OMNI Navigation System Control Panel.

The OMNI navigation system control panel, marked VHF NAV, located on the cockpit console, controls all receivers for the system. The control panel contains a frequency indicator, a power switch, two frequency selector knobs, and a dual squelch and volume control. The system is turned on by placing the power switch, marked POWER, with marked positions ON and OFF, to the ON position. The volume control, marked VOL, establishes the audio level of the receiver. A squelch control knob, marked SQ, located concentrically with the volume control knob, is used to adjust sensitivity when there is no receiver signal input, and for fine adjustment of objectionable background noise. The frequency selector knob closest to the power switch selects the frequency in megacycle increments (the numbers to the left of the decimal point), and the other frequency selector knob selects the frequency in kilocycle increments (the numbers to the right of the decimal point). Even tenths of a megacycle frequency selects VOR operation and the odd tenths of a megacycle frequency selects LCL operation.

VOR/TACAN Selector Switches.

The VOR/TACAN selector switches (31 and 55, figure 1-14), one each for the pilot and copilot, are located below their respective BDHI. The pilot's switch has marked positions VOR MASTER and TACAN SLAVE, and the copilot's switch is marked TACAN MASTER and VOR SLAVE. When the pilot's switch is in the VOR MASTER position, his CDI and No. 2 bearing pointer (BDHI) will display VOR course information and will display TACAN course information when his switch is in the TACAN SLAVE position regardless of the position of the copilot's switch. When the copilots switch is in the VOR SLAVE position, his CDI and No. 2 bearing pointer (BDHI) will display VOR course information and will display TACAN course information when his switch is in the TACAN MASTER position regardless of the position of the pilot's switch.

NOTE

After completion of TCTO 1H-3-717, the VOR/TACAN selector switches will provide TACAN bearing on the No. 2 needle when ILS is tuned and selected.

RADAR ALTIMETER SET AN/APN-171(V).

HH-3E helicopters 32 ▸ or those helicopters modified by T.O. 1H-3-611 are equipped with a Radar Altimeter Set AN/APN-171(V). The altimeter set provides instantaneous terrain clearance between the helicopter and terrain from 0 to 5000 feet. Altitude, in feet, is visually depicted by the two radar altimeter indicators (figure 4-11) located on the instrument panel in front of the pilot and copilot. A control knob on the lower left side of the indicator is a multi-purpose switch. It serves as a test switch, a low level warning index set control and an on/off power switch. The set is turned on by rotating the control knob, marked PUSH-TO-TEST, clockwise from the OFF position. Continued clockwise rotation of the control knob toward the SET position will permit the pilot to select any desired low altitude limit, which will be indicated by the low level index marker on the indicator. Depressing the PUSH-TO-TEST control knob provides a testing feature of the set at any time or altitude, which gives a visual indication of 100 ± 15 feet on the indicator if the set is functioning properly. Releasing the PUSH-TO-TEST control knob restores the set to normal operation. A low level warning light, located on the lower right side of the indicator, will illuminate and show the marking LOW any time the helicopter is at or below the selected altitude. Loss of system power or tracking condition will be indicated by a black and yellow striped flag which appears in the indicator window, located in the lower center portion of the indicator. If the system should become unreliable, the black and yellow striped flag will appear and the pointer will go behind the mask marked NO TRACK. The set is powered by the ac and dc essential busses and is protected by

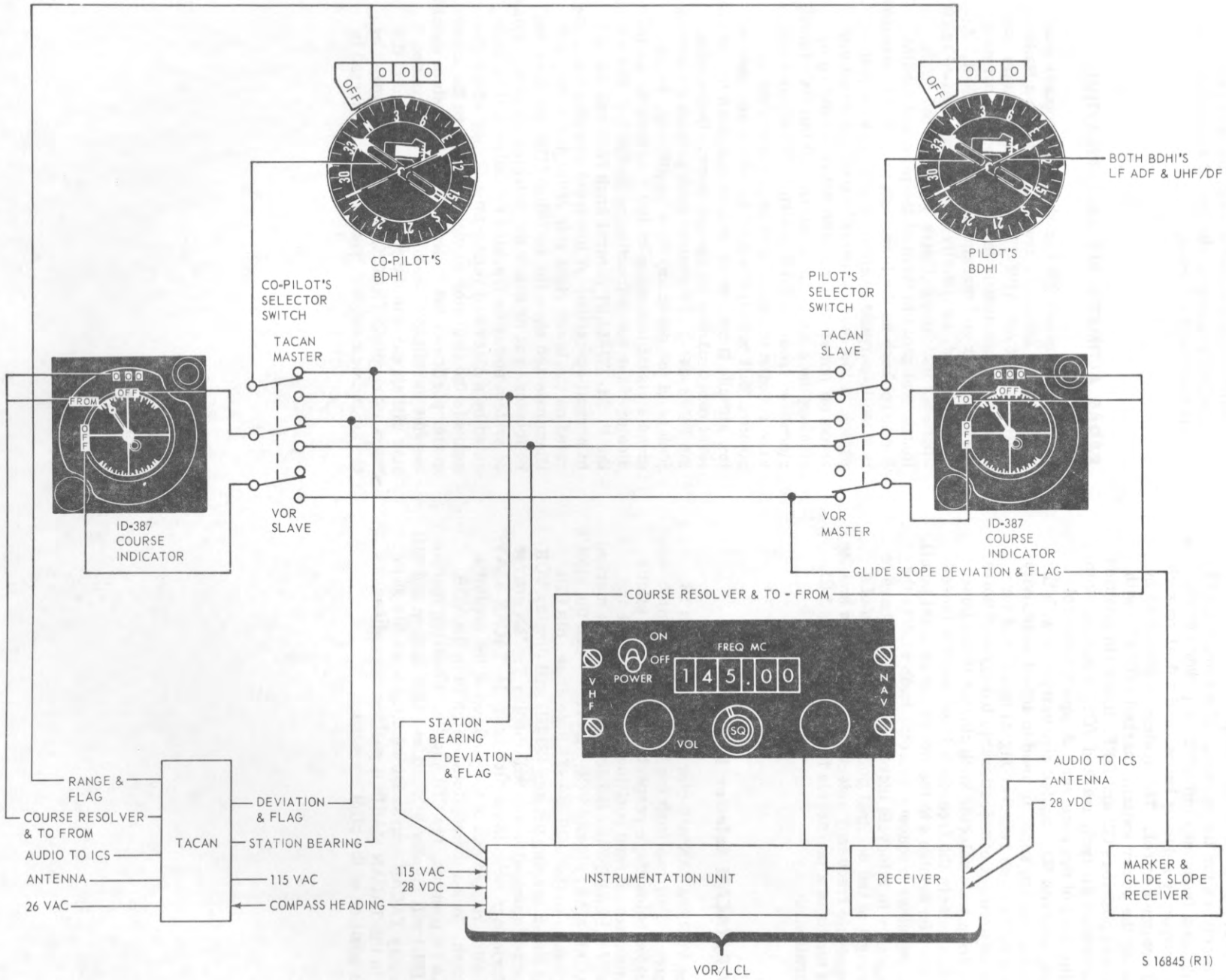


Figure 4-9. OMNI Navigation System (VOR-101) Block Diagram

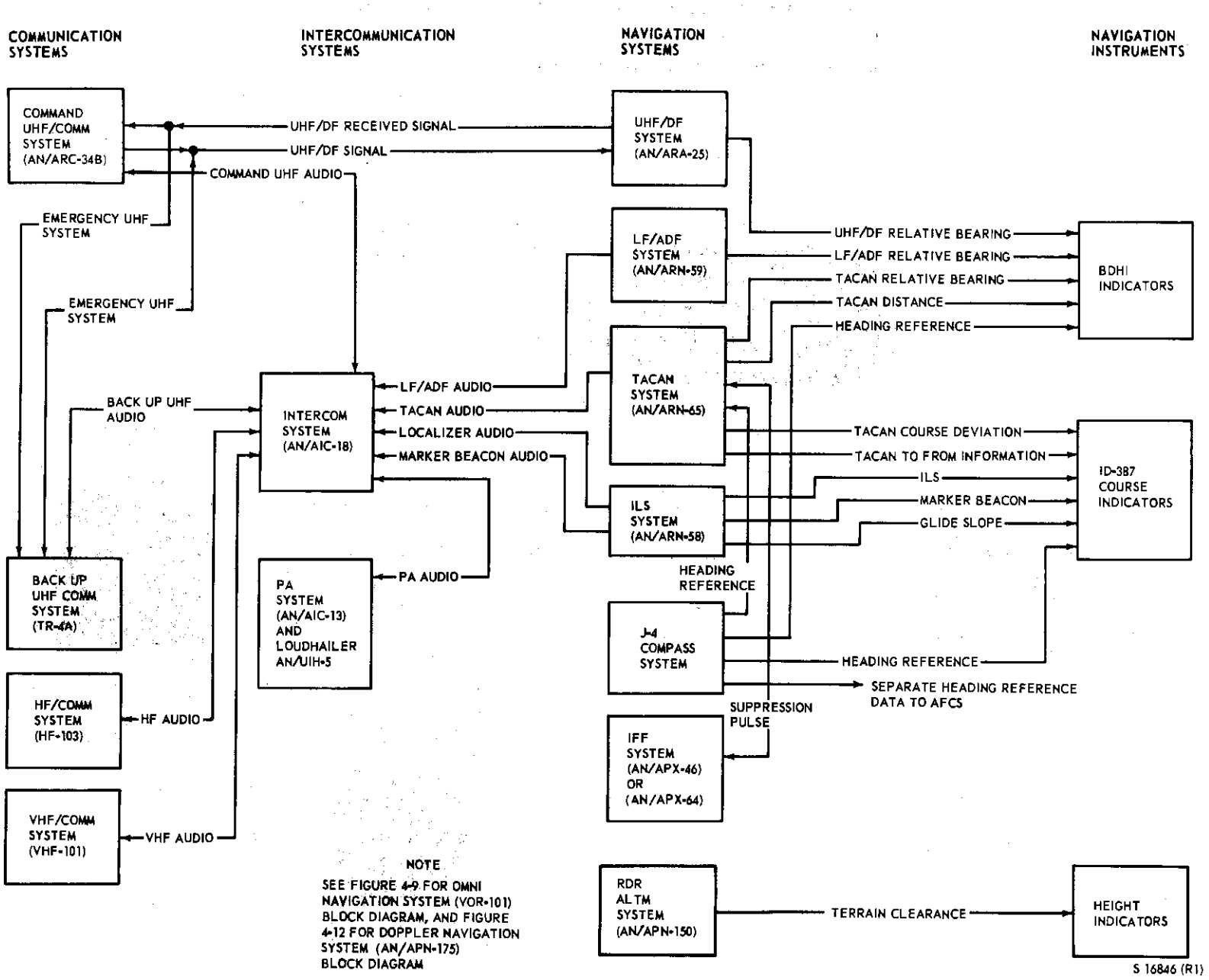


Figure 4-10. Navigation Communication System Block Diagram (Typical)

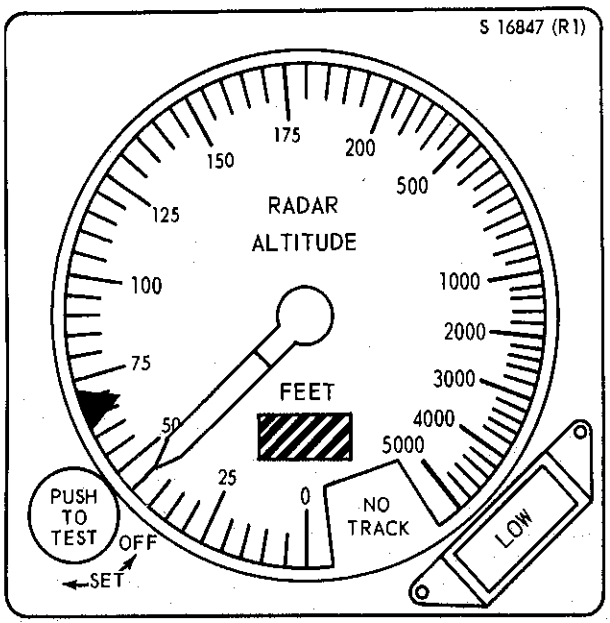


Figure 4-11. Radar Altimeter Indicator AN/APN-171(V) (HH-3E 32 ▶ or Helicopters Modified by T.O. 1H-3-611)

two circuit breakers marked RDR ALTM. One is located on the pilot's ac essential bus circuit breaker panel and the other is located on the copilot's dc essential bus circuit breaker panel. On helicopters modified by TCTO 1H-3-643, the low level warning light is dimmed when the caution and advisory lights are dimmed.

ALTIMETER SET ELECTRONIC (AN/APN-150).

Helicopters prior to CH-3E 16 not modified by T.O. 1H-3-611 are equipped with an altimeter set electronic (AN/APN-150). The altimeter set provides continuous indication of height (terrain clearance) of the helicopter from 0 to 1000 feet over land and water. Altitude in feet is shown by two altimeter indicators (3 and 25, figure 1-14), located on the instrument panel in front of the pilot and copilot. The altimeters are provided with two controls. However, only the pilot's controls will operate the set. The copilot's control is inoperative. A control knob, marked ON-ALT supplies electrical power for operation of the altimeter and mechanically positions the low altitude limit cursor (BUG) on the indicator dial. A flag indicator, marked either FAIL/ON or OFF/ON, is incorporated in the instrument. A FAIL or OFF flag indicates that either a malfunction exists or that the system has not been turned on. Inter-

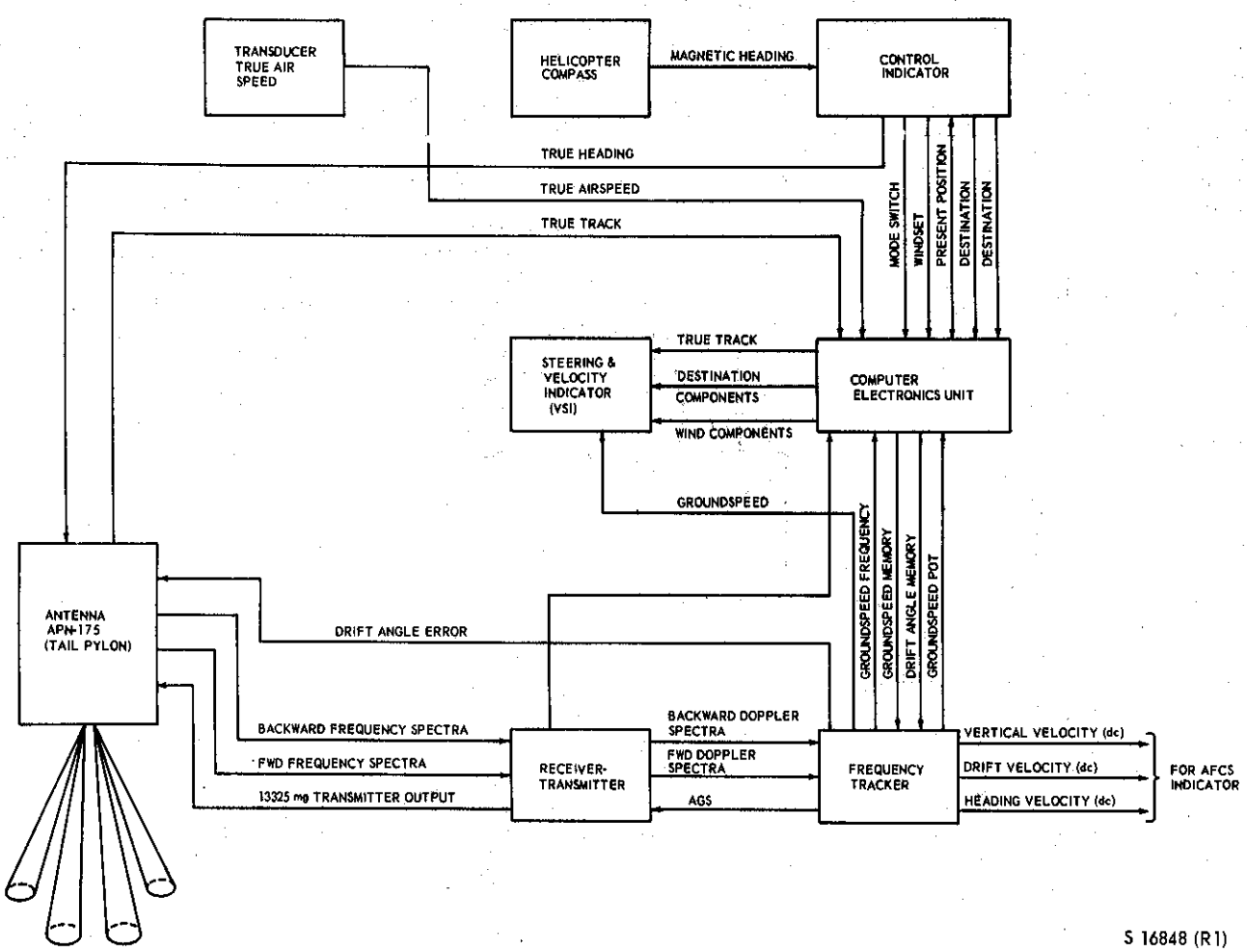


Figure 4-12. Navigation Set, Radar, System Block Diagram

ruption of power to the flag indicator will display the FAIL (OFF) portion of the flag in the window. When the helicopter is above 1000 feet, the FAIL (OFF) flag will show and the pointer will go behind the mask. A caution light, marked ALTITUDE LOW, comes on whenever the helicopter is below the altitude preselected by the low limit cursor (BUG). The AN/APN-150 set is protected by two circuit breakers, marked RDR ALTM, one located on the ac essential bus circuit breaker panel and the other located on the overhead dc circuit breaker panel.

