TM 9-6920-466-34

T E C H N I C A L  M A N U A L

# DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL: SHILLELAGH CONDUCT OF FIRE TRAINER (SHILLELAGH GUIDED MISSILE SYSTEM)

H E A D Q U A R T E R S ,  D E P A R T M E N T  O F  T H E  A R M Y
FEBRUARY 1979

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HEADQUARTERS,
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**DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL:**
**TRAINER, LAUNCHER, CONDUCT OF FIRE, M62**
**6920-01-048-8558**
**AND**
**TRAINER, TARGET, CONDUCT OF FIRE, M63**
**6920-01-048-8557**
**(SHILLELAGH GUIDED MISSILE SYSTEM)**

TM 9-6920-466-34, 22 February 1979, is changed as follows:

1. The title is changed as above.

2. The pages affected by this change, appearing in the following listing, are to be inserted in the manual immediately. Added or changed material on these pages is indicated by a vertical line in the margin.

Revised illustrations have a sequentially higher letter suffix adjacent to the identification number.

| *Remove pages* | *Insert pages* |
|---|---|
| A/(B blank) | A/(B blank) |
| i/(ii blank) | i/(ii blank) |
| 2-3 thru 2-12 | 2-3 thru 2-12 |
| 3-1 thru 3-20 | 3-1 thru 3-26 |
| 4-1 thru 4-4 | 4-1 thru 4-4 |
| 5-1 thru 5-4 | 5-1 thru 5-5/(5-6 blank) |
| B-1/(B-2 blank) | B-1/(B-2 blank) |
| I-1, I-2 | Index 1, Index 2 |

3. This transmittal sheet should be filed in front of the manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

**Official:**

J.C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-32, Section II, Direct and General Support Maintenance requirements for SHILLELAGH Missile System.

**WARNING**

WARNING

HIGH VOLTAGE

is used in the operation of this equipment

**DEATH ON CONTACT**

may result if personnel fail to observe safety precautions

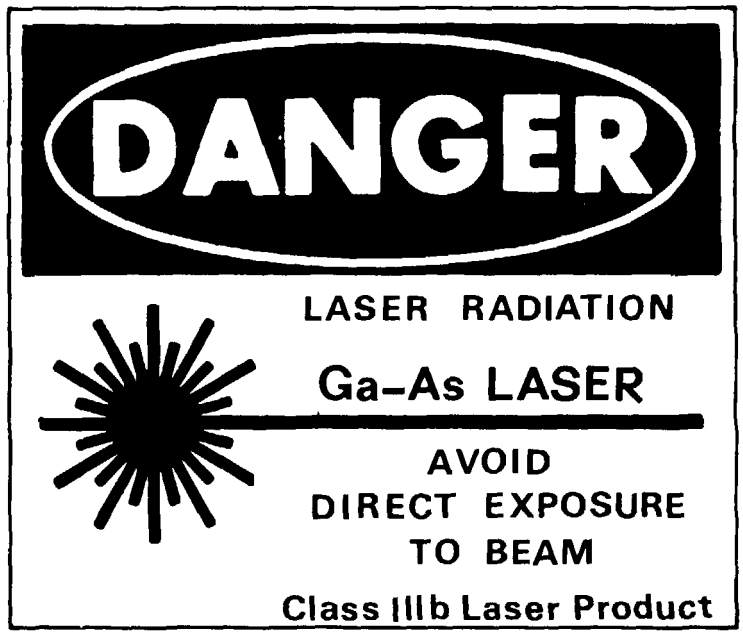
Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 208-volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

For Artificial Respiration, refer to FM 21-11.




The Infrared Projector (IRP) of the Conduct of Fire Trainer contains a Gallium Arsenide laser. The laser radiation is potentially hazardous to the human eye. The U.S. Army Environmental Hygiene Agency has found that the IRP emits optical radiation exceeding current protection standards. however, the IRP does not pose a significant hazard when used by informed operators, provided appropriate precautions are taken.

The precautions include the following:

1. Do not permit personnel without protective goggles to view the IRP from within the beam at distances less than 43 feet (13 meters), or 528 feet (160 meters) when viewing through optical instruments. The instructor shall insure that unprotected individuals are not located within the hazardous ranges in the area of the beam path.

2. The Retroreflector Target array shall not be used within 264 feet (80 meters) of the IRP.

3. Appropriate warning signs (WARNING - LASER RADIATION) shall be posted in the area during Conduct of Fire training sessions.

4. Do not activate the IRP laser inside the COFT shop unless the offset prism cover on the OSU is closed or the IRP energy monitor is properly installed.

## RETROREFLECTOR TARGET

Since the Retroreflector Target is designed to return an optical beam to its source in an efficient manner, potential hazards exist when using vehicle searchlights or laser rangefinders against the Retroreflector Target. Because the hazardous ranges associated with these devices are substantially greater than that of the IRP, rangefinders and searchlights should not be used against the Retroreflector Target without specific measures to prevent hazardous exposure of personnel.

## LIST OF EFFECTIVE PAGES

Insert latest changed pages: dispose of superseded pages in accordance with applicable regulations.

**NOTE:** On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by a letter suffixed to the MI or MS number.

Total number of pages in this manual is 57 consisting of the following:

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.

Direct Support and General Support Maintenance Manual

SHILLELAGH CONDUCT OF FIRE TRAINER
(SHILLELAGH GUIDED MISSILE SYSTEM)

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publication and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Missile Command, ATTN: DRSMI-NPM, Redstone Arsenal, AL 35809. A reply will be furnished to you.

## LIST OF ILLUSTRATIONS



## LIST OF TABLES

# CHAPTER 1

# INTRODUCTION

## Section I. GENERAL

**1-1. Scope.**

a. This manual is for your use in performing direct support (DS) and general support (GS) maintenance of the Conduct of Fire Trainer Launcher M62 and Target M63 for the SHILLELAGH Guided Missile System.

b. Refer to Appendix A for a list of other publications pertinent to this and other associated equipment.

**1-2. Maintenance Forms and Records.** Maintenance forms and records which you are required to use are listed and explained in TM 38-750.

**1-3. Administrative Storage.** Prepare the COFT for administrative storage in accordance with TM 740-90-1.

**1-4. Reporting Equipment Improvement Recommendations (EIR).** EIR's will be prepared using DA Form 2407 Maintenance Request. Instructions for preparing EIR's are provided in TM 38-750, the Army Maintenance Management System. EIR's should be mailed directly to: Commander, U.S. Army Missile Materiel Readiness Command, ATTN: DRSMI-NSM, Redstone Arsenal, Alabama 35809.

**1-5. Description.** For a general description of the SHILLELAGH Conduct of Fire Trainer refer to TM 9-6920-466-12.

**1-6. Tabulated Data.** For tabulated data refer to TM 9-6920466-12.

## Section II. SPECIAL TOOLS, TEST EQUIPMENT, AND SPARE PARTS

**1-7. Special Tools.** Special tools are required to perform maintenance on the Conduct of Fire Trainer. For a complete description of the special tools refer to TM 9-4935466-14.

**1-8. Test Equipment.** The test equipment used for troubleshooting the Conduct of Fire Trainer is Field Support Test Equipment. For a complete description of the Field Support Test Equipment refer to TM 9-4935-466-14.

**1-9. Spare Parts.** Spares and repair parts are listed and illustrated in TM 9-6920466-24P.

# CHAPTER 2

# THEORY OF OPERATION

## Section I. GENERAL DESCRIPTION

**2-1. Purpose.** The Conduct of Fire Trainer (COFT) used to train gunners and improve their tracking ability. It is mounted on a vehicle with the SHILLELAGH guided missile system. The COFT simulates the launch environment of a SHILLELAGH missile firing including launch recoil, muzzle flash, acoustical noise, missile source flying into the field of view, and time delays of the firing sequence unique to the SHILLELAGH missile. The tracking performance of the gunner is visually displayed to him a is continuously monitored by an instructor.

**2-2. COFT Equipment.** The COFT is compatible with t M-551 and M-60A2 vehicles without modification. A complete physical description is in TM 9-6920-466-1. COFT consists of the following equipment.

a. Control Display Unit (CDU). The CDU is used the instructor to control testing and training. It provides simulation controls and displays gunner's tracking performance.

b. Optical Simulation Unit (OSU). The OSU contain the visual effects simulator (VES) which provides optic simulations of the firing sequence and tracking errors to the gunner. It also contains the infrared projector (IRP), optical transmitter used to light an array of reflectors the target vehicle. The OSU is mounted over the gunner's telescope aperture on the exterior of tile turret.

c. Launch Recoil Simulator. The launch recoil simulator provides a mild impact to the gunner's helmet thereby simulating the recoil of the gun-launcher. It is mounted in place of the gunner's telescope brow pad.

d. Retroreflector Target. The target consists of cylindrical array of corner reflectors. It is used to simulate an actual target. The target reflects the transmitted beam back to the COFT system where it is used determine the gunner's tracking error. The target can mounted on several different types of vehicles by the use a universal target adapter and tiedown straps. The vehicle may be moving or stopped to simulate moving or stationary targets.

e. SHILLELAGH/COFT Interface Cable. Interface cable WI provides the necessary interconnection between the SHILLELAGH, the COFT, and vehicle system.

**2-3. COFT Functional Description (Figure 2-1).**

a. The control display unit (CDU) and optical simulation unit (OSU) comprise the major components of the COFT launcher. The infrared projector, part of the OSU, transmits an infrared signal to a moving or stationary target at distances up to 9, 900 feet (3000 meters). The target reflects this signal back to the vehicle where it is detected by the tracker of the SHILLELAGH guided missile system. (For a description of the guided missile system, refer to TM 9-1430465-30.) A quadrant detector in the tracker converts the return into four separate signals. These signals contain information representing tracking deviation from the line-of-sight (LOS) to the target, and are sent to the signal data converter (SDC) where they are converted into pitch and yaw error signals. The CDU receives the error signals and evaluates them to determine any position error in the gunner's tracking performance. At the same time the rate sensor transmits its error signals, via the SDC, to the CDU, where they are monitored. Lamps in the CDU and the OSU then provide indications of tracking errors to the instructor and to the gunner. A score meter displays the percentage of time the gunner's aim is inside of a 3.75-foot (1.14m) box centered on the target. The simulated missile flight concludes with an audio/visual blast simulation in the OSU, providing that the gunner is tracking on target or a miss tone if he is not. The visual effects simulator (VES) portion of the OSU provides the missile launch and flight simulations to the gunner.

b. The COFT has three modes of operation: a practice mode, a qualify mode, and a self test mode.

(1) In the practice mode the gunner receives visual indications of his tracking. When he tracks in an erratic manner, an excess rate or off target signal appears in the telescope field of view. Also, audible signals are heard on the intercom system.

(2) In the qualify mode the indications do not appear in the telescope, however, the instructor is able to see them on the CDU and they terminate the simulation. The gunner hears no audio signals in the qualify mode. In both the practice and qualify modes, after the instructor has reset the COFT system, training exercises are initiated when the gunner presses the trigger.

(3) In the self test mode, the COFT system goes through a programmed sequence which tests all indicator lamps on the CDU. selected circuits on the circuit cards, and the launch and flight simulations of the VES. If no malfunction occurs, the CDU GO lamp on the CDU is illuminated. If a malfunction occurs, the CDU NO GO lamp is illuminated. If the fault is in a CDU circuit card, the fault lamp on the card will also illuminate for use by DS/GS maintenance personnel after removal of the lower front panel. VES faults are visually detected by observation of indicators and displays.

c. During tracker preset, the tracker is set to the desired range. The infrared projector is turned on and aligned with the boresight telescope to be parallel with the gunner's line of slight (LOS) and the tracker line of sight.

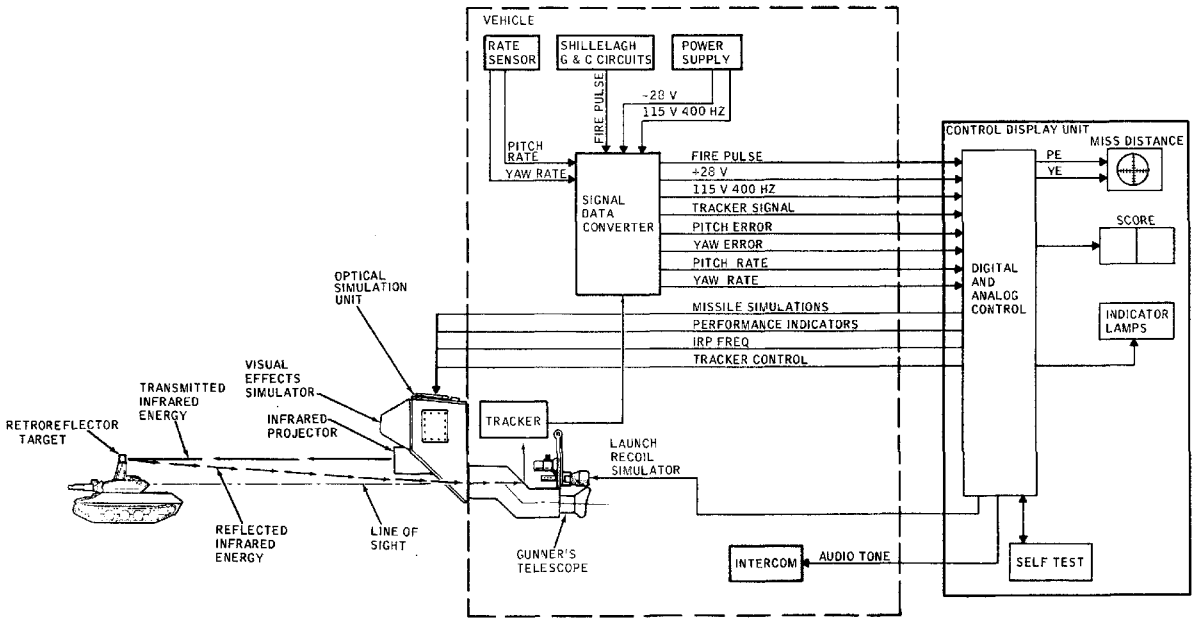



*Figure 2-1. COFT Functional Diagram*

## Section II. POWER DISTRIBUTION

**2-4. General.** The SHILLELAGH power system provides regulated 28 Vdc and 1 15 Vac 400 I-Di to the CDU through the signal data converter (SDC). Power distribution circuits in the CDU (fig. 2-2) route the 115 Vac 400 Hz to the tracker motor control circuit. The 28 Vdc is routed to the launch recoil simulator (momentarily). OSU, tracker, power supply A13. and circuit cards A3 and A5. Power supply A13 provides regulated ±15 Vdc for circuit cards Al through A7, plus 5 Vdc for system logic and infrared projector. and +35 Vdc for the VES and IRP.

**2-5. Power Distribution (Figure 2-3).** Setting circuit breaker CBI applies 28 Vdc to MODE SELECT switch S5 and power relay K6. The 115 Vac 400 Hz is applied through DI-D2 contacts of K6 and contacts of K5 to the tracker. Setting the MODE SELECT switch to SHILLELAGH SELF TEST (or any position except OFF) energizes relay K6 and applies +28V to circuit cards position limiter A3 and training mode logic AS. It also activates the tracker brake through closed relay contacts K1 and K2. With K6 energized unregulated 28 Vdc is applied to launch recoil simulator (LRS) and OSU through contacts B2 and C2 respectively. Twenty-eight Vdc is applied to power supply A13 through contacts A2 of K6, to pin 2 of DAY/NIGIIT switch S2. pin 2 of EVENT meter M1, . CDU lamps on At4, and circuit cards A3 and AS. The 115 Vac 400 Hz is applied to the tracker motor through pins 4 and 6 of K5 for capacitive starting and pin 3 for continuous running. Power supply A13 will provide regulated 35 Vdc directly to the optical sensing unit and infrared projector. Plus 5 Vdc, +15 Vdc, and all dc returns are distributed through TB1 to circuit cards Al through A4. A6 and A7. Additionally +5 Vdc with return is routed to circuit cards A5 and A8S, to the infrared projector, pin c of MODE SELECT switch SSB, pin 3 of PRACTICE/QUALIFY switch SI, pin 5 of RESET switch S3, and pin 3 of TRACKER PRESET switch S4.

**2-6. Control Display Unit Power Supply** (Figure 2-4). Twenty-eight volts dc is applied to terminal C3 through circuit breaker CBI and relay K6. Relay K1 will energize and apply 28V to boost amplifier circuitry. The boost amplifier produces +35V which is regulated by a variable pulse width control circuit. A ramp generator produces a 9.7 volt sawtooth signal whose frequency varies proportionally to its input voltage. Applying this sawtooth signal to a comparator will generate a pulse width signal which regulates the +35V. The +35V operates the DC to DC converter and supplies the voltage for the regulators that produce the regulated +SV and +1 5V. A feedback system consisting of a comparator network produces a shutdown signal when any of the voltages exceed the prescribed limits. Over-current protection is provided by an input current sensing circuit. If the total power supply current exceeds 6 amperes, a shutdown signal will be produced. It will deenergize A13KI disabling all the output voltages. Therefore. over voltage or over current, will shut down the power supply. It can be re-enabled by pressing the RESET switch. Low vehicle power also will cause the power supply to shut down the COFT. When power is stabilized, the COFT can be returned to service by pressing the RESET switch.

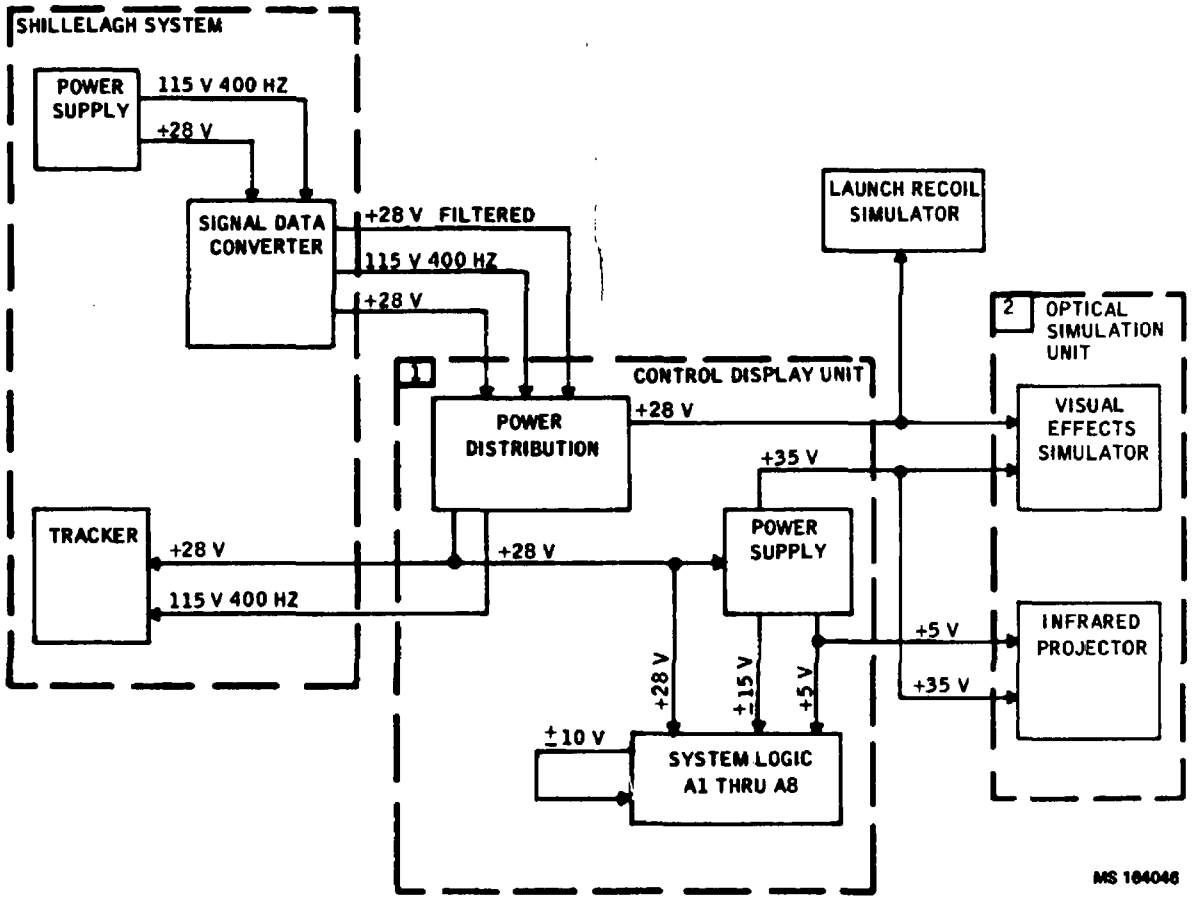



*Figure 2-2. Power Distribution Block Diagram*

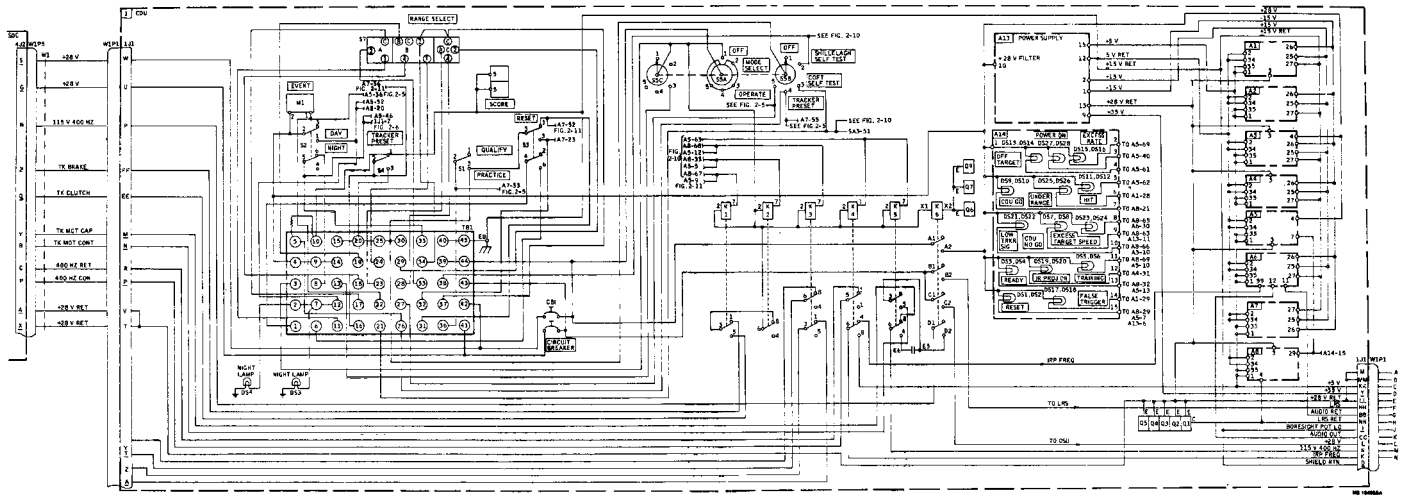


*Figure 2-3. Power Distribution Functional Diagram (sheet 1 of 2)*

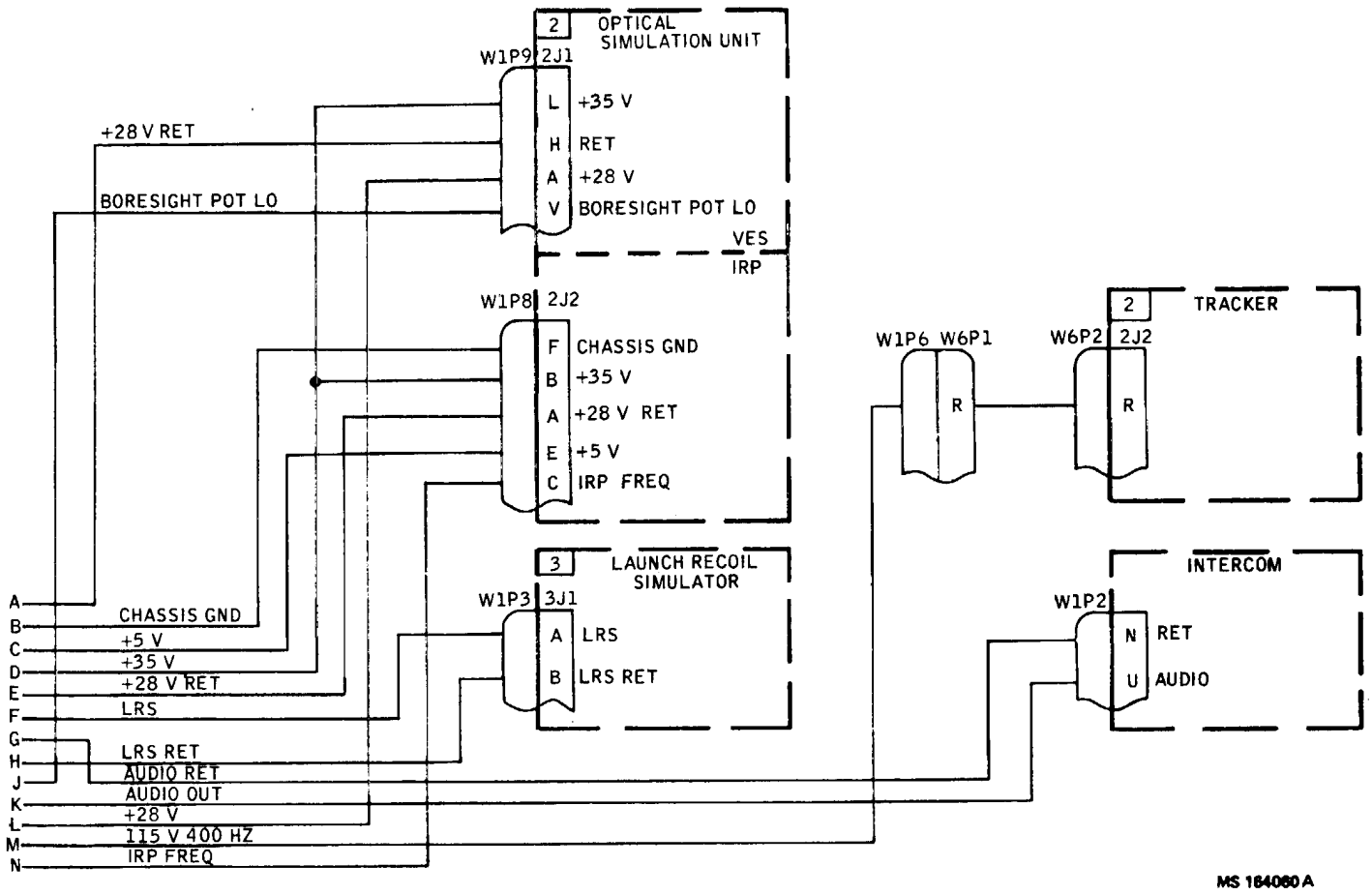



*Figure 2-3. Power Distribution Functional Diagram (sheet 2 of 2)*

## Section III. OPERATE MODE

### 2-7. Operate Mode (Figure 2-5).

**NOTE**

Table 2-1 contains definitions of the logic signals shown on functional diagrams.

a. Operate Mode Signal. With the MODE SELECT switch S5 in the OPERATE position, an OPM signal (+5V) is applied to the logic circuits: position limiter A3, rate signal A4, and self test stimulus A7. The OPM Dl signal from A7 to Z3 of master timer Al with a logic high from the selected range memory (Z6, Z9) will provide an under range signal. The under range detector on master timer Al monitors the selected range and if it is not greater than 0.5 Km, as determined by a Comparator, the UNDER RANGE lamp will light and remain on until the selected range is increased.

b. Practice/Qualify Mode. Setting PRACTICE/ QUALIFY switch S1 to PRACTICE will provide performance feedback to the gunner and instructor. It is displayed as visual simulations of the missile's flight on the visual effects simulator (VES). In the QUALIFY position the performance feedback is inhibited at the VES and displayed only on the CDU for viewing by the instructor.

c. Day/Night Operation (fig. 2-3). The DAY/NIGHT switch provides day-night display lighting for COFT operation. In the DAY position a constant voltage maintains the lamps at maximum brilliance. In the NIGHT position a 312 Hz signal at 50% duty cycle is applied to the lamps. The signal causes the lamps to blink and glow dimly. Two post lamps on the front of the panel provide night illumination of the controls.

### 2-8. Launch Events Simulation (Figure 2-5).

a. Master Timing. When the gunner presses the trigger to initiate a training exercise, a 28 Vdc signal from the SDC at 4J2-p (fire pulse) is routed through CDU 1JI-PP and to pin 4 of master timer Al. Card Al controls the timing of launch simulations, generates an analog time signal, AT, and determines the end of test signal (TO), based on the range selected.

b. Simulation Sequence.

(1) After 1.0 second, signals BRPD (Al-8), and NLP (Al-9) are generated. Signal BRPD enables relay drivers Q8 and Q1 in the CDU. As a result, a 28 Vdc return is applied to the launch recoil simulator solenoid through CDU 1J1-NN. This causes an impact force of 10 to 15 pounds (44.5 to 66.7 newtons) to be exerted on the brow pad which moves a distance of 0.2 inch (5.08 mm). Signal NLP passes through tone signal generator A6 and enables relay driver Q2 which provides a 28 Vdc return to rocket motor lamp 1DS1 in the OSU. The lamp generates a flash of light 300 msec in duration, simulating the rocket motor blast. It appears in the telescope as uniform illumination over the gunner's field of view.

(2) At 1.1 seconds, signals SCAVN (Al-6), SMSM, (Al-5) and MISS (A1-7) are generated from Al. Signal SCAVN is applied (A6-69) to a switch in tone signal generator A6, which allows the passage of scavenge noise output to amplifier AR5 and then to the intercom system. This simulates the sound of firing and scavenge system at launch. Signal SMSM energizes relay driver Q4, and a ground level is. applied to the VES for smoke solenoid L4A (fig. 2-6). Solenoid IA causes a translucent sheet (fig. 2-7) to be placed in the gunner's field of view for 1.5 seconds, simulating launch obscuration caused by rocket motor smoke. At the same time, signal MISS (fig. 2-5) appears at A1-7. This signal enables relay driver Q5, which then sends an operate signal to lamp driver 2AI (pin E2) in the VES (fig. 2.6). This pulse enables the driver which generates a 28 volt decreasing ramp pulse with a 2 second duration to missile source lamp DS2. The signal is also applied to motor M1 in the VES which rotates two cams connected to a mirror in the optical portion of the OSU (fig. 2-7). Lamp DS2 then simulates the 2 second rocket motor burn. which decreases in luminance until 3.1 seconds have elapsed. At that time the lamp driver pulse runs out and DS2 extinguishes. During the 2 second duration, the motion of the mirror causes the missile source to move at a predetermined rate in the telescopic field of view.

(3) At 2.6 seconds, the SMSM signal from relay driver Q4 (fig. 2-5) is disabled, and smoke simulation is ended. The launch simulation sequence ends at 3.1 seconds as missile source simulation is terminated.

c. False Trigger. At 3.8 seconds, CDU master timer Al activates the false trigger detector (fig. 2-5) in Al. This circuit detects multiple triggering by the gunner. If it does, signal FT (A1-29) is sent to the FALSE TRIGGER lamp DS17 on the CDU, illuminating it. Signal FT (pin 30) is sent to training mode logic (A5-32). In A5 the test over signal (TO) is enabled, RESET lamp DSI lights, and the test is ended. The system then must be reset and another training exercise started.

