2. On the remote control unit, rotate MIC VOL and TAPE VOL controls fully counterclockwise.

NOTE

Individual gain controls on the MA-600 amplifiers are pre-set and should not be changed.

3. Energize the Loudspeaker circuit breaker, set LOUDSPKR switch (figure 1-18) to ON, and set the POWER switch on the remote control unit to ON position. The three indicator lights (AMP-1, AMP-2, and

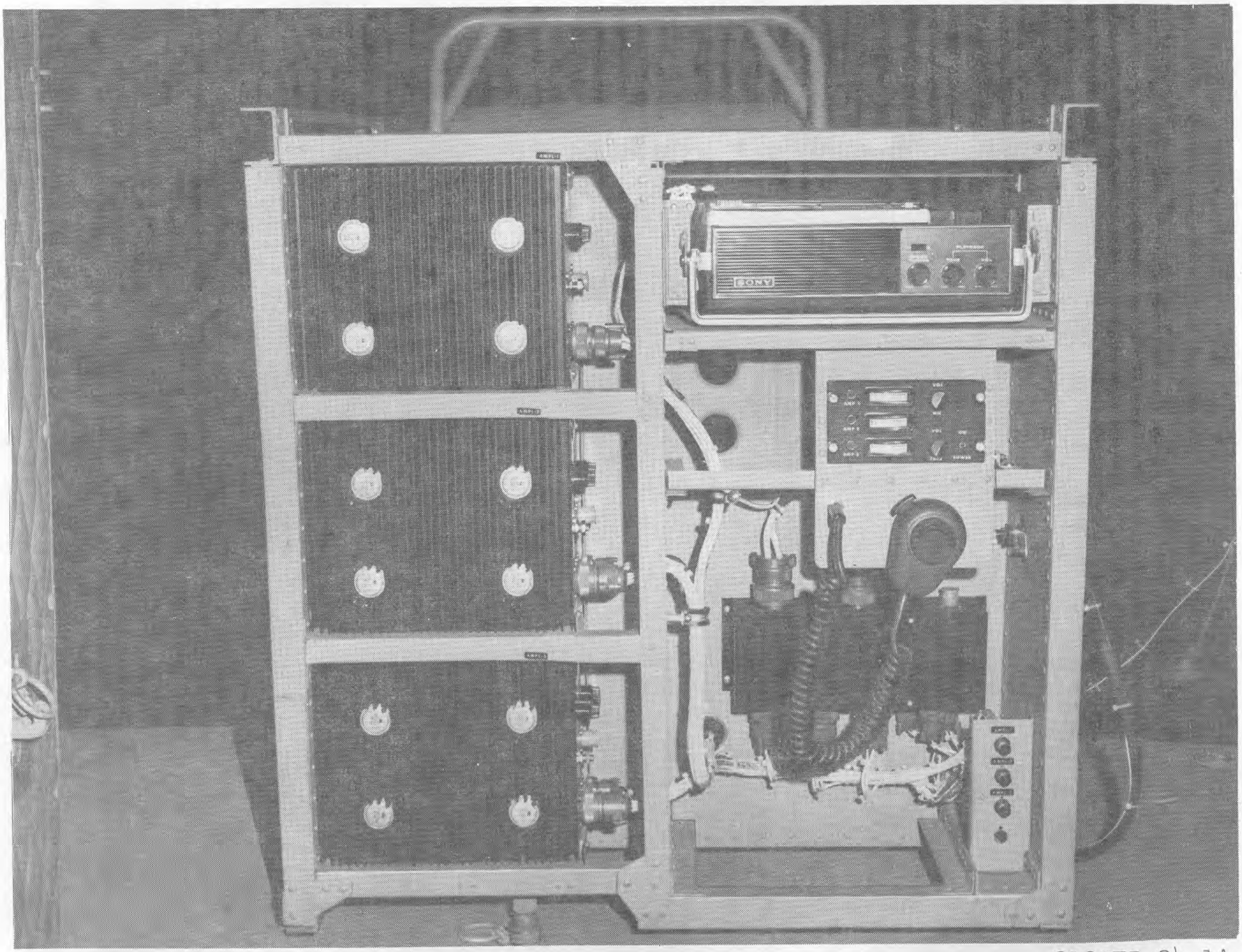

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Figure 4-22. Loudspeaker system (Sheet 1 of 2)

Figure 4-22. Loudspeaker system (Sheet 2 of 2)

AMP-3) on the remote control unit shall illuminate, indicating that primary DC power is applied to each of the amplifiers.

WARNING

Do not turn the MIC VOL or TAPE VOL controls to their full-on positions during ground operation. Serious injury to ears of personnel could result. Severe audio feedback and rumble may occur while on the ground, which could result in damage to the equipment.

CAUTION

Do not operate the system with the VU meters consistently in the red, as overheat and excessive distortion will occur.

NOTE

The tape recorder batteries are not capable of being charged. When the power plug is connected to the recorder, the batteries are automatically disconnected and the recorder will operate from aircraft power.

4. Load tape recorder with pre-recorded tape.

5. Set speed selector on the recorder to the desired speed.

6. Energize the tape recorder by pressing the Play Button, set the Playback Volume Control to mid range and gradually increase the TAPE VOL control on the Remote Control Unit until the VU meters "peak into the red area".

NOTE

The level meter on the face of the recorder indicates recording level in manual recording mode and signal level in playback mode. Also, the meter indicates the battery condition whenever the Battery Life Check Button is pressed.

OPERATING PROCEDURE (Using Microphone)

1. Energize the system as in steps 1., 2., and 3. above.

2. Press MIC switch IN and speak into microphone.

3. Slowly advance the MIC VOL control on the control panel until the VU meters on the control unit "peak" just into the red area.

EXTERIOR LIGHTING

The exterior lighting includes an anti-collision light, navigation lights, fuselage lights, a searchlight, and a landing light (figure 1-2). All exterior lights are supplied from the 28V DC essential bus, with the exception of the searchlight which is supplied from the non-essential 28V DC bus.

ANTI-COLLISION LIGHT

The anti-collision light (rotating beacon), includes the light assembly (figure 1-2), ANTI COLL light switch (figure 1-18) located on the overhead console, and the LT ANTI COLL circuit breaker (figure 1-18). With the ANTI COLL light switch in the ON position, the light assembly produces a light which revolves at a rate of approximately 90 revolutions per minute. The light is mounted on the roof of the aft engine compartment.

ANTI-COLLISION SYSTEM (A/C MODIFIED BY TCTO 1H-1(U)N-598)

Two high intensity anti-collision strobe lights are installed. One is mounted on the roof of the aft engine compartment and one is mounted on the bottom of the aircraft forward of the front cross-over tube of the landing skids. Two three-position switches and a protective circuit breaker are located on the overhead console. (See figure 1-18.) One switch is labeled OFF, WHITE, RED which is used to select the light color (white for daytime use and red for night use). The other switch is labeled BOTH, UPPER, LOWER which is used to select the desired light position/positions.

WARNING

Operation of anti-collision strobe lights during certain phases of operation (ground operation, hover, taxi, hoist operation, cargo sling, etc.) may cause hazardous distraction to personnel and the possibility of temporary vision blind spots. Therefore, consideration should be given to turning off Anti-Collision Strobe Lights (upper, lower or both) during these operations.

The lights are designed to flash alternately at the rate of 50 to 60 times per minute. 28 volts DC electrical power for the lights is supplied by the essential bus through a Power Supply Unit.

NAVIGATION LIGHTS

The navigation lights consist of a red, upper and lower left-hand light, a green, upper and lower right-hand light mounted on the roof contour and lower section of the door post, (left and right-hand side of the aircraft). Two white tail lights are mounted on the tailboom, left and right-hand side. Navigation light switches (figure 1-18), dimming resistor, a flasher unit, and a protective LTS NAV circuit breaker are included in the circuitry. The intensity of the navigation lights is controlled by the DIM/BRT switch (figure 1-18) on the overhead console. Steady or flashing mode of operation is controlled by the NAVIGATION lights STEADY-OFF-FLASH switch (figure 1-18).

FUSELAGE LIGHTS

Three white fuselage lights are mounted, one each, on the left and right sides of the roof contour and aft of the fuselage on the underside of the helicopter. The fuselage lights are controlled by NAVIGATION light switches (figure 1-18) and a protective circuit breaker, LTS FUS. Each light consists of a high-low intensity lamp with the low intensity lamps being energized when NAVIGATION lights DIM-BRT switch is set to DIM and the high intensity lights are energized when switch is set to bright. With NAVIGATION lights switch set to either STEADY or FLASH, the lights are energized.

SEARCHLIGHT

The searchlight consists of a searchlight assembly (figure 1-2), two switches (figure 1-10) and two circuit breakers labeled LT CONT SRCH and LT PWR SRCH. The searchlight assembly includes one sealed beam type light, a rotation motor, extend-retract motor, control relays, and limit switches. The SLT-OFF-STOW switch (figure 1-10) located on the pilot's collective stick, controls the light ON or OFF and STOW functions. The four-way searchlight SLT EXT-L-R-RETR switch (figure 1-10), controls extend, retract, rotate right, and rotate left motion of the searchlight. Power is furnished through the 28V DC non-essential bus.

LANDING LIGHT

The landing light consists of the landing light assembly (figure 1-2) mounted on the underside of the forward fuselage section, two LDG LT switches (figure1-10) and two protective circuit breakers LT PWR LDG and LT CONT LDG. The landing light assembly includes one sealed beam type light, an extend-retract motor, control relay, and limit switches. The LDG LT ON-OFF switch (located on the pilot's collective stick, controls the ON and OFF functions. The three position LDG LT EXT-OFF-RET switch controls the extend and retract motion of the landing light.

FORMATION LIGHTS SYSTEM

The formation lights system consists of both fuselage and rotor tip luminous amber formation lights (figure 1-2). The system is energized from the 115V AC essential bus through a common FORMATION LIGHTS PWR circuit breaker (figure 1-18). The fuselage and rotor tip formation lights are protected by FORMATION LIGHTS FUS and FORMATION LIGHTS ROTOR circuit breakers.

FUSELAGE FORMATION LIGHTS

This lighting arrangement consists of FORMATION LIGHTS FUSELAGE control (figure 1-18), four formation lights, and a 1-ampere FORMATION LIGHTS FUS circuit breaker. Clockwise rotation of FORMATION LIGHTS FUSELAGE control from OFF to position 1 will illuminate the fuselage lights dim. The intensity of the formation lights is increased for each increase in position (2, 3, 4 and BRT) of the FORMATION LIGHTS FUSELAGE control.

ROTOR TIP FORMATION LIGHTS (IF INSTALLED)

The rotor tip formation lights consist of the FORMATION LIGHTS ROTOR TIP control, two rotor tip lights, slip rings, and a 1-ampere FORMATION LIGHTS ROTOR circuit breaker. Clockwise rotation of FORMATION LIGHTS ROTOR TIP control from OFF to position 1 will illuminate the rotor tip lights to dim. The intensity of the rotor tip lights is increased for increase in position (2, 3, 4 and BRT) of FORMATION LIGHTS ROTOR TIP control. Electrical contact to the rotor tip lights is provided by the formation lights slip rings.

INTERIOR LIGHTING

The white interior lighting includes the pilot's and copilot's instrument lighting, engine instrument lighting, instrument secondary lighting, overhead console panel light, pedestal lighting, pilot's and copilot's cockpit lights and aft dome lights. All interior lighting circuits are supplied through the 28V DC essential bus. The instrument lighting circuits that require a 5 volt power source are supplied by 28 volt input -5 volt output power supplies.

PILOT AND COPILOT INSTRUMENT LIGHTS

The pilot and copilots red instrument lights are divided into four groups: Pilots instruments, Copilots instruments, Engine instruments and Instrument secondary lighting. Each group is controlled by a rheostat. The rheostat varies light intensity and is placarded OFF and BRT. The rheostats are located on the overhead console panel. Power is supplied by the 28V DC essential bus, and the circuits are protected by circuit breakers labeled LTS PLT INST., LTS INST COPLT, LTS ENG INST, and LTS INST SEC.

OVERHEAD CONSOLE AND PEDESTAL LIGHTING

The red overhead console lighting and pedestal lighting is controlled by rheostats located on the overhead console panel. The light intensity may be varied by rotating the rheostat between OFF and BRT. The console and pedestal lights operate on current from the 28V DC essential bus and are protected by circuit breakers labeled LTS CSL and LTS PED.

COCKPIT LIGHTS

The cockpit lights are multi-purpose utility lights designed to selectively provide either red or white illumination utilizing a narrow spotlight beam or a wide floodlight beam. These two portable utility lights are located adjacent to the overhead console, one on each side, with electrical protection provided by a 5-ampere LT PWR CKPT circuit breaker (figure 1-18). Controls necessary to obtain operational modes of ON-OFF, DIM-BRIGHT, SPOT (red)-FLOOD (white) illumination are incorporated into the lamp's body.

DOME LIGHTS

The dome lights include AFT DOME LTS switch, AFT DOME LTS control rheostat and a protective 5-ampere LT PWR DOME circuit breaker (figure 1-18). The aft dome lights can be illuminated red or white by placing the AFT DOME LTS switch to RED or WHITE position. The brightness level of the aft dome lights is determined by AFT DOME LTS rheostat located on the aft dome control panel in the center area of the cargo-passenger compartment (figure 1-3).

WINDSHIELD WIPERS

The windshield wiper system consists of WINDSHIELD WIPER PLT and WINDSHIELD WIPER COPLT 10-ampere circuit breakers. WIPER SELECT PILOT-BOTH-COPILOT switch (figure 1-18). WIPERS control HIGH-MED-LOW-OFF-PARK and two windshield wiper motors. The circuit breakers and control switches are located in the overhead console and the wiper motors are above the windshield. With WIPER SELECT switch, the wipers can be operated individually or simultaneously. The WIPER control can be energized at LOW, MED and HIGH speed, de-energized in the OFF position. The PARK position is a spring-loaded (returns to OFF) position for stowing the wiper blades to a location where vision is not obstructed.

CAUTION

Do not operate on a dry windshield.