NOTE

When flying more than 1000 feet above the ground with the APN-150 turned on, the FAIL (or OFF) portion of the FAIL/ON (OFF/ON) indicator will be displayed until the aircraft is at or below 1000 feet above the ground.

Altimeter Set Electronic Operation.

To turn the set on:

1. ON-ALT switch - ON.

2. ON-ALT switch - SET (BUG) TO DESIRED ALTITUDE.

To turn the set off:

1. ON-ALT switch - OFF.

NAVIGATION SET RADAR (AN/APN-175(V).

Helicopters CH-3E 16▸ and HH-3E 25▸ are equipped with a navigation set, radar. The navigation set consists of sensor group and a doppler computer group. The system is augmented by magnetic heading information from the J-4 compass system, a true airspeed transducer, and AFCS vertical gyro inputs to stabilize the antenna of the sensor group in pitch and roll (figure 4-12). The AFCS indicators are also utilized to reflect along track, across track, and vertical velocity displays in the hover mode of operation, below 25 knots ground speed. Along track information is displayed by the horizontal bar and across track information is displayed by the vertical bar, each circle representing 5 knots groundspeed. Vertical velocity information is displayed by the left-hand pointer, with each division representing 500 feet per minute. HH-3E helicopters 32▸ or those helicopters modified by T.O. 1H-3-611 are equipped with a radar altimeter set AN/APN-171(V) that eliminates the present altimeter function of the AN/APN-175(V)-2 and the altitude indicators.

HH-3E helicopters 25▸ are equipped to display altitude above the terrain, as determined by the sensor group, on the altitude indicators. The navigation set operates on 115 volts alternating current from the radio ac essential bus and is protected by two circuit breakers, marked DOPPLER COMPT, located on the pilot's overhead circuit breaker panel. The doppler blower operates on 115 volts alternating current from the radio ac essential bus and is protected by three circuit breakers, marked DOPPLER BLOWER, also located on the pilot's overhead circuit breaker panel.

Sensor Group.

The sensor group is a lightweight airborne group which operates at a frequency of 13325 megacycles through an altitude range of 2 to 30,000 feet. The set consists of a receiver-transmitter, a frequency tracker, an antenna, and a blower. The blower is provided to cool the operating components and for fume elimination in the doppler compartment. The transistorized receiver-transmitter produces a frequency-modulated signal of 13325 megacycles to the transmitting antenna, which transmits and receives four beams in a square pattern to the land or water below. There are two forward and two backward beams. The signals returned to the antenna by the reflecting surface are received by the frequency-tracker as forward and backward doppler signals from the receiver-transmitter, which produces a single frequency equal to the center frequency of the summed totals of the forward and backward signals, and provides error voltages to align the antenna with the ground track. The horn excited waveguide-type antenna is mounted on the bottom of the lower fuselage. The antenna contains one transmitting and two receiving waveguide assemblies. The antenna will rotate with drift angle changes of the helicopter up to a maximum of 90 degrees, left or right, at a minimum rate of 6 degrees per second. The antenna receives pitch and roll information from either the left or right AFCS vertical gyro (whichever gyro is selected on the AFCS channel monitor panel) and maintains a level attitude by movement of the antenna up to limits of 35° of roll (left or right) and 10° of pitch (up or down). The set provides reliable groundspeeds, from -50 to +390 knots, and left and right drift angles, up to 90 degrees, over all reflective surfaces. The groundspeed and drift angle outputs are then fed to the doppler computer group for computation of present position, as well as bearing and distance to the destination. The sensor group works in conjunction with the doppler computer group, and is operated from the control indicator. The set will detect any loss of doppler signal and send an input to the computer group to initiate a memory operation. The computer will then utilize the last reliable wind solution from the navigation set, use true airspeed and heading inputs to solve groundspeed and track, and furnish groundspeed and drift angle memory signals to the sensor group until the doppler signal returns.

Altitude Indicators.

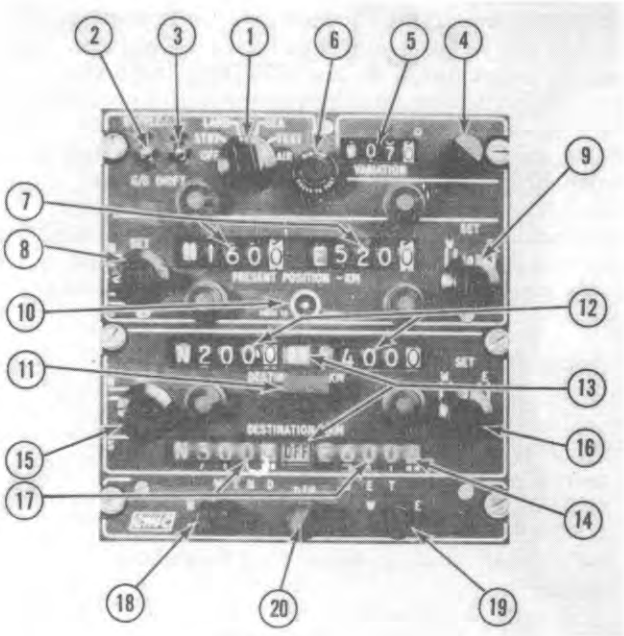
HH-3E helicopters 25▸ are equipped with altitude indicators to indicate aircraft altitude above the

terrain, as determined by the sensor group. The altitude indicators, located on the instrument panel in front of the pilot and copilot, provide indication of height of the helicopter from 0 to 2500 feet over land or water. The indicators are in operation whenever the navigation set is turned on. Each indicator contains a set knob, marked ALT SET, that is used to manually preselect a minimum altitude. The manually selected minimum altitude will be indicated by a triangular marker that rotates around the outside of the altitude scale. A red OFF flag, incorporated in the instrument face, will appear during unreliable operation due to low signal strength, when the altimeter becomes faulty, or upon loss of electrical power. A memory light, marked PRESS-TO-TEST, located on the top right-hand corner of the indicator, will illuminate whenever the navigation set is in memory operation.

On HH-3E helicopters [32] or those helicopters modified by T.O. 1H-3-611, the altitude indicators are removed and replaced with radar altimeter indicators.

Doppler Computer Group.

The doppler computer group is a transistorized navigation computer designed to provide continuous calculation of present position relative to an operator-selected grid origin (or center point), distance and bearing to a destination, and windspeed and direction. During a loss of doppler signal or erratic data from the sensor group, the computer will also use the last known or manually updated windspeed and direction to calculate groundspeed and drift angle. The group consists of a navigation computer, a velocity steering indicator, and a control indicator. The group has a memory mode of operation to insure continuity of computation when tracking information is not available from the sensor group, and an air data mode of operation to permit use of the equipment when operation of the radar transmitter is not desired. Other features of the group include visual displays of groundspeed, true track, and wind velocity. The computer uses track and groundspeed information, in conjunction with true heading and true airspeed, to continuously calculate the wind velocity.

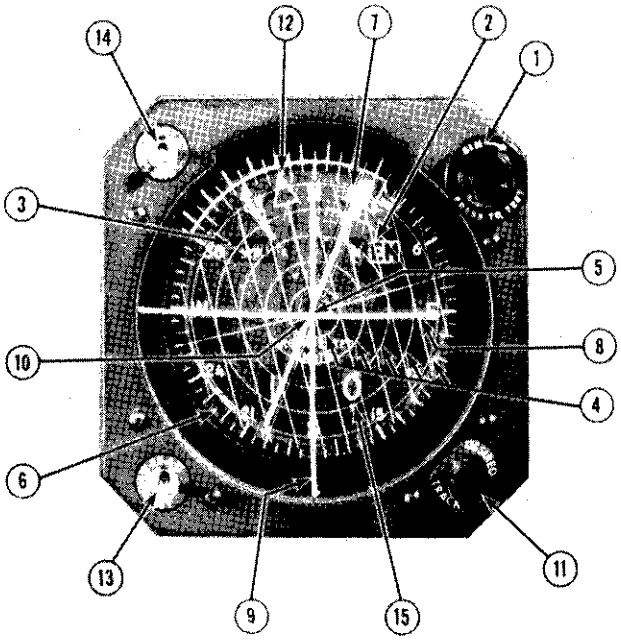


1. FUNCTION SELECTOR SWITCH
2. DOPPLER SLEW TEST SWITCH
3. DOPPLER DRIFT SWITCH
4. VARIATION SET KNOB
5. VARIATION DIGITAL COUNTER
6. PRESS-TO-TEST COMPUTER MALFUNCTION CAUTION LIGHT
7. PRESENT POSITION DIGITAL COUNTERS
8. PRESENT POSITION N-S SET KNOB
9. PRESENT POSITION W-E SET KNOB
10. PRESS-TO-STORE BUTTON
11. DESTINATION SELECTOR SWITCH
12. DESTINATION 1 DIGITAL COUNTERS
13. DESTINATION ON/OFF FLAGS
14. DESTINATION MASH (ORANGE COLOR)
15. DESTINATION N-S SET KNOB
16. DESTINATION W-E SET KNOB
17. DESTINATION 2 COUNTERS
18. N-S WIND SET KNOB
19. W-E WIND SET KNOB
20. WIND SET KNOB (PRESENT DIRECTION)

Figure 4-13. Control Indicator (C6586/AYA-3)

Control Indicator.

The control indicator is the master control for the entire navigation set, controlling both the sensor group and the doppler computer group. The control indicator provides a digital counter readout of present position, two destinations, and the magnetic variation which has been inserted to change magnetic heading to true heading. Circuitry is provided to program the computer for initial position at take-off, position correction, destination changes, and to manually slew the groundspeed drift angle of the sensor group. Switches are also provided to update the memory wind information during memory operation. The function selector switch, with marked positions OFF, STBY, LAND, SEA, TEST, and AIR, (1, figure 4-13) selects the mode of operation for both the sensor group and the doppler computer group. Placing the function switch in the OFF position turns off both groups. The STBY position places the equipment in a standby mode of operation and allows slewing of the present position and destination readouts. The STBY position is also used for pre-take-off programming. The velocity steering indicator caution light (1, figure 4-14) will illuminate and the memory flag (2, figure 4-14) will show MEM whenever the function switch is in the STBY position. The LAND position is used for normal operation over land, and the SEA position is used for normal operation over water. The AIR position places the equipment in an air data mode of operation when it is desired to operate the equipment to escape detection by radar transmitter operation. When the switch is placed in the TEST position, the computer will be placed in a self-test mode of operation and the sensor group is placed in a standby mode. The vertical steering indicator caution light (1, figure



1. VELOCITY STEERING INDICATOR MEMORY CAUTION LIGHT
2. MEMORY FLAG
3. SCALE SELECTED WINDOW
4. CONCENTRIC RANGE CIRCLE
5. CENTER MARKER
6. STATIONARY COMPASS CARD
7. TRACK POINTER
8. HORIZONTAL BAR
9. VERTICAL BAR
10. VERTICAL AND HORIZONTAL BAR INTERSECTION
11. DESIRED TRACK KNOB
12. DESIRED GRID
13. WIND SWITCH (SET/READ)
14. SCALE SWITCH
15. GROUND SPEED DIGITAL COUNTER

Figure 4-14. Velocity and Steering Indicator (ID-1282/AYA-2)

4-14) will illuminate and the memory flag will indicate MEM. The present position counters will change values, and the vertical and horizontal bars of the vertical steering indicator will indicate the relationship between present position and the destination. The doppler slew and test switch (2, figure 4-13), with marked positions DOPPLER and G/S, is used to manually slew the groundspeed information. Placing the switch in the DOPPLER position will increase groundspeed, and placing the switch in the G/S position will decrease groundspeed (for testing purposes). The doppler drift switch (3, figure 4-13), marked DRIFT, is used to manually slew the sensor group antenna (for testing purposes). The antenna will slew to the right when the switch is held in the up position, and to the left when held in the down position. The press-to-test memory caution light (6, figure 4-13), located to the right of the function switch, will be illuminated continuously in the event of a computer malfunction, or intermittently to indicate that the present position counter is being slewed at a slow rate. The variation digital counter (5, figure 4-13), marked VARIATION, indicates the degree of magnetic variation that has been manually set into the system by the variation set knob. The variation set knob (4, figure 4-13), located adjacent to the variation counter, is pulled out to engage and allow manual insertion of magnetic variation up to 99.9 degrees, east or west. The present position digital counter (7, figure 4-13), marked PRESENT POSITION - NMI, indicates the present position, north or south and east or west, in relation to a selected point. The north or south present position reading is slewed at a variable rate by rotating the rheostat knob (8, figure 4-13), marked SET, with marked positions N and S. The east or west present position reading is slewed at a variable rate by rotating the rheostat knob (9, figure 4-13), marked SET, with marked positions W and E. When the push button (10, figure 4-13), marked PRESS-TO-STORE and located below the present position counter is depressed, the computer will store present position calculations while the pilot corrects the present position counter settings. Depressing the button a second time will cause the computer to update the stored present position information to the present position counters. The PRESS-TO-STORE button will be illuminated when the stored facilities are active. The DESTINATION digital counters (12, figure 4-13), that are marked DESTINATION 1 and DESTINATION 2, indicate destinations in nautical miles north or south and east or west of an operator designated grid origin (or center point). Both are slewed at a variable rate by rotating the adjacent set knobs. The knob (15, figure 4-13), marked SET, with marked positions N and S, is used to slew the north or south settings of the destination counter not being used. The knob (16, figure 4-13), marked SET, with marked positions W and E, is used to slew the west and east settings of the destination counter not being used. The SET rheostats can only be used to slew the counters for the inactive destination. A destination selector switch (11, figure 4-13), located between the two destination counters, is used to select the desired destination counters and connect the SET rheostat knob to the inactive counters. When the switch is placed in the up position, destination 1 counters are selected and the SET rheostats are connected to the number 2 destination counters. When the switch is placed in the down position, destination 2 counters are selected and the SET rheostats are connected to the number 1 counters. When a destination counter is not in operation, a transparent orange colored mask (14, figure 4-13) will appear over the counters. Each destination counter also has a flag (13, figure 4-13) that will read ON, when the counter is active, to indicate the counter cannot be slewed. The flag will read OFF when the counter is inactive to indicate the counter can be slewed. Two wind set knobs, located on the bottom of the indicator under the heading WIND SET, are used to slew wind direction. The knob (18, figure 4-13), with marked positions N and S, is used to slew the north and south wind velocity, which is shown by displacement of the horizontal bar on the velocity steering indicator. The knob (19, figure 4-13) with marked positions W and E, is used to slew the east and west wind velocity which is shown by displacement of the vertical bar on the velocity steering indicator. The wind set knob (20, figure 4-13), marked DIR, permits rotation of the track pointer to indicate the present wind

direction when the WIND-READ-SET switch (13, figure 4-14) on the velocity steering indicator is operated.

