

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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DIRECT SUPPORT, GENERAL SUPPORT  
AND  
DEPOT MAINTENANCE MANUAL:  
GUIDED MISSILE LAUNCHER HELICOPTER  
ARMAMENT SUBSYSTEM M22  
(USED ON UH-1B HELICOPTER)

This copy is a reprint which includes current  
pages from Changes 1 through 6.

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**GUIDED MISSILE LAUNCHER HELICOPTER ARMAMENT  
 SUBSYSTEM M22  
 (USED ON UH-1B HELICOPTER)**

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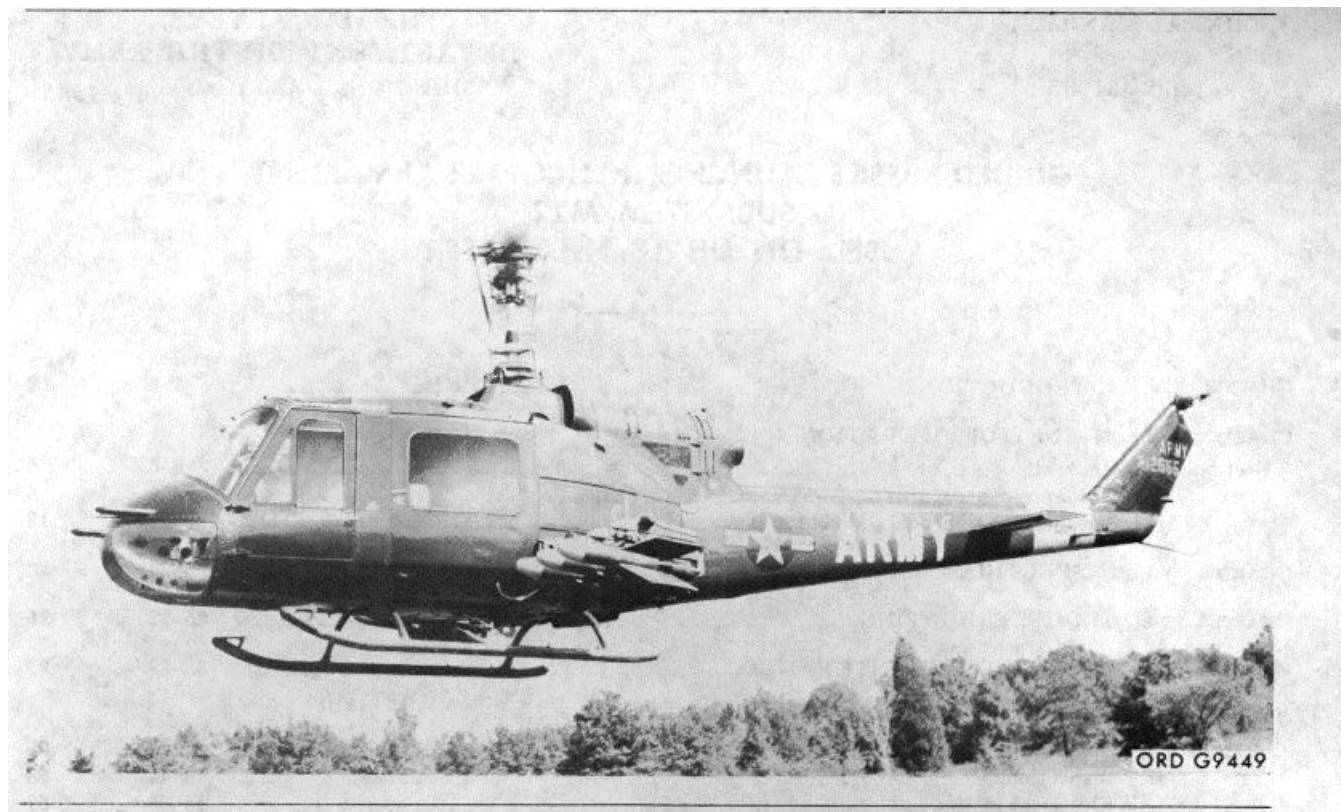


Figure 1. Helicopter guided missile launcher armament subsystem M22.



## CHAPTER 1

INTRODUCTION

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**1. Scope**

a. This technical manual contains instructions and procedures for direct support, general support, and depot maintenance of the guided-missile-launcher helicopter-armament subsystem M22 (fig. 1). These instructions contain information on maintenance that is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

b. Information in this manual is to be used in conjunction with, and is supplementary to information in the operator's (TM 9-1520-211-10) and organizational (TM 9-1400-461-20) maintenance manuals. It may be necessary to refer to the operator's or organizational maintenance manual in order to obtain complete procedures.

c. This manual contains theory of operation, troubleshooting procedures, and maintenance operations peculiar to support and depot maintenance. The instructions in this manual are intended for maintenance personnel who have been especially trained to maintain the M22 subsystem. The study and use of the information and maintenance guidelines in this manual will enable maintenance crews to perform their assigned duties and missions with maximum efficiency and safety.

d. The appendix contains a list of current references, including supply and technical manuals, forms, and other available publications applicable to the M22 armament subsystem.

e. This manual reflects the most recent technical information available. When additional or changed information affecting maintenance of the M22 armament subsystem becomes available, official changes to this manual will be printed.

**2. Errors, Omissions, and Corrections**

The direct reporting of errors, omissions, and recommendations for improving this equipment manual by the individual user, is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed using pencil, pen, or typewriter. DA Forms 2028 will be completed by the individual using the manual and forwarded to: Commanding General, U. S. Army Missile Command, ATTN: AMSMI-SMPT, Redstone Arsenal, Alabama 35809.

**3. Maintenance Allocation and Parts**

Maintenance responsibilities prescribed in this manual will apply as reflected in the maintenance allocation chart (TM 9-1400-461-20) and as reflected by the allocation of repair parts and tools listed in TM 9-1400-461-35P.

**4. Description and Data**

Refer to TM 9-1400-461-20 for the description and data applicable to the M22 armament subsystem.



## CHAPTER 2 THEORY OF OPERATION

### Section I. GENERAL

#### 5. System Theory

The overall system theory of the M22 subsystem is covered in TM 9-1400-461-20.

and depot maintenance personnel with detailed operational theory to the component level. The theory of each major component is covered in separate sections in this chapter.

#### 6. Detailed Operational Theory

This chapter provides direct support, general support,

### Section II. GUIDANCE CONTROL UNIT

#### 7. General

This section covers the operational theory of the guidance control unit (figs. 2 and 3). Operational theory of the signal generator module (fig. 3) is the only theory required as the remainder of the guidance control unit (fig. 2) contains only switches which connect straight line circuits.

#### 9. Regulated Supply Voltage (fig. 5)

Input battery voltage between 23 and 30 vdc is applied between pins 6 (negative) and 7 (positive) when the firing sequence is initiated. A regulating bridge network is connected across the inputs. This bridge is composed of two positive temperature coefficient zener diodes (CR1 and CR8) connected in series with six negative temperature coefficient diodes (CR2 through CR7). This configuration provides operational stabilization during temperatures between minus 30 degrees centigrade and positive 50 degrees centigrade. Bias voltage for Q1 base is taken between R1 and CR1. This bias voltage varies in accordance with battery supply

#### 8. Signal Generator Operational Theory

Signal generator operational theory will be covered by explaining the normal operational sequences of the unit with the control stick in the neutral position. Refer to figure 4 for block diagram of signal generator module.

### Apparatus List for the Guidance Control Unit, Figure 2

Reference designator	Description	Part No.
C1-C4	CAPACITOR, FIXED: 160v, 100,000 uuf ( $\pm 10\%$ )	10172517
DS1-DS4	LAMP, INCANDESCENT: 28v, 0.04 amp	MS 25237-327
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 2 male contacts	10172485
J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 16 female contacts	10022462
J1031	CONNECTOR, RECEPTACLE, ELECTRICAL: 19 male contacts	10172490
J1036	CONNECTOR, BULKHEAD, ELECTRICAL: 7 male contacts	10172767
K1	RELAY, ARMATURE	10172528
K2	RELAY, ARMATURE	10172527
K3	RELAY, ARMATURE	10172528
K4	RELAY, ARMATURE	10172524
K5, K6	RELAY, ARMATURE	10172528
P1	CONNECTOR, PLUG, ELECTRICAL: 16 male contacts	10172658
S1	SWITCH, ROTARY: 6 circuits, 6 positions	10172748
V	VOLTMETER	10021155



Apparatus List for the Signal Generator Module, Figure 3

Reference designator	Description	Part No.
C1, C2	CAPACITOR, FIXED, TANTALUM: 16v, 150 uf, ( $\pm 10\%$ )	10172693
C3	CAPACITOR, FIXED, TANTALUM: 35v, 6.8 uf ( $\pm 10\%$ )	10172694
C4-C7	CAPACITOR, FIXED, TANTALUM: 16v, 100 uf ( $\pm 10\%$ )	10172695
C8, C9	CAPACITOR, FIXED, MYLAR: 250v, 4,700 uuf	10172696
CR1	SEMICONDUCTOR, DEVICE, DIODE: Type 108Z4	10172690
CR2-CR7	SEMICONDUCTOR, DEVICE, DIODE: Type SG22	10172691
CR8	SEMICONDUCTOR, DEVICE, DIODE: Type 108Z4	10172690
CR9	SEMICONDUCTOR, DEVICE, DIODE: Type 12P2	10172689
CR10	SEMICONDUCTOR, DEVICE, DIODE: Type 1N64	1N64
CR11	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A47	1N3825A
CR12, CR13	SEMICONDUCTOR, DEVICE, DIODE: Type 19P2	10172687
CR14, CR15	SEMICONDUCTOR, DEVICE, DIODE: Type 13P2	10021837
CR16	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A68	10172686
CR17	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A47	1N3825A
CR18	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A68	10172686
CR19, CR20	SEMICONDUCTOR, DEVICE, DIODE: Type 19P2	10172687
CR21	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A47	1N3825A
CR22	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A68	10172686
CR23, CR24	SEMICONDUCTOR, DEVICE, DIODE: Type Z2A47	1N3825A
Q1	TRANSISTOR: OC-28	10172678
Q2	TRANSISTOR: OC-47	10172632
Q3	TRANSISTOR: 2N1566	10172680
Q4	TRANSISTOR: OC-47	10172632
Q5	TRANSISTOR: 2N493	10172681
Q6	TRANSISTOR: OC-47	10172632
Q7	TRANSISTOR: 2N1310	10172682
Q8	TRANSISTOR: OC-77	10172683
Q9	TRANSISTOR: 2N1310	10172682
Q10	TRANSISTOR: OC-77	10172683
Q11	TRANSISTOR: 2N1566	10172680
Q12	TRANSISTOR: OC-141	10172684
Q13, Q14	TRANSISTOR: OC-47	10172632
Q15	TRANSISTOR: 2N1566	10172680
Q16, Q19	TRANSISTOR: OC-47	10172632
Q20, 22	TRANSISTOR: OC-141	10172684
Q23	TRANSISTOR: OC-72	10121287
Q24	TRANSISTOR: OC-141	10172684
Q25	TRANSISTOR: OC-72	10121287
R1	RESISTOR, FIXED: 1/2w, 220 ohms ( $\pm 5\%$ )	10172649
R2	RESISTOR, VARIABLE: linear precision, 1w, 2,000 ohms ( $\pm 0.5\%$ , Z .23% linearity)	10172697
R4	RESISTOR, FIXED: 1/4w, 1,000 ohms ( $\pm 5\%$ )	10172704
R5	RESISTOR, VARIABLE: 1/2w, 100,000 ohms	10172700
R8	RESISTOR, FIXED: 1/4w, 82,000 ohms ( $\pm 5\%$ )	10172725
R9	RESISTOR, FIXED: 1/4w, 9,100 ohms ( $\pm 5\%$ )	10172717
R11	RESISTOR, FIXED: 1/2w, 10,000 ohms ( $\pm 5\%$ )	10172718
R12	RESISTOR, FIXED: 1/4w, 6,800 ohms ( $\pm 5\%$ )	10172715
R13	RESISTOR, FIXED: 1/4w, 12,000 ohms ( $\pm 5\%$ )	10172720
R14	RESISTOR, FIXED: 1/4w, 18,000 ohms ( $\pm 5\%$ )	10172722
R15, R16	RESISTOR, VARIABLE: wire wound element, 1 sec, 1w, 50,000 ohms ( $\pm 5\%$ )	10172699
R18	RESISTOR, FIXED: 1/4w, 6,200 ohms ( $\pm 5\%$ )	10172714
R19	RESISTOR, FIXED: 1/4w, 200 ohms ( $\pm 51\%$ )	10172701
R21	RESISTOR, FIXED: 1/4w, 2,200 ohms ( $\pm 5\%$ )	10172708
R22	RESISTOR, FIXED: 1/4w, 15,000 ohms ( $\pm 1\%$ )	10172721
R23	RESISTOR, FIXED: 1/4w, 20,000 ohms ( $\pm 5\%$ )	10172723
R24	RESISTOR, VARIABLE: wire wound element, 1 sec, 1w, 10,000 ohms ( $\pm 5\%$ )	10172698



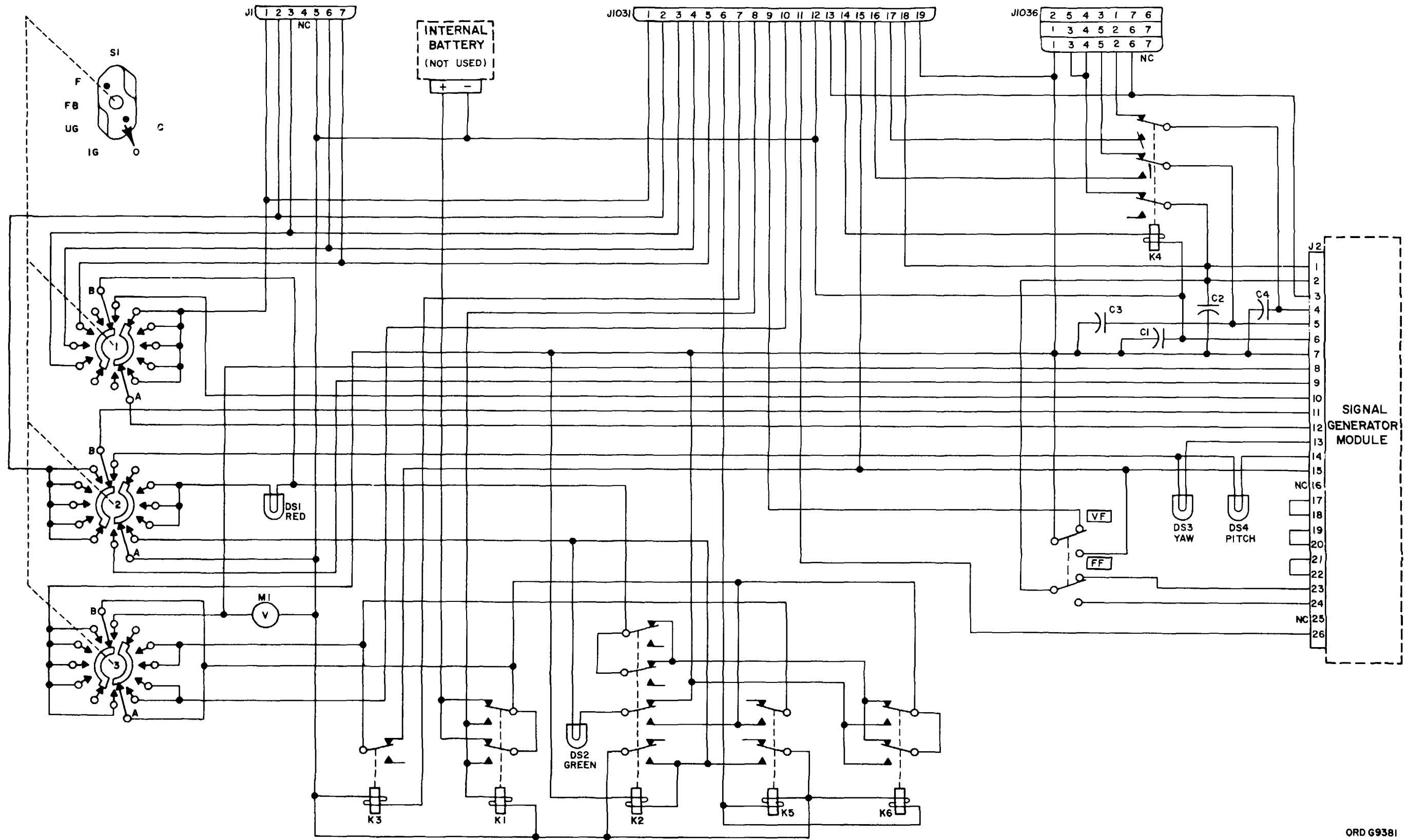


Figure 2. Guidance control unit, schematic diagram.



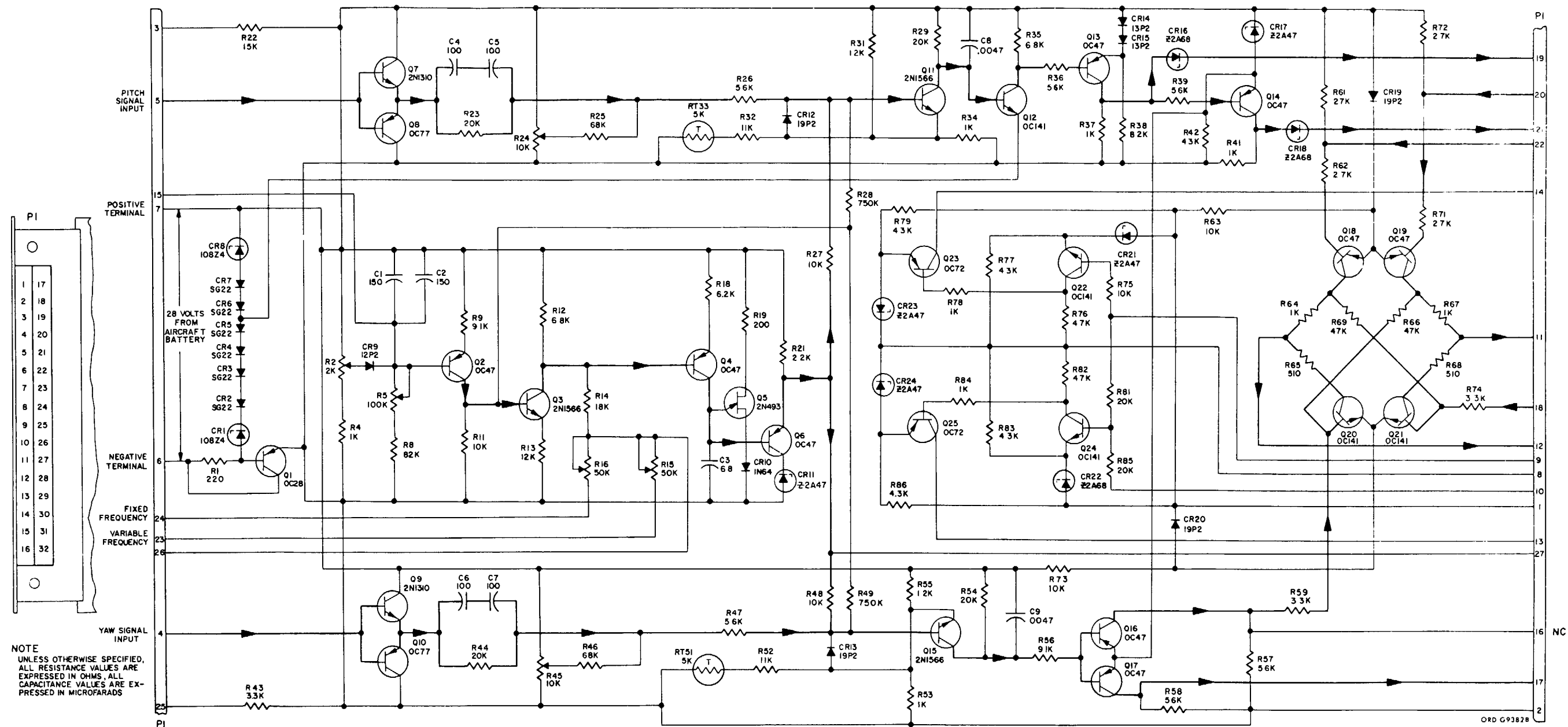


Figure 3. Signal generator module, schematic diagram.



## Apparatus List for the Signal Generator Module, Figure 3—Cont'd

Reference designator	Description	Part No.
R25	RESISTOR, FIXED: 1/4w, 68,000 ohms ( $\pm 5\%$ )	10172724
R26	RESISTOR, FIXED: 1/4w, 5,600 ohms ( $\pm 5\%$ )	10172713
R27	RESISTOR, FIXED: 1/4w, 10,000 ohms ( $\pm 5\%$ )	10172718
R28	RESISTOR, FIXED: 1/4w, 750,000 ohms ( $\pm 5\%$ )	10172688
R29	RESISTOR, FIXED: 1/4w, 20,000 ohms ( $\pm 5\%$ )	10172723
R31	RESISTOR, FIXED: 1/2w, 1,200 ohms ( $\pm 5\%$ )	10172706
R32	RESISTOR, FIXED: 1/4w, 11,000 ohms ( $\pm 5\%$ )	10172719
R33	THERMISTOR: Type A, 5,000 ohms ( $\pm 5\%$ )	10172692
R34	RESISTOR, FIXED: 1/2w, 1,000 ohms ( $\pm 5\%$ )	10172648
R35	RESISTOR, FIXED: 1/4w, 6,800 ohms ( $\pm 5\%$ )	10172715
R36	RESISTOR, FIXED: 1/4w, 5,600 ohms ( $\pm 5\%$ )	10172713
R37	RESISTOR, FIXED: 1/2w, 1,000 ohms ( $\pm 5\%$ )	10172648
R38	RESISTOR, FIXED: 1/4w, 8,200 ohms ( $\pm 5\%$ )	10172716
R39	RESISTOR, FIXED: 1/4w, 5,600 ohms ( $\pm 5\%$ )	10172713
R41	RESISTOR, FIXED: 1/4w, 1,000 ohms ( $\pm 5\%$ )	10172704
R42	RESISTOR, FIXED: 1/4w, 4,300 ohms ( $\pm 5\%$ )	10172711
R43	RESISTOR, FIXED: 1/4w, 3,300 ohms ( $\pm 5\%$ )	10172710
R44	RESISTOR, FIXED: 1/4w, 20,000 ohms ( $\pm 5\%$ )	10172723
R45	RESISTOR, VARIABLE: wire wound element, 1 sec, 1w, 10,000 ohms ( $\pm 5\%$ )	10172698
R46	RESISTOR, FIXED: 1/4w, 18,000 ohms ( $\pm 5\%$ )	10172724
R47	RESISTOR, FIXED: 1/4w, 5,600 ohms ( $\pm 5\%$ )	10172713
R48	RESISTOR, FIXED: 1/4w, 10,000 ohms ( $\pm 5\%$ )	10172718
R49	RESISTOR, FIXED: 1/4w, 750,000 ohms ( $\pm 5\%$ )	10172688
R51	THERMISTOR: Type A, 5,000 ohms ( $\pm 5\%$ )	10172692
R52	RESISTOR, FIXED: 1/4w, 11,000 ohms ( $\pm 5\%$ )	10172719
R53	RESISTOR, FIXED: 1/2w, 1,000 ohms ( $\pm 5\%$ )	10172648
R54	RESISTOR, FIXED: 1/4w, 20,000 ohms ( $\pm 5\%$ )	10172723
R55	RESISTOR, FIXED: 1/2w, 1,200 ohms ( $\pm 5\%$ )	10172706
R56	RESISTOR, FIXED: 1/4w, 9,100 ohms ( $\pm 5\%$ )	10172717
R57, R58	RESISTOR, FIXED: 1/4w, 5,000 ohms ( $\pm 5\%$ )	10172713
R59	RESISTOR, FIXED: 1/4w, 3,300 ohms ( $\pm 5\%$ )	10172710
R61, R62	RESISTOR, FIXED: 1/4w, 2,700 ohms ( $\pm 5\%$ )	10172709
R63	RESISTOR, FIXED: 1/4w, 10,000 ohms ( $\pm 5\%$ )	10172718
R64	RESISTOR, FIXED: 1/4w, 1,000 ohms ( $\pm 5\%$ )	10172704
R65	RESISTOR, FIXED: 1/4w, 510 ohms ( $\pm 5\%$ )	10172703
R66	RESISTOR, FIXED: 1/4w, 47,000 ohms ( $\pm 5\%$ )	10172707
R67	RESISTOR, FIXED: 1/4w, 1,000 ohms ( $\pm 5\%$ )	10172704
R68	RESISTOR, FIXED: 1-4w, 510 ohms ( $\pm 5\%$ )	10172703
R69	RESISTOR, FIXED: 1-4w, 47,000 ohms ( $\pm 5\%$ )	10172707
R71, R72	RESISTOR, FIXED: 1/4w, 2,700 ohms ( $\pm 5\%$ )	10172709
R73	RESISTOR, FIXED: 1/4w, 10,000 ohms ( $\pm 5\%$ )	10172718
R74	RESISTOR, FIXED: 1/4w, 3,300 ohms ( $\pm 5\%$ )	10172710
R75	RESISTOR, FIXED: 1/4w, 10,000 ohms ( $\pm 5\%$ )	10172718
R76	RESISTOR, FIXED: 1/4w, 4,700 ohms ( $\pm 5\%$ )	10172712
R77	RESISTOR, FIXED: 1/4w, 4,300 ohms ( $\pm 5\%$ )	10172711
R78	RESISTOR, FIXED: 1/4w, 1,000 ohms ( $\pm 5\%$ )	10172704
R79	RESISTOR, FIXED: 1/4w, 4,300 ohms ( $\pm 5\%$ )	10172711
R81	RESISTOR, FIXED: 1/4w, 20,000 ohms ( $\pm 5\%$ )	10172723
R82	RESISTOR, FIXED: 1/4w, 4,700 ohms ( $\pm 5\%$ )	10172712
R83	RESISTOR, FIXED: 1/4w, 4,300 ohms ( $\pm 5\%$ )	10172711
R84	RESISTOR, FIXED: 1/4w, 1,000 ohms ( $\pm 5\%$ )	10172704
R85	RESISTOR, FIXED: 1/4w, 20,000 ohms ( $\pm 5\%$ )	10172723
R86	RESISTOR, FIXED: 1/4w, 4,300 ohms ( $\pm 5\%$ )	10172711



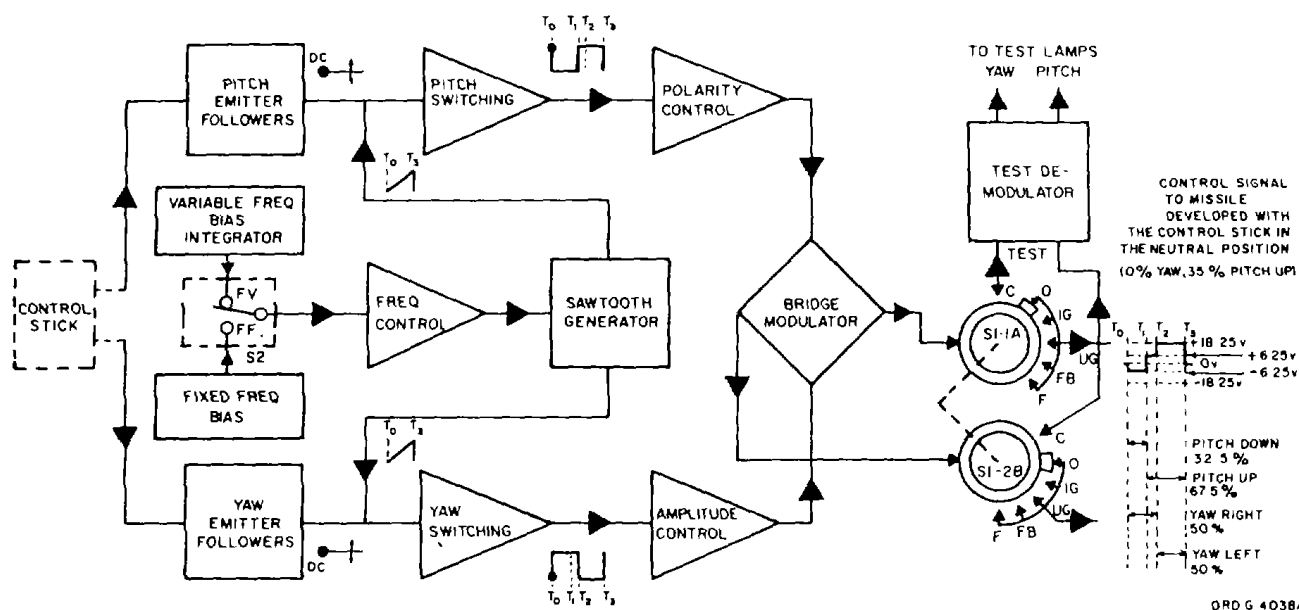


Figure 4. Signal generator module block diagram.

change. Each variation of Q1 base bias changes base collector current, producing variations in

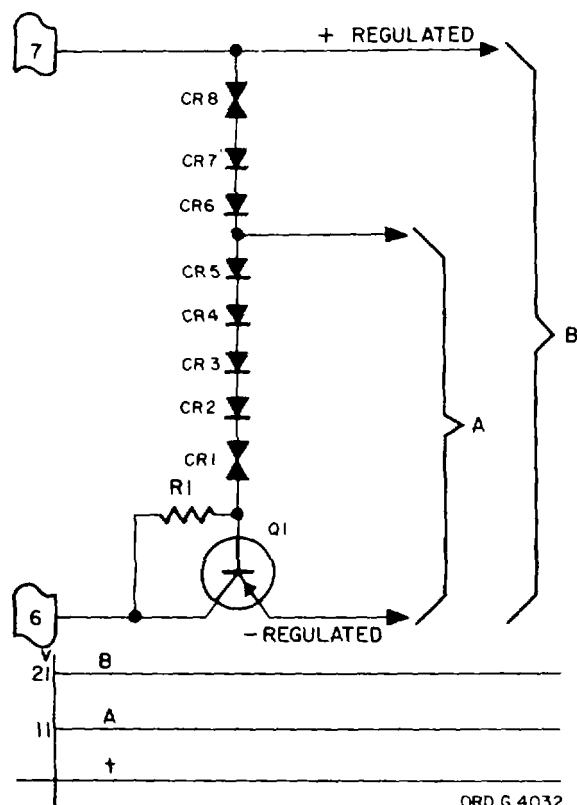


Figure 5. Regulated supply voltage, schematic diagram.

emitter-collector impedance. Changing emitter-collector impedance changes the voltage dropped, thereby maintaining a  $21 \pm 0.05$  vdc output with an input between 23 and 30 vdc. A regulated 11 vdc is also tapped between CR5 and CR6.

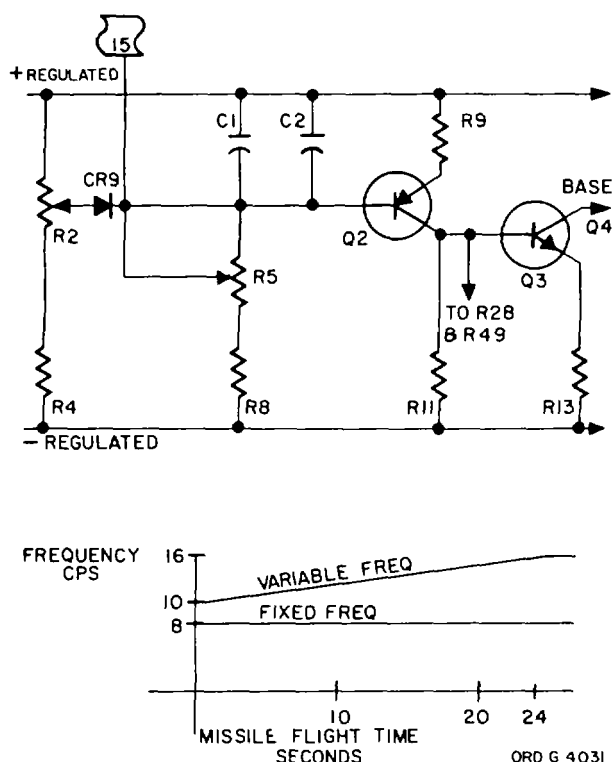
## 10. Frequency Formation Circuit (fig. 6)

The function of the frequency-formation circuit is to produce the base bias current for transistor Q4. The amplitude of the base bias current determines the output frequency of the sawtooth generator circuit. An increasing (negative) base bias increases the frequency. The frequency formation circuit is designed to produce either a variable or fixed bias current, thereby producing either a variable or fixed frequency.

*a. Fixed Bias.* Fixed bias, not used for M22 subsystem operation, is produced by shorting the frequency formation circuit through pin 15 to the positive regulated voltage. This shorts the integrator circuit C1, C2, R5, and R8 and establishes a high positive base bias on transistor Q2. The high base bias decreases the conduction of transistors Q2 and Q3 to cutoff. Fixed bias is accomplished by placing the FF-VF switch (S2) to the FF position.

*b. Variable Bias.* When the FF-VF switch is placed to the VF position a variable bias is produced by the frequency formation circuit. Base





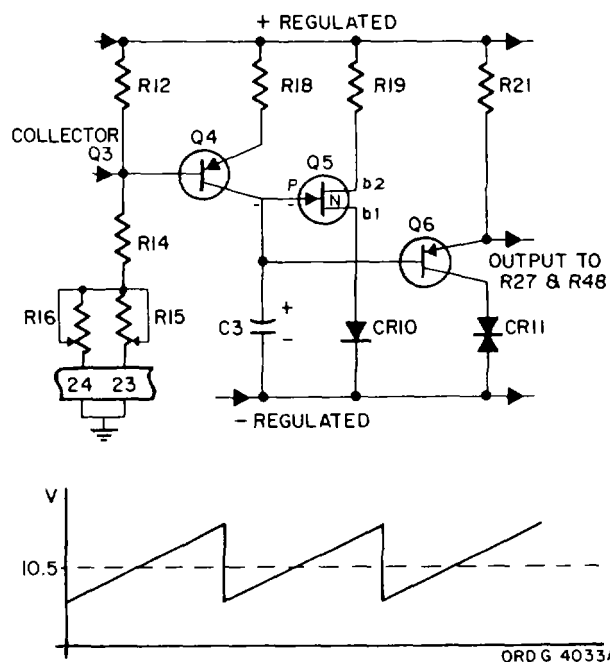
**Figure 6. Frequency formation, schematic diagram.**

bias of transistor Q2 is produced by the integrator circuit C1, C2, R5, and R8. The varying base bias current of Q2 is constantly changing during missile flight, because the time constant of the integrator circuit is considerably longer than the flight time of the missile. As C1 and C2 charge, an increasing negative potential is applied to the base of transistor Q2 because of the polarity of charge. The rate or slope of this charging is adjusted by R5. The maximum voltage (highest negative) that C1 and C2 may charge to is determined by the clamping circuit composed of R4, R2, and CR9. R2 is adjusted to limit the maximum frequency to 16.5 cps. Negative on the base causes Q2 to conduct more, causing the emitter-collector impedance to decrease. Decreasing impedance causes more current flow through Q2 and the voltage dropped across R11 and R9 to increase. This causes the base bias of Q3 (NPN) to become more positive. Transistor Q3 conducts more, causing the emitter-collector impedance to decrease. Decreasing the impedance causes more current to flow through Q3, therefore causing the base bias of Q4 to become less positive.

### 11. Sawtooth Generator (fig. 7)

The sawtooth generator circuit is a conventional unijunction-transistor oscillator. The frequency of the sawtooth generator is determined by the base bias of Q4. In the M22 sub system the output normally is a varying frequency, although a fixed frequency can be obtained. The varying frequency output of the signal generator provides a greater missile stability during the later portion of flight, due to missile continuous increase in velocity.

a. *Variable Frequency.* When the FF-VF switch on the GCU is placed to the VF position the output frequency of the sawtooth generator increases during missile flight. This is accomplished by the varying base bias applied to Q4 from the frequency formation circuit as explained in paragraph 10. Conduction of Q4 charges C3 through Q4 and R18. Transistor Q5 emitter base 1 has a very low voltage and a very high impedance condition. After a certain delay the voltage at C3 terminals is high enough to overcome the high impedance condition of Q5 emitter base 1. This causes Q5 emitter-base 1 impedance to decrease almost to zero. Capacitor C3 discharges very rapidly through the low resistance of Q5 emitter-base 1. When the residual voltage at C3 terminal reaches a lower



**Figure 7. Sawtooth generator, schematic diagram.**



limit corresponding with the normal high impedance condition of Q5 emitter base 1, impedance increases and Q5 ceases conduction. Capacitor C3 is again ready to be recharged and a new integration cycle to begin. The voltage waveform across C3 is coupled to Q6. Transistor Q6, an emitter follower, is the sawtooth current generator output stage. The explanation above is for a constant base bias on Q4. As the output from the frequency formation circuit increases, the base bias of Q4 increases. Increasing the base bias of Q4 causes C3 to charge and discharge faster, therefore increasing the sawtooth generator output frequency. Normal variation of the sawtooth signal under the variable frequency condition is from 10 to 16.5 cps. Resistor R15 adjusts the initial output frequency of this sawtooth generator to the 10 cps lower limit by establishing the base bias of Q4. Frequency formation circuit output current is not effective until this bias is overcome.

*b. Fixed Frequency.* Fixed frequency output will be explained even though it is not used. This will give the technician a better understanding of the overall signal generator module operation. When the FF-VF switch on the GCU is placed to the FF position the output of the sawtooth generator is fixed. This is caused by the frequency formation circuit being shorted as explained in paragraph 10a. When the frequency formation circuit is shorted the base bias of Q4 is fixed by voltage divider network R12, R14, and R16. The base bias of Q4 is adjustable by R16 and should be set to obtain an 8 cps sawtooth output signal.

## 12. Impedance Adapter (fig. 8)

Voltage functions of pitch (pin 5) and yaw (pin 4) from the control stick are applied to the impedance adapters (Q7 and Q8 or Q9 and Q10). Each impedance adapter is a NPN emitter follower. This configuration provides impedance matching of both decreasing and increasing variations in input voltages. Both impedance adapter circuits are the same, therefore the following explanation is applicable to both. A decreasing input voltage causes the NPN (Q7 or Q9) transistor to conduct less and PNP (Q8 or Q10) to conduct more. The NPN collector-emitter impedance increases and the PNP collector-emitter impedance decreases. The voltage

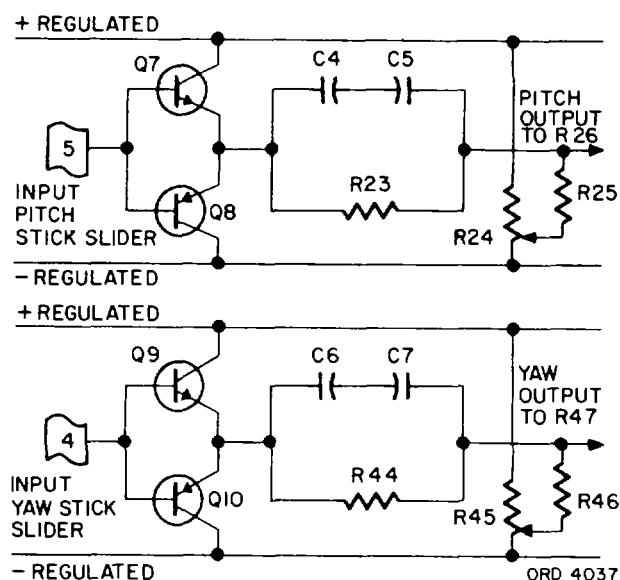


Figure 8. Impedance adapter, schematic diagram.

drop across the NPN increases and across the PNP decreases. Therefore, the output voltage from the emitters of the NPN and PNP transistors swings in a negative direction. An increasing voltage input causes the reverse effect on the conduction of the transistors. The output voltage from the emitters of the transistors swings in a positive direction. The output voltage is fed through a phase advance network which couples all sudden commands to the switching amplifiers without attenuation. The outputs of the impedance adapter circuits are linear functions of control stick position and also of the movement rate. Amplitudes of the output signals are adjusted by R24 (pitch) and R45 (yaw).

## 13. Switching Amplifiers (fig. 9)

The purpose of the switching amplifiers is to produce a square wave output proportional to the linear function of control stick position and rate of movement. The amplifiers circuits are so constructed that they function either at cutoff or saturation. The cutoff condition is caused by the clamping effect of CR12 and CR13. When the input is of sufficient amplitude to overcome the clamping condition the amplifiers immediately conduct to saturation. There are three inputs affecting the operation of the switching amplifiers; sawtooth generator (1, fig. 9), impedance adapter (2, fig. 9) and the varying output



from the collector of Q2 (3, fig. 9) in the frequency formation circuit.

a. *Sawtooth Generator Input* (1, fig. 9). The sawtooth input applied through R27 and R48 establishes the conduction and cutoff time of the switching amplifiers (Q11 and Q15). The amplifiers conduct (saturation) as long as the amplitude of the sawtooth is high enough to overcome the clamping effect of CR12 and CR13. The above mentioned sawtooth input establishes the square wave output. Reference to figure 10 will give an illustrated view of the differences in input and output signals. Let's notice that the amplitude of the sawtooth signal does not change. The reference level (4, fig. 9) at which the sawtooth is riding is the varying factor in obtaining desired signal outputs. Resistors R24 and R45 adjust the reference level at which the sawtooth rides. As this reference level is changed the up and down (pitch) command portions of the output signals differ. Also we must consider the variation in the slope of the sawtooth signal as frequency increases. As the sawtooth frequency increases the conduction

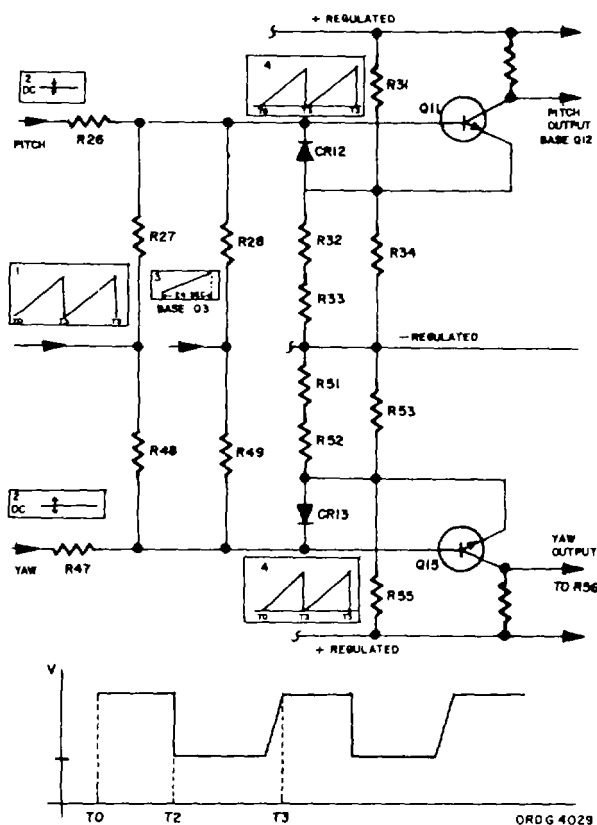


Figure 9. Switching amplifier, schematic diagram.

