D E P A R T M E N T O F T H E A R M Y T E C H N I C A L M A N U A L

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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TECHNICAL MANUAL
No. 9-1400-461-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *1 February 1965*

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

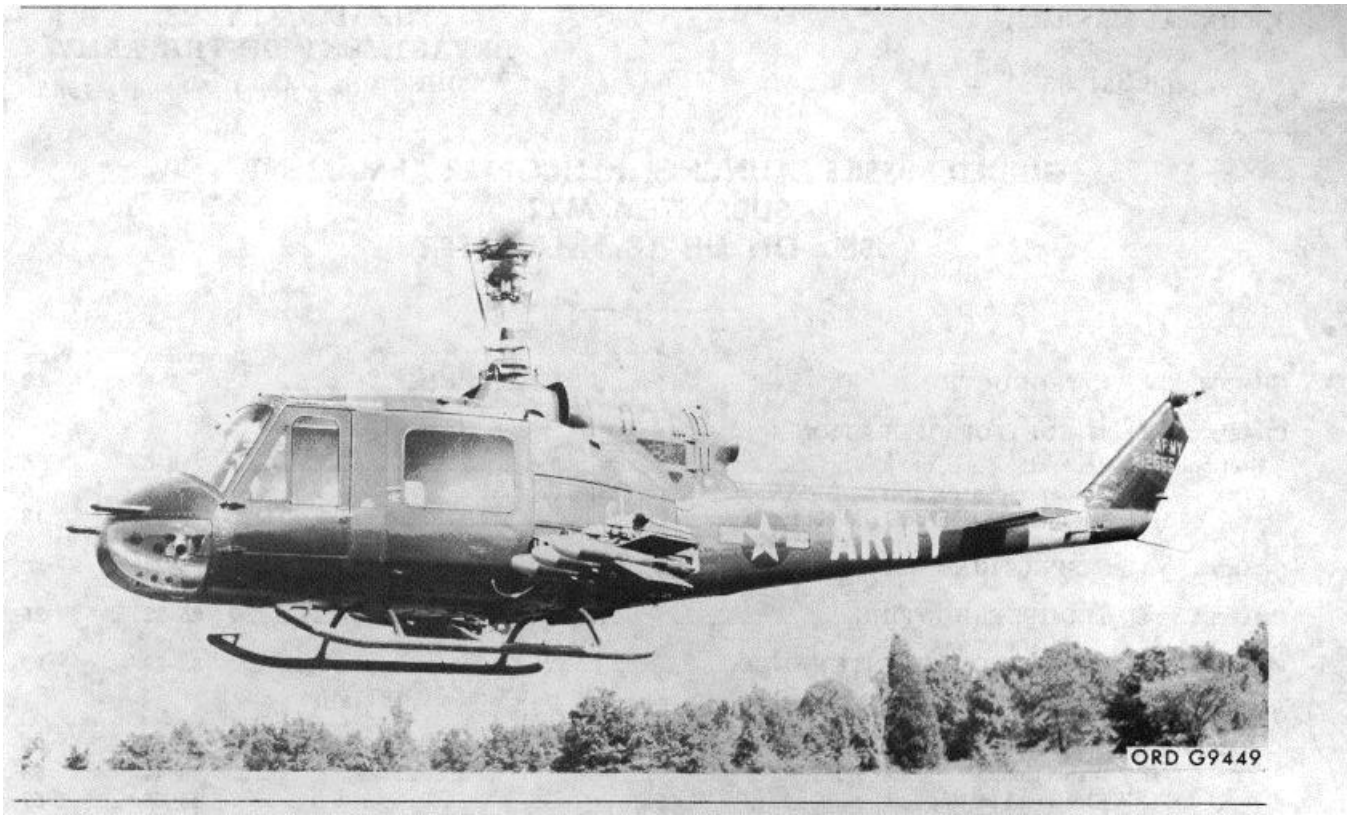


Figure 1. Helicopter guided missile launcher armament subsystem M22.

CHAPTER 1

INTRODUCTION

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.

6. Detailed Operational Theory

This chapter provides direct support, general support, 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.

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.

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.

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

Apparatus List for the Guidance Control Unit, Figure 2

Reference designator	Description	Part No.
C1-C4	CAPACITOR, FIXED: 160v, 100,000 uuf (± 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, (± 10%)	10172693
C3	CAPACITOR, FIXED, TANTALUM: 35v, 6.8 uf (± 10%)	10172694
C4-C7	CAPACITOR, FIXED, TANTALUM: 16v, 100 uf (± 10%o)	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 (±5%)	10172649
R2	RESISTOR, VARIABLE: linear precision, 1w, 2,000 ohms (± 05%, Z .23% linearity)	10172697
R4	RESISTOR, FIXED: 1/4w, 1,000 ohms (± 5%)	10172704
R5	RESISTOR, VARIABLE: 1/2w, 100,000 ohms	10172700
R8	RESISTOR, FIXED: 1/4w, 82,000 ohms (± 5%)	10172725
R9	RESISTOR, FIXED: 1/4w, 9,100 ohms (± 5%)	10172717
R11	RESISTOR, FIXED: 1/2w, 10,000 ohms (± 5%)	10172718
R12	RESISTOR, FIXED: 1/4w, 6,800 ohms (± 5%)	10172715
R13	RESISTOR, FIXED: 1/4w, 12,000 ohms (± 5%)	10172720
R14	RESISTOR, FIXED: 1/4w, 18,000 ohms (± 5%)	10172722
R15, R16	RESISTOR, VARIABLE: wire wound element, 1 sec, 1w, 50,000 ohms (± 5%)	10172699
R18	RESISTOR, FIXED: 1/4w, 6,200 ohms (± 5%)	10172714
R19	RESISTOR, FIXED: 1/4w, 200 ohms (± 51%)	10172701
R21	RESISTOR, FIXED: 1/4w, 2,200 ohms (± 5%)	10172708
R22	RESISTOR, FIXED: 1/4w, 15,000 ohms (± 1%)	10172721
R23	RESISTOR, FIXED: 1/4w, 20,000 ohms (± 5%)	10172723
R24	RESISTOR, VARIABLE: wire wound element, 1 sec, 1w, 10,000 ohms (± 5%)	10172698

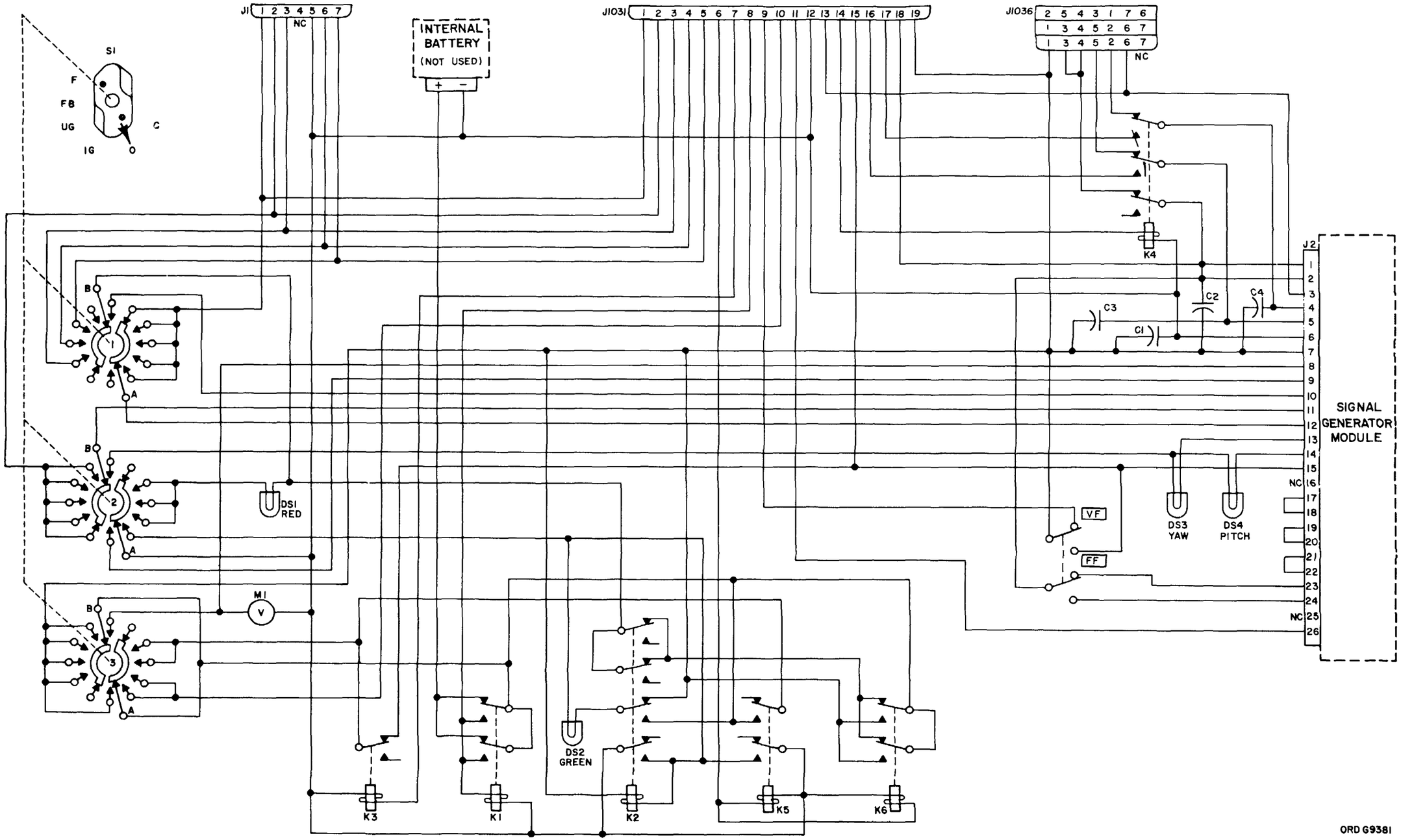


Figure 2. Guidance control unit, schematic diagram.

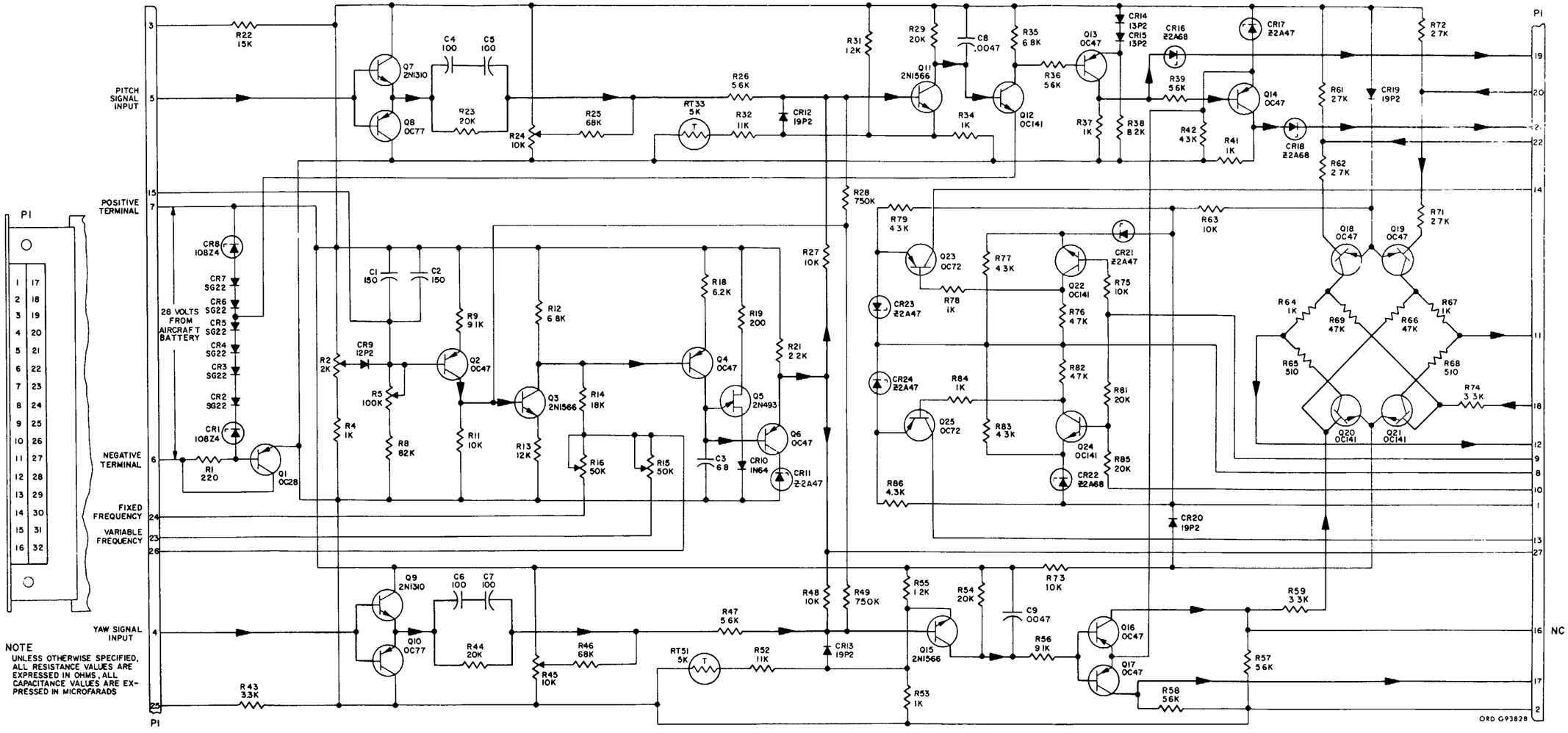


Figure 3. Signal generator module, schematic diagram.

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

Reference designator	Description	Part No.
R25	RESISTOR, FIXED: 1/4w, 68,000 ohms (± 5%)	10172724
R26	RESISTOR, FIXED: 1/4w, 5,600 ohms (± 5%)	10172713
R27	RESISTOR, FIXED: 1/4w, 10,000 ohms (± 5%)	10172718
R28	RESISTOR, FIXED: 1/4w, 750,000 ohms (± 5%)	10172688
R29	RESISTOR, FIXED: 1/4w, 20,000 ohms (± 5%)	10172723
R31	RESISTOR, FIXED: 1/2w, 1,200 ohms (± 5%)	10172706
R32	RESISTOR, FIXED: 1/4w, 11,000 ohms (± 5%)	10172719
R33	THERMISTOR: Type A, 5,000 ohms (± 5%)	10172692
R34	RESISTOR, FIXED: 1/2w, 1,000 ohms (± 5%)	10172648
R35	RESISTOR, FIXED: 1/4w, 6,800 ohms (± 5%)	10172715
R36	RESISTOR, FIXED: 1/4w, 5,600 ohms (± 5%)	10172713
R37	RESISTOR, FIXED: 1/2w, 1,000 ohms (± 5%)	10172648
R38	RESISTOR, FIXED: 1/4w, 8,200 ohms (± 5%)	10172716
R39	RESISTOR, FIXED: 1/4w, 5,600 ohms (± 5%)	10172713
R41	RESISTOR, FIXED: 1/4w, 1,000 ohms (± 5%)	10172704
R42	RESISTOR, FIXED: 1/4w, 4,300 ohms (± 5%)	10172711
R43	RESISTOR, FIXED: 1/4w, 3,300 ohms (± 5%)	10172710
R44	RESISTOR, FIXED: 1/4w, 20,000 ohms (± 5%)	10172723
R45	RESISTOR, VARIABLE: wire wound element, 1 sec, 1w, 10,000 ohms (± 5%)	10172698
R46	RESISTOR, FIXED: 1/4w, 18,000 ohms (± 5%)	10172724
R47	RESISTOR, FIXED: 1/4w, 5,600 ohms (± 5%)	10172713
R48	RESISTOR, FIXED: 1/4w, 10,000 ohms (± 5%)	10172718
R49	RESISTOR, FIXED: 1/4w, 750,000 ohms (± 5%)	10172688
R51	THERMISTOR: Type A, 5,000 ohms (± 5%)	10172692
R52	RESISTOR, FIXED: 1/4w, 11,000 ohms (± 5%)	10172719
R53	RESISTOR, FIXED: 1/2w, 1,000 ohms (± 5%)	10172648
R54	RESISTOR, FIXED: 1/4w, 20,000 ohms (+ 5%)	10172723
R55	RESISTOR, FIXED: 1/2w, 1,200 ohms (± 5%)	10172706
R56	RESISTOR, FIXED: 1/4w, 9,100 ohms (± 5%)	10172717
R57, R58	RESISTOR, FIXED: 1/4w, 5,(00 ohms (± 5%)	10172713
R59	RESISTOR, FIXED: 1/4w, 3,300 ohms (± 5%)	10172710
R61, R62	RESISTOR, FIXED: 1/4w, 2,700 ohms (± 5%)	10172709
R63	RESISTOR, FIXED: 1/4w, 10,000 ohms (± 5%)	10172718
R64	RESISTOR, FIXED: 1/4w, 1,000 ohms (± 5%)	10172704
R65	RESISTOR, FIXED: 1/4w, 510 ohms (± 5%)	10172703
R66	RESISTOR, FIXED: 1/4w, 47,000 ohms (± 5%)	10172707
R67	RESISTOR, FIXED: 1/4w, 1,000 ohms (± 5%)	10172704
R68	RESISTOR, FIXED: 1-4w, 510 ohms (± 5%)	10172703
R69	RESISTOR, FIXED: 1-4w, 47,000 ohms (± 5%)	10172707
R71, R72	RESISTOR, FIXED: 1/4w, 2,700 ohms (± 5%)	10172709
R73	RESISTOR, FIXED: 1/4w, 10,000 ohms (± 5%)	10172718
R74	RESISTOR, FIXED: 1/4w, 3,300 ohms (± 5%)	10172710
R75	RESISTOR, FIXED: 1/4w, 10,000 ohms (± 5%)	10172718
R76	RESISTOR, FIXED: 1/4w, 4,700 ohms (± 5%)	10172712
R77	RESISTOR, FIXED: 1/4w, 4,300 ohms (± 5%)	10172711
R78	RESISTOR, FIXED: 1/4w, 1,000 ohms (+ 5%)	10172704
R79	RESISTOR, FIXED: 1/4w, 4,300 ohms (± 5%)	10172711
R81	RESISTOR, FIXED: 1/4w, 20,000 ohms (+ 5%)	10172723
R82	RESISTOR, FIXED: 1/4w, 4,700 ohms (± 5%)	10172712
R83	RESISTOR, FIXED: 1/4w, 4,300 ohms (± 5%)	10172711
R84	RESISTOR, FIXED: 1/4w, 1,000 ohms (± 5%)	10172704
R85	RESISTOR, FIXED: 1/4w, 20,000 ohms (± 5%)	10172723
R86	RESISTOR, FIXED: 1/4w, 4,300 ohms (± 5%)	10172711

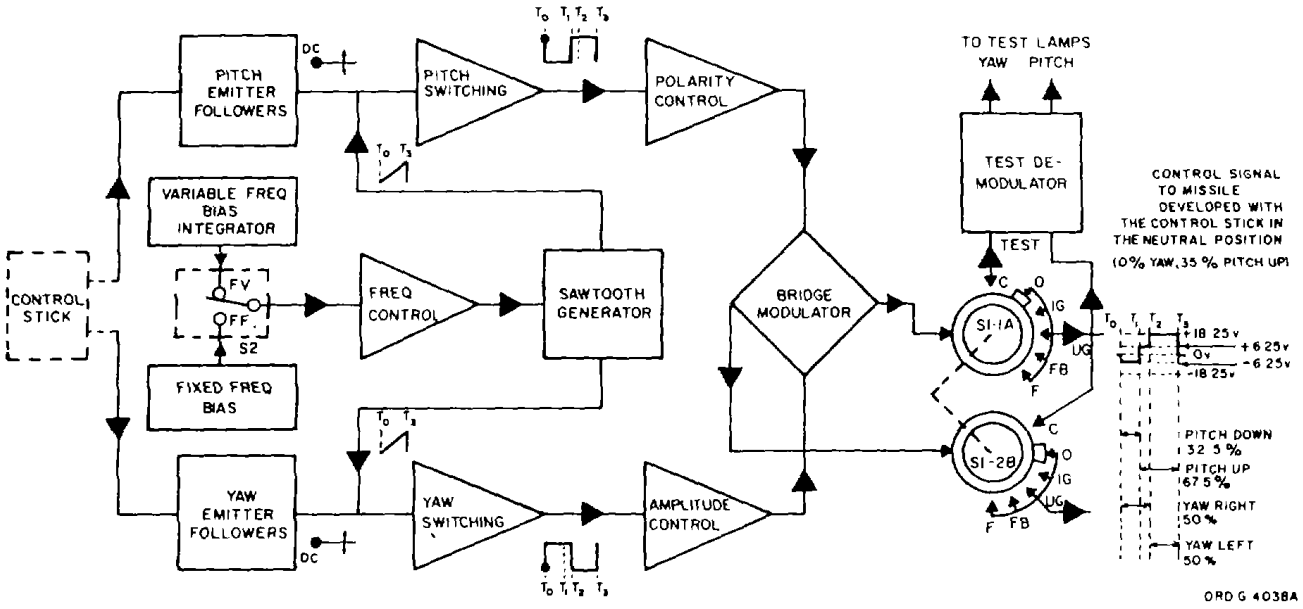


Figure 4. Signal generator module block diagram.

change. Each variation of Q1 base bias changes base collector current, producing variations in emitter-collector impedance. Changing emitter-collector impedance changes the voltage dropped, thereby maintaining a 21 ±.05 vdc output with an input between 23 and 30 vdc. A regulated 11 vdc is also tapped between CR5 and CR6.

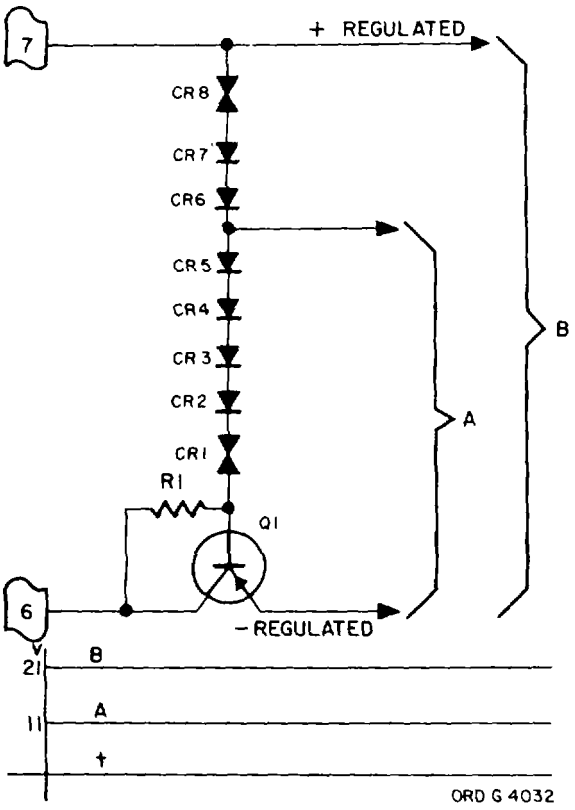


Figure 5. Regulated supply voltage, schematic diagram.

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

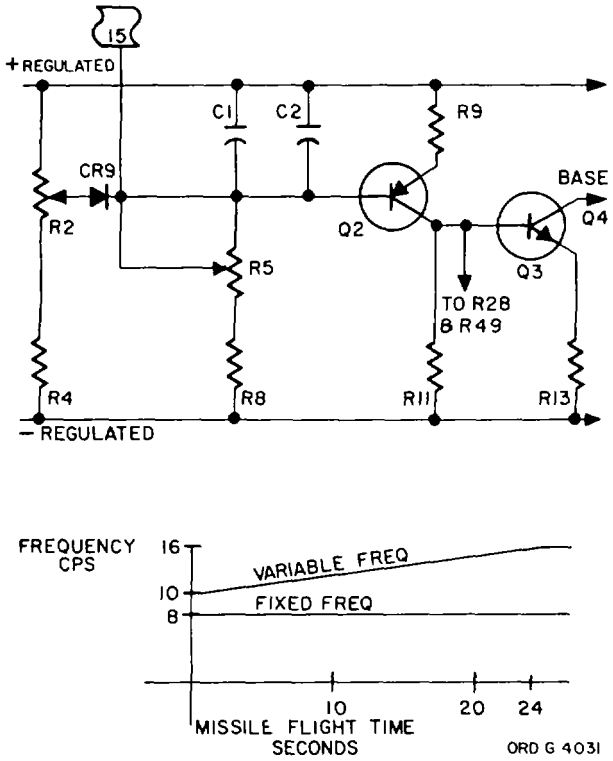


Figure 6. Frequency formation, schematic diagram.

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

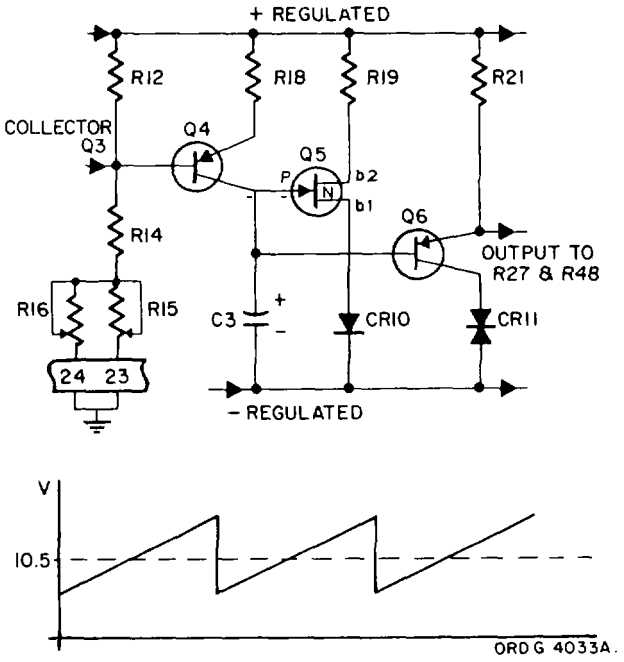


Figure 7. Sawtooth generator, schematic diagram.

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

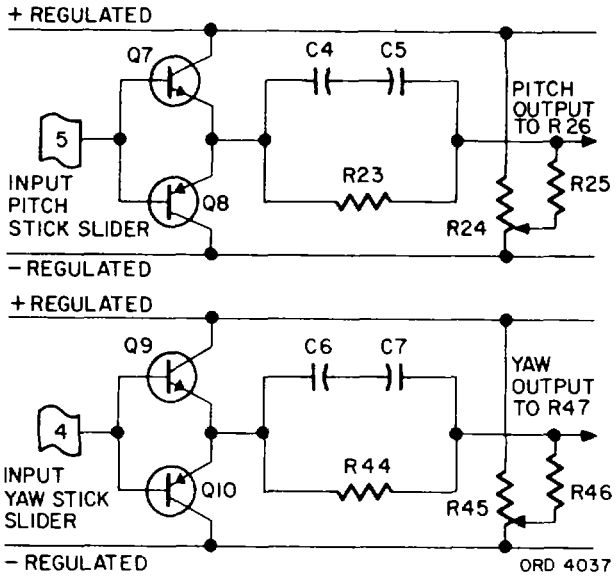


Figure 8. Impedance adapter, schematic diagram.

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

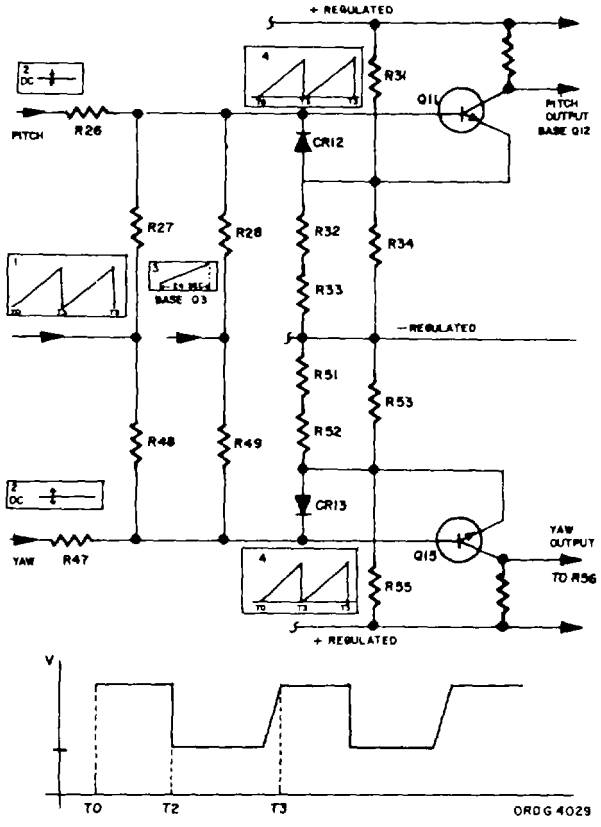


Figure 9. Switching amplifier, schematic diagram.

