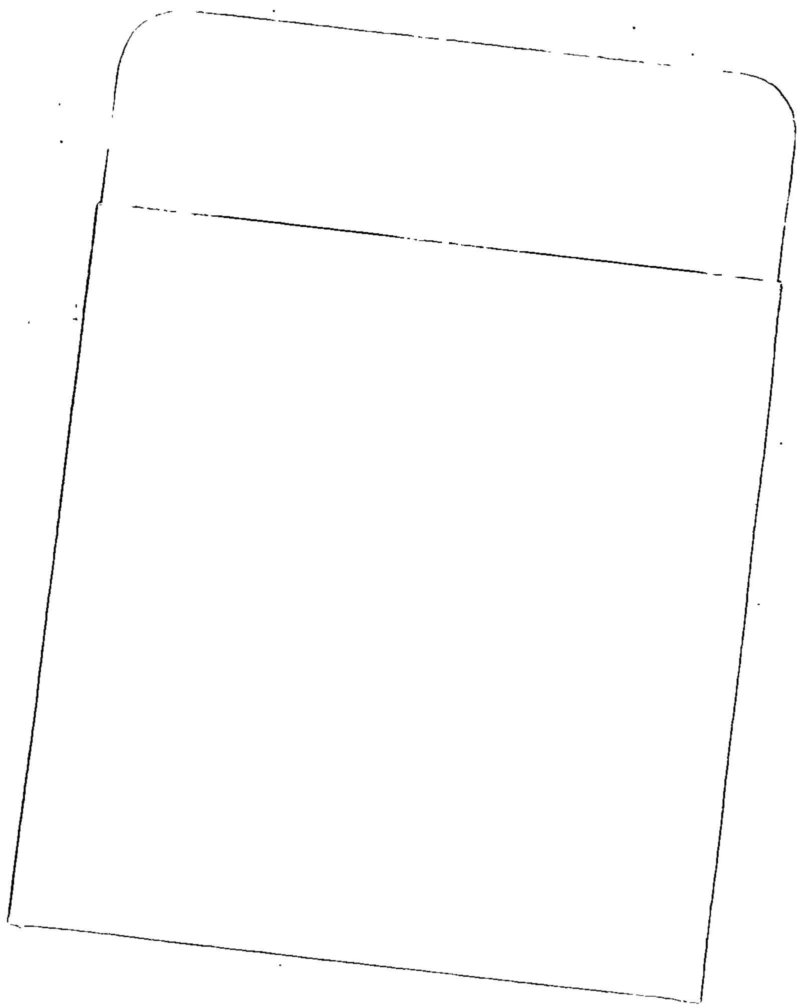
31-19 (Check)
2
S/S Aug 1977

FM 31-19 (TEST)

FIELD MANUAL

TECHNICAL TRAINING OF MILITARY FREE FALL PARACHUTISTS

HEADQUARTERS, DEPARTMENT OF THE ARMY
JULY 1974



WARNING PAGE

Personnel performing operations, procedures and practices which are included or implied in this manual shall observe the following instructions. Disregard of these warnings can cause serious or fatal injury to personnel.

AUTOMATIC RIPCORD RELEASE ASSEMBLY (para 2-7*e*). An automatic ripcord release that is installed in a parachute assembly which has been immersed in water shall be condemned.

AUTOMATIC RIPCORD RELEASE ASSEMBLY (para 2-7*e*). An automatic ripcord release that has been dropped after the timer has been wound and set, will be tested as prescribed in paragraph 3-3, TM 10-1670-205-13, before the release is placed into service. The test requirement shall also apply to an automatic ripcord release installed in a parachute packed for service which has been dropped.

AUTOMATIC RIPCORD RELEASE ASSEMBLY (para 2-7*e*). Any F-1B or FF-1 automatic ripcord release which has a defective timer will be removed from service.

OXYGEN INDOCTRINATION (para 2-10). Oxygen shall always be used when an altitude of 8,000 to 10,000 feet is expected to be maintained for at least 4 hours and at all altitudes above 10,000 feet. Do not use the pressure demand oxygen system above 43,500 feet.

OXYGEN SUPPLY SYSTEM (para 2-13). The portable oxygen console and personnel oxygen cylinders will be serviced with Aviator's Breathing Oxygen, Type 1, MIL-0-27210 only.

OXYGEN CYLINDER DISASSEMBLY (para 2-15*b*). When cylinder is being discharged, oxygen must escape through the bleed hole to prevent fire.

OXYGEN CYLINDER DISASSEMBLY (para 2-15*b*). When cylinder grease coming in contact with oxygen under pressure may cause a fire or explosion.

OXYGEN CYLINDER ASSEMBLY (para 2-15*e*). Overtorque may cause the break-off nipple to crack at center of flange, resulting in a leak, or cause the nipple to tilt to one side. If nipple tilts in direction of pressure gage, it may not fracture when oxygen release cable is actuated.

OXYGEN CYLINDER ASSEMBLY (para 2-15*e*). Do not spread the retainer pin prongs.

OXYGEN CYLINDER SERVICE (para 2-15*f*). Personnel performing these operations must have a thorough knowledge of the proper handling of oxygen and related equipment.

OXYGEN CYLINDER SERVICE (para 2-15*f*). Hands, clothing, and tools must be clean when working with oxygen equipment. Traces of oil, grease, or organic matter in contact with oxygen under pressure creates a danger of spontaneous combustion which may result in a fire or explosion.

FIELD MANUAL No. 31-19

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *30 July 1974*

TECHNICAL TRAINING OF MILITARY FREE FALL PARACHUTISTS

*This manual supersedes that portion of TM 10-1670-205-13, 29 December 1967, which concerns technical training of military free fall parachutists.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1–1. Purpose and Scope

a. This manual presents technical and procedural information on the training of military free fall parachutists. It includes methods and apparatus used in training military free fall parachutists, attachment and wearing of equipment, jumpmaster duties, jump procedures, safety requirements, and technical data on the use and repair of oxygen equipment for high altitude jumps. Tactical application of military free fall parachuting techniques is also included in this manual.

b. The contents of this manual are applicable to—

(1) General war, to include consideration of the nuclear battlefield environment.

(2) Limited war.

(3) Cold war, to include internal defense and development.

c. This manual should be jointly with TM 10–1670–205–13. Parachute, Personnel Back (HALO) and Parachutists' Kit, Free-Fall.

1–2. Training Authority

a. Military free fall parachute training is conducted by the authority contained in TRADOC Supplement 1 to AR 350–1.

b. The Commandant, US Army Institute for Military Assistance (USAIMA), Fort Bragg, North Carolina, maintains the state-of-the-art in military free fall parachuting. A formal training/qualification course is conducted by the Institute for Military Assistance. Before personnel may participate in military free fall parachuting, they must satisfactorily complete this course of instruction. Doctrine, techniques and procedures used in the military free fall training will be those currently prescribed in FM 31–20 and FM 31–21 as modified by Commandant, USAIMA. Commandant, USAIMA, is responsible for the formulation of doctrine and other literature applicable to the technical training and employment of military free fall parachutists.

1–3. Recommendations and Comments

Users of this publication are encouraged to recommend changes and submit comments for its improvement. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. **Comments should be** prepared using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and **forwarded direct to Commandant, United States Army Institute for Military Assistance, ATTN: ATSU–CTD–SF, Fort Bragg, NC 28307.**

Section II. BACKGROUND

1–4. Early Parachuting Techniques

a. Although parachutes and parachuting techniques have been advancing for the past 500 years, written history on parachuting is scarce and conflicting. Many records have been lost. During the early history of parachutes, all of the various models were attached to some sort of framework which held the canopy open. The parachutes were bulky and awkward to use and had very little practical value.

b. During the 16th Century, Sir Isaac Newton discovered that all bodies fall at the same rate of speed and that this speed increases at a uniform rate until a constant speed or terminal velocity is reached. It was commonly believed until recent years, however, that man could not survive a prolonged fall, and that he would lose consciousness or black out very quickly. It was also thought that if a man did fall he would twist, roll, tumble, and turn, powerless to control himself.

1–5. Evolution of Free Fall Parachuting Techniques

a. It was not until 1919 that the first human test of a free fall parachute was conducted by Leslie L. Irvin at McCook Field, Ohio, but even then no delayed free fall was accomplished. Irvin cleared the aircraft at 1,500 feet and immediately pulled the opening cord. The parachute blossomed above him, and the test was a success.

b. The first delayed fall was probably an accident. In 1922, Lieutenant Harold R. Harris jumped from his disabled aircraft, had difficulty finding his ripcord, and fell 2,000 feet before opening his parachute 500 feet above the ground. In 1934, Floyd Smith published an article in a commercial magazine outlining techniques developed to control the body during free fall, and the former beliefs about falling were discarded. The techniques described by Smith were basically the same as those used in free fall parachuting today.

c. France earnestly took up parachuting as a sport in 1949, and 10 public sport parachuting centers were established throughout the country. The French refined and perfected the stabilized falling position.

d. Free fall techniques were brought to the United States in 1955 by Jacques Istel after he had visited France and observed the excellent parachuting being done there. Istel organized and trained the first US sport parachuting team to compete in international competition. He was retained by the US Army in 1957 to train a select group of seven military parachutists from the 77th Special Forces at Fort Bragg, NC, in free fall parachuting techniques.

1–6 Military Free Fall Parachuting

a. AR 95–19, Participation of Army Personnel in Sport Parachuting, first published in 1958, stated that sport parachuting would be fostered and encouraged.

b. The Strategic Army Corps (STRAC) Sport Parachute Team was formed at Fort Bragg, NC, in September 1959. During the early part of 1960, STRAC team members attended an oxygen orientation course at Wright-Patterson Air Force Base, Ohio, where they were introduced to the effects of oxygen shortage at high altitudes. STRAC team members also participated in a series of tests at Fort Bragg for the Continental Army Command to determine new rates of descent tables. Results of these tests are incorporated in AR 95–19.

c. On the 16th of December 1963, a world record was established for a mass altitude exit from 43,500 feet by 14 members of the US Army and US Air Force at El Centro, California. No adverse effects were experienced.

d. The Department of the Army has established a requirement to airdrop specially equipped, highly trained personnel into remote areas. Mission requirements may demand high altitude exit from aircraft types not designed for use with the standard troop type parachute. The Army requires a free fall capability and a maneuverable parachute which permits personnel to operate at top efficiency immediately after landing. To meet these requirements, the Army has developed military free fall techniques and equipment.

CHAPTER 2
MILITARY FREE FALL TRAINING

Section I. INTRODUCTION

2–1. General

a. Military free fall parachuting is a technique by which the parachutist jumps from a high altitude, is completely free from the aircraft, and falls for a predetermined time or distance before canopy deployment. During free fall, body stabilizing techniques and necessary maneuvers are executed to aline the parachutist on his assigned heading. The parachute is activated manually by the ripcord, which is backed up by an automatic ripcord release set for a specified time interval or altitude. Use of a steerable canopy allows the parachutist to maneuver and land with great accuracy. Figure 2–1 illustrates the complete military free fall parachutist's kit required for this type jump.

b. This chapter presents guidance for the establishment and conduct of military free fall training. A military free fall course should be divided into three training phases—ground training to present the basic fundamentals of free fall parachuting; physiological training to familiarize the student with the effects of high altitude on the human body; and jumping from an aircraft in flight. Each of these phases will be discussed in detail in the remaining sections of this chapter.

2–2. Reference

For a technical discussion of the components found in the military free fall parachutist's kit, see TM 10–1670–205–13.

Figure 2-1. Military free fall parachutist.

Section II. GROUND TRAINING

2-3. General

The ground training phase of the military free fall course emphasizes five basic techniques. These techniques, when executed properly, provide a high degree of assurance for a safe and successful free fall parachute jump.

a. Control of the Jumper Inside the Aircraft. To insure that the maximum number of parachutists can safely exit an aircraft and arrive on a predesignated target area, a means of controlling the jumpers inside the aircraft at all times is necessary. This control is established by use of jump commands issued by the jumpmaster. A discussion of these commands, and jumpmaster responsibilities, is found in chapter 4. These commands, and appropriate parachutist's responses, are taught with the aid of the mock door apparatus.

b. Control of the Body From the Instant the Jumper Leaves the Door or Ramp of the Aircraft Until he Receives the Opening Shock. A jumper must be able to exit the aircraft and assume the stable body position as rapidly as possible, fall on a designated heading, and manually deploy his main parachute without losing stability. Improper or unstable body position may cause considerable dispersion prior to canopy deployment which would prohibit or hinder assembly in the air and on the ground; an out of control opening of the parachute may also cause malfunctions of the main parachute. The table top stabilization training, suspended harness (free fall) apparatus, and mock door apparatus are used extensively for teaching free fall stability.

c. Control of the Parachute During Descent. Control of the parachute is essential to assemble in the air insuring a compact tactical unit upon landing and to avoid fellow jumpers in the air or obstacles on the ground. Canopy control is taught with the aid of the suspended harness.

d. Making Contact with the Ground and the Execution of a Parachute Landing Fall. Most jump injuries result from improper landing. The parachute landing fall is a technique of landing which enables the parachutist to distribute the landing shocks over his entire body to reduce the possibility of injury.

e. Control of the Parachute After Landing. The jumper must be able to control his parachute after landing. High winds on the drop zone may cause parachutists to be dragged even after a well executed parachute landing fall and a quick recovery.

2–4. Table Top Body Stabilization Training

The table top body stabilization training apparatus can be any table top or flat surfaced material approximately 40 inches in width. An excellent device is the standard riggers pack table.

a. Purpose. Table top body stabilization training is geared to teach the student control of the body from the time the jumper leaves the door or ramp of an aircraft until he receives the opening shock created by the inflation of the parachute canopy.

b. Conduct of Training. There should be sufficient instructors to observe and critique students during the conduct of training. Two commands are used during the conduct of this training; STANDBY and GO. Students will lie on the table top, stomach down, arms and feet off the table. At the command of STANDBY, the students will become alert. At the command GO, the students will assume the modified frog position and start their 10 second count slowly moving the arms upward and arching the body until at the count of 10,000 the student will be in a stable body position.

(1) *Modified frog position* (fig 2–2). Assume the modified frog position as follows:

(*a*) Arch back, and throw head back.

(*b*) Extend arms horizontally with elbows bent and hands at eye level. Turn palms down, spread fingers, and cup hands slightly.

(*c*) Separate legs about 45° and bend knees in a relaxed position or as far as the confirmation of the body will allow.

(2) *Semi-delta position* (fig 2–3). Assume the semi-delta position as follows: Extend the body in a straight line with the legs slightly apart and the feet pointed downward. The arms and hands should be extended and straight with the hands away from the body, approximately at a 45° angle, and slightly to the rear of the jumper.

(3) *Maneuvers from the modified frog position.*

(*a*) *Right body turn* (fig 2–4). To execute a right body turn, twist the upper trunk of the body to the right at the waist leaving the head and arms in the stable fall position until you have turned to the desired heading. To stop the turn and maintain a straight heading, twist the upper trunk of the body to the left at the waist leaving the head and arms in the stable fall position. After the turn has been countered, return the body immediately to the stable body position.

(*b*) *Left body turn* (fig 2–5). To execute a left body turn, twist the upper trunk of the body to the left at the waist leaving the head and arms in the stable fall position until you have turned to the desired heading. To stop the turn and maintain a straight heading, twist the upper trunk of the body to the right at the waist leaving the head and arms in the stable fall position. After the turn has been countered, return the upper body immediately to the stable body position.

(*c*) *Orientation.* It is extremely important that the jumper always look in the direction he is turning or countering.

(4) *Pull position.* At approximately 4,500 feet, the jumper assumes the prepare to pull position (A, fig 2–6). To assume this position using the two hand pull, the jumper extends his hands and arms slightly forward which places his body in a slight feet to earth attitude and checks his altimeter. Next, the jumper locates his ripcord (B, fig 2–6). At approximately 4,300 feet, the jumper grasps the ripcord with

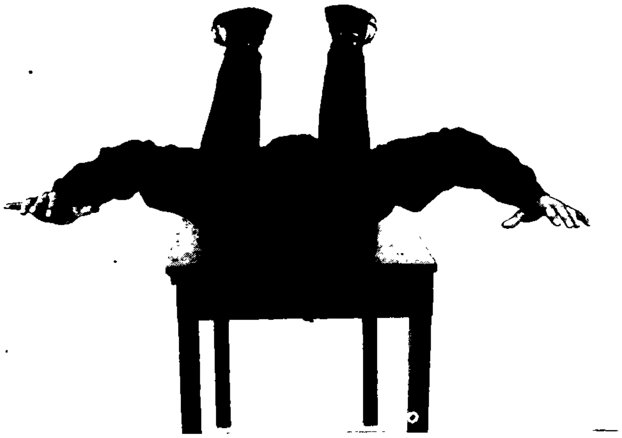


Figure 2-2. Modified frog position (front and side views).

Figure 2-3—Continued.

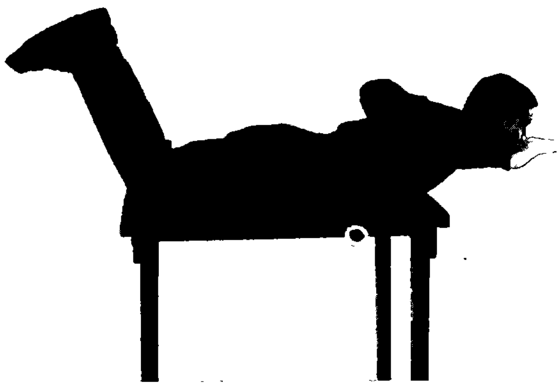


Figure 2-2—Continued.

Figure 2-4. Right body turn.

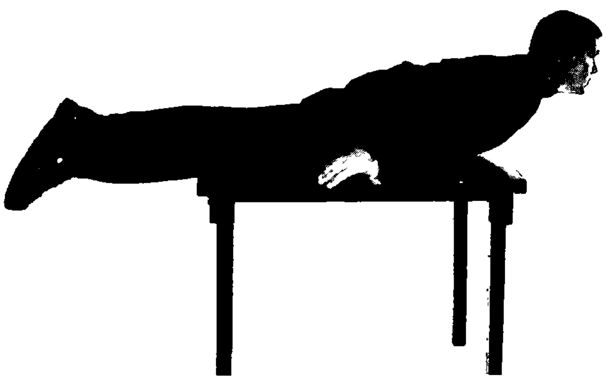


Figure 2-3. Semi-delta position (front and side views).

Figure 2-5. Left body turn.

the left hand, palm down, and at the same time places his right hand over his left (C, fig 2-6). He then simultaneously pulls down (D, fig 2-6) and out with the left hand and pushes down and out with the right hand, extending both hands back over his head until the main parachute is deployed (E, fig 2-6).

2-5. Mock Apparatus

The mock door is a replica of the cargo and passenger compartment of a troop carrier aircraft. The mock door may be the fuselage of a condemned aircraft or only an open platform with the uprights simulating doors and the ramp. Mock door training apparatus should include seats, doors, and ramp of the approximate size of an aircraft. This phase of training, although extremely important, tends to become boring, and the instructor must be prepared to keep the students motivated or bad habits may be formed.

a. Purpose. The mock door is used to teach control of the jumper inside the aircraft just prior to exiting, exit procedures, and control of the body for the first 10 seconds after exit.

b. Methods of Exit. In free fall parachute training, all jumps will normally be from the troop door or ramp of a cargo-type aircraft.

(1) *Door exit.* Execute a door exit as follows:

(*a*) *Standby position.* Move to the vicinity of the jump door approximately 24 inches from the door (1st man only).

(*b*) *Proper exit.* At the GO signal from the jumpmaster, swing out from the doorway toward the front of the aircraft (A, fig 2-7), assume a modified frog position, and align yourself with the flight path of the aircraft (B, fig 2-7). Utilizing the doors for a mass exit, all subsequent parachutists will exit as rapidly as possible without assuming the standby position.

(2) *Ramp exit.* Execute a ramp exit as follows:

(*a*) *Standby position* (A, fig 2-8). Stand on the ramp facing the rear of the aircraft approximately 12 inches from the end of the ramp.

(*b*) *Proper exit.* On the GO signal from the jumpmaster, exit off the ramp with a slight hop and turn, and assume the modified frog position facing the direction of the flight path of the aircraft (B, fig 2-8).

c. Conduct of Training. Training should follow this sequence: Half the students exit the right side door and half exit from the left side door, or half the students exit the right side of the ramp and half exit the left side of the ramp under the control of separate instructors.

d. Jump Commands. The only two jump commands used in the conduct of training are; STANDBY and GO. These are used for all drops both individual exits or to initiate the movement of a mass exit.

e. The Modified Frog Position.

(1) The exit from the mock door apparatus is made as explained in *b* above.

(2) The moment the jumper exits the apparatus, he assumes the modified frog position and in normal cadence counts 1,000, 2,000, 3,000 . . . to 10,000.

(3) Each student remains in this body position until critiqued by the instructor and told to recover. In this way, the instructor is better able to see the student's mistakes. It is also recommended that the students recover to a position where they can closely observe the remaining jumpers and hear the critique of each.

(4) After the students learn the proper methods of exiting individually, the jump commands are reviewed and the mass exit technique is a modified parachute harness attached to a given the commands; STANDBY and GO. The remaining jumpers exit in turn as rapidly as possible. (The jump commands are explained in chap 4.)

2-6. Suspended Harness (Free Fall) Apparatus

The suspended harness (free fall) apparatus is a modified parachute harness attached to a suspension ring by four risers and a center suspension strap with a pull release device. The ring is attached to a block and tackle which is used to raise and suspend the student 3 to 4 feet above the ground.

a. Purpose. The suspended harness (free fall) apparatus is used to teach the student control of the body from exit of the aircraft until canopy deployment, methods of canopy control, and emergency procedures.

b. Conduct of Training.

(1) The positions and maneuvers taught in the suspended harness (free fall) apparatus (fig 2-9 through fig 2-13) are the same as those taught during table top body stabilization training discussed in paragraph 2-4. There should be one instructor per suspended harness (free fall) apparatus to observe and critique students during the conduct of this training.

(2) The correct manipulation of the parachutist's canopy is necessary if he is to control the direction in which he moves. The canopy

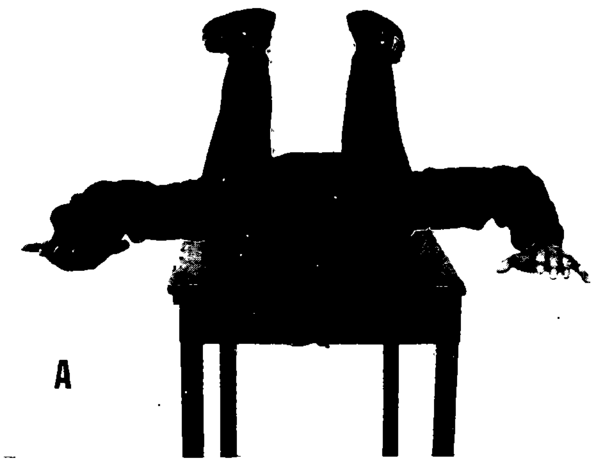


Figure 2-6. Pull position.

Figure 2-6—Continued.

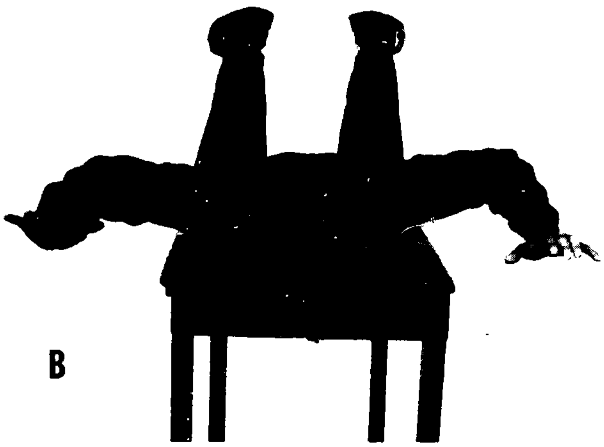


Figure 2-6—Continued.

