

**AN/SYA-1(V); AN/SYA-4(V); MAINTENANCE INSTRUCTION—DATA DISPLAY CONSOLES, CATHODE RAY TUBE (CRT) VARIANCE**

Cathode Ray Tube FSN 1N5960 990-2309, Hughes Aircraft Company (HAC) P/N 713010-9, is the standard CRT used with all AN/SYA-4(V) Data Display Consoles and all AN/SYA-1(V) Data Display Consoles modified with the CRT resolution improvement, HAC Field Bulletin (FB) Number (AN/SYA-1(V)) 204.

Due to unavailability of the standard CRT, some AN/SYA-4(V) Data Display Consoles and some HAC FB 204 Mod. Kits used an alternate type CRT (FSN 1N5960-995-2204, HAC P/N 713010-16). This CRT differs from the standard tube in placement of the focus and astigmatism elements which required a wiring interchange. Upon eventual replacement of the alternate CRT with a standard tube, it will be necessary to exchange the interchanged connections to restore the circuit to standard configuration.

When it becomes necessary to replace a CRT, the DS technician is directed to proceed as follows:

1. Replace the tube with CRT FSN 1N5960-990-2309; this is the only type available through supply channels.

2. Determine by visual inspection the HAC P/N of the defective tube.

a. If HAC P/N is 713010-9, the CRT is the standard type and wiring changes **are not** necessary.

b. If HAC P/N is 713010-16, the CRT is the alternate type and wiring changes will be required as indicated in Step 3.

3. Exchange wire connections at the focus and astigmatism programmer unit 575032, area 19, cable connector P3, Contacts **C** and **E**. The following tabulation indicates connections for the two types of Data Display Tubes:

Signal	From	To	For CRT 713010-9	For CRT 713010-16
W 9528	X Deflection Amp. A16, P 61-88	F & A Pgmr. A19	P 3-C	P 3-E
W 9546	Y Deflection Amp. A22, P 61-101	F&A Pgmr. A19	P 3-E	P 3-C

(655)

**AN/UCC-1(V) TELEGRAPH TERMINAL DIVERSITY  
PAIRS**

The AN/UCC-1(V) terminal equipment is configured to operate with any selected combination of audio-frequency diversity pairs as long as send and receive terminals correspond. The tone combinations shown in the technical manuals do not correspond with those selected for the forthcoming multi-channel broadcast. The following listed tone frequency diversity pairs should be noted by pen and ink changes to the following technical manual pages.

AN/UCC-1(V)	NAVSHIPS 94787, pages 1-8, 1-10, 1-11, 1-12, and 1-14
AN/UCC-1A(V)	NAVSHIPS 96028, pages 1-6, 1-7, 1-8, and 1-10

**Tone Frequency Diversity Pairs**

425 - 1785  
595 - 1955  
765 - 2125  
935 - 2295  
1105 - 2465  
1275 - 2635  
1445 - 2805  
1615 - 2975

(655)

**Submarine Antenna System for Loran**

Submarine installation of the Loran system using AN/UPN-12 normally include antenna coupler CV-532/UPN-12 inserted in the coaxial r.f. transmission line from the receiver to antenna patch panels. The coupler is not designed for the application, and efficiency of the system may be seriously reduced.

Omission of the coupler from future plans and removal of installed couplers is recommended for better operation.

Until further notice, yards and other field activities may omit or remove CV-532/UPN-12 antenna coupler where improved efficiency will result. Current Bureau projects, aimed toward overall improvement of submarine antenna systems, are expected to provide definite data on this subject for inclusion on future Bureau plans.

**TRACE INSTABILITY AND IMPROPER FUNCTIONING OF THE LEFT-RIGHT SWITCH IN AN/UPN-12A**

In the past few months, several reports of (1) trace instability and (2) improper functioning of the Left-Right switch (S202 in the AN/UPN-12A Loran receiving sets) have been received from the fleet. Investigation of this equipment by MOTU-8 and the Bureau of Ships reveals the following:

1. When the components are without fault, overheating of the receiver-indicator equipment can cause trace instability. This overheating is caused by the blower motor fan blade being installed backwards in some equipments. The technical manual NAVSHIPS 92988, figure 3-26) shows the blower motor as it is installed. In this figure, the back (convex) side of the fan blade appears to be pushing, rather than pulling, the air. Turning the fan blade so that the concave side is towards the motor increases the air flow appreciably. The units then do not overheat, and normal trace stability is regained.

2. The operation of the Left-Right switch during sweep functions one and two at times causes the upper and lower sections of the trace to be superimposed. This malfunction often is diagnosed incorrectly as being caused by a faulty Left-Right switch. In the most cases, it is because of the incorrect setting of the Counter and PRR bias voltages. Referring to NAVSHIPS 92988, paragraphs 6-2b10 (T-1, dated 15 Oct. 9157) and 6-2b10, the correct settings are +40 and +90 for the counter and PRR bias voltages, respectively. In some instances it will be necessary to set the counter bias as high as +42 to +43 volts because of variations in the characteristics of V-232 (the reset thyratron tube). Exercise caution, however,

when it becomes necessary to set the counter bias above  $\pm 40$  volts, since too high a voltage causes improper Left-Right functioning.

**AN/UPN-12 LORAN RECEIVING SETS—POTENTIAL SHOCK HAZARDS**

Potential shock hazards exist in the AN/UPN-12( ) Loran Receiving Sets. Exposed high voltage terminals and an ungrounded input power connector have been located on the Polarad-manufactured AN/UPN-12; possibly the same hazards are present in some pieces of equipment in the AN/UPN-12A, UPN-12B, and UPN-12C series.

Connector J802, located on line filter FL801 at the rear of the equipment cabinet, is not grounded on the noted equipments. It is recommended that ship personnel check the connector for a proper ground connection and, if necessary, provide a suitable external ground to the connector.

1600-volt dc terminals are located on terminal boards TB202 and TB205 in the Loran Indicator chassis and TB703 in the Power Supply chassis. The high voltage ends of capacitors C701, C702, and C703 are, in some instances, exposed. These capacitors are located in the Power Supply chassis. "DANGER - HIGH VOLTAGE" signs should be placed in red paint on the chassis frame-work near the voltage points described above. Though special attention is given to the 1600-volt terminals, each electrical circuit should be considered a potential source of danger and handled with caution.

**AN/UPN-12( ), AN/UPN-15( ) SERIES LORAN—MAINTENANCE HINT**

When the AN/UPN-12( ), AN/UPN-15( ) Loran receivers are installed in confined spaces, instability due to overheating is frequently a problem.

A number of ships have made cutouts in the mounting shelf directly below the blower intake. This method has been moderately successful in reducing overheating by minimizing the tendency to recirculate the heated air expelled from the rear of the cabinet.

Ships that have these equipments installed should inspect to determine if structural braces need repositioning and whether this modification is required for their particular installation. If required, an eight inch diameter lightening hole, in the mounting shelf directly below the cabinet air intake filter, is authorized.

Installation activities are requested to file this information on plans for future installations. (669)

**AN/UPN-15( ) SERIES—SURFACE VESSEL ANTENNA  
INSTALLATION NOTES**

The Electronics Maintenance Engineering Center (EMEC) has inspected numerous AN/UPN-15 installations and concludes that many ships are not aware of the antenna requirements for Loran "C" signal reception. Prior to installation of Field Change 1-AN/UPN-12( ), most ships used a long wire antenna and CU-532 antenna coupler or the AN/GRA-40 antenna group. The field change publications or technical manuals do not specify a separate Loran "C" antenna; however, experience has shown that performance is substantially improved when an efficient antenna, such as the AN/SRA-17( ), is provided and installed.

Bureau of Ships drawing number RE46C2165A applies to AN/UPN-15( ) antenna installations, and indicates use of separate antennas for Loran "A" and Loran "C". EMEC concurs in this practice and recommends that an AN/GRA-40 antenna group be connected directly to the Loran "A" receiver input, and an AN/SRA-17 antenna group connected to the Loran "C" receiver input. A long wire with CU-532 antenna coupler is satisfactory for Loran "A". This hook-up provides an effective antenna system and also eliminates all antenna switching. (651)

The major difference in the assemblies is the location of the bolt holes used in installing the equipment. The newer unit requires only 4 bolts in the base assembly and 4 bolts in the sway brace assembly. The earlier units required 8 bolts in each assembly. Figure 1 provides mounting hole locations for the newer assembly. Figure 2 provides mounting hole locations for the earlier AN/URC-32 version.

When a new AN/URC-32( ) equipment is received, detailed step-by-step instructions are provided and packed with the supplied shock and vibration mount assembly.

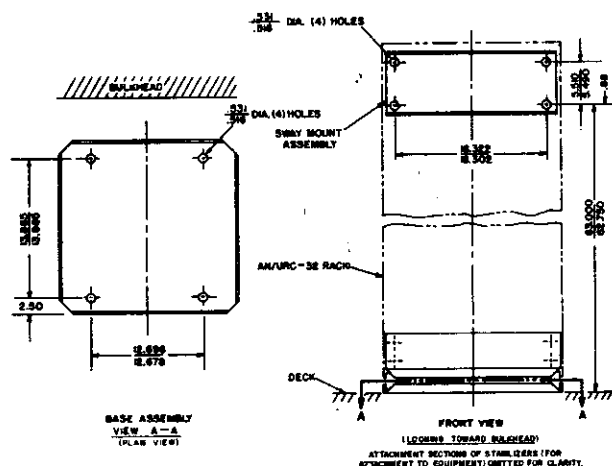


Figure 1.

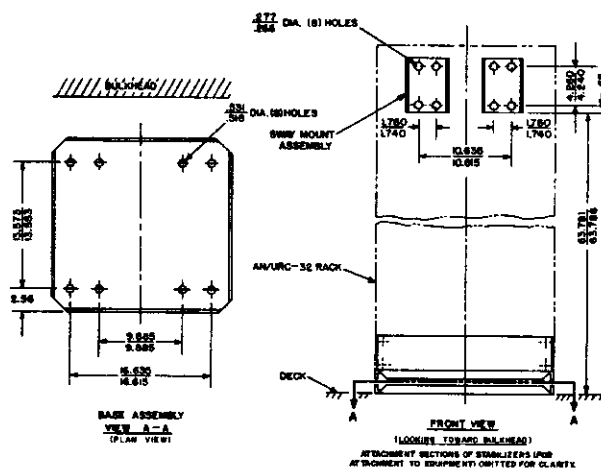


Figure 2.