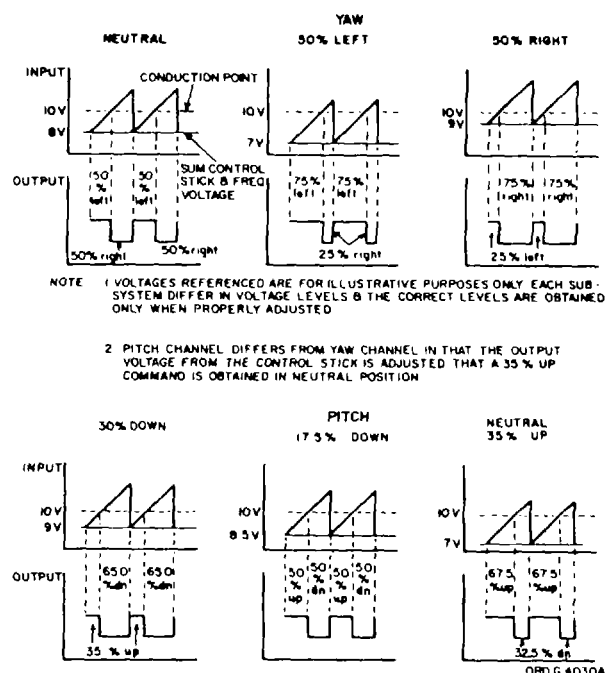


Figure 10. Switching amplifier input and output.

point (Q11 and Q15) will vary because of the change in sawtooth linearity due to the change in C3 time constant. These variations are explained in the following impedance adapter and frequency formation input paragraphs.

b. *Impedance Adapter Input* (2, fig. 9). The impedance adapter inputs combines with the frequency formation input to establish the voltage level at which the sawtooth signal rides. The impedance input is proportional to control stick position. Varying the control stick varies the output of the impedance adapters. Refer to paragraph 21 for mechanical operation of the control stick.

c. *Frequency Formation Input* (3, fig. 9). The primary purpose of the varying input from the frequency formation circuit is to adjust the voltage level which the sawtooth signal is riding. Previously we established that the change in frequency of the sawtooth caused the sawtooth slope to become more linear because of changes in applied voltage and resistance. As the slope changes, the switching amplifier outputs vary, causing an undesirable change in the output signal. This change is caused by the variation in the linear sawtooth because of the voltage and resistance change. The frequency formation input is combined with the impedance adapter



input which adjusts the amplitude of the voltage the sawtooth is riding. Changing this level causes the output of the switching amplifiers to be more linear and the command portions of the output signal to be proportioned correctly.

#### 14. Polarity Control Amplifier (fig. 11)

The output from the pitch switching amplifier Q11 is fed to the polarity control amplifier circuit. The purpose of the polarity control amplifier circuit is to establish the proper polarity of the output signals applied to the modulator bridge circuit. The switching amplifier output (pitch) is applied to the base of Q12. Q12 amplifies the input and applies it to the base of Q13. Q13 and Q14 are PNP transistors connected in series, with the collector of Q13 connected to the base of Q14. This configuration causes a 180 degree phase shift in the output signals from the collectors of the transistors. When Q13 conducts, the higher current output of the collector drives Q14 to cutoff, causing the collector current of Q14 to decrease. The reverse effect is obtained when Q13 is cutoff by the signal from pre-amplifier Q12. Tapping the two output signals from the collectors of Q13

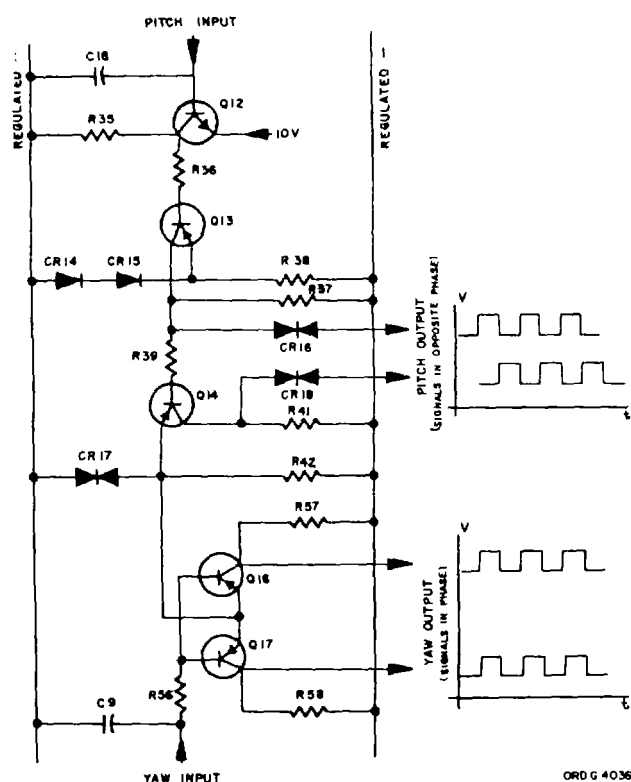


Figure 11. Polarity and amplitude control amplifier.

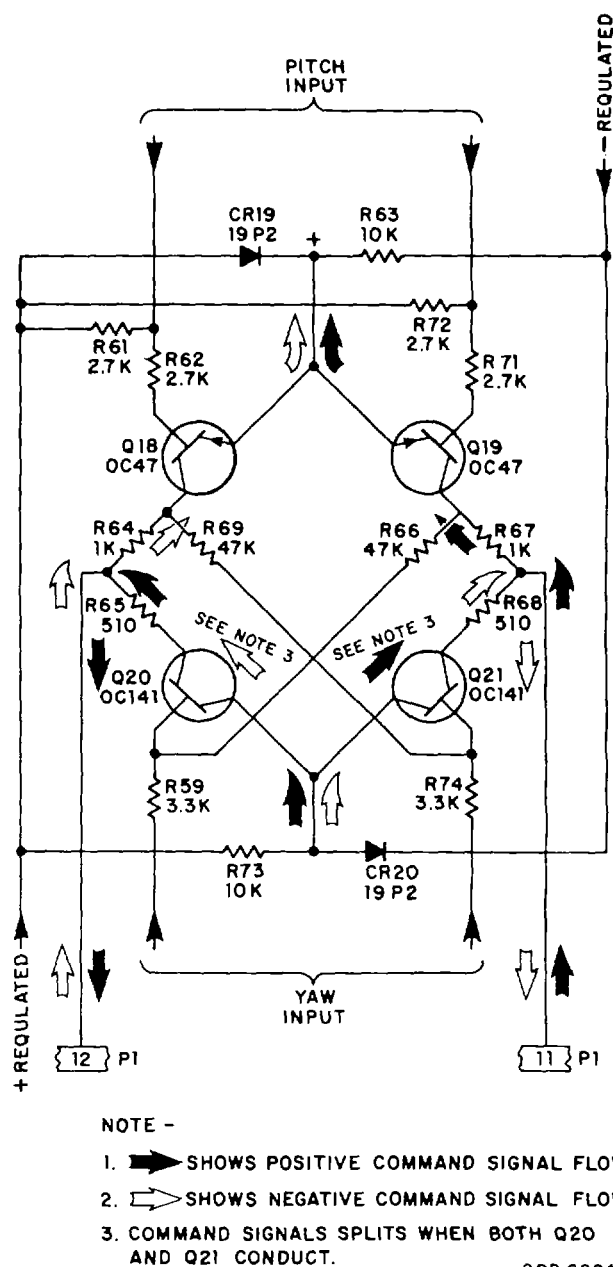


Figure 12. Bridge modulator, schematic diagram.

and Q14 through CR16 and CR18 respectively, maintains the desired 180 degree phase opposed signal output.

#### 15. Amplitude Control Amplifier (fig. 11)

The output from the yaw channel switching amplifier Q15 is fed to the amplitude control amplifiers. The purpose of the amplitude control amplifier is to establish the proper amplitude of the output signal applied to the modulator bridge. The switching amplifier output (yaw)



is applied to the bases of Q16 and Q17. The PNP transistors conduct at each negative signal input, decreasing the impedance of the transistors causes the voltage drop across R57 and R58 to increase. This produces a positive going output from the collectors of Q16 and Q17 which are in phase.

## 16. Bridge Modulator (fig. 12)

The purpose of the bridge modulator is to convert the pitch and yaw input signals into control command signals.

## 17. Command Signals

The command signals determine the corrective flight path of the missile as follows:

- a. A positive (6.25 or 18.25) corresponds to a pitch up command.
- b. A negative (-6.25 or -18.25) corresponds to a pitch down command.
- c. A low positive or negative (6.25 volts) corresponds to a yaw right command.
- d. High positive or negative (18.25 volts) corresponds to a yaw left command.

## 18. Development of Command Signals

From the above paragraph we have established the desired command signals for missile correction during flight. Now let's determine how these signals are developed in the bridge modulator.

a. *Pitch Command Signals.* The two 180 degree out of phase outputs from the polarity control amplifiers Q13 and Q14 are applied to the bases of Q19 and Q18, respectively. The latter transistors are flip-flop operated, one being cutoff when the other is conducting. Conduction and cutoff are determined by the input signal shapes. The percentage of each transistor conduction and cutoff time determines the amount of pitch (up and down) deflection of the missile. These outputs are positive (up command) or negative (down command) voltages, dependent upon the direction of flow in the remote control line (pins 11 and 12) and the transistor conducting. For example, when Q19 is conducting, Q18 is cutoff. The command signal flow is from the negative side of the bridge circuit through Q20, R65, out pin 12 to the missile, back through pin 11, R67, and Q19, to the positive side of the bridge circuit. This is a negative command signal causing the missile TM 9-1400-46135 to pitch down. Q20 is conducting with a

negative input (yaw signal input) to the base because of the voltage tapped from the collector of Q19. This voltage is of sufficient amplitude to cause Q20 to conduct. Q19 will conduct as long as the input pitch command signal maintains a negative potential on the base. The command output signal will change from a high current output to a low current output when the input yaw signal swings positive. This is caused by conduction of both Q20 and Q21. When both conduct the current is split and only a portion of the current is transmitted to the missile coder. This is explained in more detail in the following paragraph.

b. *Yaw Command Signals.* The two in phase output signals from the amplitude control amplifiers Q16 and Q17 are applied to the base of Q20 and Q21, respectively. The yaw input signals determines the amplitude of the output command signal. Variation in amplitude as related in paragraph 17 determines the yaw left and right missile flight correction. Reference to the signals illustrated in figure 12 will supplement the following explanation:

- (1) At time T0 on the yaw input signal Q20 is conducting because of voltage tapped from the collector of Q19. With Q19 and Q20 conducting, the current flow path is as explained in the discussion of the pitch command signal, paragraph 17a. Reference to T0 on the output command signal shows that a high voltage (18.25 volts) exists. This is because only Q20 is conducting and all the current flow is fed through the missile coder. This high amplitude corresponds to a yaw left command.
- (2) The above condition prevails until the yaw input signals reach T1. At this point, both Q20 and Q21 conduct. With both conducting, the total current is divided through the parallel circuits of the transistors. One path is to the missile as previously explained. The other path is through Q21 and R68, then recombined with the current from the missile. This causes the output command signal amplitude to reduce. This reduction in amplitude corresponds to a yaw right command.



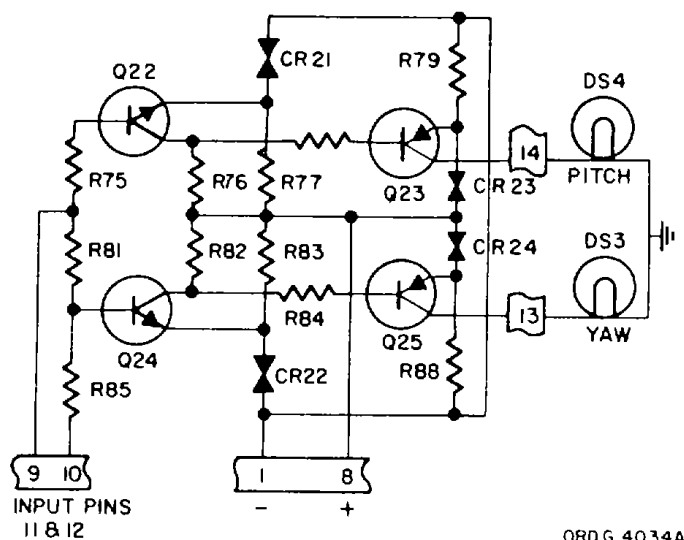


Figure 13. Demodulator, schematic diagram.

- (3) Up to this point we have had an output command signal with a positive amplitude. When the pitch input signals cause Q18 to conduct and Q19 to cutoff, a positive amplitude is produced. This is caused by the current flow being reversed through the missile coder. The path of flow is from negative side of bridge through Q21, R68, out pin 11, through the missile coder, back through pin 12, R64 and Q18 to the positive side of the bridge modulator. Also, there is current flow through Q20 and R65, causing the current to be split and the output command signal to have a low positive amplitude. Reference to the command signal output shows a neutral output condition. This output will vary as the input voltages from the control stick varies.

### Section III. MISSILE SELECTION BOX AND CONTROL STICK

#### 20. Missile Selection Box

The missile selection box contains only switches which connect straight line circuits. Reference to figure 14 will provide sufficient information in regard to detailed theory.

#### 21. Control Stick

No detailed theory of the control stick is covered as the

#### 19. Demodulator (fig. 13)

The purpose of the demodulator circuit is to show proper operation of the signal generator module. This is accomplished by placing the firing switch to the test (C) position and noting the blinking sequence of the pitch and yaw lamps on the front panel of the GCU. When the firing switch is placed to the C position, the command signal output of the signal generator is routed through S1-1A and S1-2B segments of the firing switch. This command signal is then fed through pins 9 and 10 of the signal generator module to the terminals of R81 and R75, and R85 respectively.

a. *Yaw Channel.* Resistors R81 and R85, of the same value, maintain Q24 bias as a function of current value without consideration of direction. If the input current is high, Q24 will be positive biased. The bias of its emitter is set by CR22 and R83. The voltage drop across R82 will bias the base of Q25 negatively in respect to its emitter. The emitter voltage is set by CR24. Biasing Q25 causes conduction and the yaw light to come on indicating a left command. If the input current is low, Q24 base polarity will be lower than its emitter. This cuts off Q24 and changes the bias of Q25. Q25 is also cut off causing the yaw light to go off indicating a right command.

b. *Pitch Channel.* The input current direction determines the polarity of Q22 base. If the current direction is positive, pin 9 is negative. Q22 base is negative in respect to its emitter whose voltage is determined by CR21. This causes Q22 and Q23 to be cutoff. The pitch light, connected to the collector of Q23 through pin 14, is off indicating an up command. If the current direction is negative, pin 9 is positive. Q22 base is positive in respect to its emitter. Q22 conducts causing the bias of Q23 to change. Q23 conducts, causing the pitch light to be on indicating a down command.

unit incorporates two variable resistor assemblies (fig. 15) which establish voltage references in respect to the control stick position. Mechanical theory of operation is explained by reference to the mechanical operational diagram shown in figure 16.



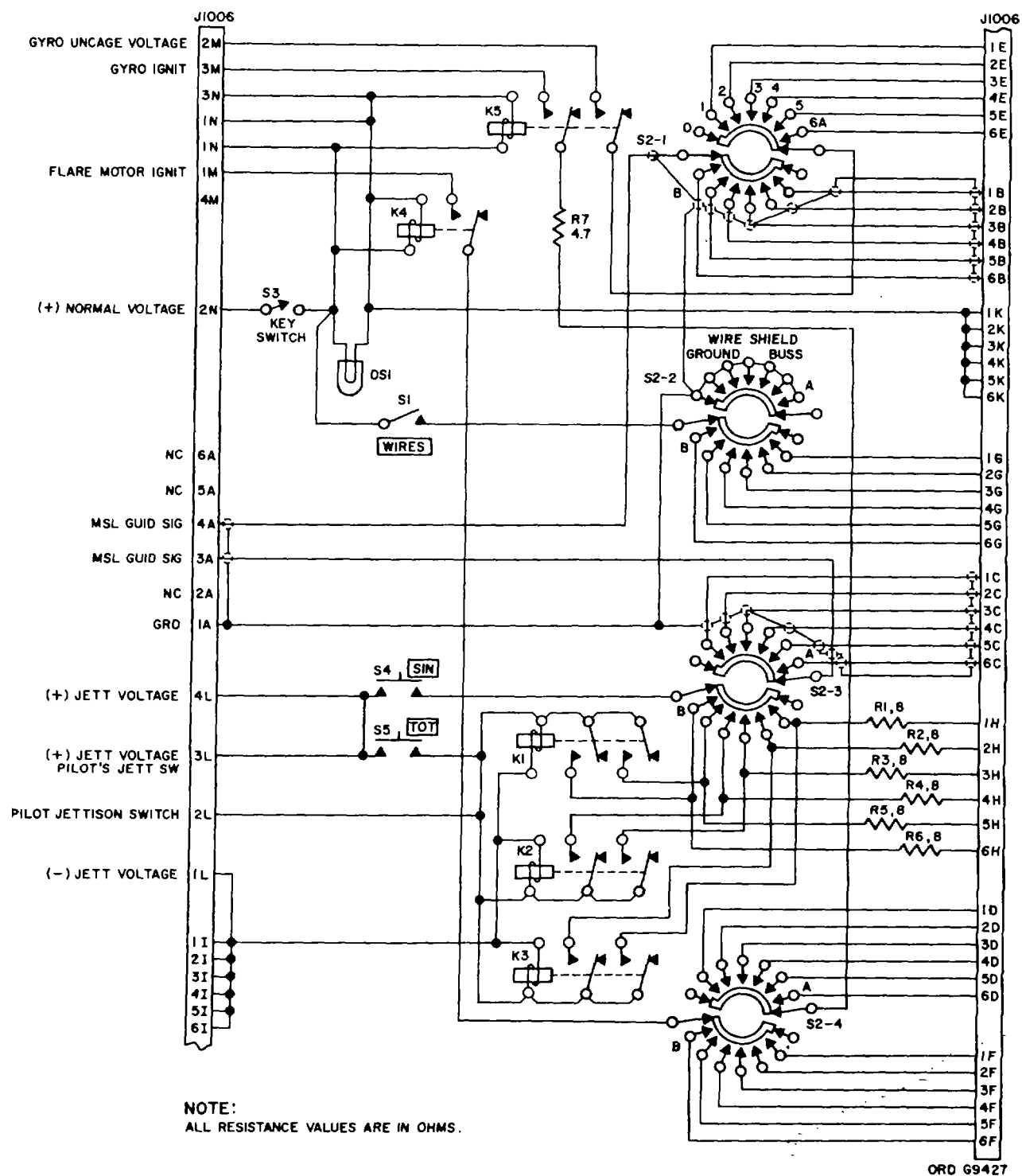


Figure 14. Missile selection box schematic diagram.



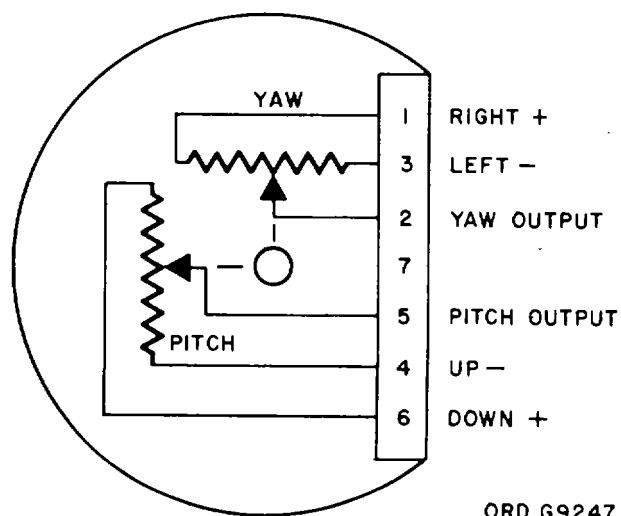


Figure 15. Control stick, schematic diagram.

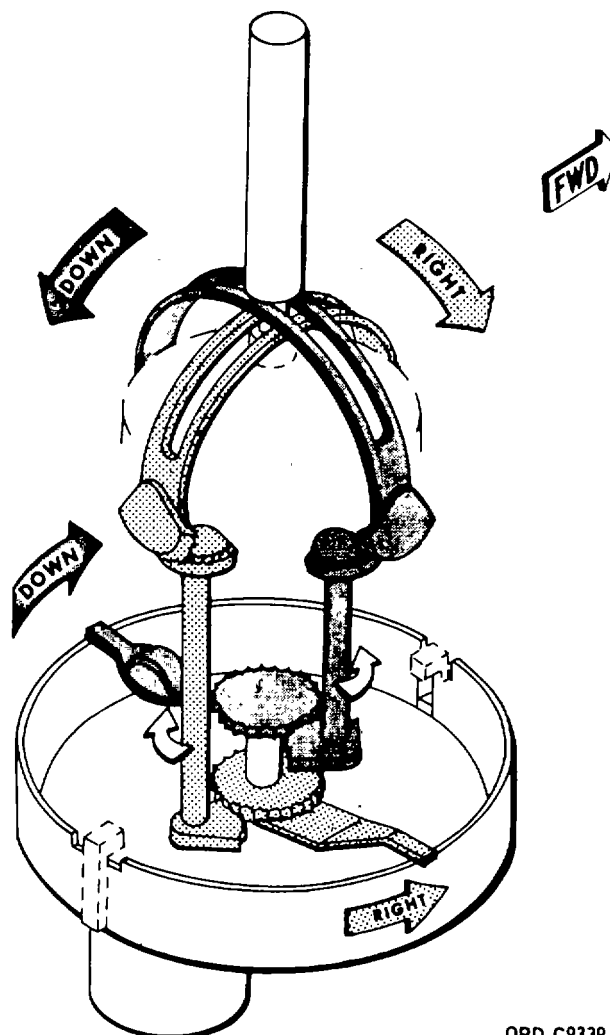


Figure 16. Control stick, mechanical operations.

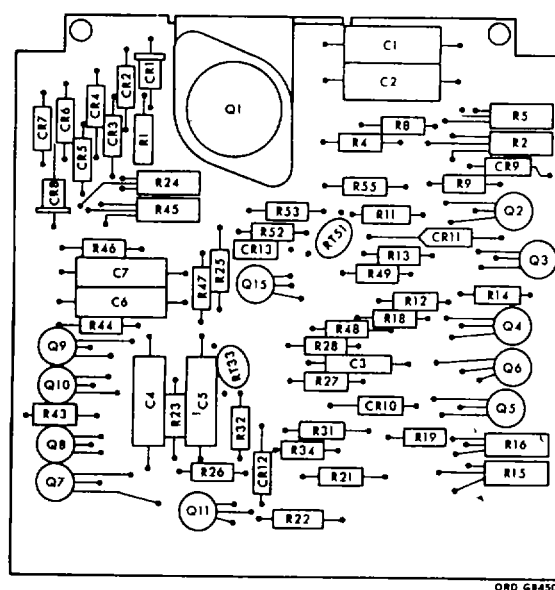


Figure 17. Component parts location signal generator module board no. 1.



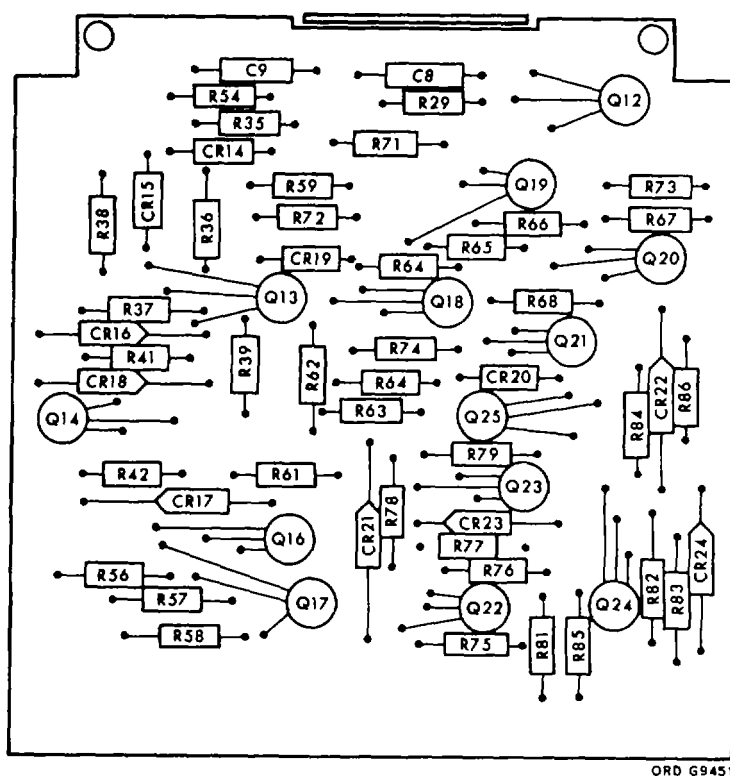


Figure 18. Component parts location signal generator module board no. 2.

#### Apparatus List for the Missile Selection Box, Figure 14

Reference designator	Description	Part No.
DS1	LAMP, INCANDESCENT: 28v, 0.04 amp	MS 25237-327
J1006	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts	10172560
J1006	CONNECTOR, RECEPTACLE, ELECTRICAL: 30 female contacts	10172772
K1-K5	RELAY, ARMATURE	10172555
R1-R6	RESISTOR, FIXED: 8 ohms	10172548
R7	RESISTOR, FIXED: 4.7 ohms	10172549
S1	SWITCH: toggle spst	10172556
S2	SWITCH: rotary, 7 circuits, 7 position	101725658
S3	SWITCH: key locking	10173698
S4-S5	SWITCH: pushbutton	10021991



## CHAPTER 3

INSPECTION

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**22. Scope**

This chapter provides specific instructions for the technical inspection by maintenance personnel of M22 subsystems in the hands of the using organization. It also defines the initial inspection of materiel when received for repair by field maintenance units, in-process inspection during repair, and final inspection after repair has been completed.

**23. Purpose of Inspection**

Inspections are made for the purpose of (1) determining the condition of an item as to serviceability, (2) recognizing conditions that would cause failure, (3) assuring proper application of maintenance policies of prescribed levels, and (4) determining the ability of a unit to accomplish its maintenance and supply mission.

**24. Categories of Inspection**

In general, three categories of inspection are performed by maintenance personnel.

*a. Command and maintenance inspection.* Command maintenance inspections will be performed annually. The purpose of the inspection is to ascertain the serviceability of equipment, to predict maintenance and supply requirements, and to determine the adequacy of facilities and effectiveness of procedures. Information obtained during the inspection should indicate future requirements for depot maintenance and for replacement, as well as disclose immediate needs for maintenance and application of modification work orders. During inspections, corrections of deficiencies will be made on the spot when practical. For additional information relative to these inspections and the forms to be

used, refer to AR 750-8. Command maintenance inspection procedures are detailed in TB 9-212/1.

*b. Shop Inspection.*

- (1) *Initial inspection.* This inspection is performed immediately upon receipt of materiel in the maintenance shops. This inspection determines the disposition of the materiel insofar as prompt repair, when work can be accomplished by field maintenance units, or evacuation to depot maintenance units when the work is more extensive.
- (2) *In-process inspection.* This inspection is performed in the process of repairing the materiel and its components. It insures that the workmanship is in accordance with approved methods and procedures and that deficiencies not disclosed by the initial inspection are found and corrected.
- (3) *Final inspection.* This is an acceptance inspection performed by a final inspector after repair has been completed to insure that the materiel is acceptable for return to the user.

*c. Preembarkation Inspection.* This inspection is conducted on materiel in alerted units scheduled for oversea duty to insure that such materiel will not become unserviceable or worn out in a relatively short time. It prescribes a higher percentage of remaining usable life in serviceable materiel to meet a specific need beyond minimum serviceability. Preembarkation inspection procedures are those detailed for command maintenance inspection outlined in TB 9-212/1.



## CHAPTER 4

## TROUBLESHOOTING

**25. General**

a. Troubleshooting is a systematic method for finding malfunctioning components. The troubleshooting procedures contained in this chapter are for use by direct support, general support, and depot maintenance personnel.

b. Troubleshooting procedures cover all major components of the M22 subsystem and the cable and harness assemblies. Troubleshooting procedures are not covered for items of the fire control installation as these items should be returned through normal supply channels for depot reconditioning.

c. Troubleshooting is accomplished by substituting the suspected defective component into

the test console in the shop van (TM 9-1400-461-15/1). Test console cabling is so constructed that the defective component can be placed upon the bench and checks performed with a minimum of difficulty.

d. The troubleshooting procedures given in each table will identify the circuit where the malfunction exists and the most probable cause.

**26. Troubleshooting Procedure for Missile Selection Box (10172477)**

Table 1 gives the troubleshooting procedure for the missile selection box. See figure 14 for the electrical schematic of the missile selection box.

**Table 1. Troubleshooting Procedures /or Missile Selection Box**

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352,/U
- (3) Stop watch

b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Substitute missile selection box under test in place of the missile selection box on the test console.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set PWR-ON-OFF switch to the ON position. <b>NORMAL and JETT indicator lamps on test console glow.</b>	a. Check NORMAL and JETT lamps and fuses. b. Check input circuitry from power supply to console (TM 9-4935-461-15/1).
2	Set the missile selections box key switch to the on position. <b>Missile selection box power lamp glows.</b>	a. Check the lamp on the selection box. b. Check power circuit (fig. 14).
3	Connect test set to test console DUMMY LAUNCHER connector no. 1.	



Table 1. Troubleshooting Procedures for Missile Selection Box--Continued.

Step	Operation and normal indication	Corrective action
4	Set the selection switch to the missile selection box to position 1.  Note. Firing switch on GCU should be in the 0 position before performing step 6.	
5	Move and hold the GCU firing switch to the IG position. <b>DUMMY LAUNCHER no. 1 EXPLOSIVE CART COPIMAND lamp on test console glows.</b>	a. Check the lamp. b. Check and replace defective component of gyro ignition circuit (fig. 14).
6	Repeat step 5 for all positions of missile selection switch and return to position 1 when complete.  <b>EXPLOSIVE CART COMMAND lamps 2-6 glow, coinciding with missile selection switch position.</b>	Same as 5 above.
7	Set the MISSILE UNLOCK switches on test console to the ON position and hold the firing switch on the GCU to the UG position.  <b>The UG lamp on the test set glows.</b>	a. Check lamp on test set. b. Check and replace defective component of gyro uncage circuit (fig. 14).
8	Repeat step 7 for all other positions of missile selection switch and return to position 1 when complete.  <b>The UG lamp on the test set goes off and remains off until the missile selection switch is returned to position 1.</b>	Same as 7 above. (Check for shorts).
9	Move and hold the GCU firing switch to the IFB position.  <b>The UG lamp on the test set goes off and the IFB lamp glows.</b>	a. Check lamp on test set. b. Check and replace defective component of igniter flare ignition circuit (fig. 14).
10	Repeat step 9 for all other positions of the missile selection switch and return to position 1 when complete.	Same as step 9. (Check for shorts).
11	Release the GCU firing switch and let it rotate to the F position.	
12	Press and hold the WIRES jettison switch on the missile selection box while rotating the missile selection switch through all positions.  <b>The WJ lamp on the test set glows only on position 1.</b>	a. Check lamp on test set. b. Check and replace defective component of wire jettison circuit (fig. 14).
13	Repeat steps 7 through 12 with the test set connected to each of the remaining DUMMY LAUNCHER connectors (2-6). Position the missile selection switch to coincide with the test set connection and return to this position when the test is complete.	



Table 1. Troubleshooting Procedures for Missile Selection Box - Continued.

Step	Operation and normal indication	Corrective action
14	<p>The IG, UG, IFB, and WJ 1 lamps on the test set should glow only when the missile selection switch coincides with the DUMMY LAUNCHER connector to which the test set is connected.</p> <p>Press and hold the SIN switch on the missile selection box while rotating the missile selection switch through all positions</p> <p>The EXPLOSIVE BOLT COMMAND lamps (1-6) on the test console glows coinciding with missile selection switch positions (1-6).</p>	<p>Same as steps 5 through 7.</p> <p>a. Check lamps and replace b. Check and replace defective component of single jettison circuit (fig. 14).</p>
15	<p>Press and hold the TOT switch on the missile selection box while rotating the missile selection switch through all positions.</p> <p>All EXPLOSIVE BOLT COMMAND lamps (1-6) glow with missile selection switch in all positions (1-6).</p>	<p>a. Check lamps and replace b. Check and replace defective component of the total jettison circuit (fig. 14).</p>
16	Move the GCU firing switch to the 0 position and the FF/VF switch to the VF position.	
17	Set the test set selector switch to the F position	
18	<p>Lift and release the GCU firing switch while watching the test set</p> <p>Test set meter pointer initially indicates 10 cps then increases to 165 cpa.</p>	<p>Check and replace the missile guidance signal circuit component (fig. 14).</p>

## 27. Troubleshooting Procedure for the Guidance Control Unit

Table 2 gives the troubleshooting procedures

for the guidance control unit See figures 2, 17, 18, and TM 9-1400 461-20 for electrical schematic, location of components, and controls.

Table 2. Troubleshooting Procedures for the GCU.

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-493561-15/1)
- (2) Multimeter TS-352/U
- (3) Oscilloscope AN/UPM-117

b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935461-15/1.
- (2) Substitute GCU under test in place of the GCU on the test console by connecting cables on top of console GCU to unit under test sitting on the bench in front of test console



Table 2. Troubleshooting Procedures for the GCU-Continued.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position.  <b>NORMAL and JETT indicator lamps on the test console glow.</b>	a. Check lamps and fuses. b. Check input circuitry from power supply to console (TM 9-4935-461-15/1).
2	Set the missile selection box key switch to the on position.  <b>Missile selection box power lamp glows.</b>	a. Check the lamp on the selection box. b. Check power circuit fig. 15).
3	Connect the test set to the test console DUMMY LAUNCHER plug no. 1.	
4	Set the missile selection switch on the missile selection box to position 1.  Note. The firing switch on the GCU must be held in the C (test) position while performing steps 5 through 9.	
5	Move and hold the firing switch on the GCU to the C (test) position.  <b>The voltmeter on the GCU indicates within the red band.</b>  <b>The pitch (white) lamp on the GCU flickers dimly. The yaw (orange) lamp flickers with a medium intensity.</b>	a. Check and replace defective voltmeter. b. Check power input circuit (fig. 2). a. Check lamps. b. Defective signal generator module (perform table 3). c. Defective power circuit in GCU (fig. 2).
6	Position the control stick to the maximum climb position (pull back on stick).  <b>The pitch (white) lamp goes off (Disregard the orange lamp).</b>	Defective signal generator module (perform table 3).
7	Position the control stick to the maximum dive position (push forward on stick).  <b>The pitch (white) lamp flickers with medium intensity.</b>	Same as step 6 above.
8	Position the control stick to the maximum yaw left (move stick to the left) position.  <b>The yaw (orange) lamp glows with a bright intensity (on all the time).</b>	Same as step 6 above.
9	Position the control stick to the maximum right yaw position (move stick to the right).  <b>The yaw (orange) lamp goes off.</b>	
10	Move and hold the GCU firing switch to the 1G position.  <b>The EXPLOSIVE CART COMMAND lamp number 1 glows.</b>	a. Check lamp. b. Replace defective component in GCU unit (fig. 2).



Table 2. Troubleshooting Procedures for the GCU-Continued.

Step	Operation and normal indication	Corrective action
11	Set the number 1 MISSILE UNLOCK switch to the ON position.  <b>The IG lamp on the test set glows.</b>	Same as step 10 above.
12	Move and hold the GCU firing switch to the UG position.  <b>The UG lamp on the test set glows and the IG lamp goes off.</b>	Same as step 10 above.
13	Move and hold the GCU firing switch to the FB position.  <b>The IFB3 lamp on the test set glows and the UG lamp goes off.</b>	Same as step 10 above.
14	Set the TEST SET FUNCTION switch to F then allow the GCU firing switch to rotate to the F position while watching the test set.  <b>Test set meter pointer initially indicates 10 cps then increases to 16.5 cps 21 to 23 seconds after the GCU firing switch reaches the F position.</b>	Same as step 6.
15	Set the function switch on the test set to the P position.  The meter on the test set indicates between 25 and 35 percent left of zero.	Same as step 6 above.
16	Move the control stick to the maximum climb position.  <b>The meter on the test set indicates between 87 and 100 percent left of zero.</b>	Same as step 6 above.
17	Slowly move the control stick from the maximum climb position to the maximum dive position.  <b>The meter moves smoothly from left to right and settles between 13 and 33 percent right of zero.</b>  Note. A steady quiver of the needle is normal.	Same as step 6 above.
18	Set the function switch on the test set to the Y position and release the control stick.  <b>The meter on the test set indicates between --10 and +10.</b>	Same as step 6 above.
19	Move and hold the control stick to the maximum left (yaw) position.  <b>The meter indicates 83 to 100 percent left of zero.</b>	Same as step 6 above.
20	Slowly move the control stick from the maximum left (yaw) position to the maximum right (yaw) position.  <b>The meter moves smoothly from left to right and settles between 83 and 100 percent right of zero.</b>	Same as step 6 above.
21	Set the function switch on the test set to the V position, and the Hi V/Lo V switch to the Hi V position.	



**Table 2. Troubleshooting Procedures for the GCU - Continued**

Step	Operation and normal indication	Corrective action
22	Set the - switch on the test set to the ( + ) position and hold the control stick in the maximum left (yaw) position. <b>The meter on the test set tester indicates between 17.25 and 19.75 volts on the 0-20 scale</b>	Same as step 6 above.
23	Keep the control stick in the maximum left (yaw) position and switch the + - switch to the (-) position. <b>The meter on the test set indicates between 17.25 and 19.75 on the 025 scale</b>	Same as step 6 above
24	Set the Hi V Lo V switch on the test set to the Lo V position. Move and hold the control stick to the maximum right (yaw) position. <b>The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale</b>	Same as step 6 above.
25	Keep the control stick in the maximum right (yaw) position and move + - the switch to the (-) position. <b>The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale.</b>	Same as step 6 above.

**28. Troubleshooting Procedure for the Signal Generator Module**

Table 3 gives the troubleshooting procedures

for the signal generator module See figures 3, 17, and 18 for schematic and location of components.

**Table 3. Troubleshooting Procedures for the GCU Signal Generator Module**

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352/U

b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Disconnect the special test cable from the test console signal generator on front panel and connect it to the signal generator module under test

Step	Operation and normal indication	Corrective action
1	Remove the suspected defective signal generator module from the GCU and connect to the special test cable.	
2	Apply power to the test console and set the PWR-ON-OFF switch to the ON position. <b>NORMAL and JETT indicator lamps on test console glow.</b>	a. Check lamps and fuses. b. Check input circuitry from power supply to console (TM 9-4935-461-15/1).



Table 3. Troubleshooting Procedures for GCU Signal Generator Module - Continued.

Step	Operation and normal indication	Corrective action
3 4	Move the GCU firing switch to the F position. Connect the oscilloscope, using one trace channel, between R64 and R65.  <b>Signal should be as shown in figure 10.</b>	Defective component in bridge modulator circuit (fig. 3).
5	With the oscilloscope still connected between R64 and R65 move the control stick forward and backward (pitch).  <b>Percentage of positive and negative portions of the output signal on the oscilloscope should change as the control stick is moved.</b>	Replace defective pitch channel component in bridge modulator (fig. 12). Defective input from polarity control amplifier (fig. 11); check using step 7.
6	With the oscilloscope still connected between R64 and R65 move the control stick left and then right (yaw).  <b>Percentage of signal amplitude should change as the control stick is moved.</b>	Replace defective yaw channel components in the bridge modulator (fig. 12). Defective input from amplitude control amplifier (fig. 11); check using step 10.
7	Connect the oscilloscope, using both trace channels, between R71 and R72; and R61 and pin 21 of the signal generator module.  <b>Square wave signals on the oscilloscope should be 180 degrees out of phase with a voltage amplitude of 75 (fig. 10).</b>	Defective input from switching amplifier (fig. 9); check using step 13. Replace defective component in polarity control amplifier (fig. 11).
8	Connect the oscilloscope, using only one trace channel to the collector of Q11 in the signal generator module.  <b>Square wave signal displayed on oscilloscope should be as shown in figure 9.</b>	Defective input from impedance adapter (fig. 8); check using step 9. Defective input from sawtooth generator (fig. 7); check using step 13. Replace defective component in the pitch channel of the switching amplifier circuit (fig. 9).
9	Connect the oscilloscope, using one trace, between C5 and R23 of the signal generator module and vary the control stick backward and forward (pitch).  <b>A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved backward and forwards.</b>	Replace defective component in pitch impedance adapter circuit (fig. 8).



