NAVSHIPS 900,000.4
(0967–000–0040)

NON-REGISTERED

ELECTRONICS INSTALLATION AND MAINTENANCE BOOK

TEST EQUIPMENT

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

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TEST EQUIPMENT

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CHANGE 3 TO
NAVSHIPS 900,000.4
(0967-000-0043)

February 1966

INSTRUCTION SHEET

This sheet provides instructions for inserting Change 3 to the Test Equipment Handbook, NAVSHIPS 900,000.4

The purpose of this change is to update the FRONT MATTER, Section 3, and add additional entries to Section 4 of the Test Equipment Handbook.

It should take no more than ten minutes to complete this change, if the following instructions are followed.

1. Remove superseded pages and insert changed pages as indicated below:

Page	Remove	Insert
	FRONT MATTER	
TP/ii	Change 2/Change 2	Change 3/Change 3
	SECTION 3 - FCIG	
3-1/3-2	Change 2/Change 2	Change 3/Change 3
3-3/3-4	Change 2/Change 2	Change 3/Change 3
3-5/3-6	Change 2/Change 2	Change 3/Change 3

2. In Section 4 all pages should be inserted in an alphabetical and numerical sequence.

	SECTION 4 - SERVICE NOTES	
4-SN-1,2	Original/Original	Original/Change 3
AN/USM-26:1	- -	Change 3/Blank
AN/USM-116:1	Change 1/Blank	Change 3/Blank
AN/USM-117:1	- -	Change 3/Blank
CBTV-C-A:1	Change 1/Blank	- -
CBTV:1	- -	Change 3/Blank
OS-8A/U:1	Original/Blank	- -
OS-8/U:1	- -	Change 3/Blank

3. Destroy superseded pages only after a check has been made against this instruction to assure that changed pages and final tear-out page have been inserted.

4. Record all previous entries of changes and the accomplishment of this change in pen-and-ink on the RECORD OF CORRECTION MADE page.

5. Insert USER ACTIVITY TECHNICAL MANUAL COMMENT SHEET, NAVSHIPS 4914, as last page of handbook.

1-AN/DSM-4—Incorporation of DC Firing Circuit in Missile Starting and Launching Console Model OA-663/DSM-4.
Correction material: T- to NS
1-A FA-60 98572
SERIAL: 1 thru 6
IDENTITY: Field change nameplates installed on front of console

1-AN/FSM-5A—Replacement of Type 5696 Tubes with Type 5727/2D21W
Correction material: T-1 to NS 91327(A)
1-A FA-8 98914 None
SERIAL: All
IDENTITY: Type 5696 tubes replaced with 5727/2D21W

1-AN/PRM-1 – BFO, install
Correction material: Change 1 to NS 91255
A FA-4 NS98272 F6625-642-5991
SERIAL: 1-220
IDENTITY: BFO toggle switch on front panel

1-AN/PSM-1 – Conversion of ZM-13/PSM-1 and ZM-14/PSM-2 Insulation Test Sets from Vacuum Tube to Selenium Rectification
Correction material: to NS91430
2-A FA-4 None
SERIAL: ZM-13/PSM and ZM-14/PSM-2 which are part of AN/PSM-1, -2
IDENTITY: Selenium Rectifier in place of Vacuum tube.

1-AN/PSM-2 – Same as 1-AN/PSM-1

1-AN/PSM-4 –Cancelled

1-AN/PSM-4A – Cancelled

1-AN/UDM-1 – Spring load safety device
Correction material: None
A FA-6 NS98542 F6665-696-9048
SERIAL: All
IDENTITY: Actuator lever can be locked in safe (closed) position.

2-AN/UDM-1 – Radiac calibrator container, install
Correction material: See 98878
B YF-2 NS98878 F6625-646-4762
SERIAL: All
IDENTITY: Cobalt 60 source replaced by Cesium 137.

1-AN/UPM-1 – Power fuse chg
A FA-½ NS98779 F5840-695-0169
SERIAL: (CHC)1-144
IDENTITY: The 5 amp fuses are replaced with 3 amp fuses.

2-AN/UPM-1 – Not applicable

3-AN/UPM-1 – Hor centering and focus cont, add
A FA-1 NS98779 None
SERIAL: (CHC) 1-144
IDENTITY: R-182, R-190, and R-191 are removed and their former common connection is returned to ground.

4-AN/UPM-1 – RF pulse rise time
A FA-1½ NS98779 None
SERIAL: (CHC) 1-5
IDENTITY: R-604, between junction of L-614, C-606 and the junction of L-607, C-603, is changed in value from 2,200 ohms to 10K ohms.

1-AN/UPM-1B – Power fuse change
A FA-½ NS98779 F5840-695-0169
SERIAL: (CIH) 1201-1421
IDENTITY: The 5 amp fuses are replaced with 3 amp fuses.

2-AN/UPM-1B – Antenna assy, incorrect
A FA-3 NS98779 None
SERIAL: (CIH) 1201-1422
IDENTITY: Disconnect any cable going to the ant. Check continuity between the two quarter-wave elements by touching one lead to the outer shell of the coaxial connector in the base of the ant. There should be no continuity. If continuity exists, field change has not been performed. Recheck as before.

