BHT-412-FM-2

MODEL 412

ROTORCRAFT FLIGHT MANUAL

BHT 33108 THROUGH 33213
AND
BHT36001 THROUGH 36019

Bell Helicopter
A Textron Company

POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

BHT-412-FM-2

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ROTORCRAFT FLIGHT MANUAL

BHT 33108 — 33213 AND 36001 — 36019

TYPE CERTIFICATION NO. H4SW REGISTRATION NO. ______

SERIAL NO. ______

APPROVED BY [signature] DATE NOVEMBER 17, 1983

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TEXAS 76193-0170

THIS MANUAL SHALL BE IN THE HELICOPTER DURING ALL OPERATIONS

Bell Helicopter
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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

29 APRIL 1992
REVISION 9 — 05 NOVEMBER 2002

NOTICE PAGE

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Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

S/N 33108 — 33213

S/N 36001 — 36019

TEMPORARY REVISION FOR AIRSPEED RESTRICTION

This Flight Manual Temporary Revision mandates a reduction of airspeed until after compliance with ALERT SERVICE BULLETIN No. 412-96-89 Installation and/or Inspection of Tail Rotor Flapping Stop.

Insert these temporary revision pages opposite like numbered pages in Flight Manual.

DO NOT remove existing pages from Flight Manual.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

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TEMPORARY REVISION — 16 AUGUST 1996

Bell MODEL 412

ROTOR CRAFT FLIGHT MANUAL

S/N 33108 — 33213

S/N 36001 — 36019

TEMPORARY REVISION FOR MAIN ROTOR DROOP RESTRAINT PREFLIGHT CHECK

This Temporary Revision addresses Main Rotor Droop Restraint Preflight Check Procedures Per ASB 412-97-91 Reissue A.

Insert these temporary revision pages opposite like numbered pages in Flight Manual.

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APRIL 29, 1982

TEMPORARY REVISION — 21 APRIL 1998

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NOTE

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Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Temporary .... 16 Aug 96

APPROVED:

Walter L. Downs

ACTG MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

LOG OF APPROVED REVISIONS

Temporary .... 21 Apr 98

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FORT WORTH, TX 76193-0170

6-11/6-12 0
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NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF FAA APPROVED REVISIONS

Original	0	17 NOV 83
Revision	1	16 DEC 83
Revision	2	31 AUG 84
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Revision	9	05 NOV 02

APPROVED:

DATE: NOV 5 2002

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GENERAL INFORMATION

ORGANIZATION

The Rotorcraft Flight Manual is divided into six sections as follows:

Section 1 — LIMITATIONS

Section 2 — NORMAL PROCEDURES

Section 3 — EMERGENCY AND MALFUNCTION PROCEDURES

Section 4 — PERFORMANCE

Section 5 — OPTIONAL EQUIPMENT SUPPLEMENTS

Section 6 — CATEGORY "A" OPERATIONS

Sections 1 through 4 contain the FAA approved data necessary to operate the basic helicopter in a safe and efficient manner.

Section 5 contains the FAA approved supplements for optional equipment, which shall be used in conjunction with the basic Flight Manual when the respective optional equipment kits are installed.

Section 6 contains limitations, procedures and performance data for Category "A" Operations.

The Manufacturer's Data (BHT-412-MD-2) manual, contains information to be used in conjunction with the Flight Manual. The manual is divided into four sections

Section 1 — WEIGHT AND BALANCE

Section 2 — SYSTEMS DESCRIPTION

Section 3 — OPERATIONAL INFORMATION

Section 4 — HANDLING/SERVICING/MAINTENANCE

TERMINOLOGY

WARNINGS, CAUTIONS, AND NOTES

Warnings, cautions, and notes are used throughout this manual to emphasize important and critical instructions as follows:

WARNING

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH, IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY OR LOSS OF LIFE.

CAUTION

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO OR DESTRUCTION OF EQUIPMENT.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

USE OF PROCEDURAL WORDS

The concept of procedural word usage and intended meaning which has been adhered to in preparing this manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

"Should" has been used only when application of a procedure is recommended.

"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicate futurity, never to indicate a mandatory procedure.

ABBREVIATIONS AND ACRONYMS

Abbreviations and acronyms used throughout this manual are defined as follows:

AC	—	Alternating Current
ADI	—	Attitude Director Indicator
AFCS	—	Automatic Flight Control System
AGL	—	Above Ground Level
ALTN	—	Alternate
ANTI COLL	—	Anticollision
API	—	Actuator Position Indicator
ATC	—	Air Traffic Control
ATT	—	Attitude
AUTO	—	Automatic
AUX SYS	—	Auxiliary System
BAT	—	Battery
C	—	Celsius
C BOX	—	Combining Gearbox
CG	—	Center of Gravity
cm	—	Centimeter(s)
CYC CTR	—	Cyclic Center
DC	—	Direct Current
DECR	—	Decrease
DME	—	Distance Measuring Equipment
ELT	—	Emergency Locator Transmitter
EMERG	—	Emergency
ENG	—	Engine
ENG RPM	—	Engine Power Turbine RPM (N2)
F	—	Fahrenheit
FAR	—	Federal Aviation Regulation
FT	—	Force Trim or Foot/Feet
FUEL PRESS	—	Fuel Pressure
FUEL TRANS		Fuel Transfer
GAS PROD	—	Gas Producer (N1)
GEN	—	Generator
GOV	—	Governor
H_D	—	Density Altitude
H_P	—	Pressure Altitude

HP 1/HP 2	—	Helipilot 1/Helipilot 2
H-V	—	Height-Velocity
HYDR SYS	—	Hydraulic System
IFR	—	Instrument Flight Rules
IGE	—	In Ground Effect
IGN	—	Ignition
IN		Inch(es)
INCR	—	Increase
INTCON	—	Interconnect
INV	—	Inverter
IMC	—	Instrument Meteorological Conditions
ITT	—	Interturbine Temperature
IVSI	—	Instantaneous Vertical Speed Indicator
KCAS	—	Knots Calibrated Airspeed
kg	—	Kilograms
KIAS	—	Knots Indicated Airspeed
KTAS	—	Knots True Airspeed
LB	—	Pound(s)
LRC	—	Long Range Cruise
LT	—	Light
MAG	-	Magnetic
MAX END		Maximum Endurance
MCP	-	Maximum Continuous Power
mm	-	Millimeter(s)
NON-ESNTL	—	Non Essential
NORM	-	Normal
OAT	—	Outside Air Temperature
OEI	—	One Engine Inoperative
OGE	—	Out of Ground Effect
OVRD	—	Override
PART SEP	—	Particle Separator
PNL	—	Panel
PRI	—	Primary
PSI	—	Pounds per Square Inch
RPM	—	Revolutions Per Minute
SAS	—	Stability Augmentation System
SL	—	Sea Level
sq	—	Square
STBY	—	Standby
TEMP		Temperature
VFR	-	Visual Flight Rules
VG	-	Vertical Gyro
VHF	—	Very High Frequency
VMC	—	Visual Meteorological Conditions
V_{NE}	—	Never Exceed Speed
V_{TOCS}	-	Takeoff Climbout Speed
V_Y		Best Rate of Climb Speed
WSHLD	- -	Windshield
XFEED	—	Crossfeed
XMSN	—	Transmission

LIST OF SECTIONS

TO USE, BEND BOOK SLIGHTLY AND FOLLOW MARGIN INDEX TO PAGE WITH BLACK EDGE MARKER

Section 1

LIMITATIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

LIST OF FIGURES

Section 1

LIMITATIONS

GENERAL

Compliance with the limitations in this section is required by appropriate operating rules.

BASIS OF CERTIFICATION

This helicopter is certified under FAR Part 29, Category "A" and "B".

TYPE OF OPERATION

The basic configured helicopter is approved as a fifteen-place helicopter and is certified for operation under day or night VFR nonicing conditions.

The IFR configured helicopter is certified for Category I IFR operation during day or night nonicing conditions.

Refer to Section 6 for additional limitation procedures and performance data for Category "A" operations.

REQUIRED EQUIPMENT

AFCS

AFCS shall be disengaged or operated in SAS mode during prolonged ground operation, except as required for AFCS check.

REQUIRED EQUIPMENT — IFR

In addition to the basic equipment required for certification, the 412-705-006 IFR Kit shall be installed and the following equipment shall be operational for IFR flight:

Both helipilots HP 1 and HP 2 shall be engaged in ATT mode during IFR flight.

Heated pitot-static system

Pilot windshield wiper

3-inch standby attitude indicator

Two VHF communications radios

Two navigation receivers with auxiliary equipment appropriate to intended IFR route of flight

DME equipment

ATC transponder

Marker beacon receiver

Pilot IVSI

Force trim

Roof window blackout curtains

EMERGENCY COMM panel, if installed, (single pilot only)

OPTIONAL EQUIPMENT

Refer to appropriate Flight Manual Supplement(s) for additional limitations.

procedures, and performance data with optional equipment installed.

FLIGHT CREW

The minimum flight crew consists of one pilot who shall operate the helicopter from the right crew seat.

The left crew seat may be used for an additional pilot when the approved dual controls and copilot instrument kits are installed.

INTERNAL CARGO OPERATION

NOTE

Refer to applicable operating rules for internal cargo operations.

DOORS OPEN OR REMOVED

Helicopter may be flown with doors open or removed only with Standard Interior or Deluxe Interior installed. Flight operation is approved for the following alternative configurations during VFR conditions only:

Both crew doors removed.

Both sliding doors locked open or removed with both hinged panels installed or removed.

In all cases, door configuration shall be symmetrical for both sides of the fuselage.

NOTE

Opening or removing doors shifts helicopter center of gravity and reduces V_{NE}. Refer to BHT-412-MD-2 and to Airspeed Limitations.

WEIGHT/CG

WEIGHT

Maximum gross weight for takeoff and landing is 11,900 pounds (5398 kilograms).

Refer to Weight-Altitude-Temperature Limitations chart (figure 1-1) for maximum allowable weight for takeoff, landing, and IGE hover operation.

Minimum gross weight for flight is 6400 pounds (2903 kilograms).

Minimum combined crew weight at fuselage station 47.0 is 170 pounds (77.1 kilograms).

CENTER OF GRAVITY — LONGITUDINAL

Longitudinal center of gravity limits vary from station 130 to 144, depending on gross weight. Refer to Gross Weight Center of Gravity Chart (figure 1-2).

CENTER OF GRAVITY — LATERAL

Lateral center of gravity limits are 4.5 inches (114.3 millimeters) left and right of fuselage centerline for all gross weights.

LOADING

NOTE

Refer to BHT-412-MD-2 for loading tables to be used in weight/CG computations.

NOTE ALLOWABLE GROSS WEIGHTS OBTAINED FROM THIS CHART MAY EXCEED CONTINUOUS HOVER CAPABILITY UNDER CERTAIN AMBIENT CONDITIONS. REFER TO HOVER CEILING CHARTS IN SECTION 4

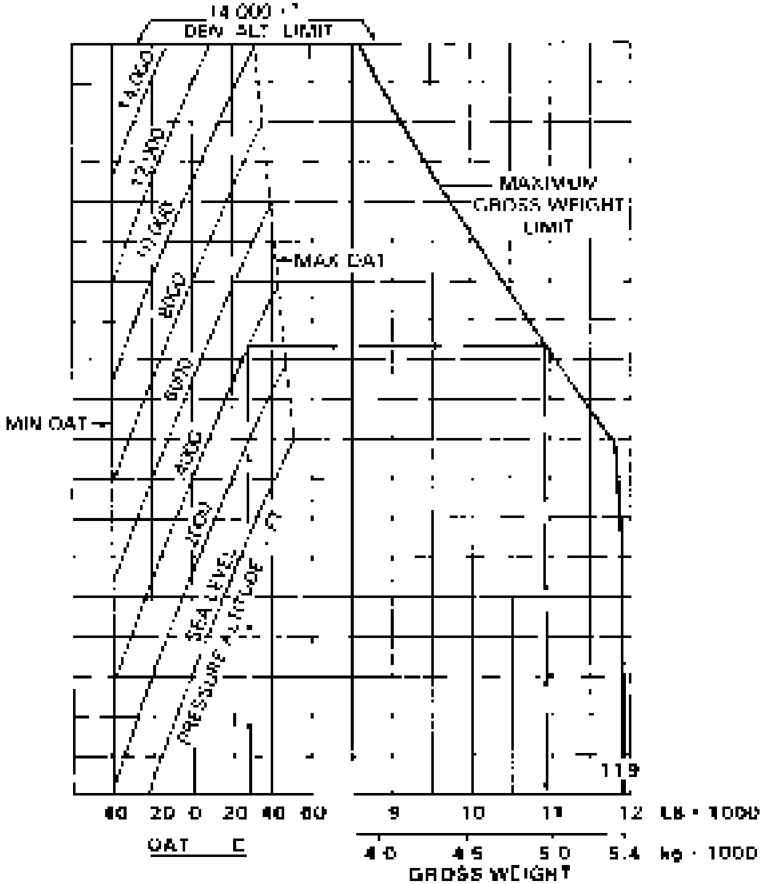
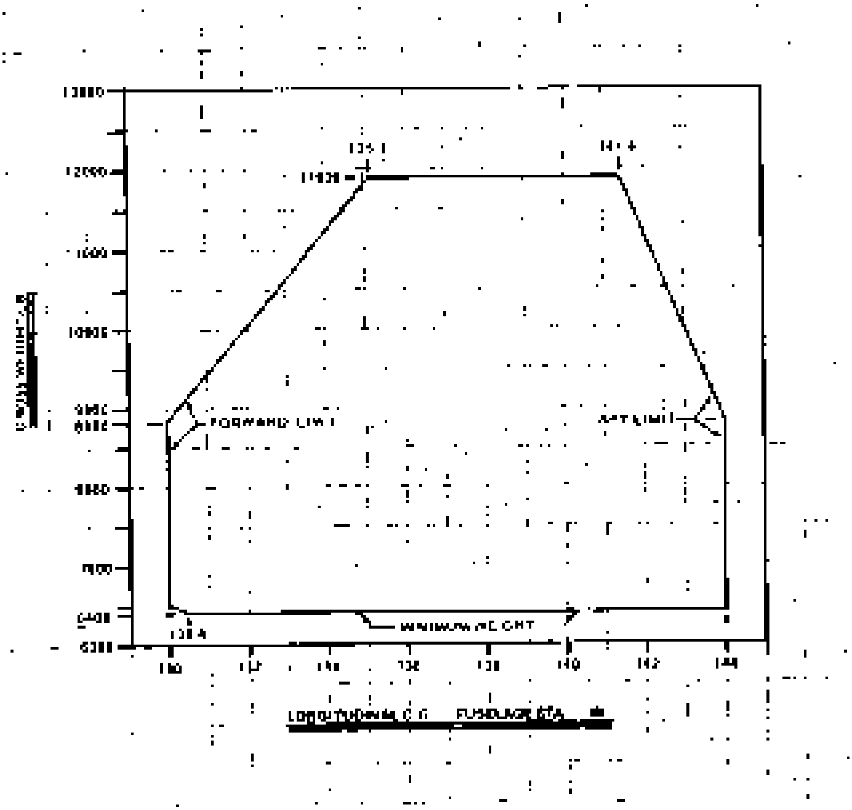
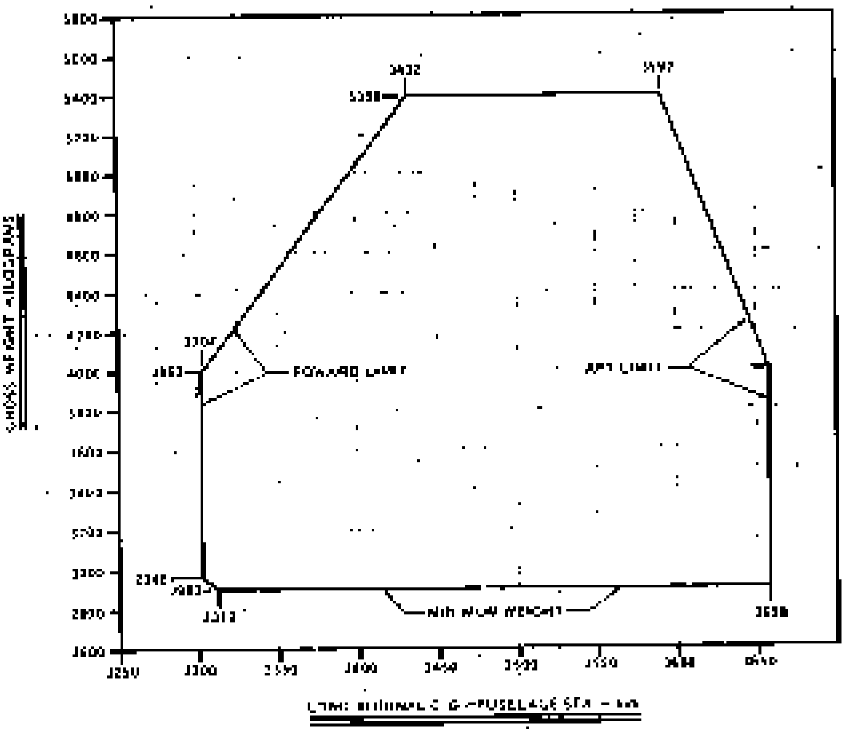


Figure 1-1. Weight-altitude-temperature limitations for takeoff, landing, and in-ground-effect maneuvers.



ENGLISH UNITS

Figure 1-2. Gross weight center of gravity charts (Sheet 1 of 2).



METRIC UNITS

Figure 1-2. Gross weight center of gravity charts (Sheet 2 of 2).

AIRSPEED

NOTE

This limitation shall remain in effect until Alert Service Bulletin (ASB) 412-96-89 has been fully implemented.

V_{NE} is 120 KIAS. Reduce all placard V_{NE} airspeeds by 20 KIAS.

PASSENGER LOADING

The outboard facing seats should not be occupied unless at least four of the forward or aft facing passenger seats are occupied.

The above loading does not apply if cargo or a combination of cargo and passengers are being transported. It shall then be pilot responsibility to ensure helicopter is properly loaded so entire flight is conducted within the limits of gross weight center of gravity charts (figure 1-2).

INTERNAL CARGO LOADING

Maximum allowable deck loading for cargo is 100 pounds per square foot (4.9 kg/100 sq cm). Deck mounted cargo tiedown fittings are provided and have an airframe structural capacity of 1250 pounds (567.0 kilograms) vertical and 500 pounds (226.8 kilograms) horizontal per fitting. Provisions for installation of cargo tiedown fittings are incorporated in the aft cabin bulkhead and transmission support structure and have an airframe structural capacity of 1250 pounds (567.0 kilograms) at 90 degrees to the bulkhead and 500 pounds (226.8 kilograms) in any direction parallel to the bulkhead. Cargo shall be secured by an approved restraint method that will not impede access to the cargo in the event of an emergency.

Maximum allowable baggage compartment loading is 400 pounds (181 kilograms), not to exceed 100 pounds per square foot (4.9 kg/100 sq cm).

AIRSPEED

NOTE

All indicated airspeed values in this manual require instrument part number 412-075-009-105 be installed.

Minimum IFR airspeed is 60 KIAS.

Basic V_{NE} is 140 KIAS from sea level to 3000 feet density altitude at all gross weights. V_{NE} decreases for ambient conditions in accordance with airspeed limitations placard (figure 1-3).

Airspeed shall not exceed 105 KIAS (or placarded V_{NE}, if less) when operating above maximum continuous transmission torque (81%).

V_{NE} with only one helipilot engaged is 115 KIAS (or placarded V_{NE}, if less). If both helipilots are disengaged, basic V_{NE} applies.

V_{NE} for steady state autorotation is:

105 KIAS at or below 10,000 feet pressure altitude;

80 KIAS above 10,000 feet pressure altitude.

V_{NE} with doors open or removed is 60 KIAS with energy attenuating passenger seats (412-706-002) installed.

V_{NE} with doors open or removed is 100 KIAS with Blanket Interior (412-705-501 or 412-705-510). Deluxe Interior (412-705-500) or Utility Seats (412-706-018 or 205-706-043) installed.

Maximum allowable airspeed for sideward or rearward flight at or below 3000 feet H_D is 35 knots. Refer to figure 1-4 for additional limitations.

Maximum allowable tailwind or crosswind speeds for hover operations at or below 3000 feet H_D is 35 knots. Refer to figure 1-4 for additional limitations.

Refer to Critical Relative Wind Azimuths diagram in Section 4.

CLIMB/DESCENT

Maximum IFR rate of climb or descent is 1000 feet per minute.

Maximum IFR approach slope is 5 degrees.

OBSERVE TEMPORARY MAXIMUM NEVER EXCEED (V_{NE}) AIRSPEED REDLINE (MARKED AT 120 KIAS). V_{NE} IS 20 KIAS LESS THAN THE VALUE PRESENTED ON THE AIRSPEED LIMITATION PLACARD FOR EACH AMBIENT CONDITION.

(TYPICAL)

Figure 1-3. Placards and decals

TWIN & 30 MIN OEI 100.8%
2 1/2 MIN OEI 102.4%

FOR GAS PRODUCER
INSTRUMENT PART NUMBER
212-075-037-101

TWIN & 30 MIN OEI 100.8%
2 1/2 MIN OEI 102.4%

FOR GAS PRODUCER
INSTRUMENT PART NUMBER
212-075-037-113

OAT °C	PRESSURE ALTITUDE IN FT x 1000									
	0-3	4	6	8	10	12	14	16	18	20
	INDICATED VNE KNOTS									
52	131									
40	[illegible]	120	122							
30	[illegible]	124	122	[illegible]	[illegible]	104	101	97		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	140	140	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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AUTOROTATION VNE IS [illegible] KIAS ABOVE [illegible] FT										

DO NOT OPERATE HEATER ABOVE 21 DEG C OAT AIR TEMP

DO NOT APPLY ROTOR BRAKE ABOVE 40% RPM

USABLE FUEL CAP [illegible] LBS
WITH AUX FUEL KIT [illegible] [illegible] LBS
[illegible] [illegible] LBS

THIS HELICOPTER MUST BE OPERATED IN COMPLIANCE WITH THE OPERATING LIMITATIONS SPECIFIED IN THE FAA APPROVED ROTORCRAFT FLIGHT MANUAL

IN ALTN POSITION MAINTAIN INSTRUMENT ACCURACY BY CLOSING WINDOWS AIRVENTS AND TURNING HEATER OFF

(If installed)

412-F[illegible]

Figure 1-3. Placards and decals.

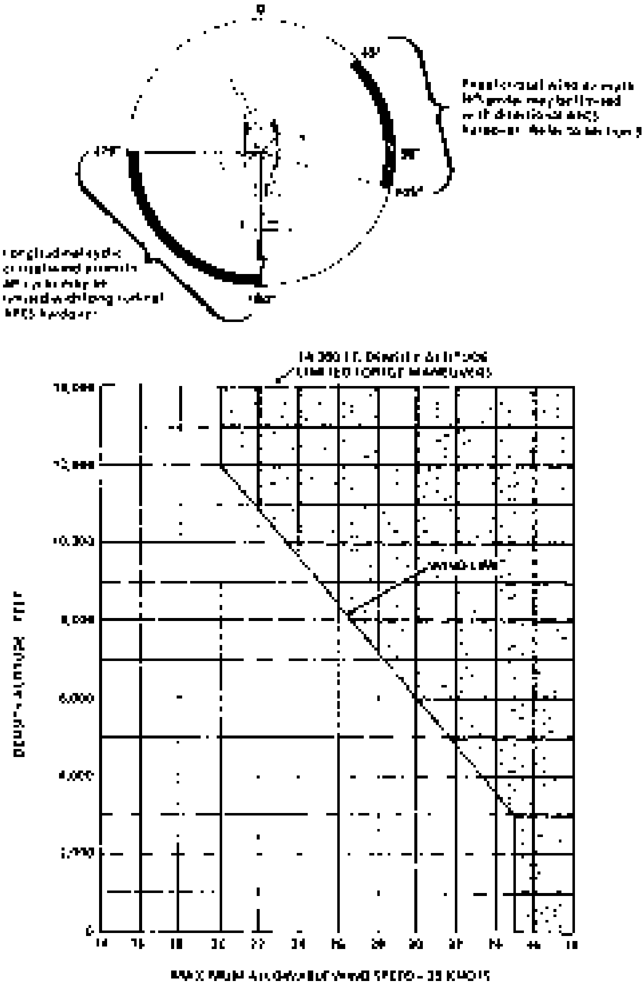


Figure 1-4. Maximum speed — sideward and rearward flight, crosswind and tailwind at a hover.

ALTITUDE

Maximum operating pressure altitude is 20,000 feet.

Maximum density altitude for takeoff, landing, and in-ground-effect maneuvers is 14,000 feet. Refer to Weight-Altitude-Temperature Limitations chart (figure 1-1).

NOTE

Refer to applicable operating rules for high altitude oxygen requirements.

AMBIENT AIR TEMPERATURE

The maximum sea level ambient air temperature for operation is +51.7°C (+125°F) and decreases with pressure altitude at the standard lapse rate of 2°C (3.6°F)/1000 feet to 20,000 feet.

The minimum ambient temperature for operation at all altitudes is -40°C (-40°F).

HEIGHT — VELOCITY

The height-velocity limitations are critical in the event of single engine failure during takeoff, landing, or other operation near the surface (figure 1-5). The AVOID area of the Height-Velocity diagram defines the combinations of airspeed and height above ground from which a safe single engine landing on a smooth, level, firm surface cannot be assured.

The H-V diagram is valid only when the Weight-Altitude-Temperature limitations are not exceeded (figure 1-1). The diagram does not define the conditions which assure continued flight following an engine failure nor the conditions from which a safe power off landing can be made.

MANEUVERING

Aerobatic maneuvers are prohibited.

SLOPE LANDINGS

Slope landings are limited to side slopes not to exceed 10 degrees.

ELECTRICAL

BATTERY

Maximum battery case temperature is 54.5°C (130°F), as indicated by illumination of BATTERY TEMP warning light.

WARNING

BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF *BATTERY TEMP* LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.

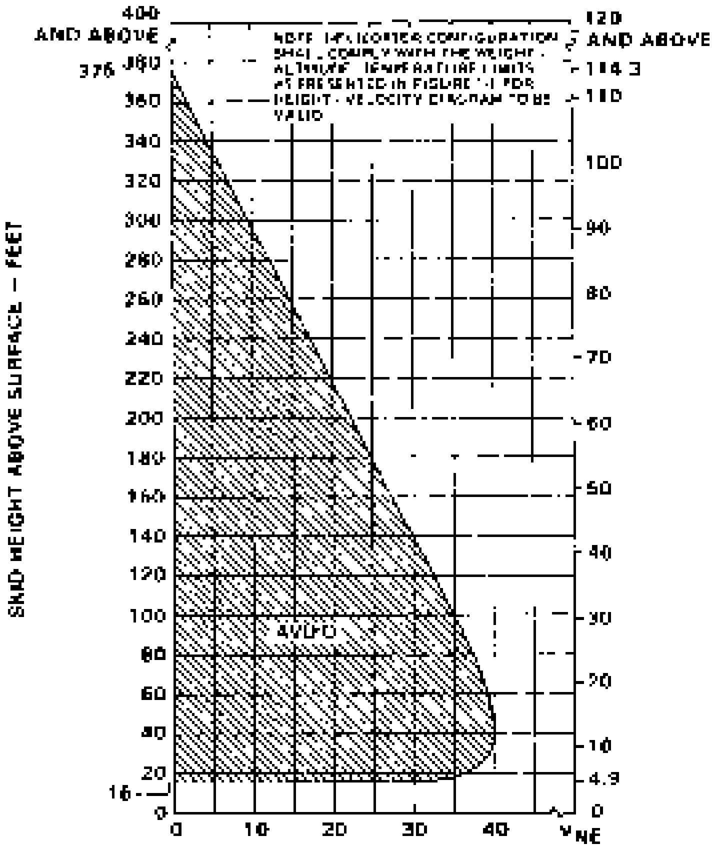
Minimum ambient temperature for battery start when battery and helicopter have been cold soaked is -25°C (-13°F).

GENERATOR

Continuous operation	0 to 75 amps
Caution	75 to 150 amps

HEIGHT - VELOCITY DIAGRAM

FOR SMOOTH LEVEL FIRM SURFACES



INDICATED AIRSPEED — KNOTS

Figure 1-5. Height-velocity diagram (OEI).

NOTE

During OEI operation electrical loads may have to be reduced to remain below 150 amps.

Maximum continuous 150 amps (each)

NOTE

Ammeter needle may deflect full scale momentarily during generator assisted start of second engine.

ENGINE STARTER

Starter energizing times shall be limited as follows

30 seconds ON

60 seconds OFF

30 seconds ON

5 minutes OFF

30 seconds ON

15 minutes OFF

GROUND POWER STARTS

28 vdc ground power units for starting shall be limited to 1000 amps maximum.

POWERPLANT

Pratt and Whitney Aircraft of Canada, Ltd. PT6T-3B

NOTE

Operation in 2 ½ minute or 30 minute OEI range is intended for emergency use only, when one engine becomes inoperative due to an actual malfunction.

Anytime an engine is operated in an OEI range, an entry shall be made in the helicopter logbook detailing the extent of operation in excess of twin engine takeoff power limits. This does not apply to approved ITT limits for starting

GAS PRODUCER RPM

TWIN ENGINE OPERATION

(Instrument P/N 212-075-037-101)

Continuous operation	61 to 100.8%
Maximum continuous	100.8%
Maximum for takeoff	100.8%

(Instrument P/N 212-075-037-113)

Continuous operation	61 to 101.8%
Maximum continuous	101.8%
Maximum for takeoff	101.8%

ONE ENGINE INOPERATIVE (OEI)

(Instrument P/N 212-075-037-101)

30 minute OEI	100.8
2 ½ minute OEI range	100.8 to 102.4%
Maximum OEI	102.4%

(Instrument P/N 212-075-037-113)

30 minute OEI	101.8
2 ½ minute OEI range	101.8 to 103.4%
Maximum OEI	103.4%

POWER TURBINE RPM (ENG RPM)

Minimum	97%
Continuous operation	97 to 100%
Maximum continuous	100%
Operation with ENG TORQUE at or below 30%	100 to 104.5%
Maximum with ENG TORQUE at or below 30%	104.5%

INTERTURBINE TEMPERATURE (ITT)

TWIN ENGINE OPERATION

Maximum continuous	765°C
Takeoff range (5 minutes maximum)	765 to 810°C
Maximum transient (5 seconds maximum)	850°C
Maximum for starting (2 seconds maximum above 960°C)	1090°C

CAUTION

INTENTIONAL USE OF ITT ABOVE 810°C IS PROHIBITED DURING NORMAL OPERATIONS EXCEPT DURING START.

ONE ENGINE INOPERATIVE (OEI)

Maximum continuous OEI	765°C
30 minute OEI range	765 to 822°C
2 ½ minute OEI range	822 to 850°C
Maximum OEI	850°C

FUEL PRESSURE

Minimum	4 psi
Continuous operation	4 to 35 psi
Maximum	35 psi

OIL PRESSURE

ENGINE

Minimum for idle	40 psi
Operation below 79% GAS PROD RPM (N1)	40 to 80 psi
Continuous operation	80 to 115 psi
Maximum	115 psi

COMBINING GEARBOX

Minimum for idle	40 psi
Operation below 94% ENG RPM (N2)	40 to 60 psi
Continuous operation	60 to 80 psi
Maximum	80 psi

OIL TEMPERATURE

ENGINE

Minimum	0°C

Continuous operation	0 to 115°C
Maximum	115°C

COMBINING GEARBOX

Minimum	0°C
Continuous operation	0 to 115°C
Maximum	115°C

ENGINE RESTART

Above 15,000 feet pressure altitude, restart shall be attempted in manual fuel control mode only

Below 15,000 feet pressure altitude, restart may be attempted in either manual or automatic fuel control mode.

ENGINE TORQUE

TWIN ENGINE OPERATION

Maximum allowable ENG TORQUE differential is 4% during normal operation. Refer to TRANSMISSION TORQUE LIMITS.

ONE ENGINE INOPERATIVE (OEI)

Maximum continuous OEI	58.9%
30 minute OEI range	58.9 to 73.2%
Maximum OEI	73.2%

TRANSMISSION

TRANSMISSION TORQUE

TWIN ENGINE OPERATION

Maximum continuous	81%
Takeoff range (5 minutes maximum)	81 to 100%

WARNING

TAKEOFF POWER SHALL NOT BE USED ABOVE 105 KIAS.

Maximum	100%

TRANSMISSION OIL PRESSURE

Minimum for idle	30 psi
Idle range	30 to 40 psi
Continuous operation	40 to 70 psi
Maximum	70 psi

TRANSMISSION OIL TEMPERATURE

Continuous operation	15 to 110°C
Maximum	110°C

ROTOR

ROTOR RPM — POWER ON

Minimum	97%
Continuous operation	97 to 100%
Maximum continuous	100%
Operation with ENG TORQUE at or below 30%	100 to 104.5%
Maximum with ENG TORQUE at or below 30%	104.5%

ROTOR RPM — POWER OFF

Minimum for autorotation with gross weight below 8000 pounds (3629 kg)	80%
Power off operation with gross weight below 8000 pounds (3629 kg)	80 to 104.5%
Minimum for autorotation with gross weight at or above 8000 pounds (3629 kg)	91%
Maximum	104.5%

ROTOR RPM — GROUND OPERATION

Minimum	77%
Minimum with stick centering indicator system inoperative	97%
Transient (avoid steady state operations)	20 to 77%

ROTOR BRAKE

Engine starts with rotor brake engaged are prohibited. Rotor brake application is limited to ground operation and shall not be applied until both engines are shut down and ROTOR has decreased to 40% RPM or below.

FUEL AND OIL

NOTE

Refer to BHT-412-MD-2 for fuel capacity and lists of approved fuels, oils, and vendors.

FUEL

Fuel conforming to ASTM D-1655 Type B, NATO F-40, or MIL-T-5624 Grade JP-4 may be used at all ambient temperatures.

Fuel conforming to ASTM D-1655 Type A or A-1, NATO F-44, MIL-T-5624 Grade JP-5, NATO F-34, or MIL-T-83133 Grade JP-8, limited to ambient temperatures above -30°C (-22°F).

ENGINE AND COMBINING GEARBOX OIL

Oil conforming to PWA Specification No. 521 Type I and MIL-L-7808 (NATO 0-148) may be used at all ambient temperatures.

Oil conforming to PWA Specification No. 521 Type II and MIL-L-23699 (NATO 0-156), or DOD-L-85734AS limited to ambient temperatures above -40°C (-40°F).

TRANSMISSION, INTERMEDIATE AND TAIL ROTOR GEARBOX OIL

Oil conforming to DOD-L-85734AS (Turbine Oil 555), MIL-L-23699 (NATO 0-156), or MIL-L-7808 (NATO 0-148) may be used at all approved ambient temperatures.

NOTE

DOD-L-85734AS or MIL-L-23699 is recommended.

HYDRAULIC

NOTE

Refer to BHT-412-MD-2 for approved fluids and vendors.

Hydraulic fluid type MIL-H-5606 (NATO H-515) shall be used at all ambient temperatures.

WARNING

THE HELICOPTER IS NOT CONTROLLABLE WITH BOTH HYDRAULIC BOOST SYSTEMS INOPERATIVE.

Both hydraulic systems shall be operative prior to takeoff.

HYDRAULIC PRESSURE

Minimum	600 psi
Caution	600 to 900 psi
Continuous operation	900 to 1100 psi
Maximum	1100 psi

HYDRAULIC TEMPERATURE

Maximum	88°C

HEATER OPERATION

Heater shall not be operated when OAT is above 21°C (69.8°F).

HOIST PENALTY REGION

Pilot shall know C.G. at time of hoist operation to determine if C.G. is within penalty region of figure 1-7, Hoist C.G. envelope.

Each hoist operation performed is defined as an extension and retraction of hoist cable while hovering with any weight attached.

Refer to BHT-412-FMS-7 for BHT-412-FMS-26 for Bell Helicopter approved Hoists.

WARNING

THIS PENALTY REGION IS VALID FOR ALL HOIST INSTALLATIONS.

OPERATION IN PENALTY REGION AFFECTS AIRWORTHINESS LIMITATIONS OF ROTOR COMPONENTS (REFER TO BHT-412-MM).

AIRSPEED

0 to 30 knots	Indicator unreliable
30 to 140 knots	Continuous operation
105 knots	Maximum for autorotation at or below 10,000 ft. Hp
140 knots	VNE

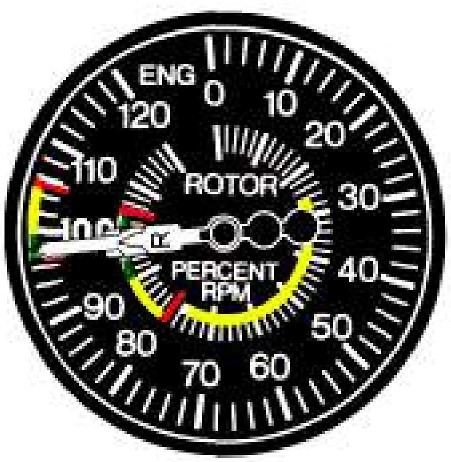
DUAL TORQUE INDICATOR

TRANSMISSION (TWIN ENGINE OPERATION)

10 to 81%	Continuous operation
81 to 100%	5 minute takeoff range
100%	Maximum

ENG (ONE ENGINE INOPERATIVE)

5 to 58.9%	Continuous OEI operation
58.9 to 73.2%	30 minute OEI range
73.2%	Maximum OEI



TRIPLE TACHOMETER

ROTOR RPM

26 to 77%	Transient ground operation
80%	Minimum for autorotation below 8000 Lb (3629 kg) gross weight
80 to 91%	Power off operation below 8000 Lb (3629 kg) gross weight
91 to 104.5%	Continuous operation (91% minimum power off)
104.5%	Maximum

ENG RPM (N2)

97%	Minimum
97 to 100%	Continuous operation
100 to 104.5%	Operation at or below 30% ENG TORQUE
104.5%	Maximum at or below 30% ENG TORQUE

Figure 1-6. **Instrument markings (Sheet 1 of 4).**

INSTRUMENT PART NUMBER
△1 212-075-037-101

△1 GAS PRODUCER RPM (N1)
EITHER GAGE MAY BE INSTALLED IN PAIRS

△	12%	Minimum for opening throttle during start
△	61%	Idle RPM
	61 to 100.8%	Continuous operation
	100.8 %	Maximum for takeoff/ 30 minutes OEI
	100.8 to 102.4%	2 1/2 minute OEI range
	102.4%	Maximum OEI

INSTRUMENT PART NUMBER
△1 212-075-037-113

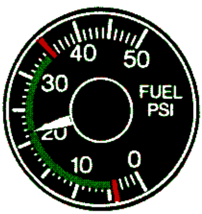
△	12%	Minimum for opening throttle during start
△	61%	Idle RPM
	61 to 101.8%	Continuous operation
	101.8%	Maximum for takeoff/ 30 minute OEI
	101.8% to 103.4%	2 1/2 minute OEI range
	103.4%	Maximum OEI

TRANSMISSION OIL TEMPERATURE

	15 to 110°C	Continuous operation
	110°C	Maximum

TRANSMISSION OIL PRESSURE

	30 PSI	Minimum for idle
	30 to 40 PSI	Idle range
	40 to 70 PSI	Continuous operation
	70 PSI	Maximum



FUEL PRESSURE

	4 PSI	Minimum
	4 to 35 PSI	Continuous operation
	35 PSI	Maximum

412-F2-1-6-2

Figure 1-6. Instrument markings (Sheet 2 of 4).

ENGINE OIL TEMPERATURE

0°C	Minimum
0 to 115°C	Continuous operation
115°C	Maximum

ENGINE OIL PRESSURE

40 PSI	Minimum for idle
40 to 80 PSI	Operation below 79% GAS PROD RPM (N1)
80 to 115 PSI	Continuous operation
115 PSI	Maximum

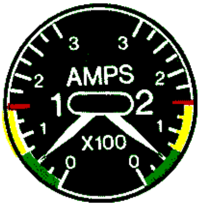
COMBINING GEARBOX OIL TEMPERATURE

0°C	Minimum
0 to 115°C	Continuous operation
115°C	Maximum

COMBINING GEARBOX OIL PRESSURE

40 PSI	Minimum for idle
40 to 60 PSI	Operation below 94% ENG RPM (N2)
60 to 80 PSI	Continuous operation
80 PSI	Maximum

Figure 1-6. Instrument markings (Sheet 3 of 4).



AMMETER

0 to 75 AMPS	Continuous operation
75 to 150 AMPS	Caution
150 AMPS	Maximum continuous

INTERTURBINE TEMPERATURE (ITT)

300 to 765°C	Continuous operation
765 to 810°C	5 minute takeoff range
810°C	Maximum for takeoff
822°C	Maximum 30 minute OEI
850°C	Maximum 2½ minute OEI
1090°C	Maximum for starting (2 seconds maximum above 960°C)

HYDRAULIC OIL TEMPERATURE

88°C	Maximum

HYDRAULIC OIL PRESSURE

600 PSI	Minimum
600 to 900 PSI	Caution
900 to 1100 PSI	Continuous operation
1100 PSI	Maximum

Figure 1-6. Instrument markings (Sheet 4 of 4).