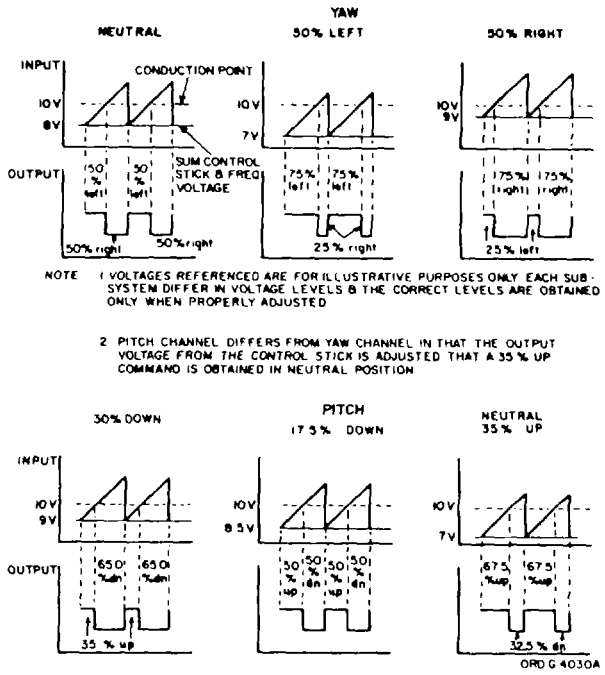


Figure 10. Switching amplifier input and output.

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

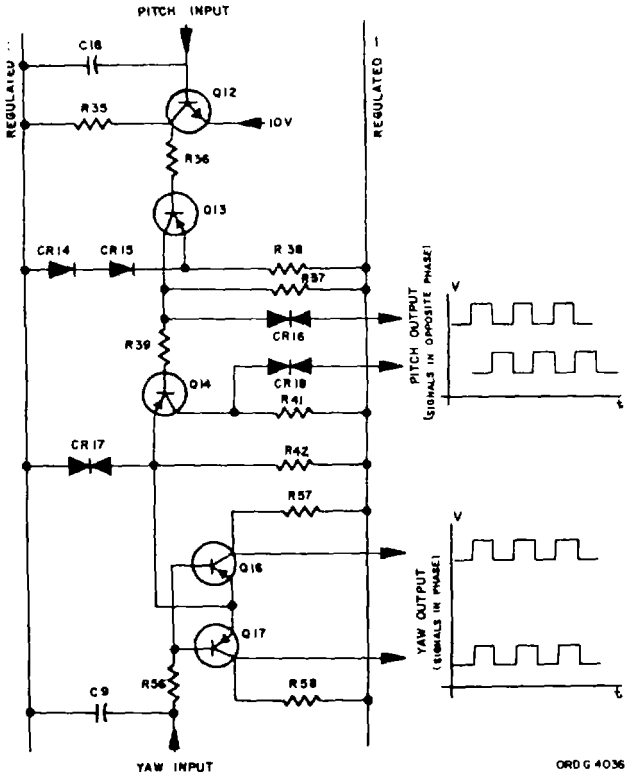


Figure 11. Polarity and amplitude control amplifier.

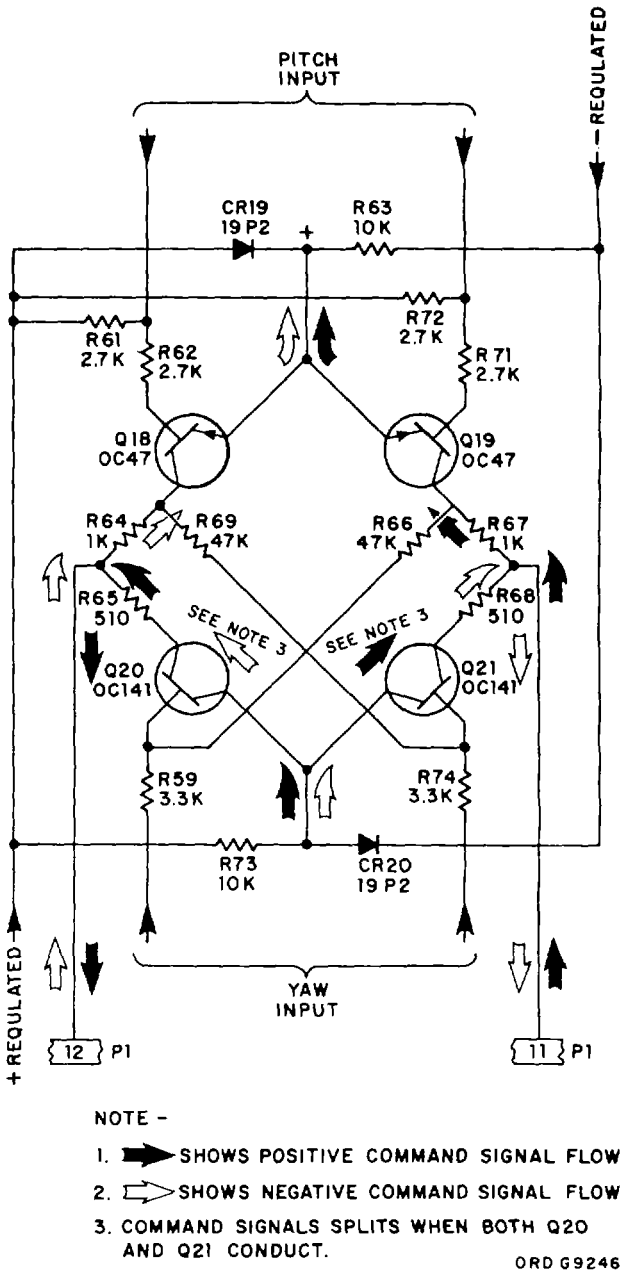


Figure 12. Bridge modulator, schematic diagram.

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 TO 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 TO 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.

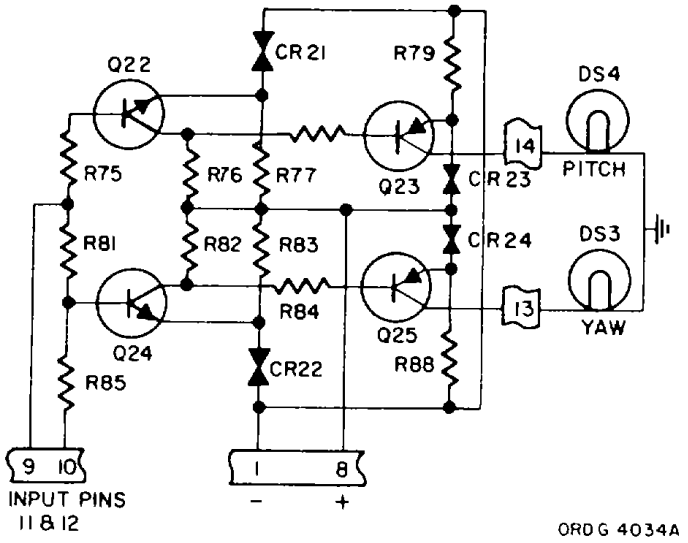


Figure 13. Demodulator, schematic diagram.

(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.

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.

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 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.

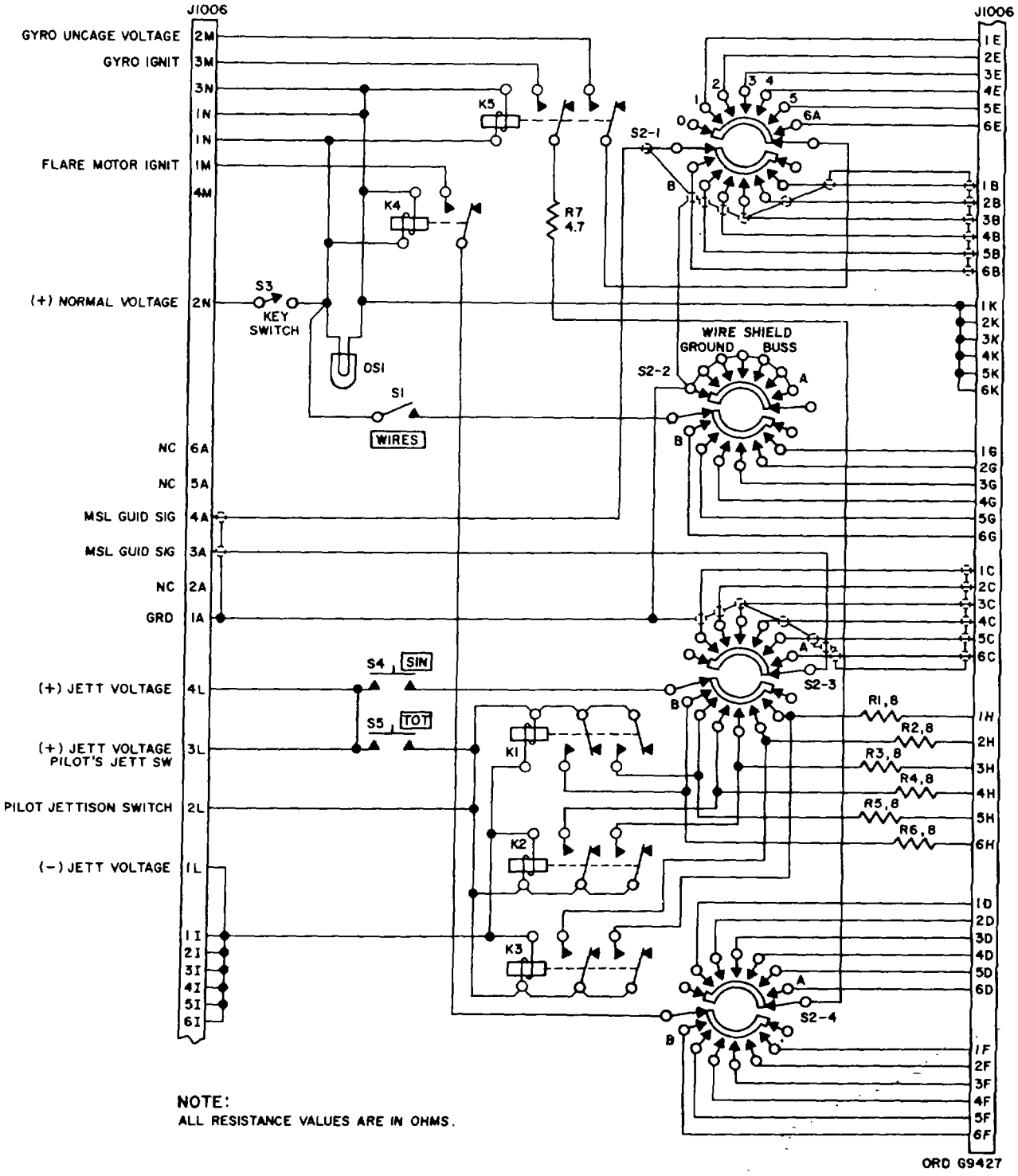


Figure 14. Missile selection box schematic diagram.

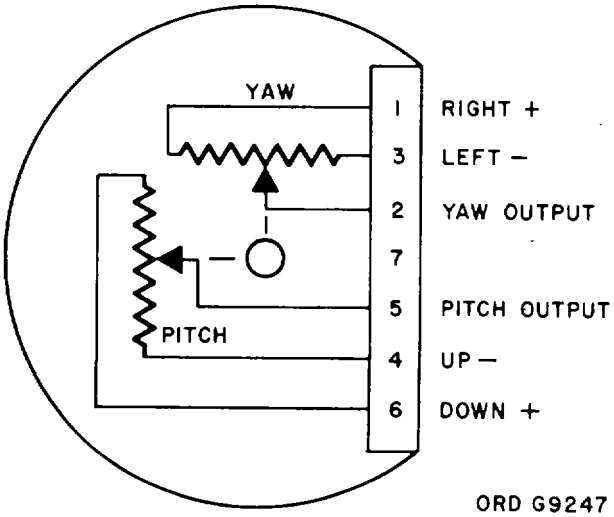


Figure 15. Control stick, schematic diagram.

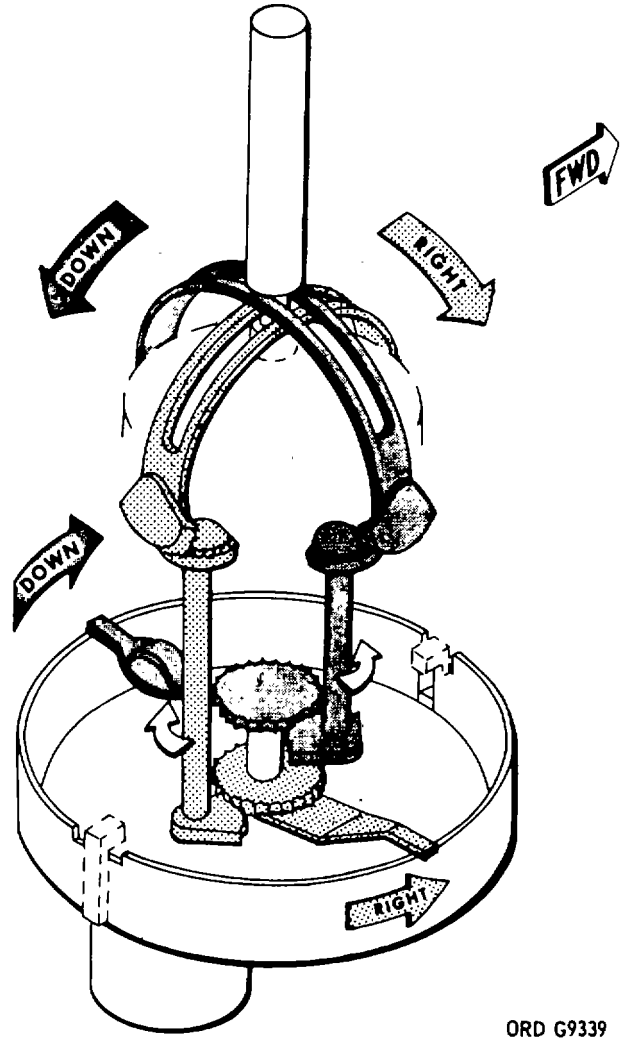


Figure 16. Control stick, mechanical operations.

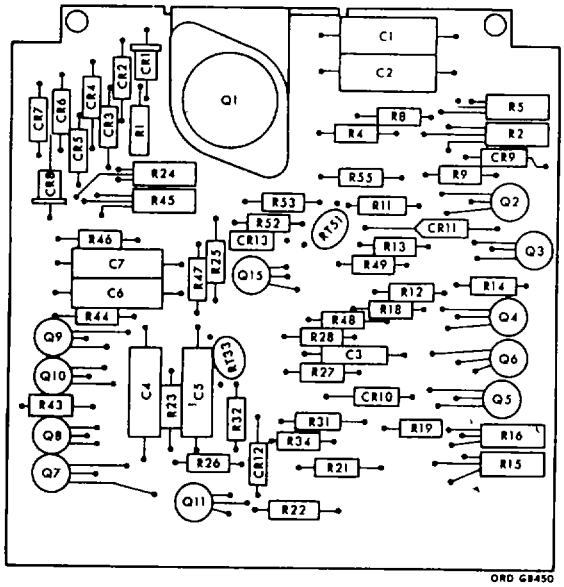


Figure 17. Component parts location signal generator module board no. 1.

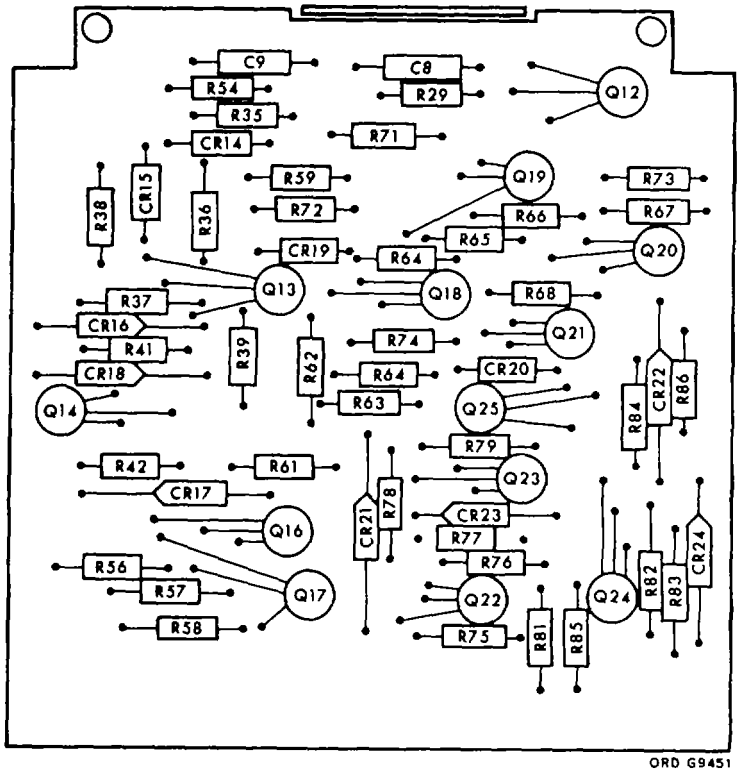


Figure 18. Component parts location signal generator module board no. 2.

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

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. **NORMAL and JETT indicator lamps on test console glow.**	*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. **Missile selection box power lamp glows.**	*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.	
	DUMMY LAUNCHER no. 1 EXPLOSIVE CART COPIMAND lamp on test console glows.	*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.	
	EXPLOSIVE CART COMMAND lamps 2-6 glow, coinciding with missile selection switch position.	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.	
	The UG lamp on the test set glows.	*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.	
	The UG lamp on the test set goes off and remains off until the missile selection switch is returned to position 1.	Same as 7 above. (Check for shorts).
9	Move and hold the GCU firing switch to the IFB position.	
	The UG lamp on the test set goes off and the IFB lamp glows.	*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.	
	The WJ lamp on the test set glows only on position 1.	*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
	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.	Same as steps 5 through 7.
14	Press and hold the SIN switch on the missile selection box while rotating the missile selection switch through all positions	
	The EXPLOSIVE BOLT COMMAND lamps (1-6) on the test console glows coinciding with missile selection switch positions (1-6).	*a.* Check lamps and replace *b.* Check and replace defective component of single jettison circuit (fig. 14).
15	Press and hold the TOT switch on the missile selection box while rotating the missile selection switch through all positions.	
	All EXPLOSIVE BOLT COMMAND lamps (1-6) glow with missile selection switch in all positions (1-6).	*a.* Check lamps and replace *b*. Check and replace defective component of the total jettison circuit (fig. 14).
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	Lift and release the GCU firing switch while watching the test set	
	Test set meter pointer initially indicates 10 cps then increases to 165 cpa.	Check and replace the missile guidance signal circuit component (fig. 14).

27. Troubeshooting 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 te3t 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.	*a.* Check and replace defective voltmeter. *b.* Check power input circuit (fig. 2).
	The pitch (white) lamp on the GCU flickers dimly. The yaw (orange) lamp flickers with a medium intensity.	*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).	
	The pitch (white) lamp flickers with medium intensity.	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.	
	The EXPLOSIVE CART COMMAND lamp number 1 glows.	*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.	
	The IG lamp on the test set glows.	Same as step 10 above.
12	Move and hold the GCU firing switch to the UG position.	
	The UG lamp on the test set glows and the IG lamp goes off.	Same as step 10 above.
13	Move and hold the GCU firing switch to the FB position.	
	The IFB3 lamp on the test set glows and the UG lamp goes off.	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.	
	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.	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.	
	The meter on the test set indicates between 87 and 100 percent left of zero.	Same as step 6 above.
17	Slowly move the control stick from the maximum climb position to the maximum dive position.	
	The meter moves smoothly from left to right and settles between 13 and 33 percent right of zero.	Same as step 6 above.
	Note. 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.	
	The meter on the test set indicates between --10 and +10.	Same as step 6 above.
19	Move and hold the control stick to the maximum left (yaw) position.	
	The meter indicates 83 to 100 percent left of zero.	Same as step 6 above.
20	Slowly move the control stick from the maximum left (yaw) position to the maximum right (yaw) position.	
	The meter moves smoothly from left to right and settles between 83 and 100 percent right of zero.	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.	
	The meter on the test set tester indicates between 17.25 and 19.75 volts on the 0-20 scale	Same as step 6 above.
23	Keep the control stick in the maximum left (yaw) position and switch the + - switch to the (-) position.	
	The meter on the test set indicates between 17.25 and 19.75 on the 025 scale	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.	
	The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale	Same as step 6 above.
25	Keep the control stick in the maximum right (yaw) position and move + - the switch to the (-) position.	
	The meter on the test set indicates between 625 and 6.75 on the 0-8 scale.	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.	
	NORMAL and JETT indicator lamps on test console glow.	*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	Move the GCU firing switch to the F position.	
4	Connect the oscilloscope, using one trace channel, between R64 and R65.	
	Signal should be as shown in figure 10.	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).	
	Percentage of positive and negative portions of the output signal on the oscilloscope should change as the control stick is moved.	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).	
	Percentage of signal amplitude should change as the control stick is moved.	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.	
	Square wave signals on the oscilloscope should be 180 degrees out of phase with a voltage amplitude of 75 (fig. 10).	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.	
	Square wave signal displayed on oscilloscope should be as shown in figure 9.	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).	
	A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved backward and forwards.	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.	
	Square wave signals displayed on the oscilloscope should be in phase (fig. 11).	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.	
	Square wave signal displayed on the oscilloscope should be as shown in fig. 9.	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).	
	A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved left and right.	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.	
	Sawtooth signal displayed on the oscilloscope as shown in fig. 7.	Defective input from frequency formation circuit (fig. 6); check using step 14.
	When switch is in FF position sawtooth signal should be 8 cps.	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.	
	With switch in the FF position the signal on oscilloscope should be a constant level (fig. 5).	Adjust R16 to obtain desired voltage level.
	With switch in the VF position the signal on the oscilloscope should vary (fig. 5).	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.	
	NORMAL and JETT indicator lamps on test console glow.	*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.	
	Missile selection box power lamp glows.	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.	
	The meter on the test set indicates between 25 and 35 percent left of zero.	Defective resistor in the control stick (perform step 12 through 17).
7	Move the control stick to the maximum climb (backward) position.	
	The meter on the test set indicates between 87 and 100 percent left of zero.	Same as step 6 above.

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

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

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	
	Multimeter should indicate a resistance of 12.5 ohms; the decrease as the control stick is moved forward and increase when moved backward	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	Apply power to the test console and set the PWRON-OFF switch to the ON position.	
	NORMAL and JETT indicator lamps on test console glow.	a Check lamps and fuses b. Check input circuitry from power supply to console (TM 94935461-15/1).
2	Connect the test set to the launcher missile connector.	
3	Install the explosive cartridge tester into the launcher assembly with the missile looking over 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 GCC to the IG position.	
	Explosive cartridge tester lamp and the IG lamp - the test set glows.	Check and replace defective cable assembly (par. 38).
7	Move and hold the firing switch to the UG position.	
	IG lamp goes off and the UG lamp glows.	Same as step 6 above.
8	Move and hold the firing switch to the FB position.	
	UG lamp goes off and the IFB lamp glows.	Same as step 6 above.
9	Reset the firing switch to the 0 position.	
10	Press the WIRES itch on the missile selection box.	
	WJ lamp the test set glows.	Same a 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.	
	The explosive bolt circuit tester lamp glows.	Check and replace defective connector.
12	Set the test set selector switch to F position.	
13	Lift and release the GCU firing switch.	
	Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.	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.	
10	Press the WIRES switch on the missile selection box. **WJ lamp on the test set glows**.	Same as step 5 above.
11	Set the test set selector switch to the F position.	
12	Lift and release the GCU firing switch. **Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.**	Same as step 5 above.

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.

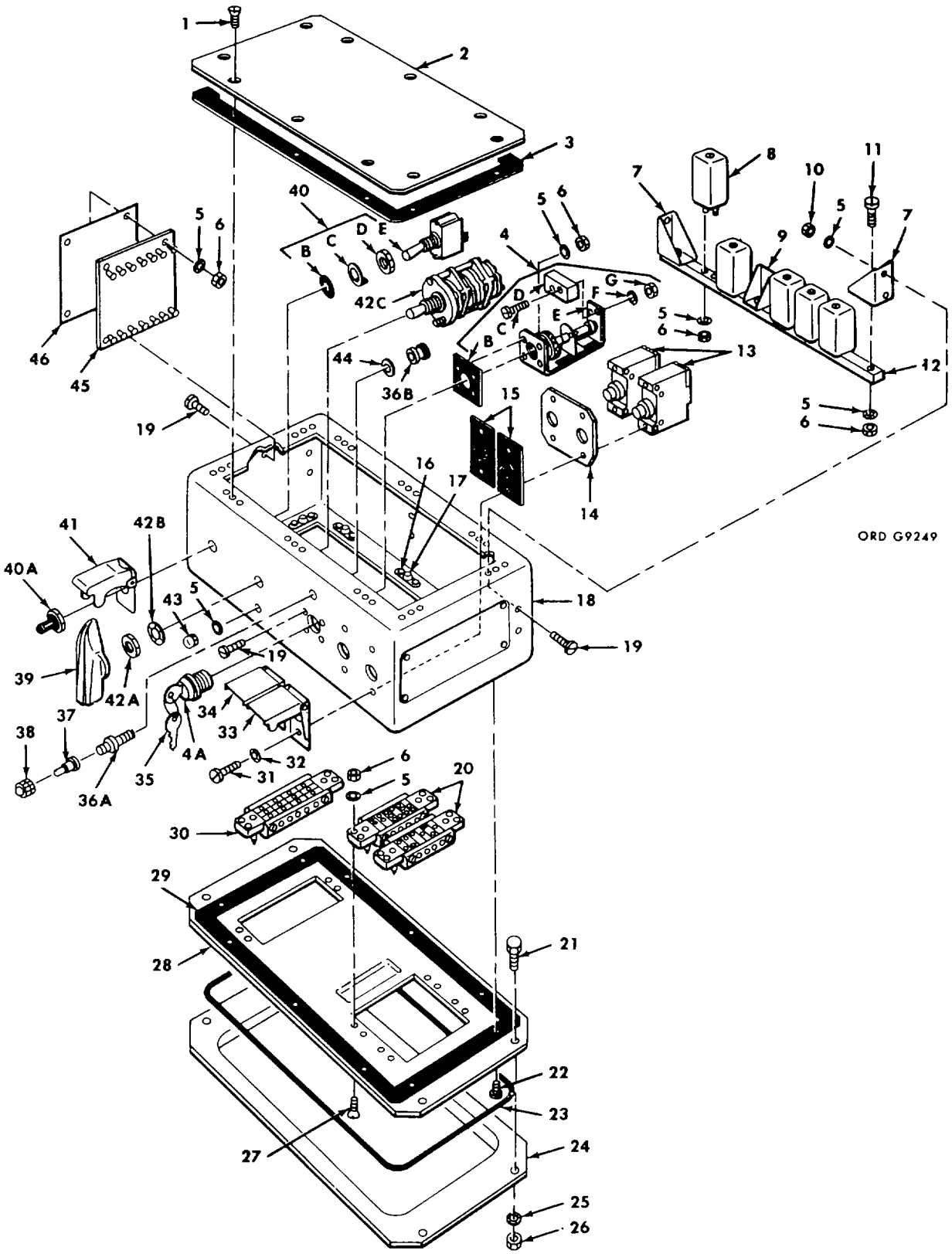


Figure 19. Missile selection box - disassembled view.

