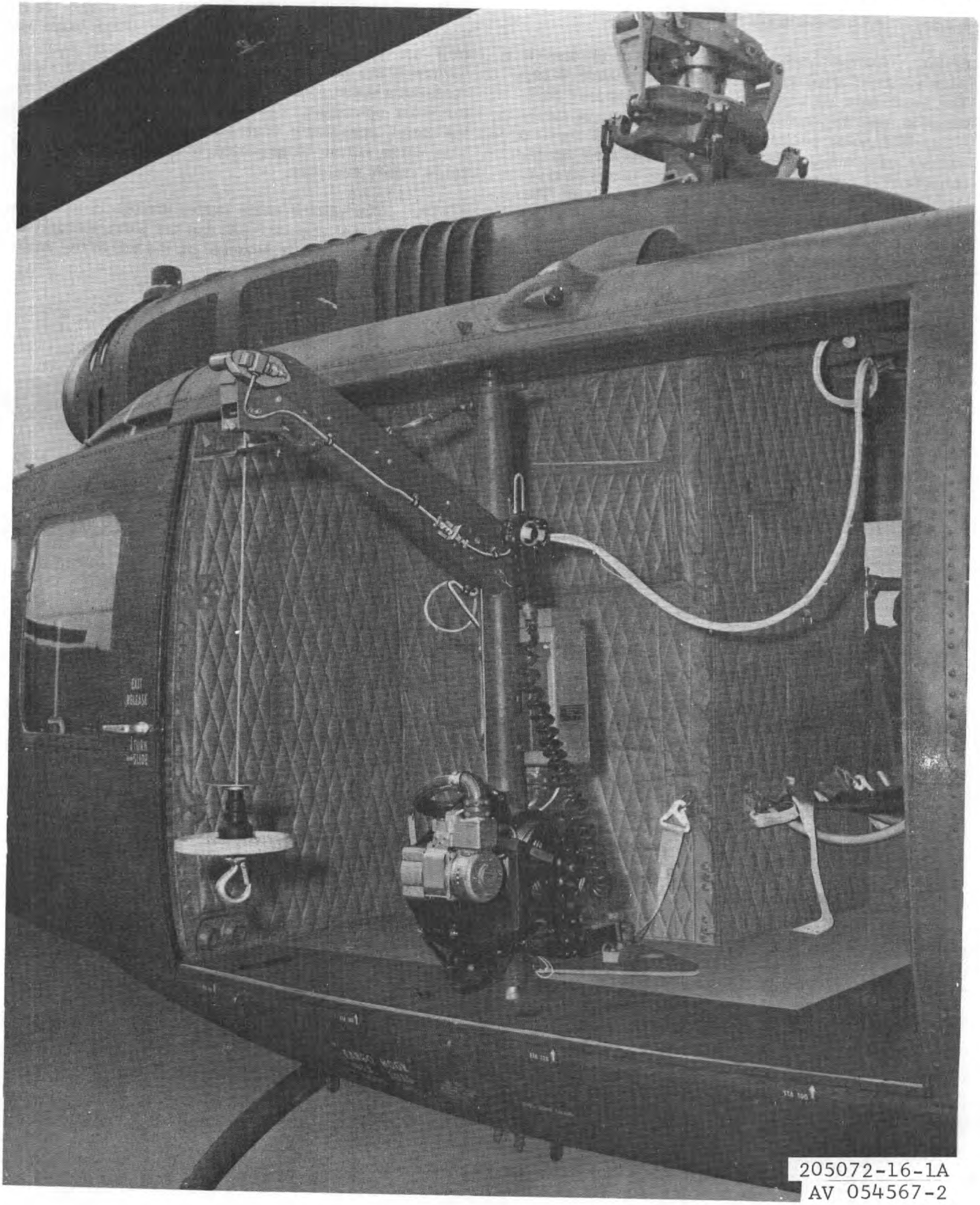


Figure 6-19. Hoist Installation (Sheet 2 of 2)

6-125. INTERNAL RESCUE HOIST.

6-126. Provisions have been made for the installation of an internal rescue hoist. (See figure 6-19.) The hoist may be installed in any one of four positions in the helicopter's cabin as shown in figure 6-20. The hoist installation consists of a vertical column extending from the floor structure to the cabin roof, a boom with an electrically powered traction sheave, and an electrically operated winch. Two electrical control stations for the operation of the rescue hoist are provided, one for the pilot, and one for the hoist operator. The pilot's control switch is located on the cyclic control stick (figure 2-4) and provides up and down operation of the hoist as well as positioning the boom. A pendant control (figure 6-21) is provided for the hoist operator and contains a boom positioning switch and a toggle switch for hoist operation. The pilot's control can override the hoist operator's control. A pressure cartridge type cable cutter is provided with two guarded type cable cutter switches.

6-127. The pilot's cable cutter switch is mounted on the pedestal (figure 6-22) and the hoist operator's cable cutter switch is mounted on the top of the hoist

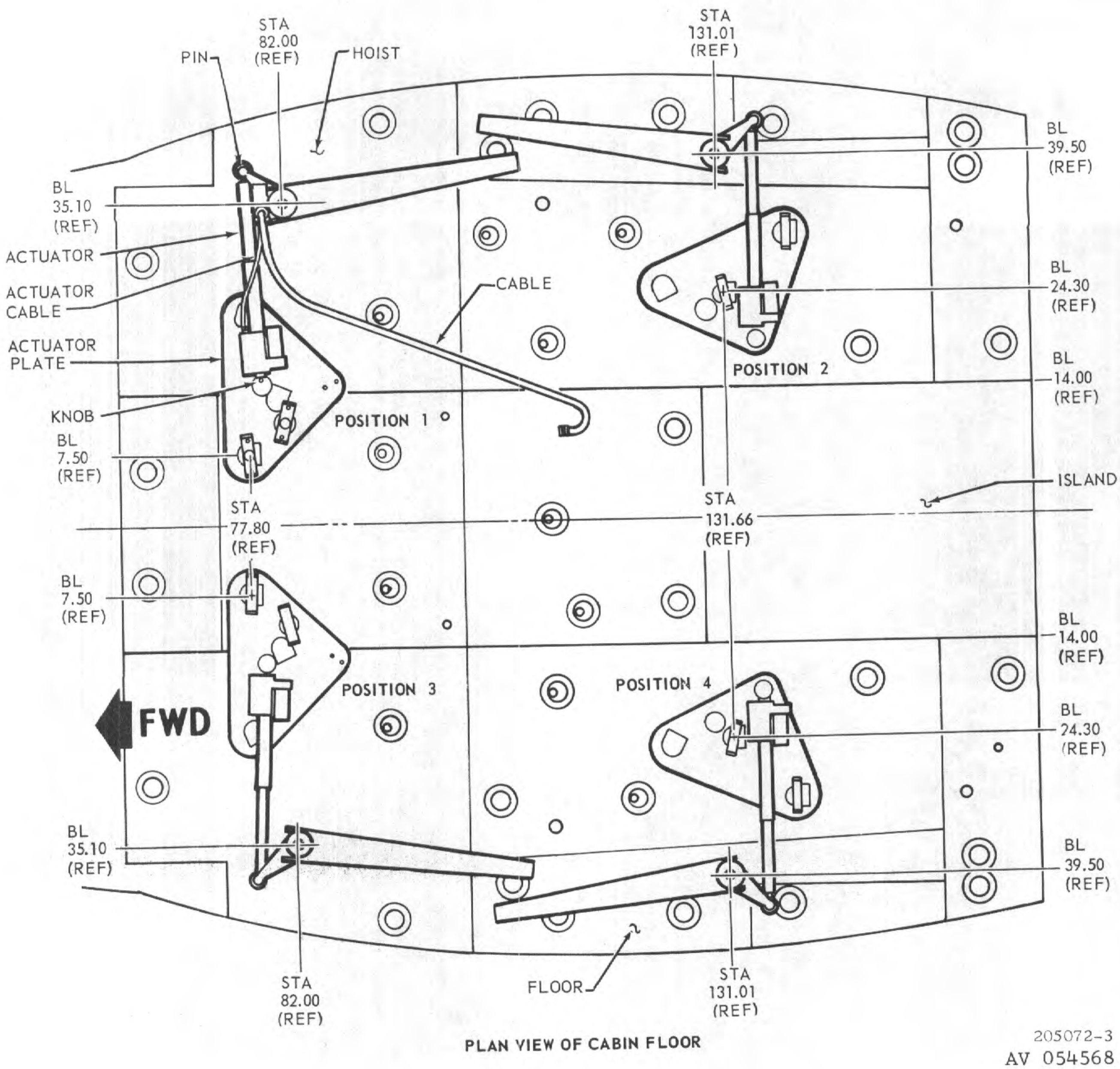
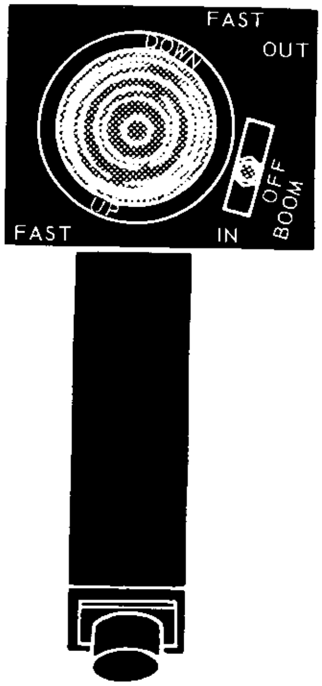


Figure 6-20. Four positions hoist may occupy in cabin



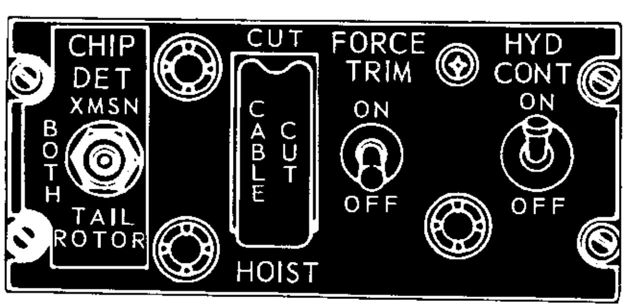
205072-10
AV 054569

Figure 6-21. Pendant control - rescue hoist

control box (figure 6-23). The hoist has a usable capacity of 256 feet of cable. Two limiting switches provide automatic stoppage to protect reel-in and reel-out limits of usable cable. The hoist operators intercom speaker is controlled by a switch on the pendant and gives the hoist operator interphone communications with the flight crew.

Note

The hoist cable is color coded as follows: The first 25 feet at the hook end is yellow, the next 175 feet is unpainted, the next 40 feet is yellow and the last 16 feet is red.



205075-22
AV 054503-5

Figure 6-22. Hoist cable cutter switch - pilot

6-128. RESCUE HOIST OPERATIONS.

6-129. The rescue hoist is used to accomplish the lifting of 600 pounds of personnel or 600 pounds of cargo when a landing cannot normally be made. The types of lifts usually required in the use of the rescue hoist are:

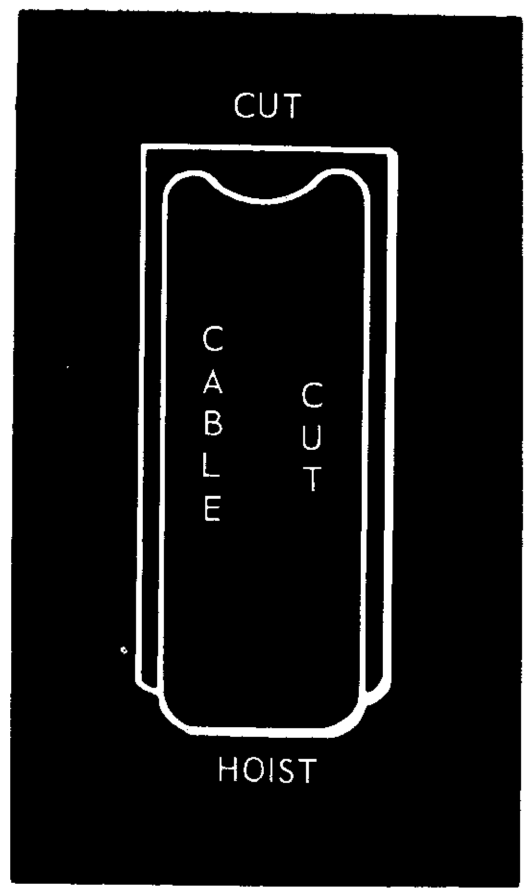
a. Pickups from wooded or obstructed areas.

b. Pickups from water.

c. Pickups from boats or ships where landings could not be accomplished.

Caution

The hoist should normally be operated in the full speed condition as slow speed operation will cause the motor to heat excessively.



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AV 054571

Figure 6-23. Hoist cable cutter switch - hoist operator

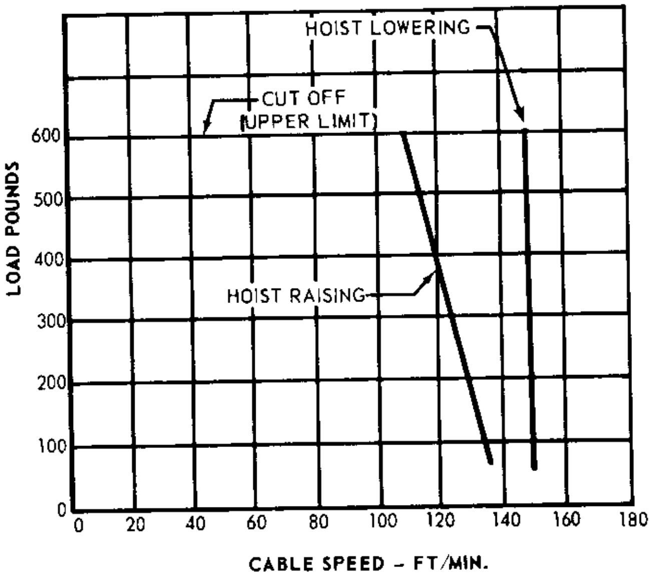


Chart 6-1. Hoist cable speed versus load plus or minus 15 percent

Note

The hoist operator has variable speed controls for raising or lowering the cable. The further the down/up toggle is pushed from its neutral position, the faster the hoist will run. See Hoist Cable Speed Versus Load Chart, 6-1.

Caution

If the hoist does not have a traction sheave, a minimum of 5 pounds tension must be applied to the cable for a reel-out (cable down) at all times. The hook and handwheel provide this weight. DO NOT PERMIT cable to become slack.

6-130. OPERATING DATA. The following general information is provided for use when operating rescue hoist.

a. Maximum Load . . . 600 pounds for raising or lowering

b. Usable Cable Length . . . . 256 feet

c. Limits:
Boom In and Boom Out . . . . . . Preset limit switches in the actuator
Up Limit. . . . . Trigger at end of boom (Contacted by rubber bumper on the hook hand-wheel)
Down Limit . . . . . . Switch (actuated when three wraps of cable remain on storage drum)

d. Override. . . . . . . The pilot's control will override the operator's control.

6-131. WEIGHT AND BALANCE INFORMATION.

6-132. Weight and balance information, resulting from installation of the internal rescue hoist, is as follows:

a. Forward position (hoist arm inside).

(1) Change in basic weight. . . . . . . Plus 151.3 pounds

(2) Moment arm . . . . 87.3 inches

(3) Change in basic moment. . . . . . 11.211 inch-pounds

(4) Chart "A" entry . . . . Not applicable

(5) Chart "C" entry . . . . . . Weight change, plus 151.3 pounds

Moment Arm 87.3 inches

Moment/100, plus 132.1 inch-pounds

b. Aft position (hoist arm inside).

(1) Change in basic weight. . . . . . . Plus 151.3 pounds

(2) Moment arm . . . . 125.1 inches

(3) Change . . . . . . .18.927 inch-pounds

(4) Chart "A" entry . . . . Not applicable

(5) Chart "C" entry . . . . Weight change, plus 151.3 pounds

Moment arm, 125.1 inches

Moment/100, plus 189.2 inch-pounds

c. Possible seating and hoist locations. (See chart 6-2.)

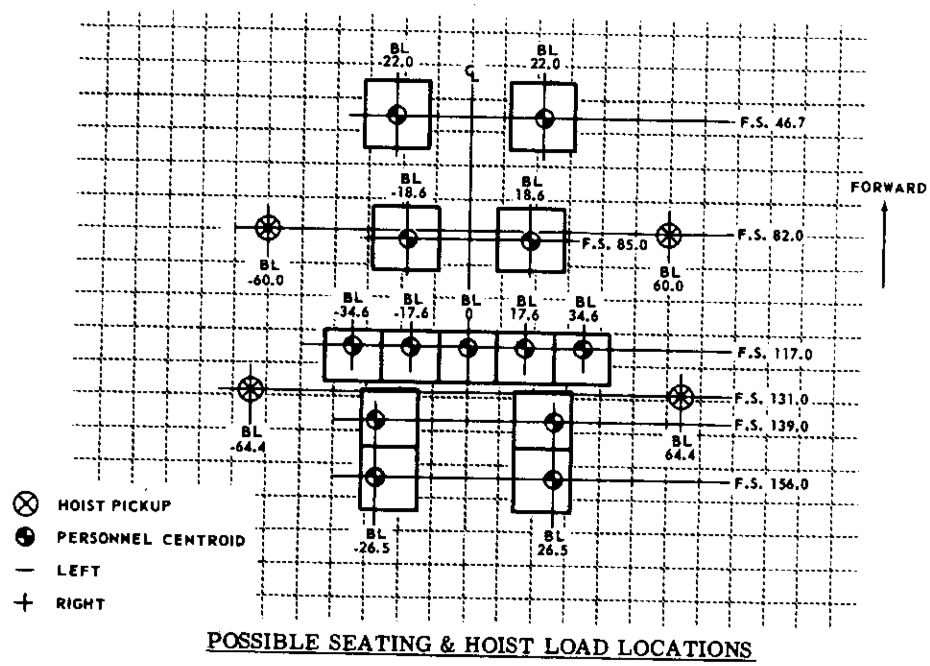


Chart 6-2. Possible seating and hoist load locations

6-133. USE OF INTERNAL HOIST LOADING CHART CHART FOR HOIST IN FORWARD RIGHT-HAND POSITION.

PROBLEM:

Determine the maximum allowable hoist load for the known weight conditions as follows:

Pilot and copilot	200 pounds each
Gross weight	6500 pounds
Longitudinal C.G.	Sta. 132.5

ANSWER:

Longitudinal Limitation (See Chart 6-3.)

Draw a straight line horizontally from C.G. location at Sta. 132.5 to extrapolated point for gross weight of 6500 pounds. Draw an intersecting vertical line down to allowable hoist load, 335 pounds.

Lateral Limitations (See Chart 6-4).

Draw a vertical line from the gross weight of 6500 pounds to the pilot and copilot line. Draw an intersecting line horizontally to the allowable hoist load, 502 pounds.

The smaller of the two weights derived must be used, therefore the maximum allowable hoist load will be 335 pounds.

Note

If additional internal load is carried during hoisting operations this load should be positioned on opposite side from hoist.

6-134. OPERATING PROCEDURE - PILOT.

6-135. The pilot's hoist control switch is located on the cyclic control stick (figure 2-4).

a. Check rescue hoist cable cutter, rescue hoist control, and rescue hoist power circuit breakers are "IN".

b. Establish zero ground speed over pick-up location.

c. Move hoist control, on cyclic stick, to right to swing boom outboard.

Note

Pilot's controls will override the hoist operator's control inputs; however, the pilot has only a single speed capability.

d. Move hoist control switch "down" to lower hook and hand-wheel assembly.

