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Engineering Development

AIRCRAFT MODIFICATION FOR THE MK 17 AND THE MK 24 ATOMIC BOMBS

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Sandia Corporation
CONTRACTORS FOR U.S. ATOMIC ENERGY COMMISSION
ALBUQUERQUE • NEW MEXICO

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ABSTRACT

This specification delineates the requirements that must be met in adapting strike aircraft to carry the Mk 17 and Mk 24 bombs. It provides the information necessary for aircraft modification including those detailed specifications previously transmitted by Sandia Corporation. Additional information relative to these bombs is included for clarification of the modification requirements.

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AIRCRAFT MODIFICATION FOR THE MK 17 AND MK 24 BOMBS

Introduction

This specification delineates the requirements that must be met in adapting strike aircraft to carry the Mk 17 and Mk 24 bombs. It provides the information necessary for aircraft modification, including those detailed specifications previously transmitted by Sandia Corporation. Additional information relative to the bombs is included for clarification of the modification requirements. Drawing SK(1241) 33611, referenced in the Appendix, is the external information drawing of the Mk 17/Mk 24 bombs.

It will be necessary for the Armed Forces to provide the following in performing the aircraft modification:

A means of loading the bombs into strike and ferrying aircraft.

A suitable suspension and release system for the bombs.

Structure to which the arming wires, the pull-out cable connector, and the parachute static line may be attached.

Adequate facilities for the inflight insertion operation and for stowage of equipment used in this operation.

Wiring and associated test equipment for the bombs.

General Bomb Description

The external configuration of the Mk 17 and Mk 24 bombs is shown in Fig. 1. The range of weights and center of gravity of these bombs have been included for use in the design of ground and flight equipment. These bombs are equipped with a manually-operated inflight insertion mechanism by which the capsule can be inserted or retracted.

In addition to being equipped with fins, the bombs have provisions for parachute attachment and stowage so that the unit may be dropped free-fall or parachute-retarded.

Bomb Handling

Storage and Transport. -- The Mk 17 and Mk 24 bombs are each provided with two sets of detachable storage bolsters which permit the use of a straddle carrier (see Fig. 2) for transport.

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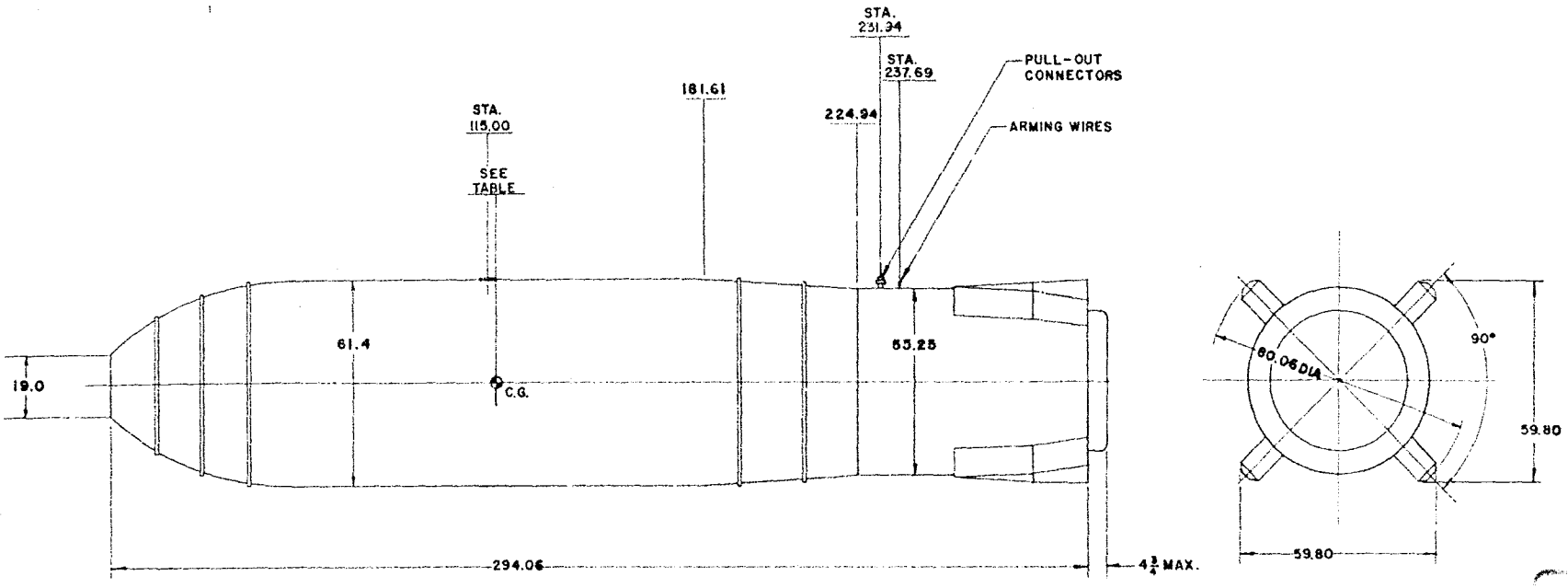


WEIGHT & C.G. TABULATION		
COMPLETE ASSEMBLY	TOTAL WT.	C.G. STA.
WITH 64' PARACHUTE ASSEMBLY	40,800 TO 42,000 LBS.	115.0 TO 117.3
UNIT FORWARD OF STATION 294.06 WITH CHUTE DEPLOYED	40,100 TO 41,300 LBS.	112.3 TO 114.6