**Table 3. Troubleshooting Procedures for GCU Signal Generator Module-Continued**

Step	Operation and normal indication	Corrective action
10	Connect the oscilloscope, using both trace channels, to the collectors of Q16 and Q17.  <b>Square wave signals displayed on the oscilloscope should be in phase (fig. 11).</b>	Defective input from switching amplifier (fig. 9); check using step 11. Replace defective component in amplitude control amplifier (fig. 11).
1	Connect the oscilloscope, using one trace channel, to the collector of Q15 in the signal generator module.  <b>Square wave signal displayed on the oscilloscope should be as shown in fig. 9.</b>	Defective input from impedance adapter (fig. 8); check using step 12. Defective input from sawtooth generator (fig. 7); check using step 13. Replace defective component in the yaw channel of the switching amplifier circuit (fig. 9).
12	Connect the oscilloscope, using one trace channel, between C7 and R44 of the signal generator module and vary the control stick left and right (yaw).  <b>A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved left and right.</b>	Replace defective component in the yaw channel of the impedance adapter circuit (fig. 8).
13	Connect the oscilloscope, using one trace channel, to pin 27 of signal generator module. Move FF-VF switch to both positions.  <b>Sawtooth signal displayed on the oscilloscope as shown in fig. 7.</b>  <b>When switch is in FF position sawtooth signal should be 8 cps.</b>	Defective input from frequency formation circuit (fig. 6); check using step 14. Adjust R16 to obtain 8 cps.
14	Connect the oscilloscope, using one trace channel, to the collector of Q3. Move the FF-VF switch to both positions.  <b>With switch in the FF position the signal on oscilloscope should be a constant level (fig. 5).</b>  <b>With switch in the VF position the signal on the oscilloscope should vary (fig. 5).</b>	Adjust R16 to obtain desired voltage level.  Adjust R5 to obtain desired voltage range. Replace defective component in frequency formation circuit (fig. 6).



## 29. Troubleshooting Procedures for the Control Stick

Table 4 covers the troubleshooting procedures for the control stick. See figure 15 for electrical schematic diagrams.

## 30. Troubleshooting Procedures for the Cable and Harness Assemblies

The only required troubleshooting procedures for the cable and harness assemblies are continuity checks. These checks can be accomplished

by reference to the cabling diagram in TM 9-1400-461-20.

## 31. Troubleshooting Procedures for Fixed Housing

Table 5 gives the troubleshooting procedures for the fixed housing assembly.

## 32. Troubleshooting Procedures for the Launcher

Table 6 gives the troubleshooting procedures for the launcher.

**Table 4. Troubleshooting Procedures for the Control Stick-Continued.**

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352/U

b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Substitute the control stick under test in place of the control stick on the test console.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position.  <b>NORMAL and JETT indicator lamps on test console glow.</b>	a. Check lamps and fuses. b. Check input circuitry from the power supply to the console (TM 9-4935-461-15/1).
2	Set the key switch on the missile selection box to the ON position.  <b>Missile selection box power lamp glows.</b>	Check and replace defective lamp.
3	Connect the test set to DUMMY LAUNCHER no. 1.	
4	Set the missile selection switch to position 1.	
5	Position the firing switch on the GCU to F position.	
6	Set the function switch on the test set to the P position.  <b>The meter on the test set indicates between 25 and 35 percent left of zero.</b>	Defective resistor in the control stick (perform step 12 through 17).
7	Move the control stick to the maximum climb (backward) position.  <b>The meter on the test set indicates between 87 and 100 percent left of zero.</b>	Same as step 6 above.



Table 4. Troubleshooting Procedures for the Control Stick-Continued.

Step	Operation and normal indication	Corrective action
8	<p>Slowly move the control stick from the maximum climb (backward) position to the maximum dive (for-ward) position.</p> <p><b>The meter moves smoothly from left to right and settles between 13 and 33 per-cent right of zero.</b></p> <p>Note. A steady quiver of the needle is normal.</p>	Same as step 6 above.
9	<p>Set the function switch on the test set to the Y position and release the control stick.</p> <p><b>The meter on the test set indicates be-tween -10 and + 10.</b></p>	Same as step 6 above.
10	<p>Move and hold the control stick to the maximum left (yaw) position.</p> <p><b>The meter indicates 83 to 100 percent left of zero.</b></p>	Same as step 6 above.
11	<p>Slowly move the control stick from the maximum left (yaw) position to the maximum right (yaw) position.</p> <p><b>The meter moves smoothly from left to right and settles between 83 and 100 per-cent right of zero.</b></p> <p>Note. The remainder of this table is resistance value checks of the control stick resistors. Perform only if a malfunction was detected during above troubleshooting.</p>	Same as step 6 above.
12	<p>Connect multimeter between pin 1 and pin 3 of the control stick-</p> <p><b>Multimeter should indicate a resistance of 25K ohms</b></p>	Replace defective yaw control resistor (par. 37).
13	<p>Connect multimeter between pins 4 and 6 of the control stick</p> <p><b>Multimeter should indicate a resistance of 25K ohms</b></p>	Replace defective pitch control resistor (par. 37).
14	<p>Connect multimeter between pins 2 and 3 and move control stick left and right</p> <p><b>Multimeter should indicate a resistance of 15.2K ohms; then increase as control stick is moved left and decrease when moved right</b></p>	Replace defective wiper yaw control resistor (par. 37).
15	<p>Connect multimeter between pins 1 and 2 and move control stick left and right</p> <p><b>Multimeter should indicate 12.5K ohms; then decrease as control stick is moved left and increase when moved right</b></p>	Same as 14 above.
16	<p>Connect multimeter between pins 5 and 6 and move control stick forward then backwards.</p> <p><b>Multimeter should indicate a resistance of 12.5K ohms; then increase as control stick is moved forward and backwards</b></p>	



Table 4. Troubleshooting Procedures for the Control Stick - Continued

Step	Operation and normal indication	Corrective action
17	<p>Connect multimeter between pins 4 and 5 and move control stick forward then backward</p> <p><b>Multimeter should indicate a resistance of 12.5 ohms; the decrease as the control stick is moved forward and increase when moved backward</b></p>	Same as 16 above

Table 5. Troubleshooting Procedures for the Fixed Housing

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS352/U
- (3) Test set (launching and guidance command test set)

b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Substitute the fixed housing under test in place of the fixed housing on the test console.

Step	Operation and normal indication	Corrective action
1	<p>Apply power to the test console and set the PWRON-OFF switch to the ON position.</p> <p><b>NORMAL and JETT indicator lamps on test console glow.</b></p>	<p>a Check lamps and fuses b. Check input circuitry from power supply to console (TM 94935461-15/1).</p>
2	Connect the test set to the launcher missile connector.	
3	Install the explosive cartridge tester into the launcher assembly with the missile looking over in the unlocked position.	
4	Connect the explosive bolt circuit tester to the connector in the fixed housing.	<p>Check and replace defective cable assembly (par. 38).</p>
5	Set the No. 6 LAUNCHER SELECTOR switch to REAL LAUNCHER position and the missile selection box to position 6.	
6	<p>Reset the firing switch to the 0 position and then hold the firing switch on the GCC to the IG position.</p> <p><b>Explosive cartridge tester lamp and the IG lamp - the test set glows.</b></p>	
7	<p>Move and hold the firing switch to the UG position.</p> <p><b>IG lamp goes off and the UG lamp glows.</b></p>	Same as step 6 above.
8	<p>Move and hold the firing switch to the FB position.</p> <p><b>UG lamp goes off and the IFB lamp glows.</b></p>	Same as step 6 above.
9	Reset the firing switch to the 0 position.	Same a step 6 above.
10	<p>Press the WIRES itch on the missile selection box.</p> <p><b>WJ lamp the test set glows.</b></p>	



Table 5.-Troubleshooting Procedures for the Fixed Housing-Continued.

Step	Operation and normal indication	Corrective action
11	Press the SIN jettison switch on the missile selection box. <b>The explosive bolt circuit tester lamp glows.</b>	Check and replace defective connector.
12	Set the test set selector switch to F position.	
13	Lift and release the GCU firing switch. <b>Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.</b>	Same as step 6 above.

Table 6. Troubleshooting Procedures for the Launcher

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352/U
- (3) Test set (launching and guidance command test set)

b. Test setup:

(1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.

(2) Substitute the launcher under test in place of the launcher on the test console.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position. <b>NORMAL and JETT indicator lamps on test console glows.</b>	a. Check lamps and fuses. b. Check input circuitry from power console (TM 9-4935-461-15/1).
2	Connect the test set to the launcher missile connector.	
3	Install the explosive cartridge tester into the launcher assembly with the missile locking lever in the up position.	
4	Set the missile selection switch on the missile selection box to position 6 and No. 6 LAUNCHER SELECTOR on the test console to the REAL LAUNCHER position.	
5	Reset the firing switch to the 0 position and then hold the firing switch to the IG position and the missile locking lever to the down position. <b>Explosive cartridge tester lamp glows.</b>	Check and replace defective microswitch (par. 39) or launcher.
6	Release the missile locking lever. <b>The IG lamp on the test set glows.</b>	Same as step 5 above.
7	Move and hold the firing switch to the UG position. <b>IG lamp goes off and UG lamp glows.</b>	Same as step 5 above.
8	Move and hold the firing switch to the FB position. <b>UG lamp goes off and IFB lamp glows.</b>	Same as step 5 above.



Table 6. Troubleshooting Procedures for the Launcher-Continued.

Step	Operation and normal indication	Corrective action
9	Reset the firing switch to the 0 position.	Same as step 5 above.
10	Press the WIRES switch on the missile selection box. <b>WJ lamp on the test set glows.</b>	
11	Set the test set selector switch to the F position.	Same as step 5 above.
12	Lift and release the GCU firing switch. <b>Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.</b>	

1—Screw 10172565  
 2—Cover  
 3—Gasket 10172541  
 4—Switch assembly  
   A—Lock  
   B—Gasket  
   C—Screw  
   D—Micro switch  
   E—Mounting Bracket  
   F—Washer  
   G—Nut  
 5—Washer 10172572  
 6—Nut 10172570  
 7—Bracket 10172553  
 8—Relay 10172555  
 9—Bracket 10172552  
 10—Nut  
 11—Screw 10172564  
 12—Support 10172551  
 13—Switch 10021991  
 14—Plate 10172542  
 15—Cover 10172543  
 16—Rivet 10172575  
 17—Anchor nut 10172574  
 18—Box assembly  
 19—Screw 10172566  
 20—Connector 10172559  
 21—Screw 10172569  
 22—Screw 10172568  
 23—Gasket 10172561  
 24—Cover 10172554  
 25—Washer 10172573

26—Nut 10172571  
 27—Screw 10172567  
 28—Base plate  
 29—Gasket 10172541  
 30—Connector 10172560  
 31—Screw 10172563  
 32—Washer  
 33—Guard 10172544  
 34—Guard 10172545  
 35—Switch key 10172546  
 36—Lampholder assembly 10172494  
   A—Body  
   B—Retainer  
 37—Lamp MS 25237-327  
 38—Lens 10172557  
 39—Knob 10172540  
 40—Switch assembly 10172556  
   A—Boot  
   B—Gasket  
   C—Washer  
   D—Nut  
   E—Switch  
 41—Guard 10021998  
 42—Switch assembly 10172558  
   A—Nut  
   B—Washer  
   C—Switch  
 43—Nut  
 44—Gasket 10172562  
 45—Component board 10172550  
 46—Insulator 10172547

Figure 19-Legend.



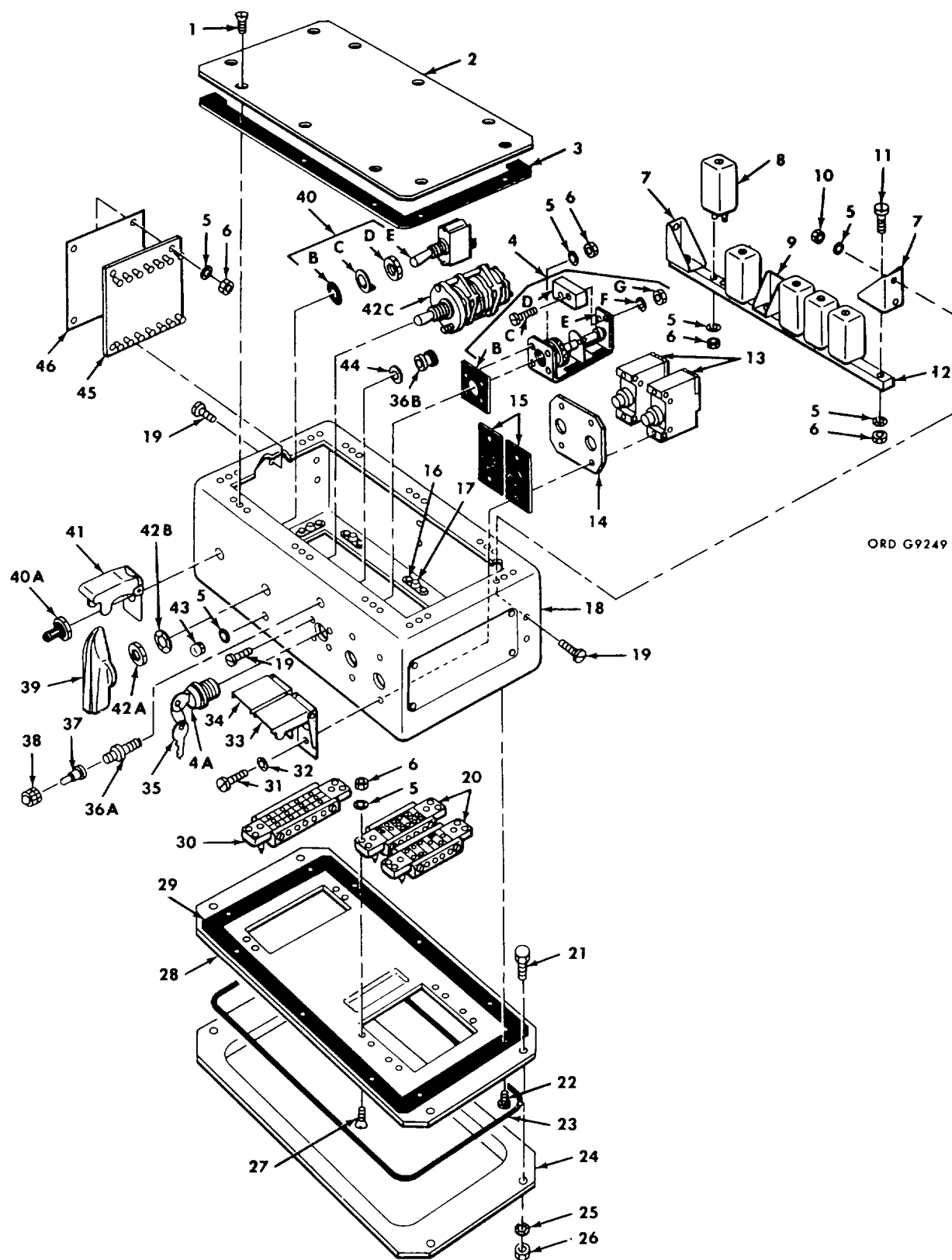


Figure 19. Missile selection box - disassembled view.



## CHAPTER 5

## CORRECTIVE MAINTENANCE

**33. Scope**

a. This chapter contains maintenance information covering the M22 subsystem that is within the scope of direct support, general support, and depot maintenance personnel. The scope of maintenance is determined by the maintenance allocation chart in TM 9-1400461-20 and the listing of repair parts and special tools authorized in TM 9-1400-461-35P.

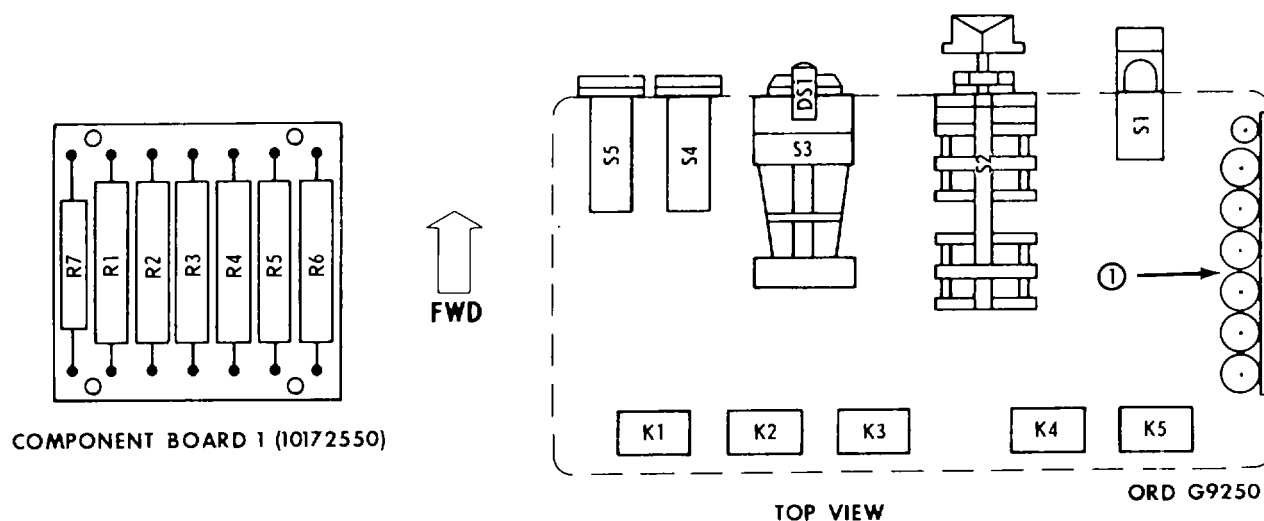
b. No instructions are given for removal, disassembly, or installation of chassis-mounted or panel-mounted parts that are soldered or fastened in the usual way. For information on solder and soldering refer to TB SIG 222.

**36. Removal and Installation of Guidance Control Unit Component Parts**

Removal and installation of component parts of the GCU are obvious upon inspection. Refer to figures 21, 22, and 23 for GCU component removal and installation. Refer to figures 17 and 18 for signal generator module component removal and installation.

**Caution:**

**When removing and installing the signal generator module from the GCU care should be taken to prevent damage to components on the printed circuit boards. Slowly work the module around until it can be removed**



**Figure 20. Missile selection box.**

**34. General Instructions**

Remove parts only as required to make repairs. Do not remove serviceable parts unless you must do so to get to the defective parts.

**35. Removal and Installation of Missile Selection Box Component Parts**

Removal and installation of components are obvious upon inspection. Location of component parts is shown in figure 19 and 20. Reference designators used on the component parts diagram are the same as those used on the schematic diagram as illustrated in figure 14.

and installed without rubbing against the side of the GCU.

**37. Removal and Installation of Control Stick Component Parts**

Removal and installation of component parts of the control stick are obvious upon inspection. Refer to figure 24 for control stick component removal and installation.

**Caution:**

**When installing the control stick components insure that the connector, small screw hole key, and name plate are lined up.**



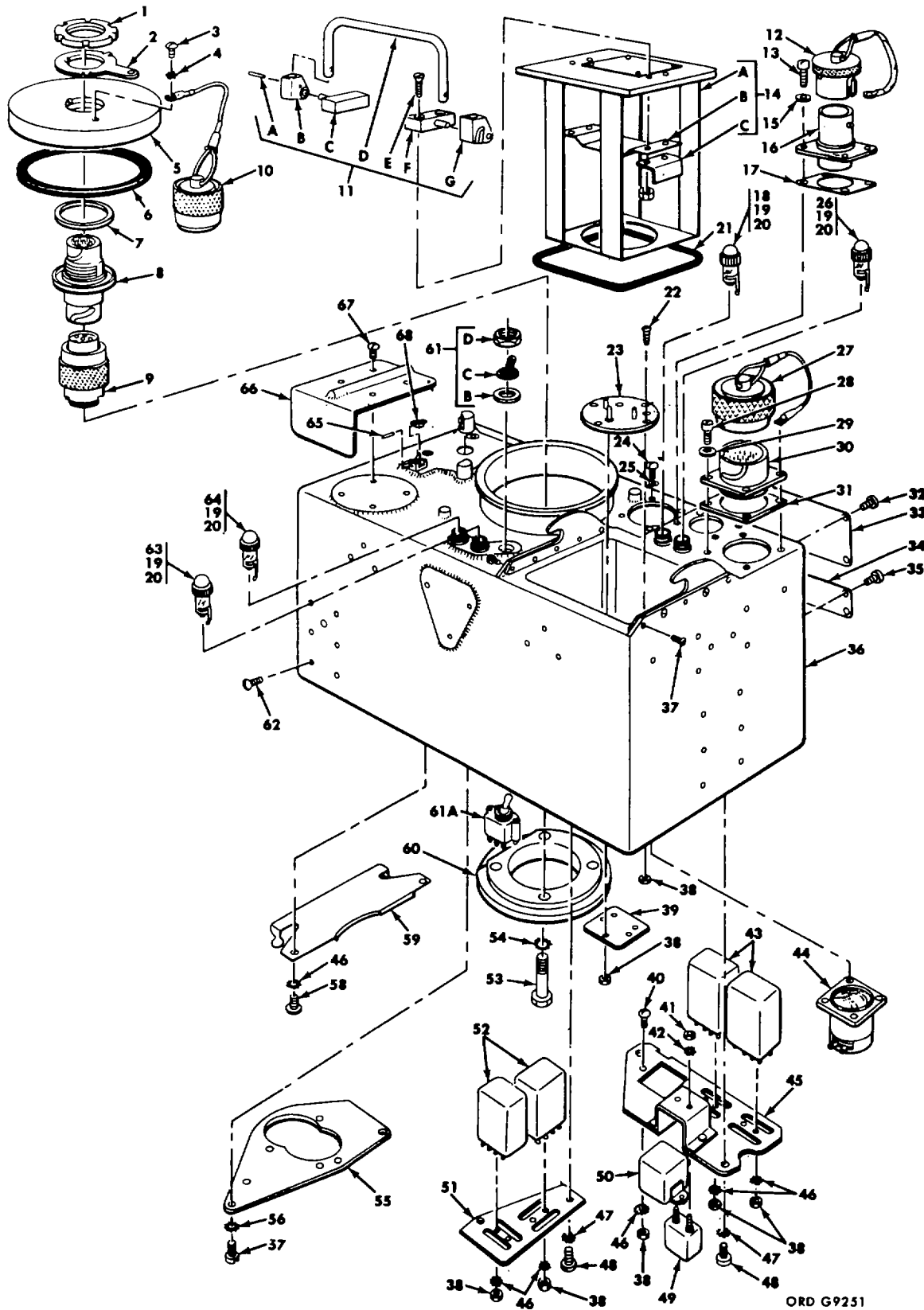


Figure 21. Guidance control unit, exploded view.



Table 1. Troubleshooting Procedures for Missile Selection Box--Continued

Step	Operation and normal indication	Corrective action
14	<p><b>The IG, UG, IFB, and WJ lamps on the test set should glow only when the missile selection switch coincides with the DUMMY LAUNCHER connector to which the test set is connected.</b></p> <p>Press and hold the SIN switch on the missile selection box while rotating the missile selection switch through all positions</p> <p><b>The EXPLOSIVE BOLT COMMAND Lamps (1-6) on the test console glows coinciding with missile selection switch positions (1-6).</b></p>	Same as steps 5 through 7.
15	<p>Press and hold the TOT switch on the missile selection box while rotating the missile selection switch through all positions.</p> <p>All EXPLOSIVE BOLT COMMAND lamps (1-6) glow with missile selection switch in all positions (1-6).</p>	<p>a. Check lamps and replace.</p> <p>b. Check and replace defective component of single jettison circuit (fig. 14).</p>
16	Move the GCU firing switch to the 0 position and the FF/VF switch to the VF position	<p>a. Check lamps and replace.</p> <p>b. Check and replace defective component of the total jettison circuit (fig. 14).</p>
17	Set the test set selector switch to the F position-	
18	<p>Lift and release the GCU firing switch while watching the test set</p> <p><b>Test set meter pointer initially indicates 10 cps then increases to 16.5 cps.</b></p>	
		Check and replace the missile guidance signal circuit component (fig. 14).

**27. Troubleshooting for the Guidance Control Unit**

Table 2 gives the troubleshooting procedures for the guidance control unit See figures 2, 17, 18, and TM 9-

140-461-20 for electrical schematic, location of components, and controls

Table 2. Troubleshooting Procedures for the GCU

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352/U
- (3) Oscilloscope AN/UPM-117

b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Substitute GCU under test in place of the GCU on the test console by connecting cables on top of console GCU to unit under test sitting on the bench in front of test console.



Table 2. Troubleshooting Procedures for the GCU-Continued.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position. NORMAL and JETT indicator lamps on the test console glow.	a. Check lamps and fuses. b. Check input circuitry from power supply to console (TM 9-4935-461-15/1).
2	Set the missile selection box key switch to the on position. Missile selection box power lamp glows.	a. Check the lamp on the selection box. b. Check power circuit fig. 15).
3	Connect the test set to the test console DUMMY LAUNCHER plug no. 1.	
4	Set the missile selection switch on the missile selection box to position 1.	
Note. The firing switch on the GCU must be held in the C (test) position while performing steps 5 through 9.		
5	Move and hold the firing switch on the GCU to the C (test) position. The voltmeter on the GCU indicates within the red band.  The pitch (white) lamp on the GCU flickers dimly. The yaw (orange) lamp flickers with a medium intensity.	a. Check and replace defective voltmeter. b. Check power input circuit (fig. 2). a. Check lamps. b. Defective signal generator module (perform table 3). c. Defective power circuit in GCU (fig. 2).
6	Position the control stick to the maximum climb position (pull back on stick). The pitch (white) lamp goes off (Disregard the orange lamp).	Defective signal generator module (perform table 3).
7	Position the control stick to the maximum dive position (push forward on stick). <b>The pitch (white) lamp flickers with medium intensity.</b>	Same as step 6 above.
8	Position the control stick to the maximum yaw left (move stick to the left) position. The yaw (orange) lamp glows with a bright intensity (on all the time).	Same as step 6 above.
9	Position the control stick to the maximum right yaw position (move stick to the right). The yaw (orange) lamp goes off.	
10	Move and hold the GCU firing switch to the 1G position. <b>The EXPLOSIVE CART COMMAND lamp number 1 glows.</b>	a. Check lamp. b. Replace defective component in GCU unit (fig. 2).



Table 2. Troubleshooting Procedures for the GCU-Continued.

Step	Operation and normal indication	Corrective action
1	Set the number 1 MISSILE UNLOCK switch to the ON position. <b>The IG lamp on the test set glows.</b>	Same as step 10 above.
12	Move and hold the GCU firing switch to the UG position. <b>The UG lamp on the test set glows and the IG lamp goes off.</b>	Same as step 10 above.
13	Move and hold the GCU firing switch to the FB position. <b>The IFB lamp on the test set glows and the UG lamp goes off.</b>	Same as step 10 above.
14	Set the TEST SET FUNCTION switch to F then allow the GCU firing switch to rotate to the F position while watching the test set. <b>Test set meter pointer initially indicates 10 cps then increases to 16.5 cps 21 to 23 seconds after the GCU firing switch reaches the F position.</b>	Same as step 6.
15	Set the function switch on the test set to the P position. <b>The meter on the test set indicates between 25 and 35 percent left of zero.</b>	Same as step 6 above.
16	Move the control stick to the maximum climb position. <b>The meter on the test set indicates between 87 and 100 percent left of zero.</b>	Same as step 6 above.
17	Slowly move the control stick from the maximum climb position to the maximum dive position. <b>The meter moves smoothly from left to right and settles between 13 and 33 percent right of zero.</b>	Same as step 6 above.
<b>Note.</b> A steady quiver of the needle is normal.		
18	Set the function switch on the test set to the Y position and release the control stick. <b>The meter on the test set indicates between -10 and +10.</b>	Same as step 6 above.
19	Move and hold the control stick to the maximum left (yaw) position. <b>The meter indicates 83 to 100 percent left of zero.</b>	Same as step 6 above.
20	Slowly move the control stick from the maximum left (yaw) position to the maximum right (yaw) position. <b>The meter moves smoothly from left to right and settles between 83 and 100 percent right of zero.</b>	Same as step 6 above.
21	Set the function switch on the test set to the V position, and the Hi V/Lo V switch to the Hi V position.	



Table 2. Troubleshooting Procedures for the GCU--Continued

Step	Operation and normal indication	Corrective action
22	Set the 4 switch on the test set to the ( + ) position and hold the control stick in the maximum left (yaw) position. <b>The meter on the test set tester indicates between 17.25 and 19.75 volts on the 0-20 scale</b>	Same as step 6 above
23	Keep the control stick in the maximum left (yaw) position and switch the i - switch to the ( - ) position. <b>The meter on the test set indicates between 17.25 and 19.75 on the 0-25 scale</b>	Same as step 6 above.
24	Set the Hi V Lo V switch on the test set to the Lo V position. Move and hold the control stick to the maximum right (yaw) position. <b>The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale</b>	Same as step 6 above.
25	Keep the control stick in the maximum right (yaw) position and move the + - switch to the ( - ) position. <b>The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale.</b>	Same as step 6 above

## 28. Troubleshooting Procedure for the Signal Generator Module

Table 3 gives the troubleshooting procedures for the signal generator module. See figures 3, 17, and 18 for schematic and location of components.

Table 3. Troubleshooting Procedures for the GCU Signal Generator Module

Preparation for test:

### a. Equipment required:

- (1) Test console (TM 94935-461-15 1)
- (2) Multimeter TS-352 U

### b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Disconnect the special test cable from the test console signal generator on front panel and connect it to the signal generator module under test.

Step	Operation and normal indication	Corrective action
1	Remove the suspected defective signal generator module from the GCU and connect to the special test cable.	a. Check lamps and fuses. b. Check input circuitry from power supply to console (TM 9-4935-461-15/1).
2	Apply power to the test console and set the PWR-ON-OFF switch to the ON position. <b>NORMAL and JETT indicator lamps on test console glow.</b>	



Table 3. Troubleshooting Procedures for GCU Signal Generator Module--Continued.

Step	Operation and normal indication	Corrective action
3 4	Move the GCU firing switch to the F position. Connect the oscilloscope, using one trace channel, between R64 and R65. <b>Signal should be as shown in figure 10.</b>	Defective component in bridge modulator circuit (fig. 3).
5	With the oscilloscope still connected between R64 and R65 move the control stick forward and backward (pitch). <b>Percentage of positive and negative portions of the output signal on the oscilloscope should change as the control stick is moved.</b>	Replace defective pitch channel component in bridge modulator (fig. 12). Defective input from polarity control amplifier (fig. 11); check using step 7.
6	With the oscilloscope still connected between R64 and R65 move the control stick left and then right (yaw). <b>Percentage of signal amplitude should change as the control stick is moved.</b>	Replace defective yaw channel components in the bridge modulator (fig. 12). Defective input from amplitude control amplifier (fig. 11); check using step 10.
7	Connect the oscilloscope, using both trace channels, between R71 and R72; and R61 and pin 21 of the signal generator module. <b>Square wave signals on the oscilloscope should be 180 degrees out of phase with a voltage amplitude of 75 (fig. 10).</b>	Defective input from switching amplifier (fig. 9); check using step 13. Replace defective component in polarity control amplifier (fig. 11).
8	Connect the oscilloscope, using only one trace channel to the collector of Q11 in the signal generator module. <b>Square wave signal displayed on oscilloscope should be as shown in figure 9.</b>	Defective input from impedance adapter (fig. 8); check using step 9. Defective input from sawtooth generator (fig. 7); check using step 13. Replace defective component in the pitch channel of the switching amplifier circuit (fig. 9).
9	Connect the oscilloscope, using one trace, between C5 and R23 of the signal generator module and vary the control stick backward and forward (pitch). <b>A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved backward and forwards.</b>	Replace defective component in pitch impedance adapter circuit (fig. 8).



Table 3. Troubleshooting Procedures for GCU Signal Generator Module-Continued

Step	Operation and normal indication	Corrective action
10	Connect the oscilloscope, using both trace channels, to the collectors of Q16 and Q17. <b>Square wave signals displayed on the oscilloscope should be in phase (fig. 11).</b>	Defective input from switching amplifier (fig. 9); check using step 11. Replace defective component in amplitude control amplifier (fig. 11).
11	Connect the oscilloscope, using one trace channel, to the collector of Q15 in the signal generator module. <b>Square wave signal displayed on the oscilloscope should be as shown in fig. 9.</b>	Defective input from impedance adapter (fig. 8); check using step 12. Defective input from sawtooth generator (fig. 7); check using step 13. Replace defective component in the yaw channel of the switching amplifier circuit (fig. 9).
12	Connect the oscilloscope, using one trace channel, between C7 and R44 of the signal generator module and vary the control stick left and right (yaw). <b>A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved left and right.</b>	Replace defective component in the yaw channel of the impedance adapter circuit (fig. 8).
13	Connect the oscilloscope, using one trace channel, to pin 27 of signal generator module. Move FF-VF switch to both positions. <b>Sawtooth signal displayed on the oscilloscope as shown in fig. 7.</b>  <b>When switch is in FF position sawtooth signal should be 8 cps.</b>	Defective input from frequency formation circuit (fig. 6); check using step 14. Adjust R16 to obtain 8 cps.
14	Connect the oscilloscope, using one trace channel, to the collector of Q3. Move the FF-VF switch to both positions. <b>With switch in the FF position the signal on oscilloscope should be a constant level (fig. 5).</b> <b>With switch in the VF position the signal on the oscilloscope should vary (fig. 5).</b>	Adjust R16 to obtain desired voltage level.  Adjust R5 to obtain desired voltage range. Replace defective component in frequency formation circuit (fig. 6).



## 29. Troubleshooting Procedures for the Control Stick

Table 4 covers the troubleshooting procedures for the control stick. See figure 15 for electrical schematic diagrams.

## 30. Troubleshooting Procedures for the Cable and Harness Assemblies

The only required troubleshooting procedures for the cable and harness assemblies are continuity checks.

These checks can be accomplished by reference to the cabling diagram in TM 9-1400-461-20.

## 31. Troubleshooting Procedures for Fixed Housing

Table 5 gives the troubleshooting procedures for the fixed housing assembly.

## 32. Troubleshooting Procedures for the Launcher

Table 6 gives the troubleshooting procedures for the launcher.

**Table 4. Troubleshooting Procedures for the Control Stick-Continued.**

Preparation for test:

**a. Equipment required:**

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352/U

**b. Test setup:**

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Substitute the control stick under test in place of the control stick on the test console.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position. <b>NORMAL and JETT indicator lamps on test console glow.</b>	a. Check lamps and fuses. b. Check input circuitry from the power supply to the console (TM 9-4935-461-15/1).
2	Set the key switch on the missile selection box to the ON position. <b>Missile selection box power lamp glows.</b>	Check and replace defective lamp.
3	Connect the test set to DUMMY LAUNCHER no. 1.	
4	Set the missile selection switch to position 1.	
5	Position the firing switch on the GCU to F position.	
6	Set the function switch on the test set to the P position. <b>The meter on the test set indicates between 25 and 35 percent left of zero.</b>	Defective resistor in the control stick (perform step 12 through 17).
7	Move the control stick to the maximum climb (backward) position. <b>The meter on the test set indicates between 87 and 100 percent left of zero.</b>	Same as step 6 above.



Table 4. Troubleshooting Procedures for the Control Stick-Continued.

Step	Operation and normal indication	Corrective action
8	<p>Slowly move the control stick from the maximum climb (backward) position to the maximum dive (forward) position.</p> <p><b>The meter moves smoothly from left to right and settles between 13 and 33 percent right of zero.</b></p> <p><b>Note.</b> A steady quiver of the needle is normal.</p>	Same as step 6 above.
9	<p>Set the function switch on the test set to the Y position and release the control stick.</p> <p><b>The meter on the test set indicates between -10 and +10.</b></p>	Same as step 6 above.
10	<p>Move and hold the control stick to the maximum left (yaw) position.</p> <p><b>The meter indicates 83 to 100 percent left of zero-</b></p>	Same as step 6 above.
11	<p>Slowly move the control stick from the maximum left (yaw) position to the maximum right (yaw) position.</p> <p><b>The meter moves smoothly from left to right and settles between 83 and 100 percent right of zero.</b></p> <p><b>Note.</b> The remainder of this table is resistance value checks of the control stick resistors. Perform only if a malfunction was detected during above troubleshooting.</p>	Same as step 6 above.
12	<p>Connect multimeter between pin 1 and pin 3 of the control stick.</p> <p><b>Multimeter should indicate a resistance of 25K ohms.</b></p>	Replace defective yaw control resistor (par. 37).
13	<p>Connect multimeter between pins 4 and 6 of the control stick.</p> <p><b>Multimeter should indicate a resistance of 25K ohm.</b></p>	Replace defective pitch control resistor (par. 37).
14	<p>Connect multimeter between pins 2 and 3 and move control stick left and right</p> <p><b>Multimeter should indicate a resistance of 15.2K ohms; then increase as control stick is moved left and decrease when moved right</b></p>	Replace defective wiper yaw control resistor (par. 37).
15	<p>Connect multimeter between pins 1 and 2 and move control stick left and right</p> <p><b>Multimeter should indicate 125K ohms; then decrease as control stick is moved left and increase when moved right</b></p>	Same as 14 above.
16	<p>Connect multimeter between pins 5 and 6 and move control stick forward then backwards.</p> <p><b>Multimeter should indicate a resistance of 12.5K ohms; then increase as control stick is moved forward and backwards</b></p>	



Table 4. Troubleshooting Procedures for the Control Stick—Continued.

Step	Operation and normal indication	Corrective action
17	Connect multimeter between pins 4 and 5 and move control stick forward then backward <b>Multimeter should indicate a resistance of 12.5K ohms; then decrease as the control stick is moved forward and increase when moved backward.</b>	Same as 16 above.

Table 5. Troubleshooting Procedures for the Fixed Housing.

Preparation for test:

a. Equipment required:

- (1) Test console (TM 9-493561-15,/1)
- (2) Multimeter TS-352/U
- (3) Test set (launching and guidance command test set)

b. Test set-up:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-493461-15/1.
- (2) Substitute the fixed housing under test in place of the fixed housing on the test console.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position <b>NORMAL and JETT indicator lamps on test console glow</b>	a Check lamps and fuses b. Check input circuitry from power supply to console (TM 9-4935-461-15/1).
2	Connect the test set to the launcher missile connector	
3	Install the explosive cartridge tester into the launcher assembly with the missile locking lever in the unlocked position	
4	Connect the explosive bolt circuit tester to the connector in the fixed housing	
5	Set the No. 6 LAUNCHER SELECTOR switch to REAL LAUNCHER position and the missile selection box to position 6	
6	Reset the firing switch to the 0 position and then hold the firing switch on the GCU to the UG position. <b>Explosive cartridge tester lamp and the IG lamp on the test set glows.</b>	Check and replace defective cable assembly (par. 38).
7	Move and hold the firing switch to the UG position. <b>IG lamp goes off and the UG lamp glows.</b>	Same as step 6 above
8	Move and hold the firing switch to the FB position. <b>UG lamp goes off and the IFB lamp glows.</b>	Same as step 6 above-
9	Reset the firing switch to the 0 position.	
10	Press the WIRES switch on the missile selection box. <b>WJ lamp on the test set glows.</b>	Same as step 6 above



Table 5.-Troubleshooting Procedures for the Fixed Housing-Continued.

Step	Operation and normal indication	Corrective action
11	Press the SIN jettison switch on the missile selection box. <b>The explosive bolt circuit tester lamp glows.</b>	Check and replace defective connector.
12	Set the test set selector switch to F position.	
13	Lift and release the GCU firing switch. <b>Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.</b>	Same as step 6 above.

Table 6. Troubleshooting Procedures for the Launcher

Preparation for test:

## a. Equipment required:

- (1) Test console (TM 9-4935-461-15/1)
- (2) Multimeter TS-352/U
- (3) Test set (launching and guidance command test set)

## b. Test setup:

- (1) Insure proper operation of test console by performing operational check procedures in TM 9-4935-461-15/1.
- (2) Substitute the launcher under test in place of the launcher on the test console.

Step	Operation and normal indication	Corrective action
1	Apply power to the test console and set the PWR-ON-OFF switch to the ON position. NORMAL and JETT indicator lamps on test console glows.	a. Check lamps and fuses. b. Check input circuitry from power console (TM 9-4935-461-15/1).
2	Connect the test set to the launcher missile connector.	
3	Install the explosive cartridge tester into the launcher assembly with the missile locking lever in the up position.	
4	Set the missile selection switch on the missile selection box to position 6 and No. 6 LAUNCHER SELECTOR on the test console to the REAL LAUNCHER position.	
5	Reset the firing switch to the 0 position and then hold the firing switch to the IG position and the missile locking lever to the down position. Explosive cartridge tester lamp glows.	Check and replace defective microswitch (par. 39) or launcher.
6	Release the missile locking lever. The IG lamp on the test set glows.	Same as step 5 above.
7	Move and hold the firing switch to the UG position. IG lamp goes off and UG lamp glows.	Same as step 5 above.
8	Move and hold the firing switch to the FB position. UG lamp goes off and IFB lamp glows.	Same as step 5 above.



Table 6. Troubleshooting Procedures for the Launcher-Continued.

Step	Operation and normal indication	Corrective action
9	Reset the firing switch to the 0 position.	Same as step 5 above.
10	Press the WIRES switch on the missile selection box. <b>WJ lamp on the test set glows.</b>	
11	Set the test set selector switch to the F position.	
12	Lift and release the GCU firing switch. <b>Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.</b>	Same as step 5 above.

- |                         |                                  |
|-------------------------|----------------------------------|
| 1- Screw 10172565       | 26- Nut 10172571                 |
| 2- Cover                | 27- Screw 10172567               |
| 3- Gasket 10172541      | 28- Base plate                   |
| 4- Switch assembly      | 29- Gasket 10172541              |
| A- Lock                 | 30- Connector 10172560           |
| B- Gasket               | 31- Screw 10172563               |
| C- Screw                | 32- Washer                       |
| D- Micro switch         | 33- Guard 10172544               |
| E- Mounting Bracket     | 34- Guard 10172545               |
| F- Washer               | 35- Switch key 10172546          |
| G- Nut                  | 36- Lampholder assembly 10172494 |
| 5- Washer 10172572      | A- Body                          |
| 6- Nut 10172570         | B- Retainer                      |
| 7- Bracket 10172553     | 37- Lamp MS 25237-327            |
| 8- Relay 10172555       | 38- Lens 10172557                |
| 9- Bracket 10172552     | 39- Knob 10172540                |
| 10- Nut                 | 40- Switch assembly 10172556     |
| 11- Screw 10172564      | A- Boot                          |
| 12- Support 10172551    | B- Gasket                        |
| 13- Switch 10021991     | C- Washer                        |
| 14- Plate 10172542      | D- Nut                           |
| 15- Cover 10172543      | E- Switch                        |
| 16- Rivet 1017257       | 41- Guard 10021998               |
| 17- Anchor nut 10172574 | 42- Switch assembly 10172558     |
| 18- Box assembly        | A- Nut                           |
| 19- Screw 10172566      | B- Washer                        |
| 20- Connector 10172559  | C- Switch                        |
| 21- Screw 10172569      | 43- Nut                          |
| 22- Screw 10172568      | 44- Gasket 10172562              |
| 23- Gasket 10172561     | 45- Component board 10172550     |
| 24- Cover 10172554      | 46- Insulator 10172547           |
| 25- Washer 10172573     |                                  |

Figure 19-Legend.