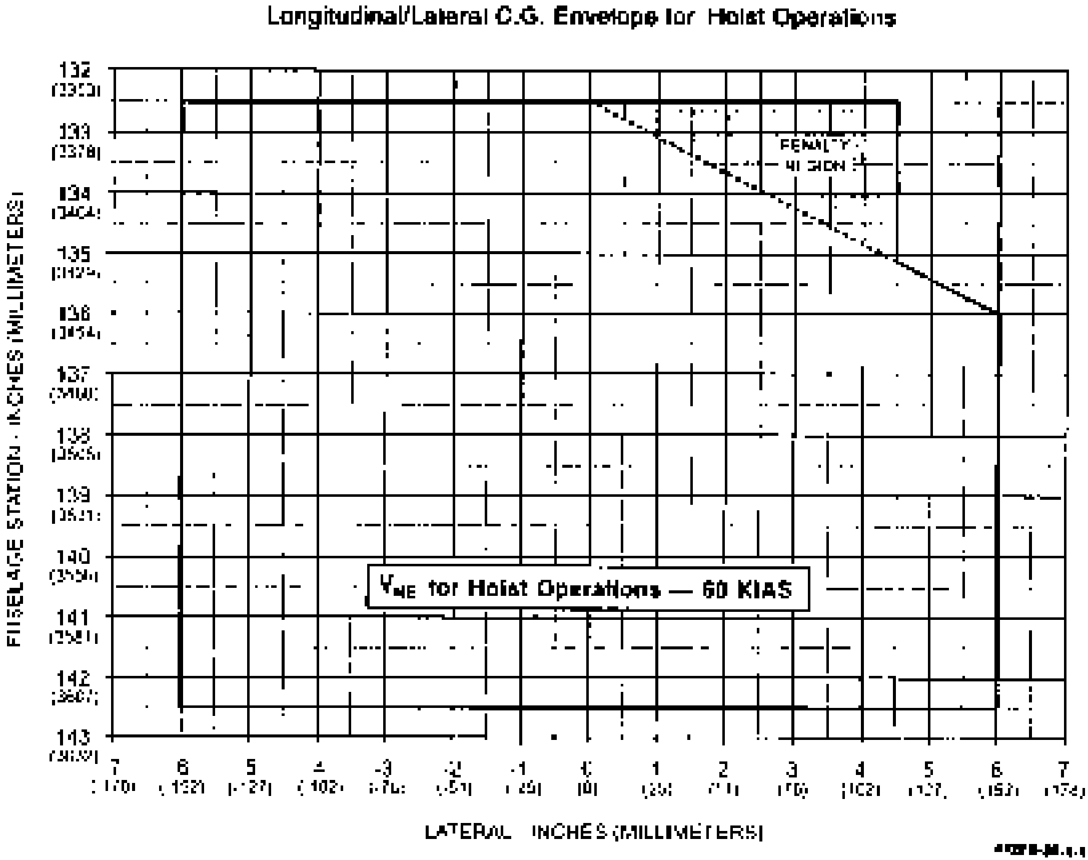


Figure 1-7. Hoist C.G. envelope

Section 2

NORMAL PROCEDURES

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Section 2

NORMAL PROCEDURES

INTRODUCTION

This section contains instructions and procedures for operating the helicopter from the planning stage, through actual flight conditions, to securing the helicopter after landing.

Normal and standard conditions are assumed in these procedures. Pertinent data in other sections is referenced when applicable.

The instructions and procedures contained herein are written for the purpose of standardization and are not applicable to all situations.

OPERATING LIMITATIONS

The minimum, normal, maximum, and cautionary operation ranges for helicopter systems and subsystems are indicated by instrument markings and placards.

Anytime an operating limitation is exceeded, an appropriate entry shall be made in the helicopter logbook. The entry shall state which limit was exceeded, the duration of time, the extreme value attained, and any additional information essential in determining the maintenance action required.

The limits depicted on instrument markings and placards represent careful aerodynamic calculations that are substantiated by flight test data.

Refer to Section 1, LIMITATIONS, for subsystems restrictions.

FLIGHT PLANNING

Each flight should be planned adequately to ensure safe operations and to provide the pilot with the data to be used during flight. Essential weight, balance, and performance information should be compiled as follows:

Check type of flight to be performed and destination.

Select appropriate performance charts to be used.

TAKEOFF AND LANDING DATA

Refer to the LIMITATIONS section for takeoff and landing weight limits and to the Performance section for takeoff and landing distance information.

WEIGHT AND BALANCE

Determine proper weight and balance of the helicopter as follows:

Consult BHT-412-MD-2 for instructions.

Compute takeoff and anticipated landing gross weight, check helicopter center of gravity (CG) locations, and determine weight of fuel, oil, payload, etc.

Ensure loading limitations listed in Section 1 are not exceeded.

PREFLIGHT CHECK

The pilot is responsible for determining whether the helicopter is in condition for safe flight. Refer to figure 2-1 for preflight check sequence.

NOTE

The pilot walk-around and interior checks are outlined in the following procedures. The preflight check is not intended to be a detailed mechanical check, but simply a guide to help the pilot check the condition of the helicopter. It may be made as comprehensive as conditions warrant, at the discretion of the pilot.

All areas checked shall include a visual check for evidence of corrosion, particularly when helicopter is flown near or over salt water, or in areas of high industrial emissions.

BEFORE EXTERIOR CHECK

Flight planning — Completed.

Gross weight and CG — Compute (refer to BHT-412-MD-2).

Publications — Checked.

Portable fire extinguishers — Condition and security.

Aft fuel sumps — Drain samples as follows:

FUEL TRANS switches — OFF.

BOOST PUMP switches — OFF.

ENGINE 1 and ENGINE 2 FUEL switches — OFF.

BAT BUS 1 switch — ON.

Aft fuel sump drain buttons (left and right) — Press.

NOTE

If aft sumps fail to drain, the sump valves may be operated manually.

Forward and middle fuel sumps — Drain samples as follows:

Press-to-drain valves — Press.

Fuel filters — Drain before first flight of day as follows:

BOOST PUMP switches — ON.

ENGINE 1 and ENGINE 2 FUEL switches — ON.

Fuel filter (left and right) — Drain samples.

ENGINE 1 and ENGINE 2 FUEL switches — OFF.

BOOST PUMP switches — OFF.

BAT BUS 1 switch — OFF.

Rotor tie downs — Removed and secured.

EXTERIOR CHECK

Refer to figure 2-1 for areas.

CAUTION

IF HELICOPTER HAS BEEN EXPOSED TO SNOW OR ICING CONDITIONS, SNOW AND ICE SHALL BE REMOVED PRIOR TO FLIGHT.

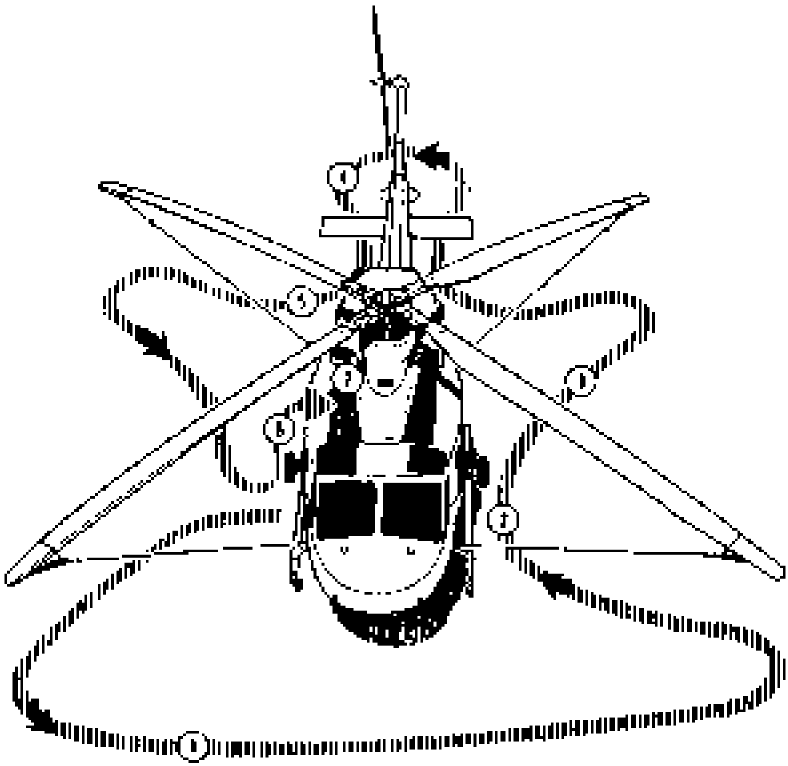

Figure 2-1 Preflight check sequence

1. FUSELAGE — FRONT

Cabin nose — Condition; all glass clean; wipers stowed.

Remote hydraulic filter bypass indicator Verify green.

Pitot tube(s) — Cover(s) removed, unobstructed

Static ports (left and right) — Unobstructed.

Rotor blade (forward) — Remove tiedown Visually check condition and cleanliness.

Cabin nose ventilators Unobstructed.

Nose compartment door Secure.

Battery vent and drain tubes — Unobstructed.

Searchlight and landing light Stowed.

Antennas Condition and security.

2. FUSELAGE — CABIN LEFT SIDE

Copilot door — Condition and operation; glass clean Check security of emergency release handles.

Position lights — Condition.

Passenger door — Condition and operation; glass clean. Condition of pop-out windows.

Landing gear — Condition; handling wheels removed.

Passenger step (if installed) — Condition and security.

3. FUSELAGE — AFT LEFT SIDE

Rotor blade (aft) — Remove tiedown. Visually check condition and cleanliness.

No. 1 engine compartment — Check.

No. 1 engine oil level — Verify actual presence of oil in sight gage Visually check oil level. Filler cap secured.

Governor spring Check condition.

Engine fire extinguisher Check bottle pressure gage and temperature range.

Combining gearbox filter — Check bypass indicator retracted.

Oil cooler blower — Unobstructed.

Access doors and engine cowling — Secured.

Drain lines — Unobstructed.

Engine exhaust ejectors — Covers removed; unobstructed

Oil coolers — Unobstructed.

4. TAILBOOM

Tailboom — Condition; access covers secured.

Tail rotor driveshaft covers Secured.

CAUTION

DO NOT BEND ELEVATOR TRAILING EDGE TAB.

Elevator — Condition and security. Check for spring condition by moving elevator toward the leading edge down position.

Tail rotor (90°) gearbox — Verify actual presence of oil in sight gage. Visually

7. CABIN TOP

Droop restrainers — Security and condition. Verify droop stop clevis is in lower position of cam plate.

check oil level, check filler cap and chip detector plug for security

Tail rotor blade — Remove tiedown. Visually check condition and cleanliness.

Tail rotor — Condition and free movement on flapping axis.

Tail rotor yoke — Evidence of static stop contact damage (deformed static stop yield indicator).

Tail skid — Condition and security.

Intermediate (42°) gearbox — Verify actual presence of oil in sight guage. Visually check oil level. Check filler cap and chip detector plug for security.

Elevator — Condition and security.

Tailboom — Condition.

Baggage compartment — Cargo secured, smoke detector condition, door secured.

5. FUSELAGE — AFT RIGHT SIDE

Aft compartment — Check unobstructed.

Tail rotor actuator — Check.

AFCS computers — Secured, compartment door secured.

Engine fire extinguisher — Check bottle pressure gauge and temperature range.

Combining gearbox oil level - Verify actual presence of oil in sight gauge. Visually check oil level

Oil cooler blower — Unobstructed

No. 2 engine compartment — Check.

No. 2 engine oil level — Verify actual presence of oil in sight gauge. Visually check oil level. Filler cap secured.

Access doors and engine cowling Secured.

Fuel filler — Visually check quantity, secure cap.

6. FUSELAGE — CABIN RIGHT SIDE

Passenger door — Condition and operation, glass clean, condition of pop-out windows.

Transmission oil — Verify actual presence of oil in sight gauge. Visually check oil level.

Position lights — Condition.

Landing gear — Condition, handling wheels removed.

Passenger step (if installed) — Condition and security.

Pilot door — Condition and operation, glass clean. Check security of emergency release handles.

7. CABIN TOP

Hub and sleeve assembly — Check condition.

Swashplate, support assembly, and collective lever — Check condition.

Main rotor pitch links — Security and condition.

Main rotor hub — Check general condition:

Mast retaining nut — Secured.

Yoke assembly — Condition.

Pitch horns — Security and condition.

Elastomeric bearings, lead-lag dampers — Check general condition.

Blade retention bolts - Security and proper latching.

Droop restrainers — Security and condition.

Simple pendulum absorbers (if installed) — Security and condition.

Rotor blades — Visually check condition and cleanliness.

Main driveshaft and couplings — Condition and security, and grease leakage. Check Temp-Plates (four places each coupling) for evidence of elevated temperature indicated by dot changing color to black.

CAUTION

IF ANY TEMP-PLATE IS MISSING OR HAS BLACK DOTS, MAINTENANCE PERSONNEL SHALL ASSIST IN DETERMINING AIRWORTHINESS PER ALERT SERVICE BULLETIN 412-93-79.

Transmission oil filler cap — Secured.

No. 1 and No. 2 hydraulic reservoirs — Visually check fluid levels; caps secured.

Antenna(s) — Condition and security.

Combining gearbox oil filler cap — Secured.

Anticollision light — Condition and security.

No. 1 and No. 2 engine air intakes — Covers removed, unobstructed; check particle separator doors closed.

Engine and transmission cowling — Secured.

Fresh air inlet screen — Unobstructed.

Rotor brake reservoir cap — Security.

INTERIOR CHECK

Cabin interior — Cleanliness and security of equipment.

Cargo and baggage (if applicable) — Check security.

Protective breathing equipment (if installed) — Condition and properly serviced.

NOTE

Opening or removing doors shifts helicopter center of gravity and reduces V_{NE}. Refer to BHT-412-MD-2 and to Section 1.

Passenger doors — Secured.

PRESTART CHECK

DELETED

Seat and pedals — Adjust.

Seat belt and shoulder harness — Fasten and adjust.

Shoulder harness inertia reel and lock — Check.

Directional control pedals — Check freedom of movement; position for engine start.

Flight controls — Position for start; friction as desired.

Transmission chip detector indicators — Check; reset if required.

Collective switches — OFF.

Lower pedestal circuit breakers — IN.

Radio equipment — OFF.

COMPASS CONTROL switch(es) — MAG (slave position).

FUEL INTCON switch — NORM.

FUEL TRANS switches — OFF.

BOOST PUMP switches — OFF.

FUEL XFEED switch — NORM.

ENGINE 1 and ENGINE 2 FUEL switches — OFF.

PART SEP switches — NORM.

ENGINE 1 and ENGINE 2 GOV switches — AUTO.

HYDR SYS NO.1 and NO.2 switches — ON.

STEP switch (if installed) — As desired.

FORCE TRIM switch — ON, cover down.

Instruments — Static check.

STATIC SOURCE switch (if installed) — PRI.

APPROACH PLATE AND MAP LIGHT knob(s) — OFF.

AUX SYS PITOT and STATIC switches (if installed) — NORM.

Altimeter(s) — Set.

Clock — Set and running.

FIRE EXT switch — OFF.

FIRE PULL handles — In (forward).

AFT DOME LIGHT rheostat and switch — OFF.

PITOT STATIC HEATERS switch — OFF.

WIPERS switches — OFF.

CARGO RELEASE switch (if installed) — OFF.

HEATER switch — OFF.

AFT OUTLET switch — OFF.

VENT BLOWER switch — OFF.

EMERG LT switch (if installed) — DISARM.

STBY ATT switch (if installed) — TEST; check standby attitude instrument light illuminates and OFF flag retracts momentarily, then switch OFF.

WSHLD HEAT switches (if installed) — OFF.

Overhead circuit breakers — In.

AFT LT rheostats — OFF.

UTILITY LIGHT switch — OFF.

POSITION light — OFF.

ANTI COLL light — ON.

EMERG LOAD switch — NORMAL.

NON-ESNTL BUS switch — Spring loaded to NORMAL.

INV 1 and 2 switches — OFF.

GEN 1 and 2 switches — OFF.

IF EXTERNAL POWER IS USED — CONNECT (1000 AMPS MAXIMUM). CHECK 27 + 1 VOLTS DC; ADJUST POWER SOURCE IF REQUIRED.

BATTERY BUS 1 and BUS 2 switches — ON; check BATTERY caution light illuminates.

NOTE

Test all lights when night flights are planned or anticipated. Accomplish light tests with external power connected or during engine runup.

ROTOR BRAKE lights — Test. Pull brake ON and check that both caution lights illuminate; return to OFF and check lights extinguish.

NOTE

Rotor brake shall be off at all times when the engines are running.

FIRE 1 and 2 warning lights test button — Press to test.

BAGGAGE FIRE warning light test button — Press to test (verify light flashes).

CYC CTR caution lights — Press to test.

Caution panel TEST switch — PNL (All segments extinguish except CAUTION PANEL).

Caution panel TEST switch — LT (All segments illuminate).

Caution Panel RESET button — Press (MASTER CAUTION light extinguishes).

FUEL SYS test switch — FWD TANK, then MID TANK; note digital and needle indications.

FUEL SYS DIGITS TEST button — Press (Digital display reads 888).

INV 1 and 2 switches — ON.

ENGINE STARTING

NOTE

If the helicopter has been cold soaked in ambient temperatures of -18°C (0°F) or less, both throttles will be difficult to move and follow through coupling may be increased.

Throttles — Rotate engine 1 throttle full open, then back against idle stop. Actuate ENG 1 IDLE STOP release, roll engine 1 throttle to full closed, then apply friction as desired. Repeat procedure using engine 2 throttle and ENG 2 IDLE STOP release.

NOTE

When either IDLE STOP release is activated, the appropriate idle stop plunger will not release if pressure is applied toward the closed position of the throttle.

Moderate frictions should be applied to overcome follow-through coupling between throttles.

RPM INCR/DECR switch — DECR for 8 seconds.

NOTE

Either engine may be started first; however, the following procedure is provided for starting engine 1 first.

ENGINE 1 START

ENGINE 1 FUEL TRANS switch — ON; check NO. 1 FUEL TRANS caution light extinguished.

ENGINE 1 BOOST PUMP switch — ON, check NO. 1 FUEL BOOST light extinguished.

ENGINE 1 FUEL switch — ON. (FUEL VALVE caution light will illuminate momentarily.)

Engine 1 FUEL PRESS — Check.

Rotor — Clear.

CAUTION

PROLONGED EXPOSURE TO AMBIENT TEMPERATURES OF 0°C (32°F) OR LESS MAY FREEZE MOISTURE IN THE ENGINE FUEL CONTROL SYSTEM. MONITOR ENG RPM (N2) DURING COLD WEATHER STARTING FOR OVERSPEED. IF AN OVERSPEED APPEARS IMMINENT, ABORT START AND CLOSE THROTTLE TO OFF POSITION.

START switch — ENG 1 position. Observe starter limitations.

Engine 1 ENGINE OIL pressure — Indicating.

Engine 1 throttle — Open to idle at 12% GAS PROD RPM (N1) minimum.

Engine 1 ITT — Monitor to avoid a hot start. Maximum ITT during start is 1090°C, not to exceed two seconds above 960°C. If

ITT continues to rise, abort start by activating idle stop release and rolling throttle fully closed. Starter should remain engaged until ITT decreases. Do not attempt restart until corrective maintenance has been accomplished.

NOTE

If engine fails to start, refer to FALSE START procedures this section.

Collective pitch — Ensure in full down position.

CAUTION

IF STICK CENTERING INDICATOR SYSTEM IS INOPERATIVE, GROUND OPERATION SHALL BE CONDUCTED AT 97% ROTOR RPM OR ABOVE.

NOTE

On side slopes greater than two degrees, disregard CYC CTR caution lights and position cyclic as required.

Cyclic — Position as necessary to extinguish CYC CTR caution lights.

NOTE

CYC CTR caution lights are inhibited between 95 and 105% ROTOR RPM.

START switch -- Off at 55% GAS PROD RPM (N1).

GAS PROD — Check 61 ± 1% RPM (N1) when throttle is on idle stop.

NOTE

During extremely cold ambient temperatures, idle rpm will be high and the ENGINE, XMSN, and GEAR BOX OIL pressures may exceed maximum limits for up to two minutes after starting. Warm up shall be conducted at 77 - 85% ROTOR RPM at flat pitch.

Do not increase ROTOR above 85% RPM until XMSN OIL temperature is above 15°C.

ENGINE, XMSN, and GEAR BOX OIL pressures -- Check.

Engine 1 PART SEP OFF caution light Check extinguished.

CAUTION

DURING RPM INCREASE, ANY ABNORMAL INCREASE IN ONE-PER-REV VIBRATION MAY INDICATE ONE OR MORE MAIN ROTOR DROOP RESTRAINERS FAILED TO DISENGAGE FROM STATIC POSITION. VERIFY PROPER OPERATION PRIOR TO FLIGHT.

Engine 1 throttle — Increase to 77 - 85% ENG RPM (N2). Friction as desired.

NOTE

For ground operation, maintain ROTOR RPM within allowable range. Higher minimum ROTOR RPM reduces blade flapping.

ROTOR RPM — Maintain 77 - 85%, as desired.

IF EXTERNAL POWER IS USED, PROCEED TO ENGINE 2 START. IF BATTERY WAS USED, PROCEED AS FOLLOWS:

GEN 1 switch - ON.

AMPS 1 — Check at or below 150 amps.

ENGINE 2 START

ENGINE 2 FUEL TRANS switch ON. Check NO. 2 FUEL TRANS caution light extinguished.

ENGINE 2 BOOST PUMP switch — ON. Check NO. 2 FUEL BOOST light out (FUEL XFEED caution light will illuminate momentarily).

ENGINE 2 FUEL switch — ON (FUEL VALVE caution light will illuminate momentarily).

Engine 2 FUEL PRESS — Check.

START switch — ENG 2 position. Observe starter limitations.

Engine 2 ENGINE OIL pressure — indicating.

Engine 2 throttle — Open to idle at 12% GAS PROD RPM (N1) minimum.

Engine 2 ITT — Monitor. Observe ITT limitations.

START switch — Off at 55% GAS PROD RPM (N1).

GAS PROD — Check 61 ± 1% RPM (N1) when engine 2 throttle is on idle stop.

CAUTION

ENSURE SECOND ENGINE ENGAGES AS THROTTLE IS INCREASED. A NONENGAGED ENGINE INDICATES 10 TO 15% *ENG RPM* (N2) HIGHER THAN THE ENGAGED ENGINE AND NEAR ZERO *TORQUE*. IF A NONENGAGEMENT OCCURS, CLOSE THROTTLE OF THE NONENGAGED ENGINE. WHEN THE NONENGAGED ENGINE HAS STOPPED, SHUT DOWN THE ENGAGED ENGINE.

IF A SUDDEN (HARD) ENGAGEMENT OCCURS, SHUT DOWN BOTH ENGINES. MAINTENANCE ACTION IS REQUIRED.

Engine 2 throttle — Increase slowly to match Engine 1 N_2 RPM. Monitor tachometer and torquemeter to verify engagement of second engine.

Engine 2 ENGINE OIL pressure — Check.

ENG 2 PART SEP OFF caution light — Check extinguished.

IF EXTERNAL POWER WAS USED — DISCONNECT. *GEN 1 SWITCH* — *ON*.

GEN 2 switch — ON. (BATTERY BUS 1 will switch OFF automatically.)

NOTE

Only one BATTERY BUS switch (1 or 2) should remain on with both generators operating.

Caution lights — Check all extinguished (except AFCS).

ENGINE, XMSN, and GEAR BOX OIL temperatures and pressures - Within limits.

AMPS 1 and 2 -- Within limits.

NOTE

AMPS 2 will indicate a higher load than AMPS 1 until battery is fully charged.

Radios — ON as required.

ELT (if installed) — Check for inadvertent transmission.

FALSE START

ATTEMPTED ENGINE START WITH NO LIGHTOFF

When the engine fails to light off within 15 seconds after the throttle has been opened to idle, the following action is recommended:

IDLE STOP release — Actuate.

Throttle — Fully closed.

Starter — Disengage.

FUEL switch — OFF.

BOOST PUMP switch — OFF.

After GAS PROD RPM (N1) has decreased to zero, allow 30 seconds for fuel to drain from engine. Conduct a DRY MOTORING RUN before attempting another start.

DRY MOTORING RUN

The following procedure is used to clear an engine whenever it is deemed necessary to remove internally trapped fuel and vapor.

Throttle — Fully closed.

BOOST PUMP switch — ON.

FUEL switch — ON.

IGN circuit breaker — Pull out.

Starter — Engage for 15 seconds, then disengage.

FUEL switch — OFF.

BOOST PUMP switch — OFF.

IGN circuit breaker — Push in.

Allow the required cooling period for the starter before proceeding. Follow normal start sequence as described on preceding pages.

SYSTEMS CHECKS

STICK CENTERING INDICATOR CHECK

CAUTION

DURING EXTREME COLD AMBIENT TEMPERATURES LIMIT CYCLIC MOVEMENTS UNTIL *XMSN OIL* TEMPERATURE REACHES 15°C.

CAUTION

DO NOT DISPLACE CYCLIC MORE THAN 1.5 INCHES FROM CENTER TO CHECK THE SYSTEM. IF *CYC CTR* CAUTION LIGHTS DO NOT ILLUMINATE WITHIN THE 1.5 INCH DISPLACEMENT, THE SYSTEM IS INOPERATIVE.

DO NOT DISPLACE CYCLIC BEYOND POINT AT WHICH *CYC CTR* CAUTION LIGHT ILLUMINATES.

NOTE

CYC CTR caution lights are inhibited between 95 and 105% ROTOR RPM.

Cyclic — Displace approximately 1.25 inch (31.7 mm) forward, aft, left and right. Check CYC CTR caution light illuminates each time when displaced and extinguishes when centered.

FORCE TRIM CHECK

Flight controls — Friction off; collective lock removed.

Cyclic and pedals — Move slightly each direction to check force gradients.

Cyclic FORCE TRIM release button — Press; check trim releases with button pressed, reengages with button released.

FORCE TRIM switch — OFF; check trim disengages and FT OFF caution light illuminates.

FORCE TRIM switch — ON, cover down.

PRELIMINARY HYDRAULIC CHECK

Throttles — Set to idle.

NOTE

Uncommanded control movement or motoring with either hydraulic system off may indicate hydraulic system malfunction.

HYDR SYS NO. 1 switch — OFF, then ON.

HYDR SYS NO. 2 switch — OFF, then ON.

ENGINE FUEL CONTROL CHECK

Throttles (both) — Idle.

CAUTION

DO NOT ALLOW *GAS PROD* TO DECREASE BELOW 60% RPM (N1).

NOTE

In the vicinity of 8000 feet pressure altitude, GAS PROD RPM (N1) may not change significantly when manual fuel control is selected.

GOV switch (ENGINE 1 or 2) — MANUAL; observe a change in GAS PROD RPM (N1) and GOV MANUAL caution light illuminates. Open respective throttle carefully to ensure GAS PROD RPM (N1) responds upward, then return to idle position. Return GOV switch to AUTO. Check for a return to original GAS PROD RPM (N1) and GOV MANUAL caution light extinguishes. Check second governor in like manner.

Throttles (both) — Increase slowly to above 89% ROTOR RPM.

FUEL CROSSFEED AND INTERCONNECT VALVE CHECK

FUEL XFEED/INTCON test switch — TEST BUS 1 and hold.

NOTE

After turning either boost pump off, FUEL BOOST caution light should illuminate on failed side only.

ENGINE 1 BOOST PUMP switch — OFF. Check engine 1 FUEL PRESS decreases, then returns to normal. (This indicates crossfeed valve has been opened by bus no. 1 power and check valve is functioning properly). Return switch to ON.

FUEL INTCON switch — OPEN. Check FUEL INTCON caution light illuminates then extinguishes. (This indicates interconnect valve has been opened by bus no. 1 power and valve is functioning properly).

FUEL INTCON switch — OVRD CLOSE. Check FUEL INTCON caution light illuminates then extinguishes.

FUEL XFEED/INTCON test switch — TEST BUS 2 and hold.

ENGINE 2 BOOST PUMP switch — OFF. Check engine 2 FUEL PRESS decreases, then returns to normal. Return switch to ON.

FUEL INTCON switch — OPEN. Check FUEL INTCON caution light illuminates then extinguishes. (This indicates that the interconnect valve has been opened by bus no. 2 power and that the valve is functioning properly).

FUEL INTCON switch — NORM. Check FUEL INTCON caution light illuminates then extinguishes.

FUEL XFEED/INTCON test switch — NORM.

FUEL XFEED switch — OVRD CLOSE.

ENGINE 1 BOOST PUMP switch — OFF. Check FUEL PRESS drops to zero on affected system. Return switch to ON. Repeat procedure for ENGINE 2 BOOST PUMP switch.

FUEL XFEED switch — NORM.

ELECTRICAL SYSTEMS CHECK

DC VOLTS — Check 27 ± 1 volts.

AC VOLTS — Check 104 to 122 volts.

AMPS 1 and 2 — Check within limits

GEN 1 and 2 switches — OFF

EMERG LOAD switch — EMERG LOAD. Check that the following items remain operational:

- One helipilot
- One NAV-COM
- Panel lights
- ICS lights
- Essential engine instruments
- Essential navigation instruments

EMERG LOAD switch — NORMAL

GEN 1 and 2 switches — ON

INV 1 switch — OFF; check INVERTER 1 caution light illuminates. Check no. 1 and no. 2 AC VOLTS for indication that inverter 2 has assumed all ac loads. Return INV 1 switch to ON.

INV 2 switch — OFF; check INVERTER 2 caution light illuminates. Check no. 1 and no. 2 AC VOLTS for indication that inverter 1 has assumed all ac loads. Return INV 2 switch to ON.

EMERG LT switch (if installed) — TEST. check all emergency lights illuminate. Switch to ARM: check lights dim to faint glow.

STBY ATT switch (if installed) — ON.

AFCS CHECK

NOTE

Verification of AFCS actuator centering is necessary. Failure of the actuators to center could result in reduced control margins and abnormal control positions.

NOTE

If fast slaving is desired, center ADI roll trim knob, then push and hold VG FAST ERECT button until attitude indicator displays zero degrees bank angle. Use of VG FAST ERECT button will disengage the respective helipilot.

Pilot and copilot attitude indicators — Erect and set as necessary

WARNING

IF AFCS IS LEFT ENGAGED IN ATT MODE DURING GROUND OPERATION, IT CAN DRIVE THE CYCLIC STICK TO A CONTROL STOP.

HP 1 and HP 2 buttons — ON. Observe ATT light illuminates. APIs center, and AFCS caution light extinguishes.

NOTE

CYC CTR caution lights may illuminate momentarily during cyclic control checks.

Move cyclic forward, aft, right, left. Observe APIs do not move.

SYS 2 button — Press and hold.

Move cyclic forward, aft, right, left. Observe APIs do not move.

SYS 2 button — Release.

Cyclic ATTD TRIM switch — Right for 2 seconds, then aft for 2 seconds. Observe APIs move right, up.

SYS 2 button — Press and hold. Observe SYS 2 actuators agree.

Cyclic FORCE TRIM release button — Press. Observe APIs move to center.

SYS 2 button — Release. Observe SYS 1 actuators centered.

SAS/ATT button — Press. Observe SAS light illuminates.

Move cyclic right, left, forward, and aft. Observe APIs move in corresponding direction.

Displace right pedal, then left. Observe yaw API moves right, left.

SYS 2 button — Press and hold.

Move cyclic right, left, forward, and aft. Observe APIs move in corresponding direction.

SYS 2 button — Release.

ENGINE RUNUP

CAUTION

IF HELICOPTER IS SITTING ON ICE OR OTHER SLIPPERY OR LOOSE SURFACE, ADVANCE THROTTLES SLOWLY TO PREVENT ROTATION OF HELICOPTER.

Engine 1 throttle — Fully open

ENG — Stabilized at 95 ± 1% RPM (N2).

Engine 2 throttle — Fully open. Check no. 1 engine increases 2% ENG RPM (N2) and both engines stabilize at 97 ± 1% ENG RPM (N2).

RPM INCR/DECR switch — Full INCR. Check ENG does not exceed 101.5% RPM (N2). Set at 100% ENG RPM (N2).

CABIN HEATER CHECK

GAS PROD — Check 75% RPM (N1) minimum (both engines).

Thermostat knob — Fully COLD.

CAUTION

HEATER SWITCH SHALL BE TURNED *OFF* WHEN HEATED AIRFLOW DOES NOT SHUT OFF AFTER THERMOSTAT IS TURNED TO FULLY *COLD*, *HEATER AIR LINE* LIGHT ILLUMINATES, OR *CABIN HTR* CIRCUIT BREAKER TRIPS.

CAUTION

DO NOT OPERATE HEATER ABOVE 21°C OAT.

HEATER switch — ON.

VENT BLOWER switch — ON.

Thermostat setting — Increase and observe heated airflow

DEFOG lever — ON; check airflow is diverted from pedestal outlets to windshield nozzles. Return lever to OFF.

AFT OUTLET switch — ON; check airflow distributed equally between pedestal outlets and aft outlets. Return switch to OFF.

NOTE

Heater operation affects performance. Refer to Hover Ceiling and Rate of Climb charts for HEATER ON in Section 4.

HEATER switch — As desired.

VENT BLOWER switch — As desired.

HYDRAULIC SYSTEMS CHECK

NOTE

The HYDRAULIC SYSTEMS CHECK is to determine proper operation of the hydraulic actuators for each flight control system. If abnormal forces, unequal forces, control binding or motoring are encountered, it may be an indication of a malfunctioning flight control actuator.

FORCE TRIM switch — OFF.

Collective — Fully down, friction removed.

ROTOR — Set to 100% RPM.

Cyclic — Centered, friction removed.

HYDR SYS NO. 1 switch — OFF. Check NO. 1 HYDRAULIC caution light and MASTER CAUTION light illuminate and system 1 pressure drops to zero.

Cyclic — Check normal operation by moving cyclic forward, aft, left, and right approximately one inch. Center cyclic.

Collective — Check for normal operation by increasing collective control 1 to 2 inches. Repeat 2 to 3 times as required. Return to fully down position.

Pedals — Displace slightly left and right. Note an increase in force required to move pedal in each direction.

HYDR SYS NO. 2 switch — OFF. Check hydraulic system 2 remains operational, and system 1 remains off.

HYDR SYS NO. 1 switch — ON. Check NO. 1 HYDRAULIC caution light extinguishes, and system 1 regains normal pressure. Check NO. 2 HYDRAULIC caution light illuminates and system 2 pressure drops to zero.

Cyclic — Check normal operation by moving cyclic forward, aft, left, and right approximately one inch. Center cyclic.

Collective — Check for normal operations by increasing collective control 1 to 2 inches. Repeat 2 to 3 times as required. Return to fully down position.

Pedals — Displace slightly left and right. Note the pedals are now hydraulically boosted.

HYDR SYS NO. 2 switch — ON. Check NO. 2 HYDRAULIC caution light extinguishes, system 2 pressure returns to normal, and hydraulic system 1 remains operational.

Cyclic and collective friction — Set as desired.

FORCE TRIM switch — ON.

WARNING

BOTH HYDRAULIC SYSTEMS SHALL BE OPERATIONAL PRIOR TO TAKEOFF.

NOTE

System 1 will normally operate 10 to 20°C cooler than system 2.

BEFORE TAKEOFF

Engine, gearbox, transmission, hydraulic, and electrical instruments -- Within operating ranges.

Caution and warning lights — Extinguished.

WARNING

MODERATE FRICTION SHALL BE APPLIED TO OVERCOME FOLLOW-THROUGH COUPLING BETWEEN THROTTLES.

Throttles — Fully open. Adjust frictions.

ENG — 100% RPM (N2) for both engines.

Flight instruments — Check operation and set.

POSITION lights — As required.

ANTI COLL light — Check ON.

PITOT STATIC HEATERS switch — ON. Check ammeter for load indication. Leave ON in visible moisture when temperature is below 4.4°C (40°F), OFF if not required.

Radio(s) - Check functioning.

Cyclic control Centered or slightly into the wind.

EMERGENCY COMM panel -- (If installed) Check for single pilot operations.

AFCS — Select ATT or SAS mode as desired (ATT mode shall be used during IFR flight. SAS mode recommended for ground operation, hover, and takeoff).

FORCE TRIM switch — ON in ATT mode, as desired in SAS mode.

STEP switch (if installed) -- As desired.

Passenger seat belts — Fastened.

All doors — Secured.

POWER ASSURANCE CHECK

Power assurance check should be performed daily. (Refer to Section 4.)

PROLONGED GROUND OPERATION

NOTE

For prolonged ground operation, AFCS shall not be operated in ATT mode.

CAUTION

MINIMUM ROTOR -- 97% RPM FOR GROUND OPERATION WITH STICK CENTERING INDICATOR SYSTEM INOPERATIVE.

NOTE

Minimize blade flapping by maintaining highest rotor RPM (N_R) within allowable range.

ROTOR RPM — 77 - 85% or above, as desired.

Cyclic — Position as necessary to extinguish CYC CTR caution lights.

NOTE

On side slopes greater than five degrees, maintain 100% ROTOR RPM. CYC CTR caution lights are inhibited.

TAKEOFF

CAUTION

DURING LIFTOFF TO HOVER, ANY ABNORMAL INCREASE IN ONE PER REV VIBRATION MAY INDICATE ONE OR MORE MAIN ROTOR DROOP RESTRAINERS FAILED TO DISENGAGE FROM STATIC POSITION. VERIFY PROPER OPERATION PRIOR TO FLIGHT.

NOTE

When AFCS is in ATT mode, the FORCE TRIM release button should be pressed before liftoff (to trim actuators to center positions) and should be held until desired climbout attitude is attained.

ENG — 100% RPM (N2).

Area — Clear.

Hover power — Check torque required to hover at four feet skid height.

NOTE

Downwind takeoffs are not recommended since the published takeoff distance performance will not be achieved

During takeoff, pitch attitude must be adjusted commensurate with power application to prevent entering the AVOID area of the Height-Velocity diagram. Torque shall not exceed 15% above IGE hover power while accelerating to Takeoff Climbout Safety Speed. (Refer to Section 4.)

Cyclic control — Apply forward cyclic to accelerate smoothly.

Collective — Adjust as desired after reaching V_{TOCS} (45 KIAS).

AIRSPEED — Within limits (60 KIAS minimum for IFR).

IN-FLIGHT OPERATION

NOTE

With the simple pendulum absorber kit, vibration isolation is most effective in cruise flight at 97% ENG RPM (N2).

ENG — 97 to 100% RPM (N2).

AIRSPEED — Within limits.

Engine, gearbox, and transmission instruments — Within limits.

NOTE

Maximum pitch attitude capability of standby attitude indicator is ± 60 degrees.

Refer to applicable operating rules for high altitude oxygen requirements.

MANEUVERING WITH AFCS IN SAS MODE

Use normal pilot control techniques.

MANEUVERING WITH AFCS IN ATT MODE

Press cyclic FORCE TRIM release button and maneuver as desired. Release button when desired attitude is reached. Helipilot will hold attitude until retrimmed to new attitude. Attitude may also be adjusted with cyclic ATTD TRIM switch.

For momentary attitude changes, manual cyclic movement may be used; however, AFCS actuators may be saturated to limit authority when cyclic is moved manually.

NOTE

Inflight use of VG FAST ERECT button will disengage the respective helipilot and decouple the automatic flight control modes.

BEFORE LANDING

Flight controls — Adjust friction as desired.

AFCS — Engage ATT or SAS mode as desired.

FORCE TRIM switch — ON in ATT mode, as desired in SAS mode.

Throttles — Fully open.

ENG — 100% RPM (N2).

Flight path — Stay clear of AVOID area of Height-Velocity diagram (Refer to Section 1). For landing distance information in the event of engine failure during approach, refer to Section 4.

STEP switch (if installed) — As desired.

CAUTION

RUN ON LANDINGS MAY RESULT IN ROLL OSCILLATIONS WHILE ON THE GROUND. IF THIS OCCURS, LOWERING COLLECTIVE FULLY DOWN OR DISENGAGING HP 1 AND HP 2 WILL STOP THE OSCILLATIONS.

AFTER LANDING

Collective — Fully down.

Pedals — Centered.

FORCE TRIM switch — ON.

AFCS — SAS mode.

CAUTION

MINIMUM ROTOR — 97% RPM FOR GROUND OPERATION WITH STICK CENTERING INDICATOR SYSTEM INOPERATIVE.

Stick centering check — Complete. Center cyclic and friction as necessary to extinguish CYC CTR caution lights.