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

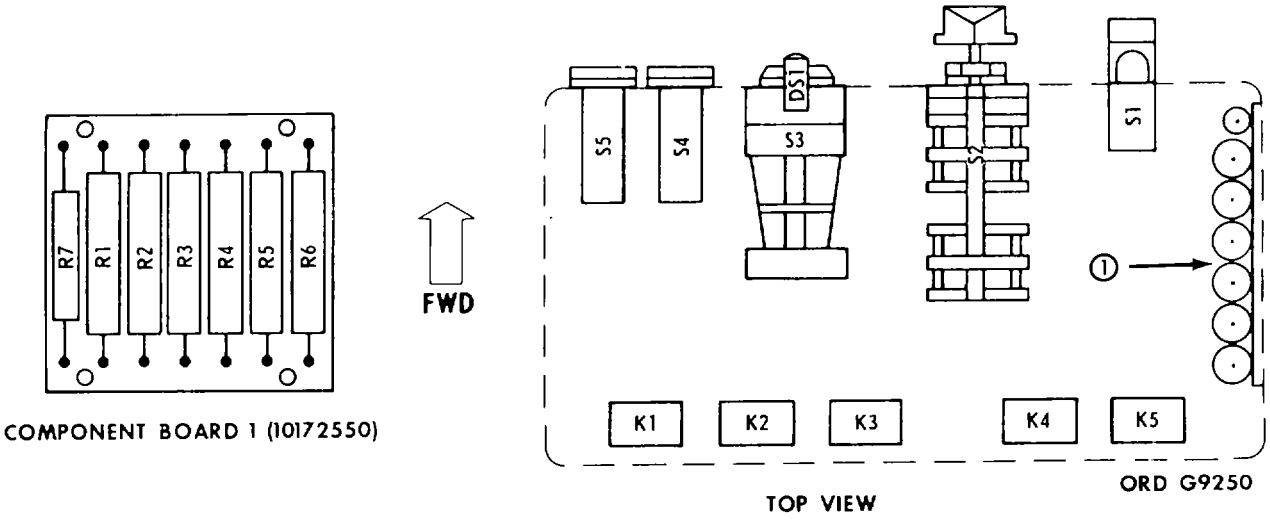


Figure 20. Missile selection box.

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.

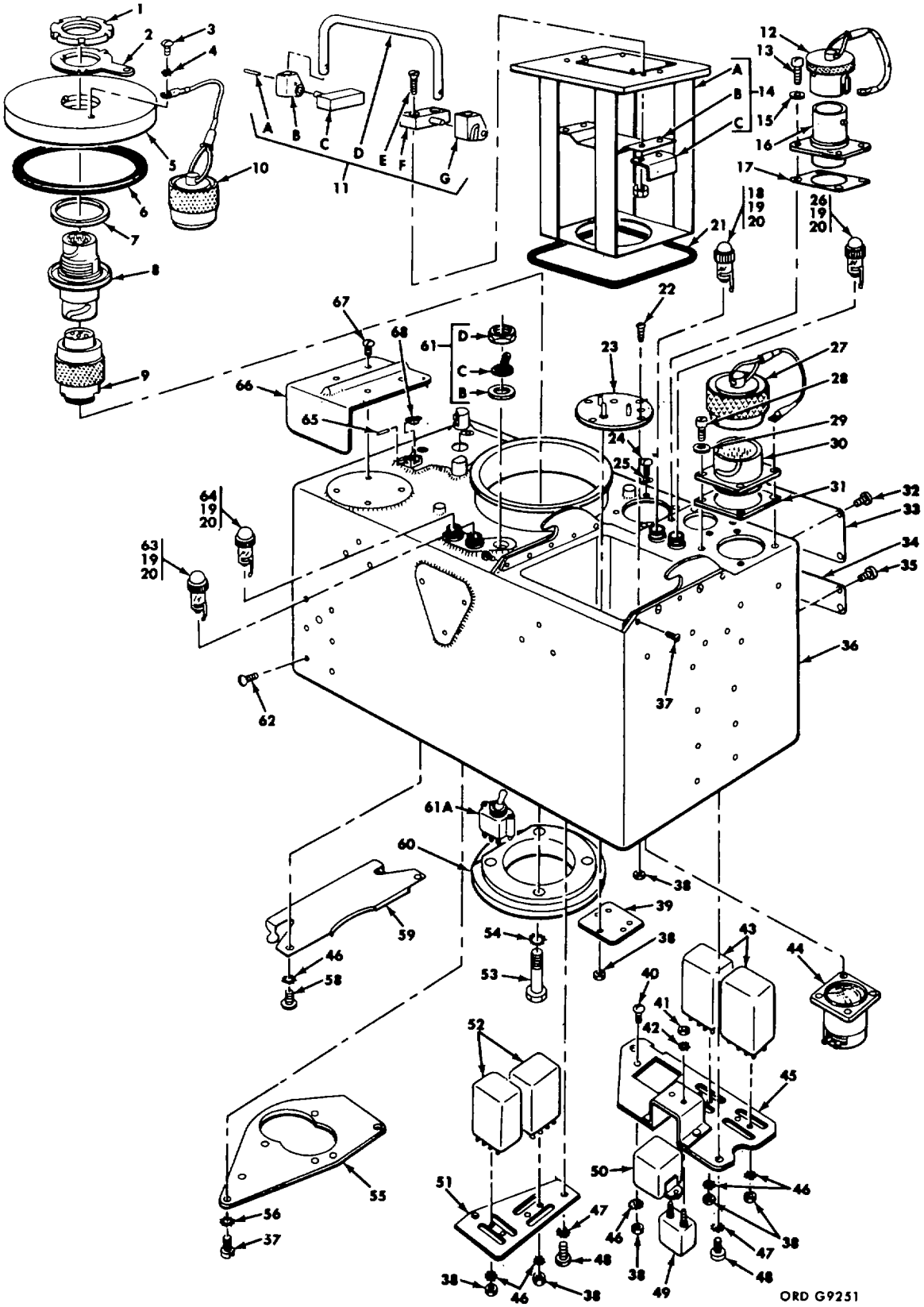


Figure 21. Guidance control unit, exploded view.

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

Step	Operation and normal indication	Corrective action
	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.	Same as steps 5 through 7.
14	Press and hold the SIN switch on the missile selection box while rotating the missile selection switch through all positions	
	The EXPLOSIVE BOLT COMMAND Lamps (1-6) on the test console glows coinciding with missile selection switch positions (1-6).	a. Check lamps and replace. b. Check and replace defective component of single jettison circuit (fig. 14).
15	Press and hold the TOT switch on the missile selection box while rotating the missile selection switch through all positions.	
	All EXPLOSIVE BOLT COMMAND lamps (1-6) glow with missile selection switch in all positions (1-6).	a. Check lamps and replace. b. Check and replace defective component of the total jettison circuit (fig. 14).
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	Lift and release the GCU firing switch while watching the test set	
	Test set meter pointer initially indicates 10 cps then increases to 16.5 cps.	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.	a. Check and replace defective voltmeter. b. Check power input circuit (fig. 2).
	The pitch (white) lamp on the GCU flickers dimly. The yaw (orange) lamp flickers with a medium intensity.	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).	
	The pitch (white) lamp flickers with medium intensity.	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.	
	The EXPLOSIVE CART COMMAND lamp number 1 glows.	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.	
	The IG lamp on the test set glows.	Same as step 10 above.
12	Move and hold the GCU firing switch to the UG position.	
	The UG lamp on the test set glows and the IG lamp goes off.	Same as step 10 above.
13	Move and hold the GCU firing switch to the FB position.	
	The IFB lamp on the test set glows and The UG lamp goes off.	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.	
	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.	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.	
	The meter on the test set indicates between 87 and 100 percent left of zero.	Same as step 6 above.
17	Slowly move the control stick from the maximum climb position to the maximum dive position.	
	The meter moves smoothly from left to right and settles between 13 and 33 percent right of zero.	Same as step 6 above.
	Note. 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.	
	The meter on the test set indicates between -10 and +10.	Same as step 6 above.
19	Move and hold the control stick to the maximum left (yaw) position.	
	The meter indicates 83 to 100 percent left of zero.	Same as step 6 above.
20	Slowly move the control stick from the maximum left (yaw) position to the maximum right (yaw) position.	
	The meter moves smoothly from left to right and settles between 83 and 100 percent right of zero.	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.	
	The meter on the test set tester indicates between 17.25 and 19.75 volts on the 0-20 scale	Same as step 6 above
23	Keep the control stick in the maximum left (yaw) position and switch the i - switch to the (-) position.	
	The meter on the test set indicates between 17.25 and 19.75 on the 0-25 scale	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.	
	The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale	Same as step 6 above.
25	Keep the control stick in the maximum right (yaw) position and move the + - switch to the (-) position.	
	The meter on the test set indicates between 6.25 and 6.75 on the 0-8 scale.	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.	
2	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 glow.	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	Move the GCU firing switch to the F position.	
4	Connect the oscilloscope, using one trace channel, between R64 and R65.	
	Signal should be as shown in figure 10.	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).	
	Percentage of positive and negative portions of the output signal on the oscilloscope should change as the control stick is moved.	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).	
	Percentage of signal amplitude should change as the control stick is moved.	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.	
	Square wave signals on the oscilloscope should be 180 degrees out of phase with a voltage amplitude of 75 (fig. 10).	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.	
	Square wave signal displayed on oscilloscope should be as shown in figure 9.	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).	
	A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved backward and forwards.	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.	
	Square wave signals displayed on the oscilloscope should be in phase (fig. 11).	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.	
	Square wave signal displayed on the oscilloscope should be as shown in fig. 9.	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).	
	A straight line should be displayed on the oscilloscope. The amplitude should vary as the control stick is moved left and right.	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.	
	Sawtooth signal displayed on the oscilloscope as shown in fig. 7.	Defective input from frequency formation circuit (fig. 6); check using step 14.
	When switch is in FF position sawtooth signal should be 8 cps.	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.	
	With switch in the FF position the signal on oscilloscope should be a constant level (fig. 5).	Adjust R16 to obtain desired voltage level.
	With switch in the VF position the signal on the oscilloscope should vary (fig. 5).	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. **NORMAL and JETT indicator lamps on test console glow.**	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. **Missile selection box power lamp glows**.	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. **The meter on the test set indicates between 25 and 35 percent left of zero.**	Defective resistor in the control stick (perform step 12 through 17).
7	Move the control stick to the maximum climb (backward) position. **The meter on the test set indicates between 87 and 100 percent left of zero.**	Same as step 6 above.

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

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

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 slick forward then backward **Multimeter should indicate a resistance of I2.5K ohms; then decrease as the control stick is moved forward and increase when moved backward.**	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 se t (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 **NORMAL and JETT indicator lamps on test console glow**	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. **Explosive cartridge tester lamp and the IG lamp on the test set glows.**	Check and replace defective cable assembly (par. 38).
7	Move and hold the firing switch to the UG position. **IG lamp goes off and the UG lamp glows**.	Same as step 6 above
8	Move and hold the firing switch to the FB position. **UG lamp goes off and the IFB lamp glows**.	Same as step 6 above-
9	Reset the firing switch to the 0 position.	
10	Press the WIRES switch on the missile selection box. **WJ lamp on the test set glows**.	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.	
	The explosive bolt circuit tester lamp glows.	Check and replace defective connector.
12	Set the test set selector switch to F position.	
13	Lift and release the GCU firing switch.	
	Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.	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.	
10	Press the WIRES switch on the missile selection box.	
	WJ lamp on the test set glows.	Same as step 5 above.
11	Set the test set selector switch to the F position.	
12	Lift and release the GCU firing switch.	
	Test set meter pointer indicates 10 cps initially, then increases to 16.5 cps.	Same as step 5 above.

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 1017257
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.

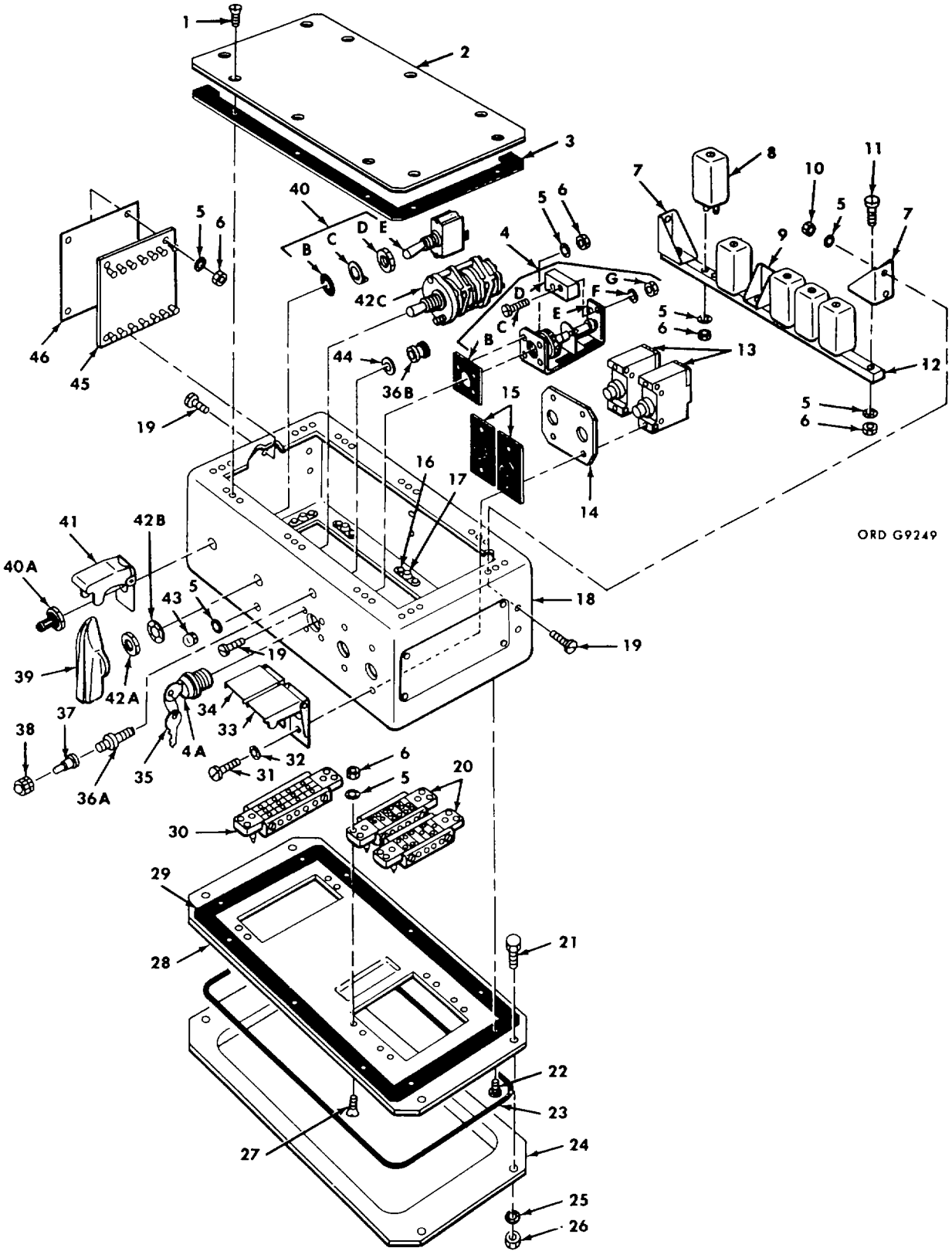


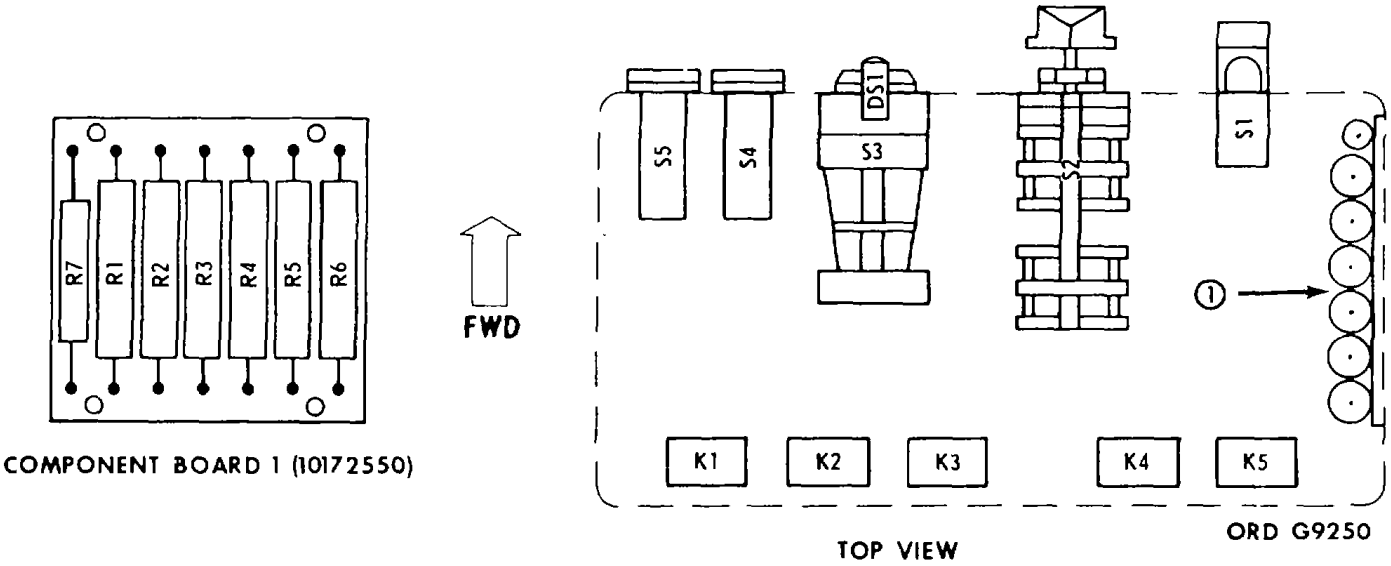
Figure 19. Missile selection box -disassembled view.

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.



COMPONENT BOARD 1 (10172550)

TOP VIEW

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.

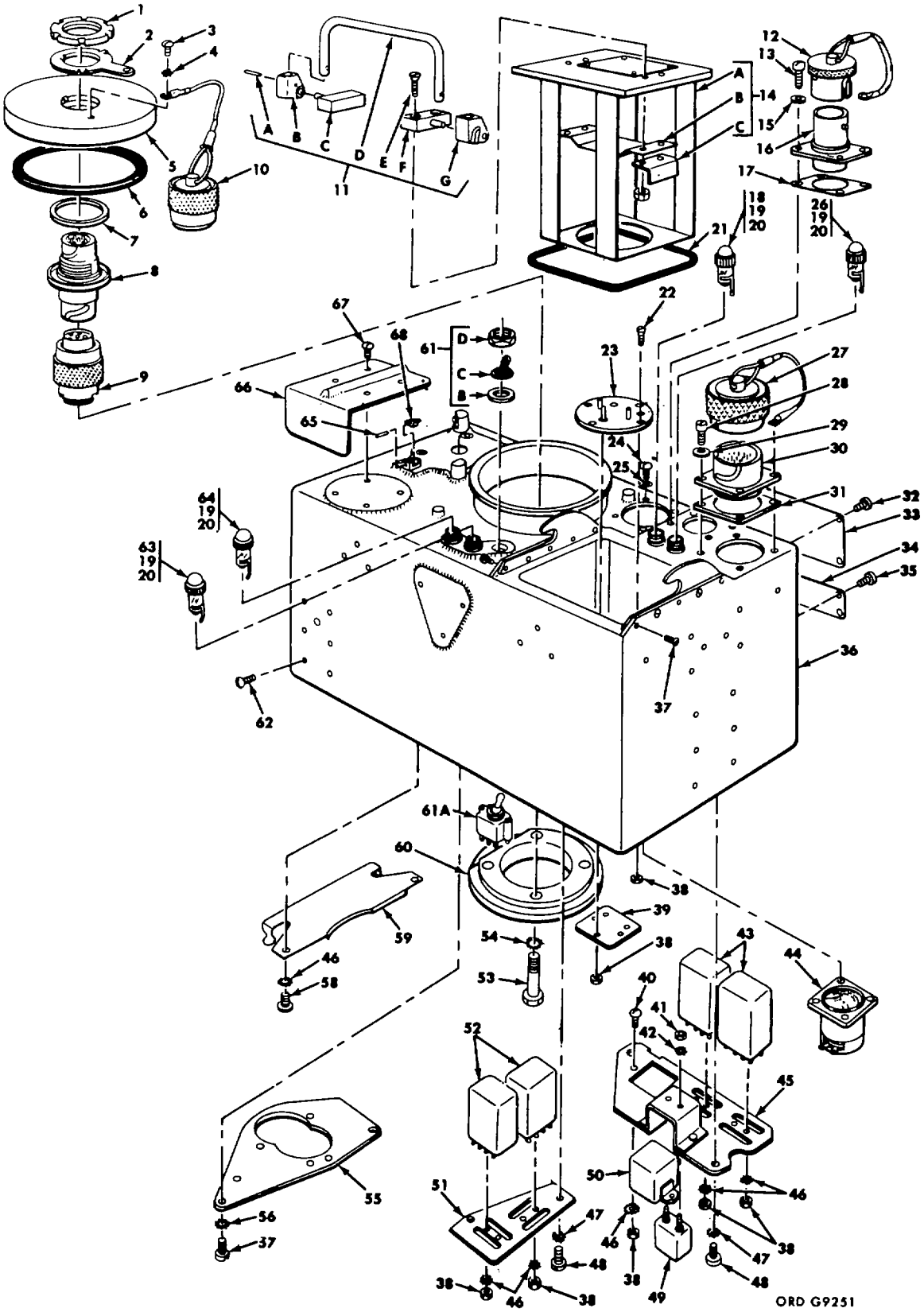


Figure 21. Guidance control unit, exploded view.

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

Figure 21. Legend

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

Figure 22. Legend.

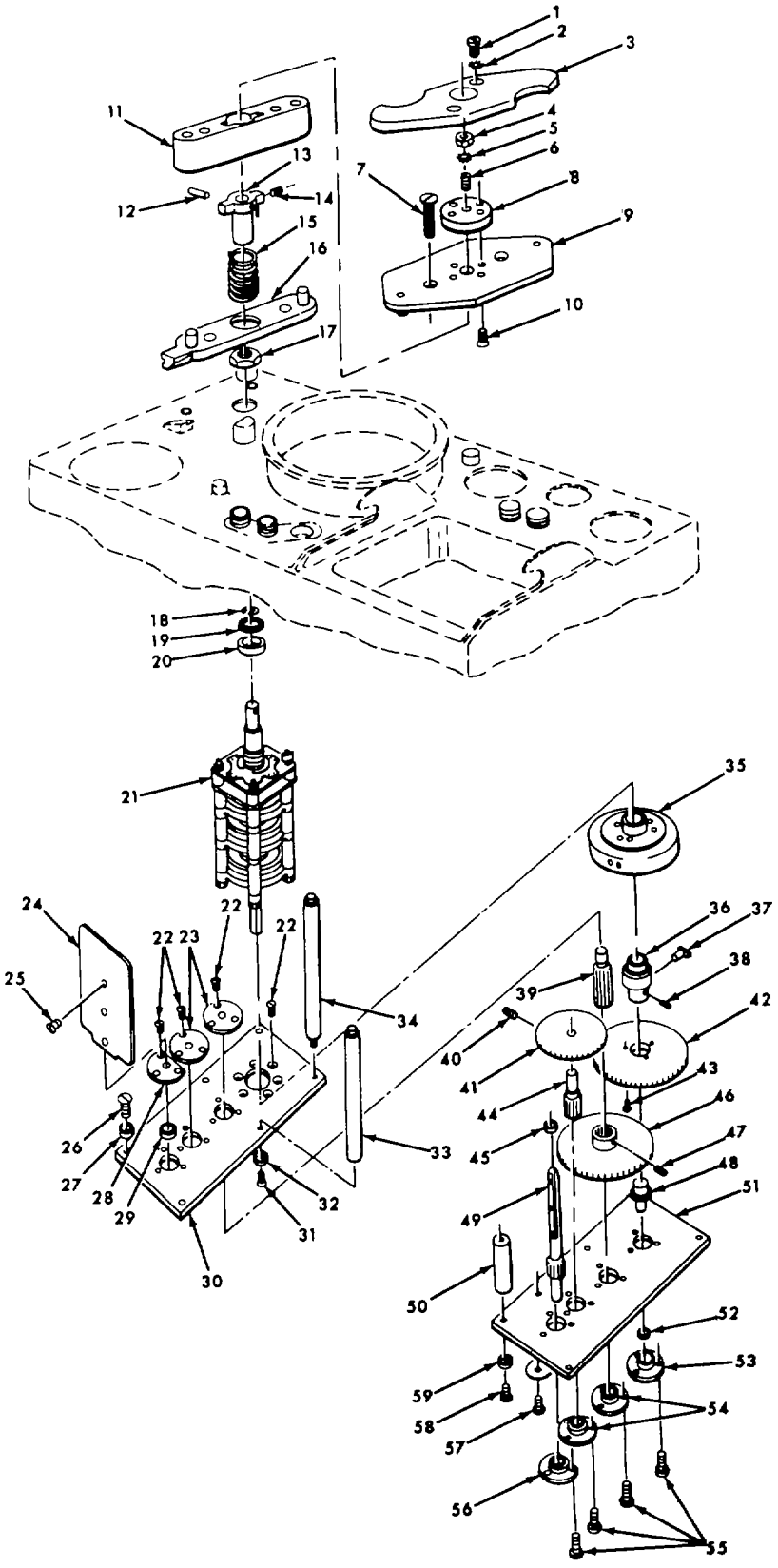


Figure 22. Guidance control unit firing switch.

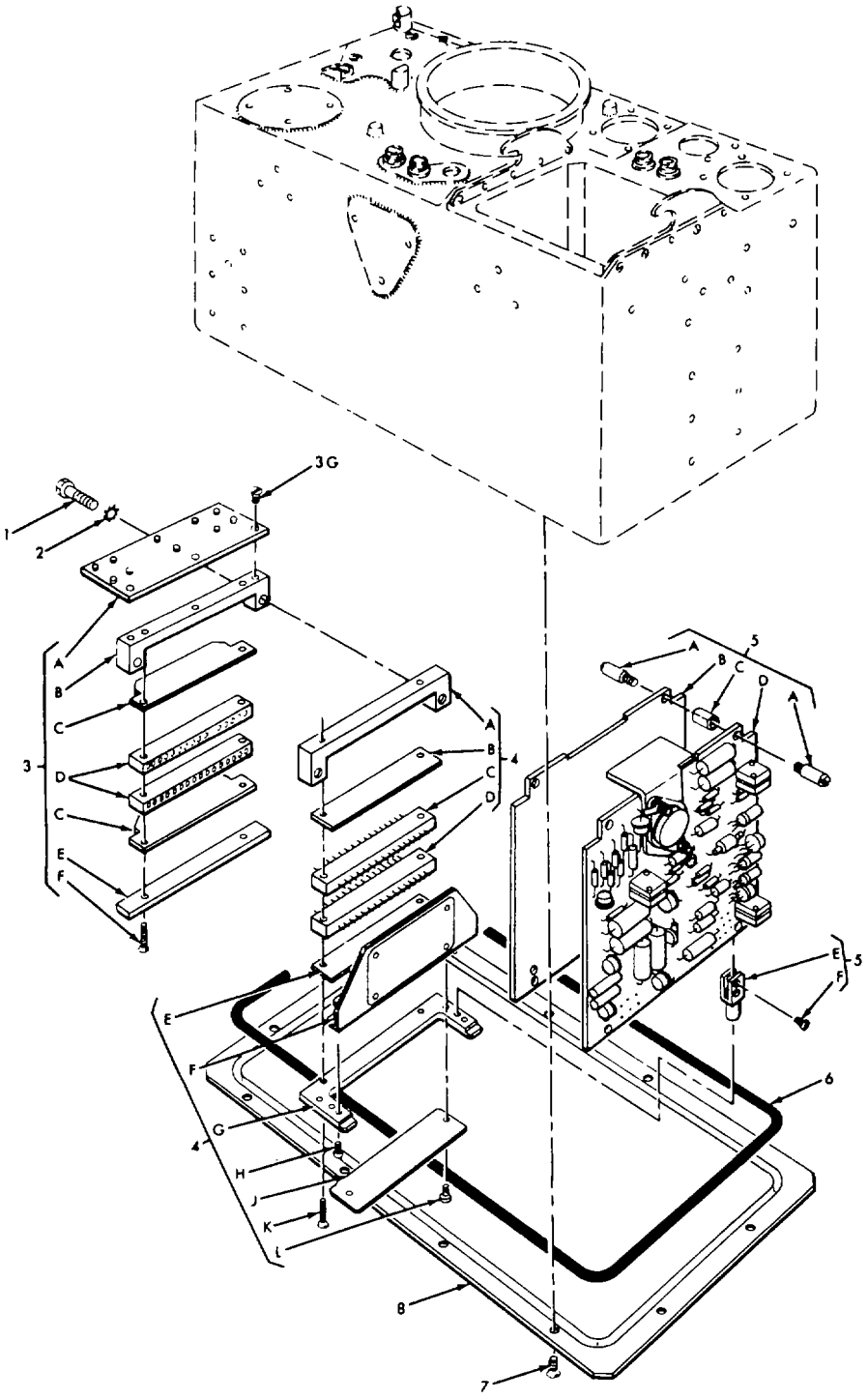


Figure 23. Guidance control unit signal generator module.

