218 O1031
HSN775B-2	W105-577	H232
HSN775B-4	W105-578	H102 H368 H1004
HSN775B-17	W105-579	H284
HSN775B-18	W105-580	H106 H253 H1009
HSN775B-31	W105-581	H1301
HSN775B-42	W105-582	H308
HSN949B-14	W105-695	H415
HSN950B-13	W105-709	H213
HSN950B-18	W105-710	H125
HSN950B-29	W105-711	H311
HU684H03-5	W105-563	H105 H218 H1048
HU684H04-5	W105-564	H217 H1047
HU838R72-2500	W105-650	H230
JAN 1Z2	W105-113	V204 V1008
JAN 3ACP	W105-110	V205 V1009
JAN 6AK5W/5654	W105-114	V101 V102 V103 V201 V1004
JAN 6AL5/5726	W105-106	V106 V1005
JAN 6AN5	W105-111	V1002 V1003
JAN 6X4W	W105-112	V105 V107
JAN 12AT7WA	W105-108	V1006 V1007
JAN5670	W105-109	V108 V202 V203 V206 V1001 V1010
JAN5686	W105-107	V104
L200312-1	W105-58P	1100 Series
L200327-1	W105-40P	1300 Series
L203245-1	W105-494	A405
L203284-1	W105-466	A1113
L203330-1	W105-67P	E601 E602
L203332-1	W105-41P	E1304
L203603-1	W105-3007	E129
L204578	W105-492	A21
L204579-1	W105-467	A202 E220
L204579-2	W105-468	A1002 E1009
L207771-1	W105-486	A301
L207834-1	W105-491	A304
L208376-1	W105-521	A1013
L208382-2	W105-3006	E1039
L211728-1	W105-102	B201 B1001
L212612	W105-3030	W601
L217258-1	W105-407	T203 T1003
L218462-1	W105-214	S1001
L220152-36	W105-131	C102 C120 C207 C1025
L220152-61	W105-132	C106 C202
L220152-70	W105-133	C103 C106 C109 C111 C112 C113 C114 C122 C203 C1002 C1006 C1012 C1014 C1035
L22015-72	W105-134	C108
L220222-1	W105-129	Z401
L22105-2	W105-103	B1002

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
L222802	W105-352	B402
L222974	W105-101	R301
L224270	W105-353	B401
L228585	W105-420	A611
L230499-1	W105-481	A211
L230499-2	W105-495	A1012
L230500	W105-487	A217
L234072	W105-433	O213 O1304
L239653	W105-426	A1411
L280907-1	W105-3049	E1063
L280907-2	W105-3028	E1062
L296633	W105-508	A1011
N200313	W105-633	1200 Series
N200692-1	W105-75P	300 Series
N200692	W105-3023	300 Series
N203225	W105-66P	K601
N203251	W105-490	A406
N203288	W105-49P	A403
N203290-1	W105-50P	A415
N204568	W195-54P	E232
N204604	W105-55P	N201 N1001
N205164	W105-439	A601
N205165	W105-64P	A604
N207337-1	W105-356	A305
N207776-2	W105-485	A306
N207892-1	W105-524	O219
N208392-1	W105-493	A1008
N208412-1	W105-355	I1001
N228303	W105-424	A1115
N228366	W105-425	A419
N229629	W105-430	A212 A1010
N233467	W105-440	A605
N239649	W105-431	A414
N239680	W105-435	O413
N239968	W105-437	A604
N240594-2	W105-449	900 Series
N240594-1	W105-450	700 Series
N240598	W105-451	800 Series
N243031	W105-422	A517 A609
N243032	W105-423	A515 A608
N246539-12	W105-755	N401
N246539-13	W105-756	N601
N246539-15	W105-759	N1201
N246539-16	W105-754	N1101
N246539-17	W105-753	N101
N246539-18	W105-761	N202
N246539-19	W105-758	N1002
N246667-33	W105-752	N701
N246667-34	W105-757	N301
N246667-35	W105-760	N901
N282054-1	W105-3045	E1022
N290904	W105-357	E308
N296572	W105-432	A1005
NS4W0105	W105-350	E206 E207 E208 E209 E210 E211 E1011 E1012 E1013 E1014 E1015 E1016 E1018 E1019 E1020 E1021
OA17005-44	W105-665	H241
OA17027-74	W105-730	H305 H329
OA17029-89	W105-592	H245 H1065 H1069
OA17030-2	W105-656	H240 H1064 H1207
OA17030-4	W105-657	H104 H236 H268 H608
OA17030-6	W105-659	H1064
OA17030-7	W105-660	H613
OA17030-8	W105-661	H239
OA17042-11	W105-731	H1070
OA17042-27	W105-732	H327
OA17042-131	W105-733	H472
OA17042-260	W105-734	H609
OA17042-261	W105-735	H610
OA17042-327	W105-736	H433
OA18019-129	W105-737	H147