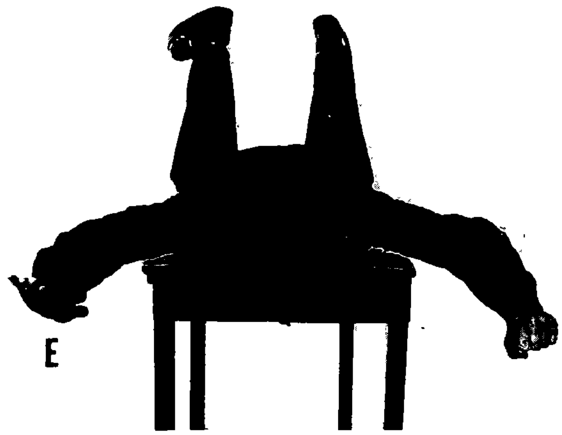


Figure 2-6—Continued.

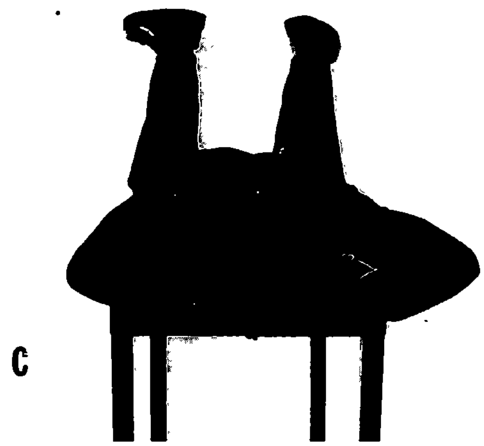


Figure 2-6—Continued.

may be manipulated with the slip risers unlocked or locked.

(*a*) *Manipulating canopy with risers unlocked.* Activate your slip risers by removing the locking forks, and rotate the canopy right or left as follows:

1. Rotating canopy to the right. Pull down on the right rear riser (A, fig 2-14), or left front riser (B, fig 2-14), or both the right rear and the left front risers (C, fig 2-14).

2. Rotating canopy to the left. Pull down on the left rear riser (A, fig 2-15), or right front riser (B, fig 2-15), or both the left rear and right front risers (C, fig. 2-15).

(*b*) *Manipulating canopy with risers locked.* Leave the locking forks in place and rotate canopy to the right or left as follows:

1. Rotating canopy to the right. Pull down on right rear riser (A, fig 2-16) to rotate

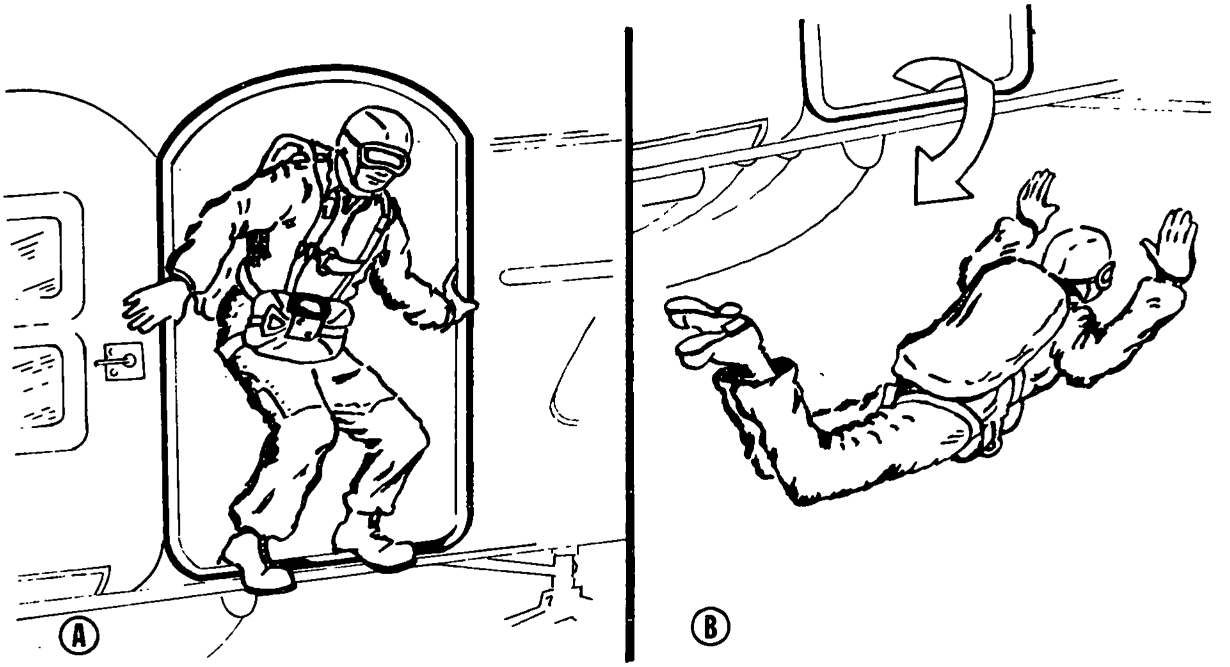


Figure 2-7. Door exit.

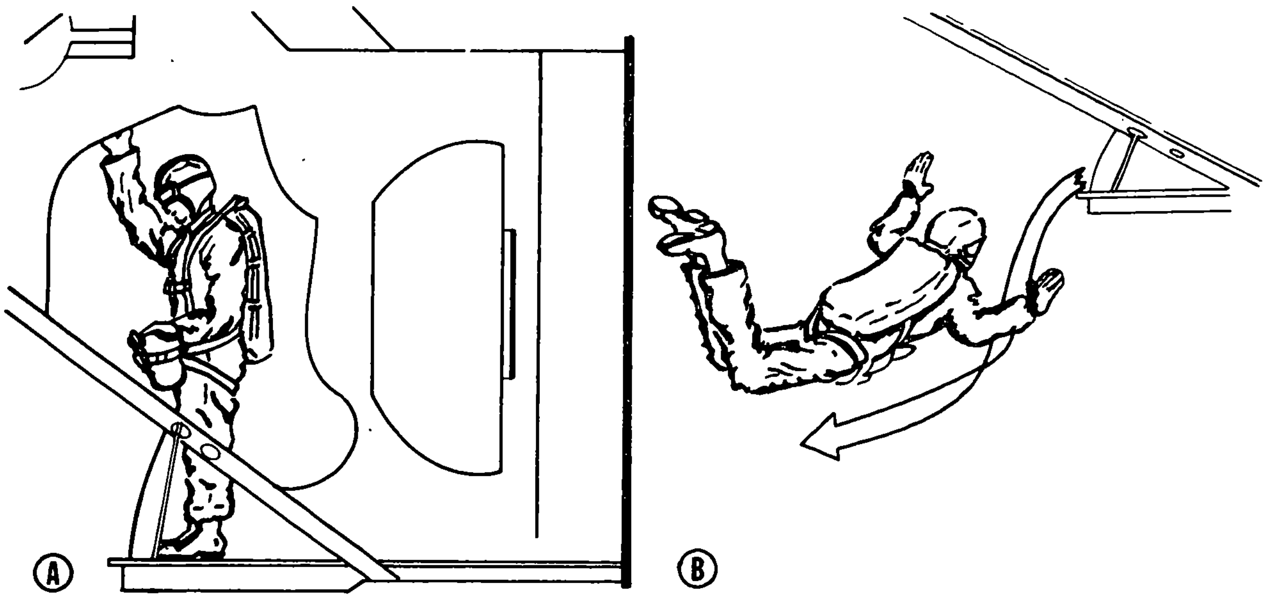


Figure 2-8. Ramp exit.

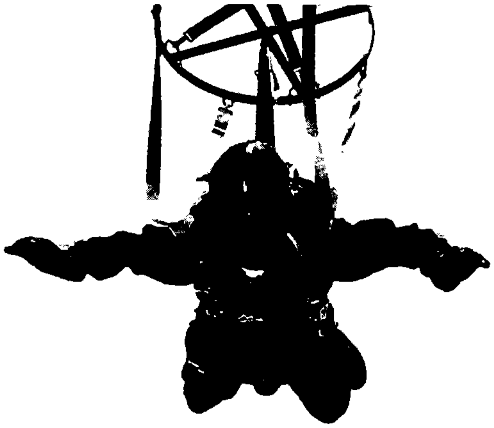


Figure 2-9. Modified frog position (front and side views).

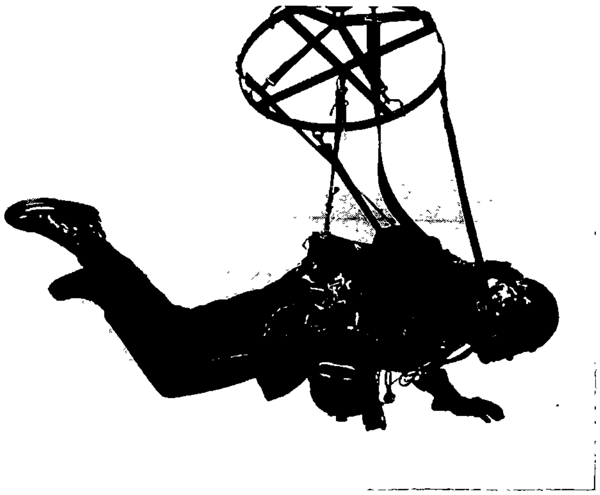


Figure 2-9—Continued.

Figure 2-10. Semi-delta position (front and side views).

Figure 2-10—Continued.

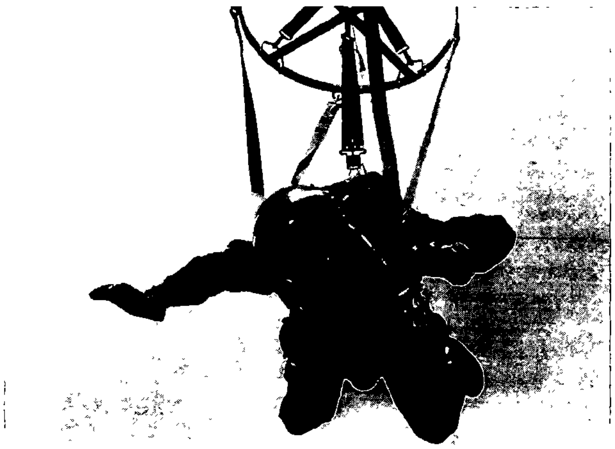


Figure 2-11. Right body turn.

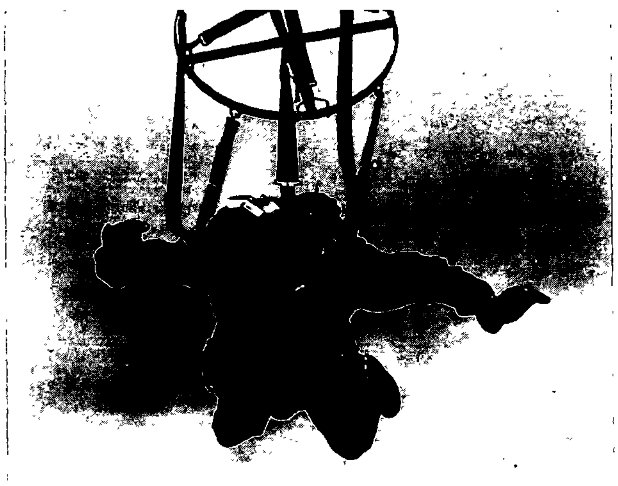


Figure 2-12. Left body turn.

Figure 2-13. Pull position.

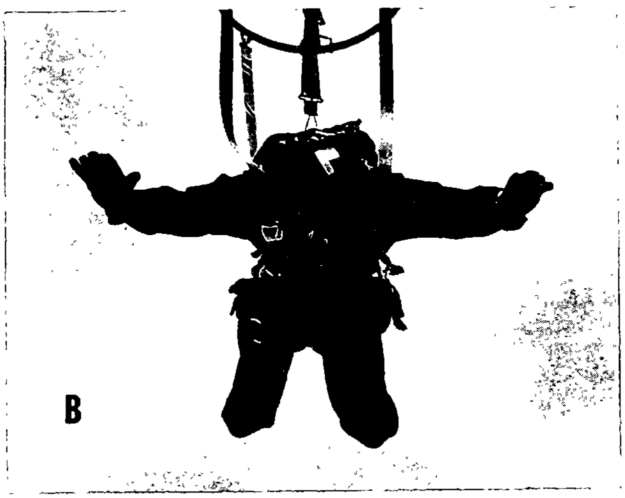


Figure 2-13—Continued.

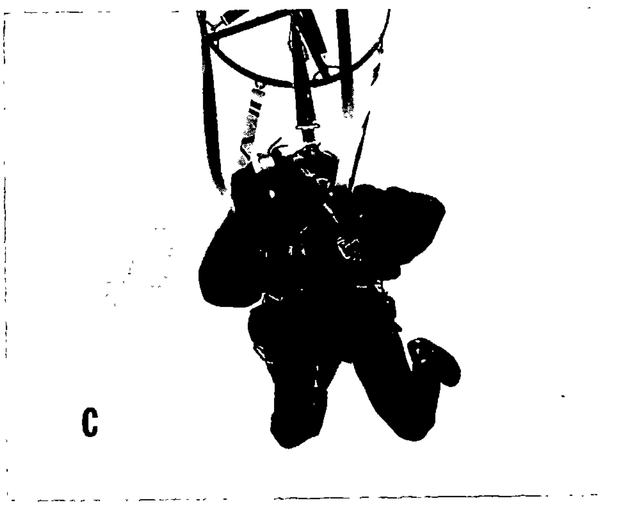


Figure 2-13—Continued.

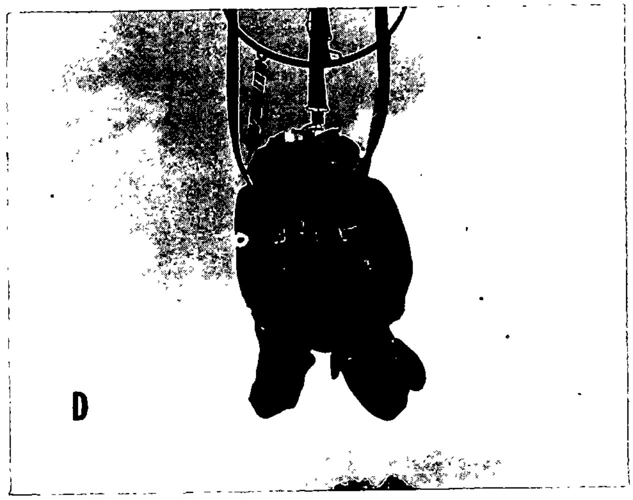


Figure 2-13—Continued.

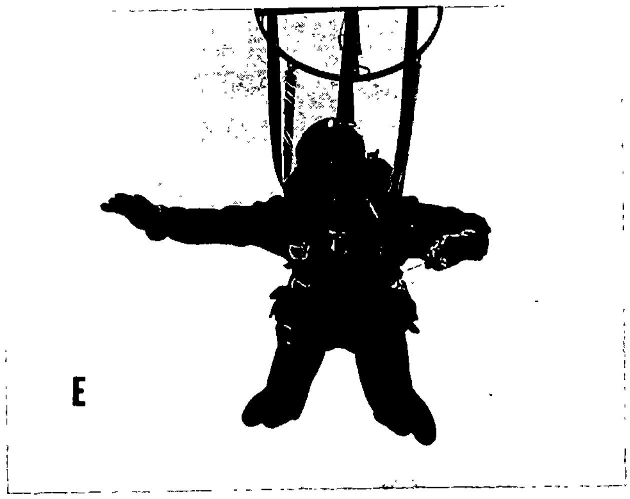


Figure 2-13—Continued.

canopy to the right. Rotate canopy faster by pulling down on the right rear and left front risers (B, fig 2-16).

2. Rotating canopy to the left. Pull down on left rear riser (A, fig 2-17) to rotate canopy to the left. Rotate canopy faster by pulling down on left rear and right front risers (B, fig 2-17).

3. Increasing forward speed. Increase forward speed by pulling down on both front risers (fig 2-18).

4. Decreasing forward speed. To slow forward speed, turn the canopy and hold into the wind (fig 2-19).

2-7. The MC-1 Parachute Assembly

One of the first items the jumper should become familiar with is his parachute equipment. When-

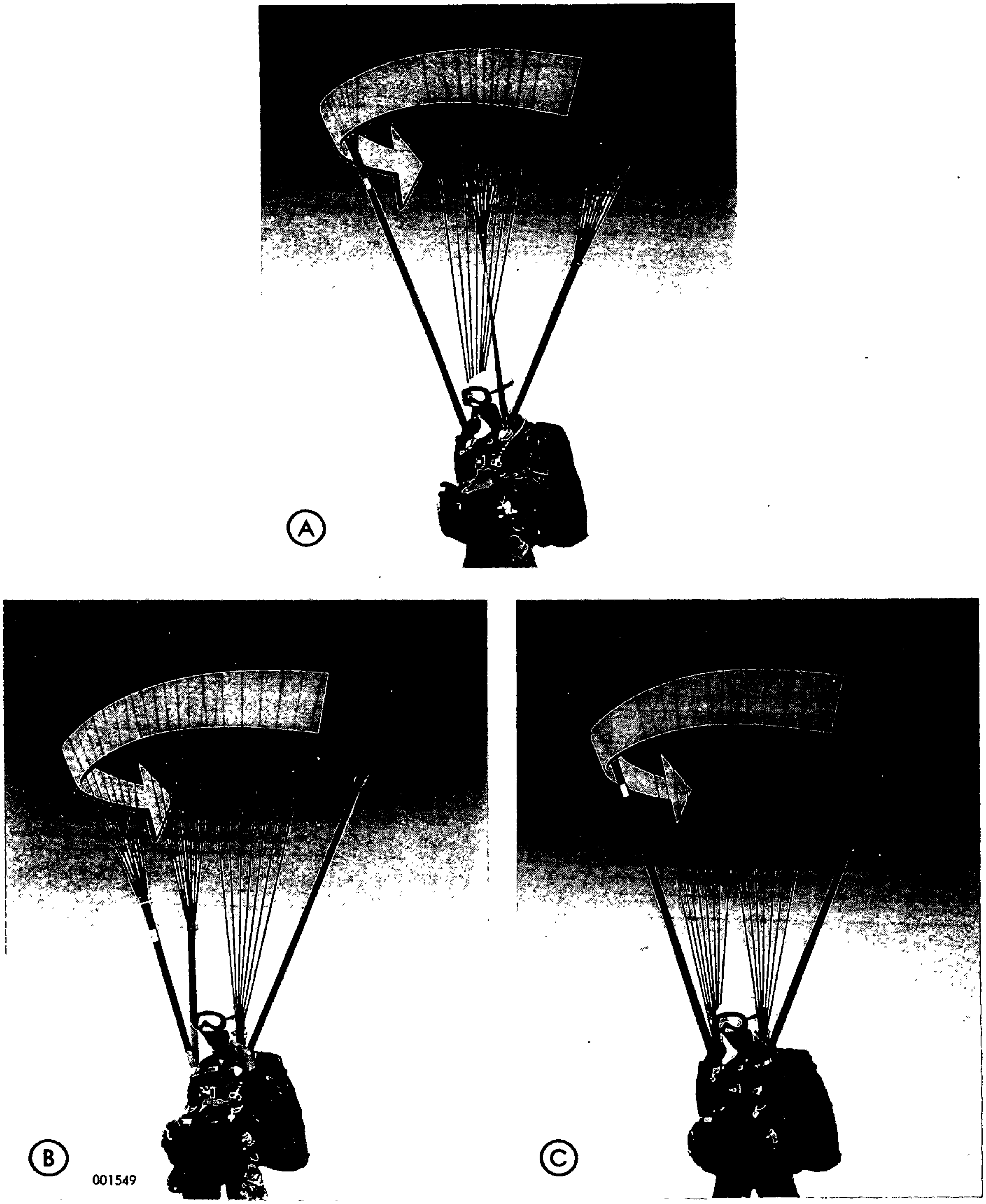


Figure 2-14. Rotating canopy to the right with risers unlocked.

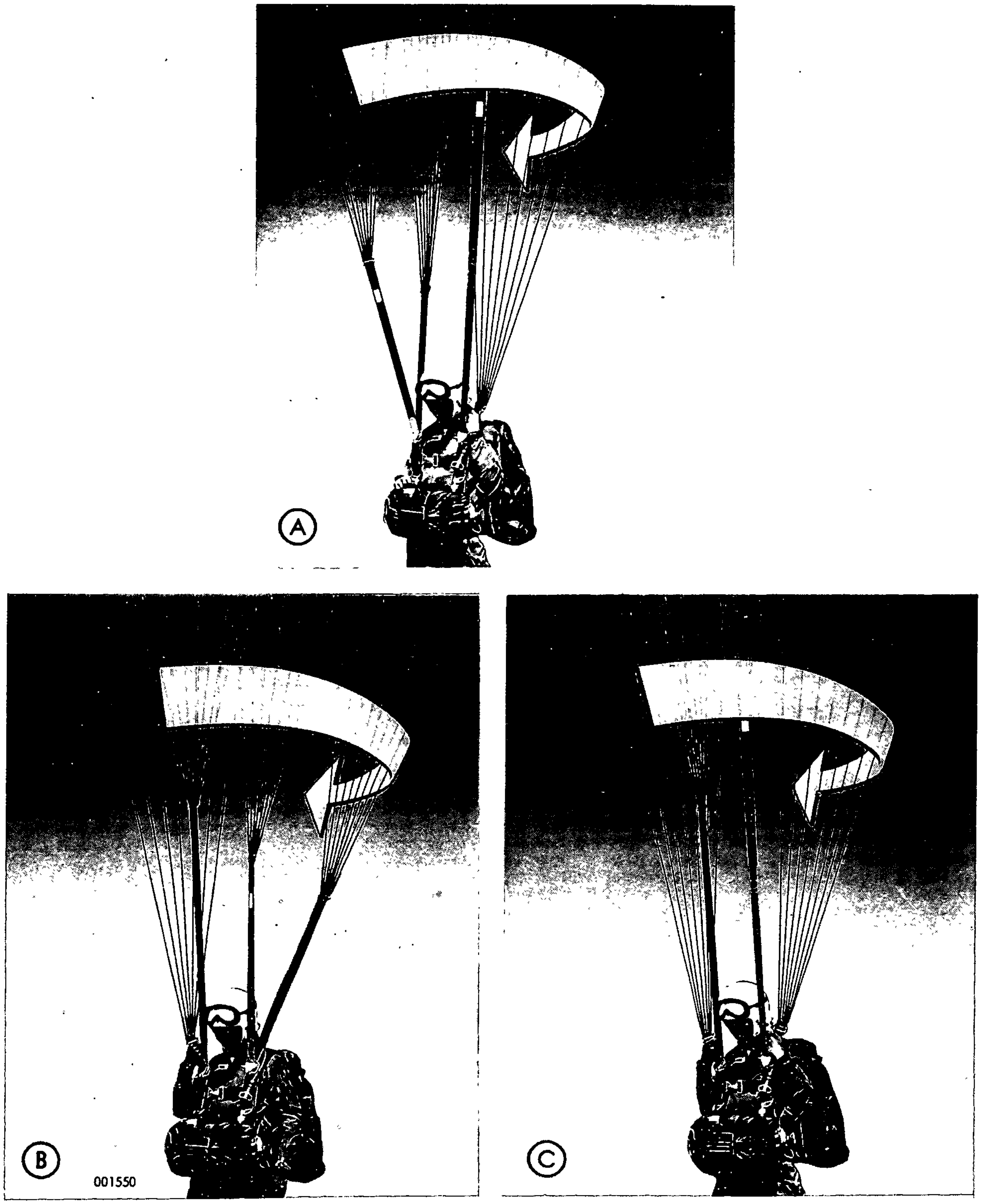


Figure 2–15. Rotating canopy to the left with risers unlocked.