EXTERNAL STORES SYSTEM

Attaching points for external stores supports extend below the forward section of the helicopter and are located on each side of stations 129 and 155. These attaching points are called "hard points" and locate installed stores at the approximate center of gravity of the helicopter. External stores are jettisoned manually by pulling the handle located on the right side of pedestal or electrically by switches on the armament control panel.

ARMAMENT SYSTEM

The helicopter can be configured with the non-nuclear weapon systems listed below to perform missions as a Gunship or combat transport. Refer to T.O. 1H-1(U)N-34-1-1 for the description, aircrew duties, capabilities, and utilization of the systems.

XM-60 Infinity Reflex Sight

M-23 subsystem (two 7.62 mm M60D machineguns).

M-93 subsystem (two 7.62 mm GAU-1B/A miniguns).

M-94 subsystem (two 40 mm XM129 grenade launchers).

LAU-59/A subsystem (two rocket launchers capable of holding a total of fourteen 2.75 Folding Fin Aerial Rockets).

LAU-68A/A subsystem (two rocket launchers capable of holding a total of fourteen 2.75 Folding Fin Aerial Rockets).

PASSIVE ARMOR

The passive armor includes armored seats for the pilot and copilot, and armored panels mounted in front of the pilot's and copilot's stations.

ARMORED SEATS

The pilot's and copilot's armored seats are adjustable, fore and aft, by a lever located under the left-hand side of the seat bucket. Up and down adjustment is accomplished by movement of the lever located on the right-hand side of the bucket. The seat consists of three major components, frame, armored bucket (with provisions for attachment of armored side panels), and removable cushions. The bucket and side panels are constructed of non-metallic backed, ceramic tile. A tilt-back feature permits the seat to be tilted aft to facilitate application of first aid and to move the injured man from the area of the flight controls. The seat is tilted aft by flipping the two red levers on the rear lower section of the seat and mount and applying a slight aft pressure on the seat back. Provisions exist for attachment of inertia reel and back-type parachute (figure 4-23). On aircraft by TCTO 1H-1(U)N-579 (Installation of Forest Penetrator Seat) the pilot's tilt back feature is negated due to interference between the seat back and the upper penetrator support bracket. On aircraft modified by TCTO 1H-1-567 (Modification of Forest Penetrator Support Clamp) the pilot's seat tilt back feature may be utilized by removing the two quick release pins from the Forest Penetrator Seat Support Clamp and removing the clamp from the bulkhead. The forest penetrator seat must be moved if it is stowed and secured to the clamp.

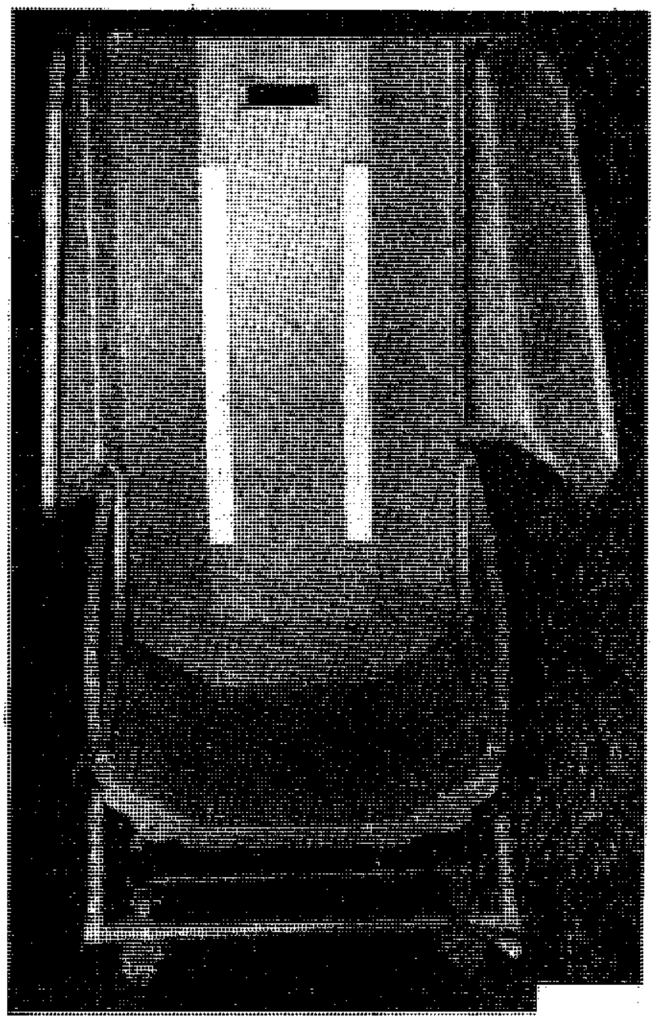


Figure 4-23. Armored seat

ARMORED PANELS

Two armored panels are provided, mounted in the floor, in front of the pilot's and copilot's stations. The panels are constructed of non-metallic backed ceramic tile.

CARGO CARRYING EQUIPMENT

The main cargo section is the area aft of the pilot's and copilot's stations (figure 1-3). This area contains 220 cubic feet of cargo space with sliding access doors on each side opening the full width of the cargo area. The deck and the aft bulkhead in the cargo area contains tie-down points for securing cargo, a net with "D" rings attached is provided for securing cargo. Refer to Section V for limitations and T.O. 1H-1(U)N-9 for detailed information.

CARGO NET

A cargo net is used for restraint and tie down of cargo in the aft portion of the passenger-cargo compartment. It is composed of prefabricated net of web straps, rings and reefing hooks for adjustment of net size to various cargo sizes. Provisions exist in aft cabin firewall and pylon support structure for attachment of tie down ring assemblies.

PERSONNEL CARRYING EQUIPMENT

Seating provisions (figure 4-24) may be installed for thirteen passengers, excluding the pilot and copilot. One four-passenger seat may be installed and secured to the floor aft of the pilot's and copilot's stations. A one-man seat attached to the forward side of the pylon support, two 2-man seats, (one on each side of one-man seat across helicopter floor) in line with the one-man seat may be installed. Two outboard facing seats may be installed. The seats are constructed of tubular steel and reinforced canvas. Seat belts are provided for each passenger and are attached at 45-degree angles. The seats can be quickly removed, folded and stowed.

CASUALTY CARRYING EQUIPMENT

Two different litter rack installations may be used. One installation accommodates six litters (three on a side, one above the other) parallel to cabin center line in aft cabin passenger compartment, and outboard transmission support structure. (Figure 4-25, sheet 1.) The other installation accommodates three litters (one above the other) parallel to and just aft of, the pilot and copilot seats. (Figure 4-25, sheet 2). Litters can be quickly installed for transporting patients, or rapidly removed for carrying cargo or personnel.

1. One-Man Seat
2. Two-Man Seats
3. Two-Man Seats
4. Four-Man Seats

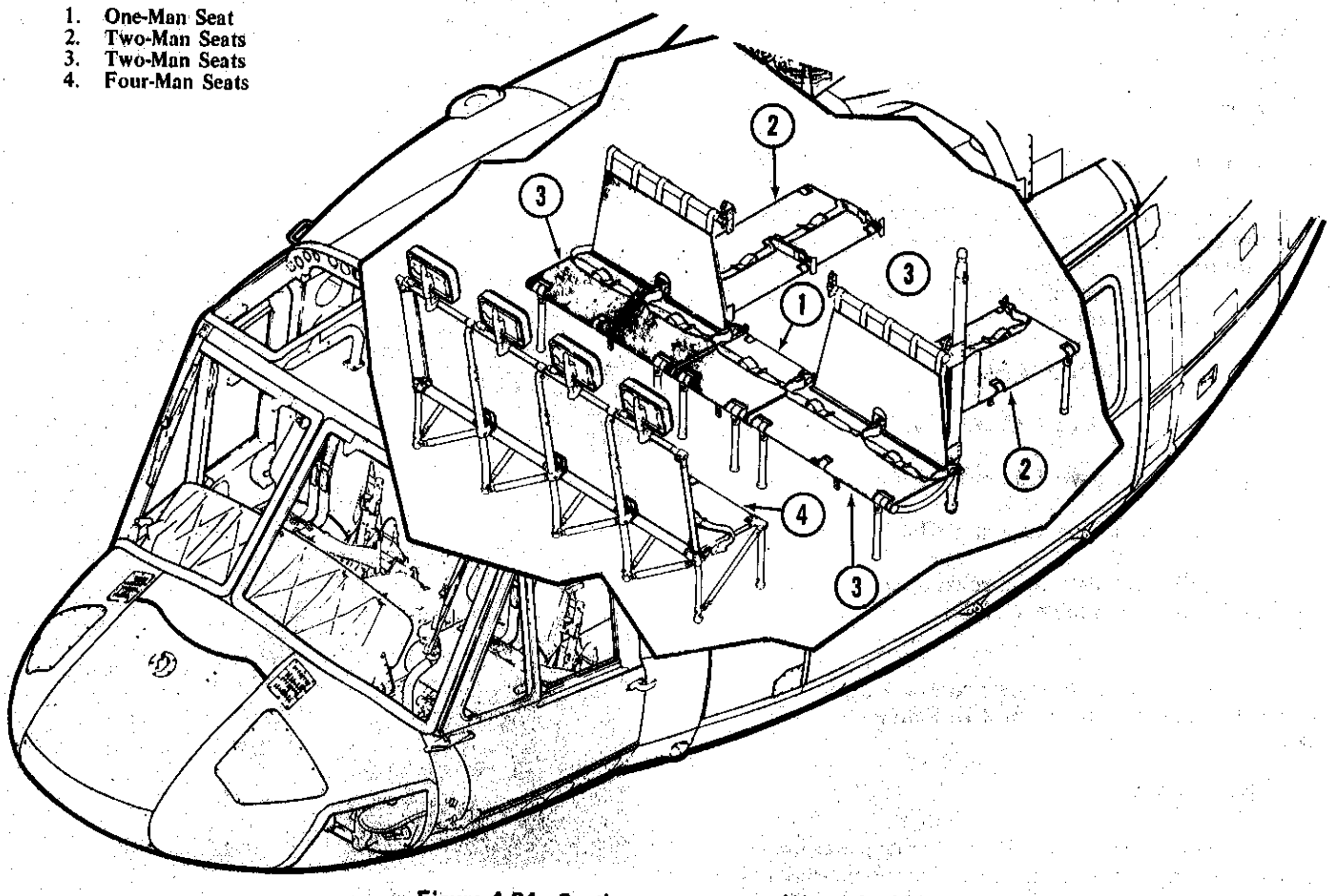
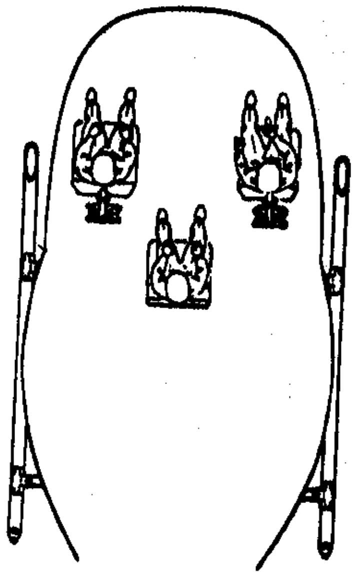


Figure 4-24. Seating arrangement (Sheet 1 of 2)



SINGLE PASSENGER SEAT
MEDICAL ATTENDANT/HOIST OPERATOR/
FLIGHT ENGINEER

Figure 4-24. Seating arrangement (Sheet 2 of 2)

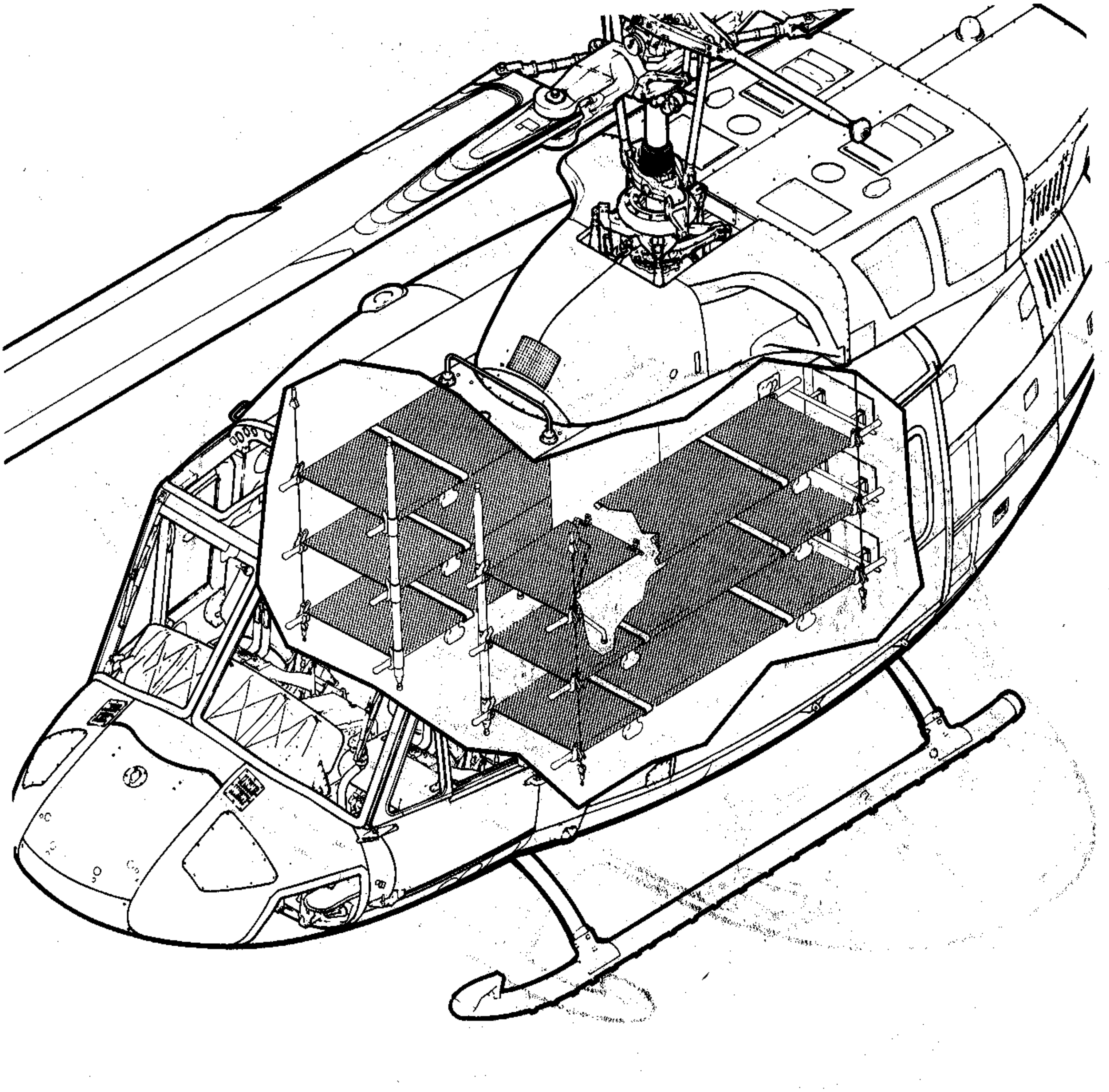


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Figure 4-25. Litter installation (sheet 1 of 2).