1-Screw 10172521
2-Washer 101792520
3-Connector assembly
- A-Board 10172516
- B-Bracket 10172514
- C-Insulator 10172512
- D-Connector 10172513
- E-Plate 10172511
- F-Screw 10172515
- G-Screw 10172519

4-Part of signal generator module 10172510
- A-Plate 10172660
- B-Insulator 10172659
- C-Connector 10172658
- D-Connector 10172658
- E-Insulator 10172659
- F-Bracket
- G-Bracket 10172661
- H-Screw 10172667
- J-Name plate
- K-Screw 10172662
- L-Screw 10172505

5-Part of signal generator module
- A-Screw 10172664
- B-Circuit board (issued w/item 5D)
- C-Nut, spacer 10172665
- D-Printed circuit board equipped 10172657
- E-Support 10172671
- F-Screw 10172675

6-Gasket 10172478
7--Screw 10172479
8—Plate

Figure 23. Legend.

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

Figure 24. Legend.

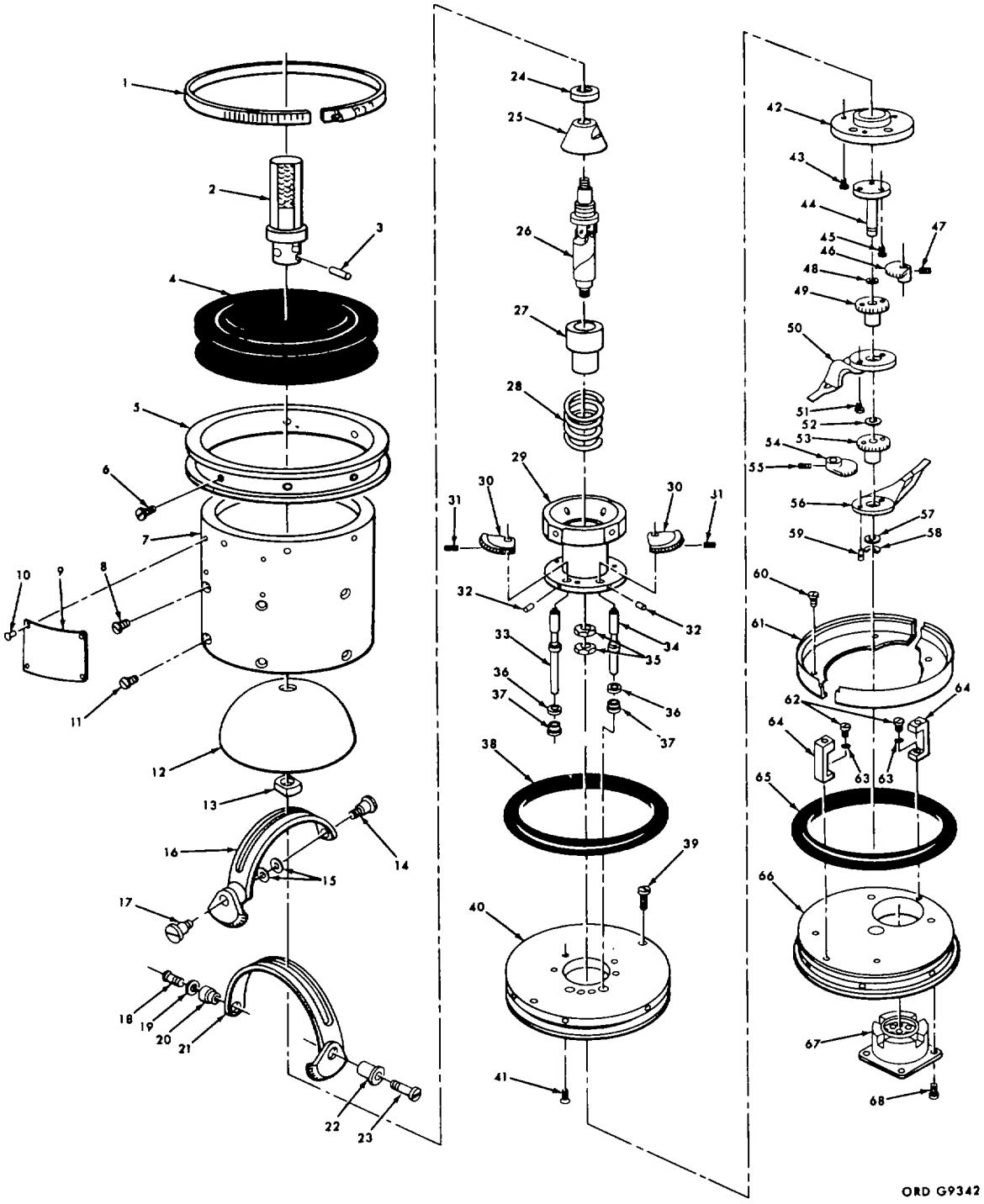


Figure 24. Control stick, exploded view.

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.

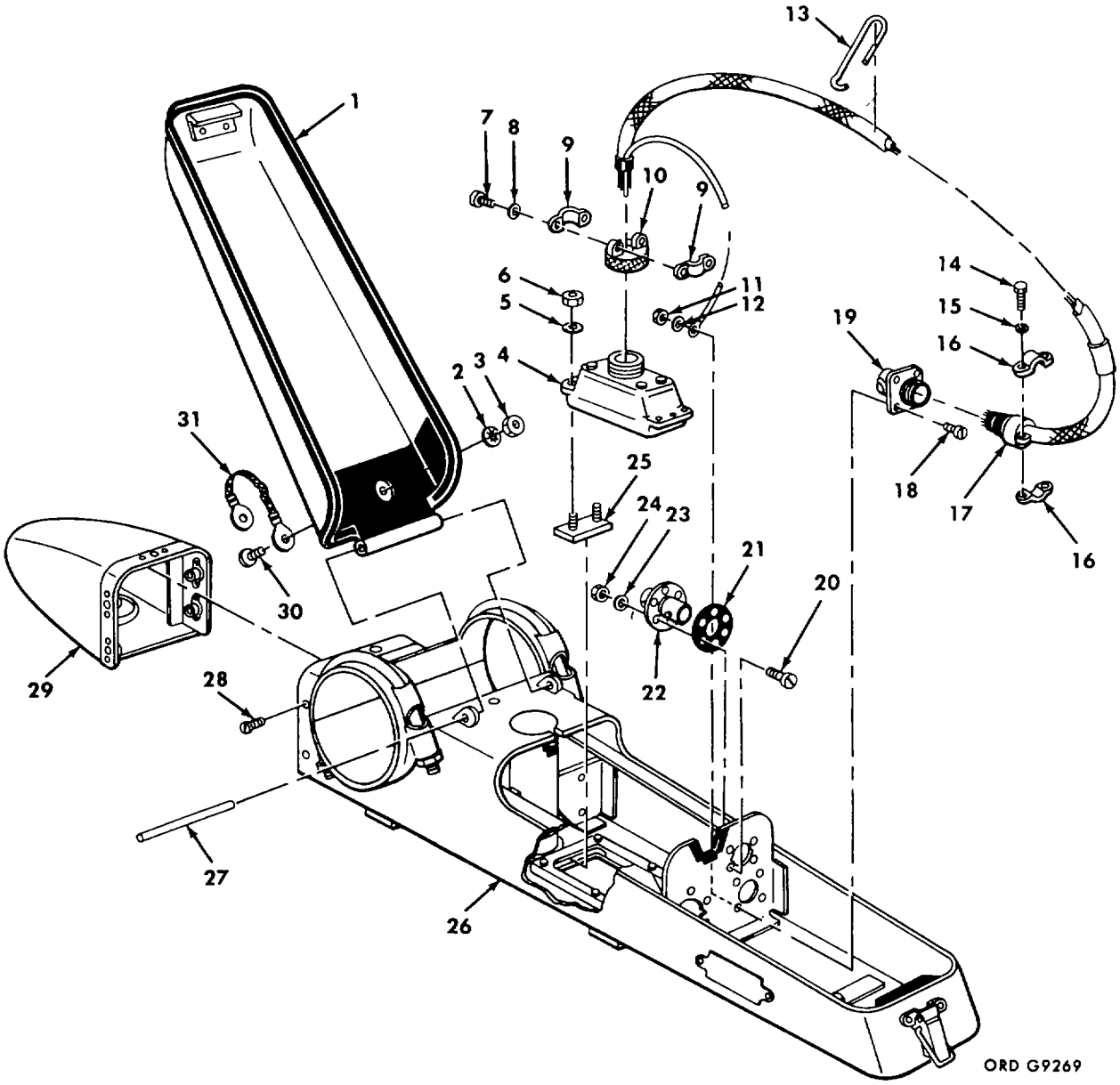


Figure 25. Fixed housing cable assembly.

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

Figure 25. Legend.

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

Figure 26. Legend.

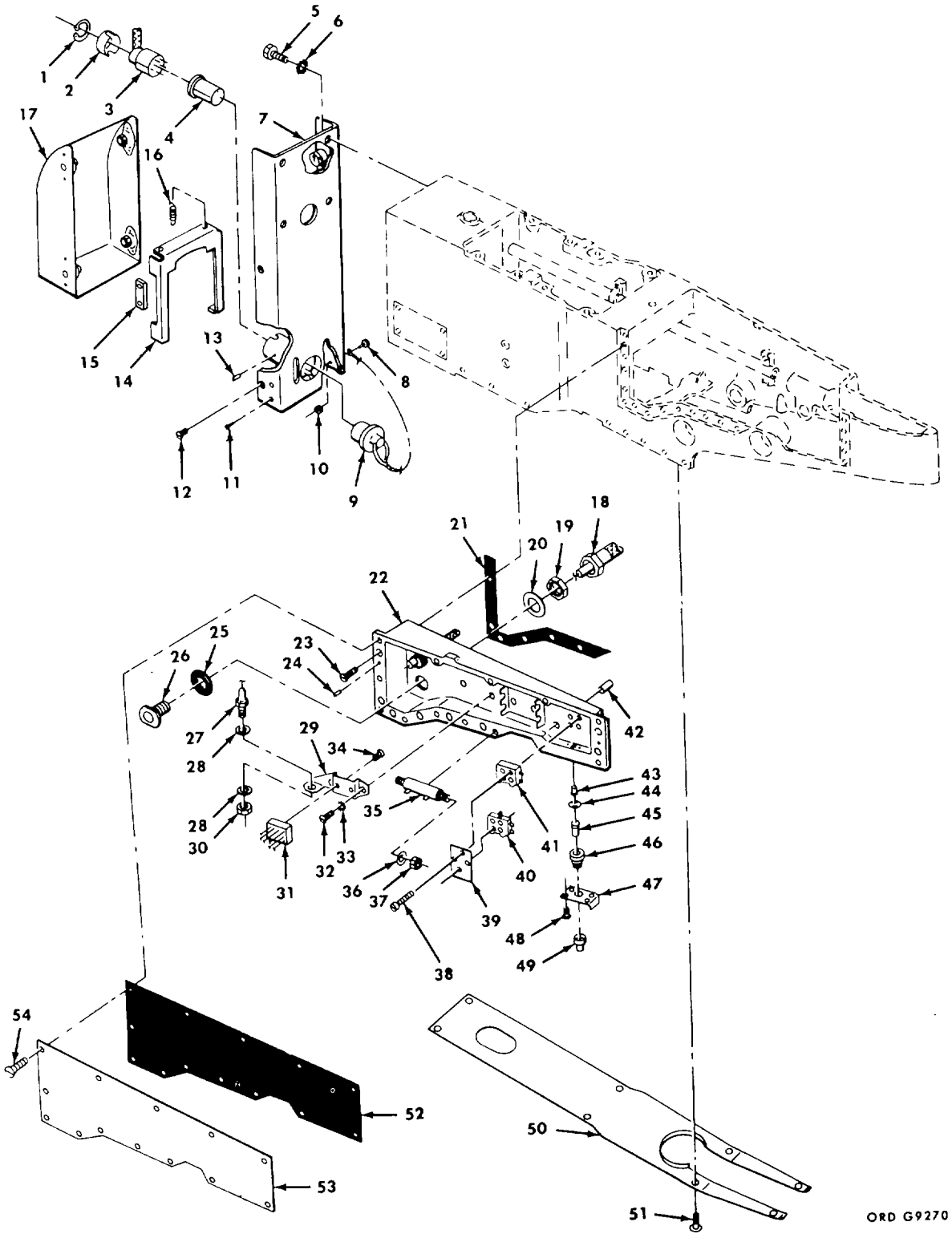


Figure 26. Launcher micro-switch.

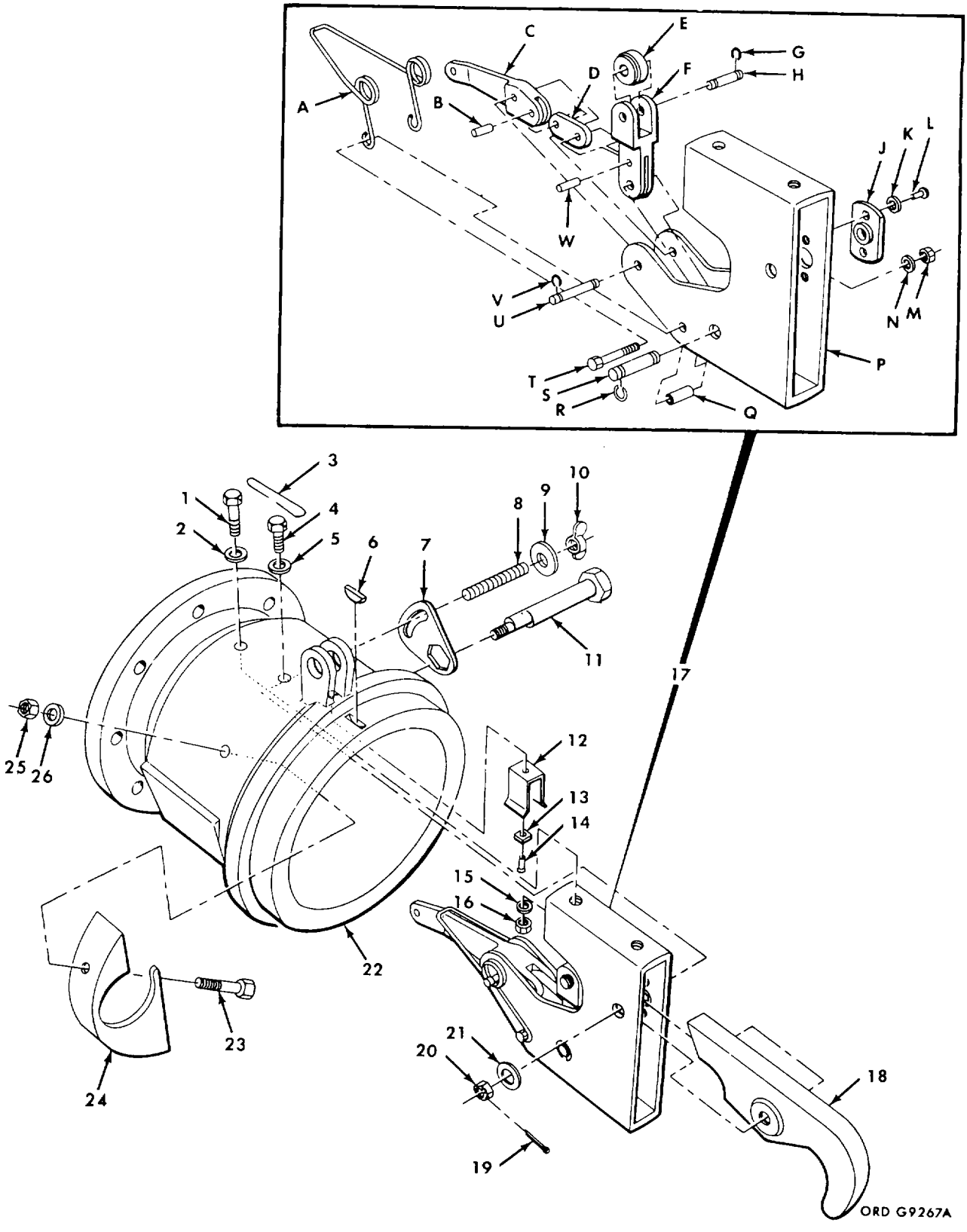


Figure 26.1. Housing assembly (8035008)-exploded view.

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

Figure 26.1. Continued.

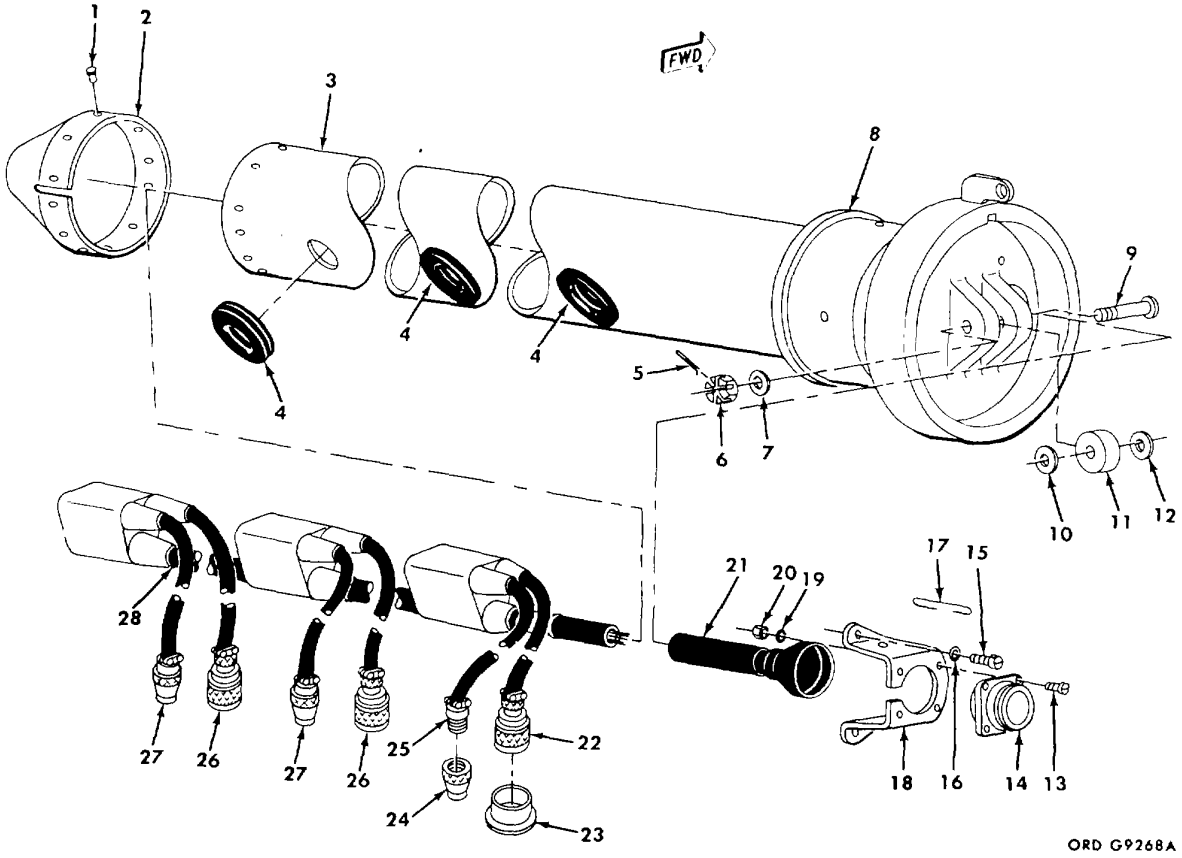


Figure 26.2. Launcher support assembly (8035001)-exploded view.

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

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.

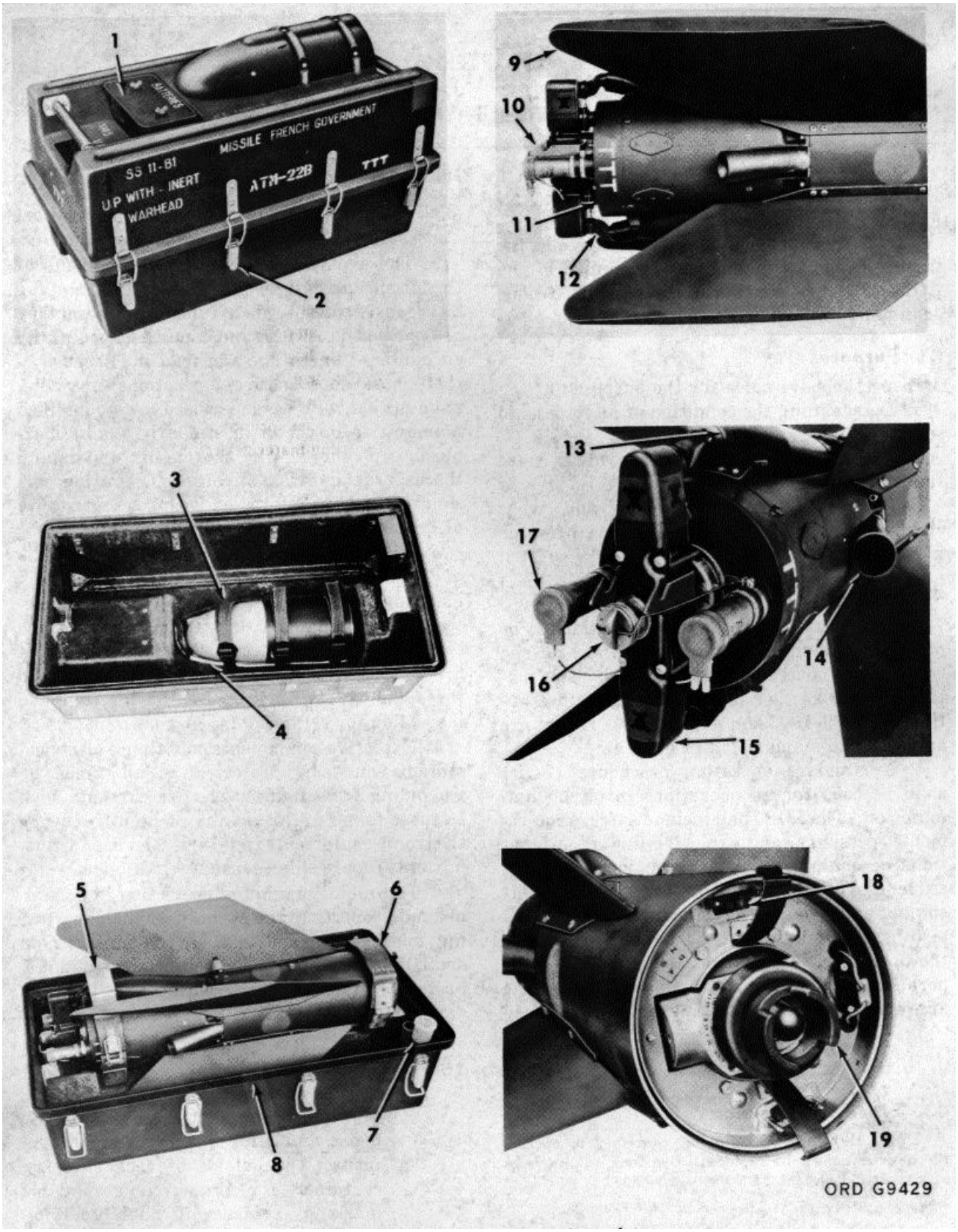


Figure 27. Ammunition inspection points.

(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 fount 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 ot 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: Missile	Markings: Warhead	Warhead tip nose color	Basic Color	Marking	Corner only	ICC Markings on containers
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).**

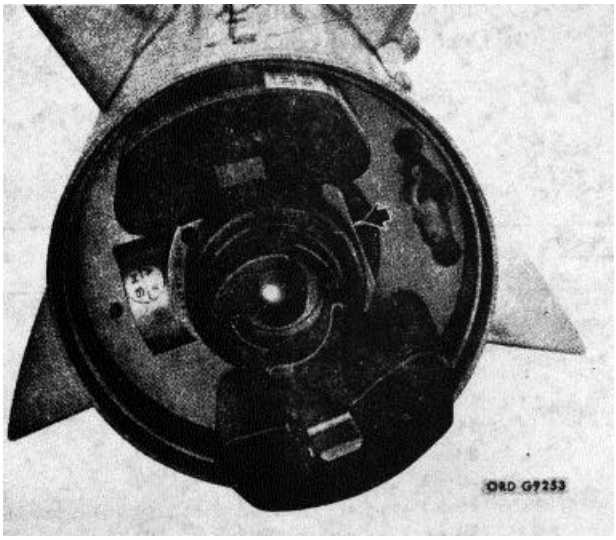


Figure 28. Warhead arming device.

(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.

(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.

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 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.

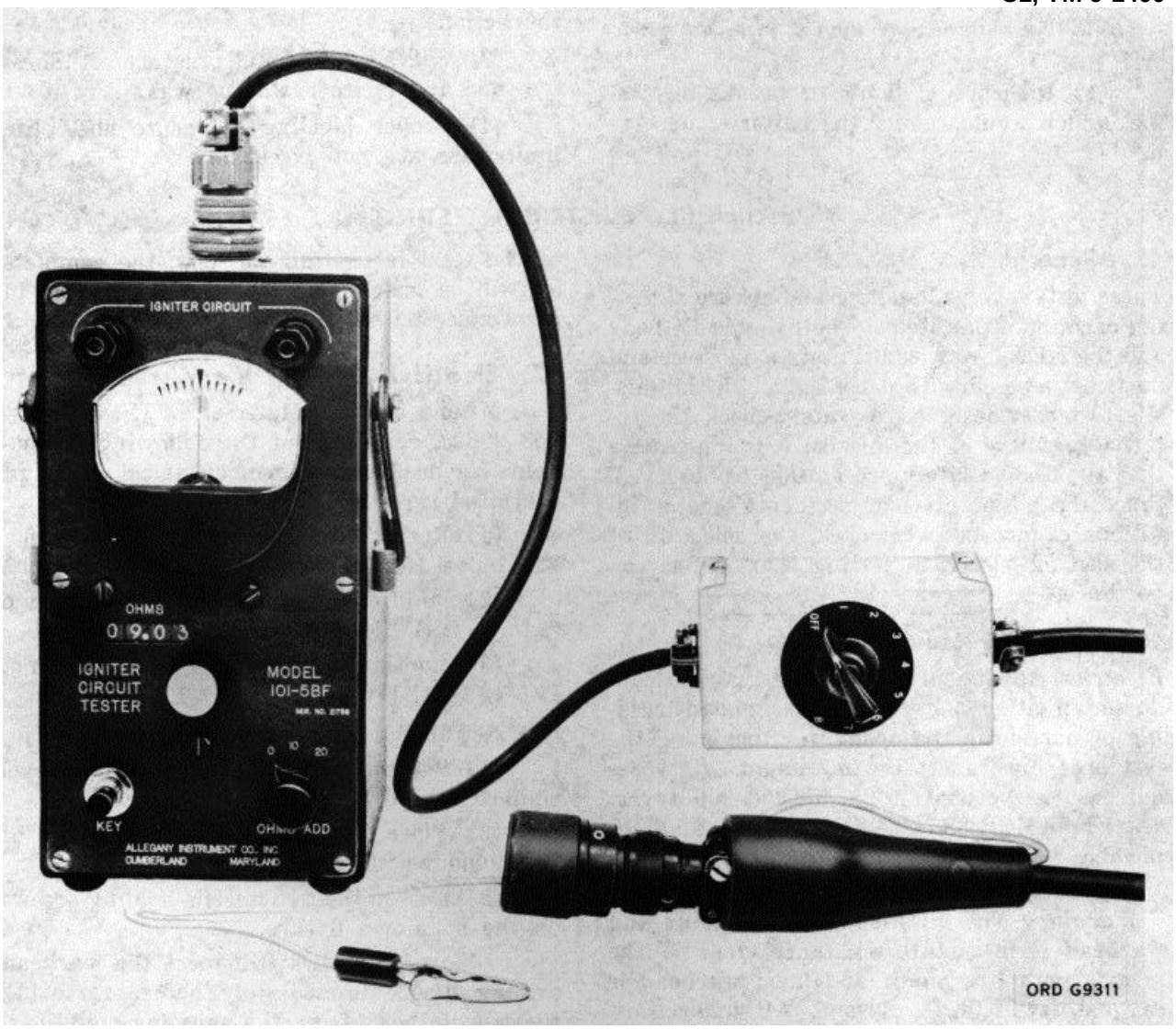


Figure 29. Alinco continuity test, Model 101-5BFG and cable.

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

AGO 6287A

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.

