This is a typical navigation flight mission. At various intervals of the mission the velocity steering indicator display is pictorially illustrated, to indicate the information that is continuously available. The desired track grid ground speed counters and other equipment have been omitted for clarity. This diagram is added to help gain an adequate understanding of the navigation system.

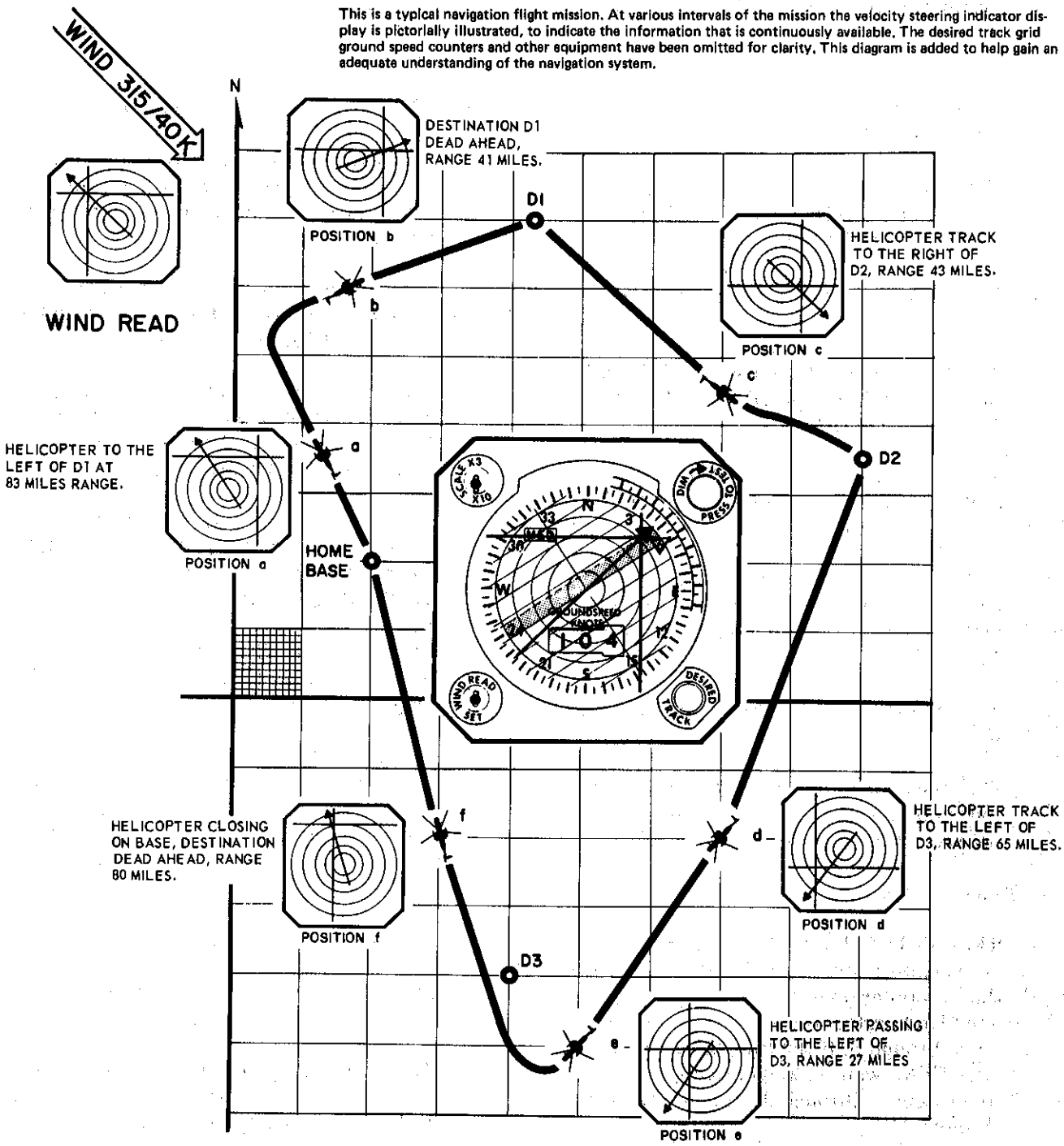


Figure 4-18. Typical Navigation System Radar Mission

11. Destination selector — DESTINATION 2 ON.

12. SET N-S knob — SLEW DESTINATION 1 COUNTERS TO DESIRED NORTH OR SOUTH COORDINATE.

13. SET W-E knob — SLEW DESTINATION 1 COUNTERS TO DESIRED EAST OR WEST COORDINATE.

14. Destination selector — DESTINATION 1 ON.

15. SET N-S knob — SLEW DESTINATION 2 COUNTERS TO DESIRED NORTH OR SOUTH COORDINATE.

16. SET W-E knob — SLEW DESTINATION 2 COUNTERS TO DESIRED EAST OR WEST COORDINATE.

17. DESIRED TRACK knob — ROTATE UNTIL THE DESIRED TRACK GRID POINTER INDICATES THE DESIRED TRACK.

18. Function switch — LAND. (SEA when over water.)

    With the helicopter stationary, the groundspeed counters on the VSI will oscillate between 0 and 5 knots.

After Takeoff-Cruise.

If the PRESENT POSITION COUNTERS were not slewed to the coordinates of the base prior to takeoff, fly the helicopter directly over the geographically located landmark at the base and continue with items 1 through 6. If the PRESENT POSITION COUNTERS were slewed correctly prior to takeoff, omit items 1 through 3 and continue with items 4 through 6.

1. PRESS-TO-STORE button — DEPRESS.

   PRESS TO STORE light in button should remain on.

2. PRESENT POSITION SET knobs — SLEW PRESENT POSITION COUNTERS TO THE EXACT COORDINATES OF THE BASE (USUALLY ZERO-ZERO).

   During slewing of present position, the control indicator panel caution light should flash.

3. PRESS-TO-STORE button — DEPRESS.

   The light should go out. The present position counters will rotate to cover the distance traveled while the computer was in STORE mode.

4. Scale switch — SELECT THE BEST SCALE FOR THE FIRST DESTINATION USING THE X10 POSITION.

5. Track pointer — TURN THE HELICOPTER UNTIL THE TRACK POINTER INTERSECTS THE DESTINATION CROSS BARS ON THE VSI.

6. Scale switch — AS THE DISTANCE BETWEEN HELICOPTER AND DESTINATION CLOSES, USE THE X3 POSITION TO PROVIDE A MOMENTARY SCALE EXPANSION ON THE VSI CROSS BARS FOR BETTER STEERING. This position is operative only in the LONG and MED range.

   When over destination: The VSI cross bars are centered and the position coordinates are the same as coordinates of Destination 1 (within a system tolerance of 5% of the distance flown).

If further destinations are to be used:

1. Destination selector — DESTINATION 2 - ON.

2. Turn the helicopter until the track pointer intersects the destination cross bars on the VSI, and proceed to destination 2.

3. SET N-S knob — SLEW DESTINATION 1 COUNTERS TO THE NORTH OR SOUTH COORDINATE OF A THIRD DESTINATION IF DESIRED.

4. SET W-E knob — SLEW DESTINATION 1 COUNTERS TO EAST OR WEST COORDINATE OF THE THIRD DESTINATION, IF DESIRED.

NOTE

Any number of destinations may be programmed in this manner. The coordinates of all destinations, however, must be in relation to the same origin.

To Correct Present Position.

Any time the helicopter flies over a known geographical fix, it is desirable to correct the present position counters as follows:

1. PRESS TO STORE button — DEPRESS AS THE HELICOPTER FLIES DIRECTLY OVER THE KNOWN POINT.
2. PRESENT POSITION SET switches — SLEW THE PRESENT POSITION COUNTERS TO THE EXACT COORDINATES OF THE KNOWN POINT.
3. PRESS TO STORE button — DEPRESS.

Operation In Memory Mode.

If the helicopter should fly over especially smooth water or if for any other reason, including doppler radar malfunction, the doppler tracking signals are too weak for good navigation, the computer will automatically switch to memory operation. When the computer switches to memory operation, it will be indicated by (a) the appearance of the OFF flag on the AFCS indicator in D mode, (b) the illumination of the memory caution light on the VSI, and (c) the appearance of the MEM flag in the VSI and (d) on those helicopters equipped with an altimetry mode, the memory light on the altitude indicators will be illuminated. In memory operation, the computer will use true heading and true airspeed inputs in conjunction with the last reliable wind velocity from the memory circuits to compute track and groundspeed. Present position will continue to be updated. The computer will automatically return to normal operation on receipt of valid signals from the doppler radar set. To determine what wind has been programmed into the memory circuit, hold the wind switch on the VSI in the WIND READ position. Wind direction will be displayed on the VSI by the track pointer and wind velocity by the intersection of the cross bars and the track pointer.

Air Data Mode Operation.

In tactical conditions under which it is undesirable to transmit doppler radar rf energy, place the function switch in the AIR position. Operation will be the same as in the memory mode. If a change in wind information is received from some outside source, the memorized wind may be manually updated as described in Before Takeoff procedures in this section.

Hover Mode.

To utilize the set in the hover mode, it is only necessary to have the function switch in either the LAND or SEA position, as required, and the AFCS indicator mode selector knob in the D position. Below 25 knots groundspeed, the set will automatically operate in the hover mode.

NOTE

If the doppler radar goes into memory mode while in hover, the computed track and groundspeed may be in error.

Errors Associated With Heading Reference.

HELICOPTER HEADING.

The overall accuracy of the system is directly dependent on the accurancy of the heading reference. When true heading is obtained from a magnetic compass system, its accuracy will be governed by compass deviations.

COMPASS DEVIATION.

Helicopter compasses are carefully swung and have virtually all deviation removed when installed. In time, however, various factors such as change in helicopter components, vibration, etc , may introduce appreciable deviations. Unfortunately such deviations are not usually constant but vary with helicopter heading. If the value of deviation for a particular heading can be established it may be combined with the appropriate variation. For example, if the variation is 14°W and the deviation card states, "To fly 062 steer 060," then this deviation of 2° East is added to the variation of 14°W to give a programmed variation of 12°W.

MAGNETIC VARIATION.

The value of magnetic variation for a particular locale is normally obtained from a topographical

map. The printed values are average values which are subject to comparatively small diurnal (daily) and seasonal changes. Large and unpredictable changes may occasionally be encountered due to magnetic storms. Deposits of iron ore, large build-up areas, etc., may also influence the value of variation.

MAP GRID.

Although heading is referenced to true north, the tranverse mercator grid coincides with true north only at the central meridian of each map sheet. This will cause errors which will be maximum at the extreme east and west sides of each map sheet. The amount of error will vary from zero at the equator to a maximum at the poles. For the southern United States the maximum error from this source is approximately one degree.

NOTE

An error of one degree in heading reference will cause an error of one nautical mile for every sixty nautical miles of distance flown. (1 in 60 rule.)

SEE 15-160 RADAR WARNING SET

LIGHTING EQUIPMENT.

The lighting equipment operates on alternating and direct current and is protected by appropriately marked circuit breakers. Switches and rheostats for operating all lights, except the cabin dome lights, floodlights, searchlight, landing light, and pilot's compartment spotlights are located on the overhead switch panel.

INTERIOR LIGHTS.

Pilot's and Copilot's Flight Instrument Panel Lights.

The pilot's and copilot's flight instrument panel lights are individually controlled by rheostats, marked PILOT FLIGHT INST LIGHTS and COPILOT FLIGHT INST LIGHTS, both with marked positions OFF and BRT, located on the overhead switch panel (figure 1-13). The intensity of the flight instrument lights may be varied by rotating each rheostat. The pilot's and copilot's flight instrument lights operate from the ac essential bus and are protected by circuit breakers, marked FLT INST COPILOT-PILOT, located on the ac essential circuit breaker panel (figure 1-39).

Non-Flight Instrument Lights.

The non-flight instrument panel lights on the instrument panel are controlled by a rheostat, marked NON-FLIGHT INST LIGHTS, with marked positions OFF and BRT, located on the overhead switch panel (figure 1-13). The intensity of the engine and transmission instrument lights, the hydraulic pressure gage lights, the fuel management panel lights, and the fuel quantity lights may be varied by rotating the rheostat. The non-flight instrument lights operate from the ac essential bus and are protected by a circuit breaker, marked NON FLT INST, on the ac essential circuit breaker panel (figure 1-39).

Console and Panel Lights.

The lights on the cockpit console, the overhead switch panel, the pilot's right-hand console, the copilot's left-hand console, and the takeoff and landing checklists are controlled by rheostats under the heading CONSOLES LOWER and OVHD, with marked OFF and BRT, located on the overhead switch panel (figure 1-13). The cockpit console and panel lights operate from the ac essential bus and are protected by a circuit breaker, marked PANEL and CONSOLE, located on the ac essential circuit breaker panel (figure 1-39).

Instrument Emergency Light.

The instrument emergency light is controlled by the rheostat, marked SECONDARY INST LTS, with marked positions OFF and BRT, located on the overhead switch panel (figure 1-13). The intensity of the instrument emergency light, a red light on the pilot's compartment dome light (figure 4-19), may be varied by rotating the rheostat on the overhead switch panel. The instrument emergency light operates from the battery bus and is protected by a circuit breaker, marked CKPT DOME SPOT, located on the battery bus circuit breaker panel (figure 1-39).

Pilot's Compartment Spotlights.

Two portable spotlights (figure 1-4), with coiled cords, are secured on each side of the overhead switch panel. The lights may be adjusted on their mountings to direct the light beams, where required, or they may be removed and used as

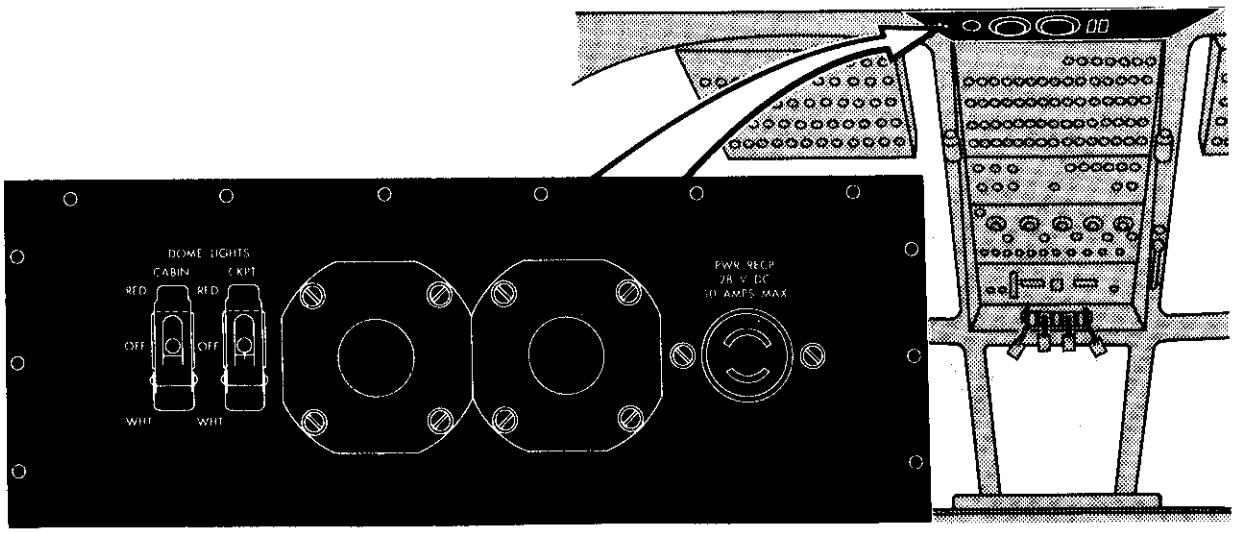


Figure 4-19. Pilot's Compartment Dome Light Panel

portable spotlights. The spotlights are each controlled by a rheostat, with marked positions OFF and BRT, or a pushbutton, located on the end of each spotlight casing. The lens casing of the light may be rotated to focus the beam and to position a red filter which converts the white light to a red light. The pilot's compartment spotlights operate from the dc battery bus and are protected by a circuit breaker, marked CKPT DOME SPOT, located on the battery bus circuit breaker panel.

Emergency Exit Lights.

Four impact type emergency exit lights (figure 4-20) are installed in the cargo compartment. The lights are installed to illuminate the emergency exit immediately below and the exit opposite the light. The impact relay is normally energized (emergency exit lights out) by electrical power from the dc essential bus through a circuit breaker, marked EMER LTS ARM, located on the overhead dc circuit breaker panel. Each light has a self-contained battery, and the impact relay will cause the lights to illuminate when subjected to a deceleration of $2 \pm 1/2$ g's. In an emergency, the light may be removed by pulling on the handle marked PULL HANDLE TO REMOVE LIGHT. The emergency exit lights will also illuminate any time electrical power is removed from the dc essential bus, deenergizing the impact relay. A switch on each light has marked positions ON, OFF, and ARM. Placing the switch in the ON position, turns the light on and checks the light's batteries. With the switch in the ARM position, the light will come on if triggered by an impact or loss of dc essential power. A switch, marked EMER EXIT LTS, with marked positions NORMAL and RESET, located on the cockpit overhead switch panel, provides power to test and arm the lights. Placing the switch to the RESET position will test the lights and reset the impact relay. The switch receives power from the battery bus through a circuit breaker, marked EMER EXIT RESET, located on the battery bus circuit breaker panel.

Cargo Compartment Dome Lights.

The cargo compartment dome lights (figure 4-21) are controlled by a guarded switch, marked DOME LIGHT - CABIN, with marked positions RED, OFF, and WHITE, located on the pilot's compartment dome light panel. The cargo compartment dome lights are equipped with a red and a white lamp. The red light may be turned on any time dc power is available at the dc nonessential bus. The white light may be turned on only if the guard is lifted. The cargo compartment dome lights operate from the dc nonessential bus and are protected by a circuit breaker, marked CABIN DOME LTS, located on the dc nonessential circuit breaker panel (figure 1-39).

Pilot's Compartment Dome Lights.

The pilot's compartment dome lights (figure 4-21) are controlled by a guarded switch, marked

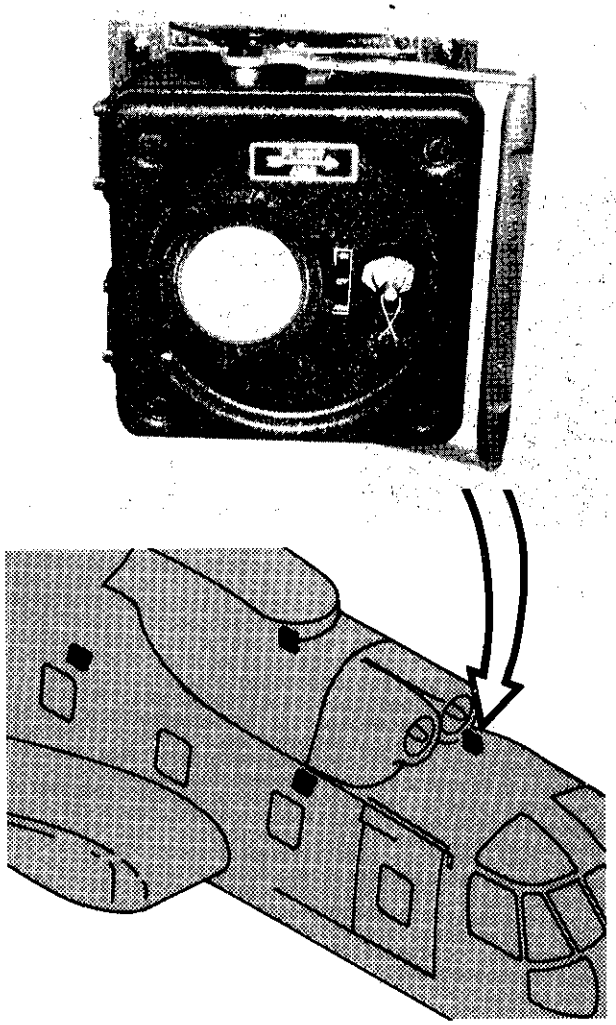


Figure 4-20. Emergency Exit Lights

DOME LIGHTS-CKPT, with marked positions RED, OFF, and WHITE, located on the pilot's compartment dome light panel (figure 4-19). One dome light is red and the other is white. The red light may be turned on at any time the battery switch is turned on, when either generator is running, or when dc external power is plugged in. The red light may also be turned on with the battery switch OFF by adjusting the rheostat marked SECONDARY INST, on the overhead switch panel. The white light may be turned on only if the guard is lifted to permit moving the switch to the WHITE position. The white light in the pilot's compartment dome light operates from the battery bus and is protected by a circuit breaker, marked CKPT DOME SPOT, located on the battery bus circuit breaker panel.

Loading Lights.

Two loading lights (figure 4-21), one in the ceiling of the cargo compartment above the ramp and one in the bottom of the tail pylon, provide illumination for the ramp loading area. The lights are controlled by a two-position switch, marked LOADING LIGHTS, ON, OFF, located on the overhead switch panel (figure 1-13). The loading lights receive power from the dc essential bus and are protected by a circuit breaker, marked LOADING, located on the overhead dc circuit breaker panel.

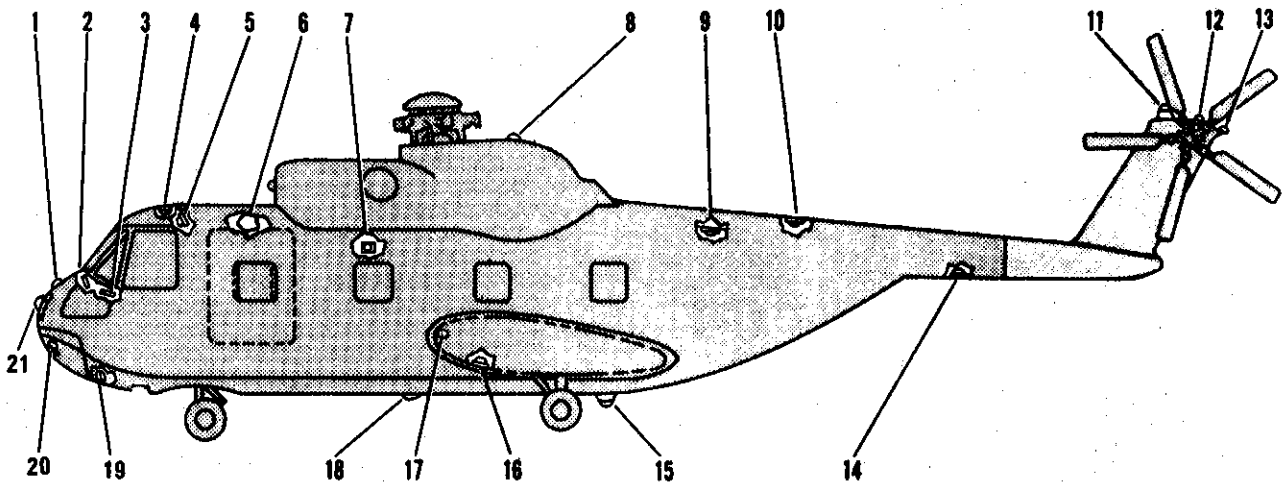
EXTERIOR LIGHTS.