Fig. 1 - - Configuration of the Mk 17 and Mk 24 bombs

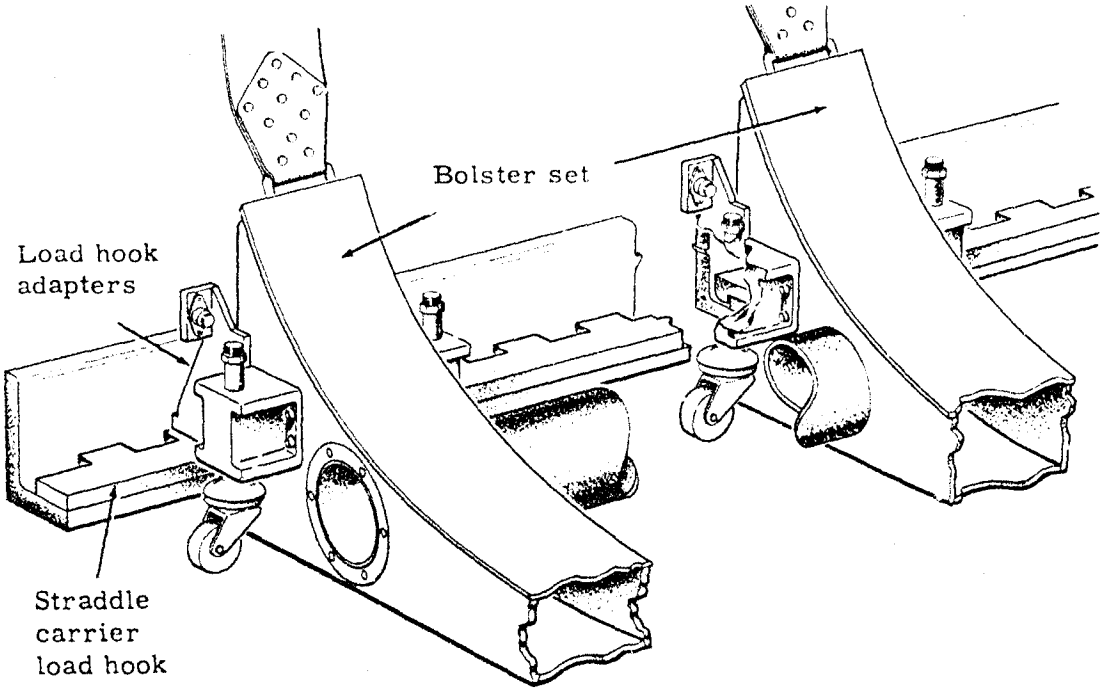


Fig. 2 -- Detail of bolster set showing straddle carrier load hook adapters

Security Cover. -- The Mk 17 and Mk 24 bombs are provided with a fabric security cover attached to the storage bolsters. It is not necessary to remove the security cover when using the straddle carrier (see Fig. 3).

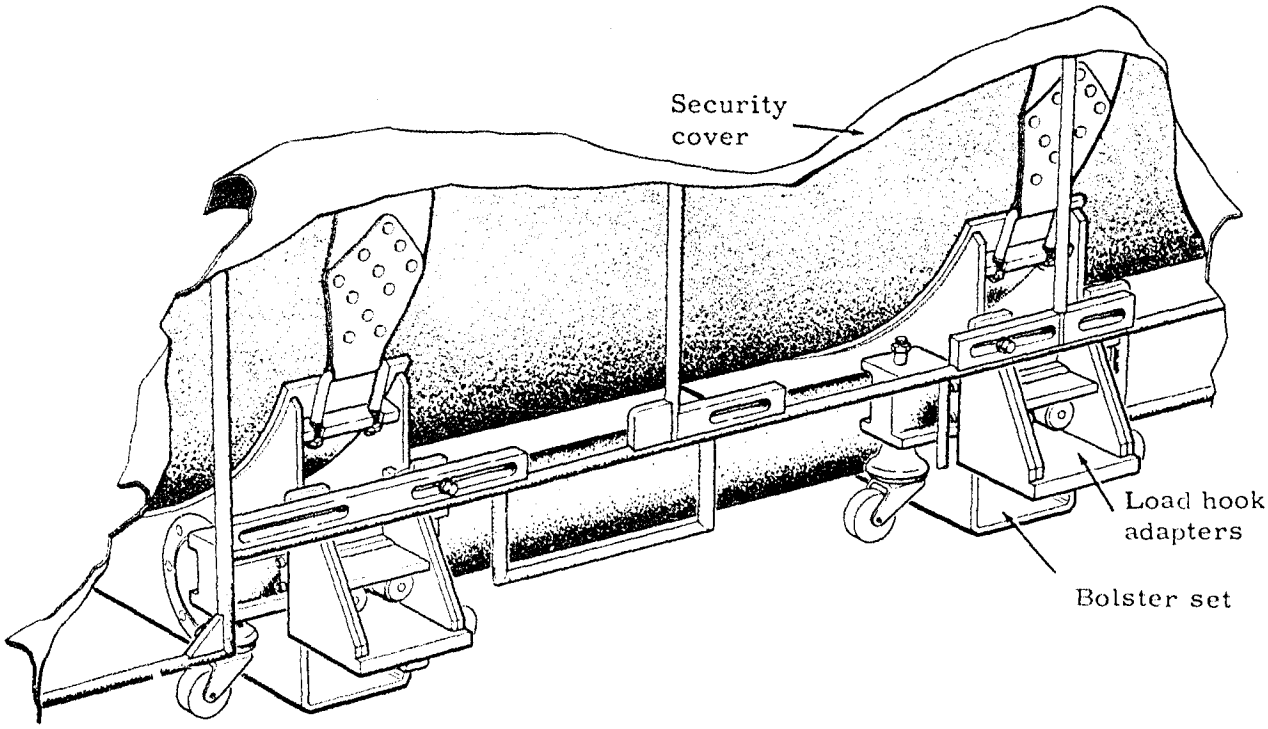


Fig. 3 -- Security cover clearance for carrier load hooks and bolster adapters

Bomb Hoisting and Local Transport. -- The detachable sets of storage bolsters provided with the Mk 17 and Mk 24 bombs permit usage of the MA-1 bomb lift for local transport and hoisting into the aircraft bomb bay. Usage of the MA-1 bomb lift will require that the lower section of the security cover be removed (see Fig. 4).

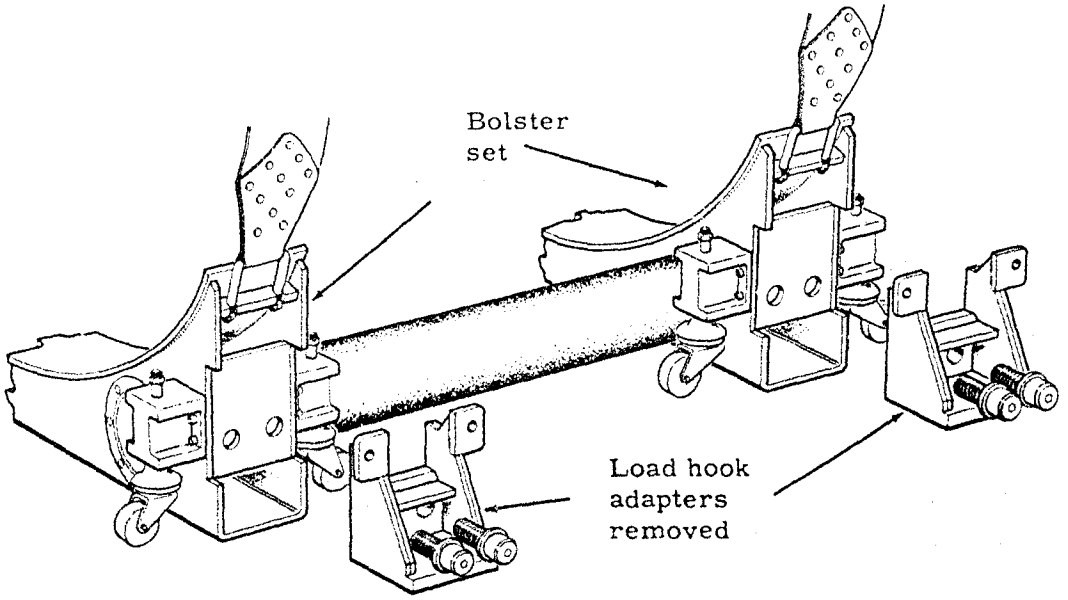


Fig. 4 -- Lower section of security cover and adapters removed for usage of MA-1 bomb lift

Aircraft Loading

Bomb Suspension. -- The Mk 17 and Mk 24 bombs shall be suspended from rigid mounting in the aircraft and a reliable release system installed in accordance with the requirements of the Armed Services. The bomb shall be located in the bomb bay so that it is accessible to the inflight insertion operator until the cabin is pressurized. The external dimensions of the fins are shown in Fig. 5; fin locations on the bomb are shown in Fig. 1. Clearance at the aft end of the bomb bay can be established by use of the dimensions shown on these two figures.