3-AN/UPM-1B – Same as 3-AN/UPM-1 - except
SERIAL: (CIH) 1201-1335

4-AN/UPM-1B – Same as 4-AN/UPM-1 - except
SERIAL: (CIH) 1201-1202

1-AN/UPM-2 – Crystal replacement
Correction material: See NS 98780
A FA-¼ NS98780 None
SERIAL: All
IDENTITY: The 7 1N21 crystals are replaced with 1N25 crystals. 2 crystals are in wavemeter, 5 crystals are in the lid of carrying case.

*1-AN/UPM-4A – Conversion to provide Mark 10 SIF test capability.
Correction material: TM for AN/UPM-99, NS93520
2-B YF-80 NS981141 F5840-586-0825
SERIAL: All
IDENTITY: Modifies equipment designation to AN/UPM-99.

1-AN/UPM-6A – Electron tube contact, repl
Correction material: to NS91467(A)
A FA-1 NS98284 F6625-301-9582
SERIAL: 1-219, 221-640, 688-872
IDENTITY: Electron tube contact replaced with Hazeltine Part No. SF-.0123-B

1-AN/UPM-6B – Same as 1-AN/UPM-6A

2-AN/UPM-6B – Modif for use w/KY-137/UPA-39
Correction material: T-3 to NS 91467(A)
B YF-4 NS98506 F5840-311-3284
SERIAL: All
IDENTITY: Adds new "video out, mod in" jack to the left of the attenuator dial.

1-AN/URM-25D – Procedure for Grounding the AN/URM-25D through the Power Receptacle.
Correction material: None
2-A FA-2 NS981675
SERIAL: All which employ a two-conductor power cable and have no provisions for grounding the equipment.
IDENTITY: Substitution of the two-conductor power cable with a three-conductor grounded tape cable.

2-AN/URM-25D–Protective Cover for Capacitors C168 and C169
Correction material: None
2-A FA-3 None
SERIAL: All
IDENTITY: Presence of an extended cover over capacitor tips C168 and C169

1-AN/URM-26A – Procedure for Obtaining Pulse Modulation
Correction material: NS91973.42
2-A FA None
SERIAL:
IDENTITY:

1–AN/URM-26B – Improving External Modulation
Correction material: T– to NS92890
2-A FA- None
SERIAL: Equipments Produced under NObsrs-85408, 57537, 71785, 59607, 75368, 75645, 75905, 81404 and 87368.
IDENTITY:

1-AN/URM-43–Securing Crystal Holders
Correction material: None
2-A FA-1 None
SERIAL: AN/URM-43 (or ME-11/U) series that are not spring loaded or have no device for securing the crystal holder

1-AN/URM-43A – Replacement of scale selector switch S-101 on wattmeter ME-11/U for easier calibration.
Correction material: T1 to NS91842
2-A FA-1/2 NS981239 None
SERIAL: All
IDENTITY: Substitution of SPDT Switch with a DPDT Switch.

1-AN/URM-47 – Impulsive interf measure, simplified
Correction material: See NS 98812 method
A FA- NS98812 F5820-501-1955
SERIAL: All
IDENTITY: Front panel contains 2 K ohms, 2 W pot for output control

2-AN/URM-47 – R-167, remove; band 6, improve & recalibrate
SERIAL: All
IDENTITY:

1-AN/USM-3A – Resistor in signal tracer, repl
Correction material: T-1 to NS 91688
1-A FA-½ NS98358 F6625-302-1066
SERIAL: 1-2740
IDENTITY: R-212 now 51K. (N16-R-50497-431)

1-AN/USM-23 – BS-1 tube holder, modif
Correction material: None
2-A FA-2 NS98616 F6625-325-7499
SERIAL: All
IDENTITY: A phosphor bronze strip in bottom half of tube holder

1-AN/USM-24 – Synch, int, sweep stab & vert atten ckt, modif
Correction material: Change 1 to NS 91687(A)
1-A FA-2 NS98620 F6625-325-7490
SERIAL: All
IDENTITY: AN/USM-24B nameplate flush with and under original nameplate

1-AN/USM-24C - Elimination of input power frequency modulation
Correction material: None
2-A FA-¼ NS981163 None
SERIAL: All
IDENTITY: Coaxial cable between sweep delay switch S15-1R, ter. 8, and pin 7 of V28.

1-AN/USM-32 – Modify of test prod tips
2-A NS981430 None
SERIAL: 1-2694
IDENTITY:

2-AN/USM-32 – Reinforcement of Front Panel Corners
Correction material: None
2-A FA-1/4 NS981568 None
SERIAL: All
IDENTITY: Presence of a small stainless steel strengthener mounted on each corner of the equipment front panel.

1-AN/USM-34 – 400 cps freq response, improve
Correction material: Pages D and E of Supplementary Instruction Book NS 92197-1
A FA-1 NS98824 F6625-505-2743
SERIAL: 1-2231
IDENTITY: Modification to improve frequency response at 400 cycles

2 – AN/USM–34 – Series limiting resistor to protect rectifier CR102
2–A FA–1 NS981217 None
SERIAL: All
IDENTITY: New resistor R146, 10 ohm, ½ w, between T101 and CR102.

1-AN/USM-105 – Increased Cooling
Corrected material:
2-A FA
SERIAL:
IDENTITY:

2-AN/USM-105 – Replace Intensity Limit Potentiome er R325
Correction material: T-1 to NS93685A, T-2 to NS93482A
1-A FA-2 NS981768 F6625-691-6105
SERIAL: All
IDENTITY: The new Intensity Limit Potentiometer and a gray insulated stand-pff which extends approximately one inch below the mounting bracket.