NOTE

On side slopes greater than five degrees, disregard CYC CTR caution lights and position cyclic as required.

ENGINE SHUTDOWN

HP 1 and HP 2 — Disengage. Check helipilot lights extinguish, AFCS and MASTER CAUTION lights illuminate

Cyclic — Frictioned as desired. Maintain cyclic stick as near center as possible at all rotor speeds.

NOTE

For ground operation, maintain ROTOR RPM within allowable range. Higher minimum ROTOR RPM reduces blade flapping.

Throttles — Reduce to 77 - 85% ROTOR RPM, as desired.

ITT — Stabilize for one minute.

ELT (if installed) — Check for inadvertent transmission.

STBY ATTD switch (if installed) — OFF.

EMERG LT switch (if installed) — DISARM.

Engine instruments — Within limits.

IDLE STOP release switch — ENG 1 position.

Engine 1 throttle — Fully closed. Check ITT and GAS PROD RPM (N1) decreasing.

BATTERY BUS 1 switch — ON.

IDLE STOP release switch — ENG 2 position.

Engine 2 throttle — Fully closed. Check ITT and GAS PROD RPM (N1) decreasing.

GEN 1 and 2 switches — OFF.

INV 1 and 2 switches — OFF.

ENGINE 1 and 2 FUEL switches — OFF.

ENGINE 1 and 2 BOOST PUMP switches — OFF.

ENGINE 1 and 2 FUEL TRANS switches — OFF.

Radios — OFF.

WARNING

DO NOT USE COLLECTIVE TO SLOW ROTOR RPM. USE OF COLLECTIVE TO SLOW ROTOR CAN CAUSE EXCESSIVE FLAPPING AND / OR CONING.

CAUTION

AVOID RAPID ENGAGEMENT OF ROTOR BRAKE IF HELICOPTER IS ON ICE OR OTHER SLIPPERY OR LOOSE SURFACE TO PREVENT ROTATION OF HELICOPTER.

Rotor brake — As desired. Apply at or below 40% ROTOR RPM. Return to stowed position after main rotor stops.

Pilot — Remain at flight controls until rotor has come to a complete stop.

Lighting and miscellaneous switches — OFF.

BATTERY BUS 1 and BUS 2 switches — OFF.

Collective down lock — Secured as desired.

AFTER EXITING HELICOPTER

If conditions require, perform the following:

NOTE

Refer to BHT-412-MD-2 for additional information.

Check general condition of droop restraint system and verify droop restraint arms are engaged in the lower detent of cam window.

Install main rotor blade tiedown socks on blades and secure to mooring points.

Install tail rotor tiedown strap and secure to vertical fin.

Install exhaust covers, engine inlet protective plugs, and pitot tube covers.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

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Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

INTRODUCTION

The following procedures contain the indications of equipment or system failure or malfunction, the use of emergency features of primary and backup systems, and appropriate warnings, cautions, and explanatory notes. Table 3-1 lists fault conditions and corrective actions required for illumination of red warning lights. Table 3-2 addresses malfunction procedures associated with yellow caution lights.

All corrective action procedures listed herein assume the pilot gives first priority to aircraft control and a safe flight path.

The helicopter should not be operated following any emergency landing or shutdown until the cause of the malfunction has been determined and corrective maintenance action taken.

DEFINITIONS

The following terms indicate the degree of urgency in landing the helicopter.

LAND AS SOON AS POSSIBLE	Land without delay at the nearest suitable area (i.e., open field) at which a safe approach and landing is reasonably assured.
LAND AS SOON AS PRACTICAL	The duration of the flight and landing site are at the discretion of the pilot. Extended flight beyond the nearest approved landing area is not recommended.

The following terms are used to describe the operating condition of a system, subsystem, assembly, or component.

Affected	Fails to operate in the intended or usual manner.
Normal	Operates in the intended or usual manner.

Table 3-1. Warning lights

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
FIRE PULL (1 or 2)	Fire indication in No. 1 or No. 2 engine compartment.	Pull illuminated FIRE PULL handle. Select MAIN fire extinguisher. Close throttle of affected engine. Select RESERVE fire extinguisher if necessary. Land as soon as possible.
BAGGAGE FIRE	Smoke in baggage compartment.	Reduce power to minimum required. Land as soon as possible. Inspect tailboom area for damage.
ENG OUT (1 or 2)	GAS PROD abnormally low, below 53 ± 2% RPM (N1), on No. 1 or No. 2 engine.	Check ENG TORQUE, GAS PROD RPM (N1), ENG RPM (N2), and ITT. Adjust power and AIRSPEED (65 KIAS). Reset remaining ENG RPM (N2) to normal range. Close throttle of affected engine. Refer to ENGINE FAILURES and RESTART IN FLIGHT procedures. Land as soon as practical.
XMSN OIL PRESSURE	Transmission oil pressure below limit.	Reduce power. Land as soon as possible.
XMSN OIL TEMP	Transmission oil temperature above limit.	Reduce power. Check XMSN OIL temperature. If not within limits, land as soon as possible.
C BOX OIL PRESSURE	Combining gearbox oil pressure below normal.	Reduce power. Land as soon as possible.
C BOX TEMP	Combining gearbox oil temperature above limit.	Reduce power. Check GEAR BOX OIL temperature. If not within limits, land as soon as possible.

Table 3-1. Warning lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATTERY TEMP	Battery case temperature above limit.	BATTERY BUS 1 and BUS 2 switch OFF. Land as soon as practical. WARNING BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATTERY TEMP LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.
ROTOR BRAKE	Rotor brake linings not retracted.	Check rotor brake handle fully up in detent. If light remains on, land as soon as possible.

Table 3-2. Caution lights

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
OIL PRESSURE (ENG 1 or 2)	Engine oil pressure below limit.	Shut down affected engine. FUEL INTCON switch — OPEN. Land as soon as practical.
DC GENERATOR (ENG 1 or 2)	Failure of dc generator.	GEN FIELD and GEN RESET circuit breakers — Check in. GEN switch (affected generator) — RESET, then ON. If light remains on, turn GEN switch OFF. If No. 2 generator failed: BATTERY BUS 2 switch — OFF. BATTERY BUS 1 switch — ON.

Table 3-2. Caution lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
		If nonessential bus power is required: NON-ESNTL BUS switch — MANUAL. DC AMPS — Monitor. If both generators fail: **CAUTION** DO NOT SELECT *EMERG LOAD* AT PRESSURE ALTITUDES ABOVE 5000 FEET. BOTH FUEL BOOST PUMPS WILL BECOME INOPERATIVE, RESULTING IN POSSIBLE FUEL STARVATION. EMERG LOAD switch — As required. Land as soon as practical.
PART SEP OFF (ENG 1 or 2)	Particle separator bypass door closed or circuit breaker out. Ice and dust protection system inoperative.	Check ENG 1 (or 2) RPM and PART SEP circuit breakers in. Move PART SEP switch to OVRD ON.
NO. 1 FUEL BOOST/ NO. 2 FUEL BOOST	Fuel boost pump failure has occurred	If practical, descend below 5000 feet H_P to prevent possible fuel starvation in the event remaining boost pump fails.

Table 3-2. Caution lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
	NOTE If either fuel boost pump fails, and the FUEL XFEED switch is in NORM position, the crossfeed valve is opened automatically by a pressure switch, allowing either boost pump to furnish fuel to both engines.	FUEL INTCON switch - OPEN. **CAUTION** IF EITHER BOOST PUMP FAILS, USABLE FUEL WILL BE APPROXIMATELY 60 POUNDS LESS THAN INDICATED. Land as soon as practical.
NO. 1 FUEL FILTER/ NO. 2 FUEL FILTER	Fuel filter is partially blocked	Land as soon as practical.
FUEL LOW (Less than 100 lbs. difference between No. 1 and No. 2 fuel quantities)	Fuel level in left or right cells at or below 190 pounds. **NOTE** The FUEL LOW light will not illuminate for the affected side when fuel quantity indication malfunction occurs. Refer to FUEL QUANTITY INDICATION MALFUNCTION.	Plan landing. **NOTE** Interconnect valve will open automatically when fuel level in opposite side decreases to 190 pounds (as indicated by illumination of FUEL INTCON caution light). This will allow the fuel quantity in the lower aft cells to equalize. If either boost pump fails, usable fuel will be approximately 60 pounds less than indicated. This fuel will be available to both engines through either boost pump. FUEL INTCON caution light can be extinguished by placing FUEL INTCON switch to OPEN position.
FUEL LOW (100 lbs. or more difference between No. 1 and No. 2 fuel quantities)	Possible fuel leak in cells with lower quantity	FUEL INTCON switch — OVRD CLOSE. Land as soon as possible.

Table 3-2. Caution lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
GOV MANUAL (ENG 1 or 2)	Engine governor in manual mode.	TORQUE, ITT, and RPM must be controlled with throttle.
ENGINE CHIP (ENG 1 or 2)	Metal particles in engine oil.	Reduce power and shut down engine as soon as practical to minimize engine damage. Land as soon as practical.
FUEL VALVE (ENG 1 or 2)	Fuel valve not properly seated or circuit breaker out.	Check FUEL VALVE circuit breakers in. Land as soon as practical. If on ground, cycle FUEL switch.
NO. 1 GEN OVHT/ NO. 2 GEN OVHT	Generator overheating.	GEN switch — OFF.
CAUTION PANEL	Caution panel inoperative.	Check MASTER CAUTION circuit breaker in. Monitor aircraft instruments. Land as soon as practical.
NO. 1 INVERTER/ NO. 2 INVERTER	Failure of ac power inverter;	Check both ac voltmeters to determine that remaining inverter automatically assumed load for failed inverter. Check INV PWR circuit breakers in. Reengage HP 1 or HP 2. During IFR flight, if both inverters fail, land as soon as practical; or continue flight under VFR, if desired.
	or	
NO. 2 INVERTER	EMERG LOAD switch in EMERG LOAD position	Place EMERG LOAD switch in NORMAL position, if electrical load shedding is not required.
EXTERNAL POWER	External power receptacle door open.	Check external power door closed.
DOOR LOCK	Passenger door(s) or baggage compartment door not secured	Check doors secured.
BATTERY	Both BATTERY switches/ relays in the same position.	Turn one BATTERY switch ON, other OFF. If light remains on, reverse BATTERY switch positions.
C BOX CHIP	Metal particle in combining gearbox oil.	Reduce power. Land as soon as practical.

Table 3-2. Caution lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
XMSN CHIP	Metal particles in transmission oil (one or more remote XMSN CHIP indicators tripped).	Reduce Power. Land as soon as practical.
42/90 BOX CHIP	Metal particles in 42° or 90° gearbox oil.	Land as soon as practical.
NO. 1 HYDRAULIC/ NO. 2 HYDRAULIC	Hydraulic pressure below limit or temperature above limit.	Verify fault and affected system from gage readings. Turn off affected system. Land as soon as possible.
NO. 1 FUEL TRANS/ NO. 2 FUEL TRANS	Fuel transfer pump or ejector pump malfunction (no fuel transfer from lower forward and middle cells to lower aft cell); or Check valve malfunction allowing fuel to leak from aft to mid cell after normal transfer is complete (total fuel 600 pounds or less). NOTE FUEL TRANS light will remain illuminated after fuel transfer with fuel quantity indication malfunction. Refer to FUEL QUANTITY INDICATION MALFUNCTION.	Check FUEL TRANS circuit breaker — in. Check FUEL TRANS switch — ON. CAUTION IF EITHER TRANSFER PUMP FAILS, USABLE FUEL WILL BE 25 POUNDS LESS THAN INDICATED. If light remains illuminated: FUEL TRANS switch — OFF. CAUTION FUEL TRAPPED IN MID CELL IS UNUSABLE AND MUST BE SUBTRACTED FROM TOTAL FUEL QTY INDICATION. Monitor MID TANK quantity periodically. Plan landing.

Table 3-2. Caution lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
FUEL INTCON (Switch in NORM position).	Fuel interconnect valve not fully closed. (Automatic valve opening is normal if FUEL LOW light is also illuminated.)	Check FUEL INTCON circuit breakers (both) in. FUEL INTCON switch — OPEN, then NORM.
FUEL INTCON (Switch in OPEN position.	FUEL interconnect valve not fully open or FUEL INTCON circuit breakers out.	Check FUEL INTCON circuit breakers in. FUEL INTCON switch — OVRD CLOSE, then OPEN.
FUEL XFEED	Fuel crossfeed valve not fully open or closed, or FUEL XFEED circuit breakers out.	Check FUEL XFEED circuit breakers (both) in. Cycle FUEL XFEED switch.
HEATER AIR LINE	Heater mixing valve malfunction.	Turn HEATER switch OFF immediately.
AFCS	Automatic flight control system hardover;	Reduce AIRSPEED to 115 KIAS or below. Check AFCS control panel. If either helipilot is off, attempt to switch ON. (Refer to AFCS malfunction procedures.)
	or Loss of ac power to HP 1 or HP 2;	
	or Loss of attitude gyro input to HP 1 or HP 2 (possible disengagement of either or both helipilots.)	During IFR flight, if both HP 1 and HP 2 are failed and will not reset, land as soon as practical; or continue flight under VFR, if desired.
	or Auto trim malfunction. Displacement between HP 1 and HP 2 actuators at least 50 percent travel.	Reduce AIRSPEED to 115 KIAS or below. Check actuator position panel. If APIs are centered, depress SYS 2 button to check HP 2 actuator displacement. Turn off affected system.

Table 3-2. Caution lights (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
FT OFF	Force trim inoperative.	Check FORCE TRIM switch ON and FORCE TRIM circuit breaker in. During IFR flight, if system remains inoperative, land as soon as practical; or continue flight under VFR, if desired. Pilot may increase cyclic friction to provide additional cyclic stabilization.
CYC CTR	Cyclic not centered.	Center cyclic.
RPM (with audio) or RPM (without audio)	ROTOR RPM at or below 95%. or ROTOR RPM at or above 105%.	Adjust collective pitch and/or RPM INCR/DECR switch as required. Refer to ENGINE FUEL CONTROL MALFUNCTION procedures.

FIRE

ENGINE FIRES

INDICATIONS

FIRE 1 PULL or FIRE 2 PULL handle illuminated.

ENGINE FIRE DURING START

PROCEDURE:

Abort start of affected engine as follows:

Throttle — Closed.

FUEL XFEED switch — OVRD CLOSE.

BOOST PUMP switch — OFF.

FUEL switch — OFF.

Appropriate FIRE PULL handle — Pull.

FIRE EXT switch — MAIN.

If FIRE warning light remains on more than 10 seconds: FIRE EXT switch — RESERVE.

Complete engine shutdown.

Exit helicopter.

ENGINE FIRE DURING TAKEOFF OR LANDING

PROCEDURE:

The primary concern for the pilot is safety of the passengers and crew. The decision whether to begin an approach, or continue the takeoff is based on landing site availability. Proceed as follows:

AIRSPEED — 45 KIAS minimum.

Collective — Reduce (altitude permitting).

Appropriate FIRE PULL handle — Pull.

FIRE EXT switch — MAIN.

If FIRE warning light remains on more than 10 seconds: FIRE EXT switch — RESERVE.

ENG — Set at 100% RPM (N2) if possible.

Land as soon as possible.

Complete engine shutdown.

Exit helicopter.

ENGINE FIRE IN FLIGHT

PROCEDURE:

Initiate emergency descent immediately if possible.

Shut down affected engine as follows:

Collective — Reduce (altitude permitting).

Appropriate FIRE PULL handle — Pull.

Throttle — Closed.

FIRE EXT switch — MAIN.

FUEL XFEED switch — OVRD CLOSE.

BOOST PUMP switch — OFF.

FUEL switch — OFF

FUEL INTCON switch — OPEN.

If FIRE warning light remains on more than 10 seconds: FIRE EXT switch — RESERVE.

ENG (unaffected engine)— Set at 100% RPM (N2) if possible.

Land as soon as possible.

If a landing site is not readily available, proceed as follows:

FIRE PULL handle — In (to provide fire protection for unaffected engine).

GEN switch (affected engine) — OFF.

NON-ESNTL BUS switch — As desired.

If No. 2 engine was shut down:

BATTERY BUS 2 switch — OFF;

BATTERY BUS 1 switch — ON.

After landing, proceed as follows:

Complete engine shutdown.

Exit helicopter.

SMOKE OR FUMES IN CABIN

INDICATIONS:

Smoke, toxic fumes, etc., in cabin.

PROCEDURE:

VENT BLOWER switch — ON.

Vents and windows — Open.

If additional ventilation is required:

AIRSPEED — Reduce to 60 KIAS or less.

Passenger doors — Open.

If time and altitude permit and the source is suspected to be electrical, attempt to identify and isolate the affected system.

Land as soon as possible.

ENGINE FAILURES

SINGLE ENGINE FAILURE

ENG RPM (N2) of the normally operating engine is allowed to droop to 97% during transition from twin engine operation to single engine operation. When the best rate of climb airspeed (70 KIAS) is obtained, ENG RPM (N2) should be increased to 100% if possible.

Flight can be continued on remaining engine until a desirable landing site is available. There are certain combinations of gross weight, altitude, and cold ambient temperatures at which a single engine approach will result in the OEI torque limit being exceeded. A run-on landing at 20 to 30 KIAS is recommended

CAUTION

RUN ON LANDINGS MAY RESULT IN ROLL OSCILLATIONS WHILE ON THE GROUND. IF THIS OCCURS, LOWERING COLLECTIVE FULLY DOWN OR DISENGAGING *HP 1* AND *HP 2* WILL STOP THE OSCILLATIONS.

Loss of an engine while hovering at high gross weight and extremely cold conditions will most likely result in exceeding the OEI torque limit. If an overtorque is observed or suspected, an appropriate log book entry shall be made. Refer to Performance charts in Section 4.

NOTE

If an engine restart is to be attempted, refer to ENGINE RESTART in MALFUNCTION PROCEDURES.

INDICATIONS:

ENG 1 OUT or ENG 2 OUT warning light illuminated.

GAS PROD below 55% RPM (N1) and decreasing.

ENG below 85% RPM (N2) and decreasing.

ITT below 400°C and decreasing.

ENG 1 or ENG 2 OIL PRESSURE, DC GENERATOR, and PART SEP OFF caution lights illuminated.

PROCEDURE:

WARNING

IF CORRECTIVE ACTION IS NOT INITIATED IMMEDIATELY, *ROTOR* RPM CAN DECAY EXCESSIVELY.

CAUTION

DURING COLD WEATHER OPERATIONS, CAREFULLY MONITOR *TORQUE* OF THE NORMAL ENGINE WHEN ONE ENGINE FAILS OR IS SHUT DOWN IN FLIGHT.

Collective — Reduce as required to maintain ROTOR RPM and power within OEI limits.

AIRSPEED — 70 KIAS.

RPM switch — INCR; set ENG RPM (N2) at 100% if possible.

Throttle (affected engine) — Closed.

BOOST PUMP switch (affected engine) — OFF.

FUEL switch (affected engine) — OFF.

FUEL XFEED switch — OVRD CLOSE.

FUEL INTCON switch — OPEN.

GEN switch (affected engine) — OFF.

NON-ESNTL BUS switch — As desired.

If No. 2 engine failed:

BATTERY BUS 2 switch — OFF;

BATTERY BUS 1 switch — ON.

MASTER CAUTION light — Reset.

Altitude — Descend below 6000 ft H_D (if possible).

Land as soon as practical.

DUAL ENGINE FAILURE

INDICATIONS:

ENG 1 OUT and ENG 2 OUT warning lights illuminated.

RPM caution light illuminated.

Rotor rpm audio on.

GAS PROD below 53% RPM (N1) and decreasing (both engines).

ENG below 85% RPM (N2) and decreasing (both engines).

ITT below 400°C and decreasing (both engines).

ENG 1 and ENG 2 OIL PRESSURE, DC GENERATOR, and PART SEP OFF caution lights illuminated.

PROCEDURE:

WARNING

IF CORRECTIVE ACTION IS NOT INITIATED IMMEDIATELY, ROTOR RPM CAN DECAY EXCESSIVELY.

Collective pitch — Reduce. Establish autorotative glide at 70 to 90 KIAS.

NOTE

AIRSPEED for best angle of glide in autorotation is 90 KIAS, and AIRSPEED for minimum rate of descent is 70 KIAS. Autorotational rate of descent is a function of AIRSPEED and ROTOR RPM and is virtually unaffected by gross weight and density altitude.

Accomplish autorotative landing.

If time permits before landing and a restart will not be attempted, proceed as follows:

Throttles (both) — Closed.

FUEL switches (both) — OFF.

BOOST PUMP switches (both) — OFF.

FUEL TRANS switches (both) — OFF.

After landing, complete shutdown.

TAIL ROTOR FAILURES

The key to successful handling of a tail rotor emergency lies in the pilot's ability to quickly recognize the type of malfunction and to select the proper emergency procedure. Following is a discussion of some types of tail rotor malfunctions and their probable effects.

COMPLETE LOSS OF TAIL ROTOR THRUST

INDICATIONS:

This is a situation involving a break in the drive system, such as a severed driveshaft, wherein the tail rotor stops turning and delivers no thrust. A failure of this type in powered flight will result in the nose of the helicopter swinging to the right (left side slip) and usually a roll of the fuselage. Nose down attitude may also be present. The severity of the initial reaction will be affected by airspeed, density altitude, gross weight center of gravity, and power being used.

LOSS OF T/R THRUST AT HOVER

PROCEDURE:

Close throttles immediately and make a hovering autorotation landing. Yawing can be expected on touchdown.

LOSS OF T/R THRUST IN CLIMB

The degree of right yaw upon failure will be greater than that experienced in level flight due to the higher power and anti-torque settings.

PROCEDURES:

Close throttles and lower collective pitch immediately. Establish a glide speed slightly above normal autorotation approach speed.

If a turn is required to reach a more desirable place to land or to align into the wind, make it to the right if possible. A turn to the right can be more nearly streamlined by the use of a little power.

Once aligned for landing, yaw can be controlled in the following manner:

Right Yaw

If the nose yaws right with power off, a pulse of up-collective will produce more friction in the mast thrust bearings, creating a left moment. The greater the input of the pulse, the more the response will be.

WARNING

DO NOT ALLOW ROTOR RPM TO DECAY BELOW MINIMUM LIMITS.

Moving the collective upward abruptly increases rotor loading. Do not hold collective up, as rotor rpm will decrease lower than desirable. It is essential that the collective be returned to the down position for autorotation. This cycle is one pulse. The pulse should be rapid (up and down) but should not be used at low altitudes.

Left Yaw

If the nose yaws left with power off, a slight addition of power should arrest it. Further increase in power results in more right yaw response

Landing

CAUTION

RUN ON LANDINGS MAY RESULT IN ROLL OSCILLATIONS WHILE ON THE GROUND. IF THIS OCCURS, LOWERING COLLECTIVE FULLY DOWN OR DISENGAGING RP 1 AND RP 2 WILL STOP THE OSCILLATIONS.

During the final stages of the approach, a mild flare should be executed and all power to the rotor should be off. Maintain helicopter in a slight flare and use collective smoothly to execute a soft, slightly nose-high landing. Landing on the aft portion of the skids will tend to correct side drift. If helicopter starts to turn, move cyclic as necessary to follow the turn until helicopter comes to a complete stop. This technique will, in most cases, result in a run-on type landing.

CAUTION

FOR ZERO GROUND SPEED LANDING, THE FLARE AND THE ABRUPT USE OF COLLECTIVE MAY CAUSE THE NOSE TO YAW LEFT DO NOT CORRECT WITH THROTTLE. ALTHOUGH APPLICATION OF THROTTLE WILL RESULT IN YAWING TO THE RIGHT, ADDITION OF POWER IS A VERY STRONG RESPONSE MEASURE AND IS TOO SENSITIVE FOR THE PILOT TO MANAGE PROPERLY. DO NOT ADD POWER AT THIS TIME. SLIGHT YAWING UPON TOUCHDOWN AT ZERO GROUND SPEED MAY BE EXPECTED.

LOSS OF T/R THRUST IN LEVEL FLIGHT OR DESCENT

PROCEDURE:

Close throttles and reduce collective pitch immediately. Attain an airspeed slightly above the normal autorotative glide speed.

If altitude permits with AIRSPEED above 60 KIAS, throttle and collective may be gently applied to determine if some degree of powered flight can be resumed. If unacceptable yawing is experienced, re-enter autorotation and continue descent to a landing.

The landing technique is the same as prescribed for the climb condition above.

LOSS OF TAIL ROTOR COMPONENTS

The loss of any tail rotor components will result in a forward center of gravity shift. Other than additional nose down pitching, this situation would be quite similar to complete loss of tail rotor thrust, as discussed above.

TAIL ROTOR FIXED PITCH FAILURES

INDICATIONS:

Tail rotor pitch change control failures are characterized either by a lack of directional response when a pedal is pushed or by locked pedals. If pedals cannot be moved with a moderate amount of force, do not attempt to apply a maximum effort, since a more serious malfunction could result.

FIXED PITCH FAILURE AT HOVER

PROCEDURE:

Do not close throttles unless a severe right yaw occurs. If pedals lock in any position at a hover, landing from a hover can be accomplished with greater safety under power controlled flight rather than by closing throttles and entering autorotation.

FIXED PITCH FAILURE IN FLIGHT

If tail rotor fixed pitch failure occurs during climb (left pedal applied), cruise (approximately neutral pedals), and descent (right pedal applied), a descent and landing can be effected safely by use of power and throttle changes.

PROCEDURES:

If the helicopter is in a trimmed condition when the malfunction is discovered, engine power and airspeed should be noted and aircraft flown to a suitable landing area.

Combinations of ENG TORQUE, ROTOR RPM, and AIRSPEED will correct or aggravate yaw attitude and these should be adjusted as required to control yaw during landing.

Right Pedal Locked Forward of Neutral

Power should be reduced and ENG RPM (N2) maintained within the green arc. This will help streamline the helicopter in flight. Right turns are easier than left turns. AIRSPEED should be maintained at or above 60 KIAS.

Execute a normal to steep approach adjusting the power as necessary to minimize or prevent right yaw. Maintain ENG RPM (N2) and an AIRSPEED of 60 KIAS during the initial part of the approach.

At 60 to 75 feet AGL and when the landing area can be made, start a slow deceleration to arrive at the intended landing point with AIRSPEED at about 25 KIAS.

At 2 to 5 feet AGL, slowly reduce throttle to overcome yaw effect and allow helicopter to settle. When aligned with the landing area, allow helicopter to touch down.

CAUTION

RUN ON LANDINGS MAY RESULT IN ROLL OSCILLATIONS WHILE ON THE GROUND. IF THIS OCCURS, LOWERING COLLECTIVE FULLY DOWN OR DISENGAGING *HP 1* AND *HP 2* WILL STOP THE OSCILLATIONS.

After ground contact, use collective and throttle as necessary to maintain alignment with landing strip, and to minimize forward speed. If helicopter starts to turn, move cyclic as necessary to follow the turn until helicopter comes to a complete stop.

Left Pedal Locked Forward of Neutral

Reduce power and maintain ENG RPM (N2) within the green arc. Normal turns can be safely made under these conditions, although the nose may be displaced to the left.

On final approach, begin a slow deceleration so as to arrive at a point about four to five feet above the intended touchdown area as effective translational lift is lost

Apply collective pitch to stop the rate of descent and forward speed, and to align the helicopter with the intended landing path. Allow helicopter to touch down at near-zero ground speed, maintaining alignment with throttle

Pedals Locked in Neutral

Reduce power and maintain ENG RPM (N2) within the green arc. Normal turns can be safely made under these conditions.

Execute a normal to shallow approach, holding AIRSPEED at 60 KIAS during the initial part of the approach. Adjust power as necessary to minimize or prevent right yaw.

At 50 to 75 feet AGL and when the landing area can be made, start a deceleration to arrive at the intended landing point with AIRSPEED at 25 KIAS.

At 2 to 5 feet AGL, use throttle slowly as necessary to maintain alignment with the landing area and to control yaw; do not allow helicopter to settle until alignment is assured, then touch down.

CAUTION

RUN ON LANDINGS MAY RESULT IN ROLL OSCILLATIONS WHILE ON THE GROUND. IF THIS OCCURS, LOWERING COLLECTIVE FULLY DOWN OR DISENGAGING HP 1 AND HP 2 WILL STOP THE OSCILLATIONS.

After ground contact, use collective and throttle as necessary to minimize forward speed and to maintain alignment. Move cyclic as necessary to follow the turn until helicopter has come to a complete stop.

LOSS OF PITCH CHANGE CONTROL LINKAGE

INDICATIONS:

In this type of failure, the pitch-change mechanism is broken at some point and the tail rotor will assume a blade angle determined by the aerodynamic and counterbalance forces.

PROCEDURES:

The corrective action procedures are described in FIXED PITCH FAILURES above. The specific procedure to be used depends on the yaw change experienced.

MAIN DRIVESHAFT FAILURE

WARNING

FAILURE OF THE MAIN DRIVESHAFT TO THE TRANSMISSION WILL RESULT IN COMPLETE LOSS OF POWER TO THE MAIN ROTOR. ALTHOUGH THE COCKPIT INDICATIONS FOR A DRIVESHAFT FAILURE ARE SOMEWHAT COMPARABLE TO A DUAL ENGINE FAILURE, IT IS IMPERATIVE THAT AUTOROTATIVE FLIGHT PROCEDURES BE ESTABLISHED IMMEDIATELY. FAILURE TO REACT IMMEDIATELY TO THE LOW ROTOR RPM AUDIO SIGNAL, CAUTION LIGHT AND TACHOMETER INDICATION WILL RESULT IN LOSS OF CONTROL.

INDICATIONS:

Left yaw.

Rapid decrease in ROTOR RPM.

Rapid increase in ENG RPM (N2).

Illumination of rotor RPM caution light with audio.

Possible increase in noise due to:

Overspeeding engine turbines.

Overspeeding combining gearbox.

Driveshaft breakage.

PROCEDURE:

Collective — As required to establish autorotative descent.

Airspeed — Establish airspeed for minimum rate of descent (70 KIAS) or maximum glide (90 KIAS).

Throttles – Close, if time permits.

Controls – As required for autorotative landing.

ENGINE HOT START

INDICATIONS:

A hot start is caused by a combination of excessive fuel in the combustion chamber and delayed fuel ignition. A hot start may be evidenced by flames emitting from the exhaust and/or excessive ITT indication internal and external damage can result.

PROCEDURE:

Abort start of affected engine as follows:

Throttle — Closed; keep starter engaged.

FUEL switch — OFF.

BOOST PUMP switch — OFF.

Starter — Continue to energize until ITT decreases.

Complete shutdown.

Exit helicopter and check for damage.

If ITT limits for starting were exceeded, refer to Engine Maintenance Manual for inspection requirements.

ENGINE RESTART IN FLIGHT

The conditions which would warrant an attempt to restart the engine would probably be a flameout, caused by a malfunction of the automatic mode of the fuel control unit. The decision to attempt an engine restart during flight is the pilots responsibility.

CAUTION

IF THE CAUSE OF ENGINE FAILURE IS OBVIOUSLY MECHANICAL AS EVIDENCED BY ABNORMAL SOUNDS, DO NOT ATTEMPT A RESTART.

PROCEDURE:

Position controls of affected engine to attempt restart as follows:

Throttle — Closed.

BOOST PUMP switch — ON.

FUEL XFEED switch — NORM.

FUEL switch — ON.

GOV switch — MANUAL.

GEN switch — OFF.

CAUTION

OEI PERFORMANCE CAN BE AFFECTED DURING GENERATOR ASSISTED START (WITH BOTH BATTERY SWITCHES ON).

For nonassisted battery start (if No. 1 engine failed):

BATTERY BUS 2 switch — OFF.

BATTERY BUS 1 switch — ON.

START switch — ENG 1; observe starter limitations.

ENGINE OIL pressure — indicating a rise.

CAUTION

WHEN RESTARTING ENGINE IN MANUAL FUEL CONTROL MODE, CAREFULLY MONITOR ITT.

Throttle — Open slowly at 12% GAS PROD RPM (N1) until ITT begins to rise. Do not open throttle further until ITT and GAS PROD RPM (N1) stabilize.

START switch — Centered at 55% GAS PROD RPM (N1).

CAUTION

WHEN OPERATING IN *MANUAL* FUEL CONTROL MODE, MAKE SLOW, SMOOTH, COORDINATED THROTTLE AND COLLECTIVE MOVEMENTS TO AVOID COMPRESSOR STALL, OVERTEMP, UNDERSPEED/OVERSPEED, AND POSSIBLE DRIVETRAIN DAMAGE.

Throttle — Increase slowly; adjust as required to control TORQUE, ITT, and GAS PROD RPM (N1).

NOTE

If TORQUE of affected engine is controlled slightly (approximately 4%) below TORQUE of normal engine, ROTOR RPM will be governed within limits automatically by normal engine.

GEN switches (both) — ON.

BATTERY BUS 2 switch — ON.

FUEL TRANS switch (affected engine) — ON.

FUEL INTCON switch — NORM.

Land as soon as practical.

If restart was unsuccessful, secure affected engine as prescribed in SINGLE ENGINE FAILURE procedure.

ENGINE FUEL CONTROL MALFUNCTIONS

Components of each engine fuel control system subject to malfunction are the manual fuel control unit, the automatic fuel control unit (containing the gas producer turbine governor), the power turbine governor, and the torque control unit. In-flight determination of which component has malfunctioned is virtually impossible and is irrelevant to the required corrective action. The pilot, therefore, is tasked with interpreting the abnormal indications only so far as to determine which engine has been affected, and which way, in order to perform the proper corrective action.

The primary indications of a fuel control failure usually will be a TORQUE split and an accompanying increase or decrease in ENG RPM (N2) and ROTOR RPM. Normal deviations of ROTOR RPM from the governed setting may occur when large collective changes are made but should not be confused with fuel control failure, unless a large steady-state TORQUE split occurs. The indications of TORQUE, GAS PROD RPM (N1), and ITT alone will not distinguish a high side failure from a low side failure. The triple tachometer must be checked for high or low ENG/ROTOR RPM indications.

The indications of a high side or a low side fuel control failure will vary in accordance with the specific cause of failure and the total power demand at the time of failure.

HIGH SIDE FUEL CONTROL FAILURE

If there is a low power demand (less than single engine power available) at the time of high side failure, ROTOR RPM and ENG RPM (N2) of the affected engine will increase considerably above the governed value. TORQUE, ITT, and GAS PROD RPM (N1) of the affected engine will also increase. As ENG RPM (N2) and ROTOR RPM increase above the governed value, the normal engine will reduce power to keep itself from overspeeding, and will indicate significantly lower TORQUE, ITT, and GAS PROD RPM (N1) than the affected engine.

If there is a high power demand (greater than single engine power available) at the time of high side failure, ROTOR RPM and ENG RPM (N2) of the affected engine will surge initially, along with TORQUE, ITT, and GAS PROD RPM (N1). As ENG RPM

(N2) and ROTOR RPM increase. the normal engine will reduce power to keep itself from overspeeding. The affected engine then tries to assume all of the load, which is beyond its capability due to the high power demand. ENG RPM (N2) of the affected engine (and ROTOR RPM) will then decrease and rejoin the ENG RPM (N2) of the normal engine, stabilizing at or slightly above the governed value as the normal engine adjusts power output to share the load.

INDICATIONS:

High ENG RPM (N2) and ROTOR RPM, possibly with RPM caution light.

Definite TORQUE split (proportional to power demand).

High GAS PROD RPM (N1), ITT, and TORQUE on affected engine.

Return of ENG RPM (N2) and ROTOR RPM to governed value (if power demand is very high).

PROCEDURE:

CAUTION

IF CORRECTIVE ACTION IS NOT INITIATED IMMEDIATELY, *ROTOR* RPM CAN OVERSPEED EXCESSIVELY.

Collective — Adjust as necessary to maintain ROTOR RPM.

Affected engine — Identify.

Throttle (affected engine) — Reduce to maintain TORQUE at or slightly below TORQUE of normal engine.

Throttle frictions — Tighten on normal engine; reduce on affected engine.

Throttle (affected engine) — Reduce to idle.

GOV switch (affected engine) — MANUAL.

CAUTION

WHEN OPERATING IN *MANUAL* FUEL CONTROL MODE, MAKE SLOW, SMOOTH, COORDINATED THROTTLE AND COLLECTIVE MOVEMENTS TO AVOID COMPRESSOR STALL, OVERTEMP, UNDERSPEED/ OVERSPEED, AND POSSIBLE DRIVETRAIN DAMAGE.

Throttle (affected engine) — Increase slowly. Adjust throttle and collective as required to maintain TORQUE of affected engine slightly below TORQUE of normal engine.

MASTER CAUTION light — Reset.

Land as soon as practical.

LOW SIDE FUEL CONTROL FAILURE

If there is a low power demand (less than single engine power available) at the time of low side failure, ROTOR RPM and ENG RPM (N2) of the affected engine will decrease and stabilize at or slightly below the governed value. TORQUE, ITT, and GAS PROD RPM (N1) of the affected engine will also decrease. As ROTOR RPM decreases, the normal engine will increase TORQUE output to assume the load. If power demand is near zero, there may not be a significant TORQUE split.

If there is a high power demand (greater than single engine power available) at the time of low side failure, ROTOR RPM will decrease along with ENG RPM (N2), TORQUE, ITT, and GAS PROD RPM (N1) of the affected engine. As ROTOR RPM decreases, the normal engine will increase to maximum power to assume the load, causing significant increases in TORQUE, ITT, and GAS PROD RPM (N1), while ENG RPM (N2) will remain below the governed value.

INDICATIONS:

Low ENG RPM (N2) and ROTOR RPM (possibly with RPM caution light and audio if power demand is in excess of single engine power available).

TORQUE split (proportional to power demand).

Low GAS PROD RPM (N1), ITT, and TORQUE on affected engine.

PROCEDURE:

WARNING

IF CORRECTIVE ACTION IS NOT INITIATED IMMEDIATELY, *ROTOR* RPM CAN DECAY EXCESSIVELY.

Collective — Adjust as necessary to maintain ROTOR RPM.

AIRSPEED — 65 KIAS.

Affected engine — Identify.

Throttle frictions - Tighten on normal engine; reduce on affected engine.

Throttle (affected engine) - Reduce to idle.

GOV switch (affected engine) — MANUAL.

CAUTION

WHEN OPERATING IN *MANUAL* FUEL CONTROL MODE, MAKE SLOW, SMOOTH, COORDINATED THROTTLE AND COLLECTIVE MOVEMENTS TO AVOID COMPRESSOR STALL, OVERTEMP, UNDERSPEED/ OVERSPEED, AND POSSIBLE DRIVETRAIN DAMAGE.

Throttle (affected engine) — Increase slowly. Adjust throttle and collective as required to maintain torque of affected engine slightly below torque of normal engine.

MASTER CAUTION light — Reset.

Land as soon as practical.

GOVERNOR ACTUATOR FAILURE (FULL INCREASE)

INDICATIONS:

ENG RPM (N2) and ROTOR RPM increase to approximately 101%.

RPM INCR/DECR switch inoperative.

PROCEDURE:

If this failure occurs during takeoff or landing, no immediate corrective action is necessary to complete either maneuver.

As soon as practical, roll back both throttles to maintain 97 to 100% ENG RPM (N2). Further adjustment of collective and throttles simultaneously will allow full power at pilot's discretion.

Land as soon as practical.

ELECTRICAL POWER FAILURES

DC POWER FAILURE

INDICATIONS:

DC GENERATOR caution light illuminates.

All lighting and avionics on nonessential buses inoperative.

PROCEDURE:

GEN FIELD and GEN RESET circuit breakers — Check in.

GEN switch (affected generator) — RESET, then ON.

If generator remains inoperative, proceed as follows:

GEN switch (affected generator) — OFF.

MASTER CAUTION light — Reset

If No. 2 generator failed:

BATTERY BUS 2 switch — OFF;

BATTERY BUS 1 switch — ON.

NON-ESNTL BUS switch — MANUAL.

DC AMPS — Monitor, if load exceeds limit:

NON-ESNTL BUS switch — As desired. Switch off unnecessary equipment as required.

If both generators fail and neither will reset, proceed as follows:

CAUTION

DO NOT SELECT EMERG LOAD AT PRESSURE ALTITUDES ABOVE 5000 FEET. BOTH FUEL BOOST PUMPS WILL BECOME INOPERATIVE, RESULTING IN POSSIBLE FUEL STARVATION.

EMERG LOAD switch — As desired.

NOTE

A fully charged battery provides electrical power for approximately 30 minutes under normal conditions. With EMERG LOAD switch in EMERG LOAD position, the battery provides approximately 90 minutes of electrical power.

Land as soon as practical.

AC POWER FAILURE

INDICATIONS:

NO. 1 or NO. 2 INVERTER caution light illuminates.

Possible loss of power to certain ac instruments (with no INVERTER caution light).

PROCEDURES:

If either INVERTER caution light illuminates, proceed as follows:

AC VOLTS — Check to determine that remaining inverter has assumed all ac loads.