Suspension Sling. -- Since the Mk 17 and Mk 24 bombs have no provisions for lug suspension, another means such as a flexible metal-link sling will be required to support the bomb in the aircraft. The sling bearing area is not critical.

Sway Braces. -- Sway bracing shall be provided which will withstand all anticipated loads during flight and ground operations. Since the bomb warhead is a continuous strong area, sway bracing is permissible anywhere between bomb stations 0.00 and 182.99, except for those areas where spoiler bands are present. Each sway brace pad must have a minimum contact area of 2.5 square inches.

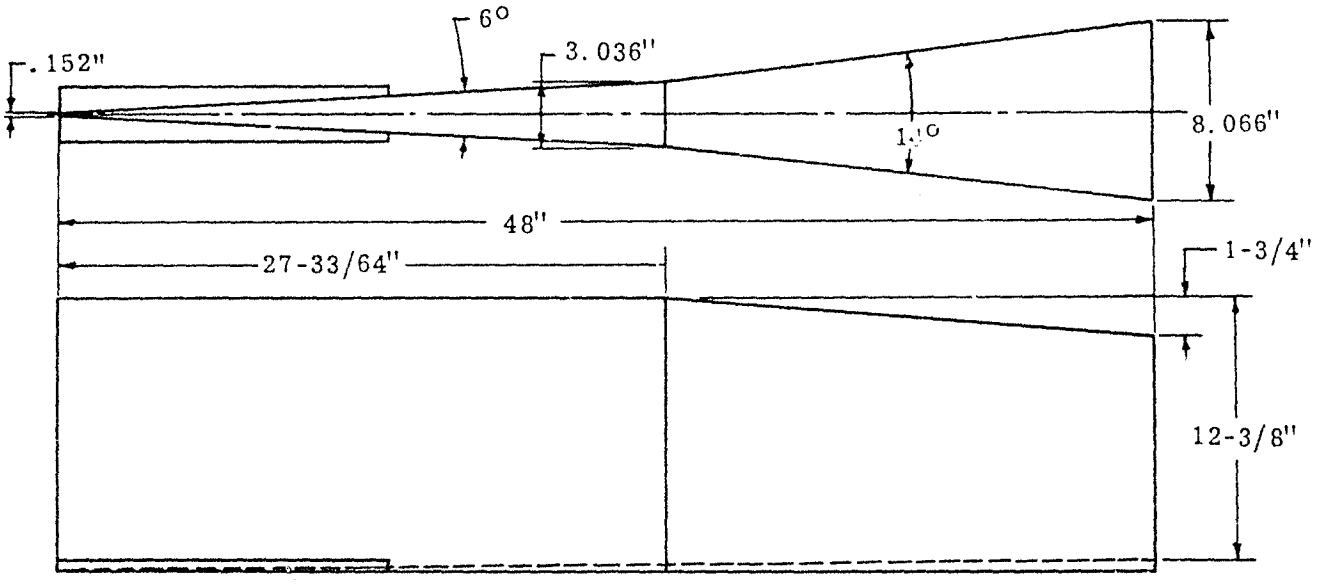


Fig. 5 -- External dimensions of the Mk 17 and Mk 24 fins

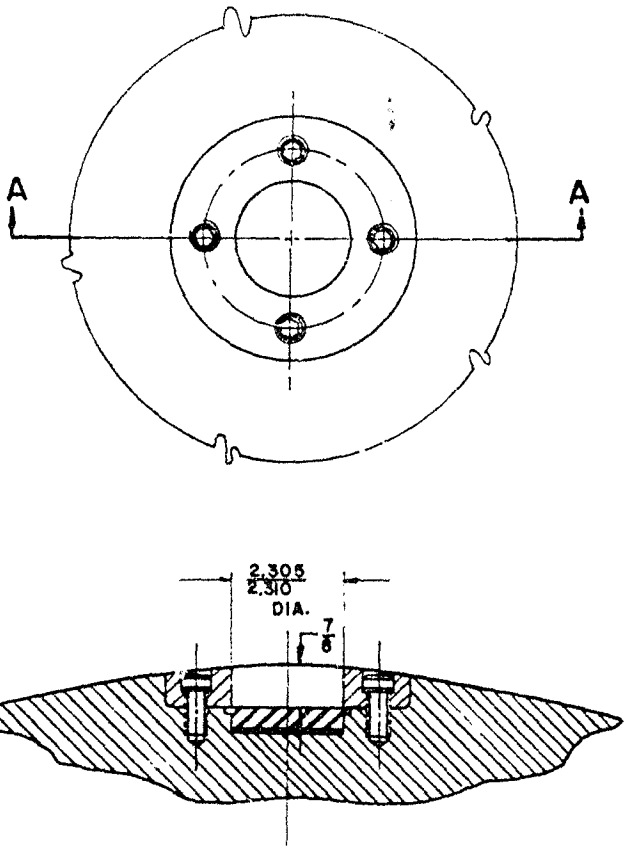
Shear Pin. -- To remove fore and aft loads on the bomb, a shear pin will be required in the aircraft which will mate with the shear cavity in the bomb case (Fig. 6). The pin must be spring-loaded to ensure proper seating and engagement. The diameter of the shear pin must be between a minimum of 2.240 inches and a maximum of 2.245 inches.

Fall Clearance. -- Suitable fall clearance fore and aft of the bomb shall be provided. When the clearance between the bomb and the sides of the bomb bay is small, guard rails may be required to prevent damage to the bomb or aircraft structure.

Pull-Out Attachments. -- The locations of the arming wires and the pull-out cable on the bomb are shown in Fig. 1. Brackets or arming controls shall be provided in the aircraft to which the arming wire shackle, the pull-out cable connector clevis, and the parachute static line V-ring will be attached. Sufficient clearance shall be provided within the bomb bay to permit attachment of the shackle, clevis, and V-ring after the bomb is loaded.

The pull-out cable, CF-1061, will be contained in AN-8024 metal shipping container, together with a spare bomb cable, CF-1060. The pull-out cable will be installed at the time the bomb is loaded. Cable CF-1061 is 14 feet long to allow the postload test to be performed while the bomb is on the loading dolly.