**AN/URC-32 Radio Set, Maintenance Article (High Voltage Interlock Switch Adjustment)**

Boston Naval Shipyard reported that, because of vibration, the interlock switch (S-1) in the high voltage power supply, AN/URC-32, operates intermittently.

When this occurs, secure the primary input voltage at the power distribution panel and then remove the cover from the high voltage power supply. Remove the two screws that hold the interlock switch (S-1) bracket. Elongate the mounting holes in the bracket to allow it to be moved forward. Move the bracket only to the extent that assures a snug fit of the cover on the switch.

**AN/URC-32, -32A, -32B, AND KWT-6(8) RADIO SETS - ARCING IN THE POWER AMPLIFIER**

This article is to advise maintenance technicians that, because of improper maintenance procedures, arcing can result in the power amplifier (AM-2061/URT). This malfunction can be caused by the following sequence of events.

1. During removal of V3 and V4 (4CX250R PA Tubes), it is necessary to move Z3 and Z4 to come into contact with C10.

2. When V3 and V4 are replaced, technicians have neglected to restore Z3 and Z4 to the original position, resulting in arcing from the plate circuit to ground of the PA tubes, possibly destroying tube sockets.

To preclude this malfunction, personnel must ensure that the clearance between Z3 and Z4 and capacitor C10 is of the same amount as it was prior to the removal of V3 and V4. (653)

**RADIO SET AN/URC-32( ) - MAINTENANCE HINT**

The purpose of this article is to provide installation and maintenance personnel with the necessary information to determine if Coil 2L8, located in the Radio Frequency Amplifier AM/2061/URT, has been properly installed.

Coil 2L8 has two terminal posts mounted on the coil form. One terminal is located 3/16 inch from the end of the coil form and the other terminal is located 3/8 inch from the opposite end of the coil form (refer to figure 1). The coil form flush mounts to the top of the chassis of the AM/2061/URT and is identified by the circuit symbol number printed on the chassis adjacent to the coil form. High level d-c and rf voltages are present on these two terminals. If the terminal that is 3/16 inch from the end of the coil form is mounted adjacent to the chassis, there is the probability that the voltages present will arc to chassis ground.

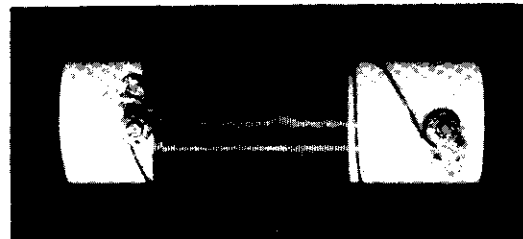


Figure 1. Coil 2L8.

Personnel are directed to inspect Coil 2L8 to ensure that the coil is mounted in such a manner that the terminal that is 3/8 inch from the end of the coil form is mounted adjacent to the chassis. The manufacturer did not attempt to position the coil form in the prescribed manner; therefore, it is mandatory that all equipments are inspected and corrected if required. (668)

**AN/URD-4 DIRECTION FINDER CABLE DISCREPANCY**

Equipment, Serial Numbers 462, 463, 465, 467, 469, 470, 473, 475, and 476 may have been shipped without the required 23-inch lengths between cables W802 and W803 and their respective AN-3057-10 Cable Clamps.

If this discrepancy actually exists in the equipments, it will not immediately affect the operation of an AN/URD-4. However, when either of the two drawers, R-353/URD-4 Receiver or PP-556/URD-4 Power Supply, is opened for servicing, a chafing action may take place upon closing. To correct the discrepancy, it is necessary to loosen the screws in the AN-3057-10 and the rubber sheathed cable clamps located between TB8-1 and the fixed end of the individual cables. The cables may then be extended until the required length is obtained and then secured by tightening the loosened screws.

**AN/URD-4 Antenna Simulator**

An antenna simulator for use with the AN/URD-4 direction finder has been constructed. When an AN/URD-4 is removed from a ship for repair, the simulator makes unnecessary the time-consuming and expensive process of removing the antenna, provided the antenna too does not need repair.

The simulator consists of a drive motor and two-phase generator, a sense relay and a calibration tone wheel and pickup. A nominal 900-rpm motor connected directly to a two-phase generator with a 9-volt output (15 cps) will suffice to produce a circular trace on the AN/URD-4 indicator. A 72-tooth tone wheel on the motor shaft and a pickup magnet and coil, similar to those of the AN/URD-4, with its output controlled by a relay, serve to produce a calibration pattern when the SENSE-CALIBRATE switch is in the CALIBRATE position. The entire assembly can be mounted on a 14-inch x 4-inch aluminum base.

By means of the antenna simulator the procedure of Section 3, paragraph 3b, "Pattern Calibration", of NAVSHIPS-91912(A) may be followed to check indicator operation and provide initial alignment. Very little alignment is then necessary when the equipment is re-installed.

The antenna simulator therefore may be used to advantage by a shipyard, tender, or any other activity which is concerned with extensive AN/URD-4 repair and maintenance.

**Tacan Performance and Operational Reports**

Recent reports indicate that difficulties are being encountered in the areas of installation, maintenance, and operation of TACAN equipments and systems.

In order to assist in correcting these difficulties as rapidly as possible, it is requested that Performance and Operational Reports, NAVSHIPS 3878, be submitted on all TACAN installations. The reports should specify the model beacon and the type of antenna group being used.

For example: indicate whether an OA-552/URN-3 or an

OA-1545/SRN-6 is being used with and AN/URN-3. Serial numbers of all units and equipments should be reported as well as the data and information required on the report form.

**AN/URD-4 ANTENNA SIMULATOR**

Mr. Leonard F. Heggstrom, Shop 67, Lang Beach Naval Shipyard, has constructed an antenna simulator for use with the AN/URD-4 direction finder. When an AN/URD-4 is removed from a ship for repair, the simulator makes unnecessary the time-consuming and expensive process of removing the antenna, provided the antenna too does not need repair.

The simulator consists of a drive motor and two-phase generator, a sense relay and a calibration tone wheel and pickup. A nominal 900-r.p.m. motor connected directly to a two-phase generator with a 9-volt output (15 c.p.s.) will suffice to produce a circular trace on the AN/URD-4 indicator. A 72-tooth tone wheel on the motor shaft and a pickup magnet and coil, similar to those of the AN/URD-4, with its output controlled by a relay, serve to produce a calibration pattern when the "Sense-Calibrate" switch is in the "Calibrate" position. Mr. Heggstrom was able to mount the entire assembly on a 14-inch x 4-inch aluminum base.

By means of the antenna simulator the procedure of Section 3, paragraph 3b, "Pattern Calibration," of NAVSHIPS-91912(A) may be followed to check indicator operation and provide initial alignment. Very little alignment is then necessary when the equipment is re-installed.

The antenna simulator therefore may be used to advantage by a shipyard, tender, or any other activity which is concerned with extensive AN/URD-4 repair and maintenance.

**R-353/URD-4, Alignment of Monitor Unit**

The Bureau of Ships has received reports of difficulty experienced in aligning the monitor unit of Receiver R-353/URD-4 when using alignment procedures contained in the basic manual, NAVSHIPS 91912(A). All concerned activities are advised that Change 5 to NAVSHIPS 91912(A) incorporates revised alignment procedures for the monitor unit. Paragraph 6-2b(2) of the Technical Manual for Direction Finder Sets AN/URD-4A and 4C, NAVSHIPS 93610(A), also contains alignment procedures for this unit in tabulated form.

**AN/URD-4 REPLACEMENT OF ANTENNA MOTOR POWER LEADS**

Reports that four ships have experienced an intermittent shorting condition, resulting in repeatedly blown fuses in the antenna motor circuit for the AN/URD-4 direction finder set.

Investigation revealed that in some cases metallic shielding, on leads W-2 and W-3 shown on page 7-53 of Technical Manual AN/URD-4 NAVSHIPS 91912(a), was

contacting terminals E and F of plus P-102. In earlier models, shielding was found to be intermittently contacting terminals E and F of jack J-103. In one instance, the clamp securing this shielded lead had cut through the insulation, shorting the conductor to ground.

Since these shorting conditions may develop in other AN/URD-4 antennas, the original leads should be replaced with insulation-covered, shielded wire whenever the antennas become available for servicing.

#### **AN/URD-4 FLEXIBLE - COUPLING SHAFT**

A new flexible-coupling shaft, 0-439, FSN N3010-315-2578; is available for Direction Finder Set AN/URD-4, serial numbers 1 through 159.

The 0-439 will not be installed unless trouble occurs. However, if neither the selector switch (S-403) nor the rotary clutch (K-403) are defective but difficulty is experienced with this channel set-up mechanism, the old style coupling assembly may be replaced with the new coupling shaft. This change makes it necessary to remove the 0-429 and 0-435 assemblies from the shaft of the switch (S-403) and the clutch (S-403). During the installation of 0-439, reference should be made to NAVSHIPS 91912(A), section 7, paragraph 3b (2) (a) 2C.

The new coupling shaft may be obtained through normal supply channels.

#### **AN/URD-4 EQUIPMENT SUPPLIED**

Radio Direction Finder Set AN/URD-4 is supplied with six, special-purpose cables (one CX-2356/U, one CX-2357/U, two CX-2358/U and two CG-1068/U) to permit testing of sub-units when withdrawn from the major unit. Reports received in the Bureau of Ships from forces afloat indicate that special-purpose cables have not been supplied to many ships which have AN/URD-4 equipments installed.

Shipyards and repair facilities are requested to exercise particular caution when installing AN/URD-4 equipments to insure that all accessories supplied with the equipment are placed on board.