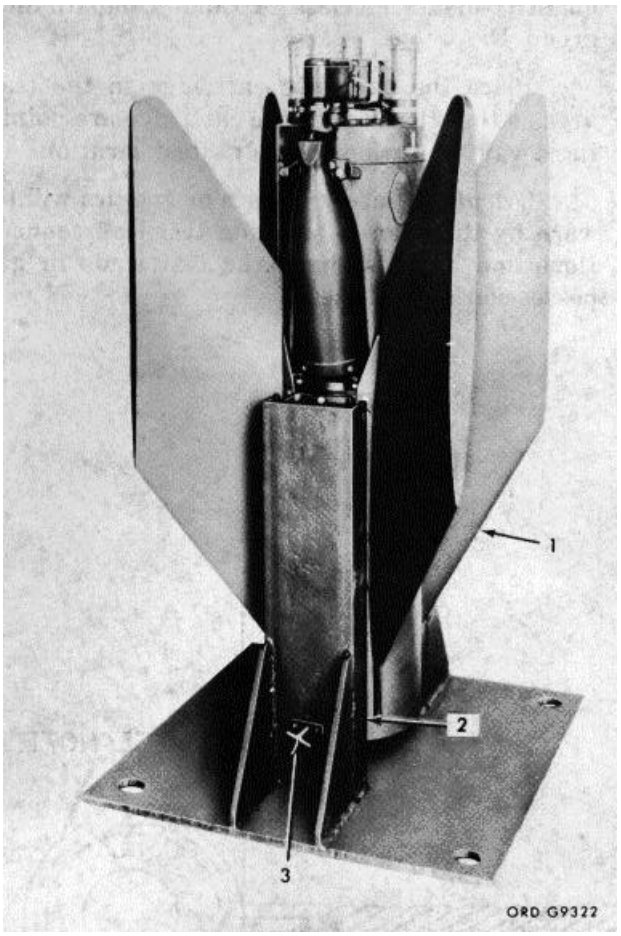


Figure 30. Missile in hold down fixture.

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.

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.

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

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.

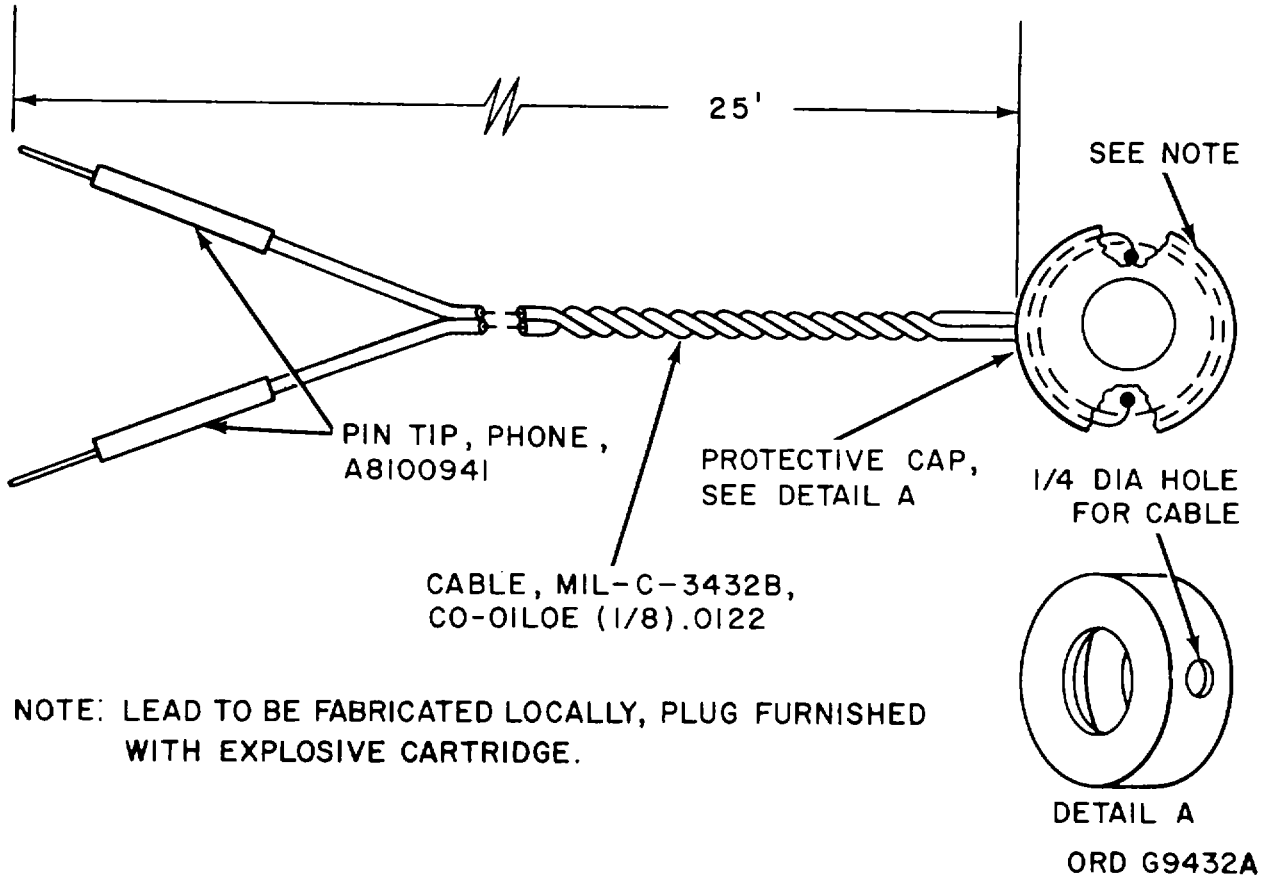


Figure 31. Explosive cartridge test lead.

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.lb 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.

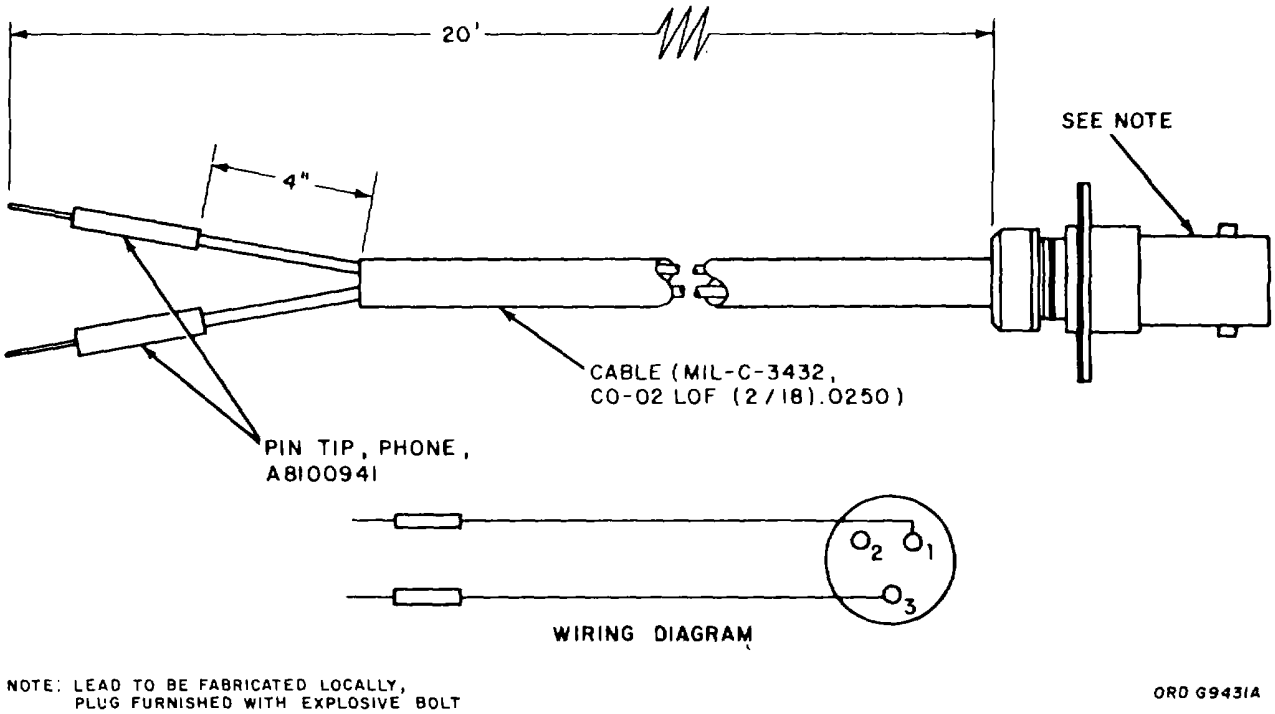


Figure 32. Explosive bold test lead.

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 galvonometer 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 I/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 ± 5" 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.

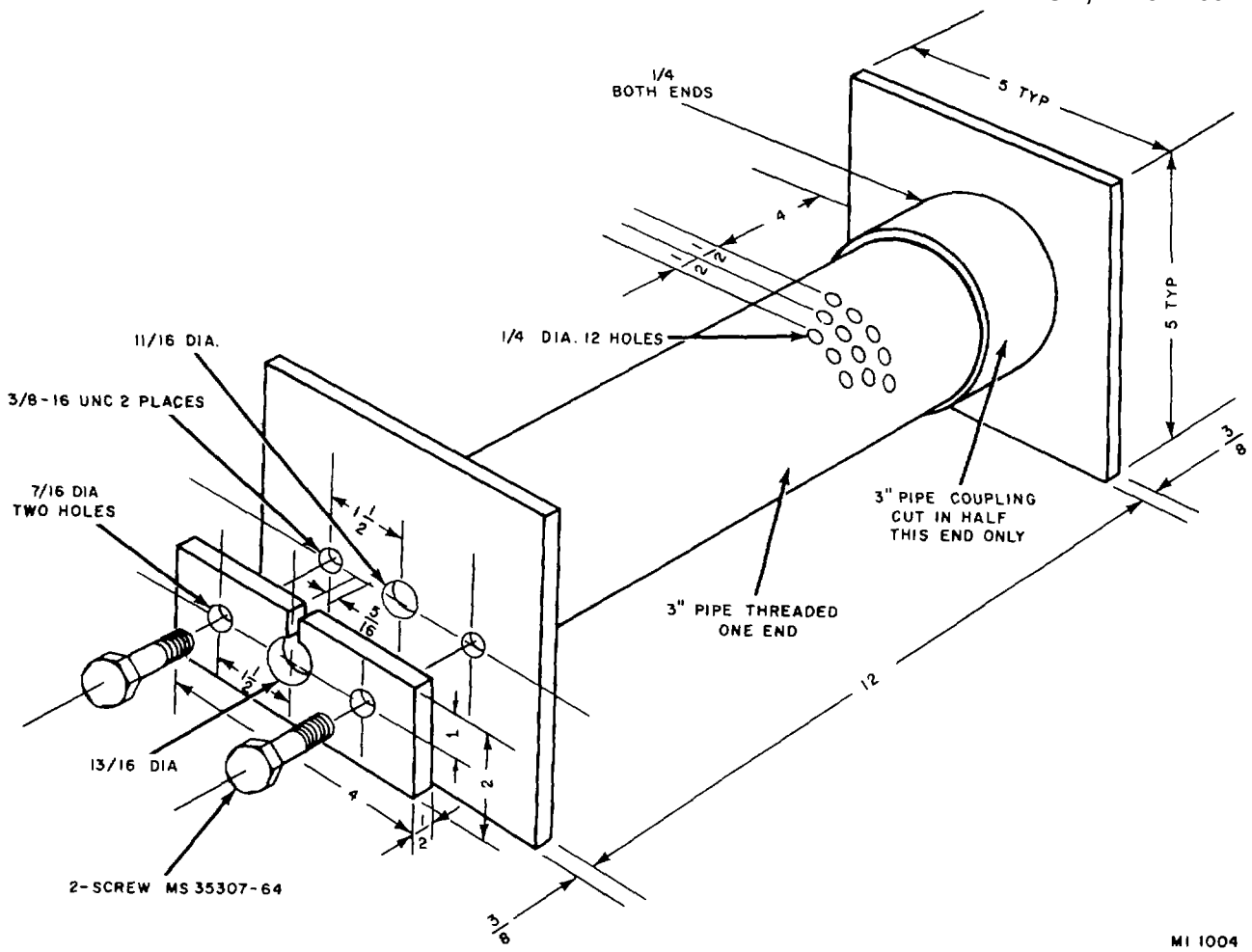


Figure 32-1. Holding fixture.

Caution:

If a misfire occurs, four successive attempts should be made immediately to fire the explosive bolts. If these attempts fail, the connections of the firing wires to the power source should be checked; then, three more attempts to fire the explosive bolts should be made. If the explosive bolt still fails to fire, disconnect the firing wires from the power source; short the ends of the firing wires together; and wait 30 minutes before investigating the cause of the misfire. Misfired bolts will be taken to the demolition area for destruction.

13) Open the barricade, and remove the holding fixture with fired bolt.

(14) Remove the explosive bolt metal parts, and dispose of them.

(15) Repeat (1) through (14) until all bolts in the waterproof sample have been subjected to the function test.

g. Low-Temperature Function.

Note.

The low temperature test will be conducted on 1/3 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 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 sale 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. **Note:.** **One operator will make electrical connections at missile while the second operator observes from outside the barricade**
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. **Note.** **If motor propellant fails to ignite or a clean burnout is not accomplished, destroy missile body as outlined in table 12.**
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.

APPROVED
BUREAU OF EXPLOSIVES
A. F. Grassmuck
MILITARY ASSISTANT
DATE 5/21/64

GENERAL NOTES

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. NOTICE: 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

MATERIAL SPECIFICATIONS

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.

LOADING & BRACING (TL & LTL) IN CLOSED OR OPEN TOP VAN TRAILER OF SS11-B1 ANTITANK MISSILE, PACKED IN PLASTIC CONTAINER (FIBER GLASS)

J.A.G.		DIW / AGE
GWP		AAL

SUBMITTED: Leslie, EXEC ASST, for COMMANDER, SAVANNA ARMY DEPOT

APPROVED: Andrew W. Bird, ARMY MISSILE COMMAND

APPROVED BY ORDER OF COMMANDER, ARMY MATERIEL COMMAND: W. M. Lancaster, ARMY SUPPLY & MAINTENANCE COMMAND

REVISIONS

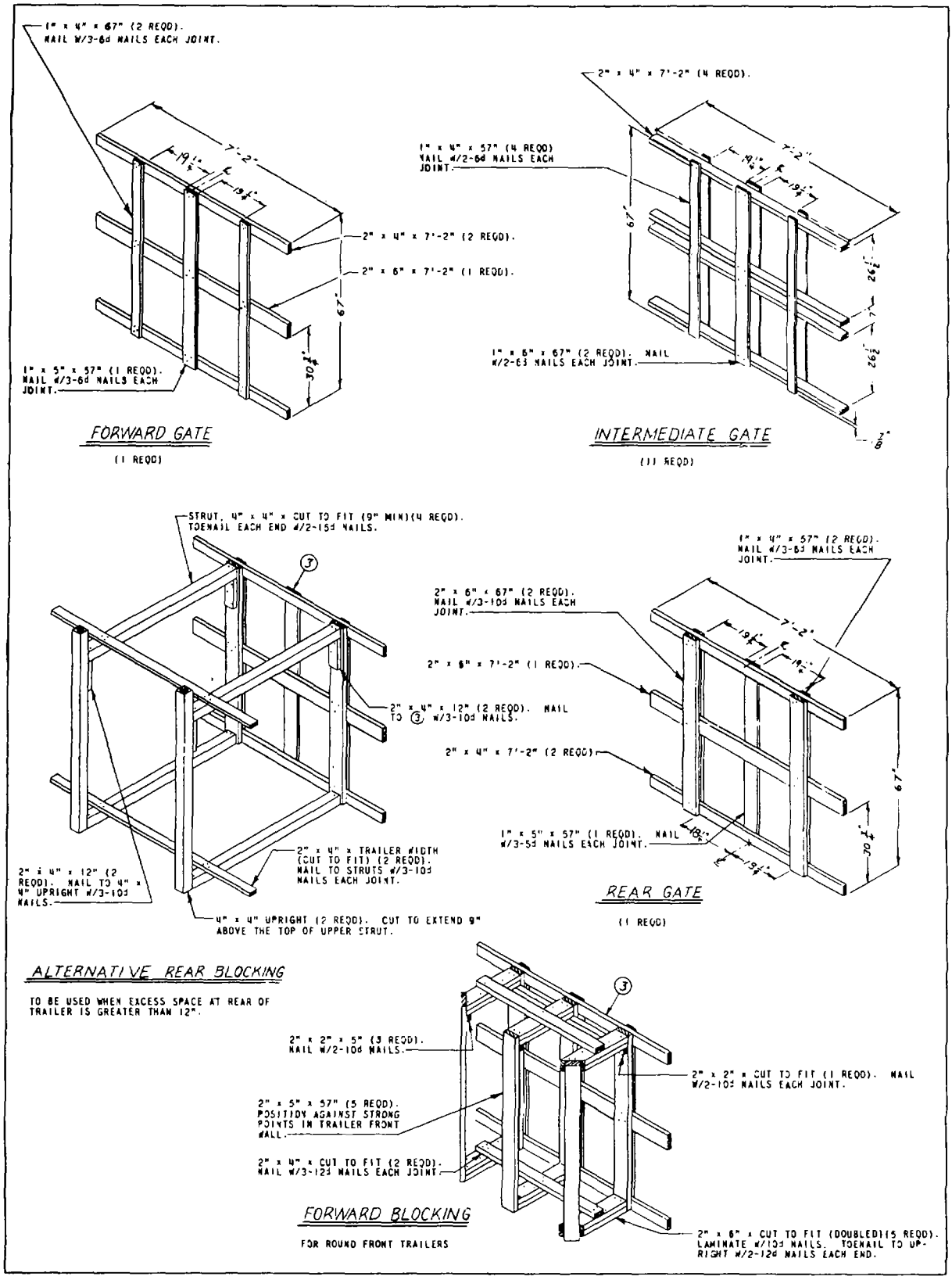
MATERIEL COMMAND U S A

10 JUNE 1964

CLASS	DIVISION	DRAWING	FILE
19	48	5722	GM 11A120

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).

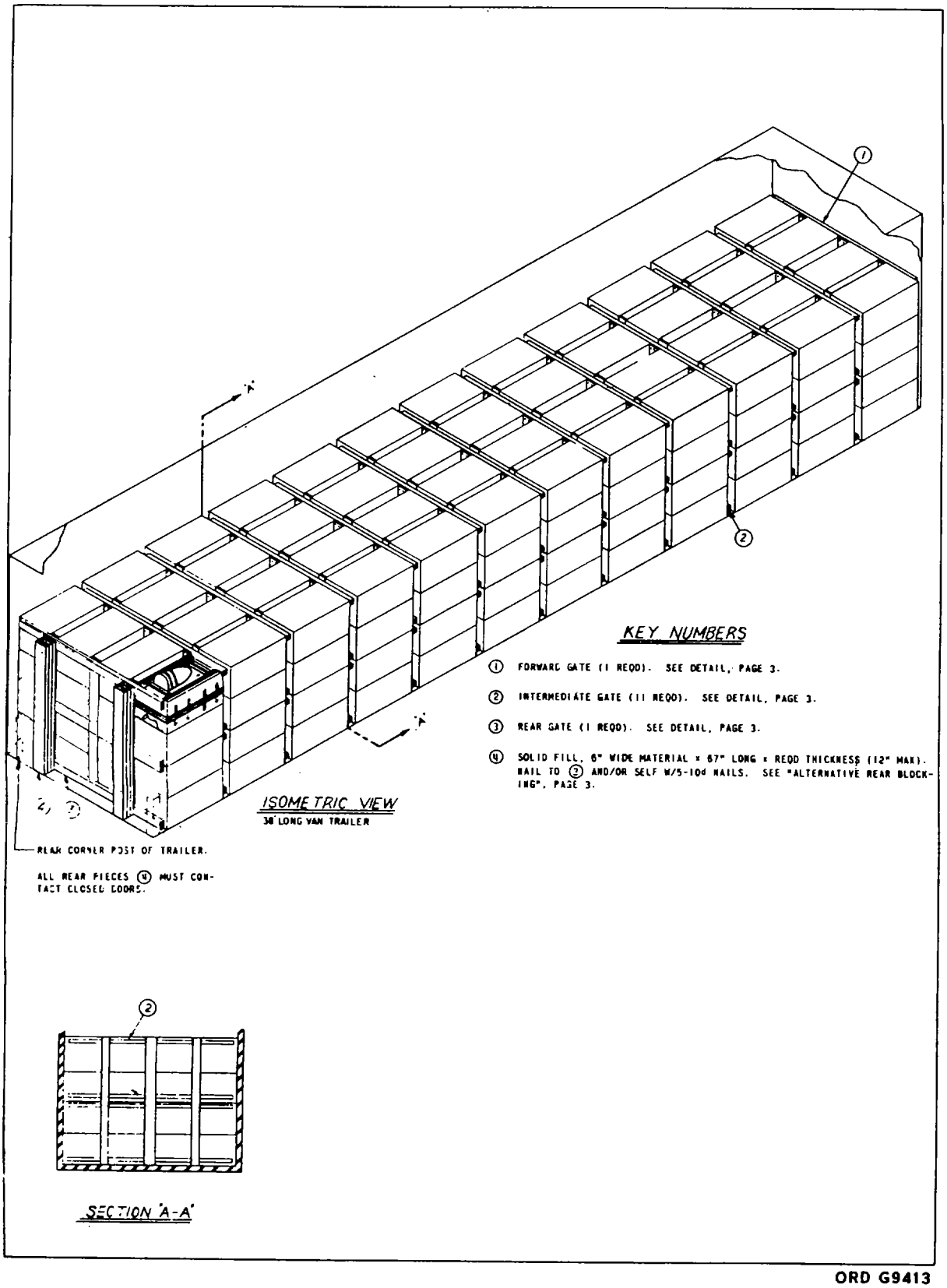
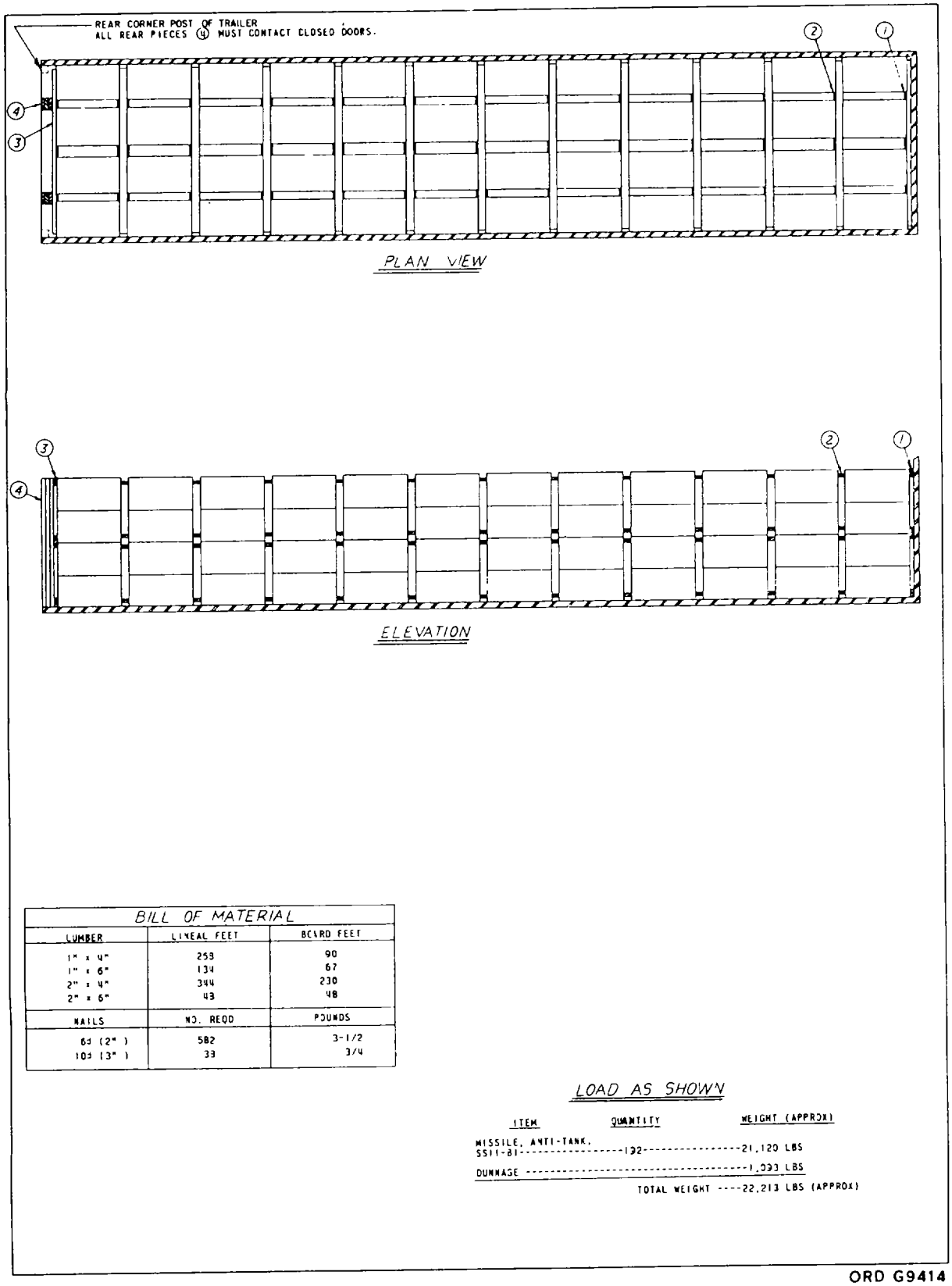


Figure 33. Loading and bracing in closed or open top van trailer, (sheet 3 of 6).



BILL OF MATERIAL		
LUMBER	LINEAL FEET	BOARD FEET
1" x 4"	253	90
1" x 6"	134	67
2" x 4"	344	230
2" x 6"	43	48
NAILS	NO. REQD	POUNDS
6d (2")	582	3-1/2
10d (3")	33	3/4

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
MISSILE, ANTI-TANK, SSII-AI	132	21,120 LBS
DUNNAGE		1,093 LBS
TOTAL WEIGHT		22,213 LBS (APPROX)

ORD G9414

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

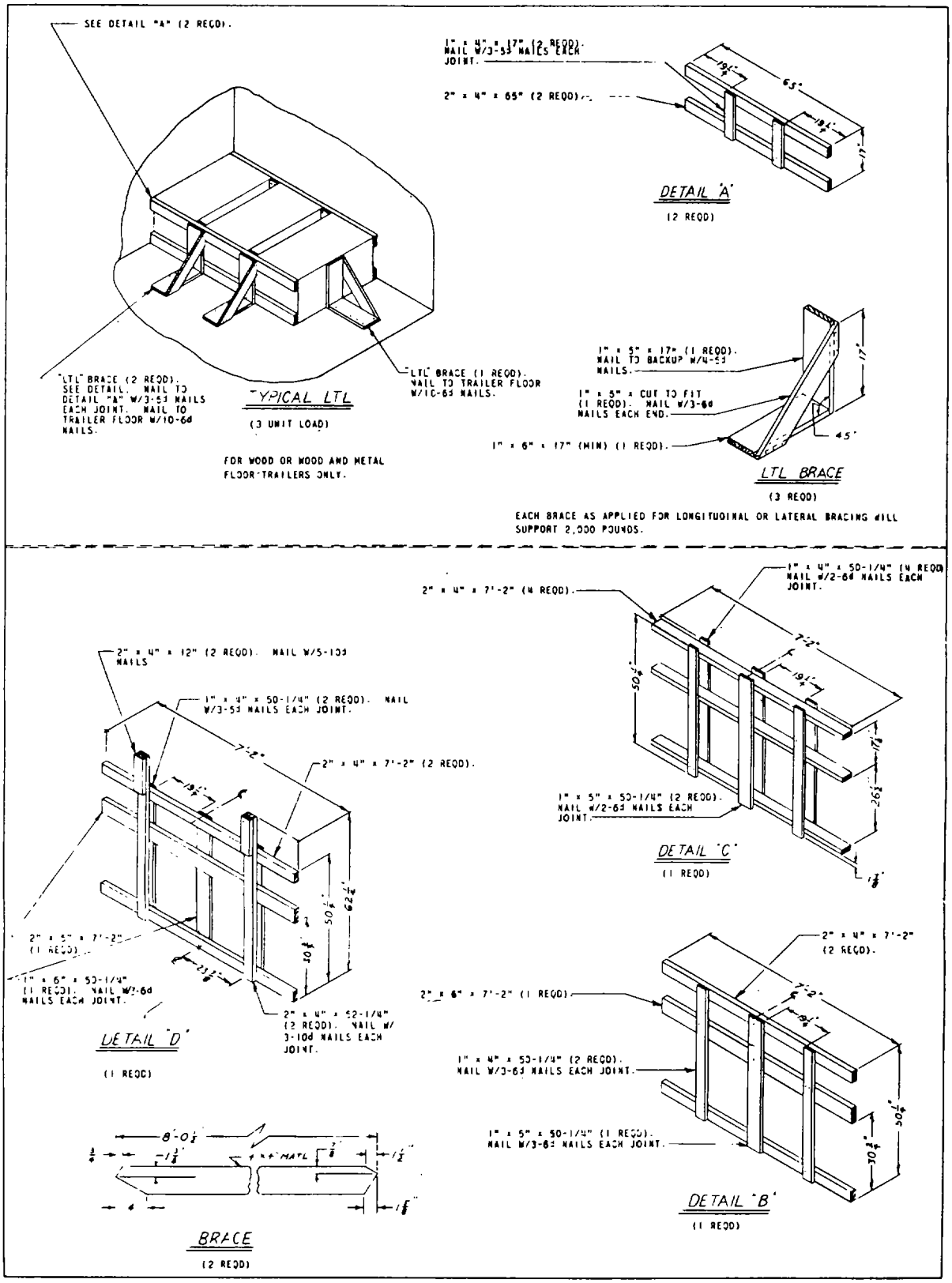


Figure 33. Loading and bracing in closed or open top van trailer, (sheet 5 of 6).