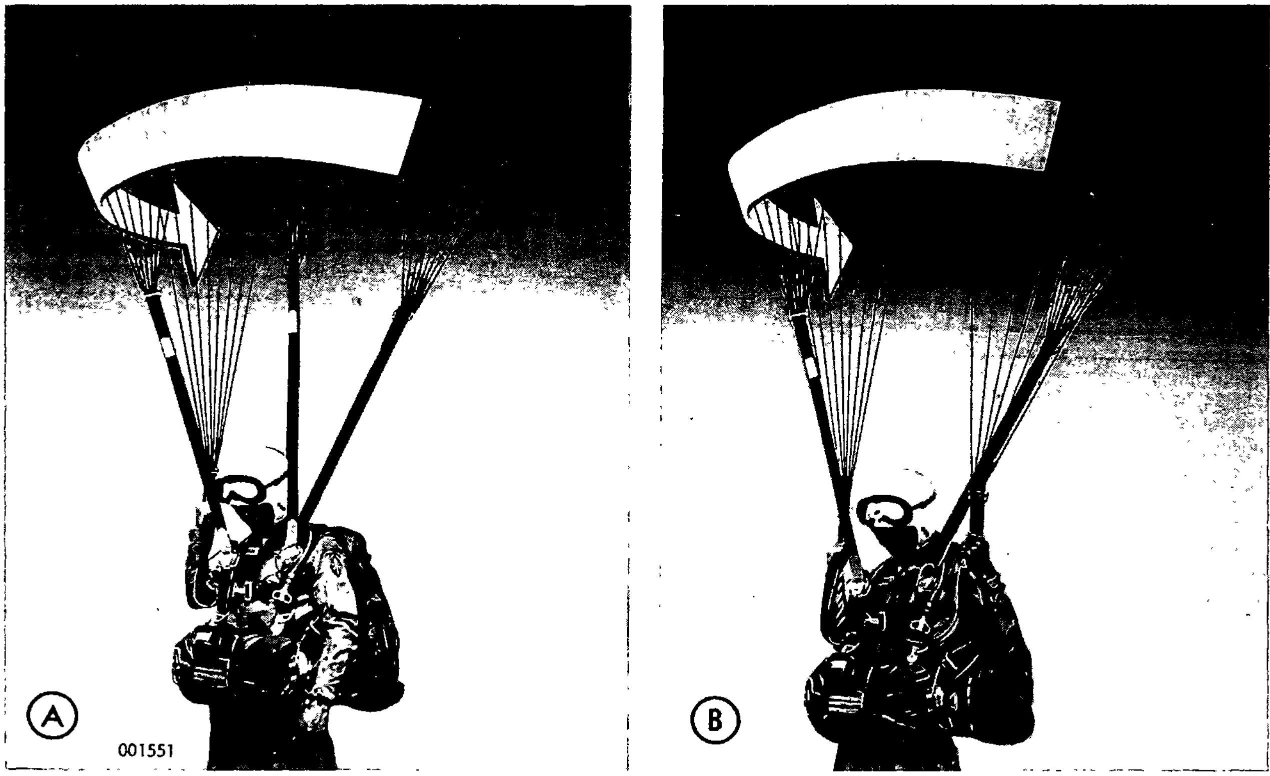


Figure 2-16. Rotating canopy to the right with risers locked.

ever this equipment is used, it should be inspected to insure that it is fitted and worn correctly. The MC-1 parachute assembly consists of a main canopy assembly and an automatic ripcord release. The assembly is supplemented with oxygen equipment when required for high altitude jumps.

a. Main Canopy Assembly. The main canopy assembly is the pack tray, 35-foot diameter canopy assembly (T-10) main, with the following modifications:

(1) A 36-inch diameter vane type pilot chute is attached to the apex of the main canopy by means of a bridle line, to serve as a means of deployment.

(2) Slip risers equipped with riser locking forks are substituted for the standard risers.

(3) An attached deployment bag, in the form of a panel, is sewn to the radial seam number 16, approximately 60 inches above the canopy skirt. The deployment bag is equipped with stow flutes for stowing suspension lines. A deployment bag locking strap is sewn over suspension line 16, 6 inches above the deployment bag.

(4) The canopy apex is equipped with a vent cap of nylon fabric.

(5) A 39.46 square foot oval orifice (fig 2-20) is constructed through 5 gores between radial seams 3 and 28.

b. Main Pack, Pack Tray. The main pack, pack tray is that part of the parachute assembly which contains the main canopy, deployment bag, and pilot chute. The back panel is shaped with spring stiffeners to conform to the average parachutist's torso. A protector flap is provided to keep the connector links separated from the suspension line stow flutes to prevent entaglement and premature removal of suspension lines from stow flutes. The exterior of the back panel is provided with harness retainer straps and an interlocking slide fastener (zipper) for attachment to the harness. The manual ripcord assembly (fig 2-21) consists of a ripcord handle, a ripcord handle socket, a steel cable with four pack locking pins, and a protective flexible steel housing. The pack is also provided with a compartment and a mounting bracket in the upper left side of the pack for mounting the automatic ripcord release (fig 2-22) and a dual housing

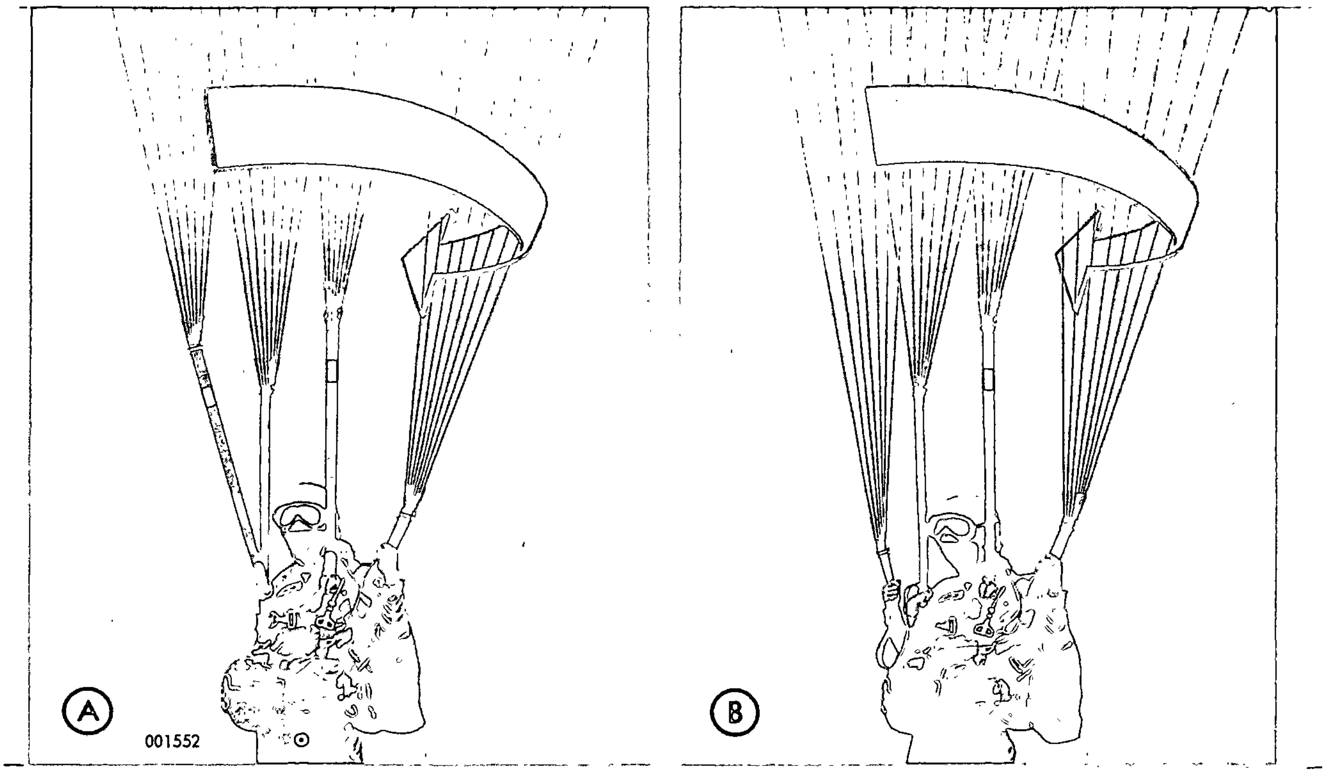


Figure 2-17. Rotating canopy to the left with risers locked.

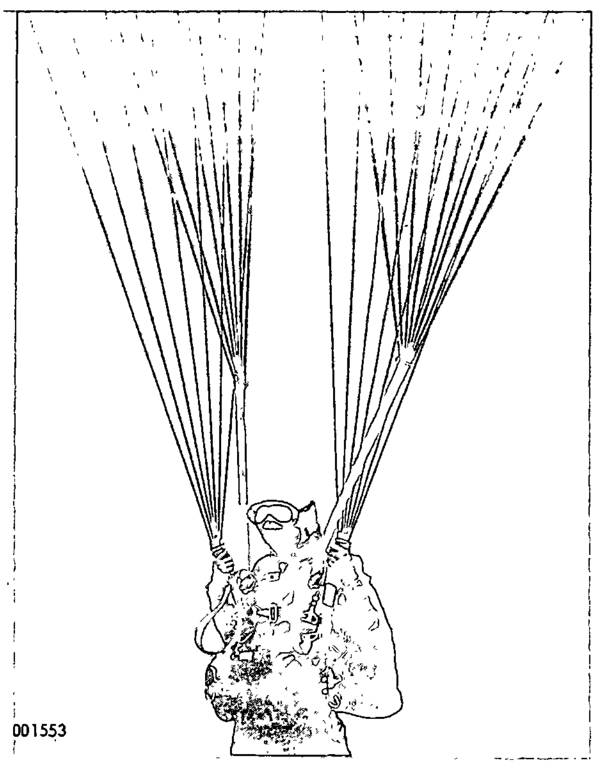


Figure 2-18. Increasing forward speed.

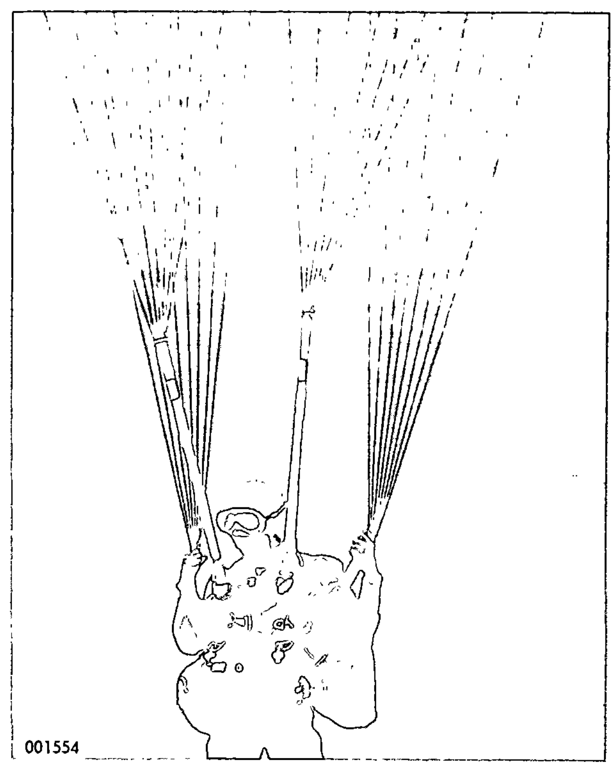


Figure 2-19. Decreasing forward speed.

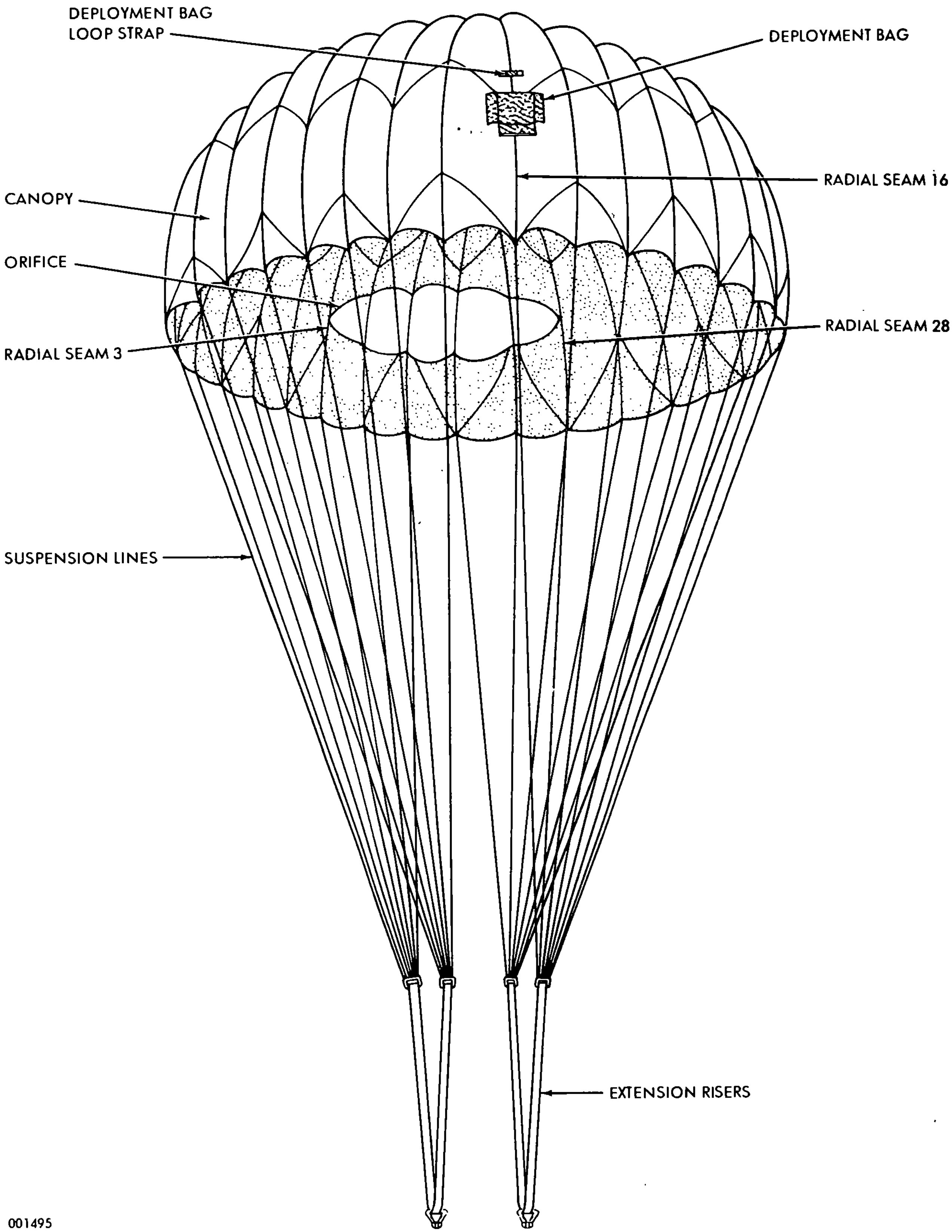


Figure 2-20. Canopy assembly and extension risers.

clamp (fig 2-23) located at the top front of the pack. The dual housing clamp provides a terminal for attachment of the automatic ripcord release power cable to the manual ripcord cable.

c. Harness. The main parachute assembly is attached to a lightweight, flexible, nylon webbing harness assembly which secures the main and reserve parachutes to the wearer. The harness assembly has a sectional main sling. Adjustment of the straps results in an automatic takeup of the sectional main sling and integrated back straps. There are three quick adjustment points with two additional adjusters adjacent to the hip links for overall adjustment to extremes in body size. Three quick ejector-type snap fasteners (fig 2-21) are provided for rapid devestment. Attachment rings are sewn into each main sling to permit a parachutist to carry an equipment container. Two canopy release fittings of the quick release (2 shot) type are provided to connect the harness to the main risers and canopy. The entire harness is mounted on a short girth vest for easy donning. The vest incorporates a sponge rubber back pad for the parachutist's comfort. Some of the harnesses in current use are provided with sponge rubber pads on the leg

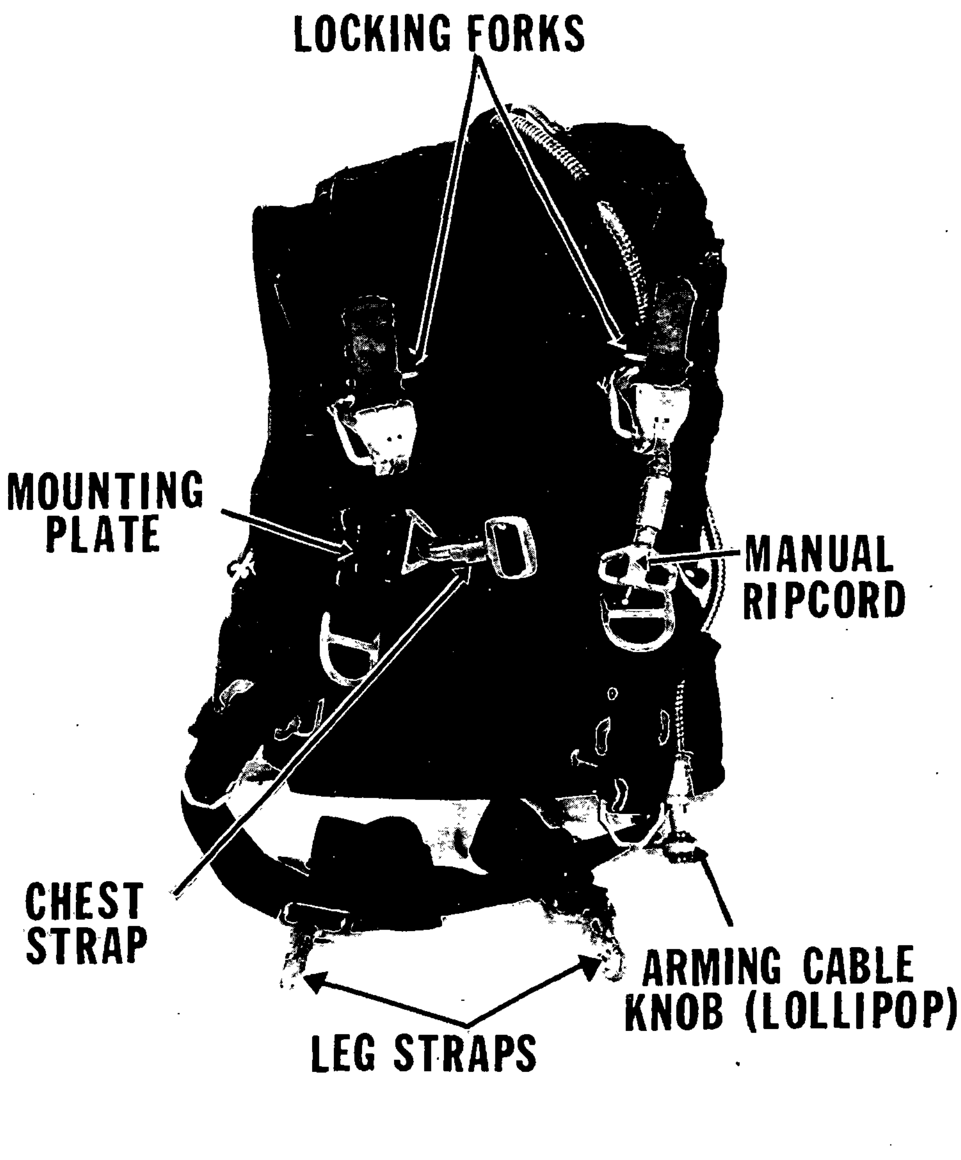


Figure 2-21. Main parachute assembly harness.

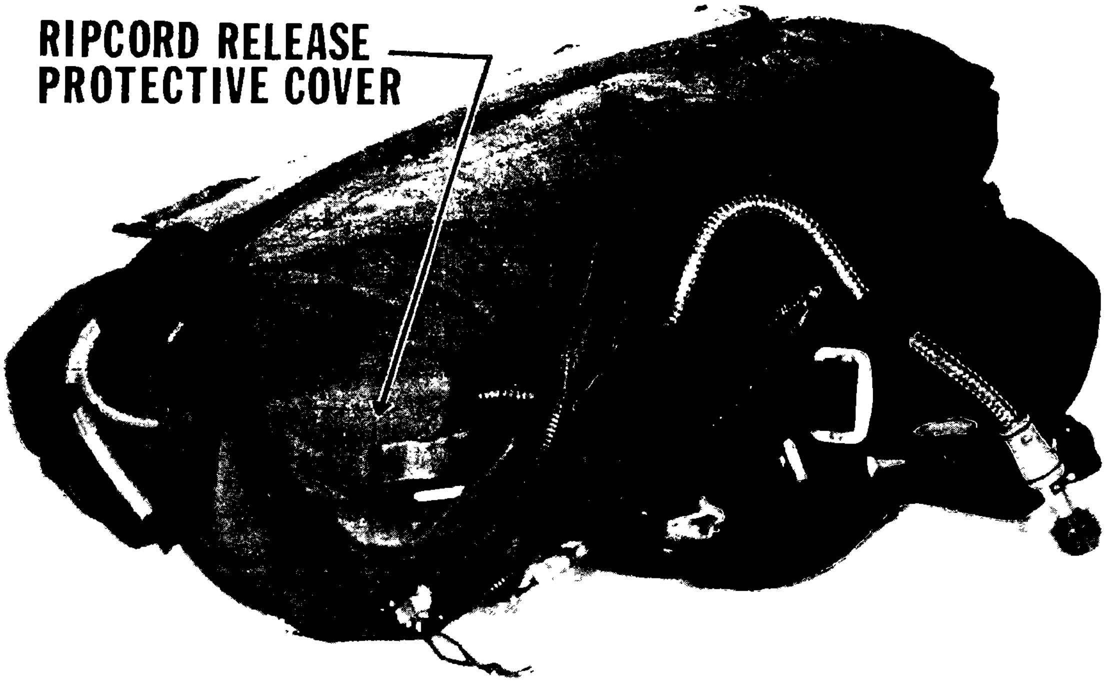


Figure 2-22. Automatic ripcord release mounting compartment.