Searchlight.

Helicopters prior to CH-3E 16 are equipped with a searchlight (figure 4-21) mounted on the battery compartment door. Three switches control the swivel type searchlight, one located on each collective pitch grip (figure 1-11), marked SLT TRAIN, and the other on the LIGHT CONTROL panel on the cockpit console. The LIGHT CONTROL switch is marked SEARCH, OFF, and STOW. When the SLT TRAIN switch is placed in the AFT position, the searchlight is extended and may be stopped by releasing the switch to direct the light beam at any vertical angle between the stowed position and full downward extended position. By placing the switch in the FWD position, the light beam may be directed at a progressively decreasing angle until the searchlight is in the stowed position. By placing the switch in the L or R positions the searchlight will rotate to the left or right to any point in a 360-degree arc, but its use is limited by fuselage interference. If the LIGHT CONTROL switch is placed in the STOW position, while the searchlight is extended, the searchlight will automatically go out and retract to the stowed position. The switch is then placed in the OFF position. The searchlight operates from the dc essential bus and is protected by circuit breakers, marked SEARCHLIGHT, PWR, and CONT, located on the overhead dc circuit breaker panel. On helicopters not modified by T.O. 1H-3-642 the vertical (FWD and AFT) control of the searchlight by the SLT TRAIN switch is reversed.

Controllable Spotlight.

CH-3E 16▸ and HH-3E helicopters are equipped with a controllable spotlight mounted on the battery compartment door. The intensity of the



1. ANCHOR LIGHT
2. INSTRUMENT PANEL LIGHTS
3. COCKPIT CONSOLE AND PANEL LIGHTS
4. SPOTLIGHTS AND OVERHEAD SWITCH PANEL LIGHTS
5. PILOT'S COMPARTMENT DOME LIGHTS (WHITE AND RED)
6. RESCUE FLOODLIGHT (CH-3E 16 ▶ AND HH-3E HELICOPTERS)
7. EMERGENCY EXIT LIGHT (4 INSTALLED)
8. FUSELAGE LIGHT
9. CARGO COMPARTMENT DOME LIGHT (WHITE AND RED - 4 INSTALLED)
10. LOADING LIGHT
11. ROTATING ANTI-COLLISION LIGHT (TAIL - RED)
12. ANCHOR LIGHT
13. POSITION LIGHT (TAIL - WHITE)
14. LOADING LIGHT
15. ROTATING ANTI-COLLISION LIGHT (BOTTOM - RED)
16. FLOOD LIGHTS LH AND RH SPONSON
17. POSITION LIGHTS (LEFT SPONSON - RED, RIGHT SPONSON - GREEN)
18. FUSELAGE LIGHT
19. LANDING LIGHT
20. FLOOD LIGHT
21. CONTROLLABLE SPOTLIGHT (CH-3E [illegible] ▶, HH-3E [illegible] ▶ OR HELICOPTERS MODIFIED BY T.O. 1H-3-511)

Figure 4-21. Lighting System (Typical)

controllable spotlight is controlled through a rheostat, marked PROBE LIGHT, located on the pressure refueling panel. The dimming control rheostat has marked positions OFF and MAX. The light intensity may be varied by moving the rheostat away from the OFF position to preclude blinding the air refueling operator. The master power switch, located on the pressure refueling panel must be in the ON position for the dimming circuit to be operative. The same master switch must be in the OFF position if it is desired to use the controllable spotlight as a bright light only. The controllable spotlight uses the same control switches, power sources, and circuit protection as outlined for helicopters prior to CH-3E 16 . When the controllable spotlight is selected for use as a probe light during aerial refueling, the light is powered from the ac essential radio bus through a circuit breaker marked INFLT REFUEL CONT SPOT LT located on the pilot's circuit breaker panel.

Floodlights.

The three floodlights, one located on the right side of the electronics compartment door and one each located on the lower leading edge of each sponson, are controlled by a switch, marked FLOOD and OFF, located on the light control panel on the cockpit console (figures 1-17 and 1-18). When the switch is placed in the FLOOD position, the floodlights illuminate an area forward and below the helicopter. Placing the switch in the OFF position turns off the floodlights. The floodlights operate from the dc nonessential bus and are protected by circuit breakers, marked FLOOD LT, CONT, LH, RH, and NOSE, located on the dc nonessential circuit breaker panel. When helicopters are equipped with a fixed landing gear, the floodlights are mounted on the lower tube of the strut assembly between the fuselage and the main landing gears.

CAUTION

The floodlights should not be left illuminated for more than 15 minutes at a time to prevent overheating.

Rescue Floodlight.

CH-3E [16] and HH-3E helicopters are equipped with an externally mounted 450-watt rescue floodlight to facilitate night rescue operations. The floodlight, attached to the rescue hoist mounting bracket, is manually adjustable in flight by the crewman. The light is controlled by a two-position switch, marked RESCUE LT, with marked positions OFF and ON, located on the overhead switch panel. The rescue light receives power from the dc essential bus and is protected by circuit breakers, marked CONT and LAMP, located on the copilot's overhead circuit breaker panel.

Landing Light.

Two three-position landing light switches control a retractable landing light, located on the bottom left side of the fuselage aft of the electronic compartment door opening. The landing light master switch, located on the LIGHT CONTROL panel with the marked positions STOW, OFF and LANDING, controls the relay which supplies ac electrical power to illuminate the landing light. The landing light control switches, located on the pilot's and copilot's collective pitch lever grips (figure 1-11), marked LDG LT, with marked positions EXT, OFF, and RET, receives electrical power from the LANDING position of the master switch to extend or retract the light. Placing the master switch in the STOW position will retract the landing light and the light will go out. The master switch receives electrical power from the dc nonessential bus through a circuit breaker, marked LDG LT CONT, located on the dc nonessential circuit breaker panel. The relay provides electrical power for the illumination of the landing light from the ac nonessential bus through a circuit breaker, marked LDG LT, located on the ac nonessential circuit breaker panel.

CAUTION

To prevent damage to the light on impact or while taxiing, the landing light control switch should be in the STOW position prior to a water landing.

Position Lights.

The position lights (figure 4-21), located on the sponsons and pylon, are controlled by a switch with marked positions DIM and BRT, located on the overhead switch panel. A three-position switch, marked FLASH, OFF, and STEADY is installed to provide either a steady or flashing operation of the lights. The flasher operates only when the switch is in the FLASH position. These position lights will be partially hidden on those helicopters that are equipped with external auxiliary fuel tanks. However, two additional position lights, one red and one green, are located on the outer edge of the appropriate auxiliary fuel tank pylon. The additional position lights are controlled by the same switches as the normal configuration. The position lights operate from the dc essential bus and are protected by a circuit breaker, marked POS LTS, located on the overhead dc circuit breaker panel (figure 1-39). If the helicopter is provided with a fixed landing gear, the position lights are mounted on the main landing gears.

Fuselage Lights.

Two fuselage lights (figure 4-21) are installed on the helicopter. One light is located on the top rear side of the transmission compartment and the other on the bottom of the hull. Both of the lights are controlled by a three-position switch, marked FUSELAGE, with marked positions DIM, OFF, and BRIGHT, located on the cockpit overhead switch panel. The lights receive power from the dc essential bus and are protected by a circuit breaker, marked FUS, under the general heading EXTERIOR LTS, located on the overhead dc circuit breaker panel.

Anchor Lights.

Two anchor lights (figure 4-21), one located on the nose and the other on the pylon, are controlled by a two-position switch marked ANCHOR, with marked positions ON and OFF, located on the overhead switch panel. The anchor lights receive power from the battery bus and are protected by a circuit breaker, marked ANCHOR, on the battery bus circuit breaker panel.

Anti-Collision (Strobe Light) System.

On aircraft modified by TCTO 1H-3-653 two high intensity strobe lights are installed on the fuselage. One light is mounted/located on the top of the tail

pylon; the other on the bottom of the fuselage. They are controlled by two switches. The left-hand switch, under heading ANTI-COLLISION with marked positions UPPER, BOTH, and LOWER, located on the overhead switch panel, is used to select the desired light position/positions. The right-hand switch, marked with positions WHITE, OFF, and RED, is used to select the color (white for daytime use and red for night use). The anti-collision (strobe) lights operate from the dc essential bus and are protected by one circuit breaker, marked ANTI-COLL FWD, located on the overhead dc circuit breaker panel.

The lights are designed to flash alternately at the rate of 50 to 60 times per minute. Twenty-eight volts dc electrical power for lights is supplied by the essential bus through a power supply unit.

WARNING

- The lower strobe light should be turned OFF during conditions of reduced visibility where the pilot could experience spatial disorientation as a result of reflections.
- Operation of the lower strobe anti-collision light during hover, taxi or cargo sling operation may cause hazardous distraction to ground personnel. The selector switch should be placed in the UPPER position during these operations. Do not look directly at operating strobe light. An eye hazard exists and eye damage may occur.

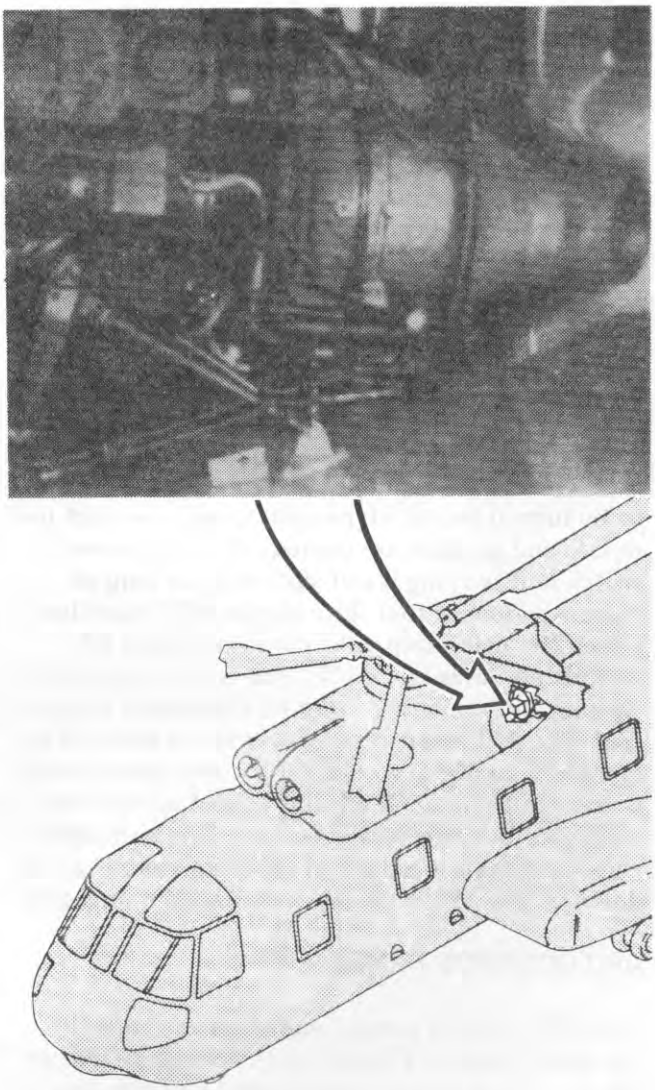


Figure 4-22. Auxiliary Power Unit

AUXILIARY POWER UNIT.

The auxiliary power unit (APU), (figure 4-22), located to the rear of the main gear box, enables ground starting of the engines and ground operation of the electrical and hydraulic systems. The APU system consists of a control panel, an accumulator assembly, a hydraulic motor, a turbine engine, a fuel system, a self-contained oil system, and a mechanical drive. Starting power for the APU is furnished by means of an accumulator system mounted on the transmission deck, left of the oil cooler. In order to provide more stored energy for cold weather starts, provisions for installation of a dual accumulator are incorporated. This consists of the normal single accumulator installation interconnected with an additional piggy back mounted accumulator. The accumulators carry an initial air charge of 1600 psi and are hydraulically charged to 3000 psi by the utility hydraulic system. In addition, the systems have provisions for hand pumping and may be charged in this manner from the transmission platform, or from the cabin interior. During operation of the utility hydraulic pump, the pressure is raised to 3000 psi. When starting circuitry is energized, the start valve is opened and hydraulic pressure from the accumulator is routed into the APU starter. As soon as the turbine reaches operating speed and is

driving the main gear box accessory section, the utility pump pressure recharges the accumulator with 3000 psi pressure. The turbine engine has a self-contained oil system. Electrical power is supplied from the dc essential bus, through a circuit breaker marked APU CONT, located on the dc essential bus circuit breaker panel, to operate the automatic control system and the automatic emergency shutdown operations of the APU. The electrical power may be supplied from the battery or from an external power source. Fuel is supplied from the aft tank. A fuel pressure switch actuates at approximately 110 psi to supply fuel to the combustion chamber through both the start fuel nozzle and main fuel ejectors and allows ignition to be turned on. At 90 percent speed, the start fuel nozzle and ignition are turned off by the speed switch and burning is self-sustaining as long as there is a flow of fuel through the APU main fuel valve. The maximum APU consumption is 83 pounds per hour at −65°F. The APU is capable of starting and operating up to an altitude of 15,000 feet. The APU shaft horsepower varies from 75 hp at −65°F to 55 hp at +125°F. A mechanical drive with an automatic clutch is provided to drive the main gear box accessories section. The automatic clutch contains a freewheel unit that enables shutdown of the APU when the rotor head is engaged.

APU CONTROL PANEL.

The APU control panel, located on the cockpit console (figures 1-17 and 1-18), contains a master switch, a tachometer, prime-pump pressure, low oil pressure, high exhaust temperature and overspeed caution lights, plus the emergency panel. The emergency panel contains a fire warning light and fuel shutoff and fire extinguisher switches. During starts, the hydraulic start valve opens to motorize the engine. The prime pump also comes on for 10 seconds, then automatically goes off.

APU Master Switch.

The APU master switch, with marked positions START, RUN, and OFF, controls the operation of the APU. The switch must be held in the START position as it is spring-loaded to the RUN position. Holding the switch in the START position energizes the components of the automatic starting system and starts the APU. When the switch is released and returns to the RUN position, the APU will run normally to drive the accessory section of the main gear box. The switch is placed in the OFF position to close the main fuel valve and shut down the APU. The APU master switch is energized by 28-volt dc current from the dc essential bus, and is protected by a circuit breaker, marked APU CONT, located on the dc essential bus circuit breaker panel.

NOTE

If battery power is too low to actuate the battery relay to the dc essential bus, the APU cannot be started without an external power source.

Tachometer.

The tachometer indicates the percentage of APU engine rpm. The tachometer receives power from an APU-driven tachometer generator.

Low Oil Pressure Caution Light.

The low oil pressure caution light, marked LOW OIL PRESS, will illuminate whenever the low oil pressure switch has been closed by low oil pressure (6 ± 1 PSI), and the APU will automatically shut down.

High Exhaust Temperature Caution Light.

The high exhaust temperature caution light, marked HIGH EXH TEMP, will illuminate to indicate abnormally high exhaust temperatures, and the APU will automatically shut down.

Prime Pump Pressure Caution Light.

The prime pump fuel pressure caution light, marked PRI-PUMP PRESSURE, illuminates when the APU master switch is placed in the START position. The light is extinguished when fuel pressure from the prime pump reaches 2 psi at the prime fuel pressure switch. After 10 seconds, a thermal relay deenergizes the APU prime pump and disables the prime pump pressure caution light. Illumination of the pri-pump pressure caution light throughout the first 10 seconds of APU operation may indicate a failure of the APU prime pump, or the prime fuel pressure switch. Illumination of the pri-pump pressure caution light for more than 10 seconds indicates a failure of the pressure switch or the caution light electrical system.

Overspeed Caution Light.

The overspeed caution light, marked OVERSPEED, will illuminate if engine speed should reach 110%, to indicate an overspeed condition of the APU, and the APU will automatically shut down.

Emergency Fuel Shutoff Switch.

The emergency fuel shutoff switch, with marked positions FUEL SHUTOFF and NORM, is used to shut the APU down in an emergency. When the switch is in the NORM position, the APU performs normally and the APU fire extinguisher circuit is deenergized. Placing the switch in the FUEL SHUTOFF position closes the main fuel valve and allows the APU fire extinguisher circuit to be energized. The emergency fuel shutoff switch is energized by direct current from the essential bus, through the APU FIRE EXT circuit breaker.

APU Fire Extinguisher Switch.

The APU fire extinguisher switch, with marked positions FIRE EXTING and OFF, discharges the APU fire extinguishing agent to the APU, when placed in the FIRE EXTING position. The switch receives power from the dc essential bus, through the FUEL SHUTOFF position of the APU emergency shutoff switch, through a circuit breaker, marked APU FIRE EXT, located on the overhead dc circuit breaker panel.

APU Fire Warning Light.

A press-to-test APU fire warning light, marked FIRE WARNING, provides an indication of fire in the APU. The light receives electrical power from the dc essential bus through the APU fire detection system, through a circuit breaker, marked APU FIRE DET, located on the dc essential circuit breaker panel.

APU Advisory Light.

The light on the advisory panel, marked APU ON, comes on whenever the main fuel valve opens and will stay on until the APU is shut down.

APU HAND PUMP AND ACCUMULATOR GAGE.

The hand pump and gage are located in the cargo compartment forward of the last window on the right-hand side. The hand pump (figure 4-23) is used during starting of the turbine, if the 3000 psi pressure from the accumulator is not sufficient. At −54°C a pressure of approximately 4000 psi is required to start the turbine. A visual indication of pressure can be observed on the hand pump gage during pumping operations. The hand pump gage is marked in 1000 psi increments up to 5000 psi. The accumulator can withstand pressures up to 7500 psi.

NOTE

When necessary to recharge due to complete loss of air charge, actuate the APU master switch to prevent hydraulic lock on accumulator piston.

APU STARTING PROCEDURE.

For APU starting procedure, refer to BEFORE STARTING ENGINES, Section II.

APU EMERGENCY STARTING PROCEDURE.

Should the normal starting procedure fail and the pressure in the accumulator becomes depleted, a manual hydraulic pumping system can be used to replenish pressure in the accumulator. The system consists of a manual hydraulic pump, a pump handle, and a pressure gage on the pump. The pressure gage can be observed during pumping operations. The pump handle is located either on the right side of the transmission deck or the right side of the cargo compartment. It will be noted at −53.9°C, a pressure of approximately 4000 psi is required to start the APU turbine engine. The use of a manual hydraulic pumping system can bring the pressure in the accumulator up to approximately 4000 psi.

CARGO COMPARTMENT.

The cargo compartment (figure 4-24), located from station 137.0 to station 379.5, is capable of carrying cargo, personnel, litters, and wheeled vehicles. The impact and wear-resistant compartment floor has a positive non-skid surface for personnel footing, and skid strips to facilitate the movement of cargo and provide floor protection. The cargo compartment floor is divided into six sections and is capable of sustaining distributed static loads of 200 pounds per square foot. Refer to the Cargo

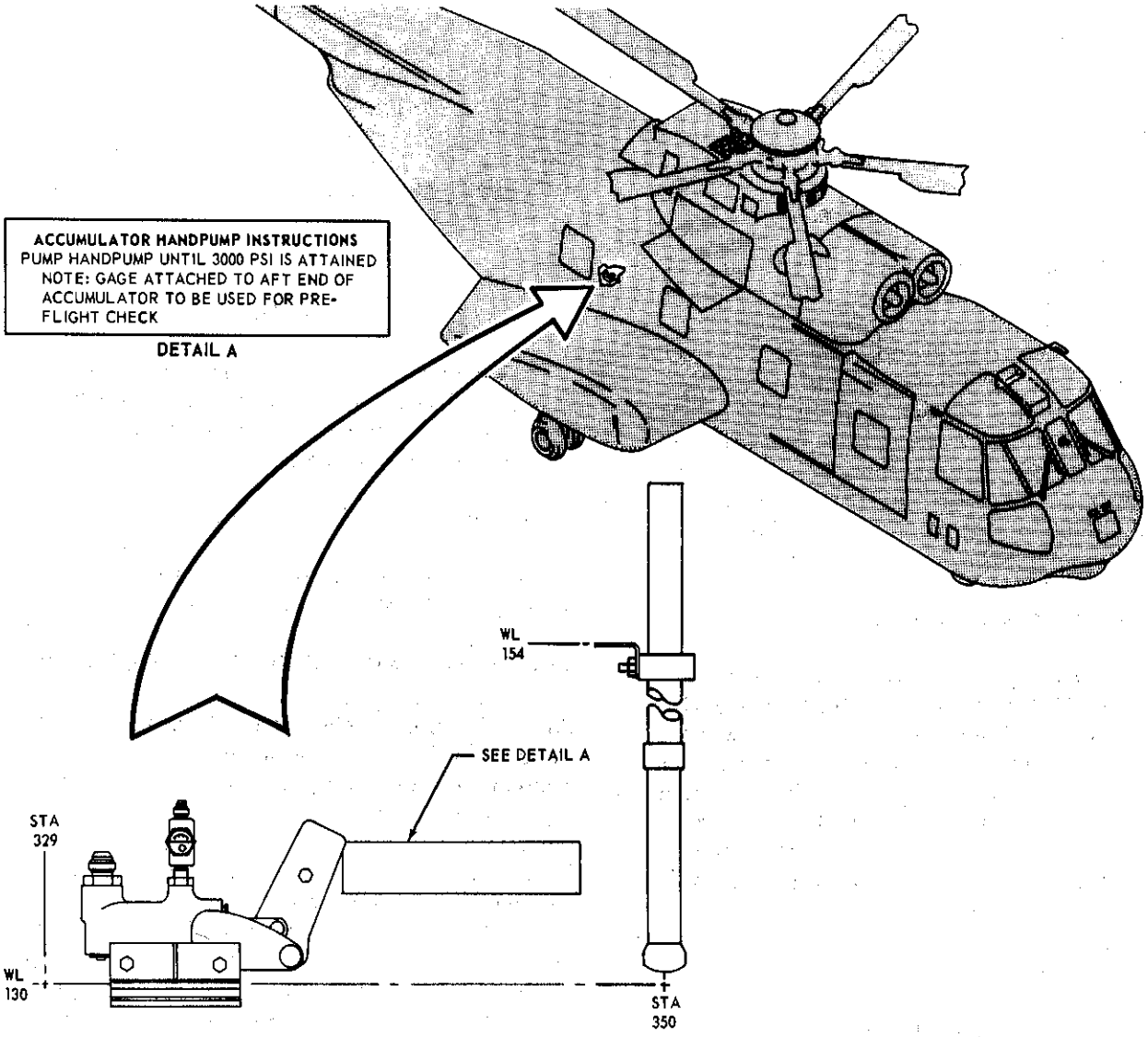


Figure 4-23. APU Accumulator Hand Pump

Loading Manual, T.O. 1H-3(C)C-9, for cargo loading instructions to distribute static loads. Tiedown fittings, rated at 2500 pounds, are installed on the cargo floor to facilitate cargo tiedown, and are provided with fittings that serve as troop-seat and litter attachment points. The cargo compartment also contains a personnel door and ramp, both of which may be used for loading personnel and cargo. When both personnel and cargo are carried in the cargo compartment, personnel are normally seated aft of the cargo. An ac electrically operated winch, normally stowed in the forward left-hand side of the cargo compartment, is provided for internal cargo handling and cargo hoist and rescue operations. Some helicopters have the soundproofing removed and armor protection added on the aft right side of the personnel door to protect the crewman during hoist operations. In addition, stowage is provided on the left side of the cargo compartment for the crew chest protectors, and an adapter is installed in lieu of the cargo compartment heater for ventilation. The electrical rescue davit, including the power reel, is removed from the helicopter and is replaced by a 600-pound