Arming Wires. -- The two arming wires are joined by one shackle, as shown in Fig. 7. The arming wire bracket, or control, shall be capable of retaining the arming wires in the aircraft upon release of the bomb. The wires should be pulled from the bomb within an angle of 10 degrees from a perpendicular to the case of the bomb. The 10-degree limit is specified primarily to provide a design standard. The forces necessary to pull the two arming wires under various conditions are shown on the following page.



Section AA

Fig. 6 -- Detail of shear pad

Temperature (°F)	Pull normal to seal ass'y (lbs) Min	Max	Pull 10° from normal (lbs) Min	Max
80	36	68	30	58
165	24	68	26	58
-85	36	60	40	62

The arming wire bracket for the Mk 17 and Mk 24 bombs need not provide an arm-safe arrangement since the bomb incorporates internal safing devices.

Pull-Out Cable Connectors. -- The bracket to which the pull-out cable is attached shall be equipped with a device capable of retaining the pull-out cable connector in the aircraft upon release of the bomb. The pull-out cable connector (Fig. 7) must be pulled from the bomb within an angle of 12 degrees from a perpendicular to the longitudinal centerline of the bomb to avoid possible damage to the bomb connector. The forces necessary to pull the connector under various conditions are:

Temperature (°F)	Pull normal to seal ass'y (lbs) Min	Max	Pull 12° from normal (lbs) Min	Max
Room	60	150	30	60
-65	105	130	120	300

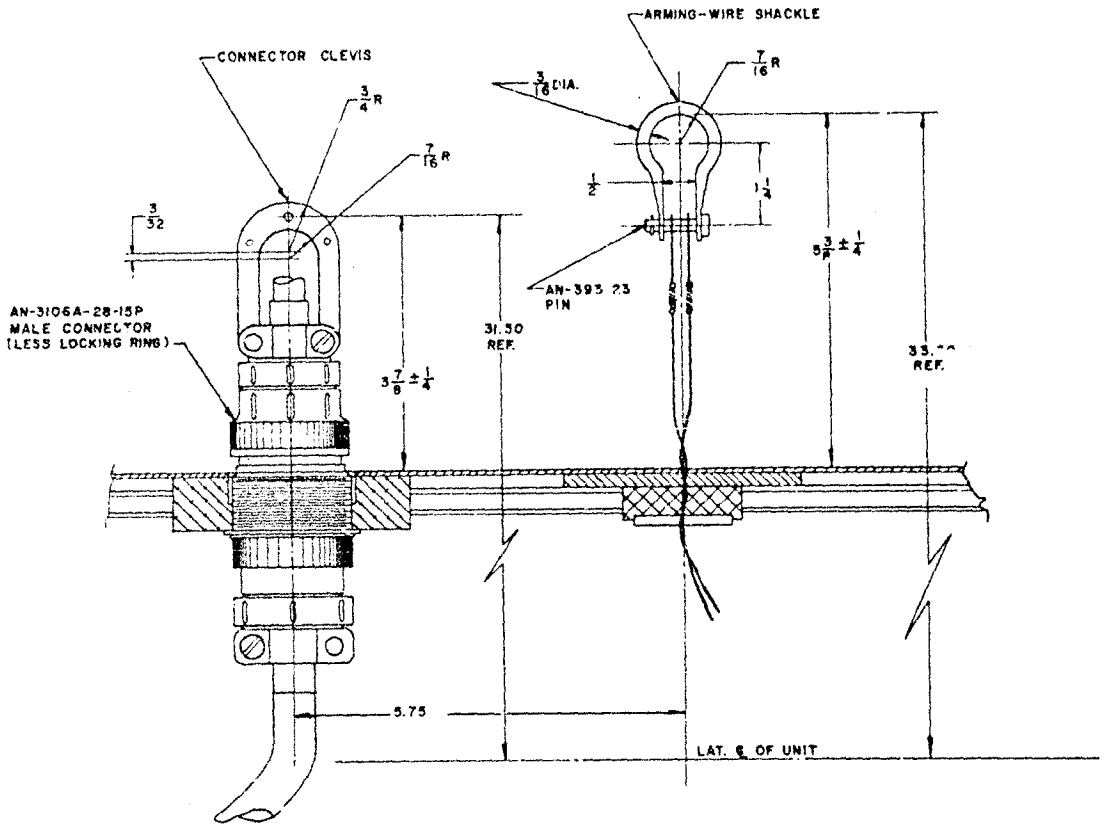


Fig. 7 -- Pull-out cable connector and arming wires

Parachute Static Line. -- Two delivery options are provided, one a parachute-retarded and the other a free-fall capability. For a parachute-retarded drop, the static line from the parachute will be equipped with a V-ring (Fig. 8) which must be attached to structure in the aircraft. If an inflight choice is desired a selective control may be utilized which will either retain or release the static line V-ring.

Inflight Insertion. -- With the bomb loaded in the bomb bay, there must be sufficient space forward of the nose to perform the inflight insertion operation. This operation consists of cranking the capsule into the pit with the handle that extends through the nose cap assembly of the bomb. A clearance of approximately 5-1/2 inches forward of Station 0 is required for installation and operation of the handle. Once the capsule has been inserted, the handle is to be removed and stowed in position readily accessible to the inflight insertion operator. Figure 9 illustrates the component handled during inflight insertion.

Working Platform. -- To facilitate the inflight insertion operation, a suitable working platform having adequate safety precautions is recommended. A catwalk is desirable where space is available.

Lighting. -- Adequate lighting facilities are to be provided in the forward part of the bomb bay. Lights should be placed in the upper forward bomb bay area and focused toward the nose section of the bomb.