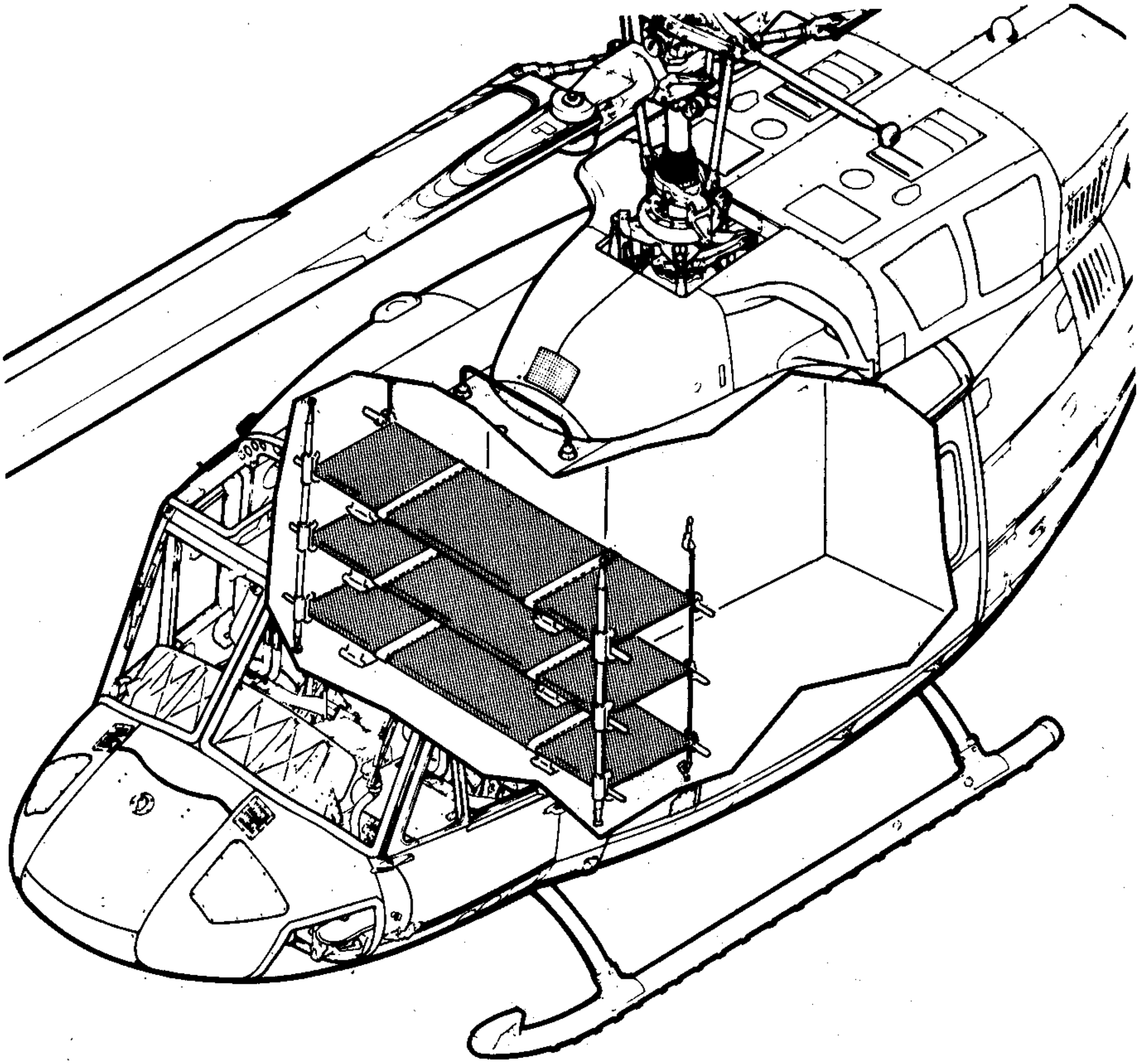

Figure 4-25. Litter installation (sheet 2 of 2).

BLACKOUT CURTAIN

Blackout curtains prevent the escape of light from the aft cabin portion of the aircraft. The blackout curtains assembly is light proof and consists of an upper section that attaches to the cabin roof, the two half sections extending the width of the cabin behind the pilot and copilot and covers for the cargo door windows. Felt pile and flaps provide a more effective light proof seal. The upper section is secured to the cabin roof with screws. The two lower sections attach to the upper section by means of slides, and to the door posts by buttons and sockets. The two halves are closed from top to bottom by a slide. The curtains covering the windows in the cargo door are secured by buttons and sockets.

AUXILIARY FUEL EQUIPMENT

Piping and electrical circuit connections are provided for installation of two auxiliary fuel tank cells (figure 4-26 and 4-27) in the cabin cargo area, increasing the total fuel capacity by approximately 290 US gallons. The bladder-type auxiliary fuel tank cells are left-hand and right-hand assemblies, shaped like quarters of cylinders to fit against the cabin rear bulkhead and each side of the pylon support structure. Tanks cells are secured in place by attaching nylon web straps to vertical rows of studs on the bulkhead and pylon support, and by cords tied between fittings on upper end of cell and on cabin structure. Each tank cell has a filler cap, a pump and float switch assembly with an electrical cable and connector. Hose assemblies are attached to the pumpoutlet, seal drain, and to tank cell drain and vent openings. All hoses have quick-disconnect couplings for connection to airframe piping at couplings located under the floor at each side of cargo door openings. The tank cell drain hose has a manual drain valve; the pump discharge hose has a directional flow check valve. Below the floor, vent and drain lines pass overboard through the lower skin. The fuel lines from auxiliary tanks cells are connected to the main fuel system at tee fittings on the forward interconnect line at front ends of underfloor cells.

The two forward auxiliary fuel tank cells, (figure 4-26) located in the cabin cargo area, increase the total fuel capacity by approximately 290 U.S. gallons. The bladder-type forward auxiliary fuel tank cells are left-hand and right-hand assemblies, shaped like quarters of cylinders to fit against the rear cabin bulkhead and each side of the pylon support structure.

The two aft auxiliary fuel tank cells, (figure 4-27) located in the compartments (immediately aft of the main fuel tank bulkhead) increase the total fuel capacity approximately 93 U.S. gallons (50 U.S. gallons in the left-hand fuel cell and 43 U.S. gallons in the right-hand fuel cell). The two self-sealing bladder-type aft auxiliary fuel tank cells are left-hand and right-hand assemblies, shaped to fit in the compartments, and secured in place by fittings and restraining panels. The aft auxiliary fuel cells contain internal fire-suppression foam baffles.

Each auxiliary tank cell has a filler cap, a pump and float switch assembly with an electrical cable and connector. Hose assemblies are attached to the pump outlet, seal drain, and to tank cell drain and vent openings. All hoses have quick-disconnect couplings for connection to airframe piping at couplings located under the floor at each side of cargo door openings. The tank cell drain hose has a manual drain valve; the pump discharge hose has a directional flow check valve. Below the floor, vent and drain lines pass overboard through the lower skin. The fuel lines from the internal auxiliary tank cells are connected to the main fuel system at tee fittings on the forward interconnect line at front ends of underfloor cells. The aft auxiliary fuel lines are connected to the main fuel system at the tee fitting on the crossover between the center and left-hand outboard aft fuel cells.

The right and left aft auxiliary fuel tanks are directly connected with a quick-disconnect interconnect line which maintains equal fuel level in both tanks at all times, allows fueling from either side and enables fuel to be pumped from both tanks simultaneously by either transfer pump. The interconnect line may be disconnected and removed, as required by mission requirements. Operation with the interconnect line permits each cell to function independently and either aft auxiliary fuel cell may be removed without affecting the remaining aft auxiliary cell. Operation and automatic auxiliary fuel transfer sequence for single tank and dual tank installations are the same except single tank installation does not provide cross-pumping, cross-fueling or transfer below five gallon quantity capabilities.
Fuel level in the aft auxiliary fuel tank cells may be determined by the wet check method-using a locally fabricated dip stick. The wet check method determines fuel level only and is not intended as a fuel quantity check.

AUXILIARY FUEL TRANSFER

Each of the auxiliary fuel tanks are equipped with an electrically driven transfer pump, which is located inside the tank. The pump is used to transfer fuel from the auxiliary tank to the main fuel cell. Control of the

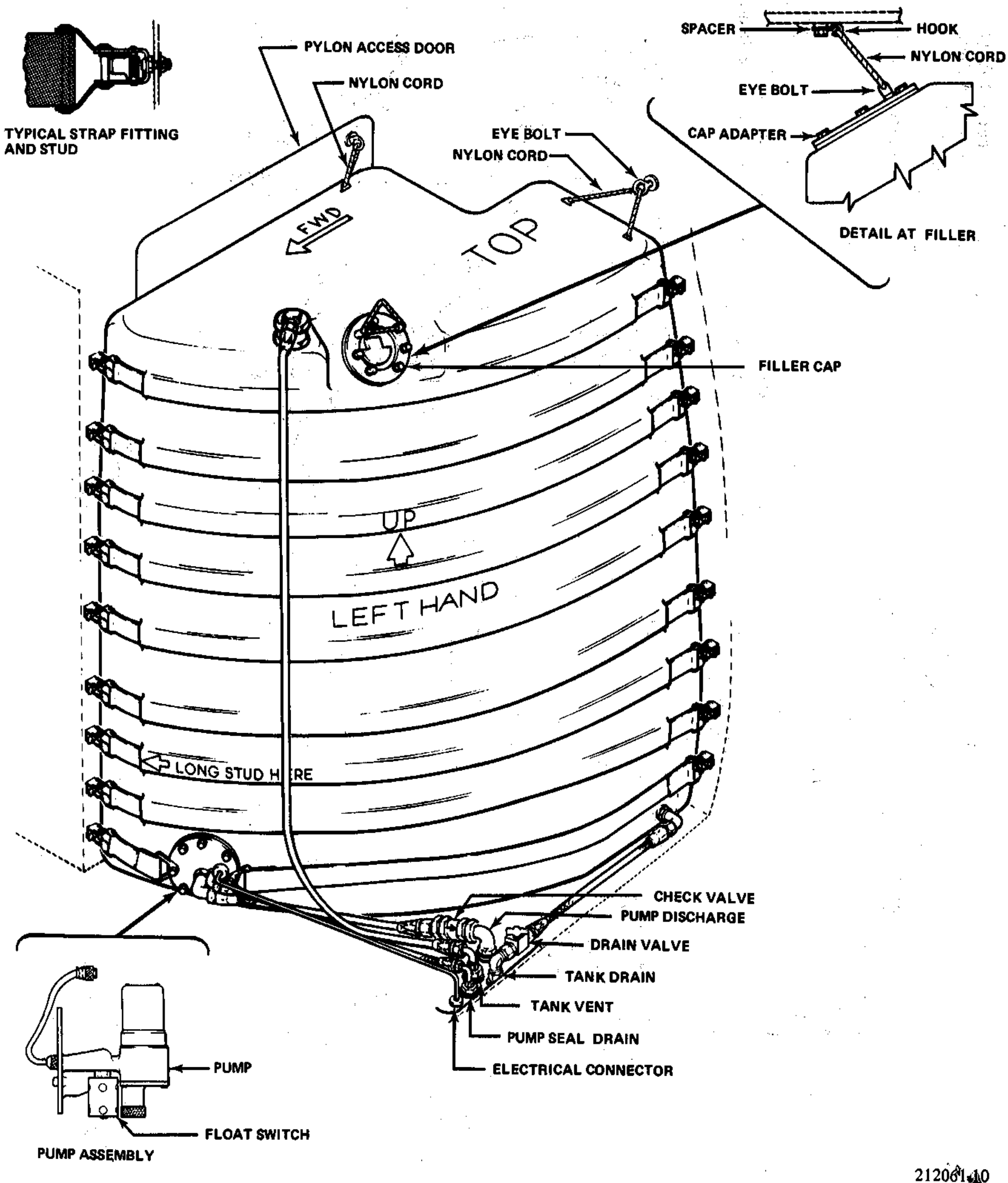

Figure 4-26. Forward auxiliary fuel cell

1. Pip Pins
2. Bolt and Washer - 3 Reqd
3. Bolt and Washer - 4 Reqd
4. Restraining Panel
5. Vent Line
6. Drain Tube (Defuel Valve)
7. Supply Line
8. Pump Drain
9. Electrical Plug
10. Interconnect Line Coupling 2 Reqd
11. Bolts and Washers - 12 Reqd
12. Cover Plate Assembly
13. Fuel Transfer Pump 2 Reqd