1-AN/USM-105A – Same as 1-AN/USM-105

2-AN/USM-105A – Same as 2-AN/USM-105

1-AN/USM-115–Adds adjustments to PRF scale factor and 75% multivibrator period
Correction material: Changes 1 and 2 to NS 94648
1-A None 981665 F6625-050-8901
SERIAL: A1 thru A60
IDENTITY: Additional adjustments to PRF scale factor

2-AN/USM-115 – Fuse Change (1F3 and 1F4)
Correction material : CH-2 to NS94648
2-A FA-1/4 None
SERIAL: A1 thru A340
IDENTITY: Presence of 1/4-ampere fuses in place of 1/8-ampere fuses in the 32-volt and 175-volt power supplies.

3-AN/USM-115 – Capacitor Replacement to Improve Stability
Correction material: CH-2 to NS94648
2-A FA-2 None
SERIAL: A1 thru B71
IDENTITY: When the 330-ohm resistor (R18) has been replaced with a 1000-ohm resistor, and when the 560-uuf capacitor (1A7C8) has been replaced with a 270-uuf capacitor.

4-AN/USM-115 – Replacement of Type 2N498 Transistor with Type 2N697
Correction Material: CH-2 to NS94648
2-A FA-1 None
SERIAL: A1 thru B329
IDENTITY: When type 2N498 transistor (1A8Q3) in subassembly 1A8 has been replaced by a type 2N697 transistor.

1-AN/USM-116A – Unit Ungrounding and extending Insulation Coverage of AC Probe
Correction material: None
1-A FA-1
SERIAL: All (1 thru 1472)
IDENTITY: Check with ohmmeter between common lead of AN/USM-116A and ground wire on AC plug. Resistance reading should be greater than 150K.

1-AN/USM-117 – Eliminate Oscillations
Correction material: T- to NS94344(A)
2-A FA-½ NS None
SERIAL: All
IDENTITY: Reading the values of the capacitors printed on capacitor case C824 and C825

2-AN/USM-117 – Improve Stability of Trigger Circuit
Correction material: T-2 to NS94344(A)
2-A FA-3 NS981762
SERIAL: All
IDENTITY: Addition of ground strap and line filter

3-AN/USM-117 – Retrofit of Support Rails for Case Interchangeability
Correction material: None required
2-A FA-1
SERIAL: Equipments which will not fit inside a replacement combination case
IDENTITY:. Observation that the AN/USM-117 will not slide completely into the combination case

1-AN/USM-118A – Improvement of Reliability of Cardmatic Switch and GM Bridge
Correction material: T-1 to NS93883
1- FA-2 NS981651
SERIAL: AN/USM-118A equipments, ser A, B, and C
IDENTITY: A 6.8K, 1-watt resistor between terminals "C" and "S" of P101.

2-AN/USM-118A – Modification to Improve Reliability and Accuracy
Correction material: T– to NS93883
1-A FA-8
SERIAL: Equipments with name plates NObsr 85003, 87278, 87343, Serials A1 to A300, B5 and C1 to C101, respectively; also N600(24) 59983, serials D1 and D93.
IDENTITY:

3-AN/USM-118A – Installation of TAUT-Band Meter and Replacement of Potentially Wave Components in Semi-Automatic Tube Test Set.
Correction material: T-2 to NS93883
1-A FA- NS981805
SERIAL: All with name plates NObsr-85003, 87278, 87343 Serial numbers A1 to A300, to B5 and C1 to C10 respectively; also N600(24 59983 Serial numbers D1 to D93.

1-AN/USM-139 – Same as 1-AN/USM-105

1-AN/USM-140A – Same as 1-AN/USM-105

2-AN/USM-139 - Same as 2-AN/USM-105A

1-AN/USM-141 – Same as 1-AN/USM-105

1-LM - Addition of adjustment lever for correction dial
Correction material:
FA- NS98782 None
SERIAL: All
IDENTITY:

2-LM – Adjust trimmer capacitor.
Correction material: None
2-A FA-1 NS981192 None
SERIAL: All
IDENTITY: Hole drilled on the left lower side of the case and sealed with a sheet metal plug.

1-LM-1 – Same as 2-LM

1-LM-2 – Same as 2-LM

1-LM-3 – Same as 2-LM

1-LM-4 – Same as 2-LM

1-LM-5 – Same as 2-LM

1-LM-6 – Same as 2-LM

1-LM-7 – Same as 2-LM

1-LM-8 – Same as 2-LM

1-LM-10 – Same as 2-LM

1-LM-11 – Same as 2-LM

1-LM-12 – Same as 2-LM

1-LM-13 – Same as 2-LM

1-LM-14 – Same as 2-LM

1-LM-15 – Same as 2-LM

1-LM-16 – Same as 2-LM

1-LM-17 – Same as 2-LM

1-LM-18 – Same as 2-LM

1-LM-19 – Same as 2-LM

1-LM-20 – Same as 2-LM

1-LM-21 – Same as 2-LM

1-LM-22 – Same as 2-LM

1-ME-6D/U – R119 to correct L-F stab, repl
Correction material: T-1 to NS 92423
A FA-10 NS98652 F6625-642-5983C2
SERIAL: 1-79
IDENTITY: R-119 having resistance of 150K

1-MX-2962/USM – Addition of External Intensity Modulation
Correction material: T-1 to NS93409
2-A FA-6 NS981648
SERIAL: All for AN/USM-105A and AN/USM-140A
IDENTITY: A DPDT toggle switch and a trigger input jack mounted adjacent and below the DEL TRIG OUTPUT jack and above the LOCK on the front panel.