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	Presto No.	
OA18041-10	W105-664	H1012
OA18041-20	W105-663	H309
OA18113-25	W105-547	H471
OA103894-10	W105-788	H310
OA10770-59	W105-562	H477
OA109267-46	W105-138	R248
		R249
		R1058
		R1060
OA113111-26	W105-568	H609
OA113111-27	W105-569	H610
OA113434-103	W105-143	R1020
OA113434-252	W105-144	R205
OA113434-253	W105-145	R216
		R223
		R1028
		R1037
OA219520-26	W105-135	R230
		R1045
OA219520-27	W105-136	R233
		R1056
OA232508-5	W105-765	A106
		A107
OA232508-6	W105-766	A104
		A105
OA232508-7	W105-767	A108
		A109
OA232508-27	W105-768	A102
		A103
OA23276-28	W105-34P	A1101
OA232764-29	W105-33P	A1102
		A1103
		A1104
		A1105
		A1106
		A1107
OA233481-1	W105-791	H315
OA243062-1	W105-515	E1308
OC217199	W105-403	T205
		T1005
OC220508-333	W105-182	R1013
OC220508-393	W105-183	R1025
		R1038
		R1039
OC220508-562	W105-184	R1024
OC220509-102	W105-185	R123
OC220509-104	W105-186	R1018
OC220509-123	W105-187	R124
		R125
		R126
		R127
		R128
		R129
OC220509-153	W105-188	R105
		R117
		R118
		R1007
		R1008
OC220509-154	W105-189	R112
OC220509-183	W105-190	R107
		R208
OC220509-184	W105-191	R212
		R1019
OC220509-221	W105-192	R206
OC550509-222	W105-193	R110
OC220509-272	W105-194	R130
OC220509-273	W105-195	R104
		R111
OC220509-392	W105-196	R254
		R255
		R1067
		R1068
OC220509-393	W105-197	R209
		R210
		R213
		R214
		R225
		R226
OC220509-472	W105-198	R1009
		R1014
OC220509-562	W105-199	R106
		R207
OC220509-563	W105-200	R1065
		R1066
OC220509-683	W105-201	R119
OC220509-824	W105-202	R204
OC239080-20	W105-773	O1301
OC239080-57	W105-775	O1302
OC245580-10	W105-787	H304
OC60068-392	W105-146	R1034
		R1035
OC60069-394	W105-140	R1069
OC60069-564	W105-141	R1071
		R1072
		R1073
		R1074
OC60069-824	W105-142	R1070
OC65460-58	W105-262	W101
OR200311-1	W105-63P	600 Series

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	Presto No.	
OR200330	W105-3022	100 Series
OR200444	W105-53P	200 Series
OR200444-1	W105-3025	200 Series
R208448	W105-61P	O1014
R228330	W105-436	A417
R650129	W105-60P	1000 Series
R200311-1	W105-3024	600 Series
R200331	W105-47P	400 Series
R20331-1 Mod.	W105-3027	400 Series
R203323	W105-48P	A407
R203340-1	W105-497	A101
R203573	W105-496	A111
R204563	W105-484	A209
R650129-1	W105-3026	1000 Series
RC20BF102J	W105-147	R1030
		R1036
RC20BF102K	W105-148	R109
		R131
RC20BF104K	W105-149	R1011
		R250
		R251
		R1010
		R1015
		R1059
		R1063
RC20BF105K	W105-150	R103
		R114
		R115
		R218
		R219
		R220
		R221
RC20BF122J	W105-151	R1075
RC20BF124K	W105-152	R135
		R1003
RC20BF152K	W105-153	R402
		R403
RC20BF153K	W105-154	R215
		R217
		R222
		R224
RC20BF182K	W105-155	R201
RC20BF185K	W105-156	R122
RC20BF221K	W105-157	R1023
		R1076
		R1077
		R1078
		R1079
RC20BF223K	W105-158	R113
RC20BF224K	W105-159	R120
		R121
		R1022
		R1043
RC20BF332K	W105-160	R401
RC20BF334K	W105-161	R1001
		R1005
RC20BF391K	W105-162	R1061
		R1062
RC20BF392K	W105-163	R240
		R241
		R1034
		R1035
RC20BF470K	W105-164	R132
RC20BF473K	W105-165	R202
RC20BF474K	W105-166	R1026
		R1932
		R1033
		R1040
RC20BF564K	W105-167	R101
		R102
		R108
		R116
		R134
		R203
RC20BF821K	W105-168	R1002
RC20BF822J	W105-169	R136
		R1004
RC30BF102K	W105-170	R137
		R231
		R1044
RC30BF104K	W105-171	R211
RC30BF222K	W105-172	R133
		R1017
RC30BF223K	W105-173	R228
		R1021
		R1047
RC30BF224K	W105-174	R227
		R229
		R234
		R235
		R236
		R1046
		R1053
		R1054
		R1055
RC30BF334K	W105-176	R232
		R1057
RC30BF391K	W105-798	R252
		R253

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
RC30BF473K	W105-177	R1016 R1048
RC30BF474K	W105-178	R244 R245 R246 R247 R1049 R1050 R1051
RC30BF564K	W105-179	R1012
RC30BF821K	W105-180	R1006
RC30BF823K	W105-181	R237 R1052
RG-5/U	W105-347	W602
RG-58A/U	W105-348	W101
RP101RD8R0KK	W105-346	R1042
ST-17A	W105-120	S402
TS-FOT101	W105-119	E102 E103 E104 E105 E203 E1005 E1006
TS-FOT102	W105-116	E1003 E1004
TS-FOT103	W105-117	E107 E108
TS-FOT104	W105-118	E114 E201 E204 E205 E1002 E1010