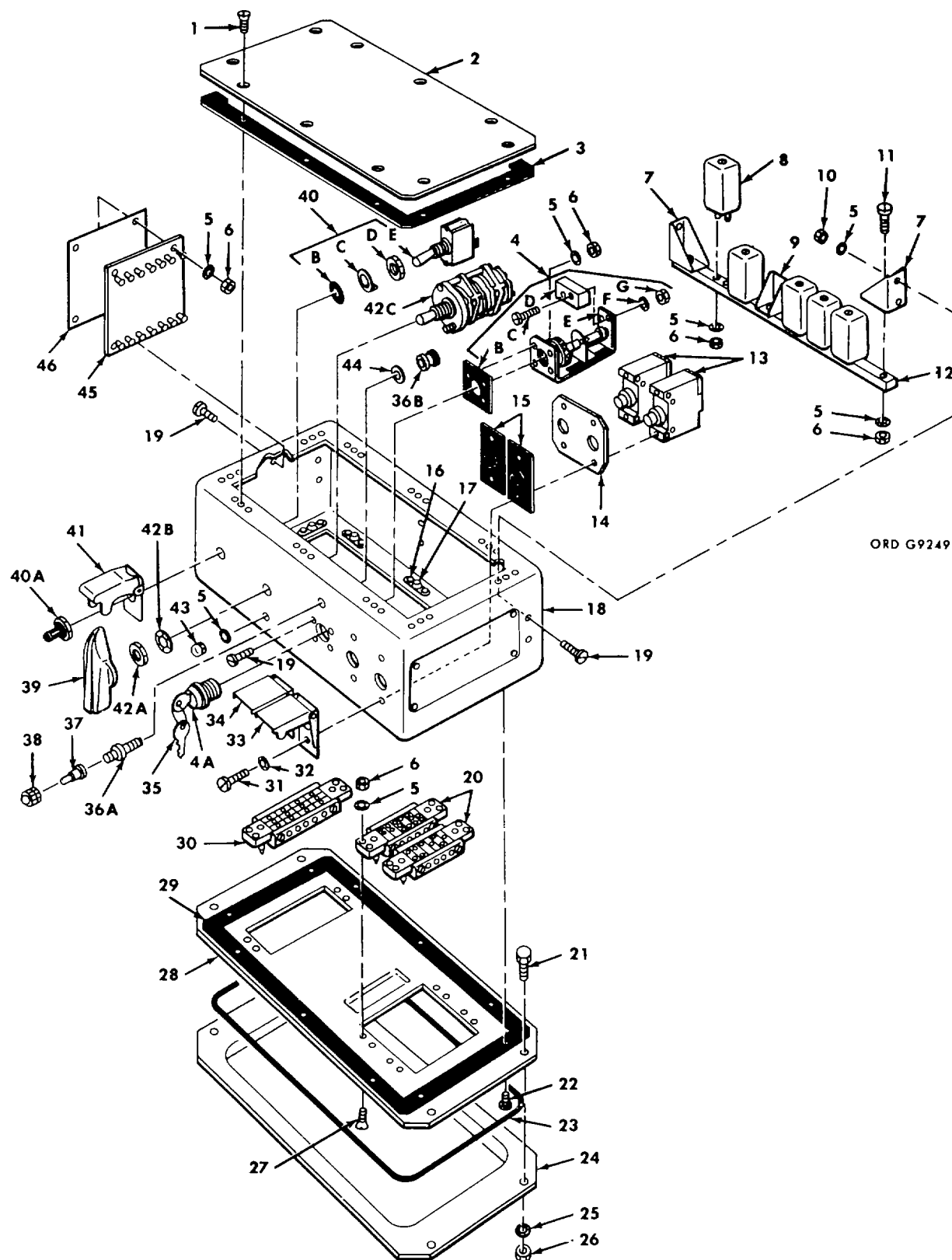


Figure 19. Missile selection box -disassembled view.

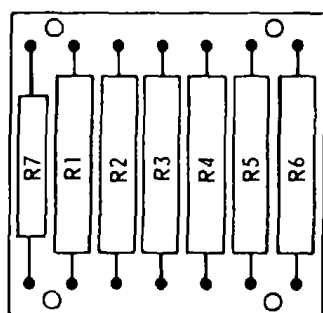


## CHAPTER 5 CORRECTIVE MAINTENANCE

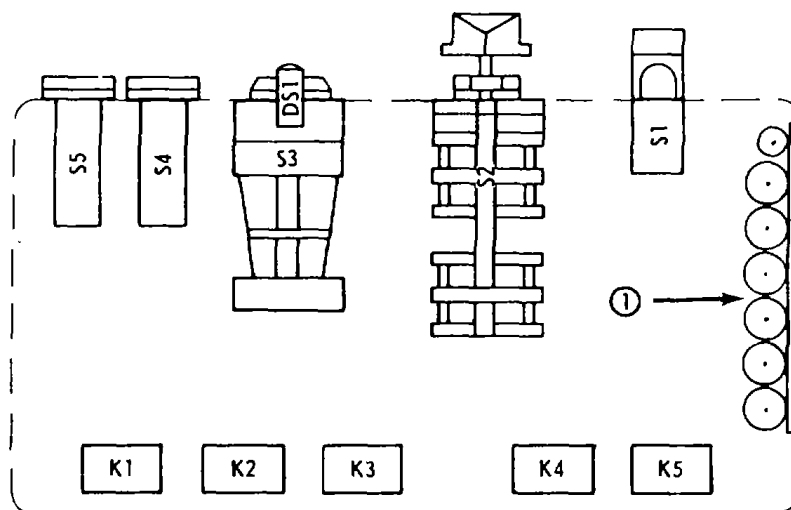
### 33. Scope

a. This chapter contains maintenance information covering the M22 subsystem that is within the scope of direct support, general support, and depot maintenance personnel. The scope of maintenance is determined by the maintenance allocation chart in TM 9-1400461-20 and the listing of repair parts and special tools authorized in TM 9-1400-461-35P.

b. No instructions are given for removal, disassembly, or installation of chassis-mounted or panel-mounted parts that are soldered or fastened in the usual way. For information on solder and soldering refer to TB SIG 222.



COMPONENT BOARD 1 (10172550)



TOP VIEW

ORD G9250

### 34. General Instructions

Remove parts only as required to make repairs. Do not remove serviceable parts unless you must do so to get to the defective parts.

### 35. Removal and Installation of Missile Selection Box Component Parts

Removal and installation of components are obvious upon inspection. Location of component parts is shown in figure 19 and 20. Reference designators used on the component parts diagram are the same as those used on the schematic diagram as illustrated in figure 14.

### 36. Removal and Installation of Guidance Control Unit Component Parts

Removal and installation of component parts of the GCU are obvious upon inspection. Refer to figures 21, 22, and 23 for GCU component removal and installation. Refer to figures 17 and 18 for signal generator module component removal and installation.

#### Caution

**When removing and installing the signal generator module from the GCU care should be taken to prevent damage to components on the printed circuit boards. Slowly work the module around until it can be removed and installed without rubbing against the side of the GCU.**

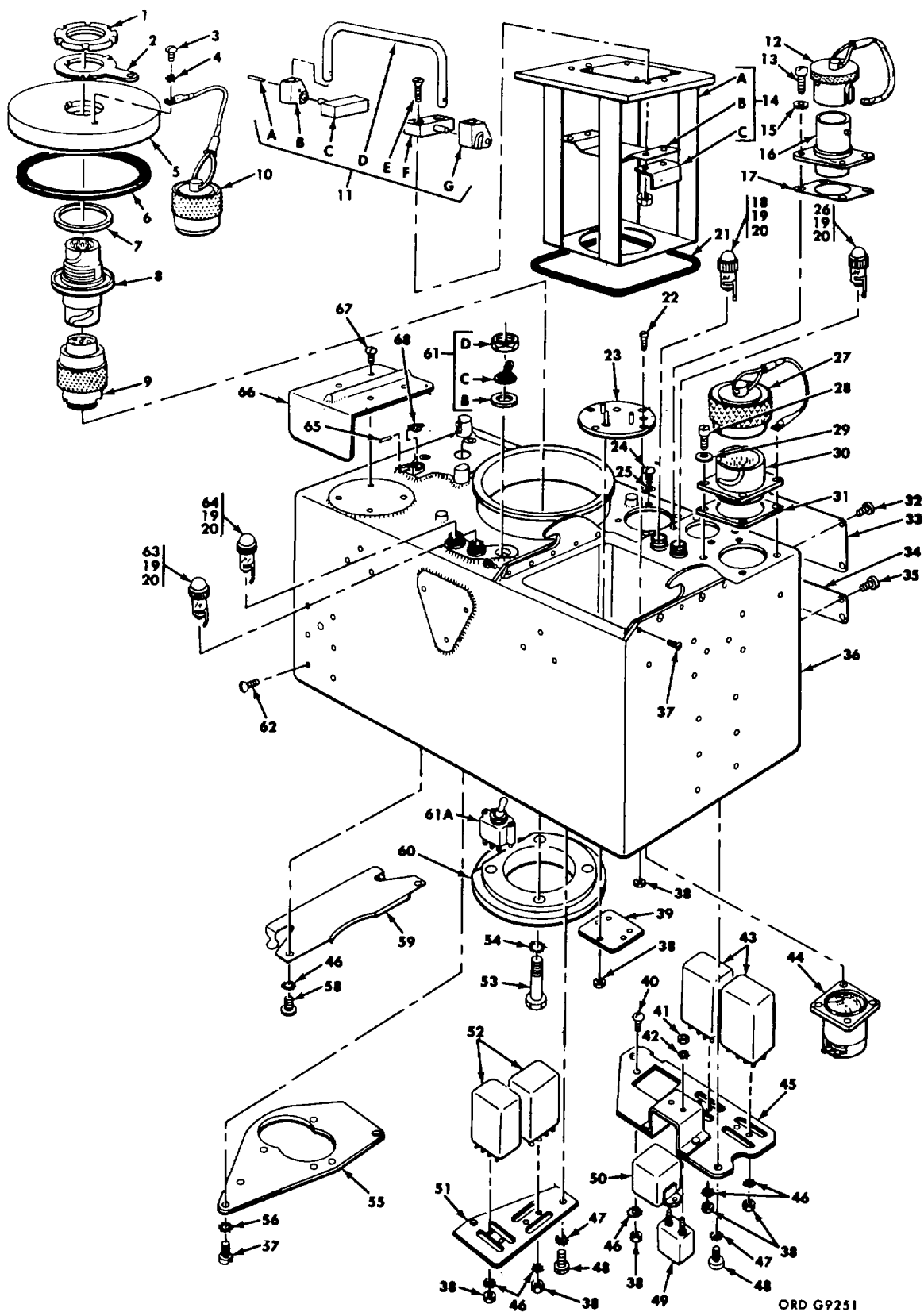
### 37. Removal and Installation of Control Stick Component Parts

Removal and installation of component parts of the control stick are obvious upon inspection. Refer to figure 24 for control stick component removal and installation.

#### Caution

**When installing the control stick components insure that the connector, small screw hole key, and name plate are lined up.**





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Figure 21. Guidance control unit, exploded view.



- |                                      |                                   |
|--------------------------------------|-----------------------------------|
| 1- Lockring                          | 32- Screw                         |
| 2- Lug                               | 33- Plate                         |
| 3- Screw 10172519                    | 34- Screw                         |
| 4- Washer 10172506                   | 35- Plate                         |
| 5- Cover 10173106                    | 36- Box                           |
| 6- Gasket 10173102                   | 37- Screw 10172502                |
| 7- Gasket                            | 38- Nut 10172407                  |
| 8- Connector 10172767                | 39- Plate                         |
| 9- Connector 10172534                | 40- Screw 10172509                |
| 10- Cap assembly 10173107            | 41- Nut 10172526                  |
| 11- Battery holder assembly 10172499 | 42- Lockwasher 10172625           |
| A- Pin                               | 43- Relay 10172528                |
| B- Pivot                             | 44- Voltmeter 10021155            |
| C- Bearing                           | 45- Support 10172523              |
| D- Handle                            | 46- Lockwasher 10172506           |
| E- Screw                             | 47- Lockwasher 10172520           |
| F- Bearing                           | 48- Screw 10172488                |
| G- Pivot                             | 49- Relay 10172524                |
| 12- Cover 10172489                   | 50- Relay 10172527                |
| 13- Screw 10172488                   | 51- Support 10172529              |
| 14- Battery holder assembly          | 52- Relay 10172528                |
| A- Battery holder                    | 63- Bolt 10173103 (810.851-2)     |
| B- Spring                            | 54- Washer 10173104 (810.851-4)   |
| C- Bracket                           | 55- Plate                         |
| 15- Washer 10021176                  | 56- Lockwasher 10172520           |
| 16- Connector 10172485               | 67- Screw 10172488                |
| 17- Gasket                           | 58- Screw 10172509                |
| 18- Lamp holder 10172494             | 59- Bracket 10172508              |
| 19- Lamp MS 25237-327                | 60- Ring clamp 10173108 (810.915) |
| 20- Lens (green) 10172496            | 61- Switch 10172484               |
| 21- Gasket                           | A- Toggle switch                  |
| 22- Screw 10172505                   | B- Washer                         |
| 23- Connector 10172504               | C- Boot                           |
| 24- Screw 10172486                   | D- Nut                            |
| 25- Washer 10172487                  | 62- Screw 10172481                |
| 26- Lens (red) 10172495              | 63- Lens (amber) 10172497         |
| 27- Cover 10172493                   | 64- Lens (clear) 10172498         |
| 28- Screw 10172486                   | 65- Pin                           |
| 29- Washer 10172492                  | 66- Plate 8934745                 |
| 30- Connector 10172490               | 67- Screw 8035048                 |
| 31- Gasket 10173101                  | 68- Ear                           |

**Figure 21. Legend**



1-	Screw	31-	Screw 10172505
2-	Washer	32-	Washer 10172763
3-	Plate, upper	33-	Spacer
4-	Nut	34-	Spacer
5-	Washer	35-	Spring drum
6-	Spring	36-	Retainer spring
7-	Screw	37-	Lug
8-	Spacer	38-	Pin
9-	Cover	39-	Shaft 10172756
10-	Screw	40-	Setscrew
11-	Body	41-	Gear 10172760
12-	Pin	42-	Gear
13-	Guide	43-	Screw
14-	Setscrew	44-	Shaft 10172757
15-	Spring	45-	Washer 10172762
16-	Base	46-	Gear 10172759
17-	Nut	47-	Setscrew
18-	Lock ring	48-	Shaft
19-	Gasket	49-	Shaft 10172758
20-	Spacer	50-	Spacer
21-	Switch 10172748	51-	Lower support plate
22-	Screw 10172765	52-	Bearing 10172754
23-	Plate 10172761	53-	Plate 10172751
24-	Blade 10172761	54-	Plate 10172751
25-	Screw 10172766	55-	Screw 10172765
26-	Screw 10172505	56-	Plate 10172752
27-	Washer 10172763	57-	Screw 10172765
28-	Plate 10172753	58-	Screw 10172505
29-	Bearing 10172755	59-	Washer 10172763
30-	Upper support plate		

Figure 22. Legend.



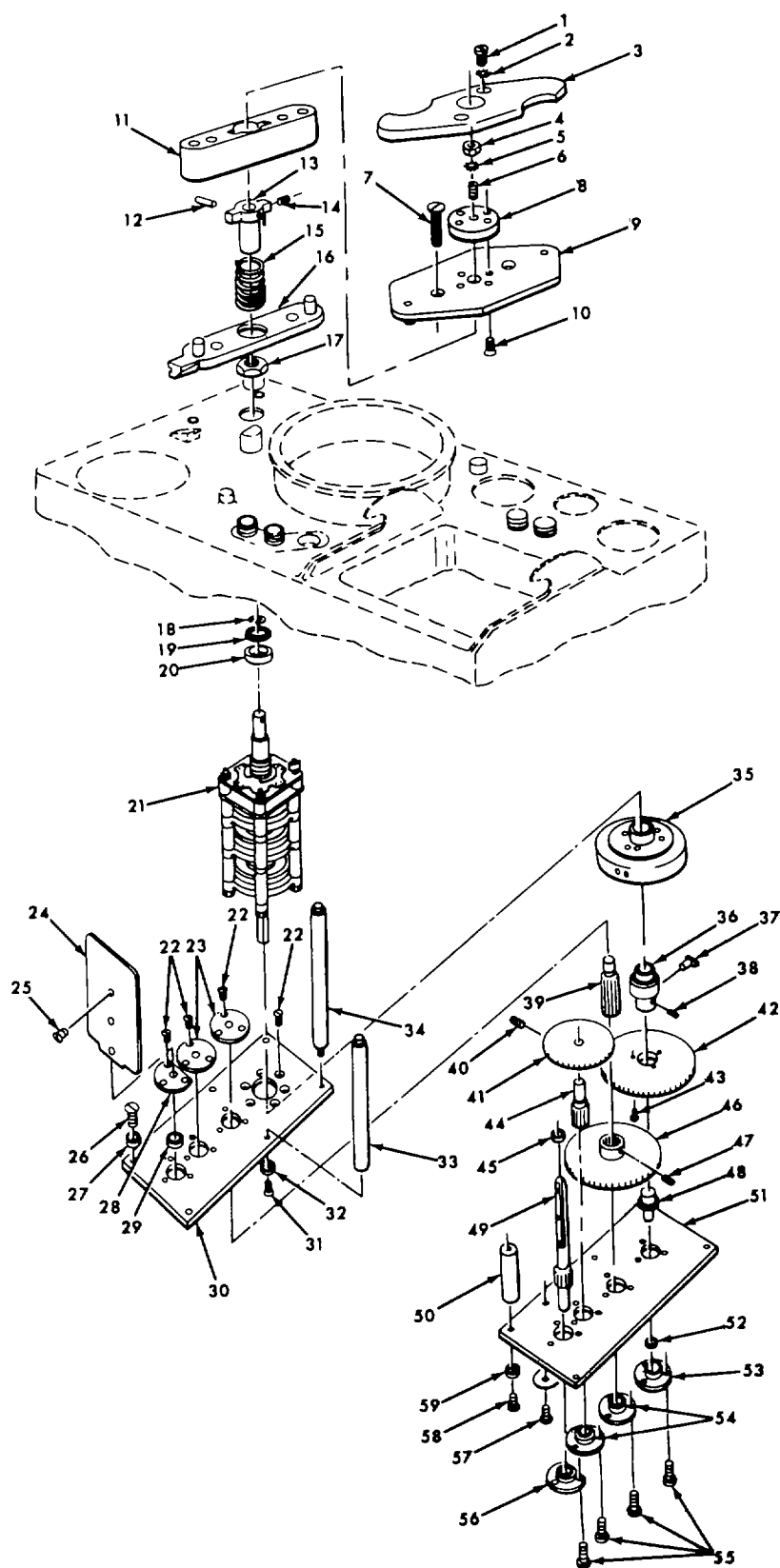
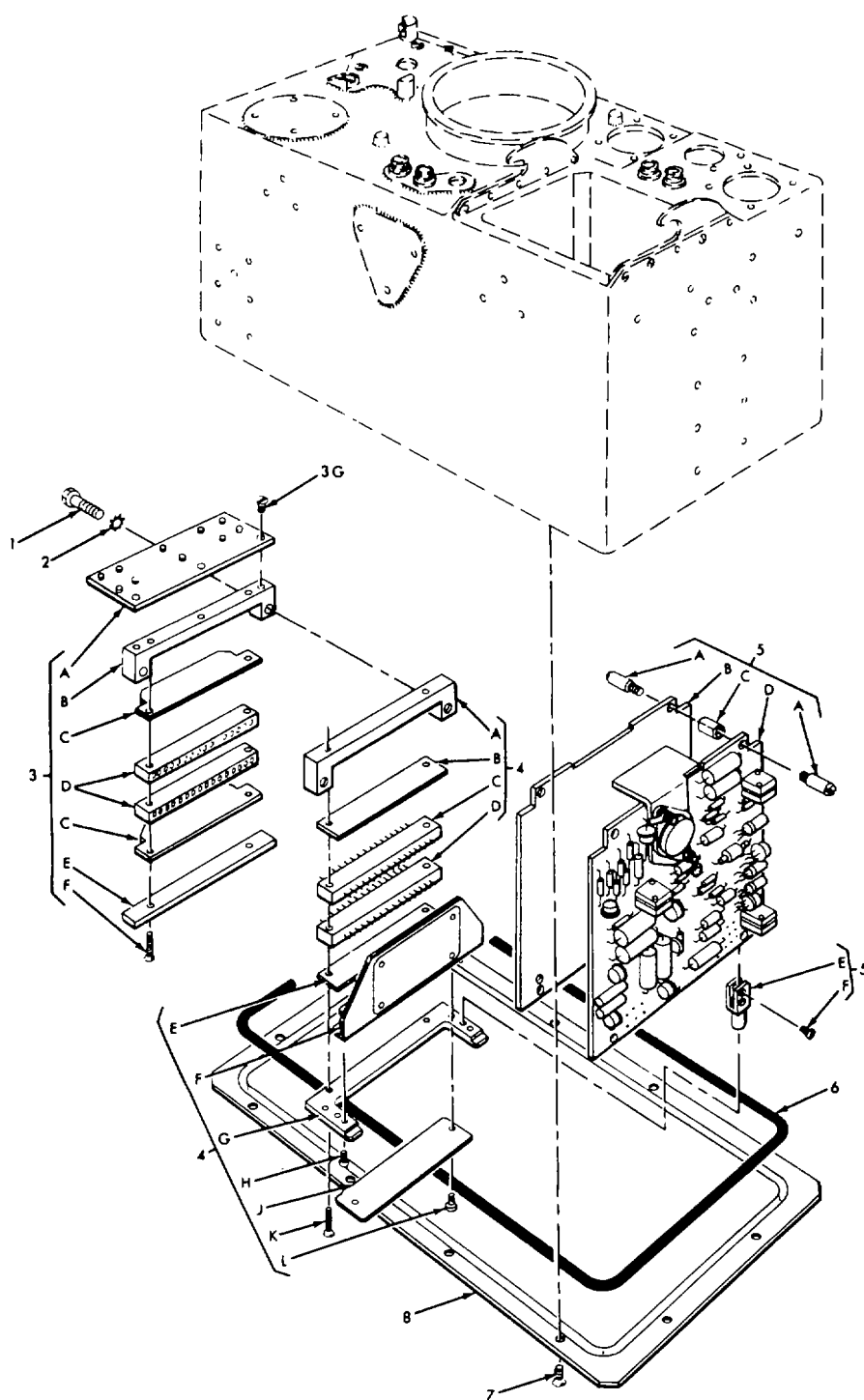


Figure 22. Guidance control unit firing switch.

ORD G9252





ORD G9341

Figure 23. Guidance control unit signal generator module.



- |  |   |
|--|---|
| 1-Screw 10172521                           | F-Bracket                                 |
| 2-Washer 101792520                         | G-Bracket 10172661                        |
| 3-Connector assembly                       | H-Screw 10172667                          |
| A-Board 10172516                           | J-Name plate                              |
| B-Bracket 10172514                         | K-Screw 10172662                          |
| C-Insulator 10172512                       | L-Screw 10172505                          |
| D-Connector 10172513                       | 5-Part of signal generator module         |
| E-Plate 10172511                           | A-Screw 10172664                          |
| F-Screw 10172515                           | B-Circuit board (issued w/item 5D)        |
| G-Screw 10172519                           | C-Nut, spacer 10172665                    |
| 4-Part of signal generator module 10172510 | D-Printed circuit board equipped 10172657 |
| A-Plate 10172660                           | E-Support 10172671                        |
| B-Insulator 10172659                       | F-Screw 10172675                          |
| C-Connector 10172658                       | 6-Gasket 10172478                         |
| D-Connector 10172658                       | 7--Screw 10172479                         |
| E-Insulator 10172659                       | 8—Plate                                   |

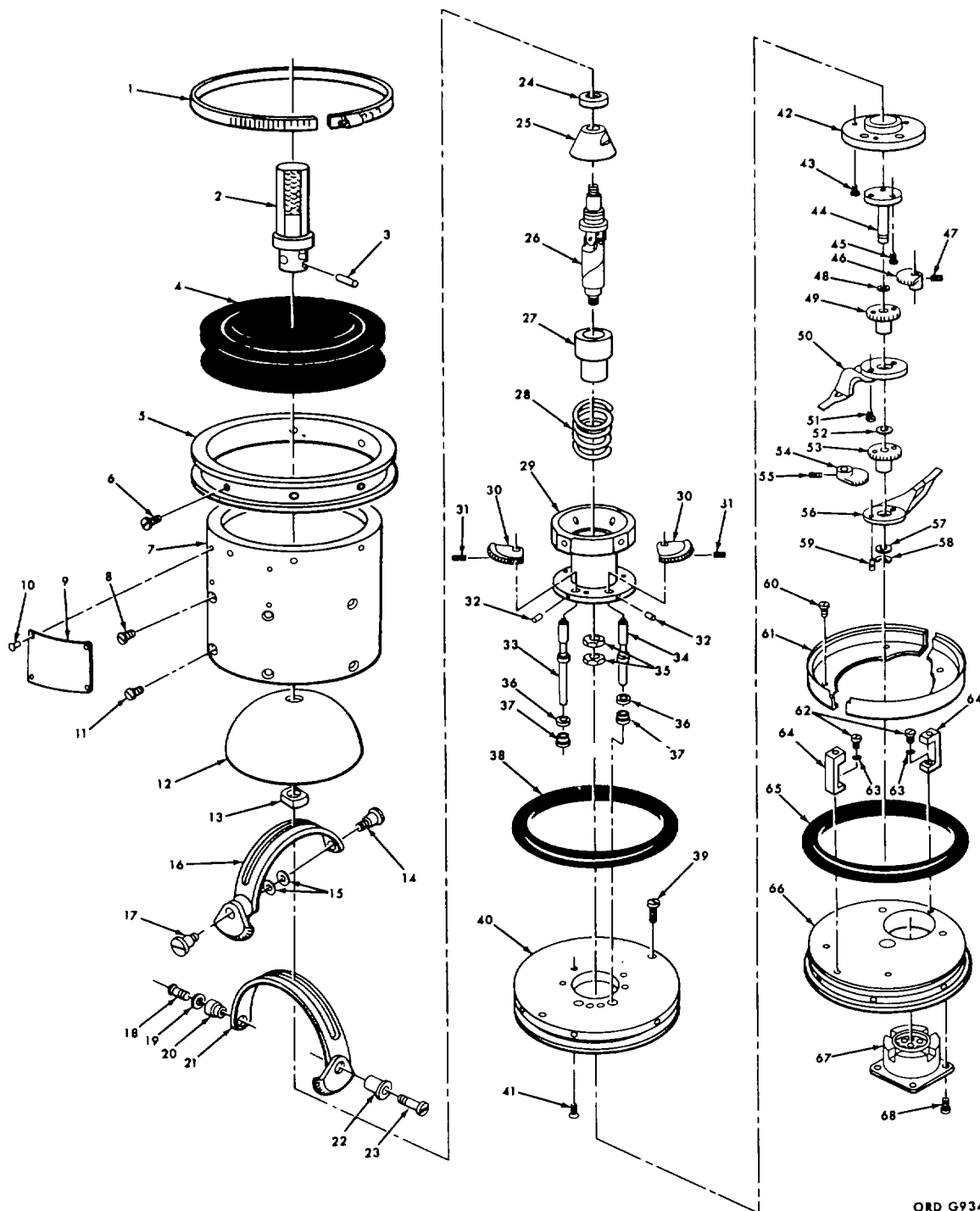
**Figure 23. Legend.**



1-Clamp 10172533	35-Nut
2-Handle 10172531	36-Washer
3-Pin 10172539	37-Spacer
4-Boot 10172530	38-Gasket 10172741
5-Ring	39-Screw 10172729
6-Screw	40-Support
7-Case	41-Screw
8-Screw 10172726	42-Adapter
9-Plate	43-Screw
10-Rivet	44-Shaft
11--Screw 10172726	45-Screw
12-Shield 10172728	46-Gear
13-Washer	47-Setscrew 10172745
14-Screw	48-Washer
16-Washer	49-Gear
16-Arch	50-Pitch wiper assembly 10172743
17-Screw	51-Screw
18-Screw	52-Spacer assortment 10172747
19-Washer	53-Gear
20-Spacer	54-Gear
21-Arch	55-Setscrew 10172745
22-Spacer	56-Yaw wiper assembly 10172744
23-Screw	57-Spacer assortment 10172747
24-Spacer	58-Ring 10172746
26-Nut	59-Screw
26-Universal joint	60-Screw 10172739
27-Spring retainer	61-Resistor 10172742
28-Spring	62-Screw 10172737
29-Housing	63-Washer 10172738
30-Gear	64-Bracket
31-Setscrew	65-Gasket 10172741
32-Pin	66-Support
33-Shaft	67-Connector 10172732
34-Shaft	68-Screw 10172735

**Figure 24. Legend.**





ORD G9342

Figure 24. Control stick, exploded view.

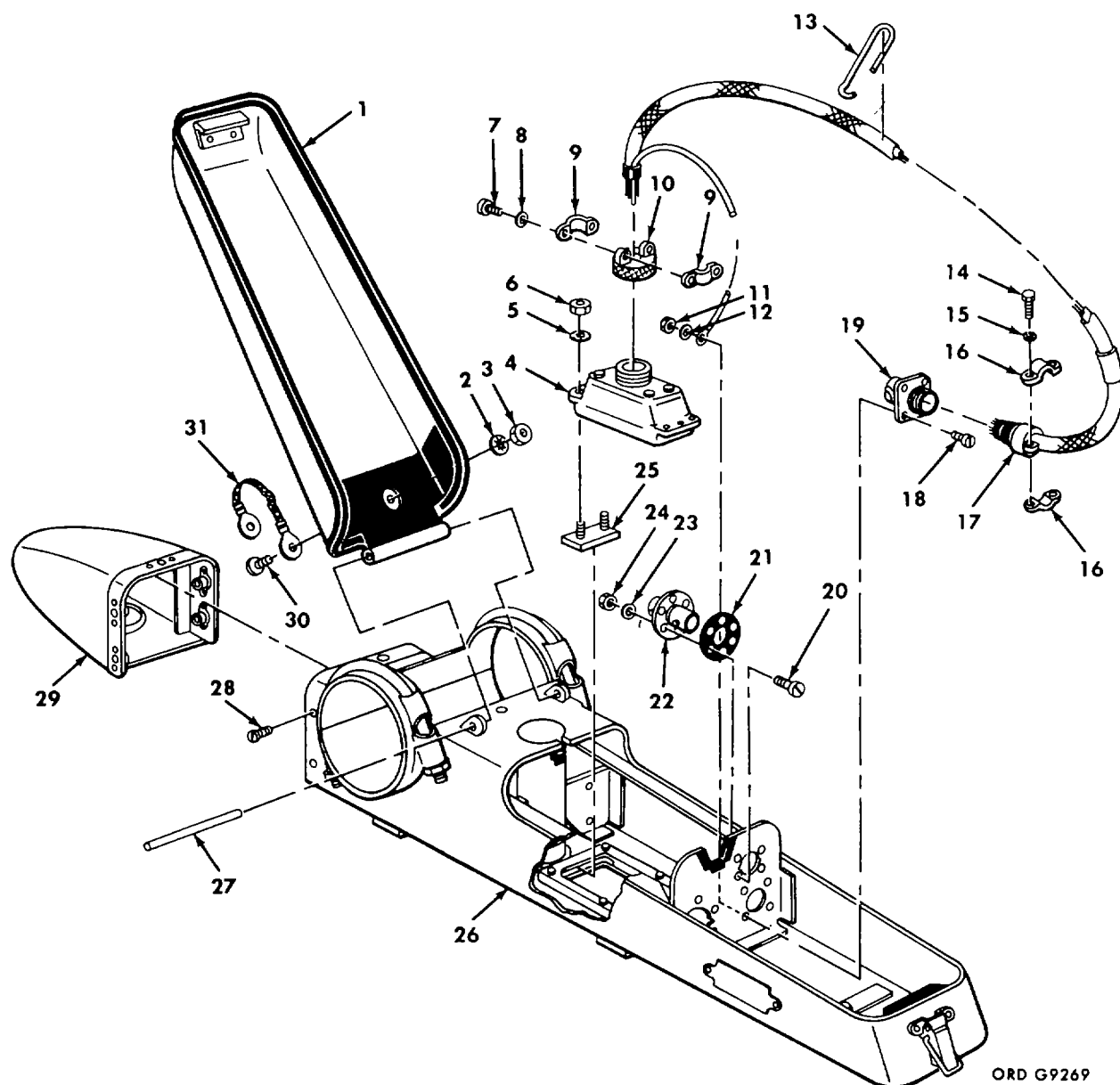


### 38. Removal and Installation of Fixed Housing Cable Assembly

Removal and installation of fixed housing cable assembly are obvious as shown in figure 25.

### 39. Removal and Installation of Launcher Microswitch Assembly

Removal and installation of launcher microswitch assembly are obvious as shown in figure 26.



ORD G9269

Figure 25. Fixed housing cable assembly.



1-Gasket 10173305	17-Connector
2-Washer	18-Connector
3-Nut	19-Connector
4-Connector	20-Screw
5-Washer	21-Gasket
6-Nut	22-Connector
7-Screw	23-Washer
8-Washer	24-Nut
9-Clamp half	25-Mount
10-Connector	26-Housing
11-Nut	27-Pin
12-Washer	28-Screw
13-Clip	29-Nose fairing
14-Screw	30-Screw
15-Washer	31-Strap
16-Clamp half	

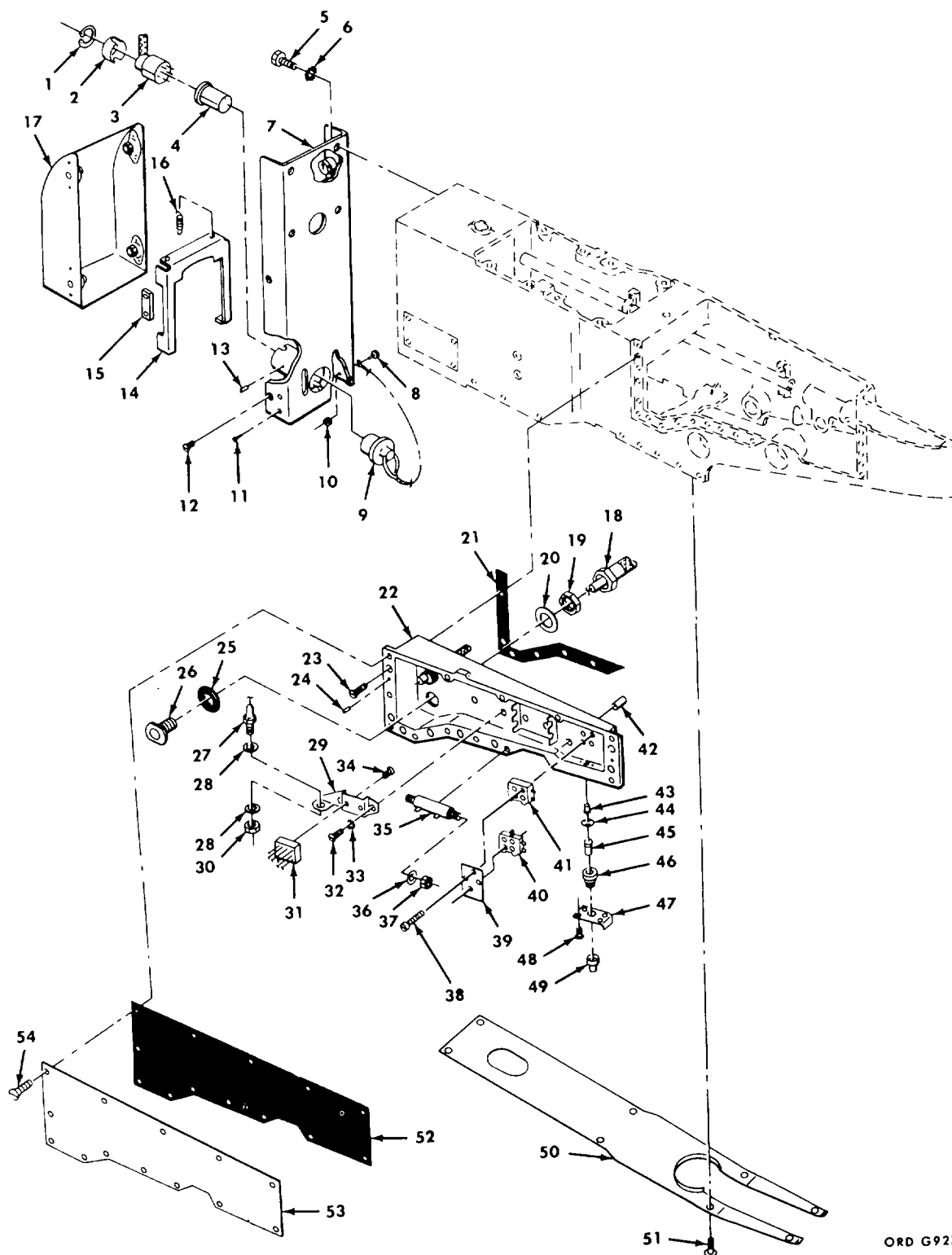
**Figure 25. Legend.**



1-Lock ring	28-Washer
2-Cover	29-Mounting plate
3-Connector	30-Nut
4-Connector	31-Junction box
5-Screw	32-Screw
6-Washer	33-Washer
7-Support	34-Screw
8-Bolt	35-Resistor
9-Cap	39-Washer
10-Nut	37-Nut
11-Screw	38-Screw
12-Screw	39-Plate
13-Pin	40-Microswitch
14-Bracket	41-Microswitch
15-Plate	42-Pin
16-Spring	43-Guide
17-Cover	44-Washer
18-Cable assembly	45-Insert
19-Nut	46-Body
20-Washer	47-Plate
21-Gasket	48-Screw
22-Housing	49-Rubber cap
23-Screw	50-Cover
24-Pin	51-Screw
25-Gasket	52-Gasket
26-Connector	63-Cover
27-Selenium rectifier	54-Screw

**Figure 26. Legend.**





ORD G9270

Figure 26. Launcher micro-switch.



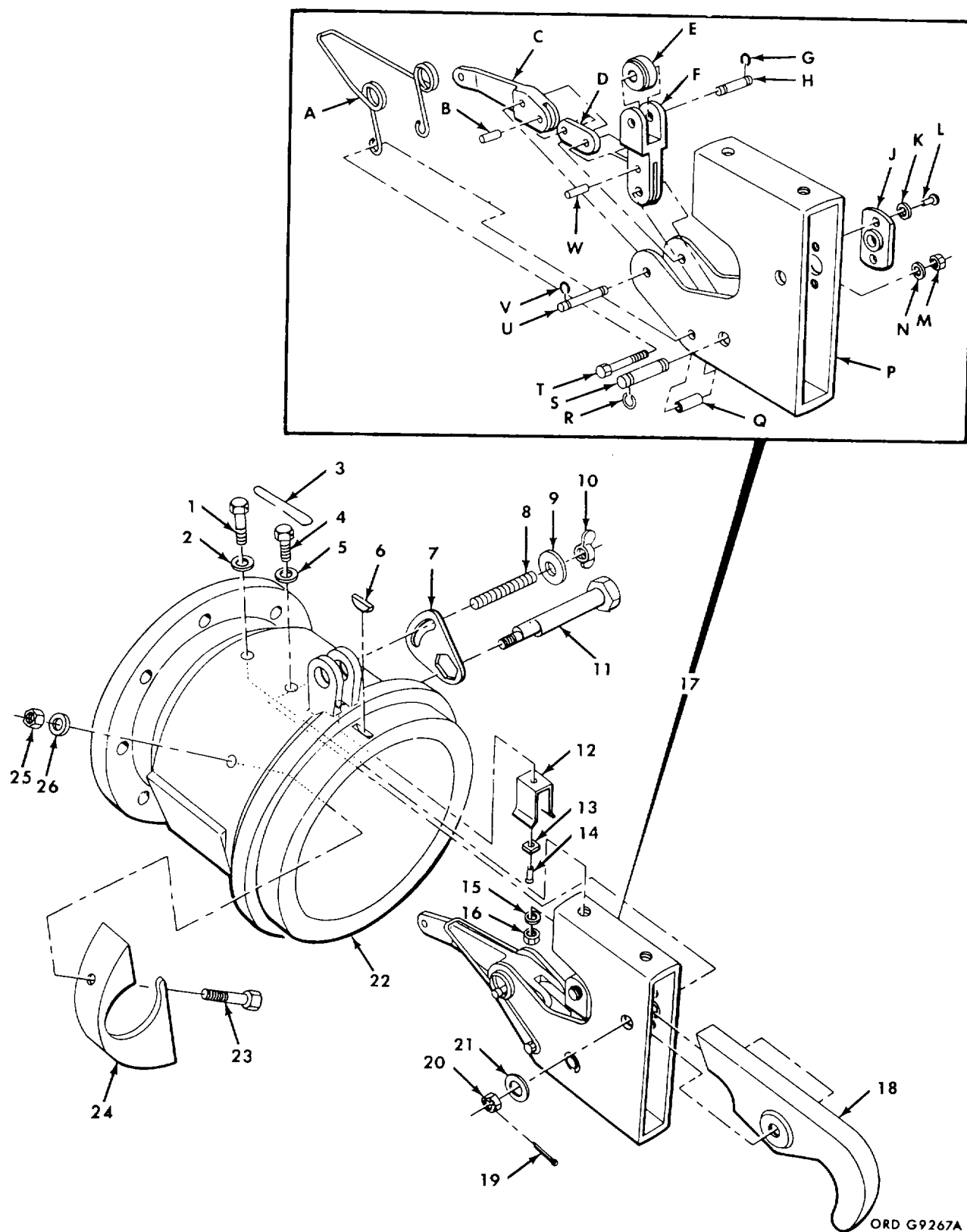


Figure 26.1. Housing assembly (8035008)-exploded view.