### RADIO-FREQUENCY MONITOR MX-1627/URN-3 INSTALLATION INFORMATION

Care should be taken in installing the rf Monitor, MX-1627/URN-3 for use with the AN/URN-3 TACAN Equipment.

For best results, the Monitor should be located in the same compartment as the AN/URN-3 below decks equipment. It has been found that with proper shielding, the MX-1627/URN-3 Monitor can be located a minimum of five feet away from the AN/URN-3 receiver-transmitter group.

The Monitor Antenna AT-592/URN-3 should be located 48 to 72 inches from the vertical center line and 43.5 inches above the antenna radome base. Reference may be made to BUSHIPS drawing, RE 36D 2085, for guidance in locating this monitor antenna.

### AN/URN-3, Coil L2107, Part Numbers MA675041AY and MA675042AY

The purpose of this article is to clarify the apparent use of two different part numbers for Coil L2107, used in the speed control power amplifier of Antenna Control C-1349/URN or C-1700/URN-3.

The questionable part numbers MA675042AY and MA675041AY are Magnetic Amplifier Corporation numbers and denote the same item. Originally, Magnetic Amplifier Corporation assigned part number MA675041AY to this item, but stamped it, by mistake, MA675042AY.

ITT-Federal Division has a newly designed direct replacement for this coil, which overcomes the overheating problem the original design presented.

Holders of equipment requiring replacement coils should request these parts through the normal supply system under part number A 1054450.

### AN/URN-3-EMERGENCY PARTS SUBSTITUTION

The following information is adapted from an article which appeared in the Technical Information Letter (AACS) of January 1961, and is offered for consideration by technicians concerned with the maintenance of TACAN equipments.

Transformer T-1406 in the MD-129A/GR--which is a component of the AN/GRC-27 system--can be used as an emergency replacement for transformer T-1801. This substitution requires no modifications and fulfills all requirements of paragraph 4b(3) (c), NAVSHIPS 92348(A), AN/URN-3.

**NOTE:** This should be considered an emergency repair in order to reduce time of the TACAN until a new T-1801 can be installed. It should be noted that T-1801 cannot be substituted for a T-1406 because of the transformer mounting differences.

### UNDESIRABLE OSCILLATIONS IN AN/URN-3A, AN/SRN-6 (SERIES), AND AN/GRN-9 (SERIES) TACAN

Undesirable oscillations have been noted in the tripler stage, V-1504, of AN/URN-3A, AN/SRN-6 (series), and AN/GRN-9 (series) TACAN. Symptoms which indicate that the tripler stage is in a self-oscillating condition are:

1. Tripler grid current will be higher than normal.
2. Tripler operation, as monitored with the receiver meter in positions 1 and 2, will remain unchanged when any of the doubler tubes are removed.

3. Oscilloscope display, as monitored at the Klystron Incident neck, will consist of distorted negative pulses.

4. Slight movements of the FMO chassis will cause fluctuation in the meter readings and scope display.

To correct the self-oscillating condition, it is recommended that the following procedure be utilized:

1. Make sure that a 2C 39 or 2C 39A tube is used.

(The use of tube type 7289 (2C 29WA) is the major cause of the spurious oscillations which result from certain differences in the physical and electrical characteristics of the tubes.)

2. Tune the tripler for maximum reading on the crystal current meter. If more than one peak or extremely sharp tuning is noticed, the circuit should be suspected of self-oscillation. Confirm this condition by removing one of the doubler tubes. If the tripler is functioning normally, the meter will read zero and the pulse output at the klystron input jack will disappear.

### CAUTION

Extreme care must be exercised to avoid shorting the filament or damaging the filter.

3. If oscillations continue, separate the filament filters in the tripler shell as much as possible.

4. Repeat the tripler tuning to ensure that the undesirable oscillations have been eliminated.

5. Do not attempt to tune the klystron until the tripler cavity self-oscillations have been corrected. Do not exchange high-band unit parts with low-band unit parts.

### 7289 - 2C39A SERIES TUBE INFORMATION

Extensive efforts to standardize on a single tube type in the 2C39 series of tubes resulted in establishment of MIL-E-1/1120 (NAVY), dated 4 October 1960, for type 7289 (FSN-5960-815/0813). It was later established that, because of the irregular design criteria for the tube cavity of the AN/URN-3, the type 7289 would not fit mechanically in the AN/URN-3 equipment. Accordingly, the requirement for tube types 2C39 or 2C39A (FSN 5960-188-8567) are stressed.

U.S. Navy Electronics Supply Office will procure on a one-time basis tube type 2C39A for use in AN/URN-3 equipment pending results of the U.S. Naval Applied Science Laboratory investigation of the incompatibility of type 7289 in AN/URN-3 equipments.

### TUBE TYPE USN-SAL-89 - DETERMINATION OF RES-TORATION FEASIBILITY

See article in AN/GRN-9 section under same title.

**RELIABLE TUBES FOR THE AN/URN-3**

A recent study of 196 reported tube failures in this equipment indicates that 85 failures of lower-quality tubes have occurred. These types can now be replaced by reliable tubes.

The first 52 equipments manufactured did not contain reliable type tubes. Equipment serials 53 and up contain 10 types of reliable tubes used in 56 sockets. Since it is essential that the AN/URN-3 operate with a maximum degree of reliability, it is highly important to use reliable tubes as replacements when tubes of lower quality fail.

For requisitioning purposes, the following reliable tubes are available for issue:

Lower Quality Tube	Reliable Type	Reliable Type Standard Navy Stock Numbers
OA2	OA2WA	N16-T-52001-3
OB2	OB2WA	N16-T-52001-8
5R4WGY	5R4WGB	N16-T-55446-5
6AS7G	6080WA	N16-T-76080-85
6AU6	6AU6WA	N16-T-56203-53
6C4W	6C4WA	N16-T-56214-55
6J4	6J4WA	N16-T-56349-85
6X4	6X4WA	N16-T-56840-60
12AT7	12AT7WA	N16-T-58240-14
5651	5651WA	N16-T-75651-85
5687	5687WA	N16-T-75687-85
5751	5751WA	N16-T-75651-85

When ordering replacement tubes for this equipment, specify the reliable type, its stock number, and state that this reliable tube is necessary for use in the AN/URN-3 equipment. As additional reliable tubes become available the information will be published.

**AN/URN-3****Preferred Transformer for Symbol T-1001**

ESO has shipped a preferred transformer, FSN N5950-568-2362, to fill requests for FSN N5950-645-1710, Symbol T-1001 in the AN/URN-3. Since the cabinet must be modified in order to install the preferred transformer, activities requesting FSN N5950-645-1710 are advised to contact the cognizant Industrial Manager for assistance. Field Change 1-AN/URN-3 has been developed to replace the non-preferred transformer.

**AN/URN-3 PARTS SUBSTITUTION T-1801**

Transformer T-1406 in MD-129 A/GR, which is a section of the AN/GRC-27 system, may be used as an emergency replacement for T-1801. This replacement requires no modifications and fulfills all requirements of paragraph 4b (3) (c), NAVSHIPS 92348 (a) AN/URN-3.

This should be an emergency repair to prevent outage of the TACAN while awaiting supply action to obtain a new

T-1801. It should be noted that reverse substitution cannot be made, due to mounting differences.

**AN/URN-3 EMERGENCY REPAIR OF TACAN ANTENNA**

Emergency repairs to an antenna AS-777/URN-3 (part of an AN/URN-3 Tacan) were successively made recently. The damage was the result of a casualty which occurred on a carrier deployed in WesPac.

**Damage to Antenna**

The casualty resulted from arcing, between the fixed array and the rotating element, which apparently had been caused by excessive vibration or shock. The fixed array (low band array assembly) was of a type that is being replaced by a field change, and the change had not been made in this instance.

The path of the discharge was from the fixed array through its fiber cover to the parasitic element of the inner fiberglass cylinder of the rotating element. From this conductor the discharge passed across the aluminum dish, which is used to stabilize the two cylinders, ending in one of the nine parasitic elements of the outer cylinder.

The damage to certain parts of the assembly can be seen in figures 1 and 2. The fixed array was severely damaged and was replaced. The second conical element from the top was badly burned and physically deformed, and the support tube for the elements was bent in that region. The surface of the cover for the array was burned and broken also. The inner of the two cylinders of the rotating element was subjected to the discharge immediately above the mid supporting flange and circumferentially in the area in which the parasitic element is placed. The surface was punctured, the flange was burned, and area extending out from the hole for about 2 inches was discolored owing to the heat of the discharge, and the parasitic element was shorted. The damage to the outer cylinder of the rotating element consisted of the shorting of one of the nine parasitic elements.

**Replacing Parasitic Elements**

To repair the cylinders of the rotating element it was necessary to obtain a suitable replacement for the wire contained in the shorted parasitic elements. An examination of a sample removed from the inner cylinder indicated a resistance factor of approximately 2,000 ohms per meter. No standard stock replacement being available, a search of the Japanese market was made. A high-quality Nichrome type of wire with a resistance factor of 1,000 ohms per meter was procured as the nearest substitute obtainable. This wire was used in the repair process now to be described.

**Repair Technique**

The two damaged cylinders of the rotating element were repaired in the following manner:

**Inner cylinder (6-inch diameter)**

The problem here was twofold. First, the damaged area at the point of discharge had to be replaced. Second,

the wire used in the parasitic element had to be renewed and replaced.

To remove the damaged wire, the outer surface for the length of the cylinder was scraped in the area of the wire to a width of about 2 inches. After the wire was removed, the area actually damaged by the discharge was cut-out (total area approximately 4 square inches).

Inner and outer dies were formed of 1/8-inch steel. When the inner die was in place and an appropriate separating film had been inserted, seven layers of resin-impregnated glass were applied over the cut-out area. (Material used: FSN 2040-372-6046 Plastic Repair Kit.) The outer die was then clamped in place, and the patch was allowed to cure for 6 hours.