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
TS-FOT105	W105-115	E106 E1007 E1008
UG-18B/U	W105-258	P601 P602
UG-21B/U	W105-259	P405
UG-58A/U	W105-260	J601 J602
UG-260/U	W105-255	P101 P102 P103 P201 P202 P203 P402 P403 P404 P1002 P1003 P1004 P1008
UG-290/U	W105-256	J101 J102 J103 J402 J403 J104 J1002 J1003 J1004 J1008
UG-291/U	W105-257	J201 J202 J203

SECTION IV

PART NUMBER CROSS INDEX

PRESTO TO BENDIX NUMBER

TO REFERENCE SYMBOL NUMBER

Part or Dwg. No.		Ref. Symbol No.
Presto No.	**Bendix No.**	
W105-1P	C249706	O1026
W105-3P	C227768	A1305
W105-5P	A295155	H1082
W105-8P	A239693	O416
		O430
W105-9P	A239686	O414
W105-10P	A295167	H1061
W105-11P	A295168	H1060
W105-12P	A241669	H445
W105-13P	A245713	H450
W105-15P	A243445	E247
		E1026
W105-16P	A245495	H1058
W105-17P	C245381-1	E305
W105-18P	C247114-1	E307
W105-19P	C247114-2	E306
W105-20P	C245381-2	E304
W105-21P	A243084	E1313
W105-24P	A233421	A1301
W105-25P	A241854	H1303
W105-26P	A241668	O418
W105-29P	A243083	H448
W105-31P	C235898	A302
		A303
W105-32P	A241178-1	H429
W105-33P	OA232764-29	A1102
		A1103
		A1104
		A1105
		A1106
		A1107
W105-34P	OA232764-28	A1101
W105-35P	A241713	H626
W105-40P	L200327	1300 Series
W105-41P	L203332-1	E1304
W105-42P	A204014-1	E1303
W105-43P	C206338-1	E1301
W105-44P	C203329	E1307
W105-45P	C203328-1	E1309
W105-46P	A204039-1	E1310
W105-47P	R200331	400 Series
W105-48P	R203323	A407
W105-49P	N203288	A403
W105-50P	N203290-1	A415
W105-51P	C203416-1	A413
W105-52P	C206352-1	E432
W105-53P	R200444	200 Series
W105-54P	N204568	E232
W105-55P	N204604	N201
		N1001
W105-56P	C204436-1	O204
W105-57P	C204436-2	O1005
W105-58P	L200312	1100 Series
W105-60P	OR650129	1000 Series
W105-61P	OR208448	O1014
W105-63P	R200311-1	600 Series
W105-64P	N205165	A604
W105-65P	A203403-1	A602
		A603
W105-66P	N203225	K601
W105-67P	L203330-1	E601
		E602
W105-68P	C203299-1	E630
W105-69P	A203339	E625
W105-70P	C203327	J501
		J601
W105-73P	A203333-1	E546
W105-75P	N200692	300 Series
W105-76P	C206357-1	E315
W105-100	C218145-81	S101
W105-102	L222974	R301
W105-102	L211728-1	B201
		B1001
W105-103	L221051-2	B1002
W105-104	C2160101	K1001

Part or Dwg. No.		Ref. Symbol No.
Presto No.	**Bendix No.**	
W105-105	C218451-1	K1002
		K1003
W105-106	JAN 6AL5/5726	V106
		V1005
W105-107	JAN 5686	V104
W105-108	JAN 12AT7WA	V1006
		V1007
W105-109	JAN 5670	VI001
		V205
W105-110	JAN 3ACP	V205
		V1009
W105-111	JAN 6AN5	V1002
		V1003
W105-112	JAN 6X4W	V105
		V107
W105-113	JAN 1Z2	V204
		V1008
W105-114	JAN 6AK5W/5654	V101
		V102
		V103
		V201
		V1004
W105-115	TS-FOT105	E106
		E1007
		E1008
W105-116	TS-FOT102	E1003
		E1004
W105-117	TS-FOT103	E107
		E108
W105-118	TS-FOT104	E114
		E201
		E204
		E205
		E1002
		E1010
W105-119	TS-FOT101	E102
		E103
		E104
		E105
		E203
		E1005
		E1006
W105-120	ST- 17A	S402
W105-121	AN3226-2	S301
W105-122	AN3021-2	S302
		S303
W105-123	CM20C151K	C1020
W105-124	CM20C470J	C123
		C124
		C125
		C1004
		C1005
W105-125	CM30B102K	C208
		C209
W105-126	CM35C103J	C101
		C121
		C128
		C201
		C401
		C1008
		C1010
		C1013
		C1021
W105-127	CM35B103K	C1033
		C1034
W105-128	CM60B103M	C204
		C1024
		C1031
W105-129	L220222-1	Z401
W105-130	C220114-1	C205
		C206
		C210
		C1026
		C1027
		C1028