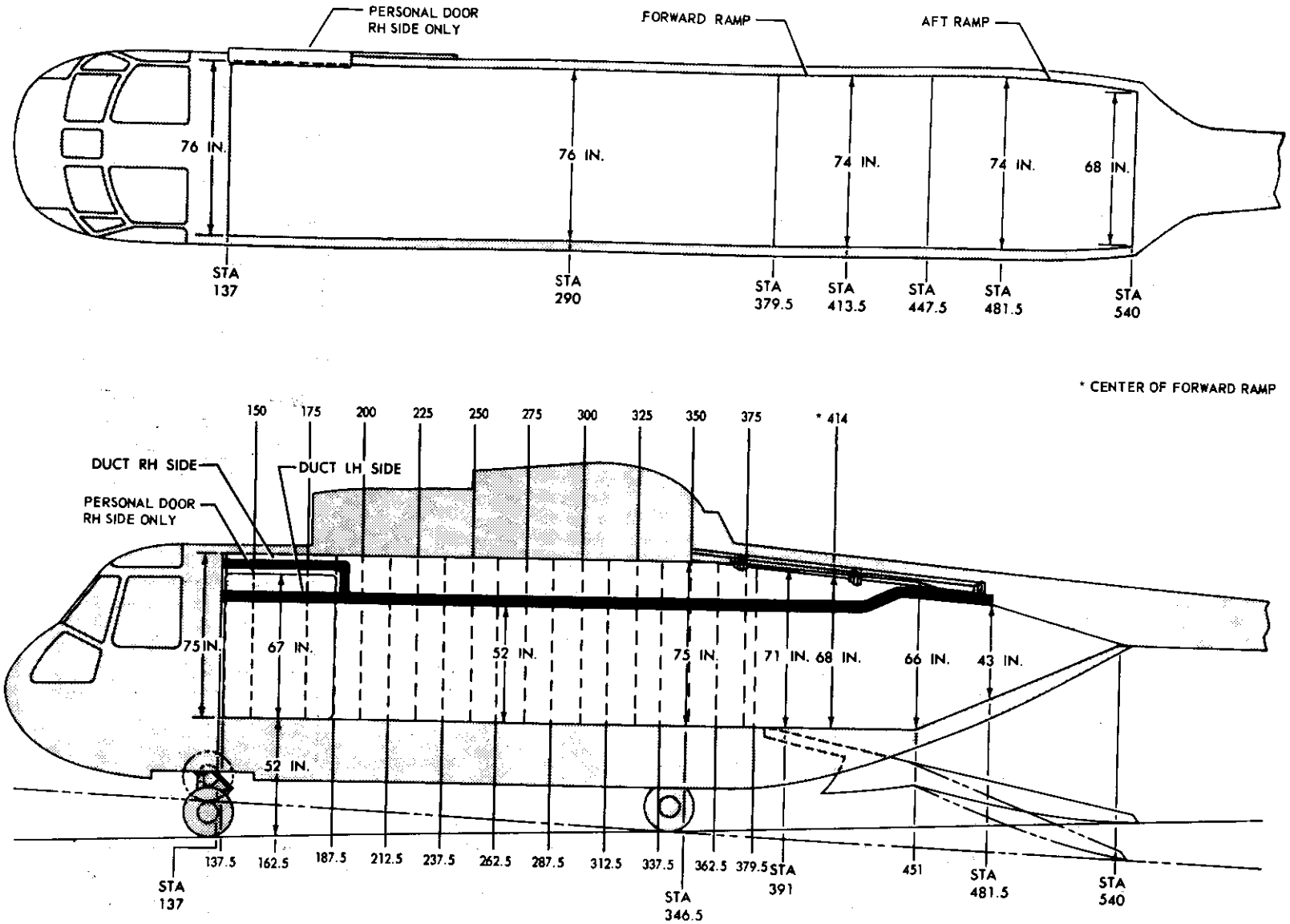


Figure 4-24. Cargo Compartment and Cargo Loading Stations (Sheet 1 of 2)

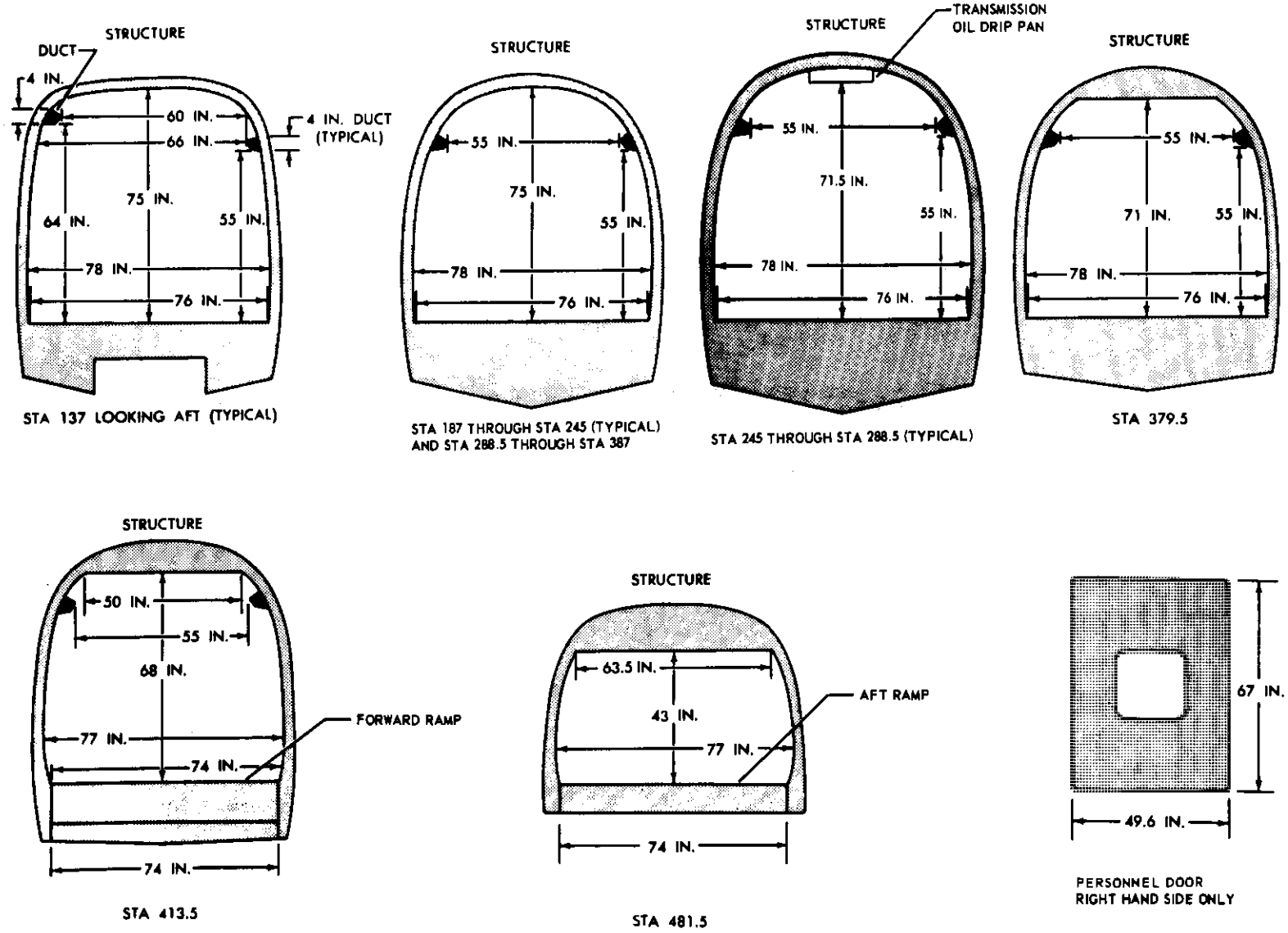


Figure 4-24. Cargo Compartment and Cargo Loading Stations (Sheet 2 of 2)

capacity hydraulic rescue hoist which is permanently externally mounted above the personnel door. On those helicopters equipped with armament configuration, a jettisonable window and release mechanism, four chest protectors, three M60 machine guns, forward and aft gun mounts, aft gun platform, ammunition containers, and rings and supports are installed. When loading the helicopter, refer to Section V for center of gravity and weight limitations and T.O. 1-B-40, Handbook of Weight and Balance Data.

WARNING

When soundproofing is removed, cargo compartment passengers should wear helmets or ear plugs to avoid possible ear damage due to the noise level.

CARGO LOADING STATIONS.

The cargo compartment is divided into marked cg stations, at 25-inch intervals, between stations 150 and 375. Cargo loading scales corresponding to these marked stations are provided on the load adjuster. The cg loading stations are marked at eye level for easy locating. The cargo compartment may also be subdivided into unmarked 25-inch interval loading areas from fuselage station 137 to 451 as indicated on load adjuster. Cargo should be loaded between these stations so that the cargo cg falls on the respective cg stations.

CARGO FLOOR.

The cargo floor, made up of one-inch thick honeycomb floor panels, is supported by transverse bulkheads and beams. The cargo floor is approximately 310.5 inches long and 76 inches wide. The last 68 inches of the floor form the horizontal ramp floor which can be lowered and raised to facilitate cargo and/or troop loading and unloading. The floor has a positive non-skid surface. Three rows of low friction longitudinal skid strips are installed on top of the cargo floor to provide floor protection and facilitate cargo handling. The cargo floor is removable in the areas above the fuel tanks and is sealed to prevent water, dust, and dirt filtering into the area beneath the floor line. The cargo floor area is designed to support, during flight and/or during loading, a maximum load of 200 pounds per square foot; however, higher weights may be carried if shoring is used to distribute the weight over a larger area.

TIEDOWN FITTINGS.

The two types of tiedown fittings (figure 4-25) used are the fitting for the standard type of cargo restraint, and the combination cargo restraint and lug for troop seat and litter floor attachments. The recessed tiedown fittings (figure 4-26) have 2500-pound restraint capability. The 2500-pound tiedown fittings are used to secure cargo, litter support straps, troop seat legs, and the crewman's safety harness. There are three 5000 pound tiedowns, one located near the personnel door and two located either side of the tail end of the aft ramp. The 5000 pound tiedown fitting near the personnel door is used for cargo loading through the ramp or as a dead-man when winching cargo out of the compartment.

TIEDOWN DEVICES.

Various types of tiedown devices may be used for securing cargo. One type is a turnbuckle arrangement for tightening the tiedown chains, another is a webbed type strap with hooks for attaching to tiedown fittings. Nets and strong rope may also be used.

RAMP SYSTEM.

The ramp system is divided into two sections, the forward ramp which is horizontal with the cargo compartment floor in the closed position, and the aft ramp which conforms to the contour of the fuselage in the closed position. The aft ramp is hinged to the forward ramp and opens outward and downward. The clearance between the ramp, in the open position, and the fuselage structure may be increased by KNEELING the helicopter. The ramp surface has transverse non-skid material installed for personnel footing and for loading vehicular cargo. Fittings rated at 2500 pounds are installed to secure light cargo carried on the forward ramp. There are no cargo tiedown fittings on the aft ramp floor. Two tiedown fittings rated at 5000 pounds each are used to suspend the ramp or for pulley block attachments when winching cargo through the ramp. The ramp system (figure 4-27) is electrically controlled and hydraulically actuated

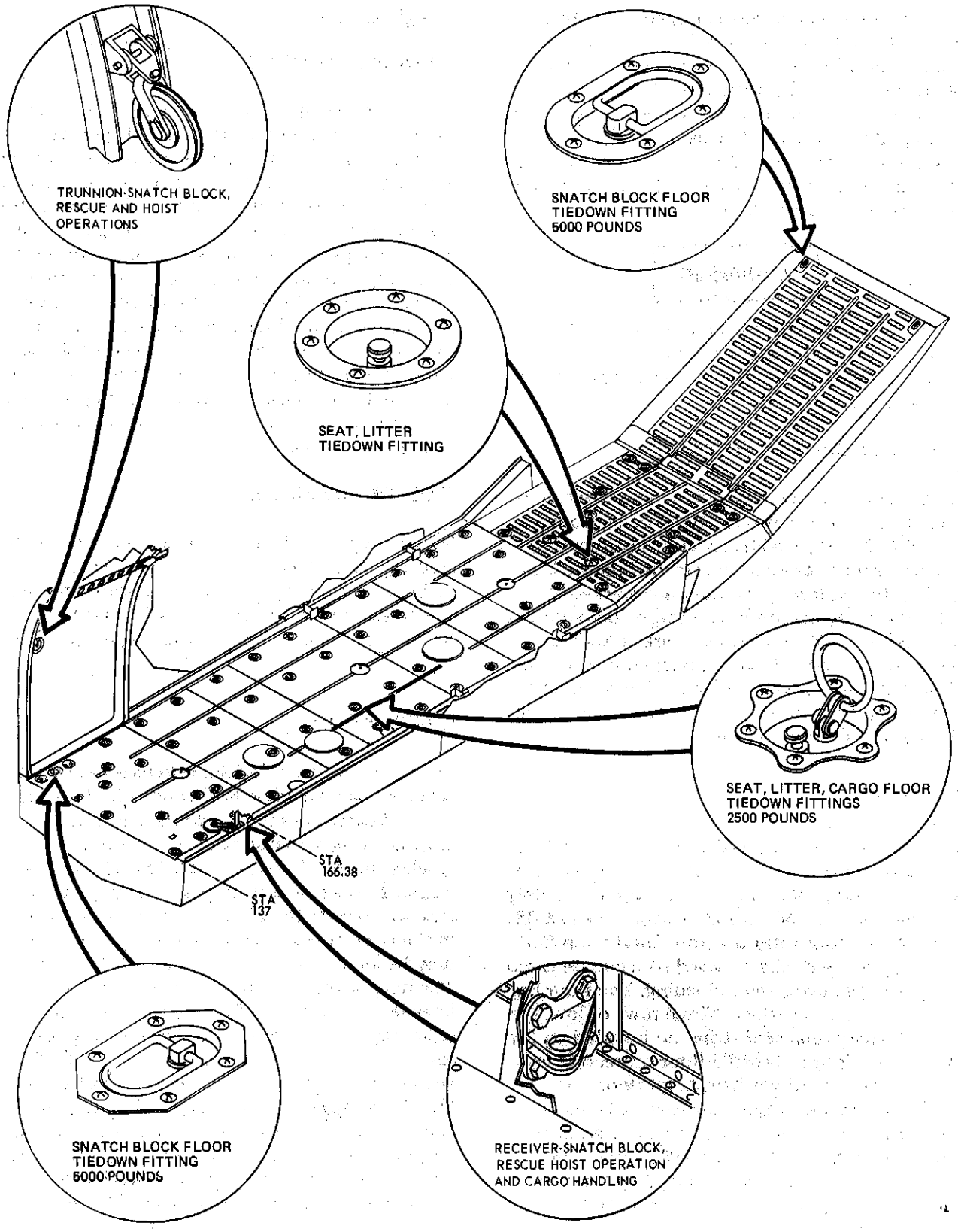


Figure 4-25. Tiedown Fittings

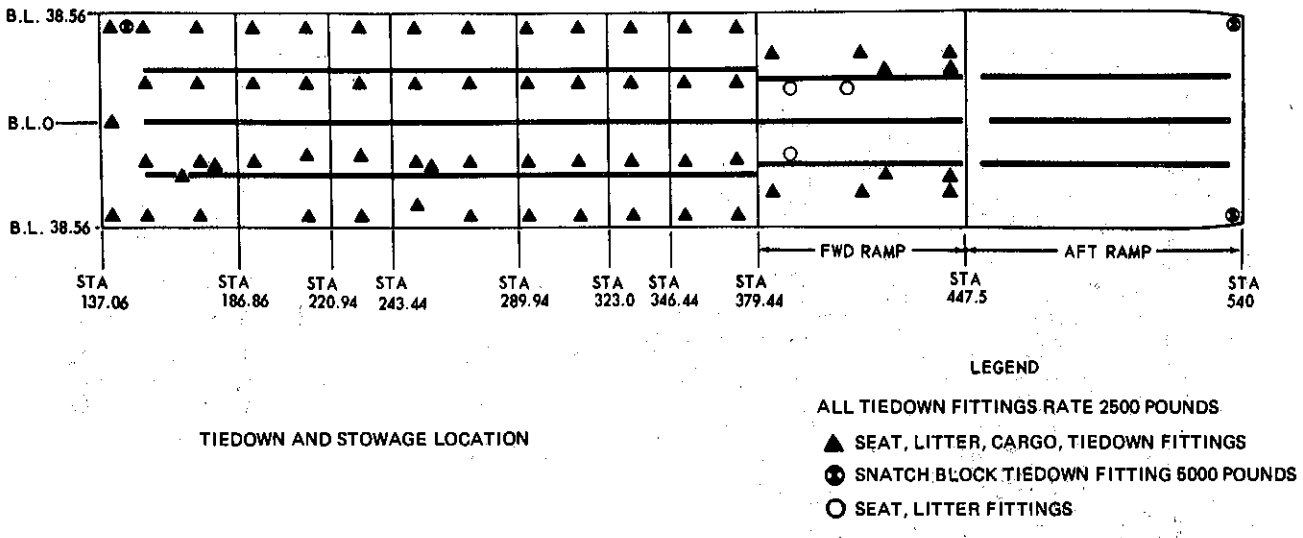


Figure 4-26. Location of Tiedown Fittings

by hydraulic pressure from the utility hydraulic system. The auxiliary power unit is the normal source of power for operation of the ramp. The ramp may be lowered manually when hydraulic or electrical power is not available. The aft ramp may be opened in the air, on the ground, or on the water. The forward ramp can be opened beyond the horizontal position only when the weight of the helicopter is on the helicopter's wheels and the aft ramp is unlocked. The ramp system controls consist of a pilot's ramp master switch, a pilot's ramp control panel, a crewmember's ramp control panel, and a manual uplock release. When actuated, electrical switches on the ramp control panels energize hydraulic solenoid valves which direct hydraulic pressure to the up or down sides of the ramp actuating cylinders.

WARNING

The aft ramp cables must be attached and the forward ramp locked for all flights. If the ramp should extend beyond the horizontal position in flight, the helicopter may assume an extreme nosedown attitude.

CAUTION

Personnel should refrain from standing on the aft ramp, without cables attached, to avoid damage to the ramp hydraulic system. To avoid damaging the aft ramp, no cargo exceeding 50 pounds should rest on the aft ramp without the aft ramp cables installed.

Aft Ramp.

An aft ramp, approximately six feet in length, at the end of the cargo compartment, is used for the loading and unloading of cargo and personnel. The aft ramp is locked in the closed position by two uplock cylinders. The uplock cylinders are mechanically latched and hydraulically released. Two safety cables are to be attached to the aft ramp whenever flight is made, regardless of whether the aft ramp is open or closed. The cables are attached to the fuselage structure and are stowed above the aft ramp along the left and right-hand cargo compartment side panels. A light, marked RAMP, on the pilot's caution panel will illuminate when the aft ramp is not up or not locked. The light receives electrical power from the dc essential bus through

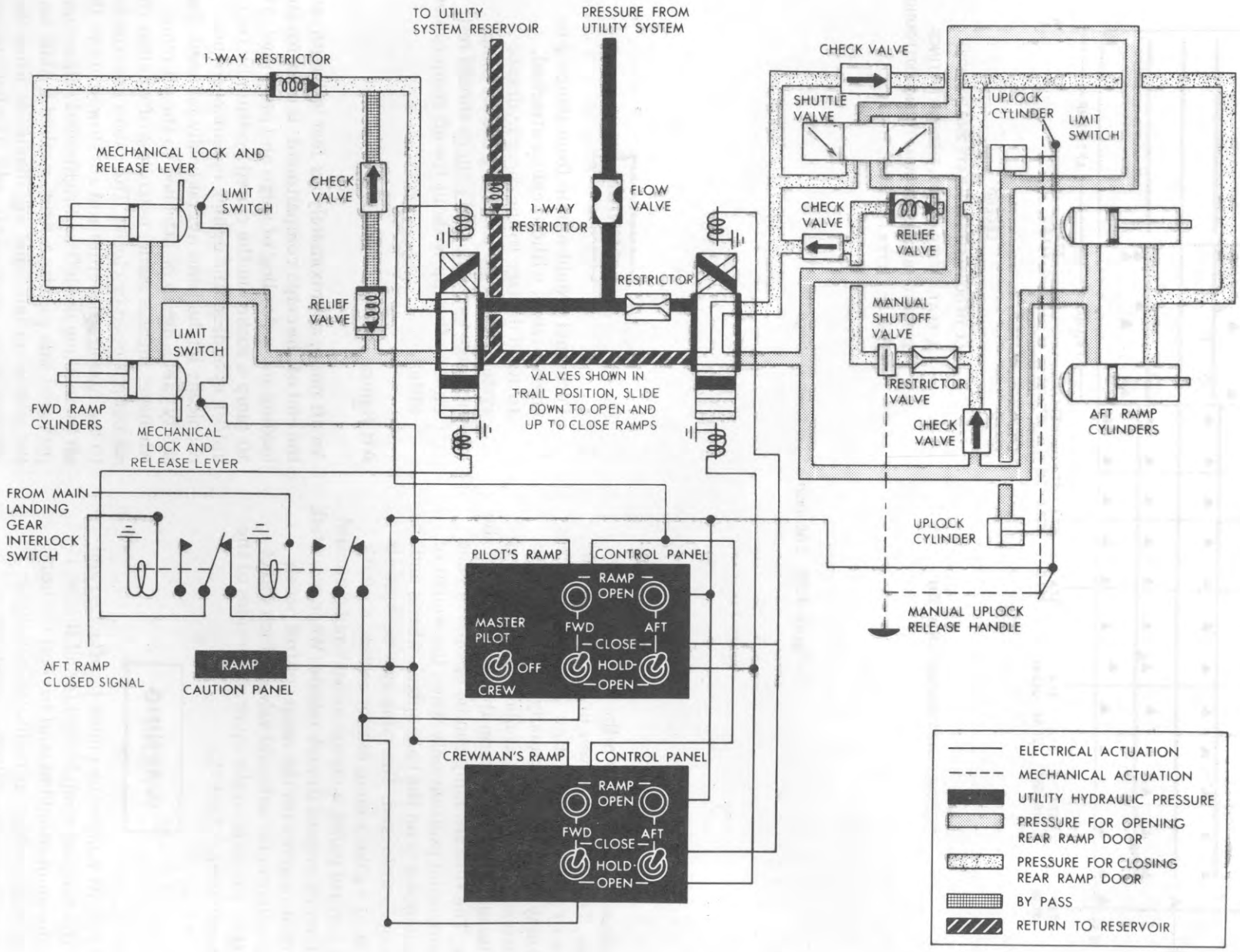


Figure 4-27. Ramp Actuating System

a circuit breaker, under the general heading INDICATOR LTS and marked RAMP, located on the overhead dc circuit breaker panel. The aft ramp will tend to float upward at speeds above 70 knots and will assume a partially closed position. On those helicopters which have the armament configuration, two tracks are installed on the aft ramp.