Velocity Steering Indicator (VSI).
(See figure 4-14.)

The velocity steering indicator, located on the instrument panel, provides a visual display of a selected destination relationship to the present position. The present position is represented by the center mark, which is an etched mark that is in the center marker (5, figure 4-14) of the concentric rings on the indicator dial. The selected destination is represented by the intersection of horizontal and vertical bar indicators. The horizontal bar (8, figure 4-14) represents the north or south distance component from present position to the destination, and the vertical bar (9, figure 4-14) represents the east and west distance component from present position to the destination. The intersection (10, figure 4-14) of the vertical and horizontal bars indicates destination bearing and the distance to the destination from the present position. The scale markers (4, figure 4-14) are concentric range circles that provide short, medium, and long distance scales. The scale selected is indicated in a window (3, figure 4-14) located on the upper left-hand portion of the indicator. The short scale indicates a range of 0 to 10 nautical miles, the medium scale indicates a range of 0 to 100 nautical miles, and the long scale indicates a range of 0 to 1000 nautical miles. Appropriate scales are selected by use of a scale switch, (14, figure 4-14) marked X10 SCALE X3, located on the upper left corner of the indicator. The X10 switch position selects the next lower range scale, when the distance to the destination has decreased to within the limits of the lower scale. If the helicopter should overfly the selected range, the scale will automatically change when the limit of the scale in use is reached. The spring loaded X3 position is used to expand the distance-to-go by a factor of three for a five second period, or as long as the switch is held, to make steering easier by allowing the track pointer to be more accurately aligned with the intersection of the horizontal and vertical bars. The track pointer (7, figure 4-14) rotates around a compass card to indicate true track. True track is maintained to a selected destination by turning the helicopter until the track indicated by the track pointer coincides with the destination bearing indicated by the intersection of the vertical and horizontal bars. The stationary compass card (6, figure 4-14), calibrated in 5-degree increments from 0 to 360 degrees, is used to facilitate track and wind direction readout. The wind set switch (13, figure 4-14), marked SET WIND READ, is located on the lower left corner of the indicator. Placing the wind switch in either the SET or READ position, converts the velocity steering indicator from a position indicator to a wind velocity indicator. When used as a wind velocity indicator, the concentric range rings read from 0 to 50 knots, with the space between each ring being equal to 10 knots. The intersection of the vertical and horizontal bars, in relation to the center of the velocity steering indicator, indicates the end of the wind vector. The distance from the center of the velocity steering indicator to the intersection of the vertical and horizontal bars represents wind velocity. The track pointer may be rotated by the DIR knob, located on the control indicator panel, to find the intersection of the cross bars on the VSI to provide readout of wind direction. The wind switch is placed in the SET position to manually program the wind. When the wind is being manually programmed, the N and S and E and W wind set knobs, located on the control indicator, are used to position the vertical and horizontal bars, and the DIR knob, also located on the control indicator, positions the track pointer to correspond to the required wind direction. When the wind has been set, the wind switch is returned to its neutral position. Wind is manually programmed to update the wind velocity when operating in the air data mode and when required to program surface wind velocities prior to take-off. The READ position of the wind switch is spring-loaded to neutral. When the switch is held in the READ position, the velocity steering indicator will display either the wind velocity computer from the sensor group, when operating in the normal mode of operation (the last reliable wind velocity stored in the memory circuits when operating in the memory mode), or the memorized or manually programmed wind velocities when operating in the air data mode. The desired track knob (11, figure 4-14), marked DESIRED TRACK, located on the lower right hand corner of the indicator, is used to manually rotate the desired track grid. The desired track grid overlay (12, figure 4-14) contains parallel lines with the center line having an arrowhead. The center line is referred to as the desired track pointer. The track grid is rotated until the desired course for a selected leg is indicated by the desired track pointer on the compass card. A traverse line running through the center of the grid and perpendicular to the desired track pointer is used to determine the distance the helicopter may have deviated from the planned course. This is accomplished by noting the distance measured along the traverse line between the center of the indicator and an imaginary line running parallel to the desired track pointer through the intersection of the vertical and horizontal bars. The groundspeed digital counter (15, figure 4-14), located in the center of the indicator, indicates groundspeed from 0 to 499 knots. The memory flag, located on the upper right side of the indicator, will show MEM when operating in any mode of operation other than the land or sea modes of operation. The press-to-test memory caution light, located on the upper right corner of the indicator, will illuminate to indicate that the navigation set has lost doppler signal or become unreliable, or that the wind set switch is in the SET position.

True Airspeed Transmitter.

The true airspeed transmitter accepts pitot and static pressure from the pilot's pitot tube, and free air temperature from a free air temperature sensor, to produce an electrical signal representative of the true airspeed of the helicopter. True airspeed is applied to the computer to be used in

the memory and air data modes of operation and for wind velocity calculation.

Navigation Set, Radar Sample Problem.

NORMAL PROCEDURES.

Flight Planning. (See figure 4-15).

Obtain a map upon which grid lines oriented to a true north are drawn, or use a nautical mile grid overlay. On the map to be used, select a convenient origin to be designated as coordinates "zero-zero" on the intersection of the grid lines, or a geographically substantiated and easily identifiable landmark. It is usually desirable to use the helicopter operating base as the origin. Locate the destination or destinations in terms of coordinates north or south and east or west of the origin. Obtain the difference between the latitudinal coordinates of the origin and the destination. One minute of latitude is equal to one nautical mile for the purpose of setting N-S counters. Obtain the difference between the longitudinal coordinates of the origin and the destination. Because of the convergency of the meridians of longitude as they approach the earth's poles, one minute of longitude is equal to one nautical mile only at the equator. In order to obtain nautical miles for purposes of setting the E-W counters, first multiply the difference of the longitudinal coordinates by the cosine of the mid-latitude between the origin and the destination. All destinations selected must be located in reference to the same origin. Using a protractor, determine the desired track for each leg. Obtain the best available wind information for the planned cruise altitude at the point of takeoff. If this is not available, use surface winds.

NOTE

Mileages for one degree of longitude at any latitude may also be found directly in several navigational texts.

NOTE

Because the earth is not a perfect sphere, one degree of latitude varies slightly from 60 miles but is not significant in the use of the doppler navigator.

Before TakeOff.

1. Function switch - STDBY.
   Allow one minute of warmup time for fully reliable doppler operation before takeoff.

2. Variation set knob - PULL TO SET MAGNETIC VARIATION.

3. Wind switch (VSI) - PLACE IN WIND SET POSITION.

4. Wind set DIR knob (control indicator) - ROTATE UNTIL THE TRACK POINTER ON THE VSI INDICATES THE PRESENT WIND DIRECTION.

5. Wind set knobs (control indicator) - SLEW CROSS BARS ON THE VSI TO INTERSECT THE TRACK POINTER AT THE CIRCLE CORRESPONDING TO THE WIND VELOCITY.
   Each circle indicates 10 knots.

6. Wind switch (VSI) - CENTER.

7. Set in present position at this point, if possible.

NOTE

Moving the wind set knobs will insert a different wind whenever the doppler is operating in STANDBY, AIR DATA, or MEMORY modes. The velocity steering indicator will not display this changing wind unless the wind-read-set switch is operated.

8. Function switch - TEST.

   a. VSI MEMORY caution light - ON.

   b. Memory flag - MEM.

   c. Preset position counters - POSITION INCREASES AT APPROXIMATELY 5 MILES PER MINUTE.

   d. VSI cross bars - SLEW TO INDICATE DESTINATION AND PRESENT POSITION RELATIONSHIP.

9. Function switch - STDBY

10. PRESENT POSITION SET knobs - SLEW PRESENT POSITION TO THE EXACT COORDINATES OF THE BASE (usually zero - zero).

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.

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.

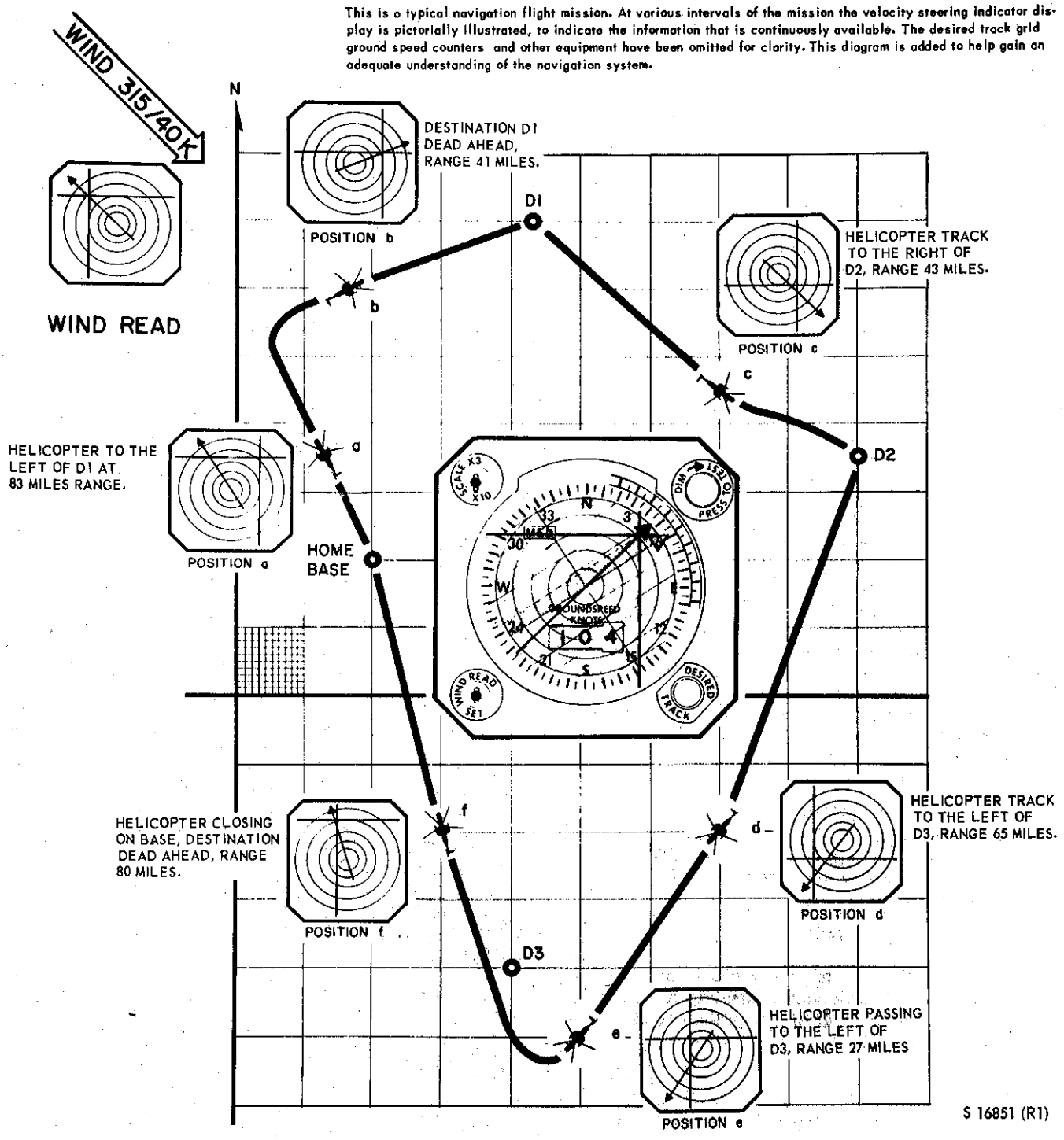


Figure 4-15. Typical Navigation System Radar Mission

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 ground speed. 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 undersirable 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 Take-Off 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.

Errors Associated With Heading Reference.

HELICOPTER HEADING.

The overall accuracy of the system is directly dependent on the accuracy 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 intro-

duce 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.)

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 1-36).

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 1-36).

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 take-off 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 1-36).

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 4-16), 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 1-36).

Pilot's Compartment Spotlights.

Two portable spotlights (8 and 36, figure 1-5), 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 portable spotlights. The spotlights are each controlled by a rheostat, with marked positions OFF and BRT, or a push-button, 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.

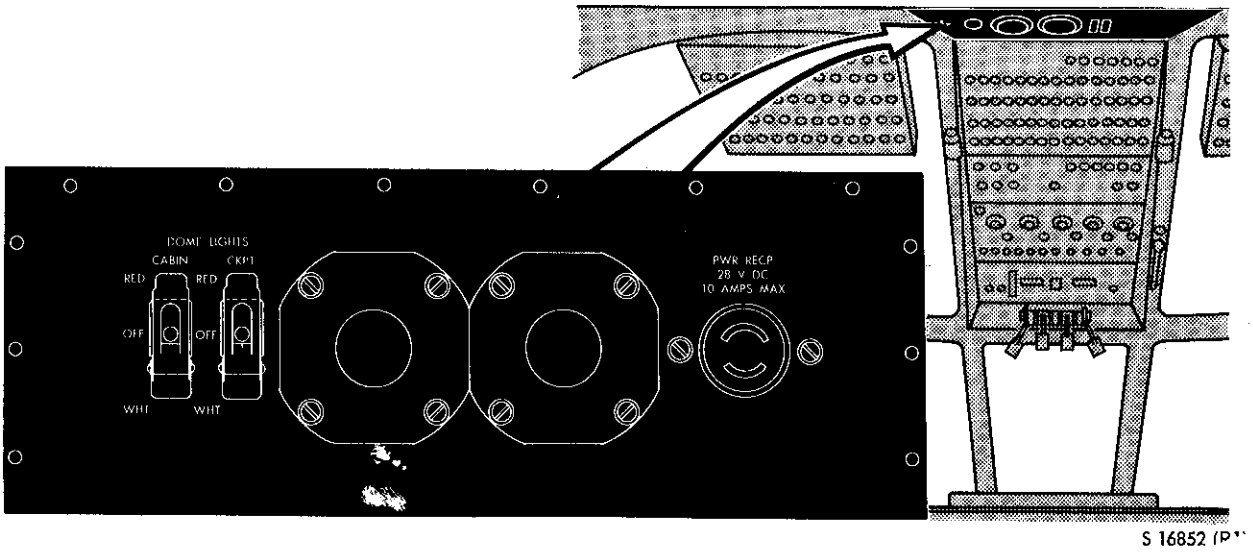


Figure 4-16. Pilot's Compartment Dome Light Panel

Emergency Exit Lights.

Four impact type emergency exit lights (figure 4-17) 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 (9, figure 4-18) 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 1-36).

Pilot's Compartment Dome Lights.

The pilot's compartment dome lights (5, figure 4-18) are controlled by a guarded switch, marked DOME LIGHTS-CKPT, with marked positions RED, OFF, and WHITE, located on the pilot's compartment dome light panel (figure 4-16). 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 (10 and 14, figure 4-18), 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 4-18) 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 progessively 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.