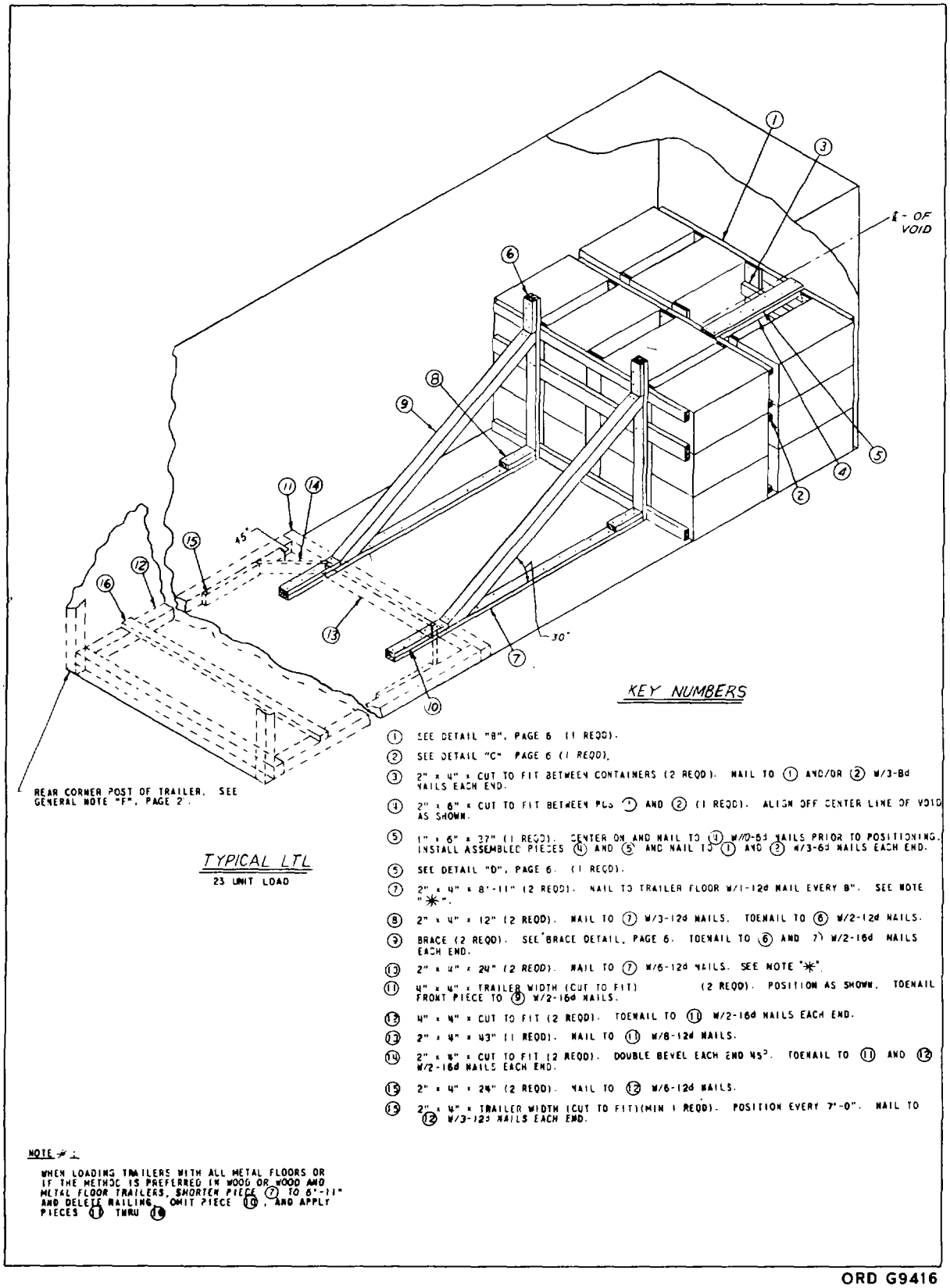
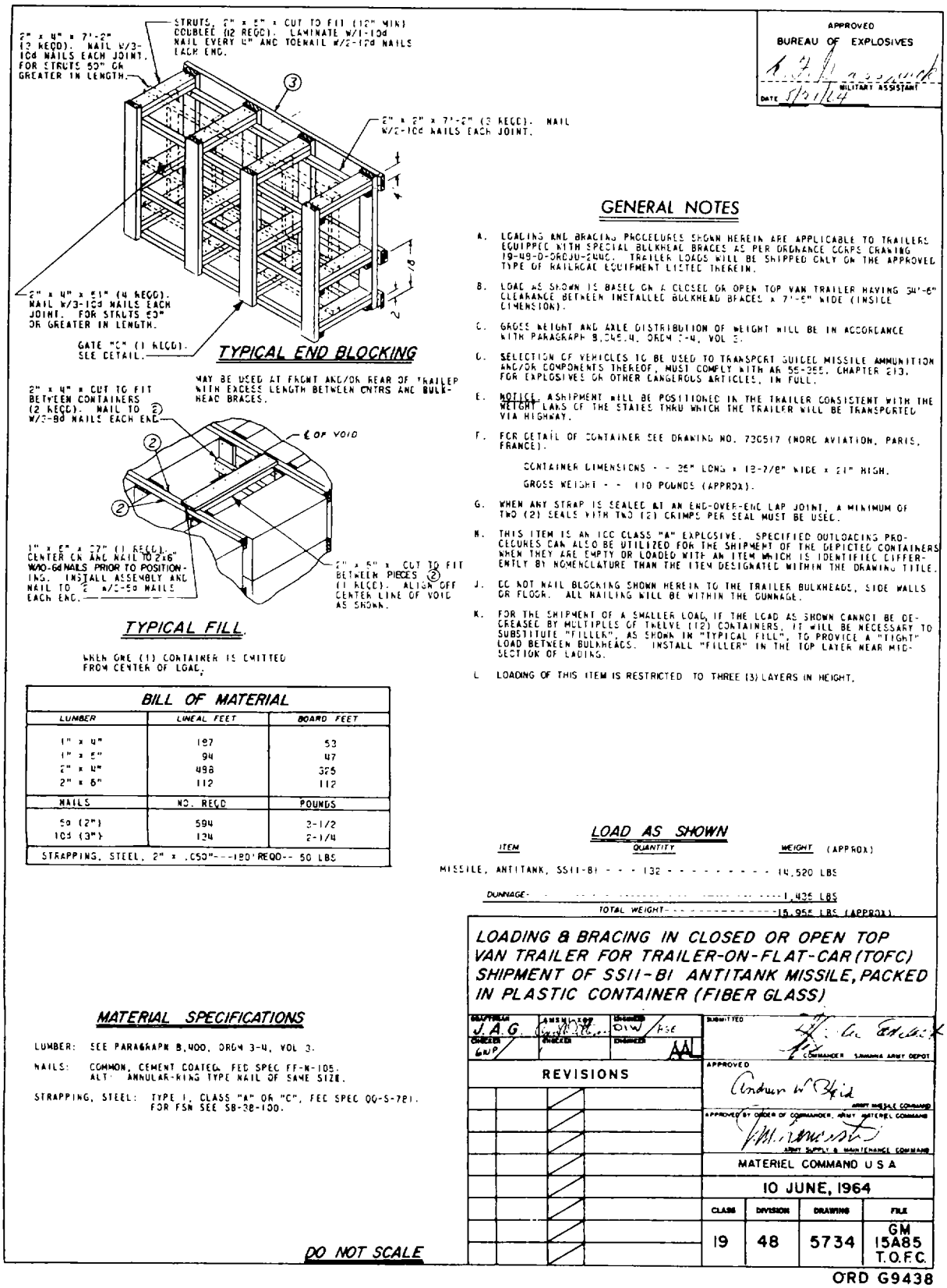


Figure 33. Loading and bracing in closed or open top van trailer, (sheet 6 of 6).



GENERAL NOTES

A. LOADING AND BRACING PROCEDURES SHOWN HEREIN ARE APPLICABLE TO TRAILERS EQUIPPED WITH SPECIAL BULKHEAD BRACES AS PER ORDNANCE CORPS DRAWING 19-49-D-ORDJU-2400. TRAILER LOADS WILL BE SHIPPED ONLY ON THE APPROVED TYPE OF RAILROAD EQUIPMENT LISTED THEREIN.

B. LOAD AS SHOWN IS BASED ON A CLOSED OR OPEN TOP VAN TRAILER HAVING 54'-6" CLEARANCE BETWEEN INSTALLED BULKHEAD BRACES x 7'-6" WIDE (INSIDE DIMENSION).

C. GROSS WEIGHT AND AXLE DISTRIBUTION OF WEIGHT WILL BE IN ACCORDANCE WITH PARAGRAPH 8,045.4, ORDM 3-4, VOL 3.

D. SELECTION OF VEHICLES 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.

E. NOTICE: SHIPMENT WILL BE POSITIONED IN THE TRAILER CONSISTENT WITH THE WEIGHT LAWS OF THE STATES THRU WHICH THE TRAILER WILL BE TRANSPORTED VIA HIGHWAY.

F. FOR DETAIL OF CONTAINER SEE DRAWING NO. 730517 (NORD AVIATION, PARIS, FRANCE).

CONTAINER DIMENSIONS - - 35" LONG x 13-7/8" WIDE x 21" HIGH.

GROSS WEIGHT - - 110 POUNDS (APPROX).

G. WHEN ANY STRAP IS SEALED AT AN END-OVER-END LAP JOINT, A MINIMUM OF TWO (2) SEALS WITH TWO (2) CRIMPS PER SEAL MUST BE USED.

H. 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.

J. DO NOT NAIL BLOCKING SHOWN HEREIN TO THE TRAILER BULKHEADS, SIDE WALLS OR FLOOR. ALL NAILING WILL BE WITHIN THE DUNNAGE.

K. FOR THE SHIPMENT OF A SMALLER LOAD, IF THE LOAD AS SHOWN CANNOT BE DECREASED BY MULTIPLES OF TWELVE (12) CONTAINERS, IT WILL BE NECESSARY TO SUBSTITUTE "FILLER", AS SHOWN IN "TYPICAL FILL", TO PROVIDE A "TIGHT" LOAD BETWEEN BULKHEADS. INSTALL "FILLER" IN THE TOP LAYER NEAR MID-SECTION OF LADING.

L. LOADING OF THIS ITEM IS RESTRICTED TO THREE (3) LAYERS IN HEIGHT.

BILL OF MATERIAL

LUMBER	LINEAL FEET	BOARD FEET
1" x 4"	197	53
1" x 6"	94	47
2" x 4"	498	375
2" x 6"	112	112
NAILS	**NO. REQD**	**POUNDS**
6d (2")	594	3-1/2
10d (3")	134	2-1/4
STRAPPING, STEEL, 2" x .050"---180' REQD-- 50 LBS		

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
MISSILE, ANTITANK, SS11-B1	132	14,520 LBS
DUNNAGE		1,435 LBS
TOTAL WEIGHT		15,955 LBS (APPROX)

MATERIAL SPECIFICATIONS

LUMBER: SEE PARAGRAPH 8,400, ORDM 3-4, VOL 3.

NAILS: COMMON, CEMENT COATED. FED SPEC FF-N-105. ALT: ANNULAR-RING TYPE NAIL OF SAME SIZE.

STRAPPING, STEEL: TYPE I, CLASS "A" OR "C", FED SPEC QQ-S-781. FOR FSN SEE SB-38-100.

DO NOT SCALE

LOADING & BRACING IN CLOSED OR OPEN TOP VAN TRAILER FOR TRAILER-ON-FLAT-CAR (TOFC) SHIPMENT OF SS11-B1 ANTITANK MISSILE, PACKED IN PLASTIC CONTAINER (FIBER GLASS)

DRAFTSMAN J.A.G. CHECKED GWP

REVISIONS

SUBMITTED
COMMANDER SAVANNA ARMY DEPOT

APPROVED
ARMY MISSILE COMMAND

APPROVED BY ORDER OF COMMANDER, ARMY MATERIEL COMMAND
ARMY SUPPLY & MAINTENANCE COMMAND

MATERIEL COMMAND U S A

10 JUNE, 1964

CLASS	DIVISION	DRAWING	FILE
19	48	5734	GM 15A85 T.O.F.C.

ORD G9438

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

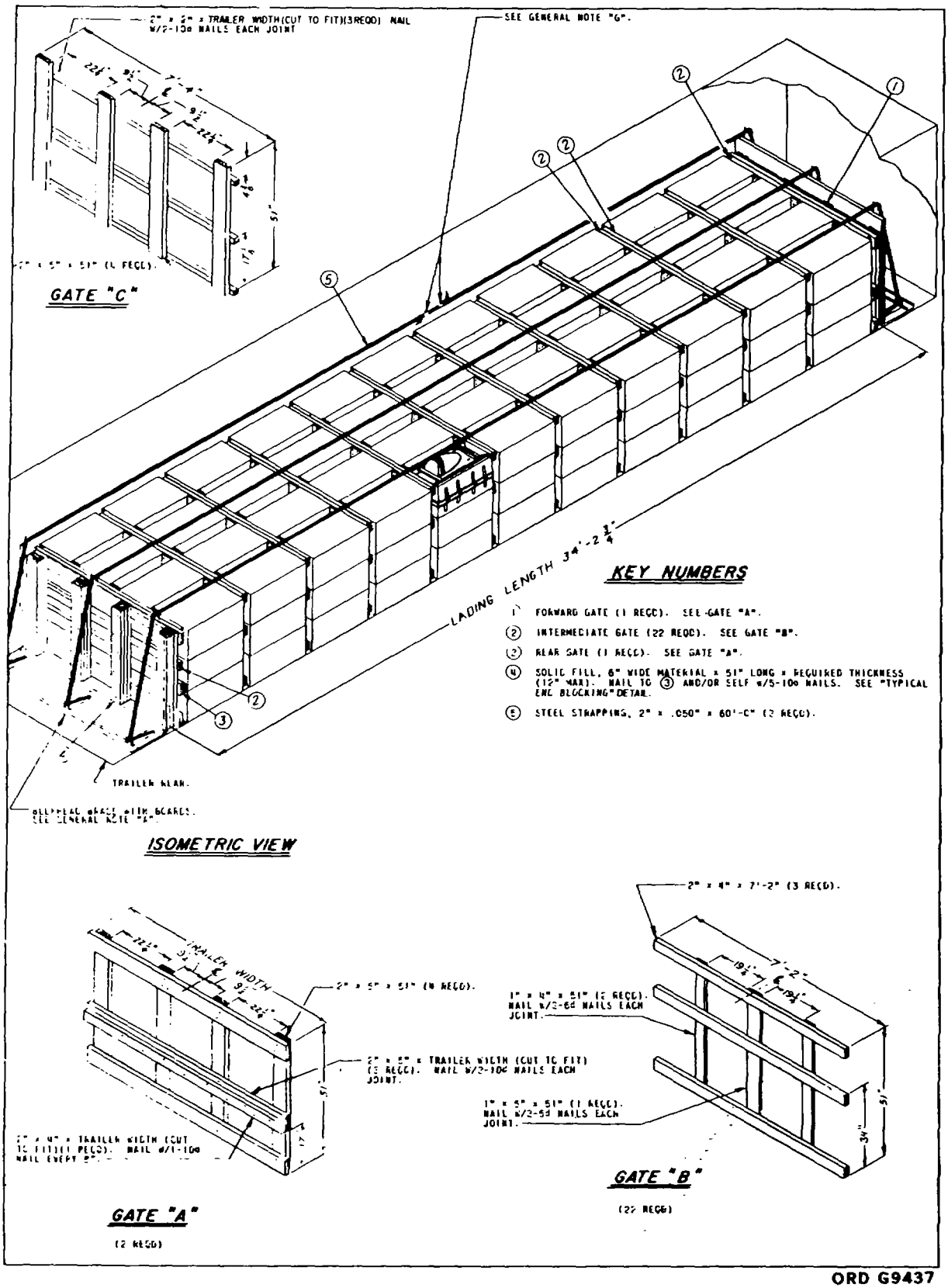


Figure 34. Loading and bracing in closed or open top van trailer for trailer-on flat-car shipment, (sheet 2 of 2).

GENERAL NOTES

APPROVED
BUREAU OF EXPLOSIVES
A. F. Grossmuck
CHIEF ASSISTANT
DATE 5/21/64

A. THE LOAD AS SHOWN ON PAGES 4 AND 5 IS BASED ON A BOX CAR 50'-6" LONG x 8'-6" WIDE WITH 8'-0" (MIN) DOORWAY OPENING.

B. THE LOAD AS SHOWN ON PAGES 6 AND 7 IS BASED ON A BOX CAR 50'-6" 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 CARLOAD 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 - 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 ORD CORPS DRAWING 19-48-2213-5P34.

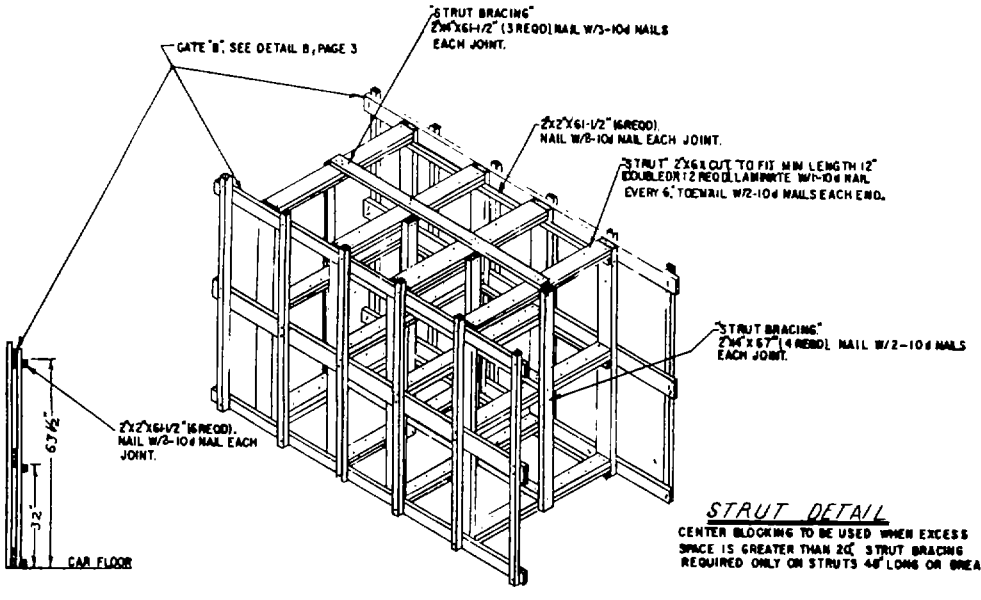
H. USE COMBINATION OF LOADING PROCEDURES SHOWN HEREIN TO PROVIDE PROPER BLOCKING AND BRACING FOR THE UNIT QUANTITIES NOT DEPICTED.

J. LOADING OF THIS ITEM IS RESTRICTED TO FOUR (4) LAYERS IN HEIGHT.

MATERIAL SPECIFICATIONS

LUMBER: SEE PARAGRAPH 8.400, ORDM 3-4, VOL 3.

NAILS: COMMON, CEMENT COATED, FED SPEC FF-N-105.
ALT: ANNULAR-RING TYPE NAIL OF SAME SIZE.



STRUT DETAIL

CENTER BLOCKING TO BE USED WHEN EXCESS SPACE IS GREATER THAN 20". STRUT BRACING REQUIRED ONLY ON STRUTS 48" LONG OR GREATER.

ORD G9403

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

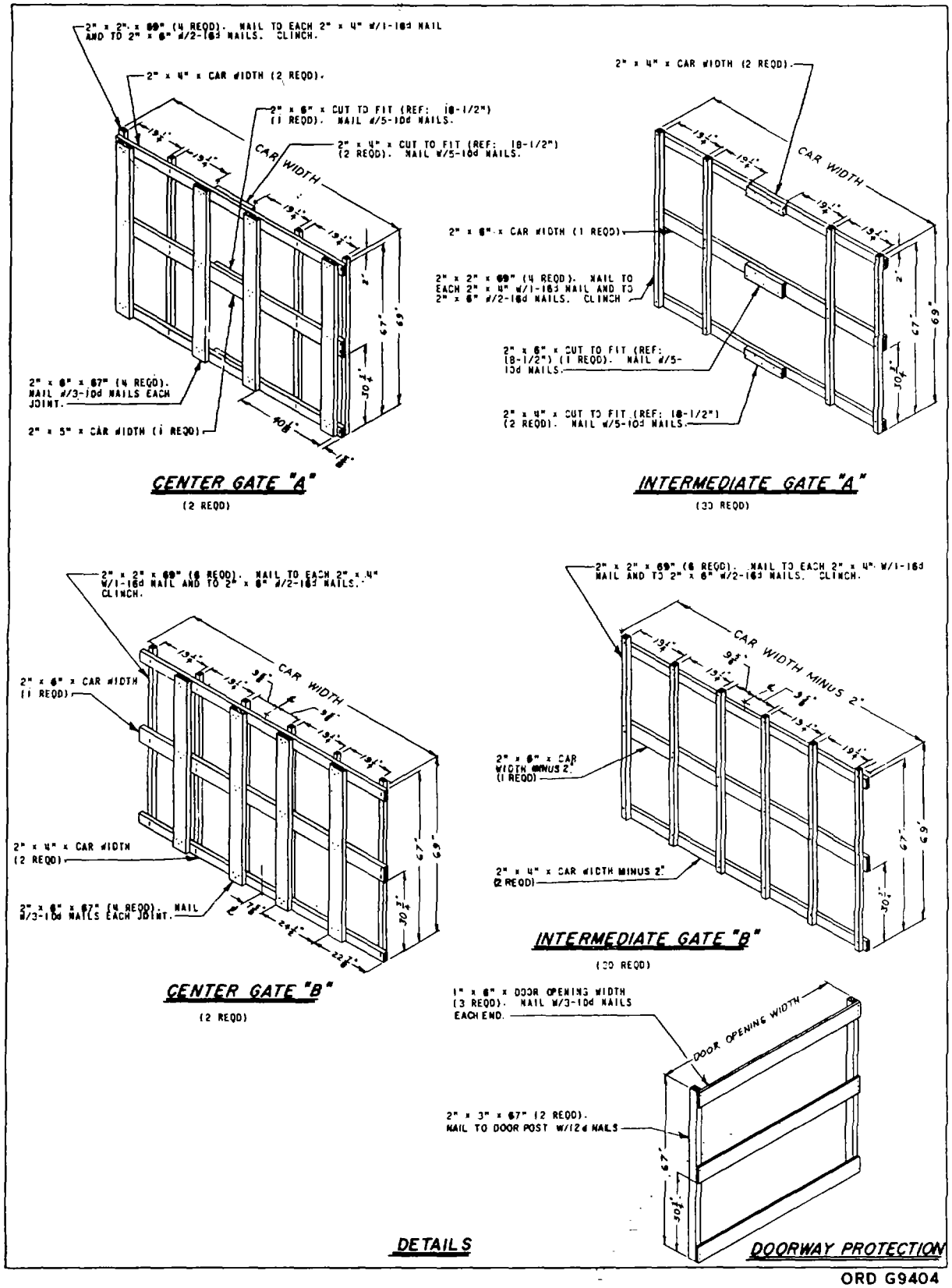


Figure 35. Loading and bracing in box cars, (sheet 2 of 8).

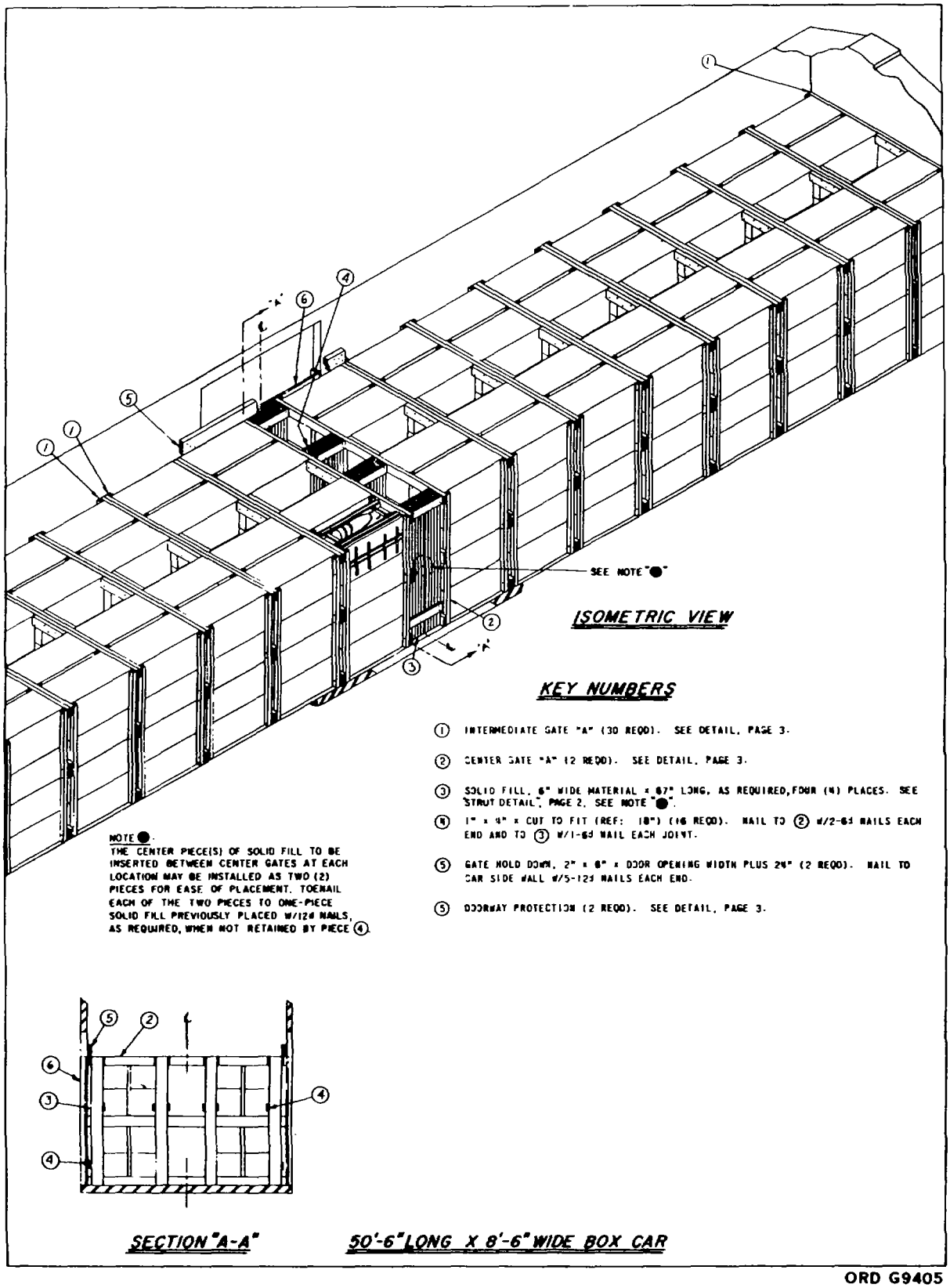
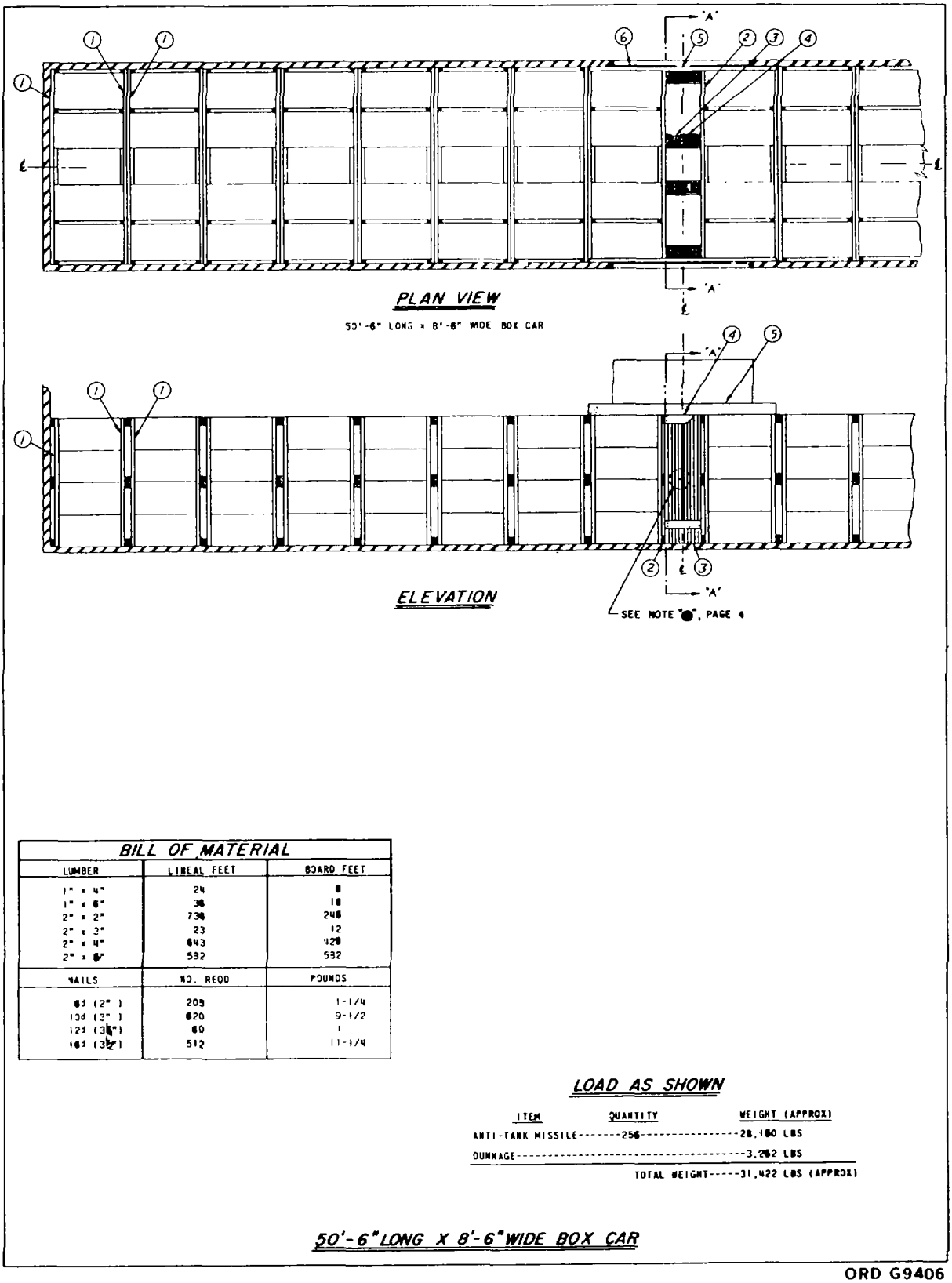


Figure 35. Loading and bracing in box cars, (sheet 3 of 8).