NOTE

The aft ramp may be opened and closed in flight and during climbs and descents at forward speeds no greater than 115 knots.

Forward Ramp.

The forward ramp, approximately five feet eight inches in length, may be lowered with the aft ramp to make an inclined entrance to the cargo compartment. The forward ramp contains tiedown fittings for cargo tiedown, troop seats, skid strips, and a nonskid material surface for traction. The forward ramp is lowered in sequence, after the aft ramp is lowered, and raised before the aft ramp is raised. The forward ramp is locked in the closed position by mechanically latched uplocks incorporated in the forward ramp actuating cylinders. The forward ramp is released by hydraulic pressure.

Pilot's Ramp Master Switch.

The ramp master switch, located on the pilot's ramp control panel, marked MASTER has marked positions, PILOT, OFF, and CREW. Placing the master switch in the PILOT position transfers electrical power to the switches on the pilot's ramp control panel. Placing the master switch in the CREW position transfers electrical power to the switches on the crewmember's ramp control panel. The master switch receives electrical power from the dc essential bus, through a circuit breaker, marked RAMP, located on the overhead dc circuit breaker panel.

Pilot's and Crewmember's Ramp Control Panels.

A pilot's ramp control panel is located on the cockpit console (figures 1-17 and 1-18). On some helicopters, the pilot's ramp control panel is located on the pilot's console to the right of the pilot's seat. The crewmember's RAMP CONTROL panel is located on the right-hand cargo compartment side panel above the ramp. The ramp control panels (figure 4-28) consist of a forward ramp switch, aft ramp switch, forward and aft RAMP OPEN warning lights, and a CABLE caution light. The aft ramp switch, marked AFT, with marked positions CLOSE, HOLD, and OPEN, controls the operation of the aft ramp. The RAMP OPEN caution light, marked AFT, will illuminate when the aft ramp is not up and locked. The forward ramp switch, marked FWD, with marked positions CLOSE and OPEN, controls the operation of the forward ramp. Extra long cargo may be extended over the aft ramp door with the aft ramp open (horizontal) in flight, but should be loaded in such a way that cargo does not come in contact with the aft ramp. Due to interlocks in the forward ramp control circuit, the forward ramp cannot be opened until the aft ramp is unlocked and the weight of the helicopter is on the helicopter's wheels. The RAMP OPEN caution light, marked FWD, will illuminate when the forward ramp is not up and locked.

NOTE

The CABLE caution light on the ramp control panel is inoperative.

Aft Ramp Uplock Release Levers.

There are two manual uplock release levers (figure 4-29). One lever is located on the right-hand side of the cargo compartment above the ramp. The other, the handle type, is located externally under the right hand side of the tail pylon, aft of the ramp, in an oblong metal container with a hinged cover marked RAMP EXIT RELEASE HANDLE INSIDE. Both controls are connected by a cable to provide a mechanical release of the aft ramp uplocks when electrical or hydraulic power is not available. When actuated, the uplocks are released and the ramp will lower under its own weight. Snubbing action during the ramp opening is provided by fluid trapped in the ramp actuating system hydraulic lines.

Forward Ramp Uplock Release Levers.

A manual release lever for the forward ramp actuating cylinder uplocks is installed on the top side of each forward ramp actuating cylinder. The manual releases provide the means of unlocking the forward ramp when electrical or hydraulic power

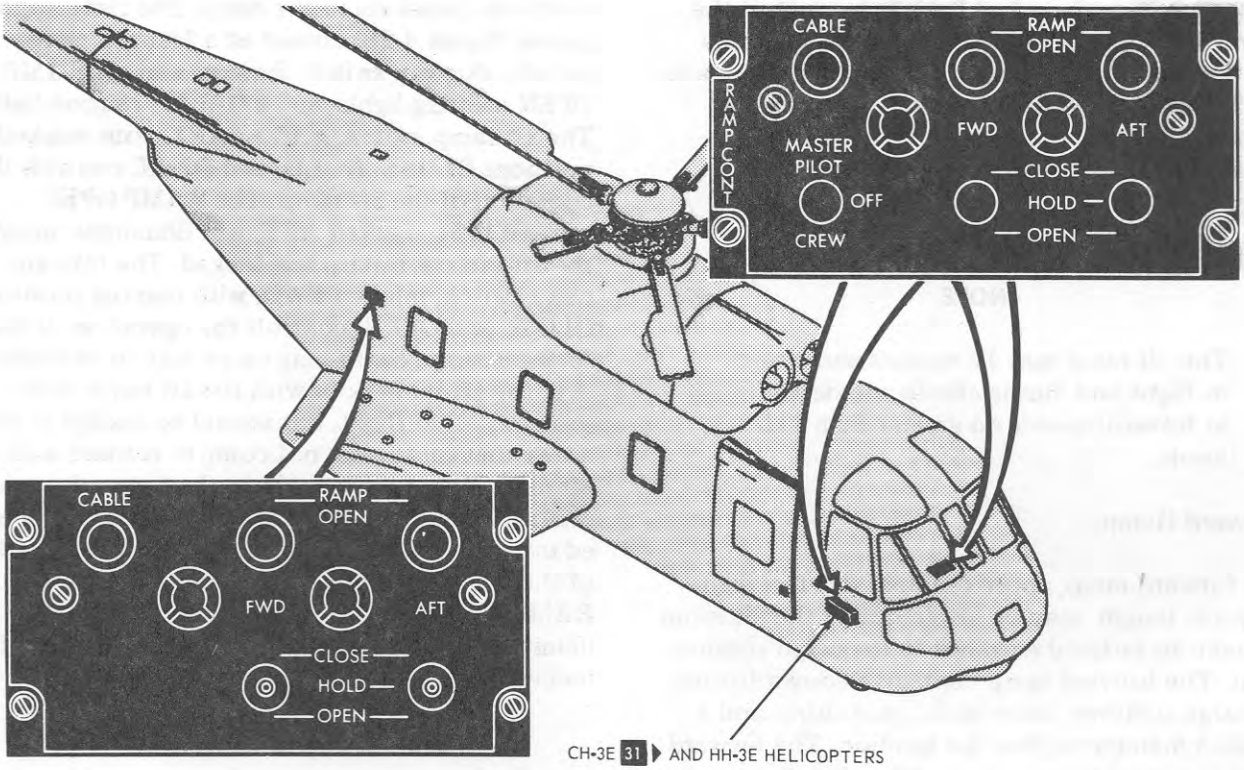


Figure 4-28. Ramp Control Panels (Typical)

is not available. The ramp will then lower under its own weight. The rate of ramp lowering is controlled by a restrictor.

Normal Operation.

To lower the ramp, proceed as follows:

1. APU — 100%.

CAUTION

Before lowering ramp, make sure that the area under the ramp is clear of personnel and equipment and the ground under the ramp is of equal load-carrying ability, to avoid twisting the ramp when heavy loads are applied. Make sure the ground is free of rocks, stumps, etc., to avoid damaging aft ramp outer skin.

NOTE

Before lowering the ramp, check that troop seats and cargo tiedown devices are disconnected from the forward ramp.

2. Ramp master switch — PILOT OR CREW.
3. AFT ramp switch — OPEN (RAMP caution light — ON, AFT RAMP OPEN WARNING light — ON).
4. FWD ramp switch — OPEN (FWD RAMP OPEN WARNING light — ON).

To raise the cargo ramp, proceed as follows:

1. APU — 100%.
2. Ramp master switch — PILOT or CREW.

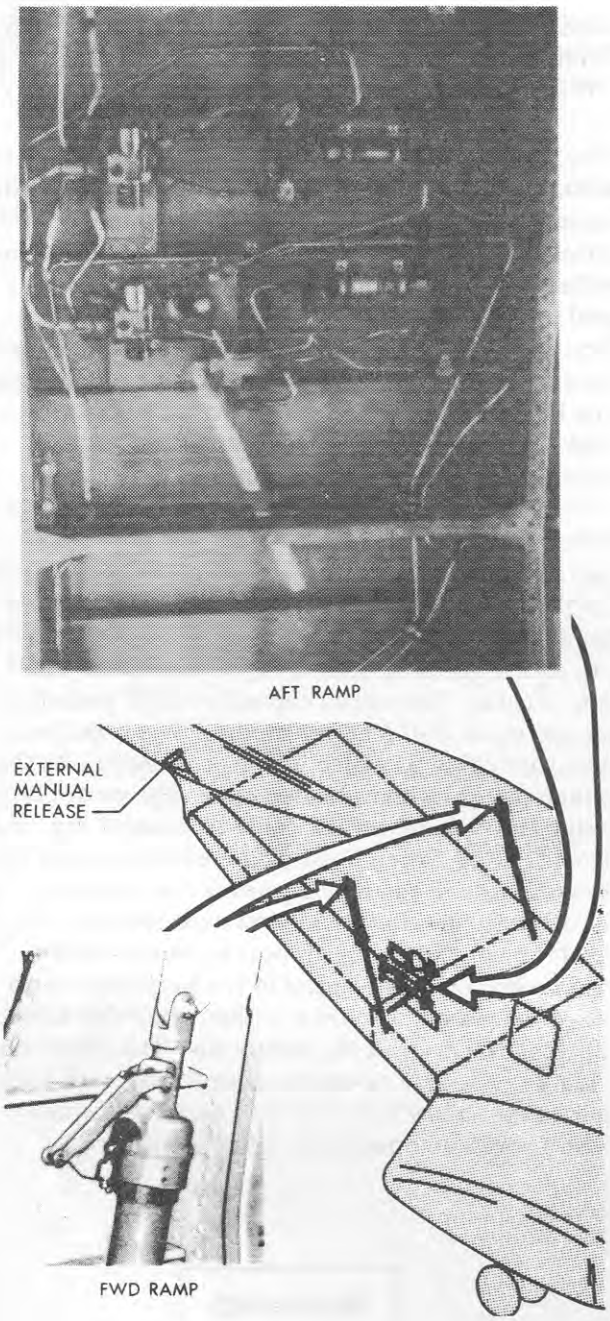


Figure 4-29. Ramp Uplock Release Levers

3. FWD ramp switch — CLOSE (FWD RAMP OPEN WARNING light — OUT).

4. FWD ramp switch — HOLD.

5. AFT ramp switch — CLOSE (AFT RAMP OPEN warning light — OUT).

6. AFT ramp switch — HOLD.

Manual Operation.

To lower the ramp, manually, proceed as follows:

1. Aft ramp uplock release levers — PULL.

2. From outside, external manual release — PULL.

3. Forward ramp uplock release levers — PULL.

NOTE

The aft ramp may be raised manually.

PERSONNEL DOOR.

A door is installed in the forward section of the cargo compartment, on the right-hand side of the fuselage. The door provides a means for loading personnel or cargo while on the ground or while hovering. The door, approximately 5.5 feet high and 4 feet wide, rides on tracks mounted above and below the door on the outside of the fuselage. A positive acting latch is installed in the door to prevent inadvertent opening in flight. The latch allows the door to be held open in three different positions. The door may be opened from inside the compartment or from the outside, while on the ground, by turning the latch handle and sliding the door aft. In the event of an emergency, the door may be jettisoned by pulling down on the release handle located at the top of the door and pushing the door outward. A personnel ladder, normally stowed on the left side of the cargo compartment aft of the electronics rack, is installed in the sill of the door to permit entry of personnel. Some helicopters are equipped with a one piece improved ladder that is stowed in the provisions provided on the left-hand cabin wall above the aft ramp. The personnel ladder should be removed and stowed prior to taxi so as not to interfere with rapid emergency egress. The hoist boom may be installed at the door for cargo loading or rescue operations. The door cannot be closed with the boom installed in the hoist position. A light, marked CARGO

DOOR, on the pilot's caution light panel, will illuminate any time the door is not closed and latched. The light receives electrical power from the dc essential bus, through a circuit breaker marked PWR, under the general heading, INDICATING LIGHTS, located on the overhead dc circuit breaker panel.

CAUTION

When opening or closing the door during flight, avoid catching the emergency release on the fuselage and jettisoning the door.

WINCH INSTALLATION.

A variable speed winch with a 2000-pound capacity is provided for cargo loading. On those helicopters not equipped with an externally mounted rescue hoist, the winch is also used for rescue operations. The winch components are a motor-driven winch containing 150 feet of cable, a winch control box, electrical power cable, electrical control panel and cable, and a removable supporting mount. An automatic clutch is built into the winch to prevent overloading. The clutch is designed to slip when the cable tension exceeds 2000 pounds. If the clutch slips during loading, operation of the winch should be discontinued immediately and the load should be reduced to avoid damage to the winch. The winch is secured to the compartment floor below the electronics closet in the forward left-hand section of the cargo compartment. The auxiliary power unit is the normal source of electrical power for operation of the cargo winch so that cargo may be handled without the engines operating. The winch pendant power cable may be plugged into either the cargo loading receptacle or the hoist receptacle. The winch may be operated by the pilot, from the cockpit, or by the crewmember, from the cargo compartment. On some helicopters, the pilot has no controls for operating the winch.

CAUTION

To prevent damage to winch, do not operate continuously for more than 5 complete duty cycles (both in and out). Duty cycles may be repeated after 45 minutes cooling period.

RESCUE HOIST OPERATION (HELICOPTERS PRIOR TO CH-3E 16 NOT MODIFIED BY T.O. 1H-3(C)C-561).

The single winch that is used for cargo handling in a stationary position is also used in the rescue hoist operation (figure 4-30). The winch cable is reeled through two snatch blocks and a snatch block and extension arm assembly, then through the power reel unit outside the personnel door. The cable is first reeved through the snatch block and arm extension assembly which is secured to a receiver on the left-hand cargo compartment wall at station 166. The cable is then reeved through a snatch block on the center of the cargo floor at station 141.5. The cable is then reeved through a snatch block secured to a fitting on the personnel door jam. The cable then travels through the power reel unit which is mounted on a truss support that extends out of the personnel door. All snatch blocks are of the quick disconnect type to expedite reeling of cable. The rescue capacity is 600 pounds at speeds up to 100 feet per minute. The hoist has a 150-foot cable of which 135 feet is usable. As the winch pays out an unloaded cable, the power reel maintains tension on the cable to prevent the cable from fouling. When hoisting a load, the power reel freewheels and the winch powers the cable in. Limit switches are provided at extreme ends of cable travel. The truss support is removable and can be installed and rigged in the helicopter with the door closed. The truss is then extended after opening the door at the rescue site. The crewman aiding in a rescue operation is provided with a gunner's type safety belt. The maximum allowable load for rescue operations is 600 pounds.

WARNING

- Loose objects can become entangled between the hoist cable and floor pulleys. Extreme care should be exercised to avoid the pendant wire, seat belts, clothing and loose objects from becoming entangled during hoist operation.

- The rescue mode of the winch is limited to use in actual emergency rescue or for training purposes using a dummy.

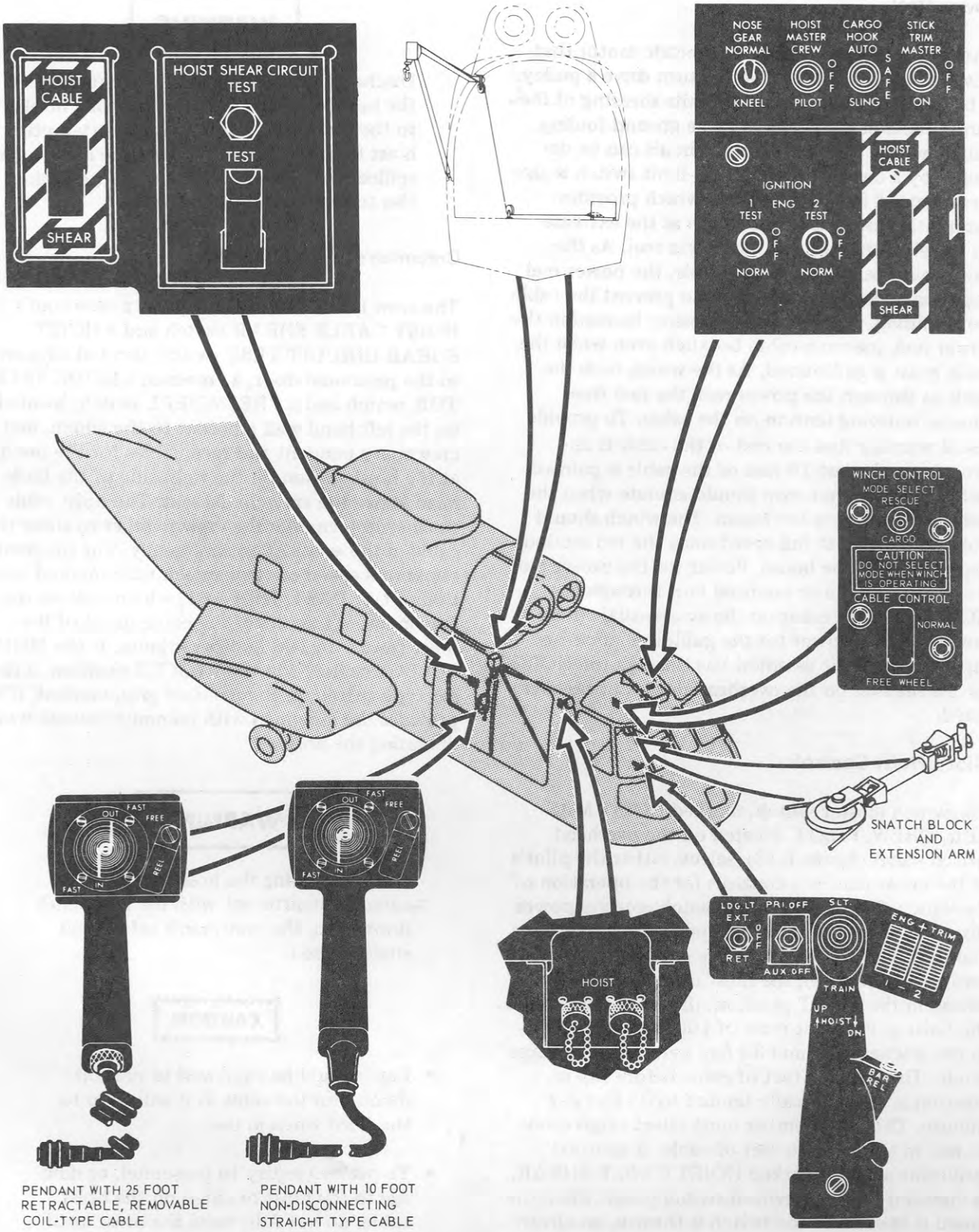


Figure 4-30. Hoist Controls (Typical) (CH-3E Helicopters Prior to 16 ▸ Not Modified to T.O. 1H-3(C)C-561)

Power Reel.

The power reel is basically an electric motor that drives a series of gears which in turn drive a pulley. A built-in guillotine circuit permits shearing of the winch cable in the event of cable ground fouling. Faulty wiring in the guillotine circuit can be detected by a circuit tester. An up-limit switch is also incorporated in the power reel which provides automatic stopping of the winch at the extreme up travel of the cable at the power reel. As the winch pays out an unloaded cable, the power reel maintains tension on the cable to prevent the cable from fouling. A backlash suppressor, located in the power reel, prevents cable backlash even when the cable hoist is guillotined. As the winch reels the cable in through the power reel, the reel freewheels, relieving tension on the cable. To provide visual warning that the end of the cable is approaching, the last 15 feet of the cable is painted red. The downlimit stop should actuate when the red section reaches the boom. The winch should not be operated at full speed once the red section appears below the boom. Power for the power reel is supplied by the ac essential bus, through the HOIST circuit breaker on the ac essential circuit breaker panel. Power for the guillotine circuit is supplied by the dc essential bus through the HOIST circuit breaker on the overhead dc circuit breaker panel.

WARNING

SEE 1S-164

Pilot's Hoist Controls.

The winch master switch, marked HOIST MASTER, CREW, PILOT, located on the overhead switch panel (figure 1-13), selects either the pilot's or the crewmember's controls for the operation of the winch. The hoist master switch receives power from the dc essential bus through a circuit breaker marked HOIST, located on the overhead circuit breaker panel. When the hoist master switch is placed in the PILOT position, the pilot can operate the hoist at constant rates of 100 feet per minute in the rescue mode and 33 feet per minute in cargo mode. The last two feet of cable before full retraction is automatically limited to 33 feet per minute. The crewmember must select cargo mode to reel in the last two feet of cable. A guarded guillotine switch, marked HOIST CABLE SHEAR, is installed on the overhead switch panel. When the guard is raised and the switch is thrown, an electrically actuated charge in the guillotine, located in the power reel, will fire and cut the winch cable.

WARNING

Discharge static electricity generated by the helicopter by touching the hoist hook to the ground or water, prior to attempting hoist hookup. Do not ground the hook near spilled fuel from damaged aircraft or vehicles to prevent fuel ignition.

Crewman's Hoist Controls.

The crew hoist controls consist of a crewman's HOIST CABLE SHEAR switch and a HOIST SHEAR CIRCUIT TEST switch, located adjacent to the personnel door, a crewman's MODE SELECTOR switch and a FREEWHEEL switch, located on the left-hand wall adjacent to the winch, and a crewman's pendant and receptacles for the pendant at the hoist station on the right side of the bulkhead above the crewchief's seat. The hoist cable shear switch enables the crewmember to shear the cable in the event of an emergency. The pendant contains a speed control switch with marked positions OUT, FAST, IN, FAST, which enables the crewmember to control the cable speed of the hoist from 0 to 100 feet per minute. If the MODE SELECT switch is in the RESCUE position, a trigger type switch on the pendant grip, marked, ICS, provides the crewman with communications while operating the hoist.

WARNING

When operating the hoist from the cargo compartment with the personnel door open, the crewman's safety belt shall be used.

CAUTION

- Care should be exercised to prevent damage to the cable as it will drop to the floor when in use.
- To prevent injury to personnel, or damage to the hoist or cargo on the hoist cable, do not fully raise the hoist until oscillations of the hoist cable have stopped.

Portable Pendant.