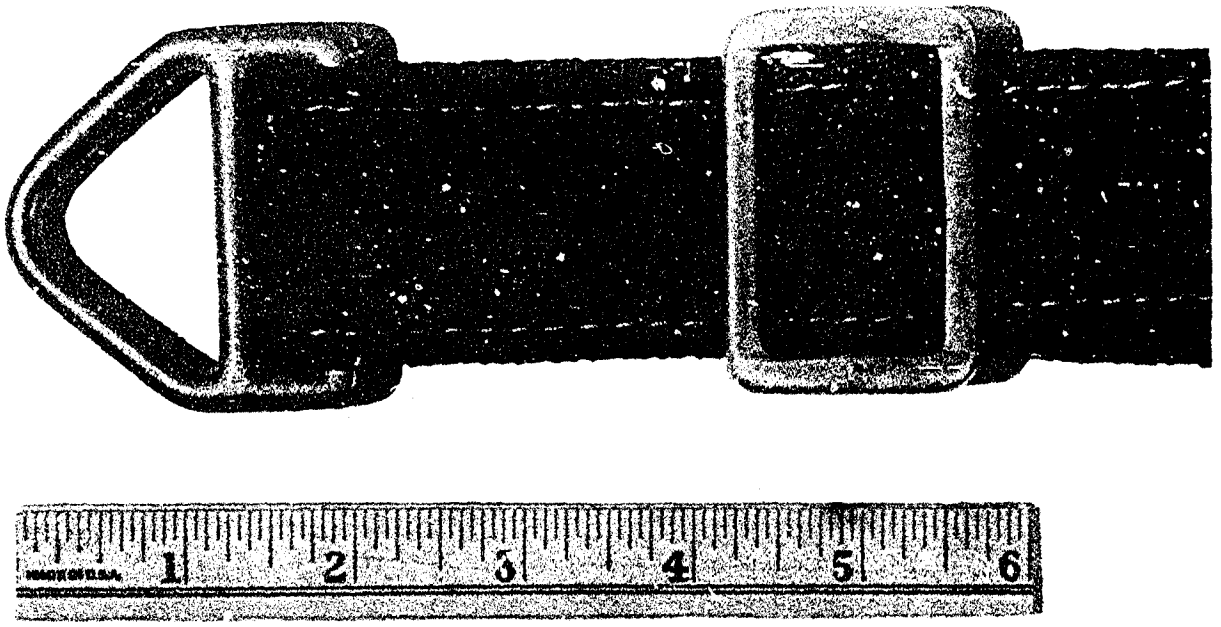


Fig. 8 -- Parachute static line clevis

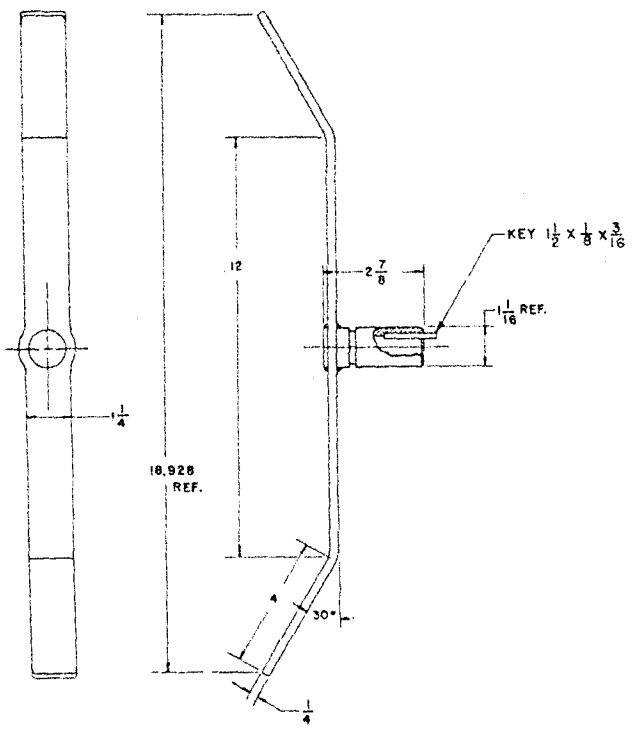


Fig. 9 -- Inflight insertion crank

Crew-Station Accommodations. -- It is recommended that standard crew-station accommodations be provided in the bomb bay for the inflight insertion operator. Accommodations should include an oxygen outlet, a heated suit outlet, an intercommunications jack box, and an emergency alarm bell.

Test Equipment

A list of the monitoring, control, and ground test equipment used in the before loading, preflight, and flight tests of the Mk 17 and Mk 24 bombs is given below. The list includes test equipment items which are designed and procured by the Armed Forces from information furnished by Sandia Corporation.

The Military-designed and -procured items have been released by Sandia Corporation with the proved schematics and functional specifications indicated to the Armed Forces for design and procurement in accordance with an agreement between Sandia Corporation and the Armed Forces Special Weapons Project.

Test Equip No.	Item	Design and procurement responsibility	Schematic and Specification No.
T-18	Inflight monitor	Armed Forces	Schematic SK(1215)3579 Final Dev Spec T-18
T-19	Inflight control	Armed Forces	Schematic SK(1215)3764 Final Dev Spec T-19
T-35	Flig : control box	Armed Forces	Schematic SK(1282)6332 Spec PDS 109
T-23	Flight circuit tester	Armed Forces	Schematic DS(5431)13733 Final Dev Spec T-23
CT-873	Adapter cable	Armed Forces	Schematic DS(5431)25171 Spec SCS-4
	Bomber wiring	Armed Forces	Schematic 101864 Spec Mil-W-5274A or JAN-C-76

Inflight Monitor (T-18). -- The T-18 (Fig. 10) provides the following information concerning the bomb:

Condition of the internal batteries (load and no-load voltage)

Condition of the baro switch network (open or closed)

Position of the safety switch (open or closed)

Voltage present at the inverter input (yes or no)

The T-18 also supplies power to the battery heaters.

Shock mounting of the T-18 may be required depending upon the vibration characteristics of the aircraft at the T-18 location.

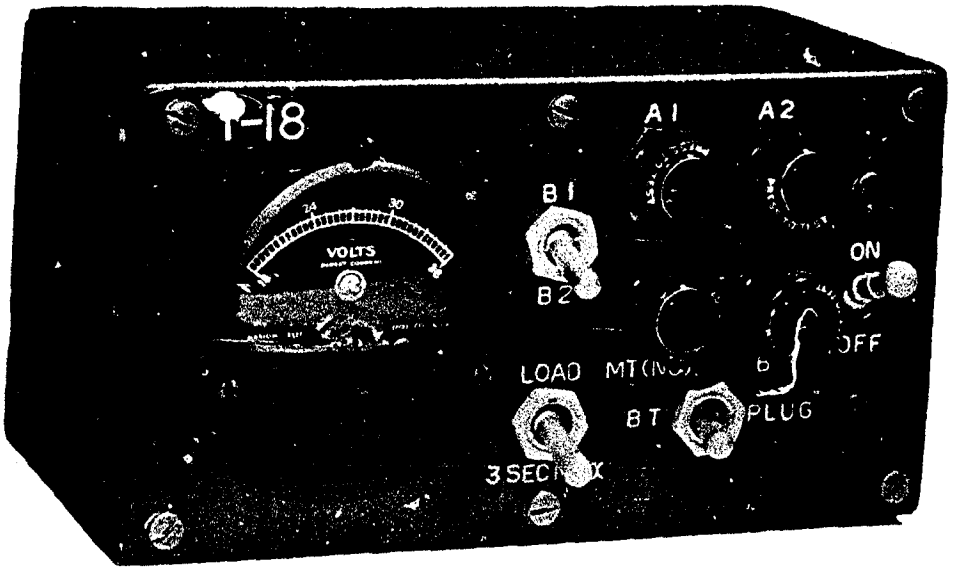


Fig. 10 -- Inflight monitor (T-18)

Inflight Control (T-19). -- The function of the T-19 (Fig. 11) is to set the baro switches and indicate the setting.

A shock mount bracket is provided as an integral part of the T-19 case assembly.