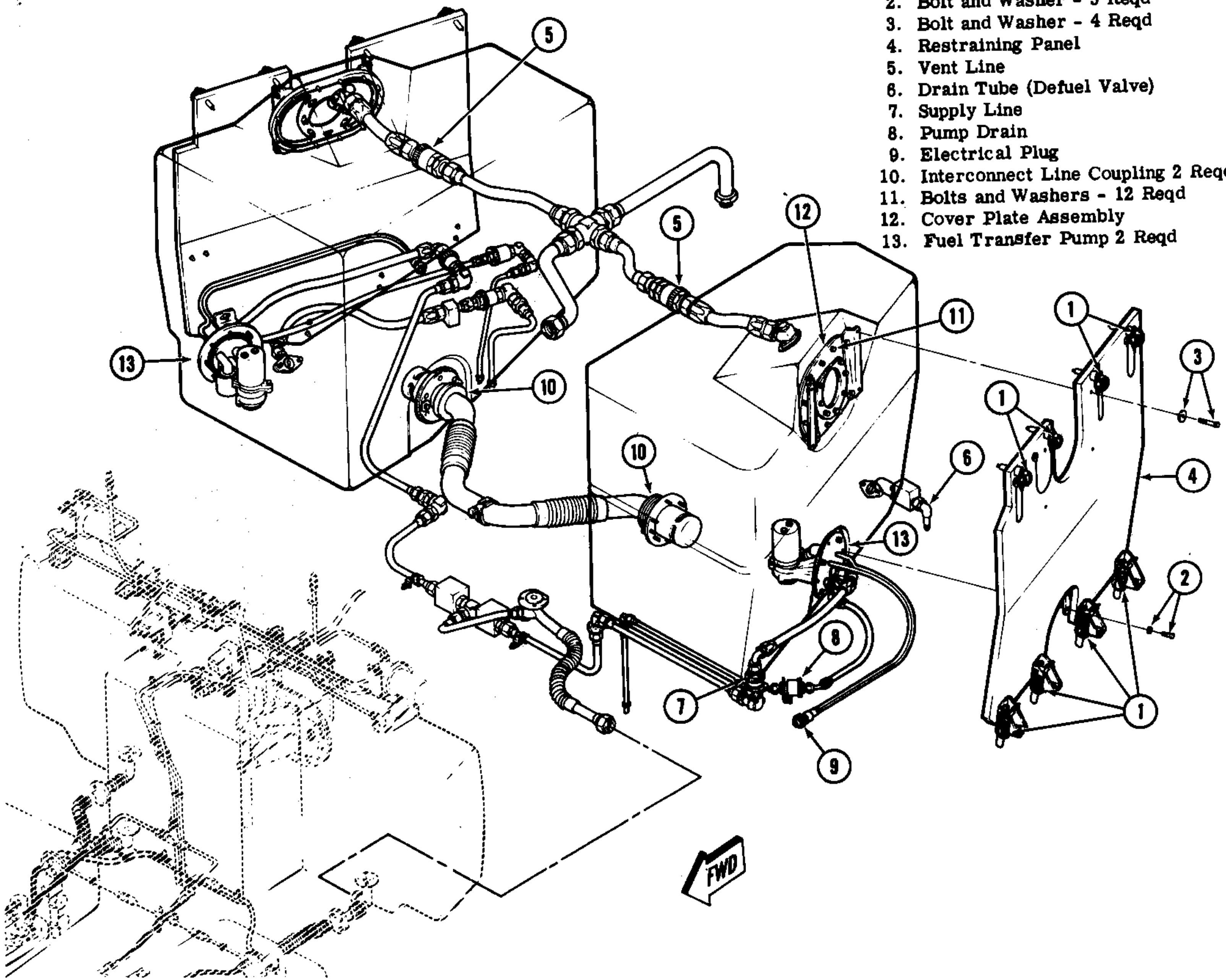

Figure 4-27. Aft auxiliary fuel cells

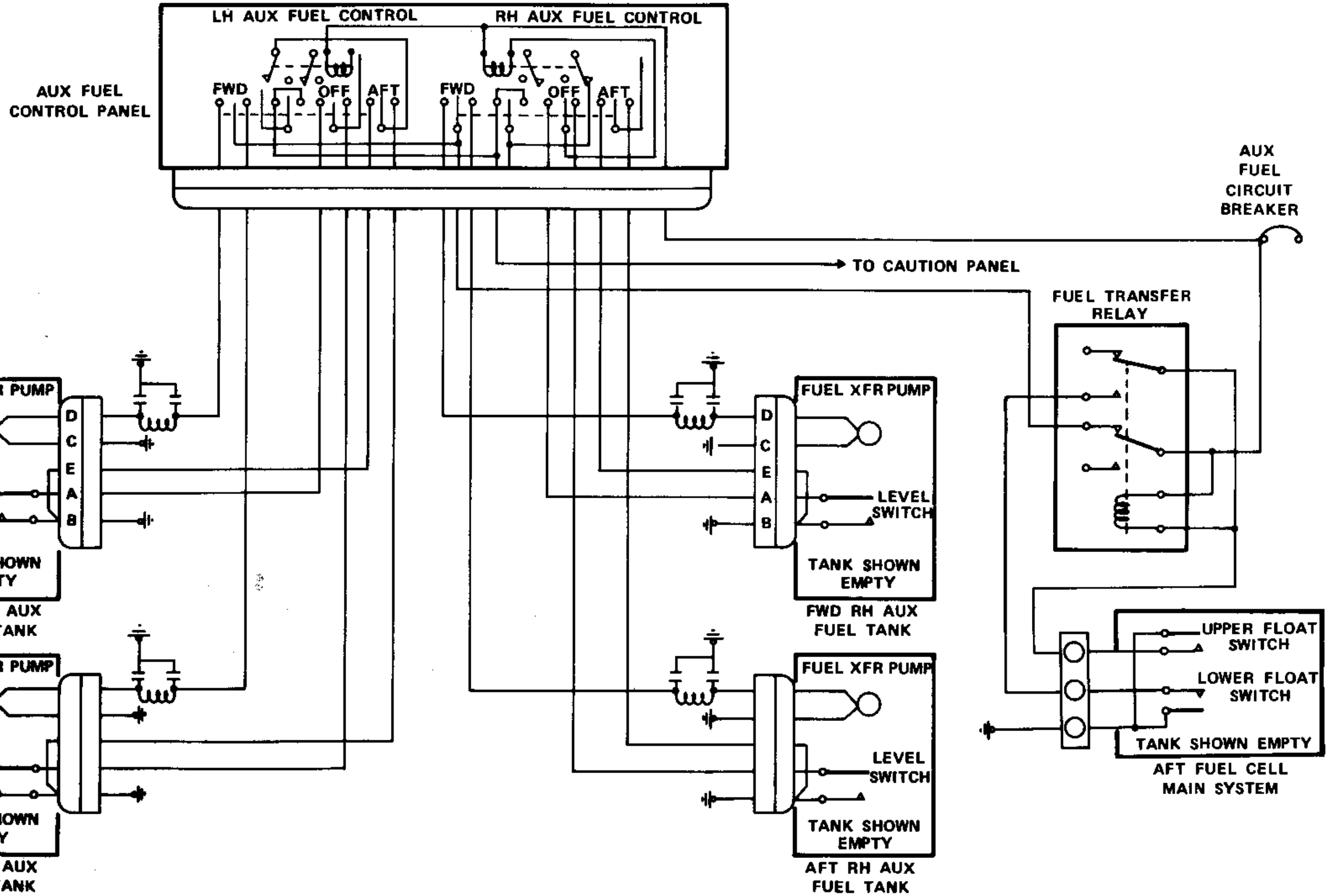

Figure 4-28. Auxiliary fuel system schematic

transfer pumps is accomplished by two position switches, located on the INT AUX FUEL control panel (figure 1-11), and marked LH and RH INT AUX FUEL TRANS PUMP. The pilot is alerted to auxiliary low condition by a worded segment, on the CAUTION PANEL (figure 1-19) which illuminates when actuated by the auxiliary tank fuel low level switch. A check valve is incorporated in the auxiliary fuel flow line to prevent fuel flow from the main fuel cells back to the auxiliary tank. Electric power to operate the fuel transfer pump and low level switch is supplied from the 28V DC non-essential bus. Circuit protection for the transfer pump is provided by a circuit breaker located in the circuit breaker panel (figure 1-17) and labeled AUX FUEL TRANS.

Each of the four auxiliary fuel tanks are equipped with an electrically driven transfer pump (figure 4-28) located inside the tank cell. The pumps transfer fuel from the respective auxiliary tanks to the main fuel cells. Operation of the transfer pumps is controlled by two three-position switches, located on the auxiliary fuel control panel (figure 4-29), marked LH and RH AUX FUEL XFR PUMP. The FWD position of either LH or RH aux fuel switch actuates the respective internal aux fuel transfer pump and the AFT position actuates the respective aft aux fuel transfer pump. Place the LH or RH AUX FUEL XFR PUMP switch to AFT energizes the selected aft auxiliary fuel transfer pump.

NOTE

> **If fuel quantity in main fuel cells is below approximately 1100 ± 50 pounds, the selected fuel transfer pump will be activated and start transfer pumping sequence. If fuel quantity is over 1100 ± 50 pounds, the selected fuel transfer pump will be armed in readiness for activation by the high-low float switches in the aft center main fuel cell.**

The high-low float switches in the aft center main fuel cell activate and automatically cause the selected transfer pump(s) to cycle on when approximately 1100 ± 50 pounds of fuel are in main fuel cells and cycle to off when approximately 1250 ± 50 pounds of fuel are in the main cells.

The pilot is alerted to a low fuel condition in the auxiliary tanks by means of the AUX FUEL LOW warning light (figure 1-10) which illuminates when actuated by any auxiliary fuel tank low level switch. Either aft auxiliary fuel tank low level switch actuates the AUX FUEL LOW warning light (with respective AUX FUEL XFR pump switch in AFT position). Approximately five gallons of usable fuel will remain in the unselected fuel tank. Upon illumination of the AUX FUEL LOW warning light, the pilot must manually place the selected AUX FUEL XFR PUMP switch to OFF and warning light will extinguish. Place the unselected transfer pump switch in the AFT position to transfer the remaining five gallons of fuel to the main fuel cell when the interconnect line is installed. When the AUX FUEL light re-illuminates, return the switch to OFF.

Check valves, incorporated in the auxiliary fuel flow lines attached to the respective tanks, prevent fuel flow from the main fuel cells to the auxiliary tanks. The valves are so set that fuel cannot free-flow from the auxiliary tanks to the main fuel cells, thus eliminating the danger of overfilling the main fuel cells with transfer pump switches in OFF position. Electrical power to operate the fuel transfer pumps and the low level switches is supplied from the 28V DC nonessential bus. Circuit protection for the transfer pumps and low level electrical switches is provided by AUX FUEL TRANS circuit breaker in the circuit breaker panel (figure 1-18).

Transfer Pump—Operation

The procedure outlined herein assumes that the complete auxiliary fuel equipment has been installed in the helicopter and the electric transfer pumps and the low level switch electrical cables are connected.

1. Circuit breakers – IN.
2. INT AUX FUEL TRANS PUMP switches (left and right) – OFF.
3. BATTERY switch – ON (OFF for APU).
4. INT AUX FUEL TRANS PUMP switch (left or right) – ON.

NOTE

> Either pump may be turned on first, or pumps may be operated singly, but care must be taken to ensure an adverse lateral CG condition does not occur by single pump operation.

5. Inverter – MAIN.

NOTE

> An automatic high-low float switch installed in the aft center fuel cell prevents overfilling of main fuel cells when TRANSfer PUMP is ON. The pump will not operate when **approximately 1250 ± 50 pounds of fuel are in the main cells and will operate when fuel in main cells reaches approximately 1100 ± 50 pounds.**

The procedure outlined herein assumes that the auxiliary fuel equipment systems (forward tanks and/or aft tanks) have been installed in the helicopter and the electric transfer pumps and the low level switch electrical cables are connected.

1. Circuit breakers – IN.

2. AUX FUEL XFR PUMP switches (left and right) – OFF.

3. BATTERY switch – ON (OFF for APU).

4. AUX FUEL XFR PUMP switch (left or right) - FWD or AFT, or OFF, as dictated by mission requirements.

CAUTION

Any one of the transfer pumps may be turned on first, or either forward pump or either aft pump (when crossover is not installed) may be operated singly, but care must be taken to ensure an adverse lateral C.G. condition does not occur by single pump operation. Forward cells and aft cells (when interconnect line is not installed) may also be pumped singly at any time, as needed, to control lateral C.G.

NOTE

The automatic high-low float switches, installed in the aft center main fuel cell, actuate the transfer pumps and prevent overfilling of the main fuel cells when transfer pump(s) are operating. The float switches actuate and automatically cause the selected fuel transfer pump(s) to cycle on when approximately 1100 ± 50 pounds of fuel are in main fuel cells and cycle off when approximately 1250 ± 50 pounds of fuel are in the main cells; in the event float switch(es) fail to cycle off, fuel flow venting overboard is imminent. Pilot must manually operate fuel transfer pump switches. Fuel is transferred into main fuel tank at the rate of approximately 25 pounds per minute for single pump, and 40 pounds per minute with both pumps operating. If both pumps fail to transfer fuel, only the fuel remaining in the main tanks will be available for completion of the flight.

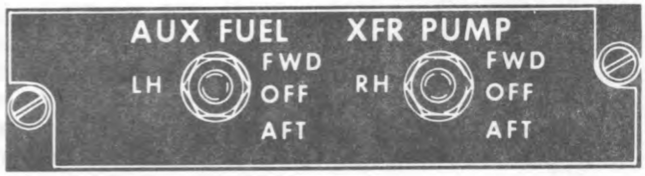

Figure 4-29. Auxiliary fuel control panel

EXTERNAL CARGO SUSPENSION UNIT

When installed this unit makes it possible to carry cargo by means of a short, single, full-swiveling suspension unit secured to the primary structure and located close to the helicopter center of gravity.

WARNING

- External loads which have aerodynamic characteristics may cause oscillations to the extent that the load may oscillate into the rotor blade and/or fuselage.

- When carrying external loads, oscillation of the load can cause oscillation of the airframe. A pilot should keep control movements small to avoid aggravating the oscillation. If uncontrollable oscillations develop, the pilot should drop the load.