The portable pendant is basically a portable speed control switch which allows for remote control operation of the winch. The pendant contains a thumb-operated speed control switch for variable winching speeds. The switch is marked FAST, OUT, IN, and FAST. A guarded thumb slide switch, marked REEL, with two marked positions, FREE and LOCK, is located to the right of the speed control switch. The reel slide switch, when the pendant is connected at the aft pendant receptacle, allows the operator to freewheel the cable so a crewman can walk the cable out to the cargo. The pendant may be installed in either of two receptacles on the right side, one aft, marked WINCH, and one forward of the personnel door, marked HOIST CONT. The pendant may have either a 10-foot straight cable, or a 25-foot coil cable. The 10-foot cable is integrally connected to the pendant while the 25-foot cable is connected with a screw type fitting. Either cable fits the receptacles for hoist winch on the cargo compartment wall. When not being used, the pendant is stowed on a bracket forward of the personnel door.

CAUTION

The 10-foot cable will drop to the floor when in use. Care should be exercised to prevent damage to the cable from cargo, pallets, or skids being winched.

Rescue Hoist Cable Shear Switches and Circuit Test Panel

Pilot's Hoist Cable Switch

The pilot's hoist cable shear switch, marked hoist cable shear, is located on the overhead control panel (figure 4-32). The guarded switch has a marked position off which is the normal switch position with the guard closed. When the guard is raised and the switch is moved to the shear position, an electrically activated charge in the guillotine will fire and cut the hoist cable.

Crewman's Hoist Cable Shear

The crewman's hoist cable shear switch marked hoist cable shear is located to the right of the personnel door (figure 4-32). Raising the switch guard and throwing the switch will enable the crew member to shear the cable.

NOTE

To shear the hoist cable from the cabin, the mode selector switch must be in the crew position. The pilot may shear the cable anytime, regardless of the mode selector switch.

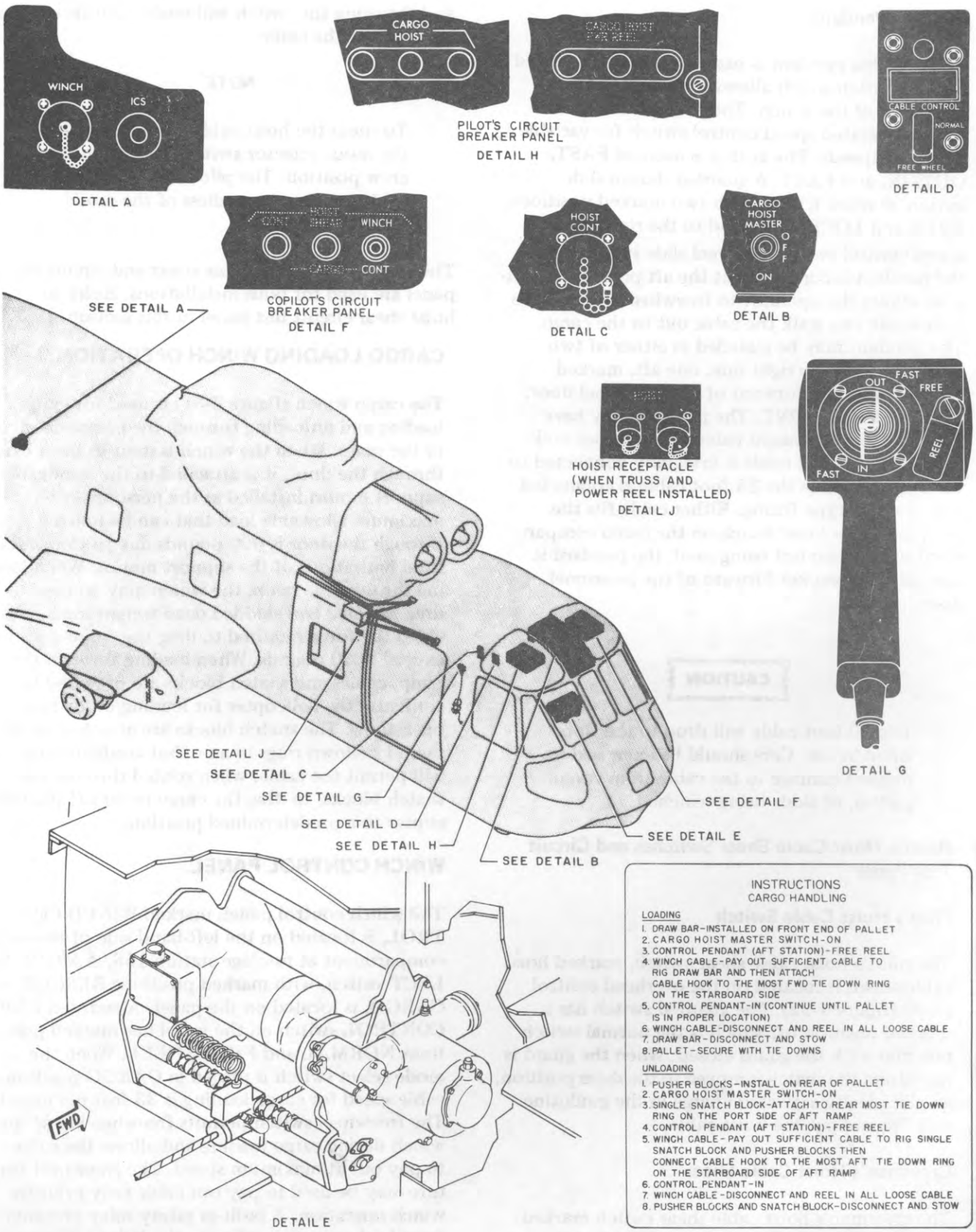
The same rescue hoist cable shear and circuit test panel are used for both installations. Refer to hoist shear circuit test panel in this section.

CARGO LOADING WINCH OPERATION.

The cargo winch (figure 4-31) is used for cargo loading and unloading through the personnel door or the ramp. When the winch is used to hoist cargo through the door, it is attached to the removable support mount installed at the personnel door. The maximum allowable load that can be hoisted through the door is 600 pounds due to the structural limitations of the support mount. When loading through the ramp, the winch may be used to drag wheeled and skidded dead weight loads, provided the force required to drag the cargo does not exceed 2000 pounds. When loading through the ramp, cables and snatch blocks are provided to configure the helicopter for loading/unloading operations. The snatch blocks are attached to 5000 pound tiedown rings in an offset configuration that will permit the cable, when routed through the snatch blocks, to drag the cargo on or off the helicopter to a predetermined position.

WINCH CONTROL PANEL.

The winch control panel, marked WINCH CONTROL, is located on the left-hand side of the cargo compartment at fuselage station 158. A MODE SELECT switch, with marked positions RESCUE and CARGO, is located on the panel. A guarded CABLE CONTROL switch on the panel has marked positions NORMAL and FREEWHEEL. When the mode select switch is placed in CARGO position, cable speed for cargo loading is 33 feet per minute. The freewheel switch permits freewheeling of the winch during cargo loading and allows the cable to pay out at maximum speed. The freewheel feature may be used to pay out cable only prior to winch operation. A built-in safety relay prevents freewheel operation when in the RESCUE mode. A built-in intermediate limit switch is actuated in



INSTRUCTIONS
CARGO HANDLING

LOADING

1. DRAW BAR-INSTALLED ON FRONT END OF PALLET
2. CARGO HOIST MASTER SWITCH-ON
3. CONTROL PENDANT (AFT STATION)-FREE REEL
4. WINCH CABLE-PAY OUT SUFFICIENT CABLE TO RIG DRAW BAR AND THEN ATTACH CABLE HOOK TO THE MOST FWD TIE DOWN RING ON THE STARBOARD SIDE
5. CONTROL PENDANT-IN (CONTINUE UNTIL PALLET IS IN PROPER LOCATION)
6. WINCH CABLE-DISCONNECT AND REEL IN ALL LOOSE CABLE
7. DRAW BAR-DISCONNECT AND STOW
8. PALLET-SECURE WITH TIE DOWNS

UNLOADING

1. PUSHER BLOCKS-INSTALL ON REAR OF PALLET
2. CARGO HOIST MASTER SWITCH-ON
3. SINGLE SNATCH BLOCK-ATTACH TO REAR MOST TIE DOWN RING ON THE PORT SIDE OF AFT RAMP
4. CONTROL PENDANT (AFT STATION)-FREE REEL
5. WINCH CABLE-PAY OUT SUFFICIENT CABLE TO RIG SINGLE SNATCH BLOCK AND PUSHER BLOCKS THEN CONNECT CABLE HOOK TO THE MOST AFT TIE DOWN RING ON THE STARBOARD SIDE OF AFT RAMP
6. CONTROL PENDANT-IN
7. WINCH CABLE-DISCONNECT AND REEL IN ALL LOOSE CABLE
8. PUSHER BLOCKS AND SNATCH BLOCK-DISCONNECT AND STOW

Figure 4-31. Winch Controls (Typical) (Sheet 1 of 2)

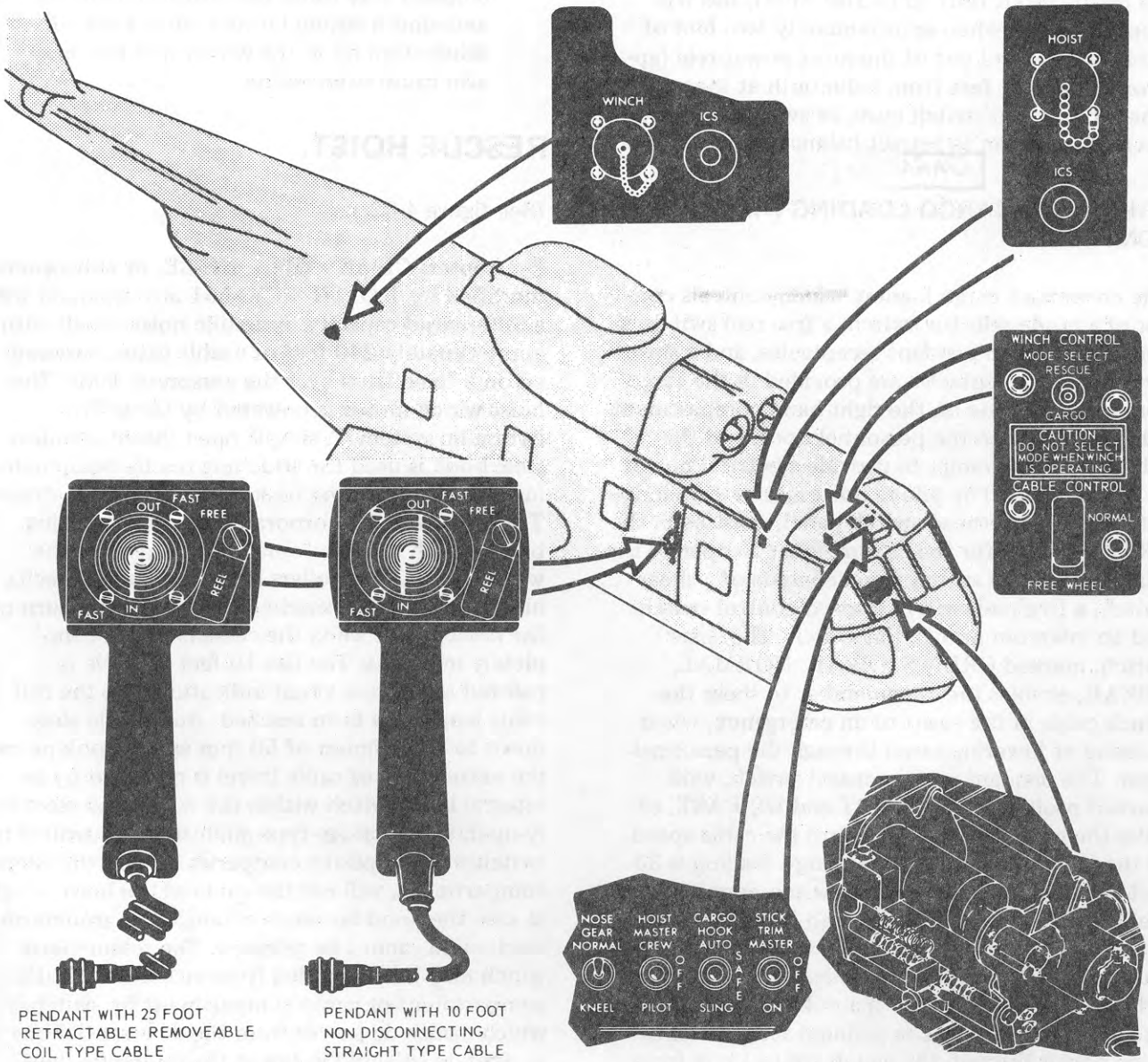


Figure 4-31. Winch Controls (Typical) (Sheet 2 of 2)

the rescue mode only (0 to 100 FPM), and will stop the winch when approximately two feet of cable is extended out of the hoist power reel (approximately 17 feet from bellmouth at the winch). The mode select switch must be switched to the CARGO position to retract balance of cable.

WARNING

SEE IS-164

CREWMAN'S CARGO LOADING WINCH CONTROLS.

The crewman's cargo loading winch controls consist of a mode selector switch, a free reel switch, a pendant and two pendant receptacles, and a shear switch. Two receptacles are provided in the cargo compartment, one on the right-hand compartment side panel next to the personnel door, and the other above the ramp, to provide electrical power to the pendant. The pilot's hoist master switch, located on the overhead switch panel, must be in the CREW position for the crewmember to operate the winch. The crew switch panel consists of a shear switch, a free reel switch, a speed control switch, and an intercommunication switch. The shear switch, marked CREW'S SHEAR, NORMAL, SHEAR, enables the crewmember to shear the winch cable in the event of an emergency, when hoisting or lowering cargo through the personnel door. The pendant speed control switch, with marked positions OUT, FAST and IN, FAST, enables the crewmember to control the cable speed of the winch. Cable speed for cargo loading is 33 feet per minute. The free reel switch permits free reeling of the winch during cargo loading operations only and allows the cable to pay out at maximum speed. The intercommunications switch provides the crewmember with a mike button while operating the winch. The pendant receptacles receive power through the winch control box from the dc essential bus, through a circuit breaker, marked HOIST, located on the overhead dc circuit breaker panel.

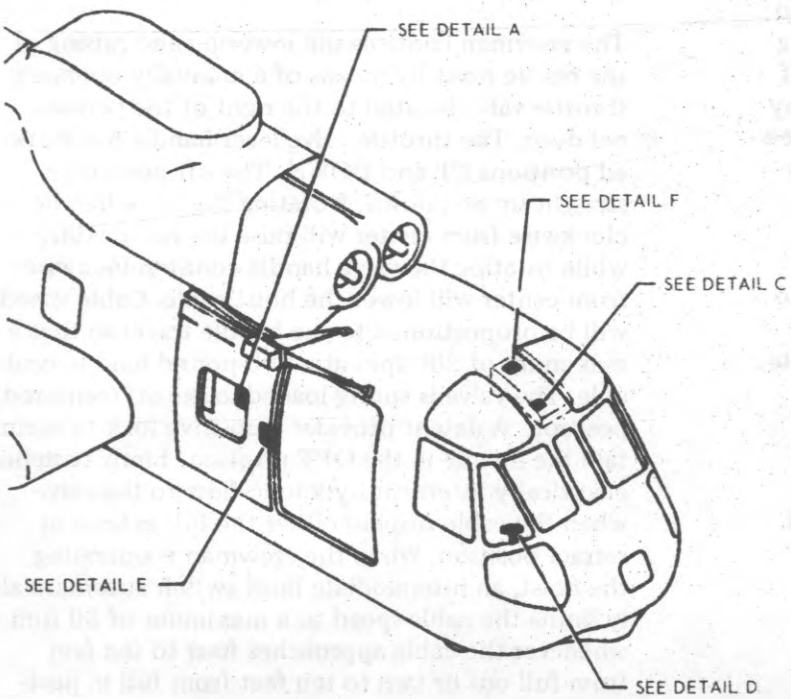
CAUTION

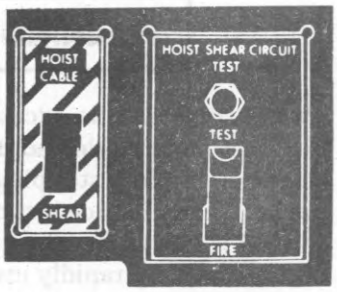
Do not reverse the winch motor action (OUT to IN, IN to OUT) until the motor has stopped turning. The pendant speed control switch determines the motor speed. Reversing the winch motor before it has stopped may cause the motor to overheat and emit a strong burned odor. Lack of lubrication oil in the winch gear box may also cause overheating.

RESCUE HOIST.

(See figure 4-32.)

Helicopters CH-3E 16▸ , HH-3E, or helicopters modified by T.O. 1H-3(C)C-561 are equipped with a 600-pound capacity hydraulic hoist winch with approximately 240 feet of usable cable, suspended on a fixed truss over the personnel door. The hoist winch motor is powered by the utility hydraulic system. A simple open throat stainless steel hook is used for attaching rescue equipment, including rescue sling basket or a forest penetrator. The hoist winch incorporates a loading holding brake which locks automatically whenever the winch stops. Feed rollers and a level wind mechanism prevent cable snarling. Microswitches turn off the hoist winch when the cable is reeled completely in or out. The last 10 feet of cable is painted to provide visual indication that the full cable length has been reached. Automatic slow down to a maximum of 50 fpm as the hook nears the extremities of cable travel is provided by an integral limit switch within the winch. An electrically-operated cartridge-type guillotine, controlled by switches in the pilot's compartment and the cargo compartment, will cut the cable at the hoist winch in case the hood becomes entangled in ground obstacles and cannot be released. The rescue hoist winch may be controlled from either the pilot's compartment or cargo compartment by switches which utilize dc power from the dc essential bus to operate solenoid valves in the hydraulic lines. The rescue hoist is protected by a circuit breaker, marked RESCUE HOIST, located on the overhead circuit breaker panel. A manual override four-way valve opens the override valve to allow hydraulic fluid to power the hoist winch either up or down in the event of electrical power loss. The crewman must monitor operation by using the manually operated throttle valve; however, the manual override button must be held engaged to maintain hydraulic power through the four-way valve. With loss of electrical power, use of the guillotine is not possible and limit switches are inoperative.





DETAIL A

CREW SHEAR SWITCH AND HOIST SHEAR CIRCUIT TEST SWITCH

EMERGENCY OPERATION
RESCUE HOIST

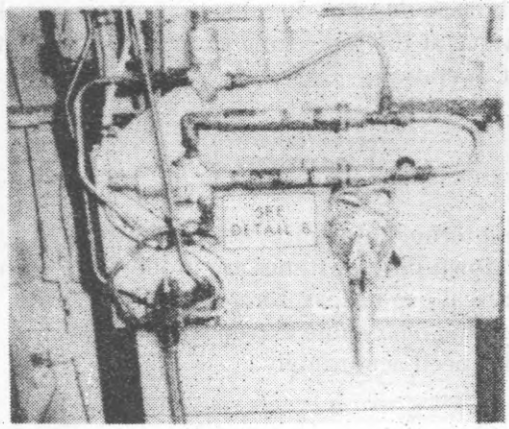
PUSH & HOLD MANUAL OVERRIDE ON 4-WAY VALVE IN DIRECTION DESIRED AND OPERATE MANUAL SPEED CONTROL.

— CAUTION —

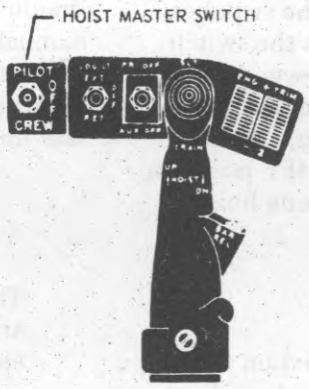
DO NOT FULLY EXTEND OR RETRACT CABLE DURING EMERGENCY OPERATION.

DETAIL B

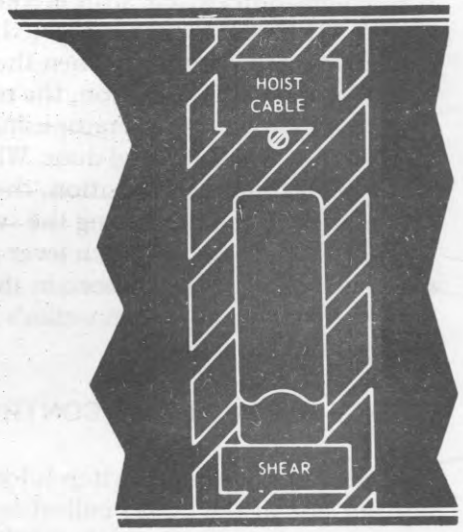
DETAIL F



DETAIL E
THROTTLE CONTROL VALVE



DETAIL D



DETAIL C

PILOT'S SHEAR SWITCH

Figure 4-32. Rescue Hoist Controls (CH-3E 16▸ *, HH-3E, or Helicopters Modified by T.O. 1H-3(C)C-561)*

WARNING

- When lifting loads in excess of 550 pounds the hoist must be slowed down prior to stopping. Rapidly stopping or reversing the hoist may induce loss of control. If control is lost while lifting, control may be recovered by rapidly moving the crewman's hoist control valve handle to the maximum raise rate position.
- Rescue hoists that have a letter Z impressed on the nameplate are limited to a capacity of 550 pounds and an average retrieval rate of 182 feet per minute.

CAUTION

Do not use hoist while in any phase of flight that causes substantial displacement of a loaded hoist cable from the vertical.

NOTE

The maximum load to be lowered by the rescue hoist is 600 pounds.

RESCUE HOIST MASTER SWITCH.

A three-position switch, with marked positions CREW, OFF, and PILOT is located on the pilot's collective pitch lever grip. When the switch is placed in the CREW position, the rescue hoist is operated by the hoist operator using the switches located near the personnel door. When the switch is placed in the PILOT position, the rescue hoist is operated by the pilot using the switch located on the pilot's collective pitch lever grip, at a fixed speed of 50 fpm. When placed in the OFF position, both the pilot's and the crewman's rescue hoist switches are inoperative.

PILOT'S RESCUE HOIST CONTROL.

The pilot's rescue hoist switch is located on the bottom side of the pilot's collective pitch stick grip. The switch, marked UP, HOIST, DN, is used to raise or lower the rescue hoist. The switch is spring-returned to the OFF position.

CREWMAN'S RESCUE HOIST CONTROL.

The crewman controls the lowering and raising of the rescue hoist by means of a manually operated throttle valve located to the right of the personnel door. The throttle valve lever handle has marked positions UP and DOWN. The off position is straight up and down. Rotating the valve handle clockwise from center will raise the hoist cable, while rotating the valve handle counterclockwise from center will lower the hoist cable. Cable speed will be proportioned to the handle travel so that a maximum of 200 fpm at a 600-pound load is available. The valve is spring-loaded to the off (centered) position. A detent provides a positive lock to maintain the handle in the OFF position. Limit switches electrically interrupt hydraulic flow to the valve when the cable reaches either the full extend or retract position. When the crewman is operating the hoist, an intermediate limit switch automatically limits the cable speed to a maximum of 50 fpm whenever the cable approaches four to ten feet from full out or two to ten feet from full in position. This prevents impact loads when traveling at high speeds.