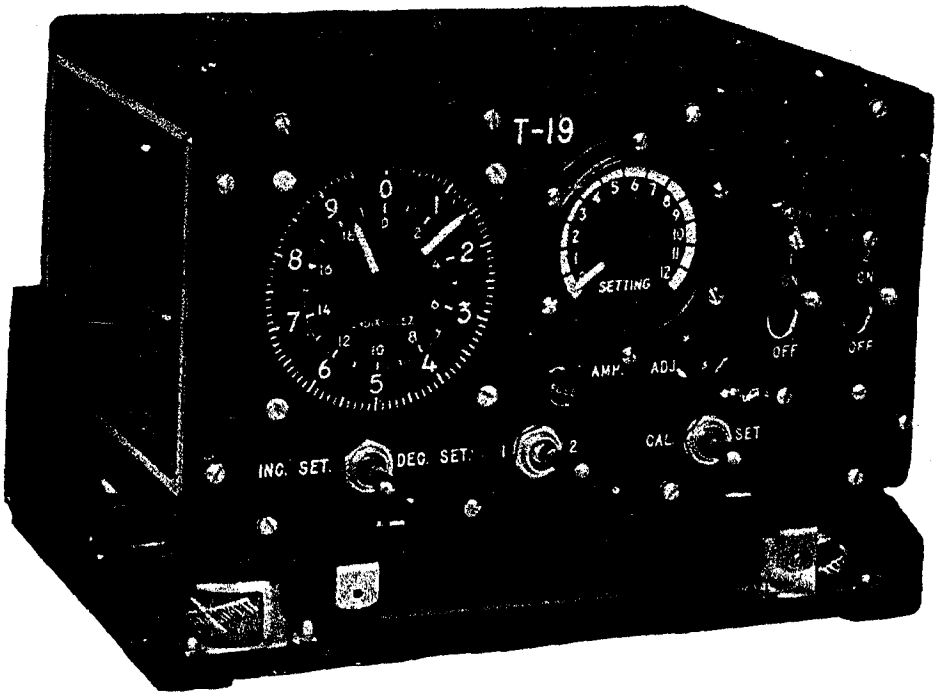


Fig. 11 -- Inflight control (T-19)

Flight Control Box (T-35). -- The function of the T-35 (Fig. 12) is to monitor and control the safety switch.

Shock mounting of the T-35 is not required.

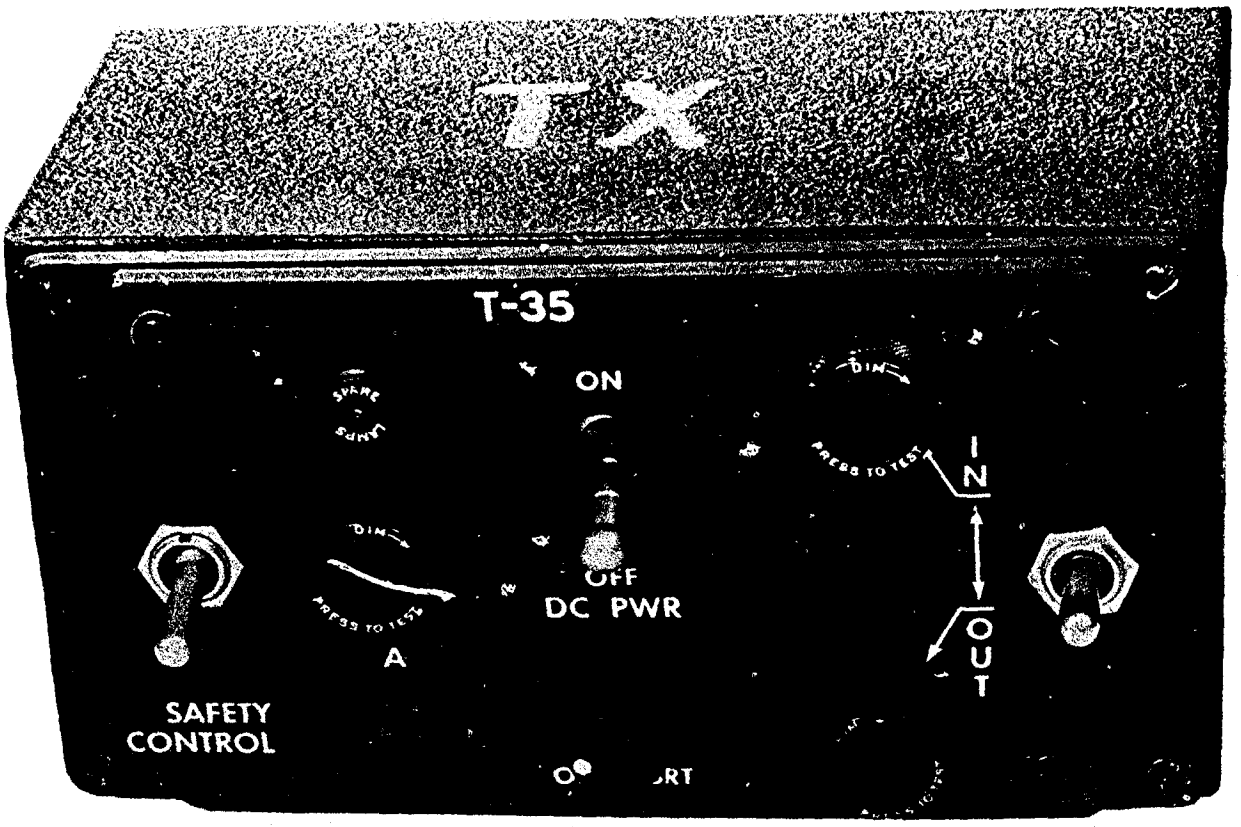


Fig. 12 -- Flight control box (T-35)

Flight Circuit Tester (T-23). -- Before the weapon is loaded into the aircraft the T-23 flight circuit tester (Fig. 13) is used to test the special aircraft wiring, T-18, T-19, and T-35. Special test cables and dummy plugs are used to connect the aircraft wiring to the T-23 (see Figs. 14 and 15). Cable CT-525 and the T-18 and T-19 dummy plugs are furnished with the T-23. Cable CT-873 connects between the pull-out cable CF-1061 in the bomb bay and the receptacle for CT-526 on the T-23. Cables CT-527, CT-576, and dummy plug T-35 are furnished with the T-23 but are not used in testing the aircraft wiring for the Mk 17 and Mk 24 bombs.

The T-23 requires a 28-v DC and an 11.8-v, 400 cps, AC power outlet in the vicinity of the T-19. If the bomb bay is more than 50 feet from the location of the T-19, a T-23 power outlet and an intercommunication station should be provided in the bomb bay to accommodate the T-23 test. The T-23 test requires 15 amperes at 28 volts DC, 50-v amperes at 26 volts, 400 cps, AC, and a negligible calibrating current at 11.8 volts, 400 cps, AC. The 26-v, 400 cps, AC power is obtained through test cable connection with the aircraft wiring.