1-OAA – Not applicable

2-OAA – Choke coil, repl
A FA-3 F5840-694-6298
SERIAL: All w/SA, SC, SK, SR
IDENTITY: L-101 is replaced with L-101A. New coil vertically mounted and wound on white ceramic with tuning slug

1-OAA-2 – Term. resistor for co-ax line
A FA-½ F6625-311-2458
SERIAL: 1-1437
IDENTITY: R-101 is replaced with a 56 ohm, ½w

2-OAA-2 – Same as 2-OAA – except
SERIAL: All

1-OCV – RF cable, repl
Correction material: T-1 to NS 3
A FA-1 NS98 None
SERIAL: 1-100
IDENTITY: Single plane twin axial rf cable w 101, w 302 and w 303 replaced with flexible cable N. T. CG-444/U

2-OCV – Noise field intensity mtr TS-587/U, convert to
Correction material: None
B YF-16 NS98076 F6625-302-4264
SERIAL: 1-100
IDENTITY: Power supply identification plate is PP-267/U

1-OS-8/U - Removal of Exposed High Voltage From Top Panel
Correction Material; T- to NS 91272
2-A FA-2
Serial; All
IDENTITY; A 0.15 uf capacitor (C142) installed between E104 and pin 7 of V104

1 – OS–8A/U – Repl resistor R–146
2–B FA–1 None
SERIAL: All
IDENTITY: No visible means

1-OZ – "low"-"normal" signal sw & tube adapter MX-1123/U, install
A FA-1 NS98199 F6625-346-4645
SERIAL: All
IDENTITY:

1-OZ-1 – Same as 1-OZ

1-OZ-2 – Same as 1-OZ

1-PP-530/URM-17 – Correction of Error in Basic Design
Correction material: To NS91388
2-A FA-1 None
SERIAL: All which have not been similarly modified in production.
IDENTITY: Presence of an additional 47K resistor connected in parallel with resistors R-305 and R-306.

1-SG-132–Sweep Generator—Addition of Capacitor to Improve FM Diviation
Correction material: T- to NS
2-A FA-2 None
SERIAL: Equipment manufactured by Bay State Electronics Corp.

1-SG-132A – Same as 1-SG-132

1-TE-50-A – Tools, add
A -¼ NS98363 F5180-512-5527
SERIAL: All
IDENTITY: Tools contained to serve TTY TT-47, 48, 69, 70/UG

1-TS-28/UPN – Ringing effect, eliminate
Correction material: See NS 98784
A FA-2 NS98784 None
SERIAL: All
IDENTITY:

1-TS-120/UP – Pulse forming circuit, chg
Correction material: None
A FA-2 NS98785 None
SERIAL: 1-4
IDENTITY: The suppressor grid of V-103 is connected to ground. R-144 is changed to 5.1K. R-145 is changed to 1.2K.

1-TS-270B/UP - Modif to tuned cavity FR-90/FPN-28
A FA-6 NS98948 None
SERIAL: Accomplish as necessary to obtain a tuned cavity FR-90/FRW-28
IDENTITY: A jumper is added between the unused bottom terminal and the center terminal of capacitor, C-387.

1-TS-488/U – Modif to tuned cavity FR-89/FPN-28
Correction material: None
A FA-4 NS98929 F5840-543-1281
SERIAL: Accomplish as necessary to obtain a tuned cavity FR-89/FRW-28
IDENTITY:

1-TS-488A/U – Same as TS-488/U – except
SERIAL: Accomplish as necessary to obtain a tuned cavity FR-90/FRW-28

1-TS-573/UP - F.C. not issued

1-TS-587/U – Improve R.F.
Correction material: See NS 98882
B YF-44 NS98882 F6625-566-7098
SERIAL: To be designated
IDENTITY: Front panel contains noise diode output nameplate and control R-622.

1-TS-890/URN-3 – Modification of TS-890/URN-3 to upgrade performance to that of the TS-890A/URN-3 modifies equipment to TS-890C/URN
Correction material: T-2 to NS93231
1-B YF-24 NS981332 F5820-624-8826
SERIAL: All
IDENTITY:

2-TS-890/URN-3–Modification of RF Unit Cover to Facilitate Alinement
Correction material: None
2-A FA-4
SERIAL: All
IDENTITY: Presence of three snap hole plugs on right side cover of RF unit

1-TS-890A/URN-3 – Same as 2-TS-890/URN-3

1-TS-890C/URN-3 – Same as 2-TS-890/URN-3

1-TS-1100/U – Modification improve the Activation of the "Short" Test Lamps to Comply with Military Specifications
Correction material: T– to NS93277
2-A FA-2 None
SERIAL: All equipments under NAVSHIPS 93277
IDENTITY: Two (2) half watt resistors (fixed, composition), mounted on the back of S-2, rotary switch.

1-TV-3/U – Modernize equip, repl roll chart
Correction material: Change 1 to NS 91254
1-A -1 NS98641 F6625-642-8716
SERIAL: All
IDENTITY: Front panel contains nameplate "filament toggle switch"

***2-TV-3/U** – Repl actual test tube socket.
Correction material: None
2-A FA-½ NS981191 None
SERIAL: All
IDENTITY: No visible means of indentification.