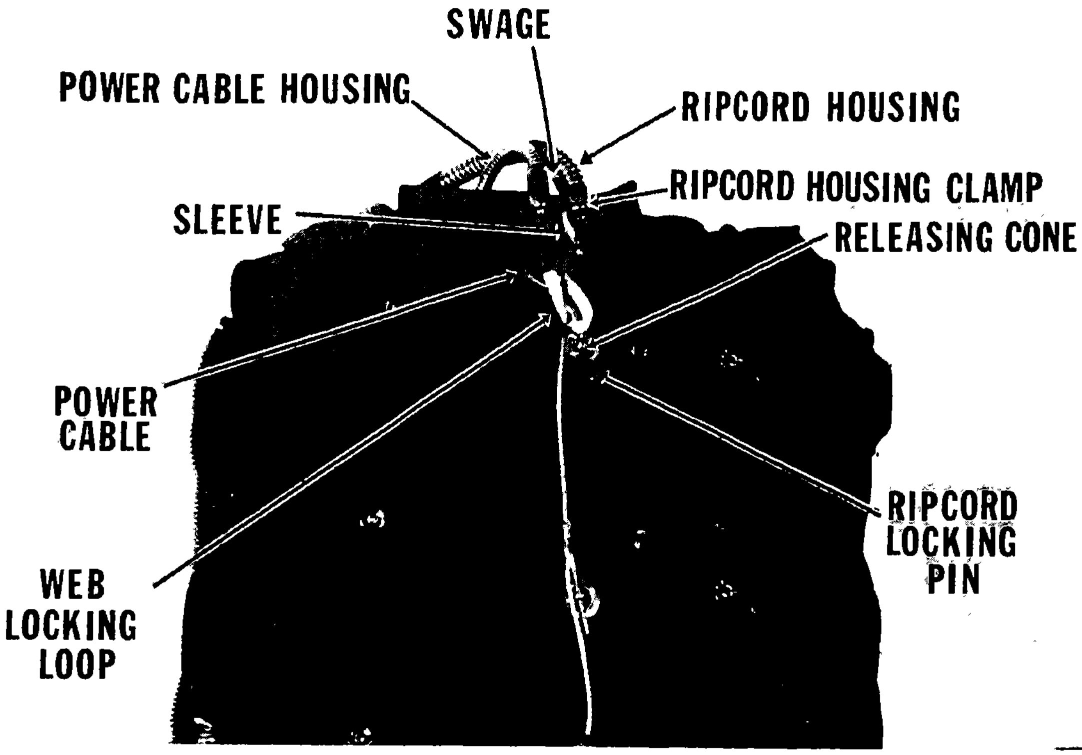


Figure 2-23. Automatic ripcord release dual housing clamp.

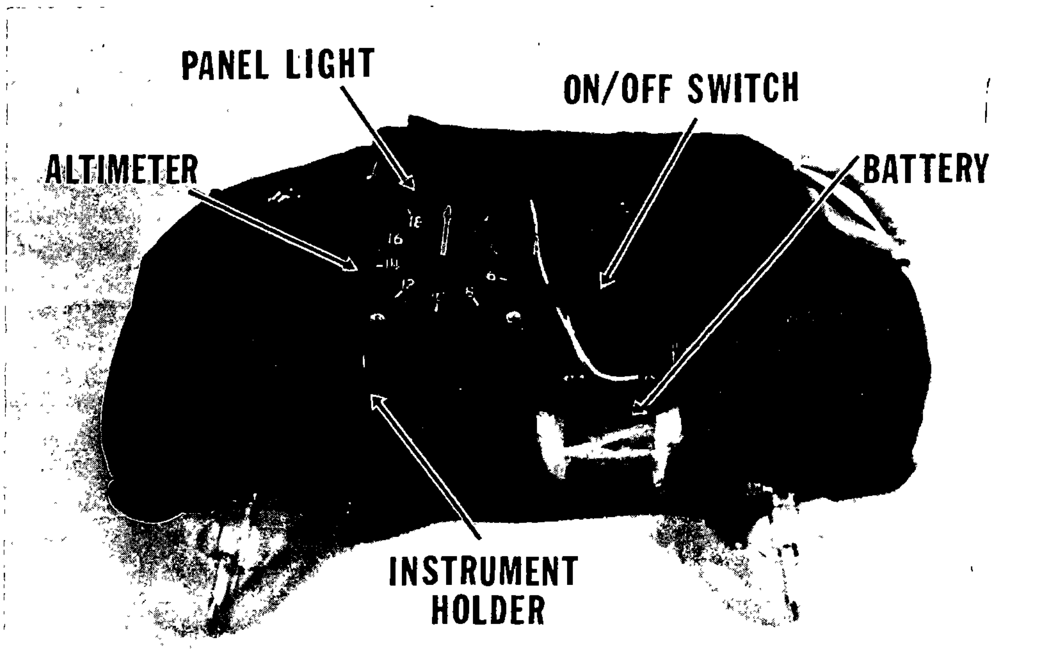


Figure 2–24. Reserve parachute assembly.

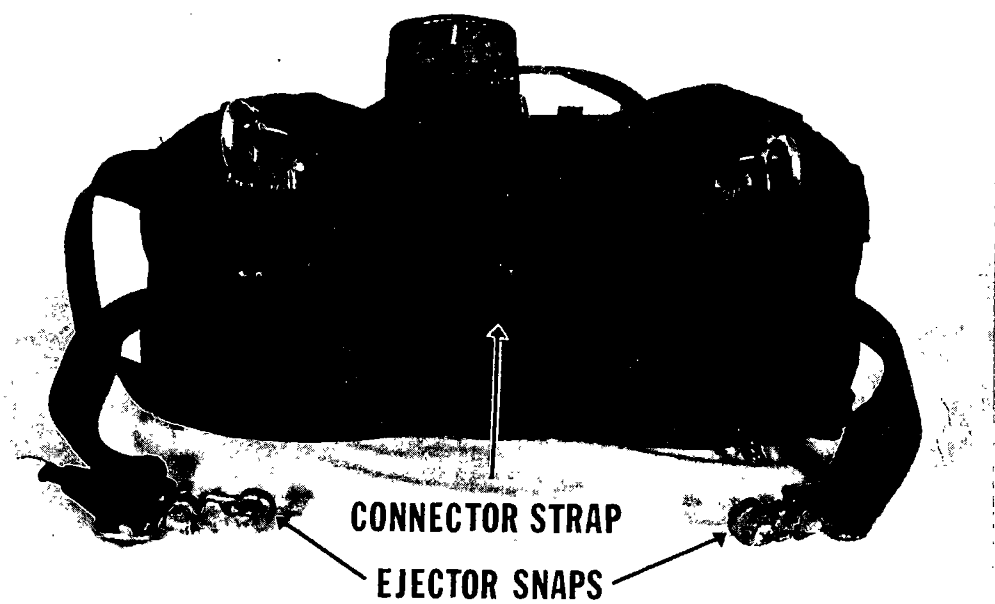


Figure 2–25. Reserve parachute restraint strap assembly.

strap V-rings, and have the chest strap sewn on the right main lift web. Later versions of the harness (fig 2–21) have the chest strap sewn to the main lift web, and have no sponge rubber pads on the V-rings. These versions also have a webbing collar above each V-ring.

d. Reserve Parachute Assembly. The reserve parachute assembly (fig 2–24) is the standard

T-10 reserve parachute assembly, equipped with an altimeter mounted on a metal frame for attachment to the outside of the pack. Under the provisions of TM 10-1670-205-13, the local unit commander may authorize alteration of a troop-chest reserve personnel parachute to allow the parachute to assume a lower position when attached to the back parachute assembly harness. The lower position of the reserve parachute will aid the stabilization of a parachutist during free fall. Use of an altered reserve parachute will further necessitate alteration of the back parachute to permit use of a reserve parachute restraint strap assembly (fig 2-25) to secure the lowered reserve parachute against the parachutist. These modification procedures are explained in detail in TM 10-1670-205-13.

e. Automatic Ripcord Release. The automatic ripcord release used with this parachute assembly is the Class 3, Type F1-B (fig 2-26). The release is equipped with an arming cable, arming cable housing, power cable, power cable housing, ripcord connector, and base locking screw with lockwasher. The power cable and power cable housing emerge from a hole in the upper left corner protector flap of the pack and connect to the dual housing clamp, where the cable is attached to the first pin of the manual ripcord cable by means of a web locking loop (fig 2-23). The arming cable and the arming cable housing (fig 2-27) are routed through a grommet on the left side of the pack, and through a webbing retainer on the left side of the short girth vest, to a point on the left side of the harness where the arming cable knob guide is hand tacked in place. Another automatic ripcord release assembly currently being used is the FF-1 model.

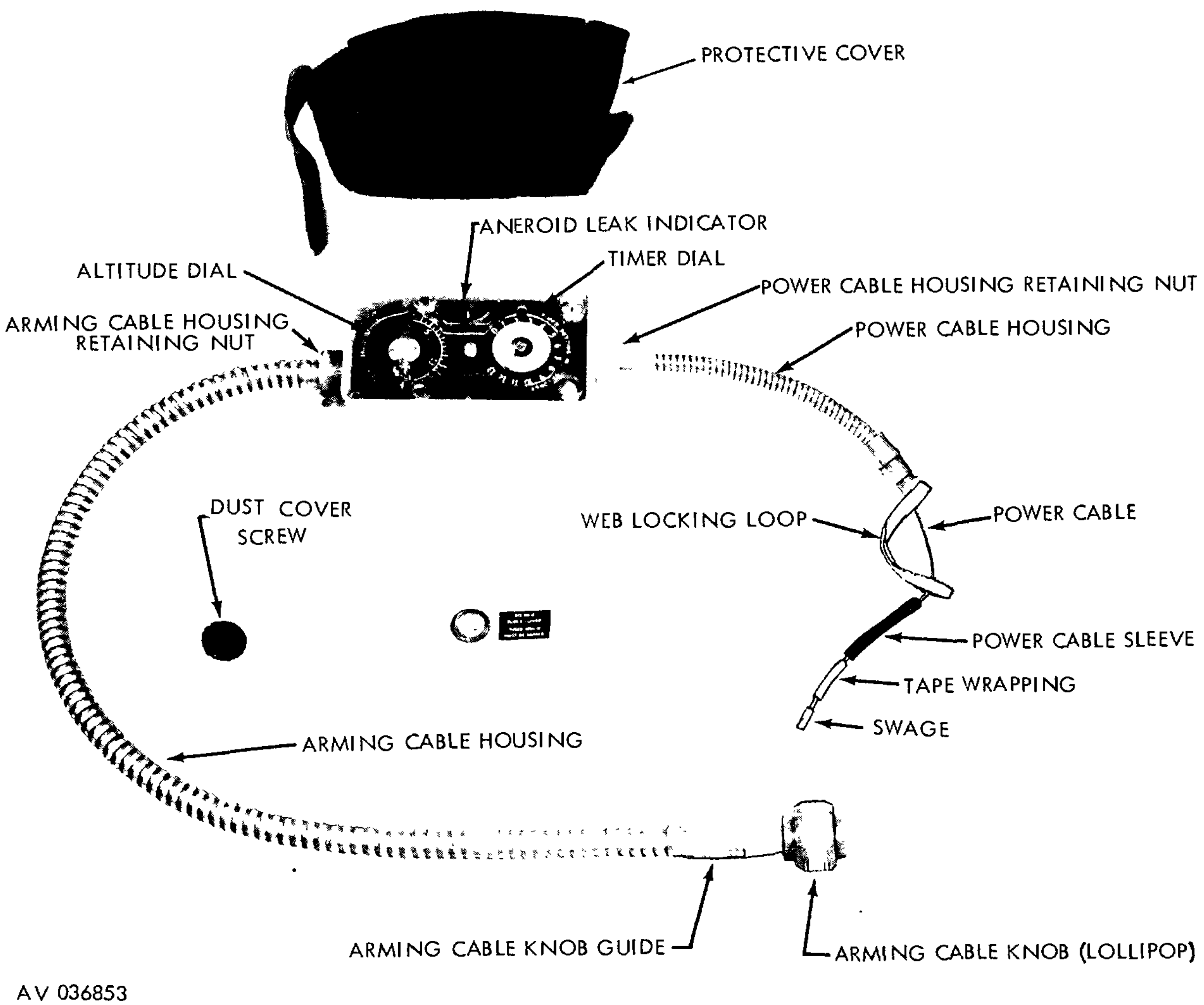


Figure 2-26. Automatic ripcord release assembly, Class 3, Type F1-B.

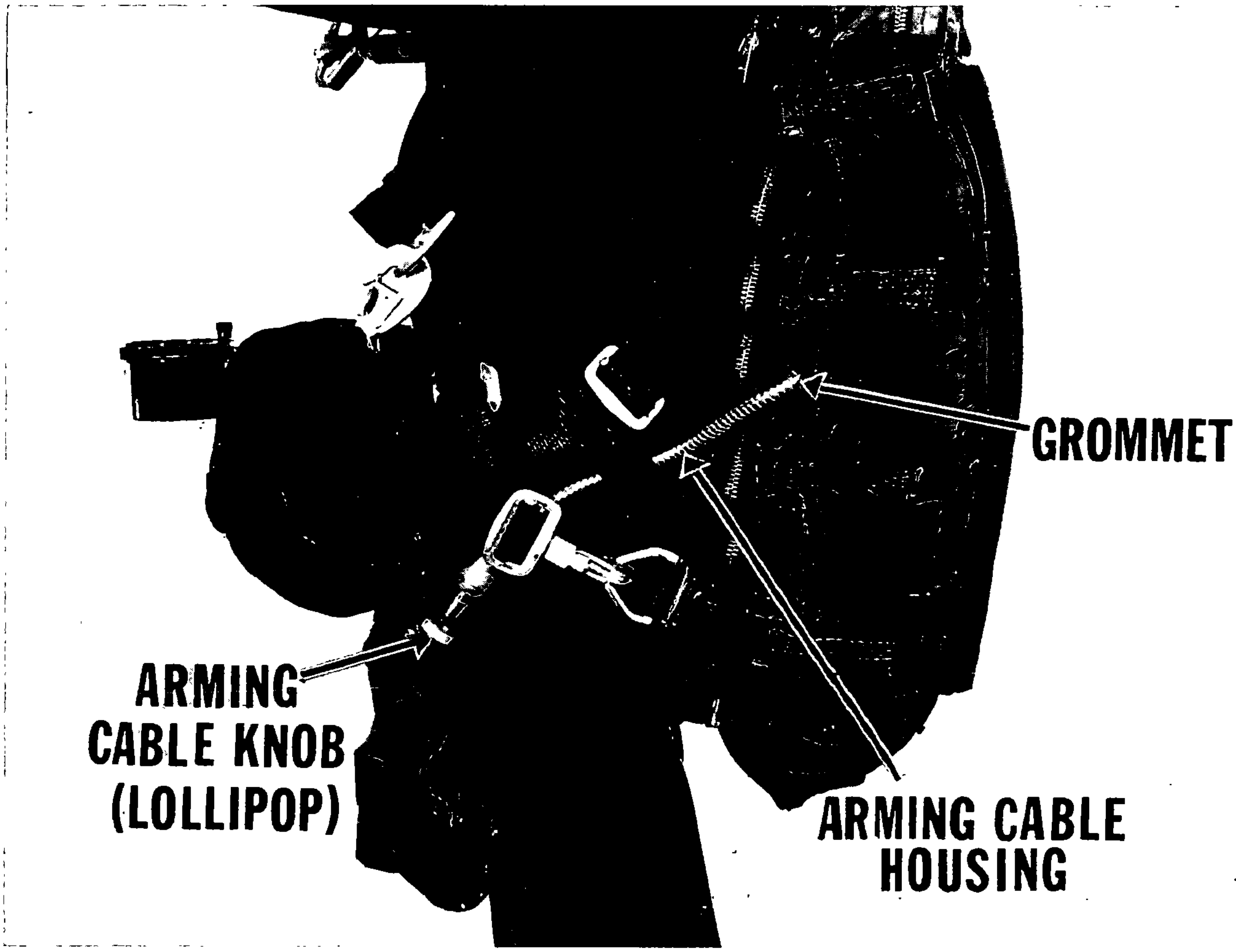


Figure 2-27. Proper routing of arming cable.

This assembly is the same as the F1-B with the following exceptions:

(1) The altitude dial can be set down to 3,000 feet.

(2) It has a plastic dust cover.

(3) It has a nonfraying power cable.

Warning: **An automatic ripcord release that is installed in a parachute assembly which has been immersed in water shall be condemned.**

Warning: **An automatic ripcord release that has been dropped after the timer has been wound and set, will be tested as prescribed in paragraph 3-3, TM 10-1670-205-13, before the release is placed into service. The test requirement shall also apply to an automatic ripcord release installed in a parachute packed for service which has been dropped.**

Warning: **Any F-1B or FF-1 automatic ripcord release which has a defective timer will be removed from service.**

2-8. Additional Military Free Fall Equipment

a. Helmet. The helmet is the MB-3 flying helmet (A, fig 2-28). The helmet provides protection to the head and serves as a mount for the oxygen mask and goggles. The helmet comes in three sizes (small, medium, and large) and should be fitted to an individual snugly but comfortably. It is held firmly in place by an adjustable chin strap.

b. Goggles. The goggles (B, fig 2-28) are standard driving type goggles. The goggles should fit snugly to form an airtight seal around the contour-fitting rubber face pad. An adjustable head strap is provided to insure proper fit. The goggles should be tacked down to the rear leather straps on the helmet, or tacked to the side.

c. Gloves. Gloves are not a component issue item of the free fall parachutist's kit but should be worn by all jumpers. The standard issue military glove with inserts will satisfactorily protect the jumper's hands normally to an altitude of 45,000 feet.

d. Instrument Holder with Altimeter. The altimeter is secured to the instrument holder (C, fig 2–28) which is then mounted on the reserve parachute. For jumps during periods of limited visibility, a night instrument lighting device may be secured to the top of the altimeter. The night instrument lighting device consists of a panel light (C–4/66), a ground cable, two mounting screws, a battery container with on and off switch, and a 7.5-volt SR–33705 mercury battery.

e. Oxygen Equipment (D, fig 2–28). Oxygen related equipment is discussed in detail in paragraphs 2–10 through 2–15.

2–9. Fitting and Wearing the Parachute Assembly

The harness is mounted on a short girth vest for easy donning and incorporates a sponge rubber back pad for the parachutist's comfort. The harness should be adjusted to fit snugly but should not be restrictive to body movement. Adjust harness as follows:

a. Don harness, and check for body size. Remove harness.

b. Adjust the two main lift webs to body size, and make certain that the lift webs are even.

c. Don harness, and fasten chest and leg straps.

d. Adjust chest and leg straps, making certain that the back can be arched properly.

e. Fold excess webbing and secure it under the retainers provided on each strap.

f. The reserve parachute should be positioned at the center of the body (fig 2–29) so as to cause an even flow of air over the upper and lower portions of the body. It is secured firmly with the reserve restraint strap (located at the bottom of the main back pack) to prevent shifting during free fall. The instrument mount should be positioned on the reserve parachute so that the altimeter can be easily seen by the parachutist at all times.

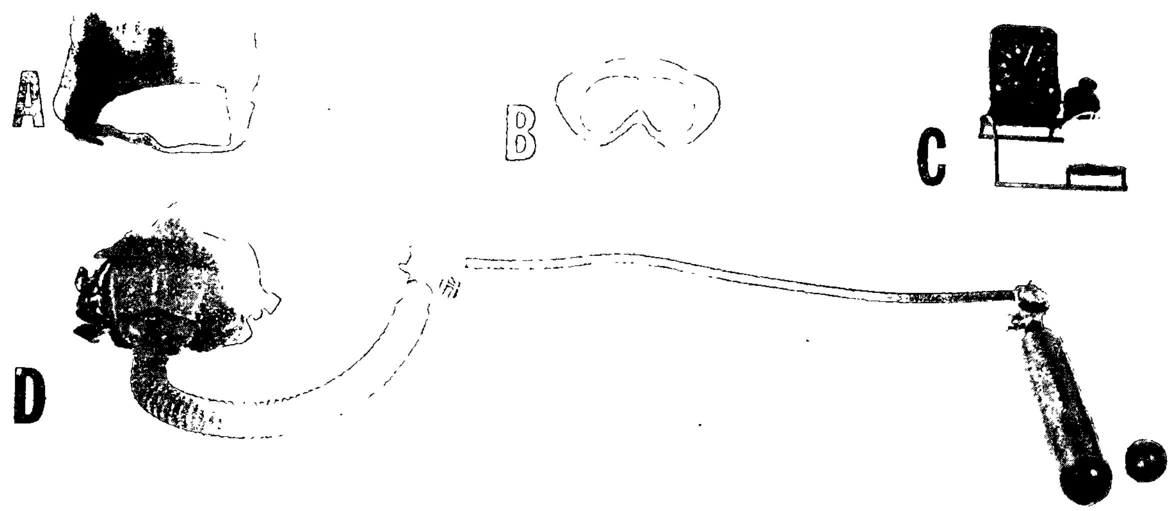


Figure 2–28. Components of free fall parachutist's kit.

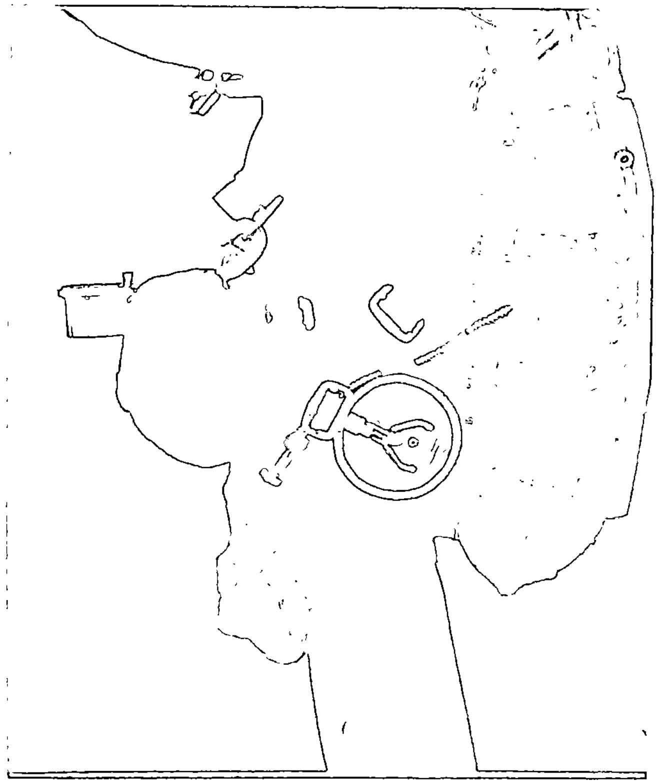


Figure 2-29. Attachment of reserve parachute.

Section III. PHYSIOLOGICAL TRAINING

2-10. General

Oxygen is as essential to the high altitude parachutist as his parachute. Since a thorough understanding of the problems encountered in the use of oxygen at high altitudes is required, it is essential that all free fall trainees be required to attend a physiological training course. This training should be conducted by a US Air Force physiological training unit. The course includes a simulated flight to operational altitudes in a pressure chamber with a rapid descent to simulate free fall, the care and use of oxygen equipment, repair of oxygen equipment, the effects of exposure to high altitudes on the human body and the measures to be taken when symptoms of certain conditions occcur.

Warning: **Oxygen shall always be used when an altitude of 8,000 to 10,000 feet is expected to be maintained for at least 4 hours and at all altitudes above 10,000 feet. Do not use the pressure demand oxygen system above 43,500 feet.**

2-11. Effects of Exposure to the Human Body at High Altitudes

a. On delayed free fall drops, the jumpmaster and parachutists must become familiar with the oxygen requirements. When oxygen is to be used, due consideration is given to amount of equipment being carried, the amount of energy being expended and the pre-breathing time of 100 percent oxygen prior to a high altitude drop. The recommended times to be spent pre-breathing 100 percent oxygen are—

Above Sea Level Drop Altitude	*Pre-Breathing Time Upon Boarding Aircraft*
10,000 ft to 20,000 ft	No minimum time
20,001 ft to 25,000 ft	30 minutes
25,001 ft to 30,000 ft	1 hour
30,001 ft to 43,500 ft	2 hours

b. The most significant stresses placed on the body at high altitudes are due to the following:

(1) *Lowered temperature.* Normal cold weather clothing, gloves, and helmet afford the parachutist adequate protection against reduced temperatures up to about 45,000 feet. However, at higher altitudes he must wear a special pressurized suit for protection against low temperatures and reduction in ambient pressure.