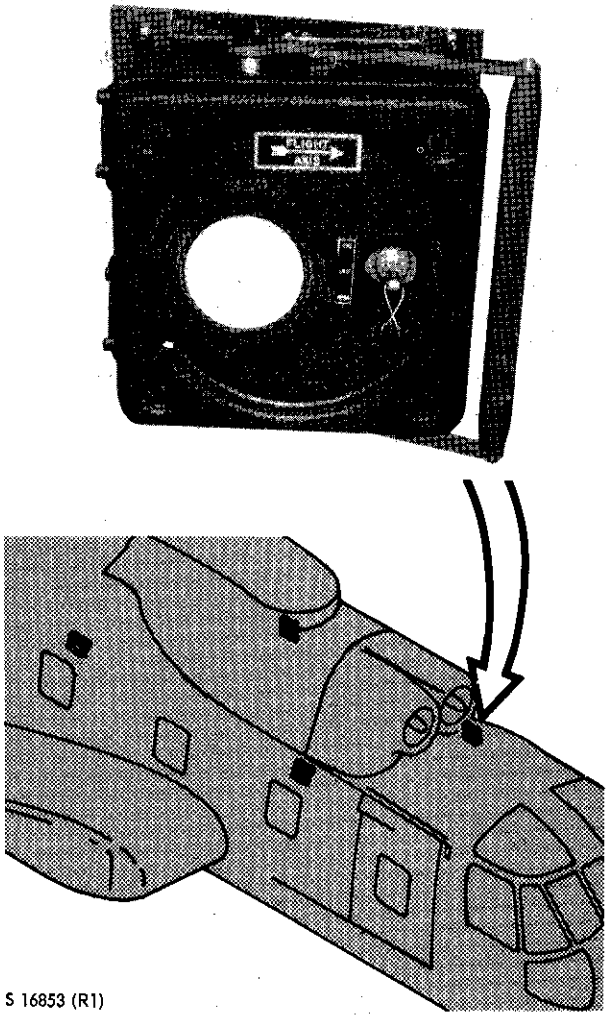


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Figure 4-17. Emergency Exit Lights

Controllable Spotlight.

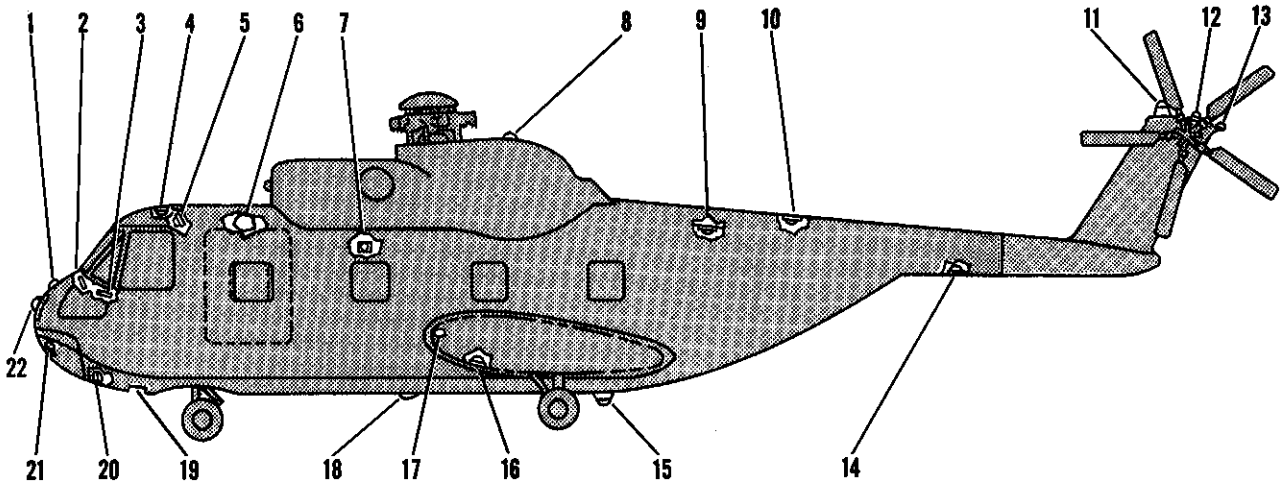
CH-3E 16 ▸ and HH-3E helicopters are equipped with a controllable spotlight mounted on the battery compartment door. The intensity of the controllable spotlight is controlled through a rheostat, marked PROBE LIGHT, located on the pressure refueling panel. The dimming control rheostat has marked positions 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 left 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.



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. SEARCH LIGHT
20. LANDING LIGHT
21. FLOOD LIGHT
22. CONTROLLABLE SPOTLIGHT (CH-3E 16 ▶, HH-3E 25 ▶ OR HELICOPTERS MODIFIED BY T.O. 1H-3-511)

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Figure 4-18. Lighting System (Typical)

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 (13 and 17, figure 4-18), 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 1-36). 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 (8 and 18, figure 4-18) 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 (1 and 12, figure 4-18), 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.

Rotating Anti-Collision Lights.

The rotating anti-collision lights (11 and 15, figure 4-18), one located on the top of the pylon and the other on the bottom of the fuselage, are controlled by two switches. The left-hand switch, under the heading ANTI-COLLISION with marked positions FWD, ON, and OFF, located on the overhead switch panel, controls the forward anti-collision light. The right-hand switch, under the heading ANTI-COLLISION with marked positions AFT, ON and OFF, located on the overhead switch panel, controls the aft rotating anti-collision light. The rotating anti-collision lights operate from the dc essential bus and are protected by two circuit breakers, marked ANTI-COLL, FWD, and AFT, located on the overhead dc circuit breaker panel.

WARNING

The FWD rotating anti-collision light should be turned OFF during water operation, or in other conditions of reduced visibility where the pilot could experience spatial disorientation as a result of the reflections of the rotating light against the clouds.

CAUTION

Turn off the FWD anti-collision light prior to water entry to prevent breakage due to heat of glass.

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 tall 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

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.

AUXILIARY POWER UNIT.

The auxiliary power unit (APU), (figure 4-19), 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.

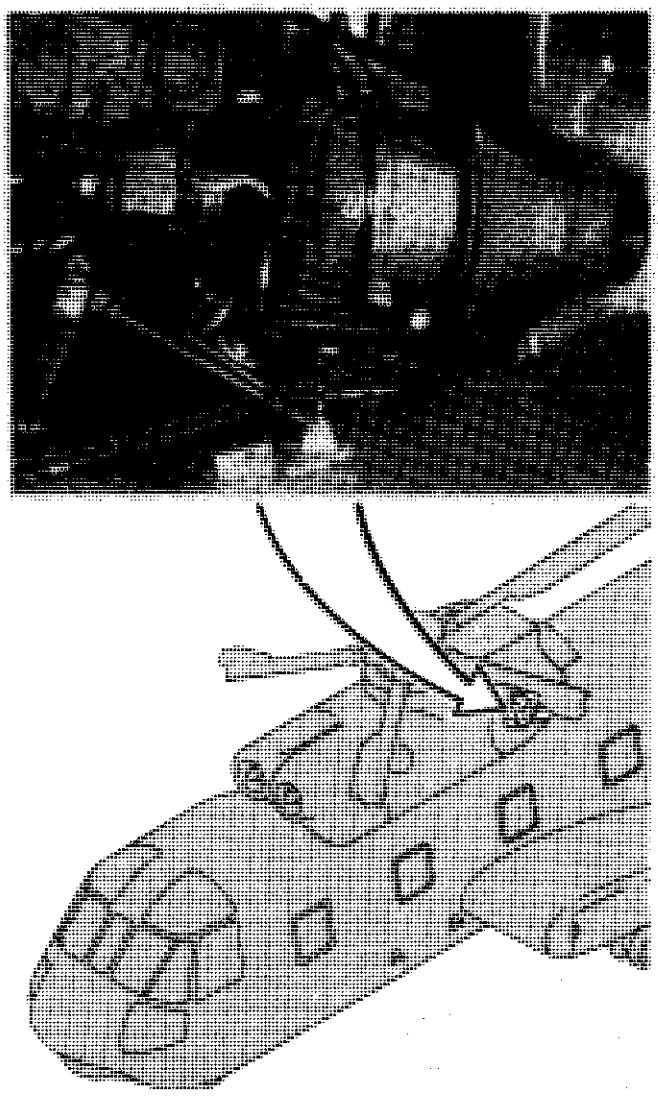

Figure 4-19. Auxiliary Power Unit

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 20 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 fuel pump pressure caution light, marked PRI-PUMP PRESS, illuminates whenever the prime pump is not delivering enough fuel pressure. A prime pump failure would be indicated by continuous illumination of the PRI-PUMP caution light during start.

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 Shut-Off Switch.

The emergency fuel shut-off switch, with marked positions FUEL SHUT-OFF 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 de-energized. Placing the switch in the FUEL SHUT-OFF position closes the main fuel valve and allows the APU fire extinguisher circuit to be energized. The emergency fuel shut-off 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 SHUT-OFF position of the APU emergency shut-off 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 (at approximately 36% APU speed), just before lite-off, 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 4-20) is used during starting of the turbine, if the 3000 psi pressure from the accumulator is not sufficient. At -54°C (-65°F) 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, the 3000 psi pressure from the accumulator has a two time starting capability. However, if 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 (-65°F), 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 4-21), 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 6 sections and is capable of sustaining distributed static loads of 200 pounds per square foot. Refer to the Cargo Loading Manual T.O. 1H-3(C)C-9 for cargo loading instructions to distribute static loads. Tie-down fittings, rated at 2500 pounds, are installed on the cargo floor to facilitate cargo tie-down, 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 capacity hydraulic rescue hoist which is permanently externally mounted above the personnel door. Refer to Rescue Hoist in the Main Difference Table, figure 1-2. 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

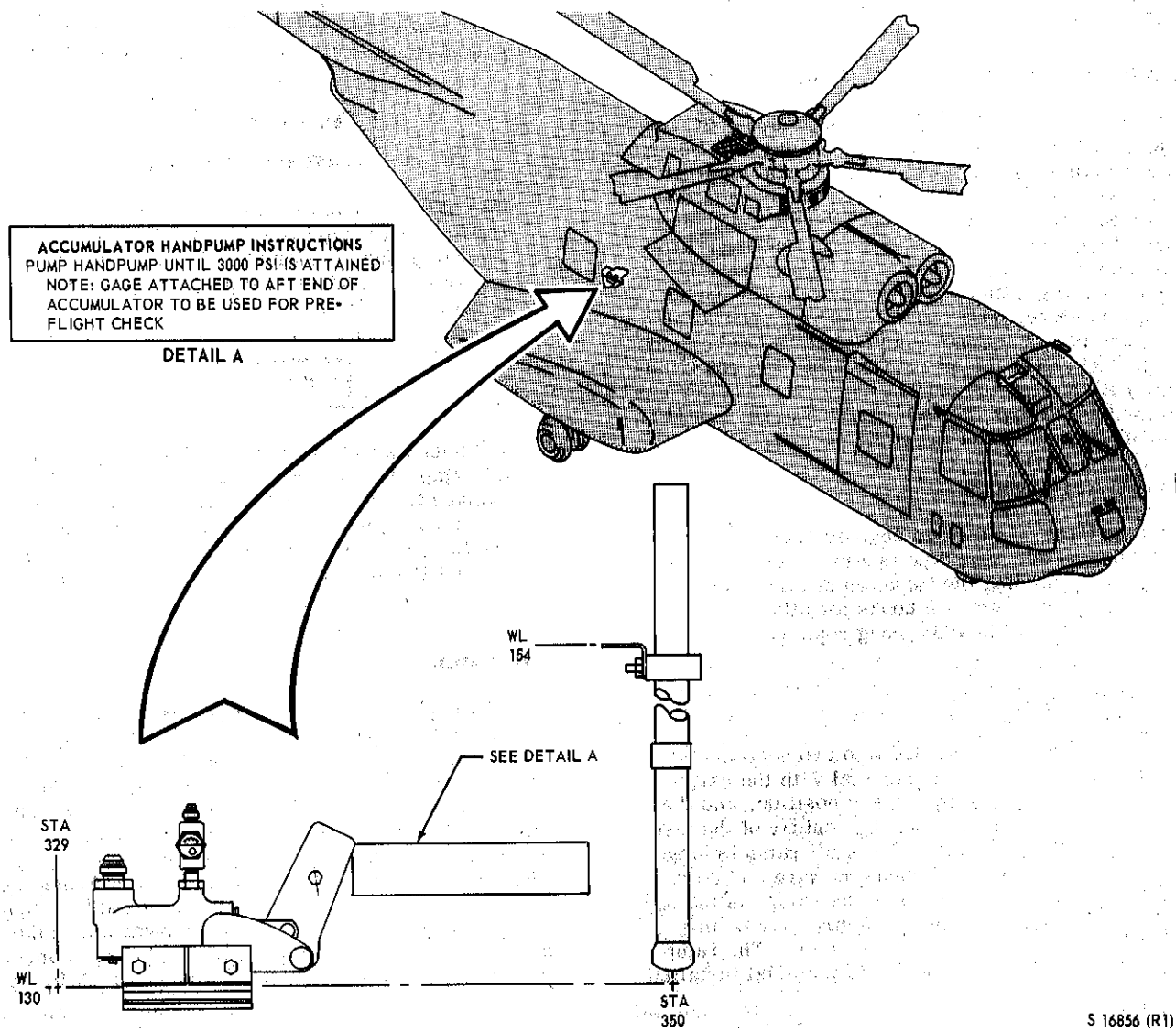

Figure 4-20. APU Accumulator Hand Pump

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.

TIE-DOWN FITTINGS.

The two types of tie-down fittings (figure 4-22) 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 tie-down fittings (figure 4-23) have 2500-pound restraint capability. The 2500 pound tie-down fittings are used to secure cargo, litter support straps, troop seat legs, and the crewman's safety harness. There are three 5000 pound tie-downs, one located near the personnel door and two located either side of the tail end of the aft ramp. The 5000 pound tie-down 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.

TIE-DOWN DEVICES.

Various types of tie-down devices may be used for securing cargo. One type is a turnbuckle arrangement for tightening the tie-down chains, another is a webbed type strap with hooks for attaching to tie-down 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 tie-down fittings on the aft ramp floor. Two tie-down 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 4-24) is electrically controlled and hydraulically actuated 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 crew member'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 nose-down 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

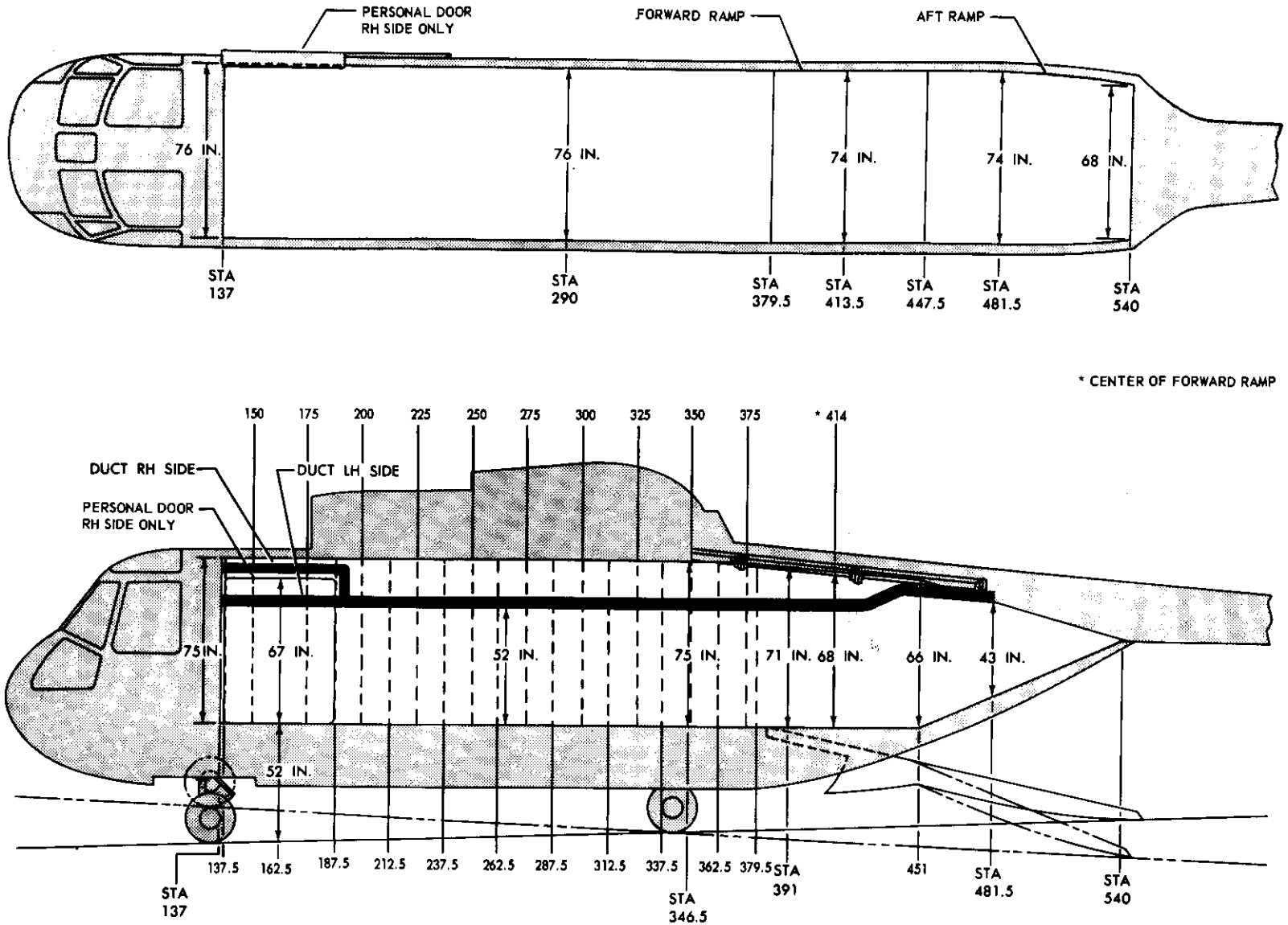

Figure 4-21. Cargo Compartment and Cargo Loading Stations (Sheet 1 of 2)