1-TV-3A/U – Modernize equip, repl roll chart
Correction material: Change to NS 91435
1-A -1 NS98639 F6625-642-8717
SERIAL: All
IDENTITY: Front panel contains nameplate "filament toggle switch"

***2-TV-3A/U** – Same as 2-TV-3/U

3-TV-3A/U–Addition of Calibration Potentiometer
Correction material: to NS 91435
2-A FA-4 None
SERIAL: All
IDENTITY: Presence of potentiometer mounted on back of cathode selector switch

1-TV-3B/U – Modernize equip, repl roll chart
Correction material: Change 1 to NS 91747
1-A -1 NS98640 F6625-642-8717
SERIAL: All
IDENTITY: Front panel contains nameplate "filament toggle switch"

***2-TV-3B/U** – Same as 2-TV-3/U

3-TV-3B/U – Same as 3-TV-3A/U

1-TV-3C/U – Not issued

***2-TV-3C/U** – Same as 2-TV-3/U except
Correction material: T-2 to NS92193

***1-TV-10/U** – Same as 2-TV-3/U

1-60ABM – Interconnecting cable, repl
Correction material: None
A FA-1 NS98781 F6625-346-4679C3
SERIAL: 1001-1347 & 91 wavemeters w/o nameplates
IDENTITY: No collar is used on new plug and a denter conductor positioning washer is supported between the bushing and the shell.

1-49992 (CV) – Storage box, add
Correction material: T-1 to NS 900,781(A)
A FA-¼ NS98173 None
SERIAL: All
IDENTITY: Storage box associated with equipment

1-60007 – Resistor chg
Correction material: T-1 to NS 900,628
A FA-1½ NS981086 None
SERIAL: All
IDENTITY: R122 & R101-104 are all single carbon film.

1-60069 – Output cont, add
Correction material: See NS 98874
A FA-½ None
SERIAL: All used w/ Loran skywave trainers
IDENTITY: Front panel contains 2 k ohm, 2 w pot for output control

TESTER FOR GAS RECTIFIER TUBES

Continuing service is of prime importance in Navy transmitting equipment. While reliability of operation has been increased through improvements in technology and maintenance techniques, unpredictable failure of gas rectifier tubes remains one of the most consistent causes of equipment break-down. One approach to this problem is the utilization of tube testing equipment which will accurately determine cathode condition of the tube. The rectifier could then be replaced at the end of its useful life, before and "in-service" failure.

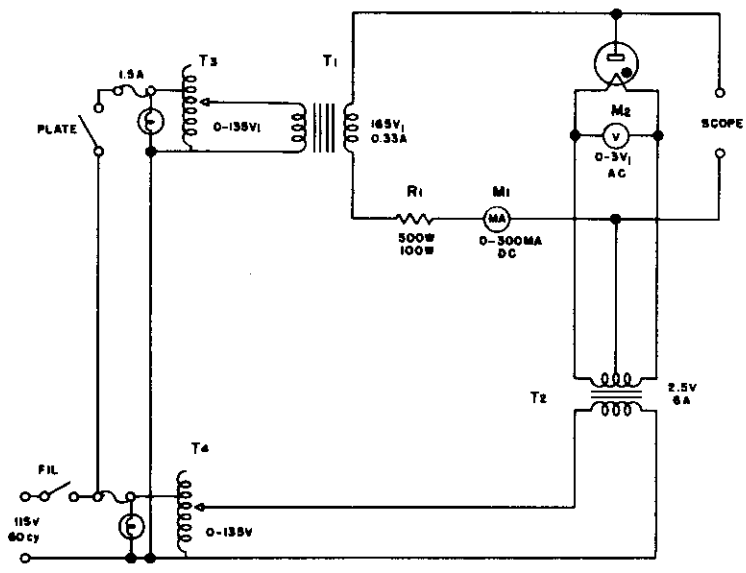
A tester and conditioner for gas rectifier tubes based on the principle of internal voltage drop* is in use at NAVRADSTA(T) Laulualie and NAVCOMSTA Pearl Makalapa Transmitter Station. Employment of the tester in routine preventive maintenance has reduced transmitter outage, resulting from gas rectifier tube failure, to negligible proportions. The device is also used in the "aging" or removal of mercury from the electrodes of mercury-vapor tubes** which have been transported or otherwise shaken.

* Austim V. Eastman, "Fundamentals of Vacuum Tubes", pg 99, McGraw-Hill Book Co., New York, 1941, Second Edition.

** Fame Dillon Cobine, "Gaseous Conductors", pg. 449, McGraw-Hill Book Co., New York, 1941

The principle of operation of the tester is measurement of the internal voltage drop of the rectifier under rated load. An oscilloscope is used, without amplifiers and with the sweep generator synchronized with the power source. It is connected between the tube plate and cathode. The resultant pattern will show a full cycle one-half being sinusoidal during the nonconducting half-cycle and the other half being a trace of the instantaneous voltage drop during conduction. The tube voltage drop will be indicated by an almost vertical line at the start of conduction, and this is used as the criterion of gas rectifier performance. For mercury-vapor types, normal tube drop is around 12-15 volts; this value increasing with the loss of cathode effectiveness. A drop of approximately 25 volts indicates the useful life of the tube has been reached, and failure is imminent. For rectifiers using gas other than mercury vapor, any sudden rise in tube voltage drop from one check to the next is an indication of the approach of the end of the tube life. It is stressed that with all gas rectifier tubes, the cathode must always be brought to full operating temperature prior to the application of plate voltage in order to prevent the partial or complete destruction of the cathode coating with a resultant shortening of tube life or immediate failure.