INV PWR circuit breakers — Check in.

HP 1 or HP 2 button (affected system) — Press to reengage helipilot.

If power is lost only to certain ac instruments, but INVERTER caution lights remain out, proceed as follows:

AC FEEDERS circuit breakers (8 each) -- Check in.

During IFR flight, if both inverters fail, land as soon as practical; or continue flight under VFR, if desired.

HYDRAULIC SYSTEM FAILURE

This helicopter has two independent hydraulic boost systems, both of which supply power to the flight control system for the main rotor. The tail rotor control system is powered by system 1 only.

If a hydraulic system failure occurs shortly after the helicopter has been cold soaked at or below -25°C (-13°F), some resistance may occur when the cyclic is near control position extremes. This resistance can be overcome by increased pilot effort.

INDICATIONS:

NO. 1 or NO. 2 HYDRAULIC caution light illuminates.

Abnormal (low, high, or fluctuating) hydraulic pressure in affected system

Possible high temperature in affected system.

Increased pedal forces (if system 1 failed).

Increased cyclic forces near control extremes (cold weather only).

PROCEDURE

If either hydraulic system fails, or if system temperature or pressure exceeds limits, proceed as follows:

WARNING

DO NOT EXTEND FLIGHT WITH FAILED HYDRAULIC SYSTEM. THE HELICOPTER IS NOT CONTROLLABLE WITH BOTH HYDRAULIC SYSTEMS INOPERATIVE.

DURING COLD WEATHER OPERATION AVOID HIGH RATES OF CLIMB. MAKE APPROACHES AND LANDINGS INTO THE WIND. AVOID EXTENDED HOVERING AND DO NOT HOVER WITH THE WIND COMING FROM THE AFT LEFT QUADRANT.

Affected system   Identify positively.

HYDR SYS switch (affected system) -- OFF.

MASTER CAUTION light — Reset.

Land as soon as possible.

AFCS MALFUNCTIONS

The automatic flight control system can be affected by malfunctions of pilot or copilot attitude gyro, either inverter, or by other electrical malfunctions. Failure of No. 1 hydraulic system will render yaw SAS inoperative but will not affect pitch or roll SAS or ATT mode functions. Failure of No. 2 hydraulic system will not affect AFCS.

If both helipilots are disengaged, the following procedures do not apply.

AFCS FAILS TO ENGAGE OR DISENGAGES

INDICATIONS:

AFCS caution light illuminated.

HP 1 or HP 2 off (button not illuminated).

Possible erratic API indications on HP 1 or HP 2.

Possible ATT flag displayed on pilot or copilot attitude indicator.

Possible illumination of NO. 1 or NO. 2 INVERTER caution light.

NOTE

If inverter 1 or 2 fails, HP 1 or HP 2 will disengage, but can be reengaged by pressing respective button on AFCS control panel.

PROCEDURE:

AIRSPEED — Reduce to 115 KIAS or less.

INV 1 and 2 switches — ON; check NO. 1 and NO. 2 INVERTER caution lights extinguished.

Pilot and copilot ADIs — Check ATT flags retracted, indicators functioning properly.

Check the following circuit breakers in:

CAUTION

DO NOT ATTEMPT TO RESET ANY CIRCUIT BREAKER MORE THAN ONCE.

INV 1 PWR and INV 2 PWR

AC FEEDERS (6)

NO. 1 and NO. 2 ESNTL BUS FEEDERS (ON MAIN DC)

AFCS (No. 1 and No. 2)

AFCS 26V (No. 1 and No. 2)

AFCS 115V (No. 1 and No. 2)

PILOT ATT SYS and CPLT ATT SYS

HP 1 or HP 2 button (affected system) — Press to reengage.

If either helipilot will not reengage, or if abnormal control disturbance occurs, proceed as follows:

Affected helipilot — Disengage.

If IFR, land as soon as practical; or continue flight under VFR, if desired.

If both helipilots fail to reengage, proceed as follows:

AIRSPEED — As desired.

If IFR, land as soon as practical; or continue flight under VFR, if desired.

AFCS FAILS TO HOLD ATTITUDE

PROCEDURE:

FORCE TRIM switch — Check ON.

SAS/ATT button — Check ATT light illuminated.

If malfunction persists, follow procedure for AFCS FAILS TO ENGAGE OR DISENGAGES.

AFCS HARDOVER OR ABNORMAL CONTROL DISTURBANCE

PROCEDURE:

WARNING

IF HP 1 OR HP 2 FAILS OR IS DISENGAGED, REDUCE AIRSPEED TO 115 KIAS OR LESS.

1. Cyclic FORCE TRIM release button — Press; correct helicopter attitude with cyclic and pedals, then release button.

2. AIRSPEED — Reduce to 115 KIAS or less.

3. Actuator position indicators — Check both systems. If any API shows maximum displacement or erratic operation of any actuator, switch affected helipilot OFF.

4. If IFR, land as soon as practical, or continue flight under VFR, if desired.

AUTOTRIM RUNAWAY

An autotrim runaway can occur only when both HP 1 and HP 2 are ON in ATT mode.

INDICATIONS:

An autotrim runaway in flight will be evidenced by the cyclic stick being driven in a direction opposite to the actuator position indications (HP 1 or HP 2). This condition occurs because the series actuators will be driven to limit authority to compensate for the autotrim runaway. When the actuators are saturated (on stops), the helicopter will respond to the runaway trim command; however, with both HP 1 and HP 2 operative, the autotrim will be cut off automatically two seconds after actuator saturation.

PROCEDURE:

1. Cyclic FORCE TRIM release button — Depress to center actuators and retrim to desired attitude.

2. AIRSPEED — Reduce to 115 KIAS or less.

NOTE

It is preferable to turn HP 2 off to retain yaw stabilization.

3. HP 2 or HP 1 — OFF.

4. APIs — Monitor for proper operation.

5. If IFR, land as soon as practical; or continue flight under VFR, if desired.

STICK CENTERING INDICATOR FAILURE

INDICATIONS:

CYC CTR caution lights fail to illuminate when cyclic is displaced 1.5 inches or more from center position while RPM caution light is illuminated.

PROCEDURE:

Maintain ROTOR between 97 and 100% RPM for ground operation before beginning ENGINE SHUTDOWN procedures.

COMMUNICATION SYSTEM

INTERCOM FAILURE

INDICATION:

Weak reception in headset.

No reception in headset.

PROCEDURE:

Check headset connection.

Verify volume and ICS controls set properly.

Cycle ICS circuit breaker out and in.

For single pilot operations only with Emergency Communications panel installed:

Plug headset into EMERGENCY COMM jack (above and behind pilot position).

Select desired radio on copilot ICS panel.

Key selected radio with EMERGENCY COMM switch (on center pedestal).

COMMUNICATION RADIO FAILURE

INDICATION:

Weak reception in headset

No reception in headset.

PROCEDURE:

Verify proper radio selected.

Verify volume properly adjusted.

Verify frequency properly set.

Cycle appropriate circuit breaker out and in.

CABIN HEATER MALFUNCTION

A malfunction in the bleed air heater controls may or may not cause heater to become inoperative.

INDICATIONS:

1. HEATER AIR LINE caution light illuminates.
2. Heated airflow does not shut off when thermostat knob is turned to fully COLD position.

PROCEDURE:

1. HEATER switch — OFF immediately.
2. CABIN HTR circuit breaker — Check; if out, do not reset.

FUEL QUANTITY INDICATIONS MALFUNCTION

INDICATION:

FUEL QTY indication goes to zero from a previously normal condition. (Possible power failure to the fuel signal conditioner.)

NOTE

A power failure to the signal conditioner will disable the FUEL LOW caution light and alter the FUEL TRANS caution indication for affected fuel system. Refer to table 3-2.

PROCEDURE:

FUEL QTY circuit breaker — Recycle. (Affected side.)

FUEL INTCON switch — OPEN.

NOTE

Allow sufficient time for fuel levels to equalize. Approximate fuel loads may be obtained by doubling remaining fuel quantity indicated.

STATIC PORT OBSTRUCTION

INDICATION

Erratic readings from the AIRSPEED indicator, VERTICAL SPEED indicator, and altimeter when operating helicopter in rain with STATIC SOURCE switch in PRI position.

PROCEDURE

1. Windows and vents — Close.
2. HEATER switch — OFF.
3. STATIC SOURCE switch — ALTN.

NOTE

This procedure selects an alternate static source (cabin air) for pilot side instruments only.

Section 4

PERFORMANCE

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LIST OF FIGURES

Section 4

PERFORMANCE

INTRODUCTION

The performance data presented herein are derived from the engine manufacturer's specification power for the engine less installation losses. These data are applicable to the basic helicopter without any optional equipment which would appreciably affect lift, drag, or power available.

POWER ASSURANCE CHECKS

Power Assurance Check charts (figure 4-1) are provided to determine if the engines can produce installed specification power.

A power assurance check should be performed daily. Additional checks should be made if unusual operating conditions or indications arise. The hover check is performed prior to takeoff, and the in-flight check is provided for periodic in-flight monitoring of engine performance. Either power assurance check method may be selected at the discretion of the pilot. It is the pilots responsibility to accomplish the procedure safely, considering passenger load, terrain being overflown, and the qualifications of persons on board to assist in watching for other air traffic and to record power check data.

If either engine does not meet the requirements of the hover or the in-flight power assurance check, published performance may not be achievable. The cause of engine power loss, or excessive ITT or GAS PROD RPM (N1) should be determined as soon as practical. Refer to Engine Maintenance Manual.

DENSITY ALTITUDE

A Density Altitude Chart (figure 4-2) is provided to aid in calculation of performance and limitations. Density altitude (H_D) is an expression of the density of the air in terms of height above sea level; hence, the less dense the air, the higher the density altitude. For standard conditions of temperature and pressure, density altitude is the same as pressure altitude (H_P). As temperature increases above standard for any altitude, the density altitude will also increase to values higher than pressure altitude. The chart expresses density altitude as a function of pressure altitude and temperature.

The chart also includes the inverse of the square root of the density ratio ($1/\sqrt{\sigma}$), which is used to calculate KTAS by the relation:

$KTAS = KCAS \times 1/\sqrt{\sigma}$

EXAMPLE:

If the ambient temperature is -15°C and the pressure altitude is 6000 feet, find the density altitude, $1/\sqrt{\sigma}$, and true airspeed for 100 KCAS.

Solution:

a. Enter the bottom of the chart at -15°C.

b. Move vertically upward to the 6000 foot pressure altitude line.

c. From this point, move horizontally to the left and read a density altitude of 4000 feet and move horizontally to the right and read $1/\sqrt{\sigma}$ equals 1.06.

d. True airspeed = KCAS × $1/\sqrt{\sigma}$ = 100 × 1.06 = 106 KTAS.

HOVER CEILING IGE

Adequate cyclic and directional control are available at the gross weights allowed by the Hover Ceiling IGE charts in relative winds up to 35 knots from any direction at or below 3000 feet H_D. Improved control margins will be achieved by avoiding winds in the critical relative wind azimuth areas (figure 4-3).

The Hover Ceiling In Ground Effect charts (figure 4-4) provide the maximum allowable gross weights for hovering IGE at all pressure altitude and outside air temperature conditions with heater on or off. Conversely, the hover ceiling altitude can be determined for any given gross weight.

HOVER CEILING OGE

The Hover Ceiling Out of Ground Effect charts (figure 4-5) provide maximum weights for hovering OGE at all pressure altitude and outside air temperature conditions with heater on or off.

CAUTION

OGE HOVER OPERATION MAY RESULT IN VIOLATION OF HEIGHT-VELOCITY LIMITATIONS.

Some of the OGE hover ceiling charts are divided into two areas as follows:

AREA A (unshaded area) as shown on the hover ceiling charts presents hover performance for which satisfactory cyclic and directional control have been demonstrated in relative winds of 35 knots from any direction at or below 3000 feet H_D. Improved control margins will be achieved by avoiding winds in the critical relative wind azimuth areas (figure 4-3).

AREA B (shaded area) as shown on hover ceiling charts presents additional hover performance which can be achieved in

MODEL 412
POWER ASSURANCE CHECK (HOVER)
PT6T-3B ENGINE (WITH GAS PRODUCER GAGE P/N 212-075-037-101)

HEATER/ECU — OFF

THROTTLES:
TEST ENGINE — FULL OPEN, FRICTIONED
OTHER ENGINE — IDLE.

ENG — 97% RPM (N2)

COLLECTIVE PITCH — INCREASE UNTIL LIGHT ON SKIDS OR HOVERING. DO NOT EXCEED 810° ITT OR 100.8% GAS PROD RPM (N1).

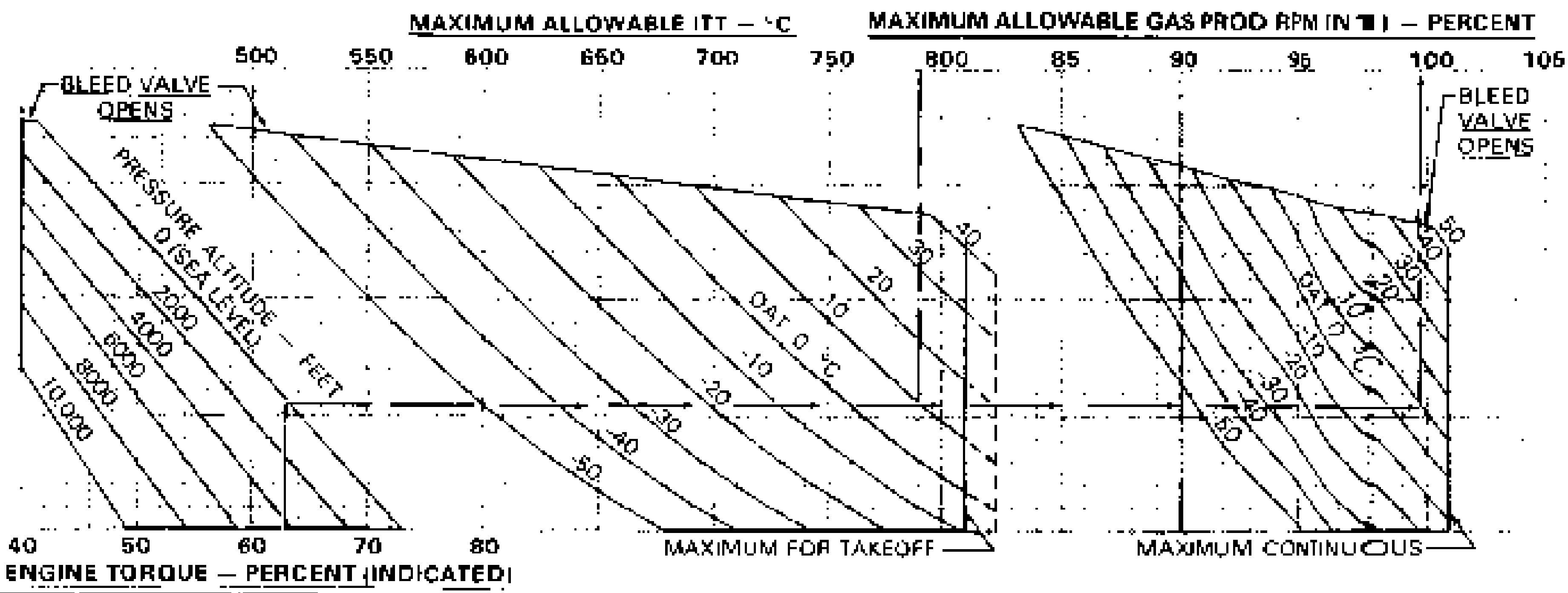
STABILIZE POWER ONE MINUTE, THEN RECORD PRESSURE ALTITUDE, OAT, ENGINE TORQUE, ITT, AND GAS PROD RPM (N1).

ENTER CHART AT INDICATED ENGINE TORQUE, MOVE UP TO INTERSECT PRESSURE ALTITUDE. PROCEED TO THE RIGHT TO INTERSECT OUTSIDE AIR TEMPERATURE, THEN MOVE UP TO READ VALUES FOR MAXIMUM ALLOWABLE ITT AND GAS PROD RPM (N1).

IF INDICATED ITT OR GAS PROD RPM (N1) EXCEEDS MAX ALLOWABLE, REPEAT CHECK, STABILIZING POWER FOUR MINUTES.

REPEAT CHECK USING OTHER ENGINE.

IF EITHER ENGINE EXCEEDS ALLOWABLE ITT OR GAS PROD RPM (N1) AFTER STABILIZING FOUR MINUTES, PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. CAUSE SHOULD BE DETERMINED AS SOON AS PRACTICAL.



412-F3-4-1-1

Figure 4-1. Power assurance check (Sheet 1 of 4)

MODEL 412
POWER ASSURANCE CHECK (IN-FLIGHT)
PT6T-3B ENGINE (WITH GAS PRODUCER GAGE P/N 212-075-037-101)

ESTABLISH LEVEL FLIGHT ABOVE 1000 FEET AGL

AIRSPEED — 100 KIAS (OR VNE IF LESS)

HEATER-FUEL — OFF

THROTTLES
- TEST ENGINE — FULL OPEN, FRICTIONED
- OTHER ENGINE — DECREASE SLOWLY UNTIL TEST ENGINE TORQUE IS WITHIN TEST RANGE. DO NOT EXCEED 810°C ITT OR 100.8% GAS PROD RPM (N1).

ENG — 97% RPM (N2)

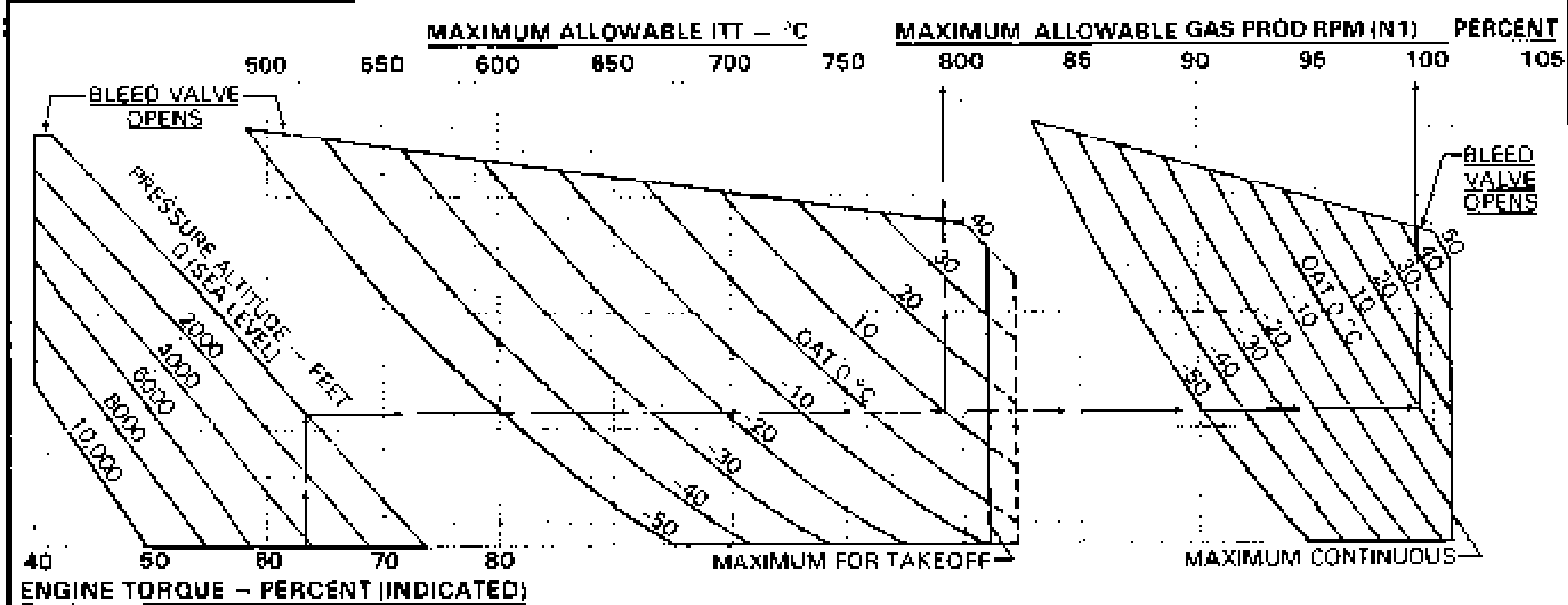
STABILIZE POWER ONE MINUTE IN LEVEL FLIGHT. THEN RECORD PRESSURE ALTITUDE, OAT, ENGINE TORQUE, ITT, AND GAS PROD RPM (N1).

ENTER CHART AT INDICATED ENGINE TORQUE, MOVE UP TO INTERSECT PRESSURE ALTITUDE, PROCEED TO THE RIGHT TO INTERSECT OUTSIDE AIR TEMPERATURE, THEN MOVE UP TO READ VALUES FOR MAXIMUM ALLOWABLE ITT AND GAS PROD RPM (N1).

IF INDICATED ITT OR GAS PROD RPM EXCEEDS MAX ALLOWABLE, REPEAT CHECK, STABILIZING POWER FOUR MINUTES.

REPEAT CHECK USING OTHER ENGINE.

IF EITHER ENGINE EXCEEDS ALLOWABLE ITT OR GAS PROD RPM (N1) AFTER STABILIZING FOUR MINUTES, PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. CAUSE SHOULD BE DETERMINED AS SOON AS PRACTICAL.



412-F9-4-1-2

Figure 4-1. Power assurance check (Sheet 2 of 4)

MODEL 412
POWER ASSURANCE CHECK (HOVER)
PT6T-3B ENGINE (WITH GAS PRODUCER GAGE P/N 212-075-037-113)

HEATER/ECU — OFF

THROTTLES.
TEST ENGINE — FULL OPEN, FRICTIONED.
OTHER ENGINE — IDLE.

ENG — 97% RPM (N2).

COLLECTIVE PITCH — INCREASE UNTIL LIGHT ON SKIDS OR HOVERING. DO NOT EXCEED 810° ITT OR 101.8% GAS PROD RPM (N1).

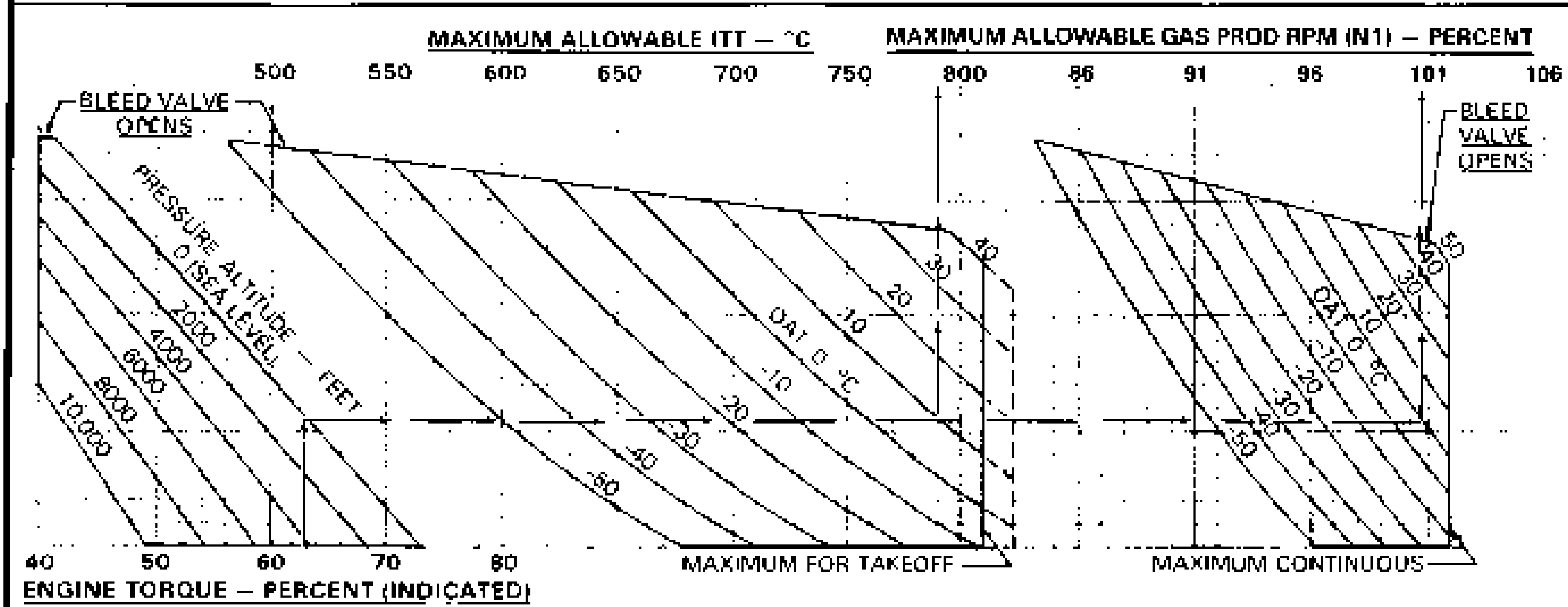
STABILIZE POWER ONE MINUTE, THEN RECORD PRESSURE ALTITUDE, OAT, ENGINE TORQUE, ITT AND GAS PROD RPM (N1).

ENTER CHART AT INDICATED ENGINE TORQUE. MOVE UP TO INTERSECT PRESSURE ALTITUDE. PROCEED TO THE RIGHT TO INTERSECT OUTSIDE AIR TEMPERATURE, THEN MOVE UP TO READ VALUES FOR MAXIMUM ALLOWABLE ITT AND GAS PROD RPM (N1).

IF INDICATED ITT OR GAS PROD RPM (N1) EXCEEDS MAX ALLOWABLE, REPEAT CHECK, STABILIZING POWER FOUR MINUTES.

REPEAT CHECK USING OTHER ENGINE.

IF EITHER ENGINE EXCEEDS ALLOWABLE ITT OR GAS PROD RPM (N1) AFTER STABILIZING FOUR MINUTES, PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. CAUSE SHOULD BE DETERMINED AS SOON AS PRACTICAL.



412-F4-1-3

Figure 4-1. Power assurance check (Sheet 3 of 4)

MODEL 412
POWER ASSURANCE CHECK (IN-FLIGHT)
PT6T-3B ENGINE (WITH GAS PRODUCER GAGE P/N 212-075-037-113)

ESTABLISH LEVEL FLIGHT ABOVE 1000 FEET AGL.

AIRSPEED — 100 KIAS (OR VNE, IF LESS).

HEATER/ECU — OFF.

THROTTLES
TEST ENGINE — FULL OPEN, FRICTIONED
OTHER ENGINE — DECREASE SLOWLY UNTIL TEST ENGINE TORQUE IS WITHIN TEST RANGE. DO NOT EXCEED 810°C ITT OR 101.8% GAS PROD RPM (N1)

ENG — 97% RPM (N2).

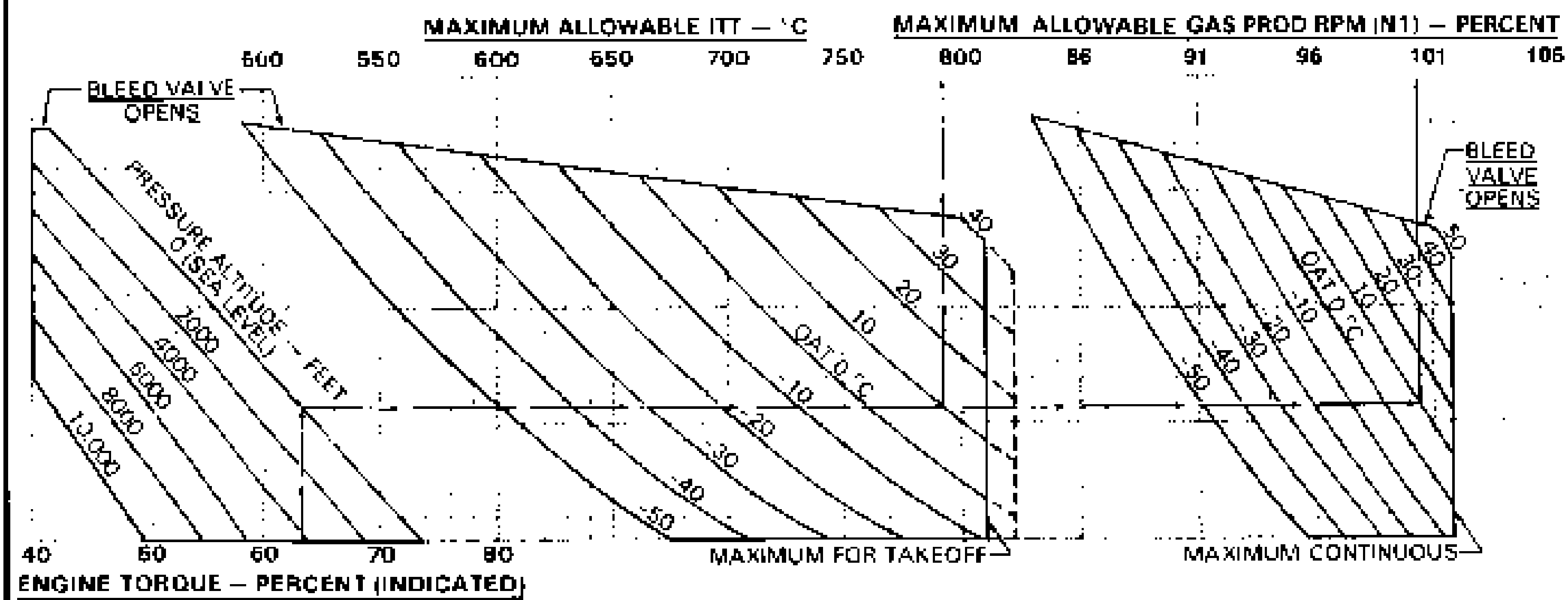
STABILIZE POWER ONE MINUTE IN LEVEL FLIGHT. THEN RECORD PRESSURE ALTITUDE, OAT, ENGINE TORQUE, ITT, AND GAS PROD RPM (N1).

ENTER CHART AT INDICATED ENGINE TORQUE, MOVE UP TO INTERSECT PRESSURE ALTITUDE, PROCEED TO THE RIGHT TO INTERSECT OUTSIDE AIR TEMPERATURE, THEN MOVE UP TO READ VALUES FOR MAXIMUM ALLOWABLE ITT AND GAS PROD RPM (N1)

IF INDICATED ITT OR GAS PROD RPM EXCEEDS MAX ALLOWABLE, REPEAT CHECK STABILIZING POWER FOUR MINUTES.

REPEAT CHECK USING OTHER ENGINE

IF EITHER ENGINE EXCEEDS ALLOWABLE ITT OR GAS PROD RPM (N1) AFTER STABILIZING FOUR MINUTES, PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. CAUSE SHOULD BE DETERMINED AS SOON AS PRACTICAL.



412-F2-4-1-4

Figure 4-1. Power assurance check (Sheet 4 of 4)

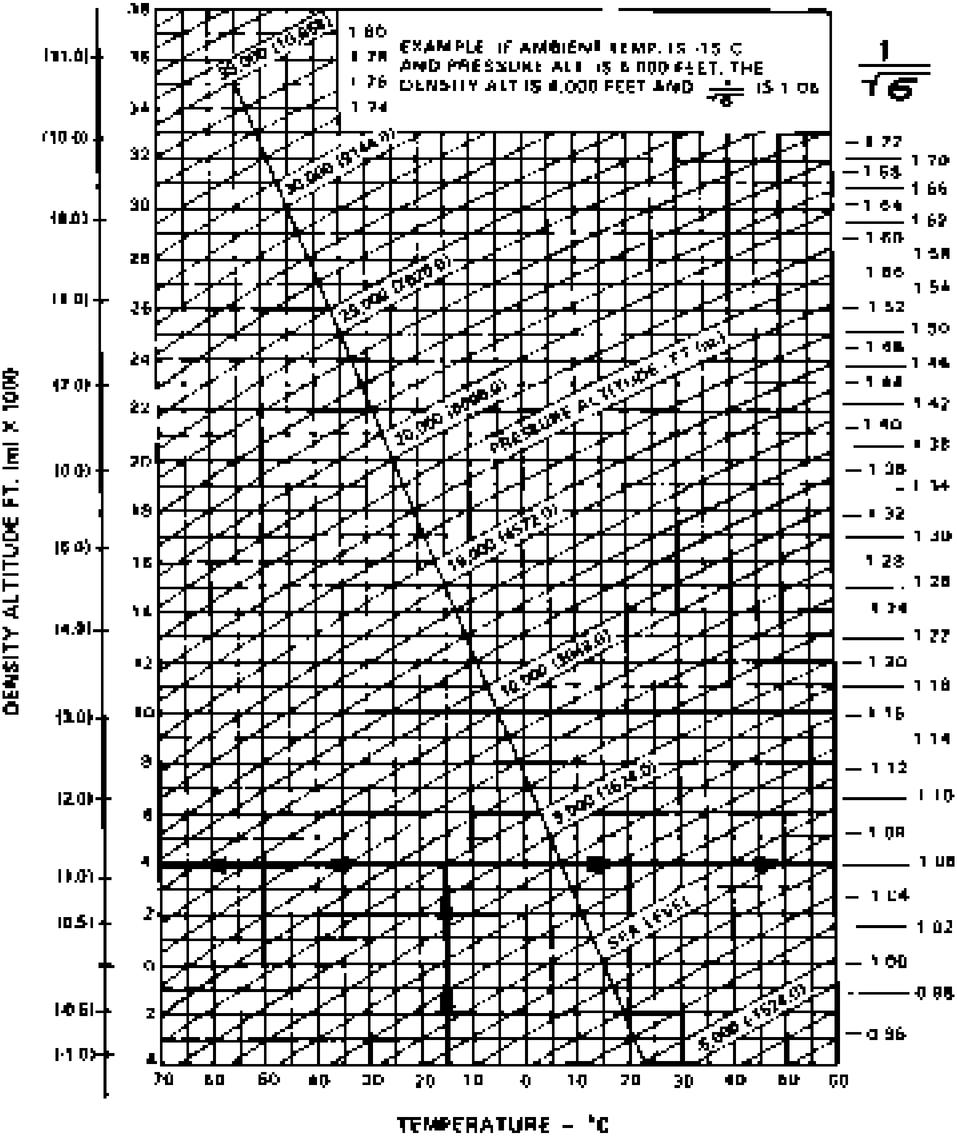


Figure 4-2. Density altitude

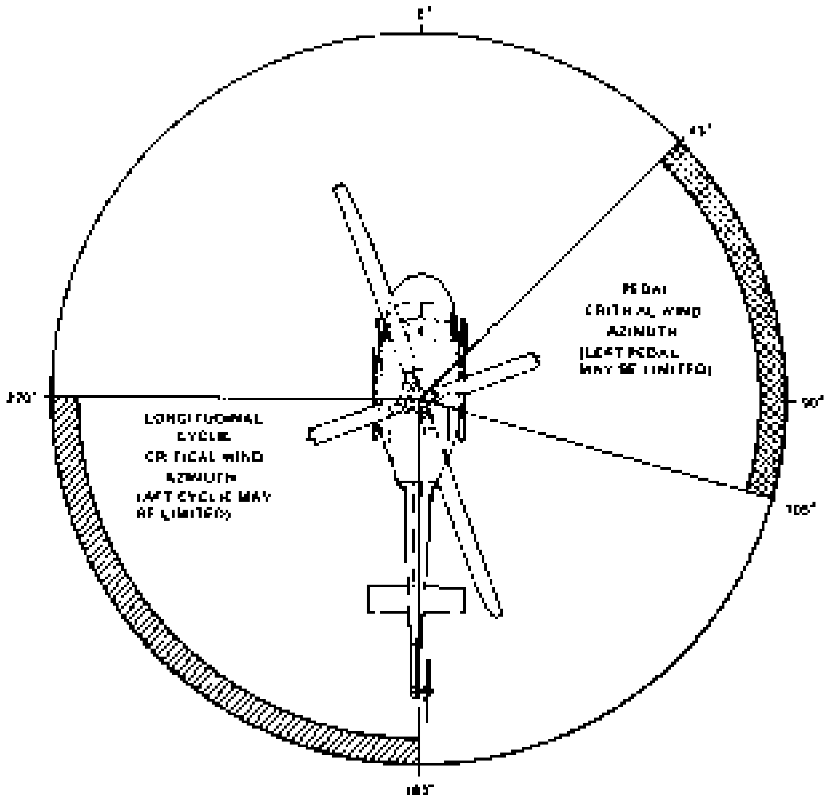


Figure 4-3. Critical relative wind azimuths

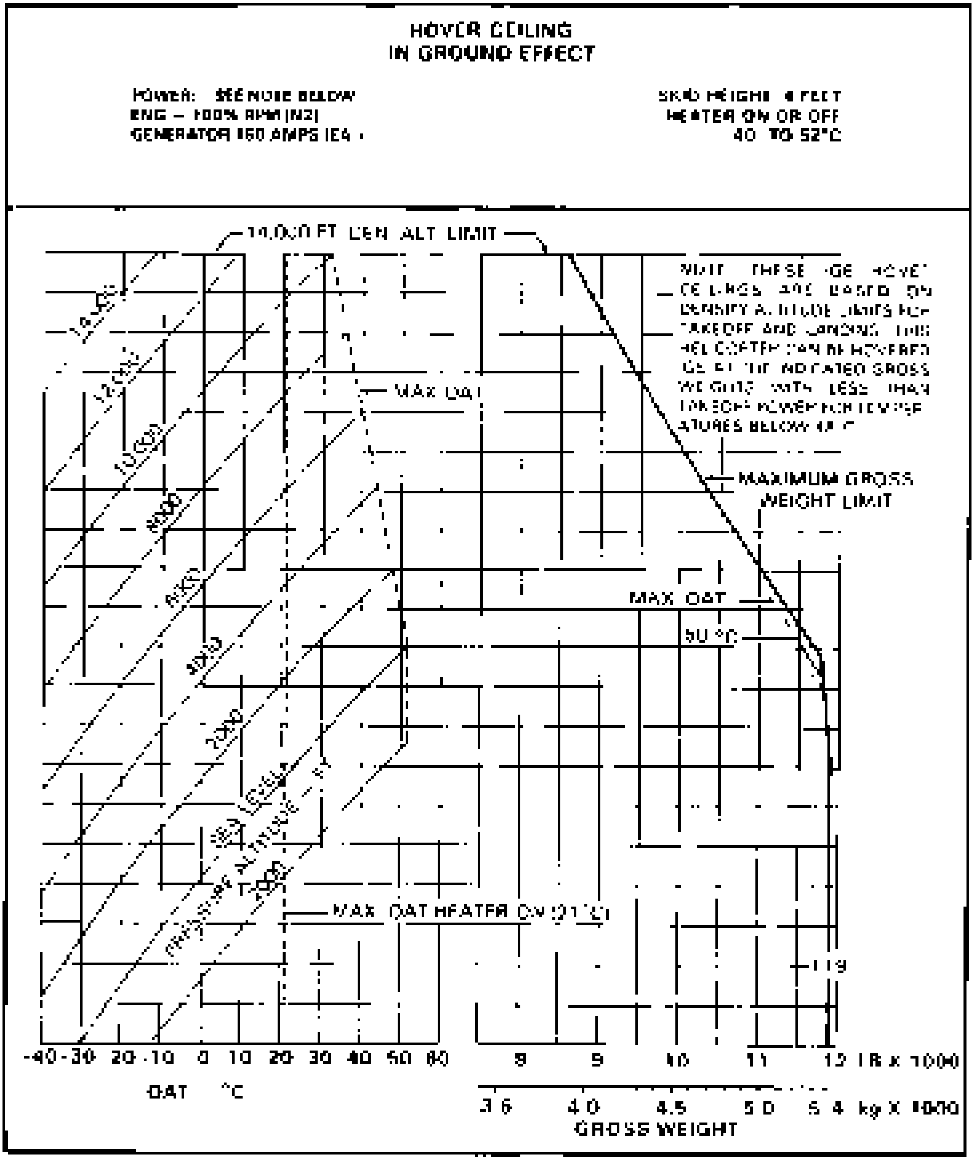


Figure 4-4. Hover ceiling in ground effect (Sheet 1 of 2)

HOVER CEILING
IN GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
-40° TO 52°C