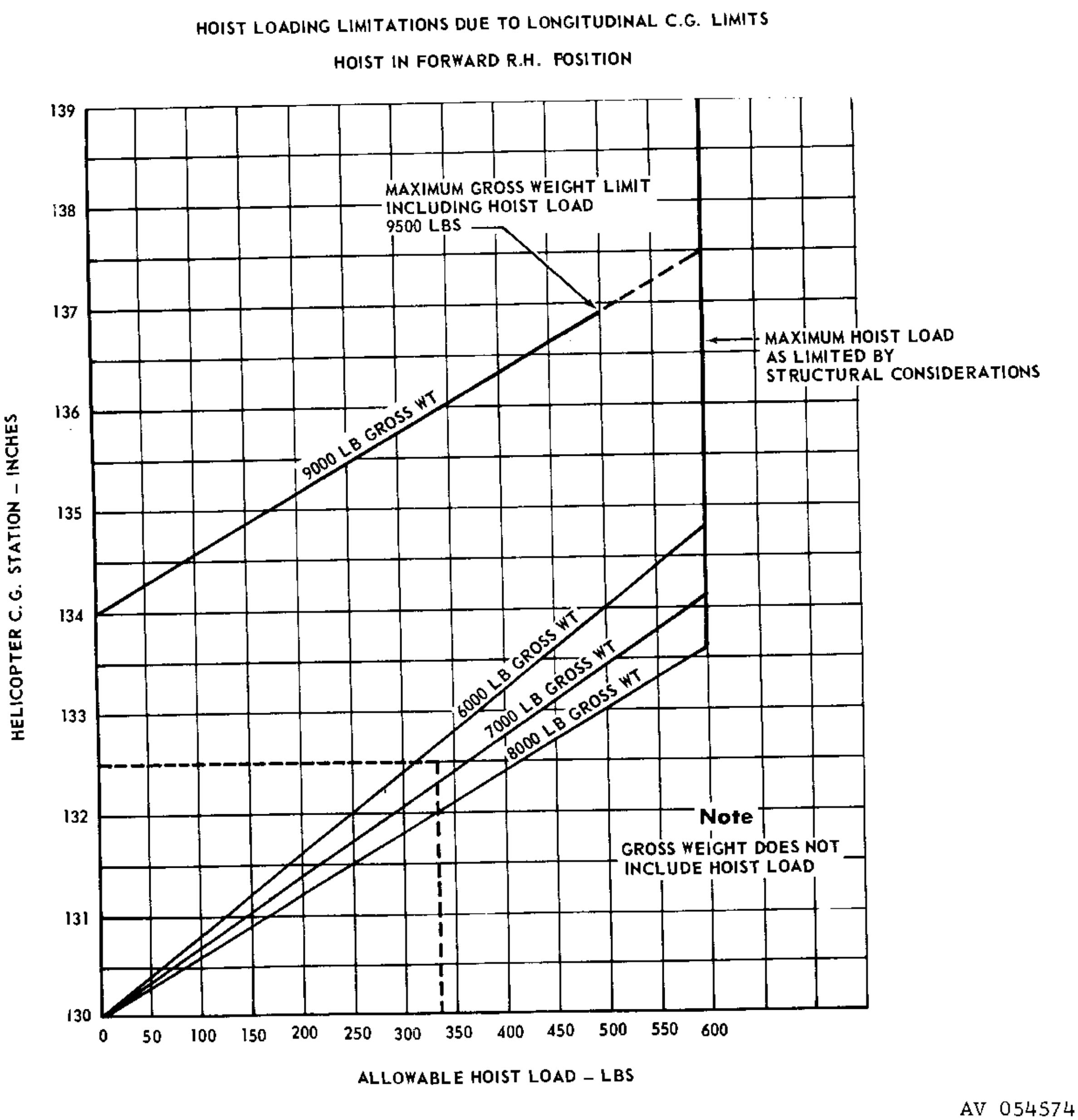


Chart 6-3. Helicopter C.G. vs allowable hoist load

Note

Hoist cable is painted at each end to provide visual indication of cable footage that is extended. The hoist cable is lowered approximately 150 feet per minute and is retracted approximately 120 feet per minute (table 6-1).

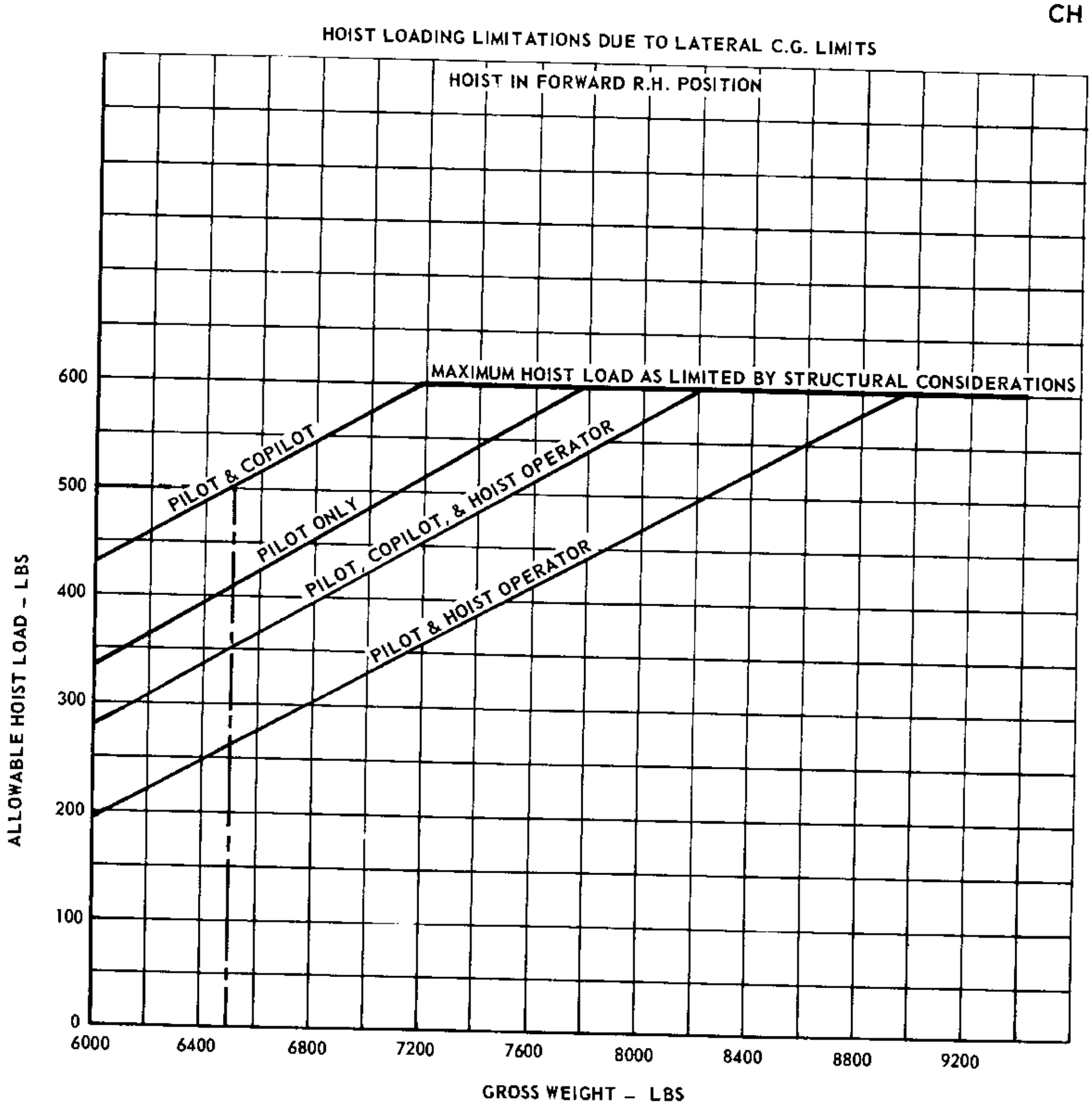
Caution

When a load attached on the hoist hook (and if conditions permit) it is advisable not to make abrupt changes in helicopter attitude until load is aboard or raised as close as possible. G-forces on hoist could become excessive if hoist load is being raised during abrupt movements of helicopter. These G-forces could result in the yield or failure of the hoist cable.

e. Move hoist control switch aft to raise hoist load.

Note

In case the extended portion of the hoist cable has to be jettisoned, a cable cut switch is provided on the instrument pedestal. (See figure 6-22.) The cable cutter is an electrically initiated pressure charged type.



Note

This weight to be the lightest weight of the helicopter during hoisting operations, but not including the weight of the hoist load. Fuel burned prior to hoisting operations must be deducted from takeoff G.W. before computing allowable hoist load.

AV 054575

Chart 6-4. Gross weight vs allowable hoist load

f. Move hoist control switch to left to swing hoist boom inboard.

g. Bring hoist load into cabin and hoist to stowed position (fully inboard).

6-136. OPERATING PROCEDURE - HOIST OPERATOR.

6-137. The hoist operator's operating procedure is set forth in Chapter 11.

6-138. HEATED BLANKET RECEPTACLES.

6-139. Six electrical receptacles are provided to furnish 28-volt DC for heated blankets. These receptacles are mounted on the inside cabin roof structure of the cargo passenger area, aligned with the forward edge of the transmission support structure, three at the right side and three at the left side. Electric power to these receptacles is supplied by the 28-volt DC nonessential bus. Circuit protection is provided by HEATED BLANKET circuit breakers on the DC circuit breaker panel (see figure 2-11).

6-140. DATA CASE.

6-141. A data case for maps, flight reports, etc., has been provided and conveniently located on the aft end of the instrument pedestal.

6-142. MOORING FITTINGS.

6-143. Moorning fittings are provided at four locations on the helicopter. Two fittings are installed under the fuselage just aft of the pilot's and copilot's stations, one at the right-hand side and one at the left-hand side. The other fittings are installed under the fuselage just aft of the skid landing gear, one on each side.

6-144. TOW RINGS.

6-145. To facilitate towing the helicopter with ground handling wheels lowered, a tow ring has been provided near the forward end of each of the landing gear skids. These rings will accommodate a standard tow bar.

6-146. GROUND HANDLING WHEELS.

6-147. Ground handling wheels have been provided on each of the landing gear skids. These wheels can be extended to accomplish ground handling (pushing and towing the helicopter). Ground handling gear is usually removed before flight, but can be left in place on skids if properly secured in retracted position by means of support rods provided on each side.

TABLE 6-1. OPERATING LIMITATIONS - HOIST

<table>
<tr><td colspan="2">256 Foot Cable:
Lower 250 lbs.
Raise 250 lbs.
Lower 0 lbs
Raise 250 lbs.
} 9 Cycles

The above is equivalent to lowering a medical attendant and then raising nine patients with the attendant. Use 30-second rest period at end of each raise or lower cycle. Use 30-minute rest period at completion of nine cycles.</td></tr>
<tr><td>256 Foot Cable:
Lower 0 lb.
Raise 600 lb.
} 3 Cycles

Thirty-second rest period at end of each raise or lower cycle. A 30-minute rest period at completion of above listed cycles.</td><td>256 Foot Cable:
Lower 0 lb.
Raise 400 lb.
} 5 Cycles

Thirty-second rest period at end of each raise. A 30-minute rest period at the end of five cycles.</td></tr>
<tr><td>256 Foot Cable:
Lower 600 lb.
Raise 0 lb.
} 3 Cycles

A 30-second rest period at end of each raise or lower cycle. A 30-minute rest period at completion of above listed cycles
250</td><td>256 Foot Cable:
Lower 400 lb.
Raise 0 lb.
} 5 Cycles

A 20-second rest period at end of each raise or lower cycle. A 30-minute rest period at completion of above listed cycles.</td></tr>
</table>

6-148. BLACKOUT CURTAINS.

6-149. Provisions have been made for installing blackout curtains behind pilot's and copilot's seats and between forward and aft cabin sections. Other blackout curtains may be installed over both cargo door windows and window in removable door post.

6-150. BLOOD BOTTLE HANGERS.

6-151. Two blood bottle hangers have been provided on the inside of the cabin roof structure within easy reach of the medical attendant's station, for administration of blood to litter patients in flight.

Note

Blood bottle hangers are not installed on helicopter serial number 65-9605 and subsequent helicopters.

6-152. MAIN AND TAIL ROTOR TIE-DOWNS.

6-153. Main and tail rotor tie-downs are provided to use in mooring the aft blade of the main rotor and the tail rotor to prevent the rotors from seesawing when the helicopter is parked. The tie-downs are stowed in the cargo compartment when not in use.

6-154. CARGO TIE-DOWN FITTINGS.

6-155. For information covering cargo tie-down fittings refer to cargo tie-down equipment in Chapter 13.

6-156. EXTERNAL CARGO REAR VIEW MIRROR.

6-157. A mirror is installed under the right-hand lower nose window to give the pilot clear visibility of the external cargo. This mirror is easily removed and stowed when not in use. (Refer to Chapter 13.)

6-158. PARATROOP STATIC LINE.

6-159. Provisions are included in the cabin for the attachment of a static line kit for parachutes. This consists of attachment fittings, spreader bar and static line.

6-160. ELECTRICAL PROVISIONS FOR LYCOMING ENGINE VIBRATION CHECK EQUIPMENT - (Serial Nos. 64-13662 and Subsequent).

6-161. Provisions are provided to permit the use of engine vibration check equipment as a maintenance aid. The provisions consist of an AC electrical receptacle, associated wiring hardware and a circuit breaker. The receptacle and circuit breaker are located on the AC circuit breaker panel.

6-162. The purpose of these provisions is to facilitate the use of the Lycoming engine vibration check equipment. The 115 volt, 60-400 CPS power source for the aircraft corresponds to the requirements of the check equipment. The electrical outlet eliminates the necessity for elaborate wiring of the equipment into the aircraft electrical distribution system to provide operating power.

SECTION XI AUXILIARY FUEL EQUIPMENT

6-163. AUXILIARY FUEL EQUIPMENT.

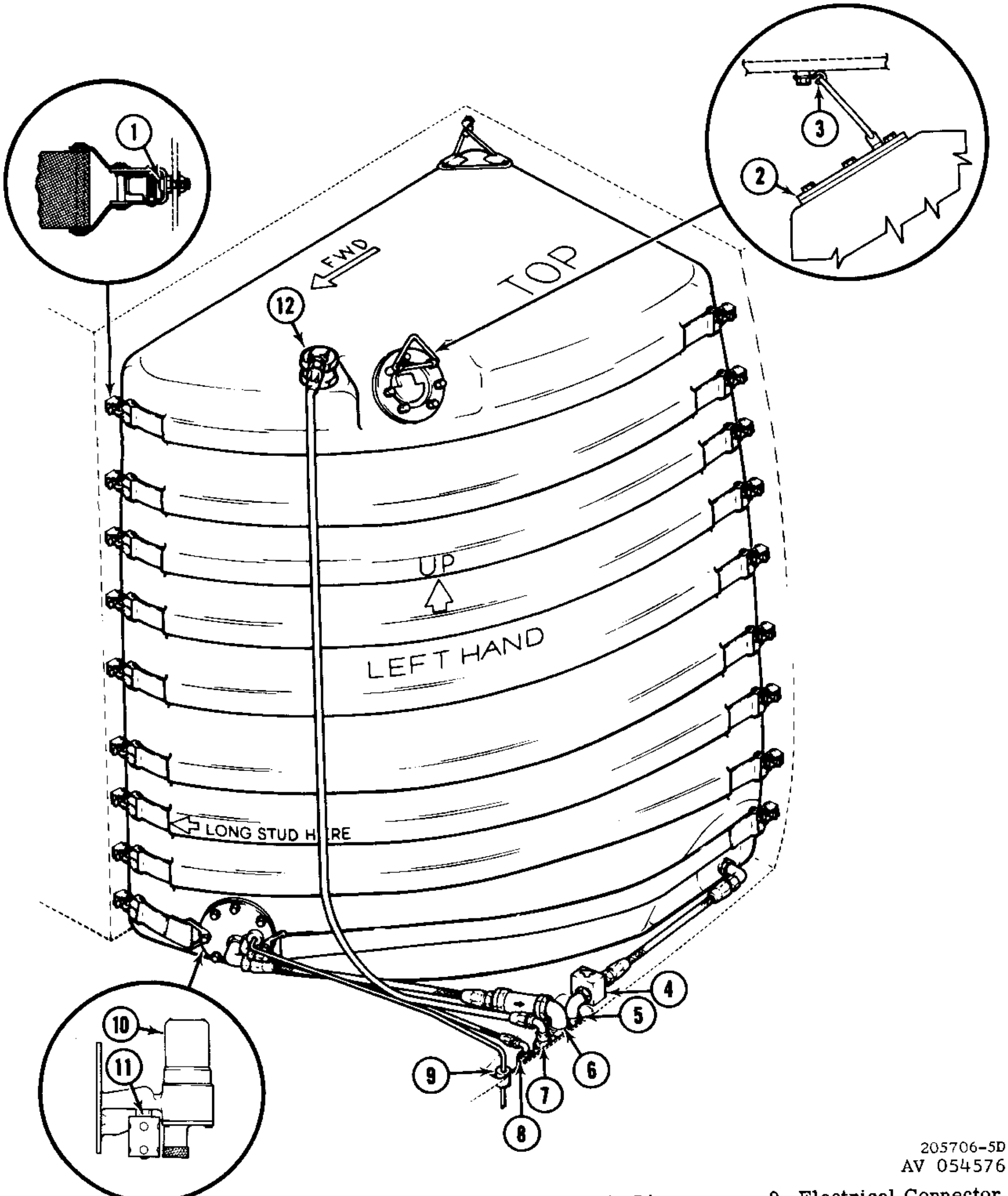
6-164. Complete privisions have been made for installing an auxiliary fuel equipment kit in the helicopter cargo-passenger compartment for extended distance and ferry missions. This equipment allows the helicopter to be serviced with an additional 300 U.S. gallons (1950 pounds) of fuel.

6-165. The kit consists of two 150-gallon bladder type tanks, fittings, fuel lines, drain lines, valves, a pump in each tank, and the necessary electrical equipment. The tanks are secured to fittings on the aft bulkhead and transmission support structure by nylon webs which are an integral part of each tank. Fuel is pumped from left auxiliary tank to left forward main fuel cell by the electrically driven transfer pump in the left auxiliary tank and controlled by the LEFT transfer pump switch. Fuel is pumped from the right auxiliary tank to the right front main fuel cell by the electrically driven transfer pump in the right auxiliary tank and controlled by the RIGHT transfer pump switch. The pilot is alerted to an auxiliary tank low condition by means of a worded segment on the CAUTION panel (figure 2-14) which illuminates when actuated by an auxiliary fuel low level switch. A check valve incorporated in the auxiliary fuel flow line attached to the tank prevents fuel flow from the main fuel cells to the auxiliary tank. This valve is 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 TRANS pump switches in OFF position.

6-166. Electrical power to operate the fuel transfer pumps and the low level switches is supplied by the 28-volt DC essential bus. Circuit protection for the transfer pumps and low level electrical switches is provided by FUEL TRANSFER PUMP circuit breaker (figure 2-11) on the DC circuit breaker panel.

6-167. OPERATION - TRANSFER PUMPS.

6-168. The procedure herein outlined assumes that the complete auxiliary fuel equipment has been securely installed in the helicopter and the electrical



1. Stud
2. Fuel Tank Cap and Adapter Assembly
3. Hook
4. Valve
5. Tank Drain Line
6. Fuel Discharge Line
7. Tank Vent Line
8. Pump Seal Drain Line
9. Electrical Connector
10. Pump Assembly
11. Float Switch
12. Vent Valve

Figure 6-24. Auxiliary fuel tank - typical transfer pumps and the low level switch electrical cables are connected.

a. TRANS PUMP switch (on ENGINE control panel) - Position forward to LEFT or RIGHT as desired.