BILL OF MATERIAL

LUMBER	LINEAL FEET	BOARD FEET
1" x 4"	24	8
1" x 6"	36	18
2" x 2"	736	245
2" x 3"	23	12
2" x 4"	643	428
2" x 6"	532	532

NAILS	NO. REQD	POUNDS
8d (2")	205	1-1/4
10d (3")	620	9-1/2
12d (3¼")	60	1
16d (3½")	512	11-1/4

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
ANTI-TANK MISSILE	256	28,160 LBS
DUNNAGE		3,262 LBS
TOTAL WEIGHT		31,422 LBS (APPROX)

50'-6" LONG X 8'-6" WIDE BOX CAR

ORD G9406

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

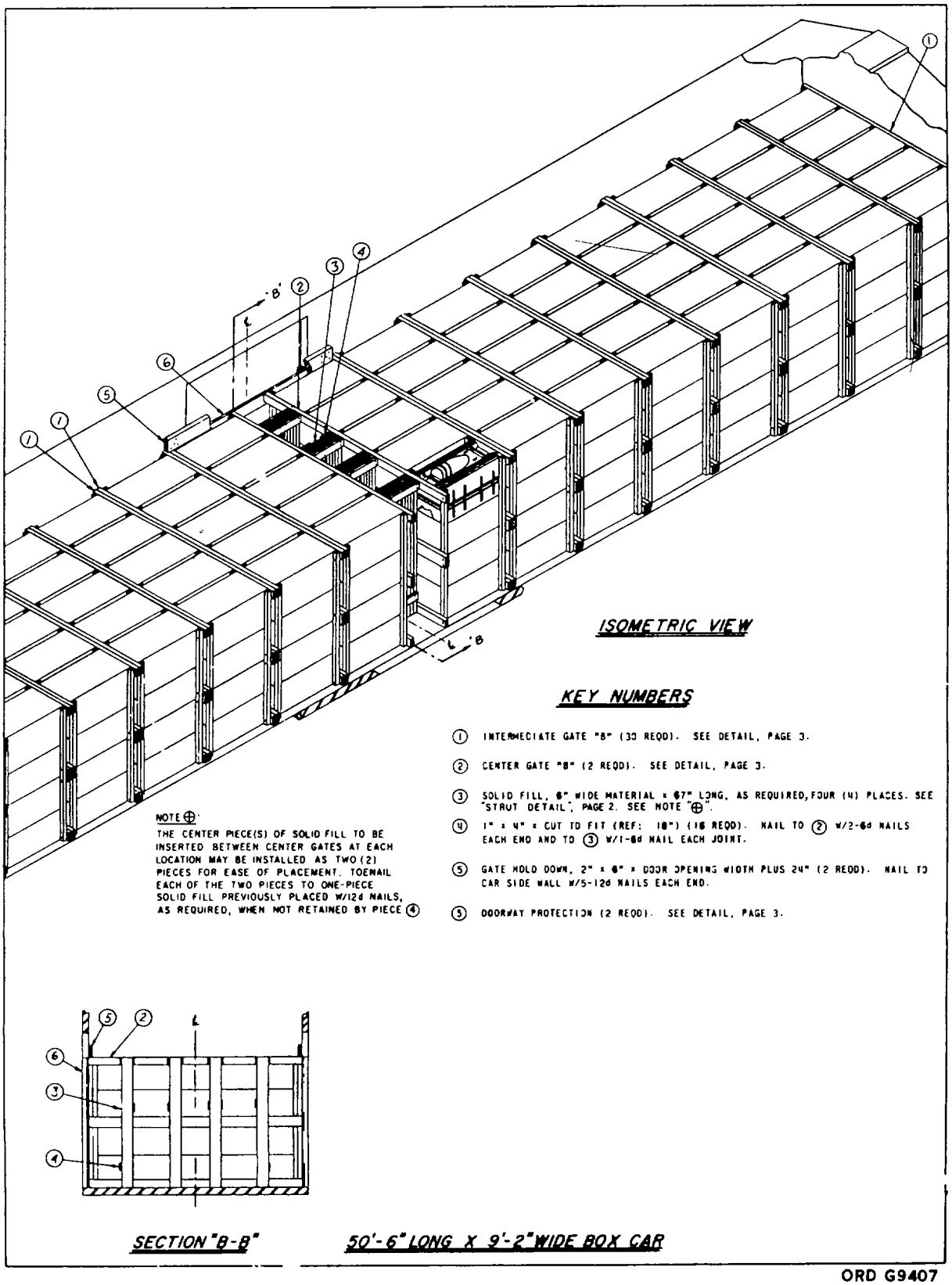
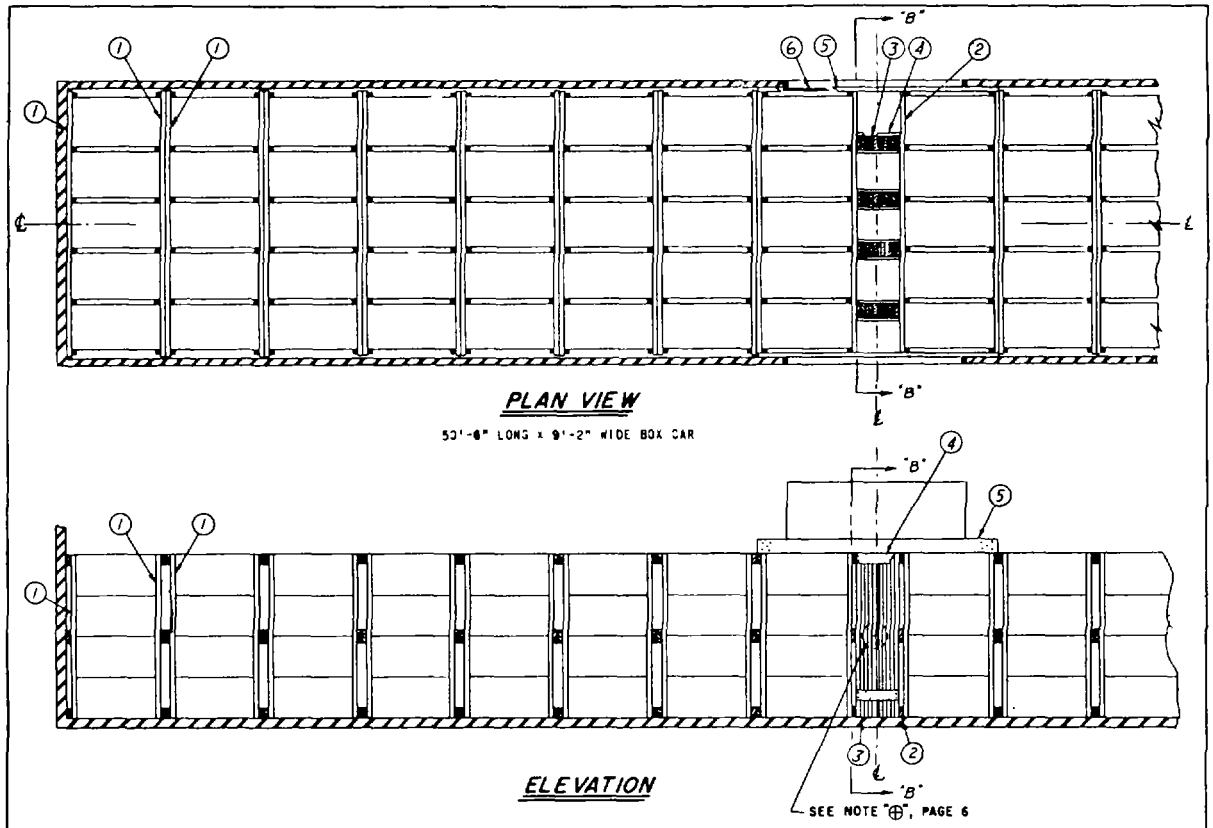


Figure 35. Loading and bracing in box cars, (sheet 5 of 8).



BILL OF MATERIAL

LUMBER	LINEAL FEET	BOARD FEET
1" x 4"	24	8
1" x 6"	36	18
2" x 2"	1,104	368
2" x 3"	23	12
2" x 4"	577	385
2" x 6"	550	550
NAILS	**NO. REQD**	**POUNDS**
6d (2")	208	1-1/4
10d (3")	140	2-1/4
12d (3¼")	60	1
16d (3½")	768	16-1/2

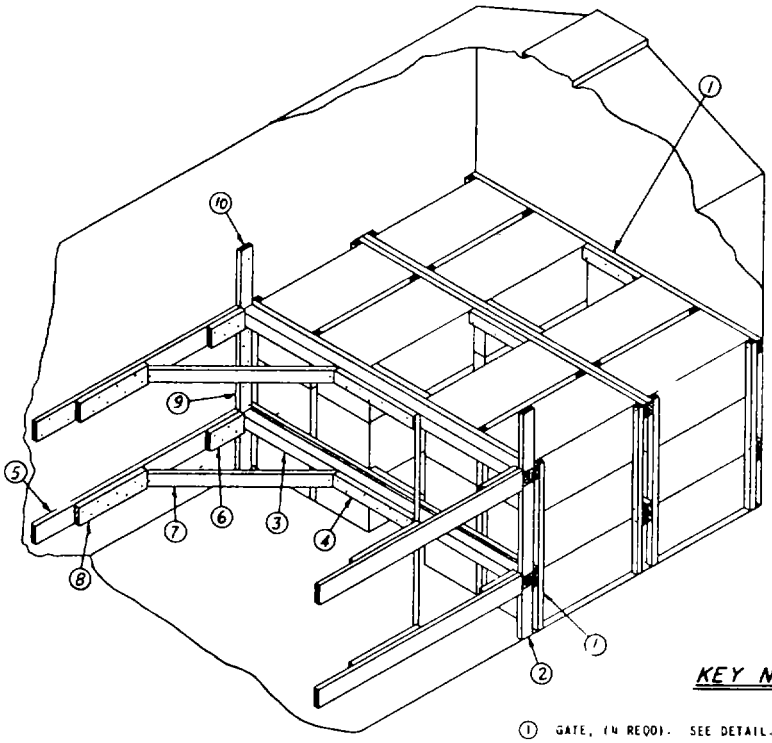
LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
ANTI-TANK MISSILE	320	35,200 LBS
DUNNAGE		3,375 LBS
TOTAL WEIGHT		38,575 LBS (APPROX)

50'-6" LONG X 9'-2" WIDE BOX CAR

ORD G9408

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



ISOMETRIC VIEW

24 UNIT LOAD. BASED ON 8'-6" WIDE BOX CAR.

KEY NUMBERS (SEE NOTE "●")

① GATE, (4 REQD). SEE DETAIL.

② 2" x 4" x 15-1/4" (2 REQD). NAIL TO CAR SIDE WALL W/3-10d NAILS.

③ 4" x 4" x CAR WIDTH (2 REQD).

④ 2" x 4" x 23" (2 REQD). NAIL TO ③ W/7-16d NAILS.

⑤ 2" x 6" x 8'-0" (4 REQD). NAIL TO CAR SIDE WALL W/16-10d NAILS.

⑥ 2" x 6" x 12" (4 REQD). NAIL TO ⑤ W/4-16d NAILS.

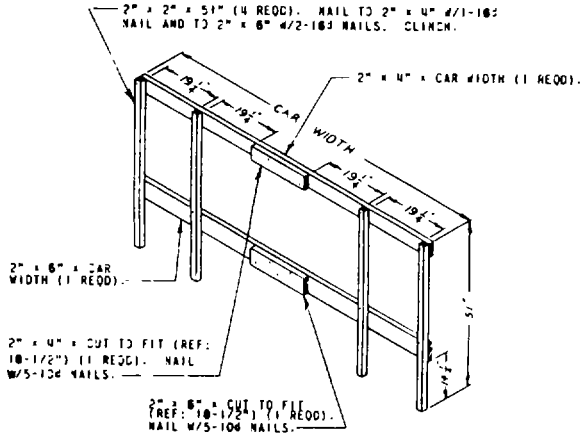
⑦ 2" x 4" x 50-1/2" (4 REQD). DOUBLE BEVEL EACH END 45°. TOENAIL TO ③ AND ⑤ W/1-16d NAIL EACH END. SEE "BRACE" DETAIL.

⑧ 2" x 6" x 24" (4 REQD). NAIL TO ⑤ W/8-16d NAILS.

⑨ 2" x 4" x 30-3/8" (2 REQD). NAIL TO CAR SIDE WALL W/4-10d NAILS.

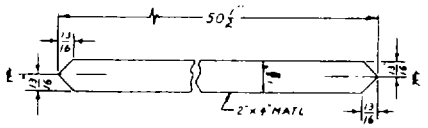
⑩ 2" x 4" x 18" (2 REQD). NAIL TO CAR SIDE WALL W/4-10d NAILS.

NOTE ●:
"K-BRACE" BLOCKING, SHOWN AS PIECES ② THRU ⑩, IS ADEQUATE FOR RETAINING A MAXIMUM LCL LOAD OF 8,000 POUNDS, SEE GENERAL NOTE "G", PAGE 2.



GATE

(4 REQD)



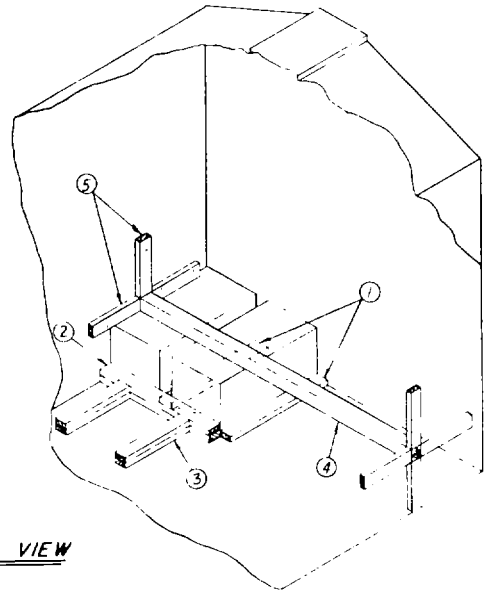
BRACE

(4 REQD)

TYPICAL LCL

ORD G9409

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



ISOMETRIC VIEW

(2 UNIT LOAD)

KEY NUMBERS

(1) 2" x 4" x 36" (2 REQD) NAIL TO CAR FLOOR W/1-16d NAIL EVERY 8"

(2) 2" x 4" x 41-3-8" (DOUBLED)(1 REQD) NAIL FIRST PIECE TO CAR FLOOR W/1-16d NAIL EVERY 8" NAIL SECOND PIECE TO FIRST W/1-40d NAIL EVERY 8"

(3) 2" x 4" x 24" (DOUBLED)(2 REQD). NAIL FIRST PIECE TO CAR FLOOR W/5-16d NAILS NAIL SECOND PIECE TO FIRST W/4-40d NAILS.

(4) 4" x 4" x CAR WIDTH (1 REQD).

(5) 2" x 4" x 18" (2 REQD) NAIL TO CAR SIDE WALL W/4-12d NAILS

TYPICAL LCL

LOADING & BRACING (CL & LCL) IN BOX CARS OF THE SSII-BI ANTITANK MISSILE, PACKED IN PLASTIC CONTAINER (FIBER GLASS)

DRAFTSMAN	ARMY ENG.	DIV	PAGE
J.A.G.			AAL
CHECKED			
GWP			

REVISIONS

SUBMITTED: Wesley Brig Gen for COMMANDER, SAVANNA ARMY DEPOT

APPROVED: Andrew W. Betts

ARMY MISSILE COMMAND

APPROVED BY ORDER OF COMMANDER, ARMY MATERIEL COMMAND

ARMY SUPPLY & MAINTENANCE COMMAND

MATERIEL COMMAND U S A

10 JUNE, 1964

CLASS	DIVISION	DRAWING	FILE
19	48	5454	GM 5A141

ORD G9410

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

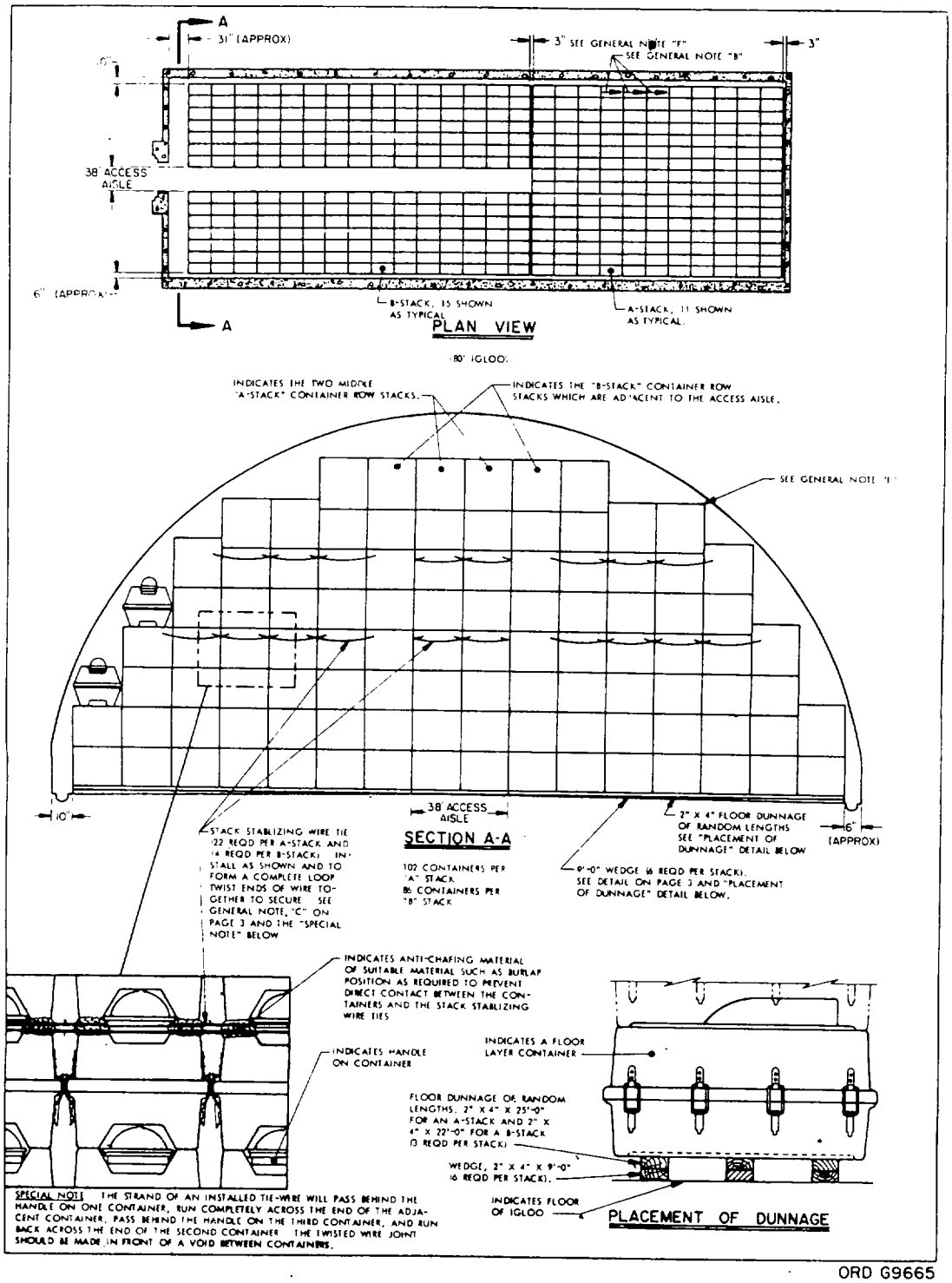
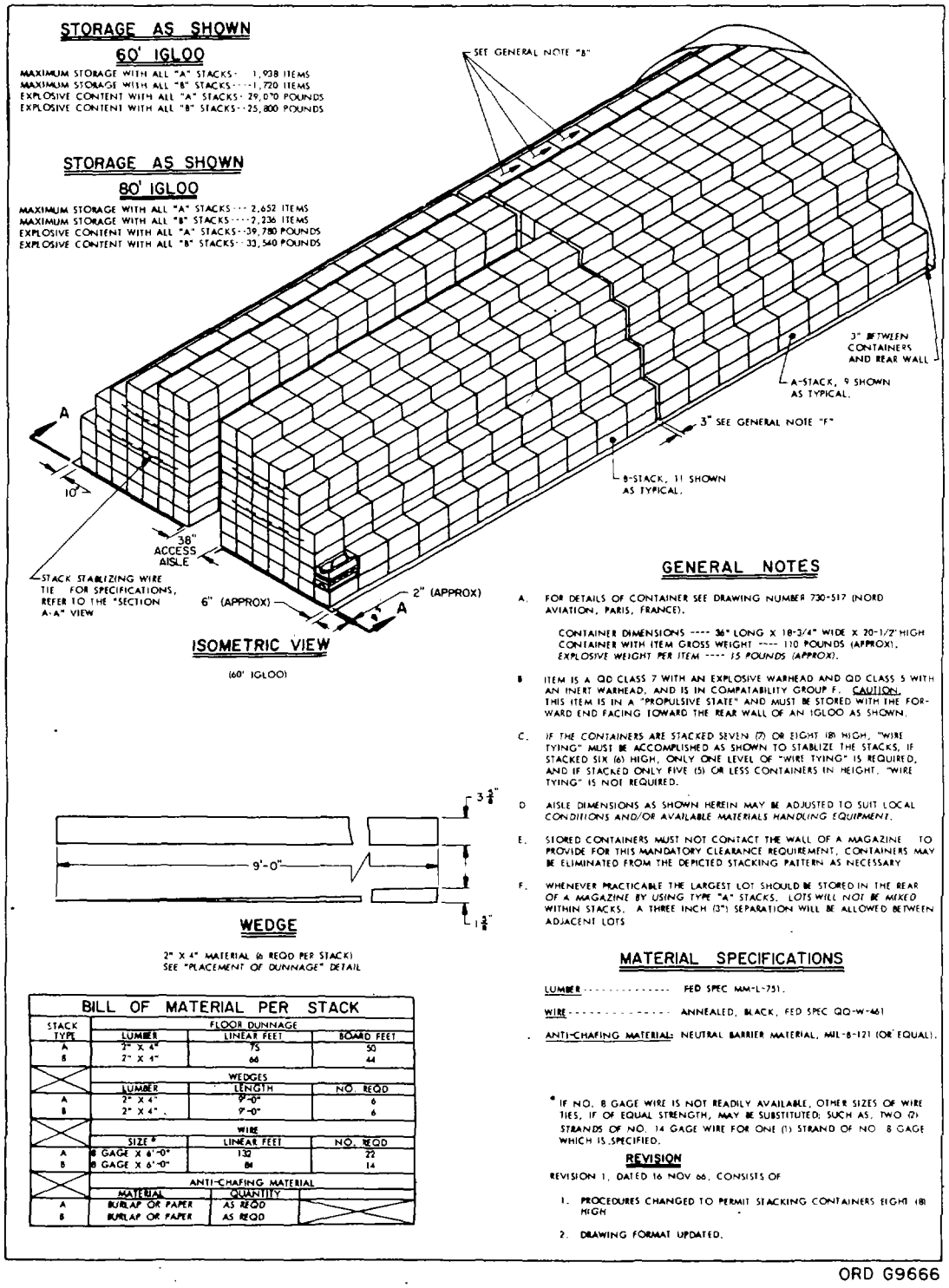


Figure 36. Storage in 60- and 80-foot igloo magazines (sheet 1 of 2).