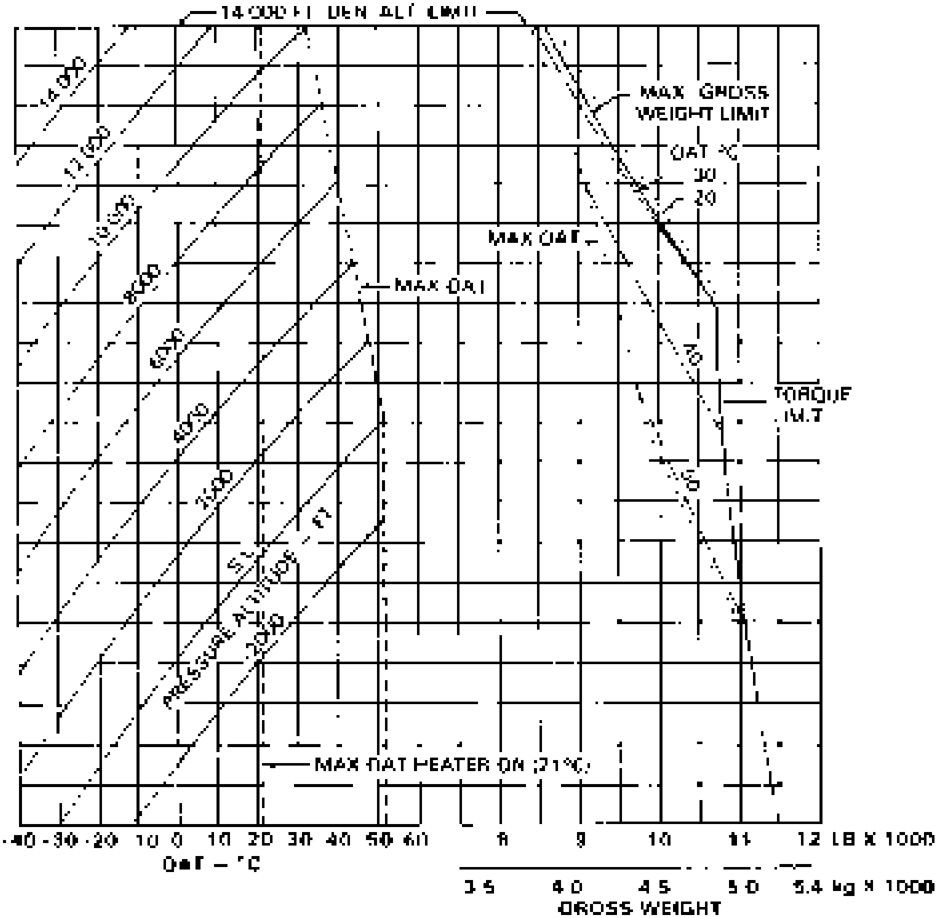


Figure 4-4. Hover ceiling in ground effect (Sheet 2 of 2)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER OFF
0 TO 52°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

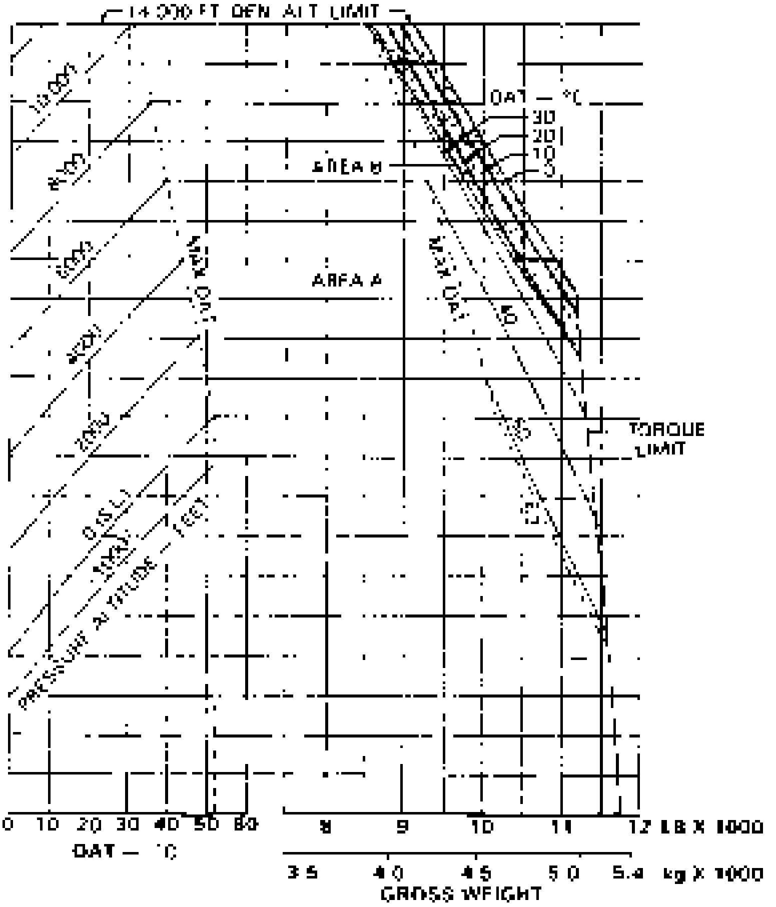


Figure 4-5. Hover ceiling out of ground effect (Sheet 1 of 5)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

SKID HEIGHT — 60 FT
HEATER OFF
40 TO 0°C

CAUTION — OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

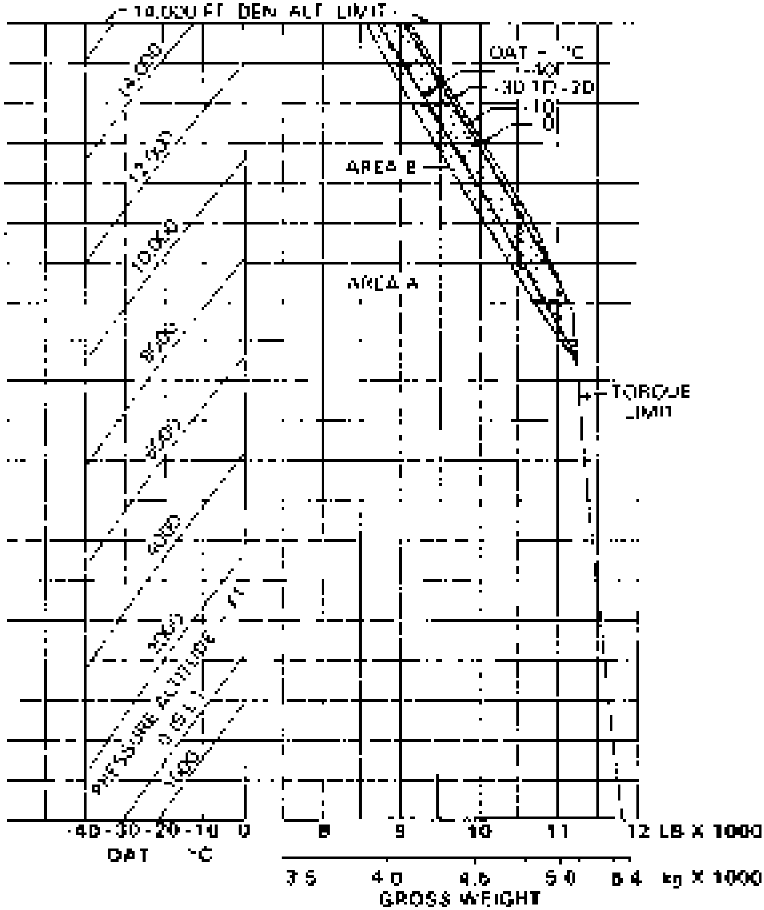


Figure 4-5. Hover ceiling out of ground effect (Sheet 2 of 8)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENG 100% RPM (N2)
GENERATOR 150 AMPS EA.

SKID HEIGHT 60 FT
HEATER ON
0 TO 20°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

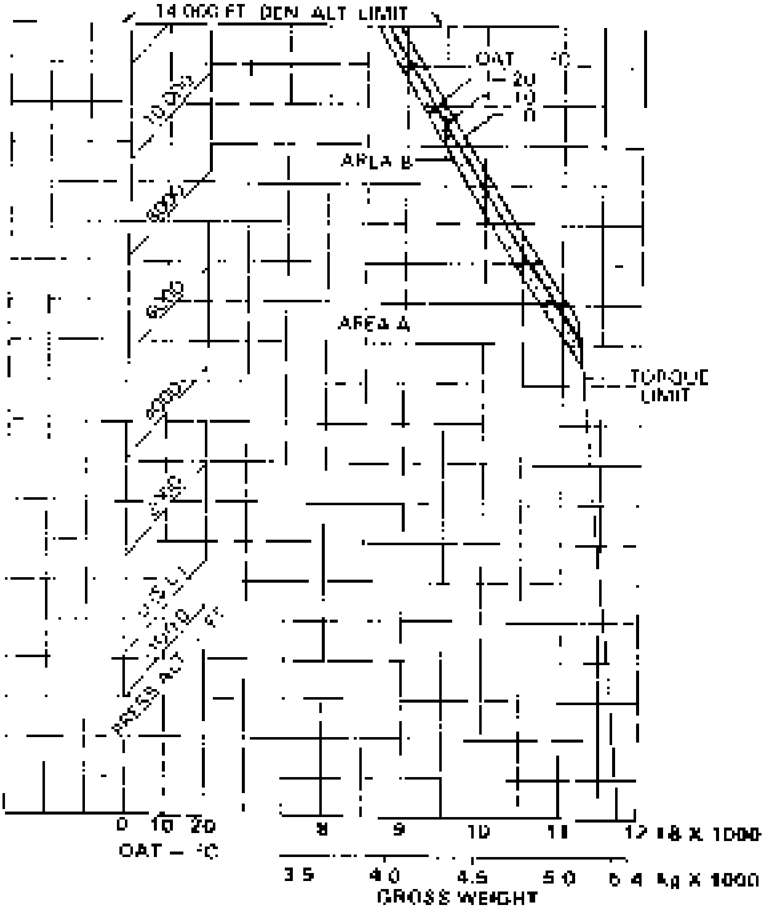


Figure 4-5. Hover ceiling out of ground effect (Sheet 3 of 8)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER ON
-40 TO 0°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

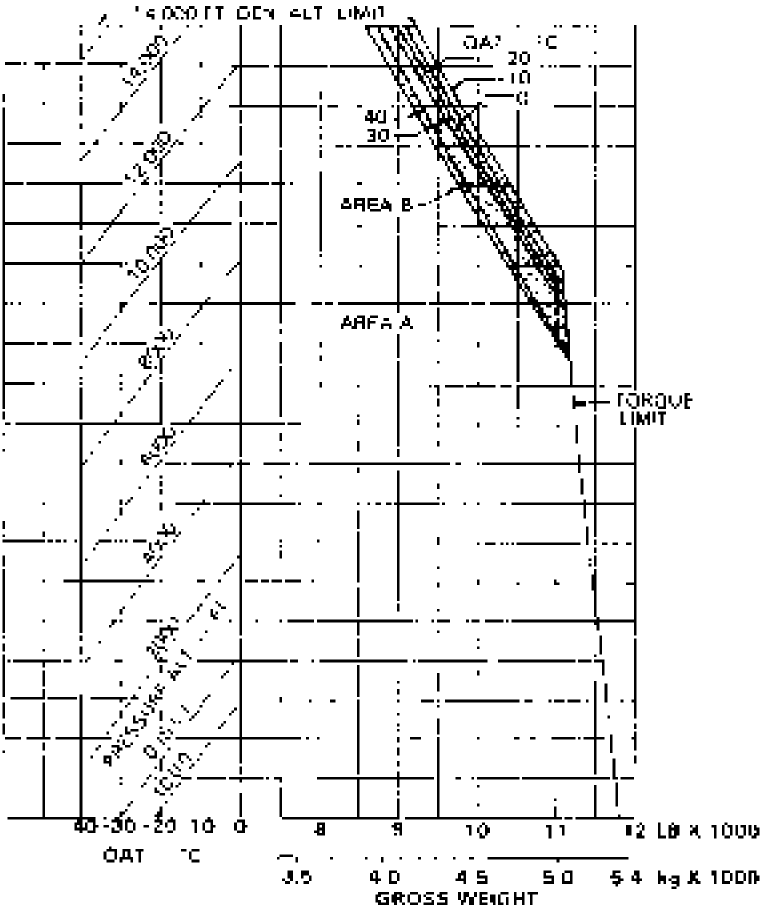


Figure 4-6. Hover ceiling out of ground effect (Sheet 4 of 8)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA)

SKID HEIGHT 60 FT.
HEATER OFF
0 TO 52°C

CAUTION — OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

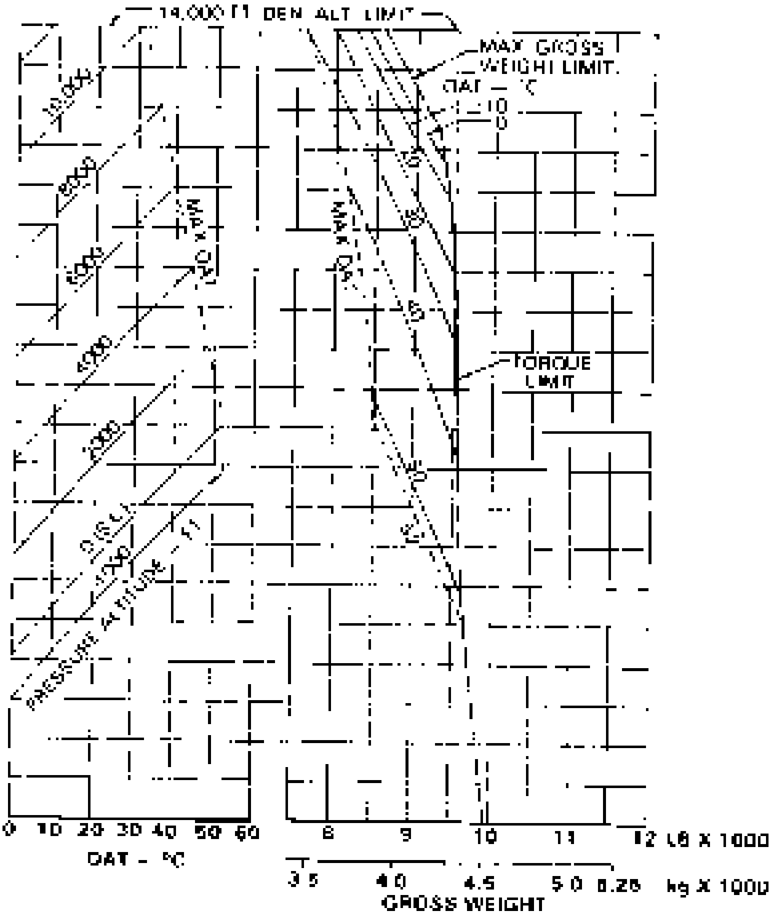


Figure 4-5. Hover ceiling out of ground effect (Sheet 5 of 8)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENG 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 40 FT
HEATER OFF
-40 TO 0°C

CAUTION OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

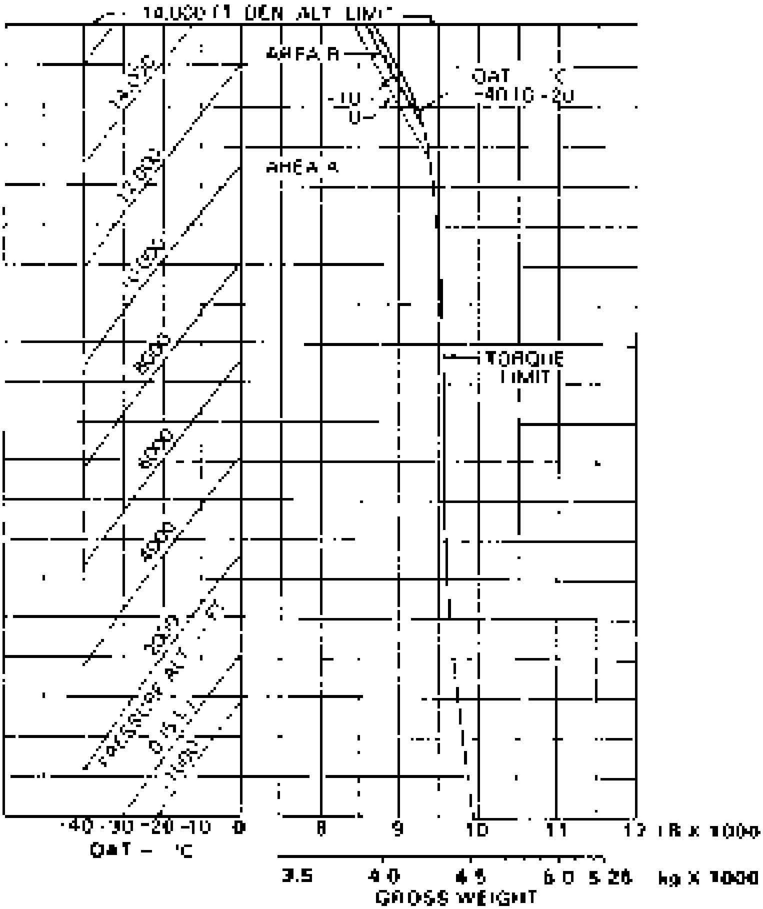


Figure 4-5. Hover ceiling out of ground effect (Sheet 6 of 8)

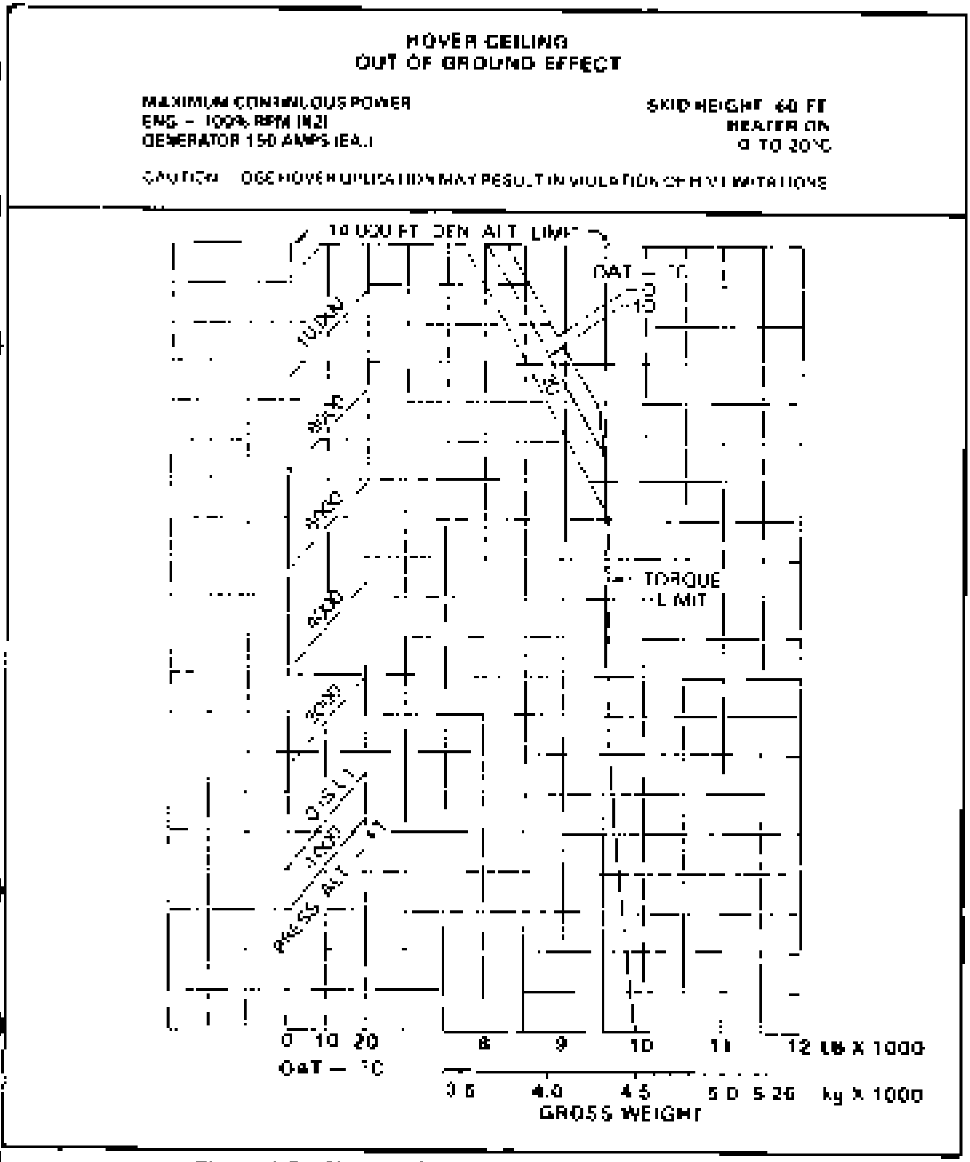


Figure 4-5. Hover ceiling out of ground effect (Sheet 7 of 8)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA)

SKID HEIGHT 60 FT
HEATER ON
-40 TO 0°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

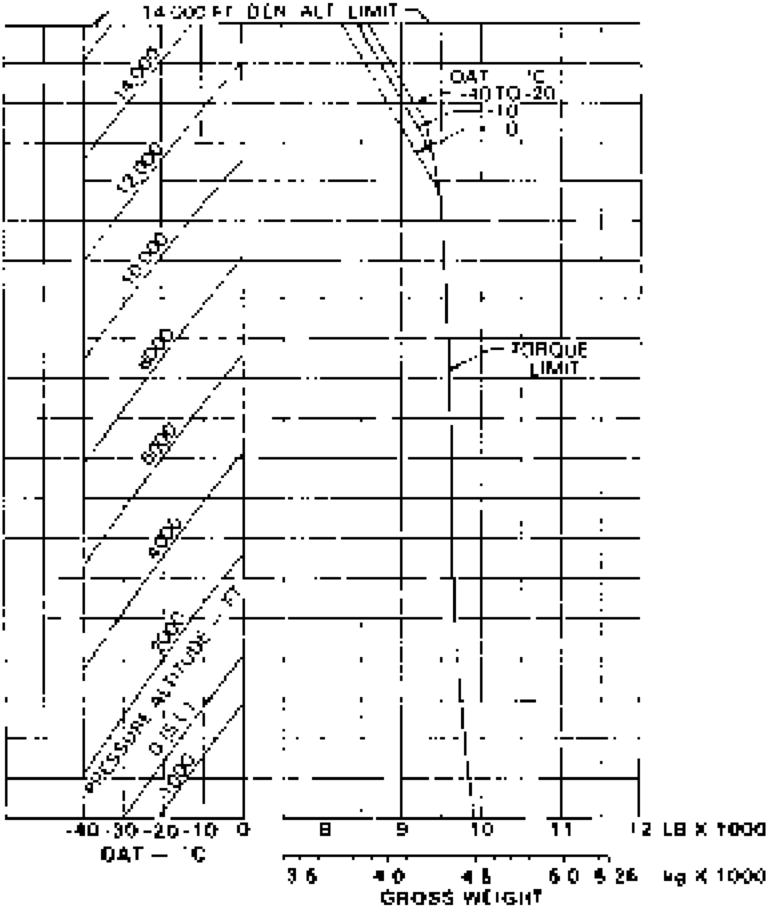


Figure 4-5. Hover ceiling out of ground effect (Sheet 8 of 8)

calm winds or winds outside the critical relative wind azimuth areas.

NOTE

Tail rotor or cyclic control margin may preclude operation in AREA B of the hover ceiling charts when the relative wind is in the respective critical wind azimuth area.

TAKEOFF DISTANCE

The Takeoff Distance charts (figure 4-6) provide takeoff distances required to clear a 50 foot or 15 meter obstacle in a zero wind condition, using a takeoff flight path which will avoid the critical areas of the Height-Velocity diagram (Section 1). Takeoff is initiated from a hover at 4 feet (1.2 meters) skid height with climbout speed of 45 knots.

NOTE

Downwind takeoffs are not recommended because the published takeoff distance performance cannot be achieved.

LANDING DISTANCE

The Single Engine Landing Distance chart (figure 4-7) provides the landing distances required to clear a 50 foot (15 meter) obstacle for all outside air temperatures, pressure altitudes, and gross weights. Landing distances are based on an approach condition of 45 KIAS and 500 feet per minute rate of descent and zero wind.

TWIN ENGINE RATE OF CLIMB

The Twin Engine Rate of Climb charts (figure 4-8) provide the rates of climb that can be obtained at all outside air temperatures/pressure altitudes/gross weight combinations with heater on or off at maximum continuous power and takeoff power.

NOTE

All rate of climb data are based on changes in true altitude (pressure altitude corrected for nonstandard temperature).

SINGLE ENGINE RATE OF CLIMB

The Single Engine Rate of Climb charts (figure 4-9) provide the rates of climb that can be obtained at all outside air temperatures/pressure altitudes/gross weight combinations with heater off at maximum continuous power and 30 minute OEI power.

NOTE

Published single engine performance is intended for emergency use only when one engine becomes inoperative due to an actual malfunction. Routine operation in 2 $^{1}/_{2}$ minute or 30 minute OEI range can affect engine service life.

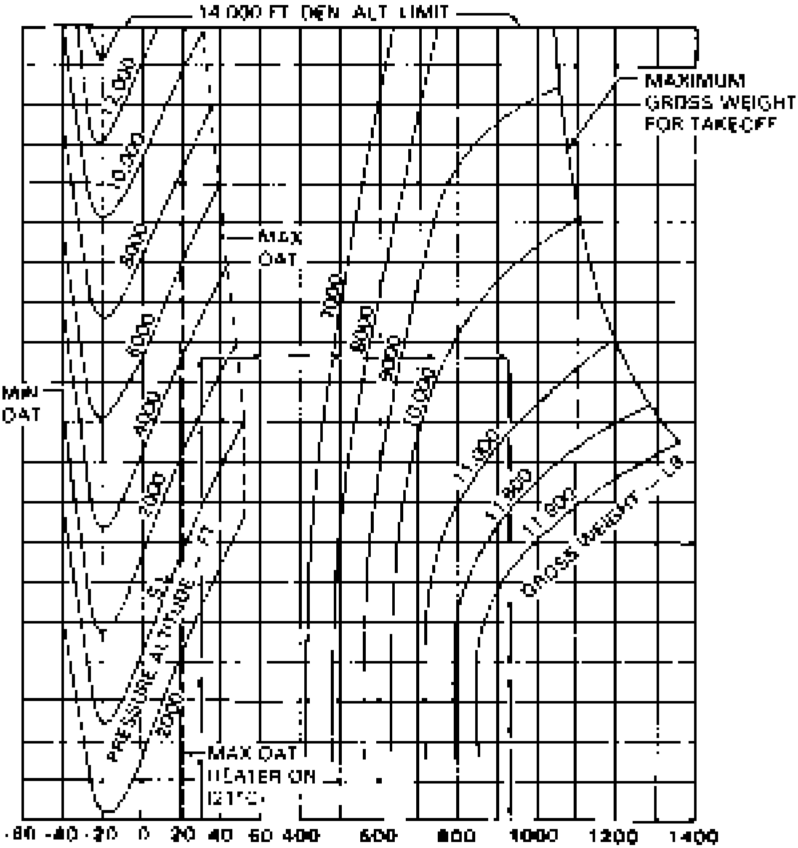
AIRSPEED CALIBRATION

The Airspeed Calibration chart (figure 4-10) provides calibrated airspeeds for all indicated airspeeds during level flight, climb and autorotation.

TAKEOFF DISTANCE
OVER 50 FOOT OBSTACLE

HOVER POWER + 15% TORQUE
ENG – 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

INITIATED FROM 4 FT. SKID HEIGHT
V_{TOCS} = 45 KIAS
HEATER ON OR OFF



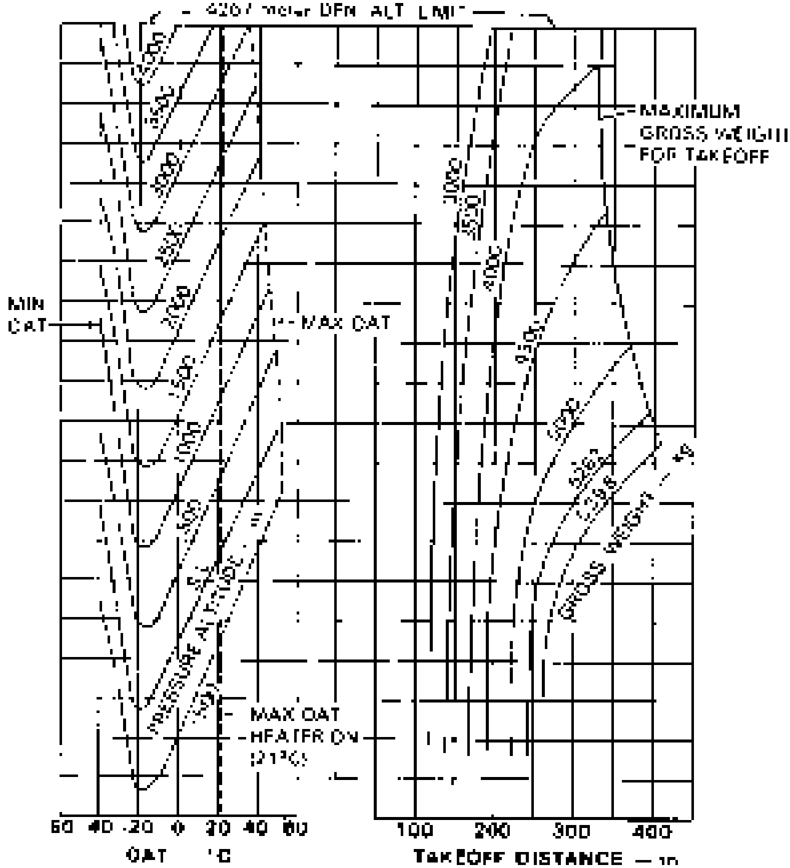
ENGLISH

Figure 4-6. Takeoff distance (Sheet 1 of 2)

TAKEOFF DISTANCE
OVER 15 METER OBSTACLE

HOVER POWER + 15% TORQUE
ENG — 100% RPM (N2)
GENERATOR 150 AMPS (EA.)

INITIATED FROM 1.2 meter SKID HEIGHT
Vtoss — 45 KIAS
HEATER ON OR OFF



METRIC

Figure 4-6. Takeoff distance (Sheet 2 of 2)

SINGLE ENGINE LANDING DISTANCE
OVER 50 FT. (15 M) OBSTACLE

2 1/2 MINUTE OEI
POWER AS REQUIRED
ENG — 97% RPM (N2)
GENERATOR 150 AMPS

45 KIAS
RATE OF DESCENT 600 FT/MIN
HARD SURFACED RUNWAY
INOPERATIVE ENGINE SECURED

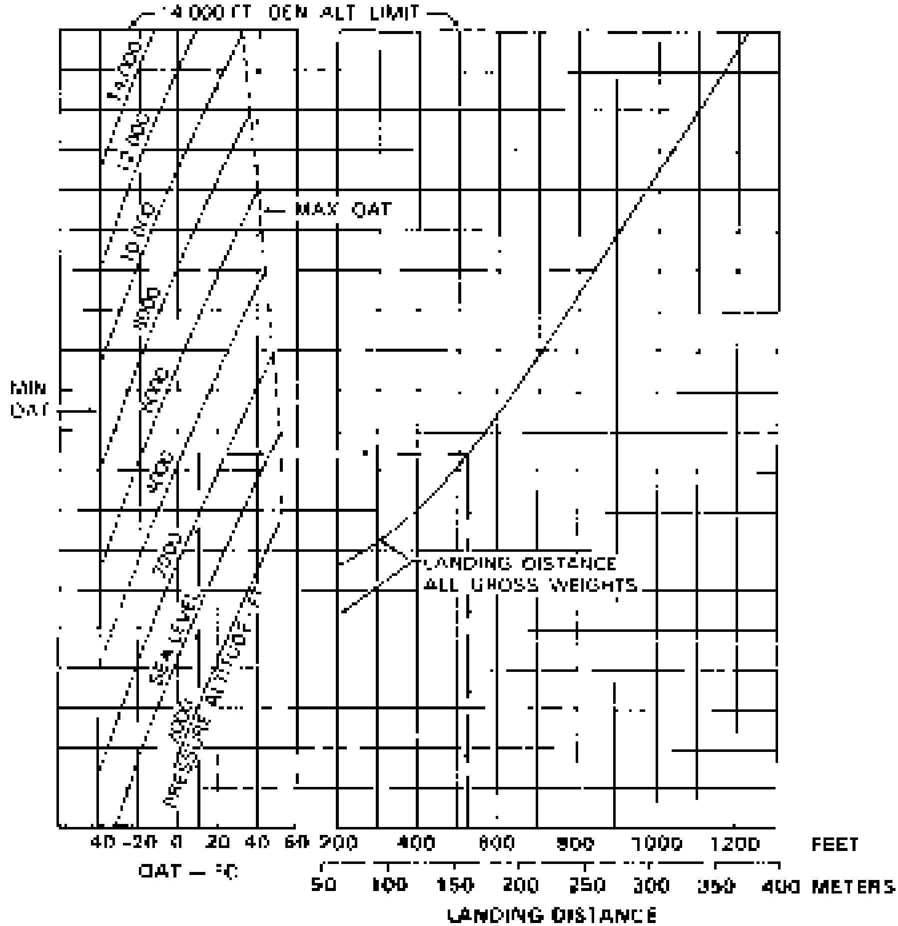


Figure 4-7. Single engine landing distance

TWIN ENGINE RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

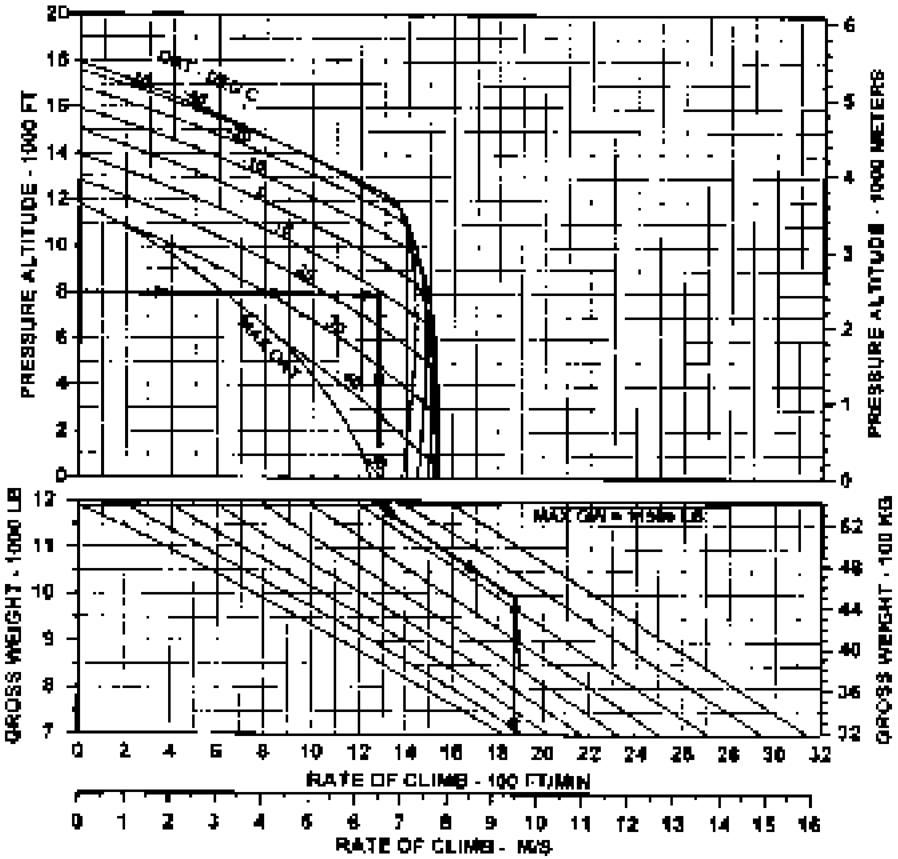


Figure 4-8. Twin engine rate of climb (Sheet 1 of 4)

TWIN ENGINE RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED

1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 375 FT/MIN

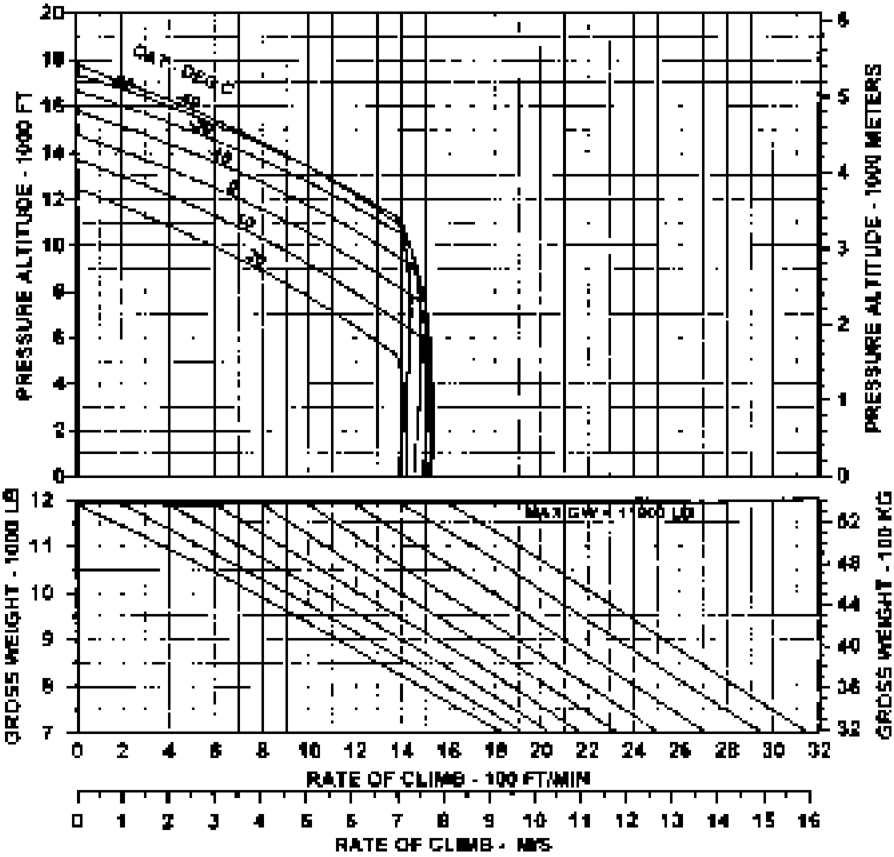


Figure 4-8. Twin engine rate of climb (Sheet 2 of 4)

TWIN ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED

1 CLIMB SPEED ≤ 60 KIAS
2 RATE OF CLIMB WILL DECREASE 275 FT/MIN

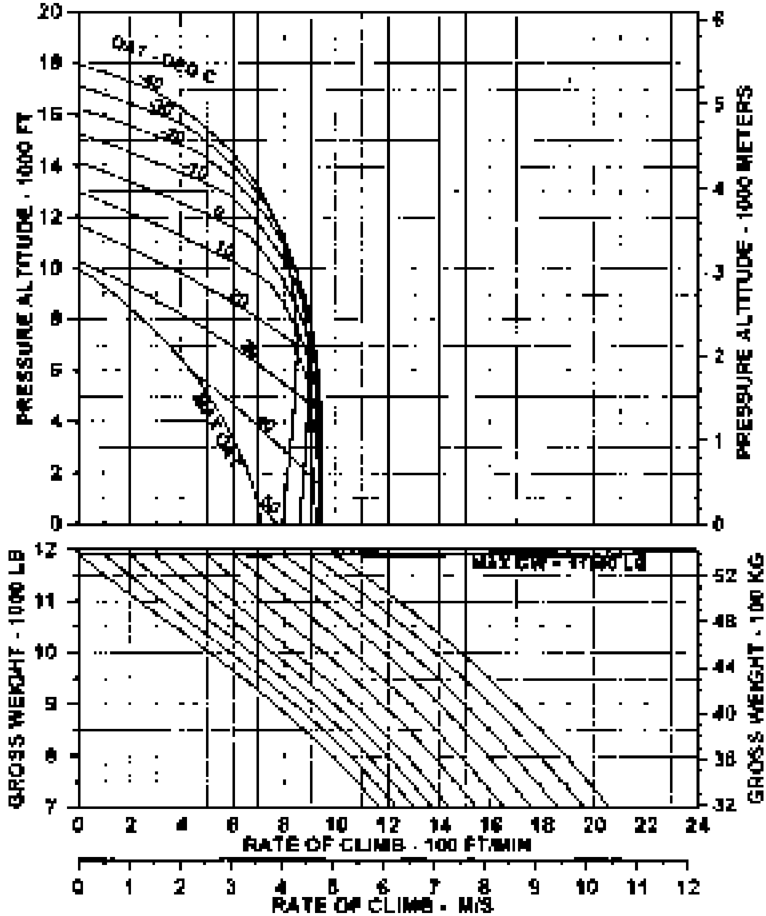


Figure 4-8. Twin engine rate of climb (Sheet 3 of 4)