Part or Dwg. No.		Ref. Symbol No.
Presto No.	**Bendix No.**	
W105-131	L220152-36	C102
		C120
		C207
		C1025
W105-132	L220152-51	C105
		C202
W105-133	L220152-70	C103
		C106
		C109
		C111
		C112
		C113
		C114
		C122
		C203
		C1002
		C1006
		C1012
		C1014
		C1035
W105-134	L220152-72	C108
W105-135	OA219520-26	R230
		R1045
W105-136	OA219520-27	R233
		R1056
W105-137	C59881-2	R1041 A.B
W105-138	OA109267-46	R248
		R249
		R1058
		R1060
W105-139	ERV30GR1U-104	R302
W105-140	OC60069-394	R1069
W105-141	OC60069-564	R1071
		R1072
		R1073
		R1074
W105-142	OC60069-824	R1070
W105-143	OA113434-103	R1020
W105-144	OA113434-252	R205
W105-145	OA113434-253	R216
		R223
		R1028
		R1037
W105-146	OC60068-392	R1034
		R1035
W105-147	RC20BF102J	R1030
		R1036
W105-148	RC20BF102K	R109
		R131
		R1011
W105-149	RC20BF104K	R250
		R251
		R1010
		R1015
		R1059
		R1063
W105-150	RC20BF105K	R103
		R114
		R115
		R218
		R219
		R220
		R221
W105-151	RC20BF122J	R1075
W105-152	RC20BF124K	R135
		R1003
W105-153	RC20BF152K	R402
		R403
W105-154	RC20BF153K	R215
		R217
		R222
		R224
W105-155	RC20BF182K	R201
W105-156	RC20BF185K	R122
W105-157	RC20BF221K	R1023
		R1076
		R1077
		R1078
		R1079
W105-158	RC20BF223K	R113
W105-159	RC20BF224K	R120
		R121
		R1022
		R1043
W105-160	RC20BF332K	R401
W105-161	RC20BF334K	R1001
		R1005
W105-162	RC20BF391K	R1061
		R1062
W105-163	RC20BF392K	R240
		R241
		R1034
		R1035
W105-164	RC20BF470K	R132
W105-165	RC20BF473K	R202
W105-166	RC20BF474K	R1026
		R1032
		R1033
		R1040
W105-167	RC20BF564K	R101
		R102
		R108
		R116
		R134
		R203
W105-168	RC20BF821K	R1002
W105-169	RC20BF822J	R136
		R1004
W105-170	RC30BFI02K	R137
		R231
		R1044
W105-171	RC30BF104K	R211
W105-172	RC30BF222K	R133
		R1017
W105-173	RC30BF223K	R228
		R1021
		R1047
W105-174	RC30BF224K	R227
		R229
		R234
		R235
		R236
		R1046
		R1053
		R1054
		R1055
W105-176	RC30BF334K	R232
		R1057
W105-177	RC30BF473K	R1016
		R1048
W105-178	RC30BF474K	R244
		R245
		R246
		R247
		R1049
		R1050
		R1051
W105-179	RC30BF564K	R1012
W105-180	RC30BF821K	R1006
W105-181	RC30BF823K	R237
		R1052
W105-182	OC220508-333	R1013
W105-183	OC220508-393	R1025
		R1038
		R1039
W105-184	OC220508-562	R1024
W105-185	OC220509-102	R123
W105-186	OC220609-104	R1018
W105-187	OC220509-123	R124
		R125
		R126
		R127
		R128
		R129
W105-188	OC220509-153	R105
		R117
		R118
		R1007
		R1008
W105-189	OC22009-154	R112
W105-190	OC220509-183	R107
		R208
W105-191	OC220509-184	R212
		R1019
W105-192	OC220509-221	R206
W105-193	OC220509-222	R110
W105-194	OC220509-272	R130
W105-195	OC220509-273	R104
		R111
W105-196	OC220509-392	R254
		R255
		R1067
		R1068
W105-197	OC220509-393	R209
		R210
		R213
		R214
		R225
		R226
W105-198	OC220509-472	R1009
		R1014
W105-199	OC220509-562	R106
		R207
W105-200	OC220509-563	R1065
		R1066
W105-201	OC220509-683	R119
W105-202	OC220509-824	R204