- **With the helicopter airborne, do not use the cargo hook external manual release, use of the external manual release is extremely hazardous and may result in injury to the ground crew man's hand or arm due to the possibility of the helicopter shifting position over the external load causing the hook to move.**

A cargo mechanical release pedal is located on the cabin floor, between the pilot's tail rotor control pedals, while an electrical release button is located on the cyclic control stick. When not in use, the cargo suspension unit need not be removed, nor does it require stowing, as the hook protrudes only slightly below the lower surface of the helicopter. Electrical power to the cargo release relay is supplied from the 28 volt DC essential bus. Circuit protection is provided by circuit breaker CARGO HOOK in the circuit breaker panel (figure 1-18). The cargo suspension unit is capable of sustaining a 5000 pound load.

CARGO HOOK-OPERATION

Cargo may be attached to the hook unit with the cargo release switch positioned in either the OFF or ARM position. Cargo can only be released electrically with the switch in the ARM position. There is no automatic touchdown release on these helicopters. However, the cargo load may be dropped by actuating the foot pedal mechanical release, regardless of the switch position.

NOTE

Under certain climatic conditions a static charge may be accumulated on the aircraft. To prevent inadvertent "shock" to hook up personnel, "ground" the aircraft prior to physical contact.

1. Approach the object to be picked up with caution. A ground handler or crewmember will direct the aircraft movement.

2. Maintain a constant altitude and position over the ground while the object is being placed on the cargo hook. Normally, the aircraft will be hovered into the wind.

3. After the object is secured to the cargo hook, raise the helicopter until sling is taut and lift the load off the ground. Take off will be accomplished to allow adequate clearance over all obstacles.

NOTE

Ensure load is not frozen to the ground prior to lifting.

4. A minimum amount of control movement (to prevent oscillation of the cargo load) is desired.

5. The landing approach angle will be determined by load weight and wind conditions, usually shallower than a normal approach. Do not allow the load to touch the ground until the helicopter is in a stable hover.

6. To deliver the load, lower the aircraft to relieve the tension of the sling, then use the release button or release pedal to release the load.

INTERNAL RESCUE HOIST

The internal rescue hoist assembly (figure 4-30) consists of a vertical column extending from the floor structure to the cabin roof, a boom and an electrically operated winch and can be positioned at any one of four locations in the cabin. Two control locations for the operation of the hoist are provided; one for the pilot and one for the hoist operator. The pilot's hoist control switch is located on the cyclic control stick (figure 1-10) and provides for boom positioning and reeling up or down of the winch cable. The pilot's control has priority over the hoist operator's controls; however, the pilot has only a fixed full speed capability.

The hoist operator's controls are located on the hoist control pendant and provide the following switches: a speed control knob that is self centering with variable speed control for reeling the cable up or down; a boom in and out switch; and an intercom trigger switch to provide communication with the pilot and copilot. An electrically initiated, ballistically actuated cable cutter (guillotine) is provided with two guarded electrical switches. The pilot's cable cut switch is located on the center pedestal (figure 1-12) and the hoist operator's cable cut switch is mounted on top of the hoist control box. Two indicator lights (automatically actuated) are provided to indicate to the crew when the hoist has automatically decelerated to 50% of speed. One indicator light is located in the lower right area of the instrument panel (44, figure 1-11) and the other indicator light is located on the hoist operator's control box.

The lights are labeled "RESCUE HOIST DECELERATION" Electrical power to the rescue hoist and its controls is supplied from the 28 volt DC non-essential bus and circuit protection is provided by the HOIST CABLE CUT circuit breaker and HOIST PWR circuit breaker in the breaker panel (Figure 1-18). Additional protection is supplied for hoist linear actuator by a 10 amp circuit breaker located on the hoist control box. The electrical connection for hoist power is located in the cabin roof above the sound proofing.

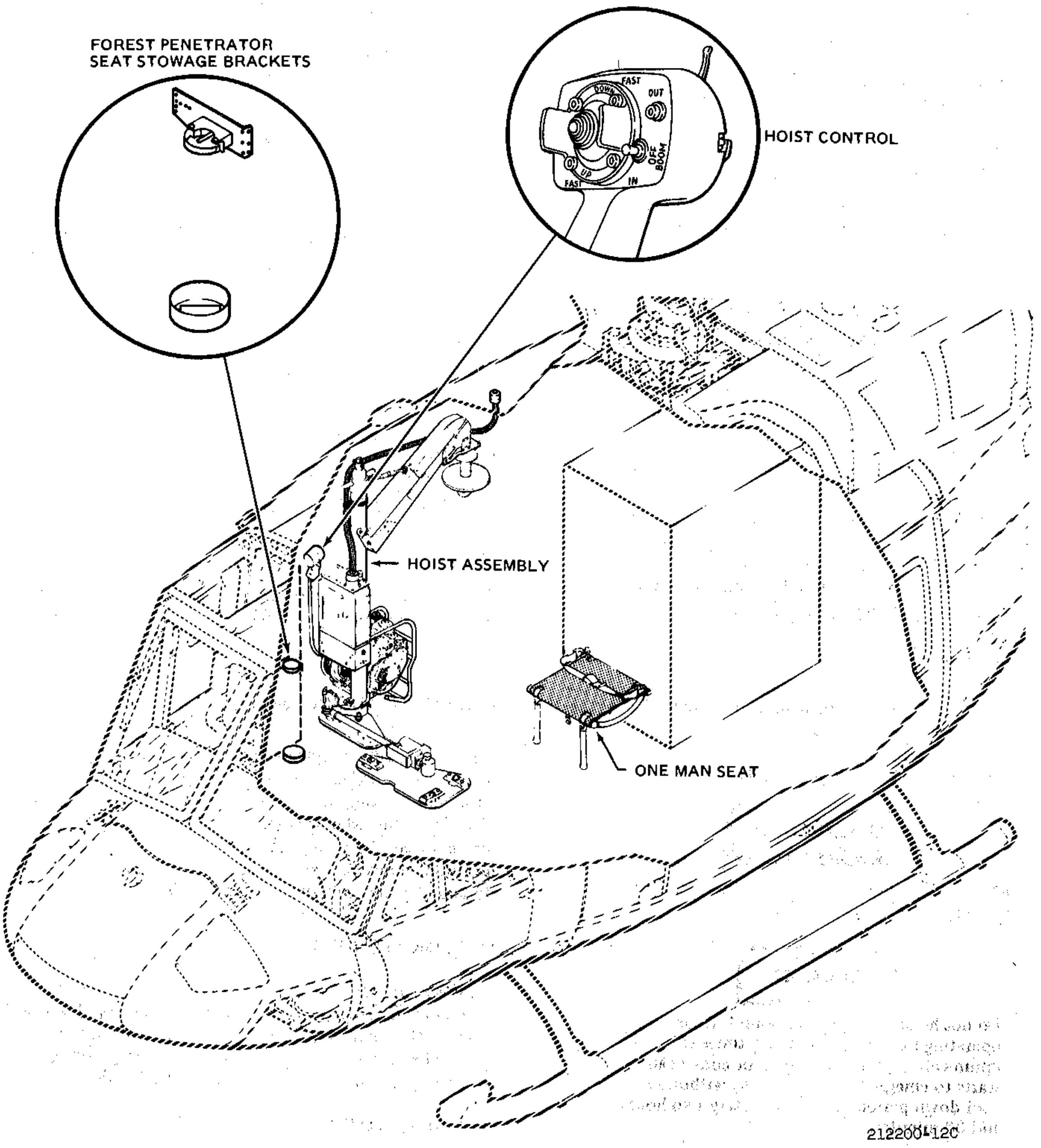

Figure 4-30. Internal rescue hoist-typical

NOTE

The hoist has approximately 269 feet of cable. The last 29 ± ½ feet are color coded (27 ± ½ feet red, 2 feet manufacturer's color code). There is approximately 240 feet of usable cable (duty cycle limited to when the red color coded cable starts to emerge from the winch).

RESCUE HOIST – OPERATION

The rescue hoist is used to accomplish the lifting or lowering of personnel and/or cargo when a landing cannot be made.

WARNING

- Prior to conducting hoist operations, the system must be preflighted to assure proper installation and cable condition. An operational check will be conducted prior to flight.
- When the internal rescue hoist is installed, personnel should not occupy the two aft seats (depending on pilots discretion) on the side the hoist is installed during landings, takeoff, or emergency conditions.

* ~~SEE SUPP 15-91~~

Operating Data

The following general information is provided for use when operating the rescue hoist.

1. Maximum load 600 pounds

WARNING

Lateral CG limits may not permit maximum load capability.

CAUTION

Do not hoist or lower 600 pounds (maximum operating load) more than two times to maximum cable extension (red color coded cable starts to emerge from the winch) without a cool down period of approximately two hours and 30 minutes.

2. Usable cable length — approximately 240 feet (duty cycle limited to when the red color coded cable starts to emerge from the winch)

3. Limit switches

Boom "IN"	Preset limit switch in actuator
Boom "OUT"	Preset limit switch in actuator
Cable "UP"	Preset limit switch at end of boom (contacted by spring assembly hook)
Cable "DOWN"	Preset limit switch on winch (actuated when three wraps of cable remain on storage drum).
DECELERATION	Preset limit switch on winch assembly when cable is within 5 to 8 feet of UP.

* WARNING SEE SUPP 15-94

Rescue Hoist Operating Procedures – Refer to Section VIII.

MISCELLANEOUS EQUIPMENT

DATA CASE

A data case for maps, flight reports, etc., has been provided and located on the left side of the pedestal.

GROUND HANDLING WHEELS

* SEE 155-95

Ground handling wheels are available for each of the landing gear skids. The wheels are for the purpose of ground handling, i.e., pushing or towing the helicopter. For flight the wheels must be manually retracted, stowed or removed. To secure ground handling wheels in retract position, insert pin end of support rods into holes on skid tube and pump wheels down until snug.

TIEDOWN FITTINGS

Tiedown fittings are provided at four locations on the helicopter. Two are located on the forward right and left sides of the fuselage just forward of the landing gear cross tube. The other two are located aft of the landing gear aft cross-tube on the fuselage right and left sides.

ROTOR TIEDOWN

Rotor tiedowns are provided for use in securing the aft blade of the main rotor and the tail rotor to prevent the rotors from flapping when the helicopter is parked.

PITOT TUBE COVER

A cover is supplied for the pitot tube. This cover is made of duck material and has a red streamer attached.

TURBINE AIR INLET AND EXHAUST COVERS

Turbine air inlet and exhaust covers are provided for protection during storage or tiedown. The covers have a red streamer attached with the warning REMOVE BEFORE FLIGHT stenciled in white.

SECTION V

OPERATING LIMITATIONS

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MINIMUM CREW

The minimum crew for the proper operation of this helicopter is the pilot. Additional crew members may be assigned at the discretion of the commander.

INSTRUMENT MARKINGS (Based on JP-4)

The instrument markings are shown in figure 5-1. The limitations indicated are not necessarily repeated in the text. The pilot should ensure that the limitations imposed by the instrument markings are not exceeded.

WARNING

The flight crew will make entries in Form 781 to indicate reading and duration when any limits in the Flight Manual have been exceeded.

ENGINE AND TRANSMISSION LIMITATIONS

ENGINE LIMITATIONS

Engine Starter Limits

Use of starter is limited as follows:

30 Seconds ON 1 Minute OFF	30 Seconds ON 5 Minutes OFF	30 Seconds ON 15 Minutes OFF

Engine Limits

Engine power section operating limits are independent of one another and are presented in the following table. Whichever limitation occurs first is the limit to be observed.

	Military	Maximum Continuous
Ng	100%	N/A
ITT	810°C	767°C
Q	83.7%	71.2%
Time	30 Minutes	N/A

CAUTION

Duration of single engine operation above 78%Q must be entered in Form 781.

Hot Start

The maximum ITT during start shall not exceed 1090 °C. ITT above 870 ° C. shall be monitored during start. If time exceeds limits shown in figure 5-2, a hot start has occurred.

Over Temperature Limits (All Conditions Except Starting.)

The maximum ITT for all conditions except starting shall not exceed limits set by figure 5-3. If any of these limits are exceeded, a condition of over temperature has been experienced.