(2) *Lowered barometric pressure.* Lowered barometric pressure at high altitudes brings about reduction of the total pressure on the body and reduction of the partial pressure of oxygen within the atmosphere. Of these two, reduced oxygen is the most dangerous because it begins to have an appreciable effect at relatively low altitudes and may rapidly produce unconsciousness or death.

(*a*) *Reduced oxygen (hypoxia).* When ascending to higher altitudes from a pressure altitude of 10,000 feet, the ambient pressure, which is the pressure of the surrounding atmosphere, falls to less than half of its sea level value. As this happens, the oxygen load available to the lungs, blood, and tissues decreases from 90 percent to nearly 65 percent and causes a condition referred to as hypoxia (oxygen deficiency). Early symptoms of hypoxia are indicated by an unusual feeling of confidence, blurred vision, loss of coordination, dizziness, poor speech, occasional headaches, emotional disturbances, and cyanosis (blush coloring of the skin, particularly noticeable on the lips or under the fingernails). When symptoms of hypoxia are observed, protective measures should be taken immediately. Breathing pure oxygen makes rapid recovery from hypoxia possible. If pure oxygen is not available, the parachutist should descend to a lower altitude.

(*b*) *Reduced total pressure (decompression sickness).* Decreased pressure has a certain undesirable effect on the body, generally termed decompression sickness. Certain body cavities, such as the middle ear, sinuses, stomach, intestines, and possibly the teeth, are filled with air and other gases, and during high altitude flight, the volume of these gases tends to increase or decrease. If movement of these gases into and out of the body cavities is not readily and easily affected, certain serious reactions occur. Symptoms of decompression sickness are abdominal pain, toothache, sinus pain, or middle ear pain. Every effort should be made to relieve these gas pressures by yawning, chewing, swallowing, valsalva experiment, or belching. If these methods do not provide relief, descend to a lower altitude.

(*c*) *Reduced total pressure (aeroembolism).* In addition to the entrapped gases mentioned above, there are other gases (especially nitrogen) which escape from the blood and other body fluids and form gas bubbles in the body. This condition is known as aeroembolism. Symptoms are pain around the joints, a burning sensation in the chest, tingling, itching, red rash accompanied by a burning sensation, and localized swelling. When these symptoms occur, the parachutist should descend to a lower altitude. Breathing pure oxygen immediately before flight and continuing on pure oxygen during ascent is an effective method of preventing aeroembolism.

(*d*) *Surplus oxygen (hyperventilation).* Hyperventilation is a condition in which the respiratory rate and depth are abnormally increased. Although it is frequently associated with hypoxia, hyperventilation may occcur independently and is often mistaken for hypoxia because the early symptoms are almost identical. Hyperventilation can be an effective means of increasing tolerance to hypoxia in an emergency situation. It is therefore recommended that voluntary hyperventilation be accomplished by anyone who, of necessity, is required to jump from extreme altitude without supplemental oxygen. Caution must be exercised to decrease respiratory rate whenever tingling sensations occur.

2–12. Oxygen Mask

The oxygen mask is the MBU–3/P pressure type (fig 2–30). The mask comes in three sizes (small, medium, and large), should fit snugly, and should be airtight. It has four points of adjustment located on the front of the mask for snug fit adjustment.

a. Fitting Oyxgen Mask. Select mask according to the size and shape of your face, and carefully check for correct fit as follows:

(1) Place mask over face and seat rubber seal on inside of mask over contours of face.

(2) Hold mask firmly against face with one hand and kink mask hose so as to block tubing completely.

(3) Take a deep breath and hold it. Mask fits properly if it adheres readily to the face.

b. Checking Mask. Check outlet valve of oxygen mask before each high altitude jump as follows:

(1) With mask properly fitted, attach adjustable straps to helmet and tighten securely in place.

(2) Cover open end of mask tubing with palm of hand.

(3) Inhale gently. You should not be able to draw in any air.

(4) Exhale gently. You should be able to exhale freely.

(5) Slide wedge of mask-to-regulator connector into V-slot of mounting plate on parachute harness, and lock in position. Make certain that head can be easily moved in all directions.

2–13. Oxygen Supply

The three types of oxygen supply systems used are the portable oxygen console, aircraft individual oxygen stations, and personnel oxygen cylinders.

***Warning:* The portable oxygen console and personnel oxygen cylinders will be serviced with Aviators' Breathing Oxygen, Type 1, MIL–0–27210 only.**

a. Portable Oxygen Console. When the air-

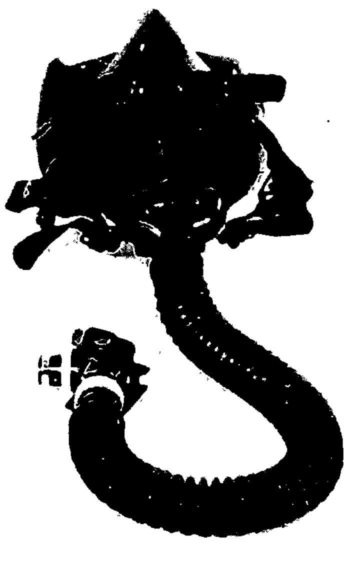


Figure 2–30. Oxygen mask, MBU–3/P.

craft is not equipped with individual oxygen stations for all parachutists, the portable oxygen console, M–2900 (fig 2–31), is used to provide oxygen en route to the drop area. Each portable oxygen console has 14 individual stations and supplies adequate oxygen for approximately 1 1/2 hours at an altitude of 30,000 feet. Before each high altitude flight, check the portable oxygen console as follows:

(1) *Oxygen supply pressure gage check.* Check oxygen supply pressure gage for indication of 1,800 to 2,000 psi (pounds per square inch).

(2) *Regulator blowby check.* Position diluter lever to NORMAL OXYGEN position. Blow gently into open end of mask-to-regulator tubing. There should be continued resistance to gentle blowing. Repeat the procedures with diluter lever set at 100 percent OXYGEN position.

(3) *Oxygen flow indicator check.* Position diluter lever to NORMAL OXYGEN position. The flow indicator should blink when oxygen flows through the system (upon inhalation). Repeat the procedures with diluter lever set at 100 percent OXYGEN.

(4) *Diluter lever check.* Before take-off, set the diluter lever to NORMAL OXYGEN position.

(5) *Hose purging.* The oxygen hoses must be purged prior to use to remove any foreign material which may be in the hoses. To accomplish this, set regulator control to 43M setting, point regulator hose away from face, and release two or three bursts of oxygen through the hose. Connect mask-to-regulator connector to regulator hose and repeat procedure.

b. Individual Oxygen Stations. Some aircraft are equipped with individual oxygen stations for each parachutist. When these stations are used, the same checks as performed on the portable oxygen console are conducted and procedures are the same.

c. Personnel Oxygen Cylinders. The oxygen cylinder (fig 2–32) supplies oxygen to the parachutist during free fall. It is activated 2 minutes before exit and provides oxygen for approximately 8 minutes. Once activated it cannot be shut off; therefore, if parachutist is unable to exit within 5 minutes after activation of oxygen cylinder, the parachutist must switch back to the oxygen console or aircraft oxygen system. The main cylinder is mounted in an envelope provided inside right side of personnel back parachute pack. This mounting point is accessible by unzipping right side zipper that holds pack tray to the harness assembly. The main oxygen cylinder hose is passed through loops sewn to the main lift web assembly and under the right riser to the mask-to-regulator connector. A second oxygen cylinder may be attached to the reserve parachute so that the parachutist may jump at a later time if the main oxygen cylinder has been used during an aborted pass. Before each jump, check oxygen cylinders as follows:

(1) *Pressure.* The cylinder pressure should be between 1,800 and 2,200 psi.

(2) *Mask-to-regulator connector.* Check connection of bayonet-type fitting on end of oxygen cylinder hose and mask-to-regulator connector, and leave the two connected so that equipment will be ready for immediate use.

(3) *Oxygen cylinder arming knob (green apple).* Make certain that green apple is accessible. Pulling green apple activates the oxygen cylinder supply.

d. Equipment Checklist. Many hypoxia accidents have occurred because of the parachutist's failure to make frequent and adequate checks of his oxygen equipment. Following is a list of points that should be checked on every flight requiring the use of oxygen. To make sure you have covvered each point, remember the name P. D. McCRIPE.

P ressure and quantity gage.
D iaphragm of regulator.

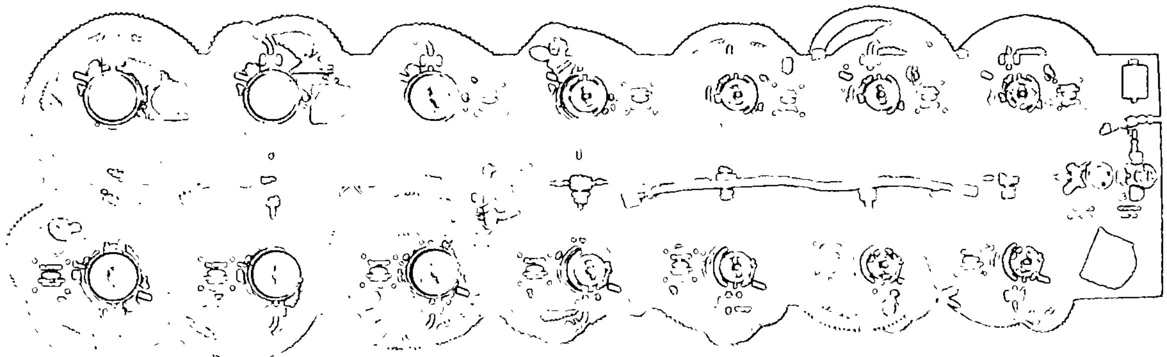


Figure 2–31. Portable oxygen console, M–2900.

M ask.
C onnections on mask.
C onnections on regulator.
R egulator.
I ndicator.
P ortable unit.
E mergency cylinder (personnnel oxygen cylinders).

2–14. Oxygen Mask-to-Regulator Connector

a. General. The oxygen mask-to-regulator connector (fig 2–33) provides a connection point for the oxygen mask hose to the oxygen regulator or oxygen cylinder. The connector fits into a mounting plate attached to the right main lift web of the parachute harness and is secured by a spring-loaded pin.

b. Repair Procedures. Repair for the oxygen mask-to-regulator connector is not authorized.

c. Replacement Replace damaged oxygen mask-to-regulator hose connector with a serviceable like item from stock.

2–15. Oxygen Cylinder Assembly

a. General. The oxygen cylinder assembly (fig 2–32) consists of a cylinder, a valve assembly, and a valve-to-mask hose and connector assembly.

(1) *Cylinder.* The steel, shatterproof, high-pressure oxygen cylinder (11, fig 2–32) has an internal volume of 22 cubic inches and requires an operating charge of not less than 1800 nor more than 2200 psi. The cylinder is attached to the valve assembly by a threaded connection.

(2) *Valve assembly.* The valve assembly consists of an oxygen pressure gage, an oxygen release cable assembly, and a valve.

(*a*) *Gage.* The gage (9), which shows the oxygen pressure on the cylinder, has no scale calibration except a mark to denote pressure of 1800 psi and a scale which is divided into two segments, red and black. The gage pointer, positioned in the black segment of the arc, indicates that the cylinder is charged to at least 1800 psi. If the pointer is in the red segment however, the cylinder content is too low for safe operation and the cylinder should be recharged. The pressure gage is attached to the valve body by a threaded connection.

(*b*) *Oxygen release cable assembly.* The oxygen release cable assembly, attached to the valve by four cadmium plated screws and washers (17), is composed of a housing base, housing (3), release cable (4), ring assembly, wooden ball (5), binding screw to hold the cable in the ball, a caution tag (1) and retainer pin (2) assembly, which prevents accidental discharge of the cylinder.

(*c*) *Valve.* The valve consists of a valve body (10), which encases a ceramic flow controller (8), a break-off nipple (7), a nipple bushing (6), and a side check and filler assembly (12 through 16).

1. The ceramic flow controller (8), which consists of a tubular body into which is secured a ceramic plug and a filter, controls the flow of oxygen from cylinder to mask. It is calibrated to discharge the cylinder pressure of 1800 psi to a predetermined flow rate of from 10 to 12 liters at 25° C (77° F) during the first minute and approximately 1 liter during the 10th minute of flow. Ten minutes is considered the maximum flow period for a cylinder charged to 1800 psi.

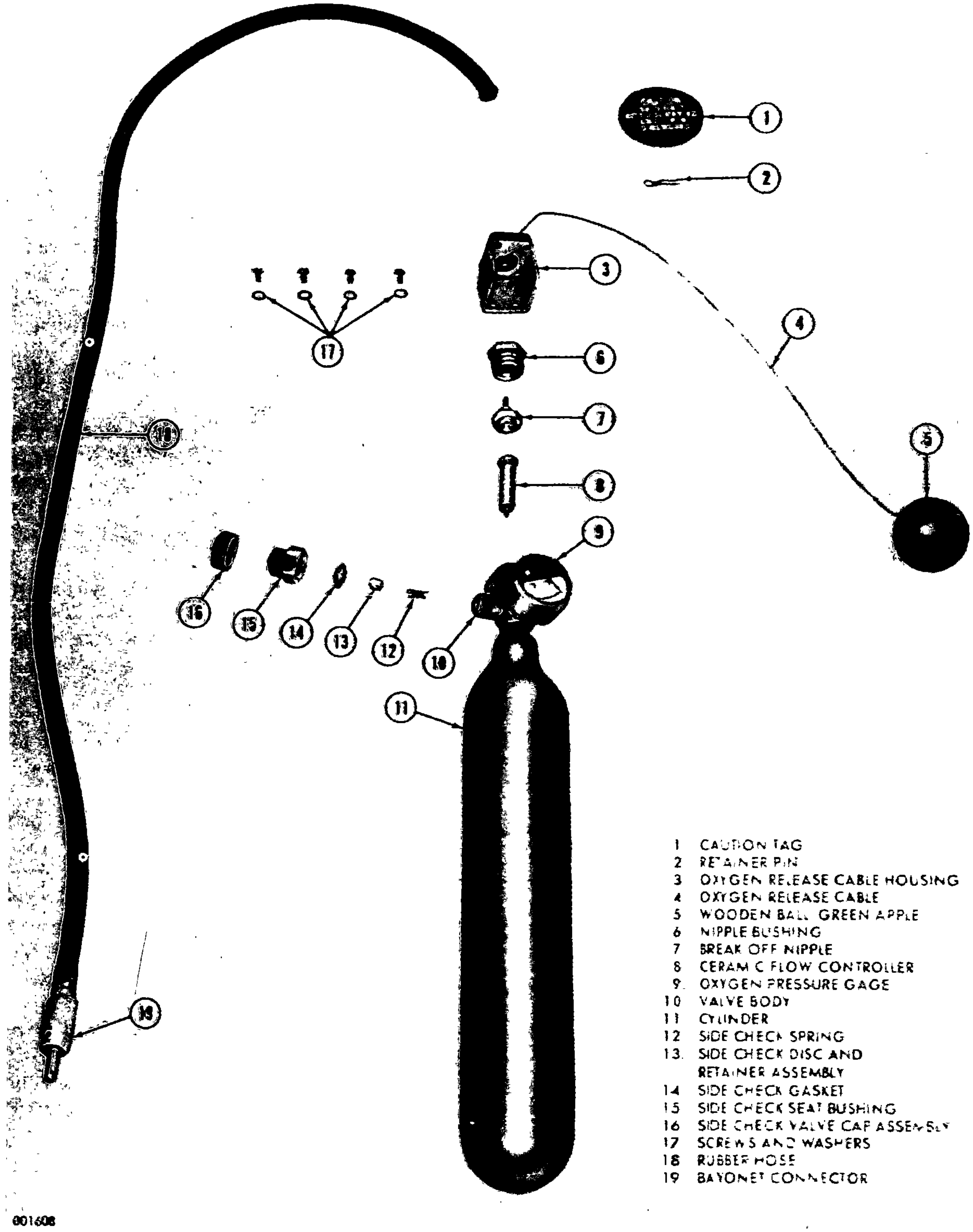


Figure 2-32. Personnel oxygen cylinder assembly, MD-1.

2. The brass break-off nipple (7), consisting of a seat, a flange, and a hollow tip, provides a leak tight seal until the tip is broken.

3. The nipple bushing (6), when tightened, forces the break-off nipple and the ceramic flow controller into operating position. When the system is activated, the ring encircling the rubber hose and nipple is pulled over in its housing, and the end of the nipple is fractured at the machined undercut, allowing oxygen to flow at full operating pressure from the cylinder through the ceramic flow controller. Oxygen leakage is

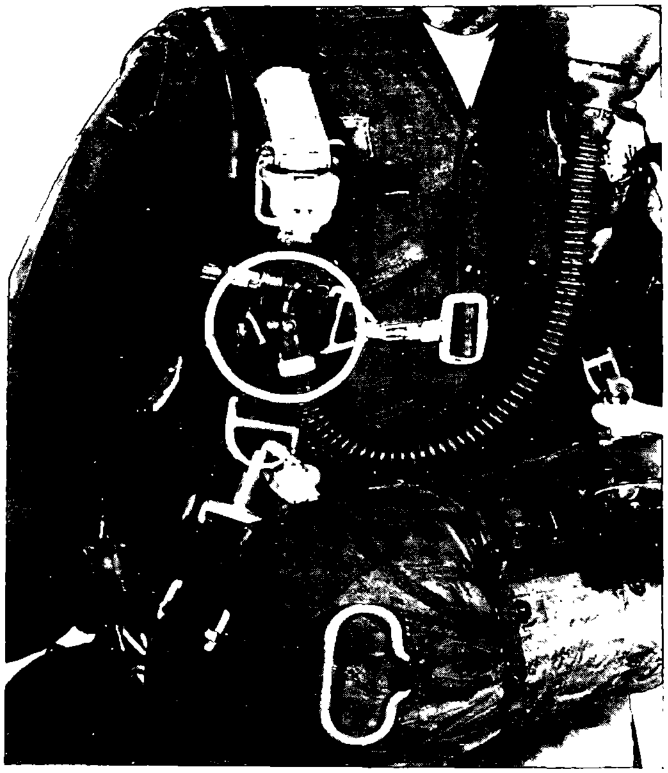


Figure 2-33. Oxygen mask-to-regulator connector.

prevented by the metal-to-metal seat between the nipple and the flow controller. A similar seating is located between the flow controller and the valve body.

4. The side check and filler assembly consists of a side check disc and retainer assembly (13), side check spring (12), copper side check gasket (14), side check seat bushing (15), and a side check valve cap and assembly (16).

(3) *Hose and connector assembly.* The hose and connector assembly is composed of a rubber hose (18) and a bayonet connector (19). The free end of the hose fits into the valve and the connector attaches to a mating connector in the oxygen mask-to-regulator connector.

b. Disassembly. Before the oxygen cylinder assembly is disassembled, all the oxygen in the cylinder must be discharged. Discharge and disassemble cylinder as follows:

(1) Remove caution tag (1, fig 2-32) and retainer pin (2) from oxygen release cable housing (3).

(2) Remove four screws and washers (17), securing oxygen release cable (4) and oxygen release cable housing (3) and slide housing along rubber hose (18) until it clears the valve body (10).

(3) Remove oxygen release cable (4) from oxygen release cable housing (3).

(4) Loosen nipple bushing (6) enough to permit oxygen to start escaping through the bleed hole. As the cylinder pressure is gradually reduced, the nipple bushing may need to be loosened approximately one and a half turns to allow oxygen to continue to escape from cylinder.

***Warning:* When cylinder is being discharged, oxygen must escape through the bleed hole to prevent fire.**

***Warning:* A drop of oil or grease coming in contact with oxygen under pressure may cause a fire or explosion.**

(5) When all oxygen has been discharged from cylinder, unscrew nipple bushing (6) from valve body (10) and withdraw rubber hose (18), break-off nipple (7), nipple bushing (6), and ceramic flow controller (8).

(6) Grasp nipple bushing in one hand and rubber hose in the other, separate by pulling, and remove nipple.

(7) Unscrew and remove gage (9) from valve body (10).

(8) Unscrew and remove side check valve cap assembly (16) from side check seat bushing (15).

(9) Unscrew and remove side check seat bushing (15), side check gasket (14), side check disc and retainer assembly (13), and side check spring (12) from valve body (10).

(10) Unscrew and remove valve body (10) from cylinder (11).

c. Inspection.

(1) *Retainer pin.* Check prongs on retainer pin (2, fig 2-32) to be sure that they are not bent. This is important because the retainer pin has a raised area on one side which provides the tension necessary to prevent accidental removal. Check hole into which retainer pin is inserted to be sure that it is not excessively worn. If hole is excessively worn, it will not retain the caution tag assembly.

(2) *Oxygen release cable.* Inspect oxygen release cable housing (3) to make sure it is not damaged or shows any signs of binding on release cable (4). Check the screw of the release cable wooden ball (5) to insure attachment of ball to cable. Inspect release cable for frayed or broken strands caused by cable rubbing over metal surface of housing.

(3) *Rubber hose.* Inspect oxygen hose (18) to ascertain that it is free from cuts or deterioration and that it is secured to bayonet fitting assembly (19). Make sure that sealing gasket is secured to bayonet fitting.

(4) *Break-off nipple* (fig 2-34).

(*a*) Inspect shank of nipple for presence of machine undercut. Check depth of undercut with tolerance gage. If shank of nipple has not been undercut deeply enough to pass through narrower section of gage reading (0.0995 to 0.1000 inch deep), condemn nipple and replace with a nipple that has been previously inspected and is known to be serviceable.

(*b*) Inspect periphery of nipple flange for presence of a slot. If slot is not present, replace with a new nipple. Make certain that nipple is completely free of oil, grease, and foreign matter before installing it in the cylinder.

(5) *Gage.* Inspect gage (9) for cracked or broken cover glass, dented case, or other visible defects.

(6) *Valve body.* Visually examine interior of valve body (10). If foreign matter or metal particles are visible, blow out with a stream of aviator's breathing oxygen or with dried water pumped air or nitrogen.

(7) *Cylinder.* Repeat procedures outlined in (6) above for cylinder (11).

d. Repair. The only repair authorized for components of the oxygen cylinders assembly is cutting off soft or split hose ends. The hose is considered serviceable to a minimum length of 22 inches.

e. Assembly.

(1) Install valve body (10, fig 2-32) in cylinder (11) and tighten.

(2) Install side check spring (12), new side check disc and retainer assembly (13), side check gasket (14), and side check seat bushing (15) in valve body (10) and tighten. Install side check valve cap assembly (16) on side check seat bushing (15) and tighten hand-tight.

(3) Install gage (9) in valve body (10) and tighten, being careful not to damage case or break cover glass.

(4) Slide nipple bushing (6) on rubber hose (18) approximately 3 inches.

(5) Push break-off nipple (7) into end of rubber hose until hose end contacts flanged face of nipple.

(6) Grasp rubber hose just above bushing and work bushing down around hose until end of bushing also contacts flanged face of nipple.

(7) Drop ceramic flow controller (8) back into original position in valve body (10).

(8) Assemble nipple bushing (6), rubber hose (18), and break-off nipple (7) as a unit, and screw into position on top of cylinder valve (10). Do not tighten nipple bushing to maximum torque until after the cylinder has been purged.

***Warning:* Overtorque may cause the break-off nipple to crack at center of flange, resulting in a leak, or cause the nipple to tilt to one side. If nipple tilts in direction of pressure gage, it may not fracture when oxygen release cable is actuated.**

(9) After cylinder has been purged, tighten nipple bushing (6) to a torque not exceeding 300 inch-pounds.