After the outer die was removed, the surface in the area of the patch was ground to match the depth of the 2-inch strip referred to above. Grooves were then scribed in the scraped area to allow the wire to be properly embedded. This work was done and tacks of resin were used to hold the wire in place. At this point the wire was tested for continuity, and 3 hours later four layers of resin-impregnated glass cloth (3 inches wide) were applied over the scraped area. The outer die was again affixed, pressure was applied, and the curing process was repeated.

A section of the mid flange that had been damaged in the discharge was cast and fitted into place on the cylinder. The final operation was one of finishing the surface and balancing the cylinder.

#### **Outer cylinder (40-inch diameter)**

The repair of the outer cylinder of the rotating element followed nearly the same steps described above. Although only one of the nine parasitic elements had been affected, to insure uniformity all nine were replaced. Note: Elements in the outer cylinder consist of two parallel rows of wire, one row embedded in the middle of the cylinder wall and the other near the inner surface. Only the latter row was damaged and replaced. Because of this fact, all work was done on the inner wall of this cylinder.

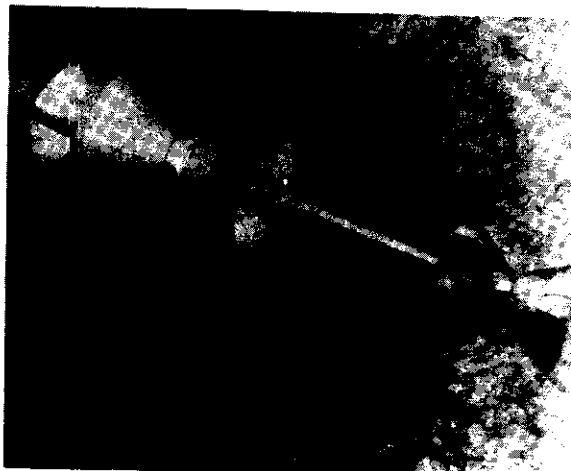
#### **Bench-Testing of Unit**

Before reassembly of the antenna, a shop test was given to all motors, synchros, and generators. The antenna was then reassembled and bench-tested before installation.

A routine check of the system of operation was made upon completion of the installation, and the power output was normal. The standing wave ratio was noted to be Incident 12, Reflected 2. This gave a ratio well above the acceptable minimum stand in the Technical Manual NAVSHIPS 92348 (A).

Later air checks bore out these observations, indicating that the Tacan was functioning normally.

Although this repair procedure is not recommended as a routine method, it is an example of what can be done to maintain Fleet operational capabilities.



### FAULTY CHASSIS TO TUBE SOCKET GROUND CONNECTIONS

This article describes the possibility of unusual problems that can be encountered and caused by faulty ground connections. The types of equipment in which ground problems are most likely to be encountered are those whose chassis have been anodized and which employ the half-ring ground tube socket mountings (see figure 1).

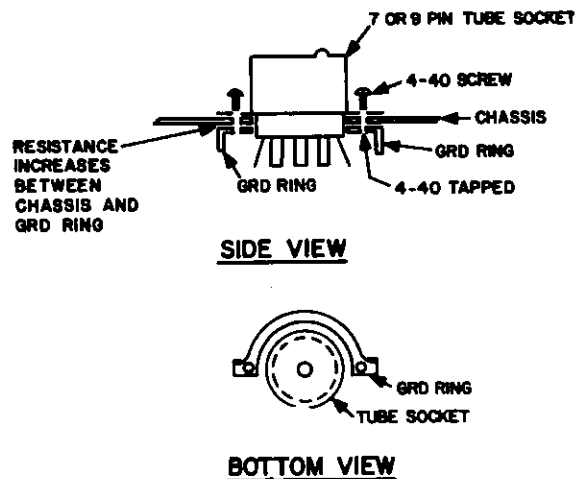


Figure 1.

The d-c resistance between the half-ring ground and the chassis increase after the equipments, aboard ships, have been operational for several years. The problems are unusual in that the symptoms caused by this condition are never the same, although the units are in the same series.

The types of equipment in which this condition has been found are the AN/URN-3 TACAN, AN/UPN-12, and AN/SRD-7. An indicator of an AN/SRD-7 had a 60-cycle ripple on its sweep; the cause was found to be a faulty ground connection on one of the sweep amplifier tube socket grounding rings. Although the d-c resistance was only 1/4 of an ohm, the heater current through this resistance was sufficient to couple the a-c voltage into the sweep amplifier tube. Because of the same condition, the TACAN and LORAN equipments also were inoperative except that the d-c resistance was between 1-1/2 to 2 ohms.

To locate and correct these faults, use a high gain oscilloscope and proceed as follows:

1. Connect the ground lead of the oscilloscope to the faulty unit chassis.
2. Apply power to the equipment.
3. Set the vertical gain control of the oscilloscope on high and place the oscilloscope probe to each tube socket ring.

NOTE: Any vertical indication of the oscilloscope means a faulty ground connection.

4. Remove the ground rings causing this faulty condition, and clean the area under ring and chassis. Reinstall the ring and check to see if the condition has been corrected. Use the same method used in step 1 through 3. (668)

**AN/USQ-20(V)-DATA SYSTEM GROUP; SPECIAL TOOLS**

The purpose of this article is to provide Federal Stock Numbers for the most commonly used special tools required in servicing the AN/USQ-20(V) Group in order to enable activities to cross reference between Federal Stock Numbers and manufacturer's part numbers.

The associated technical publications for the AN/USQ-20(V) Group list these special tools under Manufacturer Number only and difficulty has been experienced in procurement.

Item	Nomenclature	AWG Size	Mfg. No.	F.S.N.
1.	Taper Pin Crimp Tool	24/22	AMP-48698-3	9G-5120-662-8751
2.	Taper Pin Crimp Tool	20/18	AMP-47043	9G-5120-662-8823
3.	Taper Pin Insertion Tool	24/22	AMP-380306-2	9G-5120-522-2714
4.	Taper Pin Insertion Tool	20/18	AMP-380306-6	1A-1220-650-7922
5.	Taper Pin	24	AMP-41646	2R-5940-621-2195-E222
6.	Taper Pin	22	AMP-41649	1N-5940-874-1013
7.	Taper Pin (2 wire)	20	AMP-41652	2RS-5841-822-9510-E222
8.	Taper Pin (2 wire)	18	AMP-41658	9G-5940-561-7863

It is recommended that the above list be copied and retained within the maintenance complex for future reference. (657)

**AN/UXH-2; FACSIMILE RECORDER IMPROVEMENTS**

In response to the many inquiries received concerning progress on the long-awaited AN/UXH-2 recorder modification program being undertaken by BUSHIPS, a general summary is presented here. Modifications to AN/UXH-2 equipments in the Fleet, at overseas shore stations, and at some CONUS shore stations were regarded as being too complex for field application. This, coupled with the recognized need for a complete overhaul of the AN/UXH-2's for the first time since their issue, resulted in the present plan to return each recorder to Westrex for modification and rehabilitation. When reissued the equipments will then be like new.

Modification to AN/UXH-2 will include changeover to the pressure-sensitive recording technique, thus eliminating the old electrical arcing principle whereby the image was "burned" into the paper. The modified AN/UXH-2(A) utilizes a conventional paper feed drum in combination with stylus driven from a heavy, rigid, grooved rubber belt which is both stable and, best of all, trouble-free during its long life. The three stylus press the image on the back of one-time carbon paper. This carbon paper and the plain white paper on which the image finally appears are fed from separate supply spindles to avoid the slippage and binding common with integrated paper and carbon paper feed techniques during longer periods of unattended operation.

Attention is being given to improved parts provisioning in the case of the AN/UXH-2(A), to avoid some of the problems of this nature which have so seriously detracted from the efficient employment of the AN/UXH-2 to date. In the case of the new type of paper required with AN/UXH-2(A), plans include the provision of six rolls of the new-type paper and six rolls of carbon paper with each modified recorder issued. This is approximately a one month supply. Adequate prepositioned supplies have been stocked in the supply system. The Federal Stock Number for this paper is FSN-1N7530-906-8283.

Priorities have been established for initial issue of modified equipments to those Fleet units and shore stations with the greatest operational need for them. This modification program is not underway. At this time, there is no sound estimate of the elapsed time from first AN/UXH-2 on to last AN/UXH-2(A) off the Westrex assembly line. A simple one-for-one exchange of equipments in the Fleet and at shore stations is planned; i.e., a modified and overhauled AN/UXH-2(A) will be received and the same shipping container will be utilized, for shipping the ship or station AN/UXH-2 to Westrex.

It is pointed out that shipment of cannibalized recorders will slow down the modification program. Equipments requiring major replacement parts in addition to modification and overhaul will be set aside to await future contract negotiations between BUSHIPS and Westrex. It is requested therefore that all parts of the basic equipment be shipped regardless of condition.

In addition to the action being taken to modify all AN/UXH-2 recorders as indicated above, a recently completed Westrex contract will also provide a large number of new AN/UXH-2(B) recorders for Navy use. First deliveries on this contract are due during October 1965. While first call for these recorders will go to new construction vessels, there will be some back fitting into large combatants and some will be provided to FWC/FWF's and other overseas shore stations as replacements for older gear.

Other facsimile recorders which continue in operational use include the following (note the differences in scan capabilities):

Recorder Transceiver	Scan Capability (LPM)	Associated Converter
RD-92/UX	30-60	CV-172/UX
RO-160/UX	60-120	CV-1066/UX
RO-171/UX	60-90	CV-1066/UX
RO-172/UX	90-120	CV-1066/UX
TT-41B/TXC-1B	30-60	MD-168/UX
TT-321/UX	60-120	MD-168/UX

As may be plainly seen from this summary, considerable reliance must still be placed on the older types of equipment and meteorological officers should ensure that equipment on board is compatible with that type of recorder designed to copy required broadcasts. Where either appropriate or necessary, the Communications, Electronics, or Ground Electronics Officer should be consulted in the command effort to maintain facsimile recording capability during the transition to more modern recorders.