TWIN ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED

1 CLIMB SPEED IS 60 KIAS
2 RATE OF CLIMB WILL DECREASE 275 FT/MIN

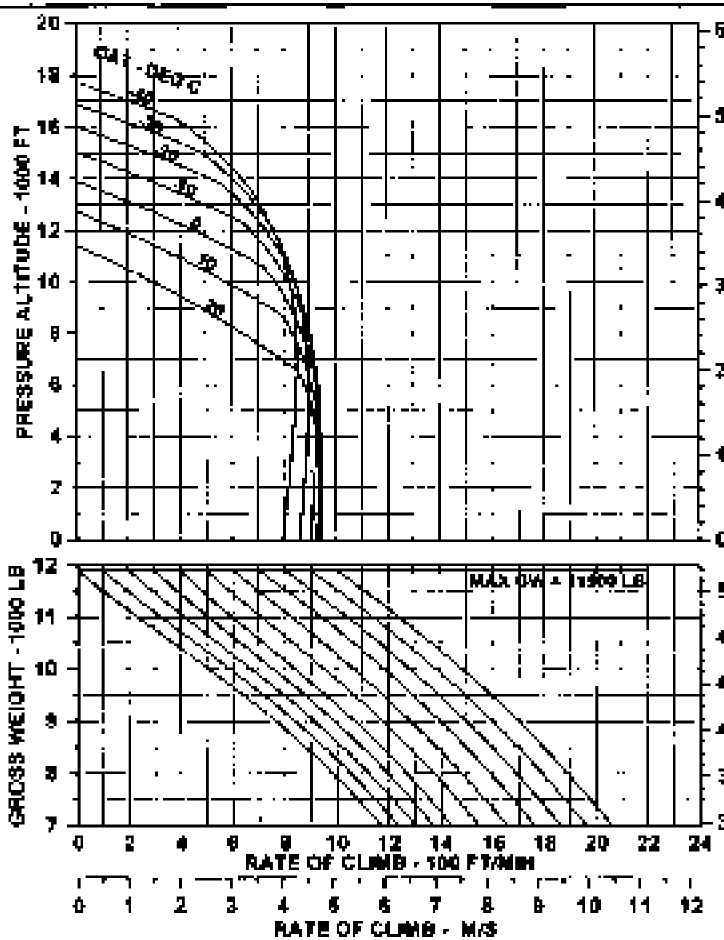


Figure 4-8. Twin engine rate of climb (Sheet 4 of 4)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED

1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

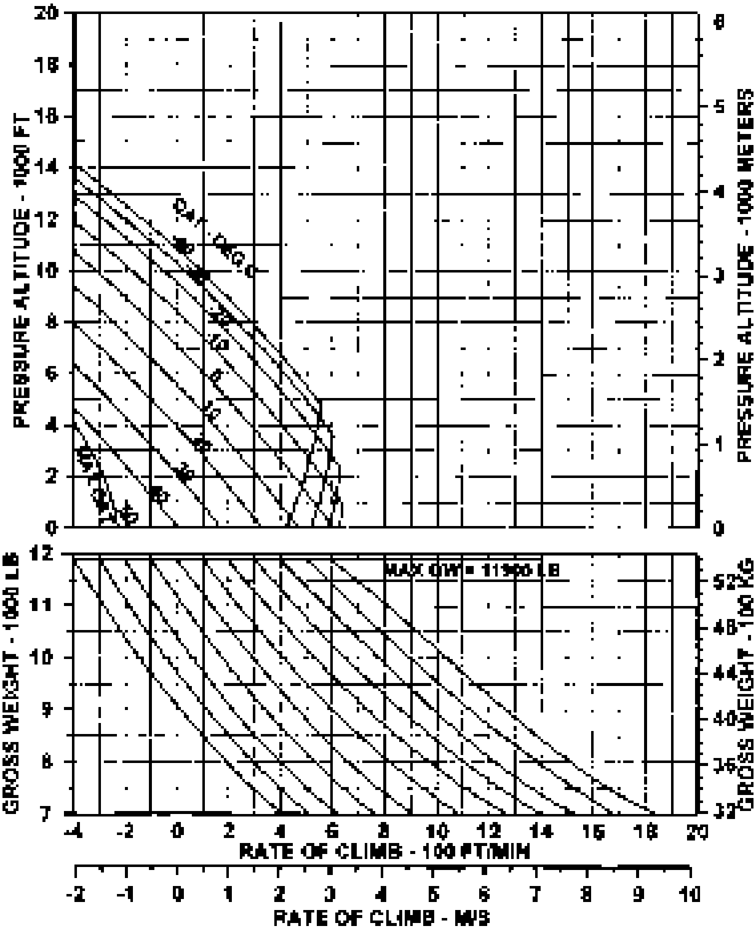


Figure 4-9. Single engine rate of climb (Sheet 1 of 2)

SINGLE ENGINE RATE OF CLIMB

CONTINUOUS POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED

1 CLIMB SPEED IS 60 KIAS
2 RATE OF CLIMB WILL DECREASE 275 FT/MIN

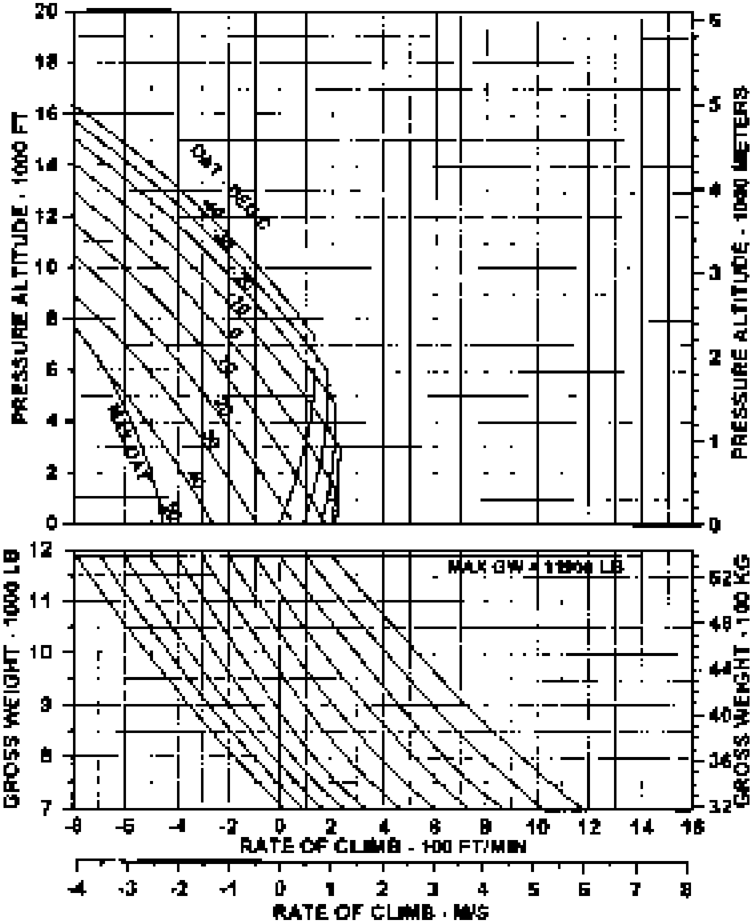


Figure 4-9. Single engine rate of climb (Sheet 2 of 2)

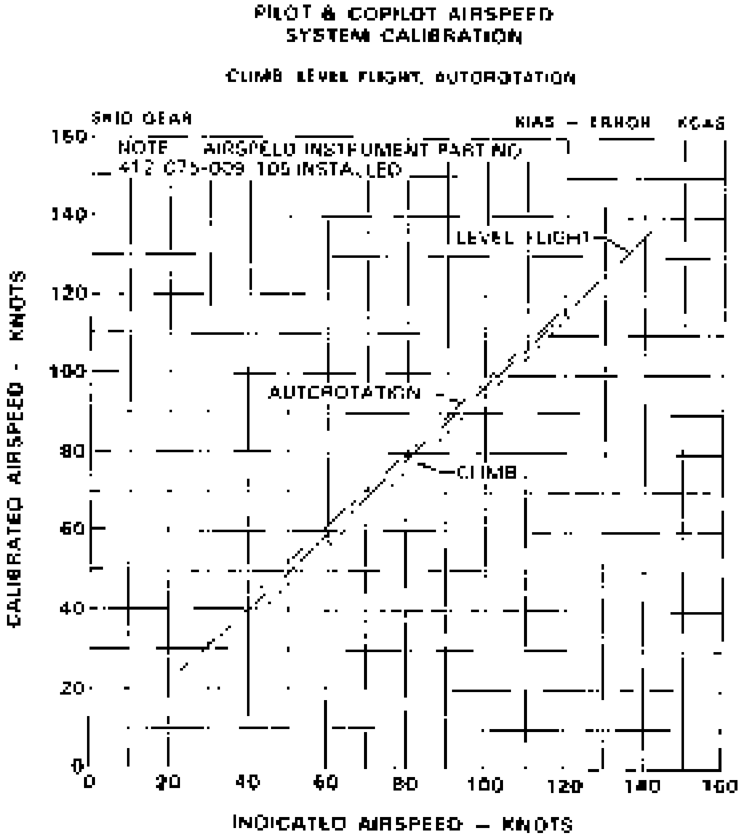


Figure 4-10. Airspeed calibration

4-11. NOISE LEVELS

4-11-A. CERTIFICATED FAR PART 36 STAGE 2 NOISE LEVELS

This aircraft is certified as a Stage 2 helicopter as prescribed in FAR Part 36, Subpart H, for gross weights up to and including the certificated maximum takeoff and landing weight of 11,900 lbs. There are no operating limitations in meeting the takeoff, flyover, or approach noise requirements.

The following noise levels comply with FAR Part 36, Appendix H, Stage 2 noise level requirements. They were obtained by analysis of approved data from noise tests conducted under the provisions of FAR Part 36, Amendment 36-14.

The certified noise levels are:

Flight Condition	EPNL (EPNdB)
Takeoff	93.2
Flyover	93.4
Approach	95.6

NOTE

No determination has been made by the Federal Aviation Administration that the noise levels of this aircraft are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

V_H is defined as the airspeed in level flight obtained using the minimum specification engine torque corresponding to maximum continuous power available for sea level, 25°C ambient conditions at the relevant maximum certificated weight. The value of V_H thus defined for this aircraft is 122 KTAS.

4-11-B. SUPPLEMENTAL ICAO ANNEX 16, CHAPTER 8 NOISE LEVEL INFORMATION

The test and analysis procedures used to obtain these noise levels are essentially equivalent to those required by the International Civil Aviation Organization (ICAO) in Annex 16, Volume I, Chapter 8. ICAO Annex 16, Volume 1, Chapter 8 approval is applicable only after endorsement by the Civil Aviation Authority of the country of aircraft registration.

Pages 4-31 through 4-40 deleted.

Section 5

OPTIONAL EQUIPMENT SUPPLEMENTS

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LIST OF TABLES

Section 5

OPTIONAL EQUIPMENT SUPPLEMENTS

OPTIONAL EQUIPMENT

Bell Helicopter Textron's policy is one of continuous product improvement and Bell reserves the right to incorporate design changes, make additions to and improve its products without imposing any obligation upon the company to furnish for or install such changes, additions, improvements, etc., on its products previously manufactured.

The following items may be installed on the basic helicopter by authorized personnel. Only the optional equipment listed in this section require a Flight Manual supplement.

NOTE

Flight Manual Supplement numbers ending with .1 or -1 are applicable to Model 412 S/N 33001 — 33107 only. Supplement numbers ending with .2 or -2 are applicable to Model 412 S/N 33108 — 33213 and 36001 — 36019. Supplement numbers ending with a .3 or -3 are applicable to Model 412 S/N 33214 — 33999 and 36020 and SUB. Flight manual supplements not ending with a decimal or dash number are applicable to all 412 helicopters.

Table 5-1. Flight Manual Supplements for Optional Equipment

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-412-FMS-1.2 Winterization Heater Operations	212-706-008	20 January 1981	Rev. 6 14 MAY 93
BHT-412-FMS-2 Emergency Floats	412-706-004	20 January 1981	Rev. 1 15 APR 95
BHT-412-FMS-3 Heated Windshield	412-706-010	20 January 1981	Reissued 18 OCT 94
BHT-412-FMS-4.1	Effectivity S/N 33001-33107		
BHT-412-FMS-5.1	Effectivity S/N 33001-33107		
BHT-412-FMS-6 Flight Director	412-706-111	13 February 1981	Reissued 8 MAY 89
BHT-412-FMS-7 Internal Hoist	214-706-003	2 October 1981	Reissued 11 MAY 95

Table 5-1. Flight Manual Supplements for Optional Equipment (Cont)

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-412-FMS-8 Litter Kit Operations	412-706-006	29 September 1981	Reissued 5 OCT 94
BHT-412-FMS-9.2 External Cargo Operation	212-706-103	14 May 1981	Reissued 15 SEP 95
BHT-412-FMS-10 Category A Operations		Data incorporated into Section 6 of basic Flight Manual	
BHT-412-FMS-11.1	Effectivity S/N 33001-33107		
BHT-412-FMS-12 Nightsun Searchlight	212-899-333	4 December 1981	Reissued 8 MAY 89
BHT-412-FMS-13 Cold Weather Operations	412-703-004	Data incorporated into basic Flight Manual	
BHT-412-FMS-14 Thailand Special Avionics	412-899-003	11 February 1982	Not Printed
BHT-412-FMS-15 Fixed Step	212-706-057	8 February 1982	Reissued 23 JUN 94
BHT-412-FMS-16 Droop Restraint, Main Rotor and Stick Centering Indicator	412-704-114/412-704-115	Data incorporated into basic Flight Manual	
BHT-412-FMS-17.2 Auxiliary Fuel Operations	412-706-007	5 January 1984	Reissued 23 JUN 94
BHT-412-FMS-18.2 Loudhailer Operations	412-899-143	17 November 1983	Reissued 8 OCT 91
BHT-412-FMS-19.2 Soft Interior	412-705-510	28 March 1985	Rev. 3 XX SEP 98
BHT-412-FMS-20 Weather Radar Kit	412-899-107	15 June 1985	Reissued 5 OCT 94
BHT-412-FMS-21 Global Nav. System GNS-500A/S3 with NAV switching	412-899-141	18 June 1984	Reissued 8 MAY 89
BHT-412-FMS-22.2 Category A Operations		6 June 1986	Rev. 1 11 NOV 89
BHT-412-FMS-23 (Reserved)			Original

Table 5-1. Flight Manual Supplements for Optional Equipment (Cont)

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-412-FMS-24 Seat Cushion Kit	412-706-019	24 July 1987	Reissued 8 DEC 95
BHT-412-FMS-25.2 Auxiliary Fuel Operations	412-706-009	10 March 1988	Reissued 23 JUN 94
BHT-412-FM-CTA-2 Brazilian Registered Helicopters		19 February 1988	Original
BHT-412-RNoAF-FMS Royal Norwegian Air Force Configuration	412-899-022	1 July 1987	Rev. 2
BHT-412-FMS-26 Two-Speed Internal Hoist	412-899-223/214-706-003	19 September 1988	Reissued 11 MAY 95
BHT-412-FMS-27 Litter Kit Operation	205-706-047	14 October 1988	Reissued 23 JUN 94
BHT-412-FMS-28.2 Dual Battery Installation	412-899-225	5 April 19 89	Reissued 9 OCT 91
BHT-412-FMS-29.2 Removal of Upper Aft Center Fuel Cell	412-899-227	23 May 1989	Reissued 8 OCT 91
BHT-412-FMS-CAN-30 Canadian Addendum to the Supplements for Internal Hoist and External Cargo Operation		9 November 1989	Reissued 23 JUN 94
BHT-412-FMS-31 Category B Operations with Approved Configuration of Nine or Less Passenger Seats STC No. SH7727SW		8 February 1990	Original
BHT-412-FMS-32.2 Improved Transmission	412-570-001-101	29 June 1990	Not Printed
BHT-412-FMS-33 Loran C Navigation System (King KLN-88)	412-899-231	22 June 1990	Original
BHT-412-FMS-34.2 Improved Hover Performance with PT6T3BE Engines and 5-Minute Takeoff Power Rating	412-570-001-103	12 October 1990	Not Printed

Table 5-1. Flight Manual Supplements for Optional Equipment (Cont)

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-412-FMS-36.2 Category B Operations when Configured with Nine or Less Passenger Seats		10 April 1991	Rev. 1 23 APR 98
BHT-412-FMS-36.3 Dual Digital Automatic Flight Control System, Search and Rescue (SAR)	Effectivity S/N 33214-33999 and 36020 and SUB		Not Printed
BHT-412-FMS-37.4	Effectivity S/N 36087 and SUB		
BHT-412-FMS-38.4	Effectivity S/N 36087 and SUB		
BHT-412-FMS-39.3 and 39.4	Effectivity S/N 36024-36086 S/N 36087 and SUB		
BHT-412-FMS-40 Increased Generator Capacity	412-706-026	29 October 1992	Reissued 5 OCT 94
BHT-412-FMS-41.3	Effectivity S/N 36020-36086		
BHT-412-FMS-43.3 and 43.4	Effectivity S/N 36020-36086		
BHT-412-FMS-44.3 and 44.4	Effectivity S/N 36020-36086		
BHT-412-FMS-45.3 and 45.4	Effectivity S/N 36020-36086		
BHT-412-FMS-46.3	Effectivity S/N 36020-36086		
BHT-412-FMS-47 Folding Step	412-898-287	25 October 1993	Original
BHT-412-FMS-48.2 Engine No. 2 Gov Trim Switch	TB 412-93-118	28 July 1994	Original
BHT-412-FMS-49.4	Effectivity S/N 36087 and SUB		

Table 5-1. Flight Manual Supplements for Optional Equipment (Cont)

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-412-FMS-53.4	Effectivity S/N 36119, 36122,36123,36126,36127, and 36133 ONLY		
BHT-412-FMS-54	TBD		
BHT-412-FMS-55.4	Effectivity S/N 36122, 36123, 36126, and SUB		
BHT-412-FMS-56.3 and 56.4	Effectivity S/N 36020 - 36086 S/N 36087 and SUB		
BHT-412-FMS-CAA-57.3 and 57.4	Effectivity S/N 36087 and SUB		
BHT-412-FMS-58.4	Effectivity S/N 36087 and SUB		
BHT-412-FMS-59.4	Effectivity S/N 36087 and SUB		
BHT-412-FMS-60.4	Effectivity S/N 36087 and SUB		
BHT-412-FMS-61.3 and 61.4	Effectivity S/N 36020 - 36086 S/ N 36087 and SUB		
BHT-412-FMS-63.2, 63.3, and 63.4 Self Sealing Fuel Cells	Effectivity S/N 33108 - 33213 S/N 36001 - 36019 S/N 36020 - 36086 S/N 36087 - SUB	19 September 1997	Rev. 1 22 OCT 97
BHT-412-FMS-65.2, 65.3, and 65.4 Ten Cell — Self Sealing Fuel	Effectivity S/N 33108 - 33213 S/N 36001 - 36019 S/N 36020 - 36086 S/N 36087 - SUB	22 June 1998	Rev. 1 2 JUL 98
BHT-412-FMS-66.4	Effectivity S/N 36087 and SUB		

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

33006 — 33213
36001 — 36019

SUPPLEMENT FOR WINTERIZATION HEATER OPERATIONS (212-706-008)

CERTIFIED

JANUARY 20,1981

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2) when the 212-706-008 Winterization Heater has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

REISSUE — 18 DECEMBER 1996

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LOG OF REVISIONS

Original	0	January 20, 1981	Revision	5	February 9, 1985
Revision	1	August 3, 1981	Revision	6	May 6, 1989
Revision	2	January 7, 1982	Revision	7	October 8, 1991
Revision	3	September 8, 1983	Revision	8	May 14, 1993
Revision	4	August 31, 1984	Reissue	0	December 18, 1998

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4-7/4-8	0		
4-9 — 4-16 Deleted	0		
4-17/4-18 Deleted	0		

APPROVED.

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

DEC 18 1998

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The Winterization Heater is installed to provide increased cabin heating capacity. The heater basically consists of a larger mixing valve, a larger noise suppressor, extra outlets, ducts, and hardware necessary for installation. Operation of the Winterization Heater is identical to the basic heater.

Section 1

LIMITATIONS

WEIGHT C/G LIMITATIONS

Actual weight change shall be determined after the heater is installed and ballast readjusted if necessary to return empty weight CG within allowable limits.

HEATER OPERATION

Heater shall not be operated when OAT is above 21°C (69.8°F).

Section 2

NORMAL PROCEDURES

PRESTART CHECK

Battery switch — ON.

Heater circuit breaker switch — In.

Heater switch — ON.

Check "Heater Air Line" light illuminates.

Heater switch — OFF.

HEATER OPERATION CHECK

Operation check may be accomplished at this time or at any time heater operation is desired.

100% (N_2) rpm and at least 75% N_1 on both engines.

Thermostat — Full cold.

WARNING

DO NOT OPERATE HEATER ABOVE 21°C (69.8°F) OAT.

Heater switch — ON.

Increase thermostat setting and observe heated air-flow.

Return thermostat to full cold and observe heater airflow shutoff. If heater airflow shutoff is observed, reset thermostat to desired temperature if heater operation is desired.

CAUTION

TURN HEATER OFF WHEN:

THE HEATER AIRFLOW DOES NOT SHUT OFF WHEN THERMOSTAT IS TURNED TO FULL COLD.

THE "HEATER AIR LINE" LIGHT ILLUMINATES.

THE HEATER CIRCUIT BREAKER TRIPS.

NOTE

If heater is on for takeoff, refer to appropriate performance chart in Section 4.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic Flight Manual.

Section 4

PERFORMANCE

Performance with Winterization Heater switched OFF is the same as that shown in basic Flight Manual for heater OFF.

Performance with Winterization Heater switched ON is presented as follows:

Refer to figure 4-1 for out-of-ground-effect hover performance.

In-ground-effect hover performance is the same as that shown in basic Flight Manual for heater ON.

Refer to figure 4-2 for takeoff performance.

Refer to figure 4-3 for climb performance.

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

SKID HEIGHT 60 FT
WINTERIZATION HEATER ON
-40° TO 20°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

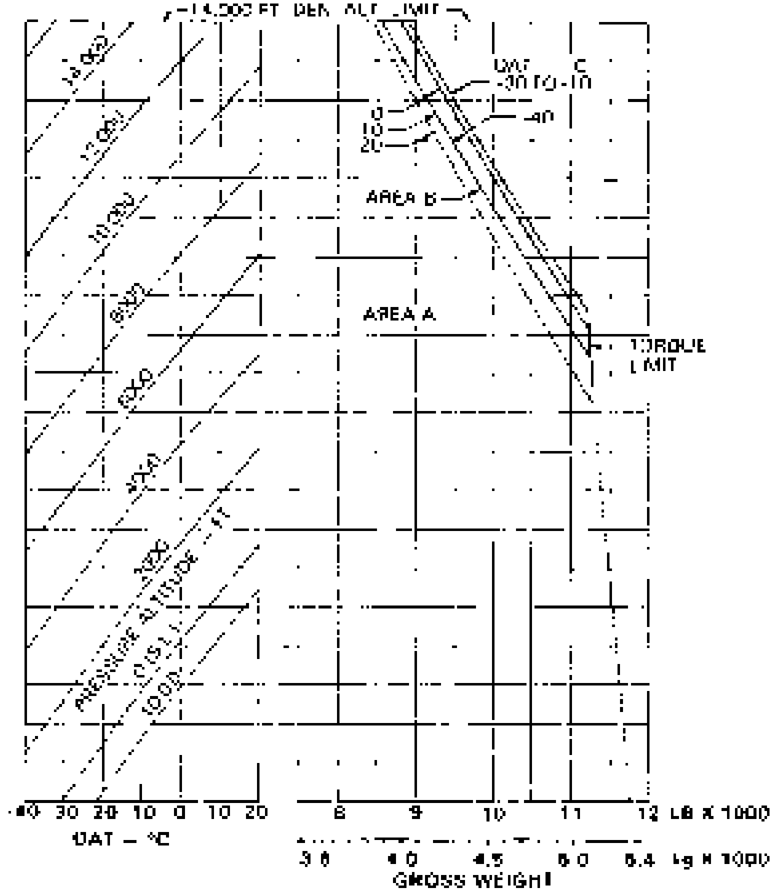


Figure 4-1. (Sheet 1 of 2)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 40 FT
WINTERIZATION HEATER ON
-40° TO 20°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS.

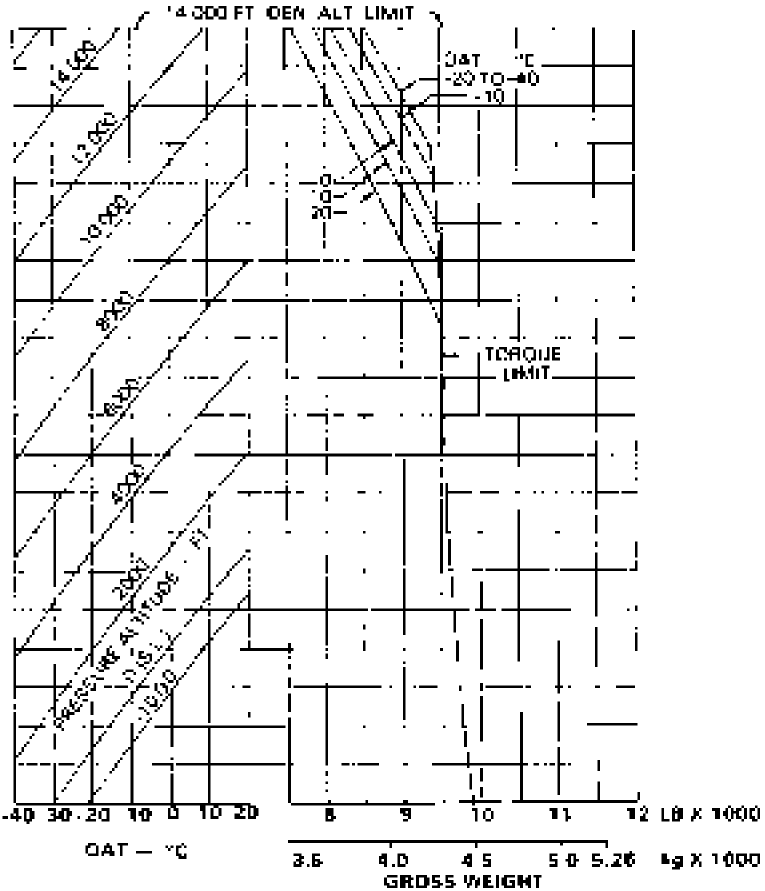


Figure 4-1. (Sheet 2 of 2)

TAKEOFF DISTANCE
OVER 50 FT. OBSTACLE

HOVER POWER - 78% TORQUE
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

INITIATED FROM 4 FT SKID HEIGHT
V_{TOSS} = 45 KIAS
WINTERIZATION HEATER ON

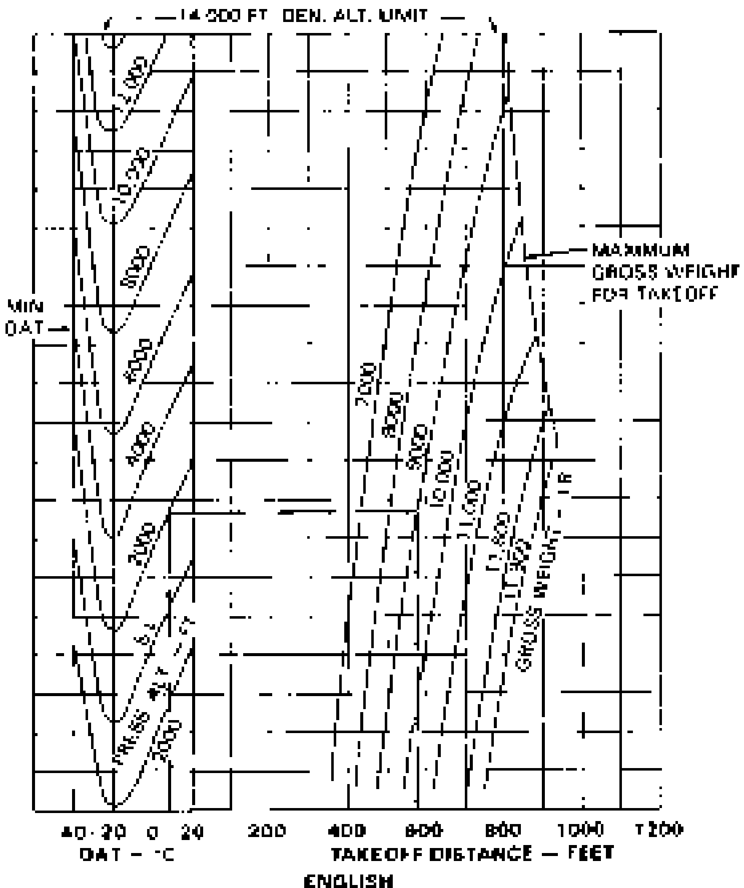
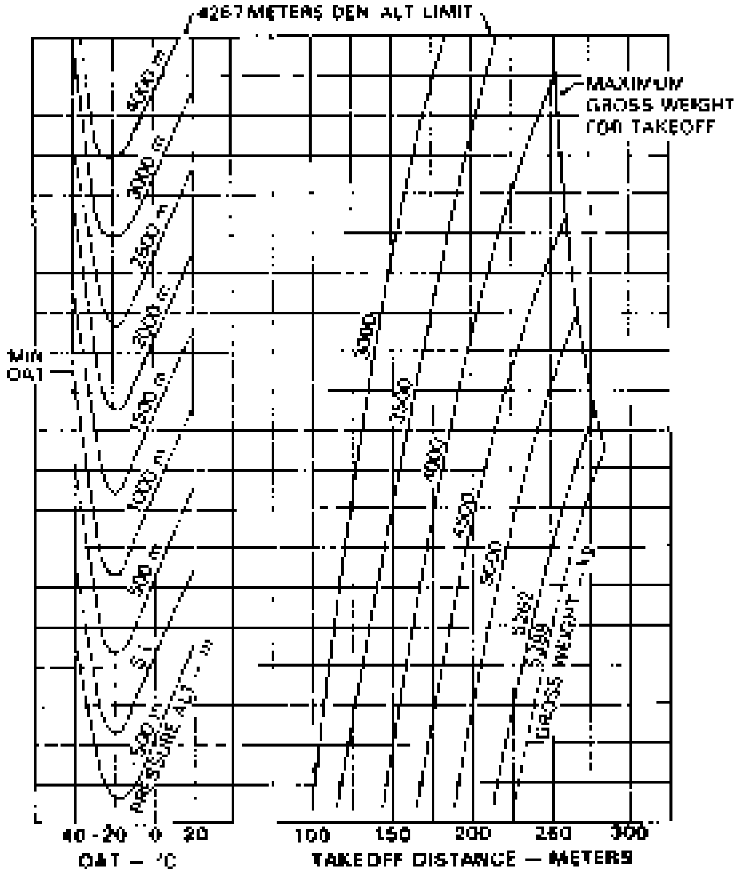


Figure 4-2. (Sheet 1 of 2)

TAKEOFF DISTANCE
OVER 15 METER OBSTACLE

HOVER POWER + 10% TORQUE
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

INITIATED FROM 1.2m SKID HEIGHT
V_{TOCS} = 45 KIAS
WINTERIZATION HEATER ON



METRIC

Figure 4-2. (Sheet 2 of 2)

TWIN ENGINE RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

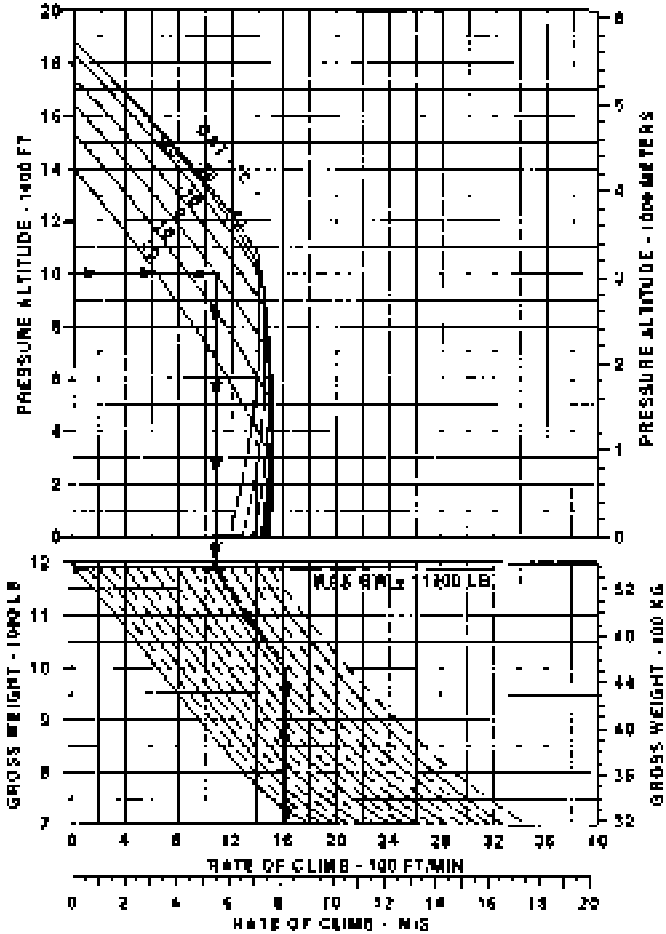


Figure 4-3. (Sheet 1 of 2)

TWIN ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED.

1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

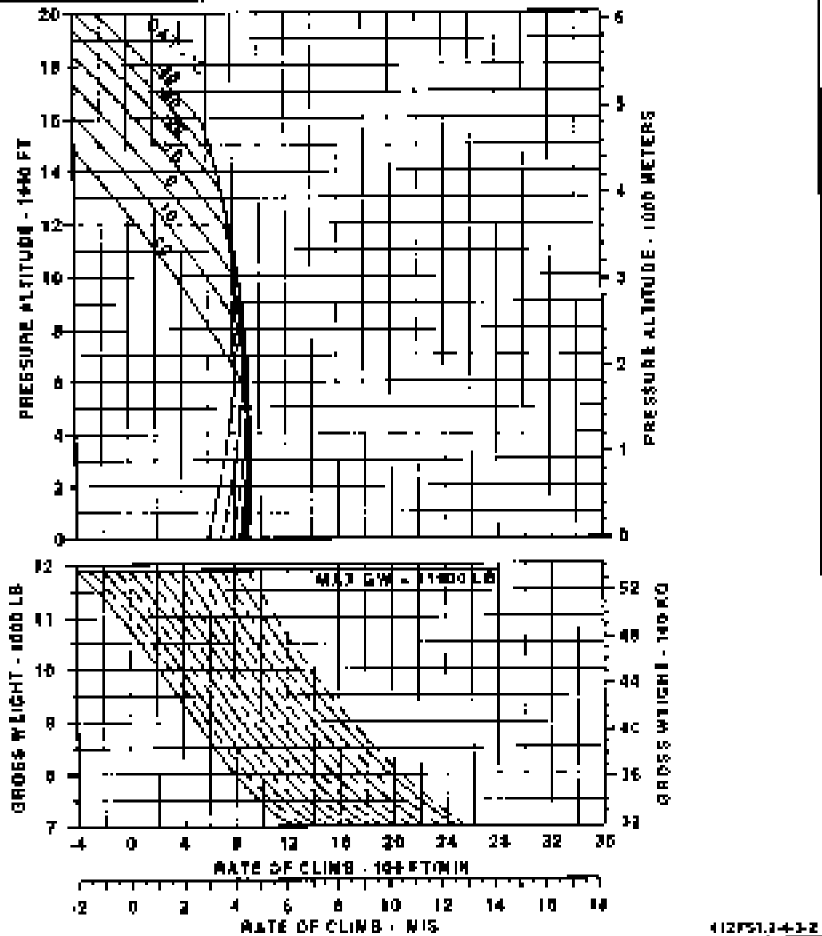


Figure 4-3. (Sheet 2 of 2)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 10,000 LB (4536 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED: 1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

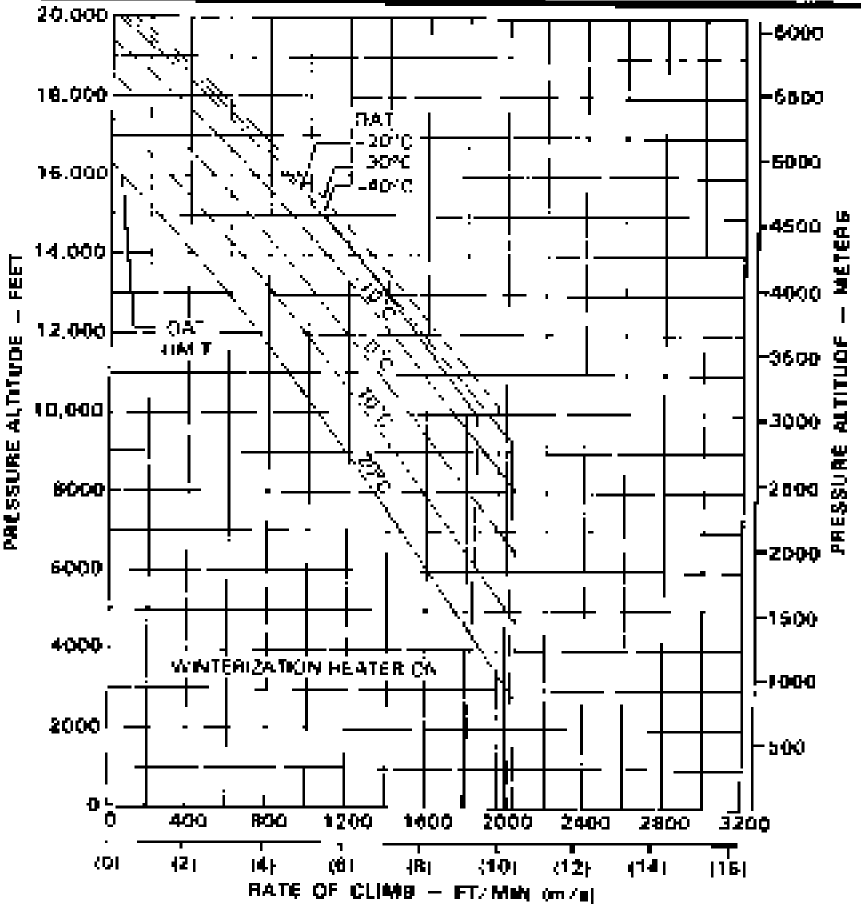


Figure 4-3. (Sheet 4 of 12)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11,000 LB (4990 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

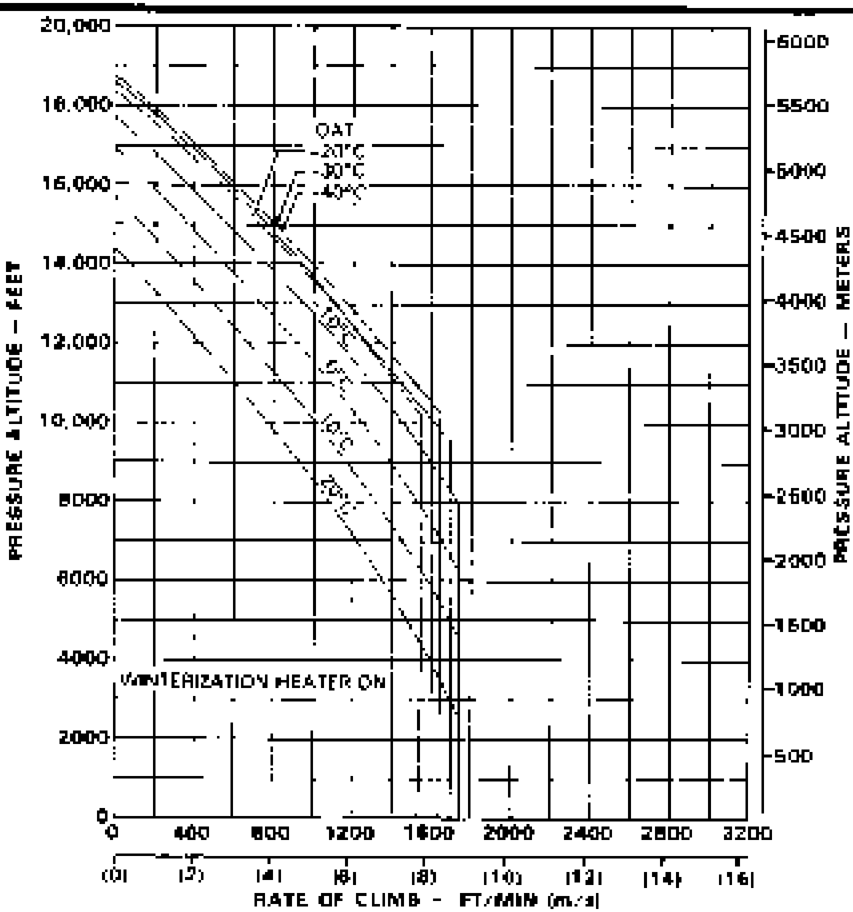


Figure 4-3 (Sheet 6 of 12)