CREWMAN'S RESCUE HOIST MANUAL OVERRIDE.

Two manual override buttons, one for up hoist and one for down hoist, are on the four-way solenoid valve. In the event of electrical power loss during hoist operations at the crewman's station, holding the desired override button depressed permits hydraulic fluid from the utility system to flow to the manual throttle valve. The crewman must hold the override button depressed and actuate the manual throttle valve at the same time to initiate and maintain hoist operation.

CAUTION

The intermediate limit switch and the up and down limit switches are inoperative with electrical power loss. Exercise caution when operating near cable extremities to adjust cable speed accordingly.

RESCUE HOIST CABLE SHEAR AND CIRCUIT TEST PANEL.

The same rescue hoist cable shear and circuit test panel are used for both installations. Refer to Hoist Shear Circuit Test Panel in this section.

EXTERNAL CARGO SLING.

CH-3E helicopters prior to 16 are equipped with a cable suspended external cargo sling. CH-3E helicopters, 16▸ and all HH-3E helicopters are equipped with a low response external cargo sling.

EXTERNAL CARGO SLING (CABLE SUSPENDED).

A cable suspended external cargo sling (figure 4-33), attached below the fuselage at four points, permits carrying loads up to 6000 pounds beneath the helicopter. Four cables extend from the fuselage attaching points to the cargo hook. The cargo hook is so designed that external loads may either be released electrically by depressing release switches located on the pilot's and copilot's cyclic stick grips, manually by the cargo emergency release pedal located on the pilot's side of the pilot's compartment, or automatically when loads contact the ground. The cargo release circuit operates on direct current from the essential dc bus and is protected by a circuit breaker, marked CARGO HOOK, located on the overhead dc circuit breaker panel. Ground personnel may open the hook by actuating the manual release lever located on the side of the cargo hook. The load beam of the cargo hook will automatically return to the normally closed position after the load is released. For a pickup, the helicopter can be hovered over the load, and the load may be attached to the hook from outside the helicopter or hooked to a preset ring by the pilot flying the hook into the ring. When the cargo sling is attached, but not in use, it is stowed under the fuselage by means of a nylon stowage line. A light, marked CARGO HOOK OPEN, located on the pilot's advisory panel, will illuminate any time the cargo hook is open. The light receives electrical power from the dc essential bus, through a circuit breaker, under the general heading INDICATOR LTS and marked CARGO HOOK, located on the overhead dc circuit breaker panel.

WARNING

- Any static electricity that may have been generated by the helicopter should be dissipated before attempting a hookup by allowing the sling to touch the ground or through a conductor that can make contact between the sling and the ground.
- External loads may cause oscillations to the extent that the load may oscillate into the rotor blades and/or fuselage, or that the load may cause a deterioration in the stability of the helicopter. Oscillations can usually be controlled by slowing the forward speed of the helicopter or entering a coordinated turn so that centrifugal force will aid in recentering the load.

CAUTION

The cargo sling should be stowed before landing to prevent the hook from striking the ground. Striking the hook on the ground can cause damage and subsequent failure of the hook. Landing on water with an unstowed hook can cause damage by denting or puncturing the hull.

Cargo Sling Master Switch.

A switch, marked CARGO HOOK, located on the overhead switch panel (figure 1-13), controls the operation of the cargo sling hook. The switch has marked positions AUTO, SAFE and SLING, and should be kept in the SAFE position during flight to prevent accidental discharge of the cargo by gusts or conditions that would lighten the load force. The SLING position energizes the finger switches on the pilot's and copilot's cyclic stick grips, which enables the pilot or copilot to electrically release the load on the sling. The cargo sling master switch should be in the SLING position during cargo hookups and until a safe altitude and airspeed are reached, to allow for quick release of the external load in the event of an emergency. The AUTO position energizes the cargo release switches and also a touchdown switch on the cargo hook. The touchdown switch, activated by load

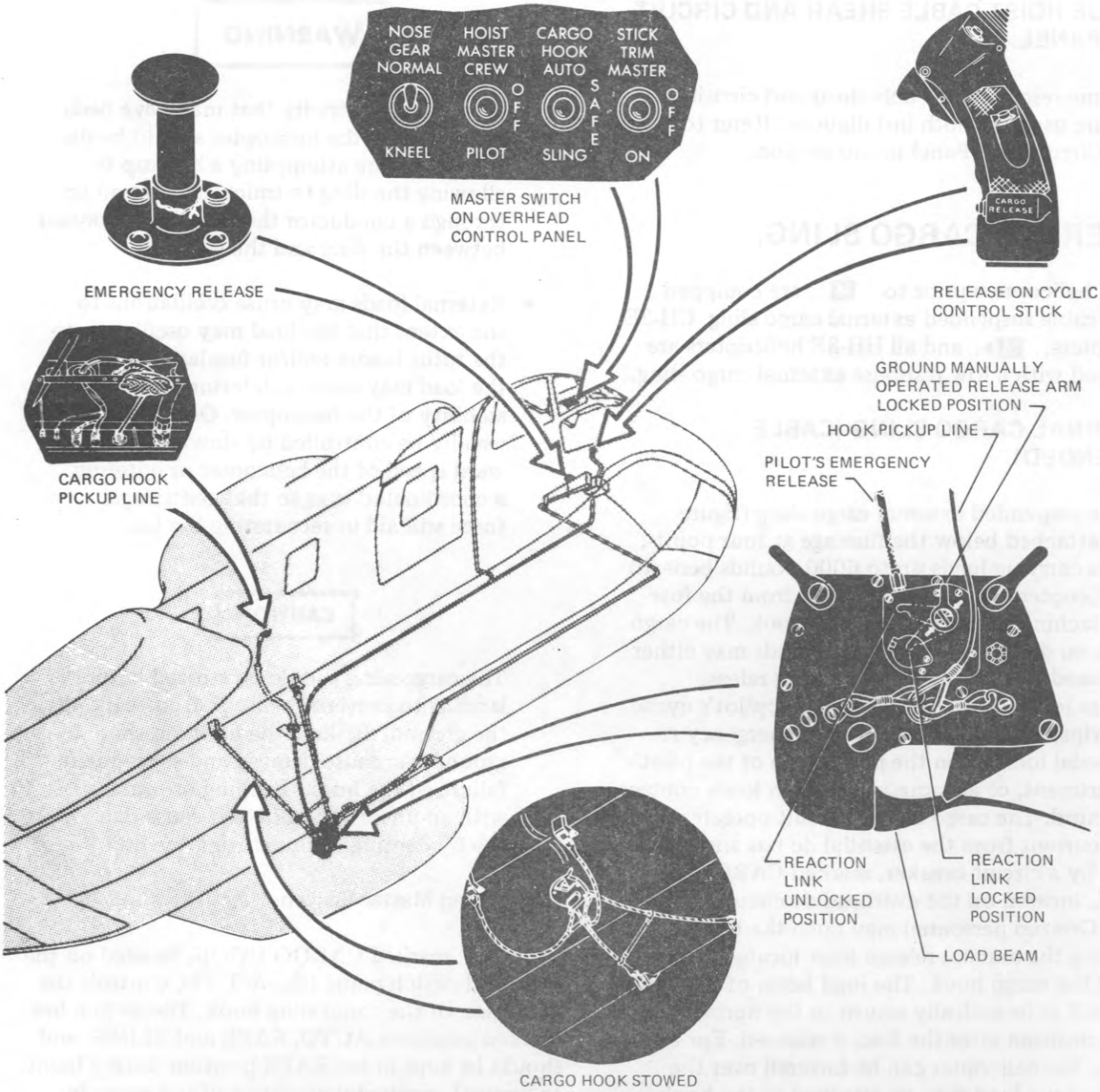


Figure 4-33. External Cargo Sling Controls (Typical)

tensions greater than 125 ± 10 pounds, will automatically release the load when the load touches the ground and the load tension on the hook becomes less than 100 pounds. Although the automatic touchdown release is set to actuate at 100 pounds or less, it is recommended that it not be used with loads less than 200 pounds. The master switch should always be returned to the SAFE position and the sling stowed after the load has been released. The master switch receives electrical power from the dc essential bus through a circuit breaker, marked CARGO HOOK, located on the overhead dc circuit breaker panel.

WARNING

The AUTO position should only be used just prior to touchdown to avoid inadvertent release of cargo. The AUTO position should not be used when carrying loads of less than 200 pounds because air gusts could momentarily lighten the load resulting in premature opening of the cargo sling hook.

Cargo Release Switches.

A cargo release switch, marked CARGO RELEASE, is located on the pilot's and copilot's cyclic stick grips. Either cargo release switch may be depressed to open the cargo sling when the cargo sling master switch is in either the AUTO or SLING position.

Cargo Emergency Release Pedal.

A cargo emergency release pedal, located on the pilot's side of the pilot's compartment, is connected mechanically by cable to the manual release lever on the cargo hook. The pedal may be depressed to mechanically open the cargo sling hook when the electrical release circuit is inoperative. The load will be released in the air or on the ground regardless of the position of the cargo sling master switch.

Cargo Hook Open Adivsory Light.

The cargo hook open advisory light is actuated by a microswitch on the cargo hook. The advisory light, marked CARGO HOOK OPEN, will come on whenever the cargo hook load beam is open.

Cargo Hook Manual Release Arm.

The cargo hook may be manually released by ground personnel by operating the manual release arm on the cargo hook. A force of 15 to 22 pounds is required to move the release arm in an upward direction to release a load beam of 8000 pounds. With no load 10 pounds is maximum required to open load beam.

Cargo Hook Stowage Line.

The cargo hook stowage line runs from the cargo hook into the fuselage through a sealed metal conduit to a cleat on the right-hand compartment side panel just aft of the personnel door. The cargo hook is stowed by lifting the cargo hook by the nylon line and tying the line to the tiedown cleat inside the cargo compartment. To release the cargo hook from the stowed position, untie the nylon line and slowly lower the cargo hook. A bungee cord, attached from the cargo hook cables to the fuselage, removes the slack from the cables when the hook is stowed.

LOW RESPONSE EXTERNAL CARGO SLING.

(See figure 4-34.)

Helicopters CH-3E 16▸, HH-3E 25▸, or those helicopters modified by T.O. 1H-3-533 are equipped with a low response cargo sling. The low response external cargo sling permits carrying loads up to 8000 pounds beneath the helicopter. The sling is made up of universal sling fittings, cables, cargo hook, pulleys and a suspension frame. The sling has two cables diagonally routed through pulleys which are individually and universally mounted at the four corners of suspension. The four corners of suspension are secured to four hard points on the underside of the fuselage by universal sling fittings. Cargo hook suspension is accomplished by one cable secured to the aft and forward rings of the hook that is routed through the left aft and right forward pulleys. The other cable is secured to the same hook rings and is routed through the right aft and left forward pulley. This suspension permits the hook to swing independently of the helicopter in any direction relative to the helicopter. Hook movement will be in an elliptic path, causing the line of reaction of the load to pass through the helicopter between the floor and the helicopter's center of gravity. This arrangement provides a

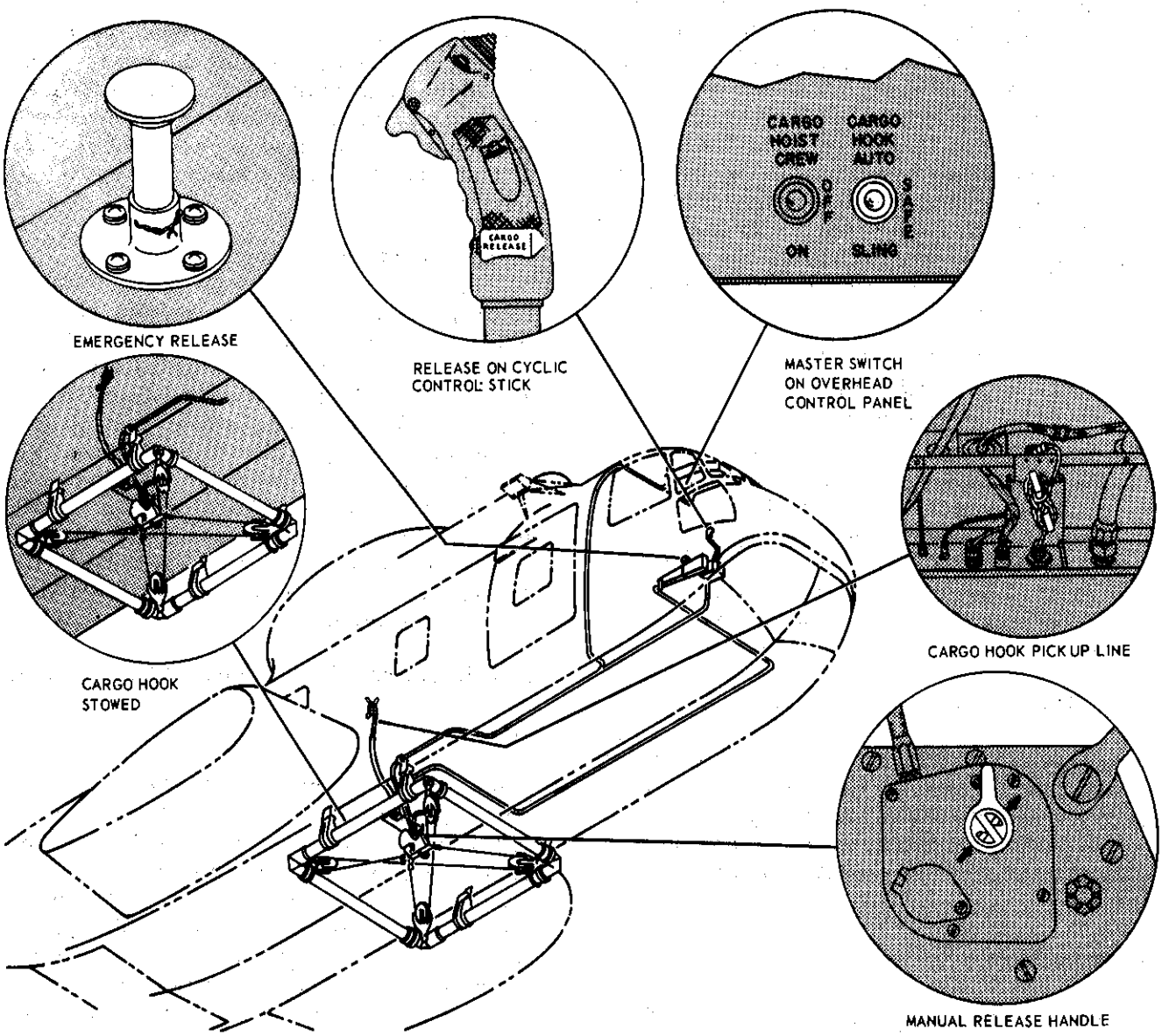


Figure 4-34. Low Response Cargo Sling System

means of 360° self-alignment of external cargo with respect to the helicopters center of gravity, thereby affecting a desirable increase in helicopter controllability and a minimum of cargo motion feedback under attitudes attained during forward and hover flight. The cargo release circuit operates on direct current from the essential dc bus and is protected by a circuit breaker, marked CARGO HOOK, located on the overhead dc circuit breaker panel. Ground personnel may open the hook by actuating the manual release lever located on the side of the cargo hook. The load beam to the cargo hook will automatically return to the normally closed position after the load is released. For a pickup, the helicopter can be hovered over the load and the load attached to the hook from outside the helicopter, or be hooked to a preset ring by the pilot flying the hook into the ring. When the cargo sling is attached, but not in use, it is stowed under the fuselage by means of a nylon stowage line. A light, marked CARGO HOOK OPEN, located on the pilot's advisory panel, will illuminate any time the cargo hook is open. The light receives electrical power from the dc essential bus, through a circuit breaker, under the general heading INDICATOR LTS and marked CARGO HOOK, located on the overhead dc circuit breaker panel. All controls and indicators for the low response cargo hook are the same as those used for the cable suspended external cargo sling. Refer to EXTERNAL CARGO SLING (CABLE SUSPENDED) in this section.

CAUTION

The cargo hook should be stowed before landing to prevent the hook from striking the ground which can cause damage and subsequent failure of the hook. Landing on water with an unstowed hook can cause damage by denting or puncturing the hull.

NOTE

With external cargo sling installed, with or without external loads, the radio sets and navigation systems may be unreliable.

TROOP CARRYING EQUIPMENT.

TROOP SEATS.

Troop seats (figure 4-35) equipped with seat belts may be installed in the cargo compartment to accommodate 25 fully equipped troops. Those helicopters that are configured with armor plate can only accommodate 23 troops, as the most forward two-man seat on the right-hand side is removed to provide armor plate protection for the hoist operator. On helicopters modified by T.O. 1H-3-594, the troop seats on both sides that cover the manually operated redundant fuel filter valve cannot be used. Twelve seats are installed on the right-hand side, aft of the personnel door, and 13 seats are installed on the left-hand side of the compartment. The aft troop seats should be folded against the compartment side panels before lowering the ramp. The last seat on each side is attached to the horizontal floor section of the ramp. The seats, in one-man and two-man assemblies, are attached to each compartment side panel, facing inboard. The seat legs are attached to the cargo tiedown studs in the compartment floor at the front of the seat assemblies. The seats are folded by disconnecting the front legs from the floor and securing the front of the seats against the upper back support with the straps provided.

CAUTION

Do not lower forward ramp with troop seats installed. Damage to the troop seat legs or the forward ramp tiedown fitting may result.

NOTE

During search operations, when maximum visibility from the cargo compartment is necessary for scanning, the seat backs blocking windows should be stowed. The seat backs should also be stowed during water operations to permit quick access to the windows in event of an emergency.

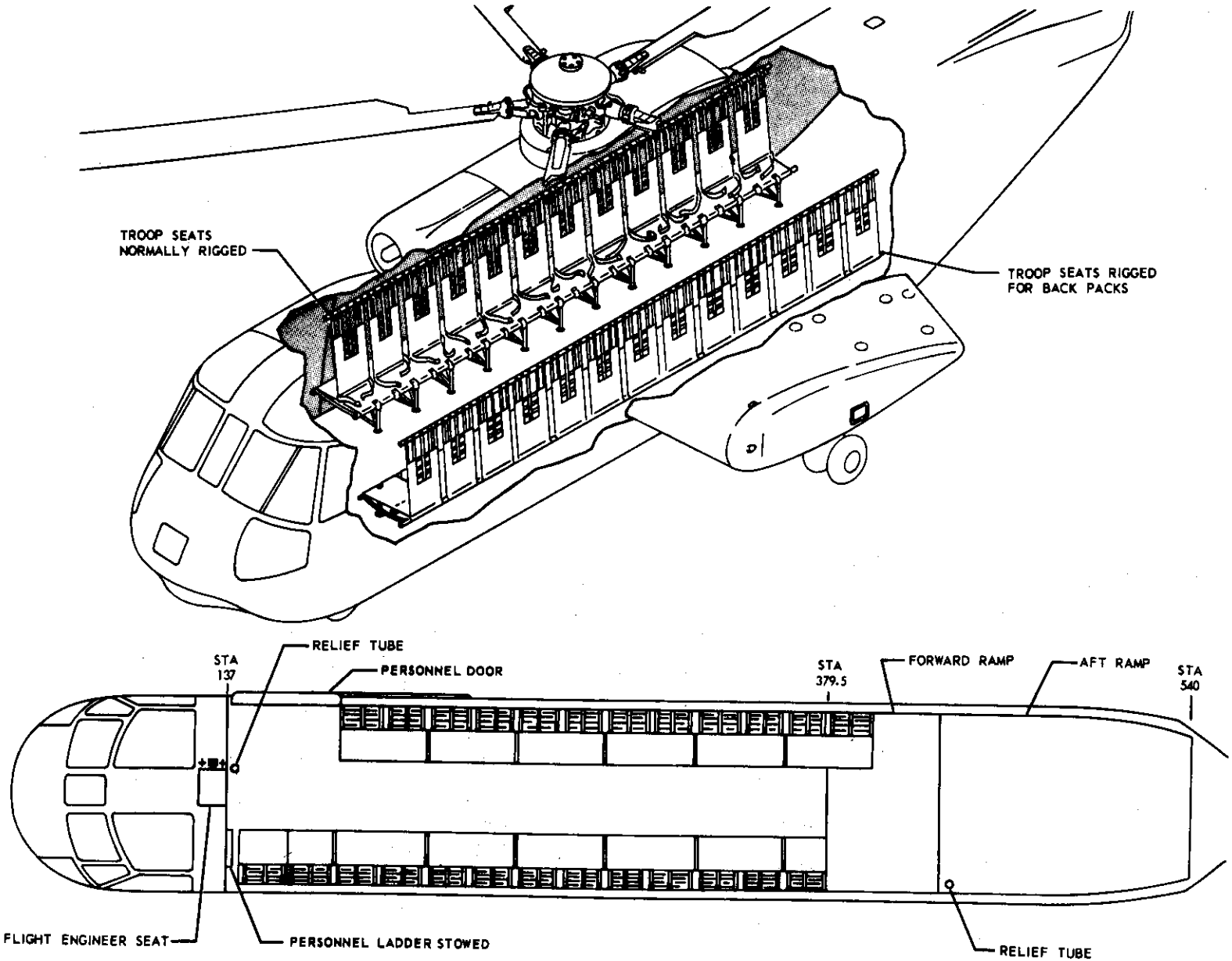


Figure 4-35. Troop Seats

CASUALTY CARRYING EQUIPMENT.

LITTERS.

Fifteen litters (figures 4-36 and 4-37) may be installed in the cargo compartment for the evacuation of the wounded, along with two attendants. The litters are arranged in four tiers of three litters, one tier of two litters and one single litter tier. The litters are positioned on outboard support brackets that slide into place on plates located on the cargo compartment walls, and inboard on brackets located on support straps secured to tiedown fittings on the ceiling and floor of the cargo compartment. The last two litter support straps, containing two litter and one litter support brackets, connect to the ceiling, then down and outboard to the cargo compartment wall. These litters may also be installed at a nine degree angle for patients requiring this service. One attendant's seat is located forward of the left-hand row of litter tiers facing the personnel door and the other attendant's seat is installed on the right forward wall facing rearward. The arrangement of litters provides a 20-inch walkway between litters.

Litter Loading Procedures.

1. Remove troop seats, cargo, and/or miscellaneous equipment if installed.

2. Install wall litter support brackets and the litter support stanchion.

3. Attach inboard litter support straps to ceiling litter tiedown support fittings.

4. Load the patient so his feet will be forward when loaded and secured in the helicopter.

5. Loading patients:

   a. If loading through the rear ramp, load the front of the helicopter first, a tier on the left side, then a tier on the right side. Load tiers from top to bottom. Place the least seriously injured personnel on the top tiers as some inflight medical care such as intravenous transfusions cannot be administered to personnel in the top tiers.

   b. Use the personnel door for loading litters only when it is impossible to use the rear ramp. Loading through the personnel door requires more personnel and more time with increased danger of additional injury to the patient. If loading through the personnel door, load the rear of the helicopter first, a tier on the left, then a tier on the right. Load tiers from top to bottom. Load the tier next to personnel door last.

   c. Load litter on wall brackets first, then secure on litter support strap bracket.