In the RDT&E area, a great deal of attention is being directed toward the time saving features of compressed signal transmission in connection with facsimile and other graphics. A practical means is being sought whereby the time consumed in present day transmission of the blank spaces may be eliminated and only the marks or actual intelligence pass over the transmission path. Compare the ratio of line coverage to open chart space contained in the average weather chart and the communication advantages of such a method become obvious. (666)

The AN/WRC-1 equipment will be delivered programmed for use with a 35-foot whip antenna. In the event that other than a 35-foot antenna is used, it will be necessary to alter the programming connections in the J-1265-U junction box as detailed in the AN/WRC-1 technical manual.

The antenna coupler should be installed within 12 inches of the base connection for the associated whip antenna. Clearance should be provided for removal of the tuning elements from its protective case. Shock and vibration mounts are not supplied and should not be used with the CU-937/UR.

This antenna coupler is also used with Radio Set AN/URC-35. The assigned Federal Stock Number for the CU-937/UR is F5820-964-9673. Detailed information on the antenna coupler is contained in the AN/WRC-1 Technical Manual (NAVSHIPS 94840(A)). If the CU-937/UR is not used, such as in submarine installations, it should be returned to stock under the above listed stock number. Normally, the CU-937/UR will not be used when the AN/WRC-1 is operated directly into a 50-ohm system, i.e., antenna multicoupler, broad-band antenna system.

### AN/WRC-1 RADIO SET; SHOCK AND VIBRATION MOUNT

The shock and vibration mount supplied with the AN/WRC-1 was designed specifically for the weight and center of gravity for the equipment. It has come to the Bureau's attention that in a recent installation of the equipment, wherein it had been mounted on the deck, ship personnel were using the equipment for a seat. The additional weight loading caused by the person sitting on the equipment resulted in a damaged shock and vibration mount.

The equipment was designed for communications use—not as a device to replace a chair.

### AN/WRC-1; GENERAL INFORMATION

#### Mode Selector Switch

It has come to the Bureau's attention that the mode selector switch of the T-827/URT and R-1051/URR may encounter a failure after a period of operational-use cycling. Although this is a standard MIL switch and had been subjected to many qualification and inspection tests, this failure had not become evident. In the event that this failure is encountered in operational use, the switch should be replaced by a stock repair unit. It is requested that the failed switch should be indicated on the next submission of the P&O report for the equipment.

#### Radio Teletype Use

To be operationally compatible with the various equipments used on radio teletype circuits, Transmitter Unit T-827/URT should be set 2 kc lower in frequency than the operational assigned frequency. For receiving radio teletype, Receiver R-1051/URR should be set 3 kc lower than the assigned frequency, switched to "VERNIER" position, and tuned to approximately 450 cps. This method of receiving is preferable to the use of the BFO control because of the higher stability of the vernier circuit.

#### CW Reception

When Receiver R-1051/URR is switched to the CW mode, the bandwidth is 7 kc. An alternate method of opera-

tion for reception of CW makes use of a 3.2-kc bandwidth filter that normally is used in single sideband mode. To copy CW in this manner, switch the emission selector to USB, tune the receiver to 2 kc lower than the assigned frequency, switch to VERNIER, and adjust the vernier control for a desired tone pitch.

In the SSB mode, a better sensitivity and an approximate 4 to 1 signal improvement will result. The equipment was designed primarily as a single sideband radio set, with the additional capability for CW and AM use. The AM 7-kc filter for the CW mode was used for the purpose of saving cost and circuitry.

#### Technical Manuals

The final technical manuals are NAVSHIPS 94840(A) and 94841(A) without the words PRELIMINARY printed on the cover.

After final printing, several errors have been discovered, and a CHANGE 1 to the technical manuals is forthcoming.

#### Submarine Installations

The AN/WRC-1 technical manual (NAVSHIPS 94840(A)), pages 2-21, and 2-22, figure 2-7, indicates that the addition of a relay for antenna tuner bypass is essential. This is not the case. The relay need only be installed if it is desired to provide for antenna tuner bypass switching directly at the front panel of the AN/WRC-1 (power amplifier unit). If this feature is not desired, and if the antenna tuner control unit (C-136Q/SRT or equivalent) is in the near vicinity of the AN/WRC-1, this antenna relay addition is not required.

Use of the CU-937/URC coupler-monitor with the AN/WRC-1 is not required and it should not be installed.

#### Nomenclature

The AN/WRC-1 equipment, as first produced, provided tuning increments of 0.5 kc. The receiver portion, R-1051/URR, additionally had provisions for continuous tuning. The AN/WRC-1A equipment, to be produced, will include the capability for tuning in 0.1-kc increments. The R-1051A/URR will also be capable of 0.1-kc synthesized increments and additionally will retain the continuous tuning capability.

### AN/WRC-1 ( ) RADIO SET; ELECTRONIC (MODULE) ASSEMBLIES, REPAIR AND EXCHANGE

BUSHIPS Instruction 9671.24, Ser. 679A-82, of June 1964 established the basic guidelines for the repair and exchange of defective electronic assemblies for Radio Set AN/WRC-1 ( ), Receiver R-1051 ( )/URR, Transmitter AN/URT-23(V), and Transmitter-Exciter T-827 ( )/URT. All ships and activities should familiarize themselves with this instruction to preclude any lengthy equipment downtime awaiting replacement assemblies.

It should be noted that "2N" assemblies must be returned to the established repair activities at the Norfolk or San Francisco Naval Shipyard.

### AN/WRC-1 RADIO SET; RF AMPLIFIER UNIT

The RF Amplifier Unit (AM-3007/URT) of Radio Set AN/WRC-1 has been designed for interchangeable use with another equipment, nomenclature AN/URC-35. The AN/URC-35 is basically a single sideband, AM, CW transceiver version of the AN/WRC-1 radio set. The AN/URC-35 uses

the same RF Amplifier AM-3007/URT as well as many of the same module assemblies and the antenna coupler unit of the AN/WRC-1 version. The AN/URC-35 is capable of operation from 115 VAC, 48-450 cps, external 24 VDC input, or from a self-contained 24 VDC battery (when installed).

The AM-3007/URT, as furnished with the AN/WRC-1 equipments, contains receptacles and circuitry that are used with the AN/URC-35 configuration when used on 24 VDC operation only. This circuitry had been included in units delivered as AN/WRC-1's for the purpose of standardization of design, common support, and interchangeability.

The AN/WRC-1 cannot be operated on 24 VDC primary power input.

#### AN/WRC-1, R-1051/URR SHOCK AND VIBRATION MOUNTS

The AN/WRC-1 and R-1051/URR equipments are supplied with shock and vibration mountings that have been designed specifically for each of the equipments to meet the rigorous requirements of specification MIL-E-16400. The mounts are not interchangeable, although they appear alike. The AN/WRC-1 shock and vibration mount is nomenclatured MT-3115/UR (Barry part no. 18870-6 ( )) and the R-1051/URR shock and vibration mount is nomenclatured MT-3114/UR (Barry part no. 18870-5 ( )).

BUSHIPS has received reports that some shock and vibration mounts supplied with the AN/WRC-1, R-1051/URR equipments appeared to be interchanged. Investigation disclosed that the prime contractor, General Dynamics, had inadvertently applied nomenclature plates incorrectly; that is, applied MT-3115/UR plates to the MT-3114/UR shock and vibration mounting on an unknown number of delivered equipments.

Each of the equipment shock and vibration mountings have the associated equipment identification stenciled on the top plate of the mounting. All activities installing these equipments should verify use of the proper mount by citing the stenciling appearing on the top plate as well as confirming the vendor's number:

Equipment	Correct Nomenclature	Correct Vendor Part Number
AN/WRC-1	MT-3115/UR	Barry no. 18870-6 ( )
R-1051/URR	MT-3114/UR	Barry no. 18870-5 ( )

Installation of the AN/WRC-1, R-1051/URR aboard ship or in vehicles without the associated shock and vibration mount can incur serious damage to the equipment if vibration and severe shock is encountered.

#### AN/WRC-1 INSTALLATION AND MAINTENANCE ADJUSTMENT

The attention of installing personnel is invited to the necessity for power amplifier (AM-3007/URT) bias adjustment during initial installation of the equipment as well as during periodic maintenance inspections. Adjustment

information is contained in the AN/WRC-1 Operator's Handbook (NAVSHIPS 94840 (A), page 3-2, paragraph 3-18 (C)).

Initial installation problems have been attributed to a failure in making this adjustment.

#### AN/WRC-1 CW BREAK-IN TIME

After a recent INSURV trial, a request was received by the Bureau concerning a change in the equipment hold-in time during CW operation. The Bureau has been advised by the equipment contractor that the present hold-in time is approximately one second and that this hold-in time can be reduced to 0.5 second by the elimination of an existing capacitor.

Refer to AN/WRC-1 technical manual (NAVSHIPS 94840 (A)), figures 5-5 and 5-29, printed circuit board A8, capacitors C10 and C11. Capacitors C10 and C11 determine the hold-in time constant. By disconnecting one of the capacitors, the time can be decreased to approximately one-half.

The above procedure is for information only to those desiring a shorter hold-in time. A formal field change will not be published at this time.

#### AN/WRC-1; GENERAL NOTES

##### AM-3007/URT R F Amplifier.

In the event of an equipment failure having a symptom of continuous rotation of the unit's turret assembly, check relay 3A2A5K6. Welding of internal contacts will cause continuous power to be applied to the turret motor.

Reports of failure of DC-to-DC converter unit components Q1, Q2 and CR5 have been attributed to ship's external cabling problems. BUSHIPS message 031635Z June 65 advises checking of remote control unit's 12 vdc terminals and "Microphone" jack receptacle for the absence of any ground. A ground at these points will cause a direct short on the 12 vdc power supplied from the DC-to-DC converter unit and resultant component failure.

##### Test Sets.

The AN/WRC-1 and R-1051/URR technical manuals (NAVSHIPS 94840(A) and 94841(A) ) provide reference to requirements for Test Sets TS-2132/WRC-1 through TS-2135/WRC-1. These test sets are for the purpose of checking individual modules (electronic assemblies) of the AN/WRC-1 and R-1051/URR equipments. The test sets have not been procured for general issue as an on-board allowance item. The test sets have only been supplied at San Francisco and Norfolk Shipyards.