Note

When an auxiliary fuel tank has emptied of all fuel, the fuel low level switch will function to cause the illumination of the MASTER CAUTION indicator on the instrument panel and the AUX FUEL LOW worded segment on the pedestal mounted caution panel (figure 2-14). The pilot must then position the RESET/TEST switch on the caution panel to RESET to extinguish the master caution indicator. The AUX FUEL LOW worded segment will not light unless a TRANS PUMP switch is ON.

b. TRANS PUMP switch - Position aft to OFF.

Note

An automatic fuel float switch installed in the center aft fuel cell prevents inadvertent overfilling of main fuel cells when a transfer pump is ON. The pump will not operate when fuel makes contact with the high-level switch element, 1390 pounds (approximately 213 U.S. gallons) of fuel. The pump operates when the fuel makes contact with the low level switch element, 1225 pounds (approximately 188 U.S. gallons) of fuel. Power is supplied by the 28-volt DC essential bus.

6-169. EXTERNAL AUXILIARY FUEL SYSTEM.

6-170. Provisions are made in the helicopter for the operation of external auxiliary fuel kit. The external auxiliary fuel tank kit consists of the necessary fuel lines, electrical wiring and attachment fittings to attach, either two 100 gallon tanks or two 60 gallon tanks to the aft external stores support assemblies. One tank shall be located on each side of the helicopter and are electrically or manually jettisonable in an emergency.

CHAPTER 7

OPERATING LIMITATIONS

SECTION I SCOPE

7-1. SCOPE OF OPERATING LIMITATIONS DATA.

7-2. All important limitations that must be covered during normal operations are covered in this chapter.

7-3. Limitations that are characteristic only of a specialized phase of operation are not repeated here.

SECTION II LIMITATIONS

7-4. INTRODUCTION.

7-5. The flight and engine limitations set forth in this chapter are the direct result of numerous flight test programs and actual operation experience. Compliance with these limits will allow YOU, THE PILOT, to safely perform the assigned missions and permit YOU to derive maximum utility from the helicopter, when used for intended purposes. The operational range limits (figure 7-1) will serve as a constant reminder during operations. Additional limits concerning maneuvers, cg. and loading are also covered in this chapter. Close observation of instrument markings is required since they represent limits that are not necessarily repeated in the text.

7-6. MINIMUM CREW REQUIREMENTS.

7-7. The minimum crew requirement for all missions consists of only the pilot, whose station is on the right side. Additional crew members, as required, will be added at the discretion of the Commander in accordance with appropriate Department of Army Regulations.

7-8. INSTRUMENT MARKINGS.

7-9. The operating ranges and limits for both the helicopter and the engine are shown in figure 7-1.

7-10. ENGINE LIMITATIONS.

7-11. The gas turbine power plant, as installed in this helicopter, is rated at an output torque value equivalent to 1100 hp at 6600 RPM for take-off and 900 hp at 6600 RPM for continuous operation. Other engine limitations are given on the instrument markings illustration. See figure 7-1.

Caution

An Engine Inspection is required if the following limits are exceeded: 6640 rpm
H (91 percent nI) for more than 2 seconds.
D (85 percent nI) for more than 3 seconds.

7-12. ROTOR LIMITATIONS.

7-13. The normal operating range of the main rotor is 294 to 324 rpm and the range is marked on the dual tachometer as a green arc on the face of the instrument. Normally, autorotation rpm will be set at approximately 310 rotor rpm at sea level, 50 to 60 knots airspeed, and an approximate gross weight of 6600 pounds. Autorotation main rotor speed shall not exceed 339 rpm. Main rotor speeds in excess of 339 rpm shall be entered in 2408-13. Rotor Operating Limits decal (figure 7-2) located at the lower left of the instrument panel, specified limitation conditions at specific altitudes and gross weights. It is possible to encounter blade stall within the operating range under high gross weight, high altitude, or high airspeed, or during acceleration or low rpm. Blade stall and the remedy are more thoroughly discussed in Chapter 8. At heavy gross weights, high density altitudes, or during maneuvering, the rotor rpm will tend to overspeed and shall be monitored and controlled by the pilot, using collective pitch to keep the rotor within limits.

7-14. AIRSPEED LIMITATIONS.

7-15. The maximum permissible indicated forward airspeed for this helicopter is 120 knots, and this maximum is indicated by a red line on the airspeed indicator. Sideward and rearward airspeeds should be limited to 30 knots, which must be estimated for lack of instruments to provide these indications. The UH-1D/H can be flown at 120 knots with the doors locked in full open position. Cargo doors may be secured in full open position only if appropriate modifications have been made to the doors and airframe. (See figure 7-3.)

Caution

Cargo door airspeed restrictions: YUH-1D, half open, 50 knots; full open, 120 knots.

INSTRUMENT MARKINGS

FUEL GRADE JP-4

T53-L-11/13 Engines
JP-4 or JP-5

FUEL PRESSURE
5 to 35 PSI Continuous Operation

ENGINE OIL PRESSURE
25 PSI Minimum
90 PSI Maximum D
100 PSI Maximum H Only

25 PSI Minimum - Flight Idle
60 to 80 PSI Normal Operating Range D
80 to 100 PSI Normal Operating Range H

ENGINE OIL TEMPERATURE
93°C Maximum

TRANSMISSION OIL PRESSURE
30 PSI Minimum
40 to 60 PSI Continuous Operation
70 PSI Maximum

TRANSMISSION OIL TEMPERATURE
110°C Maximum

205070-14-1H
AV 054577-1

Figure 7-1. Instrument markings (Sheet 1 of 3)

TORQUE PRESSURE
50 PSI Maximum

H ONLY

FUEL GRADE JP-4

T53–L–11/13 Engines
JP–4 or JP–5

EXHAUST TEMPERATURE
T53-L-13A ENGINE

390°C to 610°C Continuous Operation
610°C to 625°C 30 Minute Limit
675°C 5 Second Limit for Starting and Acceleration
760°C Maximum for Starting and Acceleration

INSTRUMENT MARKINGS

205070-14-3G
AV 054577-3

Figure 7-1. **Instrument markings (Sheet 3 of 3)**

7-16. CLIMB LIMITATIONS.

7-17. During climbs at low altitude, a safe autorotative speed shall be maintained so that in the event an engine failure occurs, sufficient airspeed is available to accomplish a safe autorotative landing. See figure 7-4 for details concerning climb limitations.

7-18. PROHIBITED MANEUVERS.

a. No aerobatic maneuvers permitted.

b. Protracted rearward flight and downwind hovering are prohibited.

c. The speed for any and all maneuvers shall not exceed the level flight velocities as stated on the Operating Limits Decal (figure 7-2).

d. Partial-power descents shall be accomplished at landing approach speed not less than shown in Landing Distance-Power Off Charts in Chapter 14.

OPERATING LIMITS

DENSITY ALTITUDE	CALIBRATED SPEED –KNOTS 6600 LB	7500 LB	8500 LB	9500 LB
SL-2000 FT	120	120	115	110
3000 FT	117	117	112	107
6000 FT		108	103	98
9000 FT	98	98	94	—
12000 FT	89	89	84	—
15000 FT	78	78	—	—
18000 FT	65	65	—	—

UP TO 7500 LBS GW USE 6000 TO 6600 RPM RANGE
OVER 7500 LBS GW USE 6400 TO 6600 RPM RANGE
REDUCE AIRSPEED WHEN VIBRATION IS EXCESSIVE

205070-39A
AV 054578

Figure 7-2. **Operating limits decal**

TORQUE PRESSURE
50 PSI Maximum

H ONLY

FUEL GRADE JP-4

T53–L–11/13 Engines
JP–4 or JP–5

EXHAUST TEMPERATURE
T53-L-13A ENGINE

390°C to 610°C Continuous Operation
610°C to 625°C 30 Minute Limit
675°C 5 Second Limit for Starting and Acceleration
760°C Maximum for Starting and Acceleration

INSTRUMENT MARKINGS

205070-14-3G
AV 054577-3

Figure 7-1. Instrument markings (Sheet 3 of 3)

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OPERATING LIMITS				
DENSITY ALTITUDE	CALIBRATED SPEED –KNOTS			
	6600 LB	7500 LB	8500 LB	9500 LB
SL-2000 FT	120	120	115	110
3000 FT	117	117	112	107
6000 FT		108	103	98
9000 FT	98	98	94	—
12000 FT	89	89	84	—
15000 FT	78	78	—	—
18000 FT	65	65	—	—
UP TO 7500 LBS GW USE 6000 TO 6600 RPM RANGE				
OVER 7500 LBS GW USE 6400 TO 6600 RPM RANGE				
REDUCE AIRSPEED WHEN VIBRATION IS EXCESSIVE				

205070-39A
AV 054578

Figure 7-2. Operating limits decal

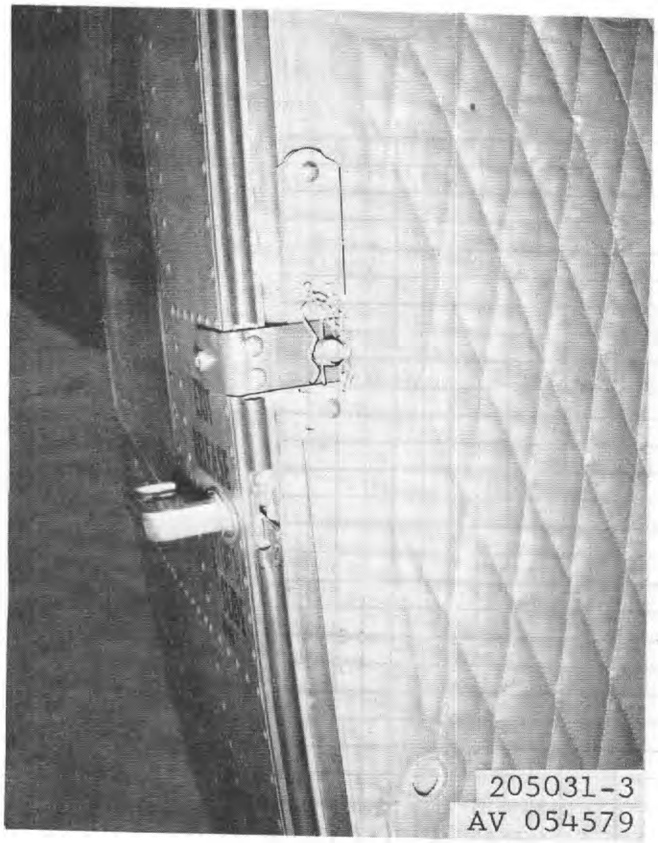


Figure 7-3. Open door latch

7-19. HOVERING LIMITATIONS.

7-20. Hovering performance limits for the helicopter are shown on the Hovering Charts in Chapter 14.

7-21. CENTER OF GRAVITY LIMITATIONS.

7-22. Center of gravity (cg) limits for loading purposes are located between fuselage station 130 and 144 (figure 7-5). For additional information concerning cg limitations, refer to Chapters 12 and 13.

Caution

Do not attempt to carry external loads with a cg aft of station 142 prior to lifting external load.

7-23. LATERAL C.G. LIMITS.

7-24. The lateral C.G. limits are plus or minus 7.5 inches.

7-25. WEIGHT LIMITATIONS CHART.

7-26. The Weight Limitations Chart (figure 7-6) provides the flight crew a rapid means of determining the load carrying capabilities of the helicopter while remaining within safe operating limits. Performance due to the requirements of a particular mission as well as structural limitations, may restrict the maximum weight at which the helicopter can be flown. Center of gravity of the helicopter is not a consideration in the information presented in the Weight Limitations Chart. This data is available by use of Chart C of the helicopter Weight and Balance Data Handbook and Chart E in Chapter 12 of this handbook. (Refer to Chapter 12 and see chart 12-2.)

7-27. EXPLANATION OF THE CHART.

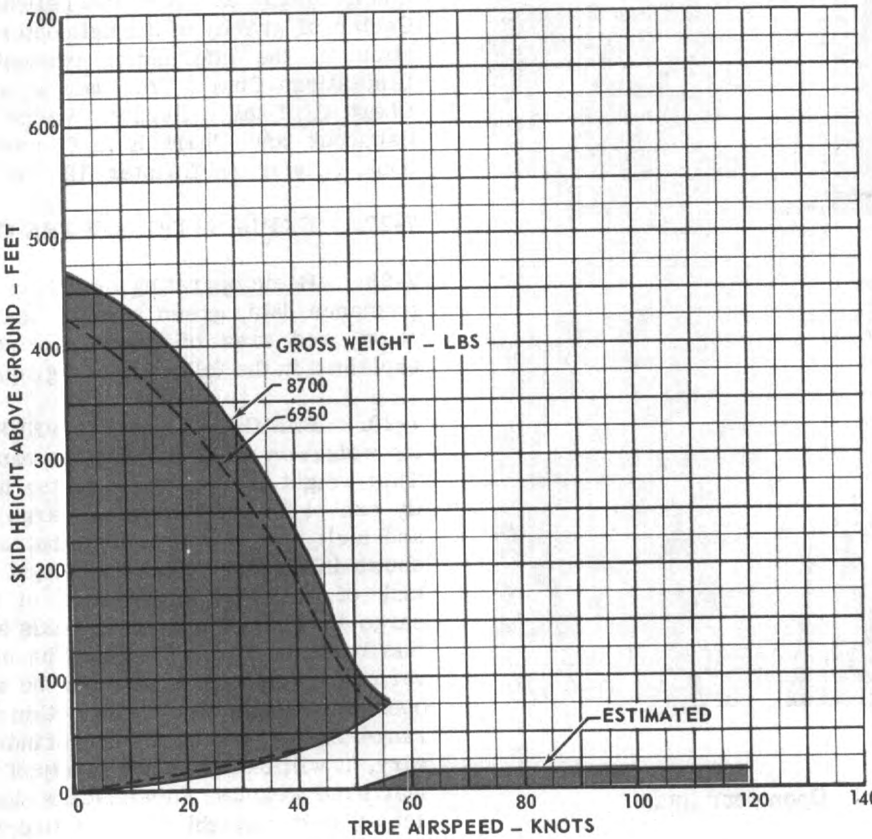
7-28. Basic operating weight, gross weight and performance data, green area of chart, yellow area of chart, red area of chart, and use of the chart are explained in the following paragraphs.

7-29. BASIC OPERATING WEIGHT. The operating weight on which the chart is based is 5120 pounds. This weight is the weight of the helicopter ready to fly except for two variables (cargo or passenger load and fuel) and is approximate basic helicopter wieght shown in Chart C plus the weight of one pilot and a tank of oil. The intersection of the passenger or cargo load and the fuel load axis at zero represents this basic operating weight. The chart indicates the various combinations that can be added to the basic operating weight to remain within the safe operating range. Since the actual weights of individual helicopters vary, it will be necessary to adjust the chart to these individual weights. To adjust the chart, determine the actual basic weight of the helicopter from chart C and add 200 pounds for the pilot and 24 pounds for the tank of oil. If the actual weight exceeds 5120 pounds, subtract the difference between the actual weight and 5120 pounds from the passenger or cargo load as shown in the chart. If the actual weight is less than 5120 pounds, add the difference to the passenger or cargo load as shown in the chart.

7-30. Four gross weights of the loaded helicopter are shown as diagonal lines in the left (colored) area of the chart: 6600 pounds design gross weight, 7500 and 8500 pounds gross weight, and 9500 pounds maximum gross weight. Performance data is presented in the right-hand area of the chart for each of these weights.

7-31. GREEN AREA. (See figure 7-6.) The green area of the chart represents normal loading conditions (figure 7-2) Operating Limits.

7-32. YELLOW AREA. (See figure 7-6.) The yellow area of the chart represents loading of progressively increasing risk as the red area is approached. Care shall be exercised when operating within this area because speed, performance, and flight load factors decrease. (See figure 7-2, Operating Limits.)



Note

Avoid continuous operation in red areas. However, if the aircraft is operated in the red areas, Emergency Procedures Relating to Engine Failures - Low Altitude, should be observed in accordance with Chapter 4.

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AV 054580

Figure 7-4. Height velocity diagram

7-33. RED AREA. (See figure 7-6.) The red area of the chart represents loading that shall not be used except under conditions of extreme emergency when safety of flight is of secondary importance. (See figure 7-2, Operating Limits.)

Note

Operating weight should never exceed that required for the mission, since unnecessary risk and equipment wear will result. The data shown in the chart is for information and guidance; however, take-off weight, especially at high ground altitude, must be considered in relation to available runway, surrounding terrain, atmospheric temperature, mission requirements, and urgency of the mission.

7-34. USE OF THE CHART. (See figure 7-6.)

Note

* Denotes 48 foot rotor configuration. (Prior to Serial No. 65-9565.)

** Denotes 48 foot rotor configuration. (Serial No. 65-9565 and subsequent.)

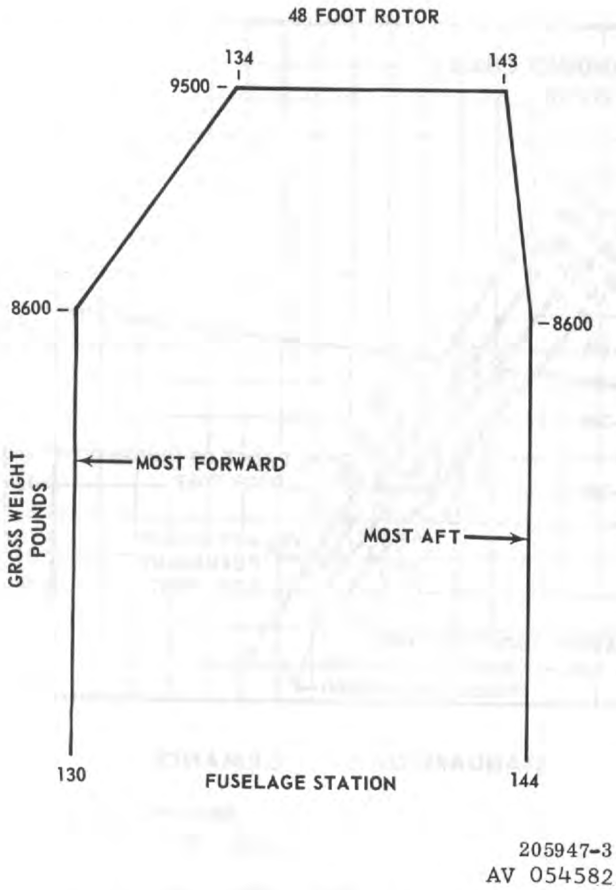


Figure 7-5. Center of gravity limits diagram

7-35. PROBLEM. In accomplishing a particular mission it is necessary to carry 800 pounds of fuel. Determine the maximum cargo load that can be carried.

7-36. SOLUTION. The chart basic operating weight will be used as actual helicopter weight in this problem. Steps e. and f. will show how to adjust the chart for actual basic weight variation.

a. Establish the basic operating weight of the helicopter by completing a Form F, using the latest basic weight from Chart C. Actual weight assumed to be chart weight (*5120, **5460 pounds) for this problem.

b. Project the fuel weight of 800 pounds vertically until the *7500, **7500 pounds gross weight line is intersected. From the intersection of the two lines, project horizontally left to the cargo load scales and read *1600, **1260 pounds. This weight is the maximum cargo load that can be carried with 800 pounds of fuel to remain at *7500, **7500 pounds gross weight.

c. For the requirements of a particular mission if it is necessary to exceed the *7500, **7500 pounds gross weight and if the reduced speed, load factor, and performance (at a higher gross weight) are satisfactory, then project the fuel weight of 800 pounds vertically until the *8500, **8500 pounds gross weight line is intersected. From this intersection, project horizontally left to the cargo load scale and read *2600, **2260 pounds.

d. When this information is obtained it is then necessary to refer to the Internal Cargo Loading Chart to obtain cargo placement information so that the center of gravity of the helicopter will be within the operating range.

e. If the actual weight of the helicopter is *5150, **5490 pounds instead of *5120, **5460 pounds, the chart must be adjusted by reducing the cargo weight. Therefore, in step b., the cargo weight will be *1600, **1260 pounds minus *30, **30 pounds, amount the helicopter is overweight, or *1570, **1230 pounds. In step c. the cargo weight will be *2600, **2260 pounds, minus *30, **30 pounds, or *2570, **2230 pounds.

f. If the actual weight of the helicopter is *5100, **5440 pounds instead of *5120, **5460 pounds, the chart must be adjusted by increasing the cargo weight by *20, **20 pounds. Therefore, in step b., the cargo weight will be *1600, **1260 pounds, plus *20, **20 pounds, or *1620, **1280 pounds. In step c., the cargo weight will be *2600, **2260 pounds, plus 20, **20 pounds, or *2620, **2280 pounds.