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
W105-203	AN3136-323	I201
		I202
		I203
		I204
		I205
		I1002
		I1003
		I1004
		I1008
		I1009
W105-204	A9320-8	I1006
W105-205	A9320-5	I1005
W105-206	C219576-1	R242A & B
W105-207	C287037-2	X101
		X102
		X103
		X105
		X106
		X107
		X201
		X1002
		X1003
		X1004
		X1005
W105-208	C287037-4	X104
		X108
		X202
		X203
		X206
		X1001
		X1006
		X1007
		X1010
W105-209	C287019-1	X204
		X1008
W105-210	C60854-2	E227
		E607
W105-211	C59935-6	E415
W105-212	C65510	X205
		X1009
W105-213	AN3140-327	I301
		I302
		I303
W105-214	C218462-1	S1001
W105-215	C218441-1	K401
W105-216	C221944-1	CR101
		CR102
		CR103
		CR201
		CR202
		CR1001
		CR1002
		CR1003
		CR1004
		CR1005
W105-217	A118521-1	E403
		E404
W105-219	CP53B4EF105L	C212
		C1029 A & B
		C1032 A & B
W105-220	CP53B4EF503L	C211
		C1030 A & B
W105-221	CP53B1FF504K	C1017
W105-222	CP54B1EF205V	C126
		C127
		C129
		C601
W105-223	CP61B1FF105V	C104
		C107
		C110
		C117
		C118
		C119
		C1007
		C1009
		C1015
		C1016
		C1022
		C1023
W105-224	CP70E1FF405V	C115
		C116
		C1011
W105-225	C218248	E518
		E609
W105-226	C219043-2	C213
		C214
		C1018
		C1019
W105-228	C243900-3	H109
		H1008
W105-230	AN3057-6	E249
		E1042
W105-231	AN3057-10	E230
		E433
		E1023
W105-232	AN3057-12	E133
		E248
		E1059
W105-233	AN3057-16	E317
W105-234	AN3057-24	E1058
W105-235	AN3102A-14S-1P	J205
W105-236	AN3102A-14S-2P	J1007
W105-237	AN3102A-14S-5P	J206
		J1006
W105-238	AN3102A-18-8P	J401
W105-239	AN3102A-20-7P	J204
		J1001
W105-240	AN3102A-20-7S	J105
W105-241	AN3102A-20-9P	J104
W105-242	AN3102A-24-7P	J103
		J301
W105-244	AN3106A-14S-1S	P205
W105-245	AN3106A-14S-2S	P1007
W105-246	AN3106A-14S-5S	P206
		P1006
W105-247	AN3106A-18-1S	J207
		J1001
		J1009
W105-248	AN3106A-18-8S	P401
W105-249	AN3106A-20-7P	P105
W105-250	AN3106A-20-7S	P204
W105-251	AN3106A-20-9S	P104
W105-252	AN3106A-24-7S	P301
W105-253	AN3106A-36	P1005
W105-255	UG-260/U	P101
		P102
		P103
		P201
		P202
		P203
		P402
		P403
		P404
		P1002
		P1003
		P1004
		P1008
W105-256	UG-290/U	J101
		J102
		J103
		J402
		J403
		J404
		J1002
		J1003
		J1004
		J1008
W105-257	UG-291/U	J201
		J202
		J203
W105-258	UG-18B/U	P601
		P602
W105-259	UG-21B/U	P405
W105-260	UG-58A/U	J601
		J602
W105-262	OC65460-58	W101
W105-317	C243043-6	E542
		E626
		E627
W105-346	RP101RD8ROKK	R1042
W105-347	RG-5/U	W602
W105-348	RG-58A/U	W101
W105-350	NS4WO105	E206
		E207
		E208
		E209
		E210
		E211
		E1011
		E1012
		E1113
		E1114
		E1115
		E1016
		E1018
		E1019
		E1020
		E1021
W105-352	L222802	B402
W105-353	L224270	B401
W105-354	A242240-A	E202
		E101
W105-355	N208412-1	I1001
W105-356	N207337-1	A305
W105-357	N290904	E308
W105-358	A209294-1	L104
W105-359	A209293-1	L103 A,B,C,
		L1001 A,B,C
W105-379	A296596	A1009
W105-380	C243544-4	A213
		E610
W105-382	AN3102A-36-405P	J1005
W105-383	B13020-10	E1049
		E1051
		E1052

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
W105-385	B13020-4	E131
		E431
W105-386	B13020-3	H214
W105-387	B13021-10	E1050
		E1053
W105-389	B13021-4	E130
W105-390	A15611-4	E132
W105-393	HSD801X-3	O217
		O1030
W105-394	HSD801X-4	O218
		O1031
W105-396	HCL802X015-032	A1302
W105-397	C240043-9	O421
W105-398	C240043-10	O422
W105-399	C240156-9	O425
		O426
W105-400	A240129-5	O423
		O424
W105-401	C217116	T101
W105-402	C217118	T102
W105-403	OC217199	T205
		T1005
W105-404	C217197	T204
W105-405	A217114	L101
		L102
W105-406	C217098-1	T201
		T202
		T1001
		T1002
W105-407	L217258-1	T203
		T1003
W105-408	A165-10	H123
W105-409	A17803-1	H473
		H474
		H475
W105-410	A17803-2	H214
		H279
		H1085
W105-411	A18169-1	H271
W105-412	A121259	H1099-3
W105-413	A291	H119
		H225
		H472
		H1056
W105-414	A291-1	H124
		H238
		H468
		H1055
W105-415	A291-2	H254
		H1054
W105-417	C233623	E231
		E1027
W105-418	C233379-7	X1012
W105-419	C233379-12	X1011
W105-420	L228585	A611
W105-421	C233459	A612
W105-422	N243031	A517
		A609
W105-423	N243032	A515
		A608
W105-424	N228303	A1115
W105-425	N228366	A419
W105-426	L239653	A1114
W105-427	C228584	A613
W105-429	C222326	E629
W105-430	N229629	A212
		A1010
W105-431	N239649	A414
W105-432	N296572	A1005
W105-433	L234072	O213
		O1304
W105-434	A239707	A411
W105-435	N239680	O413
W105-436	OR228330	A417
W105-437	N239968	A604
W105-438	A244084	E1202
W105-439	N205164	A601
W105-440	N233467	A605
W105-441	C203212-1	O404
W105-442	C203255-1	O407
W105-443	C208363-1	O1003
W105-445	C248568	O1004
W105-446	C238146	O411
W105-447	A238336	O203
		O1006
W105-448	A238234	O412
W105-449	N240594-2	900 Series
W105-450	N240594-1	700 Series
W105-451	N240598	800 Series
W105-452	A233336	A412
W105-453	A233305-1	A409
W105-454	A233305-2	A410
W105-455	A241629	A408
W105-456	C241630	O427
W105-457	C239699	A401
W105-458	C228286	A402
W105-460	C203253	O442