(10) Install oxygen release cable (4) in oxygen release cable housing (3).

(11) Slide oxygen release cable housing (3) over top of valve body (10) with oxygen release cable positioned on same side as gage, and secure with screws and washers (17).

(12) Insert retainer pin (2) with caution tag (1) attached, into retainer pin hole in oxygen release cable housing as far as possible.

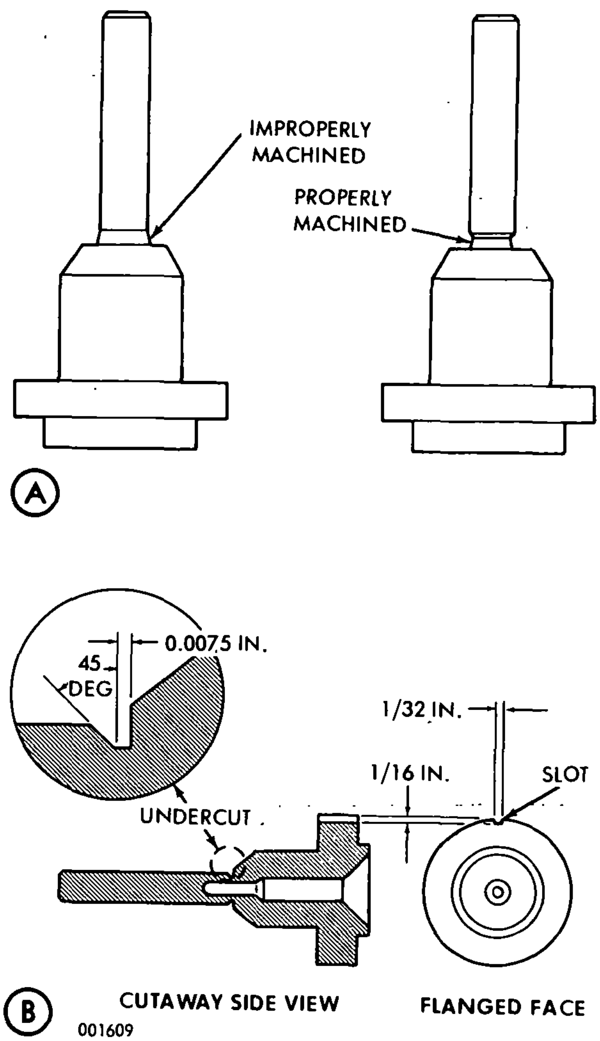


Figure 2-34. Break-off nipple.

Warning: **Do not spread the retainer pin prongs.**

f. Service. The oxygen cylinder shall be serviced upon receipt of cylinder and after each use.

(1) *Service upon receipt of oxygen cylinder.* The oxygen cylinder may be issued with only enough oxygen pressure to prevent atmospheric air from entering the cylinder and causing condensation, corrosion, or rust. The fact that an oxygen cylinder is received empty or with only a small amount of pressure does not necessarily mean the cylinder is leaking. Before the cylinder can be filled with oxygen, any oxygen already present in the cylinder must be discharged and the cylinder purged of all air and moisture. Discharge oxygen in cylinder as outlined. Leak test cylinder as outlined below.

(2) *Service after use of oxygen cylinders.* After the cylinder has been used, the break-off nipple must be replaced and the cylinder recharged as soon as possible. The cylinder must be recharged promptly because delay may cause internal condensation and corrosion or rust. Cylinder recharge includes purging and refilling. Leak test cylinders, discharge oxygen in cylinders, and replace nipples as outlined.

Warning: **Personnel performing these operations must have a thorough knowledge of the proper handling of oxygen and related equipment.**

(*a*) *Purging.* Purge the oxygen cylinder as follows:

1. Attach an oxygen cylinder filler yoke assembly (FSN 1740-492-3126) to a cylinder of aviator's breathing oxygen and open cylinder valve momentarily to purge adapter and remove traces of foreign matter and atmospheric pressure.

Warning: **Hands, clothing, and tools must be clean when working with oxygen equipment. Traces of oil, grease, or organic matter in contact with oxygen under pressure create a danger of spontaneous combustion which may result in a fire or explosion.**

2. Remove side check valve cap assembly from filler boss on side of cylinder assembly valve by unscrewing it in a counterclockwise direction.

3. With open part of yoke facing mechanic, the cylinder held down on a vertical position, and the cylinder gage facing mechanic, insert valve body into yoke until filler boss opening in cylinder valve mates with outlet port of yoke. Turn handwheel of yoke on side of valve body, thereby making a tight seal between yoke assembly and valve body.

Note. Fiber on lead seal washer should be in place around outlet port on yoke assembly before emergency cylinder is attached for charging.

4. Charge cylinder assembly with aviator's breathing oxygen to a pressure of 200 psi.

5. Release oxygen by loosening nipple bushing enough to make escape of oxygen audible.

6. After almost all the oxygen has been released, tighten the bushing. Do not allow pressure to fall to zero during this operation.

7. Repeat purging operation at least twice.

8. Tighten bushing, not exceeding maximum torque of 300 inch-pounds.

(*b*) *Refilling.* After cylinder has been purged, slowly open valve on oxygen charging cylinder, and allow a pressure of not less than 1800 nor more than 2200 psi to build up on cylinder, as indicated on the pressure gage or cylinder valve. The cylinder will become warm during this operation and must be allowed to cool to atmospheric temperature. Then close charging cylinder valve and remove cylinder assembly from yoke by loosening handwheel screw on side.

Note. At each refill, a new side check disc and retainer assembly should be installed to prevent premature leakage after the equipment is placed in service.

g. Test. After the cylinder assembly has been disassembled or serviced, perform leak test as follows:

(1) Immerse cylinder assembly (excluding gage components) in water and check for leaks at the following points.

(*a*) Valve-to-cylinder connection.

(*b*) Gage-to-valve connection.

(*c*) Nipple bushing area.

(*d*) Bleeder hole, located directly above gage thread in valve body, and side check bushing joint.

Note. If any bubbles appear, assembly is not leak-tight and should be rejected.

(2) Store cylinder for 24 hours and leak test as in (1) above.

(3) When it is certain that all joints are leak-tight, recheck pressure on cylinder gage. If the reading is not less than 1800 psi, replace oxygen release cable housing, as outlined.

(4) Replace side check valve cap assembly on side check seat bushing and tighten hand-tight.

h. Replacement. Replace all damaged items with a serviceable like item from stock.

Section IV. JUMP TRAINING

2–16. General

a. Jump training should commence upon completion of the ground training phase. There is no established or prescribed minimum or maximum number of jumps; however, the average student can be qualified to successfully accomplish a free fall mission as a jumping team member in approximately 20 free fall jumps including at least one oxygen jump, one jump with equipment, and one jump during hours of darkness.

b. The student should begin jumping at an altitude of 12,500 feet and should make nine jumps at this altitude. After nine jumps, the average student can stabilize and maintain a heading on a ground reference point or direction. The remaining jumps should be made from an altitude of 20,000 feet (or higher with permission of higher headquarters) with grouping exercises started immediately and continued throughout the duration of the course.

c. Students should be observed in the air during the initial jumps by instructor personnel and critiqued on an individual basis.

2–17. Wind Drift and Spotting

a. Wind Drift. Wind is an uncontrollable factor with which all parachutists must contend. A free fall parachutist will be confronted with the effects of wind in free fall and the effects of wind after the canopy has opened.

b. Spotting. Spotting is a technique used to determine when to exit the aircraft at a point in space which will allow the parachutists to land in a designated target area. Spotting can be accomplished by one of two methods; electronic spotting, which is normally used by the Air Force to deliver free fall parachutists in a tactical situation, and visual ground spotting, which is normally used in a training situation.

(1) *Visual ground spotting.* Visual ground spotting is one of the techniques employed by the free fall parachutist in selecting his correct exit point. This technique, when properly executed, will insure that the parachutist's exit is at a spot from which he may best take advantage of the wind currents so as to land in the target area. For training purposes, 4,000 feet is used as the altitude at which the jumper opens his parachute. The drift that will be encountered before and after canopy deployment is determined as follows:

(*a*) Wind drift both in free fall and after canopy deployment is determined from measured or predicted wind data.

(*b*) Wind information is computed for drift in free fall and drift under the canopy in knots and direction (degrees). To determine wind drift after the canopy opens, compute the average speed and direction of winds from the 1,000 foot level to 4,000 feet in increments of 1,000 feet. For example:

Winds at 1,000 feet	9 knots	220°
Winds at 2,000 feet	11 knots	205°
Winds at 3,000 feet	14 knots	220°
Winds at 4,000 feet	15 knots	190°
	49 knots	835°

49 knots divided by 4 is 12¼ knots or 12 knots.

Note. If a fraction is ½ or more, make it a whole number; if it is less than ½, disregard.

835° divided by 4 is 208 3/4 or 209°. There is an average wind speed of 12 knots from 4,000 feet to the ground and an average wind direction of 209°. The next step in determining the opening point is to multiply the average wind speed in knots by 100 meters (100 meters of drift per knot of wind or 25 meters of drift for each 1,000 feet of descent under the canopy per knot of wind. 12 × 100 = 1,200.) There will be 1,200 meters drift from 209° after the canopy opens at 4,000 feet until the parachutist lands.

(*c*) To determine drift in free fall, compute the average speed and the direction of the winds from 6,000 feet up to jump altitude. For example: If jumping from an altitude of 20,000 feet, obtain the wind data in increments of 2,000 feet and determine the average speed and direction as follows:

Winds at 20,000 feet	85 knots	160°
Winds at 18,000 feet	75 knots	160°
Winds at 16,000 feet	75 knots	165°
Winds at 14,000 feet	65 knots	165°
Winds at 12,000 feet	50 knots	155°
Winds at 10,000 feet	45 knots	150°
Winds at 8,000 feet	20 knots	185°
Winds at 6,000 feet	20 knots	185°
	435 knots	1,325°

Determine averages:

435 divided by 8 equals 54 3/8 or 54 knots.

1,325 divided by 8 equals 165 5/8 or 166°.

Next multiply the average wind speed by the constant 3, (there are 3 meters of drift per knot of wind per 1,000 feet of free fall) which would give a value of 162 (54 × 3 = 162). Multiply the value 162 by the number of feet in free fall in thousands. In this example, there are 16,000 feet of free fall. To determine the total number of meters drift in free fall, multiply 162 × 16 = 2,592 or 2,600 meters.

Note. For plotting purposes, utilize nearest whole number in one hundreds as above.

(*d*) The last factor which must be considered is the forward throw of the aircraft, which for high-performance aircraft at normal exit speeds is approximately 300 meters in the line of flight.

(*e*) Working with the known drifts and the forward throw of the aircraft and using a map or map substitute and a protractor, plot the actual exit point in this manner: From desired impact point, measure a distance of 1,200 meters on a magnetic azimuth of 209° (wind drift after canopy deployment). Next plot 2,600 meters on a magnetic azimuth of 166° from the opening point (wind drift during free fall). The last step is to plot the forward throw of the aircraft which is 300 meters into the line of flight. In this example, the aircraft is flying a track of 360°, therefore, the 300 meters must be measured back from the track of the aircraft, or 180°, which would be the actual exit point.

Note. The magnetic azimuths must be converted to grid azimuths prior to plotting them on the map.

(*f*) After the actual exit point has been determined on the map, the jumpmaster selects a good reference point in the vicinity of the exit point from the map and uses this to visually guide the aircraft over the exit point during the actual jump exercise.

(2) *Electronic spotting.* Electronic spotting is accomplished by the aircrew (pilot or navigator) using onboard navigational equipment. The navigator computes the high altitude release point (HARP) and uses electronic means to guide the aircraft over this point. Parachutists will exit the aircraft upon command of the pilot. This type of spotting will normally be used in a tactical situation and should place the parachutists in close proximity to the desired impact point within the target area. Additional ground devices such as the radar reflector, radio beacon, or visual signal are valuable aids if the situation allows employment of such devices.

2–18. Grouping and Assembly

a. Grouping. The overall objective of free fall parachutist training is grouping in the air and landing as a compact, tactical organization ready to accomplish the assigned mission. The size of the force being infiltrated has no effect on the overall objective of grouping on the ground as a compact, tactical organization.

(1) *Grouping during visual conditions.*

(*a*) Jumpers will exit aircraft as rapidly as possible and maintain heading on an assigned track. All jumpers will maintain the same heading assuring that the dispersion during free fall is along the same line.

(*b*) All jumpers will activate main parachute at the same altitude.

(*c*) All jumpers will assemble in the air after parachute opening, guiding on an assigned group leader who will be distinguished by difference in canopy color and uniform.

(*d*) After assembly in the air, all jumpers will land as close as possible to the group leader and assemble immediately on the group leader.

(2) *Grouping during darkness or inclement conditions.*

(*a*) All jumpers will exit aircraft as rapidly as possible and maintain a heading on an assigned azimuth or direction using a wrist compass or lighted team leader as a reference.

(*b*) All jumpers will activate main parachute at the same altitude.

(*c*) All jumpers will maneuver parachutes along the windline.

b. Assembly. Standard airborne night assembly techniques may be used to assemble but normally because of the nature of the terrain and the type of dispersion obtained during free fall operations, standard airborne assembly techniques are the least desirable methods of assembly. Electronic means of assembly can be effectively used to assemble free fall parachutists.

2–19. Canopy Control

a. Theory of Control. In order to control movement toward a designated target area, the parachutist must know the principle upon which the canopy operates and the factors which govern canopy control.

(1) *Governing factors.* Movement of the canopy is controlled primarily by the action of the wind, the position of the canopy orifice, and the way in which the parachutist manipulates the risers.

(*a*) *Wind.* Since the wind cannot be controlled, the parachutist must determine wind direction and approximate velocity, and use them in maneuvering the canopy.

(*b*) *Orifice.* The canopy has an orifice which provides thrust in a definite direction at approximately 6 knots per hour. The spilling of canopy air through the orifice creates a thrust on the canopy in a direction opposite that in which the orifice is pointed. The direction of this thrust can be controlled by rotation of the canopy.

(*c*) *Riser Manipulation.* The parachutist may lower or raise the risers to distort the canopy, causing it to rotate. Canopy manipulation was discussed in detail in paragraph 2-6.

(2) *Principle of Control.* The principle involved in the controlled movement of the canopy is the accurate coordination of the factors in (1) above. The following will help you to understand this principle.

(*a*) When the orifice is pointed away from the wind, the thrust of the orifice will be acting directly against the wind. This has the effect of reducing the velocity of the wind and will retard the movement of the canopy in the direction of the wind.

(*b*) When the orifice is pointed into the wind, the thrust of the orifice combines with the thrust of the wind to speed the movement of the canopy in the direction of the wind.

(*c*) When the orifice is pointed at an angle to the wind direction, the force of the wind from one direction and the thrust of the orifice at an angle will move the canopy in a direction approximately at a right angle to the direction of the orifice thrust. The direction of movement will vary with the wind velocity and the angle at which the orifice is pointed.

(*d*) Pointing orifice at a downwind angle will produce a sharper turn, while pointing orifice at an upwind angle will produce a more gradual turn.

(3) *Direction of Movement.* The course to follow in maneuvering toward the target area is determined by the windline and the effective canopy range.

(*a*) *Windline.* The windline is an imaginary line extending upwind from the target area to the opening point. This line can be marked by ground references.

(*b*) *Effective canopy range.* Effective canopy range is the maximum distance from which the canopy can be maneuvered to the target area at a given altitude. This range is greater at higher altitudes and decreases proportionately at lower altitudes, forming a cone-shaped area (fig 2-35). Changing wind directions and conditions may cause this range to shift in any direction.

(*c*) *Reference points.* Accurate reference points are essential to maneuver the parachute effectively. Check the opening altitude and pick a ground reference at a point on the windline halfway between the opening point and the target area. This is the first checkpoint. With correct canopy manipulation, this point can be reached in half the opening altitude. The second checkpoint is halfway between the first checkpoint and the target area, and should be reached in half of the remaining altitude. After reaching the second checkpoint, maneuver directly to the target area (fig 2-36).

b. A Guide to Good Canopy Control. To control the canopy corrrectly and to maneuver accurately toward the target area, follow these rules:

(1) Check canopy and orifice position after opening.

(2) Keep a sharp lookout for other jumpers.

(3) Check altitude and point at which canopy opens.

(4) Pick out ground references.

(5) Determine wind direction.

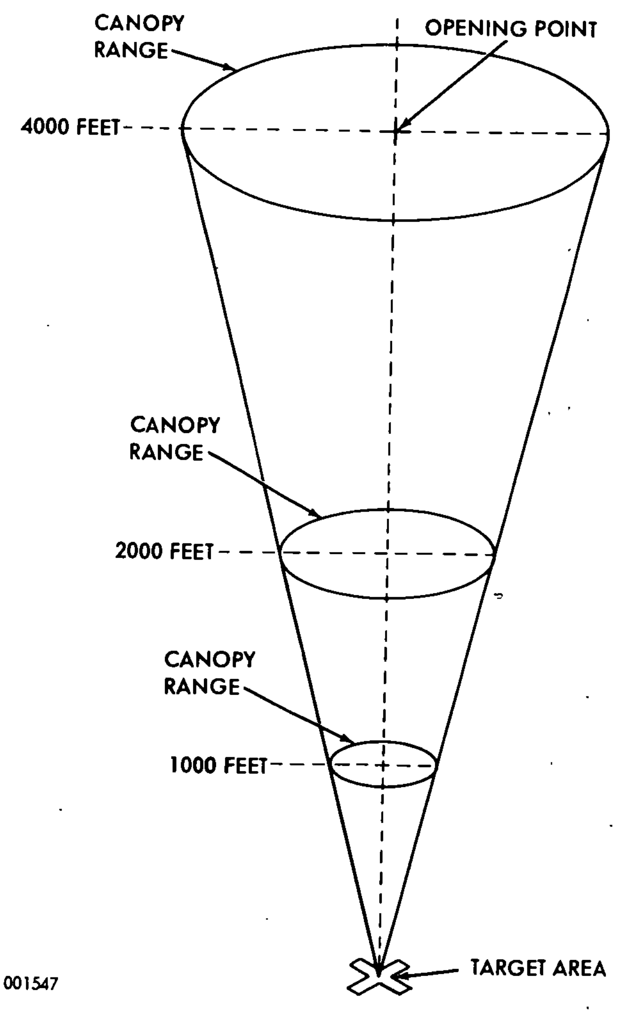


Figure 2-35. Diagram showing effective canopy range.

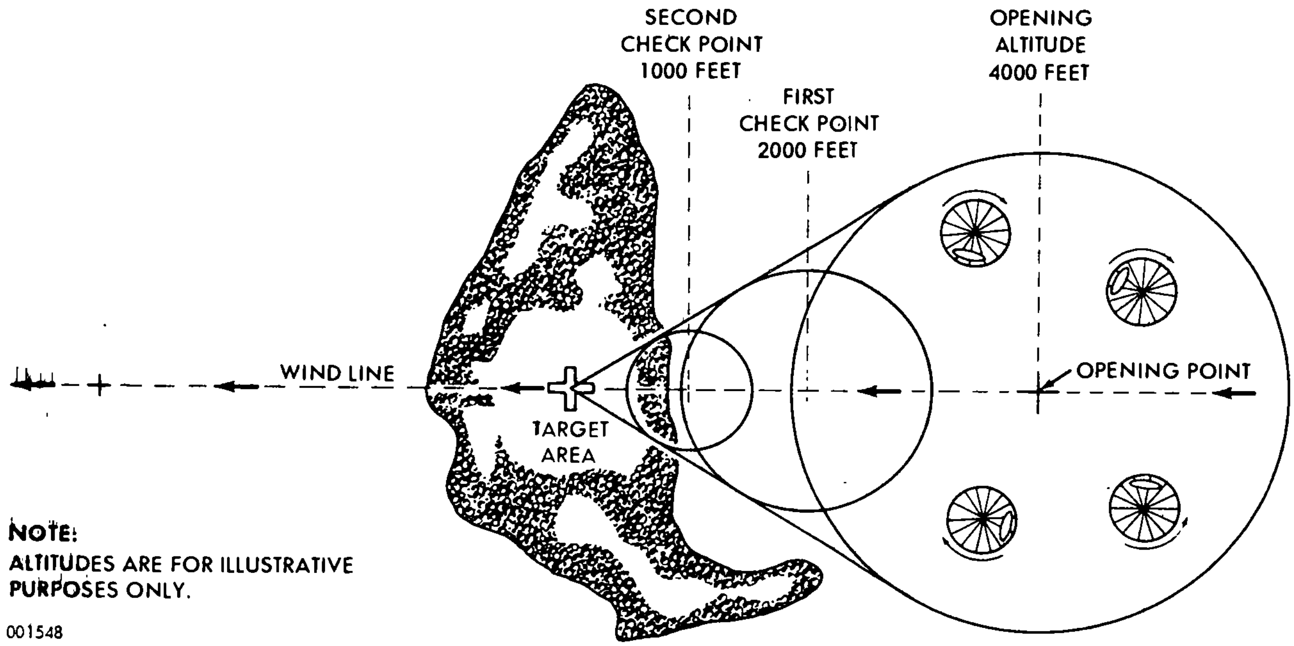


Figure 2-36. Diagram showing windline, canopy range, and checkpoints.

(6) Use upwind riser to rotate canopy.

(7) Check holding power of canopy.

(8) Locate windline and determine direction in which movement is desired.

(9) Always maneuver toward windline.

(10) Check progress at halfway and three-quarter way points, and make adjustments.

(11) Turn into wind at a minimum altitude of 100 feet.

(12) Control canopy all the way to the ground to prevent a wind-cocked condition.

(13) Always land into wind.

(14) Always execute a parachute landing fall.

2-20. Parachute Maneuver

Maneuvering the parachute requires more than simply rotating the canopy. A properly executed parachute maneuver requires correct canopy manipulation to combine the force of the wind and the thurst of the canopy orifice to cause the parachute to move in a given direction. To successfully maneuver the parachute to the target area, the parachutist may have to hold into the wind, run with the wind, or crab to the left or right while holding or running.

a. Maneuvering Upwind (Holding). To hold into the wind, rotate canopy until the orifice is on the downwind side (fig 2-37). Manipulate risers to keep canopy in this position. Maneuver (crab) to the right or left while holding as follows:

(1) *Maneuvering (crabbing) to the right.* To crab to the right while holding into the wind, rotate canopy slightly to the right (fig 2-38) noting degree of rotation. Rotating canopy too far may cause canopy to become wind-cocked and move in the direction of wind. As a canopy begins to move in desired direction, manipulate risers to keep canopy in this position until maneuver is complete.

(2) *Maneuvering (crabbing) to the left.* To crab to the left while holding into the wind, reverse procedures in (1) above (fig 2-39).

b. Maneuvering Downwind (Running). To maneuver canopy downwind or run with the wind, rotate canopy until orifice is on the upwind side (fig 2-40). Manipulate risers to keep canopy in this position.

(1) *Maneuvering (crabbing) to the right.* To crab to the right while running with the wind, rotate canopy slightly to the right (fig 2-41). Manipulate risers to keep canopy in this position.

(2) *Maneuvering (crabbing) to the left.* To crab to the left while running with the wind, reverse procedures in (1) above (fig 2-42).