AGO 6287A



1 Bolt	13 Stop	F-Arm	T-Bolt
2 Washer	14 Rivet	G-Snapring	U-Pin
3 Locking wire	15 Washer	H-Pin	V-Snapring
4 Bolt AN-6H11A	16 Nut	J-Collar	W-Pin
5 Washer	17 Release Assembly	K-Washer	18 Hook Assembly 8035013
6 Key MS35756-12	8035015-1	L-Screw	19 Pin MS24665-302
7 Latch 8035014	(RH-8035015-2)	M-Nut	20 Nut AN320CG
8 Stud	A-Spring	N-Washer	21 Washer AN960C616
9 Washer MS35336-32	B-Pin	P-Housing	22 Housing
10 Wingnut MS35425-41	C-Crank	Q-Pin	23 Bolt
11 Shaft 8035012	D-Link	R-Snapring	24 Plate Assembly
12 Clip	E-Bearing	S-Pin	25 Nut NAS679C6M
			26 Washer

Figure 26.1. Continued.

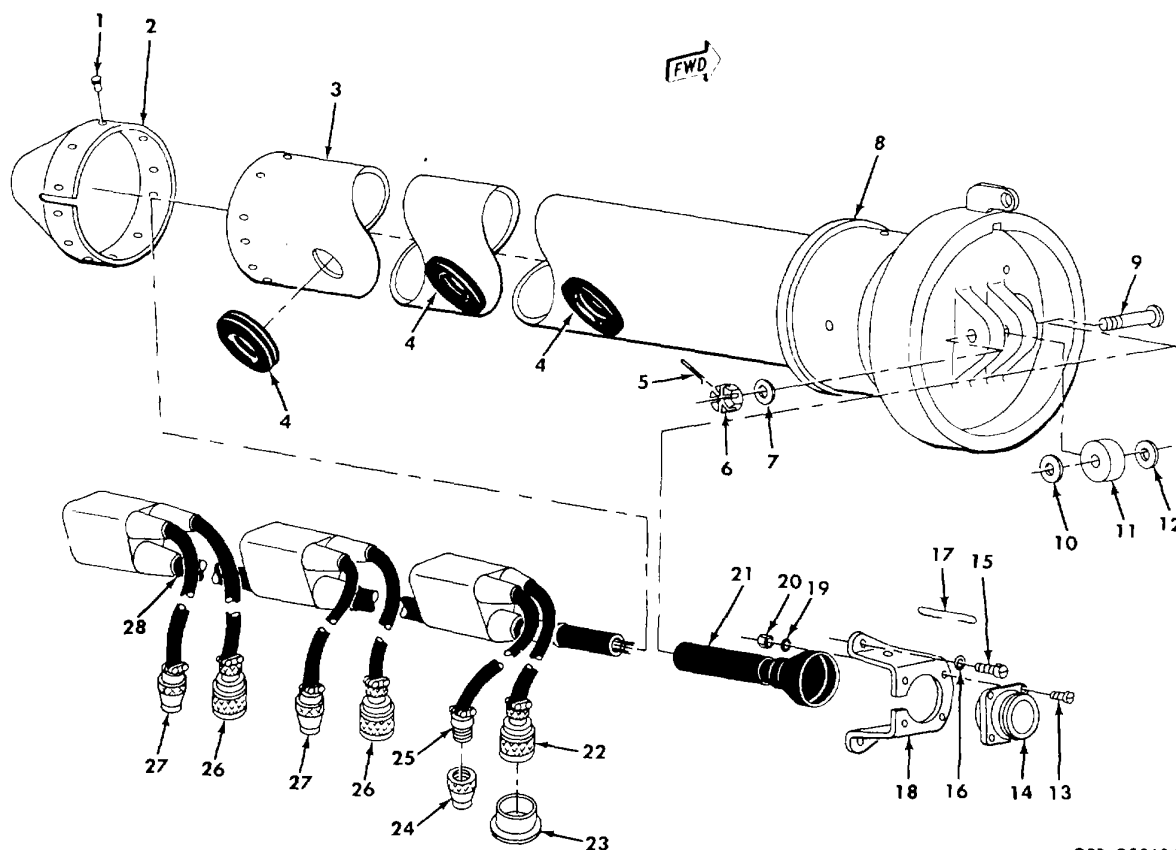


Figure 26.2. Launcher support assembly (8035001)-exploded view.

1 Rivet MS20600AD5W3	12 Washer AN960C616L	CONNECTOR ASSEMBLY 8035038
2 Cap 8035006	13 Screw	
3 Tube	14 Connector 8035042	22 Connector
4 Grommet MS35449-51	15 Screw	23 Cover
5 Pin MS24665-800	16 Washer	CONNECTOR 8035037
6 AN320-6	17 Locking Wire	24 Connector
7 Washer AN960PD616	18 Support	25 Adapter
8 Adapter	19 Washer	26 Connector Assembly 8035038
9 Bolt AN-26-34	20 Nut	27 Connector Assembly 8035037
10 Washer AN960C616L	21 Boot	28 Cable Assembly 8035034
11 Bearing 8035005		

AGO 6287A



## CHAPTER 6 AMMUNITION

### Section I. GENERAL

#### 40. Scope

This chapter provides specific instructions for the inspection by ammunition personnel of the AGM-22B missile either in the hands of troops or in ammunition depots.

#### 41. Purpose

Inspections are made for the purpose of:

- a. Determining the condition of an item as to serviceability.
- b. Recognizing conditions that would cause failure.
- c. Determine its serviceability and what changes, if any, have taken place since previous inspections.

#### 42. General Safety Precautions

a. This section contains the precautions to be observed in handling and testing of those missile components covered in this manual. The material in this section supplements those precautions in TM 9-1903 and AMCR 385-224 that are applicable to ammunition in general.

b. A standard operating procedure (SOP) shall be used for all operations involving ammunition. The SOP shall include safety requirements, personnel and explosive limits, designations of equipment to be used, locations, and sequences of operations to be performed. It shall be approved by the commanding officer and also by those designated to be responsible for the operation. No changes to the SOP will be permitted unless approved in writing by the approving authorities. All personnel concerned shall have ready access to the SOP and must understand the requirements specified in it.

c. The explosive ammunition components of the missile are designed to be as safe in handling as is consistent with their functioning; and they are packaged to withstand conditions ordinarily encountered in storage and transit. Because of their hazardous nature, operations involving ammunition will be supervised by a qualified ammunition inspector or similarly qualified explosives personnel who thoroughly understand the hazards and risks involved. Operating personnel should be impressed with the importance of taking proper safety precautions.

d. The propellant grain and the metal parts of the body section can be damaged by rough handling, dropping, etc. A body section subjected to such damage or extreme temperatures could cause a malfunction when the missile is fired. Body sections which have been exposed to these damages will not be used until a complete inspection for serviceability has been made.

e. Explosive components containing electrical systems must be protected at all times by grounding from induced electric currents such as those found in the vicinity of high-frequency electronic equipment; radio and television transmitters; radars; high tension wires; etc.

f. To provide maximum protection to personnel and property in the event of an incident during missile electrical testing, the units tested shall be placed behind substantial structures, preferably in a vertical position and nose end down.

### Section II. INSPECTION

#### 43. Types of Inspection

##### Note.

**Whenever a shipping container is opened, the desiccant must be replaced. Use four 16-unit bags of activated desiccant FSN 6850-264-6563.**

- a. *Prestorage.*

- (1) On receiving each lot of missiles at the depot, and before placing it in storage, inspect the outside of each shipping container for proper and readable markings, evidence of rough handling, and condition of the container seal.



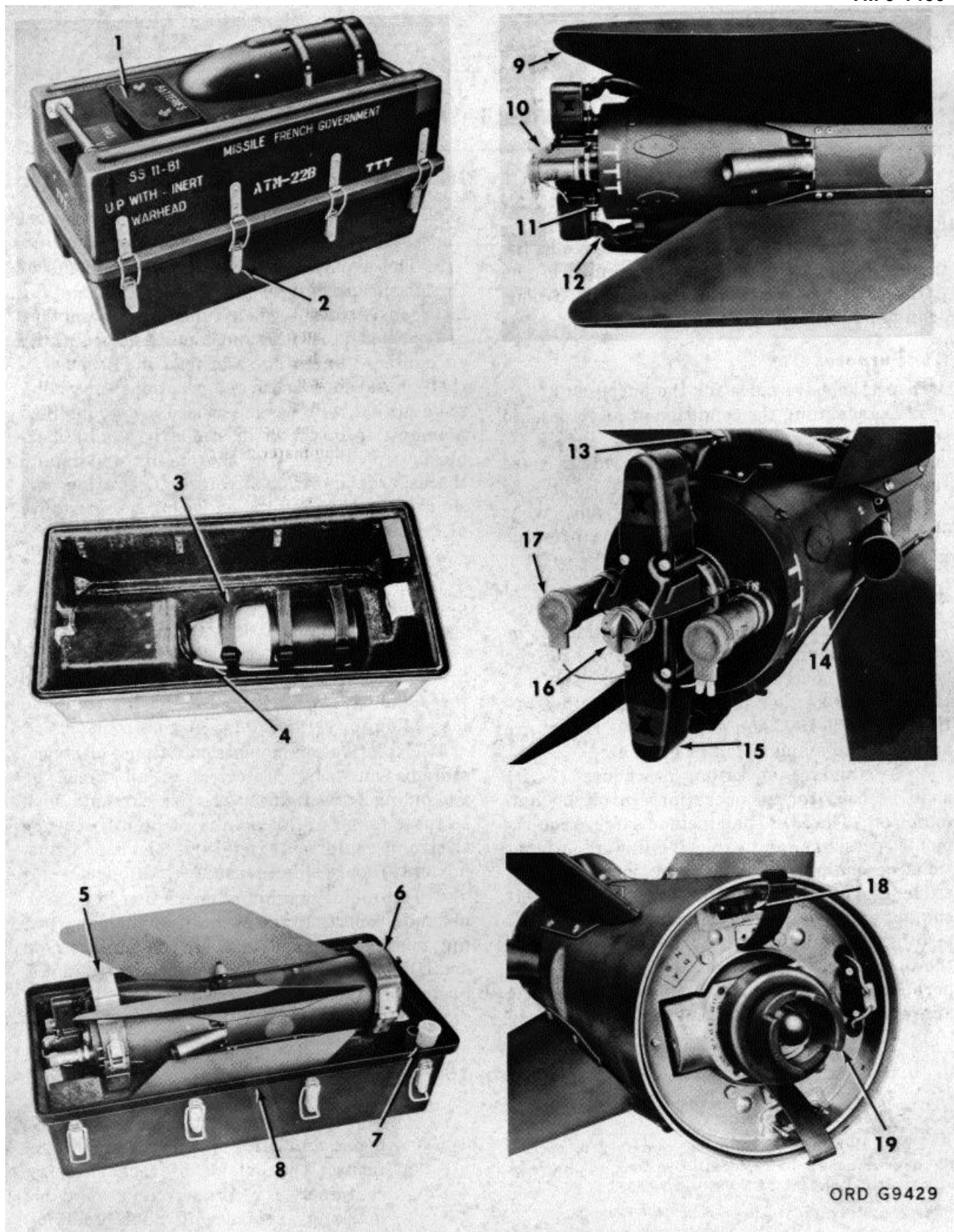


Figure 27. Ammunition inspection points.



- (2) Segregate containers which show evidence of tough handling: remove the missiles as outlined in paragraph 44. If they are found to be serviceable, replace them in the shipping containers and place the shipping containers in storage.
- (3) If the missile containers are found to be unserviceable, segregate them and make a report in accordance with paragraph 50.
- (4) In the case of missiles returned by the user, inspect each missile as outlined in paragraphs 44 and 47. This must be done within 30 days after the missiles are received.

*b. Annual.*

- (1) When a lot of missiles has been in storage 1 year, select a sample of the lot at random. See table 7 for size of the sample.
- (2) Inspect the missiles selected as outlined in paragraphs 44 and 47.

*c. Preshipment.* Inspect as required in *b* above unless the lot has been inspected in the last eight months and found serviceable, no inspection is necessary.

*d. Special inspection.* The U.S. Army Missile command may require inspection of the missiles other than those inspections indicated in *a*, *b*, and *c* above.

#### 44. Visual Inspection (fig. 27)

**Note:**

Defects printed in bold face type are considered to be major defects. If any of these defects are found during inspection of first sample, inspect a second sample for these defects. Refer to table 4 for size of the second sample. If these defects are found in the second sample, inspect the entire lot.

*a. Shipping Containers.*

- (1) Proper color coding and painting (table 8).
- (2) **Breaks, splits and holes.**
- (3) Presence and serviceability of latches and pins (2, fig. 28).
- (4) Condition and presence of battery holder, cover, clamp key and attaching hardware (1).
- (5) **Container seal (8) for proper installation, deterioration or breaks.**
- (6) Presence and condition of cartridge holder (7) in base of container.
- (7) **Proper operation and condition of forward (6) and aft clamp (5) assemblies which secure the missile in base of container.**
- (8) **Missing or damaged straps (3) that secure the warhead in top of container.**
- (9) **Presence and proper installation of warhead cushioning material (4) in top of container.**

**Warning:**

**Always inspect the warhead arming device immediately before removing the missile body from the shipping container. If it is armed call a demolition specialist to dispose of the missile.**

*b. Missiles.*

- (1) **Inspect the condition of the warhead arming device. The top of the arming piston should not protrude above the surface of the rim (fig. 28).**
- (2) Proper color coding and marking (table 5).
- (3) **Dents or breaks on the skin.**

**Table 7. Inspection-Sample Sizes**

Lot size	Inspection-sample size		Accumulative sample size
	First sample	Second Sample	
0-8	3	Balance of lot	8
9-15	3	Balance of lot	15
16-25	5	Balance of lot	25
26-40	5	10	15
41-65	7	14	21
66-110	10	20	30
111-180	15	20	30
181-300	25	50	75
301-500	35	70	105
501-800	50	100	150
801-1300	75	150	225



Table 8. Ammunition Color Coding

Nomenclature	Basic Missile	Color Warhead	Markings		Warhead tip nose color	Basic Color	Marking	Corner only	ICC Markings on containers
			Missile	Warhead					
Guided Missile AGM 22B	OD	OD	Yellow	Yellow	Yellow	OD	Yellow	Yellow	ROCKET AMMUNITION WITH EXPLOSIVE PROJECTILE
Guided Missile ATM 22B	OD	OD	White	White	Blue	OD	White	Blue	ROCKET AMMUNITION WITH INERT PROJECTILE
Missile, SS 11 completely inert.	Blue	Blue	White	White	None	OD	White	None	None

Note 1. Live motors will have four 2-inch brown squares 90 degrees apart.

Note 2. Container corner markings will be diagonally opposite.

- (4) Presence of rust, corrosion or moisture.
- (5) Loose or damaged fins (9, fig. 28).
- (6) Loose or distorted rear cover (11).
- (7) Damaged, loose or corroded electrical contacts (18).
- (8) Missing or damaged junction box (15).
- (9) Damaged or missing hook (10) (J-box release).
- (10) Broken or missing flares (17).
- (11) Missing or deteriorated sleeving on guidance wires (12).
- (12) Damaged or missing retainer springs (J-box).
- (13) Breaks or kinks in exposed guidance wires.
- (14) Broken or deteriorated wiring.
- (15) Broken or clogged exhaust ports (14).

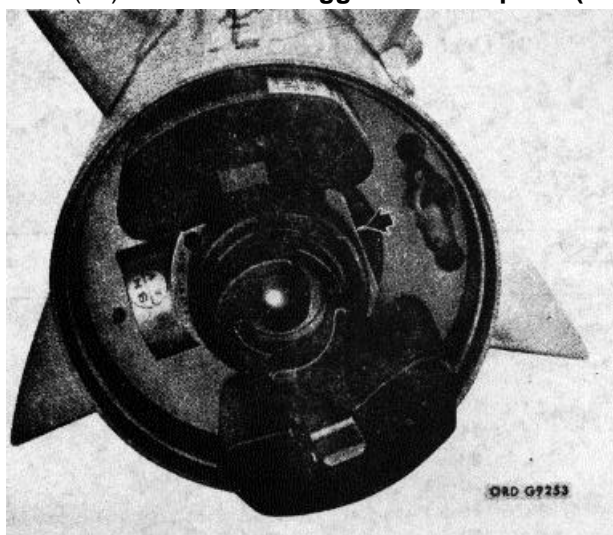


Figure 28. Warhead arming device.

- (16) Missing or damaged attaching hardware.
- (17) Breaks or dents on spool housing (13).
- (18) Missing or damaged support ring.
- (19) Bent or broken pins or corrosion on electrical plug (16).
- (20) Missing or damaged fuze protector plug (19).
- (21) Nicks, burrs, rust or corrosion on fuze threads.
- (22) Improper mating of missile to warhead.

c. Warheads

- (1) Proper marking and painting (table 5).
- (2) Presence of dents or breaks.
- (3) Corrosion or oxidation on the skin.
- (4) Evidence of rust or corrosion on internal threads.
- (5) Damaged, loose or missing screws which secure the two sections together.

d. Explosive Cartridge.

Note.

Normally the explosive cartridge is shipped in the shipping containers of the missile. It must be visually inspected for serviceability.

- (1) Proper identification
- (2) Damaged or improper packaging.
- (3) Evidence of rust or corrosion.

e. Explosive Bolt.

- (1) Serviceability and installation of shorting plug.
- (2) Proper identification.
- (3) Damaged or improper packaging.
- (4) Presence of dents, rust or corrosion.



## f. Batteries.

**Note.**

**The batteries are shipped in separate containers.**

(1) Presence of dents or breaks on casing, which would render the batteries unserviceable.

**Section III. ELECTRICAL TESTING****45. General**

These tests involve handling and electrical testing of ammunition items. The live missile body and the HEAT warhead contain explosives and must be handled with care. Although the missile tester is designed to safety-check the internal circuitry of the missile, it is imperative that all possible safety precautions be observed. Since the possibilities of accidental motor ignitions cannot be overlooked, the selection of the site for electrical testing is of prime importance.

**46. Test Area Requirements**

Electrical testing of the missile may be conducted in either a specifically designated building or outside in the open. In either case, the test area must meet the minimum safety requirements specified in TM 9-1300-206 (overseas) or AMCR 385-224 (CONUS) and all applicable standing operating procedures (SOP's).

**Warning:**

**The missile with live motor and warhead is in quantity-distance class 7; the missile with live motor and inert warhead is in quantity-distance class 5. All inspections should be in accordance with applicable quantity-distance tables and safety instructions contained in TM 9-1300-206 and AMCR 385-224.**

**46.1. Sample Sizes for Electrical and Continuity Testing**

a. Unless otherwise noted, the lot sample size for electrical and continuity tests of the missile, explosive bolts, and explosive cartridges will be as specified in table 7.

b. If during tests of the first sample, 15 percent of the sample fails to pass, a second sample will be selected in accordance with table 7. If, after testing the second sample, 25 percent of the total tested fail the

(2) Bent, broken, or corroded electrical connections.

(3) Serviceability and presence of adhesive tape and microcrystalline wax.

(4) Proper labeling to insure shelf life limitations are not exceeded.

test, the complete lot will be tested, and the results reported in accordance with TM 38750.

**47. Electrical Check of the Missile**

a. Missile test set M22 Set D (FSN 4935-953-9962), composed of the following components, is used to perform electrical check of the missile:

(1) Rocket circuit continuity tester (fig. 29), Model 101-5BFG (Alinco) 4925-712-0205.

(2) Maintenance and inspection holddown fixtures ORDXM-SMD-1939.

(3) Continuity test cable assembly (fig. 29) (SS-11B) ORDXR-FMO-1703.

b. Set up the equipment as follows:

(1) Set the holddown fixture on a level surface behind a suitable barricade.

(2) Place four sand bags on the base of the holddown fixture.

(3) Loosen the two missile-holding screws on the holddown fixture.

**Warning:**

**Always inspect the warhead arming device immediately before removing the missile body from the shipping container. If it is armed, call a demolition specialist to dispose of the missile.**

(4) Remove the missile body section from the shipping and storage container.

(5) Place the missile body in the holddown fixture as shown in figure 30. Make certain the holding screws engage in the missile-locking slots.

(6) Remove the missile container with the HEAT warhead from the checkout area, and place it behind a suitable barricade.

(7) Drive the ground stake into the ground and connect the cable between the stake and the holddown fixture.

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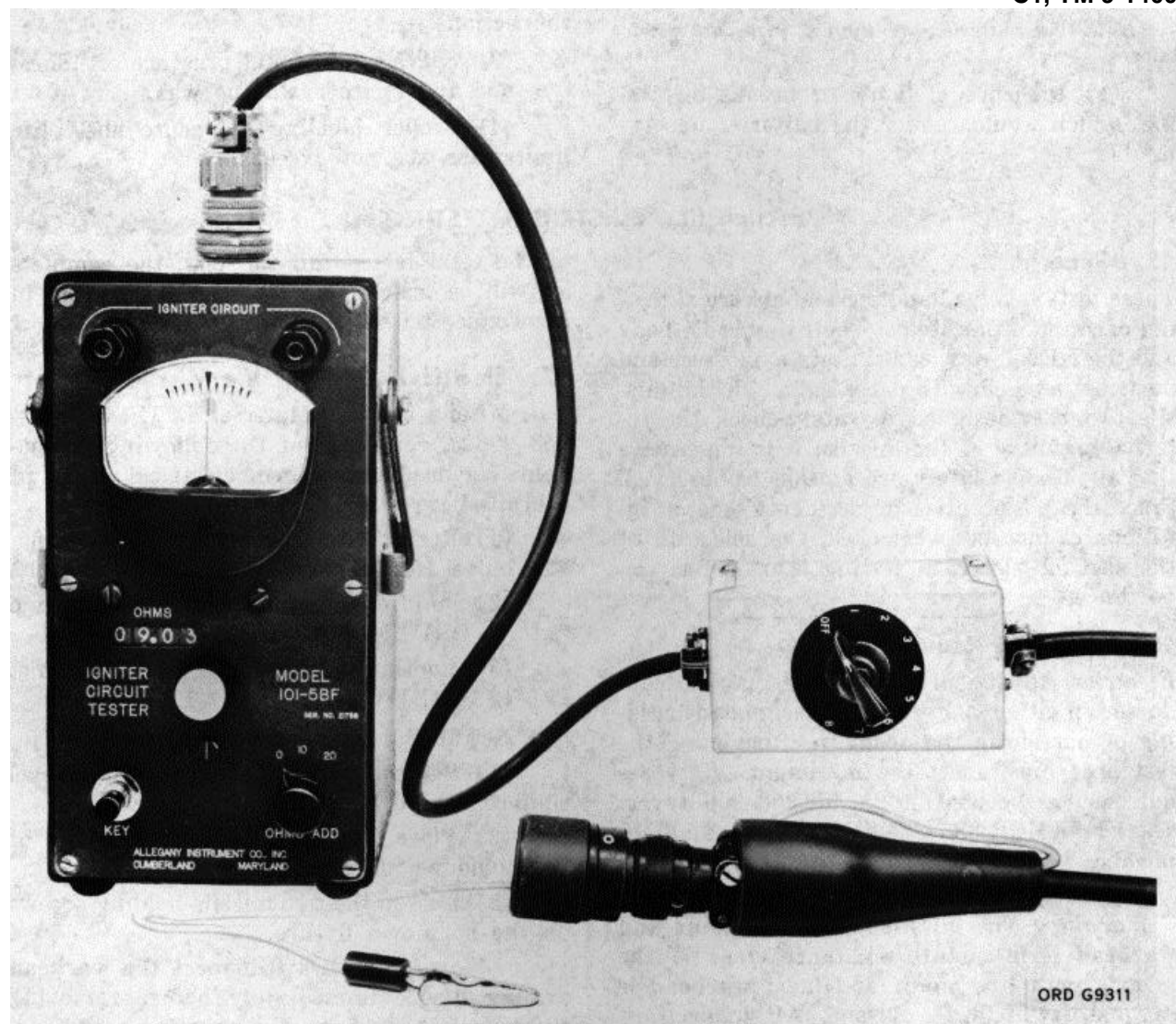


Figure 29. Alinco continuity test, Model 101-5BFG and cable.

c. Check the resistance of the test cable as follows:

(1) Connect the 2-pin connector on the test cable assembly to the receptacle on top of the continuity tester.

(2) Connect a shorting wire between pins 3 and 5 of the 7-pin plug on the test cable.

(3) Set the switch on the test cable to position 1.

**Note.**

**Make certain the OHMS ADD switch on the continuity tester is set to the 0 position.**

(4) Press and hold the KEY switch on the continuity tester.

(5) Operate the OHMS knob on the tester until the balance meter indicates zero (center scale).

(6) Release the KEY switch and record the resistance as indicated by the OHMS counter. Record also the position of the test cable switch.

(7) Repeat steps 4, 5, and 6 with the

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shorting wire connected between pins 5 and 6 and the switch set to position 2.

(8) Repeat steps 4, 5, and 6 with the shorting wire connected between pins 5 and 7 and the switch set to position 3.

(9) Repeat steps 4, 5, and 6 with the shorting wire connected between pins 4 and 5 and the switch set to position 4.

(10) Remove the shorting wire, set the switch to the OFF position, and disconnect the test cable from continuity tester.

**Warning:**

**Operator making cable connections to the missile should wear safety glasses or goggles.**

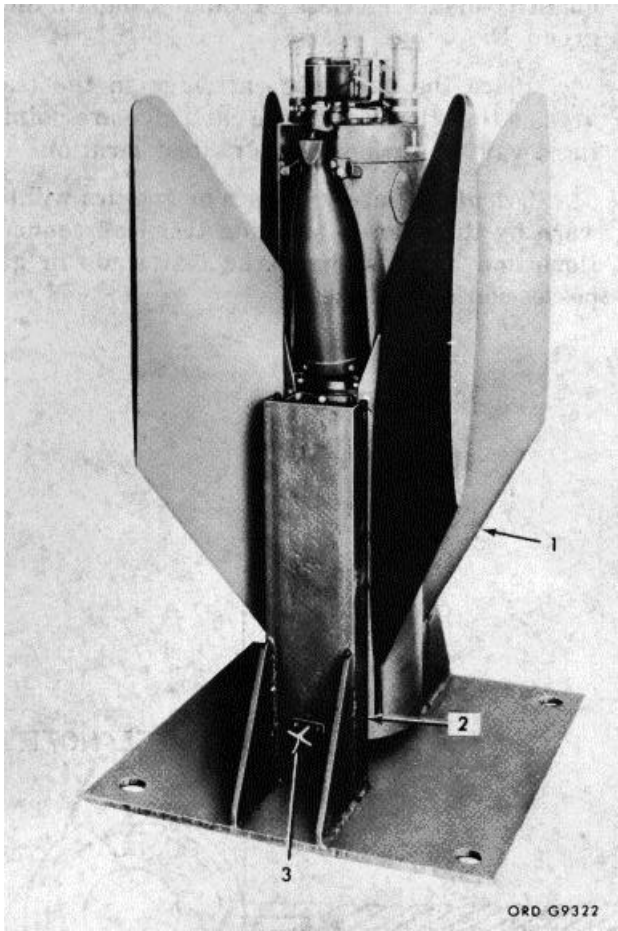
d. Lay out the test cable and connect it to the 7-pin connector on the rear of the missile junction box.

**Warning:**

**Make certain the electrical-checkout area is clear. Everyone must be behind the barricade.**

e. Make certain the switch on the test cable is set to the OFF position. Connect the test cable to the continuity tester.





**Figure 30. Missile in hold down fixture.**

f. Check the resistance of the missile ignition circuits as follows:

- (1) Set the switch on the test cable to position 1.
- (2) Press and hold the KEY switch on the continuity tester.
- (3) Operate the OHMS knob until the balance meter indicates zero (center position)
- (4) Release the KEY switch and record the resistance as indicated on the OHMS counter. Record also the position of the test cable switch.

**Table 9. Missile ignition Circuits-Resistance Tolerances**

Position of test cable switch	Minimum allowable resistance	Maximum allowable resistance
1	2.5 ohms	5.5 ohms
2	19.5 ohms	26.5 ohms
3	1.60 ohms	2.40 ohms
4	3.00 ohms	4.00 ohms

**Note.**

**This reading includes the resistance of the ignition circuits plus the cable.**

- (5) Repeat steps 2, 3, and 4 for each position of the switch on the test cable.
  - g. Disconnect the test cable from the continuity tester.
  - h. Compute the actual resistance of the missile ignition circuits using the following formula: Resistance of cable and ignition circuits (recorded in e above) *minus* resistance of cable (recorded in b above) *equals* actual resistance of missile ignition circuits.
- Note.**
- The resistance of the ignition circuits must be within specified tolerances.**
- i. Compare the computed resistance of the missile ignition circuits with the tolerances listed in table 9.
  - j. Disconnect test cable and remove the missile body from the hold-down fixture.
  - k. Repack the missile body in the shipping container from which it was removed.

**Warning:**

**Missiles which are found to be unserviceable shall not be stored with serviceable missiles. Clearly mark the containers of unserviceable missiles so that they will be stored separately.**

- l. Perform the continuity check of the explosive cartridge (packed in the shipping container) as outlined in paragraph 48.

**Note.**

**Results of the missile electrical checks are to be reported as specified in paragraph 46.1 and 50.**

**Warning:**

**Only one explosive cartridge will be allowed in the test area at a time. Only the operator will be in the immediate area while the test is being conducted.**



#### 48. Continuity Check of Explosives Cartridge FSN 1337-956/2732

a. The following equipment is required to perform the continuity check:

(1) Rocket circuitry tester, Model 101-5BFG (Alinco) 4929-712-0205.

(2) Test lead (fig. 31).

b. Remove the explosive cartridge from the missile shipping container.

#### Warning:

**Explosive cartridges are in quantity-distance class 1 and compatibility group E.**

c. Place the explosive cartridge in the test area so that the ends of the cartridge are pointing away from the operator's test position.

#### Warning:

**Safety glasses or goggles will be worn by the operator making test lead connections and he must have the test leads in his possession at all times.**

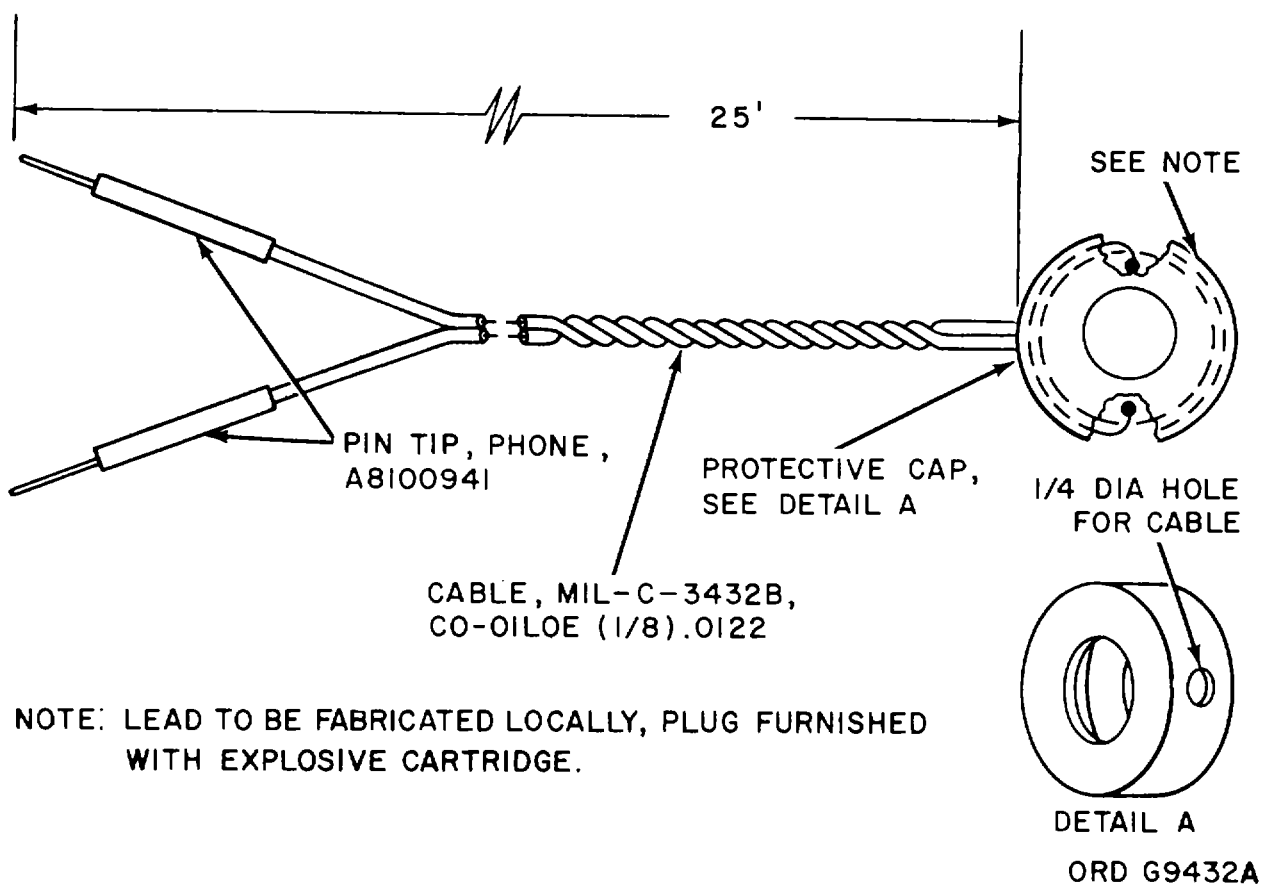


Figure 31. Explosive cartridge test lead.

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- d. Connect the test lead to the explosive cartridge.
- e. Place a sandbag on top of the cartridge (lengthwise) or place the cartridge behind a suitable barricade.
- i. Press and hold the KEY switch on the continuity tester.
- g. Operate the OHMS knob on the tester until the balance meter indicates zero (center scale).
- h. Set OHMS ADD switch on continuity tester to 10.
- i. Connect the test lead pip-pins to the binder posts on the continuity tester.
- j. Press KEY switch on tester and observe the deflection of the balance meter.
- (1) If the meter deflects to the right the circuit through the explosive cartridge is complete and the cartridge is electrically serviceable.
- (2) If the meter deflects full scale to the left, the circuit through the explosive cartridge is open, and the cartridge is unserviceable.

**Note.**

**Tag all explosive cartridges found unserviceable for destruction.**

k. Disconnect test leads from the continuity tester and from the explosive cartridge.

l. Repack serviceable explosive cartridges in the missile shipping container.

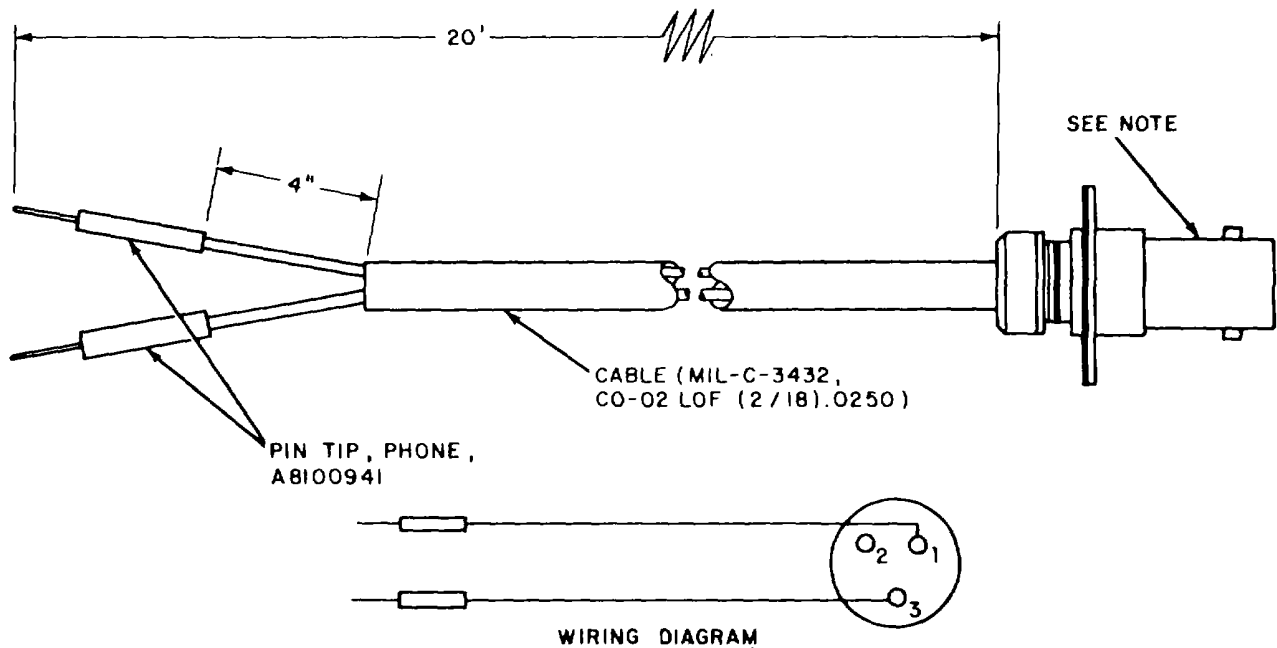
**Note.**

**Comply with paragraph 46.1b when tests I are completed.**

#### 49. Continuity Check of Explosives Bolt

**Warning:**

**Only one explosive bolt will be allowed in the test area at a time. Only one operator will be in the immediate area while the test is being conducted.**



NOTE: LEAD TO BE FABRICATED LOCALLY,  
PLUG FURNISHED WITH EXPLOSIVE BOLT

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**Figure 32. Explosive bolt test lead.**



a. The following equipment is required to perform the continuity check:

(1) Rocket circuitry testing, Model 1015BFG (Alinco) 4925-712-0205.

(2) Test lead (fig. 32).

b. Turn galvanometer needle adjust screw on Alinco tester clockwise until needle is centered on midscale graduation of meter.

c. Set digital dial (using OHMS control knob) and OHMS ADD switch on zero.

d. Connect pin-tips of test lead to binder posts of tester, and short loose end of test lead.

e. Depress test key, and rotate OHMS control knob until galvanometer needle is centered on midscale graduation of meter.

f. Read and record resistance shown on digital dial.

g. Disconnect test lead from binder post on tester.

h. Place explosive bolt behind a suitable barricade, and place a sandbag over it.

i. Remove shorting plug from explosive bolt cable, and connect test lead.

j. Connect test lead to binder post on tester.

k. Depress test key on tester, and rotate OHMS control knob until galvanometer needle is centered on midscale graduation of meter.

l. Read and record resistance shown on digital dial.

m. Subtract resistance obtained in *f* above from resistance obtained in *l* above. Resistance should be between 1.5 and 2.5.

**Note:**

**Tag all explosive bolts found unserviceable for destruction.**

n. Disconnect test lead, and replace explosive-bolt shorting plugs.

o. Remove explosive bolt from barricade, and return to storage.

**Note.**

**Comply with paragraph 46.1b when tests are completed.**

#### 49.1. Function Test of Explosives Bolt

a. *Test Requirements.* Three years after the date of manufacture, a function test will be performed (by depot personnel) on a sample of each lot of explosive

bolts in storage. The purpose of the function tests is to determine whether the shelf life of the bolts may be extended for an additional 3 years. Six years will be the maximum shelf life for these bolts; therefore, function testing will be once only for each lot.

b. *Equipment Required.* The following equipment is required to perform the function test:

(1) Cabinet, test, subzero, working chamber, American Instrument Mfg. Co., Tag TSA C310 (59-41), or equal.

(2) Barricade (ORDXR-FMO-918), or equal.

(3) Holding fixture (SMM-MAP-298) (fig. 32.1).

(4) Tester, Alinco, Model 102-5BFG, with test leads.

(5) Firing leads (twisted pair) A.W.G. 18.

(6) Protective clothing and equipment.

(7) Gloves, asbestos and leather.

(8) Safety goggles, FSN 4270-269-7911.

(9) Power supply, regulated, Model QCR 36/85, Utronics, Inc., Clinton, N. Y., or equal.

c. *Safety Precautions.* Observe the following safety precautions when performing the function test:

(1) Operators must wear flame-proof outer clothing and sparkproof safety shoes.

(2) Personnel will be kept to a minimum for a safe and efficient operation.

(3) Explosive quantity distance class 3 and compatibility group F will be observed when handling explosive bolts.

(4) Safety glasses must be worn when handling explosive bolts.

(5) Operation will be suspended when electrical storms are imminent.

d. *Sample Selection.* Use table 7 as a guide in choosing the sample. The quantity of bolts chosen, however, should be evenly divisible by three, because there are three different function tests to be performed (para *f*, *g*, and *h* below).

e. *Continuity Test.* Perform the following continuity test on the explosive bolts before function testing:

(1) Remove one bolt from its storage container; unpack and place it in the approved barricade.



**Warning:**

**Immediately after bolt has been unpacked, check for presence of shorting plug and any obvious defects or damage before continuing this operation.**

(2) Extend the cable lead end with shorting plug through the hole in the barricade, and close the barricade door.

(3) Check and record the resistance of the test cable.

(4) Remove the shorting plug from the explosive bolt lead cable.

**Caution:**

**The complete test lead cable must be in the possession of the operator making the electrical connection.**

(5) Connect the test lead provided with a shorting plug to the explosive-bolt harness.

(6) Extend the test lead cable (away) from the barricade to the Alinco tester.

(7) Using OHMS control knob, set digital dial and OHMS ADD switch at zero.

(8) Remove the shorting plug from the test lead cable, and connect it to the Alinco tester.

(9) Depress the test key, and rotate the OHMS control knob until the galvanometer needle is centered at midscale graduation of the meter.

(10) Read and record resistance on digital dial.

(11) Subtract the resistance obtained in (3) from that obtained in (10).

**Note.**

**Acceptable resistance of explosive bolts is 1.5 to 2.5 ohms.**

(12) Disconnect the test lead cable from the explosive bolt.

(13) Replace the shorting plug to the explosive bolt harness.

(14) Open the barricade door, and remove the explosive bolt.

(15) Repack and place the explosive bolt in approved temporary storage until needed for one of the following tests (para f, g, or h below).

(16) Repeat (1) through (15) above until the quantity of bolts chosen for function testing (d above) have been accumulated. If any bolts fail the continuity tests, apply the requirements in paragraph 46.1b.

**Note.**

**Tag all unserviceable explosive bolts for destruction.**

*f. Waterproof Function Test.***Note.**

**The waterproof function test will be conducted on 1/3 of the explosive bolts selected for test (d above).**

(1) Remove one explosive bolt from approved temporary storage (e(15) above), and unpack.