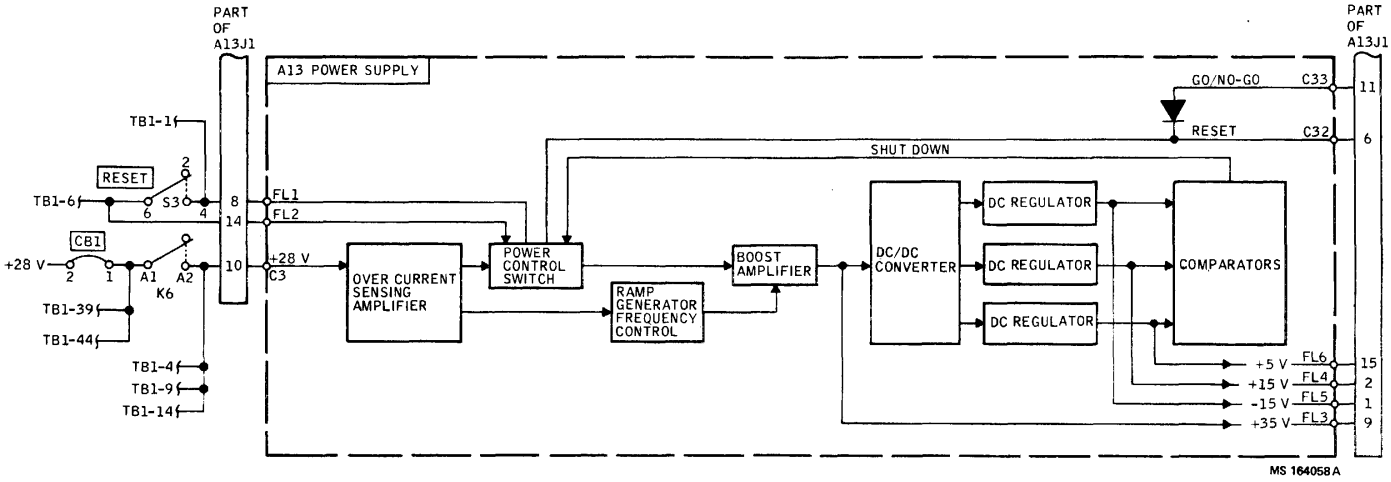



*Figure 2-4. CDU Power Supply Functional Diagram*

*Table 2-1. Logic Signal Definitions*

| Logic signal | Definition |
|---|---|
| AT | Analog Time |
| BRPD | Brow Pad |
| D/N | Day/Night Mode - Active Low Day Mode |
| EC | Event Counter |
| ETS | Excess Target Speed |
| FP | Fire Pulse |
| FT | False Trigger |
| H+TO | Hit and Test Over |
| HIT | Hit |
| HITSD | Hit Solenoid Driver |
| IRP ON | Infrared Projector On |
| K4, K5 | Relays K4 and KS |
| LSD | Least Significant Digit |
| LTS | Low Tracker Signal |
| MISS | Missile Source |
| MSD | Most Significant Digit |
| NLD | Night Lamp Driver |
| NLPi | Night Lamp Pulse |
| OPM | Operate Mode |
| OTLD | Off Target Lamp Driver |
| OTSD | Off Target Solenoid Driver |
| +PE | Up Pitch Error |
| -PE | Down Pitch Error |
| IPEI | Absolute Pitch Error |
| PEL | Position Error Logic |
| PLPE | Pitch Low Pass Error |
| PM | Practice Mode Switch |
| PMDI | Pitch Miss Distance Indicator |
| POSE | Position Error |
| PRE | Pitch Rate Error |
| PRL | Pitch Rate Limit |
| RDY | READY |
| RE | RATE ERROR |
| RE/OT | Rate Error/Off Target |
| RESD | Rate Error Solenoid Driver |
| RESET | Reset |
| SCAVN | Scavenger Noise |
| SMSM | Smoke Simulator |
| ST | Self Test |
| STFP | Self Test Fire Pulse |
| STPLPE | Self Test Pitch Low Pass Error |
| STPRE | Self Test Pitch Rate Error |
| STYLPE | Self Test Yaw Low Pass Error |
| SSL | Sum Signal Level |
| SST | Shillelagh Self Test |
| Tf'-2 | Terminal Flight -2 Seconds |
| TKRST | Tracker Reset |
| TK/TR | Tracker/Target |
| TO | Test Over |
| TPM | Tracker Preset Mode |
| TRG | Training |
| TSL | Tracker Signal Level |
| UR | Under Range |
| WTSL | Wiper Tracker Signal Level |
| lYE I | Absolute Yaw Error |
| YE | Yaw Error |
| YLPE | Yaw Low Pass Error |
| YMDI | Yaw Miss Distance Indicator |
| YRE | Yaw Rate Error |

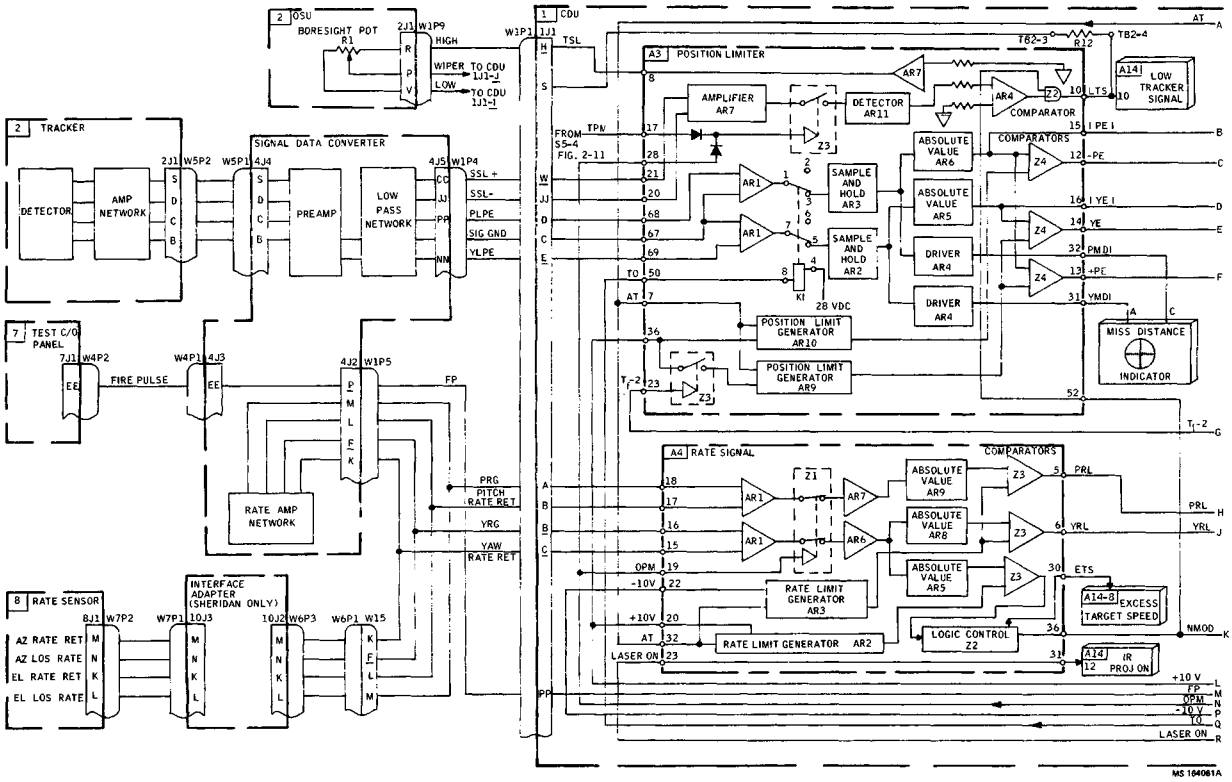



*Figure 2-5. CDU Functional Diagram (sheet 1 of 2)*

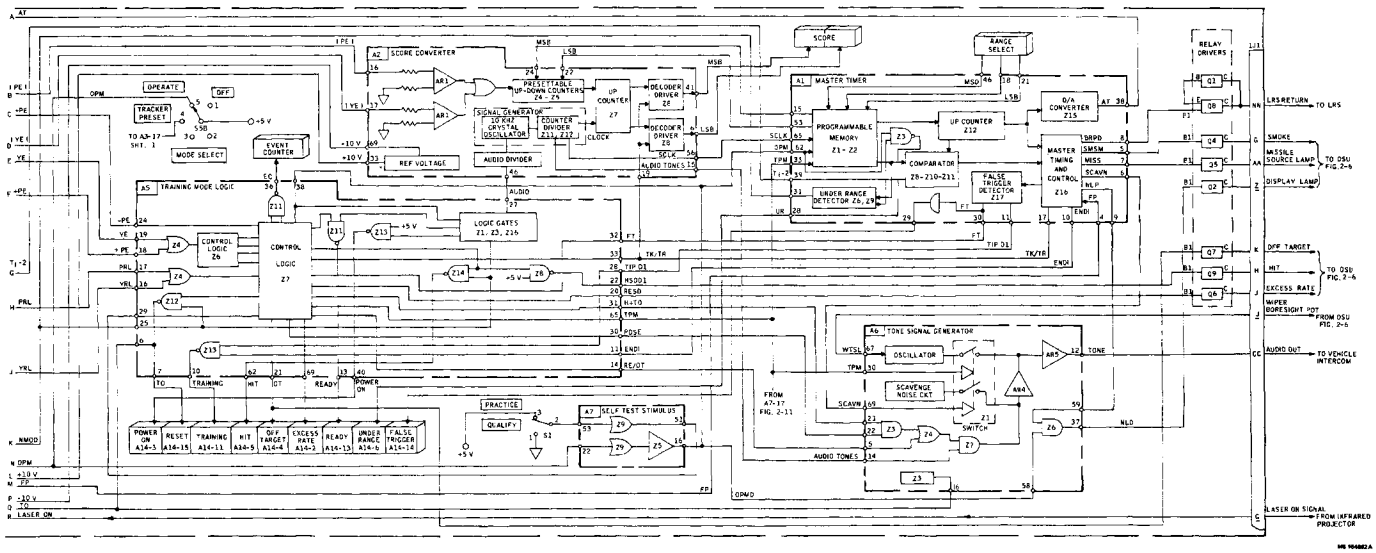



*Figure 2-5. CDU Functional Diagram (sheet 2 of 2)*

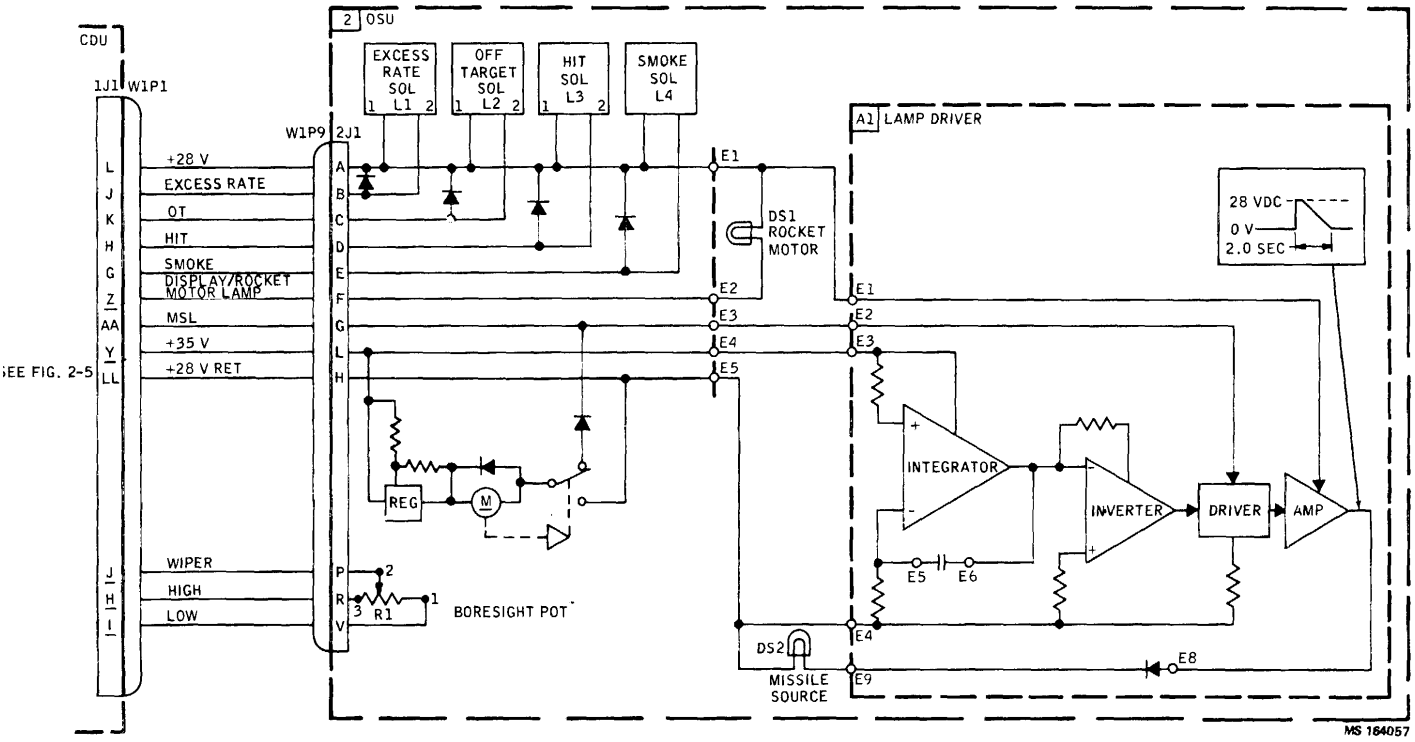



*Figure 2-6. OSU Functional Diagram*

**2-9. Infrared Projector (IRP).** The COFT system uses the infrared projector to generate a tracking signal from the vehicle to the target. The transmitted beam of light fills a minimum projected area 15 x 15 feet (4.6 x 4.6m) over the range of 0.5 to 3.0 Km. This is true only if the focus control, at rear of IRP, is set correctly to selected range. The signal reflected back to the tracker represents the position of the simulated missile relative to the line-of-sight (LOS). The CDU then derives position information from this return signal. In an actual missile flight, steering signals are derived from the position of the infrared missile source. The infrared projector consists of a laser assembly containing a GaAs light emitting diode, a laser controller/ modulator, and a laser driver.

**NOTE**

For the value of the missile frequency, hereafter referred to as $F_O$, refer to TM 9-1430-465-30, Troubleshooting of Shillelagh Guidance and Control Set, Using AN/MSM-93.

a. Power Circuit (fig. 2-8). Plus five Vdc, and +35 Vdc from the CDU power supply, and crystal oscillator Fo source frequency. for driving the laser, are applied to the IRP. The Fo frequency is generated in the CDU on score converter A2. It is sent through a buffer in tone signal generator A6 to the infrared projector through the closed contacts (pins 4 and 6) of CDU relay K4. This relay is used to automatically disable the IRP after training and acts as a safety device. When a training exercise is begun with the pressing of the RESET switch and the trigger, a logic circuit and timer in A5 are enabled which determine if the trigger switch is activated within 64 seconds of reset enable. If the trigger is not pressed within this time period, signal K4, K5 is transmitted from A5. Relays K4 and K5 will energize, removing Fo frequency from the IRP and 400 cycle power from the tracker (fig. 2-3). Test over signal (TO) (fig. 2-5) is enabled, and the RESET lamp illuminates. This insures that the laser is in operation only when training is in progress. Likewise, when a training procedure is complete, relay K4 will be energized, and the laser will be automatically disabled.

b. Laser Controller/Modulator. The laser controller/ modulator in the infrared projector receives and shapes the Fo square wave signal (A1lQ2, A1Q3) into a pulse which varies from 40 to 100 volts. A power/modulator (AIQ4) drives this signal across transformer T1l to the laser driver (A2A1). A power switch (A2AI1Q, A2AIQ2) in the driver then passes current from a charging circuit to the laser diode (A2CRI), and infrared emission begins. Detector A2BT1 detects infrared light from laser diode A2CRI. The output from A2BT1 is sent to a detector and shaper circuit and then to an interlock circuit in laser controller/ modulator. The interlock circuit provides a laser ON signal to the CDU which illuminates the IR PROJ ON lamp. Temperature sensor A2A1CR7 regulates the laser input power proportionally to temperature changes in the infrared projector. Voltage across diode CR7 changes at the rate of 2.1 mV/degree C. Therefore, when the temperature increases at the projector, input power is raised to provide sufficient output. Diode A2A1CR7 will detect temperature variations and translate them to voltages to the temperature control circuit in the controller/modulator. Output from the temperature control circuit then increases or decreases the current in the shaper and driver with temperature variations at laser transmitter A2CR1.

**2-10. Tracker Signal Level.** The tracker receives the returned infrared energy from the target. It is then sent to the SDC where it is converted into tracker sum signals SSL+ and SSL(fig. 2-5). These signals are applied to CDU detector A3AR11 and then to comparator A3AR4 on position limiter A3. If the signal level falls below 63 mVrms, a low tracker signal (LTS) (A14-10) will illuminate LOW TRACKER SIGNAL lamp DS21 on the CDU.

**2-11. Tracking Performance.**

a. General. Tracking begins from the time of the fire pulse and continues until a test termination signal is generated. The CDU receives the position and rate error information from the SDC, compares it with specified limits, and determines if these limits are exceeded. An indicator display on the CDU, in the form of a lamp matrix and a two-axis meter, then provides an overall indication of tracking performance to the instructor. If the practice mode has been selected, the gunner will receive audio and visual indications of tracking by way of the VES. However, in the qualify mode, all performance feedback to the VES is inhibited, only the CDU performance indicators are enabled.

b. Position Error Channels. Tracking signals are received from the tracker and processed in a low pass network of the SDC. This produces slowly varying DC signals PLPE (pitch low pass error) (fig. 2-5) and YLPE (yaw loss pass error) which are sent to position limiter (pins 68 and 69) in the CDU. First, the signals pass through amplifier A3AR1, contacts of relay A3K1, and then to sample and hold circuits A3AR2 and A3AR3. Three sets of position error signals are then produced in A3. Drivers A3 A3AR4 transmit analog signals PMDI and YMDI which

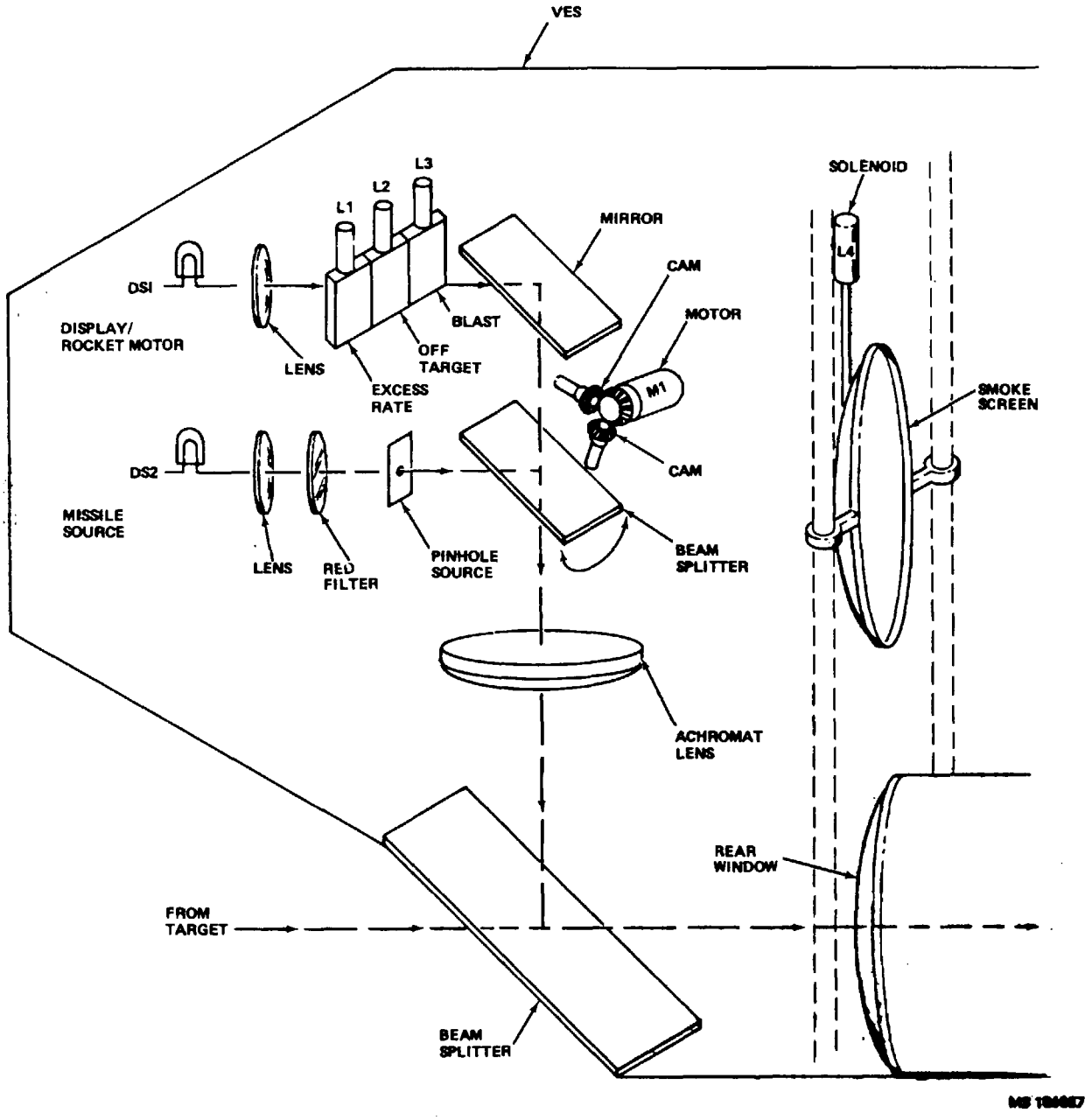



*Figure 2-7. VES Functional Diagram*

then drive the two-axis meter in the MISS DISTANCE indicator. The MISS DISTANCE indicator provides a visual measure of tracking deviation from the LOS. The meter is calibrated at 3.75 feet/volt (3 Vdc for maximum full scale deflection). Thus, an error of up to 11.2 feet from target center can be seen on the meter (fig. 2-9). The MISS DISTANCE indicator is driven from launch initiation to end of test, at which point relay A3KI is energized by signal TO (fig. 2-5), and the final error values are applied and held on the meter by the sample and hold circuits A3AR2 and A3AR3.

(1) Absolute value circuits A3AR5 and A3AR6 yield analog signals (IYEI and IPEI). These signals are applied to logic circuits on score converter A2 which computes the gunner's score. Comparators A3AR7 receive outputs from absolute value circuits A3AR5 and A3AR6 and the position limits from the position limit generators A3AR9 and A3AR10. The comparators then produce the third set of position error signals, the off target digital signals (+PE, -PE, and YE).

(2) The position limit generators AR9 and ARIO set the tracking error limits for the comparators and are shown in figure 2-9. Note that at 2 seconds prior to test termination (T-2), these limits are narrowed in both azimuth and elevation, and the test is ended for an excessive pitch down error.

(3) Error signals +PE, -PE, and YE are applied to training mode logic A5 (fig. 2-5). In the practice mode, signals +PE and YE enable signals OT, POSE, and RE/OT. Signal OT (off target) illuminates the OFF TARGET indicator on the CDU. Signal OTSD energizes solenoid L2 in the VES, which causes a flashing red OFF TARGET display to appear in the gunner's field of view. Signal RE/OT is applied to gating circuits in tone generator (A6-5), enabling an audio tone to the intercom. This tone is present for the duration of the position error. Signal POSE (AS-30) is used at simulation completion to indicate a tracking error after a hit. The pitch down error (-PE) (A5-24) enables the test over signal (TO) (AS-6), which terminates the test. Signal TO passes through tone signal generator A6 and energizes relay A3KI, clamping sample and hold circuits A3AR2 and A3AR3 at the final azimuth and elevation error level. Drivers A3AR4 will maintain signals PMDI and YMDI at this level, causing the MISS DISTANCE indicator to read and hold this final level. Signal TO (A5-7)'also illuminates the RESET lamp' on the CDU.

(4) Sufficient tracking error (+PE or YE) in the qualify mode will enable signal TO, ending the test. The RESET lamp w ill illuminate as in the -practice mode, and the MISS DISTANCE indicator will hold at its final reading.

c. Rate Error Channels. The rate outputs from the vehicle rate sensor are sent to rate signal A4 in the CDU for processing (fig. 2-5). Pitch rate error (PRE) and yaw rate error (YRE) enter amplifier network A4AR1, and pass through closed switch Z1 to bandpass amplifier A4AR6 and A4AR7. The absolute value of both pitch and yaw rate errors is taken in A4AR8 and A4AR9, and applied to comparators A4AR10. In the comparators, the rate signals are compared with limit signals from the rate limit generators (A4AR2 and A4AR3) to determine if the gunner is tracking at an excess rate in elevation or azimuth. The rate limit generators in A4 transmit signals which are proportional to the maximum allowable rate sensor output permitted during missile flight. This maximum rate decreases steadily from launch to target range. When the rate limits are exceeded in pitch or yaw, digital signals PRL or YRL are generated and sent to training mode logic AS (pins 17 and 16). The excess rate signal (RE) is produced and, if in the practice mode, the EXCESS RATE lamp on the CDU will light. Solenoid L1 in the VES is activated, resulting in a flashing red EXCESS RATE display in the gunner's field of view. In addition, signal RE/OT is generated in A5-14 and goes to A6-5 to produce an audio tone in the intercom for the duration of the error, as in the case of an off target error. If the qualify training mode had been selected instead of the practice mode, signal RE would have terminated the test immediately, and there would have been no EXCESS RATE indication in the VES. Both EXCESS RATE and RESET lamps would light on the CDU, and the MISS DISTANCE indicator would hold its reading. In the event that there is both a position error (off target) and an excess rate error, the logic in AS is arranged to give priority to excess rate. Therefore, only the EXCESS RATE lamp, on the CDU, will illuminate. The EXCESS TARGET SPEED lamp, on the CDU, will light when the target is moving too fast. In A4 the yaw rate signal out of A4AR6 is sent to an absolute value circuit A4AR5 and then to comparator A4ARIO0. The rate limit generator A4AR2 supplies the comparator with the maximum allowable yaw rate gyro steady state output. If the yaw rate exceeds this output, signal ETS (pin 30) will be generated, and the EXCESS TARGET SPEED lamp will light.

d. Hit or Miss. Target tracking continues until the clock, from master timer Al, ends the test. An up-counter in Al (fig. 2-5) continues to increment, and its output is compared with the range select setting stored in the memory. When the two are equal, the target range has been reached and signal TK/TR (pin 17) is enabled. This signal goes to A5 logic, which ends the test and determines if the gunner has hit the target. Signal TK/TR also goes to A2-19 to display the gunner's score.

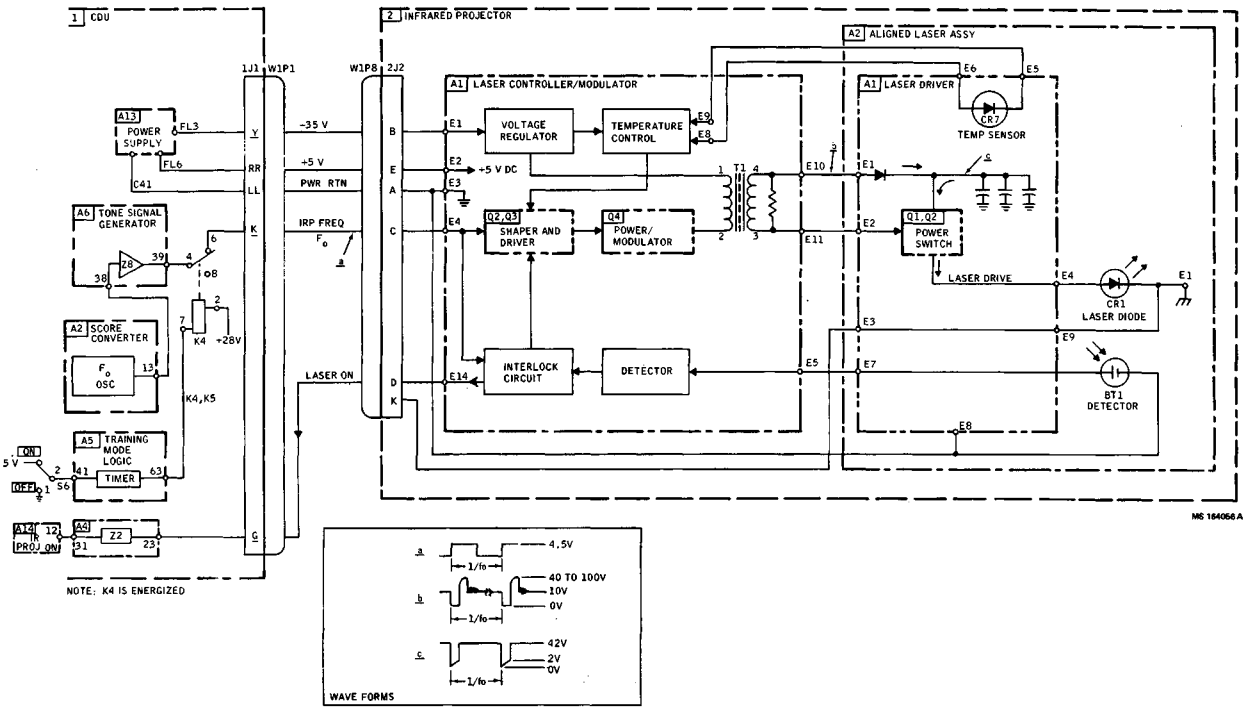



*Figure 2-8. IRP Functional Diagram*

(1) In AS, signal TK/TR enables the test over (TO) signal, which then illuminates the RESET lamp. Signal TO also energizes relay A3K1, causing the MISS DISTANCE indicator to hold at its final indication. This shows the instructor how far from target center the missile was at the end of flight. Signal TK/TR also is applied to logic circuits with position error signals +PE and YE (pins 18 and 19). If both +PE and YE are equal to zero, then a hit has been made, and a HIT signal is generated from AS (pins 22 and 62). These signals illuminate the HIT lamp in the CDU, and activate hit solenoid L3 in the VES. Solenoid L3 enables a lamp which flashes for 0.5 second in the gunner's field of view, simulating an explosion.

(2) Any tracking +PE or YE errors are stored in AS and produce a position error signal, POSE (pin 30). This signal is sent to tone signal generator A6-22 and combines with signal H + TO (hit and test over) (pin 21) to cause generation of a 2 second audio tone in the intercom when the test is over. This tone indicates that the gunner has hit the target, but that there was at least one tracking error during flight. A successful tracking without any errors produces a HIT indication without audio tone at the end of the test.

e. Scoring. Analog signals IPEI and IYEI from position limiter A3 (pins 15 and 16) represent the magnitude of tracking errors in pitch and yaw. These signals are sent to comparators AR1 in score converter A2. Here they are compared with limits representing a 3.75-foot i(.14rrm) square area at the center of the target. If these limits are exceeded, the comparators will send a pulse to stop the advance of counters Z4 and Z7 which are computing the score. (Scoring range is from 0 to 99.) Down counter Z4 in A2 will increment continuously from 99 to 0, the time; being determined by the range selected, Each time Z4 goes to 0, up counter Z7 will increment by 1. Counter Z7 computes the actual score. The cycle will continue until ended by a pitch or yaw error, from comparators contained ended by a pitch or yaw error, from comparators contained when the selected range has been reached. The score will hold at its current count for the duration of the tracking error. When the error is removed, the counters will resume their advance. If there are no tracking errors during the test, up counter Z7 will count to 99. When the master timer in Al determines that the target range has been reached, signal TK/TR enables the decoder drivers in A2, which take the score from counter Z7 and send it to the score display indicator. The score will be displayed for hits in both the practice and the qualify modes. In case of a miss, meaning excessive IPEI or IYEI present at the time of TK/TR, the score will be displayed for the practice mode but not for the qualify mode. In the event the test is ended before TK/TR is reached, a score will not be displayed in either mode.

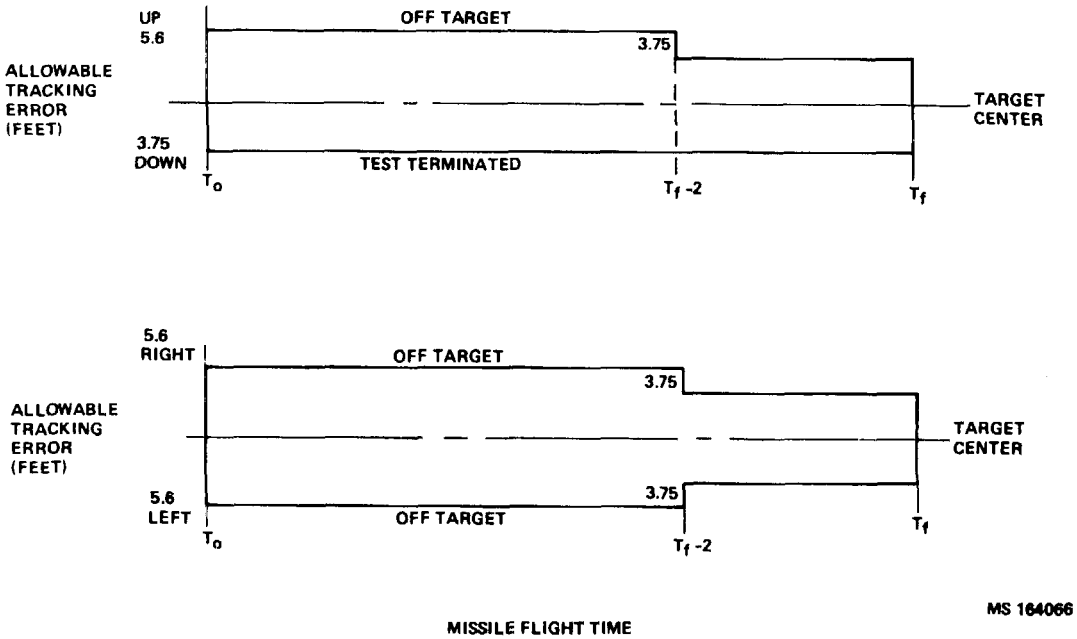



*Figure 2-9. On Target Flight Requirements*

## Section IV. SELF TEST MODE

**2-12. Self Test (Figure 2-10).**

a. SHILLELAGH Self Test (SST). The SST feature is initiated with the MODE SELECT switch in the SHILLELAGH SELF TEST position. Plus 5 volts is applied to training mode logic AS, which enables signals K2, K3, and K4, KS. These signals energize CDU relays K2 through KS (fig. 2-3) and disconnect CDU control from the tracker.

The COFT and SHILLELAGH systems are thereby separated, allowing the SHILLELAGH self test to operate.

SHILLELAGH self test is initiated at the SHILLELAGH test checkout panel (TCP) and is performed automatically by the SDC.

b. COFT Self Test (CST). COFT self test is initiated with the MODE SELECT switch in the COFT SELF TEST position. Plus 5 volts is now applied to the self test control in A7 and A8. The logic is thereby enabled and a self test fire pulse, STFP (A7-36) is sent to system logic (AI-13) and begins the simulated firing sequence. It closely follows an actual firing sequence as described in paragraph 2-8. The COFT self test performs a sequence of tests on all CDU circuits and will fault isolate a failure to the card level.

(1) CST consists of static and dynamic checks. The static checks test the position and rate error channels including the tracker sum signal detector, while the dynamic checks test all the indicators and simulated outputs. This is called a simulated firing sequence. Stimulus and monitoring circuitry are contained in the self test stimulus A7 and self test sequencer A8.

(2) Stimulus A7 provides the voltages for generating pitch and yaw rates, position error signals, and tracker low level signals to the error channels A3 and A4. Detected faults develop a no-go signal that is applied to the fault lamp drivers also in A7.