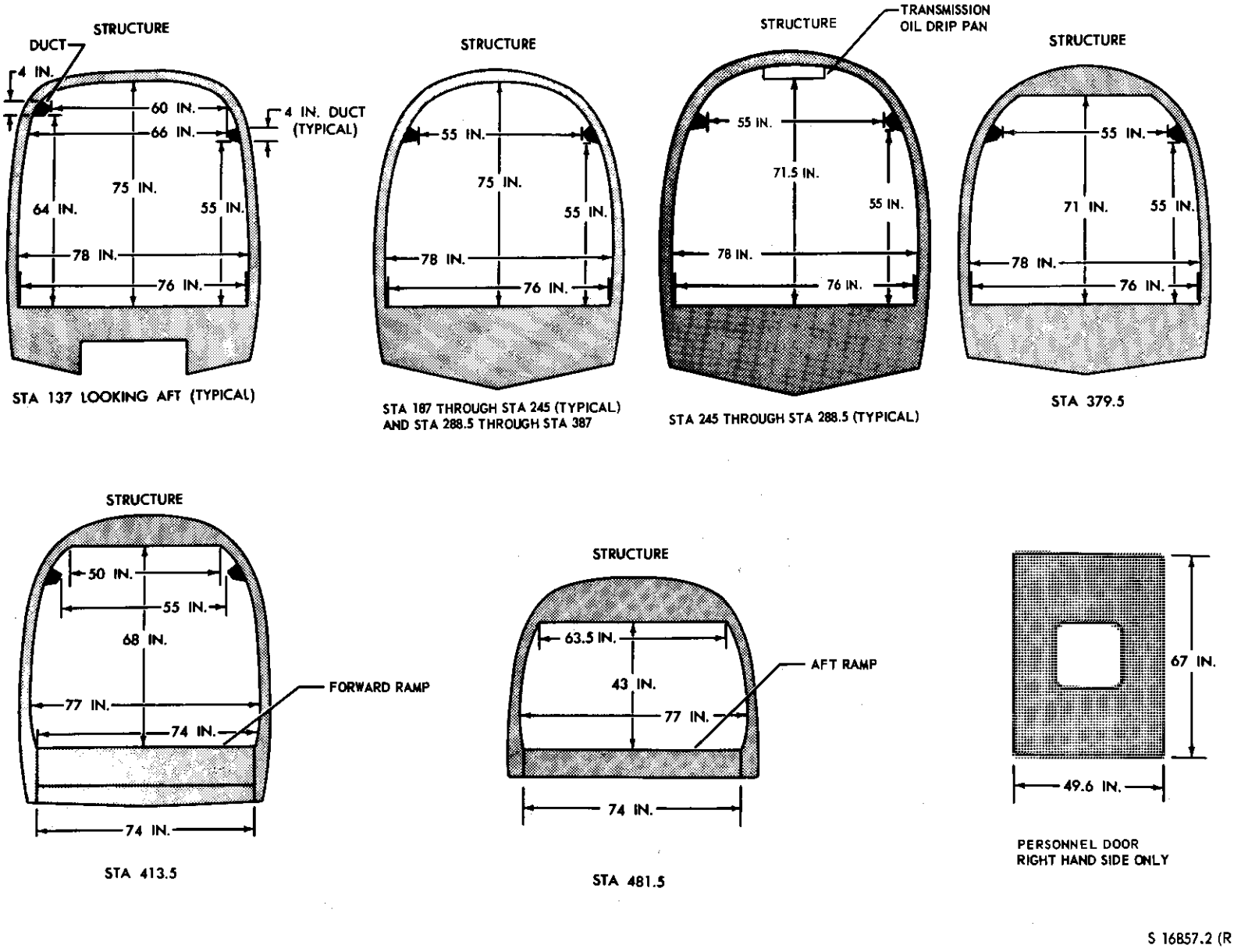

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Figure 4-21. Cargo Compartment and Cargo Loading Stations (Sheet 2 of 2)

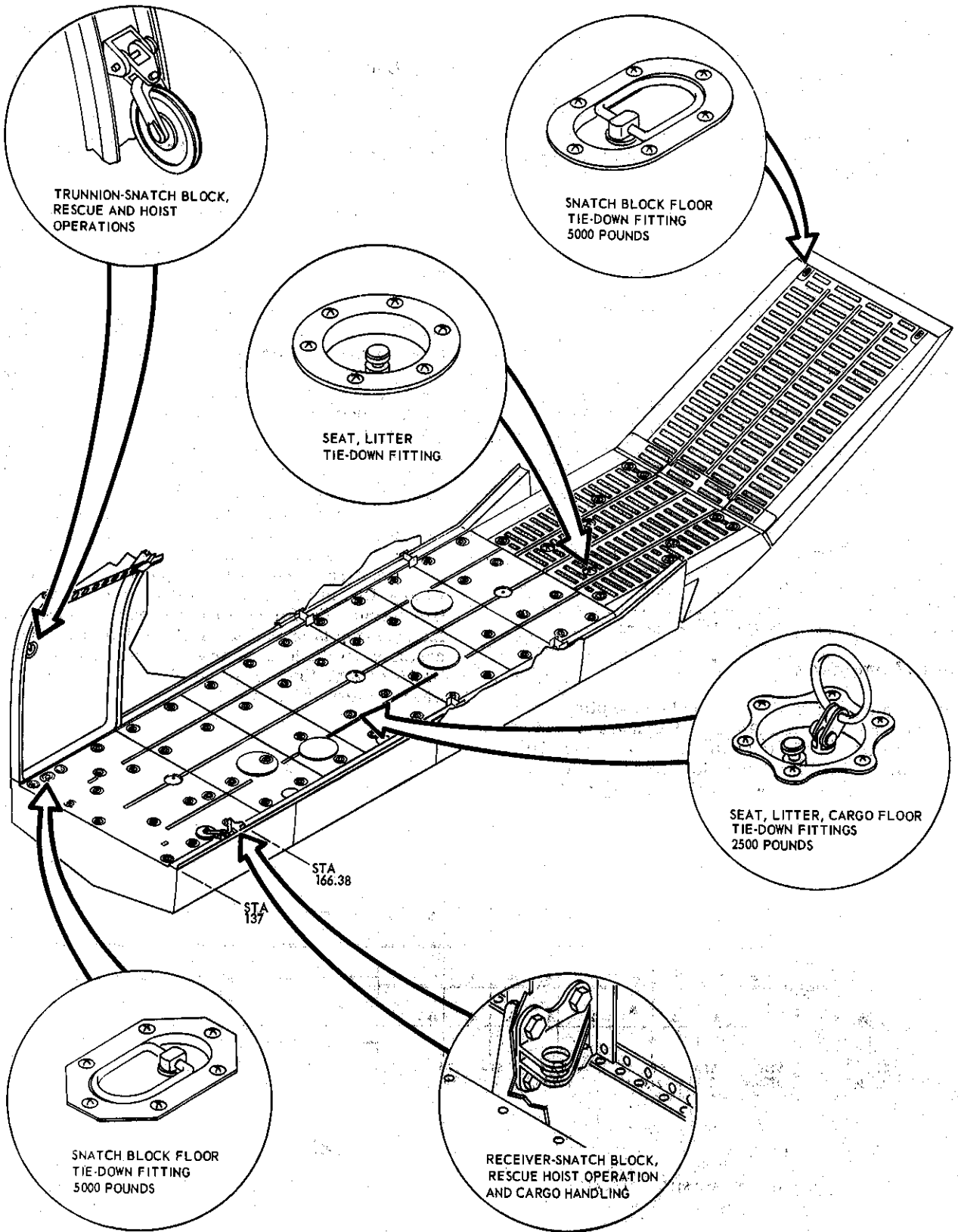


Figure 4-22. Tie-Down Fittings

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 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 tie-down fittings for cargo tie-down, 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 Crewmembers 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 4-25) 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.