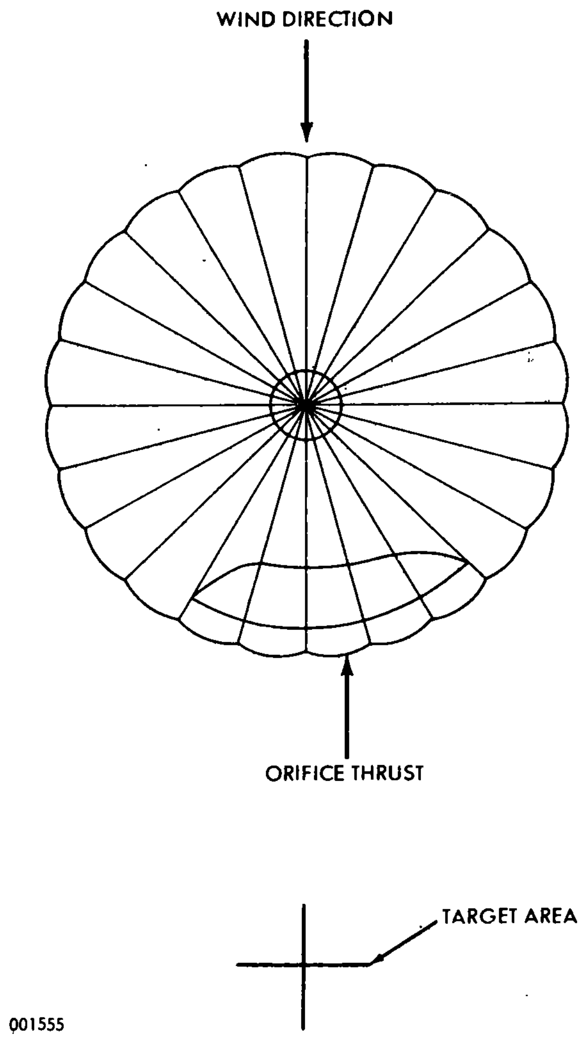


Figure 2–37. Holding maneuver.

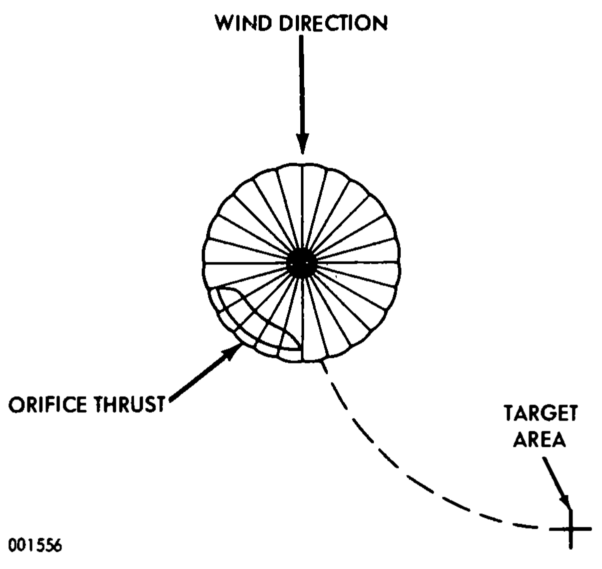


Figure 2–38. Crabbing to the right while holding.

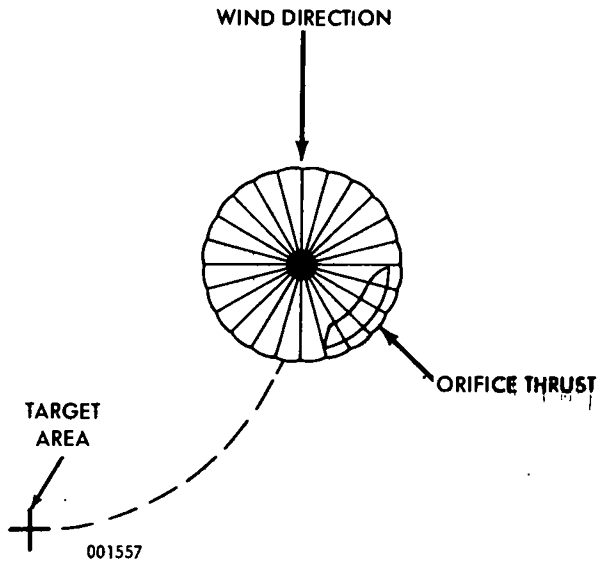


Figure 2–39. Crabbing to the left while holding.

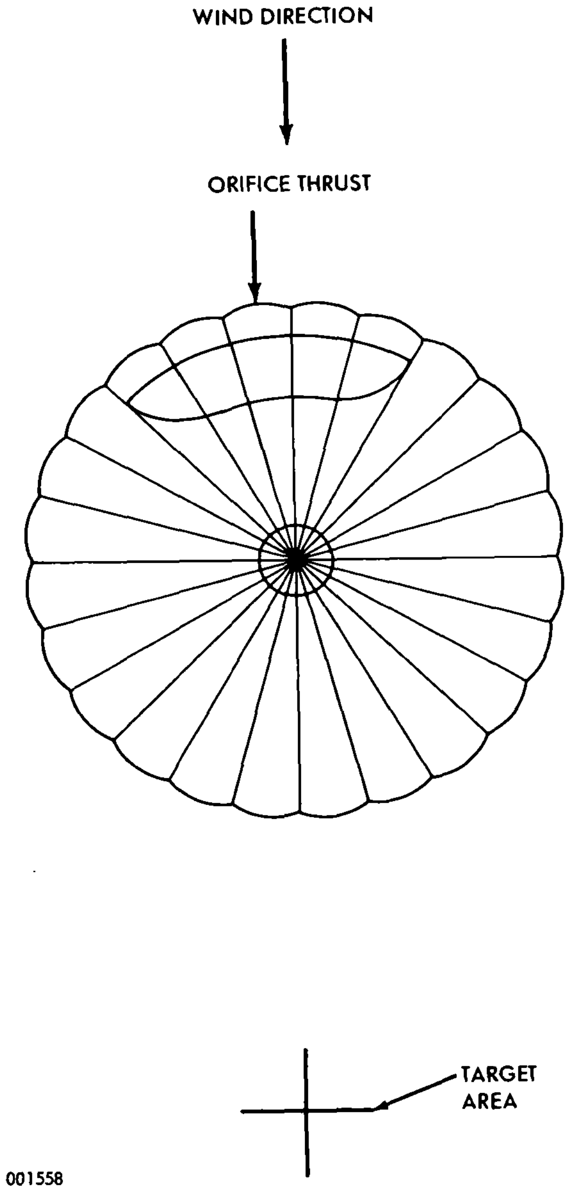


Figure 2-40. Running maneuver.

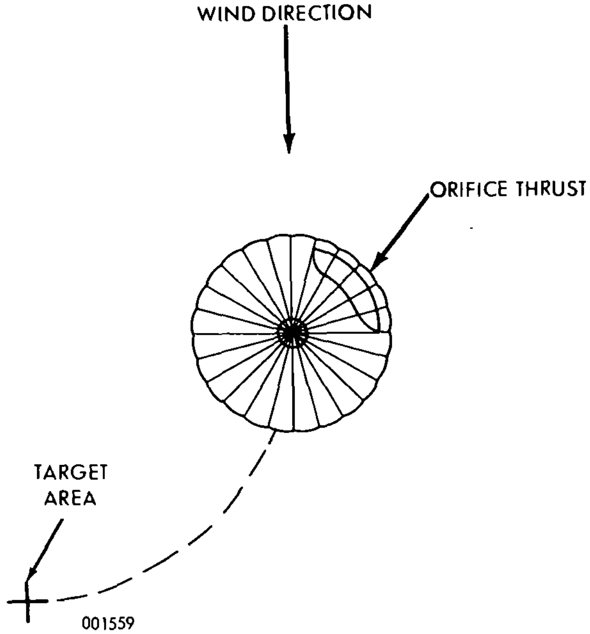


Figure 2-41. Crabbing to the right while running.

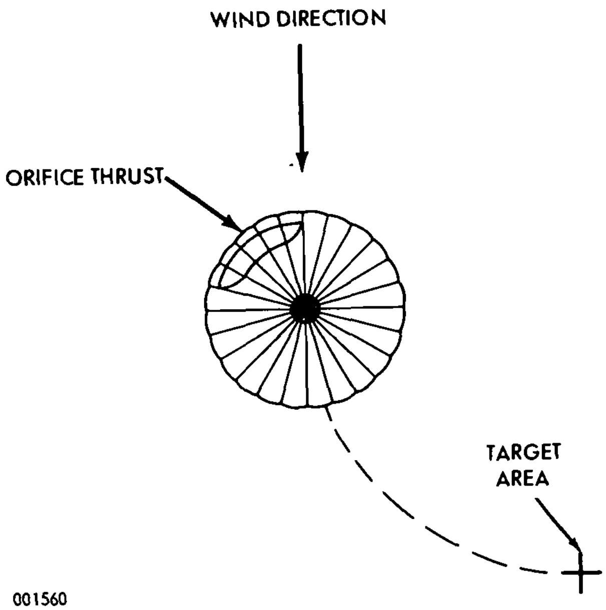


Figure 2-42. Crabbing to the left while running.

Section V. EMERGENCY PROCEDURES AND SAFETY MEASURES

2-21. Emergency Procedures

Emergencies of various types may arise during the conduct of any airborne operation. The parachutist must learn to recognize an emergency situation and know the proper action to take should one occur. Danger areas and emergency procedures are outlined below:

a. Aircraft Crash During Takeoff. Certain precautions are always taken before takeoff to insure the greatest degree of safety in event of a crash during this period. The precautions and the procedures to be employed are as follows:

(1) *Before takeoff.*

(*a*) Learn the locations of emergency exits and how to open them.

(*b*) Secure or remove all loose items.

(*c*) Wear helmet.

(*d*) Fasten seat belt securely.

(2) *Just prior to crash.*

(*a*) Tighten seat belt.

(*b*) Lean toward the forward part of the aircraft and brace for the crash.

(3) *After crash landing.*

(*a*) Clear the aircraft as soon as it stops and move well away from it in case of fire or explosion.

(*b*) Check and make sure all men are away from the wreckage.

(*c*) Report to headquarters by any means available.

b. Bailout at Low Altitude. Unless the aircraft is obviously out of control, take no action while the aircraft is in flight until the pilot so directs. In the event it becomes necessary to bailout at a low altitude, proceed as follows:

(1) Make certain that you have at least 500 feet between you and the ground. Jettison troop doors, and leave the aircraft. Activate reserve parachute immediately upon clearing aircraft.

(2) After the parachute landing, assemble with other jumpers and report to headquarters by any means available.

c. Bailout at Jump Altitude. If an emergency bailout is necessary from jump altitude, proceed as in *b*, above, using main parachute instead of reserve.

d. Accidental Activation of Reserve Parachute.

(1) Should the reserve parachute open in the aircraft, move away from the exit and immediately gather the parachute and remove it from the harness.

(2) If any part of the parachute is exposed to external air currents, leave the aircraft as quickly as possible. Failure to leave the aircraft may result in your being violently extracted from it.

2-22. Safety Measures

a. Responsibilities of the Parachutist. The speed and accuracy with which the parachutist follows the instructions below adds to the safety during jumping exercises.

(1) During ascent, compare performance of altimeter with performance of altimeters of other parachutists to insure proper functioning.

(2) Upon exiting the aircraft, quickly assume a stable body position and maintain a sharp lookout for other jumpers. Make certain that you are not over other jumpers near opening altitude.

(3) During free fall, check altitude at intervals. Pull the ripcord at 4,300 feet actual altitude. If main parachute does not open within 5 seconds, ACTIVATE RESERVE IMMEDIATELY.

(4) After main parachute opens, check canopy, activate slip risers, and keep a sharp lookout for other jumpers.

(5) Keep canopy under control at all times during descent. At a minimum of 100 feet face into wind and hold this position until landing.

(6) Always execute a parachute landing fall.

(7) When jumping from altitudes requiring the use of oxygen and when told to do so, connect oxygen mask hose to individual oxygen outlet on portable oxygen console or bottle.

(8) Be sure that you are receiving adequate oxygen, and indicate same to oxygen safety man by giving "thumbs up" sign with either hand.

(9) Keep alert for symptoms of hypoxia, and inform oxygen safety man when you observe symptoms in yourself or in any other jumper by extending your arm out to your front.

b. Jumper's Checklist. Before each free fall jump exercise, check or service equipment as follows:

(1) *Back pack.*

(*a*) Check safety wire on automatic ripcord housing.

(*b*) Check arming device cable.

(*c*) Check ripcord pins insuring that they are properly seated.

(*d*) Snap all protector covers.

(*e*) Check cable to personnel oxygen cylinder.

(*f*) Make certain that there is at least 1,800 lbs. pressure in personnel oxygen cylinder.

(*g*) Close all snap (lift the dot) fasteners.

(*h*) Perform normal backpack inspection.

(2) *Harness.*

(*a*) Check personnel oxygen cylinder hose.

(*b*) Check junction box and mount.

(*c*) Be sure that arming cable knob is securely seated in housing.

(*d*) Perform normal harness inspection.

(3) *Reserve parachute.*

(*a*) Seat ripcord pins.

(*b*) Set altimeter at ground zero for selected drop zone.

(*c*) If the reserve personnel oxygen cylinder is used, be sure it is properly mounted and does not leak, and that the hose-to-mask connector is not crimped.

(*d*) Check snaps for serviceability.

(*e*) Insure all pack opening bands are secure.

(4) *Helmet and goggles.*

(*a*) Check helmet and goggles for proper size and fit.

(*b*) Be sure goggles are clean and not cracked.

(*c*) Check hose on oxygen mask for serviceability.

(*d*) Check regulator for normal and 100 percent oxygen tests.

c. Precautions in Use of Oxygen.

(1) After parachutists go on oxygen supply, all personnel must be constantly alert for symptoms of hypoxia and other effects of exposure to high altitude.

(2) Parachutists must jump within 5 minutes after activation of personnel oxygen cylinders.

(3) Because of the limited supply of oxygen in the personnel oxygen cylinder, a parachutist who does not jump within this 5-minute period must be switched back to the oxygen console and jump at a later time.

(4) An additional personnel oxygen cylinder can be fastened to each parachutist's reserve parachute to serve as a backup supply in case a repeat live pass is necessary.

2–23. Duties of the Oxygen Safety Man

An oxygen safety man is required in each aircraft during free fall operations when oxygen is being used. The oxygen safety man must be a qualified instructor who has had physiological training. He performs the following duties:

a. Checks all oxygen equipment prior to enplaning.

b. Distributes oxygen hoses on one side of aircraft. Jumpmaster or his designated representative distributes oxygen hoses on opposite side of aircraft.

c. Insures that all parachutists are properly attached to oxygen supply on command of the jumpmaster.

d. Insures that all parachutists are receiving an adequate supply of oxygen.

e. Makes periodic checks of all oxygen equipment during flight.

f. Continually checks parachutists for symptoms of hypoxia.

g. On order from the jumpmaster, assists the parachutists to switch from individual oxygen outlets to personnel oxygen cylinders. Insures that each cylinder has been activated.

h. Stays with any parachutist suffering from oxygen sickness, or who has been unable to jump, lands with the aircraft, and assists the parachutist as required.

CHAPTER 3
COMBAT LOADS

3-1. General

a. The free fall parachutist normally jumps with the equipment and weapons he carries in combat. The combat load carried by the individual jumper should be as light as possible, with only the equipment, weapons, and ammunition needed to sustain him in combat until a resupply can be affected. Exploit other methods of delivery of equipment, weapons, and ammunition not immediately required to perform the parachutist's mission.

b. In the interest of safety, do not attach hard, bulky, or irregular shaped items to the rear of the thigh or the buttocks. When necessary, attach equipment on the front or sides and away from the five points of contact.

c. Use sufficient padding to avoid metal-to-metal, metal-to-wood, or wood-to-wood contact between items of equipment packed in one container.

d. Package weapons and equipment loads by operating units. For example, a radio and its battery pack are jumped as one load because the loss or temporary separation of one part makes the other inoperable.

e. Tape exposed snaps, hooks, and other sharp projections on the parachutist's clothing and equipment with masking tape.

3-2. Methods of Attaching and Wearing Combat Equipment

a. Individual Combat Equipment. All items of individual combat equipment, except life preservers, are carried in the rucksack when making a military free fall jump. Life preservers are worn and jumped in the manner explained in TM 57-220.

b. Rucksack.

(1) *General.* The rucksack is a general purpose item which may be used to carry designated combat equipment. It is equipped with adjustable carrying straps which permit it to be carried in the same manner as a field pack.

(2) *Packing the rucksack.* Items of equipment are inserted and padding placed between the load and front portion of the rucksack (portion with external pockets). This is to preclude damage to the equipment as the front of the rucksack will be in contact with the ground when properly rigged.

(3) *Rigging the rucksack.* Rigging the rucksack requires the use of a special harness assembly.

(*a*) *Construction, rear mounted rucksack harness.* The rear mounted rucksack harness (fig 3-1), consists of two diagonal locking straps approximately 72 inches long (A, fig 3-1), an anchor strap 18 inches long (B), a lateral locking strap 68 inches long (C), and a leg strap 80 inches long (D). The upper end of each diagonal locking strap has a friction adaptor attached. The anchor strap has a D-ring on each end and the lateral locking strap is equipped with a friction adaptor on one end. The leg strap has no attached hardware.

Note. In addition to the basic harness, the assembly includes two quick release straps and a lowering strap. The quick release straps consist of a snap fastener and a friction adaptor connected by a 3-inch length of webbing. The lowering strap employed is that standard to the parachutist's adjustable equipment (PAE) bag.

(*b*) *Rigging.* to rig the rucksack for jumping, the following must be accomplished:

1. The rucksack is fully packed with all straps tightened and secured.

2. Rucksack is placed face down with pack frame up and top of frame closest to packer.

3. Rear mounted rucksack harness is laid on pack frame with friction adaptors on the diagonal locking straps (A, fig 3-2) at the frame's bottom and the running ends (C) at the frame's top.

4. The friction adaptors of the diagonal locking straps are routed between the right and left frame truss bars and the pack frame's base.

5. The running ends of the diagonal locking straps are routed between the pack frame's shoulder straps and under the top of the pack frame.

6. Right and left D-rings of the anchor strap are routed through their respective frame support angles and over the pack frame (B, fig 3-2).

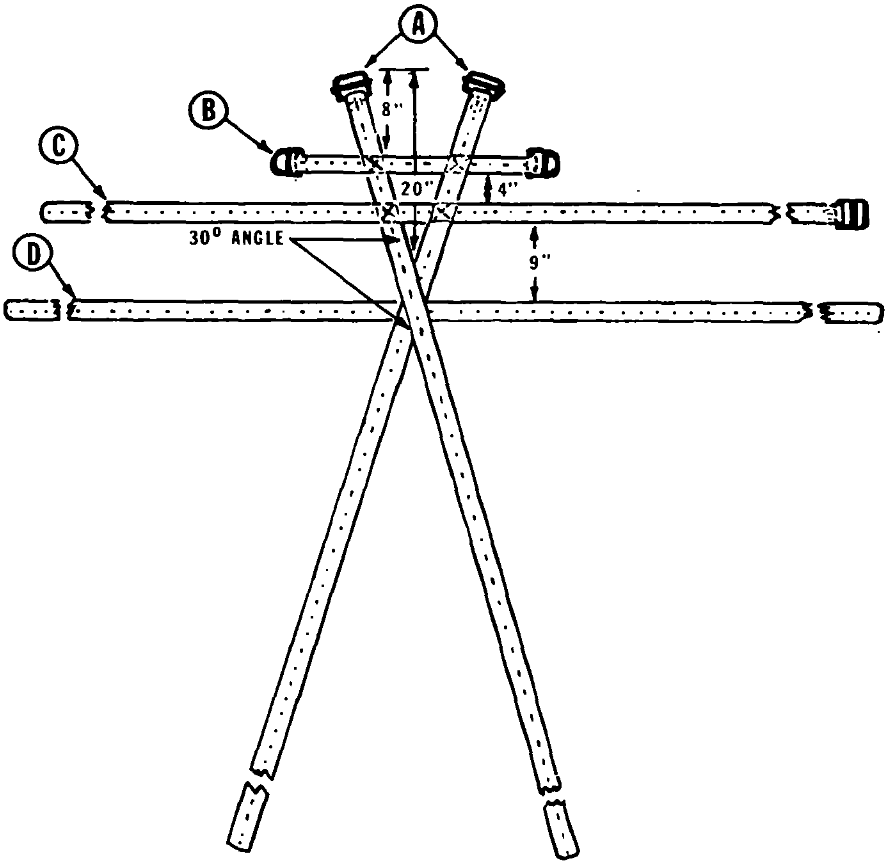


Figure 3-1. Rear mounted rucksack harness.

7. At this time, turn the rucksack on its back and route the running ends of the diagonal locking straps around the long axis of the rucksack and secure to their respective friction adaptors which protrude from beneath the pack frame's bottom (B, fig 3-3).

8. Tighten lateral locking strap around the rucksack and secure to its respective friction adaptor (A, fig 3-3).

9. The running ends of all straps are folded and secured to themselves with tape.

10. Return rucksack to the initial rigging position (frame up, pack bottom away from rigger) and connect lowering line by routing the loop end beneath the diagonal locking straps from right to left, entering below point (B, fig 3-4) and exiting above point (A).

11. Pass the running end of the lowering line through the loop end and stow the remainder using a rubber band attached to each of the two pack frame support angles. The rucksack is now ready for mounting on a military free fall parachutist.

(*c*) *Mounting the rucksack.* Before mounting the rucksack, the parachutist must be fully rigged with both main and reserve parachutes. The procedures for mounting the rucksack are as follows:

1. The rucksack is placed bottom up with the frame side facing the back of the para-

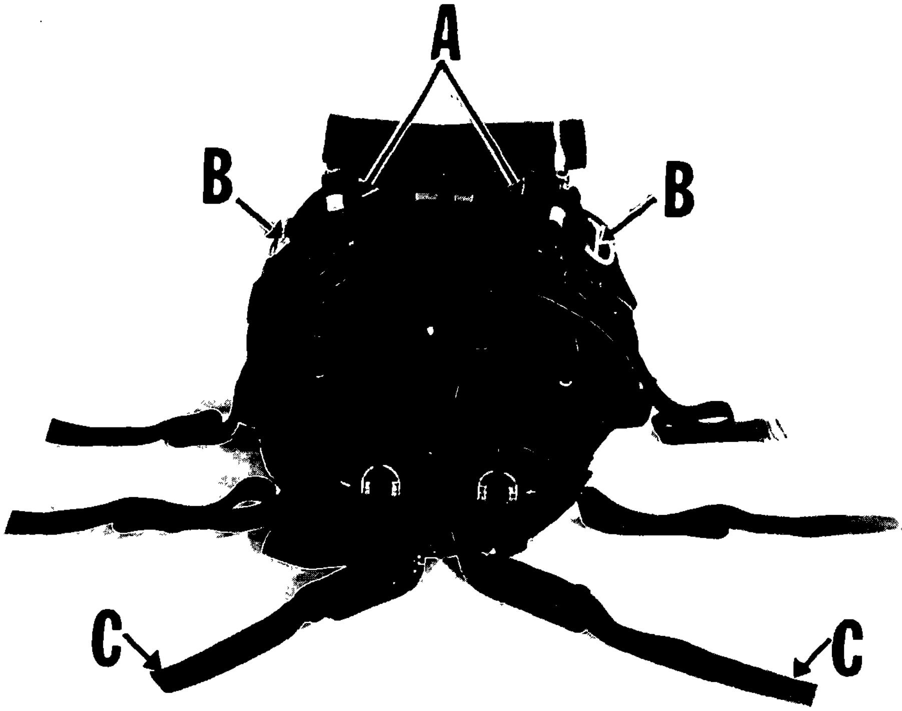


Figure 3-2. Rigging rear mounted rucksack harness (front view).