6. Securing litter support straps.

   a. Front four three-man tiers, secure litter support straps to cargo floor tiedown fittings.

   b. The last two tiers, (one man tier and two man tier), secure litter support straps to wall fittings above ramp.

7. Secure patient to litter if not previously done.

8. Install medical attendant's seat.

NOTE

On helicopters modified by T.O. 1H-3-594, the lower litters on both sides that cover the manually operated redundant fuel filter valve cannot be used.

Loading Instructions.

NOTE

For detailed information concerning loading internal and/or external cargo for delivery, refer to T.O. 1H-3(C)C-9, Cargo Loading Manual.

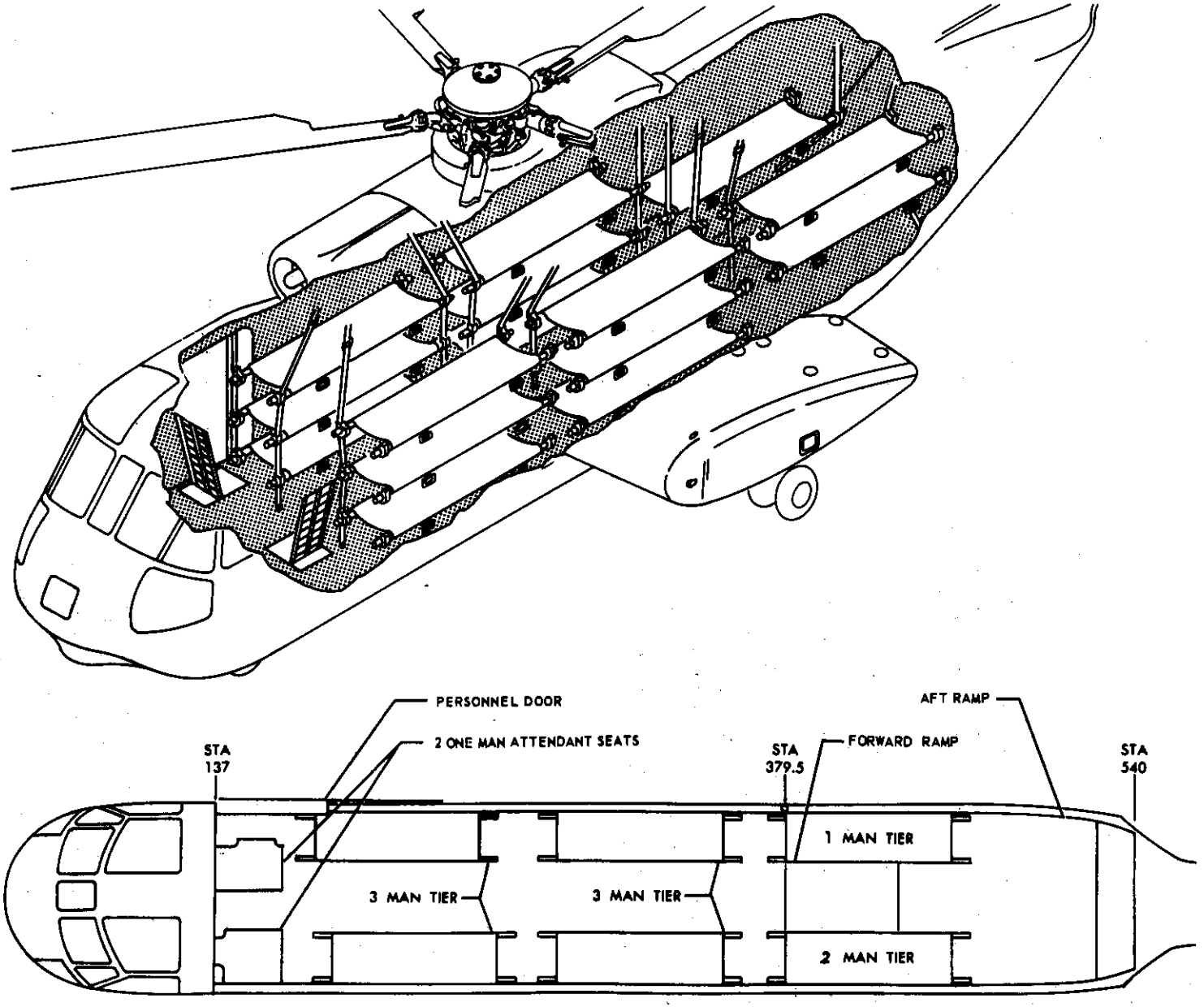


Figure 4-36. Litters

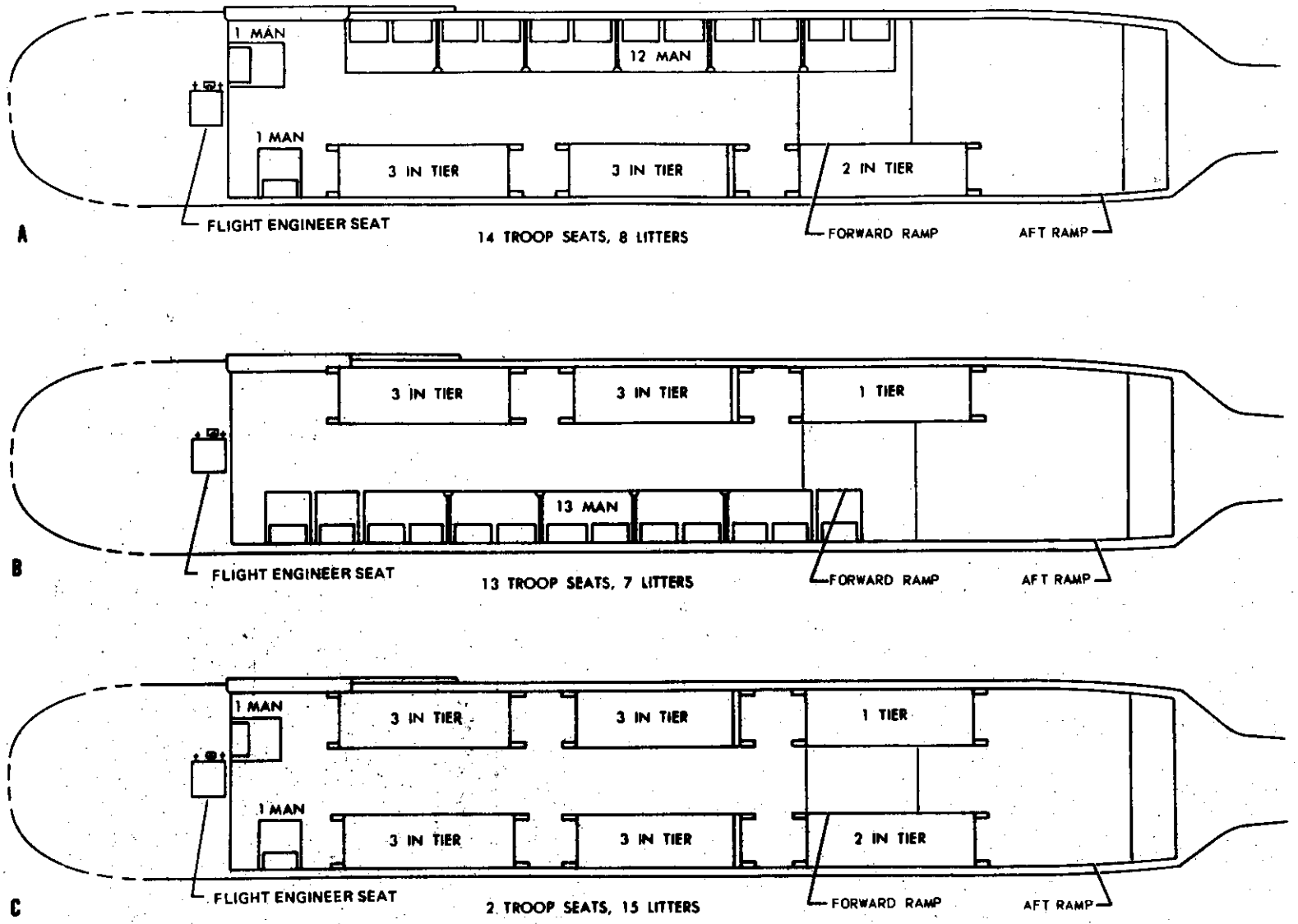


Figure 4-37. Combination Troop Seats and Litters

MISCELLANEOUS EQUIPMENT.

CHEST PROTECTORS.

Chest protectors are provided on some helicopters for the pilot, copilot, and crewmen. When not in use, they are stowed on the floor on the left side of the cabin. Chest protectors are stacked and tied down with nylon straps on a scuff pad bonded to cabin floor. On helicopters equipped with armament configuration, four chest protectors are installed. When not in use, they are stowed two on each side of the cabin floor. They are stacked two deep on scuff pads and strapped to the cargo tiedown rings. On helicopters modified by T.O. 1H-3(H)E-507, three chest protectors are installed on a scuff pad bonded to the left side of the cabin floor.

CREWMAN'S SAFETY HARNESS.

When in use, the harness may be attached to any tiedown fitting on the cargo floor or to the ring and support provided at the right or aft gun stations on CH-3E helicopters 16 , Serial No. AF66-13287 and 19▸ and HH-3E helicopters. The harness shall be worn during hoist operations and/or any time the personnel door/ramp is open and personnel are using this position for other activities. The harness length shall be properly adjusted to provide proper restraint and preclude accidental exit of the helicopter.

WARNING

The ceiling litter support fittings are designed for vertical restraint only; therefore, they should not be used with the crewman's harness as they will not provide sufficient restraint.

PERSONNEL DOOR SAFETY STRAP.

A safety strap is installed in the personnel door opening for the purpose of restraining personnel. The safety strap is a fixed length non-adjustable strap. The forward end is permanently attached to an eyebolt and ring assembly on the personnel door forward frame (Station 137). The right end of the safety strap has a quick release snap that attaches to a ring and eyebolt assembly on the personnel door rear frame (Station 186). During loading, or whenever the safety strap is not required, it is stowed by attaching the right end snap to the ring on the forward door frame.

WARNING

The personnel door safety strap shall be attached whenever the personnel door is open and the helicopter is in motion unless cabin occupants have seat belts fastened or are wearing safety harnesses.

DATA CASE.

A data case is installed on the bulkhead behind the copilot's seat in the pilot's compartment.

MOORING RINGS.

Four mooring rings are provided on the helicopter. Each main landing gear trunnion assembly has a mooring ring on the outboard side. A mooring ring is located on each side of the nose landing gear on the bottom of the fuselage.

RELIEF TUBES.

Two relief tubes are installed in the helicopter. One is in the pilot's compartment on the bulkhead behind the pilot's seat, the other on the left-hand side of the cargo compartment above the ramp.

ASH TRAYS.

Three ash trays are installed in the pilot's compartment. One is on the side panel to the right of the pilot, and one to the left of the copilot. The third is on the controls enclosure bulkhead above the crewmember's folding seat.

ELECTRICAL UTILITY RECEPTACLES.

Three capped 28-volt dc electrical utility receptacles (figure 4-38) are installed in the helicopter. One is located on the pilot's compartment dome

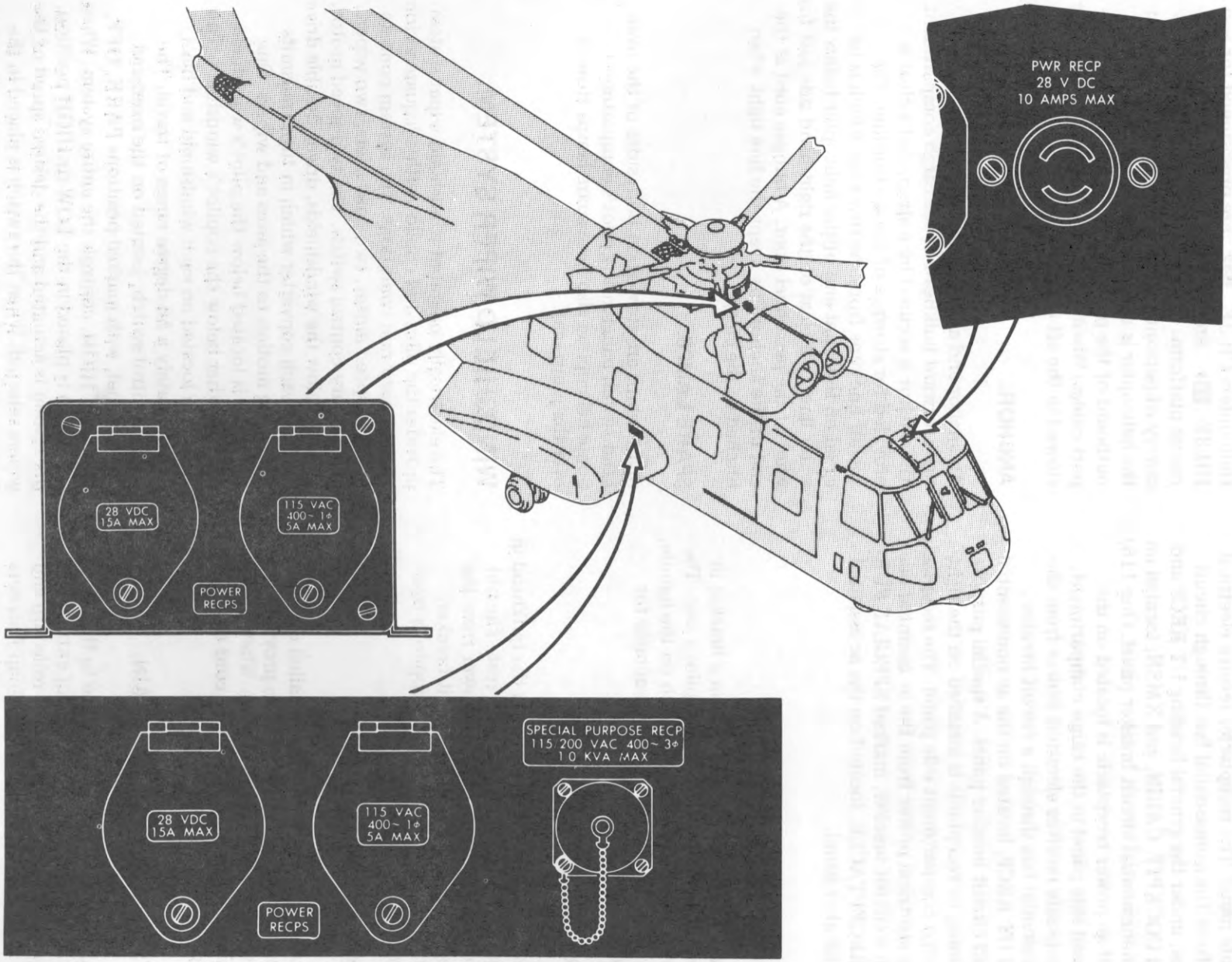


Figure 4-38. Electrical Utility Receptacles

light panel, one on the transmission deck left side, and the other on the right-hand cargo compartment side panel. The receptacles receive electrical power from the nonessential bus through circuit breakers, under the general heading UT RECP and marked COCKPIT, CABIN, and XMSN, located on the dc nonessential circuit breaker panel. One 115/200-volt ac power receptacle is located on the right-hand side panel in the cargo compartment. The receptacle receives electrical power from the ac nonessential bus through a circuit breaker, marked UT RECP, located on the ac nonessential overhead circuit breaker panel. A special purpose, three phase, ac receptacle is installed on the right-hand cargo compartment side panel. The receptacle receives electrical power from the ac essential bus through a circuit breaker, marked SPECIAL PURPOSE RECEPTACLE, located on the ac essential circuit breaker panel.

SIGNAL LIGHT.

A portable signal light is installed on a bracket in the cabin stowage area behind the pilot's seat. The light, controlled by an on-off switch on the handle, may be plugged into a dc utility receptacle for operation.

HOT CUP RECEPTACLES.

A hot cup receptacle is installed on the bulkhead in the stowage area behind the pilot's seat. The hot cup receptacle receives electrical power from the ac nonessential bus through a circuit breaker, marked HOT CUP, located on the copilot's overhead circuit breaker panel.

COCKPIT CANOPY SHADES.

Retractable window shades are installed on the overhead windows in the cockpit to provide sun protection for the pilot and copilot. When drawn, the shades are secured by a bungee cord to a hook in the frame of the window.

PILOT'S COMPARTMENT CURTAIN.

A curtain is installed at the entrance to the pilot's compartment to prevent the entry of extraneous light from the cabin. The curtain is rolled up and stowed overhead when not in use. Snap fasteners are used to secure the curtain to the frame of the entrance.

INERT VICTIM RESCUE PLATFORM.

Helicopters CH-3E ▶16◀ are provisioned for and HH-3E ▶23◀ are equipped with a detachable rescue platform. It is provided to aid in the recovery of personnel or objects from the sea when the helicopter is afloat. The platform is secured outboard of the personnel door by studs and support cables. When not in use, the platform may be stowed in the aft cabin compartment ceiling area.

ANCHOR.

An anchor and anchor line are installed on the right forward bulkhead of the cargo compartment. The anchor is secured by a strap, and a cleat is provided for stowage of the anchor line. The anchor line runs from the tow ring, which is located on the front end of the helicopter below the water line, to a cleat on the right-hand side just forward of the personnel door. A bungee cord at the end of the anchor line keeps the line tight when hitched to the cleat.

SPARE LAMPS.

Spare lamps are stowed on both sides of the overhead switch panel in the pilot's compartment. Some helicopters also have spare lamps stowed over the jump seat.

WINDSHIELD WIPER SYSTEM.

The electrically operated windshield wiper system provides the pilot and copilot with adequate vision during heavy rain conditions. The system consists of a two-speed motor, two converters, two wipers, and a rotary control switch. The two-speed motor, located below the windshields, drives flexible drive shafts to each converter which in turn transmits oscillating motion to the arms and wipers. One converter is located below the pilot's windshield and the other below the copilot's windshield. The wipers are located on each windshield and have approximately a 56 degree range of travel. The rotary control switch, located on the overhead switch panel, with marked positions PARK, OFF, LOW, and HIGH, controls the entire system. When the switch is placed in the LOW or HIGH position, the system is actuated and the desired speed of the wipers selected. When the switch is placed in the PARK position, the wipers are automatically positioned to the inboard edge of the windshields. The

system operates on alternating current from the essential bus and is protected by a circuit breaker, marked WINDSHIELD WIPER, located on the overhead ac essential circuit breaker panel.

CAUTION

To prevent scratching the windshields, do not operate the wipers on dry glass.

WINDSHIELD WASHER.

Some helicopters are equipped with a windshield washer which consists of a foot-operated pump, located on the pilot's compartment floor next to the pilot; a reservoir, located on the pilot's compartment floor behind the pilot's seat; two nozzles, located on the pilot's and copilot's windshield, and connecting tubing. Depressing the pump forces fluid from the reservoir through the tubing and the nozzles spraying the windshield. Actuating the windshield wipers on the wet windshield will remove the obstructions. The reservoir capacity is one quart of fluid. CH-3E ▶16◀ are provisioned for and all HH-3E helicopters and all helicopters modified by T.O. 1H-3-566 are equipped with a six-quart reservoir, a windshield washer motor, and straight wiper blades containing a spray bar. The windshield washer motor is controlled by a switch, marked WSHLD WASHER MOTOR, located on the overhead switch panel. Turning the windshield washer motor on causes fluid to be pumped through the spray bars on the windshield. The windshield wipers are then operated in the normal manner to remove obstructions. The windshield washer motor is powered from the dc essential bus and protected by a circuit breaker, marked WSHLD WASHER MOTOR, located on the center overhead circuit breaker panel.

BILGE PUMP.

A portable, hand-operated bilge pump (figure 4-39) is stowed on the left-hand side of the cargo compartment at station 440. The bilge pump can be installed at 7 stations when the cargo compartment is clean, 3 stations when the troop seats are installed and 3 stations when litters are installed. The bilge pump bracket at station 167 is provided to permit water removal from the electronics compartment. Two tubing connections are provided under access panels in the cabin floor to permit removal of water which may collect through a leak or damage to a fuel tank compartment. A jettison window over each sponson provides access to the outside of the fuselage and sponsons to facilitate bilge pump operations. The self-priming pump is capable of pumping up to 5 gallons a minute. The pump will draw water to a height of 4 1/2 feet and pump water up to 10 feet above the pump. The left-hand hose is placed in the hull through one of the access covers in the cargo compartment floor from which the water will be drawn. The right-hand hose will be placed out of the nearest exit. After the pump is mounted and the hoses are in position, turn the pump handle in a clockwise direction.

CAUTION

- If water cannot be pumped through the standpipe, when pumping out the two watertight fuel tank compartments, it can only be assumed the compartment is dry or the standpipe is clogged. There are no access or visual inspection plates to check water level. Trapped or undetected water in these compartments could lead to inflight CG problems and accelerate corrosion within the compartment.

- During prolonged water operations, shutdowns, and towing, the nose compartment should be inspected and pumped, as required through the nose compartment inspection hatch under the jump seat.

NOTE

- The bilge pump will work in either direction (clockwise or counterclockwise) depending upon which hose is used for suction.

- The bilge pump should be available and manned as needed whenever the helicopter is moored or sitting on water.

- The watertight compartments which contain the forward and aft fuel tanks cannot be inspected visually for leakage. During water operations, these compartments should be pumped periodically to determine presence of leakage. After water operations, the hull drains for these compartments should be opened to prevent water accumulation which might affect gross weight and/or CG, and accelerate corrosion.