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
W105-461	C246656	E245
		E1044
W105-462	C246660	N203
		N1004
W105-463	C246626	E243
		E1045
W105-466	L203284-1	A1113
W105-467	L204579-1	A202
		E220
W105-468	L204579-2	A1002
		E1009
W105-469	A233337	E405
		E406
W105-470	A239254	O201
		O202
		O1001
		O1002
W105-471	A228415-1	E410
W105-472	A228415-2	E411
W105-473	C236230	A205
		A206
W105-474	A245950-11	O428
W105-475	A239682	E401
		E402
W105-476	A296597	E1047
W105-478	A296624	E1048
W105-480	C228470	A404
W105-481	L230499-1	A211
W105-482	A242781	E547
		E613
		E614
		E615
		E616
		E617
		E618
		E619
		E620
		E621
		5622
		E623
		E624
W105-484	R204563	A209
W105-485	N207776-2	A306
W105-486	L207771-1	A301
W105-487	L230500	A217
W105-490	N203251	A406
W105-491	L207834-1	A304
W105-492	L204578	A201
W105-493	N208392-1	A1008
W105-494	L203245-1	A405
W105-495	L230499-2	A1012
W105-496	R203573	A111
W105-497	R203340-1	A101
W105-498	A243003	E412
		E413
W105-499	A243004	E514
		E605
		E606
W105-500	A243061	E1312
W105-501	A243824	E1201
W105-502	A296571	A1003
W105-503	A228771	A204
W105-504	A295114	H410
W105-505	C208455-1	A1006
W105-506	A203588	A207
W105-507	C280643-1	A1014
W105-508	L296633	A1011
W105-509	C228504	A516
		A606
W105-510	A239704	A1202
		A1203
W105-511	A239728	A1307
W105-512	C207717	E628
W105-513	C281536	A607
W105-514	C234890	O431
W105-515	OA243062-1	E1308
W105-516	A241690	H1302
W105-517	A243045	E1302
W105-518	A243044	E1311
W105-519	A241712	H625
W105-520	C236999-1	O438
W105-521	L208376-1	A1013
W105-522	A239879	E1306
W105-523	C239880	E1305
W105-524	N207892-1	O219
		O1033
W105-525	A12522-5	H607
W105-526	A12522-15	H612
W105-527	A6768	H262
W105-528	A18130-4	H220
W105-529	A18130-8	H320
W105-530	A18130-25	H229
W105-531	C63122-4	E1046
W105-532	C63122-5	E234
W105-533	N200313	1200 Series