A typical tester circuit (for the Type 866/866A mercury-vapor rectifier) is shown in the accompanying figure. The testing of tube types with different specifications with respect to filament voltage and current, rated plate current, and base type will require suitable modifications to the parts selected for the tester. At the time of construction, consideration should be made of the various gas rectifiers employed at the activity, and components selected, so that one tester may be used for all tube types.



PART LIST		
CKT SYM	SNSN	DESCRIPTION
M1	SNSN 17-M-19392-6791	METER, DIRECT CURRENT, 0-300ma
M2	SNSN 17-M-33778-4711	METER, AC VOLTAGE, 0-3v
R1	SNSN N18-R-61861-8500	RESISTOR, FIXED, WIREWOUND, 500 ohms, 100 watts
T1	SNSN N17-T-77494-7508	TRANSFORMER, PRI. 115v. 60 cy; Sec. 165v at 0.33 ma
T2	SNSN N17-T-70595-5690	TRANSFORMER, PRI. 115v. 60 cy; Sec. 2.5v at 6A
T3	SNSN N17-T-83603-1736	AUTOFORMER, VARIABLE 0-135v, 1.7 kva
T4	SAME AS T3	

Note:
MISCELLANEOUS PARTS SUCH AS AC CORD AND PLUG, SWITCHES, PILOT LIGHTS, TUBE SOCKET, TERMINAL STRIPS, ETC. TO BE OBTAINED FROM LOCAL SOURCES.

GAS FILLED RECTIFIER TUBE TESTER

Fig-1 TESTER FOR TYPE 866/866A TUBES

All gas rectifier tubes in use should be checked during preventive maintenance. A simple dated log of the checks made on each tube showing the tube voltage drop under fixed conditions of filament voltage and rated plate current will give the progressive data needed to determine the point of imminent tube failure. To keep paper-work to a minimum, the data could will be recorded in the form of a graph of the tube voltage drop plotted against the date of the test made. Each check would then required but the addition of one point and the extension of the curve.

It has been found that if provision is made for vertical stowage of mercury-vapor rectifiers, the tubes can be given their initial "aging" by the application of filament voltage for 30 minutes, and then stored for immediate use, provided their vertical positioning is maintained and they are not shaken. All gas rectifiers should be checked prior to installation, and should be tested, as with the "aging" of mercury-vapor types, between periods of routine maintenance so that a supply of tubes know to be good is available for immediate use at all times.

Dominick Constantino, ETC, NAVRADSTA, Laulualei
Robert C. Doyle ETC, NAVCOMSTA, Pearl

BUREAU NOTE: **The preceding article is an excellent example of the interest and initiative displayed by our Navy Technicians in evolving methods and constructing devices to further the cause of effective maintenance. The gas rectifier tube testing device is not a "cure-all" and does not give a full answer to whether a tube is good for all applications covered by the JAN-1A specification. It does give a general idea as to whether the tube is operable and may be useful to other activities.**

REPAIR OF ELECTRONIC TEST EQUIPMENT

Much of the test equipment now being furnished to Naval activities is very expensive and is built and calibrated to a high order of precision. Repair and recalibration quite often require special laboratory facilities and skill. In many cases, maintenance personnel not qualified by reasons of education, experience, and/or adequate facilities, have attempted to make repairs to precision portions of electronics test equipment, as a result, the equipment was in such a condition that only expensive laboratory repair could return the equipment to its proper operating condition. Although it is recommended that each activity accomplish all repairs within its capabilities, it must be realized that lack of qualified personnel or adequate facilities will limit the kind of repairs each individual activity should attempt. In generol, when maintenance of test equipment requires repair of critical calibrated or frequency determining circuits, the capability of the repair personnel to make proper repairs should be carefully reviewed before attempting any work. When repairs are accomplished locally, careful attention to the technical manual procedures and meticulous repair and assembly of parts is essential. When repairs cannot be properly accomplished by repair personnel or when the necessary post repair calibration is beyond the capabilities and facilities of repair personnel, the equipment should be forwarded to the nearest maintenance activity which has adequate repair and calibration facilities.

SHIPBOARD REPAIR AND CALIBRATION OF TEST EQUIPMENT

Reports from the fleet indicate that ET's are reluctant to repair or calibrate test equipment aboard individual ships. The principal reason for this seems to be the belief that test equipment cannot be calibrated except with special calibrating instruments. However, in many cases, test equipment is available aboard most ships which is sufficiently accurate for use in calibrating other test equipment aboard that ship.

The Bureau of Ships expects electronic technicians to perform a certain amount of maintenance and calibration of their own test equipment whenever possible. The repair parts necessary to make repairs may already be aboard ship. If they are not, they can be ordered through the Electronic Supply System.