(2) Remove the self-locking nut from the explosive bolt.

(3) Submerge the explosive bolt in a container of water for 30 minutes inside a temperature controlled chamber preconditioned to  $200 \pm 5^\circ \text{C}$ .

**Caution:**

**Do not submerge the connector and shorting plug.**

(4) Remove the bolt from the chamber.

(5) Connect the bolt to the holding fixture SMM-MAP-298 (fig. 32.1) by placing the threaded screw through the 11/17-inch hole and securing it with the backup plate and two screws MS35307-64.

(6) Place the holding fixture with explosive bolt inside the barricade.

(7) Extend the connector and shorting plug through the small opening in the barricade.

(8) Close the barricade door.

(9) Remove the shorting plug from connector on the explosive bolt, and connect the firing lead cable.

**Caution:**

**The firing lead or the power source actuating device must be in the possession of the operator making the electrical connection.**

(10) Extend the firing lead cable from the barricade to the power source.

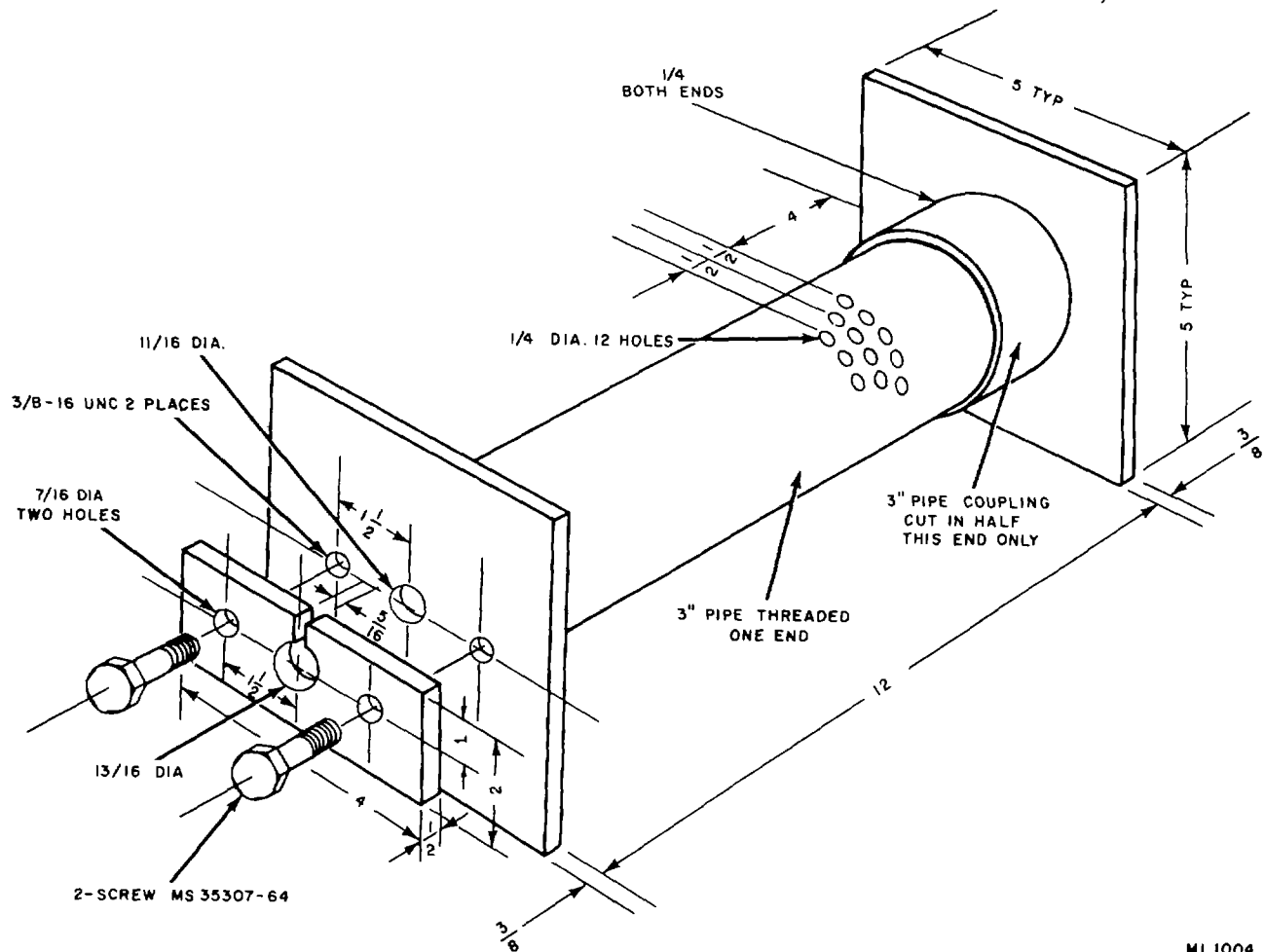
(11) Prior to making the connection to the power source, the firing circuit will be tested with a galvanometer for electrical continuity.

**Note.**

**The normal operating current for detonating the explosive bolt is one amp for a period of 1/10 second.**

(12) Fire the explosive bolt by using a 24vdc power source equipped with a voltage and amperage control device.







(2) Remove the self-locking nut from the explosive bolt.

(3) Connect the bolt to the holding fixture SMM-MAP-298 by placing the threaded screw through the 11/16-inch hole and securing it with the lockup plate and two screws MS35307-64.

(4) Precondition the temperature controlled chamber to -50° C., and place the bolt inside for a period of 1 hour.

(5) Wearing leather gloves, remove the explosive bolt and the holding fixture from the temperature controlled chamber, and place in an approved barricade.

(6) To fire the bolt, follow (7) through (14) of f above.

(7) Repeat the above procedure until all bolts selected for the low-temperature test have been subjected to the function test.

*h. High-Temperature-Function Test.*

**Note.**

**The high-temperature function test will be conducted on ½ of the explosive bolts selected for test in d above.**

(1) Remove one of the explosive bolts from temporary storage, and unpack.

(2) Remove the self-locking nut from the explosive bolt.

(3) Connect the bolt to the holding fixture by placing the threaded screw through the 11/16-inch hole and securing it with the lockup plate and two screws MS35307-64.

(4) Place the explosive bolt for one hour inside the temperature-controlled chamber, which has been preconditioned to +80° C.

(5) Using the asbestos gloves, remove the explosive bolt and holding fixture from the temperature-controlled chamber, and place in an approved barricade.

(6) To fire the explosive bolt, follow (7) through (14) of f above.

(7) Repeat the above procedure until all bolts selected for the high temperature function test have been subjected to the test.

*i. After-Test Procedures.* According to the test results, comply with (1) or (2) below.

(1) If 100 percent of the explosive bolts functioned properly, the shelf life of the lot may be extended to 6 years from the date of manufacture. Update all ammunition records to indicate the new shelf life expiration date. Report the lot number, the sample size used for function testing, and the new shelf life expiration date to Commanding General, U.S. Army Missile Command, ATTN: AMSMI-SMMDA, Redstone Arsenal, Ala. 35809.

(2) If less than 100 percent of the explosive bolts failed to function, report the complete results of the test in accordance with TM 38-750.

**50. Reports and Disposition Instructions**

*a.* Report unserviceable missiles to Commanding General, U.S. Army Missile Command, ATTN: AMSMI-SMMDA, Redstone Arsenal, Ala. 35809, on DA Form 2415 (Ammunition Condition Report) in accordance with TM 38-750. Include the following:

- (1) Nomenclature.
- (2) Federal stock number.
- (3) Lot and serial numbers.
- (4) Quantity received.
- (5) Shipping order number.
- (6) Date received.
- (7) Unsatisfactory condition encountered.
- (8) Statement as to feasibility of local corrections.
- (9) Quantity of missile on hand.
- (10) Quantity of unserviceable missiles.

*b.* Dispose of unserviceable missiles in accordance with chapter 7.



## CHAPTER 7 SHIPMENT, STORAGE, STATIC FIRING, AND DETONATION

### Section I. SHIPMENT AND STORAGE

#### 51. General

This section pertains to shipment and storage of the missile and other system explosive items. Commanders are responsible for insuring that all materiel issued or assigned to their commands is maintained in a serviceable condition and properly cared for, and that personnel under their command comply with technical instructions.

#### 52. Shipment

Preservation and other protective measures taken in the preparation of the materiel for shipment should be sufficient to protect it against deterioration and physical damage during shipment.

#### 53. Storage Precautions

a. Ammunition items should be stored separately from nonexplosive items.

b. The ammunition items should be stored only in magazines or igloos specifically designated for ammunition storage. When specially constructed magazines are not available, the building used should be sufficiently ventilated and afford adequate protection against moisture and dampness.

c. Outside storage may be used only when suitable buildings are not available. The methods used should provide adequate circulation of air and good protection against moisture. Materiel should be covered with paulins or other suitable covering. The cover should allow free circulation of air about the containers. Suitable trenches should be dug to prevent water from running under the stacks during inclement weather.

d. The storage temperature limits of minus 300 to positive 500 Centigrade should not exceed 6 hours for any one period.

#### NOTE

**For correct quantity-distance classification and compatibility groupings, see table 10.**

e. The missile and explosive cartridge have an indefinite shelf life.

f. Disregard the expiration date marked on the battery case, and consider the shelf-life to be 14 months from the date of manufacture, also stamped on the battery case. Batteries may be used for an additional 6 months (20 months total) for training purposes in CONUS.

*Table 10. Quantity-Distance Classification and Compatibility Grouping*

Component	Quantity-distance class	Compatibility group step
Complete round with explosive warhead	.....7	.....F
Complete round with inert warhead.	.....5	.....F
Explosive warhead only	.....7	.....F
Explosive bolt	.....3	.....B
Explosive cartridge	.....1	.....E

### Section II. STATIC FIRING AND DETONATION

#### 54. General

This section covers static firing and detonation of unserviceable ammunition components of the M22 subsystem.

#### 55. Static Firing of Missile

Static firing of unserviceable missiles should be accomplished in accordance with table 11.



Table 11: Static Firing of Missile

Equipment required:

- a. Protective clothing.
- b. Holding fixture, FSN 5935-991-6674.

**Note.**

**Before static firing, make sure that a 1/2 inch by 1 inch slot has been cut in the holding fixture sleeve (in the base) so the blasting cap can be inserted.**

- c. Demolition cable SMM-MAP 267, figure 38.
- d. Blasting cap, number 8 FSN 1475-0285215.
- e. Blasting galvanometer, FSN 6625-212-4605.
- f. Detect-a-meter, FSN 6625-356-0295.
- g. Masking tape, FSN 7510-266-710.
- h. Safety glasses, FSN 4240-276-7343.
- i. Electrical tape, FSN 5970644-3169.

Step	Operation
1	Place holding fixture (fig. 30) on level ground, 300 feet from barricade.
2	Place sand bag (approx 50 lbs) on each corner of holding fixture plate.
3	Lay demolition cable SMM-MAP 267 from barricade holding fixture at destruction site.
4	Lay another demolition cable (less electrical connector) from barricade to destruction site.
5	Twist ends of demolition cables together at barricade and connect to ground.
6	Transport missile to destruction site.
7	Remove missile from shipping and storage container and place in holding fixture with forward end down.
8	Transport container and warhead from destruction area to a safe location.
9	Secure missile in holding fixture with screws provided with fixture.
10	Using a detect-a-meter, check demolition cable for stray current.
11	Clear area of all personnel except two operators.
12	Remove the protective cover on the electrical connector on the aft end of missile.
13	Connect demolition cable to missile.
	<b>Note:.</b> <b>One operator will make electrical connections at missile while the second operator observes from outside the barricade</b>
14	Untwist ends of blasting cap leads and connect to demolition cable (step 4).
15	Place the explosive end of the blasting cap in the cutout of the holding fixture sleeve and secure with tape.
16	Retire to barricade.
17	Disconnect missile demolition cable from ground and untwist ends of wires.
18	Touch ends of demolition cable to blasting galvanometer. If needle shows a deflection, connect to power source of at least 28 vdc and fire the motor.
19	Disconnect warhead detonator demolition cable from ground and untwist ends of wires.
20	Touch ends of warhead detonator demolition cable to blasting galvanometer. If needle shows a deflection, unlock blasting machine cabinet and remove the blasting machine.
21	Connect demolition cable to blasting machine.
22	Raise handle of blasting machine and push down rapidly.
23	After motor and warhead detonator have fired, disconnect demolition cable at power source



Table 11. Static Firing of Missile-Continued.

Step	Operation
24.	Using flashlight, check to determine if a clean burnout was obtained during firing and the blasting cap has detonated.
	<b>Note.</b> <b>If motor propellant fails to ignite or a clean burnout is not accomplished, destroy missile body as outlined in table 12.</b>
25.	Remove the missile body from holding fixture and transport to demolition burning pit for further disposal.
26.	After burning missile body, remove inert metal scrap and transport to property disposal.

**56. Detonating Missile**

When static firing of unserviceable missiles cannot be accomplished the missile should be destroyed by detonation in accordance with table 12.

**57. Detonation of Warhead**

Detonation of unserviceable warheads should be accomplished in accordance with table 13.

Table 12. Detonation of Missiles

**Equipment required:**

- a. Blasting cap no. 8, FSN 1375-028-5215.
- Note. Blasting cap should be tested for continuity before being transported to destruction site.**
- b. Blasting galvanometer, FSN 6625-212-4605.
- c. Detect-A-Meter, FSN 6625-356-0295.
- d. Detonating cord no. 100, FCN 1375-078-5164.
- e. Firing wires, FSN 6145-188-3657.
- f. Masking tape, FSN 7510-266-6710.
- g. Plastic explosives (composition C4), FSN 1375-028-5148.
- h. Protective clothing.
- i. Safety glasses, FSN 4240-2767343.

Step	Operation
1	Lay two firing wires from barricade to destruction site. Destruction site should not be less than 300 feet from the barricade.
2	Twist ends of firing wires together and connect to ground at barricade.
3	Transport the missile to the destruction site.
4	Remove the missile body from the shipping and storage container.
5	Place the missile body on the ground.
6	Transport the container and warhead away from operation area to a safe location.
7	Tie a single knot at one end of a 24-inch detonating cord and mold two ounces of composition C4 explosives over knot. Explosives should cover approximately 3 inches of cord and be evenly distributed
8	Place the explosives end of detonating cord approximately 8 inches from the forward end of missile body on top of motor and secure in place with masking tape.
9	Position the detonating cord over warhead detonator and secure in place with masking tape.
10	Using a detect-a-meter, check firing wires for stray current.
11	Clear area of all personnel except two operators. One operator will make electrical connections at missile while the second operator observes from outside the barricade
12	Untwist blasting cap lead wires and connect to firing wires.
13	Tape blasting cap to end of detonation cord and retire to barricade.



Table 12. Detonation of Missile--Continued.

Step	Operation
14	Disconnect firing wires at ground and untwist ends of wires.
15	Touch ends of firing wires to blasting galvanometer. If needle shows a deflection, unlock blasting machine cabinet, remove blasting machine and connect firing wires to blasting machine
16	Raise handle of blasting machine and push down rapidly. Flares will probably fail to ignite during detonation but will ignite when placed in demolition burning pit.
17	After detonation, disconnect firing wires at power source.
18	Transport metal scrap to demolition burning pit for further disposal. Insure that all fire is extinguished before transporting scrap to burning pit



Table 13. Detonation of Warhead

**Equipment required:**

- a. Blasting cap no. 8, FSN 1375-028-5215.

**Note. Blasting cap should be tested for continuity before being transported to destruction site.**

- b. Blasting galvanometer, FSN 6675-212-5625.
- c. Detect-A-Meter, FSN 6625-356-0295.
- d. Detonating cord No. 100, FSN 1375-078-5164.
- e. Firing wires, FSN 6145-188-3657.
- f. Masking tape, FSN 7510-266-6710.
- g. Plastic explosive (composition C4), FSN 1375-028-5148.
- h. Protective clothing.
- i. Safety glasses, FSN 4240-276-7343.

Step	Operation
1	Dig a pit or trench approximately four feet deep 300 feet from barricade.
2	Lay two firing wires from barricade to destruction site.
3	Twist ends of firing wires together and connect to ground at barricade.
4	Transport warhead to destruction site.
5	Remove the warhead from the shipping and storage container and place in the pit with forward and down.
6	Transport warhead container from destruction area to a safe place.
7	Tie a double knot in detonating cord (54 inches long) approximately six inches from one end and mold one-half pound of composition C4 explosives around the knot.
8	Place the explosive near the center of aft end of warhead and secure in place with masking tape.
9	Cover the warhead with at least two feet of earth.
10	Using a detect-a-meter, check firing wires for stray current.
11	Clear area of all personnel except two operators. One operator will make electrical connections at destruction sight while the second operator observes from the barricade.
12	Untwist ends of blasting cap lead wires and connect to firing wires.
13	Tape blasting cap to detonating cord and retire to barricade.
14	Disconnect firing wires at ground and untwist ends.
15	Touch ends of wires to blasting galvanometer. If needle shows a deflection, unlock blasting machine cabinet and remove the blasting machine.
16	Connect firing wires to blasting machine.
17	Raise handle of blasting machine and push down rapidly.
18	After detonation, disconnect firing wires at power source and connect to ground.

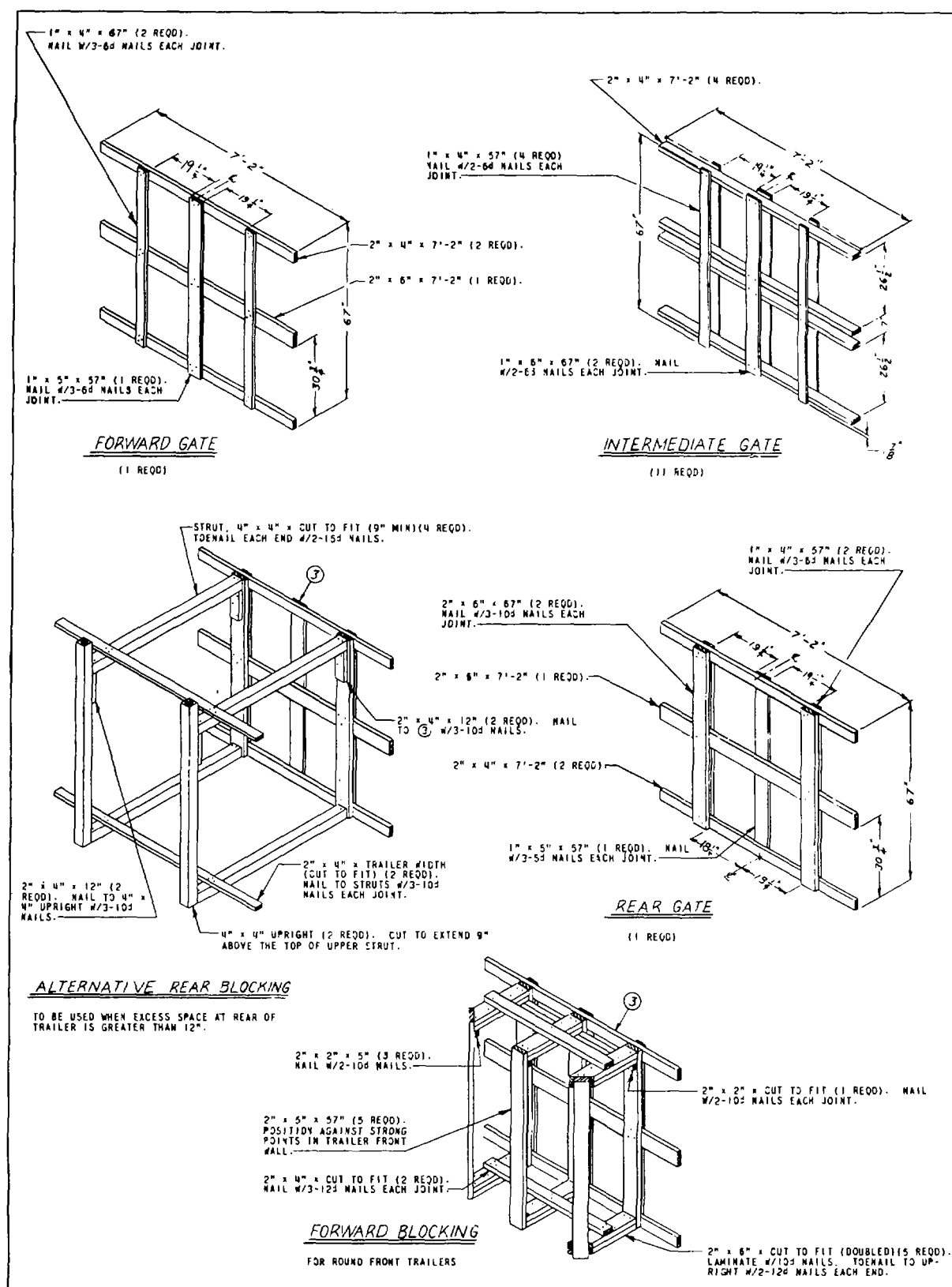


<u>GENERAL NOTES</u>		<div style="text-align: center; font-size: small;">APPROVED BUREAU OF EXPLOSIVES</div> <div style="text-align: center; font-size: x-small;"> <i>A. F. Grassmuck</i>              DATE 5/21/64              PLANT ASSISTANT           </div>																																				
A.	LOAD AS SHOWN IS BASED ON A CLOSED OR OPEN TOP VAN TRAILER 38'-0" LONG x 7'-6" WIDE (INSIDE DIMENSION) WITH WOOD, WOOD, AND METAL, OR METAL FLOOR.																																					
B.	GROSS WEIGHT AND AXLE DISTRIBUTION OF WEIGHT WILL BE IN ACCORDANCE WITH PARAGRAPH B.346.4, ORDM 3-4, VOL 3.																																					
C.	SELECTION OF VEHICLE TO BE USED TO TRANSPORT GUIDED MISSILE AMMUNITION AND/OR COMPONENTS THEREOF, MUST COMPLY WITH AR 55-355, CHAPTER 213, FOR EXPLOSIVES OR OTHER DANGEROUS ARTICLES, IN FULL.																																					
D.	<u>NOTICE:</u> A SHIPMENT WILL BE POSITIONED IN THE TRAILER CONSISTENT WITH STATE WEIGHT LAWS. THE NUMBER OF UNITS MAY BE ADJUSTED TO FIT THE DIMENSIONS OF THE VEHICLE CONCERNED OR THE QUANTITY TO BE SHIPPED; HOWEVER, THE APPROVED METHODS CONTAINED HEREIN FOR FULL OR PARTIAL TRUCKLOAD MUST BE FOLLOWED FOR BLOCKING, BRACING AND STAYING OF THIS ITEM.																																					
E.	FOR DETAIL OF CONTAINER SEE DRAWING NO 730517 (NORD AVIATION, PARIS, FRANCE). CONTAINER DIMENSIONS - 36" LONG x 18-7/8" WIDE x 21" HIGH. GROSS WEIGHT - 110 POUNDS (APPROX).																																					
F.	FOR TRAILERS NOT EQUIPPED WITH REAR CORNER POSTS, REAR BLOCKING MUST CONTACT CLOSED DOORS.																																					
G.	THIS ITEM IS AN ICC CLASS "A" EXPLOSIVE. SPECIFIED OUTLOADING PROCEDURES CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED CONTAINERS WHEN THEY ARE EMPTY OR LOADED WITH AN ITEM WHICH IS IDENTIFIED DIFFERENTLY BY NOMENCLATURE THAN THE ITEM DESIGNATED WITHIN THE DRAWING TITLE.																																					
H.	LOADING OF THIS ITEM IS RESTRICTED TO FOUR(4) LAYERS IN HEIGHT																																					
 <u>MATERIAL SPECIFICATIONS</u>  LUMBER. SEE PARAGRAPH B.430, ORDM 3-4, VOL 3.  NAILS: COMMON, CEMENT COATED, FED SPEC FF-N-105. ALT: ANNULAR-RING TYPE NAIL OF SAME SIZE.																																						
<div style="text-align: center; font-weight: bold; font-size: small;">LOADING &amp; BRACING (TL &amp; LTL) IN CLOSED OR OPEN TOP VAN TRAILER OF SSII-BI ANTITANK MISSILE, PACKED IN PLASTIC CONTAINER (FIBER GLASS)</div> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td style="width: 15%;">DRAWN BY <i>J.A.G.</i></td> <td style="width: 15%;">CHECKED BY <i>[Signature]</i></td> <td style="width: 15%;">DESIGNED BY <i>DIW/A6E</i></td> <td style="width: 15%;">SUBMITTED BY <i>[Signature]</i></td> <td style="width: 40%;"></td> </tr> <tr> <td>CLASS GWP</td> <td></td> <td></td> <td>AAI</td> <td>APPROVED BY <i>[Signature]</i> EXPL. UNIT COMMANDER, SHAWNEE ARMY DEPOT</td> </tr> <tr> <td colspan="4" style="text-align: center; font-weight: bold;">REVISIONS</td> <td rowspan="5" style="vertical-align: top; padding: 5px;"> <div style="text-align: center; font-weight: bold; font-size: small;">APPROVED</div> <div style="text-align: center; font-size: x-small;"> <i>Andrew W. Blid</i>              APPROVED BY ORDER OF COMMANDER, ARMY SUPPLY &amp; MAINTENANCE COMMAND              MATERIEL COMMAND USA              10 JUNE 1964           </div> </td> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr> <td> </td><td> </td><td> </td><td> </td><td> <div style="display: flex; justify-content: space-between; font-size: x-small;"> <span>CLASS</span> <span>DIVISION</span> <span>DRAWING</span> <span>FILE</span> </div> <div style="display: flex; justify-content: space-between; font-weight: bold;"> <span>19</span> <span>48</span> <span>5722</span> <span>GM IIA120</span> </div> </td> </tr> </table>			DRAWN BY <i>J.A.G.</i>	CHECKED BY <i>[Signature]</i>	DESIGNED BY <i>DIW/A6E</i>	SUBMITTED BY <i>[Signature]</i>		CLASS GWP			AAI	APPROVED BY <i>[Signature]</i> EXPL. UNIT COMMANDER, SHAWNEE ARMY DEPOT	REVISIONS				<div style="text-align: center; font-weight: bold; font-size: small;">APPROVED</div> <div style="text-align: center; font-size: x-small;"> <i>Andrew W. Blid</i>              APPROVED BY ORDER OF COMMANDER, ARMY SUPPLY &amp; MAINTENANCE COMMAND              MATERIEL COMMAND USA              10 JUNE 1964           </div>																					<div style="display: flex; justify-content: space-between; font-size: x-small;"> <span>CLASS</span> <span>DIVISION</span> <span>DRAWING</span> <span>FILE</span> </div> <div style="display: flex; justify-content: space-between; font-weight: bold;"> <span>19</span> <span>48</span> <span>5722</span> <span>GM IIA120</span> </div>
DRAWN BY <i>J.A.G.</i>	CHECKED BY <i>[Signature]</i>	DESIGNED BY <i>DIW/A6E</i>	SUBMITTED BY <i>[Signature]</i>																																			
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REVISIONS				<div style="text-align: center; font-weight: bold; font-size: small;">APPROVED</div> <div style="text-align: center; font-size: x-small;"> <i>Andrew W. Blid</i>              APPROVED BY ORDER OF COMMANDER, ARMY SUPPLY &amp; MAINTENANCE COMMAND              MATERIEL COMMAND USA              10 JUNE 1964           </div>																																		
				<div style="display: flex; justify-content: space-between; font-size: x-small;"> <span>CLASS</span> <span>DIVISION</span> <span>DRAWING</span> <span>FILE</span> </div> <div style="display: flex; justify-content: space-between; font-weight: bold;"> <span>19</span> <span>48</span> <span>5722</span> <span>GM IIA120</span> </div>																																		

ORD G9411

Figure 33. Loading and bracing in closed or open top van trailer, (sheet 1 of 6).

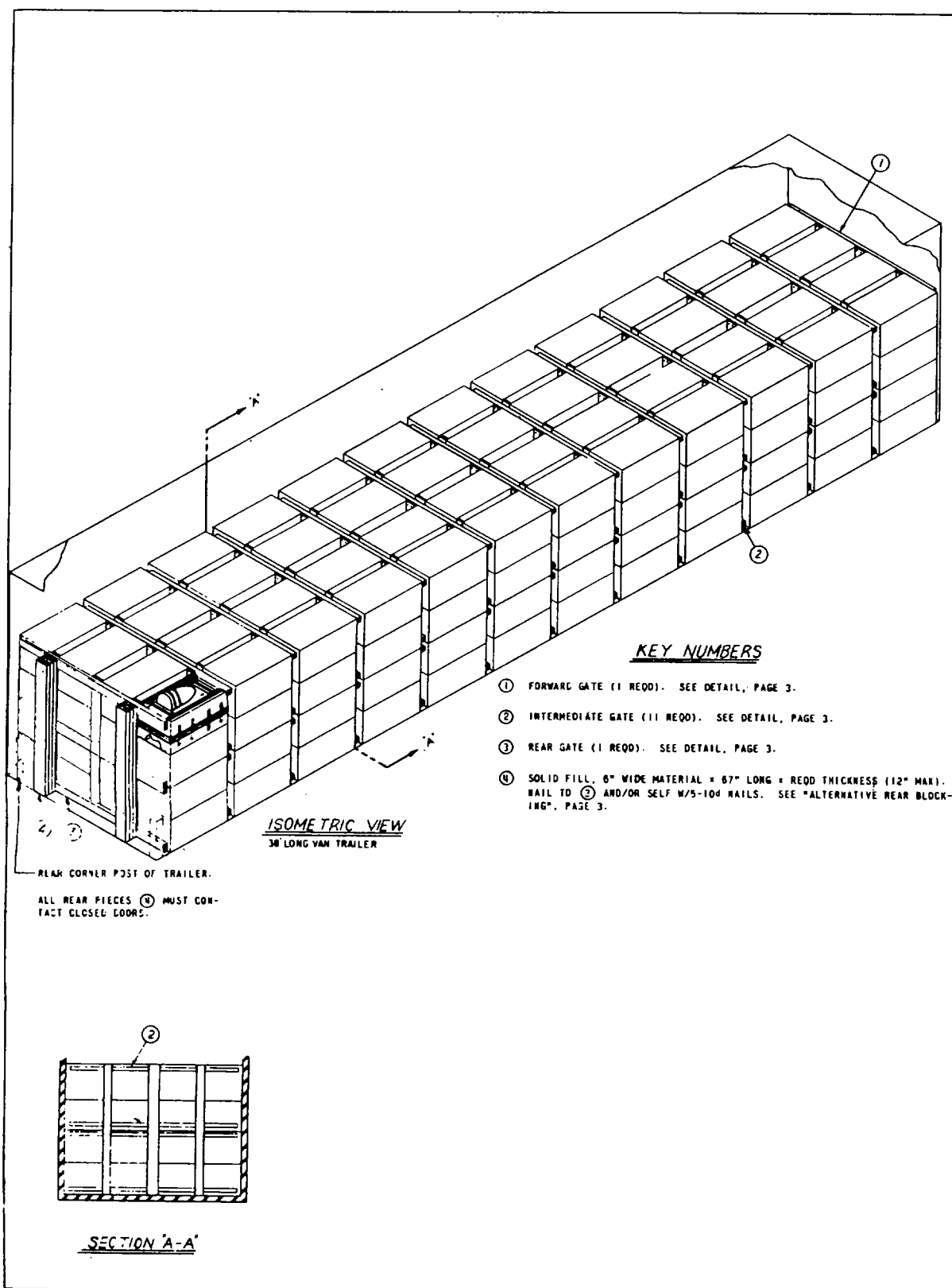




ORD G9412

Figure 33. Loading and bracing in closed or open top van trailer, (sheet 2 of 6).

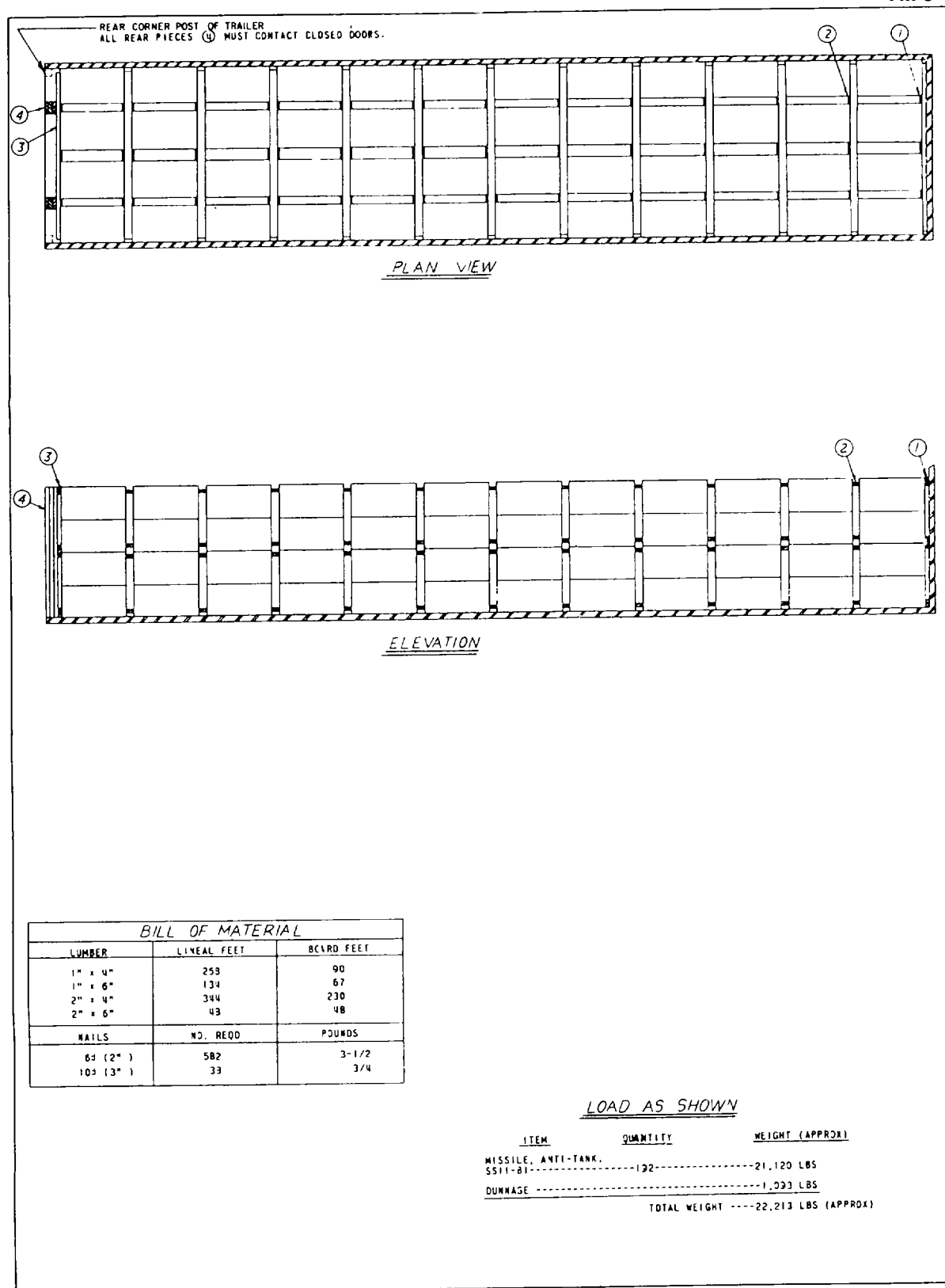




ORD G9413

Figure 33. Loading and bracing in closed or open top van trailer, (sheet 3 of 6).

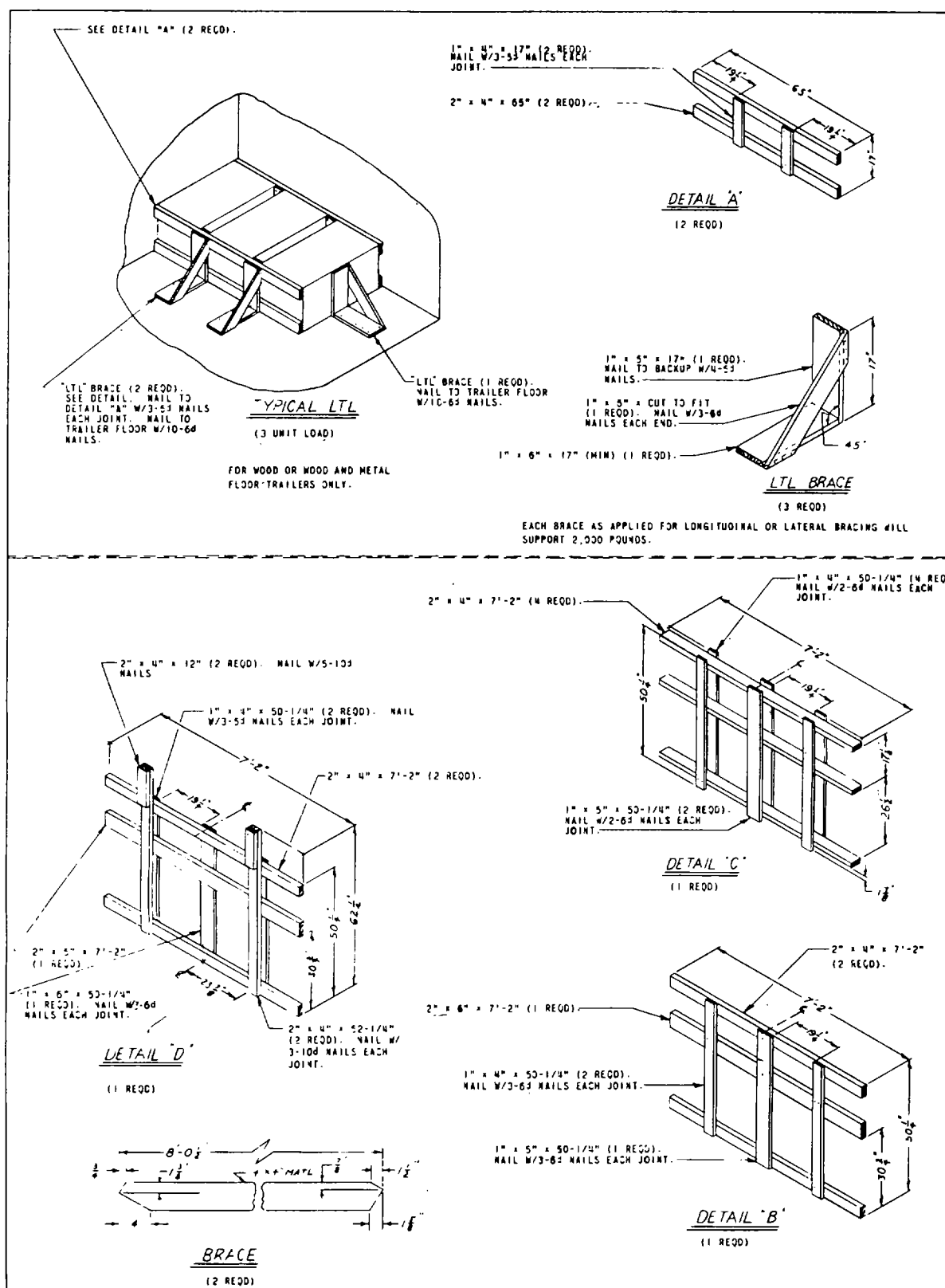




ORD G9414

Figure 33. Loading and bracing in closed or open top van trailer, (sheet 4 of 6).

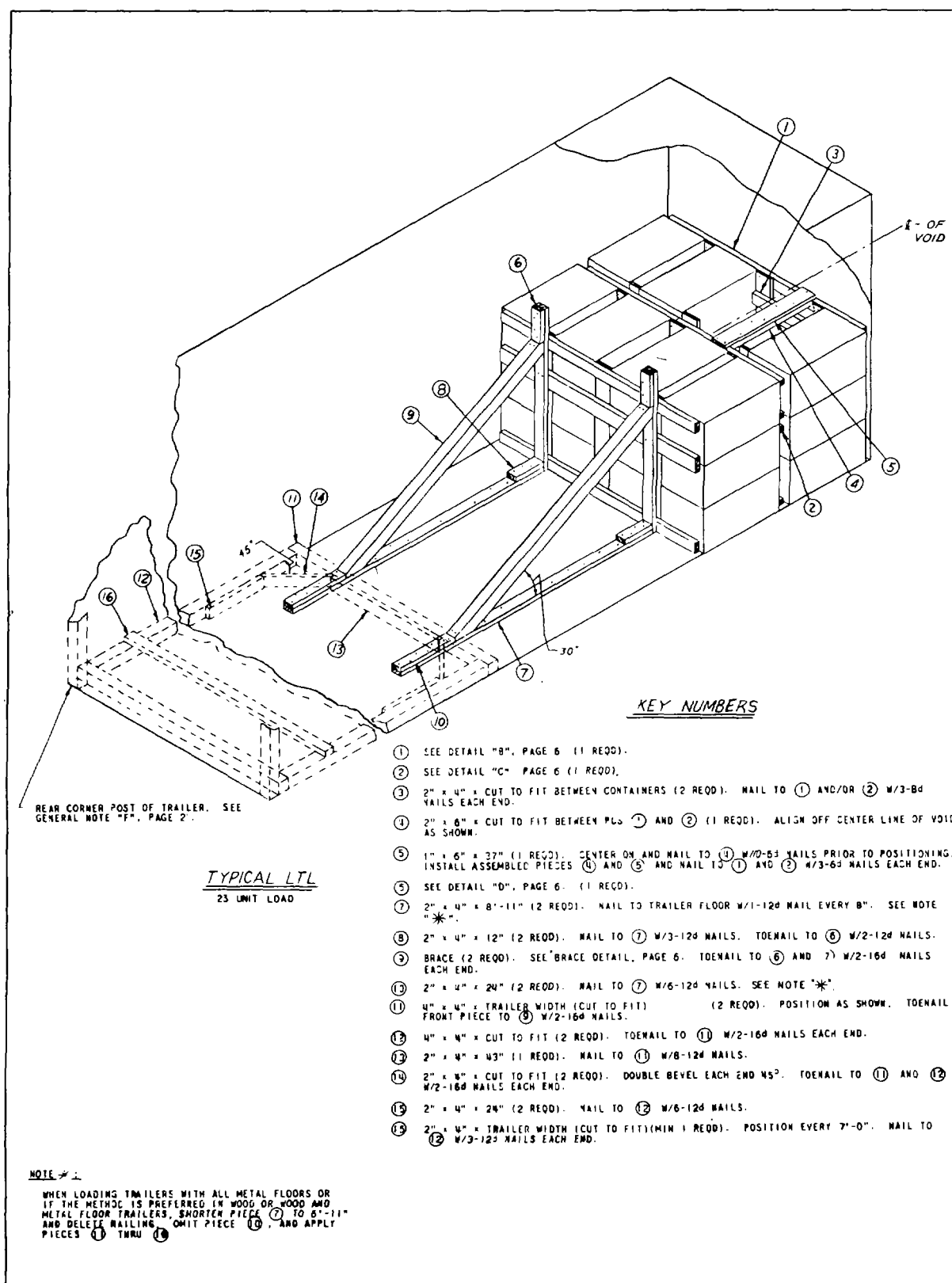




ORD G9415

Figure 33. Loading and bracing in closed or open top van trailer, (sheet 5 of 6).