(3) Self test sequencer A8 contains the decoder logic which receives the signals from cards Al through A7 that determine the failure location. If a failure is detected, A8 sends a no-go signal to the lamp driver in A7, lighting the fault lamp on the malfunctioning card (one of seven, Al through A7).

(4) All normal simulations in the VES appear as in an actual firing sequence. The error signal stimuli cycle, error channels, and all CDU indicators are activated. The MISS DISTANCE indicator is driven and the scoring is cycled 0 through 99.

**2-13. Tracker Preset.**

a. General. In tracker preset mode, the missile reticle to target alinement is made, the tracker is set according to the range selected, and the boresight telescope and infrared projector are alined to the target. The IRP is turned on and will remain on in tracker preset mode for 64 seconds.

b. Range Select. A range of 0500 to 2999m can be selected at the RANGE SELECT dial on the CDU. The selected range is applied to a programmable logic memory in master timer Al (fig. 2-11) in the form of most (MSD) and least significant digits (LSD). This memory controls the length of time that the tracker will be operated. After selecting TRACKER PRESET mode (TPM) (pin 4) on the MODE SELECT switch, RESET and TRACKER PRESET' switches are pressed. These switches enable signals within self test stimulus A7 logic which control CDU relays K1 and K2. Relays K1 and K2 are energized (fig. 2-3), removing 28 Vdc from the tracker brake (IJI-FF). A timer in Al sends a signal to self test stimulus A7 and relay K2 is deenergized, causing 28 Vdc to be applied to the tracker clutch through relay Kl and connector lJ1-EE. The tracker then operates to the range stored in Al, at which time, signal TK/TR (fig. 2-11) is enabled for A7 logic, which then deenergizes relay KI, again applying 28 Vdc power to the brake. The tracker is now set at the target range. The READY lamp on the CDU is illuminated by a signal from control logic in training mode logic A5. The IR PROJ ON lamp is illuminated by a signal from the interlock circuit.

**2-14. Infrared Projector Alinement.** A procedure is used to aline the infrared projector with the boresight telescope and to test for adequate vehicle to target signal levels. It begins when the CDU is set in the tracker preset mode. This alinement has two parts: coarse and fine. In the coarse alinement the boresight telescope reticle is centered on the target by adjusting the AZ ADJ and EL ADJ controls on the IRP adjustable mount. The fine alinement involves a null frequency adjustment. This alinement uses an audio tone, from the CDU, adjustable with the azimuth and elevation controls. These controls are adjusted for the lowest possible frequency (pitch) as monitored in the CVC helmet on the vehicle intercom. If the pitch (frequency) is too high or too low, tone control 2R1, on the side of the OSU, can be adjusted to improve the sensitivity.

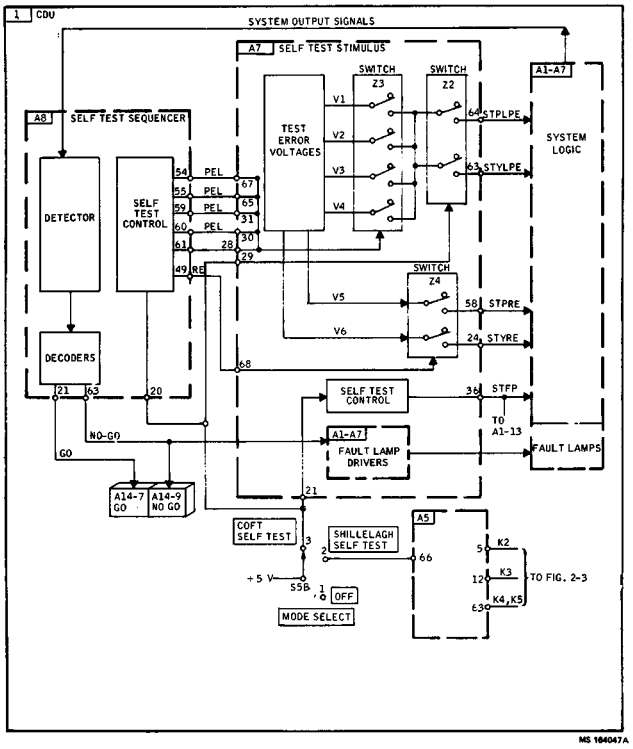



*Figure 2-10. COFT Self Test Functional Diagram*

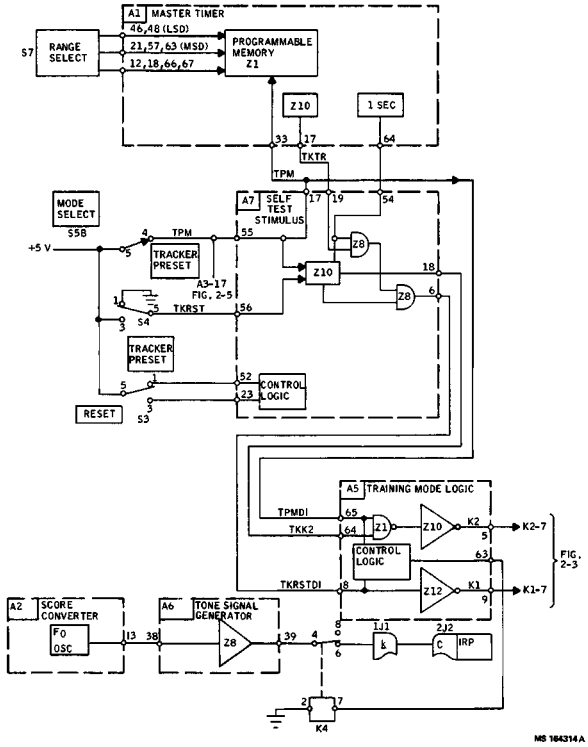



*Figure 2-11. Tracker Preset Functional Diagram*

# CHAPTER 3

# TROUBLESHOOTING

## Section I. TEST EQUIPMENT SETUP AND CHECKOUT

**3-1. General.**

a. This chapter contains the troubleshooting information for locating and correcting most of the operating troubles which may develop in the COFT system. Each malfunction for a unit or the system is followed by a series of tests which will help you to determine the corrective actions for you to take. You should perform the tests and corrective actions in the order listed.

b. This chapter cannot list all the possible malfunctions that may occur nor all the tests and corrective actions. If a malfunction is not listed or is not corrected by the corrective actions, refer to the theory of operation and functional diagrams in Chapter 2 to aid in troubleshooting.

**3-2. COFT Field Support Test Equipment.**

a. The power required to operate the COFT van, COFT field support test equipment, and COFT System during test is provided by Portable Generator PU402. It provides 208 Volts, 3 phase, 60 Hz ac power. The 28 Vdc power is provided from the van's internal power supply.

b. The test equipment includes a test panel, optical simulation unit (OSU), IRP energy monitor (IEM), telescope, launch recoil simulator (LRS), control display unit (CDU), and COFT cables. Refer to TM 94935466-14.

**3-3. Preliminary Test Setup.** Make COFT system power cable connections (fig. 3-1) as follows:

| COFT system cable | Connect to |
|---|---|
| W1P1 | J1 COFT test panel |
| W2P2 | J2 COFT test panel |
| W1P3 | 3J1 of LRS |
| WIP8 | 2J2 of IRP |
| W1P9 | 2J 1 of VES |

**NOTE**

Adapter cable W3 is connected only for cable continuity testing.

| Adapter cable | Connect from | Connect to |
|---|---|---|
| W1 | J10 COFT test panel | 1J1 of CDU |
| W2 | J11 COFT test panel | DC power connector |
| W3 | J6 COFT test panel | W1P6 cable of COFT cable assembly |

On COFT test panel connect a test lead between J1-KK and J1-W.

**WARNING**

Verify that IEM is installed or cover (9, fig. 5-1) on offset prism is closed. The laser to be operated in subsequent steps of the test procedure represents a hazard to personnel without cover closed or IEM installed.

**3-4. Equipment Turn On Procedure.**

a. Rotate power supply FINE VOLTAGE, COARSE VOLTAGE, and CUR ADJ AMPS controls fully counterclockwise.

b. Set power supply circuit breaker to ON. POWER ON lamp will light.

c. Set COARSE VOLTAGE ADJUST control to 28 Vdc as indicated on voltmeter. Use FINE VOLTAGE ADJUST as necessary.

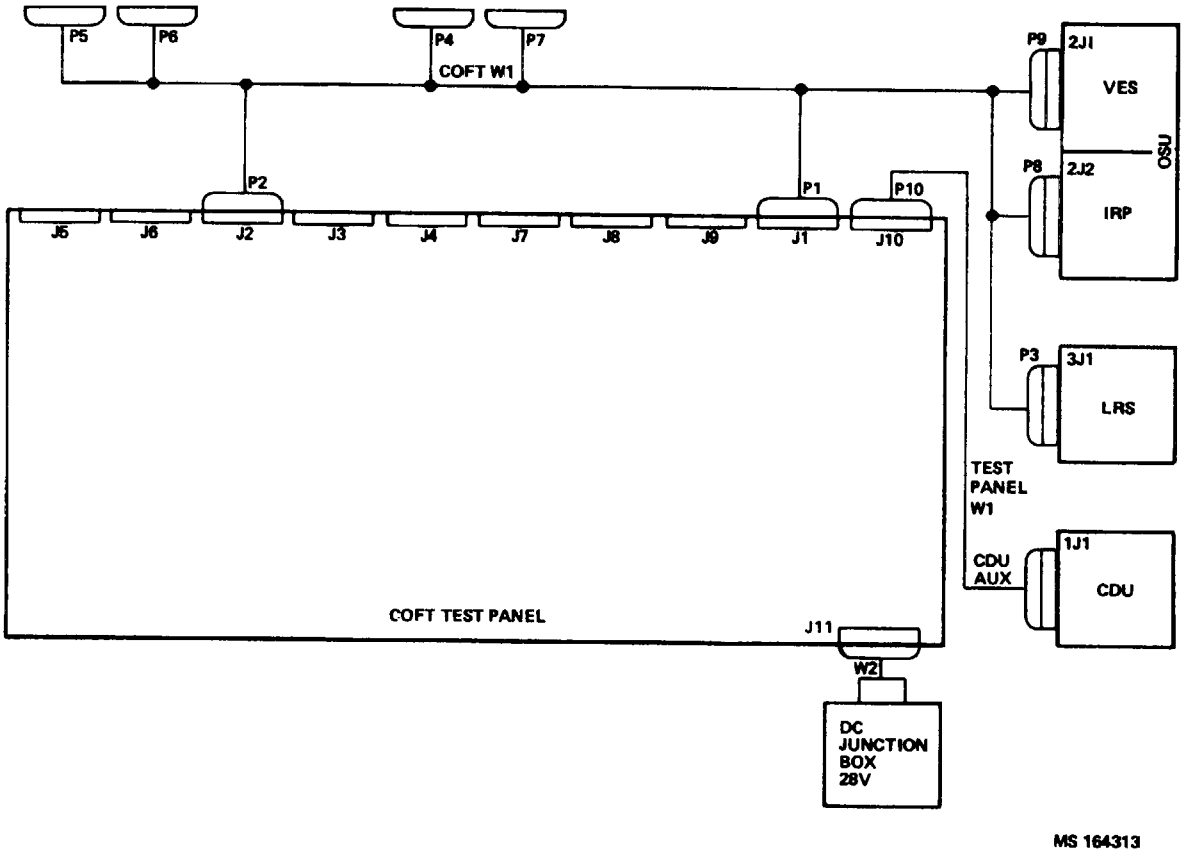



*Figure 3-1. COFT Test Setup*

d. Set CUR ADJ AMPS control fully counter-clockwise.

e. Press test panel PUSH TO RESET switch.

f. Set COFT TEST PANEL POWER switch to ON. POWER lamp will light. If POWER lamp does not light, check lamp filament resistance. If good, troubleshoot PUSH TO RESET switch circuit breaker and W2 cable (para 3-7).

g. Set switches to the following positions for initial test setup:

(1) Test panel PUSH TO RESET – Press
(2) Test panel POWER ON -- ON

(3) Test panel AUDIO VOLUME -- midrange
(4) Test panel AUDIO TONE -- midrange
(5) Test panel LASER ENABLE -- OFF
(6) CDU CB1 -- ON
(7) CDU MODE SELECT -- OFF
(8) CDU DAY/NIGHT -- DAY
(9) CDU RANGE SELECT -- 2500
(10) CDU PRACTICE/QUALIFY -- PRACTICE

**NOTE**

After equipment warmup, adjust the COARSE VOLTAGE and FINE VOLTAGE ADJUST controls and CUR ADJ AMPS control as necessary to maintain voltage stated above.

Perform fault isolation procedures in accordance with paragraph 3-6.

**NOTE**

The troubleshooting steps are to be performed in sequence as directed. When directed to perform a corrective action, the operator must return to the troubleshooting procedure step where he stopped. The operator shall then complete the procedure.

**3-5. Equipment Shutdown.** Set test panel POWER switch to OFF and MODE SELECT switch to OFF.

## Section II. FAULT ISOLATION

**3-6. Malfunction Symptom Index.** Perform a COFT self test by setting CDU MODE SELECT to SHILLELAGH SELF TEST. Press RESET and then set MODE SELECT switch to COFT SELF TEST and observe indicators. To , find the step in the troubleshooting procedures for a particular malfunction, refer to the malfunction symptom index in table 3-1.

**NOTE**

Unit under test must pass Item 18 checks before return to service.

*Table 3-1. Malfunction Symptom Index*

| | Malfunction Symptom | Table 3-2, Item No. |
|---|---|---|
| a. | CDU INDICATIONS (installed in vehicle only) | |
| | TRACKER NO GO lamp lights in vehicle. UNDER RANGE lamp will not go out in operate mode. Tracker will not range. TRACKER PRESET switch does not operate. | 5 |
| | SHILLELAGH SELF TEST NO GO lamp lights in vehicle. MISS DISTANCE consistently inaccurate. | 6 |
| | SHILLELAGH TRANSMITTER NO GO lamp lights in vehicle. SHILLELAGH transmitter operates (not stopped by COFT). | 7 |
| | Tracker motor does not operate. (No motor sounds from tracker.) MISS DISTANCE indicator driven to one limit. IRP does not operate. | 8 |
| | Tracker motor does not operate. | 9 |
| b. | CDU Under Test | |
| | CDU inoperative, READY lamp does not light. | 1 |
| | CDU NO GO lamp lights during self test. | 2 |
| | CDU NO GO lamp lights, COFT self test inoperative. COFT system functionally inoperative. | 3 |
| | CDU GO lamp lights in COFT self test, but system inoperative in vehicle. (Problem isolated to CDU.) | 4 |
| | CDU GO lamp lights in COFT SELF TEST (Condition Unknown) | 18 |

**NOTE**

COFT self test malfunction symptoms are included in items 10, 11, 12, and 13 as referenced. The most likely malfunctions are covered by the item number for each symptom noted. The events are listed in the order that they appear in COFT self test. (See table 3-3.)

| | | |
|---|---|---|
| | CDU Visual Indications | |
| | RESET lamp does not light. | 12 |
| | CDU NO GO lamp does not light. | 12 |
| | POWER ON lamp does not light. | 12 |
| | IR PROJ ON lamp does not light. | 13 |
| | LOW TRACKER SIGNAL lamp does not light. | 12 |
| | MISS DISTANCE indicator does not operate. | 12 |
| | UNDER RANGE lamp does not light. | 12 |
| | EXCESS TARGET SPEED lamp does not light. | 12 |
| | TRAINING lamp does not light | 12 |
| | EXCESS RATE lamp does not light. | 12 |
| | OFF TARGET lamp does not light. | 12 |
| | FALSE TRIGGER lamp does not light. | 12 |
| | HIT lamp does not light. | 12 |
| | SCORE indicator does not light, | 13 |
| | CDU GO lamp does not light. (Neither CDU GO nor CDU NO GO lamp lights at end of COFT self test.) | 13 |
| CDU Audio Indications | | |
| | Boresight tone missing. | 12 |
| | Miss tone missing. | 12 |
| | Rocket motor blast missing. | 12 |

*Table 3-1. Malfunction Symptom Index -- Continued*

| | Malfunction Symptom | Table 3-2, Item No. |
|---|---|---|
| b. | CDU Under Test (cont.) | |
| | Scavenge sound missing. | 12 |
| | LRS erratic, does not operate, or is locked up. | 10 |
| | Missile source motor sound missing. | 11 |
| | Warning tones missing. | 12 |
| | CDU Indications | |
| | One or all of the following lamps or indicators on the CDU do not light or operate in TRACKER PRESET or OPERATE mode:<br>CDU GO lamp<br>SCORE counter<br>IR PROJ ON lamp | 13 |
| | One or all of the following do not operate in OPERATE mode:<br>EVENT counter<br>DAY/NIGHT switch | 14 |
| | One or all of the following do not operate in OPERATE mode:<br>RESET switch<br>PRACTICE/QUALIFY switch | 15 |
| | LOW TRACKER SIGNAL lamp does not light in OPERATE mode. | 12 |
| | IR PROJ ON lamp does not light when CDU is in TRACKER PRESET mode. | 16 |
| | MODE SELECT switch erratic or does not operate.<br>Some modes operate, others do not.<br>No modes operate.<br>Tracker in vehicle resets when CDU is in COFT SELF TEST mode.<br>POWER ON lamp and panel lamps do not light | 17 |
| | TRACKER PRESET switch does not operate. | 5 |
| | *OSU Visual Indications (with CDU in self test mode, failure of any or all) | |
| | Rocket motor flash does not light or remains on. | 11 |
| | Smoke filter does not actuate or remains in place. | 11 |
| | OFF TARGET indicator does not actuate or remains in place. | 11 |
| | Missile source light does not light or remains on. | 11 |
| | EXCESS RATE indicator does not actuate or remains in place. | 11 |
| | Hit indicator does not actuate or remains in place. | 11 |
| c. | LRS Under Test | |
| | LRS erratic, does not operate, or is locked up. | 10 |
| d. | OSU Under Test | |
| | IRP inoperative. | 16 |
| | Missile source motor sound missing. | 11 |
| | OSU Visual Indications | |
| | Rocket motor flash does not light or remains on. | 11 |
| | Smoke filter does not actuate or remains in place. | 11 |

*Table 3-1. Malfunction Symptom Index -- Continued*

| | Malfunction Symptom | Table 3-2, Item No. |
|---|---|---|
| d. | OSU Under Test (cont.) | |
| | OFF TARGET indicator does not actuate or remains in place. | 11 |
| | Missile source light does not light or remains on. | 11 |
| | EXCESS RATE indicator does not actuate or remains in place. | 11 |
| | Hit indicator does not actuate or remains in place. | 11 |
| | CDU Indications | |
| | IR PROJ ON lamp does not light when IRP is on. | 16 |
| e. | WI CABLE Under Test | |
| | Missile source motor sound missing. | 11 |
| | OSU Visual Indications | |
| | Rocket motor flash does not light or remains on. | 11 |
| | Smoke filter does not actuate or remains in place. | 11 |
| | OFF TARGET indicator does not actuate or remains in place. | 11 |
| | Missile source light does not light or remains on. | 11 |
| | EXCESS RATE indicator does not actuate or remains in place. | 11 |
| | Hit indicator does not actuate or remains in place. | 11 |
| | Warning tones missing. | 12 |
| | LOW TRACKER SIGNAL lamp does not light. | 12 |
| | MISS DISTANCE indicator does not operate. | 12 |
| | UNDER RANGE lamp does not light. | 12 |
| | EXCESS TARGET SPEED lamp does not light. | 12 |
| | TRAINING lamp does not light. | 12 |
| | EXCESS RATE lamp does not light. | 12 |
| | OFF TARGET lamp does not light. | 12 |
| | FALSE TRIGGER lamp does not light. | 12 |
| | HIT lamp does not light. | 12 |
| | SCORE indicator does not light. | 13 |
| | CDU GO lamp does not light. | 13 |
| | CDU Audio Indications | |
| | Boresight tone missing. | 12 |
| | Miss tone missing. | 12 |
| | Rocket motor blast missing. | 12 |
| | Scavenge sound missing. | 12 |
| | CDU Visual Indications | |
| | RESET lamp does not light. | 12 |
| | CDU NO GO lamp does not light. | 12 |
| | POWER ON lamp does not light. | 12 |
| | IR PROJ ON lamp does not light. | 13 |
| f. | Retroreflector Target | |
| | If reflective cube is broken or more than 50 percent of surface does not reflect, refer to paragraph 6-6. | |

*Table 3-2. COFT Troubleshooting*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 1 | CDU INOPERATIVE, READY LAMP DOES NOT LIGHT. |
| | Step 1. Perform preliminary test set up (para 3-3). |
| | Step 2. Install defective CDU in place of CDU in van test setup. |
| | Step 3. Perform equipment turn on procedure (para 34). |
| | Step 4. Set MODE SELECT switch from OFF to OPERATE (do not press RESET). Set DAY/NIGHT switch to NIGHT. CDU NO GO, RESET, and NIGHT lamps should light. |
| | a. If lamps do not light, go to step 5. |
| | b. If lamps light normally, go to step 12. |
| | Step 5. Measure input voltage (50 Vdc scale) between pins W (+) and T (-) and pins U (+) and T (-) of connector J 1. It should be +28 +4.0 Vdc. |
| | a. If voltage is abnormal, check +28 Vdc source and perform continuity test on cable. |
| | b. If voltage is normal, go to step 6. |
| | Step 6. Set MODE SELECT switch to OFF and COFT test panel POWER switch to OFF. Remove relay K6 (para 4-18). Do not install new relay at this time. Proceed to step 7. |
| | Step 7. Set panel POWER switch to ON and CDU MODE SELECT switch to OPERATE. Measure voltage (50 Vdc scale) between pins A1, B1 and C1 of K6 (+) relay socket and T (-) of J1 on test panel. |
| | a. If voltage is +28 +4.0 Vdc, go to step 15. |
| | b. If voltage is incorrect on any pin, set test panel POWER switch to OFF, reinstall relay K6, and go to step 8. |
| | Step 8. Remove CDU display panel (para 4-2f(l)). Set test panel POWER switch to ON. Measure voltage (50 Vdc scale) between terminals 2 and 4 of circuit breaker CB1 (+) and pin T (-) of J1 on test panel. |
| | a. If voltage is +28 +4.0 Vdc, proceed to step 9. |
| | b. If voltage is abnormal, send CDU to depot for repair. |
| | Step 9. Measure voltage between terminals 1 (+) and 3 (-) of circuit breaker CB 1 and pin T (-) of J1 on test panel. |
| | a. If voltage is +28 +4.0 Vdc, send CDU to depot for repair. |
| | b. If voltage is abnormal, proceed to step 10. |
| | Step 10. Set test panel POWER switch to OFF and CDU MODE select switch to OFF. Replace circuit breaker CBI (para 4-9) and proceed to step I1. |
| | Step 11. Set test panel POWER switch to ON and CDU MODE SELECT switch to OPERATE. |
| | a. If RESET and CDU NO GO lamps light, go to step 12 |
| | b. If RESET and CDU NO GO lamps do not light, send CDU to depot for repair. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 1 (Cont) | Step 12. Press RESET. POWER ON and READY lamps should light.<br>a. If POWER ON and READY lamps light, go to Item 18.<br>b. If POWER ON lamp does not light, go to Item 3, step 4.<br>c If POWER ON lamp lights but READY lamp does not light, proceed to step 13.<br>Step 13. Set test panel POWER switch to OFF. Remove CDU display panel (para 4-2f(1)) and check continuity (RX1I scale) (short) between pins C and 5 of deck B on MODE SELECT switch (MODE SELECT must be in OPERATE).<br>a. If continuity is correct, replace circuit card A5 (para 4-14) and go to step 14.<br>b. If continuity is incorrect, replace MODE SELECT switch (para 4-10) and go to step 19.<br>Step 14. Set test panel POWER switch to ON. Set MODE SELECT switch to OPERATE and press RESET.<br>a. If READY lamp lights, go to Item 18.<br>b. If READY lamp does not light, set MODE SELECT switch to OFF, test panel POWER switch to OFF, reinstall original A5 card, and send CDU to depot for repair.<br>Step 15. Measure voltage (50 Vdc scale) between pin X2 (+) of K6 socket and pin T (-) of J1 on test panel.<br>a. If voltage is +28 +4.0 Vdc, set MODE SELECT switch to OFF, test panel POWER switch to OFF, replace relay K6, and go to step 17.<br>b. If voltage is not +28 t4.0 Vdc, go to step 16.<br>Step 16. Set test panel POWER switch to OFF (leave MODE SELECT switch in OPERATE). Measure continuity (RX1 scale) (short) between pins C and 5 of deck A on MODE SELECT switch.<br>a. If continuity is correct, send CDU to depot for repair.<br>b. If continuity is incorrect, replace MODE SELECT switch (para 4-10) and go to step 17.<br>Step 17. Set test panel POWER switch to ON and MODE SELECT switch to OPERATE. RESET and CDU NO GO lamps should light.<br>a. If lamps light normally, go to step 18.<br>b. If lamps do not light, send CDU to depot for repair.<br>Step 18. Press RESET. POWER ON and READY lamps should light.<br>a. If POWER ON and READY lamps light, go to Item 18.<br>b. If lamps do not light, go to Item 3, step 4.<br>Step 19. Set test panel POWER switch to ON. Set MODE SELECT switch to OPERATE. Press RESET.<br>a. If READY lamp lights, go to Item 18.<br>b. If READY lamp does not light, send CDU to depot for repair. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 2 | CDU NO GO LAMP LIGHTS DURING SELF TEST. |
| | Step 1. Perform preliminary test set up (para 3-3). |
| | Step 2. Install defective CDU in place of CDU in van test set up. |
| | Step 3. Perform equipment turn on procedure (para 3-4). |
| | Step 4. Set CDU MODE SELECT switch to COFT SELF TEST. Press RESET. Observe GO/NO GO indicators at completion of self test cycle. Set MODE SELECT switch to SHILLELAGH SELF TEST and back to COFT SELF TEST and observe GO/NO GO indicators at termination of self test cycle. Repeat for a total of three COFT self test cycles. |
| | a. If a GO occurs for each self test, go to Item 18. |
| | b. If a NO GO occurs for each self test, proceed to step 5. |
| | c. If results are intermittent (some GO, some NO GO), go to step 12. |
| | Step 5. Set MODE SELECT switch to OFF. Set test panel POWER ON/OFF switch to OFF. |
| | Step 6. Remove CDU front cover (para 4-2b( 1)) exposing the circuit cards. |
| | Step 7. Set test panel POWER ON/OFF switch to ON. Set CDU MODE SELECT switch to COFT KSELF TEST. |
| | Step 8. Press RESET. Observe circuit card fault lamps when NO GO occurs. |
| | a. If a fault indicator lamp lights, set MODE SELECT switch to OFF, and replace the associated circuit card. Repeat COFT self test. If NO GO recurs, install original circuit card and proceed to step 9. If GO lamp lights, go to Item 18. |
| | b. If no fault indicator lamps light, set CDU MODE SELECT and test panel POWER ON/OFF to OFF. Proceed to step 9. |
| | Step 9. Replace circuit card A8 and repeat COFT self test. |
| | a. If GO lamp lights, go to Item 18. |
| | b. If NO GO lamp lights, set MODE SELECT switch to OFF. Reinstall original A8 and proceed to step 10. |
| | Step 10. Replace circuit card A7 and repeat COFT self test. |
| | a. If GO lamp lights, go to Item 18. |
| | b. If NO GO lamp lights, set MODE SELECT to OFF, reinstall original A7 card, and go to step 11. |
| | Step 11. Repeat COFT self test and observe the display sequence on the CDU display panel. |
| | a. If NO GO lamp lights before the UNDER RANGE lamp lights, go to step 12. |
| | b. If NO GO lamp lights after the UNDER RANGE lamp lights, go to step 28. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 2 (Cont) | Step 12. Set MODE SELECT switch to TRACKER PRESET. Set 2500 on RANGE SELECT switch. Press RESET and proceed to step 13.<br>Step 13. Connect multimeter (50 Vdc scale) between pins FF (+) and T (-) of J1 on test panel. Press TRACKER PRESET switch. Voltage should step from +28 +4 Vdc to 0 Vdc when the TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights.<br>a. If indication is correct, proceed to step 14.<br>b. If indication is incorrect, perform relay K1 troubleshooting procedure (Item 5, step 4).<br>Step 14. Connect multimeter between pins EE (+) and T (-) of J1 on test panel. Press RESET. Press TRACKER PRESET switch. Approximately one second after pressing TRACKER PRESET switch, voltage should step from 0 Vdc to +28 +4 Vdc. When READY lamp lights, voltage should return to 0 Vdc.<br>a. If indication is correct, proceed to step 15.<br>b. If indication is incorrect, perform relay Ki troubleshooting procedure (Item 5, step 6).<br>Step 15. Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (RXI scale) between pins X and S of J1 on test panel. Press RESET. Meter should indicate continuity between pins X and S.<br>a. If continuity, proceed to step 16.<br>b. If no continuity, perform relay K2 troubleshooting procedure (Item 6, step 4).<br>Step 16. Set MODE SELECT switch to OPERATE. Press RESET. Meter should indicate no continuity from X to S.<br>a. If no continuity, proceed to step 17.<br>b. If continuity, perform relay K2 troubleshooting procedure (Item 6, step 5).<br>Step 17. Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Check for continuity (open) between pins T and Y and pins A and Z of J1 on COFT test panel. There should be no continuity.<br>a. If no continuity, proceed to step 18.<br>b. If continuity, perform relay K3 troubleshooting procedure (Item 7, step 4).<br>Step 18. Set MODE SELECT switch to OPERATE. Press RESET. Check for continuity between pins _ and Y and pins A and Z of J1 on COFT test panel. There should be continuity.<br>a. If continuity, proceed to step 19.<br>b. If no continuity, perform relay K3 troubleshooting procedure (Item 7, step 5).<br>**WARNING**<br>Do not operate laser without IRP energy monitor installed or offset prism cover closed. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION | |
|---|---|---|
| 2 (Cont) | Step 19. | Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (10 Vdc scale) between pins K (+) and T (-) of J1 on COFT test panel. Press RESET. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Meter should indicate +5 +1 Vdc while LASER ENABLE switch is ON. |
| | a. | If voltage is correct, proceed to step 20. |
| | b. | If voltage is incorrect or missing, troubleshoot relay K4 (Item 8, step 4). |
| | Step 20. | Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET switch. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Meter should indicate +2.5 +0.5 Vdc while LASER ENABLE switch is ON. |
| | a. | If voltage is correct, proceed to step 21. |
| | b. | If voltage is incorrect, troubleshoot relay K4 (Item 8, step 5). |
| | Step 21. | Set MODE SELECT switch to OPERATE. Press RESET. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Multimeter should indicate +2.5 +0.5 Vdc for approximately 64 seconds. When RESET lamp lights, voltage should rise to +5 +I Vdc. |
| | a. | If indication is correct, proceed to step 22. |
| | b. | If indication is incorrect, troubleshoot relay K4 (Item 8, step 6). |
| | Step 22. | Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (RX 1 scale) between pins P and R of J I on COFT test panel. Press RESET. Check for lack of continuity. |
| | a. | If no continuity, proceed to step 23. |
| | b. | If continuity, troubleshoot relay K4 (Item 8, step 7). |
| | Step 23. | Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET Meter should indicate continuity between P and R. |
| | a. | If continuity, proceed to step 24. |
| | b. | If no continuity, troubleshoot relay K4 (Item 8, step 8). |
| | Step 24. | Set MODE SELECT switch to OPERATE. Press RESET. Meter should indicate continuity between P and R for approximately 64 seconds and no continuity when RESET lamp lights. |
| | a. | If continuity is correct, proceed to step 25. |
| | b. | If continuity is incorrect, troubleshoot relay K4 (Item 8, s tep 9). |
| | Step 25. | Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Measure continuity between pins P and N (open) and pins N and M (short) of J I on COFT test panel. |
| | a. | If continuity is correct, proceed to step 26. |
| | b. | If no continuity, troubleshoot relay K5 (Item 9, step 4). |
| | Step 26. | Set MODE SELECT to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Measure continuity between pins P and N (short) and pins N and M (open). |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 2 (Cont) | a. If continuity is correct, proceed to step 27.<br>b. If continuity is incorrect, troubleshoot relay KS (Item 9, step 5).<br>Step 27. Set MODE SELECT switch to OPERATE. Press RESET. Measure continuity between pins P and N (short for approximately 64 seconds, open when RESET lamp lights). Press RESET and measure continuity between pins N and M (open for approximately 64 seconds, short when RESET lamp lights).<br>a. If continuity is correct, return CDU to depot for repair.<br>b. If continuity is incorrect, troubleshoot relay K5 (Item 9, step 6).<br>Step 28. Perform COFT SELF TEST while observing the items listed below for abnormal indication.<br>**NOTE**<br>Apply a slight hand pressure against the LRS brow pad during the self test cycle to assure that the solenoid is operating at full recoil. |

| | Indication | Troubleshooting Procedure |
|---|---|---|
| (1) | Rocket motor lamp does not light or lights and stays on. | Item 11, step 9 |
| (2) | LRS does not recoil, recoils and sticks, or recoil is weak. | Item 10, step 10 |
| (3) | Smoke screen does not drop or drops and sticks. | Item 11, step 10 |
| (4) | OFF TARGET logo does not appear or sticks. | Item 11, step 13 |
| (5) | Missile source does not appear or driver motor keeps running. | Item 11, step 11 |
| (6) | EXCESS RATE logo does not appear or sticks. | Item 11, step 12 |
| (7) | HIT logo does not appear or sticks. | Item 11, step 14 |
| (8) | NONE of the above functions. | Item 11, step 8 |

**NOTE**

If either missile source or smoke screen fail to function, the OFF TARGET display may continue to flash after a CDU NO/GO is indicated.

a. If any of the above indications are abnormal, proceed to the troubleshooting procedure indicated.

b. If all the above indications are correct and a NO GO condition still exists, send CDU to depot for repair.