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
W105-537	A32276-14	H636
W105-538	HC846G-126	H1046
W105-589	HC847G875	O402
W105-540	A112885-3	H280 H1083
W105-542	A18143-13	H1053
W105-543	A18143-6	H409
W105-546	A180S82-1	H1204
W105-547	OA1811S-26	H471
W105-548	A18440-2	H251
W105-549	A18440-10	H221
W105-550	A18440-13	H215
W105-552	HC860H3-0632	H1081
W105-555	HK860H97-0682	H273 H1079
W105-556	A18377-2	O439 O440
W105-557	A18143-8	H140
W105-558	A11426-4	H1052
W105-559	A18054-6	E121 E122 E123 E124 E125 E126 E127 E128
W105-560	A12008-10	H1095
W105-561	A113905-8	H1045
W105-562	OA107770-59	H477
W105-563	HU684H03-5	H105 H218 H1048
W105-564	HU684H04-5	H217 H1047
W105-566	HP789R50-012	H1110
W105-567	HN789R60-18	H436
W105-568	OA113111-26	H609
W105-569	OA113111-27	H610
W105-571	HN775B04-40	H128 H202 H318 H419 H605 H1013 H1206
W105-572	HN775B04-48	H258 H1075
W105-573	HN775B06-32	H116 H227 H314 H425 H615 H1014 H1103
W105-574	HN775B08-32	H133 H224 H412 H1015
W105-575	HN775B10-24	H136 H246 H1016
W105-577	HSN775B-2	H232
W105-578	HSN775B-4	H102 H368 H1004
W105-579	HSN775B-17	H284
W105-580	HSN775B-18	H106 H253 H1009
W105-581	HSN775B-31	H1301
W105-582	HSN775B-42	H308
W105-584	HA991E16-094	H316
W105-586	HA993E20-094	H1434
W105-587	CP06FA5	H103 H1001
W105-588	CP07FB3	H101
W105-589	A243063	E1306
W105-592	OA17029-89	H245 H1065 H1069
W105-593	A113055-19	H234 H1057
W105-594	A5943-6	H1045
W105-595	HN799P02-M	H303
W105-596	HN799P03-M	H126 H416 H1023
W105-597	HN799P04-M	H113 H130 H203 H319 H405 H606 H1022 H1107 H1202 H1305
W105-598	HN799P05-M	H249 H281 H640
W105-599	HN799P06-M	H111 H209 H323 H422 H482 H616 H1018 H1021 H1104
W105-600	HN799P08-M	H134 H205 H403 H602 H1020 H1109
W105-601	HN799P10-M	H122 H207 H312 H407 H1017 H1019
W105-602	A113055-13	H236
W105-603	A113055-20	H257
W105-604	A18362-3	H1002
W105-605	A240265	A430
W105-606	A228393	A416
W105-607	C245182-2	E1028 E1029 E1030 E1031
W105-608	C239823-1	O419 O420
W105-609	A233484	E414
W105-610	C283487	O410
W105-611	A236337	O1009
W105-612	C242999	E418
W105-613	A239694	O417
W105-614	C232725-19	O441
W105-615	A233212-3	O205 O214 O1027 O1028
W105-616	C240575	O206 O1008
W105-617	C238655-3	H265 H1078
W105-618	HC927H04-632	H267
W105-619	HC928H04-440	H401
W105-620	HC928H04-632	H430 H1043
W105-621	HC928H04-832	H1042
W105-623	HC928H06-632	H120 H228 H301 H435 H1044
W105-624	HC928H06-832	H231
W105-625	HN948B08-440	H630
W105-626	HN948B10-440	H629
W105-627	HN948B10-632	H1024
W105-628	HN948B12-440	H431 H621
W105-629	HN948B12-632	H118 H426
W105-630	HN948B12-832	H223 H1025
W105-631	HN948B12-1024	H333 H442
W105-632	HN948B14-632	H313
W105-633	HN948B20-440	H270 H461 H1099-1
W105-634	HN948B20-632	H113 H424
W105-635	HN947B12-440	H444
W105-636	HN947B20-832	H438
W105-637	HN947B20-1024	H406
W105-639	A103650-57	H285
W105-640	A103650-58	H286
W105-641	A103650-59	H1073
W105-642	HC888G08-040	H1303
W105-643	HC888G40-125	H449
W105-644	HSC838B-14	H274 H1097
W105-645	HSC838B-15	H269 H1098
W105-650	HU838R72-2500	H230
W105-653	HN999B12-088	H470
W105-655	HN999B15-121	H131
	OA17030-2	H240 H1064 H1207

Revised 1 February 1956

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
W105-657	OA17030-4	H0104
		H236
		H268
		H608
W105-659	OA17030-6	H1064
W105-660	OA17030-7	H613
W105-661	OA17030-8	H239
W105-663	OA18041-20	H309
W105-664	OA18041-10	H1012
W105-665	OA17005-44	H241
W105-666	HN949B08-632	H250
		H447
		H451
		H480
W105-667	HC949B10-632	H1067
W105-668	HC949S05-440	H628
W105-669	HC949S10-440	H983
		H627
W105-670	HC949S14-440	H1074
W105-671	HN949B04-348	H1029
W105-672	HN949B06-440	H1027
W105-673	HN949B08-440	H138
		H211
		H432
		H635
		H1026
W105-674	HN949B06-632	H1034
W105-675	HN949B08-356	H1030
W105-676	HN949B08-832	H633
		H1093
W105-677	HN949B10-440	H317
		H623
		H637
		H1028
W105-678	HN949B10-632	H208
		H421
		H1037
W105-679	HN949B10-832	H417
		H1032
W105-680	HN949B12-440	H226
		H622
W105-681	HN949B12-632	H237
		H462
		H1010
W105-682	HN949B12-832	H216
		H1033
W105-683	HN949B14-440	H213
		H1011
W105-684	HN949B14-632	H263
		H1036
W105-685	HN949B14-832	H1031
W105-686	HN949B16-632	H427
		H1006
W105-687	HN949B16-440	H222
		H634
W105-688	HN949B16-832	H255
		H1066
W105-689	HN949B16-1024	H321
		H443
W105-690	HN949B20-632	H242
W105-691	HN949B20-832	H235
		H440
W105-692	HN949B24-632	H481
		H1005
W105-693	HN949B28-832	H439
W105-694	HN949B32-632	H247
		H1035
W105-695	HSN949B14	H415
W105-696	A118520	E408
W105-697	HN950B04-440	H261
W105-698	HN950B06-440	H1203
W105-699	HN950B06-256	H302
W105-701	HN950B08-440	H129
		H201
		H404
		H604
		H1096
		H1106
W105-702	HN950B08-540	H282
		H639
W105-703	HN950B10-440	H112
		H453
		H1304
W105-704	HK950B10-632	H135
		H256
W105-705	HN950B12-440	H127
		H418
		H1039
		H1201
W105-706	HN950B12-632	H114
		H322
		H619
W105-707	HN950B12-832	H132
W105-708	HN950B12-1024	H1041
W105-709	HSN950B-13	H213
W105-710	HSN950B-18	H125
W105-711	HSN950B-29	H311
W105-712	HK950B20-1024	H266