7-37. INTERNAL CARGO LOADING CHART.

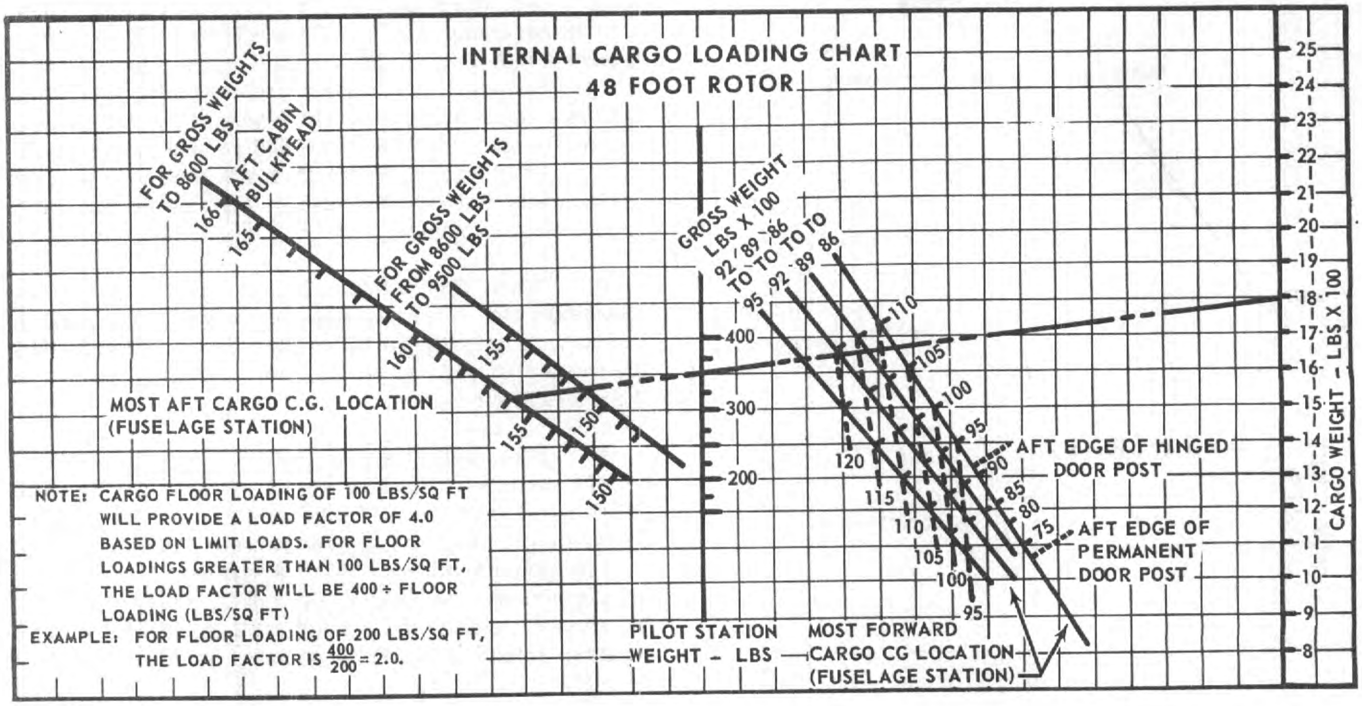
7-38. The Internal Cargo Loading Chart provides a straight line method of determining cargo location without computations. The variables shown in the chart are crew weight, cargo weight, gross weight, and most forward and most aft locations (fuselage stations) allowable. (See figure 7-6.) A sample problem is shown in the chart by dashed line (------), and working of the typical problems follows:

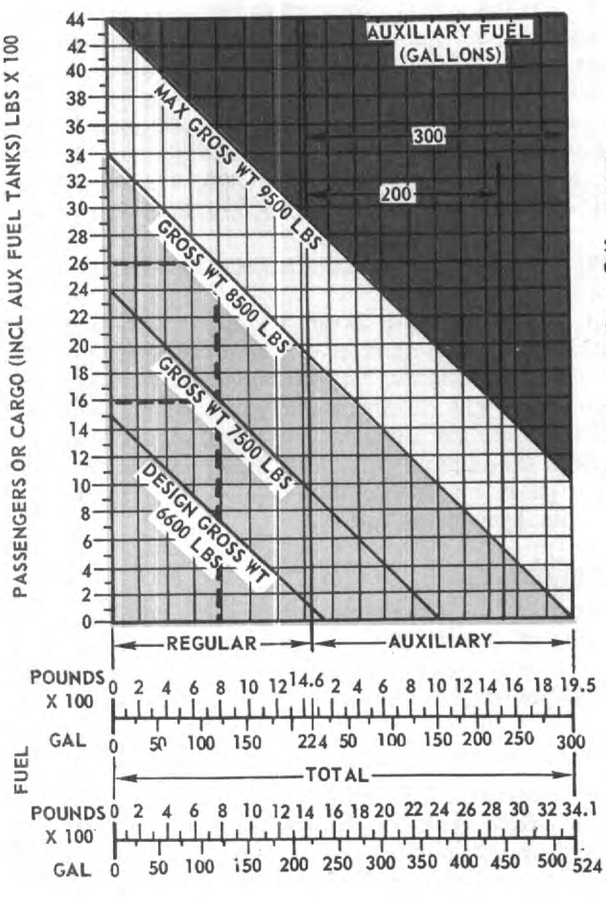
PROBLEM:

Determine the acceptable location for *1800, **1800 pounds of cargo, if the pilot weight is *350, **350 pounds and the gross weight is less than *8600, **8600 pounds.

ANSWER:

Draw a straight line from the *1800, **1800 pound cargo weight point to the *350, **350 pound pilot station weight point. Extend line through most aft cargo cg location line and most forward cg location line for a gross weight of less than *8600, **8600 pounds. Cargo cg shall be located between fuselage stations *(108 and 156), **(108 and 156), shown on diagonal lines.





STANDARD DAY PERFORMANCE

		GROSS WEIGHT - LBS			
		6600	7500	8500	9500
BEST RATE OF CLIMB AT SEA LEVEL WITH NORMAL RATED POWER (50 KNOTS)	(FPM)	2000	1660	1340	1080
SEA LEVEL VERTICAL RATE OF CLIMB WITH TAKE-OFF POWER	(FPM)	2160	1530	780	0
SERVICE CEILING WITH NORMAL RATED POWER	(FT)	23,900	20,200	16,400	12,600
HOVERING CEILING, IGE* WITH TAKE-OFF POWER	(FT)	18,200	14,200	9900	5500

*4 FT SKID HEIGHT.

WEIGHT LIMITATIONS CHART
(48 FT ROTOR)
PRIOR TO FY 65 SERIAL NO 65-9565

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AV 054581-1

Figure 7-6. Weight limitations and internal cargo loading charts (Sheet 1 of 2)

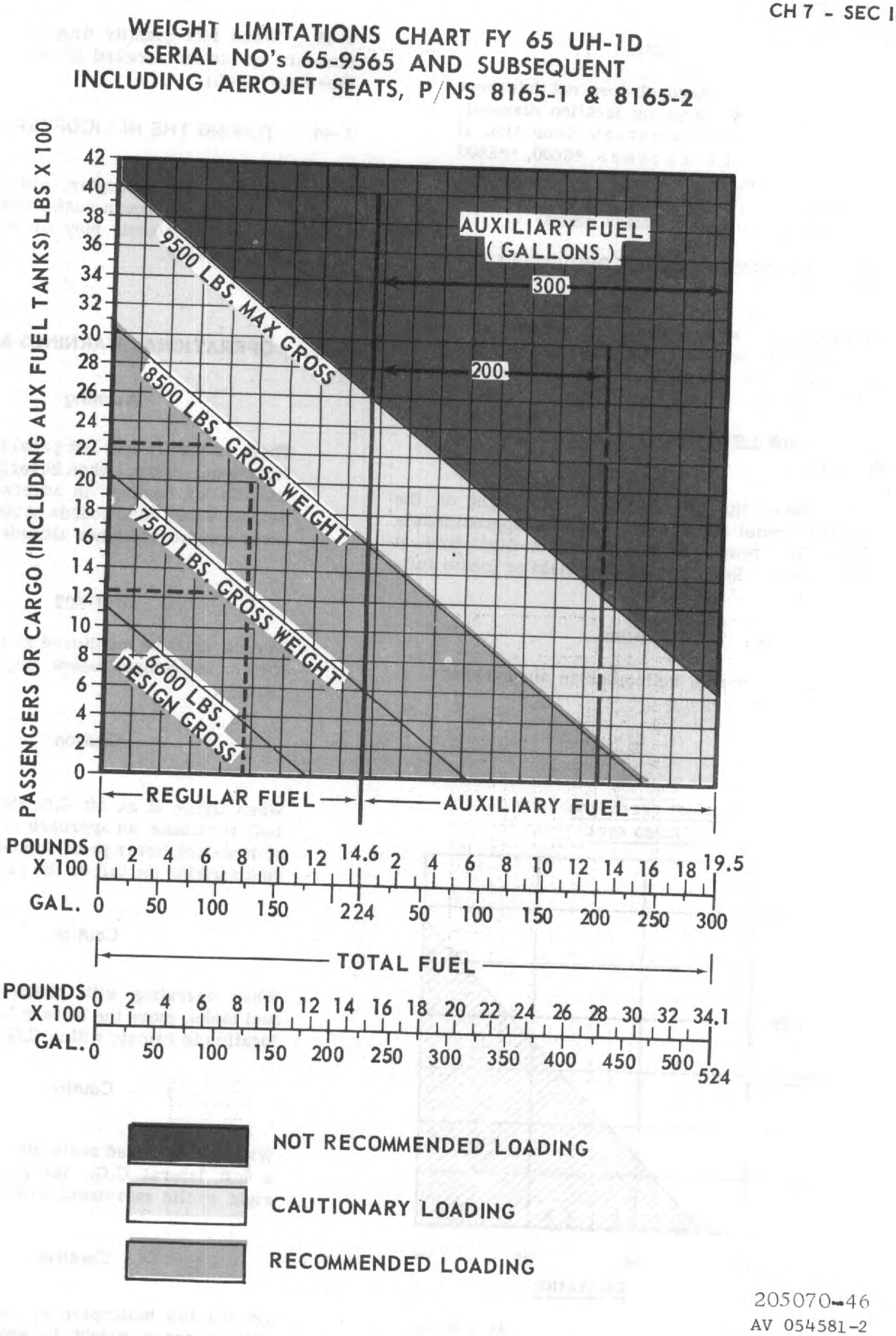


Figure 7-6. Weight limitations and internal cargo loading charts (Sheet 2 of 2)

Note

If the drawn diagonal does not intersect the most aft cargo cg location diagonal, there is no aft location limitation. If gross weight exceeds *8600, **8600 pounds, use applicable gross weight diagonal line in determining most forward and most aft cargo cg location limits.

7-39. EXTERNAL CARGO CONFIGURATION.

7-40. Caution should be exercised when carrying external cargo because handling characteristics may be affected by the size, weight, and shape of the cargo load. Maximum allowable weight of external cargo is 4000 pounds.

7-41. LOW LEVEL FUEL LIMITATIONS - YUH-1D.

7-42. When the 20 MINUTE FUEL light on the CAUTION panel illuminates, there is approximately enough fuel remaining for 20-minute flight time at cruise power. Return to landing field or locate suitable area to land helicopter.

Caution

Do not operate helicopter in shaded area of figure 7-7.

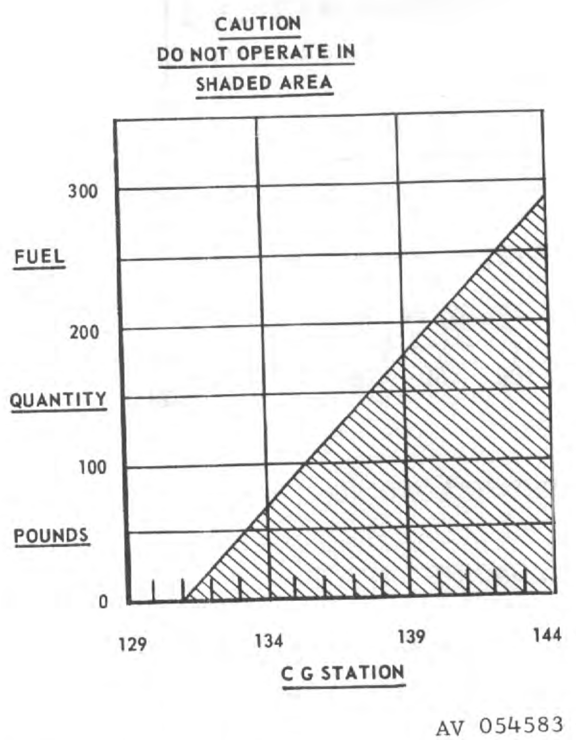


Figure 7-7. Low level fuel warning - YUH-1D

7-43. When fuel quantity drops below 300 pounds, maintain cg station forward of fuselage station 144. (See figure 7-7.)

7-44. TOWING THE HELICOPTER.

7-45. Towing the helicopter, with ground handling wheels installed, on rough surfaces at gross weights in excess of 9500 pounds may cause permanent set in the aft cross tube.

7-46. OPERATIONAL WARNINGS AND CAUTIONS.

Warning

There is insufficient left pedal to maintain directional control when hovering, making takeoffs or landings in adverse winds at weights above 8300 pounds at 5000 feet, and lower weights at higher altitudes.

Warning

Torque must be monitored as the primary power instrument below engine critical altitude.

Caution

When flying at an aft C.G. (Station 140 to 144) terminate an approach at a minimum of five-foot hover prior to landing to prevent striking the tail on the ground.

Caution

When operating with bladder-type ferry fuel tanks, move the battery to the forward location to remain within C.G. limits.

Caution

With the armored seats installed and with a left lateral C.G., the pilot's arm and right cyclic movement will be restricted.

Caution

Do not tow helicopter on rough surfaces with a gross weight in excess of 9500 pounds.

CHAPTER 8

FLIGHT CHARACTERISTICS

SECTION I SCOPE

8-1. SCOPE.

8-2. The function of this chapter is to describe the flight characteristics of the helicopter. Emphasis has been placed on the advantageous as well as dangerous flight characteristics.

8-3. The information herein is based on operations at maximum gross weight.

SECTION II GENERAL FLIGHT CHARACTERISTICS

8-4. OPERATING CHARACTERISTICS.

8-5. The flight characteristics of this helicopter in general are similar to other single-rotor helicopters. The noticeable difference is in the additional stability that is evident during take-off, hovering, and all flight speeds. This stable condition is the result of the gyroscopic action 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 directional control pedals by means of a force trim system. To increase helicopter forward speed, simultaneously apply forward control stick and increase main rotor pitch; power is automatically adjusted to maintain constant rpm. Constant altitude is maintained throughout the entire range of forward flight speeds by fore and aft use of the cyclic control stick in coordination with power and main rotor pitch application. Directional heading is controlled by the application of lateral cyclic control and the appropriate directional control pedal.

8-6. BLADE STALL.

8-7. Blade stall is caused by a high angle of attack on the retreating blade and starts at the inboard section and progresses outboard with increased airspeed. However, this condition will not be encountered when the helicopter is operated within the limits imposed in the preceding chapters of this manual. Blade stall is the result of numerous contribution factors such as gross weight, rotor rpm, airspeed, acceleration, 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 with higher values of altitude and gross weight. One of the more important features of the two-blades seimi-rigid rotor system is its warning to the pilot of impending blade stall. Prior to progressing fully into the stall region, the pilot will feel a marked increase in airframe vibration. Consequently, corrective action can be taken before the stall condition becomes severe.

Note

When rotor stall progresses into a severe state, feedback may occur, primarily in the cyclic controls.

8-8. BLADE STALL - CORRECTIVE ACTION.

8-9. When blade stall is evident, the condition may be eliminated by accomplishing one or a combination of the following corrective actions:

a. Reduce collective.

b. Reduce airspeed.

c. Increase operating rpm.

d. Descend to lower altitude.

e. Decrease the severity of the maneuver.

8-10. MANEUVERING FLIGHT.

8-11. Action and response of the controls during maneuvering flight are normal at all times when the helicopter is operated within the limitations set forth in this manual.

8-12. ROTOR CAPABILITIES.

8-13. The UH-1D/H helicopters are capable of delivering a maximum thrust commensurate with rotor-engine limitations and the density of the atmosphere in which they are operating. Maximum thrust can be utilized to obtain maximum airspeed optimum rate of climb, or, at some reduced airspeed, the maximum maneuver potential. The pilot may employ the capabilities of the helicopter within maximum limitations and in accordance with the enviornment under which he is operating.

8-14. A descending turn or autorotational turn at a given angle of bank and stabilized rate of descent imposed the same "G" load on the rotor. Hence, if the turn is too abrupt (tight) and rotor limits are exceeded, further application of controls will not check the rate of descent if the turn is continued. In order to alleviate this condition the pilot must roll out of the turn to reduce the rotor load and provide control response, and reduce rate of descent. The permissible bank angles vs altitudes and gross weights will affect the turning radius of the helicopter. A light gross weight helicopter turns within an area comparable in size to that contained within the boundaries of a foot ball field. The same helicopter at normal gross weight and at a density altitude of 12,000 feet will require a much larger area to accomplish the same turn.

8-15. HOVERING CAPABILITIES.

8-16. Hovering capability is affected by in-ground effect (IGE), out-of-ground effect (OGE), outside air temperature (OAT), density and pressure altitude, wind speed, engine torque (power available), and gross weight of the helicopter. Hovering IGE performance is better than OGE because during IGE the rotor sets up a current flow between the helicopter and the ground, providing a cushion of air to partially support the helicopter weight. Temperature variations affect engine and rotor performance. For each four-degree centigrade rise in temperature, there is approximately a four percent loss in engine power. Hovering with heavier gross weights or at higher altitudes is possible with lower temperatures and wind velocities. Lower temperatures increase engine efficiency and wind represents airspeed therefore, either condition or both will increase hovering performance due to the ability of the main rotor to provide more lift.

8-17. OPERATING RULES OF THUMB.

8-18. The following general rules are factors contributing to the hovering capability of the helicopter.

a. A rise of three degrees centigrade above standard causes a loss of 1.5 psig or torque.

b. Assuming a standard temperature lapse rate, approximately 0.75 psig of torque is lost with each 1000-foot increase in altitude.

c. An increase of 1.0 psig in torque is equivalent to 200 pounds lift capability.

d. For a given power setting, there is approximately 1000 pounds difference in gross weight between IGE and OGE hovering.

e. Hovering OGE requires approximately five more psig of torque than hovering IGE.

f. Generally, IGE performance figures should not be used for sling loads. (Refer to Chapter 14.)

SECTION III CONTROL CHARACTERISTICS

8-19. FLIGHT WITH INTERNAL LOADS.