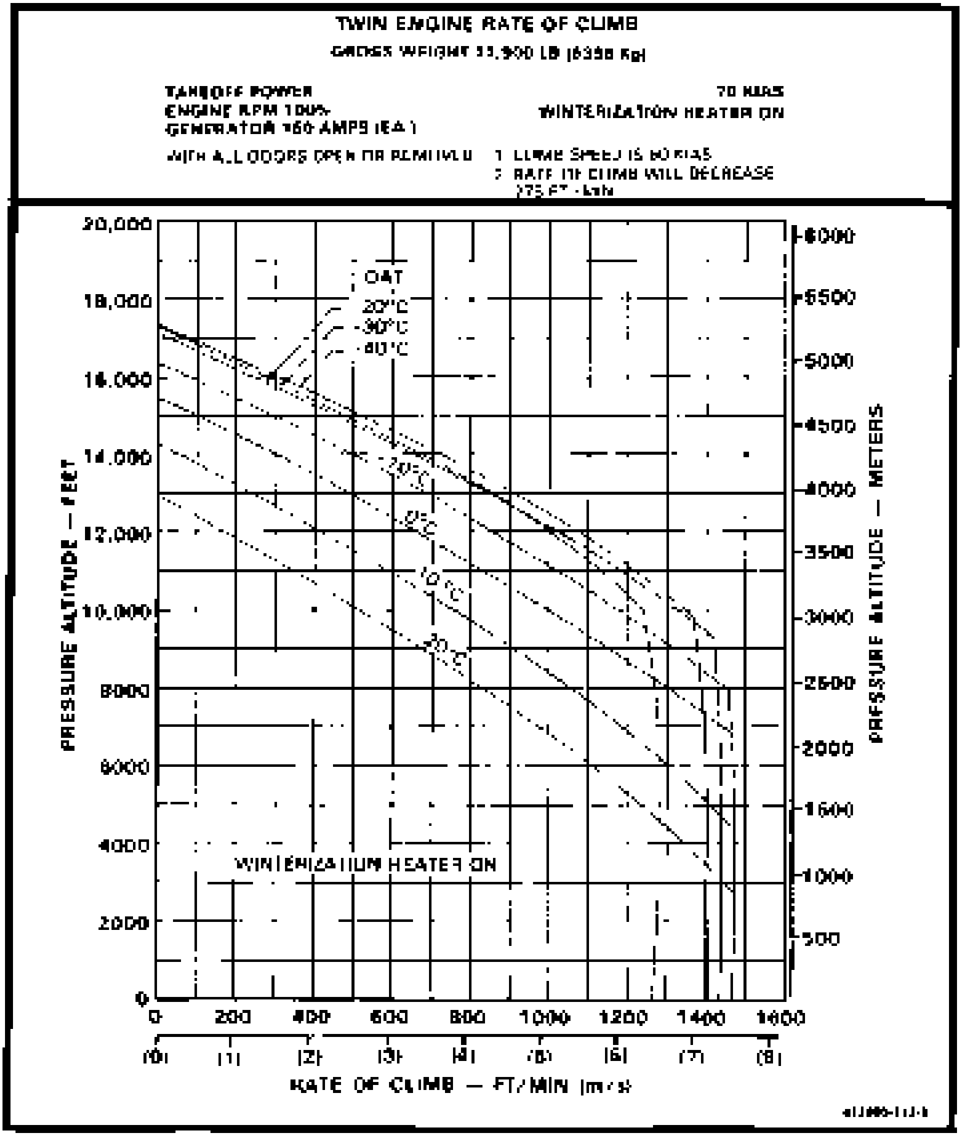


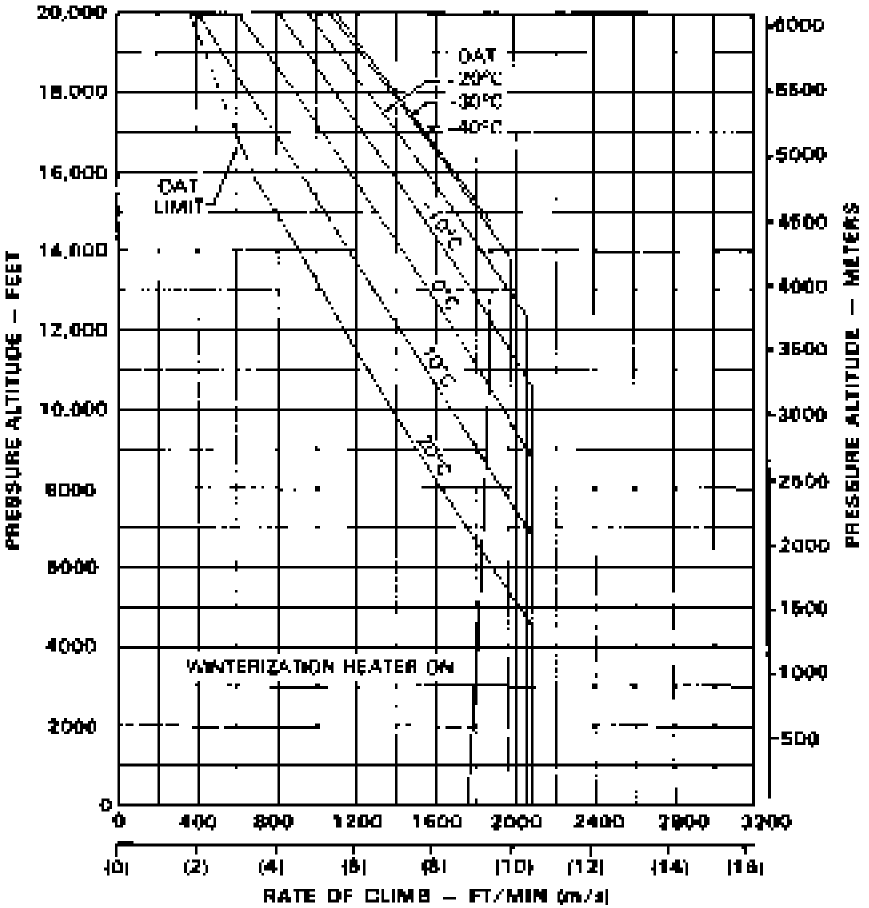
Figure 4-3. (Sheet 6 of 12)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 7000 LB. (3175 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 160 AMPS (EA)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



412900-38-28

Figure 4-3 (Sheet 7 of 12)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 8000 LB (3629 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED: 1. CLIMB SPEED ≤ 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

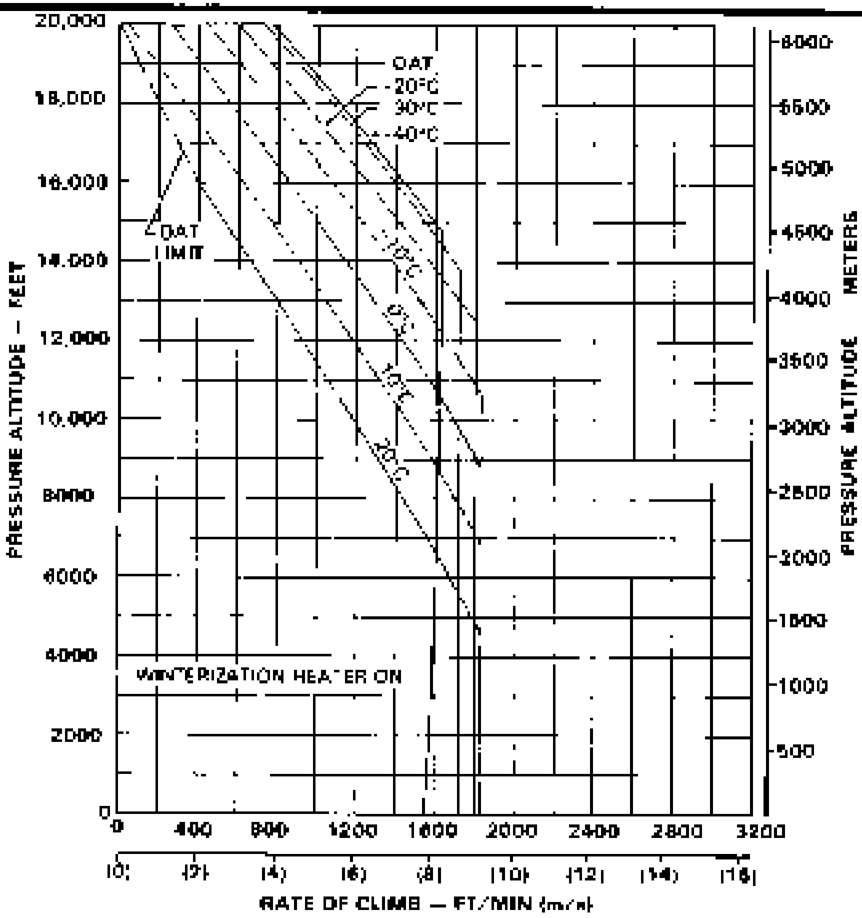


Figure 4-3. (Sheet 8 of 12)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 9000 LB (4082 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED 1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

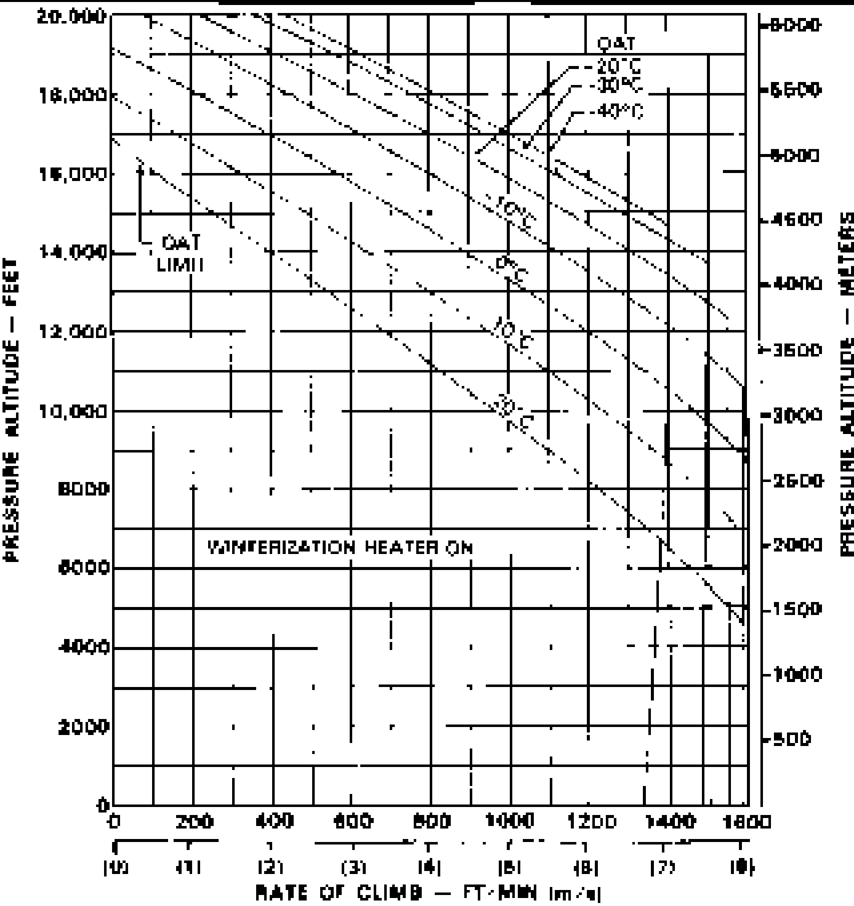


Figure 4-3. (Sheet 9 of 12)

TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 10 000 LB (4536 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 160 AMPS (EA)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED

1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN

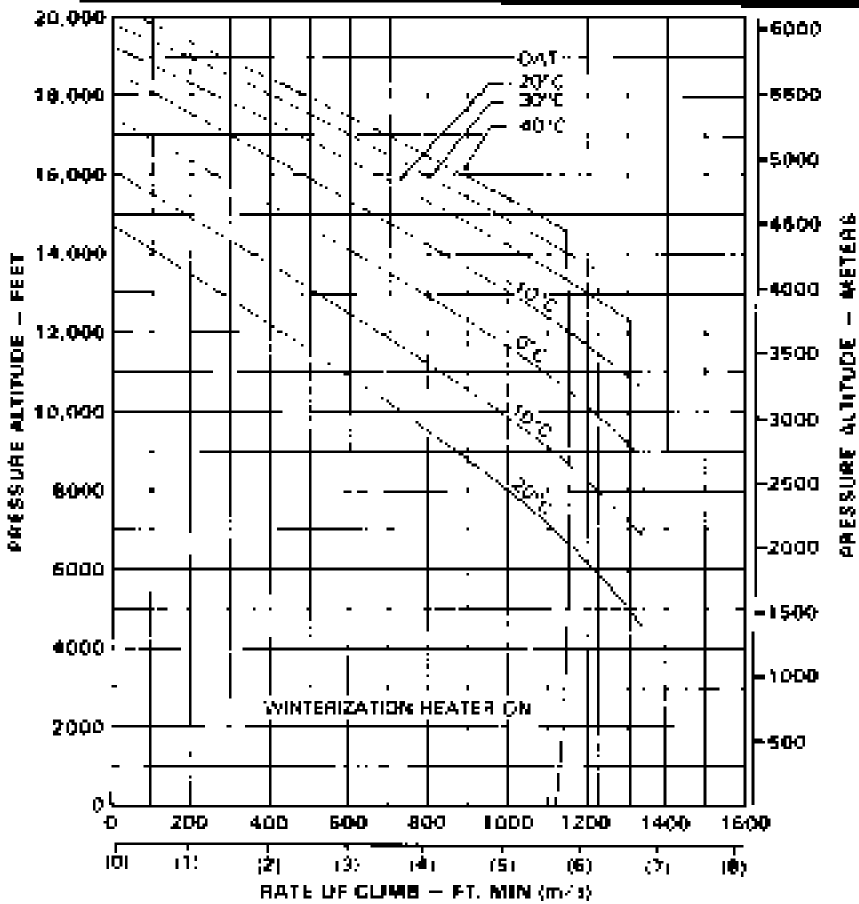


Figure 4-3. (Sheet 10 of 12)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11 000 LB (4990 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED: 1. CLIMB SPEED IS 50 KIAS
2. RATE OF CLIMB WILL DECREASE 375 FT/MIN

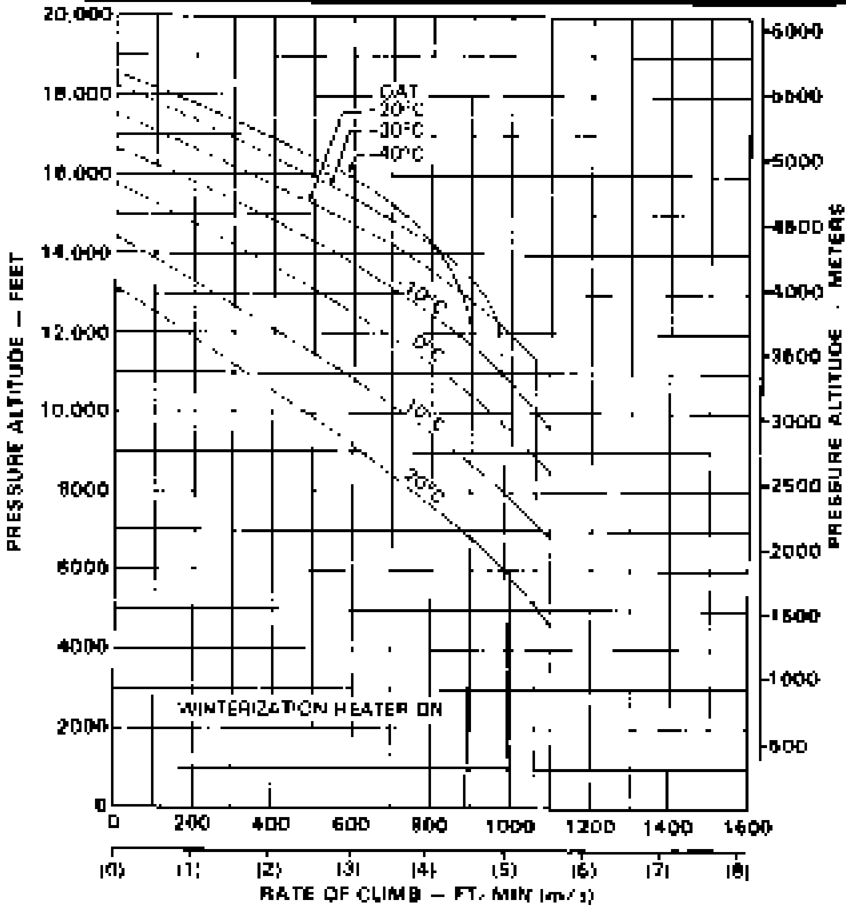


Figure 4-3. (Sheet 11 of 12)

TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 11 900 LB (5398 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
WINTERIZATION HEATER ON

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 225 FT/MIN

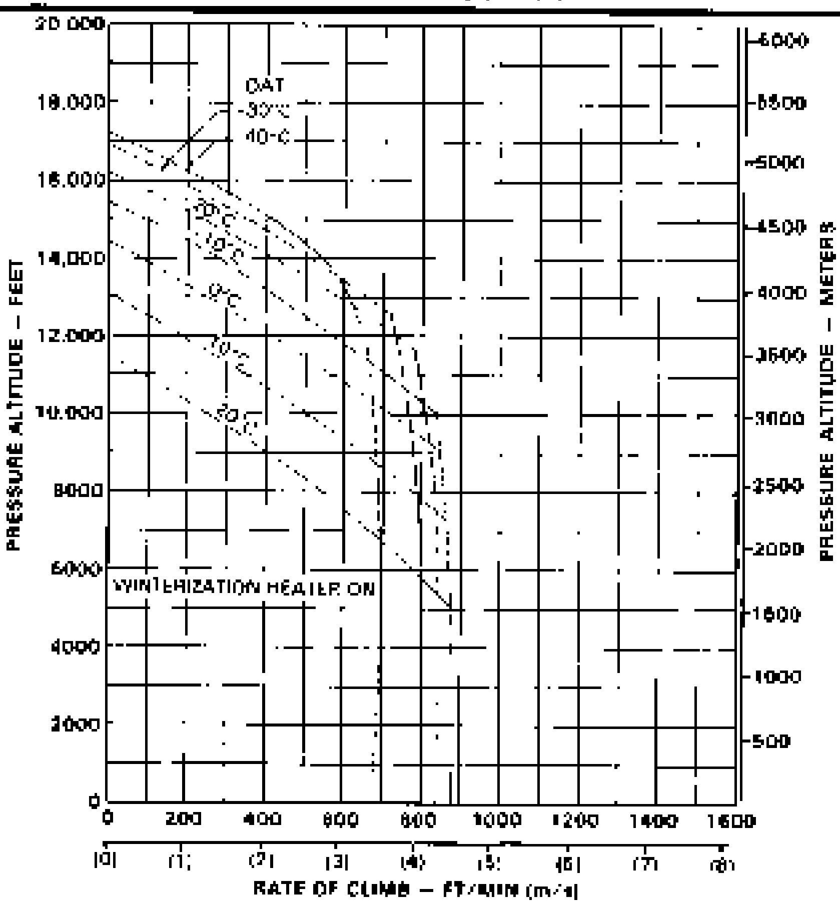


Figure 4-3. (Sheet 12 of 12)

Bell MODELS 412/412 EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT
EMERGENCY FLOATS

(412-706-004)

CERTIFIED
20 JANUARY 1981

This supplement shall be attached to the Models 412 and 412 EP Flight Manual when the 412-706-004 Emergency Floats have been installed.

Refer to BHT-412-FMS-55.4 for S/N 36122, 36123, 36125 and subsequent.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

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23 JUNE 1994
REVISION 1 — 15 APRIL 1996

NOTICE PAGE

Additional copies of this publication may be obtained by contacting:
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Fort Worth, Texas 76101-0482

LOG OF REVISIONS

Original	0	20 Jan 81
Reissue	0	16 May 89
Reissue	0	20 Oct 93
Reissue	0	23 Jun 94
Revision	1	15 Apr 96

LOG OF PAGES

PAGE	REVISION NO.
Title	1
NP	0
A — B	1
i/ii	0
1 — 4	0

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Original	0	20 Jan 81
Reissue	0	16 May 89
Reissue	0	20 Oct 93
Reissue	0	23 Jun 94
Revision	1	15 Apr 96

APPROVED.

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

The emergency floats will allow the helicopter to land in water during an emergency situation. The kit consists of six skid mounted float bags, four water activated float switches that are mounted on the underside of the fuselage, a pneumatic bottle located in the nose compartment, a collective mounted EMERG FLTS switch, a pedestal mounted EMER INFLATION handle, and the necessary hardware to complete the installation. Also, the kit includes provisions for installing life rafts and vests.

The floats automatically inflate when the EMERG FLTS switch is in the ARMED position and the water activated float switches are submerged. If the system or one of the float bags rupture after inflation, check valves in each float bag will maintain float integrity. An instrument panel mounted EMER FLOATS caution light illuminates whenever the EMERG FLTS switch is in the ARMED position. System security is protected by an EMERG FLOATS circuit breaker located on the overhead console.

The EMER INFLATION handle provides for manual activation of the emergency flotation system in the event the floats fail to inflate automatically.

Section 1

LIMITATIONS

TYPE OF OPERATION

The emergency floats are installed for assistance during emergency ditching and use is approved for VFR and IFR operation.

FLOATS switch shall be OFF and FLOATS caution light extinguished when operating over land.

Emergency float safety pin shall be removed prior to flight over water.

FLIGHT WITH OPTIONAL EQUIPMENT INSTALLED

Fixed passenger step shall not be installed concurrently with emergency floats.

Retractable passenger step shall be stowed prior to flight over water.

When internal hoist is installed, hoist cable anti-chafing guard shall be installed on same side of helicopter as hoist.

AIRSPEED LIMITATIONS

Inflation of emergency floats during forward flight is prohibited. Flight after landing with floats inflated is prohibited.

WARNING

SEVERE NOSE UP PITCHING WILL OCCUR IF EMERGENCY FLOATS ARE INFLATED IN FORWARD FLIGHT OR DESCENT. REFER TO INADVERTENT FLOAT INFLATION IN FLIGHT (SECTION 3).

Maximum autorotation Airspeed (floats stowed):

105 knots below 10,000 feet pressure altitude

80 knots above 10,000 feet pressure altitude

Maximum forward speed for ditching:

33 knots in calm water

15 knots in rough water

Rate of descent should be reduced as low as possible upon water contact.

ALTITUDE LIMITATIONS

Maximum pressure altitude for inflation of emergency floats is 10,000 feet. Helicopter operation above 10,000 feet is permitted provided the FLOATS switch is in the OFF position and FLOATS caution light is extinguished.

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after floats are installed and ballast readjusted, if necessary, to return empty weight cg within allowable limits.

The emergency float kit does not change the CG limits of the helicopter.

FLOAT ARMING

Floats shall not be armed:

1. Over land.
2. Above 60 KIAS.
3. Above 600 feet AGL.

PLACARDS

FLOAT INFLATION OR OPERATION IN FORWARD FLIGHT IS PROHIBITED

(Located above pilot airspeed indicator.)

Section 2

NORMAL PROCEDURES

EXTERIOR CHECK

NOTE

Ensure that emergency floats have had periodic inflation and inspection.

Emergency floats — Stowed.

Emergency float covers and supports — Clean and secured.

INTERIOR CHECK

EMER INFLATION handle — Down and safetied.

Nitrogen bottle — Secured and pressure within allowable limits for pressure altitude and ambient temperature as shown on chart decal, located on nitrogen bottle.

Emergency floats safety pin -- Remove for over-water flight.

PRESTART CHECK

FLOATS switch — OFF.

EMER FLOATS circuit breaker — IN.

BEFORE TAKEOFF OVER WATER

STEP switch — STOW.

FLOATS switch — ARMED; check FLOATS caution light illuminated.

IN-FLIGHT OPERATION

FLOATS switch — OFF upon reaching 600 feet above water and airspeed of 60 KIAS or above, or when over land; check FLOATS caution light extinguished.

BEFORE LANDING OVER WATER

FLOATS switch — ARMED when below 600 feet above water and airspeed of 60 KIAS or below; check FLOATS caution light illuminated.

AFTER LANDING

FLOATS switch — OFF; check FLOATS caution light extinguished.

BEFORE LEAVING HELICOPTER

Emergency floats safety pin — Installed.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

INADVERTENT FLOAT INFLATION IN FLIGHT

In event of unintended inflation, reduce airspeed, adjust rate of descent to 200 fpm or less, and land as soon as possible. Avoid landing on terrain which could damage float bags.

ELECTRICAL MALFUNCTIONS

FLOATS CAUTION LIGHT ON WITH FLOATS SWITCH OFF

If FLOATS caution light illuminates with FLOATS switch OFF, pull EMER FLOATS circuit breaker.

NOTE

If EMER FLOATS circuit breaker is pulled floats will not deploy automatically.

If FLOATS caution light remains illuminated after pulling circuit breaker, land as soon as practical.

ELECTRICAL SYSTEM FAILURE

Pull EMER INFLATION handle upon water contact to inflate floats.

EMERGENCY DITCHING

WARNING

CREW AND PASSENGER DOORS SHALL REMAIN CLOSED DURING DITCHING.

FLOATS switch — ARMED; check FLOATS caution light illuminated. Establish an autorotative glide speed of 65 to 70 knots for all gross weight.

WARNING

SEVERE NOSE UP PITCHING WILL OCCUR IF EMERGENCY FLOATS ARE INFLATED IN FORWARD FLIGHT OR DESCENT.

At 100 feet altitude execute a moderate cyclic flare to reduce airspeed. Adjust collective and cyclic pitch sufficiently to touchdown in a nose-up attitude with forward speed and rate of descent as low as possible.

If emergency floats do not inflate immediately upon water contact, pull EMER INFLATION handle.

After water touchdown, complete shutdown, check for damage, and determine if helicopter should be abandoned.

NOTE

Takeoff after emergency landing with floats inflated is prohibited.

EGRESS AFTER DITCHING

Ensure rotor is stopped prior to egress.

Crew egress should be accomplished by jettisoning crew doors.

Passenger egress should be accomplished by pushing out passenger door windows at corners marked EMERGENCY EXIT PUSH HERE.

Section 4

PERFORMANCE

No change from basic manual.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR HEATED WINDSHIELD

(412-706-010)

CERTIFIED
20 JANUARY 1981

This supplement shall be attached to the Models 412 and 412 EP Flight Manual when the 412-706-010 Heated Windshield has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
A Subsidiary of Textron Inc.

POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

REISSUE — 18 OCTOBER 1994

LOG OF REVISIONS

Original . . . . . 0 . . . . .20 Jun 81
Reissue . . . . . 0 . . . . .08 May 89
Reissue . . . . . 0 . . . 18 Oct 94

LOG OF PAGES

Page	Revision No.	Page	Revision No.
Title — A	0		
i/ii	0		
1 — 2	0		
3/4	0		

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The Heated Windshield Kit allows the crew to electrically defrost/defog the windshield. The kit consists of two heated windshield panels, switches, circuit breakers, caution/advisory lights, and the necessary hardware and wiring to complete the installation.

The ON/OFF switches are located on the overhead console and identified as WSHLD HEAT LH and RH. Placing either switch in the ON position activates the corresponding heated windshield panel and illuminates the respective ON advisory light. The caution/advisory lights are located on the instrument panel. The caution portion of the light illuminates HOT whenever the respective heated windshield panel overheats. Electrical power is provided by the 28 Vdc NON ESNTL bus. CONT and PWR circuit breakers, located on the overhead console and identified as WINDSHIELD HEAT LH and RH, provide circuit protection.

Section 1

LIMITATIONS

PLACARDS AND DECALS

CAUTION

STAND BY COMPASS UNRELIABLE
WITH WINDSHIELD HEAT ON

WSHLD HEAT

LH RH

INDICATOR

ON ON — GREEN

HOT HOT — YELLOW

Section 2

NORMAL PROCEDURES

PRESTART CHECK

WSHLD HEAT LH switch — OFF.

WSHLD HEAT RH switch — OFF.

WINDSHIELD HEAT circuit breakers — In.

BATTERY BUS 1 switch — ON

WINDSHIELD HEAT caution/advisory light segments — PRESS TO TEST; check ON lights illuminate green, HOT lights illuminate amber.

NOTE

The intensity of the heated windshield lights is controlled by the caution panel BRIGHT/DIM switch when PILOT INSTR LT rheostat is on.

BEFORE TAKEOFF

WSHLD HEAT LH switch — ON (if desired); check ON light illuminates.

WSHLD HEAT RH switch — ON (if desired); check ON light illuminates.

NOTE

The windshield heat green advisory lights will illuminate and extinguish as the windshield heat cycles on and off during normal operation.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

DC GENERATOR FAILURE

NON-ESNTL BUS switch — MANUAL

NOTE

DC power for the heated windshield is supplied by the nonessential bus.

WINDSHIELD HEAT CAUTION LIGHT

If either WSHLD HEAT caution light illuminates (HOT), turn respective WSHLD HEAT switch OFF.

WINDSHIELD HEAT CIRCUIT BREAKER

If LH or RH WINDSHIELD HEAT CONT or PWR circuit breaker pops out, turn respective WSHLD HEAT switch OFF.

Section 4

PERFORMANCE DATA

No change from basic Flight Manual.

Bell Model 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR FLIGHT DIRECTOR

(412-706-111)

CERTIFIED
FEBRUARY 13, 1981

This supplement shall be attached to the Model 412 Flight Manual when the 412-706-111 Flight Director has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

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POST OFFICE BOX 482 - FORT WORTH, TX 76101

13 FEBRUARY 1981
REISSUED 8 MAY 1989

LOG OF REVISIONS

Original . . . . . 0 . . . . 13 Feb 81
Reissued . . . . 0 . . . . 5 May 89

LOG OF PAGES

FLIGHT MANUAL Page	Revision No.	MANUFACTURER'S DATA Page	Revision No.
Title — A	0	6 — 6	0
i/ii	0		
1 — 5	0		

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION DIRECTORATE
AIRCRAFT CERTIFICATION SERVICE
DEPARTMENT OF TRANSPORTATION
SOUTHWEST REGION, FORT WORTH, TEXAS

NOTE: Revised text is indicated by a black vertical line.
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INTRODUCTION

The Flight Director assists the flight crew in control and navigation of the helicopter. Nine Flight Director modes, in addition to standby (SBY) mode, are available for selection by the flight crew: Altitude (ALT), Indicated Airspeed (IAS), Vertical Speed (VS), Heading (HDG), Navigation (NAV), Localizer and Glideslope (ILS), Back Course (BC), VOR Approach (VOR APR), and Go-Around (GA). Flight director operation is controlled by the mode selector on the instrument panel.

The Flight Director can be coupled to the Automatic Flight Control System (AFCS) for fully automatic (hands off) flight path control.

Section 1

LIMITATIONS

TYPE OF OPERATION

The Flight Director may be used during VFR or IFR noniciing conditions.

NOTE

Flight Director bars are repeated on copilot ADI.

FLIGHT DIRECTOR LIMITATIONS

During VOR approaches, except for VORs collocated at the airport, the Flight Director shall not be coupled in VOR APR mode prior to VOR station passage inbound.

Maximum approach gradient is 6 degrees.

Flight Director modes may not be commanded from the copilot position.

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after the Flight Director is installed and ballast readjusted, if necessary, to return empty weight CG within allowable limits.

AIRSPEED LIMITATIONS

Minimum airspeed for coupled operation of Flight Director is 60 KIAS.

Section 2

NORMAL PROCEDURES

PRESTART CHECK

PILOT INSTR LT knob — OFF (day operation).

AUX SYS PITOT and STATIC switches — NORMAL.

SYSTEMS CHECKS

FLIGHT DIRECTOR CHECK

FORCE TRIM switch — ON.

HP1 and HP2 buttons — ON.

Flight director SBY button — Depress and hold: check DCPL light and all mode selector and helipilot controller lights illuminate and FD fail flag on ADI appears, then release button.

HSI heading marker — Set to aircraft heading.

Flight director HDG button — Depress, check HDG and CPL lights illuminate, SBY light extinguishes.

ADI roll command bar — Check centered.

HSI heading marker — Move right: check ADI roll command bar moves right and roll actuator position indicator (API) moves right, check cyclic stick moves right in approximately 2 seconds.

HSI heading marker — Reset to aircraft heading.

Flight director VS button — Depress, check VS light illuminates.

ADI pitch command bar — Check centered.

Cyclic ATTD TRIM switch — Move aft: check ADI pitch command bar moves up and pitch API moves up: check cyclic stick moves aft in approximately 2 seconds.

Cyclic NAV STBY button — Depress momentarily and release. Check HDG, VS, and CPL lights extinguish, SBY light illuminates, check all APIs center, pitch and roll command bars retract from view.

HSI heading marker — Set to takeoff heading.

NOTE

For prolonged ground operation, AFCS shall be operated in SAS mode only.

TAKEOFF

SAS/ATT button — ATT or SAS as desired during hover and takeoff. ATT prior to entering Instrument Meteorological Conditions (IMC).

NOTE

It is recommended that the cyclic FORCE TRIM release button be depressed before liftoff to trim actuators to center positions.

Cyclic FORCE TRIM release button — Depress and hold until desired climbout attitude is attained, then release.

Flight director — Select modes as desired after reaching 60 KIAS.

Collective pitch — Adjust to desired climb power setting.

Airspeed — Adjust to desired climb speed.

Flight director — Select modes as desired.

IN FLIGHT OPERATION

Flight director — Select modes as desired.

DESCENT AND APPROACH

Flight director — Select mode for type of approach to be flown.

Collective pitch — Adjust to maintain desired approach speed.

GO-AROUND

Collective GO-AROUND button — Depress at Missed Approach Point.

LANDING

Cyclic NAV STBY button — Depress at or above 60 KIAS to decouple flight director.

AFCS — SAS or ATT mode as desired.

NOTE

It is recommended that the cyclic FORCE TRIM release button be depressed before touchdown to trim actuators to center positions.

For prolonged ground operation, AFCS shall be operated in SAS mode only.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

Table 3-1. Caution lights

CAUTION LIGHT WORDING	FAULT CONDITION	CORRECTIVE ACTION
DCPL	Flight director not coupled	Ensure that HP1 and HP2 are engaged in ATT mode. Engage flight director modes as desired. Depress CPL button if CPL light not illuminated.

Table 3-2. Warning flags

FLAG WORDING	FLAG LOCATION	FAULT CONDITION	CORRECTIVE ACTION
ATT	ADI	Vertical gyro not running at full speed/attitude information unreliable (Flight director may or may not decouple.)	If only pilot ATT flag is displayed, pilot shall monitor standby attitude indicator and flight director. If only the copilot ATT flag is displayed, the copilot shall monitor the standby attitude indicator. Flight director is functional and flight director indications repeated on copilots ADI are valid. Check PILOT and CPLT ATTD SYS circuit breakers — In. If flag does not retract, continue flight in ATT or SAS mode.
FD	ADI	Flight director not coupled due to flight director failure. (Pitch and roll command bars may or may not retract from view.)	Check FLT DIR (AC and DC) circuit breakers in. Check desired mode(s) engaged. If flag does not retract from view, continue flight in ATT or SAS mode. (ATT mode for IMC conditions.)
GS (No legend)	HSI	Glideslope signal unreliable. (ADI pitch command bar retracts from view. AFCS holds pitch attitude present at time of signal failure.)	Continue flight in any mode, using cyclic ATTD TRIM switch and collective to maintain airspeed and glidepath. (Monitor raw glideslope data.)
NAV (No legend)	HSI	VOR or localizer signal unreliable. (ADI roll command bar retracts from view. HSI course deviation bar and No. 1 bearing pointer unreliable. AFCS holds roll level attitude.)	Check NAV 1 (DC) circuit breaker in. Check VHF NAV 1 tuned properly signal identified. Continue flight in HDG or ATT mode.
OFF	HSI	Directional gyro failure or HSI failure. Heading information unreliable. (AFCS holds roll level attitude.)	Check PILOT and CPLT HSI and GYRO CMPS (AC) circuit breakers in. Continue flight in any mode except HDG.

FLIGHT DIRECTOR FAILS TO COUPLE

HP1 and HP2 buttons — ON

SAS/ATT button — ATT

CPL button — Depress if CPL light not illuminated.

NOTE

The Flight Director will not couple if HP1 or HP2 is inoperative.

PITOT-STATIC SYSTEM MALFUNCTION

In the event of an apparent malfunction of the copilot altimeter, vertical speed indicator, and/or airspeed indicator, proceed as follows.

AUX SYS PITOT or STATIC switch (as applicable) — OFF

Flight director — Disengage vertical modes.

Section 4

PERFORMANCE DATA

No change from basic Flight Manual.

Section 1

MANUFACTURER'S DATA

WEIGHT AND BALANCE

No change from basic Flight Manual

Section 2

MANUFACTURER'S DATA

SYSTEMS DESCRIPTION

FLIGHT DIRECTOR (412-706-111)

The flight director is designed for use as a workload reliever to assist the pilot in control and navigation of the helicopter. The flight director has nine modes of operation, any of which may be coupled to the helipilot system for fully automatic hands off flight path control. When decoupled from the helipilots, the flight director provides automatic flight path computation and visual pitch and roll command indications to direct the pilot in maneuvering the helicopter to maintain the selected flight path. When the flight director is coupled in the appropriate modes, the automatic flight control system will maneuver the helicopter to perform the following functions:

Maintain a constant pressure altitude (ALT).

Maintain a constant indicated airspeed (IAS).

Maintain a constant vertical speed climb or descent (VS).

Turn to and maintain a selected magnetic heading (HDG).

Capture and track a selected VOR radial (NAV or VOR APR).

Capture and track an ILS localizer and glideslope (ILS).

Capture and track a localizer back course (BC).

Initiate a missed approach (go-around) climbout (GA).

The flight director computer analyzes vertical and lateral flight and navigational data to generate pitch and roll steering commands which are displayed visually on the attitude director indicator (ADI). The vertical channel combines pitch attitude, airspeed, altitude, vertical speed, and glideslope deviation information to produce computed pitch command signals. The lateral channel combines roll attitude, heading, and course deviation information to produce computed roll command signals. Automatic flight path control is achieved when the pitch and roll commands from the flight director computer are coupled to the helipilot computers.

Should a flight or navigation data signal become invalid, the affected pitch or roll channel will revert to attitude hold mode and the respective command bar on the ADI will retract from view. If either helipilot fails or is disengaged, the flight director will decouple automatically.

FLIGHT DIRECTOR CONTROLS

MODE SELECTOR

The mode selector (figure 2-1) enables the pilot to select the desired flight director mode by depressing the appropriate push-on/push-off button. Selected modes are annunciated by illumination of the respective mode select buttons. The NAV, BC, and VOR APR buttons have two lights each (ARM and CAP) to advise the pilot of the status of the flight director computer. The ILS button legends (ARM and GS) advise when the computer has armed or captured the glideslope. Depressing the SBY button disengages all modes and tests the illumination of all mode selector lights. Turning the PILOT INSTR LT knob clockwise dims all mode selector lights for night operation.

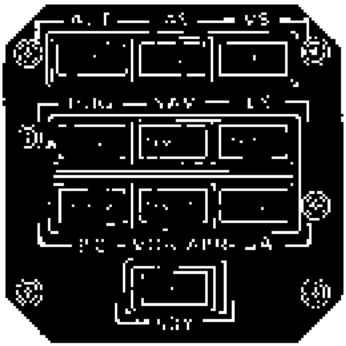

Figure 2-1. Flight director mode selector

COUPLE BUTTON

The CPL button is a push-on/push-off button located on the helipilot control panel on the pedestal. When both helipilots (HP1 and HP2) are engaged in the attitude retention mode (ATT), selecting any valid flight director mode will couple the flight director to the helipilots automatically, as indicated by illumination of the ON legend of the CPL button. The pilot may decouple the flight director by depressing the CPL button. When decoupled, the flight director will continue functioning in the selected mode, providing visual pitch and roll commands to the pilot on the attitude director indicator (ADI). Once depressed, the CPL button must be depressed again to recouple any flight director mode.

FORCE TRIM SWITCHES

The FORCE TRIM switch on the pedestal must be ON anytime the flight director is coupled for automatic flight control.

The cyclic mounted FORCE TRIM release button can be depressed to allow the pilot to reposition the cyclic control and pedals manually for large scale pitch, roll, and yaw corrections. Upon depressing the button, the rotary trim actuators are de-energized, the flight director modes are decoupled momentarily, the helipilot pitch, roll, and yaw linear actuators return to center positions, and the helipilot computers are placed in a fast follow-up mode to track flight control positions. Upon releasing the button, the helipilots and flight director will resume functioning in the preselected modes. If previously decoupled in the ATT mode, the helipilots will maintain the attitude existing at the time the button is released.

ATTITUDE TRIM SWITCH

The cyclic mounted ATTD TRIM switch can be moved fore and aft to adjust pitch attitude and laterally to adjust roll attitude during decoupled operation in attitude retention mode. The switch is also used to make small pitch attitude changes when coupled in any mode except ALT and ILS after glideslope capture. Roll attitude can also be adjusted by the ATTD TRIM switch, except when a lateral mode is engaged. (Large attitude changes should be made by depressing the cyclic FORCE TRIM release button.)