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 3 | CDU NO GO LAMP LIGHTS, SELF TEST INOPERATIVE, COFT SYSTEM FUNCTIONALLY INOPERATIVE. |
| | Step 1. Perform preliminary test set up (para 3-3). |
| | Step 2. Install defective CDU in place of CDU in van test set up. |
| | Step 3. Perform equipment turn on procedure (para 34). |
| | Step 4. Set MODE SELECT from OFF to OPERATE. RESET and CDU NO GO lamps should light. |
| | a. If lamps light, go to step 5. |
| | b. If lamps do not light, go to Item 1, step 4. |
| | Step 5. Press RESET. POWER ON and READY lamps should light. |
| | a. If POWER ON and READY lamps do not light, go to step 6. |
| | b. If lamps light normally, go to Item 18. |
| | c. If POWER ON lamp lights but READY lamp does not light, go to Item 1, step 13. |
| | Step 6. Measure between indicated pins of J 1 on COFT test panel for the following voltages (50 Vdc scale): |

| From | To | Vdc |
|---|---|---|
| Pin T (return) | Pin Y | +35 ±3 |
| | L | +28 ±4 |
| | KK | +5 ±1 |

| | |
|---|---|
| | a. If voltages are normal, proceed to step 7. |
| | b. If voltages are abnormal, proceed to step 8. |
| | Step 7. Remove CDU rear cover (para 4-2). Measure voltage (50 Vdc scale) at pin 18 and 16 of TB2, using pin T of J 1 on test panel for return. Voltage should be +15 +2 Vdc at pin 18 and -15 +2 Vdc at pin 16. |
| | a. If voltages are normal, replace circuit card AS and proceed to step 10. |
| | b. If either voltage is incorrect, set test panel POWER switch to OFF and replace power supply (para 4-4). Proceed to step 10. |
| | Step 8. Perform equipment shut down (para 3-5). Remove CDU front cover (para 4-2b(1)). Remove and check power supply fuse. |
| | a. If fuse is defective, install new fuse (para 4-4). Go to step 9. |
| | b. If fuse is good, replace power supply (para 4-4). Go to step 9. |
| | Step 9. Perform equipment turn on procedure (para 3-4). Set MODE SELECT switch to COFT SELF TEST and press RESET. If fuse has been replaced and blows again, replace power supply. Go to step 10. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 3 (Cont) | Step 10. Set test panel POWER ON/OFF switch to ON and MODE SELECT switch to COFT SELF TEST. Press RESET. |
| | a. If GO lamp lights at end of COFT self test, go to Item 18. |
| | b. If NO GO lamp lights, troubleshoot circuit cards (Item 2, steps 4 through 10). |
| | c. If POWER ON and READY lamps fail to light, troubleshoot RESET switch (Item 15). |
| 4 | CDU GO LAMP LIGHTS, BUT SYSTEM INOPERATIVE IN VEHICLE. (Problem isolated to CDU at organizational level.) |
| | Step 1. Perform preliminary test set up (para 3-3). |
| | Step 2. Install defective CDU in place of CDU in van test set up. |
| | Step 3. Perform equipment turn on procedure (para 3-4). |
| | Step 4. Perform COFT self test while applying a slight hand pressure against the LRS brow pad. The LRS should recoil twice during self test. |
| | a. If the LRS functions normally, proceed to step 5. |
| | b. If LRS operation is abnormal, proceed to Item 10, step 10. |
| | Step 5. Perform COFT self test and observe EXCESS RATE display through FSTE telescope. |
| | a. If EXCESS RATE display appears normal, proceed to step 6. |
| | b. If EXCESS RATE display is abnormal, proceed to Item 11, step 12. |
| | Step 6. Set MODE SELECT switch to TRACKER PRESET. Set 2500 on RANGE SELECT switch. Press RESET and proceed to step 7. |
| | Step 7. Connect multimeter (50 Vdc scale) between pins FF (+) and T (-) of J1 on test panel. Press TRACKER PRESET switch. Voltage should step from +28 +4 Vdc to 0 Vdc when the TRACKER PRESET switch is pressed and return to +28 f4 Vdc when the READY lamp lights. |
| | a. If indication is correct, proceed to step 8. |
| | b. If indication is incorrect, perform relay K1 troubleshooting procedure (Item 5, step 4). |
| | Step 8. Connect multimeter between pins EE (+) and T (-) of J1 on test panel. Press RESET. Press TRACKER PRESET switch. Approximately one second after pressing TRACKER PRESET switch, voltage should step from 0 Vdc to +28 +4 Vdc. When READY lamp lights, voltage should return to 0 Vdc. |
| | a. If indication is correct, proceed to step 9. |
| | b. If indication is incorrect, perform relay Kl troubleshooting procedure (Item 5, step 6). |
| | Step 9. Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (RX1 scale) between pins X and S of J1 on test panel. Press RESET. Meter should indicate continuity between pins X and S. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 4 (Cont) | a. If continuity, proceed to step 10. |
| | b. If no continuity, perform relay K2 troubleshooting procedure (Item 6, step 4). |
| | Step 10. Set MODE SELECT switch to OPERATE. Press RESET. Meter should indicate no continuity from X to S. |
| | a. If no continuity, proceed to step 11. |
| | b. If continuity, perform relay K2 troubleshooting procedure (Item 6, step 5b). |
| | Step 11. Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Check for continuity between pins T and Y and pins A and Z of J1 on COFT test panel. There should be no continuity. |
| | a. If no continuity, proceed to step 12. |
| | b. If continuity, perform relay K3 troubleshooting procedure (Item 7, step 4). |
| | Step 12. Set MODE SELECT switch to OPERATE. Press RESET. Check for continuity between pins T and Y and pins A and Z of J1 on COFT test panel. There should be continuity. |
| | a. If continuity, proceed to step 13. |
| | b. If no continuity, perform relay K3 troubleshooting procedure (Item 7, step 5). |
| | **WARNING**<br>Do not operate laser without IRP energy monitor installed or offset prism cover closed. |
| | Step 13. Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (I0 Vdc scale) between pins K (+) and T (-) of J1 on COFT test panel. Press RESET. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Meter should indicate +5 ±1 Vdc while LASER ENABLE switch is ON. |
| | a. If voltage is correct, proceed to step 14. |
| | b. If voltage is incorrect or missing, troubleshoot relay K4 (Item 8, step 4). |
| | Step 14. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET switch. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Meter should indicate +2.5 +0.5 Vdc while LASER ENABLE switch is ON. |
| | a. If voltage is correct, proceed to step 15. |
| | b. If voltage is incorrect, troubleshoot relay K4 (Item 8, step 5). |
| | Step 15. Set MODE SELECT switch to OPERATE. Press RESET. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Multimeter should indicate +2.5 +0.5 Vdc for approximately 64 seconds. When RESET lamp lights, voltage should rise to +5 +1 Vdc. |
| | a. If indication is correct, proceed to step 16. |
| | b. If indication is incorrect, troubleshoot relay K4 (Item 8, step 6). |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---|---|
| 4 (Cont) | Step 16. | Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (RXI scale) between pins P and R of J1 on COFT test panel. Press RESET. There should be no continuity. |
| | a. | If no continuity, proceed to step 17. |
| | b. | If continuity, troubleshoot relay K4 (Item 8, step 7). |
| | Step 17 | Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Meter should indicate continuity between P and R. |
| | a. | If continuity, proceed to step 18. |
| | b. | If no continuity, troubleshoot relay K4 (Item 8, step 8). |
| | Step 18. | Set MODE SELECT switch to OPERATE. Press RESET. Meter should indicate continuity between P and R for approximately 64 seconds and no continuity when RESET lamp lights. |
| | a. | If continuity is correct, proceed to step 19. |
| | b. | If continuity is incorrect, troubleshoot relay K4 (Item 8, step 9). |
| | Step 19. | Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Measure continuity between pins P and N (open) and pins N and M (short) of J 1 on COFT test panel. |
| | a. | If continuity is correct, proceed to step 20. |
| | b. | If continuity is incorrect, troubleshoot relay K5 (Item 9, step 4). |
| | Step 20. | Set MODE SELECT to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Measure continuity between pins P and N (short) and pins N and M (open). |
| | a. | If continuity is correct, proceed to step 21. |
| | b. | If continuity is incorrect, troubleshoot relay K5 (Item 9, step 5). |
| | Step 21. | Set MODE SELECT switch to OPERATE. Press RESET. Measure continuity between pins P and N (short for approximately 64 seconds, open when RESET lamp lights). Press RESET and measure continuity between pins N and M (open for approximately 64 seconds, short when RESET lamp lights). |
| | a. | If continuity is correct, proceed to step 22. |
| | b. | If continuity is incorrect, troubleshoot relay K5 (Item 9, step 6). |
| | Step 22. | Set MODE SELECT switch to TRACKER PRESET and press RESET. Connect multimeter (use RX10, 000 scale) between pins N and N of J1 on test panel. After an initial dip toward zero resistance, the meter should indicate an open circuit. Reverse meter leads to N and N and observe a momentary short circuit indication, followed by an open circuit indication. |
| | a. | If indications are correct, go to step 23. |
| | b. | If indications are incorrect, set test panel POWER switch OFF and MODE SELECT switch OFF. Replace capacitor C1 (para 4-19) and go to step 33. Step 23. Set MODE SELECT switch to OPERATE. Set PRACTICE/QUALIFY switch to PRACTICE. Install a test lead between pins KK and C of J1 on test panel. Press RESET. MISS DISTANCE INDICATOR (MDI) should deflect fully up and right. |
| | Step 23. | Set MODE SELECT switch to OPERATE. Set PRACTIVE/QUALIFY switch to PRACTICE. Install a test lead between pins KK and C of J1 on test panel. Press RESET. MISS DISTANCE INDICATOR(MDI) should deflect fully up and right. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---|---|
| 4 | a. | If MDI deflection is correct, go to step 24. |
| (Cont) | b. | If MDI deflection is incorrect, perform MDI troubleshooting per Item 12, step 5. |
| | Step 24. | Install a test lead between pins KK and C of J1 on test panel. Press RESET. Initiate a training cycle by pressing FIRE switch on test panel. The OFF TARGET display should be illuminated and the off target warning tone should be audible throughout the training cycle. |
| | a. | If indications are correct, go to step 26. |
| | b. | If indications are incorrect, set MODE SELECT switch to OFF, panel POWER switch to OFF, replace PRACTICE/QUALIFY switch (para 4-7), and go to step 25. |
| | Step 25. | Set test panel POWER ON/OFF to ON and MODE SELECT switch to OPERATE and press RESET. Press FIRE switch on test panel. The OFF TARGET display and warning tone should be on throughout the training cycle. |
| | a. | If indications are correct, remove test lead from pins KK and C and go to Item 18. |
| | b. | If indications are incorrect, perform troubleshooting procedures for OFF TARGET lamp and off target tone in Item 12, step 5. |
| | Step 26. | Set PRACTICE/QUALIFY switch to QUALIFY. Press RESET. Press FIRE switch. The OFF TARGET and RESET displays should illuminate immediately. |
| | a. | If indications are correct, go to step 28. |
| | b. | If indications are incorrect, set test panel POWER switch to OFF and MODE SELECT switch to OFF. Replace PRACTICE/QUALIFY switch (para 4-7) and go to step 27. |
| | Step 27. | Set test panel POWER switch ON and MODE SELECT switch to OPERATE. Set PRACTICE/ QUALIFY switch to QUALIFY. Press RESET. Press FIRE switch. The OFF TARGET and RESET displays should illuminate immediately. |
| | a. | If indications are correct, remove test lead from pins KK and C and go to Item 18. |
| | b. | If indications are incorrect, send CDU to depot for repair. |
| | Step 28. | Set PRACTICE/QUALIFY switch to PRACTICE. Remove test lead from pins C and KK of J1. Press RESET. Press FIRE switch. Immediately after firing, connect a test lead between pins KK and B of J1. The EXCESS RATE and EXCESS TARGET SPEED lamps should illuminate. The EXCESS RATE lamp should go out after approximately two seconds and the EXCESS TARGET SPEED lamp should remain on throughout the training cycle. |
| | a. | If indications are correct, go to step 30. |
| | b. | If indications are incorrect, set MODE SELECT switch to OFF. Replace circuit card A4 (para 4-14) and go to step 29. |
| | Step 29. | Set MODE SELECT switch to OPERATE and PRACTICE/QUALIFY switch to PRACTICE. Remove test lead from pins KK and B of J1 on test panel. Press RESET. Press FIRE switch. Immediately after firing, install a test lead between pins KK and B of J on test panel. The EXCESS RATE and EXCESS TARGET SPEED lamps should illuminate. The EXCESS RATE lamp should go out after approximately two seconds and the EXCESS TARGET ISSPEED lamp should remain on throughout the training cycle. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---|---|
| 4 | a. | If indications are correct, remove test lead from pins KK and B and go to Item 18. |
| (Cont) | b. | If indications are incorrect, set MODE SELECT to OFF, reinstall original A4 card (para 4-14), and send CDU to depot for repair. |
| | Step 30. | Remove test lead from pins KK and B and connect between pins KK and C of J1 on test panel. Press RESET. Press FIRE switch. During training cycle, alternately switch DAY/NIGHT between DAY and NIGHT positions and verify that the CDU display lamps and OFF TARGET logo dim and CDU night lamps light when the switch is in the NIGHT position. |
| | a. | If indications are correct, go to step 31. |
| | b. | If indications are incorrect, go to Item 14, step 6. |
| | Step 31. | Remove test lead from pins KK and C of J1 and connect between pins GG and L. Press RESET. UNDER RANGE display should be illuminated. Press FIRE switch. The READY light should remain illuminated and the TRAINING display should remain off. |
| | a. | If indications are correct, go to Item 18. |
| | b. | If indications are incorrect, remove test lead from pins GG and L, set MODE SELECT switch to OFF, and replace circuit card Al (para 4-14). Go to step 32. |
| | Step 32. | Set MODE SELECT switch to OPERATE. Press RESET. UNDER RANGE display should be illuminated. Press FIRE switch. The READY lamp should remain illuminated and the TRAINING display should remain off. |
| | a. | If indications are correct, remove test lead from pins GG and L on test panel and go to Item 18. |
| | b. | If indications are incorrect, set MODE SELECT to OFF, reinstall original Al card, and send CDU to depot for repair. |
| | Step 33. | Set test panel POWER switch to ON and MODE SELECT switch to TRACKER PRESET. Press RESET. Connect multimeter (RX10, 000 scale) between pins N and N of J1 on test panel. After i an initial dip toward zero resistance, the meter should indicate an open circuit. Reverse meter leads to N and N and observe a momentary short circuit indication followed by an open circuit indication. |
| | a. | If indications are correct, go to Item 18. |
| | b. | If indications are incorrect, send CDU to depot for repair. |
| 5 | TRACKER NO GO LAMP LIGHTS IN VEHICLE. UNDER RANGE LAMP DOES NOT GO OUT IN OPERATE MODE. TRACKER WILL NOT RANGE. TRACKER PRESET SWITCH DOES NOT OPERATE. | |
| | Step 1. | Perform preliminary test set up (para 3-3). |
| | Step 2. | Install defective CDU in place of CDU in van test set up. |
| | Step 3. | Perform equipment turn on procedure (para 3-4). |
| | Step 4. | Connect multimeter (50 Vdc scale) between pins FF (+) and T (-) of J1 on test panel. Set MODE SELECT switch to TRACKER PRESET. Set 2500 on RANGE SELECT switch. Press RESET. Press TRACKER PRESET. Voltage should step from +28 -4 Vdc to O Vdc when the TRACKER PRESET switch is pressed and return to +28 +4 Vdc when the READY lamp lights. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 5 (Cont) | a. If voltage reading is correct, go to step 6. |
| | b. If voltage reading is incorrect, set MODE SELECT switch to OFF and replace relay K 1 (para 4-17). Go to step 5. |
| | Step 5. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Voltage should step from +28 +4 Vdc to 0 Vdc when the TRACKER PRESET switch is pressed and return to +28 +4 Vdc when the READY lamp lights. |
| | a. If voltage indication is correct, go to Item 18. |
| | b. If voltage indication is incorrect, set MODE SELECT switch to OFF. Remove K1 and go to step 8. Step 6. Connect multimeter between pins EE (+) and T (-) of J1 on test panel. Press RESET. Press TRACKER PRESET. Approximately one second after pressing TRACKER PRESET, meter should step from 0 Vdc to +28 +4 Vdc. When READY lamp lights, the voltage should drop to zero. |
| | a. If voltage is correct, go to Item 18. |
| | b. If voltage is incorrect, set MODE SELECT switch to OFF and replace relay K1(para 4-17). Go to step 7. |
| | Step 7. Set MODE SELECT switch to TRACKER PRESET. Press RESET. While monitoring multimeter, press TRACKER PRESET. Approximately one second after pressing TRACKER 'PRESET switch, meter should step from 0 Vdc to +28 +4 Vdc. When READY lamp lights, voltage should drop to zero. |
| | a. If voltage is correct, go to Item 18. |
| | b. If voltage indication is incorrect, set MODE SELECT switch to OFF, reinstall original K1 relay, and go to step 10. |
| | Step 8. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Check for +28 +4 Vdc between pins 3 (+) of K 1 socket and T (-) of J 1 on test panel. Press TRACKER PRESET. Voltage should step from +28 +4 Vdc to 0 Vdc for one second after pressing TRACKER PRESET and then return to +28 +4 Vdc. |
| | a. If voltage is correct, replace original relay K and go to step 10. |
| | b. If voltage is incorrect, set MODE SELECT switch to OFF and replace relay K2 (para 4-17). Reinstall original relay K1, and go to step 9. |
| | Step 9. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Connect multimeter between pins FF (+) and T (-) of J 1 on test panel. Press TRACKER PRESET. Voltage should step from +28 ±4 Vdc to 0 Vdc when TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights. |
| | a. If voltage is correct, go to Item 18. |
| | b. If voltage is incorrect, reinstall original K2 relay and go to Item 6, step 4. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION TEST OR INSPECTION | CORRECTIVE ACTION |
|---|---|---|
| 5 | Step 10. | Perform equipment shut down (para 3-5). Remove front panel (para 4-2b(1l)). Replace (Cont)circuit card A7 (para 4-14) and go to step 11. |
| | Step 11. | Set test panel POWER switch ON and MODE SELECT switch to TRACKER PRESET. Press RESET. Monitor multimeter and press TRACKER PRESET. Voltage should step from +28 +4 Vdc to 0 Vdc when TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights. |
| | a. | If voltage is correct, go to Item 18. |
| | b. | If voltage indication is incorrect, set MODE SELECT switch to OFF and reinstall original A7 card. Replace circuit card A5 and go to step 12. |
| | Step 12. | Set MODE SELECT switch to TRACKER PRESET. Press RESET. Monitor multimeter and press TRACKER PRESET. Voltage should step from +28 +4 Vdc to 0 Vdc when TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights. |
| | a. | If voltage is correct, go to Item 18. |
| | b. | If voltage indication is not correct, go to step 13. |
| | Step 13. | Set test panel POWER switch to OFF and MODE SELECT switch to OFF. Remove CDU display panel (para 4-2f(1)). Set MODE SELECT switch to TRACKER PRESET. Using multimeter (RX1 scale), check continuity (short) between pins C and 4 of deck B of the MODE SELECT switch. |
| | a. | If continuity is correct, set MODE SELECT switch OFF and test panel POWER switch OFF. Replace TRACKER PRESET switch (para 4-8) and go to step 14. |
| | b. | If continuity is incorrect, set test panel POWER switch OFF and MODE SELECT switch OFF. Replace MODE SELECT switch (para 4-10) and go to step 15. |
| | Step 14. | Set test panel POWER switch ON. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Voltage (50 Vdc scale) between pins FF (+) and T (-) of J1 should step from +28 ±4 Vdc to 0 Vdc when TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights. |
| | a. | If voltage is correct, go to Item 18. |
| | b. | If voltage is incorrect, set test panel POWER switch OFF and MODE SELECT switch OFF. Replace RANGE SELECT switch (para 4- ll) and go to step 15. |
| | Step 15. | Set test panel POWER switch ON and MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Voltage between pins FF (+) and T (-) should step from +28 ±4 Vdc to 0 Vdc when TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights. |
| | a. | If voltage is correct, go to Item 18. |
| | b. | If voltage is incorrect, send CDU to depot for repair. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 6 | SHILLELAGH SELF TEST NO GO LAMP LIGHTS IN VEHICLE. CONSISTENT INACCURATE MISS DISTANCE. |
| | Step 1. Perform preliminary test set up (para 3-3). |
| | Step 2. Install defective CDU in place of CDU in van test set up. |
| | Step 3. Perform equipment turn on procedure (para 3-4). |
| | Step 4. Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Measure continuity (RXI scale) (short) between pins X and S of J1 on the test panel. |
| | a. If continuity, go to step 5. |
| | b. If no continuity, go to step 6. |
| | Step 5. Set MODE SELECT switch to OPERATE. Press RESET. Measure continuity (open) between pins X and S of J1 on test panel. |
| | a. If no continuity, go to Item 18. |
| | b. If continuity, go to step 6. |
| | Step 6. If relay K2 has already been replaced and this is a retest, go to step 7. If not a retest, set MODE SELECT switch to OFF and replace relay K2 (para 4-17). Repeat steps 4 and 5 to verify repair. |
| | Step 7. If circuit card A7 has already been replaced and this is a retest, go to step 8. If not a retest, set MODE SELECT switch to OFF and reinstall original relay K2 (para 4-17). Replace circuit card A7 (para 4-14). Repeat steps 4 and 5. |
| | Step 8. If circuit card AS has already been replaced and this is a retest, go to step 9. If not a retest, set MODE SELECT switch to OFF and reinstall original A7 card (para 4-14). Replace circuit card AS (para 4-14). Repeat steps 4 and 5. |
| | Step 9. If circuit card A8 has already been replaced and this is a retest, go to step 10. If not a retest, set MODE SELECT switch to OFF and reinstall original AS card. Replace circuit card A8 (para 4-14). Repeat steps 4 and 5. |
| | Step 10. If step 10 has already been performed and this is a retest, send CDU to depot for repair. If not a retest, set MODE SELECT switch to OFF and test panel POWER switch OFF. Reinstall original A8 circuit card (para 4-14). Remove CDU display panel and check for continuity (RX1 scale) (short) between pins C and 2 of deck B of the MODE SELECT switch (switch must be in SHILLELAGH SELF TEST). |
| | a. If continuity is correct, send CDU to depot for repair. |
| | b. If continuity is incorrect, set MODE SELECT to OFF, test panel POWER to OFF, replace MODE SELECT switch (para 4-10), and repeat steps 3 through 5. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 7 | SHILLELAGH TRANSMITTER NO GO LAMP LIGHTS IN VEHICLE. SHILLELAGH TRANSMITTER OPERATES (NOT STOPPED BY COFT).<br>Step 1. Perform preliminary test set up (para 3-3).<br>Step 2. Install defective.CDU in place of CDU in van test set up.<br>Step 3. Perform equipment turn on procedure (para 3-4).<br>Step 4. Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Check for continuity (RXI scale) (open) between pins T and Y and pins A and Z of J1 on the test panel.U<br>a. If no continuity, proceed to step 5.<br>b. If continuity, go to step 6.I<br>Step 5. Set MODE SELECT switch to OPERATE. Press RESET. Check continuity (short) between pins T and Y and pins A and Z of J I on test panel.<br>a. If continuity, go to Item 18.1<br>b. If no continuity, go to step 6.<br>Step 6. If step 6 has already been performed and this is a retest, go to step 7. If not a retest, set MODE SELECT switch to OFF and replace relay K3 (para 4-17). Repeat steps 4 and 5 to verify repair.<br>Step 7. If step 7 has already been performed and this is a retest, go to step 8. If not a retest, set MODE SELECT switch to OFF and reinstall original K3 relay (para 4-17). Replace circuit card AS (para 4-14). Verify repair by repeating steps 4 and 5.<br>Step 8. If step 8 has already been performed and this is a retest, go to step 9. If not a retest, set MODE SELECT switch to OFF and reinstall A5 card (para 4-14). Replace circuit card A8 (para 4-14). Verify repair by repeating steps 4 and 5.<br>Step 9. If step 9 has already been performed and this is a retest, send CDU to depot for repair. If not a retest, set MODE SELECT switch to OFF and test panel POWER switch to OFF. Reinstall original A8 card (para 4-14). Remove CDU display panel (para 4-2) and check for continuity (RXI scale) (short) between pins C and 2 of deck B on MODE SELECT switch with switch in SHILLELAGH SELF TEST position.<br>a. If continuity is correct, send CDU to depot for repair.<br>b. If continuity is incorrect, replace MODE SELECT switch (para 4-10) and repeat steps 4 and 5. |
| 8 | TRACKER MOTOR DOES NOT OPERATE (NO MOTOR SOUNDS FROM TRACKER). IRP DOES NOT OPERATE. MISS DISTANCE INDICATOR IS DRIVEN TO ONE LIMIT.<br>Step 1. Perform preliminary test set up (para 3-3).<br>Step 2. Install defective CDU in place of CDU in van test set up.<br>Step 3. Perform equipment turn on procedure (para 3-4). |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 8 (Cont) | **WARNING**<br>Do not operate laser without IRP energy monitor installed or offset prism cover clo sed. |

Step 4. Set MODE SELECT switch to SHILLELAGH SELF TEST. Connect multimeter (10 Vdc scale) between pins K (+) and T (-) of Jl on test panel. Press RESET. On test panel lift switch guard, set and hold LASER ENABLE switch ON. Voltage should read +5 +1 Vdc while the LASER ENABLE switch is ON.

a. If voltage is correct, proceed to step 5.

b. If voltage is incorrect, go to step 10.

Step 5. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET switch. On test panel lift switch guard, set and hold LASER ENABLE switch ON. Meter should indicate approximately +2.5 +0.5 Vdc between pins K (+) and T (-) of J1 on test panel while LASER ENABLE switch is ON.

a. If voltage is correct, go to step 6.

b. If voltage is incorrect, go to step 10.

Step 6. Set MODE SELECT switch to OPERATE. Press RESET. On the test panel lift the switch guard, set and hold LASER ENABLE switch ON until RESET lamp lights. The meter should indicate approximately +2.5 +0.5 Vdc between pins K (+) and T (-) of J1 on the test panel for approximately 64 seconds after the RESET switch is pressed. When RESET lamp lights, voltage should increase to +5 +1 Vdc.

a. If voltage is correct, go to step 7.

b. If voltage is incorrect, go to step 10.

Step 7. Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Measure continuity (RX 1 scale) (open) between pins P and R of J1 on test panel.

a. If no continuity, go to step 8.

b. If continuity, go to step 10.

Step 8. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET Measure continuity (short) between pins P and R of J1 on test panel.

a. If continuity, go to step 9.

b. If no continuity, go to step 10.

Step 9. Set MODE SELECT switch to OPERATE. Press RESET. Measure continuity between pins _P and R of J 1 on test panel. There should be continuity for approximately 64 seconds after RESET switch is pressed. When RESET lamp lights, there should be no continuity.

a. If continuity is correct, go to Item 18.

b. If continuity is incorrect, go to step 10.

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION |
|---|---|
| 8 | Step 10. If step 10 has already been performed and this is a retest, go to step 11. If not a retest, set (Cont)MODE SELECT switch to OFF and replace relay K4 (para 4-17). Repeat steps 4 through 9 to verify repair. |
| | Step 11. If step 1 I has already been performed and this is a retest, go to step 12. If not a retest, set MODE SELECT switch to OFF and reinstall original relay K4 (para 4-17). Replace circuit card A5 (para 4-14) and repeat steps 4 through 9 to verify repair. |
| | Step 12. If step 12 has already been performed and this is a retest, go to step 13. If not a retest, set MODE SELECT switch to OFF and reinstall original A5 card (para 4-14). Replace circuit card A7 (para 4-14). Verify repair by repeating steps 4 through 9. |
| | Step 13. If step 13 has already been performed and this is a retest, send CDU to depot for repair. -If not a retest, set MODE SELECT switch to OFF and test panel POWER switch to OFF. Reinstall original A7 circuit card (para 4-14). Remove CDU display panel (para 4-2f(l) and check MODE SELECT switch continuity as follows (RX1 scale): TRACKER PRESET MODE - pin C to pin 4 of deck B (short) OPERATE MODE - pin C to pin 5 of deck B (short) |
| | a. If continuity is correct, send CDU to depot for repair. |
| | b. If continuity is incorrect, replace MODE SELECT switch (para 4-10). Set test panel POWER switch ON and repeat steps 4 through 9 to verify repair. |
| 9 | TRACKER MOTOR DOES NOT OPERATE |
| | Step 1. Perform preliminary test set up (para 3-3). |
| | Step 2. Install defective CDU in place of CDU in van test set up. |
| | Step 3. Perform equipment turn on procedure (para 3-4). |
| | Step 4. Set MODE SELECT switch to SHILLELAGH SELF TEST. Press RESET. Measure continuity (RX1 scale) between pins P and N (open) and pins N and M (short) of J1 on the test panel. |
| | a. If continuity is correct, go to step 5. |
| | b. If continuity is incorrect, go to step 7. |
| | Step 5. Set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET. Measure continuity between pins P and N (short) and pins N and M (open) of J1 on the test panel. |
| | a. If continuity is correct, go to step 6. |
| | b. If continuity is incorrect, go to step 7.U |
| | Step 6. Set MODE SELECT switch to OPERATE. Press RESET. Measure continuity between pins P and N (short for 64 seconds, open when RESET lamp lights). Press RESET and check continuity between pins N and M (open for 64 seconds, short when RESET lamp lights) of J1 on test panel. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 9 (Cont) | a. If continuity is correct, go to step 11.<br><br>**NOTE**<br>If this is a retest and continuity is correct, go to Item 18.<br>b. If continuity is incorrect, go to step 7.<br><br>Step 7. If step 7 has already been performed and this is a retest, go to step 8. If not a retest, set MO DE SELECT switch to OFF and replace relay K5 (para 4-17). Repeat steps 4 through 6 to verify repair.<br>Step 8. If step 8 has already been performed and this is a retest, go to step 9. If not a retest, set MODE SELECT switch to OFF and reinstall original K5 relay (para 4-17). Replace circuit card AS (.para 4-14). Repeat steps 4 through 6 to verify repair.<br>Step 9. If step 9 has already been performed and this is a retest, go to step 10. If not a retest, set MODE SELECT switch to OFF and reinstall original A5 circuit card (para 4-14). Replace circuit card A7 (para 4-14) and repeat steps 4 through 6 to verify repair.<br>Step 10. If step 10 has already been performed and this is a retest, send CDU to depot for repair. If this is not a retest, set MODE SELECT switch to OFF and test panel POWER switch to OFF. Reinstall original A7 card (para 4-14). Remove CDU display panel (para 4-2) and check MODE SELECT switch continuity as follows (RX1 scale):<br><br>TRACKER PRESET mode - pin C to pm 4 of deck B (short)<br><br>OPERATE mode - pin C to pin 5 of deck B (short)<br><br>a. If indications are correct, reinstall CDU display panel (para 4-2f(2)). Send CDU to depot for repair.<br><br>b. If indications are incorrect, replace MODE SELECT switch (para 4-10). Set test panel POWER switch ON and repeat steps 4 through 6 to verify repair.<br><br>Step 11. Set MODE SELECT switch to TRACKER PRESET and press RESET. Connect multimeter (use RX 10, 000 scale) between pin N and pin N of J1 on test panel. After an initial dip toward zero resistance, the meter should indicate an open circuit. Reverse meter heads between N and N and observe a momentary short circuit indication followed by an open circuit indication on the meter.<br><br>a. If indications are correct, go to Item 18.<br><br>b. If indications are incorrect, set MODE SELECT to OFF, replace capacitor C1(para 4-19), and repeat measurements of step 11 to verify repair.<br><br>(1) If indications are correct, go to Item 18.<br><br>(2) If indications are incorrect, send CDU to depot for repair. |
| 10 | LRS ERRATIC, DOES NOT OPERATE, OR IS LOCKED UP<br><br>Step 1. Perform preliminary test set up (para 3-3). If unit under test is CDU, proceed to step 8. If unit under test is LRS, proceed to step 2. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 10 (Cont) | Step 2. Install defective LRS in place of LRS in van test set up. |
| | Step 3. Perform equipment turn on procedure (para 3-4). |
| | Step 4. Set CDU MODE SELECT switch to COFT SELF TEST. Press RESET. During self test, the LRS should recoil twice. |
| | a. If LRS operates normally, perform step 7. |
| | b. If LRS does not operate, perform step 5, |
| | Step 5. Replace LRS solenoid (para 6-2). Go to step 6. |
| | Step 6. Perform COFT self test. |
| | a. If LRS operates normally, LRS is good. Return to service. |
| | b. If LRS fails to operate, reinstall original solenoid and go to step 7 (troubleshoot CDU). |
| | Step 7. Perform equipment shut down (para 3-5). |
| | Step 8. Install defective CDU in place of CDU in van test set up. |
| | Step 9. Remove CDU rear cover (para 4-2(1)). |
| | Step 10. Perform equipment turn on procedure (para 34). |
| | NOTE<br>When performing the procedures of step 1I 1 and step 13, apply a slight hand pressure to the LRS brow pad to assure that the solenoid is operating at full recoil. |
| | Step 11. Set CDU MODE SELECT switch to COFT SELF TEST and press RESET. The LRS should recoil twice during self test. |
| | a. If LRS does not recoil or recoils and sticks, set MODE SELECT to OFF and replace transistor Q8 (para 4-16). Repeat self test. |
| | (1) If LRS operates normally, go to Item 18. |
| | (2) If LRS still does not recoil, or recoils and sticks, set MODE SELECT to OFF, reinstall the original Q8, and replace transistor Q1 (para 4-15). Repeat self test. |
| | (a) If LRS operates normally, go to Item 18.1 |
| | (b) If LRS still does not recoil, or recoils and sticks, set MODE SELECT to OFF, reinstall the original Q1, and go to step 12. |
| | b. If LRS operates normally, go to Item 18. |
| | Step 12. Perform equipment shut down (para 3-5). Disconnect P3 from the LRS. Test diode CR1 by measuring forward and reverse resistance between pins HH and NN of JI on test panel with the multimeter (use RX10 scale). Reverse resistance should be at least 10 times the forward resistance. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 10 (Cont) | a. If diode resistance is correct, perform step 14.<br>b. If diode resistance is not correct, perform step 13.<br>Step 13. Perform equipment shut down procedure (para 3-5). Remove diode CR1 and install a good diode (para 4-20). Connect P3 to LRS and set panel POWER switch to ON. Repeat COFT self test.<br>a. If LRS operates normally, go to Item 18.<br>b. If LRS does not operate, or recoils and sticks, go to step 14.<br>Step 14. Connect P3 to LRS and set panel POWER switch to ON. Set MODE SELECT switch to OPERATE. Press RESET. Measure voltage (50 Vdc scale) between pins HH (+) and T (-) of J1 on test panel. It should be +28 +4 Vdc.<br>a. If voltage is normal, troubleshoot circuit cards (Item 2, steps 4 through 10). If Item 2 has already been performed, send CDU to depot for repair.<br>b. If voltage is incorrect, troubleshoot relay K6 (Item 1). If Item 1 has already been performed, send CDU to depot for repair. |
| 11 | IN GUNNER'S (OR FSTE) TELESCOPE. IF ANY ONE OR ALL OF THE FOLLOWING ERROR INDICATORS AND SIMULATIONS DO NOT APPEAR OR ARE LOCKED UP:<br><br>EXCESS RATE<br>OFF TARGET<br>Rocket motor flash<br>Smoke<br>Missile source lamp<br>HIT<br><br>Step 1. Perform preliminary test set up (para 3-3).<br>Step 2. If unit under test is CDU, proceed to step 6. If unit under test is OSU, proceed to step 3.<br>Step 3. Install OSU (UUT) in place of OSU in van test set up. Reconnect cables WIP3, WIP8, and WIP9.<br>Step 4. Perform equipment turn on procedure (para 3-4). Set CDU MODE SELECT switch to OPERATE. Press RESET and proceed to step 5.<br>Step 5. Press the following buttons on the COFT test panel while watching for the visual indicators.<br><br>Button — Indication<br>DISPLAY LAMP — White light in telescope.<br>SMOKE — Screen should drop in VES.<br>MISSILE SOURCE — Missile source should appear in telescope.<br>DISPLAY LAMP and OFF TARGET — OFF TARGET should appear in telescope.<br>DISPLAY LAMP and EXCESS RATE — EXCESS RATE should appear in telescope.<br>DISPLAY LAMP and HIT — HIT should appear in telescope. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 11 (Cont) | a. If all of the indications and simulations appear normally, OSU is operational. Go to Item, 18B step 4.<br><br>b. If the display lamp or missile source lamp fails to illuminate, replace OSU bulbs (para 5-3) and repeat step 5. If indications are still missing, send OSU to depot for repair.<br><br>c. If any indicator or simulation is stuck, send OSU to depot for repair.<br><br>Step 6. Install CDU (UUT) in test set up. Proceed to step 7.<br><br>Step 7. Perform equipment turn on procedure (para 3-4). Perform COFT self test procedure while observing OSU display sequence listed below through FSTE telescope. If the problem is one of the following, remove CDU rear cover (para 4-2c(l)) and go to the step indicated below.<br><br>Problem — Go to Step<br>(1) Rocket motor lamp does not come on or comes on and stays on. — 9<br>(1) Smoke screen does not drop or drops and sticks. — 10<br>(3) OFF TARGET does not appear or sticks. — 13<br>(4) Missile source does not appear or driver motor keeps running. — 11<br>(5) EXCESS RATE does not appear or sticks. — 12<br>(6) HIT does not appear or sticks. — 14<br>(7) None of the above functions. — 8<br><br>NOTE<br><br>If either missile source or smoke screen fail to function, the OFF TARGET display may continue to flash after a CDU NO/GO is indicated.<br><br>Step 8. It none of the OSU displays function during COFT self test, measure voltage (50 .Vdc scale) between pins L (+) and T (-) of J1 on test panel.<br><br>a. If voltage between pins L and T is +28 +4 Vdc, go to step 9.<br><br>b. If voltage between pins L and T is not +28 +4 Vdc, go to Item 1, step 4.<br><br>Step 9. Rocket motor lamp does not come on or lamp comes on and stays on.<br><br>a. If simulation does not appear, perform equipment shut down (para 3-5) and replace transistor Q2 (para 4-16). Perform COFT self test,<br><br>(1) If simulation appears normally and a CDU GO occurs, go to Item 18.<br>(2) If simulation appears normally, but a CDU NO GO occurs, look for other m alfunctions in Item 11. If there are no other malfunctions, perform procedures of Item 2. |