8-20. The airspeed with external cargo is limited by controllability.

Exercise care, when carrying external cargo, as the handling characteristics may be affected due to the size, weight, and shape of the cargo load.

8-21. LEVEL FLIGHT CHARACTERISTICS.

8-22. The level flight characteristics of this helicopter are normal throughout the range of operating limits. Control response is immediate and gives positive results.

8-23. FLIGHT CONTROLS COORDINATION.

8-24. The most efficient performance of this helicopter is obtained by the coordinated movement of the controls; coordinated control movement is as important for helicopter operation as it is for fixed-wing aircraft.

8-25. TYPES OF VIBRATION.

a. Rotor vibrations felt during in-flight or ground operations are divided in general frequencies as follows:

Extreme low frequency - Less than one revolution (pylon rock).

Low frequency - One or two revolutions.

Medium frequency - General four, five, or six revolutions.

High frequency - Tail rotor revolutions or faster.

b. Most vibrations are always present at low magnitudes. The main problem is deciding when a vibration level has reached the point of being excessive.

c. The only source of vibrations of any frequency are the rotating or moving parts on the ship, other parts vibrating only in sympathy with an existing vibration.

d. Extreme low, low, and most medium frequency vibrations are caused by the rotor or dynamic controls. Various malfunctions in stationary components can affect the absorption or damping of the existing vibrations and increase the overall level felt.

e. A number of vibrations are present which are considered a normal characteristic. Two per revolution is the most prominent of these, with four or six revolutions the next most prominent. There is always a small amount of high-frequency vibration present that may be felt if a person looks for it. Experience is necessary to learn the normal vibration levels. Sometimes the mistake is made of concentrating on feeling one specific vibration and concluding that the level is higher than normal.

f. Extreme low-frequency vibration is usually limited to pylon rock. Pylon rocking, two to three cycles per second, is inherent with the rotor, mast, and transmission system. To keep the vibration from reaching noticeable levels, transmission mount dampening is incorporated to absorb the rocking. Malfunctions in the dampening system will allow rocking to start. A quick check of the dampening system may be made while in a hover. Moving the cyclic fore and aft at about one movement per second will start the pylon rocking. The length of time it takes for the rocking to die out after the motion of the cyclic is stopped is indicative of the quality of the dampening. An abnormal continuation of rock during the check or a continued presence of rock during normal flight is an indication that something is wrong with the transmission mounts or dampers.

8-26. LOW-FREQUENCY VIBRATIONS.

a. Low-frequency vibrations are caused by the rotor itself. One revolution vibrations are of two basic types, vertical or lateral. A one revolution vertical is caused simply by one blade developing more lift at a given point than the other blade. A lateral vibration is caused by a spanwise unbalance of the rotor due to a difference of weight between the blades. The minor differences will affect flight but are compensated for by adjustments of trim tabs and pitch settings.

b. Generally, verticals felt prodominantly in low power descent at moderate airspeeds (60-70 knots) are caused by a basic difference in blade lift and can be corrected by rolling the grip slightly out of track. Vertical vibrations felt in forward flight, worsening as airspeed increases, are usually due to one blade developing more lift with increased speed than the other (a climbing blade). This condition is corrected by adjustment of the trim tabs.

8-27. LOW - FREQUENCY VIBRATION - VERTICAL.

8-28. Associated with the one revolution vertical vibration is the intermittent one revolution vertical. Essentially, this is a vibration initiated by a gust effect causing a momentary increase of lift in one blade giving a one revolution vibration. The momentary vibration is normal; but if picked up by the rotating collective controls and fed back to the rotor causing several cycles of one revolution becomes undesirable. Sometimes during steep turns one blade will "pop" out of track and cause a hard one revolution vertical. This condition is usually caused by too much differential tab in the blades and can be corrected by rolling one blade at the grip and removing some of the tab, (as much as can be done without hurting the ride in normal flight).

8-29. LOW FREQUENCY VIBRATION - LATERAL.

a. Should a rotor, or rotor component, be out of balance, a one revolution vibration called a lateral will be present. This vibration is usually felt as a vertical due to the rolling motion it imparts to the aircraft, causing the pilot's seats to bounce up and down out of phase; that is, the pilot goes up while the copilot goes down. An unusually severe lateral vibration can be felt as a definite sideward motion as well as a vertical motion.

b. Lateral vibration existing due to an unbalance in the rotor are of two types; spanwise and chordwise.

c. Spanwise unbalance is caused simply by one blade and hub being heavier than the other (i.e., an unbalance along the rotor span).

d. A chordwise unbalance means there is more weight toward the trailing edge of one blade than the other. Both types of unbalance can be caused by the hub as well as the blades.

e. Lateral vibrations are usually felt in a hover and in descending moderate airspeed turns and tend to disappear in forward flight, although many times a lateral can manifest itself as a vertical in forward flight. An out-of-ground effect hover is usually the best place to feel a lateral vibration and reducing the RPM to 6000 will often make the lateral more prominent.

f. Two revolution vibrations are inherent with two-bladed rotor systems and a low level of vibration is present.

8-30. MEDIUM - FREQUENCY VIBRATIONS.

8-31. Medium - frequency vibrations at frequencies of four or six revolutions are another inherent vibration associated with most rotors. An increase in the level of these vibrations is caused by a change in the capability of the fuselage to absorb vibration, or a loose airframe component, such as the skids, vibrating at that frequency. Changes in the fuselage vibration absorption can be caused by such things as fuel level, external stores, structural damage, structural repairs, internal loading, or gross weight. Abnormal vibration levels of this range are nearly always caused by something loose; either a regular part of the aircraft or part of the cargo or external stores. The vibration is felt as a rattling in the aircraft structure. The most common cause is loose skids.

8-32. HIGH - FREQUENCY VIBRATIONS.

8-33. High-frequency vibrations can be caused by anything in the ship that rotates or vibrates at a speed equal to or greater than that of the tail rotor. The most common and obvious causes; tail rotor balance and track. Pilot experience can help greatly in troubleshooting the cause of a high-frequency vibration, as a pilot who has experienced a vibration can often recognize the cause the next time he feels the same vibration. A comparison between the feel of the helicopter without excessive vibration and the aircraft with the vibration is helpful in precluding erroneous conclusions.

CHAPTER 9

SYSTEMS OPERATION

(Not Applicable)

CHAPTER 10

WEATHER OPERATION

SECTION I SCOPE

10-1. SCOPE.

10-2. The purpose of this chapter is to provide information relative to operations during various weather conditions, including instrument flight, night flying, cold weather operation, high altitude operation, flight through ice and rain, hot weather operation, and turbulence and thunderstorm operation.

SECTION II INSTRUMENT FLIGHT PROCEDURES

10-3. GENERAL.

10-4. The helicopter is provided with the necessary instruments and navigation equipment to accomplish missions under instrument operations including light icing conditions, day or night flying, and to navigate by dead reckoning, or by use of radio aids to navigation. Instrument flights should be carefully planned, keeping in mind that icing conditions, turbulent air, thunderstorms will greatly affect the flight.

Note

The decreased speeds imposed during instrument flights to insure smooth vibration free maneuvers may necessitate an appreciable loss of range. This loss of range, lack of ice protection equipment, and effect of turbulence require that all flights be carefully planned. A qualified copilot is required on all instrument flights. The copilot must be capable of navigating, handling radios, and making position reports in addition to relieving the pilot for short periods.

Caution

Be sure external cargo hook-up mirror is removed and stowed or mirror cover is on before all instrument and night operations.

10-5. To lessen pilot fatigue during stabilized instrument flight conditions (cruise, steady state descents, etc.), full utilization should be made of the force trim (sick centering) to trim out opposing control forces. The fatigue factor will also be considerably reduced if the pilot controls the helicopter with as little tenseness as possible.

10-6. All instrument flying is to be accomplished with the power turbine speed governor set at 6600 rpm. Maintaining rpm descreases the chance of encountering retreating blade stall in turns and turbulence. The maximum throttle setting insures that the pilot has full thrust available when applying collective pitch to recover from any unusual situations that may arise. Total rotor thrust, which is a direct function of collective pitch setting, is measured by the engine torquemeter. Therefore, all power settings for instrument flying are given in terms of torquemeter readings.

10-7. PREFLIGHT AND GROUND CHECKS.

10-8. Perform the normal pre-flight check, including the night flight checks, as outlined in the normal operating instructions in Chapter 3. Check operation of flight instruments, navigation equipment, external and internal lighting, windshield wipers and defrosters, pitot heat, generators, inverters, and engine ice detector system (if installed). Inspect filter in sand and dust separator unit.

Note

If possible, set and check altimeters for error before engine start. After engine start, note the decrease in altimeter reading induced by rotor downwash effect. This decrease will be approximately 20 feet with a collective pitch setting calling for 15 pounds torque.

10-9. INSTRUMENT TAKE-OFF.

10-10. The attitude indicator, heading indicator, and torquemeter are primary for instrument take-offs. By use of these instruments, along with the following procedures, ITO's are easily accomplished.

10-11. After positioning the helicopter on a level or near-level surface and into the wind, set helicopter heading to top of the heading indicator and adjust the horizon bar of the attitude indicator so that the miniature airplane will appear approximately one bar width above the horizon bar. Prior to take-off, set pitot heat selector switch as required and apply sufficient friction to the collective pitch control to minimize over-controlling.

10-12. With a steady smooth motion apply collective pitch until five pounds of torque more than required for hovering is obtained. As the helicopter leaves the ground, position the cyclic stick so that the miniature airplane will appear one to two bar widths below the horizon bar and in a wing level attitude. Maintain directional control (heading), with the pedals until airspeed increases, generally 30 to 40 knots, then transition to coordinated flight.

Warning

The airspeed and vertical speed indicators and altimeter are unreliable below 25 knots IAS because of rotor down-wash effect on the pitot static system. During take-off, do not rely on these instruments until the airspeed indicator reads at least 25 knots IAS. The time required to reach this speed will be approximately seven seconds.

10-13. The take-off attitude (miniature airplane one to two bars below horizon) and power setting (five psi plus hovering power) are to be maintained until the airspeed approaches the desired climbing airspeed, then adjust to the climbing attitude (miniature airplane on the horizon bar). As climbing airspeed and attitude are attained, the power (collective pitch) should be adjusted to result in a 500 fpm rate of climb. Higher rates of climb may be used for extended climbs.

10-14. INSTRUMENT CLIMB.

10-15. The helicopter handles well in climbs and climbing turns. After the desired rate of climb and IAS are reached, no change should be made to collective pitch setting unless the airspeed changes more than 5 knots IAS or vertical velocity more than 100 fpm. Turns should be made, using the attitude indicator to obtain the recommended 15 degree angle of bank which approximates a standard rate of turn of three degrees per second. Any pitch attitude corrections should not exceed one bar width. The angle of bank should never exceed 20 degrees.

10-16. INSTRUMENT CRUISING FLIGHT.

10-17. Upon reaching normal cruise speed the attitude indicator should be set for a nose-level indication. Thereafter, any pitch or bank corrections should be made, using the attitude indicator. Pitch corrections should not exceed one bar width. The recommended angle of bank for cruising turns is 15 degrees and should not exceed 20 degrees.

Note

The attitude indicator should never be reset in flight except to align the miniature airplane with the horizon bar. In all cases the helicopter shall be in straight and level flight at recommended cruise speed when this adjustment is made.

10-18. The most economical long range cruise speeds are not recommended for instrument cruising because of their close proximity to the speeds at which induced vibrations occur. As the vibration level permits, use operating limits as specified on the OPERATING LIMITS decal. (Refer to Chapter 7.)

10-19. COMMUNICATIONS AND NAVIGATION EQUIPMENT.

10-20. There are no unusual transmitting or reception characteristics that render this equipment unreliable for instrument flight.

10-21. NORMAL DESCENTS.

10-22. Enroute descents to traffic altitude can be initiated and maintained without difficulty using the following procedures.

a. Before starting the descent, check and reset, if necessary, the attitude indicator for a nose-level indication with the helicopter in straight and level flight at the recommended cruise speed.

b. To establish the descent, reduce the torque to set up a 500 fpm rate of descent and maintain recommended cruise speed, angle of bank, and pitch attitude. During the descent, the miniature airplane will remain on the horizon bar. Higher rates of descent may be used for extended descents and approaches.

In general, below 7000 feet density altitude, a reduction of one pound of torque will increase the rate of descent approximately 100 fpm.

10-23. MAXIMUM (AUTOROTATIVE) DESCENTS.

10-24. Autorotations are not difficult to perform while on instruments. However, due to the high rate of descent, they are recommended for emergencies only (loss of engine, etc.). The following procedures are for establishing and conducting autorotations on instruments.

a. Reduce collective pitch as required to maintain rotor rpm within limits.

b. Assume a one bar width nose-high attitude and maintain directional control. The airspeed will gradually decrease to 60 knots IAS. Approximately a one bar width nose-high attitude will give this speed, which should be maintained until visual contact is made. As soon as the autorotation is established and the helicopter is under positive control, complete the Engine Failure During Flight check list in Chapter 4. During the descent, limit the angle of bank in turns to 15 degrees.

10-25. HOLDING.

10-26. Holding presents no handling or control problems at speeds up to 80 knots. Speeds above 80 knots are not recommended for holding because of increased pilot workload. The decrease in fuel consumption realized from using maximum endurance airspeeds instead of 80 knots would be negligible for all practical purposes.

10-27. For all pitch and bank corrections, utilize the attitude indicator. Do not exceed a one bar width pitch correction for minor altitude changes and limit the angle of bank in turns of 15 degrees. It is best not to make a collective pitch change unless the airspeed varies more than plus or minus 10 knots IAS.

10-28. INSTRUMENT APPROACHES.

10-29. Before starting the approach, have the attitude indicator properly set (i.e., minature airplane on horizon bar at a straight and level cruise.

10-30. For all pitch and bank corrections, use the attitude indicator. Do not exceed a one bar width pitch correction for minor altitude changes and limit the angle of bank in a turn to 15 degrees.

10-31. During the descent phase of an approach, make rate-of-descent corrections with the cyclic pitch by reference to the attitude indicator. Allow the airspeed to vary plus or minus 10 knots during these corrections before making a collective pitch adjustment.

10-32. MISSED APPROACH.

10-33. A missed approach is executed at the missed approach point by applying power and establishing a normal climb.

10-34. BOOST OUT OPERATION.

10-35. It is recommended that the pilot establish VFR conditions as soon as possible, if the hydraulic control boost becomes inoperative while under instrument conditions. Safe instrument approaches can be conducted with the control boost inoperative by using the normal recommended technique and procedures.

10-36. NIGHT FLYING.

10-37. Night flying presents many of the same problems as instrument flying, plus additional problems caused by illumination of the instruments and by cockpit and exterior reflections.

Caution

During night approaches, the lower nose canopy visibility is extremely restricted due to landing light reflection; however, the visibility improves as the lighted touchdown area comes beneath the helicopter. Night landings can be made with the navigation lights on "steady" if the landing and searchlights are inoperative. However, exercise extreme caution, since the navigation lights do not furnish sufficient illumination for depth perception until just before touchdown.

Note

When operating in the clouds at night, turn navigation lights to steady and anti-collision lights off to reduce distracting reflections from the clouds.

10-38. For a night take-off and approach, set the landing light approximately 15 degrees down from horizontal. This will give the pilot a reference point during take-off and also light the approximate touchdown area following a normal approach. During take-off, climb, and approach, use the searchlight as desired to keep to a flight path that is free of obstructions.

SECTION III COLD WEATHER OPERATIONS

10-39. INTRODUCTION.

10-40. Operation of the helicopter in cold weather or in arctic environment presents no unusual problems, if the operators are aware of these changes that do take place and conditions that may exist because of the lower temperatures and freezing moisture.

10-41. PREPARATION FOR FLIGHT.

10-42. The pilot must be more thorough in the walk-around inspection when temperatures have been or are below 0°C (32°F). Water and snow may have entered many parts during operation or in periods when the helicopter was parked unsheltered. This moisture often remains to form ice which will immobilize moving parts or damage structure by expansion and will occasionally damage electric circuits. Protective covers provide adequate protection against rain, freezing rain, sleet, and snow when installed on a dry helicopter prior to the precipitation. Since it is not practicable to completely cover an unsheltered helicopter, those parts not protected by covers and those adjacent to cover overlap and joints require closer attention, especially after blowing snow or freezing rain. Accumulation of snow and ice should be removed prior to flight. Failure to do so can result in hazardous flight, due to aerodynamic and center of gravity disturbances as well as the introduction of snow, water, and ice into internal moving parts and electrical systems. The pilot should be particularly attentive to the main and tail rotor systems and their exposed control linkages.

Caution

> If temperatures are 29°C (minus 20°F) or below, the pilot should maintain minimum RPM (flight idle) in order to reduce the engine oil pressure while the oil warms and the pressure drops below maximum operating limits.

10-43. WINTERIZATION KIT.

10-44. Provisions have been made for the installation of a winterization kit to effect and maintain a cabin temperature of plus 5°C (plus 41°F) when the outside temperature is minus 54°C (minus 65°F).

10-45. ELECTRONIC EQUIPMENT.

10-46. The proper functioning of radio equipment in the Arctic is of primary importance because of the large areas of unmapped territory and the poor check points, even in mapped areas. Although in general, radio equipment gives little additional trouble at low temperature, pilots and maintenance personnel should be aware of a few conditions and phenomena which at some time may affect their safe passage over rugged, uninhabited terrain. Radio fade-outs occur periodically in the Arctic and are caused by solar explosions and sun spot activity. The accepted theory is that the sun emits electrified particles which produce heavy ionization on reaching the earth's atmosphere. The ionized blanket disrupts radio ceilings everywhere, but particularly in the polar regions. Fade-outs may last for several weeks. As these are referable to sun spots activity, they may be forecast. Short term fade-outs caused by solar explosions, similar to the detonation of atom bombs, may occur in the Arctic during both daylight and darkness. The atmospheric disturbance is revealed about eight minutes after a solar explosion. The fade-out conditions last for 15 minutes to several hours and cannot be forecast. Radios are unserviceable and communication leading to rescue may be delayed. Do not interpret these fade-outs as faulty equipment. At temperatures below 0°C (32°F), the efficiency of the equipment is affected by decreasing temperatures.

10-47. BEFORE EXTERIOR CHECK 0°C (32°F) AND LOWER - (EXTERNAL POWER AVAILABLE).

a. All switches - OFF.

b. Collective Pitch - DOWN.

c. Throttle - CLOSED.

d. External power supply connected - CHECK that DC voltmeter shows proper polarity.

Note

> The following should be performed and the equipment left in warm-up operation during the exterior check.

e. Main Inverter switch - ON.

f. Main fuel switch - ON.

g. Heater - CHECK operation.

10-48. BEFORE EXTERIOR CHECK 0°C (32°F) AND LOWER.

10-49. Perform check as specified in Chapter 3.

10-50. EXTERIOR CHECK 0°C TO MINUS 54°C (32°F TO MINUS 65°F).

a. Perform checks as specified in Exterior Check in Chapter 3.

Caution

> Check all surfaces and controls free of ice and snow.

Note

> Contraction of fluids in the aircraft systems at low temperature causes indication of low levels.

Note

> A check made just after the previous shutdown and carried forward to the walk around check is satisfactory, if no leaks are in evidence. Filling when the system is cold-soaked will result in an over-full condition immediately after take-off, with the possibility of forced leaks at seals.

b. Main Rotor Blades - Check upper surface free of ice, frost and snow. Untie the blades and walk through 360 degrees in the direction of rotation and check to see that there is no restriction of operation due to ice formation. Check flapping action, observing the operation of the stabilizer bar.