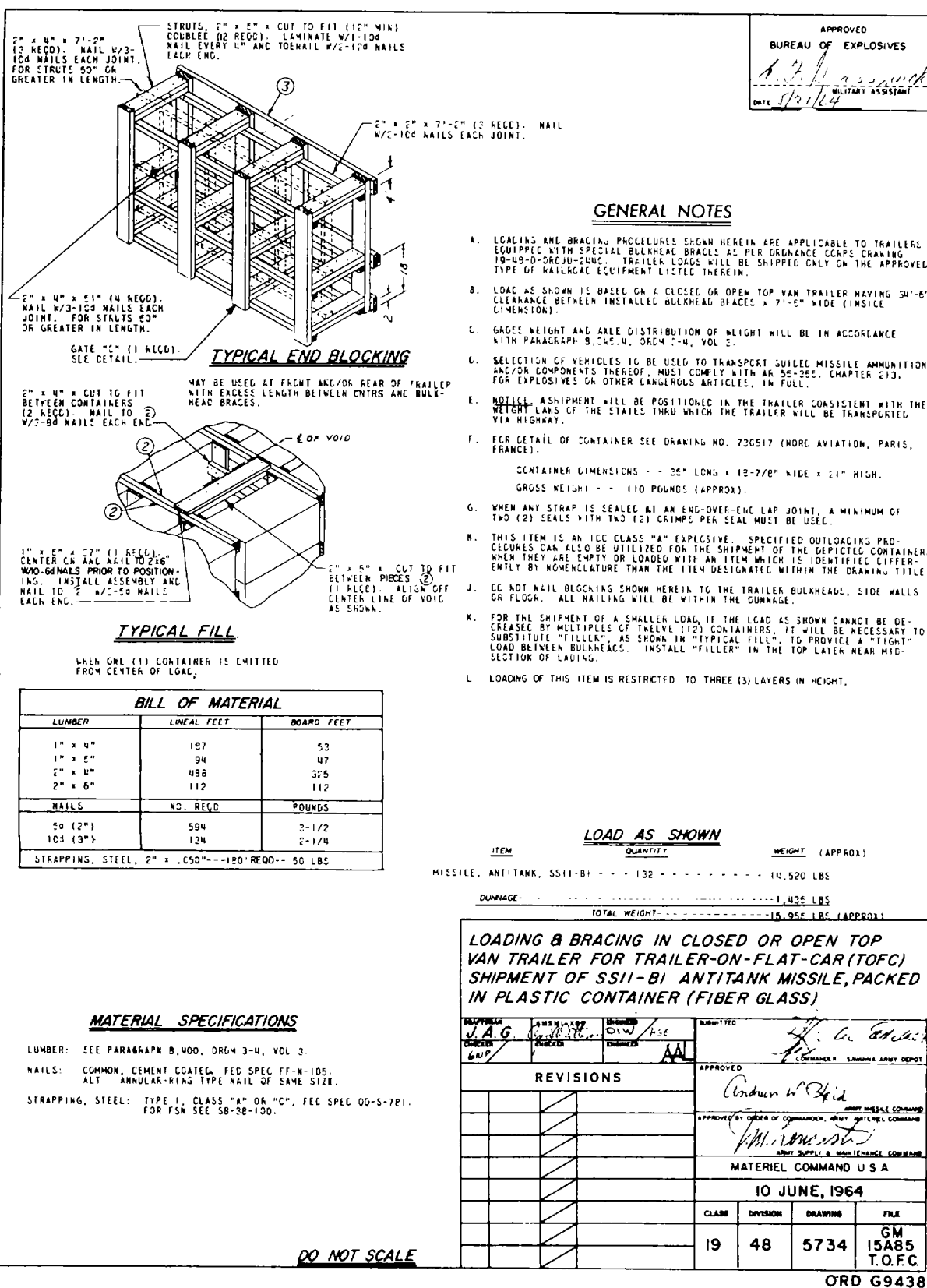




ORD G9416

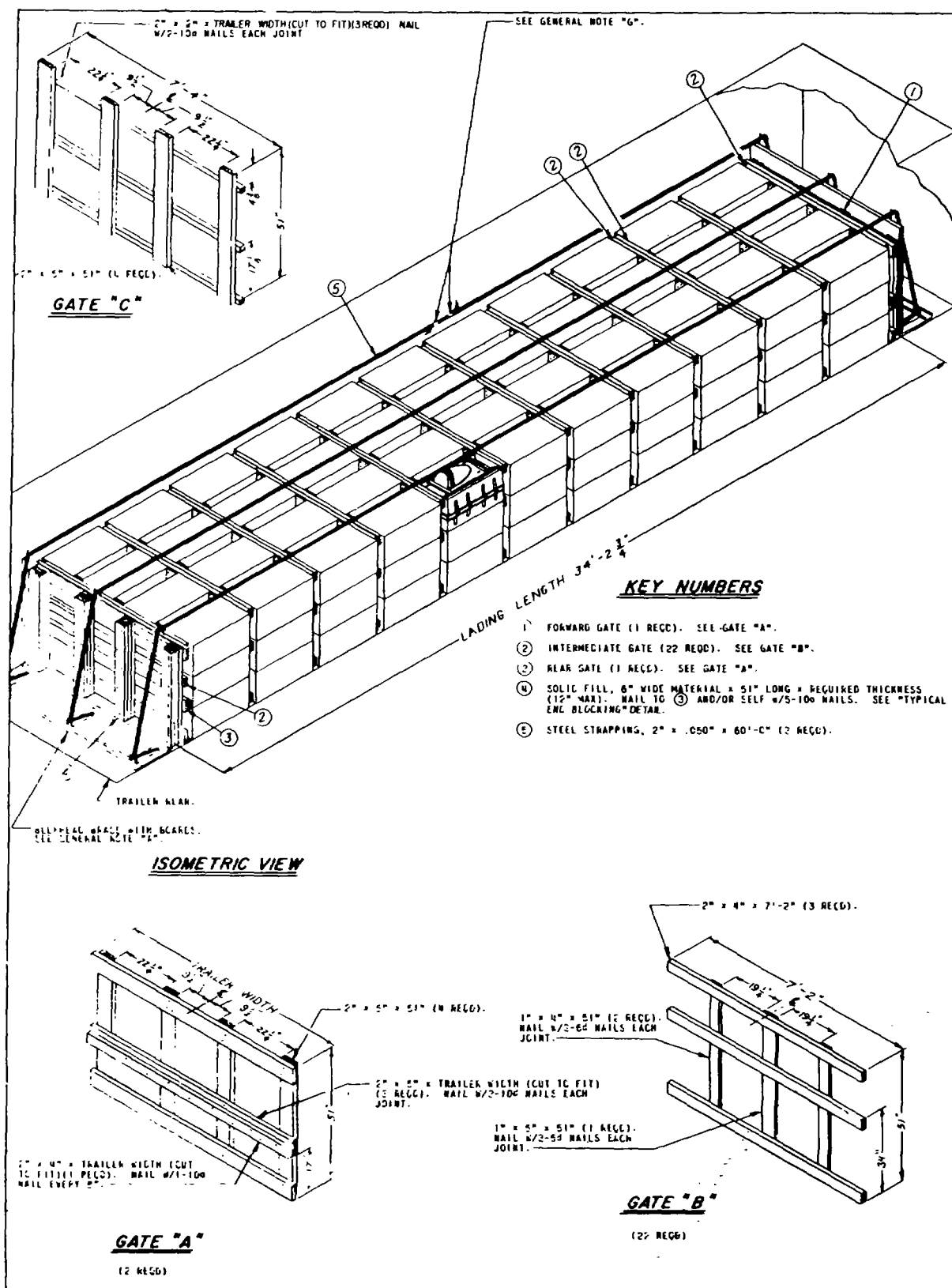
Figure 33. Loading and bracing in closed or open top van trailer, (sheet 6 of 6).





**Figure 34. Loading and bracing in closed or open top van trailer for trailer-on flat-car shipment, (sheet 1 of 2).**





**Figure 34. Loading and bracing in closed or open top van trailer for trailer-on flat-car shipment, (sheet 2 of 2).**



# GENERAL NOTES

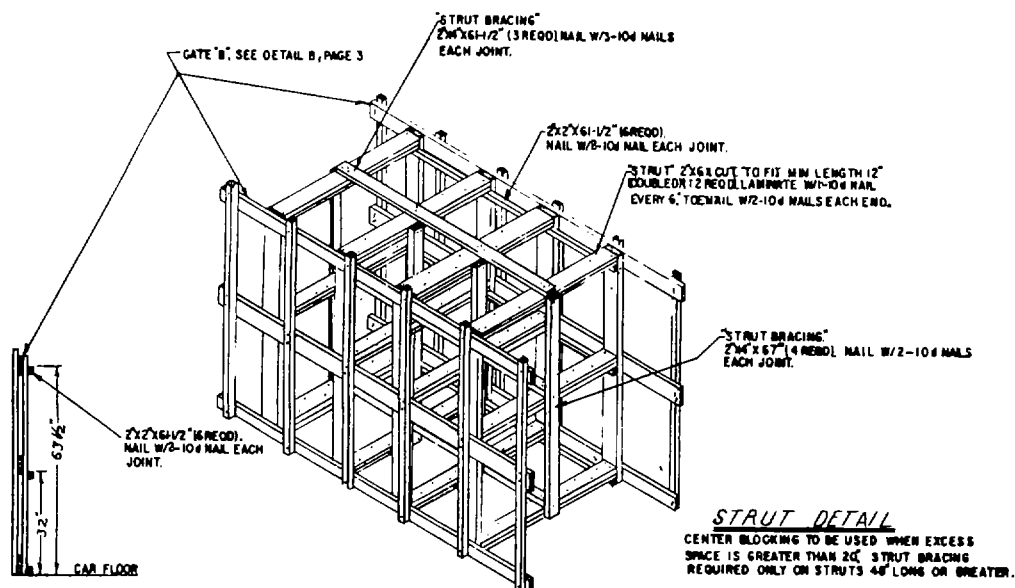
- A. THE LOAD AS SHOWN ON PAGES 4 AND 5 IS BASED ON A BOX CAR 50'-0" LONG x 8'-0" WIDE WITH 8'-0" (MIN) DOORWAY OPENING.
- B. THE LOAD AS SHOWN ON PAGES 6 AND 7 IS BASED ON A BOX CAR 50'-0" LONG x 9'-2" WIDE WITH 8'-0" (MIN) DOORWAY OPENING.
- C. SELECTION OF RAIL CARS FOR THE TRANSPORT OF THIS ITEM, WILL BE IN ACCORDANCE WITH PARAGRAPH 3.300.4, ORDM 3-4, VOL 3.
- D. NOTICE: A SHIPMENT WILL BE POSITIONED IN THE RAIL CAR IN COMPLIANCE WITH THE WEIGHT DISTRIBUTION REQUIREMENTS OF THE AAR. THE NUMBER OF UNITS MAY BE ADJUSTED TO FIT THE RAIL CAR CONCERNED OR THE QUANTITY TO BE SHIPPED; HOWEVER, THE APPROVED METHODS CONTAINED HEREIN FOR FULL OR PARTIAL LOADS MUST BE FOLLOWED FOR BLOCKING, BRACING AND STAYING OF THIS ITEM.
- E. FOR DETAIL OF CONTAINER SEE DRAWING NO 730517 (WORD AVIATION, PARIS, FRANCE).  
CONTAINER DIMENSIONS - 38" LONG x 18-7/8" WIDE x 21" HIGH.  
GROSS WEIGHT - 110 POUNDS (APPROX)
- F. THIS ITEM IS AN ICC CLASS "A" EXPLOSIVE. SPECIFIED OUTLOADING PROCEDURES CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED CONTAINERS WHEN THEY ARE EMPTY OR LOADED WITH AN ITEM WHICH IS IDENTIFIED DIFFERENTLY BY NOMENCLATURE THAN THE ITEM DESIGNATED WITHIN THE DRAWING TITLE.
- G. FOR AUTHORIZED METHODS OF BRACING PARTIAL LAYERS, SEE ORDCORPS DRAWING 19-48-2213-5P34.
- H. USE COMBINATION OF LOADING PROCEDURES SHOWN HEREIN TO PROVIDE PROPER BLOCKING AND BRACING FOR THE UNIT QUANTITIES NOT DEPICTED.
- J. LOADING OF THIS ITEM IS RESTRICTED TO FOUR (4) LAYERS IN HEIGHT.

APPROVED  
BUREAU OF EXPLOSIVES

*A. J. Prosser*  
DATE 5/21/67 ASSISTANT

# MATERIAL SPECIFICATIONS

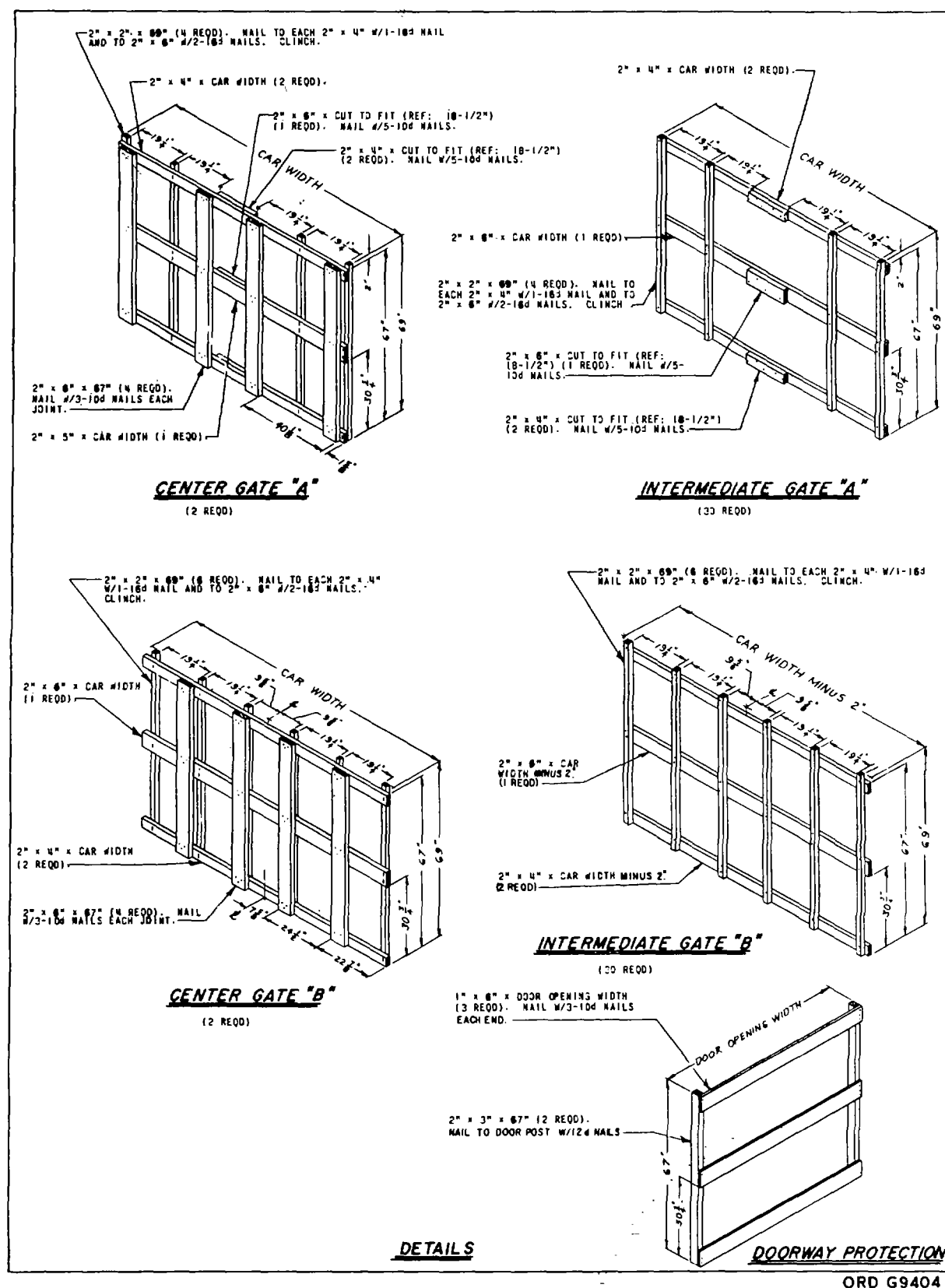
- LUMBER: SEE PARAGRAPH 9.400, ORDM 3-4, VOL 3.  
NAILS: COMMON, CEMENT COATED, FED SPEC FF-N-105.  
ALT: ANNULAR-RING TYPE NAIL OF SAME SIZE.



ORD G9403

Figure 33. Loading and bracing in box cars, (sheet 1 of 8).

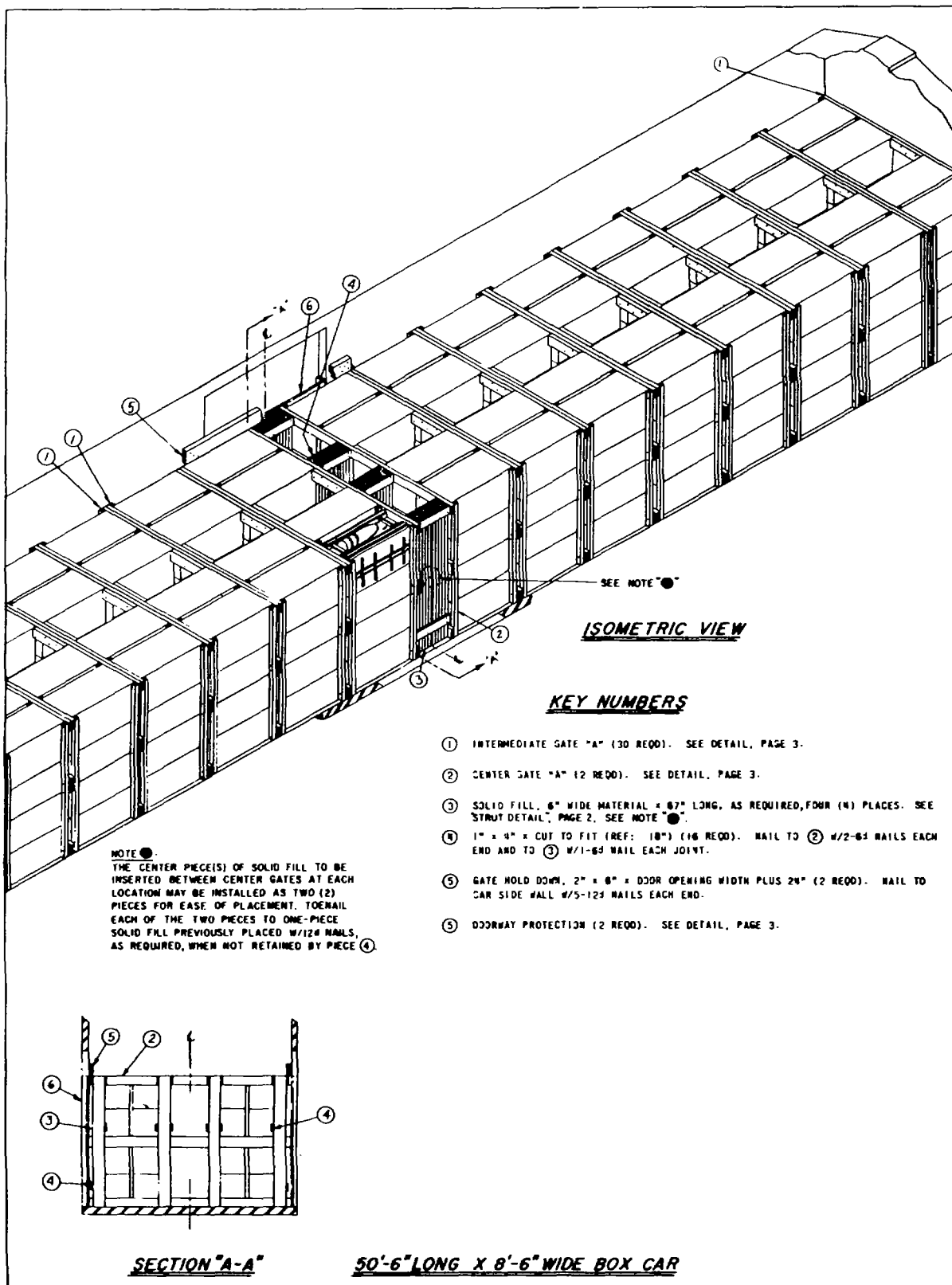




ORD G9404

Figure 35. Loading and bracing in box cars, (sheet 2 of 8).

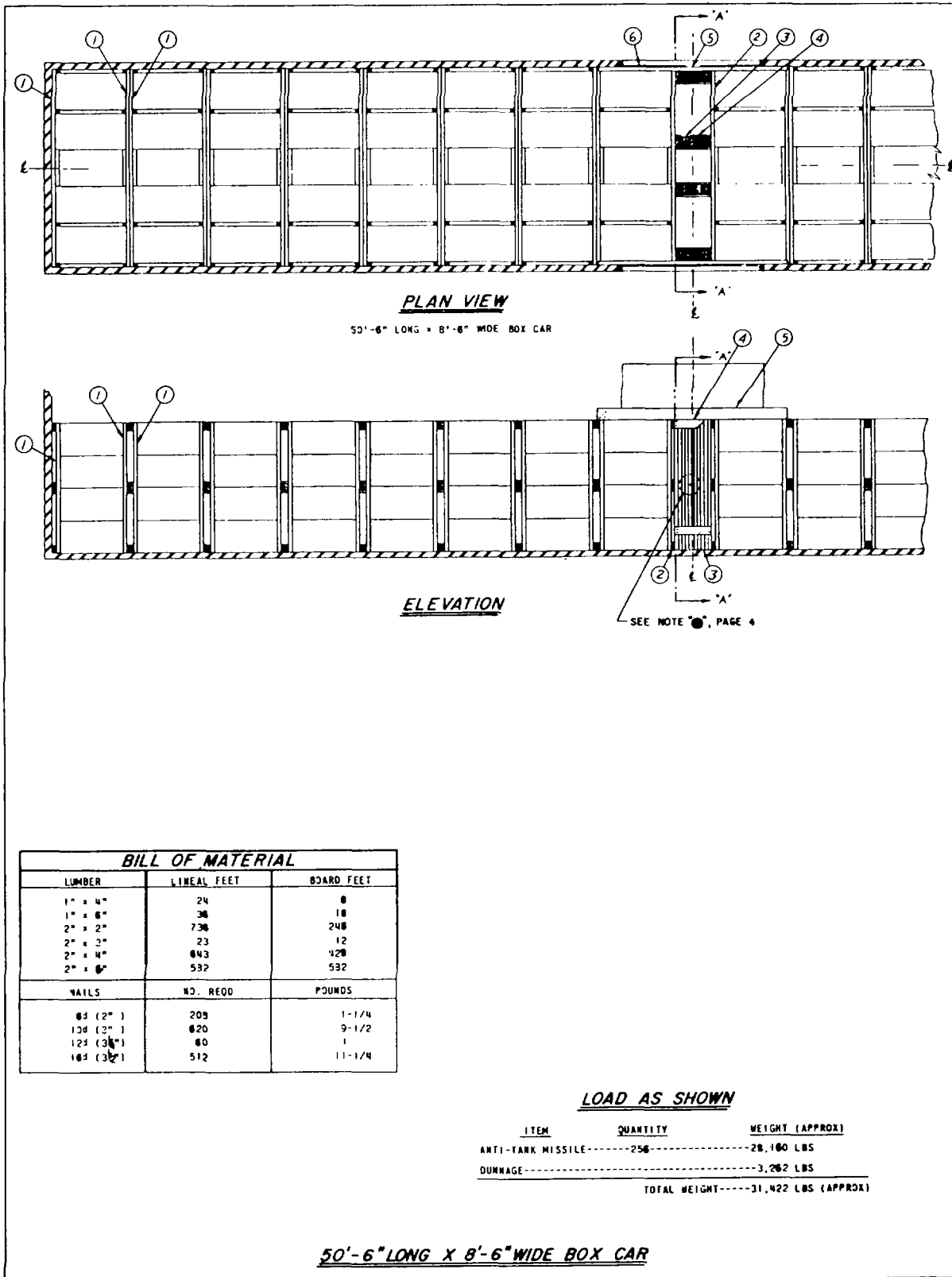




ORD G9405

Figure 35. Loading and bracing in box cars, (sheet 3 of 8).

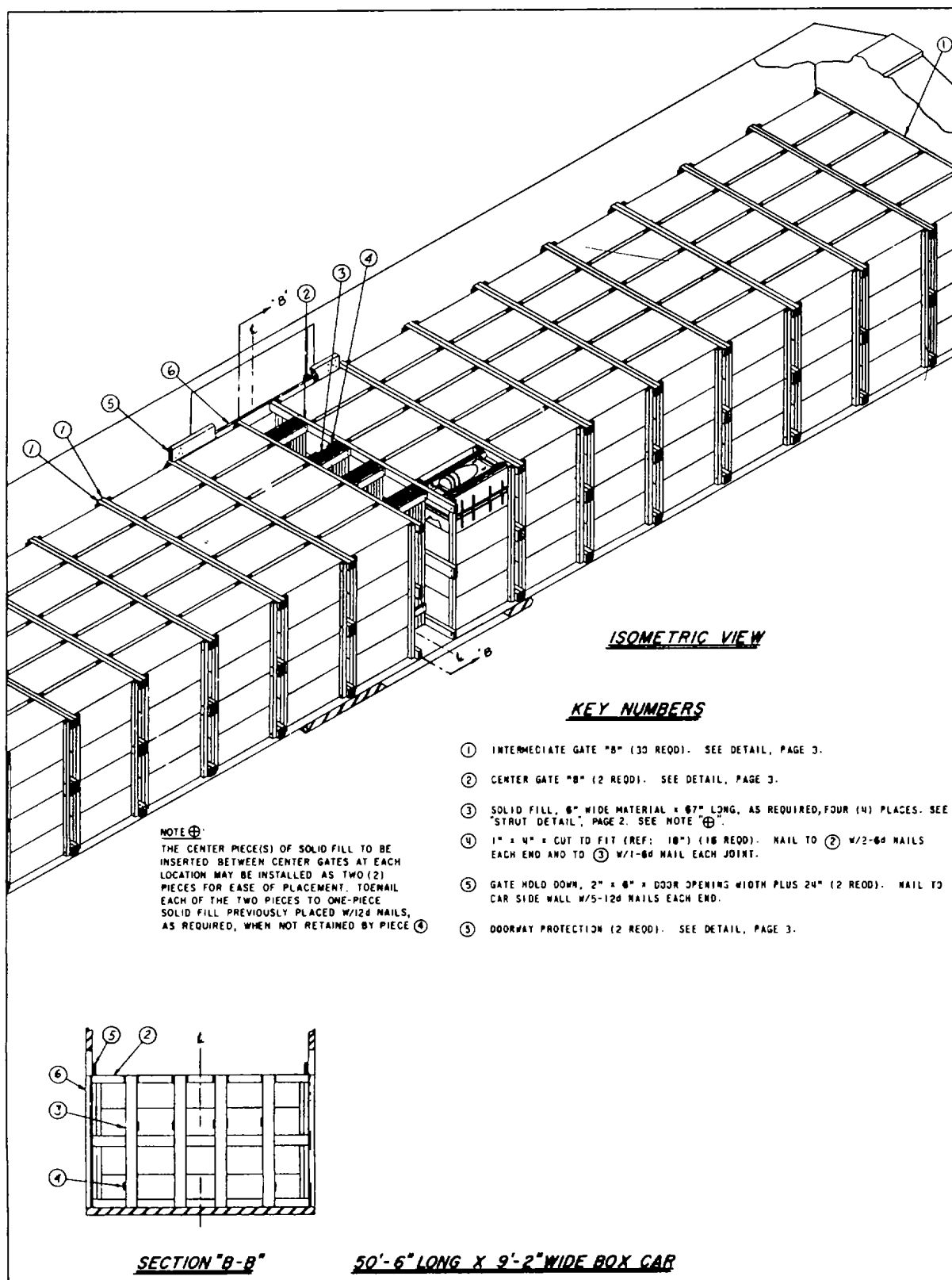




ORD G9406

Figure 35. Loading and bracing in box cars, (sheet 4 of 8).

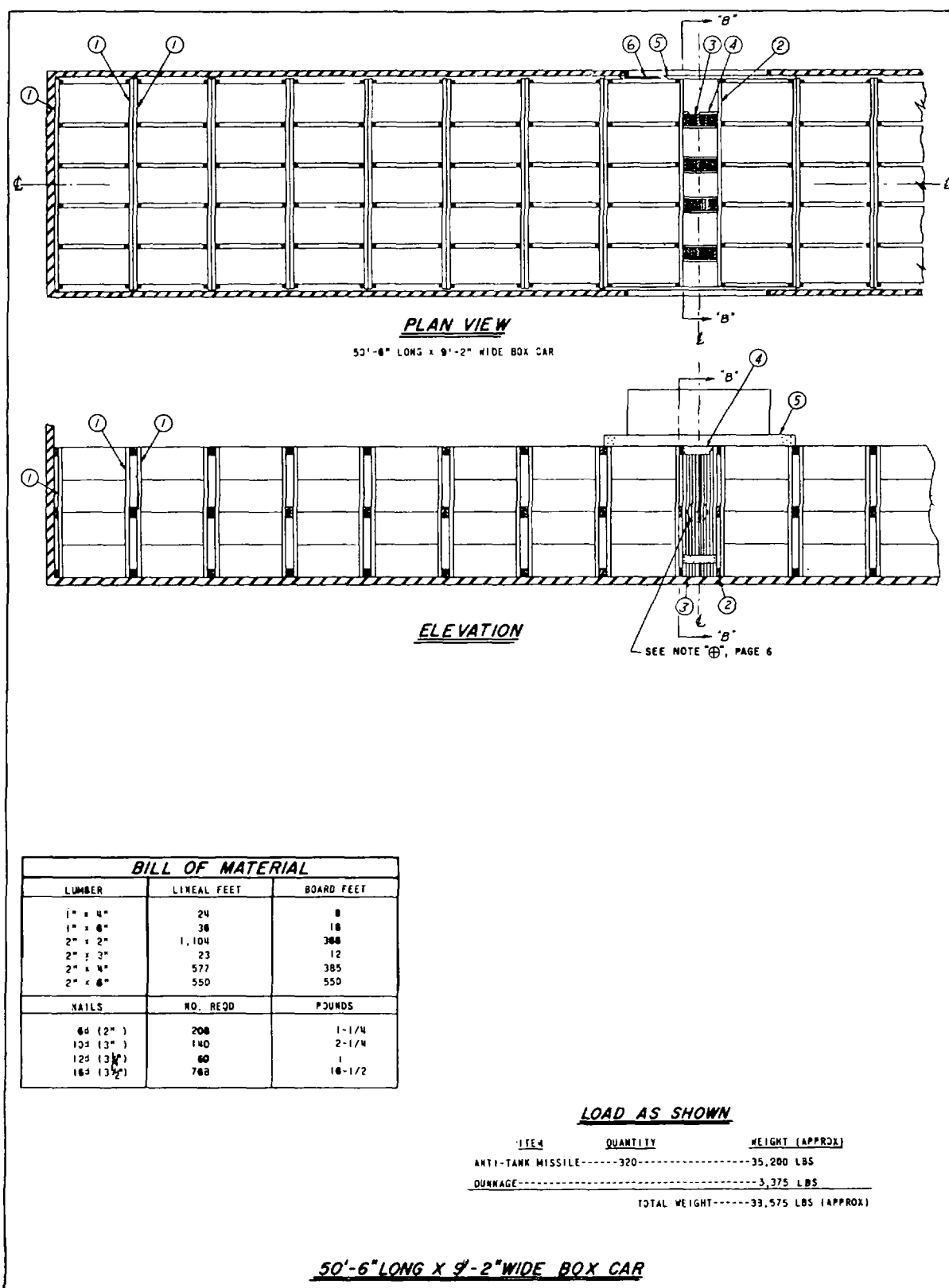




ORD G9407

Figure 35. Loading and bracing in box cars, (sheet 5 of 8).





ORD G9408

Figure 35. Loading and bracing in box cars, (sheet 6 of 8).



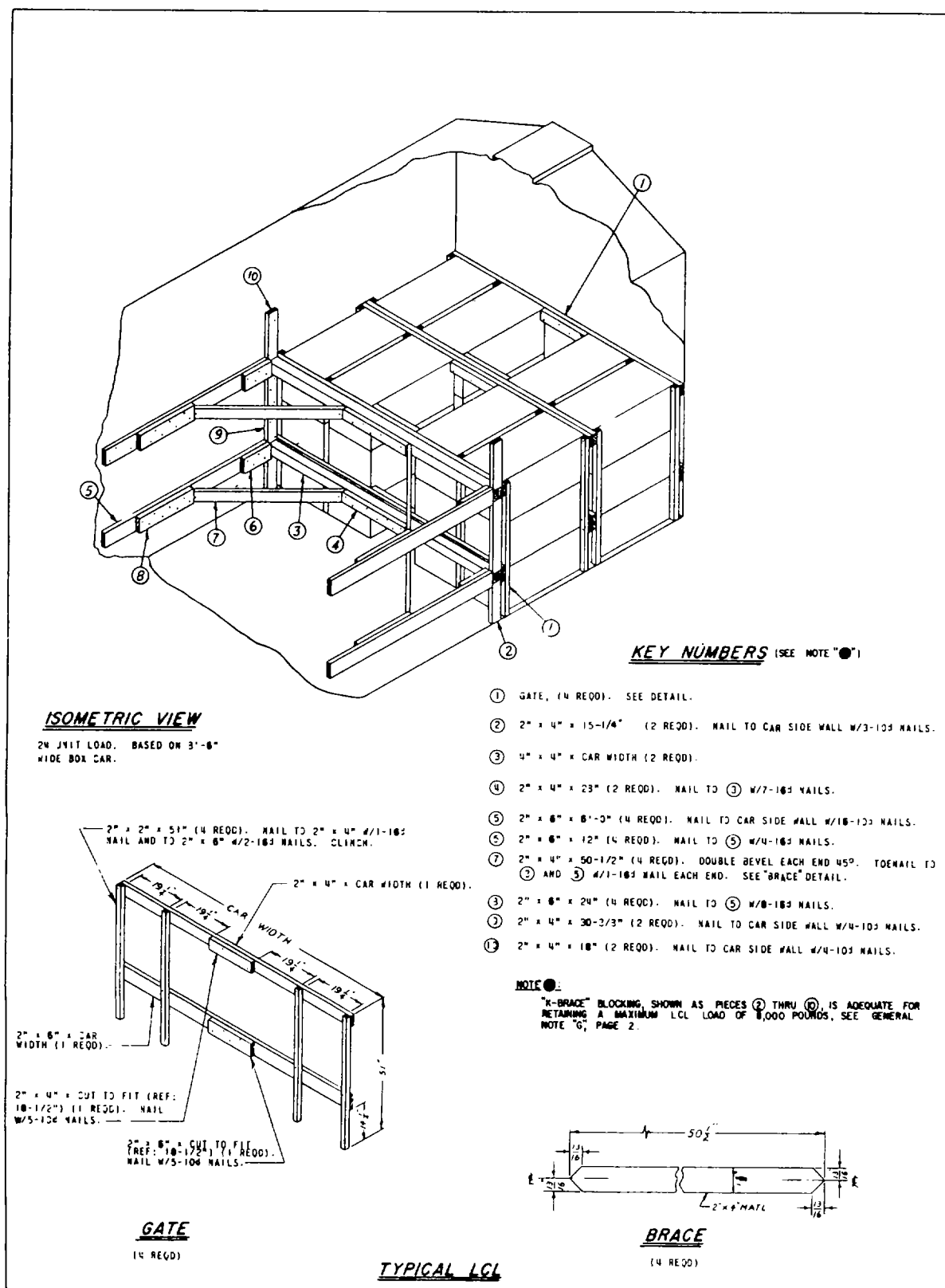


Figure 35. Loading and bracing in box cars, (sheet 7 of 8).

ORD G9409



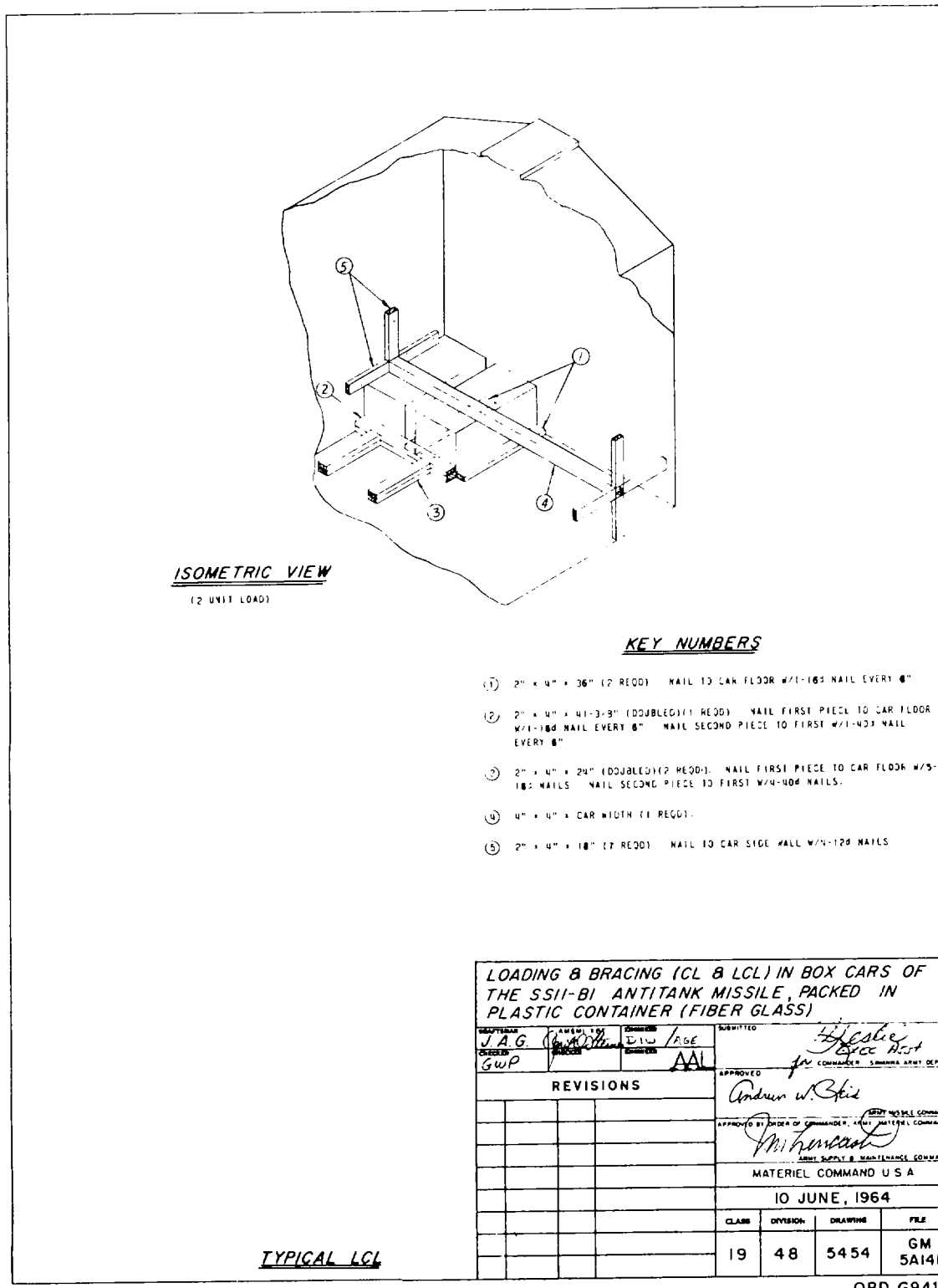
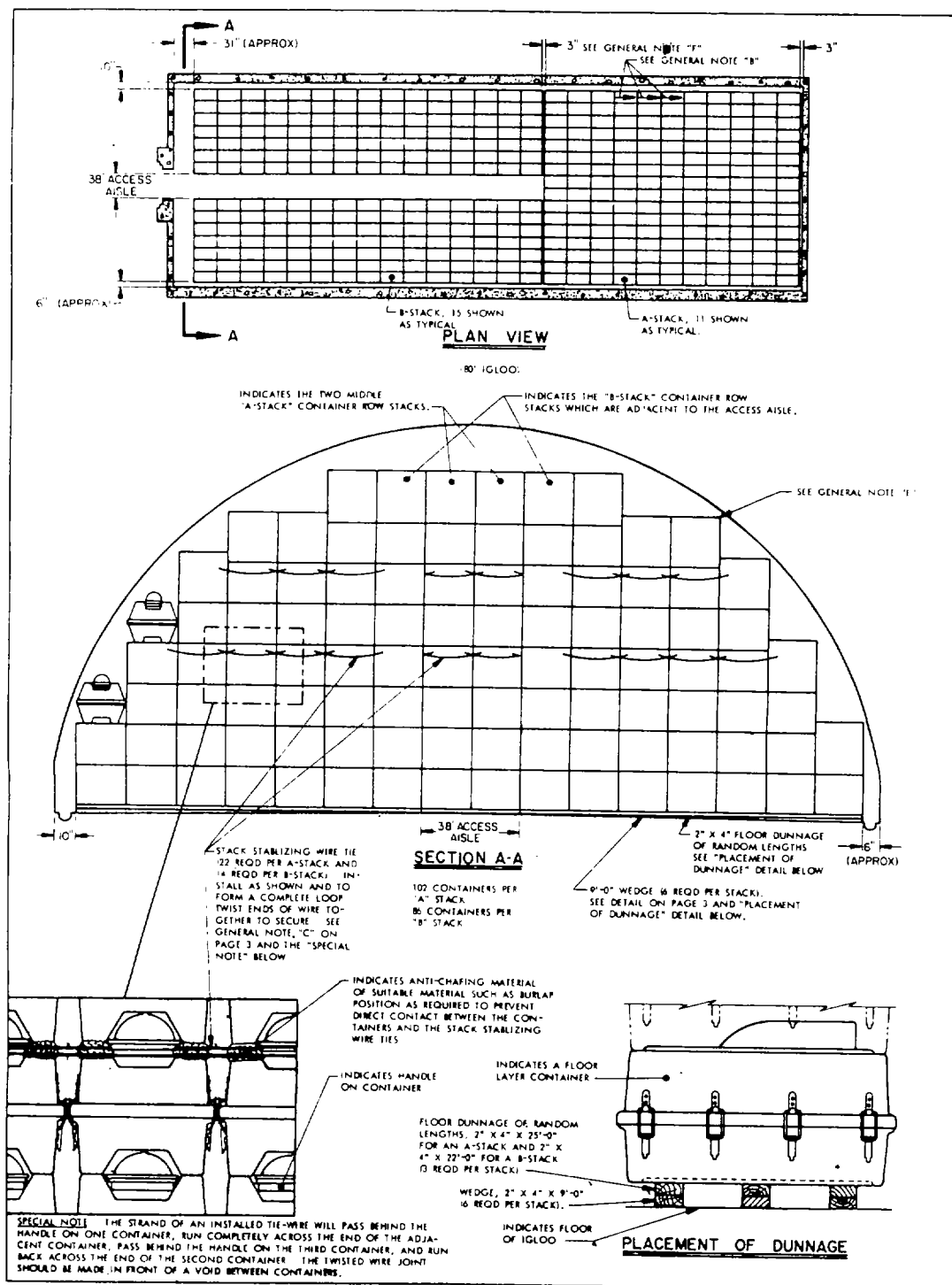


Figure 35. Loading and bracing in box cars, (sheet 8 of 8).