##### Technical Manual Change.

CHANGE 1 to the publications NAVSHIPS 94840(A), 94841(A), and 94841.42(A) has been published and stocked at Naval Supply Depot, Philadelphia.

##### Repair Manual.

The manual "Repair of AN/WRC-1 and R-1051/URR 2N Modules," NAVSHIPS 0967-034-2000, is now available at



NSD, Philadelphia. This manual supersedes the earlier version NAVSHIPS 95700. The manual is intended for use in conjunction with the test sets supplied to the module repair activities, however, a bulk stock of the manual has been obtained for general reference use.

#### R-1051/URR.

It is recommended that the receiver unit be left in a "standby" condition if not being operationally used. This will increase reliability and retain the internal frequency standards stability. When the receiver is turned completely "off" the existing front-end protective circuit (A9 subassembly) is de-energized and in the event of high-level rf feed-in on the antenna input, damage could be caused to the equipment. A field change is being investigated to assure retention of this circuit even though the receiver is "off."

#### New Production.

Recent new production of the AN/WRC-1A. This and any later production will include provisions for tuning in 0.1 KC high-stability increments in lieu of the 0.5 kc of the present AN/WRC-1 models. All modules will be interchangeable with the exception of the translator-synthesizer units. The later 0.1 kc version will be interchangeable with the 0.5 kc type of the AN/WRC-1, however, interchanging the 0.5 kc type into the AN/WRC-1A at later versions will not be possible (i.e., 0.1 kc circuitry will not be available). Depot modification of the 0.5 kc translator-synthesizer unit is under consideration and will be accomplished upon the availability of funding. (663)

#### AN/WRC-1; PLUG-IN ASSEMBLY (MODULE) REFERENCE INFORMATION

The following chart is provided for rapid reference purposes:

Module, Plug-In Assembly	Symbol No.	Federal Stock Number
Translator-Synthesizer	1A2A6	2N5820-078-4720
R F Amplifier	1A2A4	2N5820-078-4721
Frequency Standard	1A2A5	2N6625-078-4718
Receiver IF/Audio	1A2A2	1N5820-078-4725
Receiver Mode Selector	1A2A1	1N5895-078-4723
Transmitter Mode Selector	2A2A1	1N5820-078-4724
Transmitter IF Amplifier	2A2A10	1N5820-969-4216
FSK Generator	2A2A9	1N5820-078-4722
APC/PPC/Dir. Coupler	3A2A2	1N5820-078-4717
DC/DC Converter	3A2A5	1N5820-078-4719
AC Power Supply	3A2A3	1N6130-969-4217
Transmitter Audio Amp.	2A2A2	1N5820-078-4726

NOTE: Assemblies 1A2A6, 1A2A4, 1A2A5, 1A2A2, and 1A2A1 are used in the R-1051/URR receiver unit of the AN/WRC-1 Radio Set as well as the R-1051/URR Receiver when used separately. (661-665)

Old Style 1-MC Oscillator (Manson OSC) Used in Sets, SN 1 through 294

Symbol	Description	Mfr.	Westinghouse Drawing No.	FSN
E1304	1-mc board	Westinghouse	336C762G01	1N5820-701-0070
Z1301	Proportional Oven	Manson	152A919H01	1N5820-715-4032
Z1302	Oven Control Unit	Manson	152A919H02	1N5820-668-3419

New Style 1-MC Oscillator (Reeves-Hoffman) Used in Sets, SN 295 and up

Symbol	Description	Mfr.	Westinghouse Drawing No.	FSN
E1304	1-mc board	Reeves Hoffman	378A349H03	1N5820-856-0534
Alt. A. Z1301	Proportional Oven	Reeves Hoffman	378A349H01	*N5955-446-0069
Alt. A. Z1302	Oven Control Unit	Reeves Hoffman	378A349H02	*N5955-446-6572
Alt. A. A1301	Matched Set (Proportional Oven and Oven Control Unit)	Reeves Hoffman	378A349G01	1N5820-855-9412

\* These Federal Stock Numbers were originally assigned to the individual units but they are stocked only as matched sets under FSN 1N5820-855-9412.

#### AN/WRT-2 RADIO TRANSMITTER - HIGH-VOLTAGE GROUNDING CIRCUITS

This article discusses a little known but very important part of the AN/WRT-2 Transmitter—the high voltage grounding circuits.

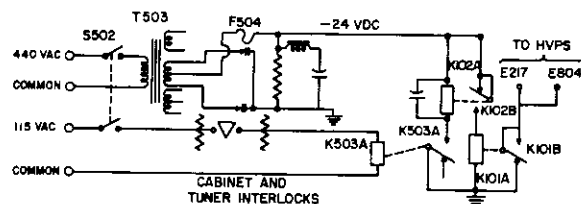
Two circuits are provided for high-voltage grounding in this transmitter. The first is a mechanical shorting bar which grounds the high-voltage supply whenever the Power Supply (PP-2222/WRT) drawer is withdrawn from the cabinet. This shorting bar is shown schematically on the high-voltage power supply schematic, Figure 6-29 (Change 3) in NAVSHIPS 93319(A).

**CAUTION:** The "Plate Power On" button should not be energized while the power supply drawer is withdrawn from the cabinet. Any attempt to do so will result in blowing two or more of the main fuses F201, F202, or F203.

The second high voltage grounding circuit consists of relays K101 and K102. These relays are mounted on the rear wall of the Electrical Equipment Cabinet (CY-2558/WRT-2) and are shown only on the cabinet wiring diagram, Figure 6-47 (Change 1). This wiring diagram is seldom used in shipboard maintenance. It is possible that personnel who are not thoroughly familiar with the AN/WRT-2 may not be aware of the existence of K101 and K102 or of their intended function.

A simplified schematic of this high voltage grounding circuit is shown in Figure 1.

Figure 1.



It can be seen from Figure 1 that, upon start up, relay K503A is energized from 115 VAC through the Equipment Cabinet and Tuner interlocks. Contact K503B then closes to energize K102A from the -24-volt power supply. The normally open contact of K102B then is closed, completing the circuit from -24 volts through K101A coil to ground. When K101A is energized, one of the normally closed contacts on this relay removes the ground from the high-voltage lead which runs between E217 in the Power Supply drawer and E804 in the Radio Frequency Amplifier drawer through the cabinet harness.

If any drawer is withdrawn from the Equipment Cabinet, or if the Filament Power switch is turned off, K503 is de-energized, which in turn de-energizes K102. Capacitor C102, across the coil of K102, provides a sufficient amount of time delay to prevent the operation of K101 (the high voltage grounding relay) until the high voltage power con-

tactors in the high voltage power supply have dropped out. This prevents the application of the short on the cabinet high voltage lead before power is removed from the high voltage power supply.

Note that relays K101 and K102 are operated from the -24-volt supply. The loss of this supply voltage either from failure of F504 (-24-volt control fuse) or any other reason will result in the cabinet **high voltage bus being grounded continuously**. This could lead to an erroneous conclusion that the high voltage lead in the cabinet harness had arced or otherwise acquired an **Unwanted ground**. Again, any attempt to energize the high-voltage power supply with the transmitter in this condition will result in blowing two or more of the main-line fuses F201, F202, or F203.

On AN/WRT-2 Transmitters, Serial 1 through 263 an indicating type fuse is used at F504. It is important that exact replacement fuses be used and that they be installed in the fuseholder properly (red plunger visible through the clear plastic cap). On AN/WRT-2, serials B1 through B151 and serials C1 through C458, a fuseholder with a built-in neon indicator lamp is used. These indicators should largely eliminate the possibility of overlooking a blown F504 fuse. (656)

#### AN/WRT-2 RADIO SET - ADJUSTMENT FOR EQUAL RF POWER OUTPUTS IN MARK AND SPACE

The AN/WRT-2 Transmitter normally should be adjusted so that equal audio inputs to the USB and LSB Modulators provide equal RF power outputs in the ISB mode. The characteristics of the FSK electronics switch in the AN/WRT-2 are such that these adjustments do not ensure compatibility with FSK mode operation and unequal RF power outputs usually occur in MARK and SPACE.

The following adjustment procedures are recommended when the AN/WRT-2 is to be employed primarily for FSK operation:

1. Set the transmitter for 500 watts RF power output in the CW mode on 15 MC.
2. Turn DRIVE ADJUST control fully counterclockwise.
3. Set EMISSION SELECTOR to ISB.
4. Set TEST TONE switch to USB/LSB.
5. Set CARRIER REINSERT switch to FSK, ISB.
6. Set USB and LSB audio signals to "2-tone" mark on MOD LEVEL meter.

NOTE: Set SIDEBAND SELECTOR control to UPPER position when setting USB level to "2-

tone" and to the LOWER position when setting the LSB level to "2-tone."

7. Set EMISSION SELECTOR switch to FSK.

8. Set FSK TEST switch to LINE.

9. Key transmitter. Advance DRIVE ADJUST control for RF output indication of 400 watts.

10. Set FSK TEST switch to MARK - note RF power output.

11. Set FSK TEST switch to SPACE - note RF power output.

NOTE: The USB LEVEL ADJ (R1207) and the LSB LEVEL ADJ (R1217) pots are located on the left side of the Radio Frequency Oscillator, P-581/WRT-2, drawer.

12. If RF power output is lower in SPACE position:

a. Rotate R1217 clockwise to equalize RF power outputs.

b. If R1217 is fully clockwise set FSK TEST switch to MARK and rotate R1207 clockwise to equalize RF power outputs.

13. If RF power output is lower in the MARK position:

a. Rotate R1207 clockwise to equalize RF power outputs.

b. If R1207 is fully clockwise set FSK TEST switch to SPACE and rotate R1217 counterclockwise to equalize RF power outputs.

14. If there is a slight difference of RF output levels in MARK and SPACE when the transmitter is tuned to a frequency other than 15 MC, it may be equalized by a slight readjustment of C1222 (located on left side of the Radio Frequency Oscillator drawer).