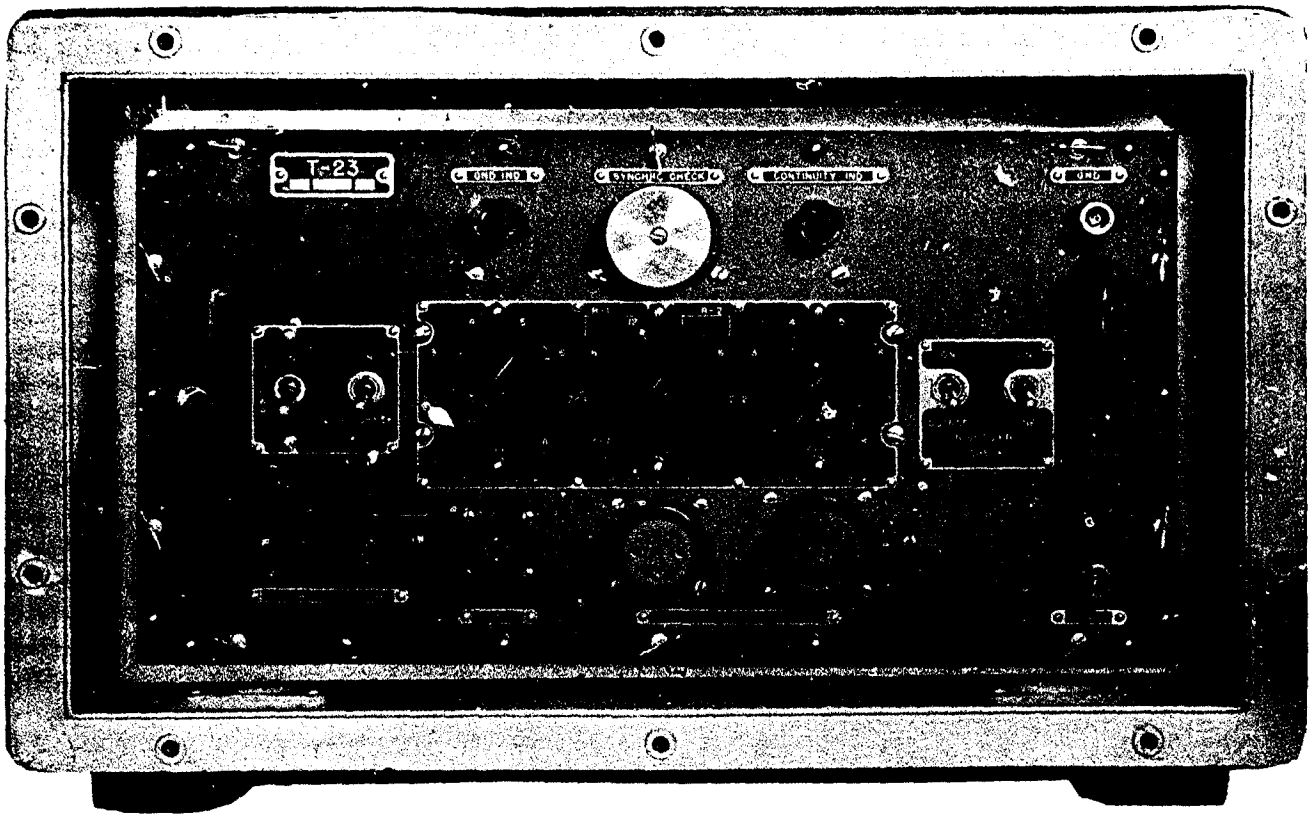


Fig. 13 -- Flight circuit tester (T-23)

Aircraft Wiring

A schematic representation of the aircraft wiring necessary to accommodate the Mk 17 and Mk 24 bombs is given in Fig. 16. This is the universal aircraft wiring system which includes circuit provisions for other atomic weapons and was released to the Armed Services on Sandia drawing 101864. The pull-out cable, CF-1061, which is furnished with the bomb, is attached to connectors AN-3102A-28-11S, AN-3102-32-7S, and AN-3102-24-9S of the bomb bay junction box. All aircraft wiring shall be in accordance with specifications Mil-W-5274A or JAN-C-76 and shall be installed in accordance with specification Mil-W-5088.

Power Requirements. -- A detailed chart of the power requirements of the Mk 17 and Mk 24 bombs during flight is given below. All voltage, unless otherwise, are 28 volts DC and the voltage should be maintained between 22 and 30 volts at the pull-out connectors for proper functioning of the bomb.

Component	Load (at -90°F)	Time duration
Battery heaters	7 amps	Continuous (thermo-controlled)
Safety switch	15 amps	2 sec
	26 Volts 400 Cycle	
MC-5 or MC-10 baro switch	6 volt amps	Steady
	20 volt amps	During setting