*Table 3.2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 11<br>(Cont) | NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair.<br><br>b. If rocket motor lamp does not come on or comes on and stays on, set MODE SELECT to OFF, reinstall original Q2, and troubleshoot circuit cards (Item 2, steps 4 through 10).<br><br>NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair.<br><br>Step 10. Smoke screen does not appear or drops and sticks, set MODE SELECT to OFF, replace transistor Q4 (para 4-16). Perform COFT self test.<br><br>a. If smoke screen operates normally and a CDU GO occurs, go to Item 18.<br><br>b. If smoke screen operates normally, but a CDU NO GO occurs, look for other malfunctions in Item 11. If there are no other malfunctions, perform procedures of Item 2.<br><br>c. If the smoke screen does not appear or drops and sticks, set MODE SELECT to OFF, reinstall original Q4, and troubleshoot circuit cards (Item 2, steps 4 through 10).<br><br>NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair.<br><br>Step 11. Missile source does not appear or driver motor keeps running, set MODE SELECT to OFF and replace transistor Q5 (para 4-16). Perform COFT self test.<br><br>a. If missile source operates normally and a CDU GO occurs, go to Item 18.<br><br>b. If missile source operates normally, but a CDU NO GO occurs, look for other malfunctions in Item 11. If there are no other malfunctions, perform procedures of Item 2.<br><br>c. If missile source does not operate or driver motor keeps running, set MODE SELECT to OFF, reinstall original QS, and troubleshoot circuit cards (Item 2, steps 4 through 10).<br><br>NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair.<br><br>Step 12. EXCESS RATE does not appear or comes on and stays on. Set MODE SELECT to OFF and replace transistor Q6 (para 4-16). Perform COFT self test.<br><br>a. If EXCESS RATE operates normally and a CDU GO occurs, go to Item 18.<br><br>b. If EXCESS RATE operates normally, but a CDU NO GO occurs, look for other malfunctions in Item 11. If there are no other malfunctions, perform procedures of Item 2.<br><br>c. If the EXCESS RATE does not operate or comes on and stays on, set MODE SELECT to OFF, reinstall original Q6, and replace transistor Q3. Repeat COFT self test.<br><br>(1) If EXCESS RATE operates normally and a CDU GO occurs, go to Item 18. |

*Table 3-2. COFT Troubleshooting- Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 11 (Cont) | (2) If EXCESS RATE does not operate normally, set MODE SELECT to OFF, reinstall original Q3, and troubleshoot circuit cards (Item 2, steps 4 through 10).<br><br>NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair.<br>Step 13. OFF TARGET does not appear or comes on and stays on. Set MODE SELECT to OFF and replace transistor Q7 (para 4-16). Perform COFT self test.<br><br>a. If OFF TARGET operates normally and a CDU GO occurs, go to Item 18.<br><br>b. If OFF TARGET operates normally, but a CDU NO GO occurs, look for other malfunctions in Item 1 1. If there are no other malfunctions, perform procedures of Item 2.<br><br>c. If OFF TARGET does not operate or comes on and stays on, set MODE SELECT to OFF, reinstall original Q7, and replace transistor Q3. Repeat COFT self test.<br><br>(1) If OFF TARGET operates normally and a CDU GO occurs, go to Item 18.<br><br>(2) If OFF TARGET does not operate normally, set MODE SELECT to OFF, reinstall original Q3, and troubleshoot circuit cards (Item 2, steps 4 through 10).<br><br>NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair.<br><br>Step 14. HIT does not appear or comes on and stays on. Set MODE SELECT to OFF and replace transistor Q9 (para 4-16). Perform COFT self test.<br><br>a. If HIT operates normally and a CDU GO occurs, go to Item 18.<br><br>b. If HIT operates normally, but a CDU NO GO occurs, look for other malfunctions in Item 11. If there are no other malfunctions, perform procedures of Item 2.<br><br>c. If HIT does not operate or comes on and stays on, troubleshoot the circuit cards (Item 2, steps 4 through 10),<br><br>NOTE<br><br>If Item 2 has already been performed, send CDU to depot for repair. |
| 12 | ANY ONE OR ALL OF THE FOLLOWING LAMPS OR INDICATORS DO NOT FUNCTION.<br><br>*POWER ON — EXCESS RATE — *Step 4<br>*RESET — FALSE TRIGGER — Others step 5<br>READY — *LOW TRACKER SIGNAL<br>TRAINING — EXCESS TARGET SPEED<br>*CDU NO GO — UNDER RANGE<br>HIT — MISS DISTANCE INDICATOR (does not operate)<br>OFF TARGET — Bore scavenging and missile launch noise, miss and off target tones.<br>Step 1. Perform preliminary test set up (para 3-3).<br><br>Step 2. Exchange defective CDU with test CDU in test set up. |

*Table 3.2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 12 (Cont) | Step 3. Perform equipment turn on procedure (para 3-4).<br><br>Step 4. For POWER ON RESET, LOW TRACKER SIGNAL, and CDU NO GO lamps, verify that circuit breaker CB1 is ON and MODE SELECT switch is set to SHILLELAGH SELF TEST.<br><br>The following lamps should light: RESET and CDU NO GO.<br><br>Press RESET. POWER ON and LOW TRACKER SIGNAL should light.<br><br>a. If any of the lamps do not light, set MODE SELECT to OFF and inspect it. If defective, install new bulb (para 4-5).<br><br>(1) If the respective lamp now lights, perform step 6.<br><br>(2) If the respective lamp does not light, perform steps b, c, or d.<br><br>b. If POWER ON lamp does not light, set MODE SELECT to OFF and replace circuit card A5 (para 4-14).<br><br>(1) If POWER ON lamp lights, perform step 6.<br><br>(2) If POWER ON lamp does not light, troubleshoot relay K6 (Item 1).<br><br>c. If RESET lamp does not light, set MODE SELECT to OFF and install operational power supply (para 4-4).<br><br>(1) If RESET lamp lights, perform step 6.<br><br>(2) If RESET lamp fails to light, troubleshoot relay K6 (Item 1).<br><br>d. If NO GO lamp does not light, set MODE SELECT to OFF and install operational power supply (para 4-4).<br><br>(1) If NO GO lamp lights, perform step 6.<br><br>(2) If NO GO lamp fails to light, troubleshoot relay K6 (Item 1).<br><br>Step 5. Set MODE SELECT switch to COFT SELF TEST. During test MISS DISTANCE indicator deflects to on target limits then to off target limits. Also, following lamps should light: RESET, READY, HIT, OFF TARGET, EXCESS RATE, FALSE TRIGGER, LOW TRACKER SIGNAL, EXCESS TARGET SPEED, and UNDER RANGE.<br><br>NOTE<br>Perform step 4a (check lamps) prior to changing any circuit cards in steps 5a through 5k.<br><br>a. If MISS DISTANCE indicator does not operate, set MODE SELECT to OFF and install operational circuit card A3 (para 4-14).<br><br>(1) If MISS DISTANCE indicator operates, perform step 6.<br><br>(2) If MISS DISTANCE indicator fails to operate, set MODE SELECT to OFF, set test panel POWER to OFF and replace MDI (para 4-6). If failure persists, perform step 7. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 12<br>(Cont) | b. If RESET lamp does not light, perform step 4b above.<br><br>c. If the READY lamp fails to light, set MODE SELECT to OFF and replace circuit card AS (para 4-14).<br><br>(1) If READY lamp lights, perform step 6.<br><br>(2) If READY lamp fails to light, perform step 7.<br><br>d. If HIT lamp fails to light, set MODE SELECT to OFF and replace circuit card AS (para 4-14).<br><br>(1) If HIT lamp lights, perform step 6.<br><br>(2) If HIT lamp fails to light, perform step 7.<br><br>e. If OFF TARGET lamp fails to light, set MODE SELECT to OFF and replace circuit card AS (para 4-14).<br><br>NOTE<br><br>If circuit card has already been replaced, go to step 6.<br><br>(1) If OFF TARGET lamp lights, perform step 6.<br><br>(2) If OFF TARGET lamp fails to light, perform step 7.<br><br>f. If EXCESS RATE lamp fails to light, set MODE SELECT to OFF and replace circuit card ASI (para 4-14).<br><br>(1) If EXCESS RATE lamp lights, perform step 6.<br><br>(2) If EXCESS RATE lamp fails to light, perform step 7.<br><br>g. If FALSE TRIGGER lamp fails to light, set MODE SELECT to OFF and replace card A1 (para 4-14).<br><br>(1) If the FALSE TRIGGER lamp lights, perform step 6.<br><br>(2) If FALSE TRIGGER lamp fails to light, perform step 7.<br><br>h. If LOW TRACKER SIGNAL lamp fails to light, set MODE SELECT to OFF and install operational circuit card A3 (para 4-14).<br><br>(1) If LOW TRACKER SIGNAL lamp lights, perform step 6.<br><br>(2) If LOW TRACKER SIGNAL lamp fails to light, perform step 7.<br><br>i. If EXCESS TARGET SPEED lamp fails to light, set MODE SELECT to OFF and replace circuit card A4 (para 4-14).<br><br>(1) If EXCESS TARGET SPEED lamp lights, perform step 6.<br><br>(2) If EXCESS TARGET SPEED lamp fails to light, perform step 7. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 12 (Cont) | j. If UNDER RANGE lamp does not light, set MODE SELECT to OFF and replace circuit card Al (para 4-14).<br><br>(1) If UNDER RANGE lamp lights, perform step 6.<br><br>(2) If UNDER RANGE lamp does not light, perform step 7.<br><br>k. If TRAINING lamp does not light, set MODE SELECT to OFF and replace circuit card A8 (para 4-14).<br><br>(1) If TRAINING lamp lights, perform step 6.<br><br>(2) If TRAINING lamp does not light, perform step 7.<br><br>1. If any of the simulated missile flight sounds (missile launch noise, and miss and off target tones) are not heard on the COFT TEST PANEL speaker, set MODE SELECT to OFF and install operational circuit card A2 (para 4-14).<br><br>(1) If the noises or tones are heard, perform step 6.<br><br>(2) If the noises or tones are not heard, set MODE SELECT to OFF, reinstall original circuit card A2, and replace circuit card A6 (para 4-14).<br><br>(a) If noises or tones are heard, perform step 6.<br><br>(b) If they are not heard, troubleshoot COFT cable W1P2 (para 3-7).<br><br>Step 6. Go to Item 18.<br><br>Step 7. Perform equipment shut down (para 3-5). Remove CDU from test set up and send to depot for repair. |
| 13 | ANY ONE OR ALL OF THE FOLLOWING INDICATORS OR LAMPS DO NOT OPERATE OR LIGHT:<br><br>SCORE counter (step 4)<br>CDU GO (neither CDU GO nor CDU NO GO lights at end of COFT self test) (step 5)<br>IR PROJ ON (step 7)<br><br>Step 1. Perform preliminary test set up (para 3-3).<br><br>Step 2. Install defective CDU in place of CDU in van test set up.<br><br>Step 3. Perform equipment turn on procedure (para 3-4).<br><br>Step 4. Set CDU MODE SELECT switch to OPERATE. Insure that a test lead is connected between pins KK and W of J1 on test panel. Press RESET. Press FIRE button on test panel. Observe SCORE counter for an indication of 99.<br><br>a. If SCORE counter reads 99, go to step 8.<br><br>b. If SCORE counter gives an improper indication or does not light, replace it (para 4-13). Retest using step 4. If failure persists, send CDU to depot for repair. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 13 (Cont) | Step 5. If neither CDU GO nor CDU NO GO lamp lights, replace circuit card A8 and perform COFTU self test.<br><br>a. If CDU GO lamp lights, go to step 8.<br><br>b. If CDU GO lamp does not light, go to step 6.<br><br>Step 6. Set MODE SELECT to OFF and replace CDU GO lamp bulb. Perform COFT self test.I<br><br>a If CDU GO lamp lights, go to step 8.<br><br>b. If CDU GO lamp does not light, send CDU to depot for repair.<br><br>Step 7. If the IR PROJ ON lamp does not illuminate, set MODE SELECT switch to TRACKER PRESET. Press RESET. Press TRACKER PRESET switch. IR PROJ ON lamp should light.<br><br>a. If lamp lights, go to step 8.<br><br>b. If lamp fails to light, set MODE SELECT to OFF, set test panel power to OFF, and replace the bulb (para 4-5). Retest by repeating step 7.<br><br>(1) If lamp lights, go to step 8.<br><br>(2) If lamp fails to light, set MODE SELECT to OFF and replace circuit card A4. If trouble persists, send CDU to depot for repair.<br><br>Step 8. Go to Item 18. |
| 14 | ANY ONE OR ALL OF THE FOLLOWING DO NOT OPERATE:<br><br>EVENT counter (step 4)<br>DAY/NIGHT switch (step 6)<br><br>Step 1. Perform preliminary test set up (para 3-3).<br><br>Step 2. Install defective CDU in place of CDU in van test set up.<br><br>Step 3. Perform equipment turn on procedure (para 3-4). Perform appropriate step below.<br><br>Step 4. EVENT counter. Set CB1 to ON and MODE SELECT switch to OPERATE. Press RESET. Press FIRE button on test panel. After firing cycle terminates, press RESET. EVENT counter should increment by 1.<br><br>a. If FVENT counter increments, CDU is operational, go to Item 18.<br><br>b. If EVENT counter fails to increment, perform COFT self test.<br><br>(1) If a GO occurs, set MODE SELECT to OFF and replace circuit card AS (para 4-14). Repeat COFT self test. Go to step 5.<br><br>(a) If EVENT counter increments, go to Item 18.<br><br>(b) If EVENT counter does not increment, go to step 5. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 14 (Cont) | (2) If a NO GO occurs, set MODE SELECT to OFF and replace circuit card A5 (para 4-14). Repeat self test.<br><br>(a) If a GO occurs and EVENT counter increments, go to Item 18.<br><br>(b) If a GO occurs and EVENT counter does not increment, set MODE SELECT to OFF, reinstall A5 card, and go to step 5.<br><br>(c) If a NO GO occurs, go to Item 2.<br><br>Step 5. Perform equipment shut down (para 3-5). Replace EVENT counter (para 4-12). Retest by repeating COFT self test.<br><br>a. If EVENT counter operates normally, go to Item 18.<br><br>b. If EVENT counter fails to increment, send CDU to depot for repair.<br><br>Step 6. DAY/NIGHT switch. Set the DAY/NIGHT switch to NIGHT. The night lamps should light and CDU display lamps should dim.<br><br>a. If night lamps light and CDU display lamps dim, connect a test lead between pins KK and C of J 1 on test panel. Press RESET. Press FIRE switch on test panel and alternately switch from DAY to NIGHT while observing logo display through FSTE telescope. The OFF TARGET logo should dim in the NIGHT position.<br><br>(1) If the OFF TARGET logo dims in the NIGHT position, the DAY/NIGHT switch is normal. Go to Item 18.<br><br>(2) If the OFF TARGET logo does not dim, set MODE SELECT to OFF, set test panel POWER to OFF, replace DAY/NIGHT switch, and go to step 7.<br><br>b. If night lamps do not light and CDU display lamps do not dim, set MODE SELECT to OFF, set test panel POWER to OFF, replace DAY/NIGHT switch (para 4-7), and go to step 7.<br><br>c. If CDU 'display lamps dim and night lamps do not light, inspect night lamps. If defective, install new lamps (para 4-5), and go to step 7.<br><br>Step 7. Set MODE SELECT switch to OPERATE. Press RESET. Set DAY/NIGHT switch to NIGHT. CDU display lamps should dim and night lamps should light.<br><br>a. If indications are normal, go to Item 18.<br><br>b. If indications are not normal, send CDU to depot for repair. |
| 15 | ANY ONE OR ALL OF THE FOLLOWING SWITCHES DO NOT OPERATE:<br><br>RESET (step 4)<br>PRACTICE/QUALIFY (step 6)<br><br>Step.1. Perform preliminary test set up (para 3-3).<br><br>Step 2. Install defective CDU in place of CDU in van test set up.<br><br>Step 3. Perform equipment turn on procedure (para 3-4). |

*TABLE 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 15 (Cont) | Step 4. Set MODE SELECT switch from OFF to SHILLELAGH SELF TEST. RESET and CDU NO GO should light.<br>a. If lamps light, go to step 5.<br>b. If lamps do not light, go to Item 1, step 4.<br>Step 5. Press RESET. POWER ON lamp should light.<br>a. If POWER ON lamp lights, go to step 6.<br>b. If POWER ON lamp does not light, go to Item 3. If Item 3 has already been performed, set test panel POWER switch to OFF and replace RESET switch (para 4-4). Go to step 7.<br>Step 6. Set MODE SELECT switch to OPERATE. Press RESET. RESET lamp should go out and READY lamp should illuminate.<br>a. If READY lamp lights, RESET switch is good. Go to Item 18.<br>b. If READY lamp does not light, set MODE SELECT to OFF and test panel POWER switch to OFF. Replace the RESET switch (para 4-8). Go to step 7.<br>Step 7. Set test panel POWER switch to ON and MODE SELECT switch to OPERATE. Press RESET. POWER ON and READY lamps should light.<br>a. If POWER ON and READY lamps light, go to Item 18.<br>b. If both POWER ON and READY lamps do not light, send CDU to depot for repair.<br>c. If POWER ON lamp lights, but READY lamp does not light, go to Item 1, step 13.<br>Step 8. PRACTICE/QUALIFY switch. Set MODE SELECT switch to OPERATE. Set PRACTICE/ QUALIFY switch to PRACTICE. Press RESET. Press FIRE switch on test panel. After firing, induce an OFF TARGET by connecting a test lead between pins KK and E of J1 on the test panel. Monitor warning tone and look for OFF TARGET in the FSTE telescope.<br>a. If OFF TARGET and warning tone are present, go to step 9.<br>b. If OFF TARGET and warning tone are not present, go to step 10.<br>Step 9. Set PRACTICE/QUALIFY switch to QUALIFY. Press RESET. Press FIRE switch on test panel. After firing, induce an OFF TARGET by connecting a test lead between pins KK and E of J1 on the test panel. The OFF TARGET indication and warning tone should not be present.<br>a. If warning tone and OFF TARGET indication are not present, go to Item 18.<br>b. If warning tone and OFF TARGET indication are present, go to step 0.<br>Step 10. If PRACTICE/QUALIFY switch has already been replaced and this is a retest, go to step 11. If this is not a retest, set MODE SELECT to OFF and panel POWER switch to OFF. Replace PRACTICE/QUALIFY switch (para 4-7). Set panel POWER switch to ON, MODE SELECT to ON, and repeat step 8.<br>Step 11. If circuit card A7 has already been replaced and this is a retest, send CDU to depot for repair. If this is not a retest, set MODE SELECT to OFF and replace circuit card A7 (para 4-14). Repeat step 8. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 16 | IR PROJ ON LAMP DOES NOT LIGHT/IRP INOPERATIVE |

**WARNING**

Do not operate laser without infrared energy monitor (IEM) installed or offset prism cover closed.

Step 1. Perform preliminary test set up (para 3-3).

Step 2. Install defective OSU in place of OSU in van test set up.

Step 3. Connect infrared energy monitor (IEM) to infrared projector as follows:

a. Pull oscilloscope POWER switch to on.

b. Set TIME/DIV to .1I ms.

c. Turn VARIABLE CAL fully CW.

d. Set TRIGGERING to CHI.

e. Set LEVEL to AUTO.

f. Set input selector to CH1.

g. Set CHI VOLTS/DIV to .02.

h. Set CHI VOLTS/DIV VAR (inner knob) fully CW.

i. Set mode switch of CHI to AC.

j. Attach IEM to IRP.

k. Set IEM switch to OPERATE.

l. Attach BNC/banana jack adapter to INPUT 1 on oscilloscope,

m. Connect one jumper from black terminal (COM) of IEM to black terminal (ground) of adapter. Connect another jumper from red terminal (SIG) of IEM to red terminal of adapter.

Step 4. Turn on IRP by setting MODE SELECT SWITCH to TRACKER PRESET: press LASER ENABLE switch on COFT TEST PANEL, and hold while observing waveform on oscilloscope. Adjust oscilloscope INTENSITY, FOCUS, ASTIGMATISM, and SCALE ILLUM as necessary to produce clear display. Waveform should be sinewave with small discontinuities within 0.02 millisecond of minima. Its period should be 1/Fo and its peak-to-peak amplitude a minimum of 0.090 volt. (See fig. 3-2.)

a. If waveform is as described above, IRP is operating normally, go to Item 18B, step 5.

b. If waveform is not as described, IRP is not operating normally, set MODE SELECT to OFF, test panel POWER to OFF and replace IRP (para 5-2 through 5-5).

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 17 | MODE SELECT SWITCH ERRATIC OR DOES NOT OPERATE. |

The following symptoms may occur.

Some modes operate, others do not.
No modes operate.
Tracker in vehicle resets when CDU in COFT self test mode.
Relays not energized - No relay energized click is heard when MODE SELECT is changed from OFF to any other position.
POWER ON lamp and panel lights do not light.

Step 1. Perform preliminary test set up (para 3-3).

Step 2. Install defective CDU in place of CDU in van test set up.

Step 3. Set MODE SELECT switch to OFF. Set circuit breaker CB1 to OFF. Disconnect CDU auxiliary cable WI from connector IJI of the CDU.

Step 4. Remove the CDU display panel (para 4-2f_(l)).

Step 5. Inspect all terminals on MODE SELECT switch for any foreign material that may be shorting terminals. Remove any foreign material found.

Step 6. Using multimeter (RXI scale) check for indicated continuity between the following pins.

| Switch Position | Deck A | Deck B | Deck C |
|---|---|---|---|
| OFF | C to I (open) | | |
| SHILLELAGH SELF TEST | C to 1 (short) | C to 2 (short) | |
| COFT SELF TEST | C to 1 (short) | Cto3 (short) | Cto3 (short) |
| TRACKER PRESET | C to I (short) | C to 4 (short) | |
| OPERATE | C to 1 (short) | C to 5 (short) | |

a. If all indications are correct, MODE SELECT switch is good. Troubleshoot circuit breaker CB 1 and relay K6 (Item I). If this procedure has already been done, send the CDU to depot for repair.

b. If any indication is incorrect, replace MODE SELECT switch (para 4-10) and repeat steps 5 and 6.

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 18 | VERIFICATION PROCEDURE<br>The unit under test shall pass the test specified in this Item before return to service. CDU tests are specified in Item 1 8A, OSU in 18B, and LRS in 18C.<br><br>A. CDU VERIFICATION PROCEDURE<br><br>Step 1. Perform preliminary test set up (para 3-3).<br><br>Step 2. Install CDU under test in place of CDU in van test set up.<br><br>Step 3. Perform equipment turn on procedure (para 3-4).<br><br>Step 4. Perform COFT self test three times, observing GO/NO GO indicators at termination of each self test cycle.<br><br>a. If a GO occurs for each self test, go to step 5.<br><br>b. If a NO GO occurs for each self test, go to Item 2, step 5.<br><br>c. If results are intermittent (some GO, some NO GO), go to Item 2, step 12.<br><br>d. If COFT self test is inoperative, go to Item 1, step 4.<br><br>Step 5. Set MODE SELECT switch to SHILLELAGH SELF TEST and press RESET. Using the multimeter (RXI scale), perform the checks listed below. If any abnormal indication is obtained, go to the troubleshooting procedure indicated for that check. |

| Measurement | Test Panel J 1 Pins | Correct Indication | Troubleshooting Procedure |
|---|---|---|---|
| Continuity | X to S | short | Item 6, step 4 |
| Continuity | T to Y | open | Item 7, step 4 |
| Continuity | A to Z | open | Item 7, step 4 |
| Continuity | P to R | open | Item 8, step 7 |
| Continuity | P to N | open | Item 9, step 4 |
| Continuity | N to M | short | Item 9, step 4 |
| DC Voltage (10 Vdc scale) | K (+) to T (-) | +5 +1 Vdc | Item 8, step 4 |

If above measurements are correct, go to step 6.

Step 6. Set MODE SELECT switch to OPERATE. Press RESET. Using the multimeter, make the continuity checks indicated below (RXI scale). If any abnormal indication is obtained, go to the trouble-shooting procedure indicated for that step.

NOTE

If READY light goes out while performing checks, press RESET.

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|

18 (Cont)

| Test Panel J1 Pins | Correct Indication | Troubleshooting Procedure |
|---|---|---|
| X to S | Open | Item 6, step 5 |
| I to Y | Short | Item 7, step 5 |
| A to Z | Short | Item 7, step 5 |
| P to R | Short | Item 8, step 9 |
| P to N | Short | Item 9, step 6 |
| N to M | Open | Item 9, step 6 |

If above measurements are correct, go to step 7.

**WARNING**

Do not operate laser without IRP energy monitor installed or offset prism cover closed.

Step 7. Connect multimeter (10 Vdc scale) between K (+) and T (-). With MODE SELECT switch in OPERATE, lift switch guard on test panel. Set and hold LASER ENABLE switch ON. Press RESET. Multimeter should indicate approximately +2.5 +0.5 Vdc for approximately 64 seconds. When RESET lamp lights, voltage should rise to +5 fl Vdc.

a. If voltage is correct, go to step 8.

b. If voltage is incorrect, go to Item 8, step 6.

Step 8. Set MODE SELECT switch to TRACKER PRESET. Set 2500 on RANGE SELECT switch. Press RESET. On COFT test panel lift switch guard, set and hold LASER ENABLE switch ON. Meter should indicate approximately +2.5 + 0.5 Vdc while LASER ENABLE switch is ON.

a. If voltage is correct, go to step 9.

b. If voltage is incorrect, go to Item 8, step 5.

Step 9. With MODE SELECT switch in TRACKER PRESET, perform the checks listed below. If any indication is incorrect, go to the troubleshooting procedure noted.

a. Connect multimeter (50 Vdc scale) between FF (+) and T (-) of J1. Press RESET. Press TRACKER PRESET. Voltage should drop from +28 Vdc to 0 Vdc when TRACKER PRESET switch is pressed and return to +28 +4 Vdc when READY lamp lights.

(1) If voltage is correct, go to step 9b.

(2) If voltage is incorrect, go to Item 5, step 4.

b. Connect multimeter between EE (+) and T (-). Press RESET. Press TRACKER PRESET. Approximately one second after pressing TRACKER PRESET, voltage should be +28 +4 Vdc. When READY lamp lights, voltage should be 0 Vdc.