A slight unbalance may exist in the USB and LSB Modulators after the preceding adjustments for FSK are completed. If it is desired to operate in ISB, the unbalance may be compensated for on the front panel as follows:

1. Set the MOD LEVEL meter for equal audio inputs in USB and LSB.

2. Adjust the SIDEBAND SELECTOR control for equal RF power outputs on USB and LSB.

The foregoing information is documented in NAVSHIPS 96085, "Fault Location Procedures for AN/WRT-2 Transmitter."

The adjustments in this article also will be included in the proposed revision of the AN/WRT-2 Maintenance Standards Book by EMEC. (653)

**CP-642/USQ-20 and CP-642A/USQ-20 COMPUTER MEMORY FAILURES**

Several memory stacks have been damaged beyond economical repair by maintenance personnel. Maintenance personnel are directed not to attempt field repair on memory stacks.

A limited pool of spare computer-memory chassis has been established by the Bureau of Ships Technical Representative, St. Paul. These chassis (less cards) will be priority air shipped on an exchange basis. The replacement memory chassis (less cards) will be shipped upon notification of failure and shipment of defective chassis. Notification, via message, of failure and shipping data shall be directed to BUSHIPS TECHREP ST PAUL with info copies to BUSHIPS and EMEC. Activities are directed to use this service when failures occur in memory stacks.

Direct liaison between fleet activities and BUSHIPS Technical Representative, 1902 West Minnehaha Ave., St. Paul, Minn. 55104, is authorized, whenever computer memory stacks fail. (668)

**CU-714/SRA-22 COUPLERS - IMPROPER HANDLING OF**

The Electronics Maintenance Engineering Center (EMEC) is in receipt of reports stating that many CU-714/SRA-22 Couplers have been received at repair facilities in a damaged condition, due to their being shipped without the pressure proof case.

Activities are advised that the shipping of this unit without the case results in damage to the 1C7 vacuum capacitor, which is not repairable by either the module repair facility or the manufacturer.

The cost to replace the damage 1C7 capacitor is approximately \$219.00 each, and the cost to replace the missing pressure proof case is \$496.00 each.

Therefore, in order to eliminate costly replacements, those activities which have shipped these units to repair facilities without the pressure proof cases shall ship these cases to the respective repair facility at the earliest practicable date.

In addition, activities are advised that no further shipments of this unit shall be made without the pressure proof case.

When requisitioning units of the AN/SRA-22 Antenna Group, the following applies:

UNIT	FSN
1. CU-714/SRA-22 Coupler	F5985-789-1987
2. C-2698/SRA-22 Control	F5820-897-5501
3. AN/SRA-22 Antenna Group (671)	F5985-543-1861

**CY-1123/USQ-20(V) KEYSET CENTRAL-GENERAL  
INFORMATION**

Naval Tactical Data Systems Maintenance activities have found difficulty in attempting to cross-reference some of the more commonly used semi-conductors and transistors in the Analog to Digital Converter of the Keyset Central. Listed below is a cross-reference between these items and Federal Stock Numbers:

Item	Symbol	Nomenclature	Federal Stock Number
1	1N277	Semi-conductor	9N-5960-968-3858
2	1N746A	Semi-conductor	9N-5960-847-5246
3	1N746A	Semi-conductor	9N-5960-847-5246
4	1N749AM	Semi-conductor	9N-5960-995-2312
5	1N759A	Semi-conductor	1N-5960-846-9157
6	1N3016B	Semi-conductor	9N-5960-833-8906
7	2N334	Transistor	9N-5960-809-9046
8	2N335	Transistor	9N-5960-552-0243
9	2N338	Transistor	9N-5960-474-6710
10	1N495	Transistor	9N-5960-754-5592
11	2N657	Transistor	9N-5960-752-6081
12	2N697	Transistor	9N-5960-964-8658
13	2N697	Transistor	9N-5960-964-8658
14	107-279		1N-5960-884-0212
15	107-317		1N-5960-803-5640
16	112-463		1N-5960-884-0217
17	202-333		1N-5960-884-0214
18	202-334		1N-5960-884-0211
19	202-359		9N-5960-884-0219
20	202-374		1N-5960-884-0223
21	202-447		1N-5960-884-0222

It is suggested this list be placed within the maintenance area for future reference. (673)

**COLLINS RADIO SET KWM-2A; POWER SUPPLY PM-2  
MODIFICATIONS**

Holders of the collins model KWM-2A having the attached type power supply PM-2 are advised that a Service Bulletin is available from the Collins Radio Co., Cedar Rapids, Iowa. The Bulletin is identified as PM-2 Bulletin No. 1, dated 17 April 1963.

The bulletin provides details on equipment modifications to extend the design specifications for input voltage limits. This modification **is not** intended to allow continuous operation at higher voltages, but to allow operation under wider fluctuations of line voltage such as those encountered in installations having poorly regulated primary power sources. This modification will allow momentary primary surges up to 150 volts without subjecting components to breakdown. This modification is recommended for installations which have experienced difficulties in line voltage regulation.

To determine if the modification is installed, remove the PM-2 dust cover. If there are two 100 UF capacitors under the speaker, this change has been made; if not, this change has not been made.

Modification kits as described in the Bulletin have **not** been procured by BUSHIPS. (666)

**MODEL 28 TELETYPEWRITERS, SELECTOR UNIT—  
INFORMATION CONCERNING**

The purpose of this article is to clarify difference in armature and armature springs used on various units.

Armatures with one anti-freeze button, part numbers 152424, 153543, and 160180, should be used with armature spring 151715. Adjustment requirement: (A) 1-1/2 to 2 ounces for 20 MA operation, (B) 2-1/2 to 3 ounces for 60 MA operation.

Armatures with two anti-freeze buttons, part number 195251, should be used with armature spring 104824. Adjustment requirement: (a) approximately 1/2 ounce for 20 MA operation, (b) approximately 3/4 ounces for 60 MA operation.

**NOTE: WITH THE SELECTOR MAGNETS ENERGIZED, THE FRONT ANTI-FREEZE BUTTON MUST BE IN CONTACT WITH ITS MAGNET CORE.**

The spring tensions given above permit operation of the typing unit prior to measurement of receiving margins. Refine the spring tension for maximum selector performance, with unit connected to specific circuit in which it is to operate.

When a distortion test set is available, refine the selector armature spring adjustment to meet selector receiving margins outlined in the Technical Manual.

The two anti-freeze button armatures are being used on the latest teletypewriter equipment being manufactured. This armature is a quick release armature that helps to overcome the adhesive effect of any oil film that may be present on the armature. (673)

**MOD 28 SERIES TELETYPEWRITERS AND TT-187/UG  
SERIES TRANSMITTER DISTRIBUTORS; MAINTENANCE  
OF GOLD CONTACTS UTILIZED FOR LOW-LEVEL KEYING**

The purpose of this article is to provide teletypewriter maintenance personnel with recommended maintenance procedures for the Gold Contacts used in low-level keying.

**CAUTION:** Care must be taken to ensure that Current and Voltage higher than the 110v d-c at 5 milliamperes not be allowed through the contacts as this will damage them. NEVER PLACE LOW/LEVEL GOLD PLATED CONTACTS ON A 20 or 60 MILLIAMPERES CIRCUIT FOR TEST OR CHECKING OPERATIONS

1. The gold-plated signal contacts may be strobed with a standard distortion test set (DXD) such as the TS-383/UG.

Current and voltage shall be limited to 110v dc at 5 milliamperes.

2. After strobing, clean the contacts only with TWILL JEAN CLOTH (KS2423). Burnishers, files or any type of abrasives shall not be used.

3. To clean the contacts, draw the center area of a Twill Jean strip up and down between the closed contacts but do not permit the edge of the strip to be drawn between the contacts. This procedure will prevent small fibers from the edge of the Twill Jean strip from lodging between the contacts.

4. The above recommended, on these contacts should be conducted at approximately every 1500 hours of operation or sooner if required due to improper operation.

5. After a period of service, loose specks or flakes of gold will collect in the contact box and the contact area may appear to have lost its plating. However, if clean, the contacts will conduct reliably even though the gold may not be seen without the use of a microscope.

6. When it becomes necessary to replace these contacts, order the complete contact assembly by teletype part nr. 179639, rather than individual parts in order to simplify installation.

Operating and maintenance personnel are advised that the operation of more than two teletypewriters from the output of the TSEC/KWR-37 may result in garbling. Under normal operating conditions, reliable operation of no more than two teletypewriters may be obtained from the output of the TSEC/KWR-37.

If operational requirements demand the operation of more than two teletypewriters from the TSEC/KWR-37, it is recommended that a Teletype corporation **selector magnet driver** be installed in each teletypewriter in excess of two in order to ensure reliable operation.

The general use of these **selector magnet drivers** on other teletypewriter circuits is not required not recommended.

These **selector magnet drivers** are available in Navy stock at an estimated cost of \$36.00 each. Pertinent supply data is as follows:

Nomenclature	Teletype Corp. Part No.	Federal Stock Number
Selector Magnet Driver (660)	177010	1N-5815-065- 9728



### RADIO RECEIVING SET R-390A/URR ANTENNA CONNECTIONS

The Operational Test and Evaluation Force, Pacific Projects Division, has reported that many R-390A/URR Receivers, on ships they have visited, are connected to the coaxial antenna cables in such a manner as to impair performance substantially. It is possible that the original yard installation may have been incorrectly made, and the situation may be similar in other ships using these receivers.

There are two antenna input terminals on the back of the receiver; one, J103 marked "WHIP-UNBALANCED" and a second, J104, marked "125 OHM-BALANCED." On all the receivers inspected, the coaxial cable from the antenna patch panel was connected to terminal J103, perhaps the logical place to connect it since the antennas themselves are whip antennas or unbalanced wire antennas. However, this input terminal J103 is intended to be used only where a **very short** wire or cable runs from the antenna to receiver, such as in a vehicular or jeep installation. In the average shipboard installation, the coaxial cable length from antenna to receiver is many feet. Under these conditions the coaxial cable from the antenna should be connected to terminal J104 using an UG-970/U adapter-connector. This connector is built so that it grounds one side of the input terminal J104, adapting it for use with unbalanced coaxial cables. Figure 10, on page 17, of the **Technical Manual** TM 11-856A, illustrates this connector and page 13, paragraph 15 b-(2) discusses this point.