BILL OF MATERIAL PER STACK

STACK TYPE	FLOOR DUNNAGE LUMBER	LINEAR FEET	BOARD FEET
A	2" X 4"	75	50
B	2" X 4"	66	44
	WEDGES		
	LUMBER	LENGTH	NO. REQD
A	2" X 4"	9'-0"	6
B	2" X 4"	9'-0"	6
	WIRE		
	SIZE *	LINEAR FEET	NO. REQD
A	8 GAGE X 6'-0"	132	22
B	8 GAGE X 6'-0"	84	14
	ANTI-CHAFING MATERIAL		
	MATERIAL	QUANTITY	
A	BURLAP OR PAPER	AS REQD	
B	BURLAP OR PAPER	AS REQD	

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

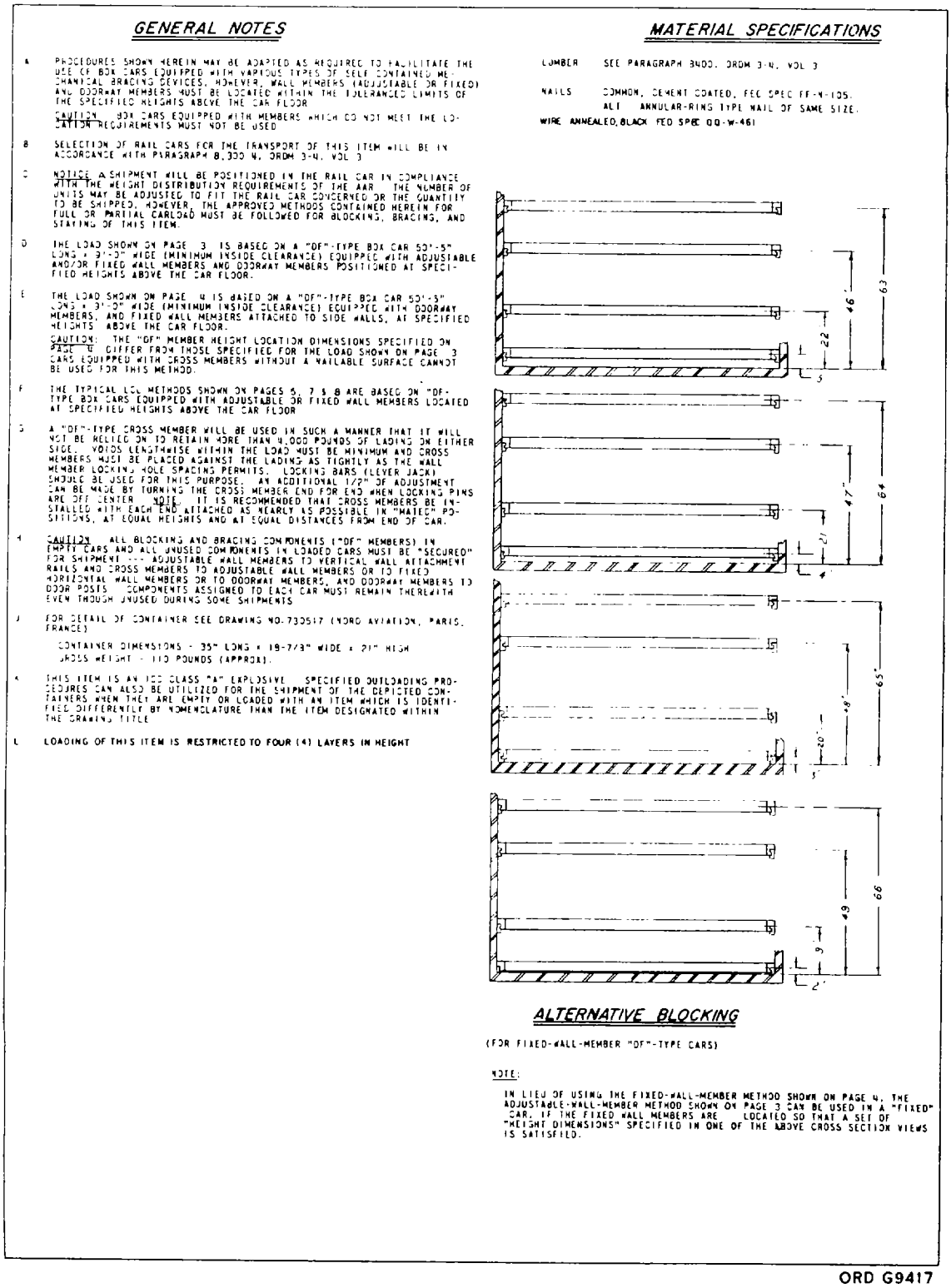


Figure 37. Loading and bracing in DF type box cars, (sheet 1 of 7).

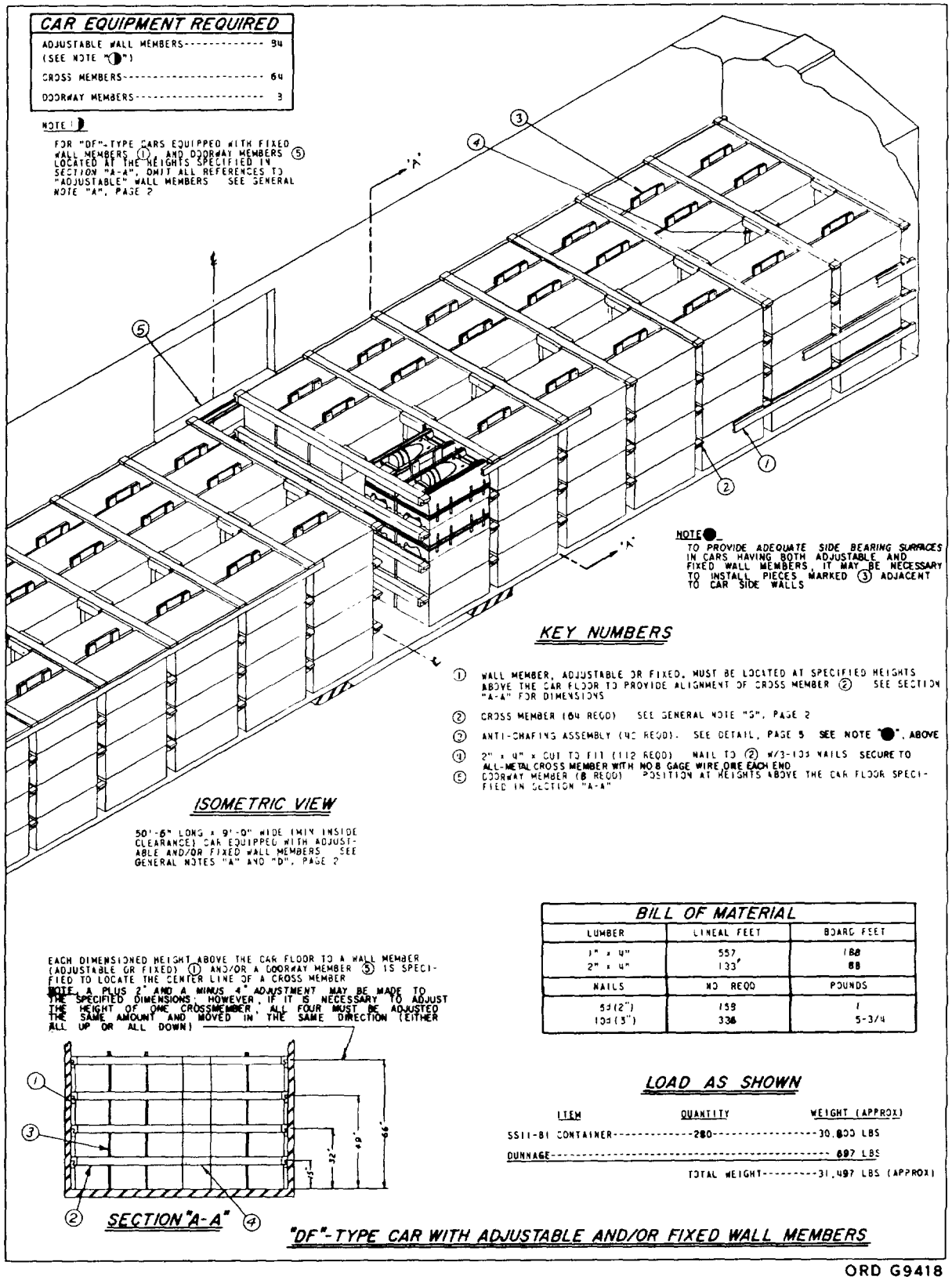


Figure 37. Loading and bracing in DF type ox cars, (sheet 2 of 7).

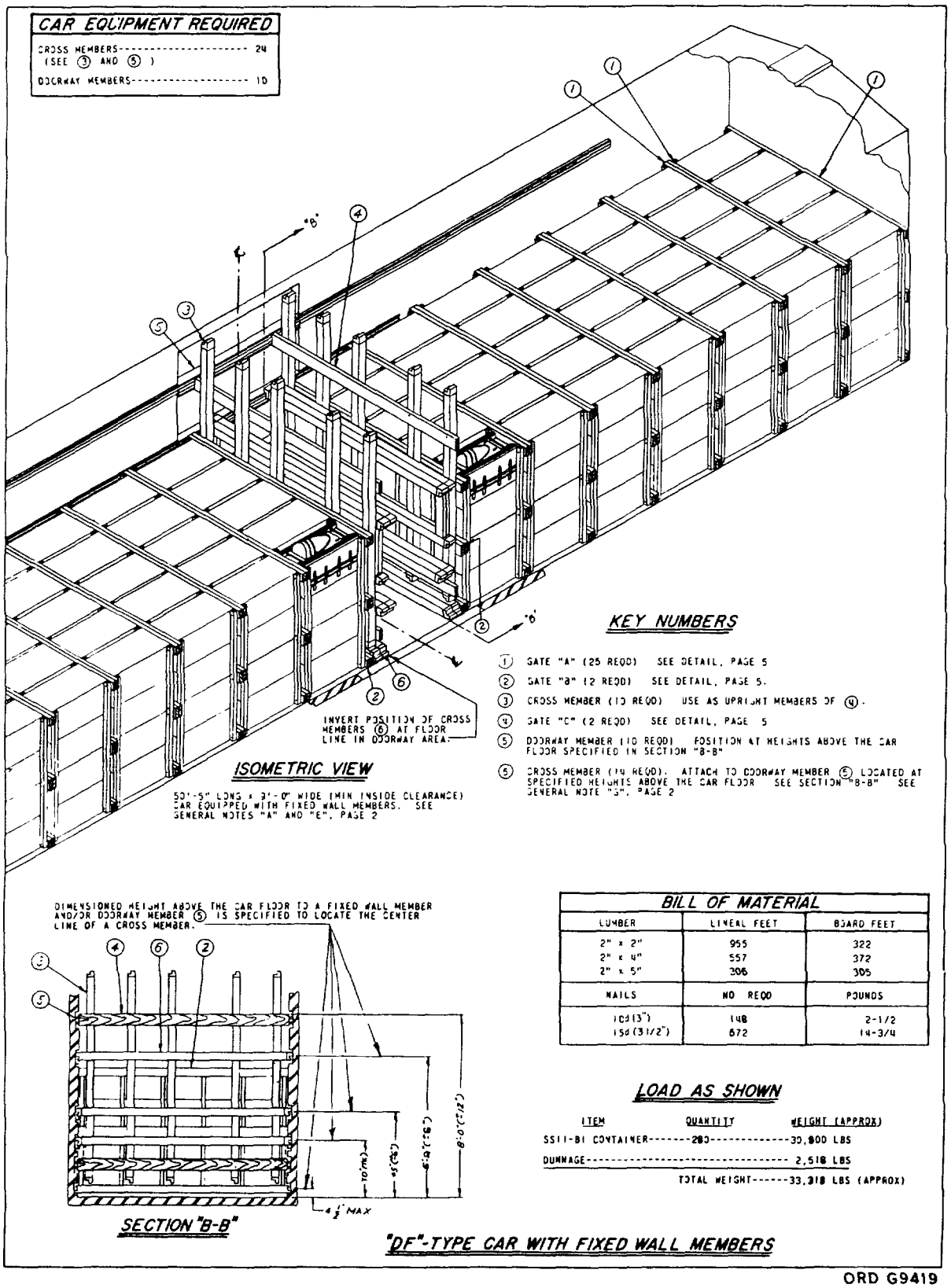


Figure 37. Loading and bracing in DF type box cars, (sheet 3 of 7).

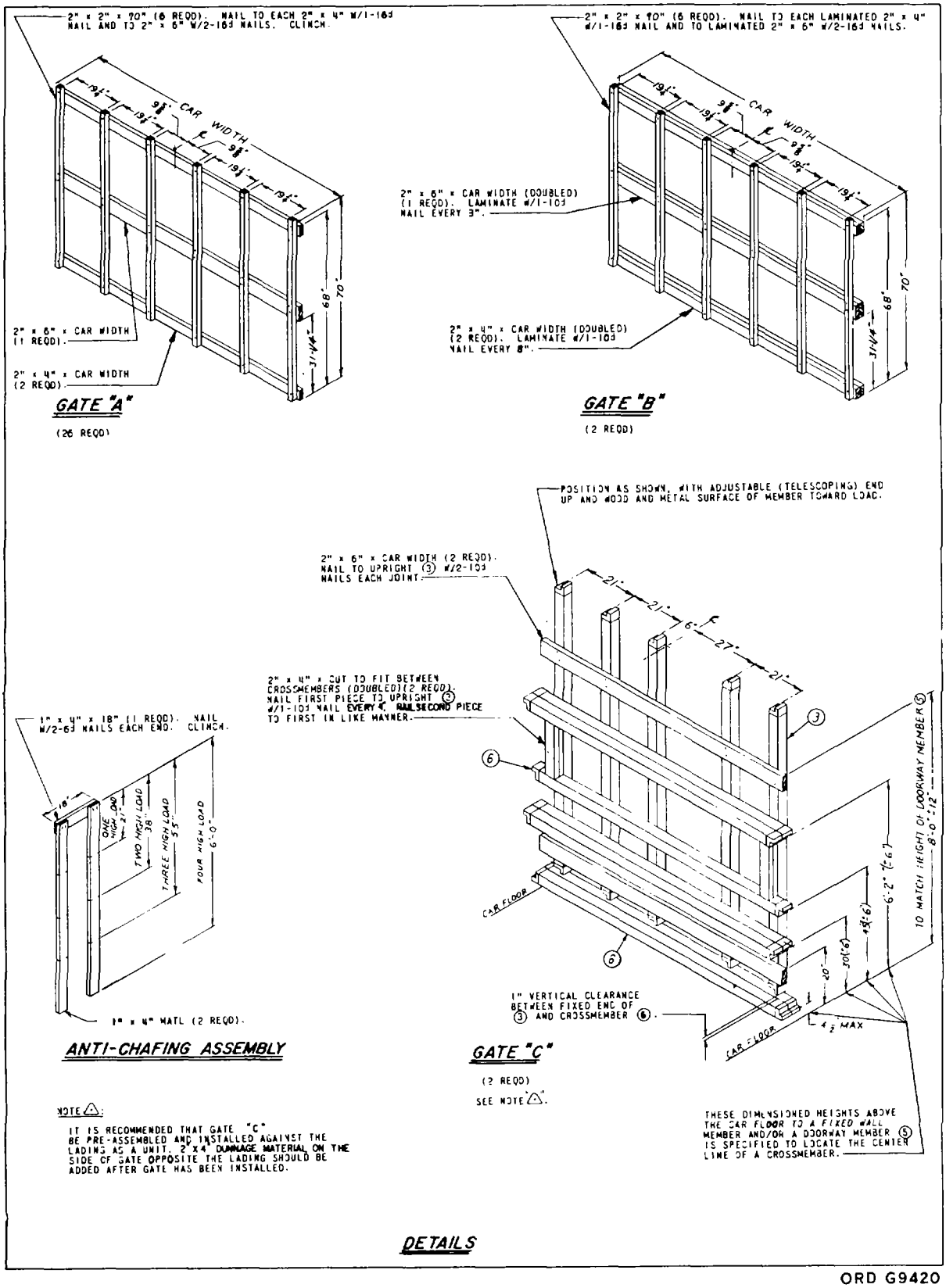


Figure 37. Loading and bracing in DF type box cars, (sheet 4 of 7).

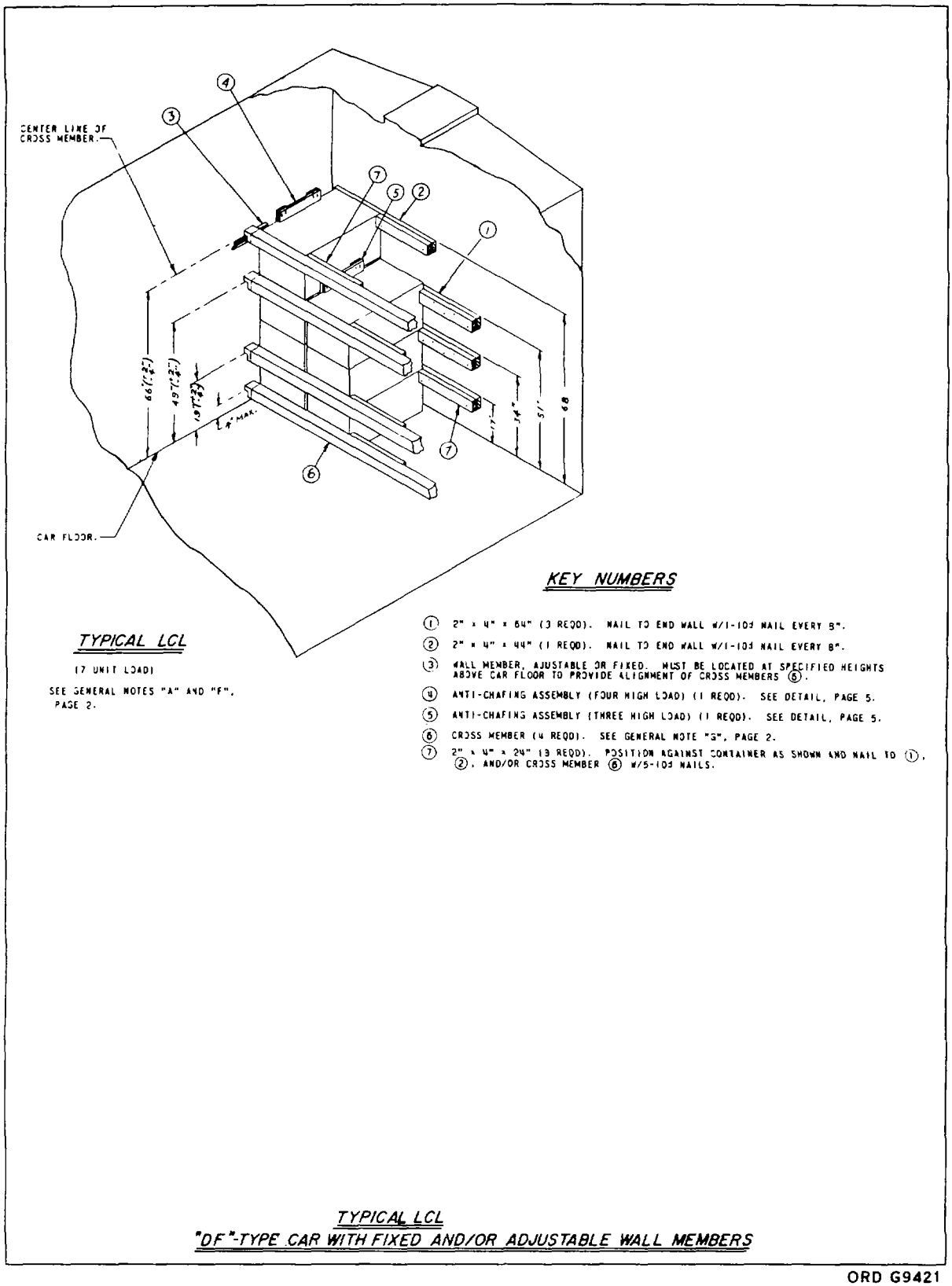
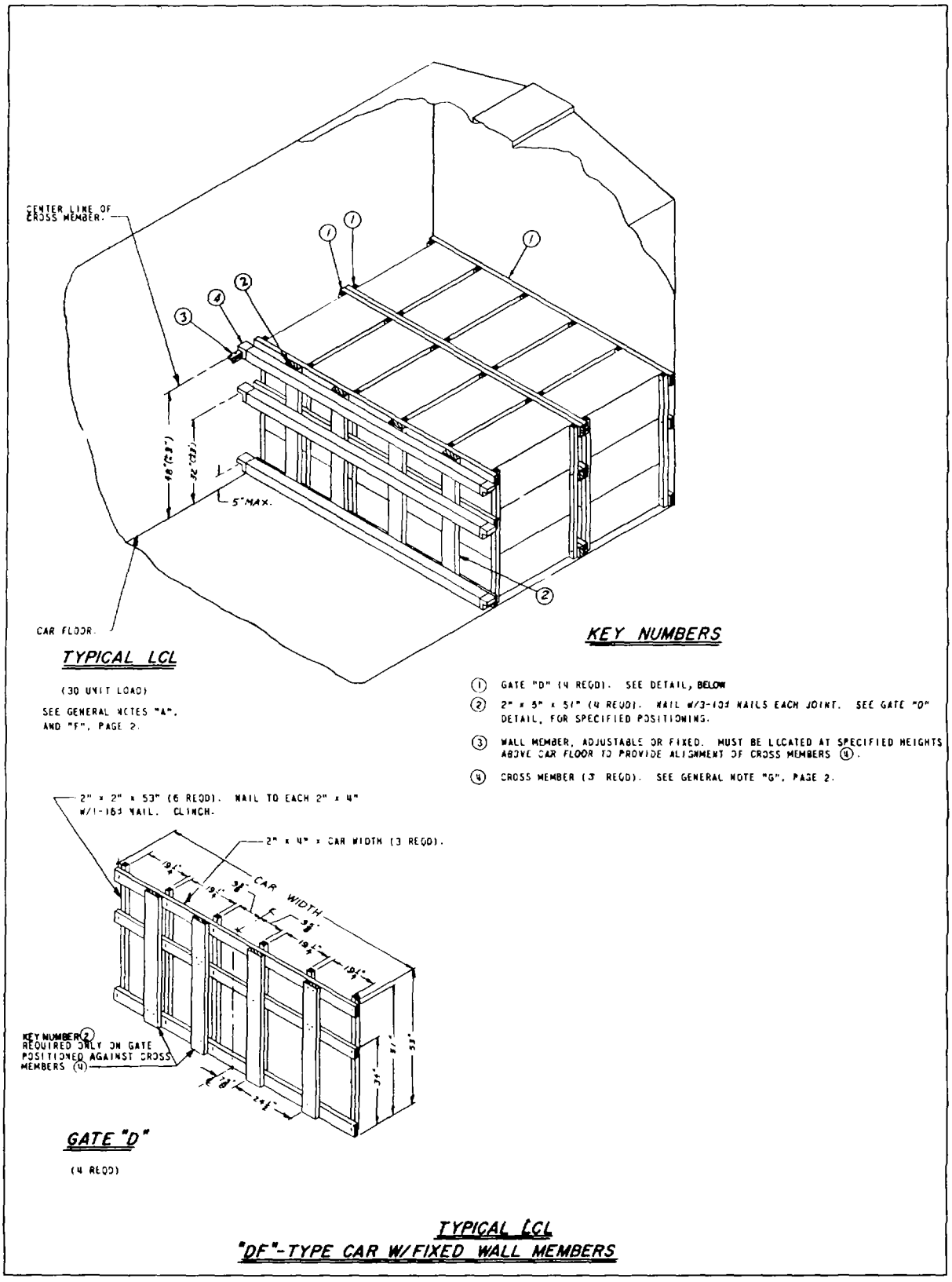


Figure 37. Loading and bracing in DF type box cars, (sheet 5 of 7).



ORD G9422

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

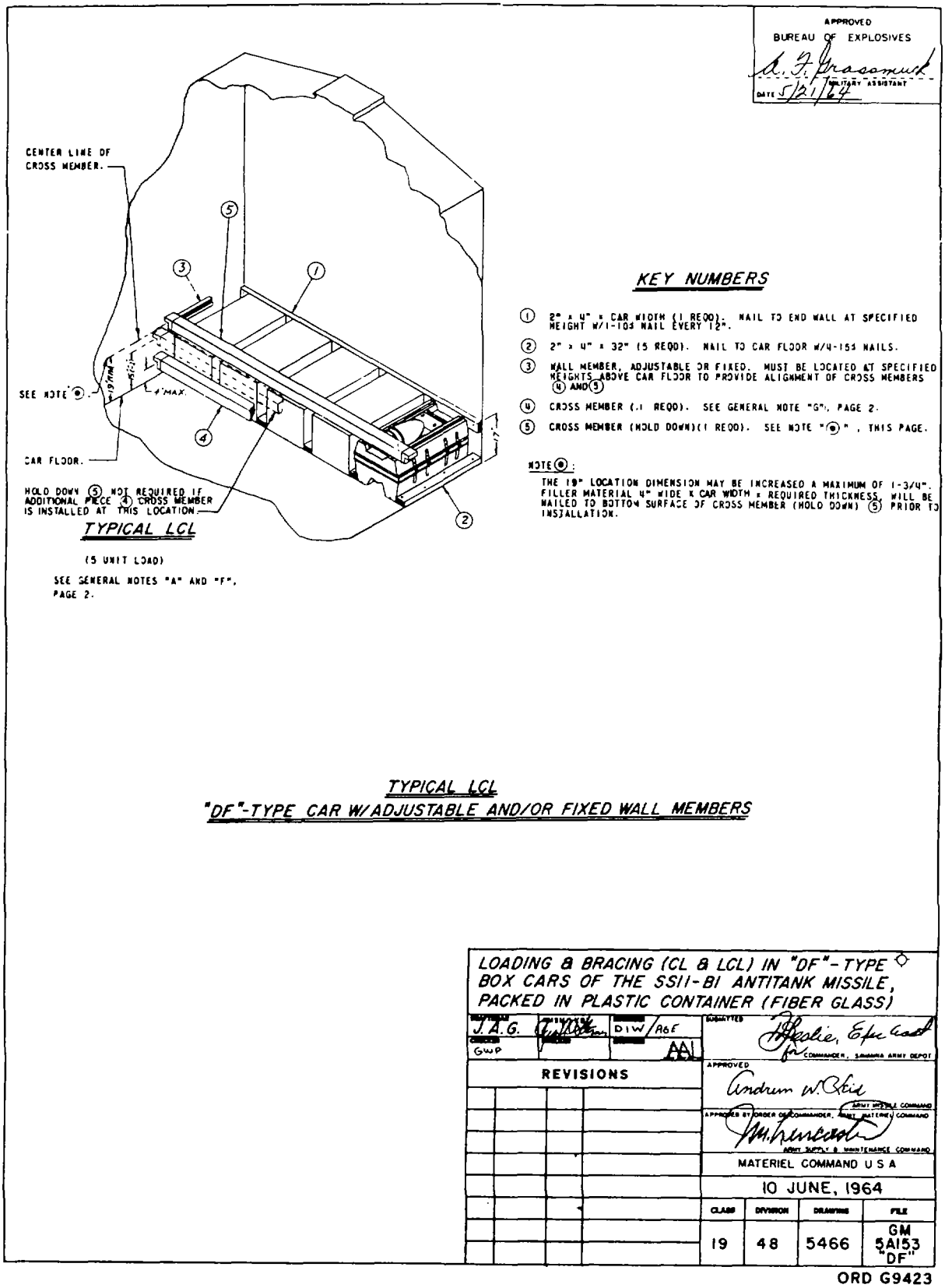


Figure 37. Loading and bracing in DF type box cars, (sheet 7 of 7).

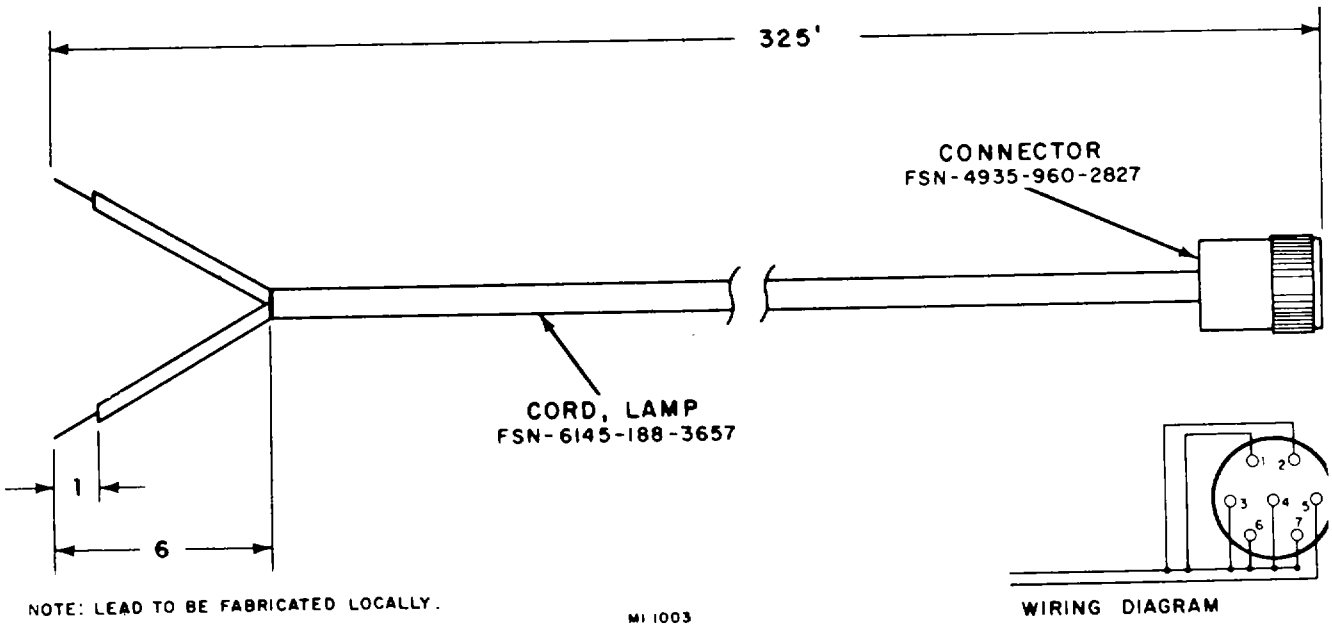


Figure 38. Demolition cable.

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-IA & UH-1B Helicopters	TM 55-1520-211-10

3. Supply Manuals

The following manuals o 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

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

INDEX

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

The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

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

Square Measure

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

Cubic Measure

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

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

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

PIN: 022843-000