INSTRUMENT MARKINGS

TRANSMISSION OIL TEMPERATURE AND PRESSURE

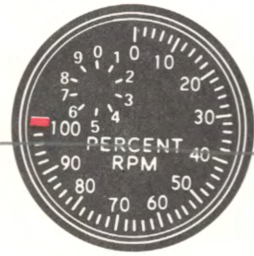
TEMPERATURE (T)

- 110°C

PRESSURE (P)

- 30 psi
- 30 to 40 psi
- 40 to 70 psi
- 70 psi

GAS PRODUCER TACHOMETER



- 100%

Normal operating limit at Power 100%
No load (Flight idle). 61% ± 2%
Acceleration (Transient 10 second limit) 101%

COMBINING GEARBOX OIL TEMPERATURE AND PRESSURE

TEMPERATURE (T)

- 116°C

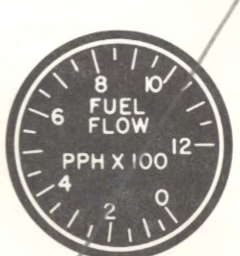
PRESSURE (P)

- 40 psi
- 40 to 60 psi
- 60 to 85 psi
- 85 psi

INTER TURBINE TEMPERATURE

- 767 to 810°C
- 810°C

FUEL FLOW



BASED ON
JP-4 FUEL

ENGINE OIL TEMPERATURE AND PRESSURE

TEMPERATURE (T)

- 116°C

PRESSURE (P)

- 40 psi
- 40 to 80 psi
- 80 to 112 psi
- 112 psi

NOTE: 150 PSI MAX AT OAT −45°F. (-43°C)

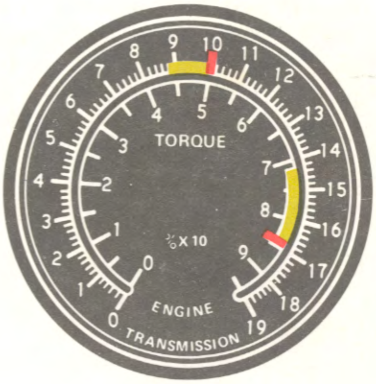
212072-2-1G

X SEE SUPP I5-94

Figure 5-1. Instrument markings (Sheet 1 of 2)

INSTRUMENT MARKINGS

DUAL TORQUE INDICATOR



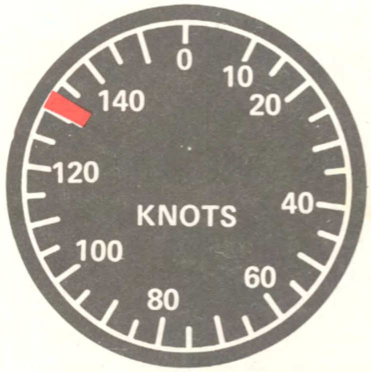
TRANSMISSION

88 to 100%
100%

ENGINE

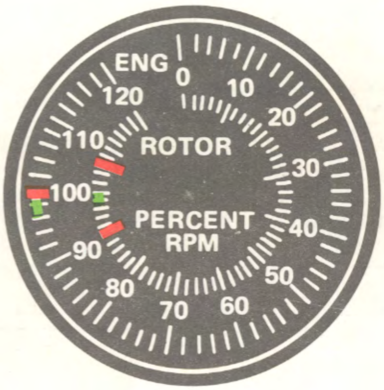
71.2 to 83.7%
83.7%

AIRSPEED



130 Knots Maximum

TRIPLE TACHOMETER



ROTOR

91%
97 to 100%
104.5%

ENGINE

97 to 100%
100%

DUAL AMMETER

200 to 225 amps
225 amps

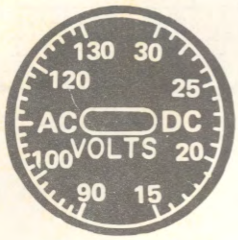
Engine RPM Limits:

Acceleration (Transient 10 second Limit)	110%

Rotor RPM Limits:

Power On —	
Normal Operation	97 to 100%
Operation in this range is not recommended	100.0 to 104.5%
Transient Maximum	104.5%
Transient Minimum	91%
Power Off —	
Maximum	104.5%

VOLTMETER



BASED ON
JP-4 FUEL

212072-2-2D

Figure 5-1. Instrument markings (Sheet 2 of 2)

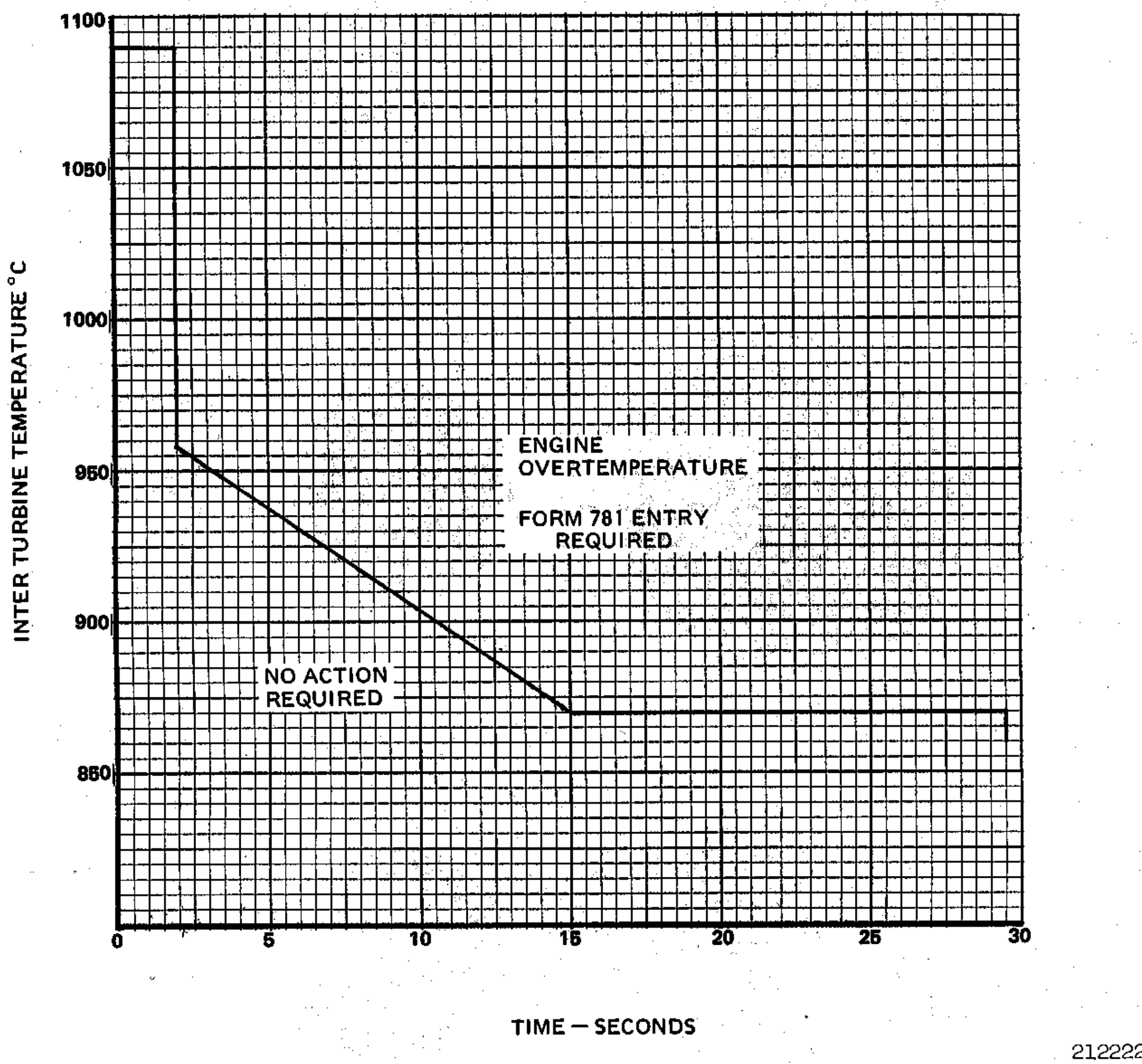


Figure 5-2. Engine overtemperature - starting

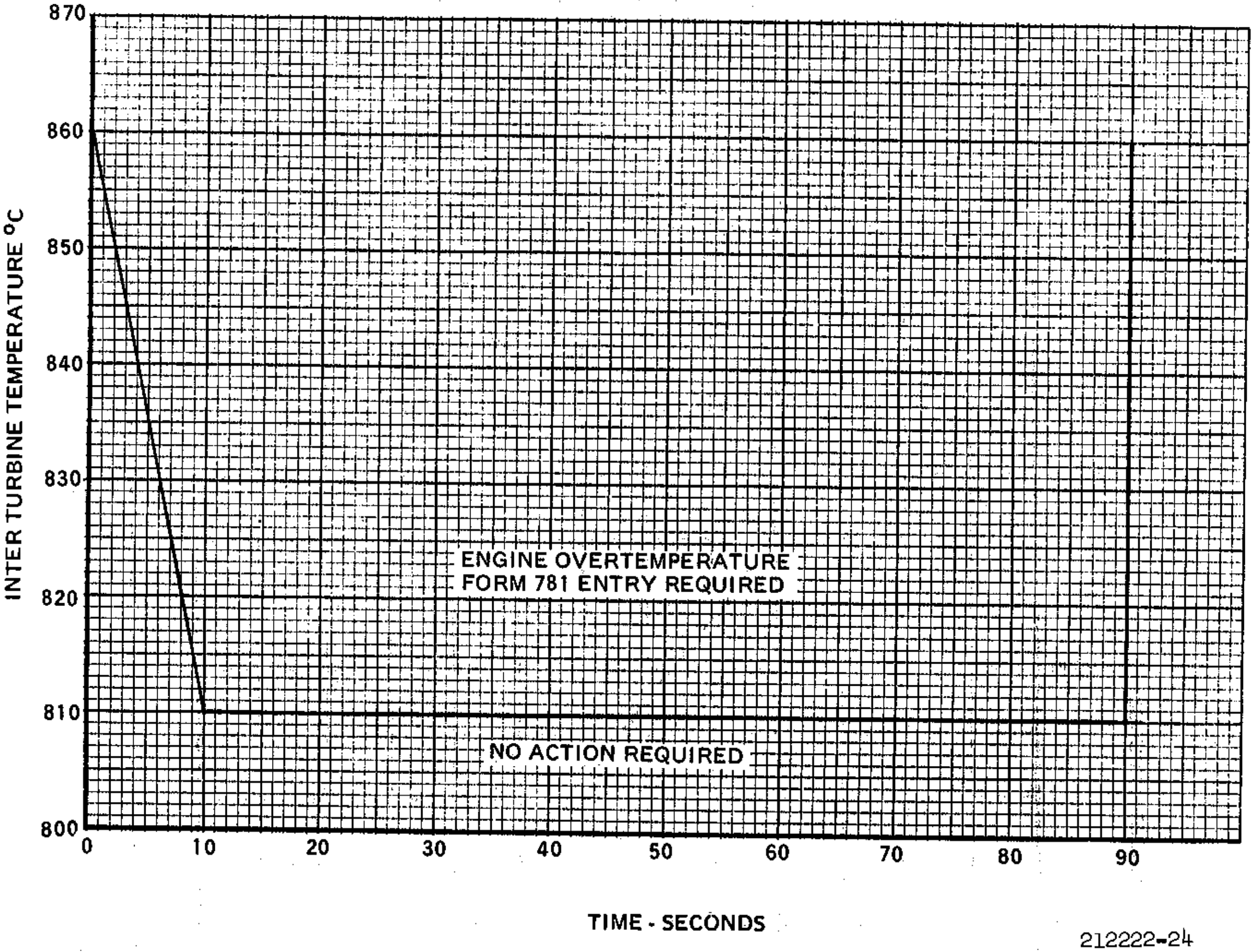


Figure 5-3. Engine overtemperature - all conditions except starting

ITT FLUCTUATION LIMITATIONS

Allowable ITT fluctuation is plus/minus 5° C, provided fluctuations are not rapid or erratic.

NOTE

Transient fluctuations can be expected during turbulence or while hovering crosswind.

TRANSMISSION LIMITATIONS

The transmission is limited to 88% torque for continuous operation. Operation from above 88% to 100% torque is limited to 5 minutes.

COMBINING GEAR BOX OIL PRESSURE FLUCTUATION LIMITATIONS

Allowable combining gear box oil pressure fluctuations is plus/minus 5 PSI within the normal operating range of 60 PSI to 85 PSI. This fluctuation is acceptable if it occurs at mean indications of 60 PSI or 85 PSI such that readings of 55 to 65 or 80 to 90 are experienced. Slow variations of pressure within the normal operating range are permissible.

NOTE

Momentary reductions in oil pressure can occur during certain maneuvers within the flight envelope and are acceptable.

DECREASE V_{NE} 3 KNOTS PER 1000 FEET ALTITUDE ABOVE 3000 FEET DENSITY ALTITUDE.

NR RANGE:	POWER ON	97 TO 100%
	POWER OFF	91 TO 104.5%

MAX. STEADY STATE AUTO ROT. AIRSPEED 110 KTS
MAX. DENSITY ALT. FOR ALL GROSS WEIGHTS ABOVE 10,000 LB. IS 10,000 FT
MAX. AIRSPEED (110 KT) FOR XM-94 CONFIGURATION DURING FIRING FOR ALL GROSS WEIGHTS