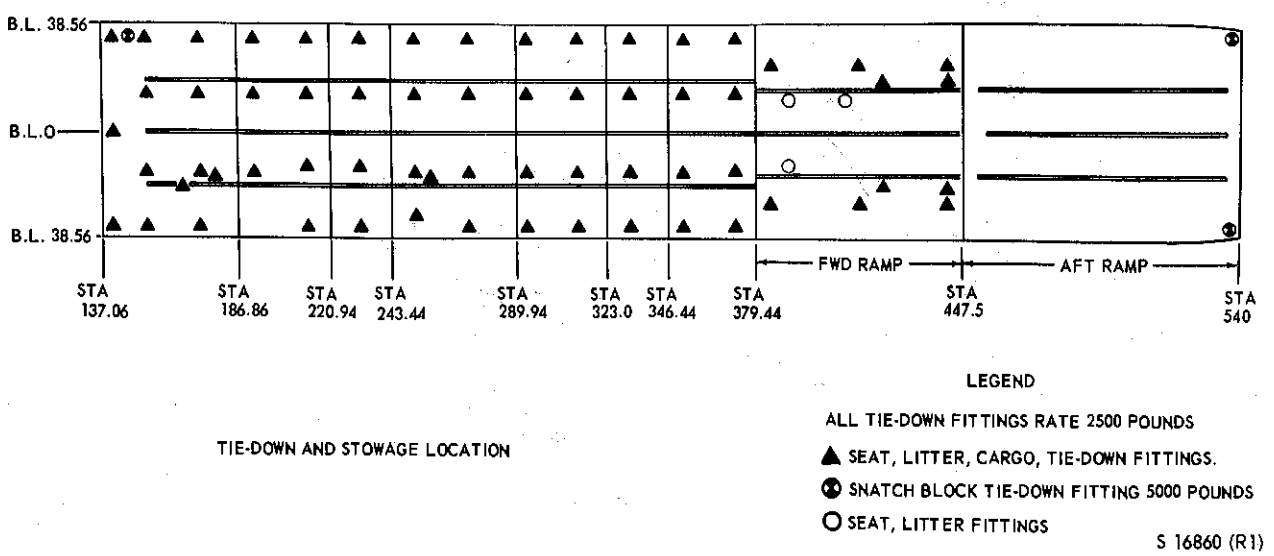


Figure 4-23. Location of Tie-Down Fittings

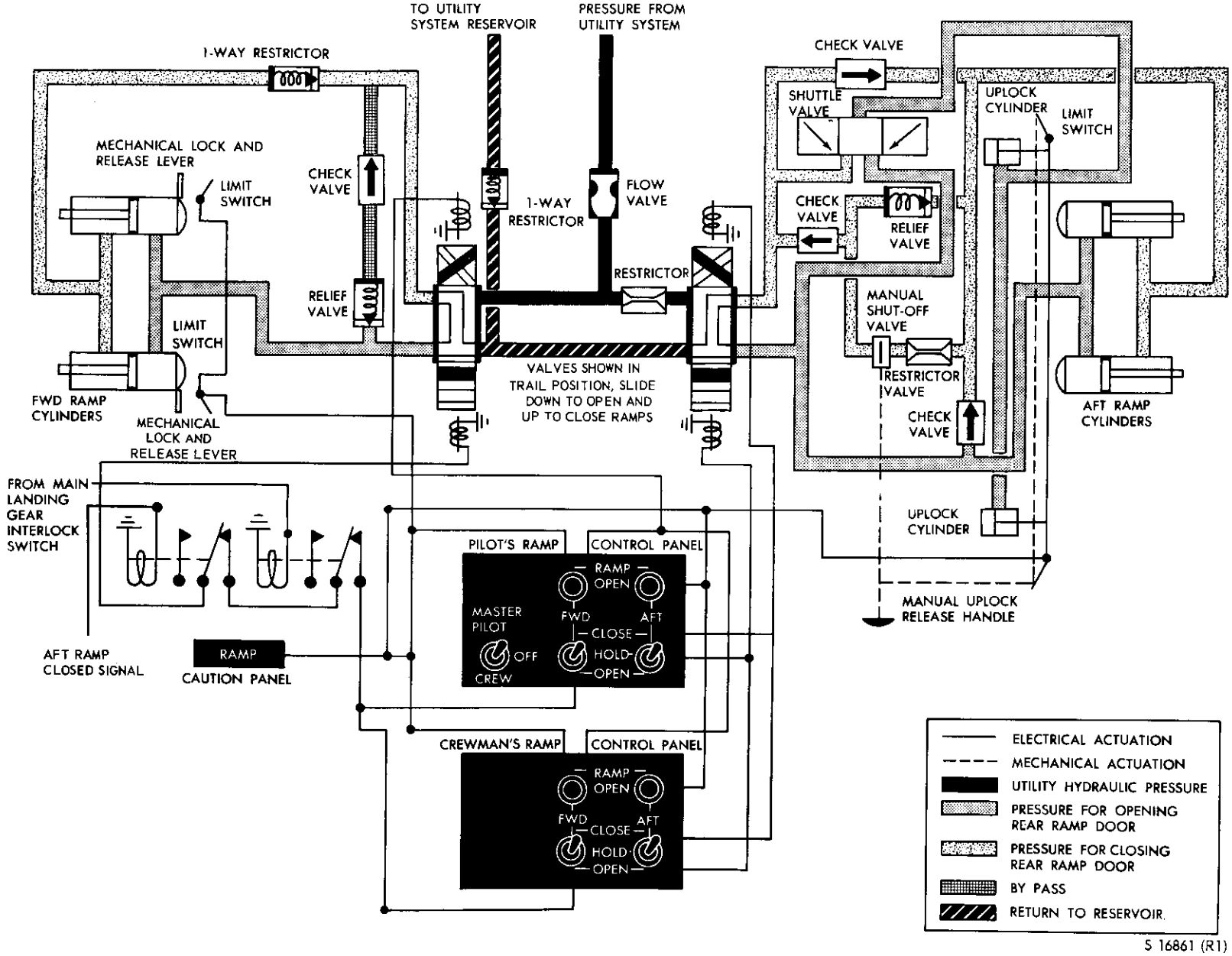


Figure 4-24. Ramp Actuating System

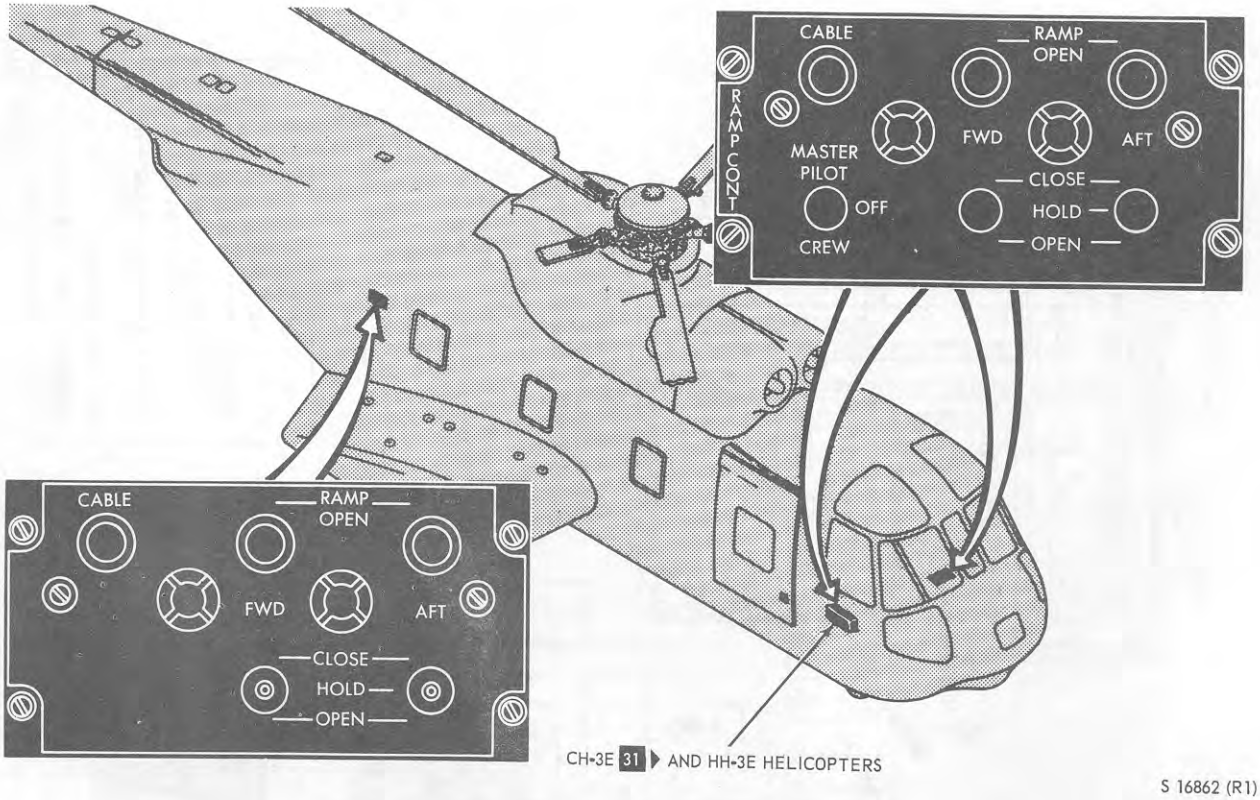


Figure 4-25. Ramp Control Panels (Typical)

Aft Ramp Uplock Release Levers.

There are two manual uplock release levers (figure 4-26). 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 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 tie-down 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.

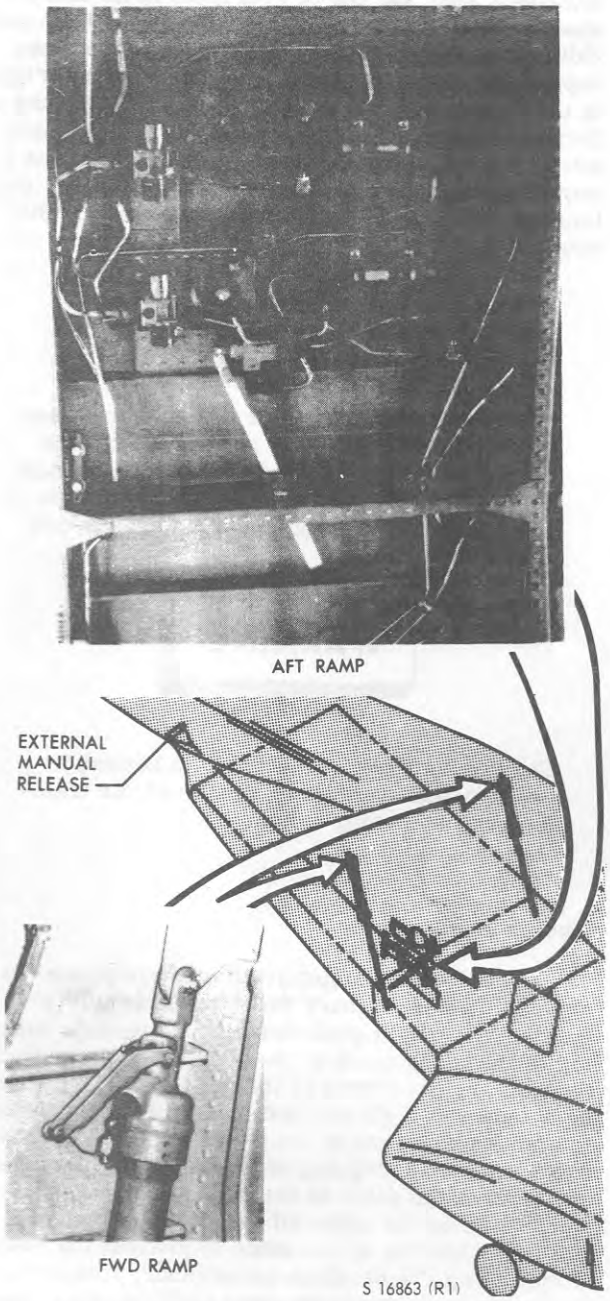


Figure 4-26. Ramp Uplock Release Levers

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 inadvertant 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 4-27). 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.

WARNING

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

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 down-limit 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.

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

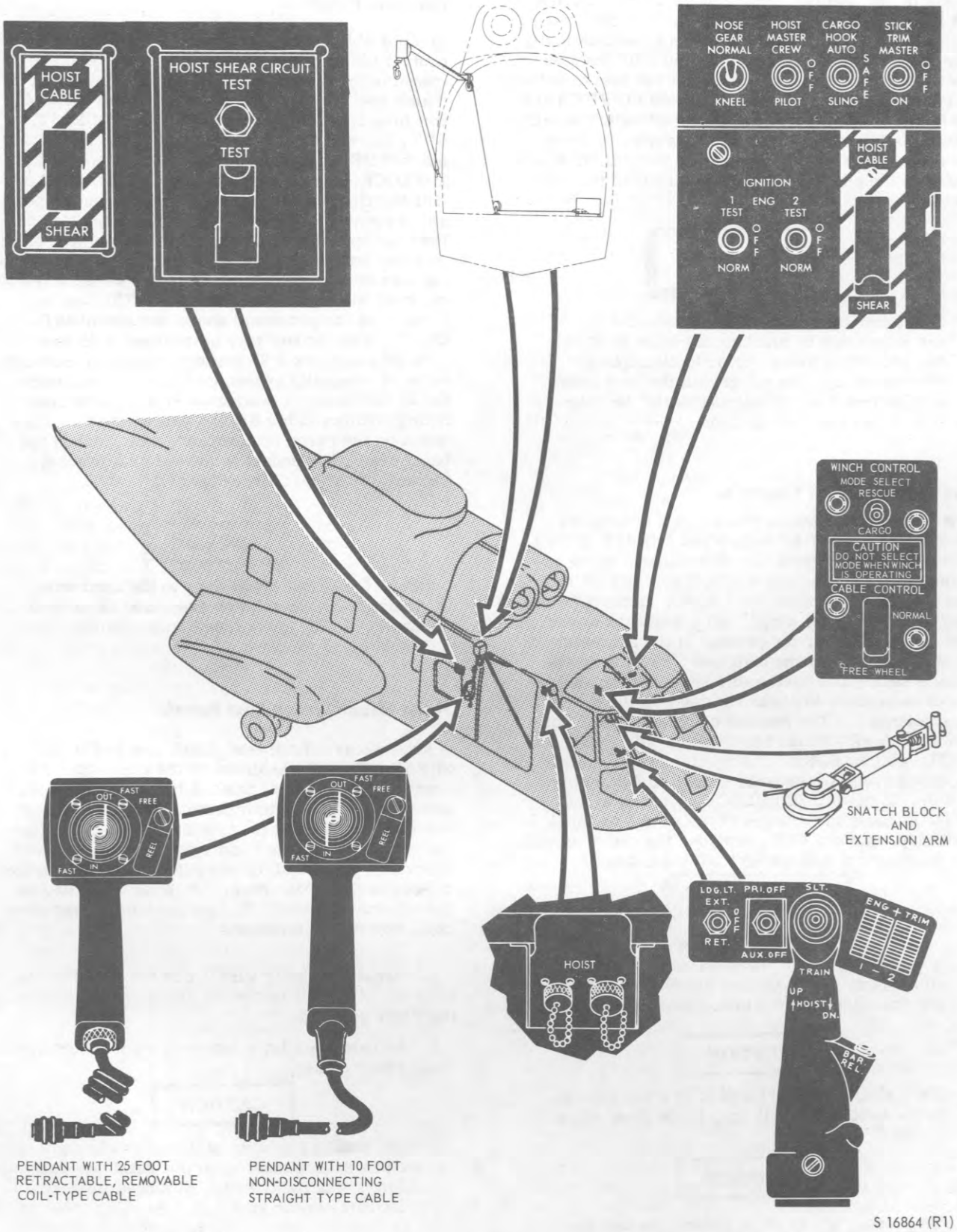


Figure 4-27. Hoist Controls (Typical)(CH-3E Helicopters Prior to 16 Not Modified by T.O. 1H-3(C)C-561)

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 pilot 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 hook-up. 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 crewmen'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.

CAUTION

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.

Hoist Shear Circuit Test Panel.

A hoist shear circuit test panel, marked HOIST SHEAR CIRCUIT, mounted on the right-hand cargo compartment side panel aft of the personnel door, provides the means to test the winch cable shear circuit. A light, marked TEST, is located on the top center of the panel and a guarded switch, with marked positions TEST and FIRE is located on the bottom center of the panel. A decal is located on the side of the panel. To test the hoist shear circuit, proceed as follows:

1. Break the safety wire. Lift the guard on the hoist shear circuit test panel and move the switch to the TEST position.

2. Actuate the pilot's and/or crewmember's hoist cable shear switch.

CAUTION

When testing the hoist cable shear circuit, the test switch must be in the TEST position before actuating the pilot's or crewmember's hoist cable shear switch.

3. The light on the hoist shear circuit test panel will go on indicating that the system is functioning properly.

4. Safety-wire the guard in the FIRE position upon completion of the test.

CARGO LOADING WINCH OPERATION.

The cargo winch (figure 4-28) 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 tie-down 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 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.

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.

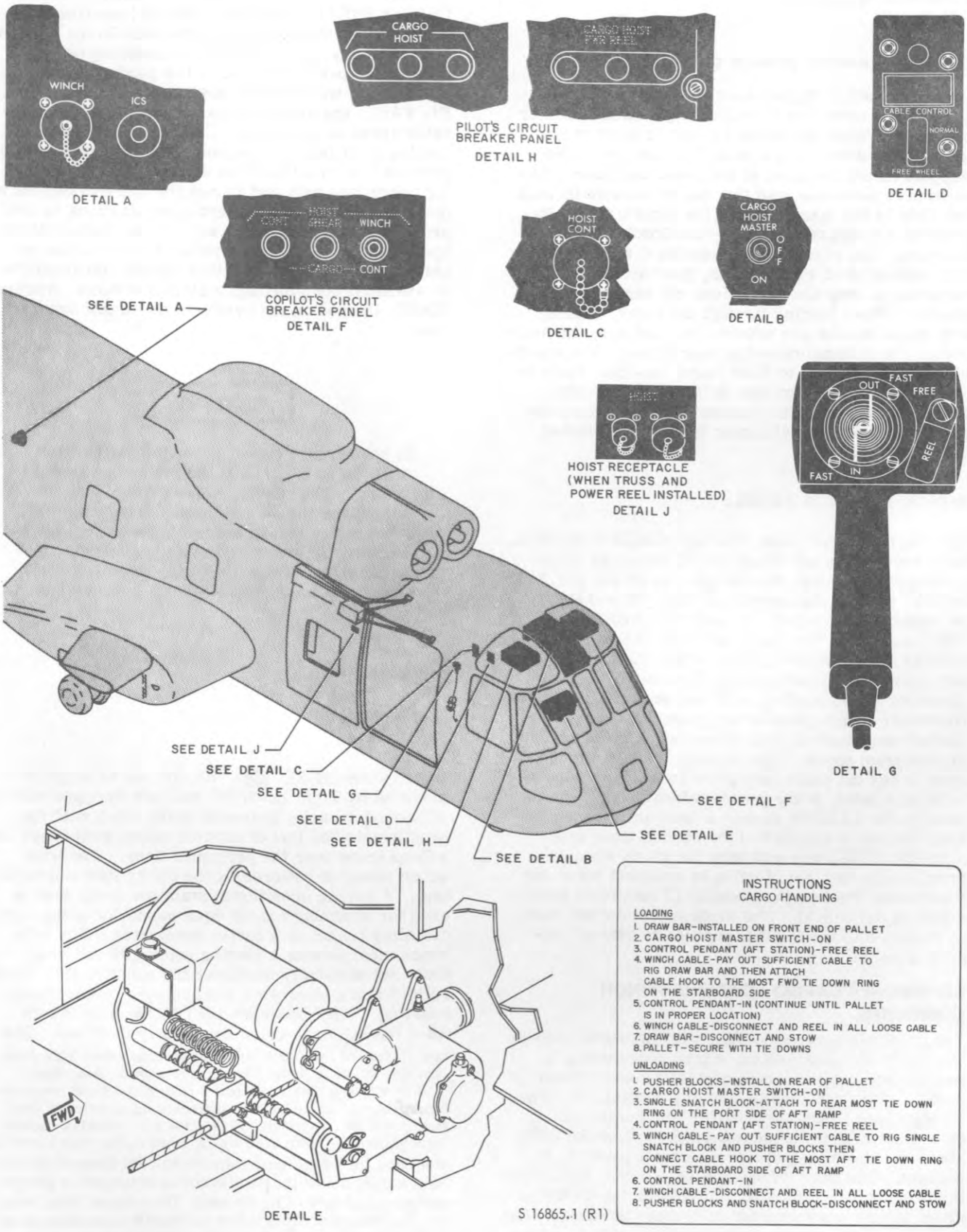
CAUTION

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 4-29.)