Calibration of one piece of test equipment with another requires that the calibrating instrument be more accurate than the instrument being calibrated. Ideally, the calibrating instrument should be about ten times more accurate, however, this extreme accuracy is not always necessary. Consider Multimeters as an example. They are the most used and also one the most frequently sent totenders for repair and calibration, although they are the easiest to repair and calibrate. Voltmeters and ammeters with accuracies of 0.75 and 0.5% are usually put aboard ships in the custody of the electricians. These equipments may be used to calibrate the multimeters used in the fleet. Another example is that of frequency calibration of signal generators such as the AN/URM-26. Any ship with an AN/USM-29 or TS-186/U frequency meter aboard can calibrate the lower accuracy instruments as far as frequency is concerned. Just remember that if the tender crew is relieved of the simpler test equipment repair jobs, they will have more time to get the tough jobs done.

Always be sure you have read the Technical Manuals of both the "Calibration Standard" and the instrument to be calibrated.

PROTECTION OF MICROWAVE COMPONENTS FOR TEST EQUIPMENT

It has been noted that coaxial, waveguide, and variable attenuators, coaxial termination, lowpass and bandpass filters, and directional couplers have been damaged as the result of abuse and/or mishandling during storage and use. Such items frequently are procured from commercial sources and are not normally supplied with storage cases. It is recommended that labels or tags be attached to these items with the following notation.

WARNING
DELICATE INSTRUMENT
HANDLE WITH CARE

Additionally, it is recommended that whenever practical, protective cases be fabricated from thin wood, plywood, corrugated cardboard, or other suitable material which may be available locally. When the protective cases, originally supplied with the equipment, provide satisfactory storage, it is suggested that equipment be returned to them when it is not in use.

AN/USM-26 OSCILLATOR INSTABILITY

Background.—Successful communications using single sideband techniques are largely dependent on the accuracy with which the transmitter/receiver combination can be maintained precisely on a discrete operating frequency.

Recent developments in the art of frequency synthesis have produced frequency synthesizers for use with transmitters and receivers which meet the stability requirements necessary for successful single sideband communications.

The fact that the stability of the frequency standards used with frequency synthesizers is continually being improved makes improved frequency measuring techniques mandatory.

The design specifications for the AN/USM-26 Frequency Counter calls for the internal frequency standard to be stable within ±2 parts in 10^6 per week. Applying simple arithmetic shows that this design tolerance can account for an error of 30 cycles per week at 15 mc. Recent tests by a U.S. Naval Aviation Engineering Service Unit indicates that the internal frequency standard in the AN/USM-26 does not exceed its design specification.

In other words, the AN/USM-26 will not provide reliable frequency measurement on an equipment whose internal frequency standard is inherently more stable than the internal frequency standard used in the AN/USM-26 Frequency Counter.

The Problem.—Transmitters designed for single sideband operation, such as the AN/URT-18 and the AN/FRT-39B-D, are equipped with extremely stable internal reference standards which discipline the synthesizers used to produce the final transmitter output frequency.

Frequency synthesizers for new radio transmitters, and sythesizers for use with radio receivers which are currently under development and/or procurement, will possess internal frequency standards with stabilities better than 1 port in 10^8 per day.

Activities attempting to use the AN/USM-26 Frequency Counter to measure the output frequencies of ultra-stable radio transmitters and receiver frequency synthesizers should be aware of the limitations stated above.

The Fix.—The fix is simple. Connect the 100-Kc output frequency from the station frequency standard AN/URQ-9 to the "EXT. STD. IN" connector of the AN/USM-26 Frequency Counter. The stability of the internal reference standard in the AN/URQ-9 is better than 1 part in 10^8 per 60-day period. This degree of stability is more than adequate to provide accurate frequency measurements when the gating circuits in the AN/USM-26 are disciplined by the 100-Kc standard frequency output from the AN/URQ-9.

Activities provided with AN/URQ-9 Frequency Standard are urged to install the coaxial cabling required to facilitate use of the 100-Kc standard frequency output from the AN/URQ-9 in lieu of the internal standard normally used with the AN/USM-26 Frequency Counter. Figure 1 illustrates of typical hook-up.

AN/USM-116 ELECTRONIC MULTIMETER

USS Forrestal has reported an error in NAVSHIPS 93808, page 4-3, paragraph 4-2A (3) line 2: bias control should be corrected to read R56 instead of R57.

Another error exists on page 3-7, paragraph 3–4d(2) (a). This paragraph should be deleted and the following substituted:

"(a) Remove the white teflon tip by unscrewing (in a counter-clockwise direction) the outer ring from the front housing (see Figure 5–8). Resistor R1 will be damaged if the white tip is rotated with respect to the front housing."

The following comments are in response to P&O reports:

RF probe: To obtain a good high frequency response, compromises were made in the mechanical design. Extreme care must be taken in stowage, use, and disassembly to preclude damage to V1 and R1 which are contained within the probe (see NAVSHIPS 93808, Figure 5–8).

Some activities have suggested that certain commercial instruments are easier to use because they have fewer leads and are more accurate because they have larger panel meters. The number of leads is dictated by the high accuracy requirements. Other instruments having multipurpose leads have more limited accuracy or frequency response characteristics. Although readability is improved in a larger ponel meter, such meters do not provide the required accuracy under shipboord environmental conditions. A larger ponel meter suitable for shipboard use is being developed; if successful, it will be used in future production of this multimeter.