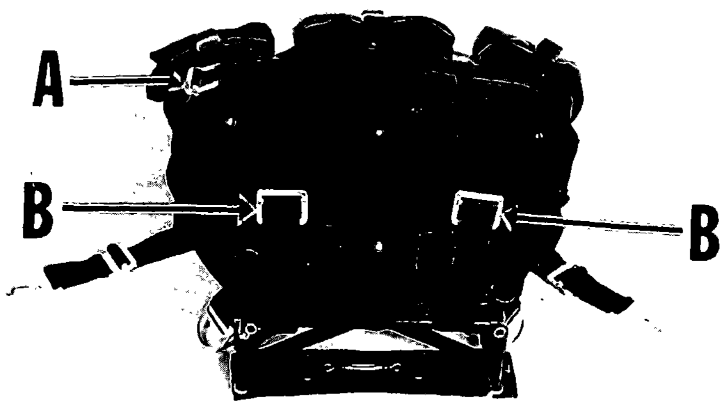


Figure 3-3. Rigging rear mounted rucksack harness (rear view).

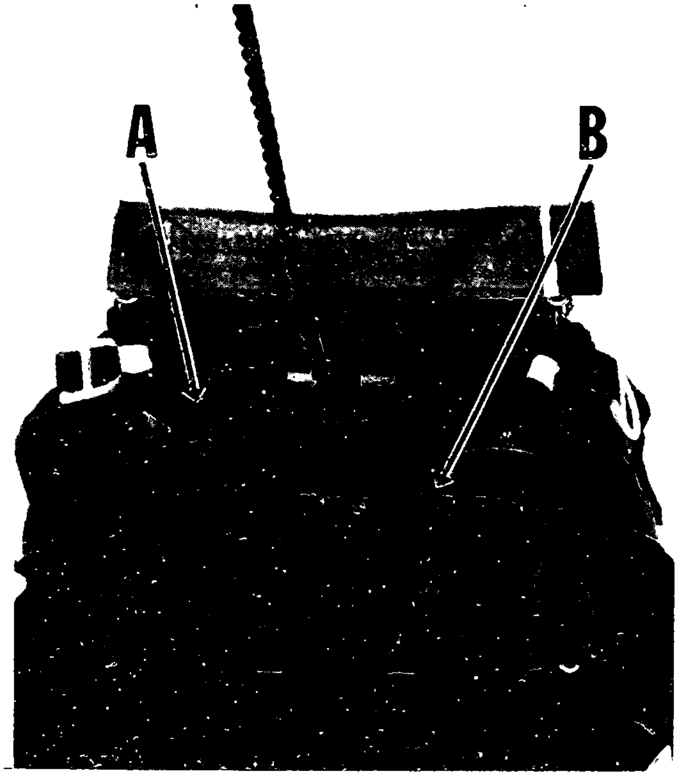


Figure 3-4. Proper routing of lowering line.

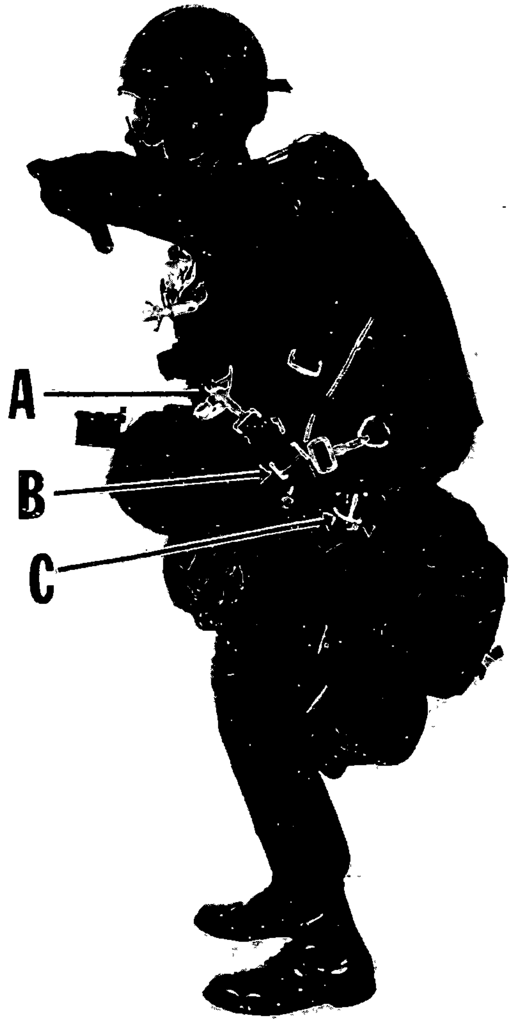


Figure 3-5. Mounting the rucksack on a military free fall parachutist.

chutist's legs. The running ends of the leg strap are passed between and then to the left/right of the respective legs of the parachutist. They are then routed under and through their respective D-rings on the anchor strap (C, fig 3-5).

2. The quick release straps are now connected, mouth down, to each of the two upper D-rings on the parachute's main lift web (A, fig 3-5). At this point, assistance is required to lift the rucksack assembly and hold it securely in place beneath the main parachute pack. The leg straps (B fig 3-5) are pulled comfortably tight and are secured to their respective quick release straps with a quick release loop. Insure that the rucksack rides snugly against the bottom of the main parachute and the parachutist's buttocks.

Note. When weapons are to be jumped, they are attached to the parachutist prior to mounting the rucksack. The rucksack is mounted in the same manner as explained above with the exception of the left running end of the leg strap. After passing the left running end of the leg strap between the parachutist's legs, it is passed under the weapon and then routed under and through the left D-ring on the anchor strap. The running end is then passed over the weapon and reserve parachute restraint strap and attached to the quick release strap (fig 3-6).

3. The anchor end of the lowering strap is, at this time, attached to the lower D-ring on the parachutist's right main lift web with a quick release loop. Insure that the lowering strap follows the shortest route from the rucksack to the D-ring without encircling either leg or other webbing.

4. With this accomplished, rigging of the rear mounted rucksack is complete.

3-3. Weapons

a. General. Individual weapons are normally carried secured to the left side. Care must be taken to insure that the muzzle does not become clogged while landing and that sharp edges are covered. All tiedowns are 80-pound test cotton webbing or a like item (string or cord).

Figure 3-6. Proper routing of left leg strap when jumping weapon.

b. M16 Rifle.

(1) *Preparation.* See TM 57-220.

(2) *Positioning* (fig 3-7). The weapon is slung over the left shoulder, muzzle down and trigger guard to the front. It should ride as low as possible so that the butt of the weapon is positioned as close to shoulder level as possible. The sling is placed inside the chest strap and left D-ring of the harness and is held there by the left snap connector of the reserve parachute. The reserve parachute restraint strap is placed over the sling and the front handguard and is secured to the V-ring of the back pack.

(3) *Tiedowns.* Two tiedowns with bowknots further secure the weapon. The upper tiedown is a 36-inch tie tape securing the sling to the pack attaching loop. The lower tiedown secures the muzzle of the rifle to the jumper's leg to prevent possible entanglement with the suspension lines of the parachute. It is removed prior to landing to avoid injury of the jumper.

c. M79 Grenade Launcher.

(1) *Preparation.* See TM 57-220.

(2) *Positioning* (fig 3-8). The weapon is slung over the left shoulder, muzzle up, with the trigger guard to the front. The muzzle should be below the level of the jumper's shoulder with the sling supporting the weight of the weapon. The sling is placed inside the chest strap and left D-ring of the harness and held with the left snap connector of the reserve parachute. The reserve parachute restraint strap is placed over the sling and the front handguard and is secured to the V-ring of the back pack.

Figure 3-7. Positioning the M16 for jumping.

(3) *Tiedowns.* Two tiedowns with bowknots further secure the weapon. The upper tiedown secures the sling to the pack attaching loop. The lower tiedown secures the butt to the jumper's leg to prevent possible entanglement with the parachute suspension lines. The lower tiedown is removed prior to landing to avoid injury to the jumper.

d. Machinegun, 7.62-mm, M60.

(1) *Preparation* (fig 3-9). The sling is removed from the weapon. The sling keeper is removed from the sling. A loop is formed by run-

Figure 3-8. Positioning the M79 for jumping.

ning the sling through the sling hook. The sling is replaced by placing the loop around the cover assembly. The sling keeper is replaced and the sling is secured to the upper sling swivel with a half hitch. Padding is secured over the entire barrel assembly. Additional padding is secured over the sight and operating rod assemblies. The butt plate is taped closed.

(2) *Positioning* (fig 3-10). The weapon is slung over the left shoulder, muzzle down and pistol grip to the front. It should ride as low as possible so that the butt of the weapon is positioned as close to shoulder level as possible. The sling is placed inside the chest strap and left D-ring of the harness and is held there by the left snap connector of the reserve parachute. The reserve parachute restraint strap is placed over the sling and the handguard and is secured to the V-ring of the back pack.

(3) *Tiedowns.* Two tiedowns with bowknots further secure the weapon. The upper tiedown is a 36-inch tie tape securing the sling to the pack attaching loop. The lower tiedown secures the muzzle of the machinegun to the jumper's leg to prevent possible entanglement with the suspension lines of the parachute. It is removed prior to landing to avoid injury to the jumper.

e. Pistol. If the pistol is jumped in the holster, it is fitted on the right side of the pistol belt. The holster should be taped closed or the pistol should be secured to the pistol belt by means of a lanyard.

Figure 3-9. Preparing the M60 for jumping.

Figure 3-10. Positioning the M60 for jumping.

CHAPTER 4

DUTIES OF THE JUMPMASTER

Section I. GENERAL

4-1. Qualifications

The jumpmaster is the senior-qualified free fall parachutist on board the aircraft or his designated representative. He must be qualified by special training and free fall experience to perform his duties as outlined below.

4-2. Responsibilities

There is only one Army jumpmaster in any one aircraft. He has command authority over, and responsibility for, all Army airborne personnel in the aircraft. The jumpmaster is responsible for an inspection of the aircraft and personnel, the enplaning and jumping of personnel, and the dropping of air delivery containers. His responsibility includes assurance that all free fall personnel aboard the aircraft observe flight safety regulations and comply with instructions from the pilot.

Section II. DUTIES PRIOR TO ENPLANING

4-3. Inspection of the Aircraft

The aircraft must be inspected in accordance with procedures described in detail in TM 57-220.

4-4. Inspection of Personnel

The jumpmaster, who may be assisted by the assistant jumpmaster, must inspect the equipment of each parachutist as follows:

a. Check helmet and goggles for fit and security.

b. Insure that canopy releases and locking forks are properly assembled.

c. Insure that chest ejector snap is locked.

d. Insure that manual ripcord handle (main parachute) is properly seated.

e. See that instrument mount panel is clean and check operation and setting of altimeter.

f. Check reserve parachute as outlined in TM 57-220.

g. Insure that automatic ripcord arming knob (lollipop) is properly seated and readily accessible.

h. Insure that leg ejector snaps are attahced to harness V-rings and locked.

i. Check risers for twists.

j. Insure that manual ripcord and power cable assemblies are secure in clamp assembly.

k. Insure that ripcord pins are properly positioned.

l. Insure that pack opening bands are fastened.

m. Check entire harness for frays and twists.

n. Insure that canopy fabric is not exposed.

o. See that all flaps of main parachute are secured.

p. If oxygen is to be used, insure that parachutist's oxygen mask is properly fitted and that personnel oxygen cylinder has the proper amount of pressure and check hose. Insure that oxygen activation cable is readily accessible.

4-5. Briefing the Pilot

The jumpmaster must brief the pilot before the flight so that the pilot will be familiar with the entire plan of operation. The following points must be covered:

a. Location of drop zone.

b. Exit point.

c. Exits and spotting procedures: During the conduct of training, spotting of the aircraft and actual release is accomplished by the Army jumpmaster. Air Force electronic means will be utilized for combat jumps (HARP).

d. Desired flight track.

e. Desired speed of aircraft at time of exit.

f. Altitude.

g. Number of parachutists participating in exercise.

h. Number of passes over drop zone required.

i. Emergency procedures for leaving aircraft when airborne.

4-6. Briefing of Parachutists

Before enplaning, the jumpmaster must brief the parachutists on the following points:

a. Drop zone to be used.

b. Exit airspeed.

c. Direction of flight.
d. Altitude.
e. Winds aloft and on the surface.
f. Pass and stick numbers.
g. Assembly areas.

Section III. DUTIES DURING FLIGHT

4-7. General

During flight the jumpmaster will:

a. Insure that jumpers are seated in proper exit sequence, with helmets and seat belts secured. Personnel will remain in this position until instructed to do otherwise by the jumpmaster.

b. Remain in constant communication with the pilot by use of the interphone located in the rear of the aircraft.

c. Keep himself oriented at all times as to the position of the aircraft in relation to the flight route and drop zone.

d. Be alert for sick parachutists, and be responsible for the conduct of Army airborne personnel throughout the flight.

e. Make a check upon receipt of the 20-minute warning to insure that:

(1) Helmets are fastened.

(2) Ripcord handles on both the main and reserve parachutes are snug in their pockets.

(3) Equipment is properly secured.

(4) Parachutists are in their proper seats.

4-8. Procedures Prior to Exit

a. Jump Commands. Approximately 20 minutes before drop time, the pilot alerts the jumpmaster, who alerts all other personnel. At this time the pilot adjusts the cabin pressure to 10,000 feet and holds this pressure until oxygen safety checks are conducted. The jumpmaster will notify the pilot once these checks are performed and the cabin pressure will be adjusted to jump altitude. If jump altitude is 13,000 feet or less, the pilot will fully depressurize the cabin at the 20-minute warning.

b. Command Sequence. The following jump commands are for any high performance standard jump aircraft. Minor modifications may be necessary when jumping other types of aircraft. The jumpmaster positions himself in the rear of the aircraft where he may be seen by the greatest number of parachutists and gives the jump commands. The noise of the engines and an oxygen mask make it difficult to hear; therefore, arm and hand signals are used with each command. These signals are given vigorously with smooth, coordinated movements. One hand is used.

c. Procedures When Oxygen is not Used. The commands used when oxygen is not available are ARM MAIN PARACHUTE, STAND UP, STAND BY, AND GO.

(1) *Arm main parachute.*

(*a*) This command directs the parachutist to pull his lollipop and hold it up so that the assistant jumpmaster can collect them from each jumper.

(*b*) The arm and hand signal is given by extending one arm to the rear at buttocks level with the hand in the form of a fist. The arm is moved in a pulling motion towards the front.

(2) *Stand up.*

(*a*) On this command all personnel stand and, at a separate signal from the jumpmaster, move to the ramp or door.

(*b*) The arm and hand signal is given by extending the arm, elbow locked, palm up; rotate straight up to at least shoulder level. When the jumpmaster wants you to move to the ramp or door, he will indicate this by extending his arm out and bringing it back to his chest at chest level.

(3) *Stand by.*

(*a*) This command is given approximately 15 seconds prior to exit of the aircraft to alert the parachutist and inform him of the imminence of the exit.

(*b*) The arm and hand signal is given by extending the arm, elbow locked, at shoulder level with the hand in a fist and the thumb up.

(4) *Go.*

(*a*) This command is given at the exact exit point and is the signal for the parachutist to exit the aircraft as rapidly and safely as possible.

(*b*) The arm and hand signal is given by extending one arm and pointing with the index finger.

d. Procedures When Oxygen is Used. The commands used when oxygen is used are ARM MAIN PARACHUTE, STAND UP, ACTIVATE BAILOUT BOTTLE, STAND BY, and GO.

(1) *Arm main parachute.* Same procedure as that in *c*(1) above.

(2) *Stand up.*

(*a*) On this command, the parachutist will stand up and face the rear of the aircraft. The parachutist will remain attached to the oxygen console at this time.

(*b*) The arm and hand signal is the same as that in *c*(2) above.

(3) *Activate bailout bottle.*

(*a*) This command is given approximately 1 minute from drop time. At this command, the parachutist will pull the activation cable to arm the personnel oxygen cylinder, unhook from the oxygen console, and move to the vicinity of the ramp or jump doors, whichever is being used.

(*b*) The arm and hand signal is given by extending one arm, elbow bent, with the hand in the vicinity of the activation cable. A downward pulling motion is made until the arm is fully extended, elbow locked.

(4) *Stand by.* Same procedure as that in *c*(3) above.

(5) *Go.* Same procedure as that in c(4) above.

CHAPTER 5

TACTICAL APPLICATION

5-1. General

a. Tactical Application. When the tactical situation and mission requirements demand a clandestine penetration of selected areas, a preferred method may be the release of parachutists from high altitudes using a free fall parachute technique to infiltrate personnel and cargo into an operational or objective area. Free fall parachute operations are generally characterized by flights over the objective area at altitudes not normally associated with parachute operations, and will normally be conducted in darkness or twilight to reduce the chance of enemy observation or detection. The parachutists are released at a point in space which is calculated to allow them to land within their objective area. Maneuverable parachutes, coupled with automatic opening devices, provide the detachment with the capability of all personnel opening at a predesignated altitude and landing together safely as a tactical unit prepared to execute its mission. Tactical military free fall parachuting should not be expected to produce pin point landing accuracy, but must be regarded as the means of entering a designated impact area within the objective area. The success of this type of drop, except under the most adverse circumstances, is assured regardless of the local weather condition or visibility. Free fall paracuting is advantageous under the following circumstances:

(1) As a means of infiltration into hostile areas when low altitude penetration is not practical because of enemy detection or anti-aircraft capability.

(2) In mountainous terrain, where parachute operations using aircraft as low altitudes are prohibited, unsafe, or otherwise impracticable.

(3) When the impact area is limited in size.

(4) When infiltration is to occur with other operations involving aircraft, or formations of aircraft, flying at high altitudes.

(5) For infiltration of small Special Forces pilot teams or blind drop infiltrations.

(6) When aircraft flying above hearing range will not be detected, e.g., in areas of operation where no radar or other sophisticated detection systems exist.

b. Considerations. When planning free fall operations, commanders should consider the following:

(1) Coordination must be affected with necessary agencies and services to provide a jamming capability to the supporting air service or to plan for the disruption of the detection system if the operations are planned in hostile areas protected by enemy radar and other detection systems.

(2) The availability of aircrews working under arduous conditions in depressurized aircraft at high altitudes is vitally important.

(3) Free fall parachuting is valid from operational drop altitudes (static line) up to high altitudes depending on the capability of the supporting aircraft.

c. Equipment.

(1) Free fall parachutists will have in their possession normal operating TOE equipment which will include TA clothing and equipment in keeping with the climatic conditions, food, and survival items. The only exception to this is the free fall parachutist's jump helmet, goggles, and altimeter used for free fall parachuting. All detachment equipment and supplies will be jumped and carried as individual loads. If selected items must be dropped as accompanying supplies, they will be packed in appropriate aerial delivery containers. There are various methods and techniques for free falling this equipment into operational areas, and these are described below. Once the drop is in progress, free fall parachutists will locate and follow the bundles to the ground which lessens the possibility of losing the equipment in the drop. Techniques that may be used to free fall equipment are—

(*a*) Nonelectric blasting caps may be used to fire parachute retaining devices with time fuze cut in accordance with altitude and desired free fall time to opening.

(*b*) Use of power-actuated, reefing line cutters, and items of issue available to airborne units, when shorter delays are necessary.

(*c*) Use of high altitude bombing techniques are satisfactory for delivery of time-delay cargo parachutes.

(*d*) Use of F1B timer and a ripcord deployed parachute.

(2) For altitudes above 10,000 feet, oxygen equipment is mandatory. Special equipment needed in addition to the goggles and helmets are oxygen masks and several main oxygen sources.

5-2. Procedures

Employed correctly, the free fall technique can be used by full operational detachments of larger units. However, since the number of personnel that will normally be dropped in this manner is small, emphasis should be directed toward taking only absolutely essential equipment and supplies.

a. Briefing. The briefing should include a review of en route plans and actions at specified points along the route in the event of an abort to enemy action. All the techniques of the jump, to include oxygen procedures, when to arm the automatic opening device on the parachute, and actions at the 20-, 6-, and 2-minute warnings are explained. A minimum of two extra parachutes and altimeters should be carried in the event of premature firing of an automatic opening device or the failure of an altimeter.

b. Station Procedures. Under tactical conditions, the detachment should be completely rigged prior to takeoff. This insures that, in the event of an abort or enemy action, the detachment will exit the aircraft with all of their equipment. A final check of all equipment is made and all altimeters are calibrated. Altimeters are normally calibrated so that the instruments read distance above the ground at the drop zone; however, while in flight, the aircraft commander will keep the detachment informed of changes to the altimeter reading if it is necessary to abort and make an emergency exit.

c. In-Flight Procedures. En route, the aircraft commander keeps the jumpmaster informed of the position of the aircraft. In turn, the jumpmaster keeps the jumpers informed. This information is essential so that the detachment members know their relative position along the route and can apply the required actions in the event of an abort or enemy action. All actions at the 20-, 6-, 2-, and 1-minute warnings will be in accordance with premission briefings. The pilot will signal the jumpmaster when he has reached the high altitude release point. The jumpers will exit the aircraft on the command of the jumpmaster.

d. Free Fall Procedures. Once the jumpers have gained stability in free fall, they take up a preselected heading so that all are oriented in the same direction. They then fall in "bomb line" plot activating their parachutes at a preselected altitude or upon activation of the automatic opener. These actions will keep the parachutist's dispersion relatively constant during free fall. In determining the heading, reliance cannot be made on visual sighting of terrain features, since that is not always possible, e.g., night operations, flat jungle areas, or mountainous areas. A reliable means of determining heading is that upon exiting the aircraft, all jumpers maintain heading in the direction of the aircraft. An alternate means of maintaining heading is to use a wrist compass. The jumpers make no effort to move laterally during free fall in an attempt to move toward a specific terrain feature; however, they may adjust their position to maintain contact with the lead man or equipment bundle. Night operations and lack of familiarity with the terrain make such operations extremely difficult and may cause wide dispersion.

5-3. Drop Zones

a. General. Free fall infiltration envisages the selection of a drop zone in an area of low population density. While a desired impact point on the ground is jointly selected by the air support unit and the Special Forces unit, the success of the operation is not dependent on hitting this exact spot. Using the desired impact point as a reference, the HARP is calculated based on available weather data. During actual execution, current weather information may be provided either from the objective area or from the navigational equipment of the aircraft. This data may necessitate changing the HARP, desired impact point, or both. In any event, the jumpmaster is kept fully informed of the prevailing conditions, and he is turn keeps his jumpers informed. At the appropriate time, the jumpers exit the aircraft employing the technique described above. The success of the infiltration is dependent on their landing together within the operational area in the proximity of the desired impact point.

b. Marking and Authentication.

(1) *Marking.* Unlike static line infiltration, for free fall operations, drop zone markings are not used. Terrain features are used to indicate the release point during the day, and

ground reference lights are desirable to determine the release point at night.

(2) *Authentication.* The most positive means of authentication for free fall infiltration operations is to use coded electronic radio signals from the drop zone to the aircraft. Visual signals, commonly used in normal air infiltration, can be employed if the aircraft altitude and visibility will permit the pilot to see the signal; however, since in all probability the pilot cannot see the signal, they may serve as a guide to the jumpers upon reaching opening altitude. This system may be used when a reception committee is expected.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
Active Army, ARNG, USAR: To be distributed in accordance with DA Form 12-31, section III requirements for Operator and Crew for Parachute Personnel (qty rqr block no. 405).

☆U.S. GOVERNMENT PRINTING OFFICE: 1974—713-214/350