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	**Presto No.**	
W105-713	HC950B12-440	H272
W105-714	HN950B14-632	H110
		H614
		H1040
W105-715	HN0950B14-832	H402
		H618
		H1108
W105-716	HN950B14-1024	H206
W105-717	HN950B16-632	H620
W105-718	HN950B16-832	H204
		H411
		H617
		H1038
W105-719	HN950B16-1024	H121
		H408
W105-720	HN950B18-440	H1205
W105-721	HN950B18-632	H212
		H1091
W105-722	HN950B20-432	H603
W105-723	HN950B20-832	H611
W105-724	HN950B20-1024	H260
		H1068
W105-725	HN950B24-440	H146
W105-726	HN950B24-832	H601
W105-727	HN950B32-632	H1101
W105-728	A4735-4	H139
W105-730	OA17027-74	H305
		H329
W105-731	OA17042-11	H1070
W105-732	OA17042-27	H327
W105-733	OA17042-131	H472
W105-734	OA17042-260	H609
W105-735	OA17042-261	H610
W105-736	OA17042-327	H433
W105-737	OA18019-129	H147
W105-739	A241113-8	H259
		H1071
W105-741	A230243-1	A218
W105-742	A230243-2	E1054
W105-743	C60187-2	E101
		E213
		E214
		E222
		E223
		E1032
		E1033
		E1034
W105-744	A236727	O101
		O102
W105-746	A228772	A203
W105-747	A235876-1	E512
		E603
W105-748	A235876-2	E513
		E604
W105-749	C232827-6	H145
W105-750	C245605-3	H264
		H1077
W105-751	AC62724-11	A110
W105-752	N246667-33	N701
W105-753	N246539-17	N101
W105-754	N246539-16	N1101
W105-755	N246539-12	N401
W105-756	N246539-13	N601
W105-757	N246667-34	N301
W105-758	N246539-19	N1002
W105-759	N246539-15	N1201
W105-760	N246667-35	N901
W105-761	N246539-18	N202
W105-762	C203341-1	E644
		E611
W105-753	C203341-2	E545
		E612
W105-765	OA232508-5	A106
		A107
W105-766	OA232508-6	A104
		A105
W105-767	OA232508-7	A108
		A109
W105-768	OA232508-27	A102
		A103
W105-769	C208375	O1015
W105-770	A243487	E250
		E251
		E252
		E1055
		E1056
		E1057
W105-771	A243488	E224
		E225
		E226
		E1035
		E1036
		E1037
W105-772	A249620	E517
		E608
W105-773	OC239080-20	O1301

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	Presto No.	
W105-774	C239080-38	O209
		O215
		O216
		O1029
		O1035
		O1036
W105-775	OC239080-57	O1302
W105-778	C238572	H275
		H1099-2
W105-781	A245234	A1017
		A1018
W105-782	A203456	A610
W105-785	C296582	A1004
W105-787	OC245580-10	H304
W105-788	OA103894-10	H310
W105-789	A241997	H277
		H1072
W105-791	OA233481-1	H315
W105-792	C230-744-1	E302
		E303
W105-793	C293045	E301
W105-797	A229231	A112
		A113
W105-798	RC30BF391K	R252
		R253
W105-799	C294234-1	H1099
W105-800	A18362-20	H1003
W105-802	HN948B14-440	H278
W105-3002	C204149-1	E120
W105-3003	C20419-2	E119
W105-3004	C203598-1	E118
W105-3005	C203921-1	E116
W105-3006	L208382-2	E1039
W105-3007	L203603-1	E129
W105-3008	C203571-1	E239

Part or Dwg. No.		Ref. Symbol No.
Bendix No.	Presto No.	
W105-3009	C203571-2	E238
W105-3010	C203596-1	E117
W105-3011	C204575-1	E236
W105-3012	C204574-1	E235
W105-3013	C203573-1	E237
W105-3014	C203567-1	E241
W105-3015	C203566-1	E242
W105-3016	C208425-2	E1041
W105-3017	C208386-1	E1040
W105-3018	A203605-1	E240
W105-3019	C204569-1	E246
W105-3021	C203634-2	E437
W105-3022	OR200330	100 Series
W105-3023	N200692-2	300 Series
W105-3024	R200311-1	600 Series
W105-3025	R200444-1	200 Series
W105-3026	R650129-1	1000 Series
W105-3027	R200331-1 Mod.	400 Series
W105-3028	L280907-2	E1062
W105-3029	C203597-1	E109
W105-3030	L212612	W601
W105-3031	C203634-1	E407
W105-3033	C203568-1	E216
W105-3034	C203569-1	E217
W105-3035	C204572-1	E228
W105-3036	C204571-1	E229
W105-3037	C204570-1	E215
W105-3041	C203599-1	E110
W105-3042	C203915-1	E113
W105-3043	C208425-1	E1025
W105-3045	N282054-1	E1022
W105-3046	C203602-1	E112
W105-3047	C204148-1	E111
W105-3048	C204148-2	E115
W105-3049	L280907-1	E1063

☆ U.S. GOVERNMENT PRINTING OFFICE: 1991 O - 281-486 (43227)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 028189-000