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 useable 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 connot be released. The rescue hoist winch may be controlled from either the pilot's compartment or cargo compartment by switches which utilize dc power



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 4-28. Winch Controls (Typical) (Sheet 1 of 2)

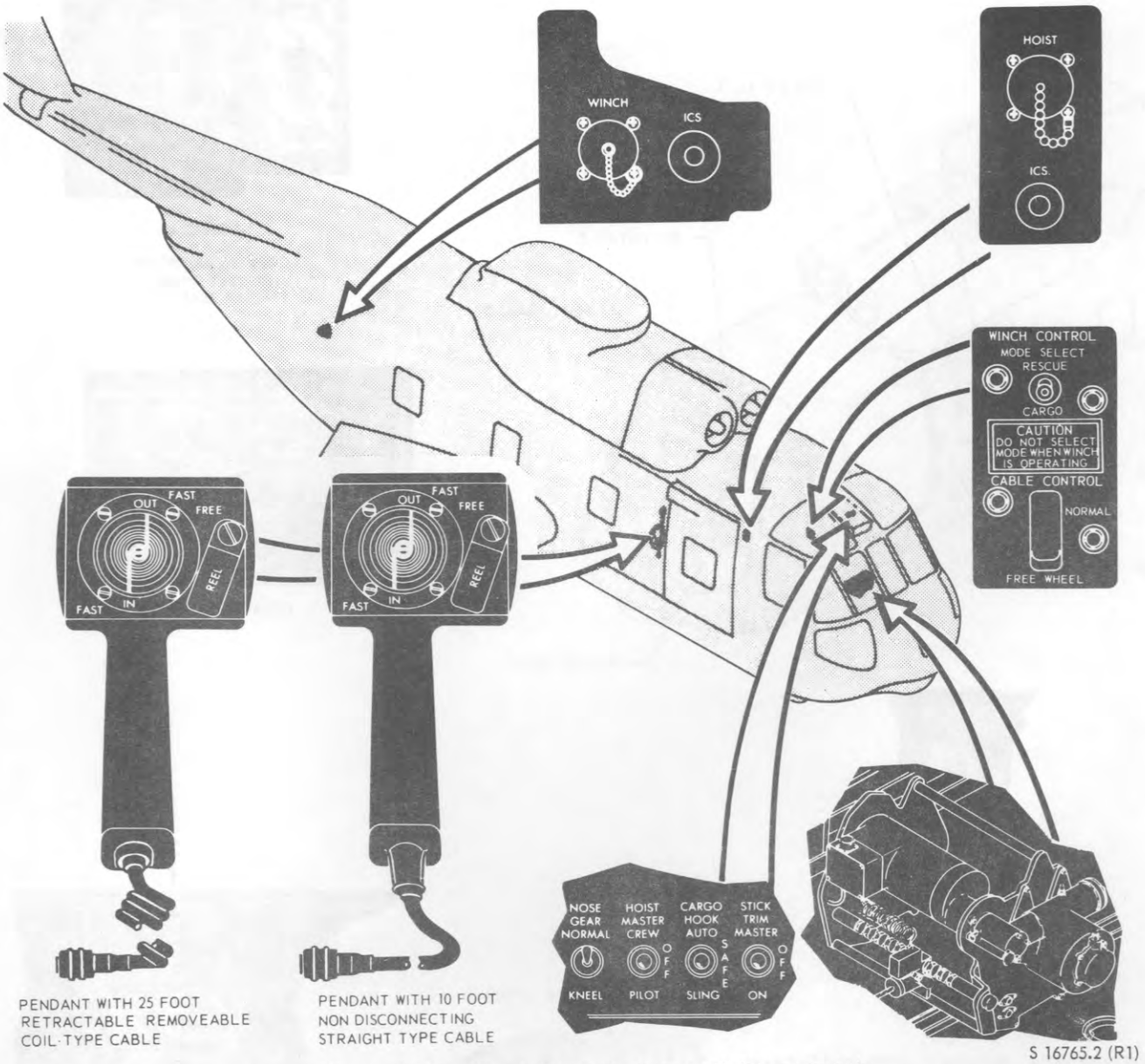
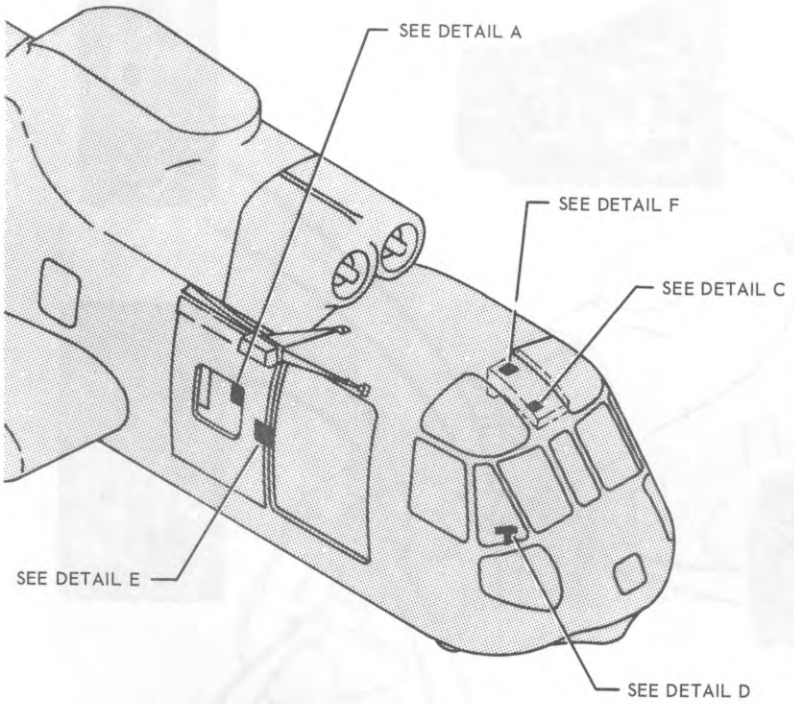


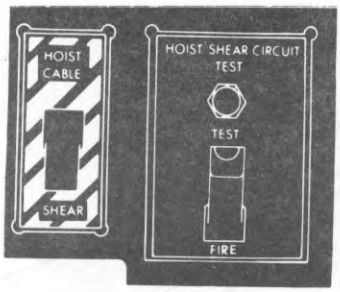
Figure 4-28. Winch Controls (Typical) (Sheet 2 of 2)

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. Crewman must monitor operation by using the manually operated throttle valve; however, the manual overrrde 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.

WARNING

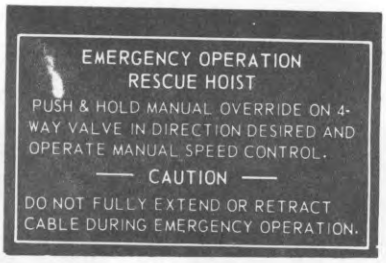
When lifting loads in excess of 550 pounds, the hoist must be slowed down prior to stopping. Rapidly stopping or reversing the hoist may induce loss of control. If control is lost while lifting, control may be recovered by rapidly moving the crewman's hoist control valve handle to the maximum raise rate position.





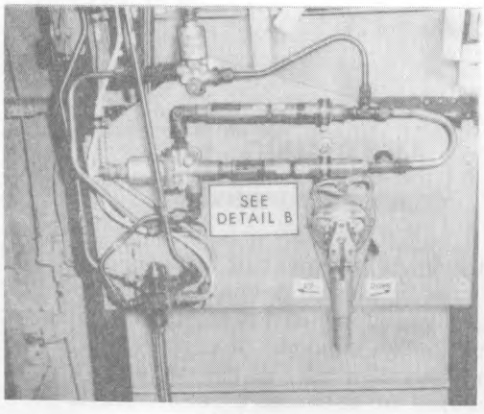
DETAIL A

CREW SHEAR SWITCH AND HOIST SHEAR CIRCUIT TEST SWITCH

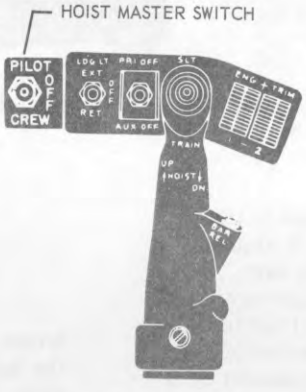


DETAIL B

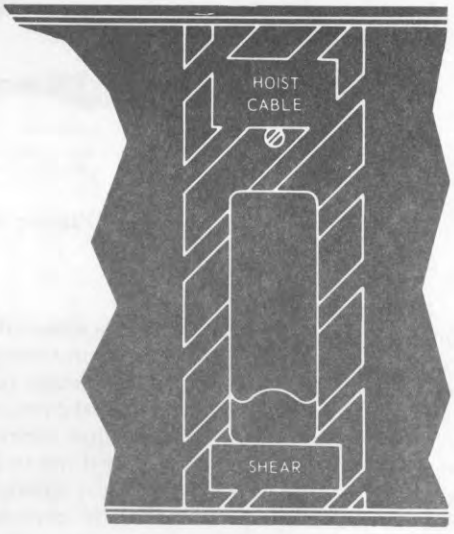
DETAIL F



DETAIL E
THROTTLE CONTROL VALVE



DETAIL D



DETAIL C

PILOT'S SHEAR SWITCH

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Figure 4-29. Rescue Hoist Controls (CH-3E 16, HH-3E, or Helicopters Modified by T.O. 1H-3(C)C-561)

WARNING

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 300 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 4-30), attached below the fuselage at four points, permits carrying loads up 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 thumb 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 release. 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.

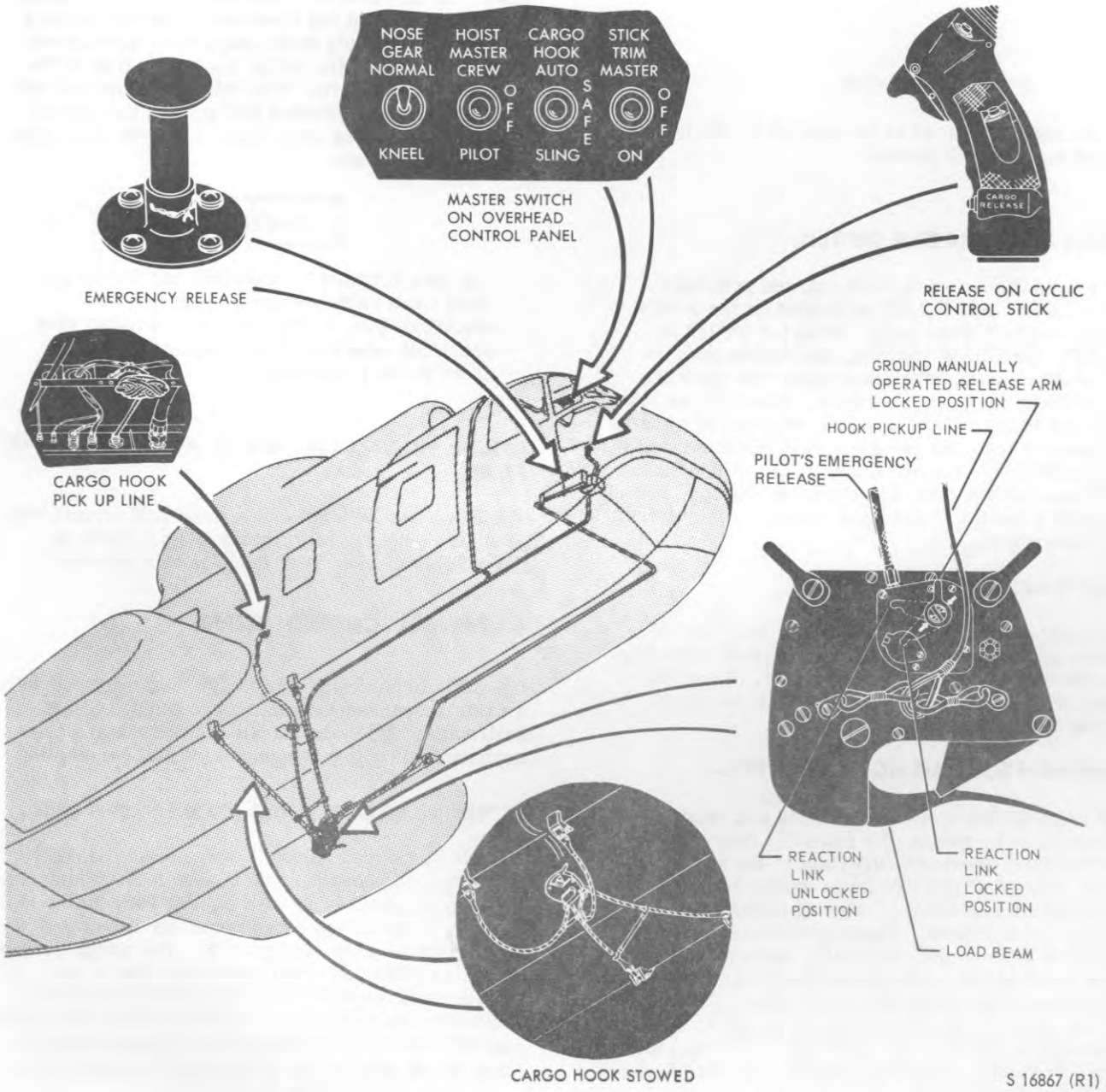

Figure 4-30. External Cargo Sling Controls (Typical)

WARNING

Any static electricity that may have been generated by the helicopter should be dissipated before attempting a hook-up by allowing the sling to touch the ground or through a conductor that can make contact between the sling and the ground.

WARNING

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 hook-ups 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 tensions greater than 125 $\pm$ 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 Advisory 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 tie-down 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 4-31.)

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 helicopters center of gravity. This arrangement provides a means of 360° self-alignment of external

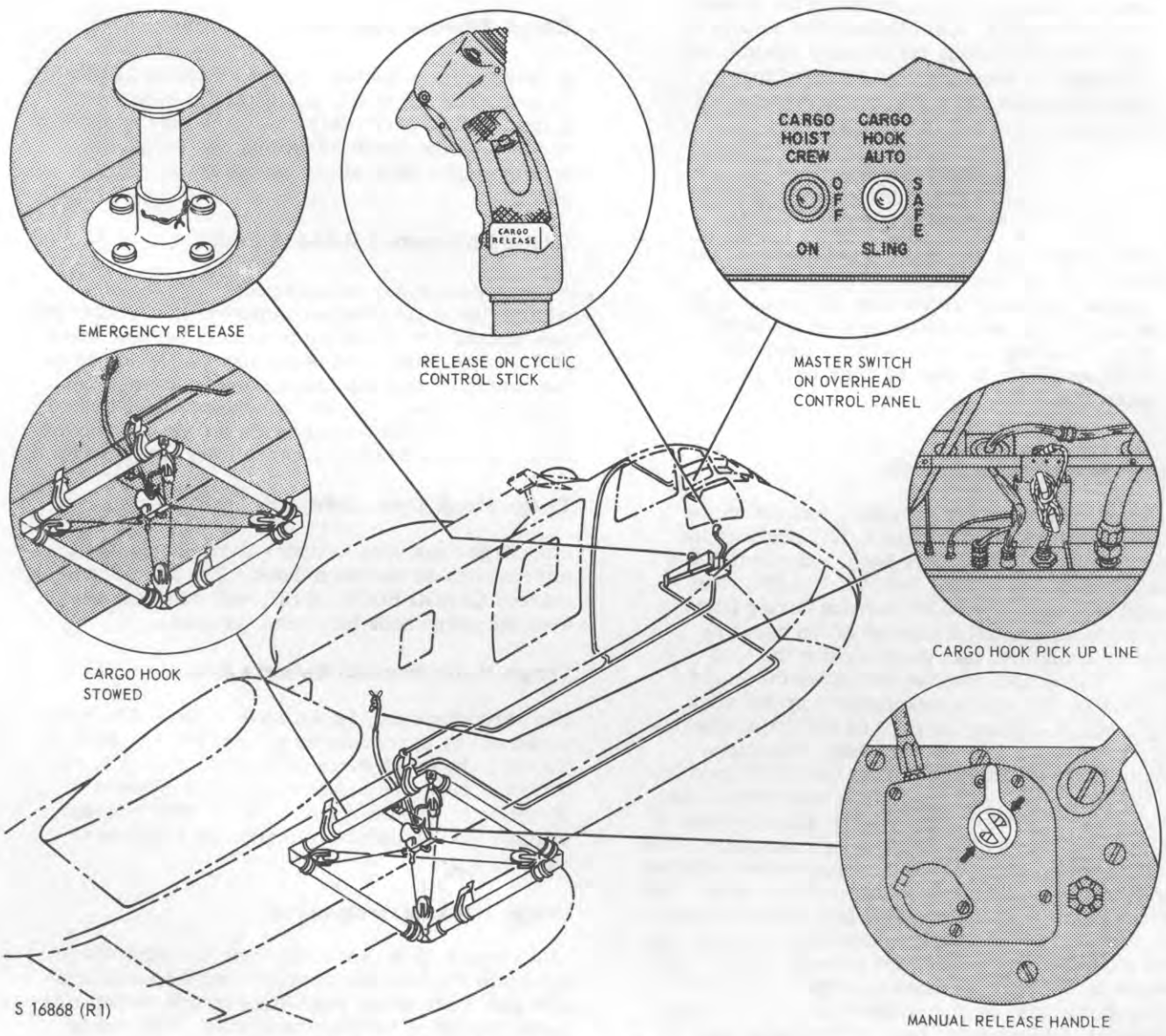

Figure 4-31. Low Response Cargo Sling System

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 4-32) 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 tie-down 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 tie-down 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.