Note

At temperatures of minus 35°C (minus 31°F) and lower, the grease in the spherical couplings of the main transmission drive shaft may congeal to a point where the couplings cannot be operated properly. If found frozen, apply heat to thaw the couplings before attempting to start the engine. Indication of proper operation is obtained by turning the main rotor opposite to direction of rotation while observer watches the drive shaft to see that there is no tendency for the transmission drive shaft to "wobble" while the drive shaft is turning.

c. Cabin Top - Remove all loose snow that could be pulled into and block the engine intake during starting.

10-51. INTERIOR CHECK - ALL FLIGHTS 0°C TO MINUS 54°C (32°F TO MINUS 65°F).

10-52. Perform checks as specified in Interior Check, Chapter 3.

10-53. INTERIOR CHECK - NIGHT FLIGHT 0°C TO MINUS 54°C (32°F TO MINUS 65°F).

a. Perform check as specified in Chapter 3.

b. External Power Connected.

Note

When an engine start is to be made without external power, the night flight checks shall be performed after engine start is accomplished and the electrical loadmeter shows an indication of sufficient generator output to prevent battery drain.

c. Cockpit lights - CHECK.

10-54. BEFORE STARTING ENGINE 0°C TO MINUS 54°C (32°F TO MINUS 65°F).

a. (External Power Available.) Perform checks as specified in Before Starting Engine, Chapter 3.

Note

External power should be used for starting when temperatures are below 0°C (32°F) to prevent draining the battery. When external power is connected, electrical systems will be powered and function normally.

b. Heater - CHECK operation by opening main fuel valve (automatically activates boost pump).

10-55. STARTING ENGINE 0°C TO MINUS 54°C (32°F TO MINUS 65°F).

10-56. With external power connected perform start as specified in Chapter 3.

L-11S Note

At low ambient temperatures, JP-5 fuel may cause slower engine starts. If engine fails to start when using JP-5 fuel, the starting fuel line must be disconnected from the scheduled fuel port and connected to the unscheduled port. The starting procedure for this configuration is the same as with the scheduled port.

L-13 Note

The engine oil pressure gage will indicate maximum during cold weather starting. Run engine at flight idle until indication is within operating limits. Time required for warm-up is dependent on the starting temperature of the engine and lubrication system.

10-57. ENGINE RUN-UP.

10-58. Perform engine run-up as specified in Chapter 3.

Caution

If temperatures are -29°C (-20°F) or below, the pilot should maintain minimum RPM (flight idle) in order to reduce the engine oil pressure while the oil warms and the pressure drops below maximum operating limits.

Note

At OAT between minus 21°C and minus 54°C (minus 4°F and minus 65°F) the exhaust gas temperature may be as low as 290°C (554°F) at flight idle.

Warning

A rapid throttle increase while parked on snow or ice can result in violent yawing.

Note

Movement of nII governor indicator may be very slow due to climatic conditions.

Warning

Control systems checks should be performed with extreme caution when helicopter is parked on snow and ice. There is reduction in ground friction holding the helicopter stationary; controls are sensitive and response is immediate.

10-59. COLD WEATHER CAPABILITY.

10-60. The cold weather capability has been improved with the installation of nickel-cadmium battery which, because of its partial immunity to low temperatures, can be used to start engine at temperatures to minus 30°C (minus 22°F). The operator is cautioned that a battery start should be attempted only if the battery is fully charged and that the safety margin for starting is increased if the battery has been warmed. Following each cold weather flight, the pilot should (before shutting down the engine), check the battery for charge using the following procedures:

a. Main Rotor Speed - Minimum 250 RPM, main generator ON.

b. Main Generator Loadmeter Reading - Note.

c. Battery Switch - OFF, note CHANGE in reading.

10-61. A change of 0.1 in loadmeter reading would indicate a charge rate of 30 amperes and the battery not sufficiently charged for subsequent engine starting. A change of 0.02 in loadmeter reading indicates a charge rate of six amperes and the battery considered reasonably charged. After a flight of one-half hour or more during which the main generator and battery were ON and the main generator voltage at 28 (plus or minus 1.5) volts, a battery charging rate of less than six amperes should be expected.

10-62. EMERGENCY ENGINE STARTING WITHOUT EXTERNAL POWER.

10-63. If a battery start must be attempted when the helicopter and battery have been cold-soaked at temperatures between minus 26°C to minus 37°C (minus 15°F to minus 35°F), preheat the engine and battery if equipment is available and time permits. Preheating will result in a faster starter cracking speed, which tends to reduce the hot start hazard by assisting the engine in reaching a self-sustaining speed (40 percent nl) in the least possible time.

10-64. ENGINE PRE-START CHECK.

10-65. Perform engine pre-start check as specified in Chapter 3.

10-66. ENGINE STARTING CHECK.

10-67. Perform engine start as specified in Chapter 3.

H **Note**

The engine oil pressure gage will indicate maximum during cold weather starting. Run engine at flight idle until indicator is within operating limits. Time required for warm-up is dependent on the starting temperature of the engine and lubrication system.

10-68. TAKE-OFF.

10-69. Take-off on snow from an air base may be considered normal except for the following precautions that should be observed.

Warning

Under cold weather conditions, make sure all instruments have warmed up sufficiently to insure normal operation. Check for sluggish instrument indications before take-off.

a. Select an area that is free of loose or powdery snow so visibility will not be restricted by blowing snow.

Warning

Pilots of aircraft with barrier filter or fine mesh screen installed will exercise extreme caution during ground operation in loose snow. Snow and ice accumulation during ground operation may be detrimental to the engine and hazardous to the aircraft and operator. Ground operation time should be minimized and filter assemblies should be inspected prior to takeoff.

b. Before attempting to take-off make sure the landing gear skids are free and not frozen to the surface.

c. The first take-off after a cold start should include a visual check of the ground surface for evidence of hydraulic leaks. This should be done under hovering power conditions. If hydraulic leaks are present, further flight should be aborted.

10-70. LANDING.

10-71. Landing on snow at an airbase may be considered normal except for the following precautions that should be observed.

a. Select an area free of loose or powdery snow so that visibility will not be restricted by blowing snow.

b. Accomplish a normal landing with a minimum hover before touchdown. Limited visibility will result from swirling snow when hovering is attempted before making a touchdown.

10-72. EVALUATION OF STRANGE AREA SNOW LANDING SITE.

10-73. Landings may often be necessary in areas other than operational air bases. In addition to the basic factors in landing site evaluation, factors pertinent to landings on snow are outlined in this paragraph.

a. The pilot should have knowledge of the type of terrain under the snow (bush, marsh land, tundra, etc.).

b. The snow depth is usually less in clear areas where there is little drifting snow effect. Clean areas normally form gentle swells with the crests of these swells usually crusted. The heaviest crust will generally be found on the upwind side of the crests.

c. Deep snow is usually found in the valleys and to the "lee". These areas are suitable for landings and take-offs if caution is exercised.

d. When making a landing on snow in a strange area, observe the following:

(1) Anticipate loose powdery snow and crusts on all landings.

(2) Landings should always be made when visual ground reference can be maintained. The reference point should be kept forward and to the right so that it will be visible to the pilot at all times.

Note

When making an approach and landing on snow it should be one continuous operation without extended hover, in order to reduce the white-out condition that results from extended hovering over snow. This white-out will usually occur on loose snow and can cause the pilot to lose all reference with the ground or any object he is approaching. If the object being used as reference, should become completely obscured, accomplish a go-around.

10-74. STOPPING THE ENGINE.

10-75. At temperatures below minus 7°C (20°F), or if main rotor grip seal leakage is evident on engine shutdown, use the following procedure.

a. Prior to engine shutdown, maintain 6000 to 6200 rpm, for one minute in minimum pitch.

b. Make normal engine shutdown with collective pitch control in full down position.

Note

Do not use collective pitch control to decelerate rotor speed.

c. At extreme low temperatures the time in minimum pitch may have to be extended to allow seals to seat properly.

10-76. BEFORE LEAVING THE HELICOPTER.

10-77. Before leaving the helicopter perform required checks as specified in Chapter 3.

Note

Open pilot's and copilot's windows approximately one and one-half inches to permit free circulation of air. Install protective covers as required.

10-78. HIGH ALTITUDE OPERATION.

10-79. Before operation at high altitude accomplish the following.

a. Determine the pressure altitude for the area into which the flight is intended and compute maximum gross weight at which a hover may be possible from the appropriate charts.

b. Determine the existing and forecast wind conditions whenever possible.

c. Insofar as practicable, plan the flight to avoid known and probable areas of turbulence.

10-80. ENGINE STARTING.

10-81. For engine starting refer to Chapter 3.

10-82. TAKE-OFF.

10-83. The take-off should be made to obtain airspeed and altitude simultaneously. The take-off should begin with a slow acceleration to obtain translational lift, followed by a gradual increase in power and airspeed until a normal climb is attained.

a. All turns should be shallow. Avoid turns close to the ground.

b. Control movements should be gentle.

c. Sufficient altitude should be maintained to allow for any emergency, keeping in mind the high rate of autorotational descent associated with high altitudes.

d. Forward airspeed should be limited to prevent blade stall which is preceded by blade "buffeting".

e. Avoid areas of known turbulence such as the base of clouds, the lee side of the mountains, and steep canyons.

10-84. DESCENT.

10-85. Accomplish high altitude descents as outlined in the following steps.

a. All descents should be gradual. Under no circumstances shall a high rate of descent be allowed to develop.

b. Caution should be used during descents to maintain a safe airspeed. Increasing the airspeed above normal approach speed can cause the rate of descent to increase very rapidly. Low airspeed may also result in a high rate of descent, and when the nose is lowered in recovery the condition is aggravated.

c. Power applications should be anticipated because this helicopter does not respond to power at high altitudes as rapidly as at a lower elevation.

10-86. LANDING.

10-87. All approaches to landings should be planned and performed in an area of suitably level ground.

10-88. AUTOROTATIONS.

10-89. Autorotations at high altitudes are characterized by higher rates of descent and less effective collective pitch control available to cushion the landing. An airspeed of approximately 60 knots should be maintained during autorotation. At an altitude of 75 to 85 feet, decelerate to decrease airspeed and rate of descent. At approximately 10-15 feet, a small amount of pitch should be applied with the helicopter still in a deceleration attitude. The helicopter should then be leveled and sufficient collective pitch should be applied to cushion the touchdown. Avoid a vertical descent during the last 5 to 10 feet.

Caution

Practice autorotations at high altitudes should be made only to prepared landing areas, even when a power recovery is anticipated. Power recoveries should not be initiated below 400 to 500 feet altitudes, depending upon helicopter weight and field elevation, due to a combination of slow engine acceleration characteristics, high rotor blade angle of attack, and accompanying high rate of descent. The presence of these factors makes a quick power recovery impossible. The altitude at which safe power recovery should be initiated increases with helicopter gross weight and/or field elevation.

SECTION IV DESERT AND HOT WEATHER OPERATION

10-90. HOT WEATHER OPERATION.

10-91. Operations, when outside air temperatures are above standard day temperatures require closer monitoring of oil temperatures and EGT.

Note

At very high ambient temperatures, the helicopter loses efficiency with high gross weights.

SECTION V TURBULENCE AND THUNDERSTORM OPERATION

10-92. TURBULENCE AND THUNDERSTORMS.

10-93. Flight in thunderstorms and heavy rain which accompanies thunderstorms should be avoided. If turbulence and thunderstorms are encountered inadvertently, use the following procedures:

a. Check that all occupants are seated with safety belts and harnesses tightened.

b. Pitot heat - ON.

c. Power - Adjust to maintain a penetration speed of 80 knots.

d. Radios - Turn volume down on any radio equipment badly affected by static.

e. At night - Turn interior lights to full bright to minimize blinding effect of lightning.

10-94. IN THE STORM.

a. Maintain a level attitude and constant power setting airspeed fluctuations should be expected and disregarded.

b. Maintain the original heading, turning only when necessary.

c. The altimeter is unreliable due to differential barometric pressures within the storm. An indicated gain or loss of several hundred feet is not uncommon and should be allowed for in determining minimum safe altitude.

SECTION VI ICE AND RAIN

10-95. ICE AND RAIN.

10-96. In heavy rain, a properly adjusted wiper can be expected to clear the windshield adequately throughout the entire speed range. However, when poor visibility is encountered while cruising in rain, it is recommended that the pilot fly by reference to the flight instruments and the copilot attempt to maintain visual reference. Rain has no noticeable effect on handling or performance of the helicopter.

Note

If the windshield wiper does not start in LOW or MED position, turn the control to HIGH. After the wiper starts, the control may be set at the desired position.

10-97. Before entering icing conditions (visible moisture and below-freezing temperatures), the pilot should actuate the pitot heat, windshield defroster and de-icing system.

Caution

To preclude the possibility of icing, it is recommended that the engine inlet air filters be removed when it is anticipated that the helicopter will be flown under atmospheric conditions conducive to icing.

Caution

Continuous flight in light icing conditions is not recommended because the ice shedding induces rotor blade vibrations, adding greatly to the pilot's work load.

10-98. During flight in icing conditions, the pilot can expect one or all of the following to occur.

a. At any temperature below freezing, a low frequency main blade vibration, caused by asymmetric self-shedding ice.

b. To maintain airspeed, the torque must be increased.

c. An increase in engine egt.

Caution

When operating at outside air temperatures of 40°F or below, icing of the engine air inlet screens can be expected. Ice accumulation on the inlet screens can be detected by illumination of the "Engine Inlet Air" warning light. Continued accumulation of ice will result in partial or complete power loss. It should be noted that illumination of the "Engine Inlet Air" warning light indicates blockage at the inlet screen only and does not reveal icing conditions in the sand and dust separator or on the FOD screen.

Warning

If the ENGINE ICING light fails to illuminate in known icing conditions, or if for any other reason, the engine ice detector system is suspected to be inoperative, pull the ANTI-ICE ENG circuit breaker and check the ENGINE ICE DET light. Ensure DE-ICE switch is ON. If this light does not illuminate the pilot can be reasonably certain the engine ice detector system is inoperative.

Note

Engine ice detector system data not applicable if sand and dust separator unit is installed.

d. Illumination of the ENGINE ICING light.

Note

If the windshield defrosters fail to keep the windshield clear of ice, the side windows may be opened for clear visibility in landing.

CHAPTER 11

CREW DUTIES

SECTION I SCOPE

11-1. SCOPE.

11-2. This chapter covers the responsibilities of each crew member and the primary and alternate functions of each.

11-3. The purpose of this chapter is to provide a compact collection of material and the procedure that must be followed wherein each crew member can readily determine his complete duties.

SECTION II RESPONSIBILITIES

11-4. RESCUE HOIST OPERATING PROCEDURE - HOIST OPERATOR.

11-5. The following sets forth the necessary steps for the hoist operator to actuate the hoist boom outboard, lower cable, retract cable, and return hoist boom to the stowed position. The pilot's hoist controls have priority over the hoist operator's controls.

Note

The hoist cable is color coded as follows: The first 25 feet from the hook end is yellow, the next 175 feet is unpainted, the next 40 feet is yellow and the last 16 feet is red.

a. Check with the pilot (use intercom) that rescue hoist cable cutter, rescue hoist control, and rescue hoist power circuit breakers are in.

b. After pilot has established zero airspeed over the desired location, move boom toggle switch to OUT position to swing hoist boom outboard.

c. Move variable speed control (labeled DOWN/UP) on the hoist control pendant to DOWN to lower the hoist cable. The speed control must be moved to the right then forward.

Note

The further the DOWN/UP speed control is moved from its neutral position, the faster the hoist will run. Hoist cable is painted at each end to provide visual indication of cable footage that is extended.

Caution

The hoist should normally be operated at full speed, as slow speed operation will cause the motor to heat excessively.

d. Move DOWN/UP speed control to UP to raise the hoist load. The speed control must be moved to the left then aft.

Note

In case the extended portion of the hoist cable has to be jettisoned, a CABLE CUT switch is provided on the control box. The cable cutter is an electrically initiated pressure charge type.

e. Move boom toggle switch to IN position to swing hoist boom inboard.

f. Bring hoist load into cabin and swing hoist boom to stowed position (fully inboard).

CHAPTER 12

WEIGHT AND BALANCE COMPUTATION

SECTION I SCOPE

12-1. SCOPE OF WEIGHT AND BALANCE DATA.

12-2. This chapter contains sufficient instructions and data so that the pilot, knowing the basic weight and moment of the helicopter, can compute any combinations of weight and balance.

12-3. No computers are provided for the helicopter; hence, no computer instruction is included.

SECTION II INTRODUCTION

12-4. INTRODUCTION.

12-5. The purpose of this chapter is to provide appropriate information required for the computation of weight and balance for loading an individual helicopter. The data inserted on charts and forms are applicable only to the individual helicopter, the serial number of which appears on the title page of various forms and charts. The charts and forms may change from time to time, but the principle on which they are based will not change. The forms currently in use are the DD 365 series.

Note

For the purpose of clarity, Models YUH-1D, UH-1D and UH-1H helicopters are in Class I Category.

12-6. The aircraft manufacture will insert all identifying data and complete one Weight and Balance Form F if applicable, at time of delivery. (Refer to TM 55-405-9 and AR95-16.)

12-7. The helicopter must be weighed periodically as required by pertinent directives, when major modification or repairs are made, when pilot reports unsatisfactory flight characteristics, and when the basic weight data contained in the records are suspected to be in error.

SECTION III CHART EXPLANATIONS

12-8. CHART C - BASIC WEIGHT AND BALANCE RECORD - DD FORM 365C.

12-9. Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes. The last weight and moment/constant entry is the current weight and balance status of the basic helicopter.

12-10. USE. See chart 12-1 for a sample of DD Form 365C. At time of delivery of a new helicopter, the manufacturer enters the basic weight and moment/constant of the individual helicopter. This chart becomes a part of the "G" file of the helicopter. Subsequent additions to or subtractions from the basic weight and moment/constant in Chart C, are made by the weight and balance technician.

12-11. CHART E - LOADING DATA.

12-12. The loading data in Chart E provides information necessary to work a loading problem for the helicopter.

12-13. USE. From the loading data tables contained in Chart E (chart 12-2) weight and moment/constant are obtained for all variable load items and are added arithmetically to the current basic weight and moment/constant (from Chart C) to obtain the gross weight and moment.

a. The cg of the loaded helicopter is represented by a moment figure opposite the gross weight on the table.

b. If the helicopter is loaded within the forward and aft cg limits, the moment figure will fall numerically between the limiting moments.

c. The effect on cg by the expenditure in flight of such items as fuel, ammunition, etc., may be checked by subtracting the weight and moments of such items from the take-off gross weight and moment, and checking the new moment with the cg table.

Note

This check should be made to determine whether or not the cg will remain within limits during the entire flight.

12-14. The data in chart 12-3 provides weight and balance information for various kits available on the UH-D/H helicopters. Data is provided for the following listed kits:

100,000 BTU Heater Winterization Kit

Aft Battery Installation

Armored Seat Kits

300 Gallon Internal Auxiliary Fuel Tank.

60 Gallon External Auxiliary Fuel Tanks.

100 Gallon External Auxiliary Fuel Tanks.

SM-23 Door Mounted M-60.

M-6 Subsystem.

XM-3 FFAR Subsystem.