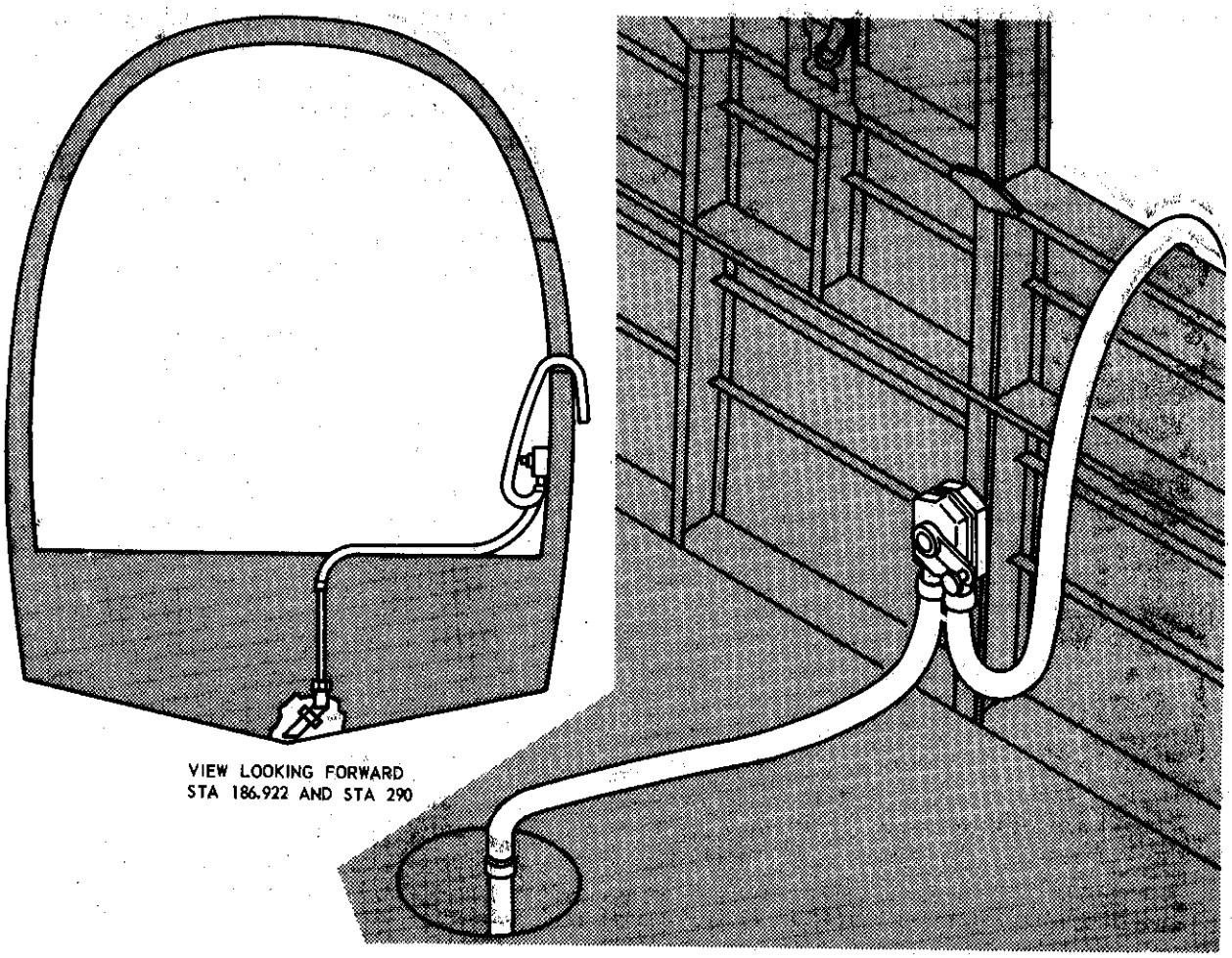


Figure 4-39. Bilge Pump

BILGE PUMP LOCATIONS FOR USE

CARGO COMPARTMENT

WALLS CLEAN	WITH LITTERS	WITH TROOP SEATS
1. Forward: LH side sta. 167, RH side sta. 219 upper and sta. 221 lower	Forward: RH side sta. 219 upper	Forward: LH side sta. 167, RH side sta. 221 lower
2. Aft: LH side sta. 321 upper and sta. 323 lower; RH side sta. 320 upper and sta. 323 lower.	Aft: LH side sta. 321 upper and RH side sta. 320 upper	Aft: LH and RH sides sta. 323 lower

LOAD ADJUSTER.

A slide rule type load adjuster (figure 4-40) stowed in a case in the pilot's compartment is used for computing CG limits when loading the CH-3E or HH-3E helicopter. Operating proficiency will save the time and effort of having to solve the center of gravity problem by means of mathematical calculations. When used with the charts and forms in the Weight and Balance Manual Data, T.O. 1-1B-40, a safe loading is provided by checking in advance exactly how the balance position will be affected by each item of load added or removed.

INSTRUCTIONS FOR USE OF THE LOAD ADJUSTER.

Colored Top Strip.

The colored top strip of the load adjuster ensures safe loading as the red sections show the limits of the loading range. A sloping line defines a limit according to the gross weight of the loaded helicopter, and a vertical line indicates a limit that is constant at all gross weights. The colored top strip also contains a note to check landing conditions. This note is very important in that the use of fuel and other expendable loads can cause a change in the balance position. The loading must then be rearranged to allow for the CG change, or the allowable limits will be exceeded as fuel or other expendable load is consumed.

Transparent Indicator.

The transparent indicator is movable to translate the change in balance position as the load is changed in terms of the index scale on the bottom of the adjuster. The index scale is merely a simple reference that is mathematically related to the center of gravity grid, or balance diagram, which appears on the inner recess of the load adjuster.

Center of Gravity Grid.

The center of gravity grid is the basis of the load computer's design. The forward and aft red sections show the CG limits in terms of inches from the reference datum, and it is from these limits that the top strip of the load adjuster is devised. The CG position, in terms of inches from the reference datum, may be read directly from this grid. The crosswise lines represent the weight, and diagonal lines represent inches. To convert an index reading to inches from the reference datum, note the point at which the indicator hairline and the gross weight line intersect. The inches from the reference datum are estimated at that intersection. The marks across the top of the grid are inches from the reference datum.

Fuselage Diagrams.

The fuselage diagrams on the back of the load computer will be of great assistance in deciding where to place load items since they provide information concerning station locations.

Basic Weight and Moment Scales.

The basic weight and moment scales on the inner side of the load adjuster slide determine the basic index which is the starting point of all loading calculations. These scales are based on the index formula shown in the recess on the inside of the rule. The procedure outlined below should be followed to arrive at a basic index:

1. Set the indicator hairline at 0 on the index scale.
2. Move the slide until the basic weight is under the hairline.
3. Slide the indicator to the basic moment and read the basic index under the hairline on the index scale.

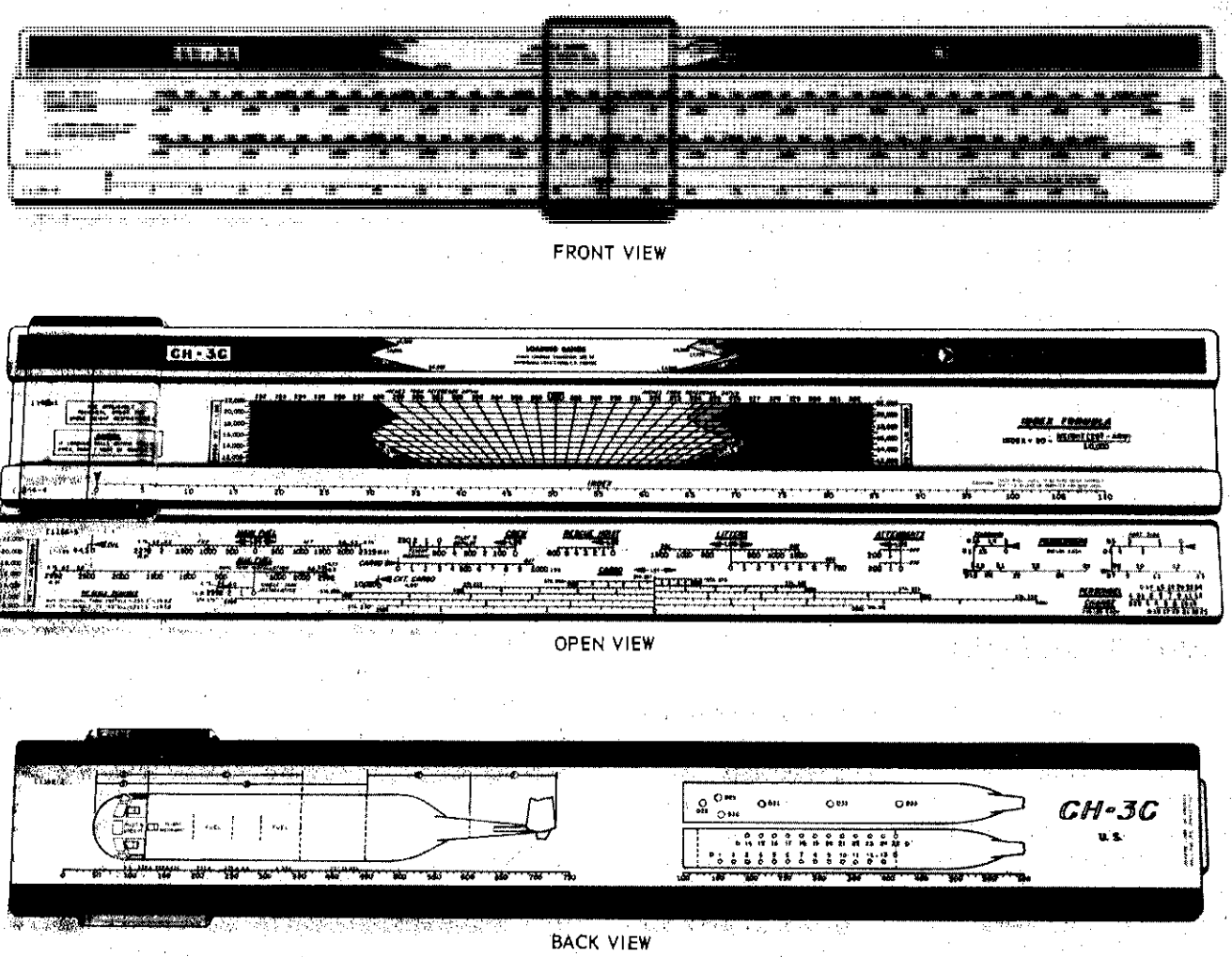


Figure 4-40. Load Adjuster

If the basic moment should happen to be on a scale other than that containing the basic weight, proceed as follows:

4. Move the slide until the basic weight is under the index scale.

5. Move the indicator to the final moment mark at the end of the scale containing the basic weight.

6. Move the slide again until the same moment value at the beginning of the next scale, below, is under the hairline.

7. Move the indicator to the applicable moment figure and read the index under the hairline or the moment value at the end of the second scale.

8. Repeat steps 3 and 4 if the basic moment should appear on the third scale, and the basic weight appears on one of the other scales.

LOAD ADJUSTER OPERATION.

After the basic index has been determined, all loading calculations start with the hairline of the indicator over the basic index. From this point on, it

requires two operations to load each of the totals shown on the Form 365F. These two operations are repeated for each loading total that appears on the Form 365F. The computations are made in the order that the times appear on the Form 365F and the resulting index is progressively entered in the index column.

1. Move the slide until the 0 vertical starting line of the scale to be used is under the hairline.

2. Move the indicator until the hairline is over the weight to be added. The new index is then read under the hairline on the index scale at the bottom of the rule.

The effect of the removal or redistribution of a load is determined by following the same two steps above, except the hairline is not set over the 0 line of any given scale, but instead is set over the total weight to be removed and the last recorded index reading. The indicator is then moved to the 0 line of the scale, or to an intermediate weight, and the new index is read under the hairline on the index scale.

NOTE

- When moving the slide, ensure that the indicator does not move, and when moving the indicator, ensure that the slide remains in position.

- The use of the load adjuster shall be required to determine CG condition of the helicopter loading. When load adjuster shows the helicopter to be in the critical (yellow shaded) load condition, Form 365F must be filed.

SAMPLE PROBLEM FOR THE LOAD ADJUSTER.

Suppose that Chart C of T.O. 1-1B-40 for your helicopter shows a basic weight of 12,500 pounds and a basic index of 60.0. Form 365F is filled out as in the example given here. Index readings for each of the load items have been listed so that you can start using the load adjuster. Check your answers with the index readings given.

ITEM	WEIGHT	INDEX
Basic Helicopter	12,500	60.0
Oil	44	59.5
Crew (3 - 200 pounds each)	600	50.0
OPERATING WEIGHT	13,144	50.0
Takeoff Fuel (Main)		
Forward (6.5 pounds per gallon)	1,100	44.2
Aft (6.5 pounds per gallon)	1,100	49.8
Passengers (D1-D8)	1,600	43.0
(D14-D19)	1,200	40.1
Cargo (D27)	1,000	55.0
TAKEOFF CONDITION	19,144	55.0
TAKEOFF CG IN INCHES 269.7"		

Set the indicator hairline over the basic index of 60.0 to begin.

1. Move the slide until the 0 vertical starting line of the OIL SCALE is under the hairline.

2. Move the indicator until the hairline is over the 44 pound full oil tick mark. The index will now be 59.5.

3. Move the slide until the 0 vertical starting line of the crew scale is under the hairline.

4. Move the indicator until the hairline is over the 400-pound tick mark on the PILOT and COPILOT portion of the scale. Again move the slide until the starting line of the FLIGHT ENGINEER portion of the scale is under the hairline. Move the indicator to the 200-pound tick mark for the crew loading index of 50.0

Addition of Fuel.

The foregoing computations produce the balance position for the operating weight of the helicopter. (Reference 8 on Form 365F.) The weight of the fuel must be added to the operating weight before payload distribution can be considered.

1. Set the 0 starting line of the fuel scale (MAIN) under the indicator hairline at the operating weight index of 50.0.

2. Move the indicator until the hairline is over the 1100-pound tick mark on the forward fuel scale. The result is an index of 44.2.

3. By using the aft fuel scale in the same manner, the fuel loading index of 49.8 will be determined.

NOTE

When the load adjuster is utilized in computing aircraft balance, auxiliary fuel in the external tanks may be added by use of the station 300 cargo scale. To determine if the weight of the empty auxiliary fuel tanks is included in the weight and balance index, refer to charts A and E of T.O. 1-1B-40.

Distribution of Allowable Load.

The balance of the loading computation, showing the load distribution, is worked on the PASSENGERS and CARGO SCALES, resetting the slide to the zero line before each new addition from Form 365F. For the addition of the passengers in seats D1 - D8:

1. Move the slide until the zero mark of the port scale is under the hairline at the 49.8 index position.

2. Move the indicator to the D8 position for an index of 43.0.

3. Move the slide until the zero mark of the starboard scale is under the hairline at the 43.0 index reading.

4. Move the indicator to the D19 tick mark for an index reading of 40.1.

5. Using the D27 cargo scale in the same manner to load the 1000 pounds will produce a takeoff index of 55.0.

Determination of Landing CG.

It is very important to determine that the CG will be safe when landing after fuel has been consumed. This computation is accomplished by the reverse use of the load adjuster scales. For example, let us assume that all but 500 pounds of fuel in each of the tanks has been consumed.

1. Set the indicator hairline at the takeoff index of 55.0.

2. Move the slide until the 1100-pound tick mark on the forward fuel scale (MAIN) is under the hairline.

3. Move the indicator to the 500-pound mark, thus removing 600 pounds of fuel. Removing 600 pounds of fuel by using the aft fuel scale in the same manner will produce a landing index of 55.1.

Redistribution of Load.

The same reverse use of the load adjuster scales may be followed for redistributing load when required corrections are to be accomplished by moving cargo. If the corrections are to be produced by relocating passengers, then the PERSONNEL CHANGE SCALE would be used. It will be assumed that a more aft CG position is now to be produced by moving the occupant of seat D1 to D9.

1. Set the D1 tick mark on the PERSONNEL CHANGE SCALE under the hairline at the takeoff index of 55.0.

2. Move the indicator to the D9 position, producing the more aft CG reading of 58.9.

Reading the CG Position from the Grid.

To convert the takeoff index of 55.0 to inches from the reference datum:

1. Set the hairline at the takeoff index of 55.0 and move the slide so that the gross weight figures on its left-hand side will be conveniently close to the indicator hairline.

2. Note the point of intersection of the hairline and the gross weight line on the grid which is closest to the takeoff gross weight. In this position, that line will be the 19,000 pound line.

3. This intersection occurs between the 269 and 270 lines. Therefore, the reading in inches may be estimated at 269.7.

Distribution of Allowable Load (Cargo in Compartment).

The cargo compartment is divided into marked stations (figure 4-24) at 25-inch intervals between Station 150 and 375. Cargo loading scales corresponding to these marked stations are provided on the load adjuster enabling the distribution of load throughout the compartment. A cargo load CG, located between the marked stations, may be set up by moving the indicator the proportionate distance between the corresponding points on the adjacent scales.

EXAMPLE: Add 3000 lb. of cargo at Sta 235; with helicopter index already at 55.0, move the slide until the 0 lb. line at Sta 267 is under the hairline. The 3000-lb. mark for Sta 225 is over index 42.4. The 3000-lb. mark for Sta 250 is over index 49.8. Therefore 3000 lb. at Sta 235 will be over index.

$$42.4 + \frac{235 - 225}{250 - 225} (49.8 - 42.4) \text{ or } 45.4$$

WEAPON SYSTEM.

The helicopters are equipped with slightly different weapon systems. CH-3E helicopters [16], Serial No. AF66-13287, and [25]▸ are provisioned for a weapon system. HH-3E helicopters [24]▸ are equipped with a weapon system. HH-3E [23]▸ [24] are equipped with 7.62MM M60 machine guns which have the ammunition container mounted on the gun and [19]▸ are equipped with 7.62 MM M60D machine guns with the ammunition containers mounted on the floor. Helicopters modified by T.O. 1H-3-577 are equipped with a KB-18A panoramic strike camera. Both systems will be discussed, except for major differences, under common headings as one system. The weapon system is comprised of three 7.62MM machine guns, gun mounts, ammunition containers and feed belt, and armor plate protection. The system is solely operated by aircrewmen with no additional inputs by the pilot other than voice readiness signals. The system is used as a fire suppressive deterrent to ground troops and soft target areas.

7.62MM MACHINE GUN.

The 7.62MM machine gun (figure 4-41) is an air-cooled, link-belt fed, gas-operated weapon. The gun is capable of firing approximately 550 rounds per minute. Due to the relatively low rate of fire, plus the quick-change barrel feature, the service life of the gun is greatly increased. The primary weapon controls are the latch lever, barrel lock lever, cocking handle, safety lever and trigger (see figure 4-41). The guns are mounted at three stations in the helicopter. One gun is located on a moveable platform on the aft ramp, and the other two are located on mounts on the left and right-hand sides of the forward cabin. The right-hand gun has an extension installed to prevent firing into the hoist cable (see figure 4-42).

FORWARD GUN MOUNTS.

Each mount consists of a tube, pintle, cam, cam follower, platform, hinge brackets, supports, tension pins and cables. The right mount is attached to the personnel door armor, and the left is attached to the left cabin wall. When use of the guns is anticipated, the mounts are pivoted on a hinge point from a stowage support and pinned in the firing position. The cam and cam follower limits the field of gunfire which prevents firing into any portion of the helicopter (see figure 4-42).

AFT GUN MOUNT.

The mount consists of a tube, tie rod, cam, cam follower, pintle, brackets, supports, tension pin and cable, and is bolted to the aft gun platform. It prevents the gun firing into any portion of the helicopter (see figure 4-42).

AFT GUN PLATFORM.

The platform consists of armor plates, retainer, mounting pad, brackets, rollers, locking mechanism and handle. It is attached to the tracks on the aft ramp. When use of the aft gun is anticipated, the locking handle is pulled, releasing the lock; the platform is pushed aft to the firing position and the handle is pushed in, engaging the lock. The

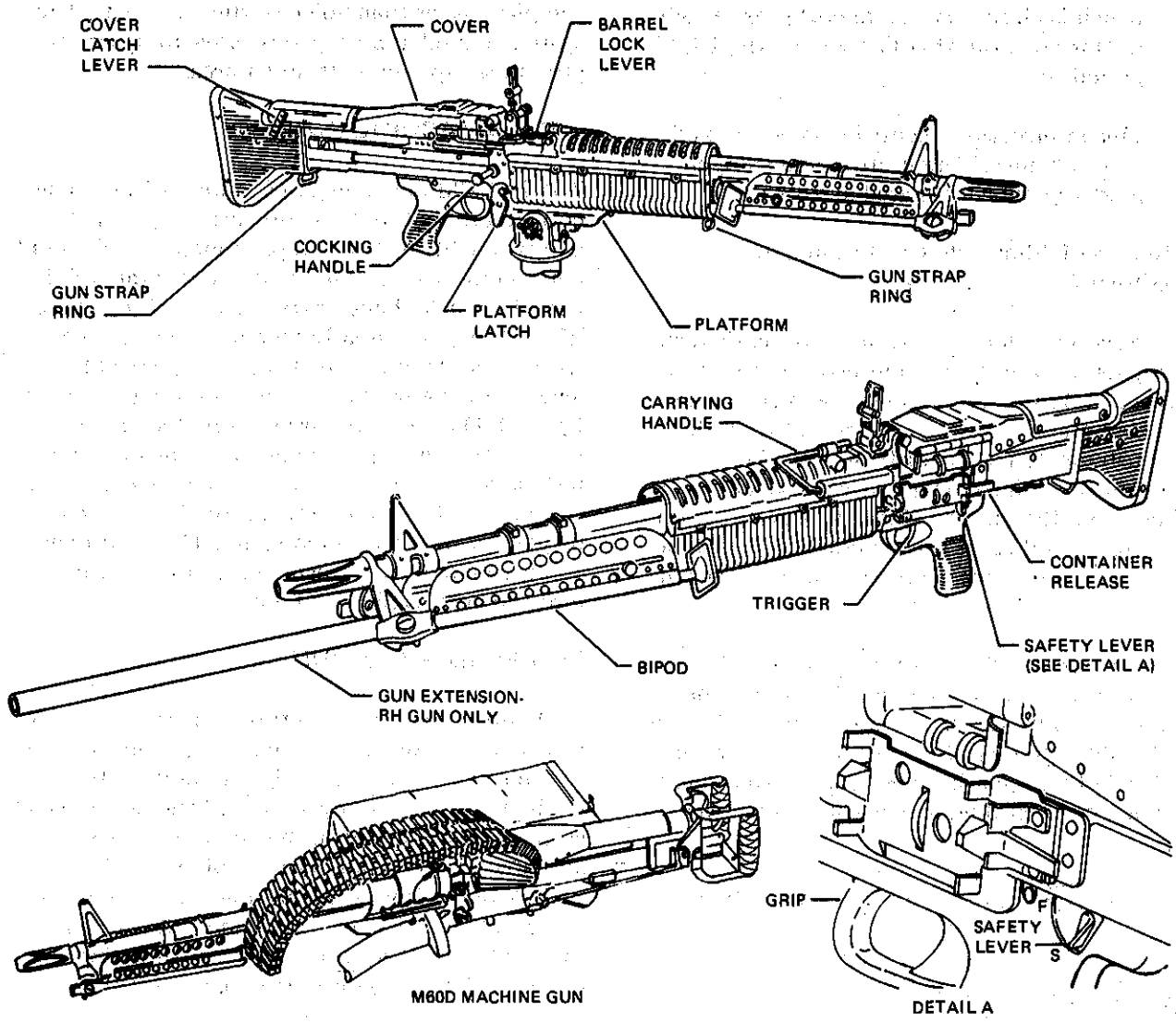


Figure 4-41. M60 Machine Gun (Typical)