CASUALITY CARRYING EQUIPMENT.

LITTERS.

Fifteen litters (figures 4-33 and 4-34) 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 tie-down 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.

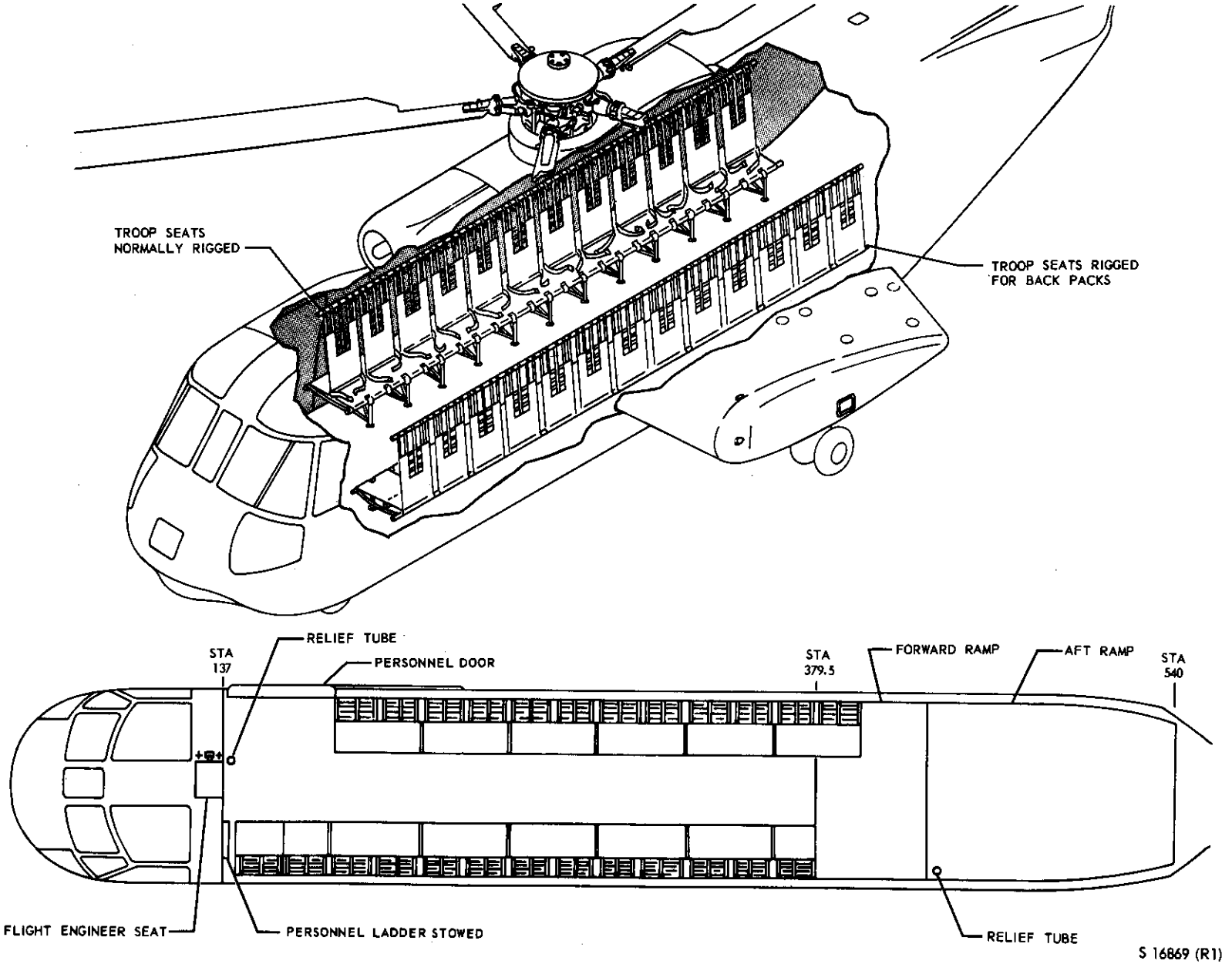

Figure 4-32. Troop Seats

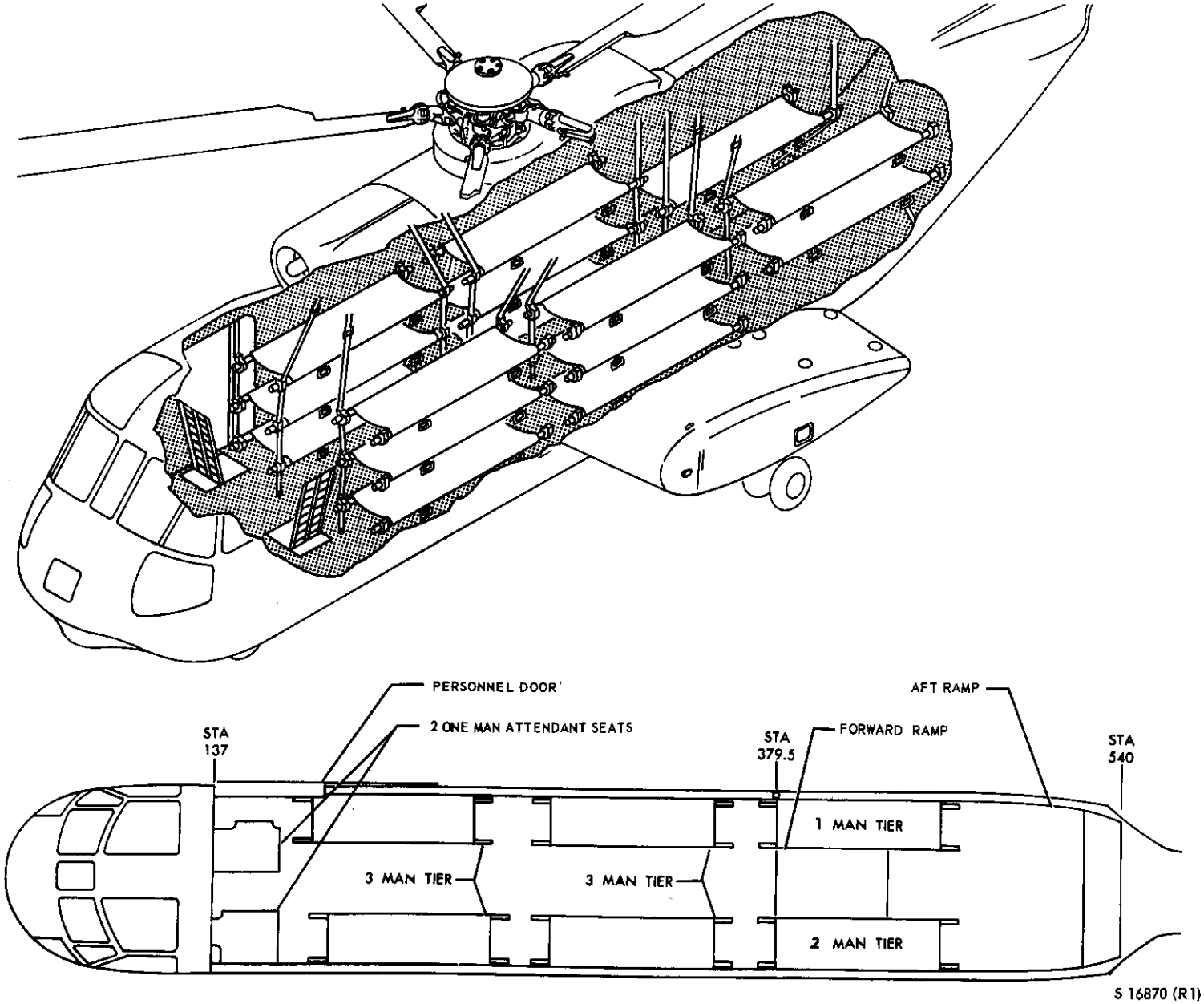

Figure 4-33. Litters

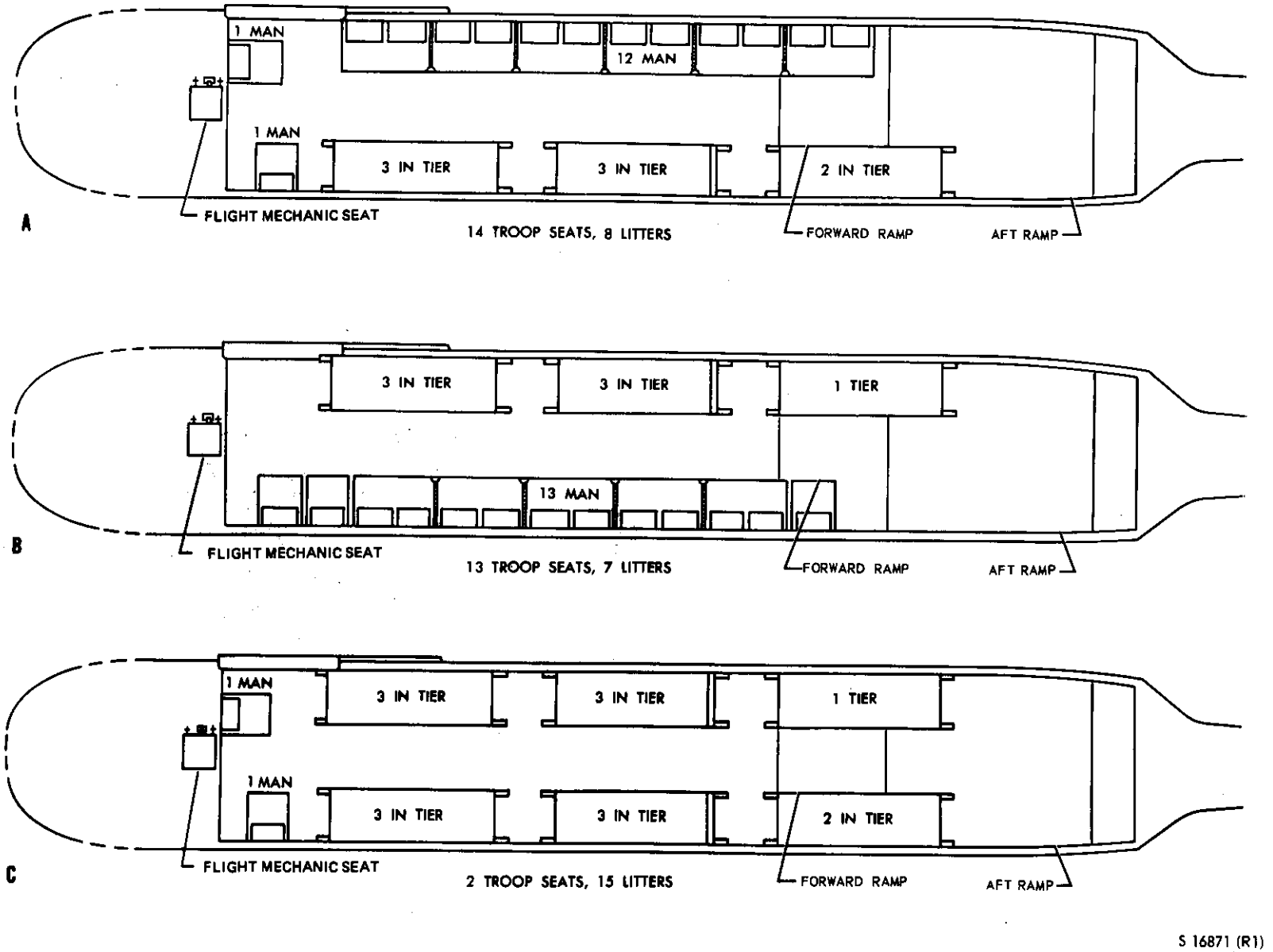

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Figure 4-34. Combination Troop Seats and Litters

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

3. Attach inboard litter support straps to ceiling litter tie-down 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 tie-down 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.

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 tie-down 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 tie-down 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. AF 66-13287 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.

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

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 4-35) are installed in the helicopter. One is located on the pilot's compartment dome 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 receptacles 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 25 ▸ 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,

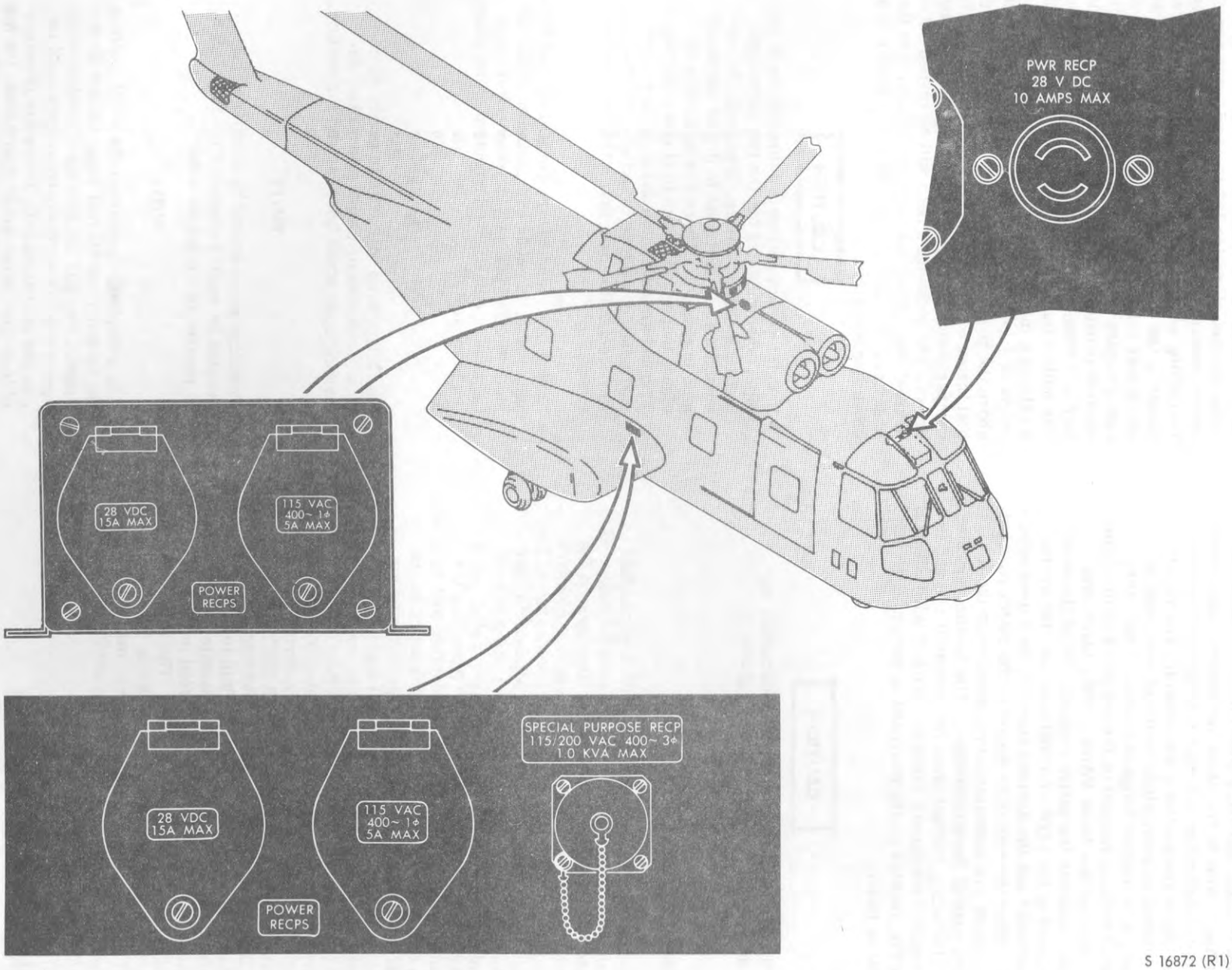

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Figure 4-35. Electrical Utility Receptacles

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 4-36) 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.

NOTE

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

NOTE

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.