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 18<br>(Cont) | (1)If voltage is correct, go to step 9c.<br><br>(2) If voltage is incorrect, go to Item 5, step 6.<br><br>c. Check continuity (RXI scale) (short) between pins P and R.<br><br>(1) If continuity, go to step 9d.<br><br>(2) If no continuity, go to Item 8, step 8.<br><br>d. Check continuity (RXI scale) between pins P and N (short) and N and M (open).<br><br>(1) If continuity is correct, go to step 9e.<br><br>(2) If continuity is incorrect, go to Item 9, step 5.<br><br>e. Connect multimeter (use RX 10, 000 scale) between pins N and N. After an initial dip toward zero resistance, the meter should indicate an open circuit. Reverse meter leads to N and N and observe a momentary short circuit indication followed by a return to open circuit indication.<br><br>(1) If indications are correct, go to step 10.<br><br>(2) If indications are incorrect, go to Item 9, step 11.<br><br>Step 10. Perform COFT self test while applying a slight hand pressure against the LRS brow pad and observing FSTE telescope for EXCESS RATE display. The LRS should function twice during self test and the EXCESS RATE logo should appear briefly after the first LRS function.<br><br>a. If LRS and EXCESS RATE logo functions are correct, go to step 11.<br><br>b. If LRS function is abnormal, go to Item 10, step 10.<br><br>c. If EXCESS RATE logo function is abnormal, go to Item I 11, step 12.<br><br>Step 11. Set MODE SELECT switch to OPERATE. Set PRACTICE/QUALIFY switch to PRACTICE. Install a test lead between pins KK and C of Jl on test panel. Press RESET and observe that the MISS DISTANCE INDICATOR (MDI) is fully deflected up and right.<br><br>a. If MDI deflection is correct, proceed to step 12.<br><br>b. If MDI deflection is incorrect, perform MDI troubleshooting per Item 12, step 5a.<br>c.<br><br>NOTE<br><br>Jumper installed during step 11 (KK to C) must remain for steps 12 through 14.<br><br>Step 12. Install a jumper from KK to W of J 1 on test panel. Press RESET. Initiate a training cycle by pressing FIRE switch on test panel. The OFF TARGET display should be illuminated and the OFF TARGET warning tone audible throughout the training cycle (the TRAINING lamp should remain on for approximately 12 seconds after FIRE).<br><br>a. If indications are correct, proceed to step 13.<br><br>b. If indications are incorrect, go to Item 4, step 24. |

*Table 3-2. COFT Troubleshooting - Continued*

| ITEM | MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|---|
| 18 (Cont) | Step 13. Press RESET. Press FIRE switch on test panel. During the training cycle, alternately switch DAY/NIGHT switch between DAY and NIGHT positions and verify that the CDU display lamps and OFF TARGET logo dim and CDU night lamps light when the switch is in the N'GHT position.<br><br>a. If indications are correct, go to step 14.<br><br>b. If indications are incorrect, go to Item 14, step 6.<br><br>Step 14. Set PRACTICE/QUALIFY switch to QUALIFY. Press RESET. Press FIRE switch. The OFF 'TARGET and RESET lamps should light immediately after FIRE switch is pressed and the TRAINING lamp should not illuminate.<br><br>a. If indications are correct, proceed to step 15.<br><br>b. If indications are incorrect, go to Item 4, step 26.<br><br>Step 15. Set PRACTICE/QUALIFY switch to PRACTICE. Remove test lead from pins C and KK of J 1. Press RESET. Press FIRE switch. Immediately after firing, connect a test lead between pins KK and B of J 1. The EXCESS RATE and EXCESS TARGET SPEED lamps should illuminate. The EXCESS RATE lamp should go out after approximately two seconds and the EXCESS TARGET SPEED lamp should remain on throughout the training cycle.<br><br>a. If indications are correct, go to step 1 6.<br><br>b. If indications are incorrect, go to Item 4, step 28.<br><br>Step 16. Remove test lead from pins KK and B of J11 and connect between GG and L. The UNDER RANGE lamp should light. Press RESET. Press FIRE switch. The READY lamp should remain ON and the TRAINING lamp should remain OFF.<br><br>a. If indications are correct, go to step 17.<br><br>b. If indications are incorrect, go to Item 4, step 15.<br><br>Step 17. If steps 1 through 16 have been successfully completed, remove all test leads from panel a nd return CDU to service.<br><br>B. OSU VERIFICATION PROCEDURE<br><br>Step 1. Inspect VES for cracked or broken rear window and beam splitter window glass. If replacement is required, go to the appropriate paragraph indicated below:<br><br>a. Rear window (para 5-13).<br><br>b. Beam splitter window (para 5-12).<br><br>Step 2. Inspect IRP for cracked or broken lenses on offset prism assembly and telescope. If broken lenses on either offset prism or telescope, replace IRP ( para 5-2 through 5-5).<br><br>Step 3. Perform OSU tests defined in Item 11, step 4.<br><br>Step 4. Perform IRP tests defined in Item 16, step 3.<br><br>Step 5. If steps 1 through 4 are successful, return OSU to service.<br><br>C. LRS VERIFICATION PROCEDURE<br><br>Step 1. Perform LRS tests defined in Item 10, step 4. |

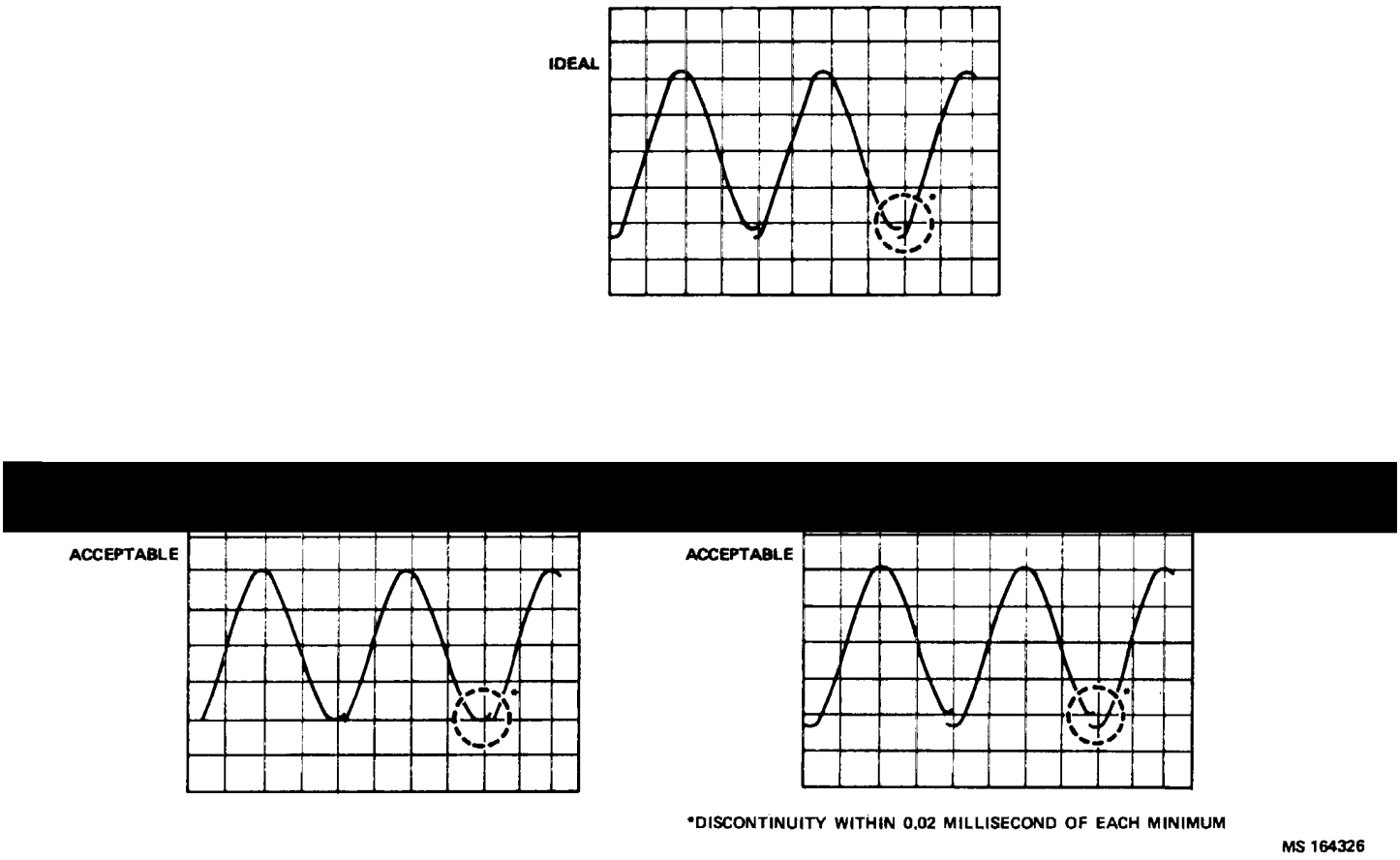



*Figure 3-2. Acceptable Waveforms*

*Table 3-3. COFT Self Test Indications*

These lamps light when MODE SELECT switch is set to COFT SELF TEST from OFF:

1. RESET
2. CDU NO GO

These lamps light when RESET is pushed.

1. IR PROJ ON
2. LOW TRACKER SIGNAL
3. POWER ON
4.

These lamps light in the following sequence during COFT self test.

1. READY
2. LOW TRACKER SIGNAL
3. UNDER RANGE
4. RESET
5. EXCESS TARGET SPEED
6. TRAINING
7. EXCESS RATE
8. OFF TARGET
9. FALSE TRIGGER
10. HIT
11. CDU GO

These audible sounds occur in the following sequence during COFT self test.

1. Boresight tone
2. Miss tone
3. Rocket motor blast
4. LRS recoil (solenoid actuation)
5. Scavenge
6. Missile source motor
7. Warning tone

These indications are seen in the following order in OSU.

1. Launch flash (white light)
2. Smoke screen
3. OFF TARGET
4. Missile source (red dot)
5. EXCESS RATE
6. HIT

These indications also occur during COFT self test.

1. MISS DISTANCE meter should deflect to off target limits.
2. MISS DISTANCE meter should deflect to on target limits.
3. SCORE should read 99 when HIT occurs.

The following indications should be present at end of COFT self test.

1. UNDER RANGE lamp on
2. POWER ON lamp on
3. READY lamp on
4. LOW TRACKER SIGNAL lamp on
5. CDU GO lamp on
6. MISS DISTANCE meter centered
7. No logos activated in OSU
8. LRS in normal position

## Section III. CABLE W1 CONTINUITY CHECK

**3-7.General**. A series of continuity checks can be made to the entire COFT cable. These will check every wire in COFT cable for continuity. Figure 3-3 is a wiring diagram of the cable.

**3-8.Preliminary Test Setup.**

a. Perform inspection of cable in accordance with TM 9-6920-466-12.;
b. Connect cable to COFT TEST PANEL by mating cable connectors to panel connectors (fig. 34). Do not connect CDU adapter cable W1.
c. Set range control on volt-ohmmeter to lowest resistance range. If indication for any continuity check is 1 ohm or greater, reject the cable and send to depot for repair.

**NOTE**

The continuity checks will only determine an open circuit. There is no check for a short between

**3-9. Control Display Unit Cable Connector J1 Continuity Check.**

a. Perform preliminary test setup (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J1-A | J5-M;J6-M |
| J1-B | F5-L;J6-L |
| J1-C | J4-V |
| J1-D | J4-PP |
| J1-G | J9-E |
| J1-H | J-D |
| J1-J | J9-B |
| J1-K | J9-C |
| J1-L | J9-A |
| J1-M | J9-H |
| J1-N | J6-X |
| J1-P | J5-N;J6-N |
| J1-R | J5-C;J6-C |
| J1-T | J6-X;J5-X; J1-V |
| J1-U | J6-G;J5-G; J1-W |
| J1-V | J6-X;J5-X J1-T |
| J1-W | J6-G;J5-G J1-U |
| J1-X | J5-D |
| J1-Y | J7-D |
| J1-Z | J7-H |
| J1-A | J7-T |
| J1-B | J5-F;J6-F |
| J1-C | J5-K;J6-K |
| J1-D | J6-H;J5-H |
| J1-E | J4-NN |
| J1-G | J8-D |
| J1-H | J9R |
| J1-I | J9-V |
| J1-J | J9-P |
| J1-K | J8-C |
| J1-M | J5-X |
| J1-N | J5-B;J6-B |
| J1-P | J5-P;J6-P |
| J1-S | J6-D |
| J1-T | J7-Z |
| J1-W | J4-CC;J4-DD; J4-EE;J4-FF |
| J1-Y | J8-B;J9-L |
| J1-Z | J9-F |
| J1-AA | J9-G |
| J1-BB | J2-K |
| J1-CC | J2-A |
| J1-EE | J5-Q;J6-Q |

| From | To |
|---|---|
| J1-FF | J5-Z;J6-Z |
| J1-GG | J5-E;J6-E |
| J1-HH | J3-A |
| J1-JJ | J4-JJ |
| J1-KK | J8-E |
| J1-LL | J8-A |
| J1-MM | J8-F |
| J1-NN | J3-B |
| J1-PP | J5-P;J6-P |

**3-10. Intercom Cable Connector J2 Continuity Check.**

a. Perform preliminary test setup (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J2-A | J1-CC |
| J2-K | J1-BB |

**3-11. Launch Recoil Simulator Cable Connector J3 Continuity Check.**

a. Perform preliminary test setup (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J3-A | J1-HH |
| J3-B | J1-NN |

**3-12. SHILLELAGH Signal Data Converter Cable Connector J4 Continuity Check.**

a. Perform preliminary test setup (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J4-CC | J1-W |
| J4-DD | J1-W |
| J4-EE | J1-W |
| J4-FF | J1-W |
| J4-JJ | J1-JJ |
| J4-NN | J1-E |
| J4-PP | J1-D |
| J4-V | J1-C |

**3-13. SHILLELAGH Signal Data Converter Cable Connector J5 Continuity Check.**

a. Perform preliminary test setup (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J5-B | J6-B;J1-N |
| J5-C | J6-C;J1-R |
| J5-D | J1-X |
| J5-E | J6-E;J1-GG |
| J5-F | J6-F |
| J5-G | J6-G |
| J5-K | J6-K;J1-C |
| J5-L | J6-L;J1-B |
| J5-M | J6-M;J1-A |
| J5-N | J6-N;J1-P |
| J5-P | J6-P;J1-P |
| J5-S | J6-S |
| J5-T | J6-T |
| J5-W | J6-W |
| J5-X | J1-M |
| J5-Y | J6-Y |
| J5-Z | J6-Z;J1-FF |
| J5-A | J6-A |
| J5-B | J6-B |
| J5-C | J6-C |
| J5-F | J6-F;J1-B |
| J5-G | J6-G;J1-U;<br>J1-W |
| J5-H | J6-H;J1-D |
| J5-I | J6-I |
| J5-J | J6-J |
| J5-K | J6-K |
| J5-0M | J6-M |
| J5-N | J6-N |
| J5-P | J6-P;J1-PP |
| J5-Q | J6-Q;J1-EE |
| J5-R | J6-R |
| J5-S | J6-S |
| J5-T | J6-T |
| J5-U | J6-U |
| J5-W | J6-W |
| J5-X | J6-X;J1-V;J1-T |
| J5-Y | J6-Y |

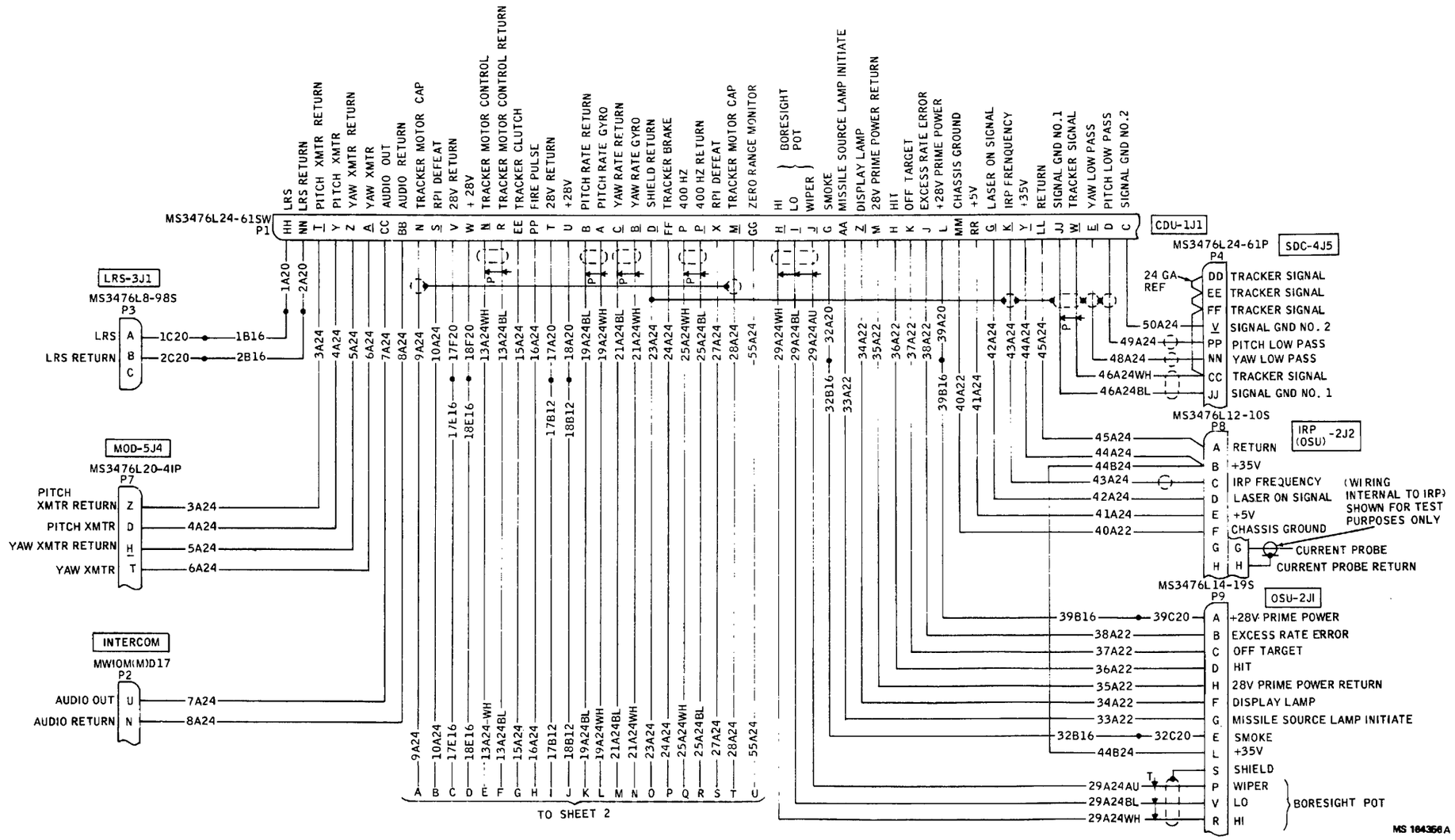



*Figure 3-3. COFT Cable Wiring Diagram (sheet I of 2)*

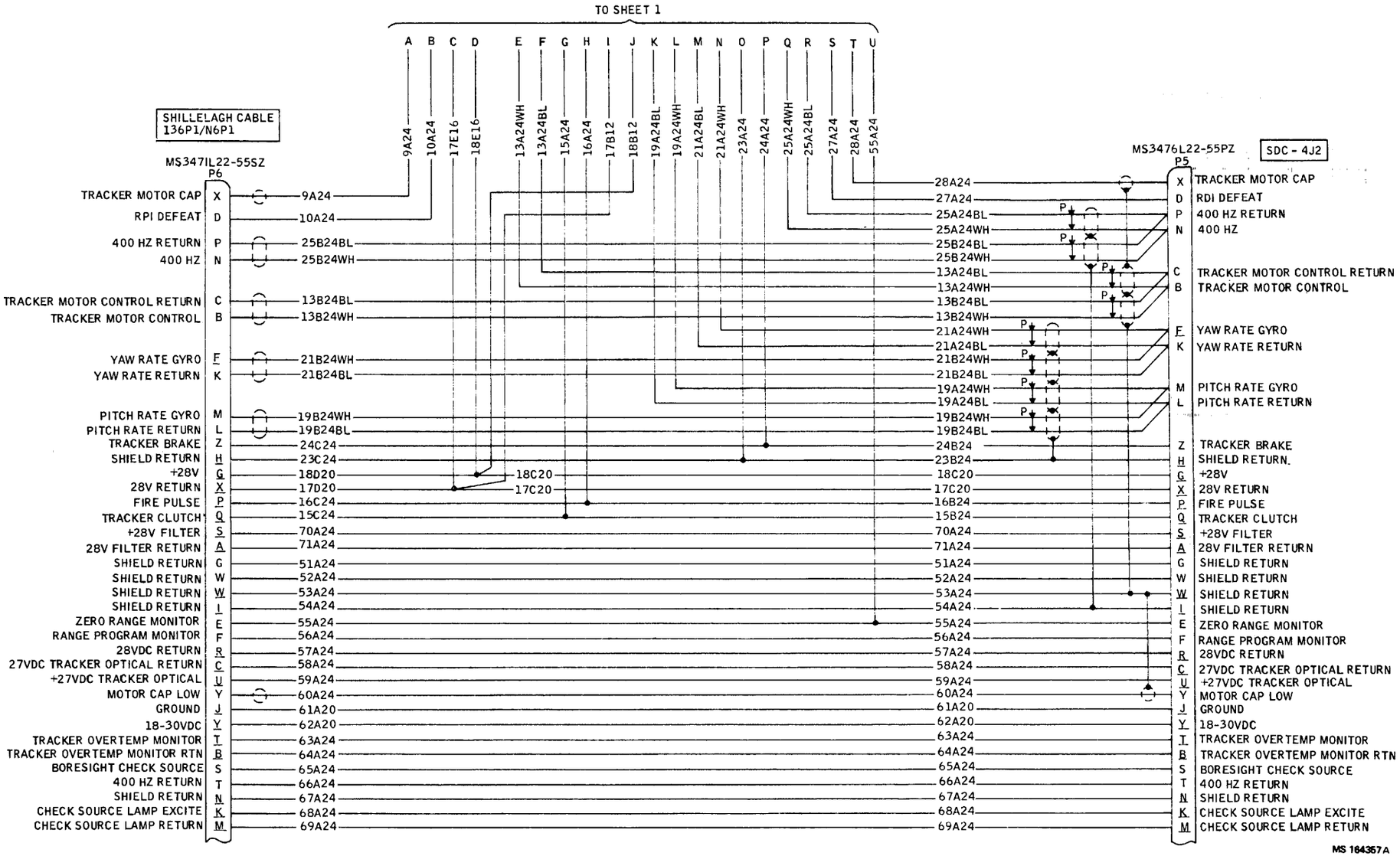



*Figure 3-3. COFT Cable Wiring Diagram (sheet 2 of 2)*

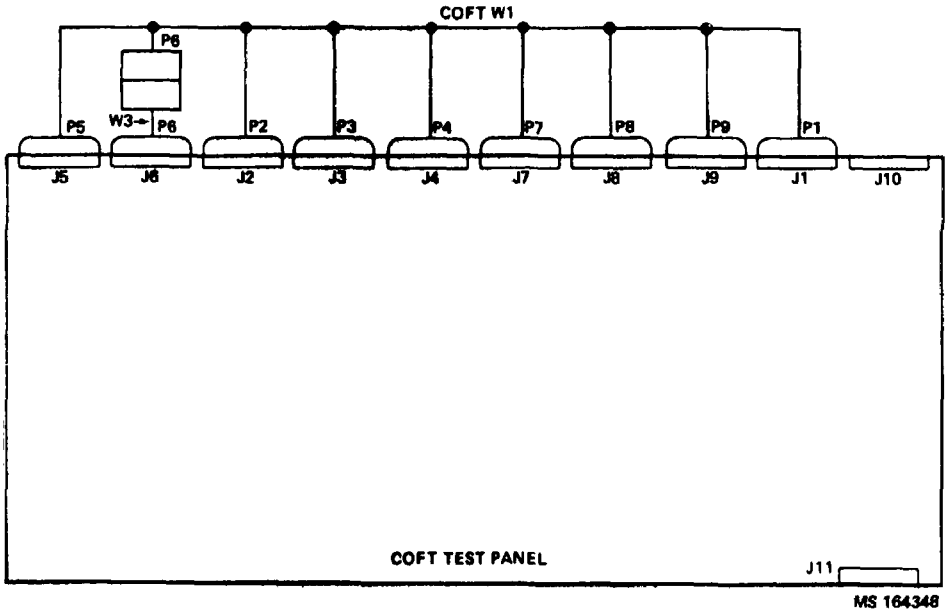



*Figure 3-4. COFT Cable Continuity Test Setup*

**3-14. SHILLELAGH G and C Cable Connector J6 Continuity Check.**

a. Perform preliminary test set up (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J6-B | J5-B;J1-N |
| J6-C | J5-C;J1-R |
| J6-D | J1-S |
| J6-E | J5-E;J1-GG |
| J6-F | J5-F |
| J6-G | J5-G |
| J6-K | J5-K;J1-C |
| J6-L | J5-L;J1-B |
| J6-M | J5-M;J1-A |
| J6-N | J5-N;J1-P |
| J6-S | J5-S |
| J6-T | J5-T |
| J6-W | J5-W |
| J6-X | J1-N |
| J6-Y | J5-Y |
| J6-Z | J5-Z;J1-FF |
| J6-A | J5-A |
| J6-B | J5-B |
| J6-C | J5-C |
| J6-F | J5-F;J1-B |
| J6-G | J5-G;J1-U;J1-W |
| J6-H | J5-H;J1-D |
| J6-I | J5-I |
| J6-J | J5-J |
| J6-K | J5-K |
| J6-M | J5-M |
| J6-N | J5-N |
| J6-P | J5-P;J1-PP |
| J6-Q | J5-Q;J1-EE |
| J6-R | J5-R |
| J6-S | J5-S |
| J6-T | J5-T |
| J6-U | J5-U |
| J6-W | J5-W |
| J6-X | J5-X;J1-T;J1-V |
| J6-Y | J5-Y |

**3-15. SHILLELAGH Modulator Cable Connector J7 Continuity Check.**

a. Perform preliminary test set up (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J7-D | J1-Y |
| J7-H | J1-Z |
| J7-T | J1-A |
| J7-Z | J1-T |

**3-16. Infrared Projector Cable Connector J8 Continuity Check.**

a. Perform preliminary test set up (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J8-A | J1-LL |
| J8-B | J1-Y;J9-L |
| J8-C | J1-K |
| J8-D | J1-G |
| J8-E | J1-KK |
| J8-F | J1-MM |

**3-17. Visual Effects Simulator Cable Connector j9 Continuity Check.**

a. Perform preliminary test set up (para 3-8).
b. Perform continuity check as follows:

| From | To |
|---|---|
| J9-A | J1-L |
| J9-B | J1-J |
| J9-C | J1-K |
| J9-D | J1-H |
| J9-E | J1-G |
| J9-F | J1-Z |
| J9-G | J1-AA |
| J9-H | J1-M |
| J9-L | J8-B;J1-Y |
| J9-P | J1-J |
| J9-R | J1-H |
| J9-V | J1-I |

# CHAPTER 4
# CONTROL DISPLAY UNIT REPAIR INSTRUCTIONS

## Section I. DISASSEMBLY AND ASSEMBLY OF HOUSING

**4-1. Scope.** This section provides instructions for disassembling and assembling the control display unit housing hardware.

**CAUTION**

Do not for any reason attempt to probe, repair or modify flex harness in any way as circuit damage could result.

**4-2.Housing Disassembly and Assembly (Figure 4-1).**

a. Hinged Panel.
- (1) Removal.
  - (a) Push latches (1) down and disengage from latch brackets (2).
  - (b) Swing hinged panel (3) partway open and(2) lift from hinge (4).
- (2)Installation.
  - (a) Engage hinge on panel (3) with hinge (4).
  - (b) Push panel (3) closed.
  - (c) Engage latches (1) with latch brackets (2).

b. Front Cover.
- (1)Removal
  - (a) Remove 12 screws (5).
  - (b) Separate front cover (6) and gasket (7)CAUTION from housing (8).
- (2)Installation.
  - (a) Place front cover (6) and gasket (7) in position.
  - (b) Install and tighten 12 screws (5).

c. Rear Cover.
- (1)Removal.
  - (a) Remove 16 screws (9).
  - (b) Separate rear cover (10) and gasket (11) from housing (8).
- (2)Installation.
  - (a) Place rear cover (10) and gasket (11) in position.
  - (b) Install and tighten 16 screws (9).

d. Breather Valve.
- (1) Removal.
  - (a) Remove rear cover per paragraph 4-2c.(l).
  - (b) Remove nut (12).
  - (c) Separate breather (13) from rear cover (10).
- (2)Installation.
  - (a) Place breather (13) in rear cover (10).
  - (b) Install and tighten nut (12).
  - (c) Install rear cover per paragraph 4-2c.(2).

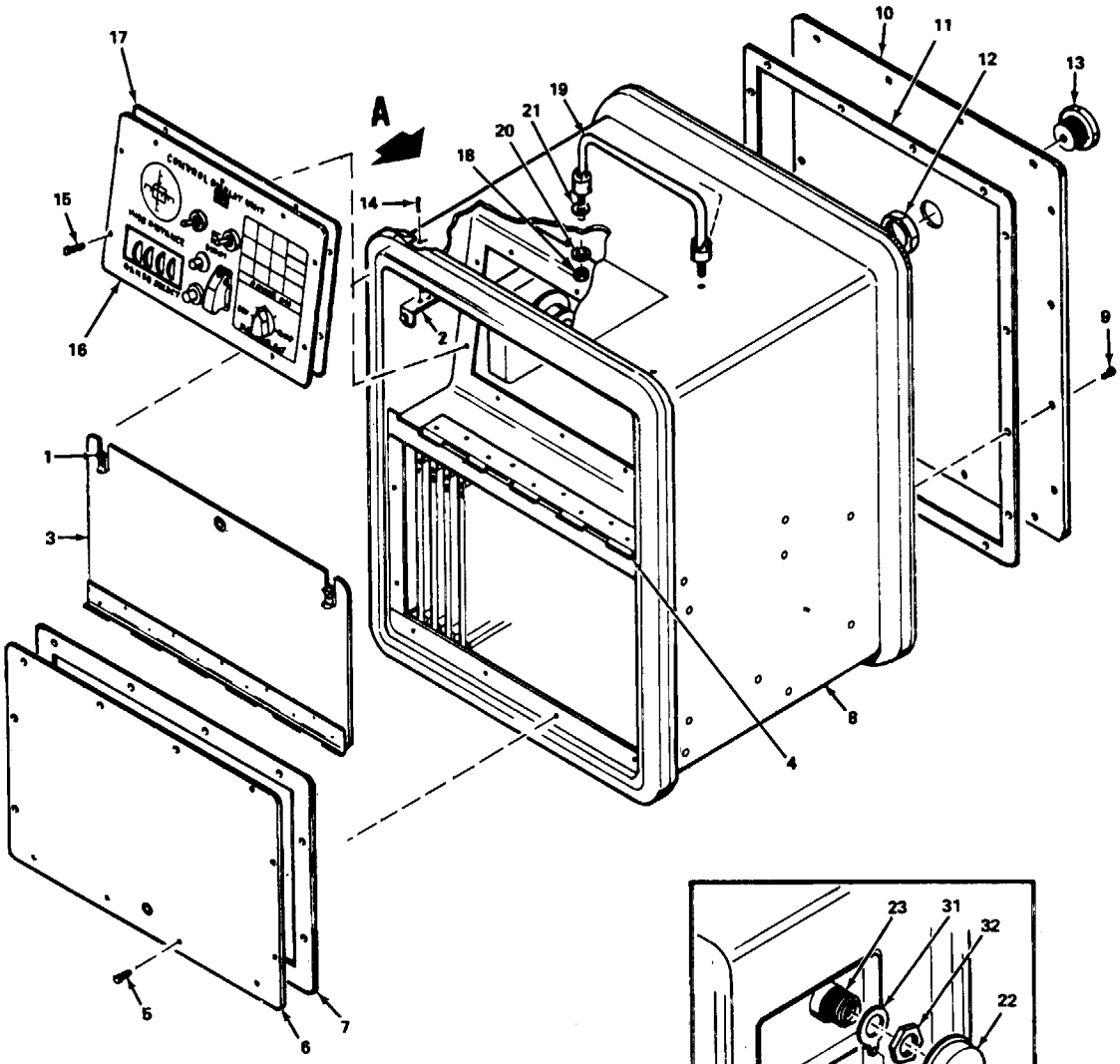
e. Latch Bracket.
- (1) Removal.
  - (a) Remove hinged panel per paragraph 4-2a.(1).
  - (b) Remove two screws (14).
  - (c) Separate brackets (2) from housing
- (2).Installation.
  - (a) Place brackets (2) in position in housing (8). Apply sealant MIL-S-22473 grade E (Item 5, Appendix B) to the threads of four screws (14).
  - (b) Install screws (14).
  - (c) Install hinged panel per paragraph 4-2a.(2).

f. Display Panel.

**CAUTION**

Exercise extreme care when working near flex harness. Insure that there are no sharp bends when installing.

- (1) Removal.
  - (a) Remove rear cover per paragraph 4-2c.(l).
  - (b) Remove hinged panel per paragraph 4-2a.(l).
  - (c) Remove latch brackets per paragraph 4-2e.(l).
  - (d) Remove ten screws (15).
  - (e) Separate panel (16) and gasket (17) from housing (8) by pushing panel from rear.




DISASSEMBLY AND ASSEMBLY OF CDU HOUSING

| | | | |
|---|---|---|---|
| 1 | LATCH | 17 | GASKET |
| 2 | LATCH BRACKET | 18 | NUT |
| 3 | HINGED PANEL | 19 | HANDLE |
| 4 | HINGE | 20 | WASHER |
| 5 | SCREW | 21 | WASHER |
| 6 | FRONT COVER | 22 | CONNECTOR COVER |
| 7 | GASKET | 23 | CONNECTOR |
| 8 | HOUSING | 24 | SCREW |
| 9 | SCREW | 25 | WASHER |
| 10 | REAR COVER | 26 | NUT |
| 11 | GASKET | 27 | CHAIN |
| 12 | NUT | 28 | SCREW |
| 13 | BREATHER | 29 | WASHER |
| 14 | SCREW | 30 | NUT |
| 15 | SCREW | 31 | RETAINING RING |
| 16 | DISPLAY PANEL | 32 | CONNECTOR NUT |

*Figure 4-1. CDU Housing Disassembly and Assembly*

(2)Installation.
(a) Place panel(16) and gasket (17)in position.
(b) Install and tighten ten screws (15).
(c) Install latch brackets per paragraph 4-2e.(2).
(d) Install hinged panel per paragraph 4-2a(2).
(e) Install rear cover per paragraph 4-2c.(2).

g. Handle.
(1) Removal.
(a) Remove rear cover per paragraph 4-2c.(1),
(b) Remove two nuts (18) and washers (20)1.
(c) Separate handle (19) and sealing washers (21) from housing (8).
(2)Installation.
(a) Install handle (19) with two sealing washers (21) in housing (8).
(b) Install washers (21) and nuts (18). Tighten nuts.
(c) Install rear cover per paragraph 4-2c.(2).

h. Connector Cover.
(1) Removal and Disassembly.
(a) Remove rear cover per paragraph 4-2cg.(1).
(b) Remove cover (22) from connector (23).
(c) Remove screw (24), washer (25), and nut (26).
(d) Separate chain (27) from connector cover (22).
(e) Remove screw (28), washer (29), and nut (30).
(f) Separate chain (27) from retaining ring (31).
(g) Remove connector nut (32).
(h) Remove retaining ring (31) from connector (23).
(2)Assembly and Installation.
(a) Attach chain (27) to retaining ring (31) using screw (28), washer (29), and nut (30).
(b) Attach chain (27) to connector cover (22) using screw (24), washer (25), and nut (26).
(c) Install retaining ring (31) and connector nut (32) on connector (23). Tighten nut (32).
(d) Install rear cover per paragraph 4-2c.(2).

i. Warning Label Replacement (Figure 4-2).
(1) Inspect warning label (87).
(2)If label is illegible or missing, clean metal surface with alcohol MIL-A-609-1 (Item 1, Appendix B) to remove grease, dirt and foreign matter (piece of old label). Wipe dry.
(3) Remove paper backing from label (87) and apply solvent (methyl ethyl ketone, TM-M-261 (Item 7, Appendix B)) lightly with spray or brush; allow approximately 10 seconds to permit excess solvent to flash off.
(4)Apply label (87) in location shown.