External Stores Support

XM52 Smoke Generator Sybsystem

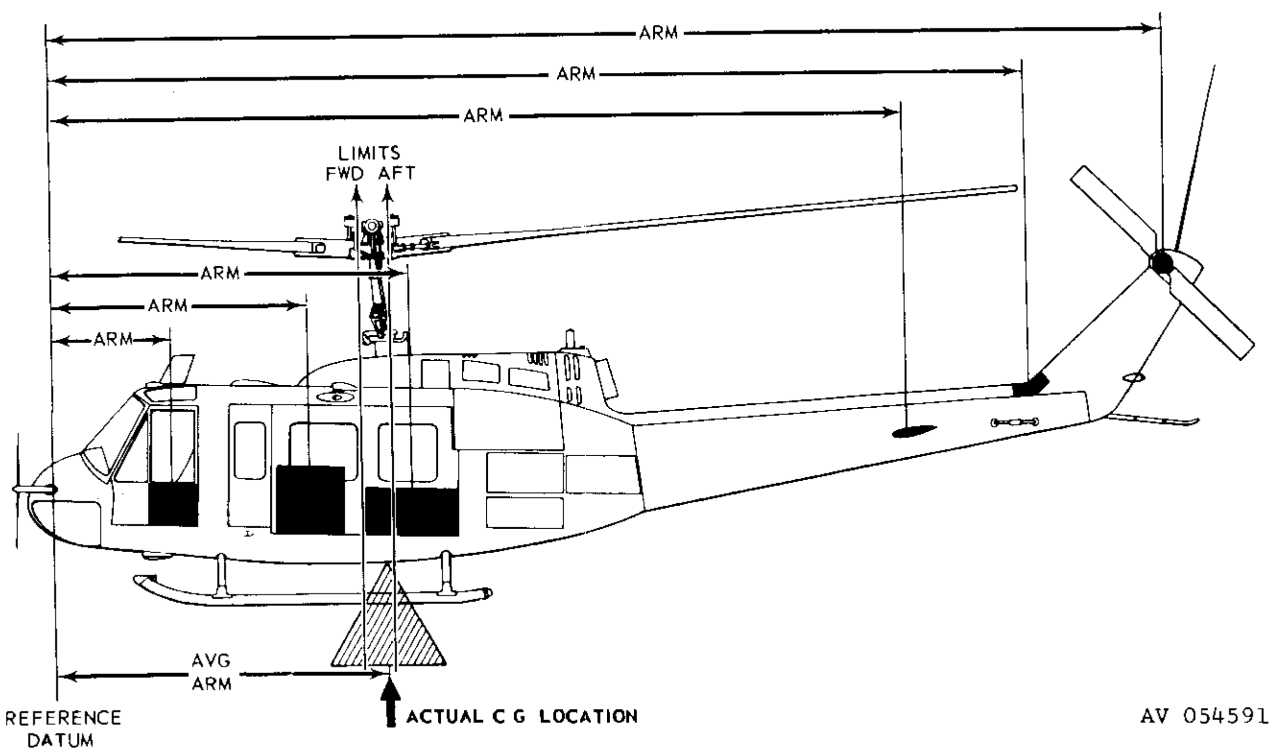


Figure 12-1. Reference datum

CHART C—BASIC WEIGHT AND BALANCE RECORD

(CONTINUOUS HISTORY OF CHANGES IN STRUCTURE OR EQUIPMENT AFFECTING WEIGHT AND BALANCE)

FOR USE IN T. O. 1-1B-40 & AN 01-1B-40

PAGE NO.

AIRPLANE MODEL: YHU-1D

SERIAL NO.: SAMPLE

DATE	ITEM NO. IN	ITEM NO. OUT	DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE ADDED (+) WEIGHT	ADDED (+) ARM	ADDED (+) MOMENT[1] /100	REMOVED (−) WEIGHT	REMOVED (−) ARM	REMOVED (−) MOMENT[1] /100	RUNNING TOTAL BASIC AIRPLANE WEIGHT	RUNNING TOTAL MOMENT[1] /100	RUNNING TOTAL INDEX[1] CG
10-25-61			BASIC HELICOPTER							4722.0	6876.0	145.6
CAMPBELL 11-15-61	✓		HEATER KIT (CHARTA-ITEM D-13)	73.0	197	143.1				4795.0	7019.1	146.4
12-6-61	✓		APX-44 TRANSPONDER (CHARTA-ITEMD-10	23.0	191	43.9						
RUCKER	✓		TRANS. MT (CHART A-ITEM D-11)	2.0	191	4.3				4822.0	7068.1	146.6
	✓		APX-44 CONTROL (CHARTA-ITEM B-8)	2.0	32	0.8						
12-29-61		✓	ENGINE L-E06010				480.0	187	897.6	4820.0	7064.4	146.6
RUCKER	✓		ENGINE L-E06089	478.0	187	893.9						

[1] Enter constant used below line.

[1] Balance computer index.

DD FORM 1 SEP 54 365C

PREVIOUS EDITIONS OF THIS FORM MAY BE USED UNTIL STOCKS ARE EXHAUSTED.

16—70676-1 U. S. GOVERNMENT PRINTING OFFICE

Chart 12-1. Sample DD form 365C (Chart C)

HELICOPTER DIAGRAM

CHART E
SHEET 1 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

48 FOOT MAIN ROTOR

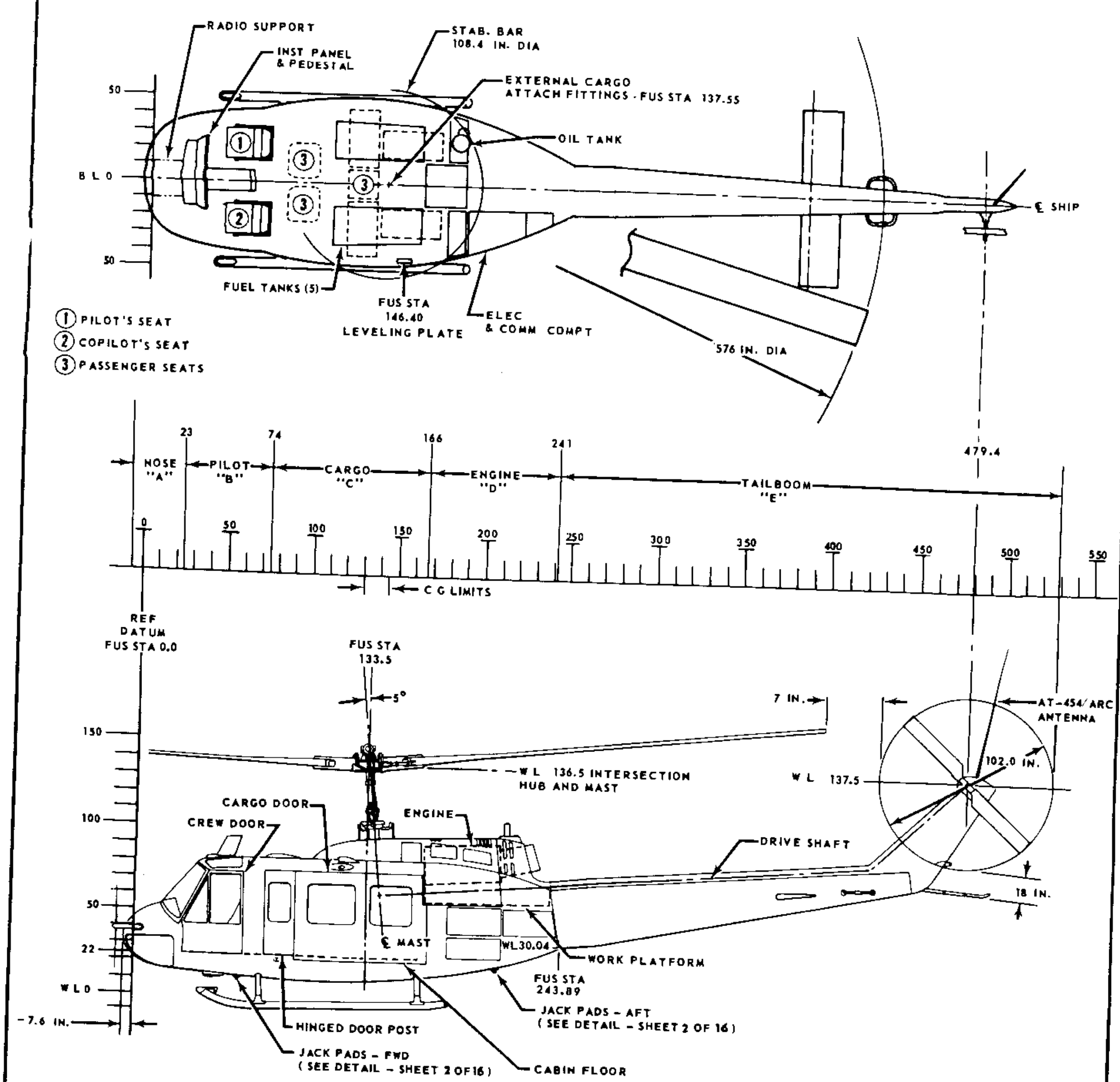
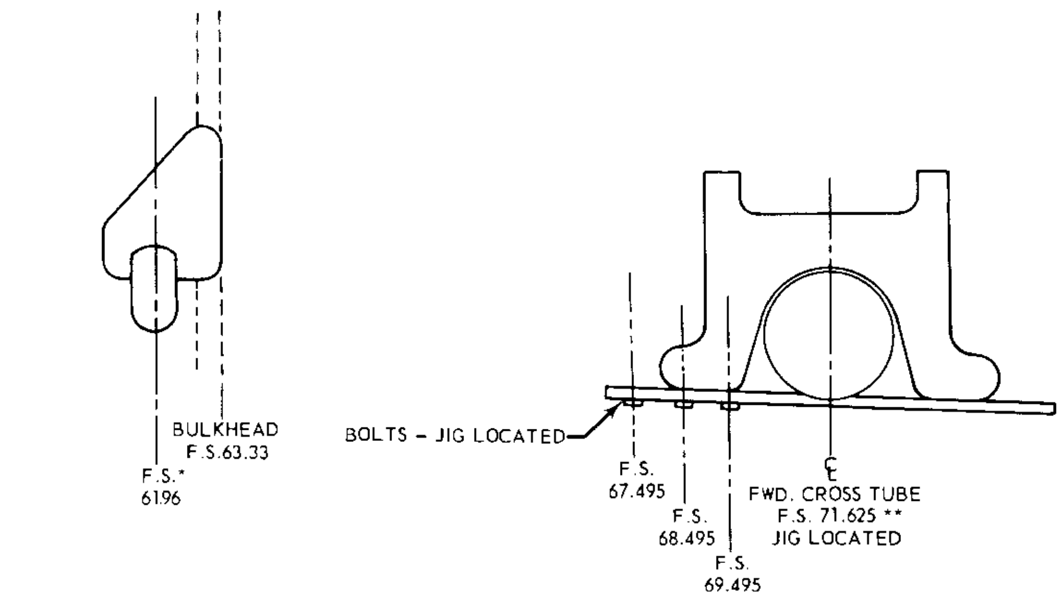


Chart 12-2. Chart E - loading data (Sheet 1 of 16)

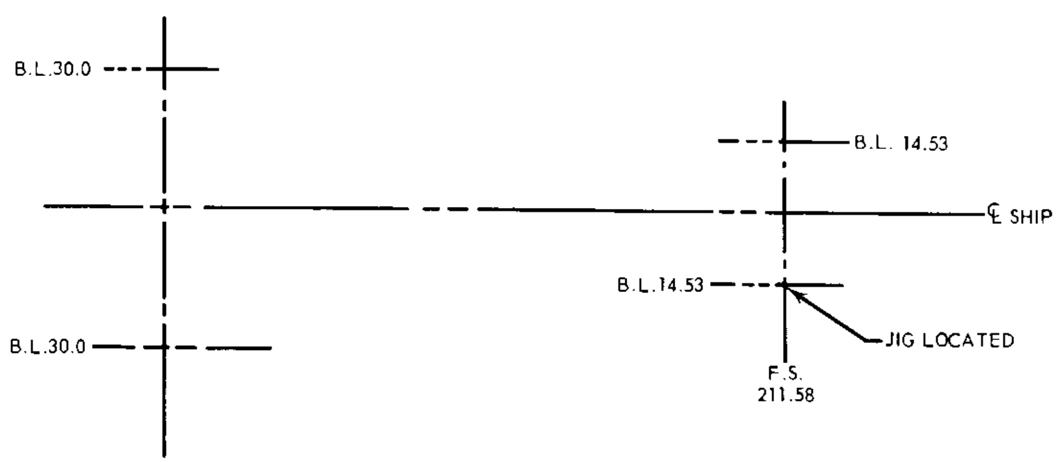
CHART E
SHEET 2 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

JACK PAD LOCATION DATA



*F.S. 61.96 IS APPROXIMATE BUT SHOULD BE ACCURATE WITHIN ± 1/32 INCHES. FOR EXACT STATION DROP PLUMB BOB FROM CENTER OF FORWARD CROSS TUBE (F.S. 71.625) OR FROM CENTER OF ONE OF THE STRAP ATTACHING BOLTS SHOWN IN VIEW AT RIGHT, AND FROM JACK PAD AND MEASURE EXACT DISTANCE.

**CROSS TUBE USED AS JIG POINT ON WEIGHING RECORD, FORM 365B.



JACK PADS - PLAN VIEW

Chart 12-2. Chart E - loading data (Sheet 2 of 16)

CHART E
SHEET 3 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

FUEL LOADING TABLES
REGULAR

GAL	WEIGHT 6.5 LB/GAL	C G	MOMENT/100	GAL	WEIGHT 6.5 LB/GAL	C G	MOMENT/100
10	65	144.0	94	120	780	137.1	1069
20	130	144.0	187	130	845	139.4	1178
30	195	144.0	281	140	910	141.5	1288
40	260	138.0	359	150	975	143.4	1398
50	325	133.9	435	160	1040	145.1	1509
60	390	131.0	511	170	1105	146.5	1619
70	455	129.1	587	180	1170	147.8	1729
80	520	127.7	664	190	1235	148.9	1839
*85	553	127.1	703	200	1300	149.9	1949
90	585	127.7	747	210	1365	150.8	2058
100	650	130.5	848	220	1430	151.6	2168
110	715	134.1	959				

*Most critical fuel amount for most forward flight condition.

AUXILIARY-INTERNAL-300 GALLONS

GAL	WEIGHT 6.5 LB/GAL	MOMENT/100 STA 151.0	GAL	WEIGHT 6.5 LB/GAL	MOMENT/100 STA 151.0
10	65	98	190	1235	1865
20	130	196	200	1300	1963
30	195	294	210	1365	2061
40	260	393	220	1430	2159
50	325	491	230	1495	2257
60	390	589	240	1560	2356
70	455	687	250	1625	2454
80	520	785	260	1690	2552
90	585	883	270	1755	2650
100	650	982	280	1820	2748
110	715	1080	290	1885	2846
120	780	1178	300	1950	2945
130	845	1276			
140	910	1374			
150	975	1472			
160	1040	1570			
170	1105	1669			
180	1170	1767			

FUEL TANK SEQUENCE:

When auxiliary tank is installed, fuel is pumped from the auxiliary tank to the regular tank. Fuel level in regular tank is controlled by float switches. The auxiliary tank is emptied before any appreciable amount is removed from the regular tank.

Chart 12-2. Chart E - loading data (Sheet 3 of 16)

CHART E
SHEET 4 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

FUEL LOADING TABLE

AUXILIARY - EXTERNAL

GAL	WEIGHT 6.5 LB/GAL	MOMENT/100 STA 142.5	GAL	WEIGHT 6.5 LB/GAL	MOMENT/100 STA 142.5
10	65	93	110	715	1019
20	130	185	120	780	1112
30	195	278	130	845	1204
40	260	371	140	910	1297
50	325	463	150	975	1389
60	390	556	160	1040	1482
70	455	648	170	1105	1575
80	520	741	180	1170	1667
90	585	834	190	1235	1760
100	650	926	200	1300	1853

FUEL TANK SEQUENCE:

When auxiliary tank is installed, fuel is pumped from the auxiliary tank to the regular tank. Fuel level in regular tank is controlled by float switchs. The auxiliary tank is emptied before any appreciable amount is removed from the regular tank.

Chart 12-2. Chart E - loading data (Sheet 4 of 16)

CHART E
SHEET 5 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

OIL LOADING TABLE

GAL	WEIGHT (LB)	MOMENT/100 STA 173.0	GAL	WEIGHT (LB)	MOMENT/100 STA 173.0
0.5	4	7	2.5	19	33
1.0	8	14	3.0	23	40
1.5	11	19	3.5	26	45
2.0	15	26	4.0	30	52
			4.5	34	59

EXTERNAL CARGO LOADING TABLE

WEIGHT (LB)	MOMENT/100 STA 138.0	WEIGHT (LB)	MOMENT/100 STA 138.0	WEIGHT (LB)	MOMENT/100 STA 138.0
50	69	1550	2139	3050	4209
100	138	1600	2208	3100	4278
150	207	1650	2277	3150	4347
200	276	1700	2346	3200	4416
250	345	1750	2415	3250	4485
300	414	1800	2484	3300	4554
350	483	1850	2553	3350	4623
400	552	1900	2622	3400	4692
450	621	1950	2691	3450	4761
500	690	2000	2760	3500	4830
550	759	2050	2829	3550	4899
600	828	2100	2898	3600	4968
650	897	2150	2967	3650	5037
700	966	2200	3036	3700	5106
750	1035	2250	3105	3750	5175
800	1104	2300	3174	3800	5244
850	1173	2350	3243	3850	5313
900	1242	2400	3312	3900	5382
950	1311	2450	3381	3950	5451
1000	1380	2500	3450	4000	5520
1050	1449	2550	3519		
1100	1518	2600	3588		
1150	1587	2650	3657		
1200	1656	2700	3726		
1250	1725	2750	3795		
1300	1794	2800	3864		
1350	1863	2850	3933		
1400	1932	2900	4002		
1450	2001	2950	4071		
1500	2070	3000	4140		

Chart 12-2. Chart E - loading data (Sheet 5 of 16)

CHART E
SHEET 6 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

CARGO TIE DOWN FITTING DATA

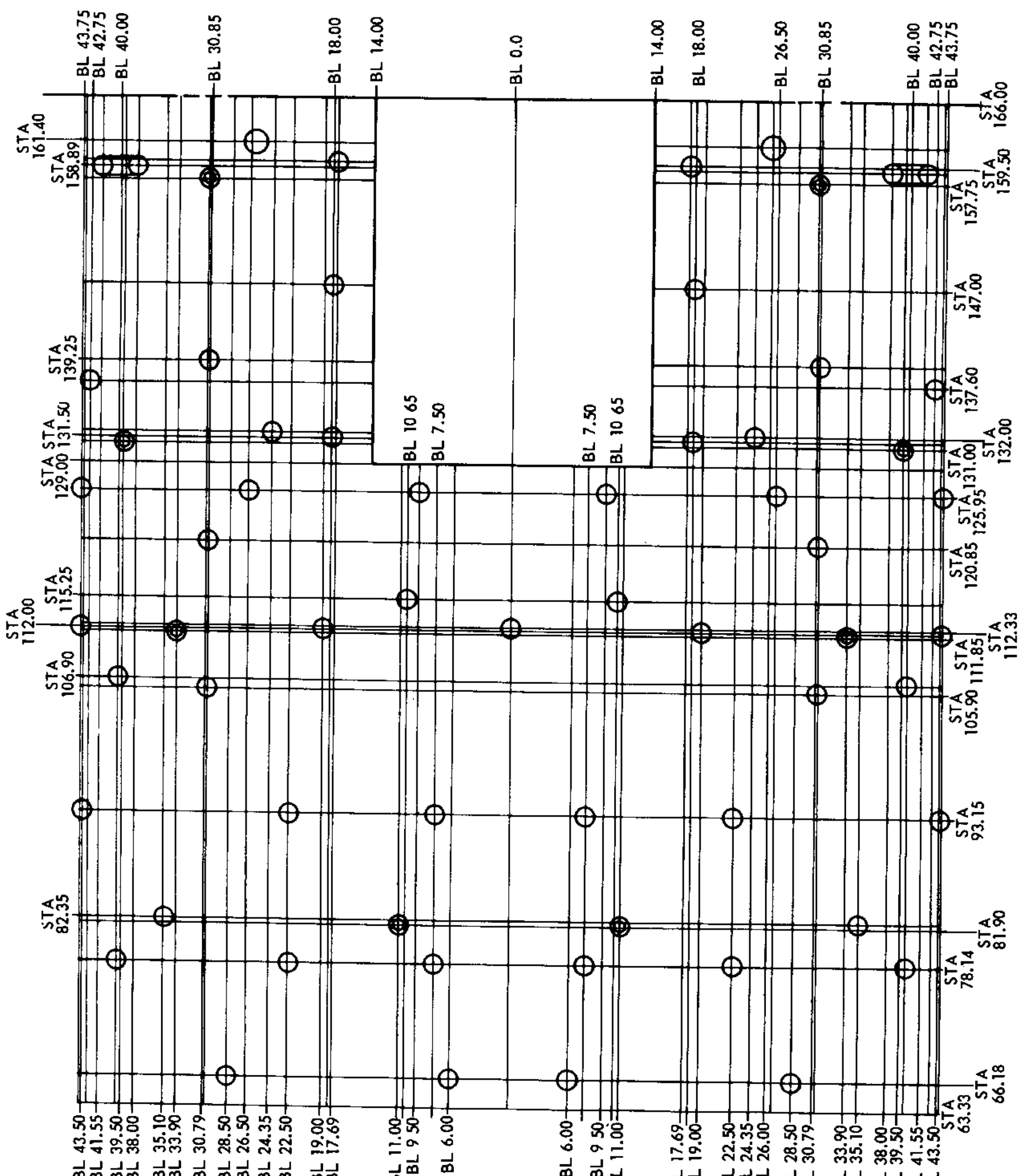


Chart 12-2. Chart E - loading data (Sheet 6 of 16)