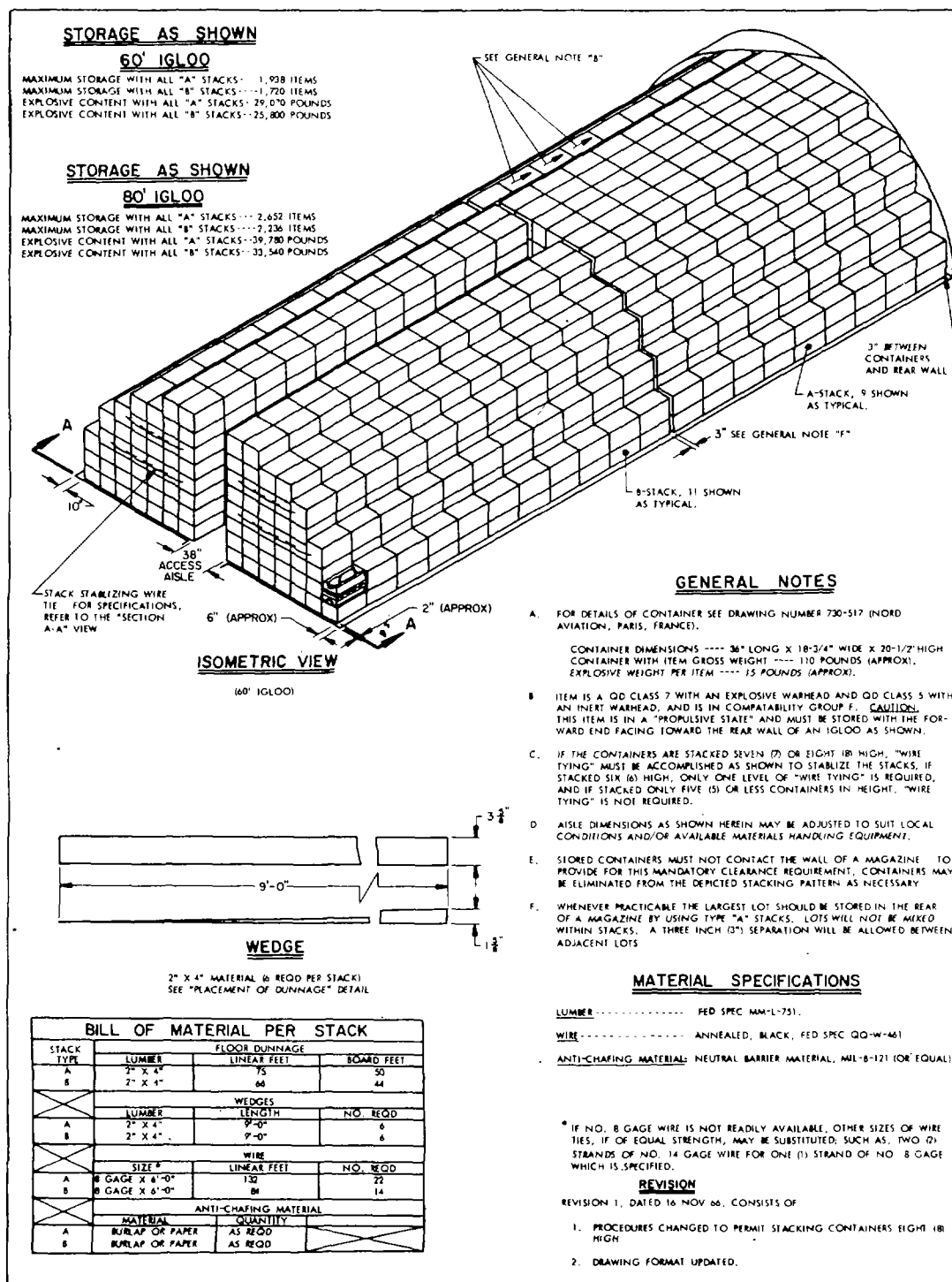




ORD G9665

Figure 36. Storage in 60- and 80-foot igloo magazines (sheet 1 of 2).

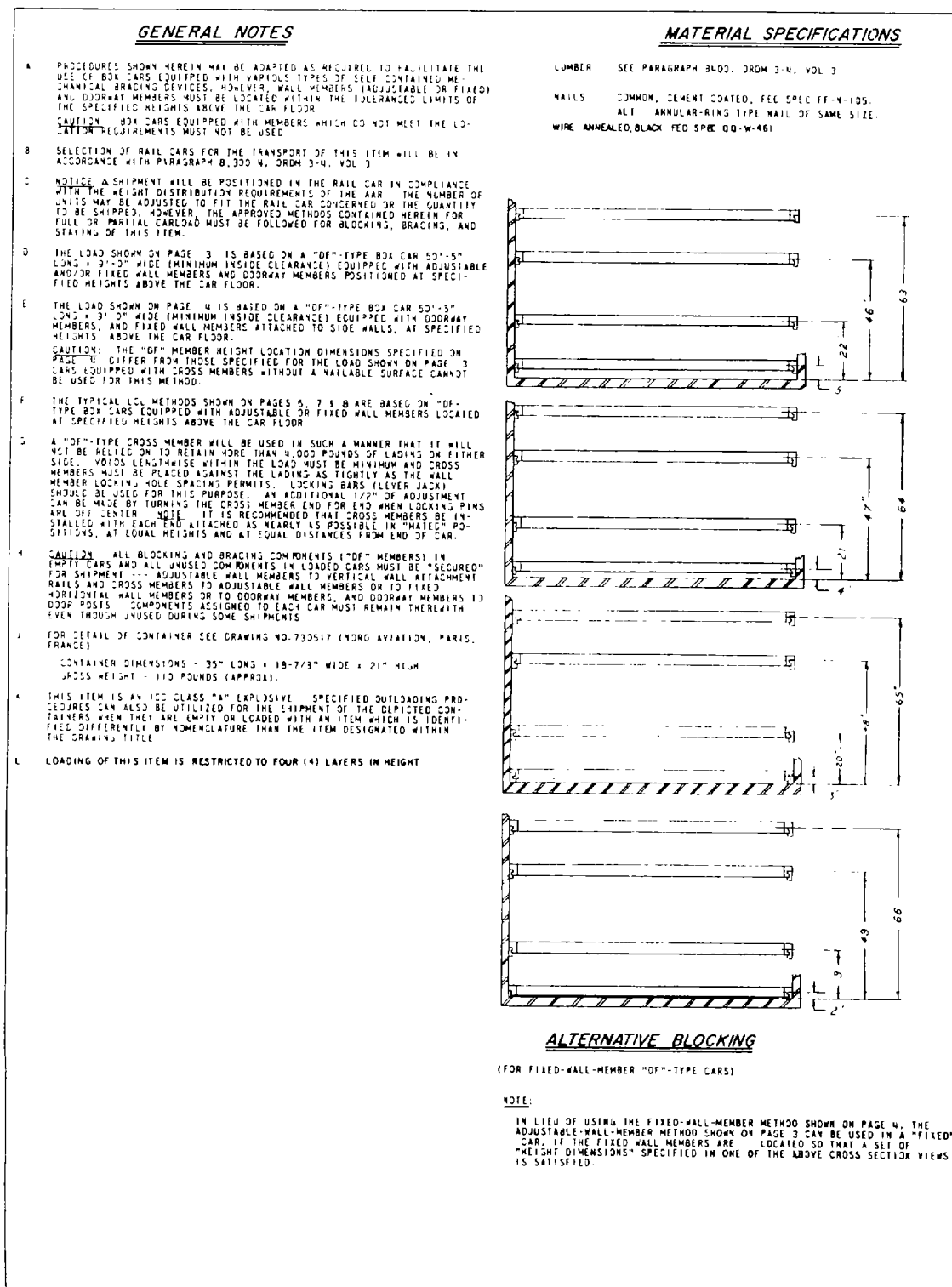




ORD G9666

Figure 36. Storage in 60- and 80-foot igloo magazines (sheet 2 of 2).

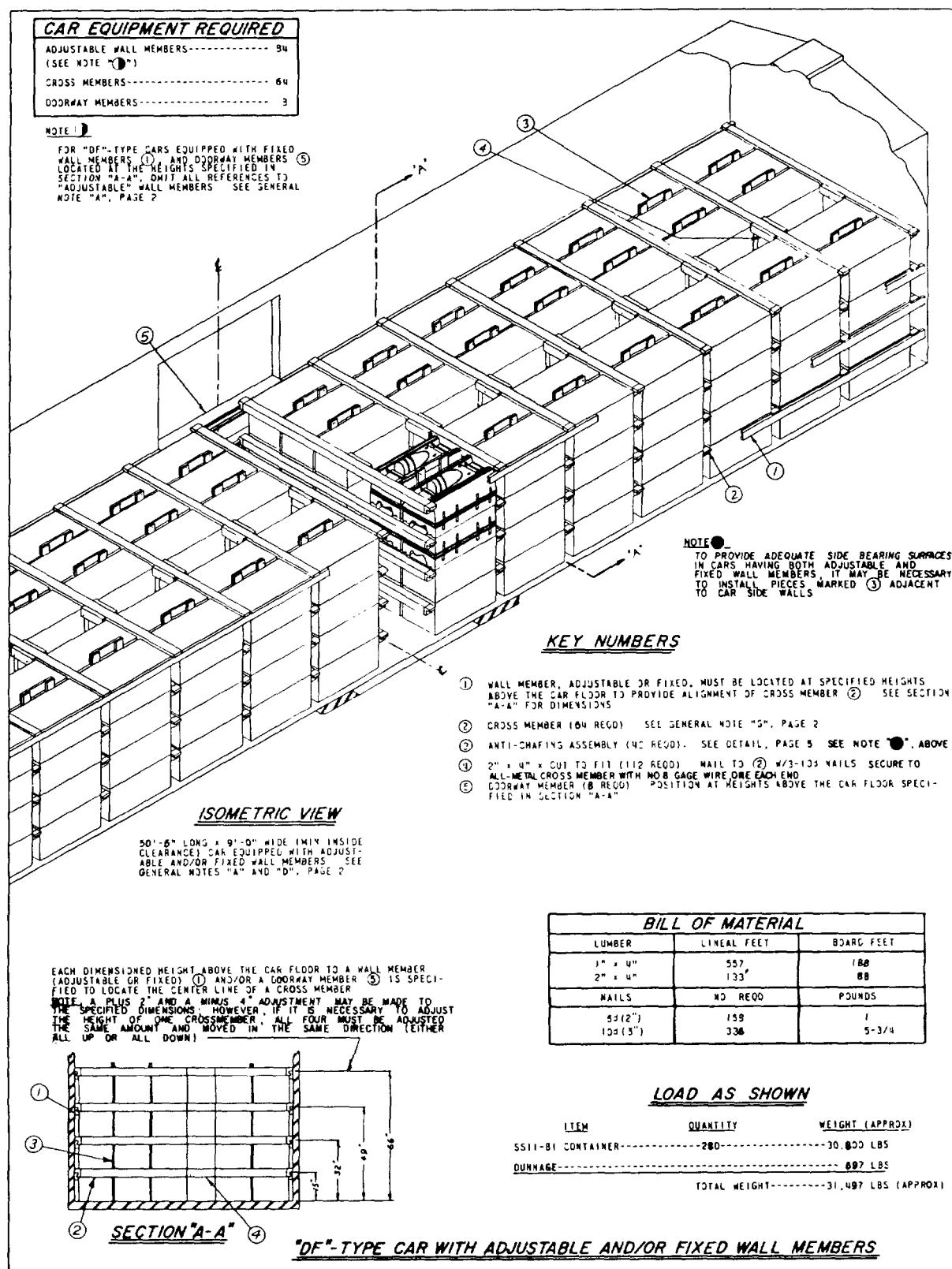




ORD G9417

Figure 37. Loading and bracing in DF type box cars, (sheet 1 of 7).

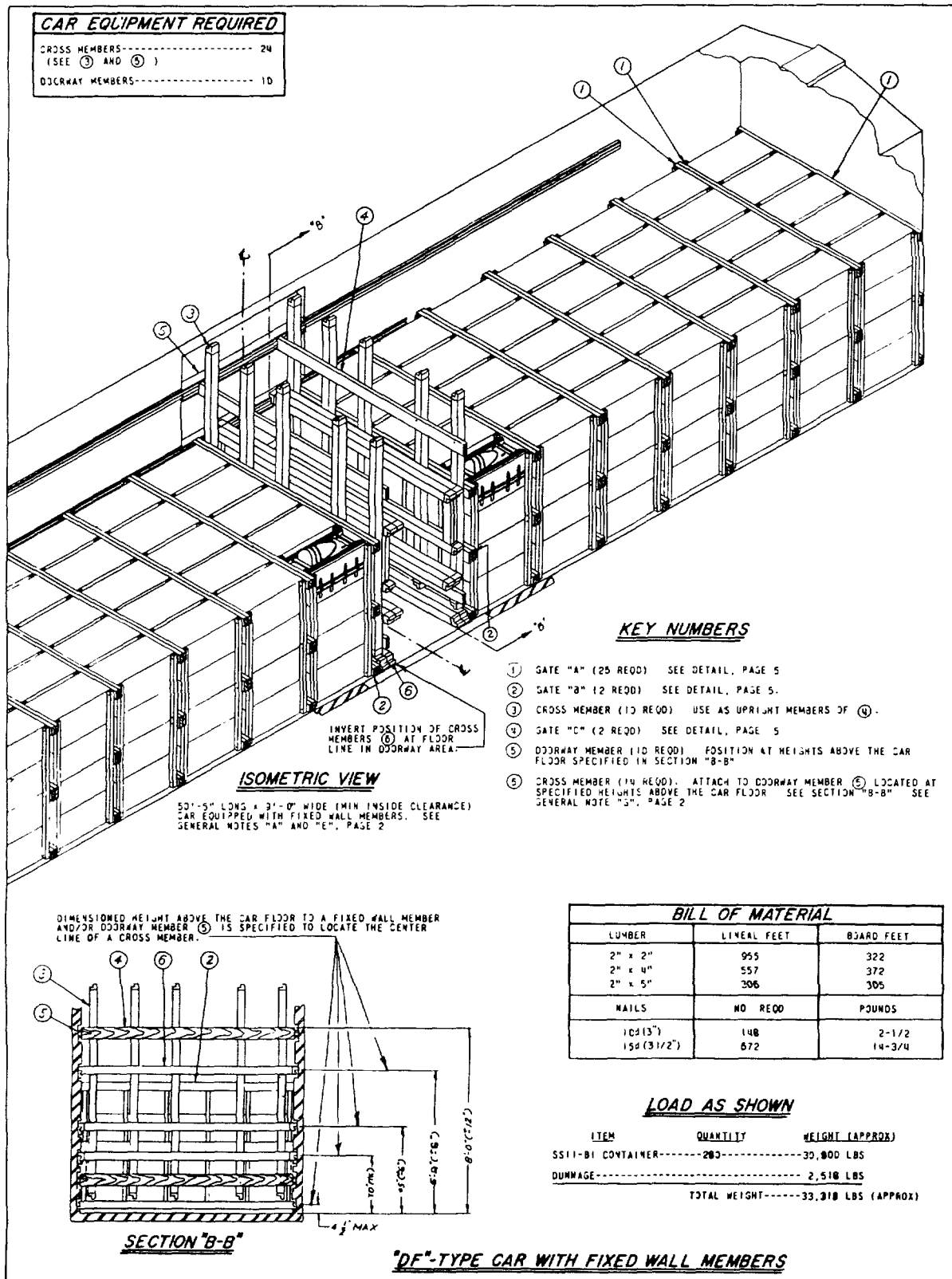




ORD G9418

Figure 37. Loading and bracing in DF type ox cars, (sheet 2 of 7).

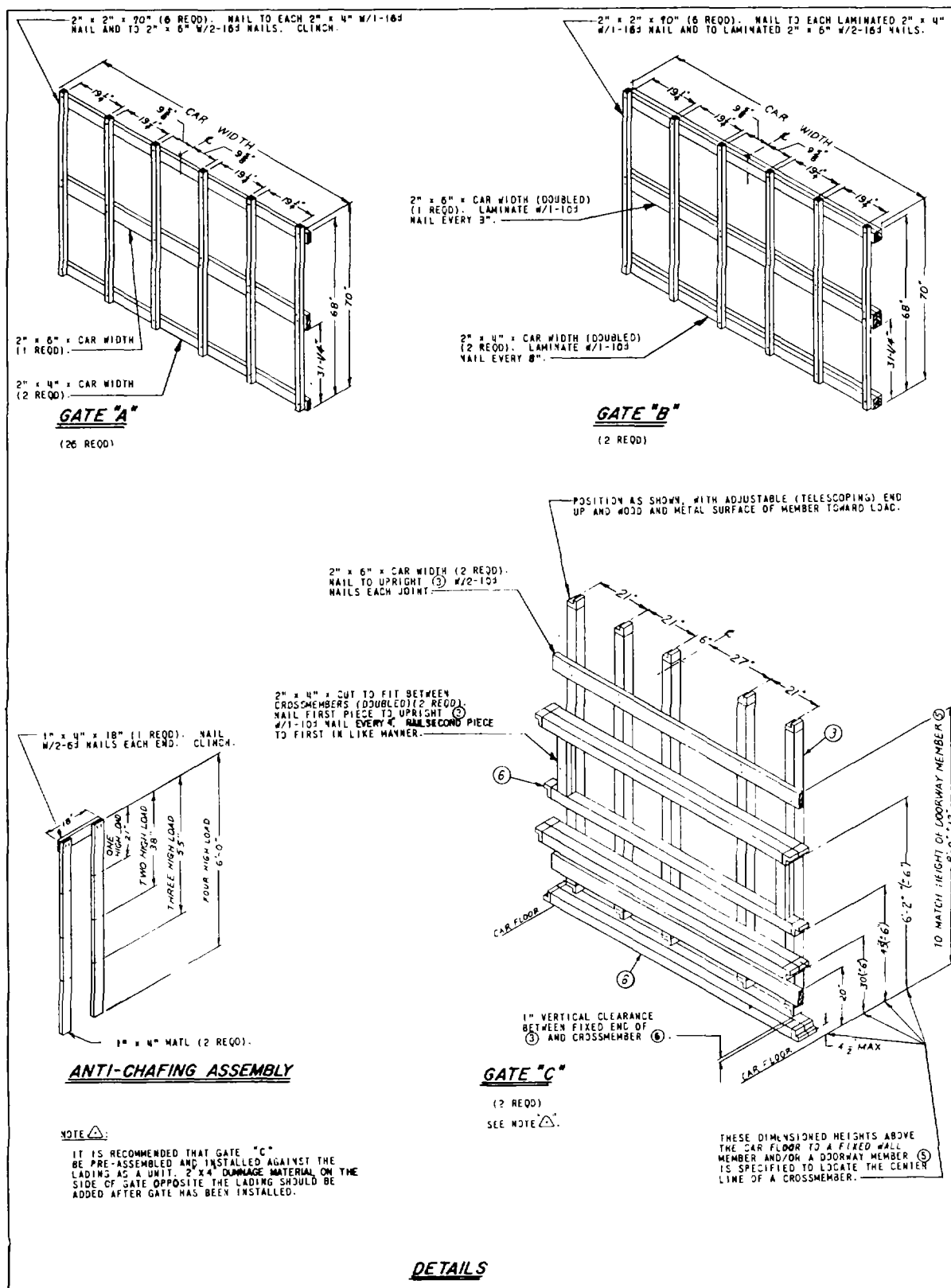




ORD G9419

Figure 37. Loading and bracing in DF type box cars, (sheet 3 of 7).

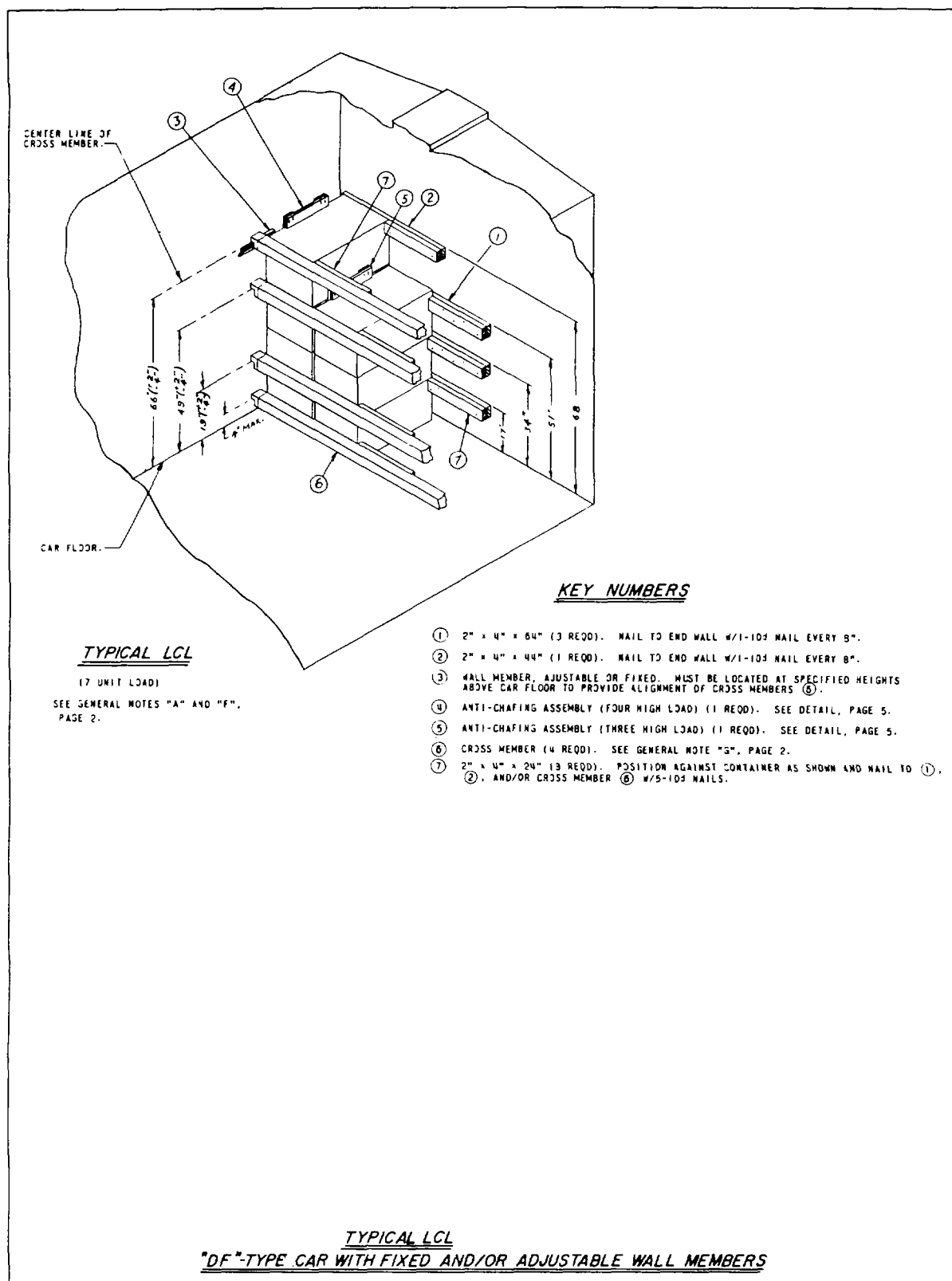




ORD G9420

Figure 37. Loading and bracing in DF type box cars, (sheet 4 of 7).

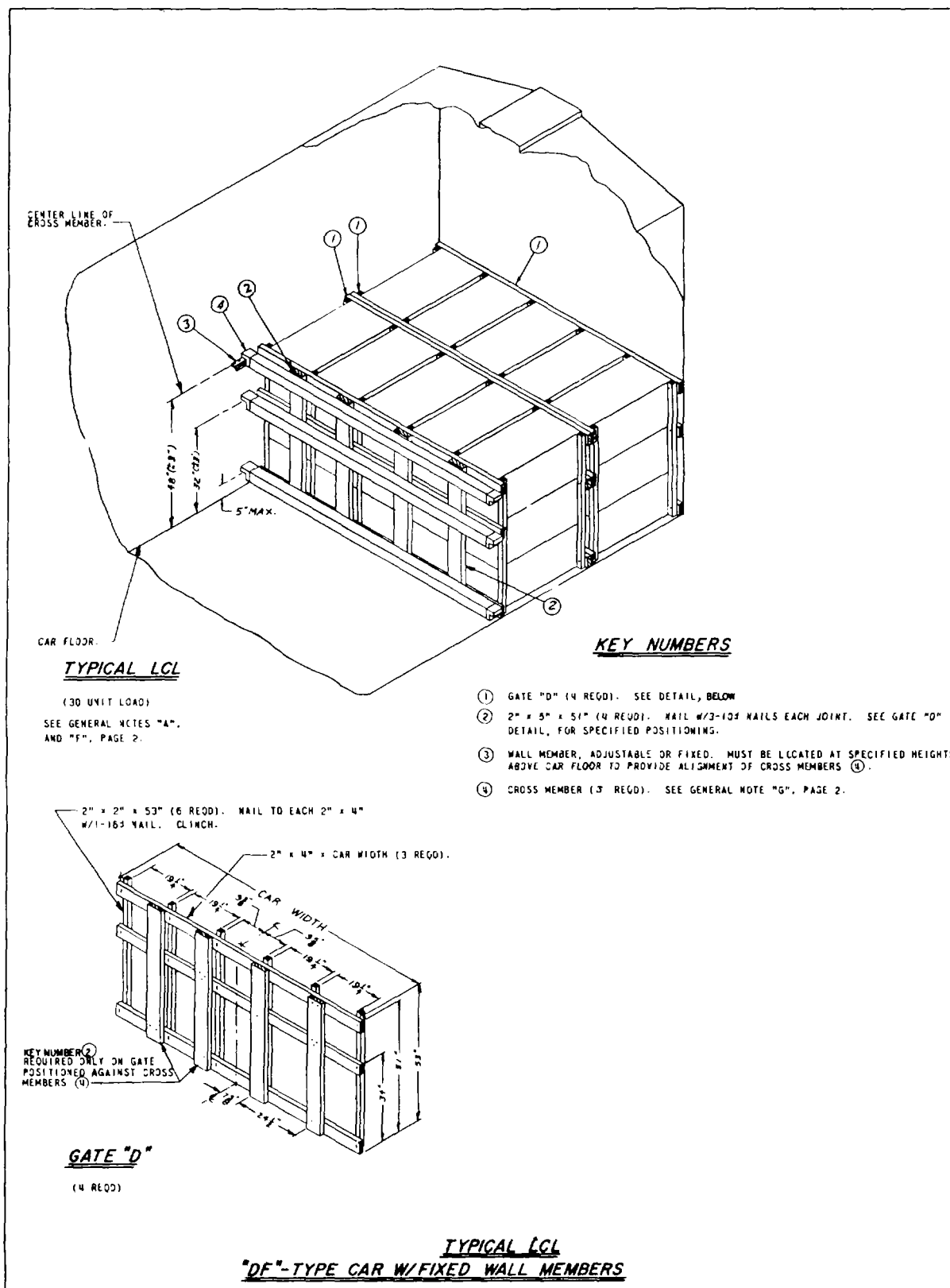




ORD G9421

Figure 37. Loading and bracing in DF type box cars, (sheet 5 of 7).

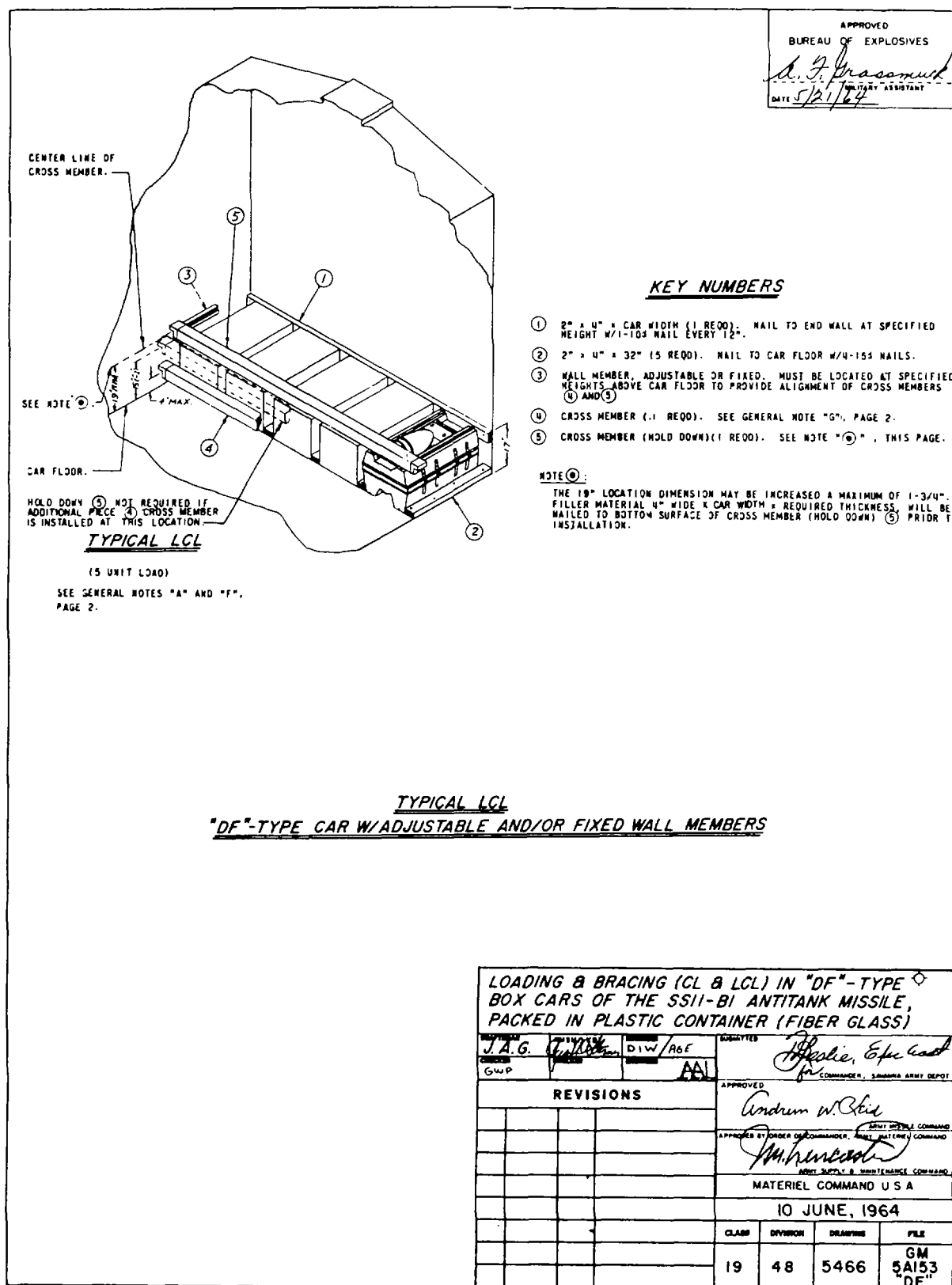




ORD G9422

**Figure 37. Loading and bracing in DF type box cars, (sheet 6 of 7).**





ORD G9423

Figure 37. Loading and bracing in DF type box cars, (sheet 7 of 7).



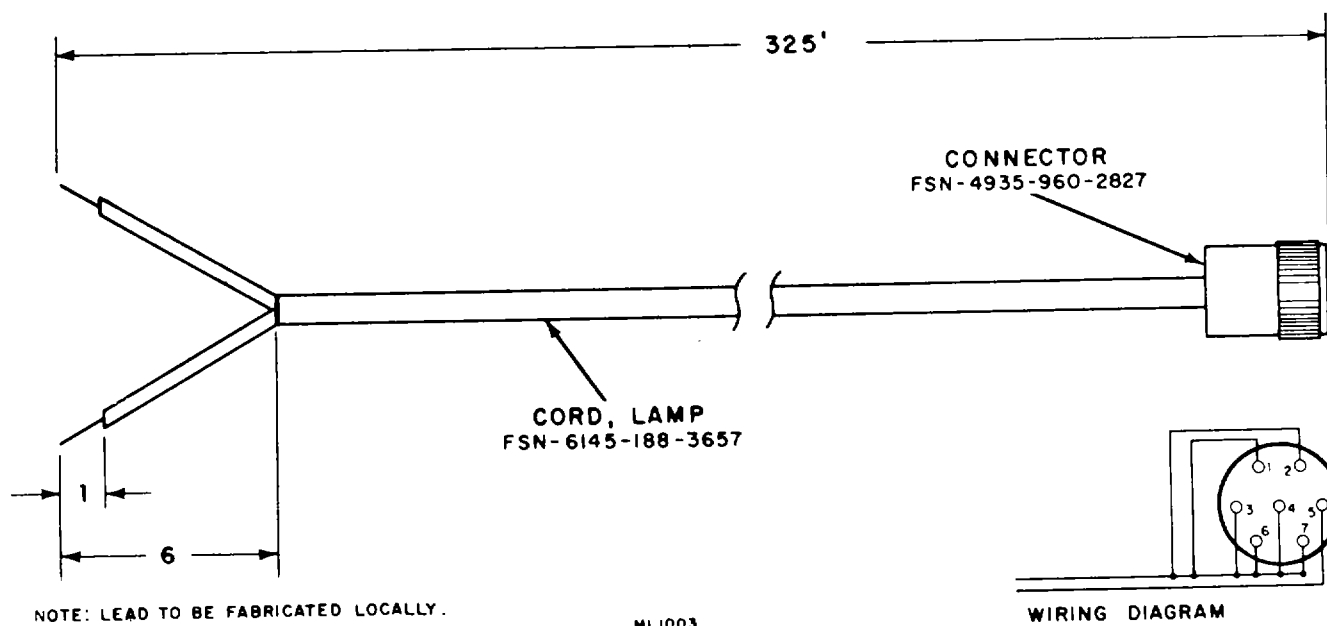


Figure 38. Demolition cable.



## REFERENCES

### 1. Publications Indexes

Consult the following indexes frequently for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this technical manual.

#### Military Publications:

Index of Blank Forms .....	DA Pam 310-2
Index of Tables of Organization and Equipment, Tables of Organization, Type Tables of Distribution, and Tables of Allowances.....	DA Pam 310-7
Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.....	DA Pam 310-4
Index of Supply Manuals, Ordnance Corps .....	DA Pam 310-29

### 2. Related Technical Manuals

Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Truck-Mounted Maintenance Equipment (Guided Missile Helicopter- Armament Subsystem M22).....	TM9-4935-461-15/1
Operator's and Crew Member's Manual, Army Models UH-1A & UH-1B Helicopters.....	TM 55-1520-211-10

### 3. Supply Manuals

The following manuals of the Department of the Army Supply Manual pertain to this materiel:

#### *a. General.*

Introduction .....	ORD 1
Ordnance Major Items and Major Combinations and Pertinent Publications .....	SB 9-1
Requisitioning of Repair Parts and Assemblies Added by Modification Work Orders .....	SB 9-150

#### *b. Inspection and Repair.*

Command Maintenance Inspection .....	AR 750-8
Crystal Rectifiers.....	TB SIG 162
Electrical Wiring.....	TM5-760
Inspection of Ordnance Materiel in Hands of Troops .....	TM 9-1100
Inspection Procedure for Repaired Electrical Indicating Instruments.....	TB SIG 24
Protection of Coaxial Cable Assemblies Against Corrosion .....	TB SIG 276

#### *c. Instruction Guides.*

Maintenance Responsibility and Shop Operation .....	AR 750-5
Operation in the Arctic.....	FM 31-71
Ordnance Maintenance: Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel, and Related Materials Including Chemicals, Lubricants, Indicators, and Hydraulic Fluids .....	TM 9-1007
Painting Instructions for Field Use .....	TM 9-213
Solder and Soldering.....	TB SIG 222
Varnish, Moisture and Fungus Resistant, for the Treatment of Communication, Electronic, and Associated Electrical Equipment. ....	MIL-V-173A

#### *d. System Supply Manuals.*

Direct support, General Support, and Depot Maintenance, Repair Parts and Special Tool Lists for Helicopter Guided Missile Launcher Armament Subsystem M22 (Used on UH-1B Helicopter).....	TM 9-1400-461-35P
Direct support, General Support, and Depot Maintenance, Repair Parts and Special Tool Lists for Truck-Mounted Maintenance Equipment (Guided Missile Helicopter-Armament Subsystem M22) .....	TM 9-4935-461-35P



Organizational Maintenance, Repair Parts and Special Tool Lists for Helicopter Guided Missile Launcher Armament Subsystem M22 (Used on UH-1B Helicopter) .....	TM 9-1400-461-20P
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#### 4. Forms

The following forms pertain to this materiel:

Exchange Part or Unit Identification Tag .....	DA Form 9-81
Guided Missile Component Evaluation Data Report .....	DA Form 9-110
Maintenance Request and Register .....	DA Form 811
Materiel Inspection Tag .....	DA Form 9-1
Organizational Equipment File .....	DA Form 478
Parts Requisition .....	DA Form 9-79
Preventive Maintenance Schedule and Record .....	DA Form 460
Recommended Changes to DA Technical Manuals, Parts Lists, or Supply Manuals 7, 8, or 9 .....	DA Form 2028
Report of Damaged or Improper Shipment .....	DD Form 6
Request for Issue or Turn-In .....	DA Form 1546

#### 5. Other Publications

The following explanatory publications control information pertinent to this materiel and associated equipment:

##### *a. Decontamination.*

Decontamination .....	TM 3-220
Defense Against CBR Attack .....	FM 21-40

##### *b. Electronics.*

Basic Theory and Application of Transistors .....	TM 11-690
Electrical Fundamentals (Direct Current) .....	TM 11-661
Theory and Use of Electronic Test Equipment .....	TM 11-664
Transients and Waveforms .....	TM 11-669

##### *c. General.*

Accident Reporting and Records .....	AR 385-40
Dictionary of United States Army Terms .....	AR 320-5-1
Electronic Failure Report .....	AR 700-39
Inspection of Ordnance Materiel in Hands of Troops .....	TM 9-1100
Military Symbols .....	FM 21-30
Ordnance Direct Support Service .....	FM 9-3
Ordnance General and Depot Support Service .....	FM 9-4
Ordnance Service in the Field .....	FM 9-5
Safety: Accident Reporting and Records .....	AR 385-40
Special Operations, Northern Operations .....	FM 31-71
Unsatisfactory Equipment Report .....	AR 700-38

##### *d. Shipment and Limited Storage.*

Ordnance Operational List of Specifications and Instructions for Packaging and Processing General Supplies .....	SB 9-156
Preservation, Packaging, and Packing of Military Supplies and Equipment .....	TM 38-250
Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army .....	SB 38-100
Protection of Ordnance General Supplies in Open Storage .....	TB ORD 379
Report of Damaged or Improper Shipment .....	AR 700-58
Storage and Materiel Handling .....	TM 743-200
Storage and Army Supplies and equipment in Shed and Open Storage .....	SB 38-1



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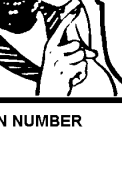
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The Adjutant General.*

HAROLD K. JOHNSON  
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Chief of Staff.*

Distribution:

To be distributed in accordance with DA Form 12-31, Requirements for Field Maintenance instruction for G.M.L.-M22.



<div style="display: flex; justify-content: space-between; align-items: center;">  <div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;"> <p style="margin: 0;">THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.</p> </div> </div> <div style="text-align: right; padding-right: 20px;"> <h2 style="margin: 0;">SOMETHING WRONG WITH PUBLICATION</h2> </div>				
<b>FROM:</b> (PRINT YOUR UNIT'S COMPLETE ADDRESS)		<b>DATE SENT</b>		
<b>PUBLICATION NUMBER</b>		<b>PUBLICATION DATE</b>		<b>PUBLICATION TITLE</b>
<b>BE EXACT PIN-POINT WHERE IT IS</b>				<div style="text-align: center; padding-top: 20px;"> <h3>IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.</h3> </div>
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PREVIOUS EDITIONS  
ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.



## The Metric System and Equivalents

### Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

### Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 decagram = 10 grams = .35 ounce  
 1 hectogram = 10 decagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

### Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

### Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

### Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
----	------------------------	----------------------------	---------------------	----



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