## Section II. DISASSEMBLY AND ASSEMBLY OF ELECTRONICS

**4-3. Scope**. This section provides instructions for disassembling and assembling the control display unit electronics.

### 44. Power Supply A13 and Power Supply Fuses Replacement (Figure 4-2).

a. Removal.
(1) Remove front cover per paragraph 4-2b(1).
(2) Grasp fuse holder cover (1), press in and rotate counterclockwise. Remove cover (1) and fuse (2) from holder (3).
(3) Grasp spare fuse (4) and pull from spring clip (5).
(4) rear cover per paragraph 4-2c(1).

**CAUTION**

Exercise extreme care when working near flex harness.

(5) Disconnect connector A13 J1 at rear of power supply

b. Installation.

**CAUTION**

Exercise extreme care when working near flex harness. Insure that there are no sharp bends when installing.

(1) Install power supply (6) in housing (8). Install and tighten six screws (7).
(2) Connect connector A13J1 at rear of power supply (6).
(3) Place spare fuse (4) against spring clip (5) and push into place.
(4) Install fuse (2) in fuse holder (3). Put fuse holder cover (1) in place, press in and rotate clockwise.
(5) rear cover per paragraph 4-2c(2) and I front cover per paragraph 4-2b_(2).

**4-5. Panel Lamps Replacement (Figure 4-2).**

a. Night Lighting Lamps Removal and Installation.
   (1) Remove hinged panel per paragraph 4-2a(1).
   (2) Grasp lamp housing (9) and pull out of lamp socket (10). Grasp base of lamp (11)and pull from lamp housing (9).
   (3) Push lamp (11) into lamp housing (9). Push lamp housing (9) into lamp socket (10).
   (4) Install hinged panel per paragraph 4-2_(2).

b. Matrix Lamps Removal and Installation.
   (1) Remove display panel per paragraph 4-2f(1).
   (2) Remove four screws (12), flat washers (13), lockwashers (14), and nuts (15) and separate lamp socket board (16) from matrix display housing (17).
   (3) Grasp lamp (18) by base and remove from socket (19). Remove socket adapter (18.1).
   (4) Install lamp (18) with socket adapter (18.1) in socket (19).
   (5) Install lamp socket board (16) against matrix display housing (17). Install and tighten four screws (12), flatwashers (13), lockwashers (14), and nuts (15).
   (6) Install display panel per paragraph 4-2f(2).

**4-6. MISS DISTANCE Meter Replacement (Figure 4-2).**

a. Removal.
   (1) Remove display panel per paragraphs 4-2f(1) and (6).
   (2) Remove four nuts (21) and terminal lugs (22) from meter (20).
   (3) Remove four lock nuts (23) and washers (24) and separate meter (20) from display panel (25).

b. Installation.
   (1) Install meter (20) at rear of panel (25). Install and tighten four locknuts (23) and washers (24).
   (2) Install terminal lugs (22) at rear of meter (20). Install and tighten four nuts (21)
   (3) Install display panel per paragraph 4-2f(2).

**4-7. DAY/NIGHT or PRACTICE/QUALIFY Toggle Switch Replacement (Figure 4-2).**

a. Removal.

**NOTE**

Procedure given is for DAY/NIGHTswitch (26). The method for replacing PRACTICE/QUALIFY switch (32) is identical.

   (1) Remove display panel per paragraph 4-2f(l).
   (2) dress ring (27), lockwasher (28), and' bushing (29) from switch (26) and remove it with nut (30) and key ring(31) from panel (25).
   (3) Tag and unsolder wires to switch (26).

b. Installation.
   (1) Solder wires, removed in step (3) above, to switch (26).
   (2) Install switch (26) with nut (30) and key ring (31) in panel (25). Install bushing (29), lockwasher (28), and dress ring (27).
   (3) Install display panel per paragraph 4-2f(2).

**4-8. RESET and TRACKER PRESET Buttons Replacement (Figure 4-2).**

a. Removal.

**NOTE**

The procedure given below is for RESET button (33). The method for replacing the TRACKER PRESET button (38) is identical.

   (1) Remove display panel per paragraph 4-2f(1).
   (2) Tag and remove wires to RESET button (33).
   (3) Remove dress ring (34), lockwasher (35), and flat washer (36) from button (33) and remove it and sealing washer (38) from panel (25).

b. Installation.
   (1) button (33) with sealing washer (37). Install flat washer (36) lockwasher (35), and dress ring (34).
   (2) Install wires to button (33).
   (3) Install display panel per paragraph 4-2f(2).

**4-9. Circuit Breaker CB1 Replacement (Figure 4-2).**

a. Removal.
   (1) Remove display panel per paragraph 4-2f(1).
   (2) Tag and remove wires to circuit breaker CB1 (39).
   (3) dress ring (40), lockwasher (41), bushing (42), and switchguard (43) from circuit breaker (39) and remove it from panel (25).

b. Installation.
   (1) Install circuit breaker (39), switchguard (43), bushing (42), lockwasher (41), and dress ring (40).
   (2) Install wires to back of CB1(39).
   (3) Install display panel per paragraph 4-2f(2).

**4-10. MODE SELECT Switch Replacement (Figure 4-2).**

a. Removal.
   (1) display panel per paragraphs 4-2(5) and (6).

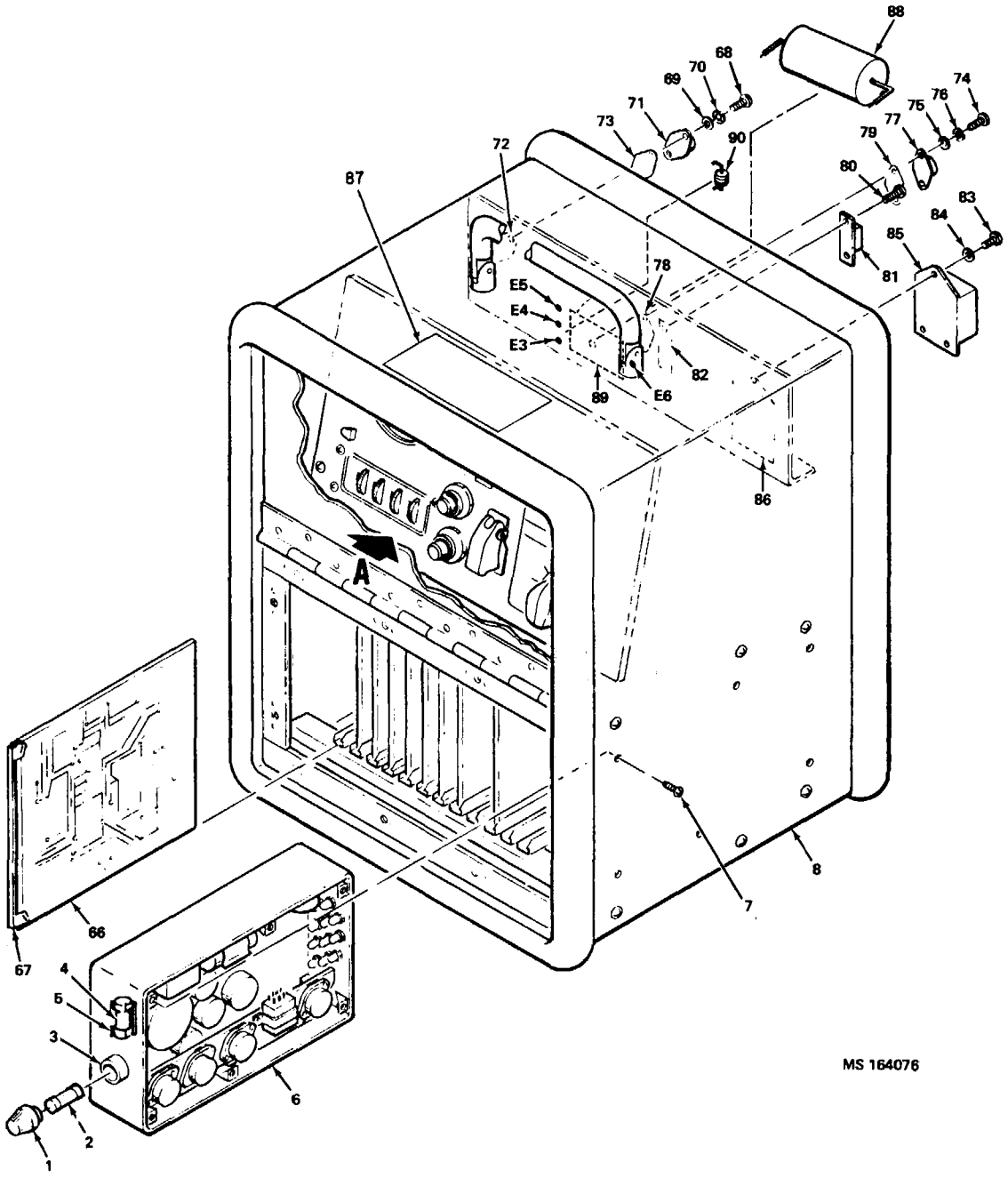
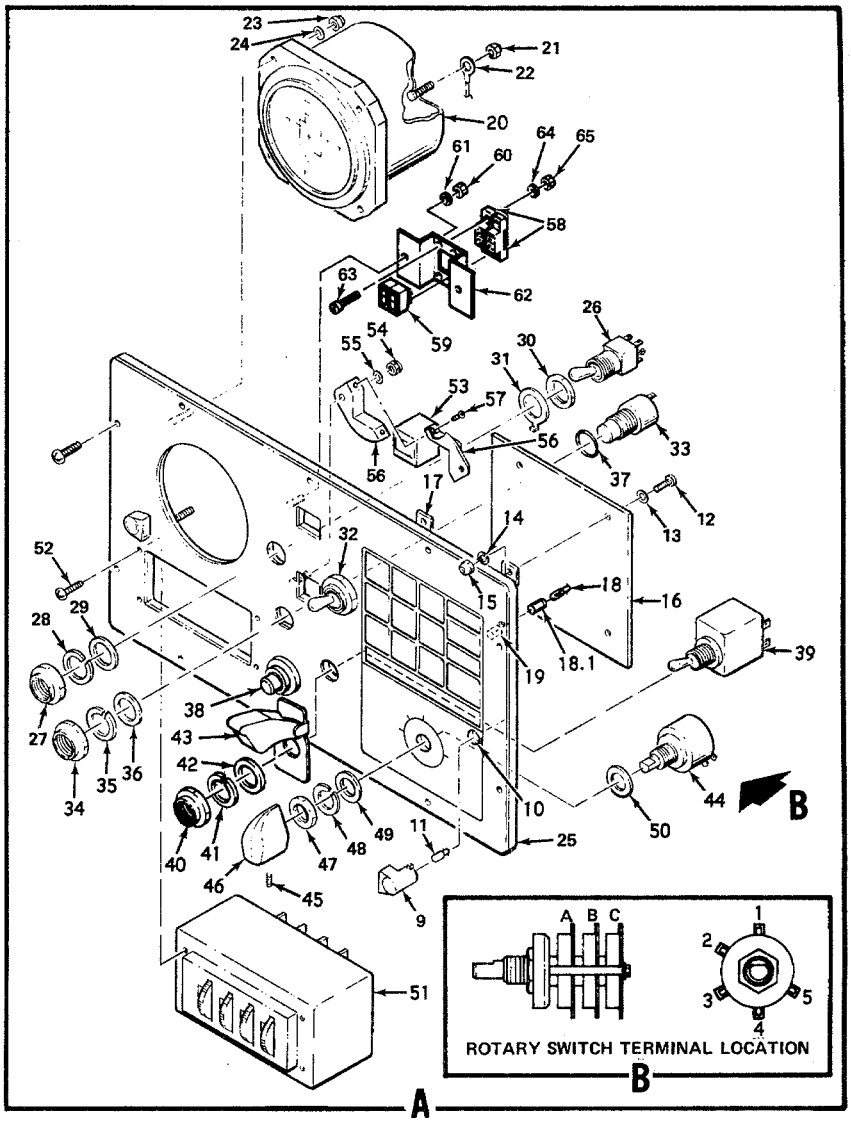



*Figure 4-2. CDU Electronics disassembly and Assembly*




1 FUSE HOLDER COVER
2 FUSE
3 FUSE HOLDER
4 FUSE
5 SPRING CLIP
6 POWER SUPPLY
7 SCREW
8 HOUSING
9 LAMP HOUSING
10 LAMP SOCKET
11 LAMP
12 SCREW
13 WASHER
14 LOCK WASHER
15 NUT
16 LAMP SOCKET BOARD
17 MATRIX DISPLAY HOUSING
18 LAMP
18.1 SOCKET ADAPTER
19 LAMP SOCKET
20 MISS DISTANCE METER
21 NUTS
22 TERMINAL LUGS
23 LOCKNUTS
24 WASHERS
25 DISPLAY PANEL
26 SWITCH
27 DRESS RING
28 LOCK WASHER
29 BUSHING
30 NUT
31 KEY RING
32 SWITCH
33 BUTTON
34 DRESS RING
35 LOCK WASHER
36 FLAT WASHER
37 SEALING WASHER
38 BUTTON
39 CIRCUIT BREAKER
40 DRESS RING
41 LOCK WASHER
42 BUSHING
43 SWITCHGUARD
44 MODE SELECT SWITCH
45 SET SCREW
46 KNOB
47 NUT
48 LOCKWASHER
49 WASHER
50 SEALING WASHER
51 SWITCH
52 SCREW
53 EVENT COUNTER
54 LOCK NUT
55 WASHER
56 BRACKET
57 SCREW
58 CONNECTOR
59 INDICATOR
60 LOCK NUT
61 WASHER
62 BRACKET
63 SCREW
64 WASHER
65 NUT
66 CIRCUIT BOARD
67 HANDLE
68 SCREW
69 WASHER
70 LOCK WASHER
71 TRANSISTOR
72 TRANSISTOR SOCKET
73 INSULATOR
74 SCREW
75 WASHER
76 LOCK WASHER
77 TRANSISTOR
78 TRANSISTOR SOCKET
79 INSULATOR
80 SCREW
81 RELAY
82 RELAY SOCKET
83 SCREW
84 WASHER
85 RELAY
86 RELAY SOCKET
87 WARNING LABEL
88 CAPACITOR C1
89 COMPONENT CLIP
90 DIODE CR1

*Figure 4-2. CDU Electronics disassembly and Assembly*

(2) and remove wires to MODE SELECT switch (44) (see view B).
(3) Loosen setscrew (45) and remove knob (46).
(4) Remove nut (47), lockwasher (48), and flatwasher (49) from switch (44) and remove it and sealing washer (50) from panel (25).

b. Installation.

(1) MODE SELECT switch (44) with sealing washer (50) in panel (25). Install washer (49), lockwasher (48), and nut (47). Tighten nut, : (2)Install knob (46) on switch (44) and tighten setscrew (45).
(3) Install wires to back of switch (44).
*(4) Install display panel per paragraph 4-2f(2).

**4-11. RANGE SELECT Switch Replacement (Figure 4-2).**

a. Removal.

(1) display panel per paragraphs 4-2f(1) and (7).
(2) and remove wires to RANGE SELECT switch (51).
(3) four screws (52) and remove switch (51) from panel (25).

b. Installation.

(1) Place RANGE SELECT switch (51) in panel (25). Install and tighten four screws (52).
(2) Install wires to back of switch (51).
(3) Install display panel per paragraph 4-2f(2).

**4-12. EVENT Counter Replacement (Figure 4-2).**

a. Removal.

(1) Remove display panel per paragraph 4-2f(l).
(2) Identify and unsolder wires to EVENT counter (53).
(3) two locknuts (54) and washers (55) and separate bracket (56) from panel (25). Remove two screws (57) that clamp bracket (56) to counter (53) and separate it from bracket (56).

b. Installation.

(1) EVENT counter (53) in bracket (56) using two screws (57). Install bracket (56) in panel (25) using two locknuts (54) with washers (55). Tighten nuts (54).
(2) Solder previously identified wires to counter (53).
(3) Install display panel per paragraph 4-2f(2).

**4-13. SCORE Indicator and Associated Mounting Hardware Replacement (Figure 4-2).**

a. Removal.

(1) Remove display panel per paragraph 4-2f(5).
(2) Remove two locknuts (60) and washers (61) and separate bracket (62) from panel (25).
(3) Remove indicators (59) from connectors (58).
(4) Remove four screws (63), washers (64), and nuts (65) and separate connectors (58) from bracket (62).

b. Installation.

(1) Place connectors (58) in bracket (62). Install four screws (63), washers (64), and nuts (65).
(2) Install indicators (59) on connectors (58).
(3) Install bracket (62) on panel (25) using two locknuts (60) and washers (61). Tighten locknuts.
(4) Install display panel per paragraph 4-2[(2).

**4-14. Circuit Boards Al-A8 Replacement (Figure 4-2).**

a. Removal.

(1) Remove front cover per paragraph 4-2b(1).
(2) Grasp circuit board, (66) by handle (67) and pull directly out of housing (8).

b. Installation.

(1) Slide circuit board (66) into housing (8) until handle (67) just contacts housing (8); then, pull out on handle (67) while pushing in on board (66) until it seats. Release handle. Press in on handle once again to seat board.
(2) Close front cover per paragraph 4-2b(2).

**4-15. Transistor Q1 Replacement (Figure 4-2).**

a. Removal.

(1) rear cover per paragraph 4-2c(1).
(2) Remove two screws (68), flatwashers (69), and lockwashers (70) and separate transistor (71) from transistor socket (72). Remove insulator (73).

**CAUTION**

When installing transistors, be sure insulator is intact and properly installed. Be sure joint compound is applied and screws are installed and tight (torque not to exceed 7 in.-lb).

b. Installation.

(1) Apply joint compound (10228866, Item 11, Appendix B) to both sides of insulator (73) and place against bottom of transistor (72).
(2) Press transistor (71) into socket (72). Install two screws (68), flatwashers (69), and lockwashers (70). Tighten screws (torque not to exceed 7 in.-lb).
(3) Install rear cover per paragraph 4-2c(2).

**4-16. Transistors Q2-Q9 Replacement (Figure 4-2).**

a. Removal.

(1) Remove rear cover per paragraph 4-2c(1).
(2) Remove two screws (74), flatwashers (75), and lockwashers (76) and separate transistor (77) from transistor socket (78). Remove insulator (79).

b. Installation.

(1) Apply joint compound (10228866, Item 11, Appendix B) to both sides of insulator (79) and place against bottom of transistor (77).
(2) Press transistor (77) into socket (78). Install two screws (74), washers (75), and lockwashers (76). Tighten screws (torque not to exceed 7 in.-lb).
(3) Install rear cover per paragraph 4-2c(2).

**417. Relays K1-K5 Replacement (Figure 4-2).**

a. Removal.

(1) Remove rear cover per paragraph 4-2c(1).
(2) Remove two screws (80) and separate relay (81 from relay socket (82).

b. Installation.

**NOTE**

Insure coded pin on relay is aligned with coded hole in socket.

(1) Push relay (81) into socket (82) and install two screws (80). Tighten screws.

(2) Install rear cover per paragraph 4-2c(2).I

**4-18Relay K6 Replacement (Figure 4-2).**

a. Removal.

(1) rear cover per paragraph 4-2(1).
(2) Remove three screws (83) and washers (84). Separate relay (85) from socket (86).

b. Installation.

(1) Push relay (85) into socket (86) and install three screws (83) with washers (84). Tighten screws.
(2) Install rear cover per paragraph 4-2c(2).I

**419. Capacitor C1 Replacement (Figure 4-2).**

a. Removal.

(1) rear cover per paragraph 4-2c(1).
(2) Unsolder capacitor (88) at terminals E5 and E6.
(3) Remove capacitor (88) from component clip (89).

b. Installation.

(1) Place capacitor (88) in component clip (89).
(2) Solder capacitor (88) in place at terminals E5 and E6.
(3) Install rear cover per paragraph 4-2c(2).1

**4-20. Diode CR1 Replacement (Figure 4-2).**

a. Removal.

(1) rear cover per paragraph 4-2c(1).
(2) Note polarity of diode (90) relative to terminals E3 and E4.
(3) Unsolder diode (90) at terminals E3 and E4 and remove.

b. Installation.

(1) Orient diode (90) with polarity as noted in (2) above.
(2) Solder diode (90) in place at terminals E3 and E4.
(3) Install rear cover per paragraph 4-2c(2).I

## CHAPTER 5
## OPTICAL SIMULATION UNIT REPAIR INSTRUCTIONS

### Section I. DISASSEMBLY AND ASSEMBLY OF OPTICAL SIMULATION UNIT

**5-1.Scope.** This section provides the instructions for separating the optical simulation unit into its three major assemblies: adjustable mount, infrared projector assembly, and visual effects simulator. Disassembly and assembly of the individual assemblies are treated in subsequent sections.

5-2.Adjustable Mount Removal (Figure 5-1). Remove four screws (1) and washers (2) and separate the adjustable mount (3) from the visual effects simulator (4).

NOTE
It may be necessary to reposition AZ ADJ knob (8) to expose screws (5).

5-3.Infrared Projector Assembly Removal (Figure 5-1).

Loosen four screws (5) with washers (6) and separate mount (3) from projector (7). Inspect warning label (14).

If label is damaged or missing, replace as described in 5-4 d and e below.

5-4.Infrared Projector Installation on Adjustable Mount (Figure 5-1).

a. Position infrared projector (7) against adjustable mount (3).

b. Apply primer MLS-22473 grade N, form R (Item 4, Appendix B) to four screws (5). Allow to dry then apply sealant MIL-S-22473 Grade H (Item 6, Appendix B).

c. Engage tour screws kt) with washers (6) in infrared projector (7), and tighten. It may be necessary to reposition AZ ADJ knob (8) to expose three of the four screw heads.

d. Clean metal surface with alcohol (Item 1, Appendix B) to remove grease, dirt, and foreign matter.

Wipe dry.

e. Remove paper backing from label (14) and apply solvent methyl ethyl ketone, TT-M-261 (Item 7, Appendix B), lightly with spray or brush, allow approximately 10 seconds for excess solvent to flash off. Apply label in location shown.

5-5. Adjustable Mount Installation (Figure 5-1).

a. Position adjustable mount (3) against visual effects simulator (4).

b. Apply primer MILS-22473 grade N, form R (Item 4, Appendix B), to four screws (1). Allow to dry.

c. Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to threads of screws (1).

d. Install four screws (1) and washers (2) and tighten.

### Section II. DISASSEMBLY AND ASSEMBLY OF ADJUSTABLE MOUNT

**5-6. Scope**. This section provides the instructions for disassembling and assembling the adjustable mount.

**5-7. Adjustable Mount Disassembly (Figure 5-2).**

a. Remove cotter pin (1) and washer (2) from elevation adjustment lock handle (3). Discard cotter pin.

b. Unscrew and remove the elevation adjustment lock handle (3).

c. Remove two snap rings (7) from elevation pivot pin (8), and remove pin. Mount bracket (9) becomes a loose part.

d. Unscrew outer EL ADJ screw (4) until it disengages ) from inner screw (5) and retainer (6).

e. Remove cotter pin (10) and washer (11) from azimuth adjustment lock handle (12). Discard the cotter pin.

f. Unscrew and remove azimuth adjustment lock handle (12) and recess cover (13).

g. Remove two screws (14) that attach inner azimuth retainer (15) to adjustment plate (23).

h. Remove screw (16) that attaches azimuth retainer (17) to adjustment plate (23).

i. Separate inner azimuth retainer (15), dowel pin (18), and azimuth retainer (17) from adjustment plate (23).

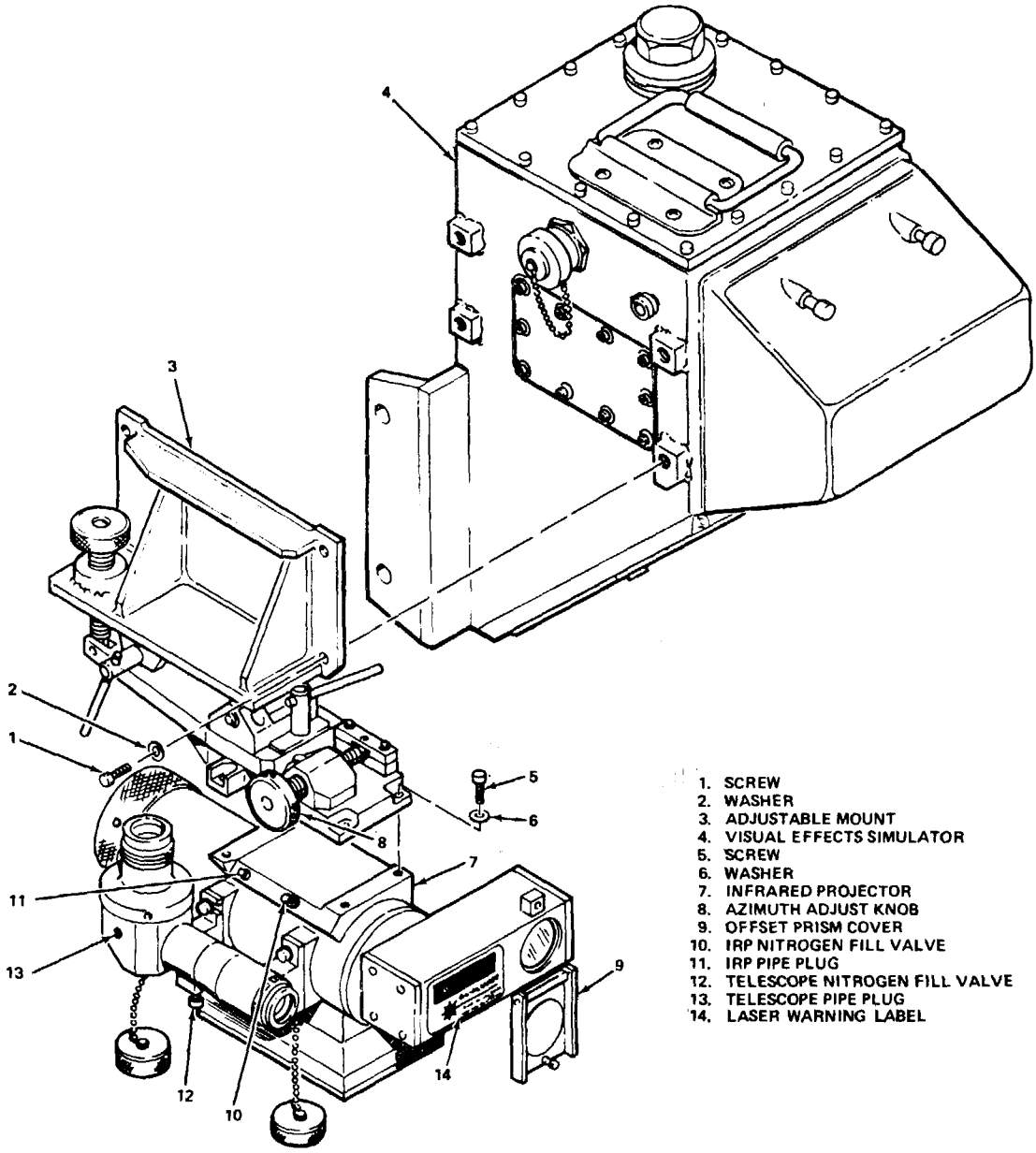



*Figure 5-1. Optical Simulation Unit Disassembly and Assembly*

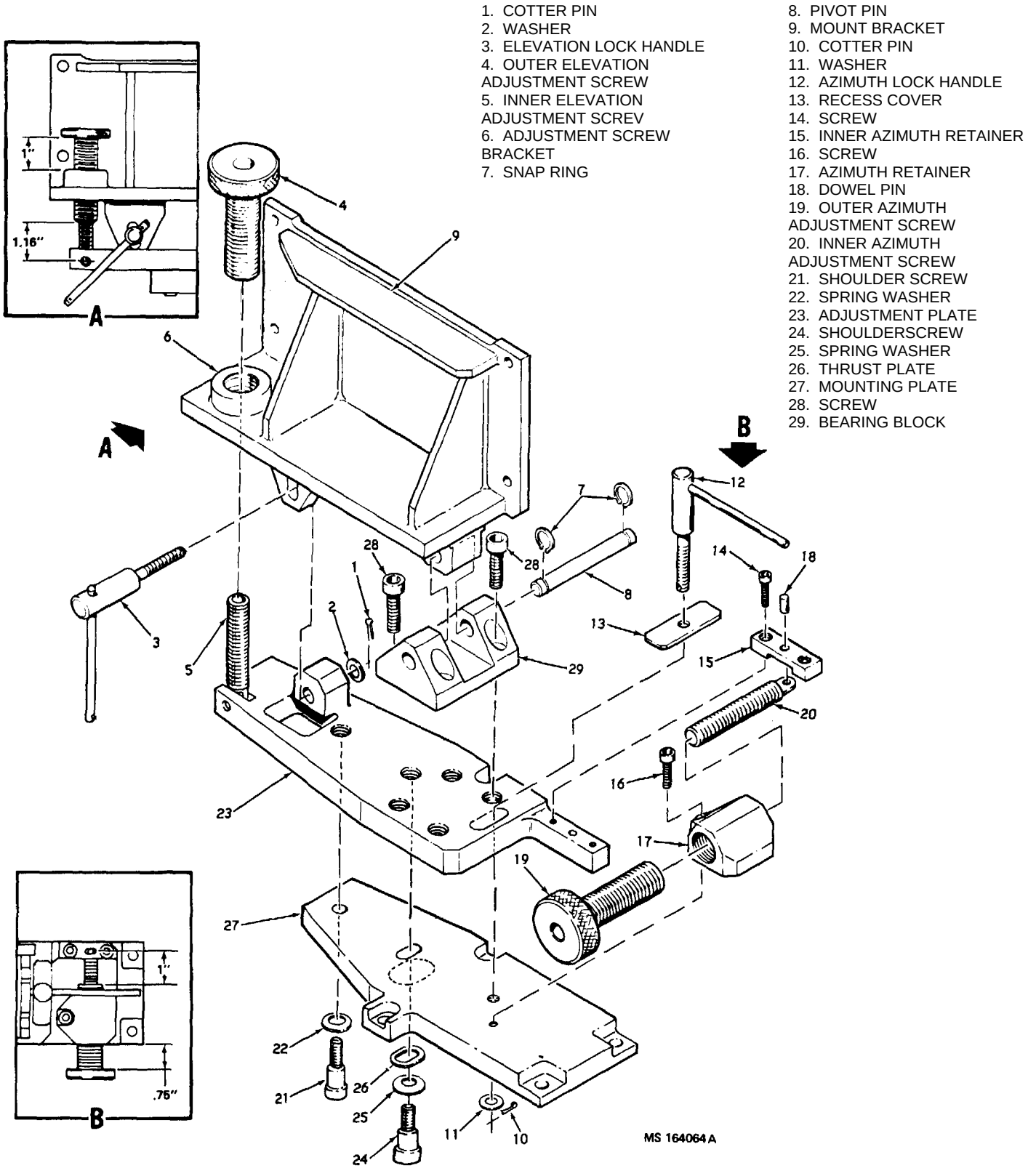



*Figure 5-2. Adjustable Mount Disassembly and Assembly*

j. Unscrew outer AZ ADJ screw (19) until it disengages from inner screw (20) and azimuth retainer (17).
k. Remove shoulder screw (21) and spring washer (22 from adjustment plate (23).
l. Remove remaining shoulder screw (24), spring washer (25), and thrust plate (26) from adjustment plate (23). Separate adjustment plate (23) front mounting plate (27).
m. Remove four screws (28) which attach bearin1 block (29) to adjustment plate (23) and remove bearing block.
n. Deleted.

**5-8. Adjustable Mount Assembly (Figure 5-2).**

a. Wash all mating parts and surfaces with alcohol (Item 1, Appendix B) and clean all parts with wiping rag (Item 8, Appendix B).

**CAUTION**

Coating of dry film lubricant MILL46147 Type II (Item 9, Appendix B) on fine threads must be applied sparingly to avoid filling of threads and resultant binding and difficult assembly.

b. After cleaning per a above, repair dry film lubricant MIL-L-46147 Type II (Item 9, Appendix B) b: spraying a light coating on parts listed below. Ai dry per instructions on lubricant container. If n( instructions are provided or if room temperature will drop below 680F (200C), air dry 24 hour before assembly.