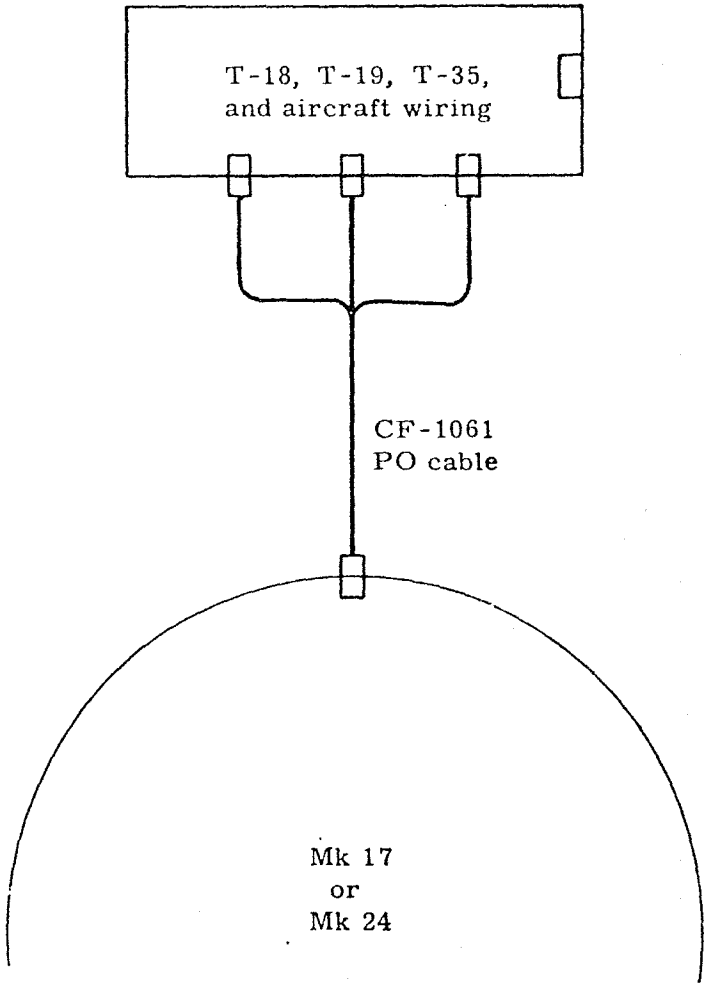


Fig. 14 -- Before loading test for Mk 17 and Mk 24

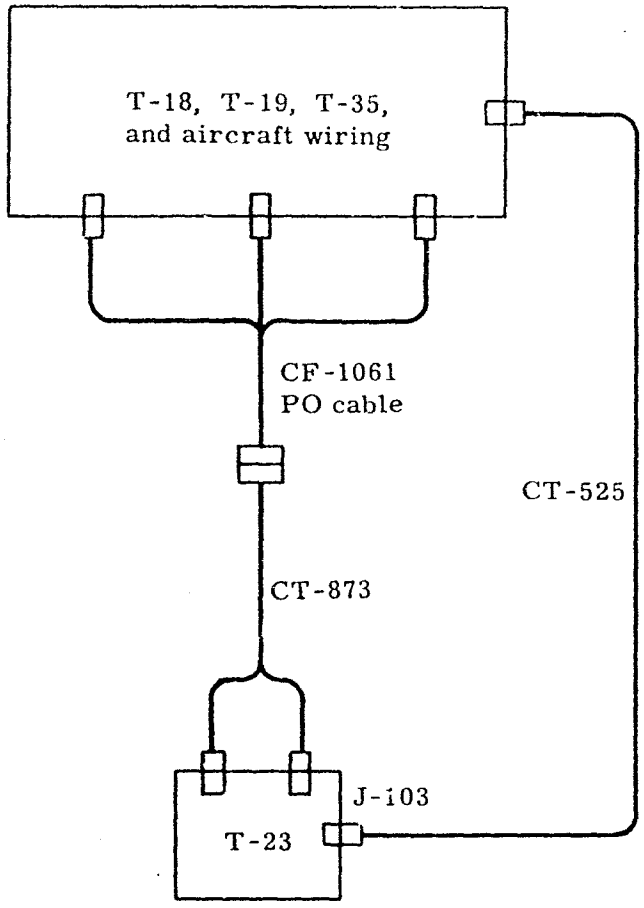


Fig. 15 -- Flight circuit test for carriage of Mk 17 and Mk 24

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APPENDIX A

Explanation of Figures

The illustrations in this specification are for general information only. The numbers of the drawings represented by the illustrations are given below. The latest issues of these drawings should be referred to before any aircraft modification is initiated.

Fig. No.	Description	Drawing No.
1	Configuration of the Mk 17 and Mk 24 bombs	SK(1241)33611
5	External dimensions of the Mk 17 and Mk 24 fins	SK(1241)33611
6	Detail of shear pad	SK(1241)33611
7	Pull-out cable connector and arming wires	SK(1241)33611
9	Inflight insertion crank	ACF-Y-3073
10	Inflight monitor (T-18)	SK(1215)3579
11	Inflight control (T-19)	SK(1215)3764
12	Flight control box (T-35)	SK(1282)6332
13	Flight circuit tester (T-23)	DS(5431)13733
14	Before-loading test for Mk 17 and Mk 24	SK(1283)33946
15	Flight circuit test for Mk 17 and Mk 24	SK(1283)33946
16	Aircraft wiring	101864

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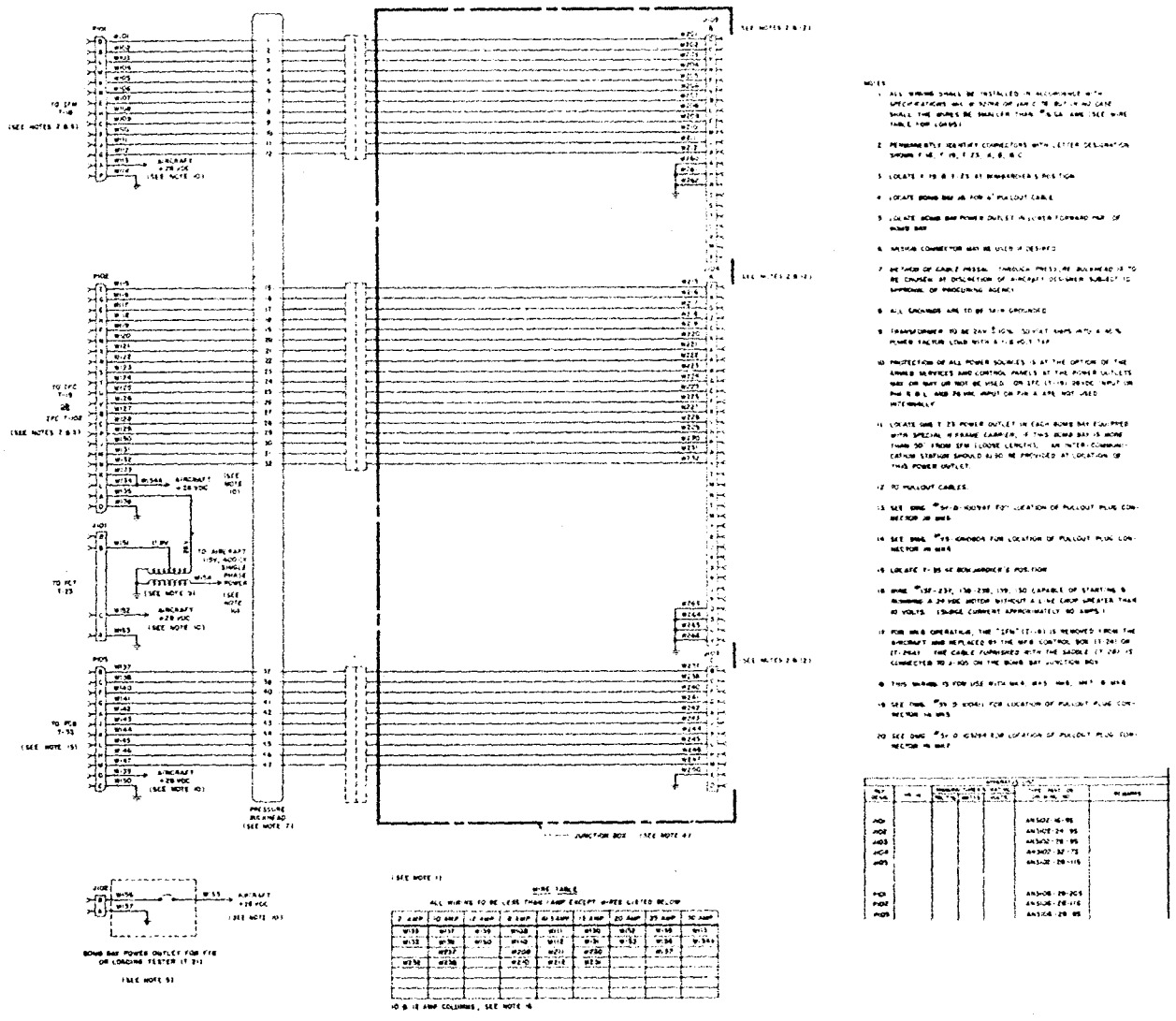

Fig. 16 -- Aircraft wiring requirements for the Mk 17 and Mk 24