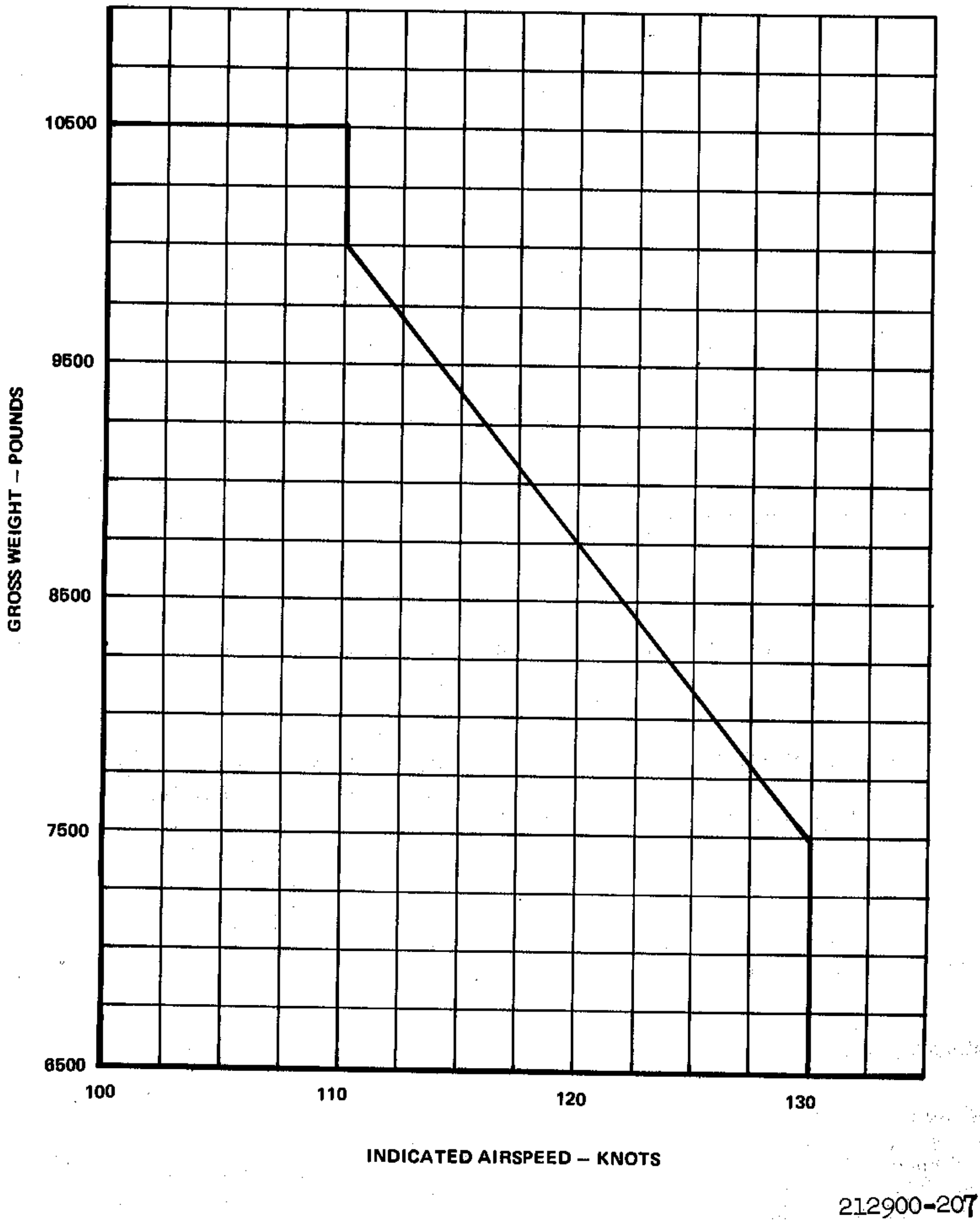


Figure 5-4. Operating limits decal

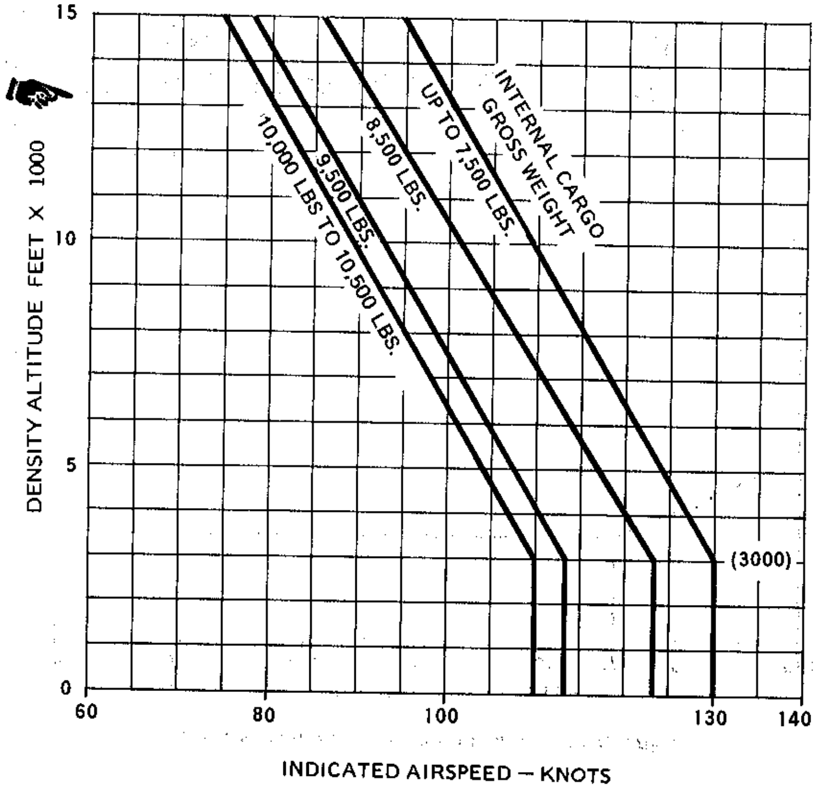


Figure 5-5. Airspeed vs density altitude

ENGINE OIL PRESSURE FLUCTUATION LIMITATIONS

Allowable engine oil pressure fluctuation is plus/minus 5 PSI, within the normal operating range of 80 PSI to 112 PSI.

AIRSPEED LIMITATIONS

MAXIMUM AIRSPEED

The maximum permissible airspeed is 130 knots indicated airspeed. Figure 5-4 and 5-5 show the maximum airspeed as limited by gross weight and density altitude. The maximum airspeed with an extended load on the rescue hoist is 80 knots indicated airspeed.

Sideward and Rearward Airspeed

Sideward airspeed shall be limited to a maximum of 35 knots, including wind factor. Rearward airspeed shall be limited to a maximum of 30 knots including wind factor.

Sideward is the 90° quadrant on either side of the aircraft, from 45° off the nose to 45° off the tail. Rearward is the 90° quadrant 45° on either side of the tail.

NOTE

With gross weights above 9,600 pounds and density altitudes above 10,000 feet, a severe degradation of sideward and rearward flight capability can be expected. Sufficient control authority may not be available to attain sideward and rearward flight velocities in excess of 15 knots.

Cargo Door Airspeed Limits

The maximum airspeed with the cargo doors partially opened (unsecured) or to open and close doors in flight is 80 KIAS. Maximum airspeed with cargo doors fully opened and secured is VNE or 120 KIAS whichever is less. When operational requirements dictate the hinged cargo door panels may be removed provided both sliding cargo doors are either removed or secured open, and maximum cargo door open airspeed limit is not exceeded.

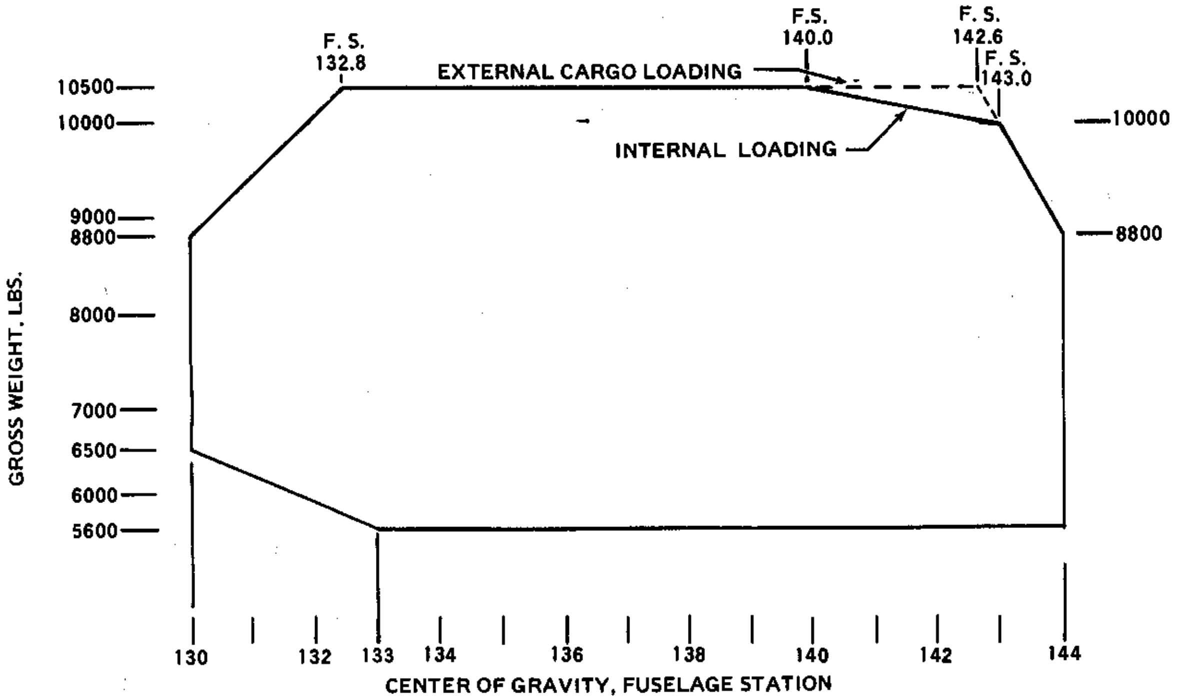


Figure 5-6. Longitudinal center of gravity limits

Autorotations

Under all circumstances autorotational landings should be attempted into the wind. The maximum steady state autorotation airspeed is 110 knots indicated airspeed.

CENTER OF GRAVITY LIMITATIONS

Longitudinal center of gravity limits are shown in figure 5-6. The lateral center of gravity limits are 6 inches left or right of the longitudinal axis.

ACCELERATION LIMITS

The maximum permissible acceleration is 3.5g positive and 0.5g negative for gross weights up to 6600 pounds. At higher gross weights, positive acceleration is limited to 2.2g at 10,500 pounds and a negative acceleration to 0.32g at 10,500 pounds gross weight. In turbulent air, pilot discomfort may be used as a guide to determine the extent of roughness that is acceptable.

CAUTION

The helicopter should never be in excess of 10,500 pounds maximum gross weight.

SIDESLIP LIMITATIONS

The Sideslip Envelope of Figure 5-7 shall apply.

CARGO LIMITATIONS

FORWARD CARGO AREA

The forward cargo area is located aft of the crew stations and contains approximately 220 cubic feet of obstruction free cargo loading space. Hi-density cargo should be distributed over the deck area to maintain a loading of 100 pounds per square foot. This will provide a safety load factor of 3.5 based on limit loads. For floor loading in excess of 100 pounds per square foot, the load factor will be 350 divided by floor loading in number of square feet.

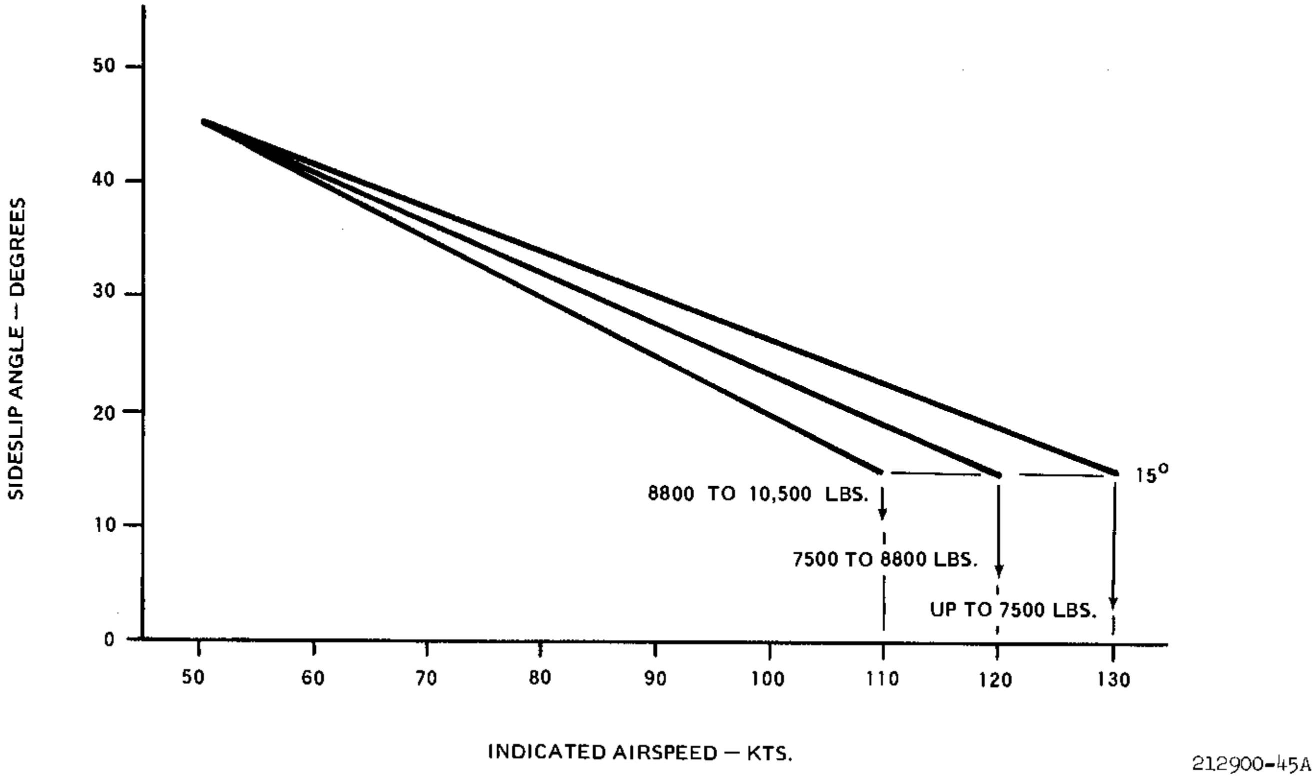


Figure 5-7. Sideslip limitations

CARGO FLOOR LOADING VS. ALLOWABLE LOAD FACTOR

LBS. SQ. FT.	ALLOWABLE LOAD FACTOR	
350	1.0	(G's)
300	1.2	(G's)
200	1.8	(G's)
150	2.3	(G's)
100	3.5	(G's)

Floor and aft bulkhead tiedown fittings strength per fitting is 1250 pounds perpendicular and 500 pounds parallel to the mounting.

WARNING

This information is not intended as weight and balance data or cargo weight limits. Refer to Basic Weight Check List and Loading Data, and the Handbook of Weight and Balance for cargo weight limits.

NOTE

Baggage or cargo will not be carried in any compartment except the cabin.

PROHIBITED MANEUVERS

1. Aerobatic maneuvers

2. Abrupt movement of the flight controls. (Control movement thru full throw in 2 seconds or less)

PROHIBITED OPERATION

ROTOR BRAKE

Do not apply rotor brake above 40% NR except for emergency.

WIND LIMITATIONS

Starting and stopping rotor with surface winds above 45 knots is prohibited.

IFR FLIGHT

Intentional flight through known icing conditions with OAT colder than minus 5 degrees C is prohibited.

EXTREME TEMPERATURE OPERATION

Operation in ambient temperatures above 51.5° C (125°F) and below –54°C (–65° F) is prohibited.

MAXIMUM ALTITUDE OPERATION

The maximum operational altitude is 15,000 feet pressure and/or density altitudes.

HYDRAULIC CONTROL

Except for emergencies, intentional in-flight operation with the Hydraulic Control Master switch - OFF is prohibited.

KIT LIMITATIONS

Operation of the aircraft with LAU-59/A or LAU-68A/A rocket launchers installed is authorized within the jettison envelope of 120 KIAS maximum power ON and 100 KIAS maximum power OFF.

Firing of the XM-94 armament subsystem in flight is limited to airspeeds up to 110 KIAS maximum.

Maximum airspeed with the Model 3090-3 spray system installed is 110 KIAS.