Incorrect installation can make a very substantial difference in receiver performance. Tests made at 55-spaced frequencies, between 2 and 30 MC on an R-390A/URR Receiver have shown that the average audio output voltage due to signals picked up by a receiving antenna was 123 times, or 42 decibels, greater with the antenna cable connected through a UG-970/U adapter to input terminal J104 than with the cable connected to terminal J103. At ten of the 55 frequencies the audio output voltage was in excess of 500 times greater.

The reconnection is extremely simple to make. Detach the antenna cable from input terminal J103, fit adapter-connector UG-970/U to the coaxial antenna cable, and connect the combination to antenna input terminal J104.

### RADIO RECEIVER R-390A/URR-ORDERING ZERO ADJUST CONTROL

It has been found that there is no reference in the APL (Allowance Parts List, revised 1962) to the zero adjust control contained in Radio Receiver R-390A/URR. The receiver is purchased under Army contract, and has Signal Corp design cognizance. The subject part may be ordered using FSN N5820-784-9316 (Signal Corp drawing number SM-B-343663). Request replacement parts from: Electronic Supply Office; Great Lakes, Illinois; Attention: Mr. Flinn, Code 1016.

### R-390/URR, AVAILABILITY OF TRANSMISSION LINE RADIO INTERFERENCE FILTERS

See article in AN/SRR-11 section under the same title.

### TUNING RADIO RECEIVERS USING A FREQUENCY COUNTER

To set the frequency of a receiver with an electronic counter, the following system can be used effectively to better than one part in  $10^5$ .

Example: Tuning a high frequency receiver:

CAQI-524D	AN/URM-25	R-390/URR
or	Series	Receiver
AN/USM-26	Signal	Antenna
	Generator	

Connect the RF OUTPUT X 20,000 jack of the AN/URM-25 signal generator to the input of the 100 megacycle head of the counter. Adjust the AN/URM-25 MULTIPLIER dial to maximum attenuation and connect the RF OUTPUT X MULT jack output to the antenna input of the R-390/URR receiver in place of the antenna.

Then:

1. Place MOD SELECTOR switch of AN/URM-25 on OFF.
2. Place METER READS switch of AN/URM-25 on RF.
3. Vary carrier control until the meter of AN/URM-25 reads approximately full scale.
4. Vary the frequency of the AN/URM-25 until the desired frequency is read on the counter.
5. Turn receiver frequency dial to desired frequency reading.
6. Adjust the receiver for wide-band reception.
7. Vary the output attenuator of the AN/URM-25 until a voltage registers on the receiver output meter.
8. Decrease the receiver bandwidth to .1kc while varying the receiver frequency dial to obtain maximum signal strength reading on the receiver output meter.
9. The receiver will then be set on the frequency which is indicated on the counter. Verify receiver dial reading.

NOTE: On some models of AN/URM-25 the RF OUTPUT X 20,000 is designated HIGH RF and the MULTIPLIER dial is designated ATTENUATOR and reads in microvolts full scale.

### R390A/URR MAINTENANCE NOTES-REPLACEMENT OF DEFECTIVE CERAMIC FILTERS

Serial numbers 1 through 413 of the R390A/URR Radio Receiver manufactured by the Electronics Assistance Corp. under contract No. 22137-PC-60 used ceramic filters in lieu of mechanical filters in the IF Amplifier Assembly. When the ceramic filters fail they should be replaced with the mechanical filters listed in the equipment APL. It should

be noted that additional circuit changes are required to return equipment to operating condition. This is necessary since equipments having ceramic filters do not utilize the capacitors shown in figure 15 of NAVSHIPS 93053, Volume III. When replaced by mechanical filters, the capacitors are required. These capacitors were physically installed but not connected in equipments utilizing ceramic filters. This provided means for future mechanical filter replacement.

The following notes will be helpful when replacement is required: Refer to NAVSHIPS 93053, Volume III.

1. Ceramic filters have 2 terminals while mechanical filters have 3 terminals at each end. The ground terminal at each end of the mechanical filter should not be used.

2. Excessive heat during soldering may damage filters.

3. The capacitor assembly at the top and bottom may be removed to provide additional space for soldering. When connecting capacitors or remounting capacitor assembly, insure that the 51 mmfd fixed capacitors (C507 and C516) are in the correct location. Refer to figure 15, 39 and symbol number markings on side of IF assembly and filter cover for correct position.

4. The common lead on the bottom capacitor assembly should be connected to the ground lug nearby on the chassis.

5. The lead (orange-white) from bandwidth switch S-503-8 to top of filters, should be connected to the common side of the four filters.

6. Connect only associated capacitors to filter being replaced. Make sure the remaining capacitor leads will not touch circuit wiring.

7. Make sure that related wiring is as shown in figure 12 with an additional trimmer capacitor across input and output of mechanical filter installed.

8. Adjust trimmer capacitors in accordance with paragraph 64 b 10 of the technical manual using an AN/USM-116 in lieu of TS505.

9. Adjust the IF Gain following the procedure outlined in paragraph 73 of the technical manual. Check the bandwidth following the procedure given in the Maintenance Standards Book, NAVSHIPS 93053.42A. (668)

#### **R-390A/URR MAINTENANCE HINT-CAL ZERO ADJUST ASSEMBLY FAILURES**

In response to reports received, the following information will be helpful, when failures occur.

The CAL ZERO ADJUST Assembly, Symbol E-124, FSN 1N5820-784-9316, usually is repairable. This assembly fails due to the clutch disk breaking loose from the peened and rolled end of the shaft, when the CAL ZERO ADJUST knob is turned too far counterclockwise. To prevent unnecessary down time, have the local machine shop make the following repairs when failure occurs. The size screw thread used may vary, depending on tools and screws available, but the screw head should be pan-head type to work properly. Remove the CAL ZERO ADJUST assembly from the R-390A/URR (NAVSHIPS 93053, Vol. 3, para. 58). Have the machine shop cut off spindle flush at the end of the shaft, and then drill and tap for a 4-40 screw. The depth of the hole should be less than the length of the screw used (about 3/32-inch). A 3/8-inch screw with hole depth of 1/4-inch is recommended. Enlarge the disk center hole to accommodate the screw. Shorten the length of the screw to allow lateral movement (.003 to .006 inch clearance between the disk and the screw head) when assembled. This will allow flush engagement with the three clutch pins on the gear train assembly. Replace the assembly and adjust the helical ring clamp position behind the CAL ZERO ADJUST knob, for positive stop after engagement of clutch pins. (669)

**RECOMMENDED TOOLS FOR SERVICING TT-298 AND TT-299 SERIES MITE TELETYPEWRITERS**

The recommended tools for servicing the Model 28 Series teletypewriter equipment as well as all models of the TE-50 tool kit are not intended to service the TT-298 and TT-299. An entirely different set of tools is required for this new equipment. The following tools are recommended for servicing the TT-298 and TT-299 equipment and should be requisitioned through normal Navy supply channels by equipment holders:

Item	Mite Corp. Part No.	FSN
Wrench	4534	1N5120-015-1291
Wrench	2241	1N5120-015-0811
Handwheel	4533	1N5815-015-1292
Wrench	4535	1N5120-015-1293
Plug	4597	1N5815-015-1294
Antiseize	5146-1	1N5815-015-1295
Loctite	5145-2	1N5815-015-1296
Allen Key	5120-1	1N5120-015-1297
Allen Key	5120-2	1N5120-015-1303
Allen Key	5120-3	1N5120-015-1304
Allen Key	5120-4	1N5120-015-1313
Allen Key	5120-5	1N5120-015-1305
Allen Key	5120-6	1N5120-015-1306
Allen Key	5122-1	1N5120-015-1307
Allen Key	5122-2	1N5120-015-1308
Handle	5121-1	1N5120-015-1309
Handle	5121-2	1N5120-015-1298
Handle	5121-3	1N5120-618-3214
Handle	5121-4	1N5120-015-1300
Handle	5121-5	1N5120-015-1301
Handle	5121-6	1N5120-015-1302
Wrench	5029-1	1N5120-824-1485
Wrench	5029-2	1N5120-051-2894
Wrench	5029-5	1N5120-051-2895
Cable Test	561	1N5995-571-7248
Jumper	2548	1N6625-015-1311
Grease	5041-1	9W9158-205-6843
Oil, Light	5042-2	9W5815-412-7065

**TT-298B/UG AND TT-299(SERIES)/UG—MAINTENANCE HINTS**

The electrical and mechanical systems of the teletypewriter set are delicate equipment and must be so treated. Many cases of equipment malfunction can be attributed to **CARELESS ATTEMPTS** at repair or adjustment by maintenance personnel. Caution must be exercised to prevent abuse to the unit. Only qualified graduates of an approved maintenance course should repair this teletypewriter. Pay particular attention to the following:

1. Never lift the printer from the base by the advance drum or take-up drum, because of their fragility. The mounts bend, which causes a misalignment of the advance ratchet, and the check or feed pawls. This can damage the drum and cause excessive wear of the pawls.
2. After twenty-four hours of operation, it is necessary to clean the cylinder, yoke, and hammer shafts with a soft lint-free cloth. If exceptionally dirty, apply a few drops of oil to the shafts while they are running, and then wipe completely dry. Wipe off all dust, lint, and paper shavings.
3. Never use a cotton ribbon. Use only nylon, as recommended.
4. The Mite Corporation has developed a new, recommended lubricant with the trade name, Non-Fluid-Oil (NFO). This is the only oil to use on the clutches and other locations, as recommended by the Technical Manual, NAVSHIPS 95898. The normal lubrication interval for NFO is 500 hours. (672)

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