AN/USM-116A ELECTRONIC MULTIMETER, PERSONNEL SAFETY HAZARD

All AN/USM-116A Electronic Multimeters manufactured by Winslow Teletronics, Inc., Asbury Park, New Jersey, under contract N600(24)60931, present a potential personnel hazard. The rf probe is improperly insulated on some or all equipments now in use and the floating common ground may be tied to the power line ground through internal chassis connection. Therefore, holders of AN/USM-116A equipments should exercise care when making voltage measurements. Since the common lead or probe ground must be connected to an electrical ground when any voltage measurements are made, such measurements can be made only if one of the measurement points is at electrical ground potential.

AN/USM-117–ATTENUATOR FAILURES

An increased number of failures of the Weinschel AS-3 series, 50 series, 210, and 530 series attenuators used with power meters such as the AN/USM-117 or Hewlett-Packard Models 430 and 431 has been reported. The general type of failute is burn-out caused by too much RF power being applied to the attenuator. Before inserting any attenuator within the test setup, determine what RF power level (from calculations or POMSEE reference) will be applied and what is the power rating of the attenuator. The power ratings vary with their attenuation values. Example: The 8-db to 20-db attenuators of the above series have ratings of 1-watt average and 1-kilowatt peak power. The lower value attenuators have a higher power handling capability.

The power being delivered to the input after being attenuated by the other elements (directional couplers, cables, and the like) located in the circuit before the attenuator must not exceed the attenuator's rated capability. Although the power ratings may be indicated on the nameplates of some units, this information should be conspicuously marked on the unit to insure its being noticed.

Information concerning failures of the subject attenuators will be reported on NAVSHIPS 10550-1, Electronic Equipment Failure Report, or through the Maintenance Data Collection system (MDC), on those ships on which MDC is installed.

CBTV MAINTENANCE HINTS ON TEKTRONIX SCOPES TYPE 53/54c PLUG-IN UNITS

Type 53/54 c dual trace plug-in units may not function properly in the ALTERNATE mode. The fault may occur when a plug-in unit with serial number above 14078 is used with an older scope. The suggested remedy is to change R78, located in circuit of V78, the multitrace sync amplifier, from 47K ± 5 percent, 1/2 watt composition, to 36K ± 5 percent, 1/2 watt composition.

Probe Repair Kit

A repair kit has been made available by Tektronix to support the P410 and P510 probes. A quantity of the electrical and mechanical parts which are most subject to failure is included, along with instructions for using them.

Priced at $8.50, the kit carries the Tektronix number, 040-180, and the name, Universal Probe Repair Kit. The address is Tektronix, Inc., P.O. Box 831, Portland 7, Oregon.

Soldering Ceramic Strips

Silver solder is used to bond the component parts to the ceramic support strips. If a soldering iron is applied too long, especially when using conventional solder, the silver which is bonded to the ceramic tends to amalgamate with the solder, drawing it out of the slot. To prevent this, only silver-bearing solder should be used. A 3-percent (or higher) silver-bearing solder is recommended. A small hank is supplied inside each scope.

Fan Motors

These motors should be oiled periodically. A couple of drops on the end of a toothpick should suffice for several months. It is also recommended that the air filter be cleaned periodically to prevent possible damage to the motor or equipment. A good practice is to oil the motor each time the air filter is cleaned. If a new motor is installed, it should be oiled before being placed in service.

ELIMINATION OF HUM FROM TEKTRONIX TYPE 316 OSCILLOSCOPE

The Tektronix Type 316 oscilloscope contains sufficient power line hum in the vertical amplifier to cause difficulty in use or calibration of the 0.01 volt/division range.

This hum has been caused by inadequate ground termination of C-154 (500 ufd 6 VDC) capacitor. Although the metal mounting strap around the capacitor may appear to make a good ground, it can contribute to a ground loop effect. The hum may be eliminated by making the following simple modification: remove capacitor C-154 and solder a 4-inch piece of No. 20 (or heavier) stranded wire to the top of the metal can (of C-154). Insulate the outside of capacitor C-154 from the chassis with two layers of electrical tape and re-install the metal grounding strap over the insulating tape. Resolder the "hot" end of C-154 to its original connection. Connect the newly added stranded wire to the front panel ground lug located on the lower left of the front panel.

OS-8A/U WARNING NOTICE

The metal shield, covering the high-voltage Tube 1Z3 in Oscilloscope OS-8A/U, is kept from shorting out to ground by a thin bakelite disc which lies loosely within the shield. No markings on the outer shield or in the instruction book indicate the importance of this bakelite disc. If the disc is installed at an angle, or left out, Tube 1Z2 is shorted to ground, disabling the equipment.

It is suggested that the following warning notice be attached to the metal tube shield of the 1Z2: "Check Bakelite disc for proper placement to prevent hv grounding." The warning may be painted on the shield or a decal containing the inscription may be affixed to the shield.

OS-8B/U AND OS-8C/U OSCILLOSCOPES, CORRECTION OF VERTICAL GAIN

R-106, the grid return resistor (3.3 megohm, 1/2-watt, fixed carbon) normally is connected between the wiper terminal of S101B and the grounded lug of potentiometer R104B. It has been found that many OS-8B/U and OS-8C/U oscilloscopes have this resistor connected between S101B and pin 2 of V101A. This results in an error in the attenuation factor between the vertical gain positions AC-1, AC-10, and AC-100 because of the change in cathode follower gain in the AC-1 position.

If the correct attenuation factor cannot be obtained through normal calibration procedures, it should be determined that this resistor is connected to the ground lug of R104B and not to pin 2 of V101A.

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