External Cargo Sling and Internal Rescue Hoist Operating Limitations are as Follows:

1. External cargo sling operations are authorized with a hook load of up to 5000 pounds maximum, airspeed up to 80 KIAS maximum, and a maximum aircraft gross weight of 10,500 pounds. Center of gravity limits must never be exceeded.

2. Rescue hoist operation is not authorized with external equipment installed on the hard points.

EXCEPTION
Rescue hoist operation is authorized with the M-23 subsystem installed on hard points if the hoist is mounted in the left or right forward position.

3. The internal rescue hoist is restricted from operation and shall remain in the stowed position anytime the M-23 gun system, located on either side of the aircraft is:

a. in operation

b. in the FIRE mode

c. in any gun position other than stowed and with all ammunition cleared from the gun.

SECTION VI

FLIGHT CHARACTERISTICS

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HANDLING AND STABILITY

The flight characteristics of this helicopter in general are similar to other single rotor helicopters. The additional stability that is evident during takeoff, hovering, and all flight regimes is the result of the inertia effect of the stabilizer bar. The control system, with hydraulic servo assist, provides the pilot with a near zero force required for control movement; however, control feeling is induced into the cyclic stick and tail rotor control pedals by means of a force trim system.

NOTE

During flight at large sideslip angles, the aircraft may develop a divergent oscillation in pitch and yaw. Reduced sideslip angle or reduced collective pitch will bring the oscillation under control.

HOVERING CHARACTERISTICS

The hovering characteristics are normal. However, the directional control pedals are sensitive, responding immediately to slight pressure. There are no noticeable trim changes when the helicopter is lifted to a hover with the exception that an increase in left pedal will be required to compensate for torque.

CLIMB CHARACTERISTICS

Climbing characteristics of the helicopter are acceptable; however, when climbing at maximum allowable power and optimum climb speed, it is difficult to maintain airspeed due to decreased longitudinal stability. The stability changes with rate of climb and is poorest at high rates of climb. It is easily controlled by the pilot if he maintains attitude with the attitude indicator or visual reference.

To stabilize climb airspeed when climbing at high rates of climb, it is best to establish a climb attitude and maintain this attitude until airspeed stabilizes. If adjustments to climb airspeed are required, establish a new attitude to correct the speed and maintain until airspeed stabilizes. Climbing at 70 to 80 knots is recommended when optimum climb speed is not required.

LEVEL FLIGHT CHARACTERISTICS

The level flight characteristics of the helicopter are good throughout the operating range. When trimmed, the helicopter can be flown hands-off in smooth air for short periods of time. Airspeed can be maintained without difficulty.

As the helicopter is decelerated from cruise condition, power required decreases until 50 KIAS is attained. Below this airspeed, power required increases as airspeed decreases. (Figure 6-1 portrays only unaccelerated level flight condition). During conditions of light gross weights, low altitudes and temperatures, power required will normally be less than power available allowing a margin for maneuver. At heavy gross weights, high altitudes and temperatures, the power required may exceed the power available; thereby preventing level flight at slower speeds. Figure 6-1 illustrates conditions where power required exceeds power available, resulting in descending flight until increased airspeed is attained. When the helicopter is decelerating, descending or rotor rpm has decayed and the condition is to be reversed, power required will be even greater. Even if there is sufficient power available to reverse the rate of descent or deceleration, the engines may not fully accelerate before the speed or rpm has decayed below the point where level flight is possible. When operating in conditions where OGE hover is not possible, level flight below 50 KIAS and less than 97%N_r should be avoided.

SIDEWARD AND REARWARD FLIGHT CHARACTERISTICS

In the zero to ten-knot speed range, and in the speed range above 20 knots, the UH-1N has acceptable flight characteristics. Small pedal movements will be required to hold desired heading as the helicopter moves into sideward or rearward flight. In the translational lift zone, approximately 15 to 20 knots, a large rapid control input will be required in order to control a nose down trim change, and large, rapid pedal inputs will be required to control yaw excursions. Above 20 knots excursions in pitch are readily controlled with small cyclic inputs, but excursions in yaw require large, rapid pedal inputs to maintain heading, especially in rearward flight. Adequate control margin exists at 35 knots sideward and 30 knots rearward.

Under flight conditions in which 97% NR is used in sideward flight, the UH-1N should be restricted to sideward flight velocities of 30 knots.

The helicopter accelerates easily into rearward flight. There is a slight, easily - controlled tendency to turn into the relative wind. When translational lift is reached a sudden but easily-controlled nose down tendency will be apparent. Adequate control margin is available through 30 knots.

NOTE

> With gross weights above 9,600 pounds and density altitudes above 10,000 feet, a severe degradation of sideward and rearward flight capability can be expected. Sufficient control authority may not be available to attain sideward and rearward flight velocities in excess of 15 knots.

BLADE STALL

Blade stall is caused by a high angle of attack on the retreating blade and starts at the outboard section and progresses inboard with increased airspeed. Blade stall is the result of factors such as gross weight, rotor rpm, airspeed, acceleration, attitude, and altitude. The condition is most likely to occur at higher airspeeds and low operating rpm; it also follows that the condition will occur sooner at higher density altitudes and gross weight. Prior to progressing fully into the stall region, the pilot will feel a marked increase in both airframe vibration and vibration in the controls. When blade stall is evident, the condition may be eliminated by accomplishing one or a combination of the following corrective actions:

1. Decrease the severity of the maneuver.
2. Increase operating rpm.
3. Reduce airspeed.
4. Reduce power with collective pitch.
5. Descend to lower altitude if possible.

FLIGHT WITH CARGO SUSPENSION LOADS

The helicopter has no unusual characteristics when carrying an external load, due to the single point suspension cargo hook, suspended at the C.G. of the helicopter. The release of external cargo while in flight results in no abnormal control reaction. Airspeeds should generally be reduced when flying with external load, depending on the nature of the load.

WARNING

- When picking up an external load in cold weather, care should be taken to ensure cargo is not frozen to the ground.
- External loads which are of low density and great bulk and/or loads which have aerodynamic characteristics may tend to go unstable in flight as airspeed is increased and may contact fuselage or rotor system. This oscillating load will greatly impair the flying qualities of the helicopter and immediate action should be taken to get out of this condition. Normally, the sling load is excited by increased speed and reducing airspeed will stabilize the load. If this does not stop the oscillation or if the oscillation is endangering the aircraft, the load should be jettisoned.

FLIGHT CONTROL VIBRATION CHARACTERISTICS

Chattering will occur in the cyclic and or collective controls when the control is moved at a rate greater than full travel in one second. This rate of control movement exceeds the boost system response capability. High frequency vibration or chattering of small amplitude can be expected to occur in the tail rotor controls during normal operation. The helicopter dynamic systems produce a large number of vibratory forces which are transmitted to adjacent assemblies. Main rotor frequencies of one/rev and two/rev are easily identified by the pilot. However, as the frequencies increase, they become more difficult to identify and are usually noted as a buzz. Normal main and tail rotor frequencies, hydraulic and oil pump frequencies, relief valve and oil cooler fan frequencies are a major source of vibration. The stiffer fuselage structure of the UH-1N over previous UH-1 series helicopters has a significant impact on these vibration characteristics. The location of the directional servo is such that it provides a means of transmitting these vibrations to the tail rotor controls. The amplitude transmitted is a function of numerous variables and consequently may vary between aircraft and also between the actual servo cylinders themselves.

If the magnitude of frequency in the tail rotor control pedals increases or decreases as rotor rpm is changed, a problem exists within the tail rotor control system and will be investigated. If the frequency in the tail rotor control pedals does not change with rotor rpm change, the source of the vibrating is either within the T/R servo cylinder or is originating from some external source other than the T/R control system.

BOOST OFF CHARACTERISTICS

The individual hydraulic system boost off control characteristics are acceptable. Operation with system No. 1 - ON is normal, operation of system No. 2 – ON is characterized by normal cyclic/collective forces and increased pedal forces. Operation with both systems OFF is usually characterized by extremely high, variable cyclic/ collective forces and increased pedal forces.

FORCE TRIM

The force trim provides artificial feel in the cyclic and rudder controls. If the pilot is holding the pedals against the force gradient, and the gradient is suddenly released, there will be a tendency to overcontrol. Judicious use of the force trim release button on the cyclic stick will eliminate this tendency.

COLLECTIVE BOUNCE

The collective control system requires a minimum absolute friction of eight pounds to prevent vertical oscillation. When the absolute friction is less than eight pounds, oscillation can be initiated by sudden, inadvertent pilot input.

NOTE

The term "Absolute Friction" refers to the break-away force required to move the collective stick in an upward direction. The "eight pound" value is a true force measured with the hydraulic boost system operative which negates the weight of the collective stick.

Vertical oscillation (collective bounce) will manifest itself in any flight regime, including ground operation, by rapid build up of vertical bounce at approximately three cps. The severity of the oscillation is such that effective control of the aircraft can be lost.

Before flight ensure at least eight pounds absolute collective friction is available. If required, use pilot's adjustable collective friction to provide minimum of eight pounds absolute friction force, as measured from the center of the pilot's No. 1 throttle. ~~Measurement with a fish scale is desirable, however, the pilot's best judgment is acceptable.~~ Aircraft should be running and the hydraulic boost system "ON" for this friction check.

WARNING

Do not reduce the collective friction to below the take-off friction setting.

POWER SETTLING

At high altitudes, at high gross weights, or when operating with reduced power, it may not be possible to maintain level flight due to a lack of power that will cause settling to occur. The settling is of minor consequences, except at certain rates of descent and low forward speed, where it is extremely critical. During an approach, as the glide slope steepens at constant speed, the power required initially decreases; however, this trend does not continue indefinitely. After a certain glide slope is reached, further steepening of the glide slope requires more, rather than less power. At any altitude or gross weight, when the airspeed is below translational lift and the rate of descent is high, settling with power may occur. The possibility of entering settling with power is further increased, during conditions of low airspeed and high rates of descent, if a tailwind exists or a large or rapid application of aft cyclic is applied. When a critical power settling condition occurs, roughness and a partial loss of control may occur, indicated by ineffectiveness of the controls. The vertical velocity of the downward airflow through the main rotor is high while at near hovering attitude. Under certain power and rate of descent combinations, the downwash from the rotor begins to recirculate, up, around, and back down through the effective outer rim of the rotor disc. The helicopter sinks into the air mass it has just displaced in trying to obtain lift and the main rotor blades work continually in their own turbulent airstream. The velocity of the recirculating air mass may become so high that full up collective pitch lever may not produce sufficient lift to control rate of descent. Increasing collective pitch and/or adding more power normally has little effect towards recovery since it only antagonizes the turbulent airflow. To recover from the condition, increase forward airspeed, decrease collective pitch, or enter autorotation if altitude permits. A considerable loss of altitude may occur before the condition is recognized and recovery is completed. During approach for landing, the conditions causing power settling should be avoided. During descent or takeoff above congested areas or mountainous terrain, anticipate changes in wind velocity and direction and cross-check airspeed with ground speed.

CAUTION

Avoid rates of descent in excess of 800 feet per minute with airspeed below translational lift.

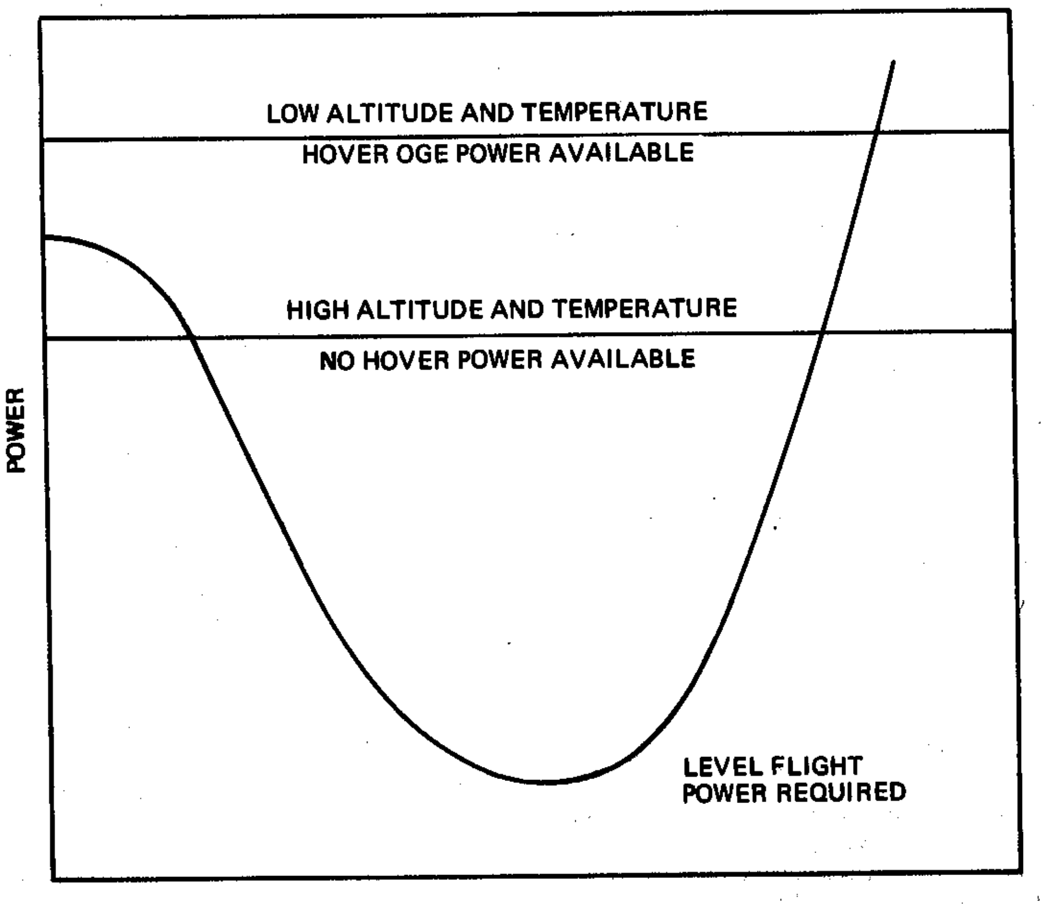

Figure 6-1. Forward Airspeed (Unaccelerated Level Flight)