(1) Elevation adjustment lock handle (3) threads
(2) Elevation adjustment screw (4) threads.
(3) Inner adjusting screw (5) threads and pivot.
(4) Adjusting screw retainer (6) mating surfaces.
(5) Pivot pin (8).
(6) Azimuth adjustment lock handle (12) threads
(7) Azimuth adjustment screw (19) threads.
(8) Inner adjusting screw (20) threads and pivot.
(9) Azimuth retainer (17) threads.
(10) Shoulder screw (21) threads.
(11) Spring washer (22) mating surfaces.
(12) Adjustment plate (23) mating surfaces.
(13) Shoulder screw (24) threads.
(14) Spring washer (25) mating surfaces.
(15) Thrust plate (26) mating surfaces.
(16) Mounting plate (27) mating surfaces.

c. Thread elevation adjustment screw (4) into adjusting screw retainer (6). Align elevation adjusting screw (4) with inner adjusting screw (5) and turn mount bracket (9) until the two are mated and the desired adjustment is obtained as shown in view A, figure 5-2.
d. Deleted.
e. Deleted.
f. Place mounting plate (27) against adjustment plate (23) with lubricated surfaces together. Apply primer MI&S-22473 grade N, form R (Item 4, Appendix B), to the threads of shoulder screw (24) and allow to dry. Apply sealant MIL-S-22473 grade E (Item 5, Appendix B) to the threads of shoulder screw (24).
g. Install shoulder screw (24), spring washer (25), and thrust plate (26) near center of mounting plate (27) and tighten. Apply primer MILS-22473 grade N, form R, (Item 4, Appendix B), to the threads of shoulder screw (21) and allow to dry. Apply sealant MIL-S-22473 grade E (Item 5, Appendix B) to the threads of shoulder screw (21).
h. Install shoulder screw .(21) and spring washer (22) near end of mounting plate (27) and tighten.
i. Thread azimuth adjustment screw (19) into azimuth retainer (17). Align azimuth adjusting screw (19) with inner adjusting screw (20) and turn outer screw until the two are mated and the desired adjustment is obtained as shown in view B, figure 5-2.
j. Apply primer MILS-22473 grade N form R, (Item 4, Appendix B) to the threads of two screws (14) and screw (16), allow to dry. Apply sealant MIL-S-22473 grade E (Item 5, Appendix B) to the threads of two screws (14) and screw (16).
k. Place azimuth retainer (17) and inner azimuth retainer (15) in place on adjustment plate (23). Install two screws (14), dowel pin (18), and screw (16). Tighten screws.
l. Place bearing block (29) against adjustment plate (23). Apply primer MIL-S-22473, grade N, form R (Item 4, Appendix B), to the threads of four screws (28) and allow to dry. Apply sealant MIL-S-22473 grade E (Item 5, Appendix B) to the threads of four screws (28). Install two of four screws (28) at rear.
m. Align holes in bearing block (29) and adjustment plate (23). Install pivot pin (8) through bearing block (29) and mount bracket (9). Install two snap rings (7). Install two screws (28).
n. Install recess cover (13) and thread in azimuth adjustment lock handle (12) until it bottoms out.

o. Install washer (11) and cotter pin (10) at end of handle (12).

p. Thread in elevation adjustment lock handle (3) until it bottoms out.

q. Install washer (2) and cotter pin (1) at end of handle.

r. After assembly perform the following:

(1) Fill void where ends of shoulder screws (21) and (24) protrude from adjustment plate (23) with black silicone adhesive MIL-A46106 TYPE 1 (Item 12, Appendix B).

(2) Apply a 0.02 in. (5.08 mm) minimum thick coat of grease MILG-23827 (Item 15, Appendix B) to the following surfaces:

(a) Deleted.

(b) All exposed non-painted surfaces on mount bracket (9), adjustment plate (23), elevation adjustment block (32) and mounting plate (27).

## Section III. DISASSEMBLY AND ASSEMBLY OF VISUAL EFFECTS SIMULATOR

**5-9. Scope.** This section provides the directions for disassembling and assembling the visual effects simulator.

### 5-10.Lamps Replacement (Figure 5-3).

a. Removal.

(1) Loosen two screws (1) which attach lamp access cover (2) to housing (3) and allow cover to swing open.

**CAUTION**

Allow time for lamp to cool before removing. Do not grasp lamp with bare fingers as body oil in contact with glass may cause breakage when lamp is turned on.

(2) Grasp lamp (11), press in and turn slightly counterclockwise. Remove lamp from socket (12).

**CAUTION**

When installing lamp, apply only a slight twisting force or damage to bulb may result.

b. Installation.

(1) Place lamp (11) in socket (12); press in and turn slightly clockwise. Wipe lamp with clean cloth (Item 8, Appendix B).

(2) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to the threads of two screws (1), allow to dry. Apply sealant MILS22473 grade H (Item 6, Appendix B) to the threads of two screws (1). 'Close lamp access cover (2). Engage and tighten two screws (1).

### 5-11. Lamp Access Cover, Beam Splitter Cover, and Hinge Replacement (Figure 5.3).

a. Removal.

(1) Loosen two screws (1) which attach lamp access cover (2) to housing (3) and allow cover (2) to swing open.

(2) Loosen screw (4) which holds beam splitter protective cover (5) closed and allow cover to swing open.

(3) Remove two screws (6) and washers (7) that hold the hinge (8) in place. Remove hinge (8), cover (5), and cover (2) from housing.

(4) Separate cover (2) and cover (5) from hinge pin (9) by snapping off of pin one end at a time.

b. Installation.

(I) Snap lamp access cover (2) and beam splitter cover (5) onto hinge pin (9) one end at a time. Apply primer MIL-S-22473 grade N form R (Item 4, Appendix B), to the threads of two screws (6) and allow to dry. Apply sealant MILS-22473 grade H (Item 6, Appendix B) to the threads of two screws (6).

(2) Place hinge (8) with attached covers against housing. Install and tighten two screws (6) with washers (7).

(3) Close beam splitter cover (5). Engage and tighten screw (4).

(4) Close lamp access cover per paragraph 5-10b(2).

### 5-12.Beam Splitter Window Replacement (Figure 53).

a. Removal.

(1) Depressurize VES by slowly removing pipe plug (35).

(2) Loosen screw (4) which holds beam splitter protective cover (5) closed and allow cover to swing open.

**CAUTION**

Do not drop window as breakage may result.

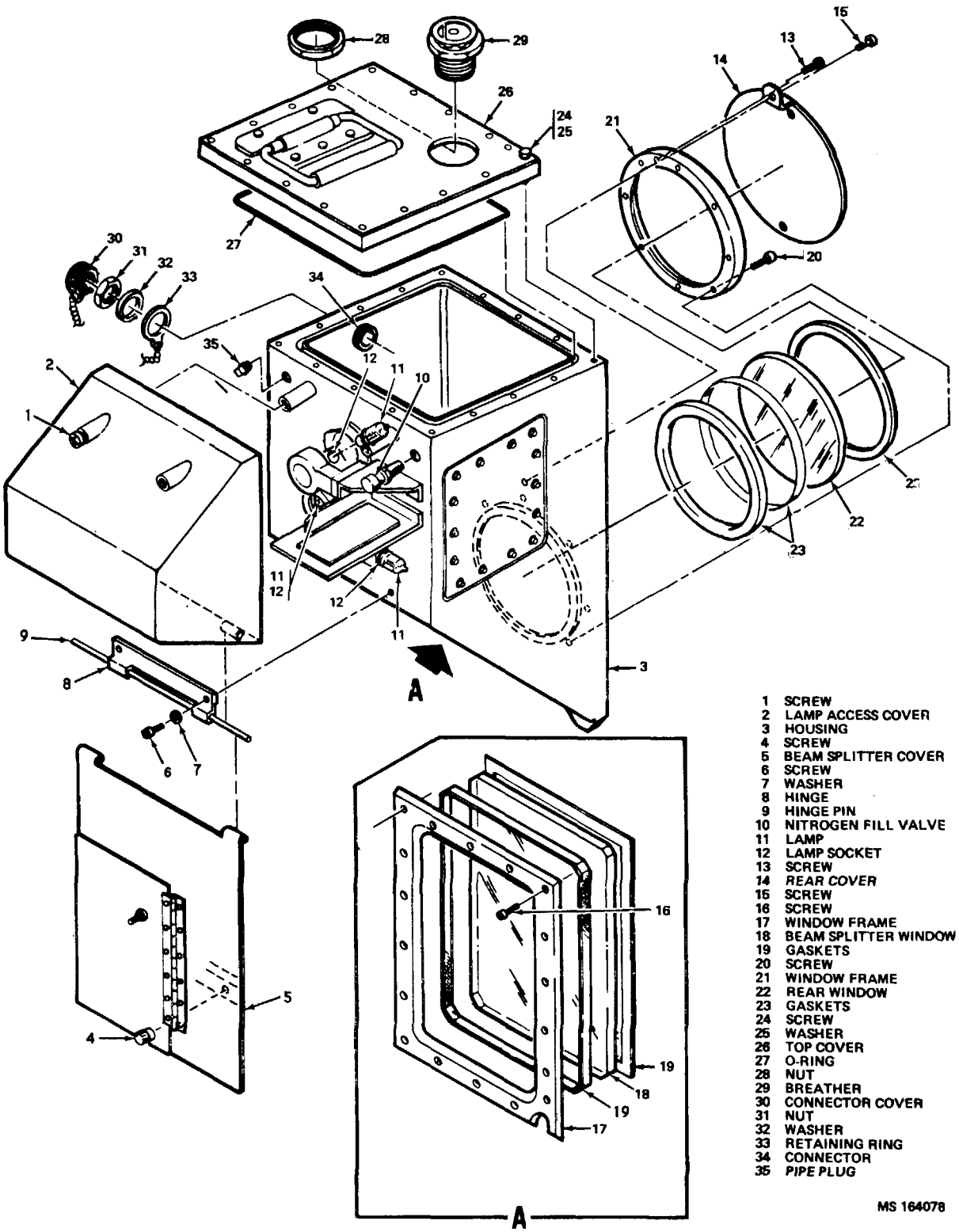



*Figure 5-3. VES Disassembly and Assembly*

(3) Remove 18 screws (16) that attach beam splitter window frame (17) to housing. Separate frame (17), window (18), and gaskets (19) from housing.

b. Installation.

(1) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to the threads of 1I screws (16) and allow to dry.

(2) Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to the threads of 18 screws (16). Clean window (18) with lens tissue (Item 3, Appendix B) moistened with alcohol (Item 1, Appendix B).

**CAUTION**

Tighten screws carefully to reduce possibility of window damage.

(3) Place gaskets (19) on beam splitter window (18) (one gasket on edge of window, one between window and housing) and install in housing. Install frame (17). Install 18 screws (16). Set screws in frame, then tighten with 1/4 turn increments alternating diagonally opposite screws until fully tight.

(4) Close beam splitter cover (5). Engage and tighten screw (4).

(5) Perform leak test per paragraph 5-20.

(6) Purge with nitrogen per paragraph 5-17.

**5-13. Rear Window and Cover Replacement (Figure 5-3).**

a. Removal.

(1) Depressurize VES by slowly removing pipe plug (3 5).

(2) Loosen two captive screws (13) that hold rear cover (14) in place against housing. Remove shoulder screw (15) above which cover pivots and separate cover from housing.

**CAUTION**

Do not drop window as damage may result.

(3) Remove eight screws (20) that attach rear window frame (21) to housing. Separate frame (21), window (22), and gaskets (23) from housing.

b. Installation.

(1) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to the threads of eight screws (20) and allow to dry. Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to the threads of eight screws (20).

(2) Clean rear window cavity. Clean window with lens tissue moistened with alcohol. Place gaskets (23) on rear window (22) (one gasket 5-4 on edge of window, one between window and housing) and install in housing. Install frame (21). Install and tighten eight screws (20). Apply prime MIL-S-22473 grade N, form R (Item 4, Appendix B) to the threads of 18 screws (16) and allow to dry. Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to the threads of 18 screws (16).

(3) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B)to the threads of shoulder screw (15), and allow to dry. Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to the threads of shoulder screw (15).

(4) Place rear cover (14) against housing. Install shoulder screw (15) and retaining screws (13). Tighten screws.

(5) Perform leak test per paragraph 5-20.

(6) Purge with nitrogen per paragraph 5-17.

**5-14. Nitrogen Fill Valve and Plug Replacement (Figure 5-3).**

a. Removal.

(1) Depressurize VES by slowly removing pipe plug (35).

(2) Loosen two screws (1) which attach lamp access cover (2) to housing (3) and open cover.

(3) Remove nitrogen fill valve (10) and pipe plug (35) from housing.

b. Installation.

(1) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to the mating threads of nitrogen fill valve (10), pipe plug (35), and housing. Allow to dry.

(2) Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to threads of fill valve (10) and pipe plug (35). Install valve (10) in housing and tighten.

(3) Purge with nitrogen per paragraph 5-17.

(4) Close lamp access cover per paragraph 5-10b(2).

**5-15. Connector Cover Replacement (Figure 5-3).**

a. Removal. Remove connector cover (30), connector nut (31), washer (32), and retainer (33) from connector (34).

b. Installation.

(1) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to the threads of connector (34) and allow to dry. Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to the threads of connector (34).

(2) Install connector cover retainer (33), washer (32), connector nut (31), and cover (30) on connector (34).

(3) Purge with nitrogen per paragraph 5-17.

**5-16. Top Cover and Breather Valve Replacement (Figure 5-3).**

a. Removal.
   (1) Depressurize VES by slowly removing pipe plug (35).
   (2) Loosen 16 captive screws (24) with washers (25) which attach top cover (26) to housing. Separate top cover (26) and O-ring (27) from housing.
   (3) Remove hex nut (28) from breather (29) and remove breather (29) from top cover (26).

b. Installation.
   (1) Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to mating threads of breather (29) and hex nut (28). Allow to dry.
   (2) Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to threads of breather. Install breather through cover (26). Install and tighten hex nut (28). Apply primer MIL-S-22473 grade N, form R (Item 4, Appendix B) to the threads of 16 screws (24) and allow to dry. Apply sealant MIL-S-22473 grade H (Item 6, Appendix B) to the threads of 16 screws (24).
   (3) Coat O-ring (27) with silicone lubricant MILS-8660 (Item 13, Appendix B) and install in groove at top of housing (3). Install top cover (26). Engage 16 screws (24) with washers (25). Torque to 23 +1 in.-lb (2.6 Nm).
   (4) Purge with nitrogen per paragraph 5-17.

**5-17. Purging VES With Nitrogen (Figure 53).**

a. Loosen two screws (1) which attach lamp access cover (2) to housing (3) and open cover.
b. Remove pipe plug (35) if not previously removed.
c. Open nitrogen tank valve all the way. Clear the air hose by slowly turning regulator clockwise until outlet gage reads 10 psig, verify outlet flow, then shut off regulator.
d. Remove cap front fill valve (10) and connect nitrogen hose adapter to fill valve. Observe outlet pressure gage and set regulator pressure to 4 psig.
e. Purge with dry nitrogen at 4 psig for 20 minutes into housing through valve (10).
f. Apply adhesive MIIA-46106 type II (Item 16, Appendix B) to threads of pipe plug (35) and install.
g. Shut off regulator. Remove nitrogen hose at VES and install cap on fill valve (10). Close nitrogen tank valve and bleed regulator pressure to 0 psig. Apply leak detector MIL-L-22567 Type I (Item 10, Appendix B) around pipe plug and observe for leakage.
h. Close lamp access cover per paragraph 5-10b(2).

**5-18. Purging IRP With Nitrogen (Figure 5-1).**

a. Remove IRP pipe plug (11).
b. Open nitrogen tank valve all the way. Clear the air hose by slowly turning regulator clockwise until outlet gage reads 10 psig, verify outlet flow, then shut off regulator.
c. Remove cap from fill valve (10) and connect nitrogen hose adapter to fill valve. Observe outlet pressure gage and set regulator pressure to 4 psig.
d. Purge with dry nitrogen at 4 psig for 20 minutes into housing through valve (10).
e. Apply adhesive MILA-46106 type II (Item 16, Appendix B) to threads of pipe plug (11) and install.
f. Shut off regulator. Remove nitrogen hose at IRP and install cap on fill valve (10). Close nitrogen tank valve and bleed regulator pressure to 0 psig. Apply leak detector MIL-L-22567 Type I (Item 10, Appendix B) around pipe plug and observe for leakage.

**5-19. Purging Telescope With Nitrogen (Figure 51).**

a. Remove telescope pipe plug (13).
b. Open nitrogen tank valve all the way. Clear the air hose by slowly turning regulator clockwise until outlet gage reads 10 psig, verify outlet flow, then shut off regulator.
c. Remove cap from fill valve (12) and connect nitrogen hose adapter to fill valve. Observe outlet pressure gage and set regulator pressure to 4 psig.
d. Purge with dry nitrogen at 4 psig for 20 minutes into housing through valve (12).
e. Apply adhesive MIUA-46106 type II (Item 16, Appendix B) to threads of pipe plug (13) and install.
f. Shut off regulator. Remove nitrogen hose at telescope and install cap on fill valve (10). Close nitrogen tank valve and bleed regulator pressure to 0 psig. Apply leak detector MIL-L-22567 Type I (Item 10, Appendix B) around pipe plug and observe for leakage.

**5-20. Leak Test Procedure**

a. Set up nitrogen purge set per paragraph 5-17.
b. Attach hose to fill valve.
c. Purge for one minute at 4 psig.
d. Install pipe plug (35). Maintain pressure of 4 psig during test.
e. Apply MIL-L-25567C, Type I (Item 10, Appendix B) leak detector solution with small brush

(Item 14, Appendix B) to joints, seams, and seals; observe for bubbles or fuzz at points of leakage.

f. If leakage occurs, mark all locations and reduce pressure to 0 psig. Disconnect hose and proceed to rework the repair procedure to eliminate the leaks.

g. If no leakage occurs after five minutes, reduce pressure to 0 psig. Remove pipe plug and vent cavity to atmospheric pressure.

h. Proceed to complete purging at 4 psig for 20 minutes per paragraph 5-17.

## CHAPTER 6

## LAUNCH RECOIL SIMULATOR AND RETROREFLECTOR TARGET REPAIR INSTRUCTIONS

## Section I. LAUNCH RECOIL SIMULATOR

**6-1. Brow Pad Removal and Installation (Figure 6-1).**

a. Removal
   (1) Remove screw (4) and screw (1), spring (2). and washer (3).
   (2) Pull detent pin (6) out of forward support (7) and brow pad (9).
   (3) Remove screw (8) from forward support and remove brow pad.
   (4) Inspect brow pad cushioning material. If it is damaged, deteriorated, or is loose in bracket, replace brow pad.

b. Installation
   (1) Place brow pad (9) in channel of forward support (7), and insert detent pin (6) through forward support and into brow pad.
   (2) Apply sealant MILS-22473, grade H, (Item 6, Appendix B) to threads of screw (8). Install screw through slot in forward support into brow pad. Verify that brow pad slides freely in forward support. Loosen screw (8) until it does.
   (3) Apply sealant MILS-22473, grade H (Item 6, Appendix B) to screw (4). Install screw (4) through aft support (5) into forward support.
   (4) Apply sealant MIL-S-22473, grade H, (Item 6, Appendix B) to threads of screw (1). Install screw (1) with spring (2) and washer (3) through aft support and into forward support. Allow 8 hours for sealant to cure before operating unit.

**6-2.Solenoid Assembly Removal and Installation (Figure 6-1).**

a. Removal
   (1) Remove nut holding connector to connector support (12).
   (2) Remove four screws (10) and washers (11) which hold solenoid assembly (13) to aft support (5).
   (3) Remove plunger tip (14), nut (15), and O-ring (16) from solenoid shaft, and retain.

b. Installation
   (1) Place O-ring (16), nut (15), and plunger tip (14) on solenoid shaft. Do not tighten.
   (2) Place connector support (12) on aft support (5), and install solenoid with two screws (10) and washers (11) in opposite corners.
   (3) Insert connector into connector support (12) and install nut on connector.
   (4) Energize solenoid by hand and measure gap at bottom between aft support and forward support (7). The dimension of the gap should be 3/16 + 1/32 inch. If the gap is not correct, remove two screws (10) and washers (I 11) and lift out solenoid assembly.
   (5) Screw plunger tip (14) in or out to obtain correct dimension. When dimension is correct, tighten nut (15) against plunger tip.
   (6) Apply sealant MILS-22473, grade H, (Item 6, Appendix B) to threads of screws (10), and install with washers (11). Allow sealant 8 hours to cure before operating solenoid.
   (7) Install plastic dust cap within 1/16 inch of deenergized solenoid plunger.

**6.3 Detent Pin and Lanyard Removal and Installation (Figure 6-1).**

a. Removal.
   (1) Pull detent pin (6) out of forward support (7) and brow pad (9).
   (2) Remove screw (21) and separate lanyard (20) from forward support (7).

b. Installation.
   (1) Attach lanyard (20) to forward support (7) using screw (21).
   (2) Insert detent pin (6) into forward support (7) and brow pad (9).

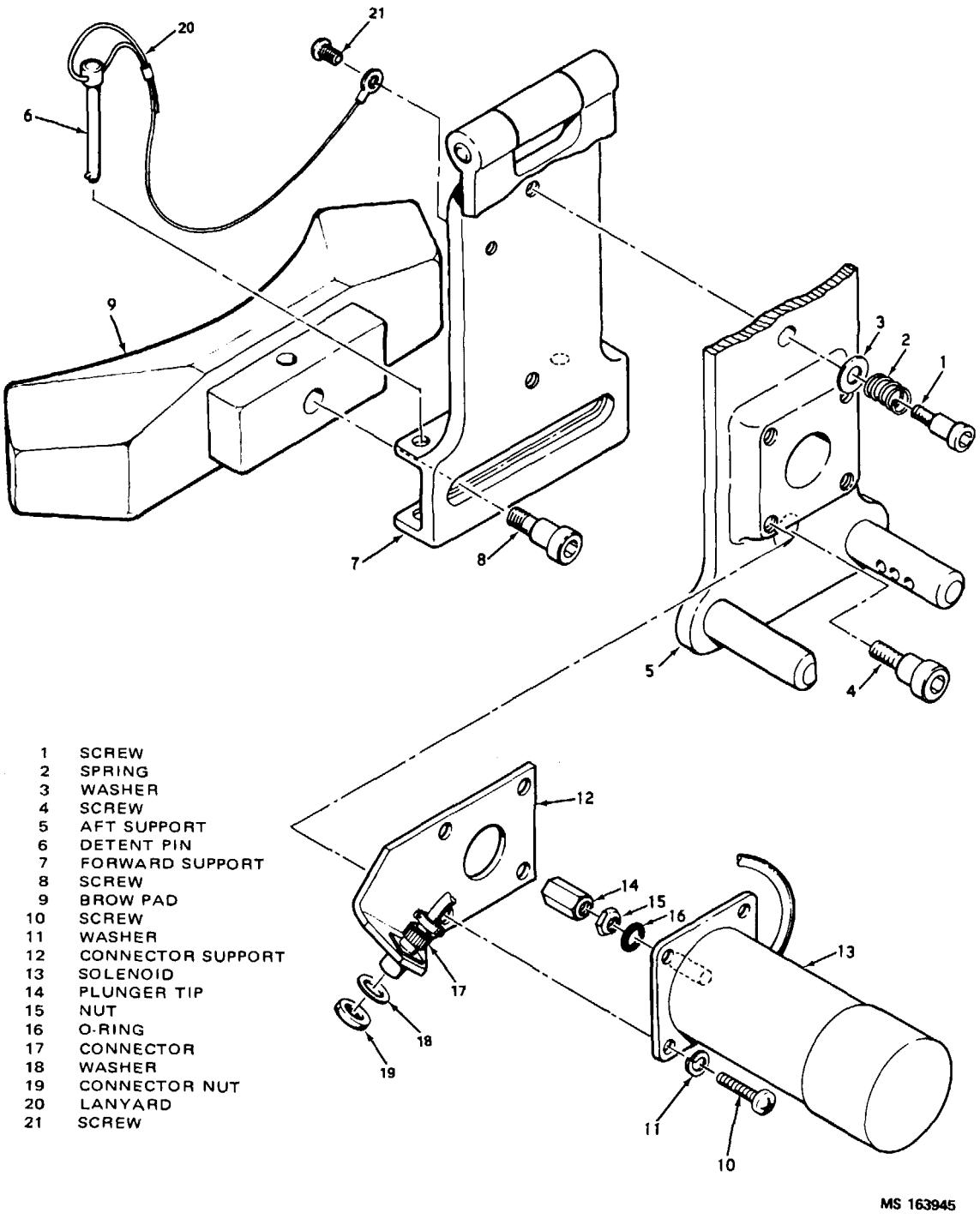



*Figure 6-1. Launch Recoil Simulator Disassembly and Assembly*

## Section III. RETROREFLECTOR TARGET

### 6-4. Top Cover Replacement (Figure 6-2).

a. Removal.
   (1) Remove screws (1) and (2) holding handles (3) to top cover (6).
   (2) Remove 10 screws and washers (4) and (5) and 3 screws (7) and remove top cover from pedestal (12).

b. Installation.
   (1) Place top cover (6) on pedestal (12) and install 10 screws and washers (4) and (5) and 3 screws (7). Tighten screws.
   (2) Place handles (3) on top cover and install screws (1) and (2). Tighten screws.

### 6-5. Bottom Cover Replacement (Figure 6-2).

a. Removal. Remove 23 screws and washers (9) and (10) holding bottom cover (11) to pedestal (12).

b. Installation. Place bottom cover (11) on pedestal (12) and install 23 screws and washers (9) and (10). Tighten screws.

### 6-6.Corner Cube Replacement (Figure 6-2).

a. Removal.
   (1) Remove bottom cover (11) according to paragraph 6-5a.
   (2) Remove screw (13) from ring clamp (14) which retains ring assembly (15) corner cube reflector (16) and gasket (17) in pedestal (12).

**NOTE**

Two ring clamps must be removed before a corner cube reflector can be removed.

b. Installation. Place ring assembly (15) over corner cube reflector (16) and position reflector against gasket (17) in pedestal opening. Install ring clamps (14) with screws (13) and tighten.

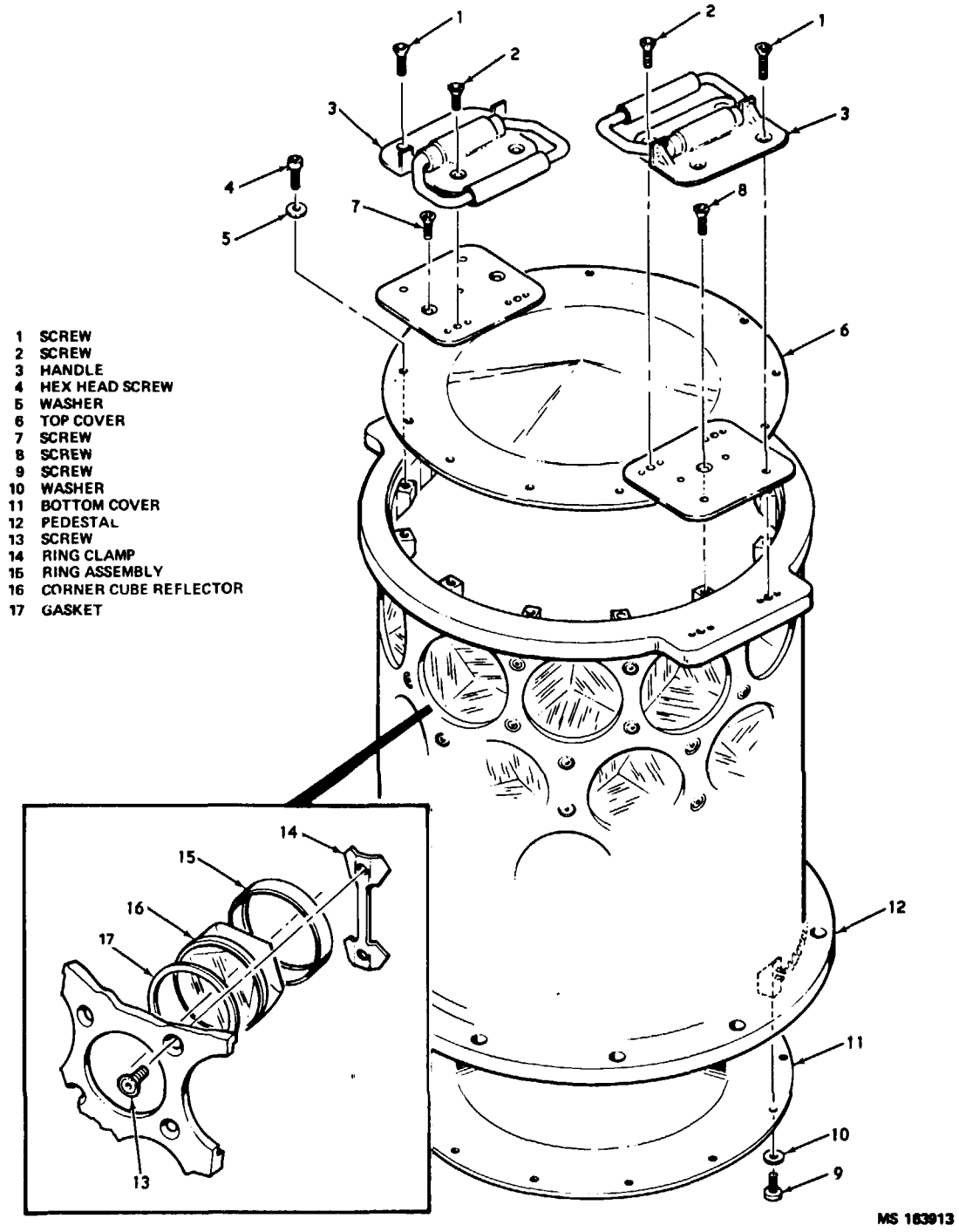



*Figure 6-2. Retroreflector Target Disassembly and Assembly*

## APPENDIX A

## REFERENCES

| | |
|---|---|
| The Army Maintenance Management System | TM 38-750 |
| All Combat Vehicles: Failure of Azimuth Indicator, Lighting, and Fire Control Instruments | TB ORD 548 |
| Report of Packaging and Handling Deficiencies | AR 700-58 |
| Painting Instructions | TM 9-213' |
| Storage and Materials Handling | TM 7-743-200 |
| Operator and Organizational Maintenance Manual for Armored Reconnaissance/ Airborne Assault Vehicle: FT, 152MM, XM551 | TM 9-2350-230-12 |
| Organizational, Direct and General Support, and Depot Maintenance Repair Parts and Special Tools List for Armored Reconnaissance Airborne Assault Vehicle: FT., 152MM Gun Launcher, XM551 -Turret Elevating and Traversing Systems, Cupola, Gun-Launcher, Small Arms and Fire Control | TM 9-2350-230-25P/2 |
| Operator's Manual for Tank, Combat, Full-Tracked: 152MM Gun Launcher M60A2, W/E | TM 9-2350-232-10 |
| Organizational Maintenance Manual for Tank, Combat, Full-Tracked: 152MM Gun Launcher M60A2 | TM 9-2350-232-20 |
| Administrative Storage of Equipment | TM 740-90-1 |
| Operator and Organizational Maintenance Manual for SHILLELAGH Conduct of Fire Trainer (SHILLELAGH Guided Missile System) | TM 9-6920-466-12 |
| Operator, Organizational, Direct Support, and General Support Maintenance Manuals for Field Support Test Equipment SHILLELAGH Conduct of Fire Trainer (SHILLELAGH Guided Missile System) | TM 94935466-14 |
| Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List | TM 9, 6920466-24P |
| DS Maintenance Manual: Troubleshooting of the SHILLELAGH Guidance and Control Set, Using the Guided Missile System Test Set AN/MSM-93 (YO-2) (SHILLELAGH Guided Missile System) | TM 9-1430-465-30 |

# APPENDIX B

## EXPENDABLE SUPPLIES AND MATERIALS LIST

### Section I. INTRODUCTION

**B-1. Scope**. This appendix lists expendable supplies and materials you will need to operate and maintain the M62 and M63. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

**B-2. Explanation of Columns.**

a. Column 1 Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App. B").

b. Column 2 Level. This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column 3 National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5 Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

### Section II. EXPANDABLE DUPPLIES AND MATERIALS LIST

| (1) ITEM NUMBER | (2) LEVEL | (3) NATIONAL STOCK NUMBER | (4) DESCRIPTION PART NO. AND FSCM | (5) UNIT OF MEAS. |
|---|---|---|---|---|
| 1 | C | 68 10-00-2014)-0906 | Alcohol, denatured, O-E-760 pt | |
| 2 | C | 7920-00-205-1427 | Brush. dusting ea | |
| 3 | C | 6640-00-261-3663 | Paper, lens, NNN-P40 100 sh | |
| 4 | F | 8030-00-052-8021 | Primer, MIL-S-22473, Grade N, Form R Pt | |
| 5 | F | 8030-00-052-8021 | Sealant, MIL-S-22473, Grade E Pt | |
| 6 | F | 8030-004)52-8021 | Sealant, MIL-S-22473, Grade H Pt | |
| 7 | F | 6810-00-281-2785 | Methyl Ethyl Ketone, TT-M-261 ga | |
| 8 | C | 7920-00-205-1711 | Rag. wiping. DDD-R-30, Class 2 lb | |
| 9 | F | 9150-00-168-2000 | Lubricant, dry film, MIL-L-46147, Type II cn | |
| 10 | F | 6850-00-051-5052 | Leak test compound, MIL-L-25567C, Type 1 1/2 pt | |
| 11 | F | 59704)0-241-5406 | Thermal joint compound, 10228866 oz | |
| 12 | F | 8040-00-877-9872 | Adhesive, silicone. MIL-A-46106, Type I oz | |
| 13 | F | 6850-00-880-7616 | Silicone compound, MIL-S-8660 tu | |
| 14 | F | 8020-00-260-1306 | Brush, varnish ea | |
| 15 | F | 9150-00-985-7243 | Grease, MIL-G-23827 lb | |
| 16 | F | 8040-01-4)30-6154 | Adhesive, MIL-A-46106, Type II cn | |

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**INDEX (Continued)**

## INDEX (Continued)

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