CHART E
SHEET 7 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

INTERNAL CARGO LOADING TABLE

MOMENT/100

CARGO WEIGHT (POUNDS)	CARGO CENTER OF GRAVITY (FUS STA)						CARGO WEIGHT (POUNDS)	CARGO CENTER OF GRAVITY (FUS STA)					
	75.0	90.0	105.0	120.0	135.0	150.0		75.0	90.0	105.0	120.0	135.0	150.0
50	38	45	53	60	68	75	1550	1163	1395	1628	1860	2093	2325
100	75	90	105	120	135	150	1600	1200	1440	1680	1920	2160	2400
150	113	135	158	180	203	225	1650	1238	1485	1733	1980	2228	2475
200	150	180	210	240	270	300	1700	1275	1530	1785	2040	2295	2550
250	188	225	263	300	338	375	1750	1313	1575	1838	2100	2363	2625
300	225	270	315	360	405	450	1800	1350	1620	1890	2161	2430	2700
350	263	315	368	420	473	525	1850	1388	1665	1943	2220	2498	2775
400	300	360	420	480	540	600	1900	1425	1710	1995	2280	2565	2850
450	338	405	473	540	608	675	1950	1463	1755	2048	2340	2633	2925
500	375	450	525	600	675	750	2000	1500	1800	2100	2400	2700	3000
550	413	495	578	660	743	825	2050	1538	1845	2153	2460	2768	3075
600	450	540	630	720	810	900	2100	1575	1890	2205	2520	2835	3150
650	488	585	683	780	878	975	2150	1613	1935	2258	2580	2903	3225
700	525	630	735	840	945	1050	2200	1650	1980	2310	2640	2970	3300
750	563	675	788	900	1013	1125	2250	1688	2025	2363	2700	3038	3375
800	600	720	840	960	1080	1200	2300	1725	2070	2415	2760	3105	3450
850	638	765	893	1020	1148	1275	2350	1763	2115	2468	2820	3173	3525
900	675	810	945	1080	1215	1350	2400	1800	2160	2520	2880	3240	3600
950	713	855	998	1140	1283	1425	2450	1838	2205	2573	2940	3308	3675
1000	750	900	1050	1200	1350	1500	2500	1875	2250	2625	3000	3375	3750
1050	788	945	1103	1260	1418	1575	2550	1913	2295	2678	3060	3443	3825
1100	825	990	1155	1320	1485	1650	2600	1950	2340	2730	3120	3510	3900
1150	863	1035	1208	1380	1553	1725	2650	1988	2385	2783	3180	3578	3975
1200	900	1080	1260	1440	1620	1800	2700	2025	2430	2835	3240	3645	4050
1250	938	1125	1313	1500	1688	1875	2750	2063	2475	2888	3300	3713	4125
1300	975	1170	1365	1560	1755	1950	2800	2100	2520	2940	3360	3780	4200
1350	1013	1215	1418	1620	1823	2025	2850	2138	2565	2993	3420	3848	4275
1400	1050	1260	1470	1680	1890	2100	2900	2175	2610	3045	3480	3915	4350
1450	1088	1305	1523	1740	1958	2175	2950	2213	2655	3098	3540	3983	4425
1500	1125	1350	1575	1800	2025	2250	3000	2250	2700	3150	3600	4050	4500

CAUTION

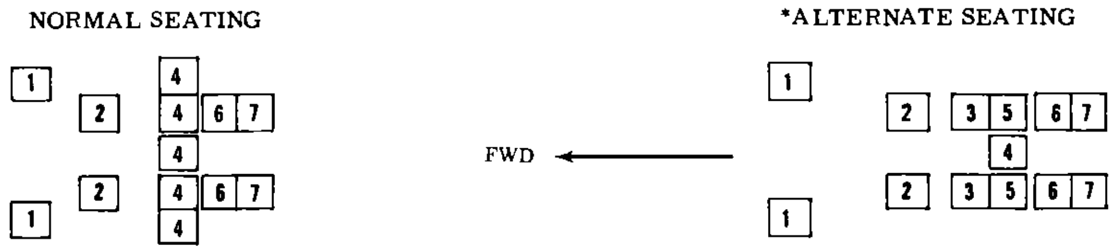
It is possible to exceed the cg limits by improper loading. Fuel consumption, cargo weight and placement, and correct crew weight must be determined for satisfactory balance. All necessary information may be obtained from this manual.

Chart 12-2. Chart E - loading data (Sheet 7 of 16)

CHART E
SHEET 8 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

TABLE OF MOMENTS FOR PERSONNEL

POSITION IDENTIFICATION



*FOR LITTER INSTALLATION. REMOVE 2. 3. 5. 6. AND 7; REPLACE 3. 5. AND 6 WITH [8]

MOMENT/100

Weight (Lb)	Pilot or Copilot Sta 46.7	Passenger Sta 85.0	Passenger Sta 105.0	Passenger or Attendant Sta 117.0	Passenger Sta 122.0	Passenger Sta 139.0	Passenger Sta 156.0	Litter Patient Sta 120.0
Position -	1	2	3	4	5	6	7	8
170	79	145	179	199	207	236	265	204
180	84	153	189	211	220	250	281	216
190	89	162	200	222	232	264	296	228
200	93	170	210	234	244	278	312	240
210	98	179	221	246	256	292	328	252
220	103	187	231	257	268	306	343	264
230	107	196	242	269	281	320	359	276
240	112	204	252	281	293	334	374	288
250	117	213	263	293	305	348	390	300

TABLE OF MOMENTS FOR CREW MOVEMENT

MOMENT/100

	To Position							
From Position	1	2	3	4	5	6	7	8
1	----	+77	+117	+141	+151	+185	+219	+147
2	- 77	---	+ 40	+ 64	+ 74	+108	+142	+ 70
3	-117	-40	----	+ 24	+ 34	+ 68	+102	+ 30
4	-141	-64	- 24	----	+ 10	+ 44	+ 78	+ 6
5	-151	-74	- 34	- 10	----	+ 34	+ 68	- 4
6	-185	-108	- 68	- 44	- 34	----	+ 34	- 38
7	-219	-142	-102	- 78	- 68	- 34	----	- 72
8	-147	- 70	- 30	- 6	+ 4	+ 38	+ 72	----

NOTE: Based on 200 pounds per man.

Chart 12-2. Chart E - loading data (Sheet 8 of 16)

CENTER OF GRAVITY TABLE MOMENT/100

CHART E
SHEET 9 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

GROSS WEIGHT (POUNDS)	Numbers in Italic are actual moment limits for weights indicated but not for stations shown in column head.										
	130.0	131.0	132.0	133.0	134.0	136.0	138.0	140.0	142.0	143.0	144.0
4900	6370	6419	6468	6517	6566	6664	6762	6860	6958	7007	7056
4925	6403	6452	6501	6550	6600	6698	6797	6895	6994	7043	7092
4950	6435	6485	6534	6583	6633	6732	6831	6930	7029	7069	7128
4975	6468	6517	6567	6617	6667	6766	6866	6965	7065	7114	7164
5000	6500	6550	6600	6650	6700	6800	6900	7000	7100	7150	7200
5025	6533	6583	6633	6683	6734	6834	6935	7035	7136	7186	7236
5050	6565	6616	6666	6717	6767	6868	6969	7070	7171	7222	7272
5075	6598	6648	6699	6750	6801	6902	7004	7105	7207	7257	7308
5100	6630	6681	6732	6783	6834	6936	7038	7140	7242	7293	7344
5125	6663	6714	6765	6816	6868	6970	7073	7175	7278	7329	7380
5150	6695	6747	6798	6850	6901	7004	7107	7210	7313	7365	7416
5175	6728	6779	6831	6883	6935	7038	7142	7245	7349	7400	7452
5200	6760	6812	6864	6916	6968	7072	7176	7280	7384	7436	7488
5225	6793	6845	6897	6949	7002	7106	7211	7315	7420	7472	7524
5250	6825	6878	6930	6983	7035	7140	7245	7350	7455	7508	7560
5275	6858	6910	6963	7016	7069	7174	7280	7385	7491	7543	7596
5300	6890	6943	6996	7049	7102	7208	7314	7420	7526	7579	7632
5325	6923	6976	7029	7082	7136	7242	7349	7455	7562	7615	7668
5350	6955	7009	7062	7116	7169	7276	7383	7490	7597	7651	7704
5375	6988	7041	7095	7149	7203	7310	7418	7525	7633	7686	7740
5400	7020	7074	7128	7182	7236	7344	7452	7560	7668	7722	7776
5425	7053	7107	7161	7215	7270	7378	7487	7595	7704	7758	7812
5450	7085	7140	7194	7249	7303	7412	7521	7630	7739	7794	7848
5475	7118	7172	7227	7282	7337	7446	7556	7665	7775	7829	7884
5500	7150	7205	7260	7315	7370	7480	7590	7700	7810	7865	7920
5525	7183	7238	7293	7348	7404	7514	7625	7735	7846	7901	7956
5550	7215	7271	7326	7382	7434	7548	7659	7770	7881	7937	7992
5575	7248	7303	7359	7415	7471	7582	7694	7805	7917	7972	8028
5600	7280	7336	7392	7448	7504	7616	7728	7840	7952	8008	8064
5625	7313	7369	7425	7481	7538	7650	7763	7875	7988	8044	8100
5650	7345	7402	7458	7515	7571	7684	7797	7910	8023	8080	8136
5675	7378	7434	7491	7548	7605	7718	7832	7945	8059	8115	8172
5700	7410	7467	7524	7581	7638	7752	7866	7980	8094	8151	8208
5725	7443	7500	7557	7614	7672	7786	7901	8015	8130	8187	8244
5750	7475	7533	7590	7648	7705	7820	7935	8050	8165	8223	8280
5775	7508	7565	7623	7681	7739	7854	7970	8085	8201	8258	8316
5800	7540	7598	7656	7714	7772	7888	8004	8120	8236	8294	8352
5825	7573	7631	7689	7747	7806	7922	8039	8155	8272	8338	8388
5850	7605	7664	7722	7781	7839	7956	8073	8190	8307	8366	8424
5875	7638	7696	7755	7814	7873	7990	8108	8225	8343	8401	8460

Chart 12-2. Chart E - loading data (Sheet 9 of 16)

CENTER OF GRAVITY TABLE MOMENT/100

CHART E
SHEET 10 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

Numbers in Italic are actual moment limits for weights indicated but not for stations shown in column head.

GROSS WEIGHT (POUNDS)	130.0	131.0	132.0	133.0	134.0	136.0	138.0	140.0	142.0	143.0	144.0
5900	7670	7729	7788	7847	7906	8024	8142	8260	8378	8437	8496
5925	7703	7762	7821	7880	7940	8058	8177	8295	8414	8473	8532
5950	7735	7795	7854	7914	7973	8092	8211	8330	8449	8509	8568
5975	7768	7827	7887	7947	8007	8126	8246	8365	8485	8544	8604
6000	7800	7860	7920	7980	8040	8160	8280	8400	8520	8580	8640
6025	7833	7893	7953	8013	8074	8194	8315	8435	8556	8616	8676
6050	7865	7926	7986	8047	8107	8228	8349	8470	8591	8652	8712
6075	7898	7958	8019	8080	8141	8262	8384	8505	8627	8687	8748
6100	7930	7991	8052	8113	8174	8296	8418	8540	8662	8723	8784
6125	7963	8024	8085	8146	8208	8330	8453	8575	8698	8759	8820
6150	7995	8057	8118	8180	8241	8364	8487	8610	8733	8795	8856
6175	8028	8089	8151	8213	8275	8398	8522	8645	8769	8830	8892
6200	8060	8122	8184	8246	8308	8432	8556	8680	8804	8866	8928
6225	8093	8155	8217	8279	8342	8466	8591	8715	8840	8902	8964
6250	8125	8188	8250	8313	8375	8500	8625	8750	8875	8938	9000
6275	8158	8220	8283	8346	8409	8534	8660	8785	8911	8973	9036
6300	8190	8253	8316	8379	8442	8568	8694	8820	8946	9009	9072
6325	8223	8286	8349	8412	8476	8602	8729	8855	8982	9045	9108
6350	8255	8319	8382	8446	8509	8636	8763	8890	9017	9081	9144
6375	8288	8351	8415	8479	8543	8670	8798	8925	9053	9116	9150
6400	8320	8384	8448	8512	8576	8704	8832	8960	9088	9152	9216
6425	8353	8417	8481	8545	8610	8738	8867	8995	9124	9188	9252
6450	8385	8450	8514	8579	8643	8772	8901	9030	9159	9224	9288
6500	8450	8515	8580	8645	8710	8840	8970	9100	9230	9295	9360
6525	8483	8548	8613	8678	8744	8874	9005	9135	9266	9331	9396
6550	8515	8581	8646	8712	8777	8908	9039	9170	9301	9367	9432
6575	8548	8613	8679	8745	8810	8942	9074	9205	9337	9402	9468
6600	8580	8646	8712	8778	8844	8976	9108	9240	9372	9438	9504
6625	8613	8679	8745	8811	8878	9101	9143	9275	9408	9474	9540
6650	8645	8712	8778	8845	8911	9044	9177	9310	9443	9510	9576
6675	8678	8744	8811	8878	8945	9078	9212	9345	9479	9545	9612
6700	8710	8777	8844	8911	8978	9112	9246	9380	9514	9581	9648
6725	8743	8810	8877	8944	9012	9146	9281	9415	9550	9617	9684
6750	8775	8843	8910	8978	9045	9180	9315	9450	9585	9653	9720
6775	8808	8875	8943	9011	9079	9214	9350	9485	9621	9688	9756
6800	8840	8908	8976	9044	9112	9248	9384	9520	9656	9724	9792
6825	8873	8941	9009	9077	9146	9282	9419	9555	9692	9760	9828
6850	8905	8974	9042	9111	9179	9316	9453	9590	9727	9796	9864
6875	8938	9006	9075	9144	9213	9350	9488	9625	9763	9831	9900

Chart 12-2. Chart E - loading data (Sheet 10 of 16)

CENTER OF GRAVITY TABLE MOMENT/100

CHART E
SHEET 11 of 16
MODELS UH-1D and UH-1H
CHART DATE: APRIL 20, 1964

Numbers in italic are actual moment limits for weights indicated but not for stations shown in column head.

GROSS WEIGHT POUNDS	130.0	131.0	132.0	133.0	134.0	136.0	138.0	140.0	142.0	143.0	144.0
6900	8970	9039	9108	9177	9246	9384	9522	9660	9798	9867	9936
6925	9003	9072	9141	9210	9280	9418	9557	9695	9834	9903	9972
6950	9035	9105	9174	9244	9313	9452	9591	9730	9869	9939	10008
6975	9068	9137	9207	9277	9347	9486	9626	9765	9905	9974	10044
7000	9100	9170	9240	9310	9380	9520	9660	9800	9940	10010	10080
7025	9133	9203	9273	9343	9414	9554	9695	9835	9976	10046	10116
7050	9165	9236	9306	9377	9447	9588	9729	9870	10011	10082	10152
7075	9198	9268	9339	9410	9481	9622	9664	9905	10047	10117	10188
7100	9230	9301	9372	9443	9514	9656	9798	9940	10082	10153	10224
7125	9263	9334	9405	9476	9548	9690	9833	9975	10118	10189	10260
7150	9295	9367	9438	9510	9581	9724	9867	10010	10153	10225	10296
7175	9328	9399	9471	9543	9615	9758	9902	10045	10189	10260	10332
7200	9360	9432	9504	9576	9648	9792	9936	10080	10224	10296	10368
7225	9393	9465	9537	9609	9682	9826	9971	10115	10260	10332	10404
7250	9425	9498	9570	9643	9715	9860	10005	10150	10295	10368	10440
7275	9458	9530	9603	9676	9749	9894	10040	10185	10331	10403	10476
7300	9490	9563	9636	9709	9782	9928	10074	10220	10366	10439	10512
7325	9523	9596	9669	9742	9816	9962	10109	10255	10402	10475	10548
7350	9555	9629	9702	0776	9849	9996	10143	10290	10437	10511	10584
7375	9588	9661	9735	9809	9883	10030	10178	10325	10473	10546	10620
7400	9620	9694	9768	9842	9916	10064	10212	10360	10508	10582	10656
7425	9653	9727	9801	9875	9950	10098	10247	10395	10544	10618	10692
7450	9685	9760	9834	9909	9983	10132	10281	10430	10579	10654	10728
7475	9718	9792	9867	9942	10017	10166	10316	10465	10615	10689	10764
7500	9750	9825	9900	9975	10050	10200	10350	10500	10650	10725	10800
7525	9783	9858	9933	10008	10084	10234	10385	10535	10686	10761	10836
7550	9815	9891	9966	10042	10117	10268	10419	10570	10721	10797	10872
7575	9848	9923	9999	10075	10151	10302	10454	10605	10757	10832	10908
7600	9880	9956	10032	10108	10184	10336	10488	10640	10792	10868	10944
7625	9913	9989	10065	10141	10218	10370	10523	10675	10828	10904	10980
7650	9945	10022	10098	10175	10251	10404	10557	10710	10863	10940	11016
7675	9978	10054	10131	10208	10285	10438	10592	10745	10899	10975	11052
7700	10010	10087	10164	10241	10318	10472	10626	10780	10934	11011	11088
7725	10043	10120	10197	10274	10352	10506	10661	10815	10970	11047	11124
7750	10075	10153	10230	10308	10385	10540	10695	10850	11005	11083	11160
7775	10108	10185	10263	10341	10419	10574	10730	10885	11041	11118	11196
7800	10140	10218	10296	10374	10452	10608	10764	10920	11076	11154	11232
7825	10173	10251	10329	10407	10486	10642	10799	10995	11112	11190	11268
7850	10205	10284	10362	10441	10519	10676	10833	10990	11147	11226	11304
7875	10238	10316	10395	10474	10553	10710	10868	11025	11183	11261	11340

Chart 12-2. Chart E - loading data (Sheet 11 of 16)