FLIGHT DIRECTOR STANDBY BUTTON

The cyclic mounted NAV STBY button is a remote switch having the same function as the SBY button on the flight director mode selector. Depressing the button disengages all flight director modes, cease the illumination of all mode selector lights, retracts the pitch and roll command bars on the ADI, and places the flight director in a standby status. The pilot must then reselect the modes if continued flight director operation is desired.

GO-AROUND BUTTON

The GO-AROUND button, located on the collective control head, is a remote switch having the same function as the GA button on the flight director mode selector. Depressing the button places the flight director in go-around mode and disengages all other modes. In GA mode the flight director commands a roll level attitude and a pitch attitude which will provide a 750 feet-per minute rate of climb. (The pilot must adjust collective pitch to maintain desired climb airspeed.)

AUXILIARY PITOT-STATIC SWITCHES

The AUX SYS PITOT and STATIC switches provide a means for isolating the flight director airspeed and altitude sensors from the copilot pitot-static system in the event of leakage or other system malfunction. When the PITOT switch is OFF the flight director airspeed sensor is disconnected, rendering the IAS mode inoperative. Placing the STATIC switch in the OFF position disconnects both the airspeed and altitude sensors of the flight director and thereby disables the ALT, IAS, and VS modes. The pilot should disengage the affected vertical modes to prevent undesirable flight control inputs when either switch is in the OFF position.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

SINGLE-SPEED INTERNAL HOIST

214-706-003

CERTIFIED
OCTOBER 2, 1981

This supplement shall be attached to the Model 412 or 412EP Flight Manual when the 214-706-003 Single Speed Internal Hoist has been installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

Bell Helicopter TEXTRON
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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

REISSUE — MAY 11, 1995

NOTICE PAGE

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Commercial Publication Distribution Center
Bell Helicopter Textron Inc.
P. O. Box 482
Fort Worth, Texas 76101-0482

LOG OF REVISIONS

Original .... 0 ....October 2, 1981	Reissued .... 0 ....October 8, 1991
Reissued ....0 ....May 6, 1989	Reissued ....0 ....May 11, 1995

LOG OF PAGES

PAGE	REVISION NO.	PAGE	REVISION NO.
FLIGHT MANUAL		35/36	0
Title — NP	0	**MANUFACTURER'S DATA**	
A — B	0	37 — 38	0
i/ii	0		
1 — 34	0		

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Original	0	October 2, 1991	Reissued	0	October 8, 1991
Reissued	0	May 5, 1993	Reissued	0	May 11, 1995

APPROVED:

for MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

The Single Speed Internal Hoist enables cargo and emergency rescue operations in areas where landings cannot be accomplished. The hoist can raise or lower loads up to 600 pounds (272 kilograms). The hoist cable is 250 usable feet (76.2 meters) in length. Each of the four cabin mounting locations allows the hoist to be extended 90 degrees outboard. Caution lights on each side of the hoist illuminate when the hook reaches 20 feet (6 meters) below the skids during retraction. An electrically actuated cable cutting device allows pilot or hoist operator to sever the cable in an emergency. A manually operated cable cutter, accessible to the hoist operator, may be used to sever the cable if the electrical cable cutter fails

Section 1

LIMITATIONS

1-3. TYPES OF OPERATION

Hoist operations shall be conducted under appropriate operating rules for external loads.

Passenger operations with hoist installed are approved if hoist is stowed and electrical system is deactivated.

Hoist operations are prohibited during instrument meteorological conditions.

1-4. FLIGHT CREW

A crewmember wearing an approved safety harness in passenger compartment is required during all phases of hoist operations. Crewmember shall wear protective gloves for guiding cable during operation. The hoist operator shall be familiar with hoist operating procedures and limitations.

1-5. CONFIGURATION

1-5-A. REQUIRED EQUIPMENT

Hoist cable antichafing guard shall be installed on standard or high skid landing gear (with or without floats) on same side of helicopter as hoist.

1-5-B. OPTIONAL EQUIPMENT

Fixed passenger step shall not be installed concurrently with internal hoist.

Retractable passenger steps shall be stowed during hoist operations.

Hoist operation with flight director in coupled mode is prohibited.

Hoisting or lowering an empty litter in open position (except Stokes litter) is prohibited.

Refer to appropriate Flight Manual Supplement(s) for additional limitations, procedures, and performance data.

1-6. WEIGHT AND CENTER OF GRAVITY

Actual weight change shall be determined after hoist is installed and ballast readjusted, if necessary.

For maximum gross weight, including hoist load, refer to applicable Flight Manual or BHT-412-FMS-19.1 when Increased Gross Weight and Takeoff Horsepower kit is installed.

Maximum hoist load is 600 pounds (272 kilograms). This is a structural limitation only and does not ensure that longitudinal or lateral CG will remain within approved limits. Maximum allowable hoist load varies with gross weight, center of gravity, and hoist location. Refer to appropriate Hoist Loading Schedule.

NOTE

The center of gravity of hoist load in forward position is F.S. 82 (2083 mm) and B.L. 60 (1524 mm). The center of gravity of hoist load in aft position is F.S. 131 (3327 mm) and B.L. 64.4 (1636 mm).

For Longitudinal vs. Lateral CG limits with internal hoist refer to internal hoist CG envelope figure 1-1.

1-7. AIRSPEED

VNE with asymmetrical door configuration is 20 KIAS.

VNE with hinged panels locked open and cargo doors open is 20 KIAS.

VNE with hinged panels removed and cargo doors removed or secured open is 60 KIAS.

1-24. HOIST DUTY CYCLE LIMITATIONS

The hoist is approved for continuous operation with loads not to exceed 600 pounds (272 kilograms).

1-25. ALLOWABLE HOIST LOAD

Select hoist loading schedules (figures 1-2 through 1-5) appropriate for position in which hoist is installed.

NOTE

Hoist loading schedules are based on most adverse loading combinations of pilot, copilot, and hoist operator, each weighing 170 or 200 pounds (77.1 or 90.7 kilograms), and on a weight empty CG of 0.3 inches (7.3 mm) to right of centerline prior to adding hoist. If lateral CG is appreciably different or crewmember weights are out of this range, allowable hoist load shall be computed. For computation, assume hoist operator in forward position to be located at F.S. 87 (2210 mm) and B.L. 40 (1016mm), and in aft position F.S. 125 (3175mm) and B.L. 40 (1016mm).

1-25-A. LEFT HOIST INSTALLATIONS

Enter appropriate schedule, figures 1-2 through 1-5 at gross weight of helicopter prior to hoisting. Proceed vertically to intersect with diagonal line representing number of crewmembers on board, top of schedule, or right cutoff line. Proceed horizontally to left to read maximum allowable hoist load. Intersecting with right cutoff line gives maximum load which does not cause helicopter to exceed gross weight limitations.

Using Weight empty chart, Section 5 and left hoist loading schedules ensures that both longitudinal and lateral limits are not exceeded during first hoist operation. However, for subsequent hoisting, additional precautions must be taken to avoid exceeding forward longitudinal limits.

1-25-A-1. LEFT FORWARD HOIST LOCATION

To continue using maximum allowable hoist capability: (Refer to figure 1-2 through 1-5)

a. put hoisted load (people or cargo) along side of island, or

b. when hoisted load is put immediately forward of island, reduce maximum hoist load to 300 pounds.

WARNING

DO NOT PUT HOISTED LOAD IN FORWARD AREA OF PASSENGER COMPARTMENT UNLESS MAXIMUM HOIST LOADS ARE COMPUTED FOR THAT CONFIGURATION.

1-25-A-2. LEFT AFT HOIST LOCATION

To continue using maximum allowable hoist capability: (Refer to figure 1-2 through 1-5)

a. put hoisted load along island or immediately forward of island, or

b. ensure empty weight CG is within Area A. Refer to Weight empty chart, Section 5.

1-25-B. RIGHT HOIST INSTALLATIONS

Right lateral limit for hoist operations varies with longitudinal center of gravity of the helicopter. The loading schedules have been modified to account for this variation

a. Starting with appropriate schedule for number of crewmembers on board, enter at gross weight of helicopter prior to hoisting.

b. Proceed vertically to intersect with diagonal line representing helicopter center of gravity prior to hoisting, top of schedule, or right cutoff line.

c. Proceed horizontally to left to read maximum allowable hoist load.

When helicopter center of gravity is between STA. lines, interpolate to determine CG.

Intersecting right cutoff line gives maximum load which does not cause helicopter to exceed gross weight limitations or forward longitudinal limits.

For multiple hoists during a single flight, after each hoist operation enter appropriate schedule at revised gross weight and proceed to new center of gravity to determine maximum allowable hoist load.

EXAMPLE 1: NORMAL

Determine Hoist Load when hoist is in R/H FWD POISTION and crew consist of Pilot, Copilot and Hoist Operator.

GIVEN.

Gross Weight — 9,500 lbs.

CG — STA. 135.5 before hoisting

From appropriate 11,600 lb. GW schedule obtain hoist load as follows:

Enter gross weight at 9,500 lbs.

Proceed up GW line to interpolated STA. 135.5

Proceed left to read hoist load of 210 lbs. Point (A).

EXAMPLE 2: NORMAL

Determine Hoist Load when hoist is in R/H FWD POSITION and crew consist of Pilot, Copilot and Hoist Operator.

GIVEN:

Gross Weight — 9,500 lbs.

CG — STA. 138.5 before hoisting

From appropriate 11,600 lb. GW schedule obtain hoist load as follows:

Enter gross weight at 9,600 lbs.

Proceed up GW line to STA. 138.5

Proceed left to read hoist load of 550 lbs. Point (B).

1-25-C. RIGHT HOIST INSTALLATION - PENALTY REGION OPERATION

The dashed line on schedules represents longitudinal center of gravity prior to hoisting which will result in a gross weight center of gravity at Sta. 135.2 and B.L. 4.5 during hoist operations with maximum hoist loads derived using this line. This center of gravity is the corner of but not in Penalty Region shown in Limitations.

Hoist loads derived for Normal Operations may be increased when GW/CG combinations are forward of those represented by dashed line. Loads may be increased up to but not greater than those defined by dashed line. However, this procedure will result in operations within Penalty Region. Refer to Section 1, Internal Hoist CG Envelope, for Penalty Region.

EXAMPLE 3: PENALTY REGION

Determine Hoist Load when hoist is in R/H FWD POSITION and crew consist of Pilot, Copilot and Hoist Operator.

GIVEN:

Gross Weight — 9,500 lbs.

CG — STA. 135.5 before hoisting

From appropriate 11,600 lb. GW schedule obtain hoist load as previously determined in Example 1 the maximum hoist load for normal operations is 210 lbs. Point (A).

To increase hoist load to maximum for condition without exceeding GW/CG limits, proceed up to dashed line and read left to find 435 lbs. Point (C).

The Penalty Region is any load greater than Point (A) up to maximum load at Point (C).

For GW vs. CG combinations aft of the CG represented by the dashed line (see Example 2), there is no Penalty Region.

1-26. WEIGHT EMPTY CHART

The Weight empty chart for internal hoisting operations is shown in Section 5. Refer to the maintenance manual for additional information.

NOTE

Allowable hoist load must be computed when weight empty is not within specified guidelines, shown in Section 5.

NOTE

Allowable hoist loads must be computed when AUX Fuel kits are installed.

Longitudinal/Lateral C.G. Envelope for Internal Hoist Operations

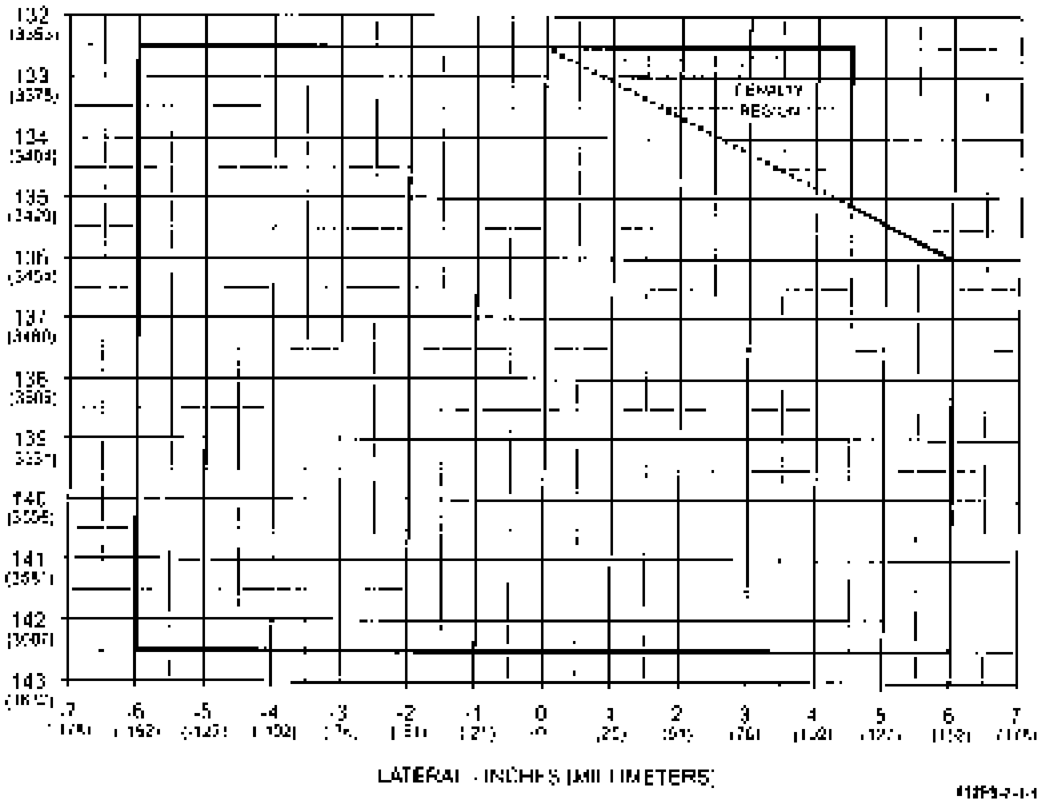


Figure 1-1. Internal hoist CG envelope

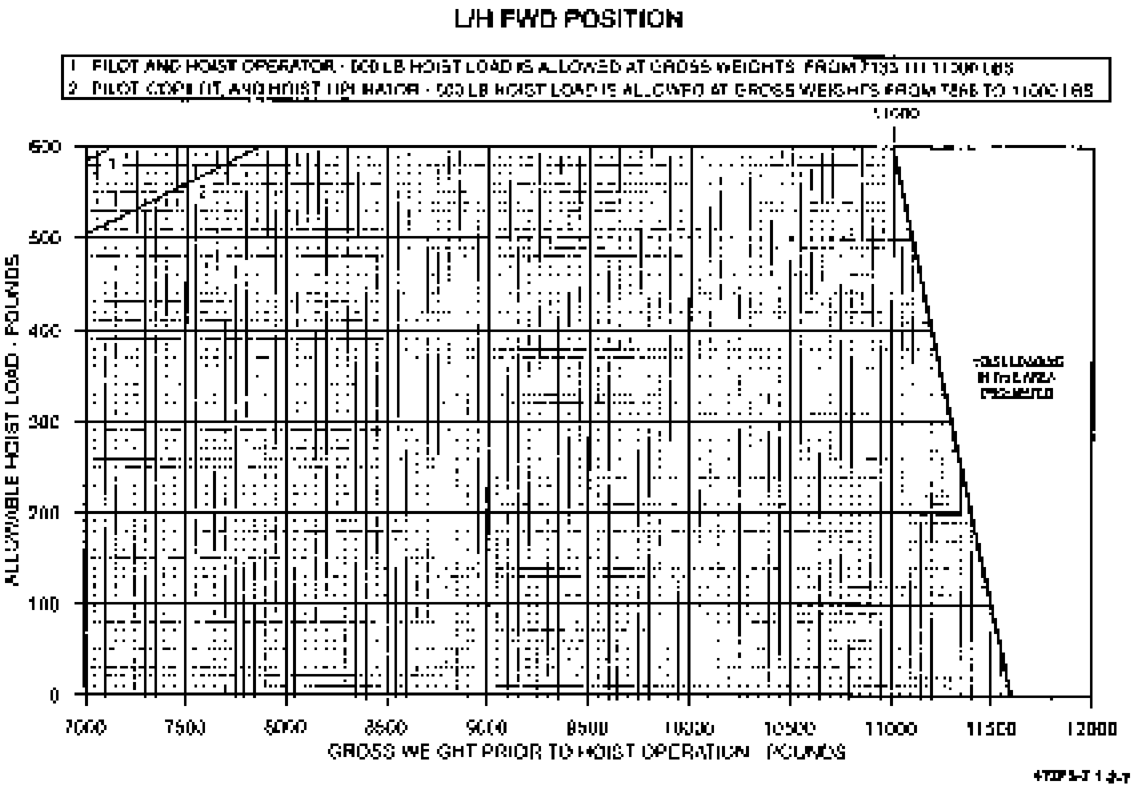


Figure 1-2. Hoist loading schedule 11,600 lb. GW (English) (Sheet 1 of 6)

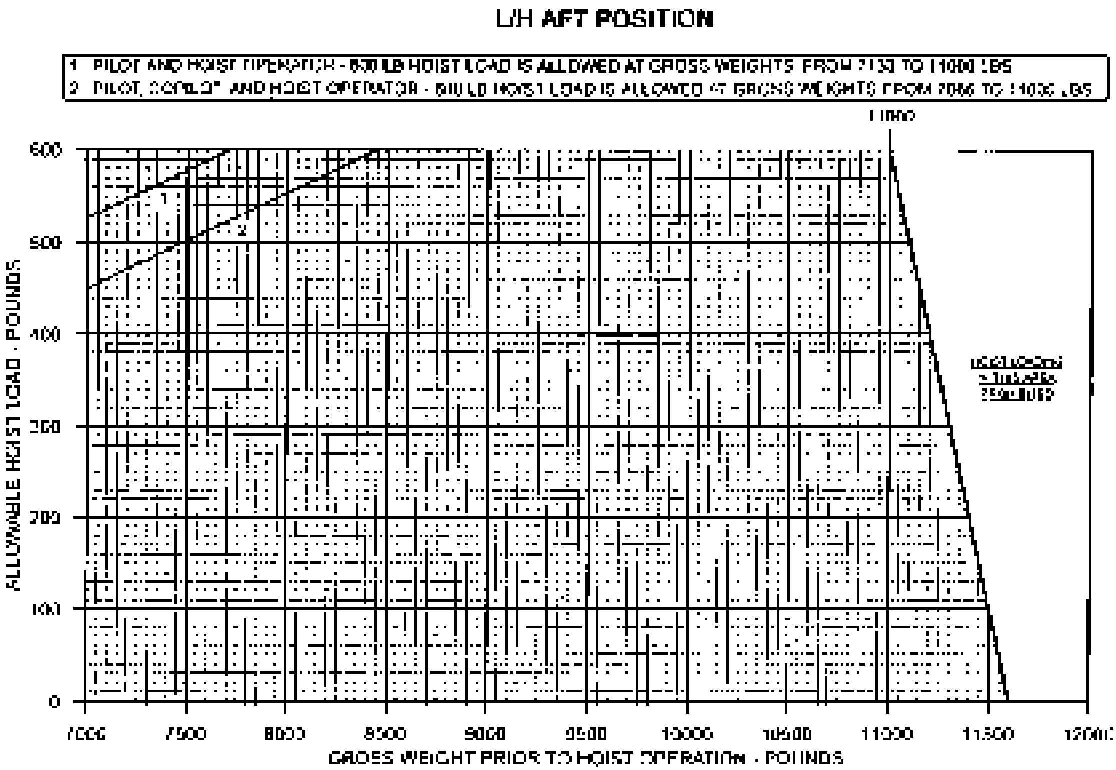
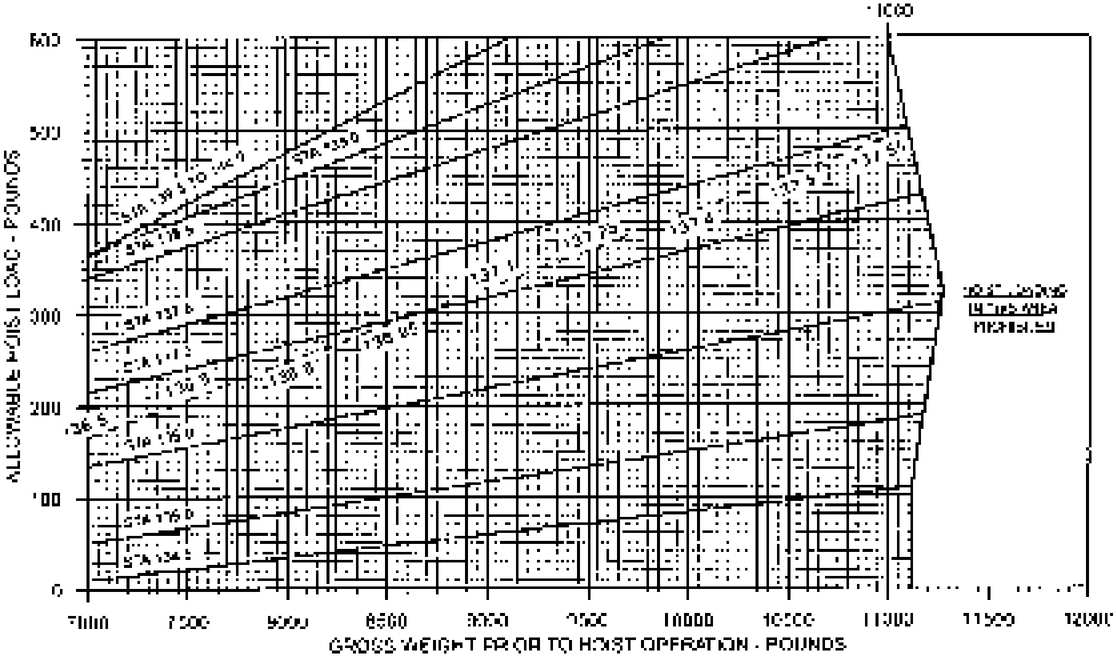


Figure 1-2. Hoist loading schedules 11,600 lb. GW (English) (Sheet 2 of 6)

R/H FWD POSITION - PILOT AND HOIST OPERATOR

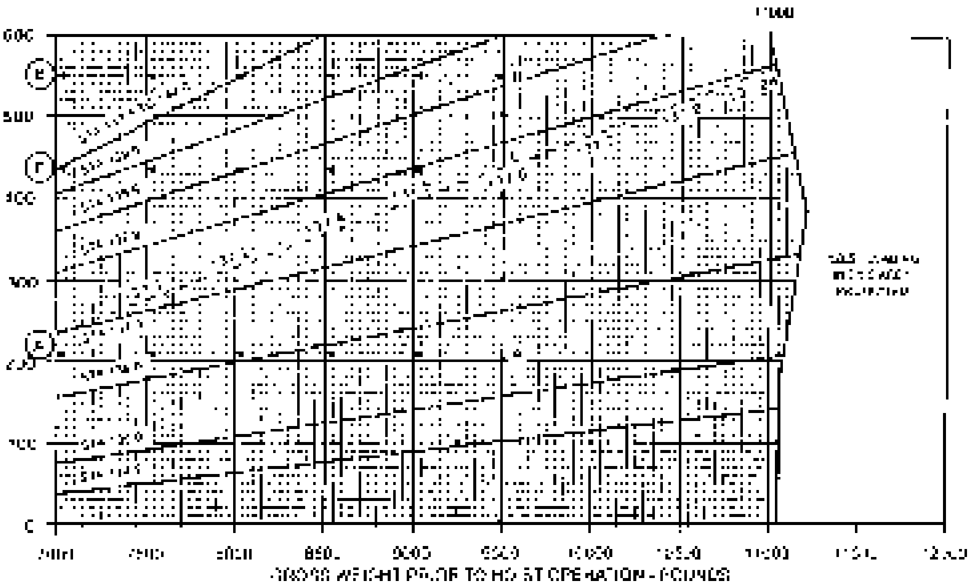


NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

412FS-7-1-2-3

Figure 1-2. Hoist loading schedules 11,900 lb. GW (English) (Sheet 3 of 8)

R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR

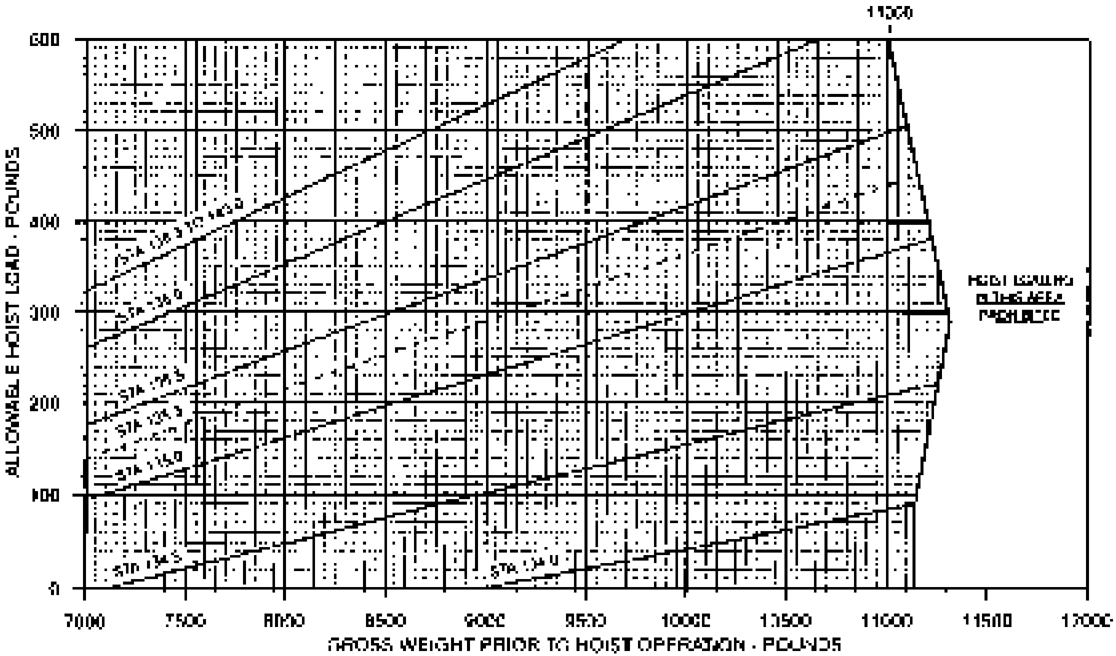


NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

412FB-F-1-2-4

Figure 1-2. Hoist loading schedules 11,900 lb GW (English) (Sheet 4 of 6)

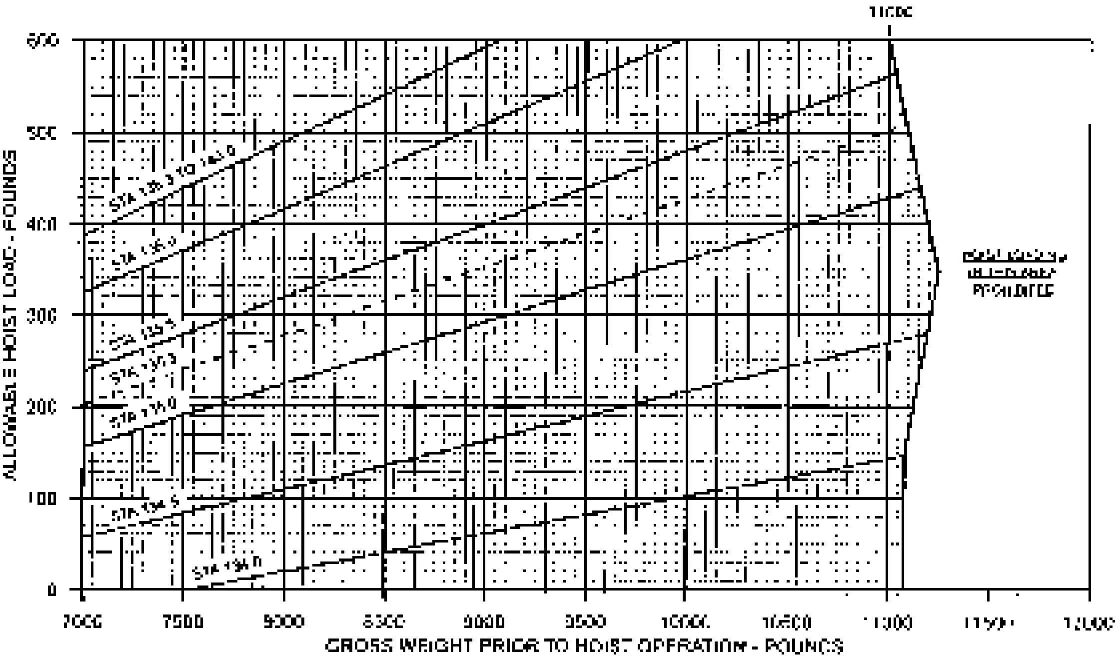
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-2. Hoist loading schedules 11,600 lb. GW (English) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR

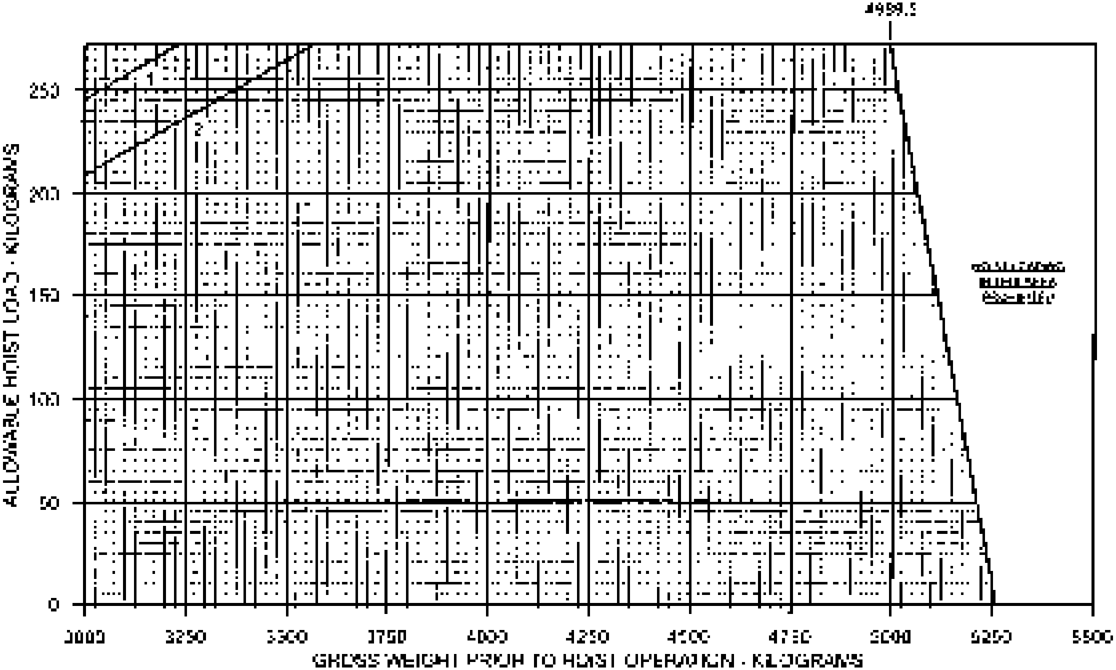


NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-2. Hoist loading schedules 11,900 lb GW (English) (Sheet 6 of 6)

L/H FWD POSITION

1 PILOT AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM 3231.8 TO 4958.5 KGS.
2 PILOT, COPILOT, AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM 3950.[illegible] TO 4959.[illegible] KGS.



412FL2 1-3-1

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 1 of 6)

L/H AFT POSITION

1 PILOT AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM [illegible] TO [illegible] KGS
2 PILOT, COPILOT, AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM [illegible] TO [illegible] KGS

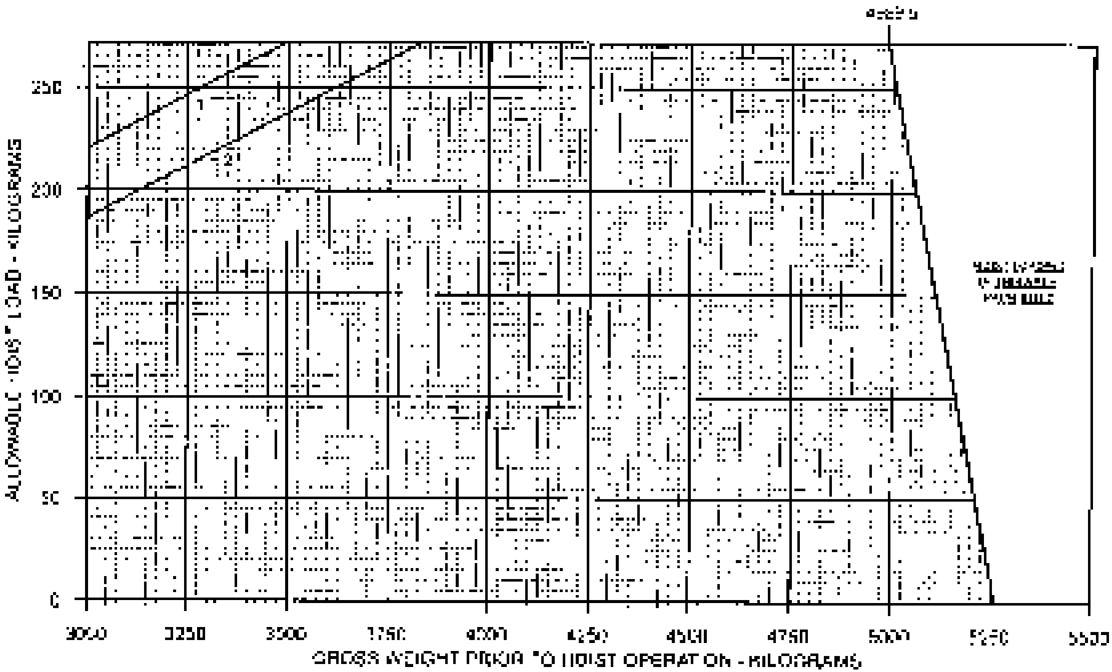
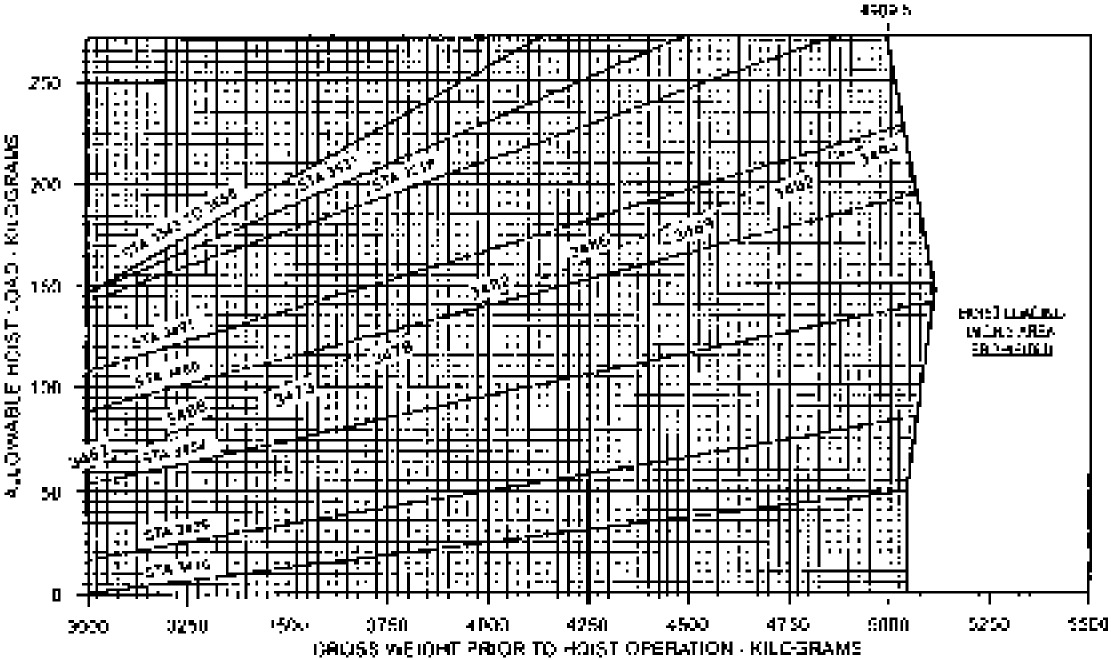


Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 2 of 6)

R/H FWD POSITION - PILOT AND HOIST OPERATOR

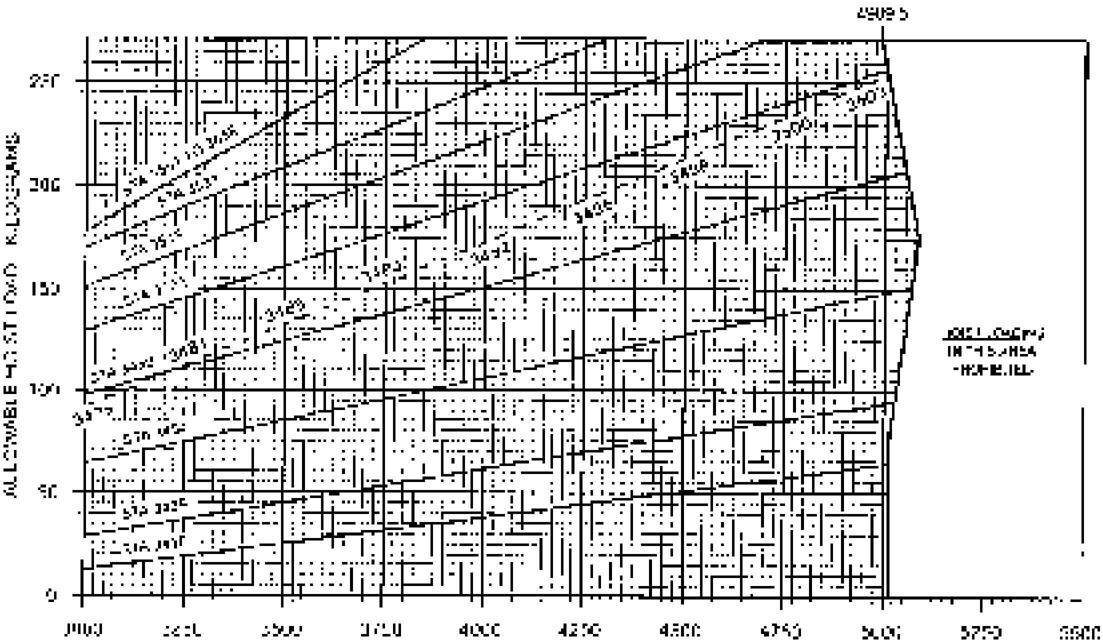


NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT.

412FM-7-1-3-4

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 3 of 6)

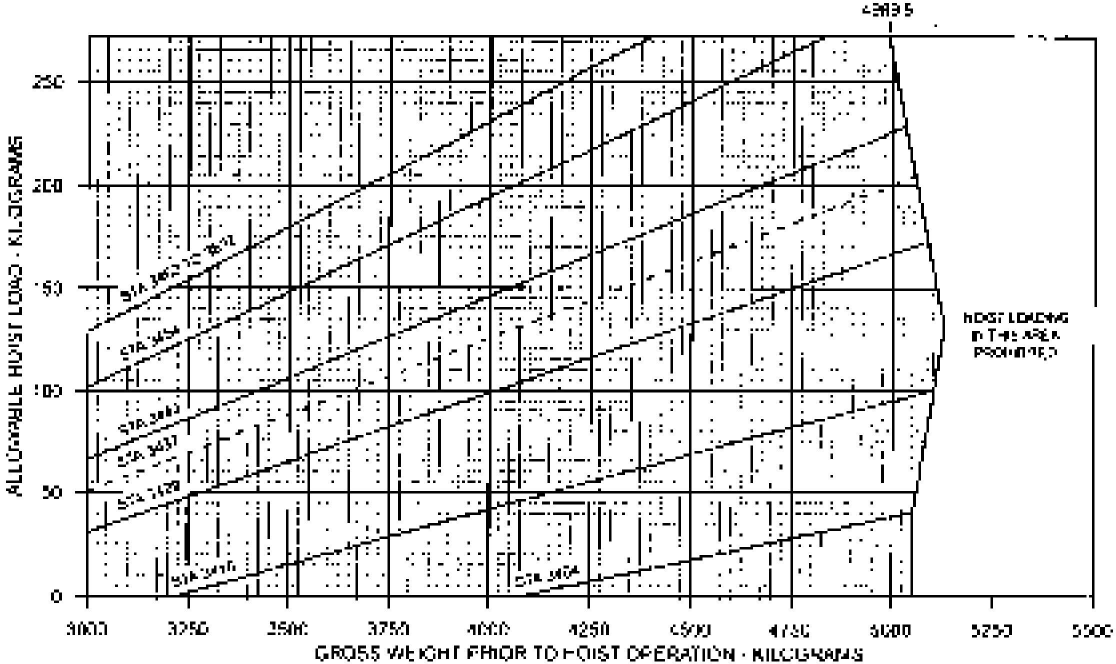
R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 4 of 6)

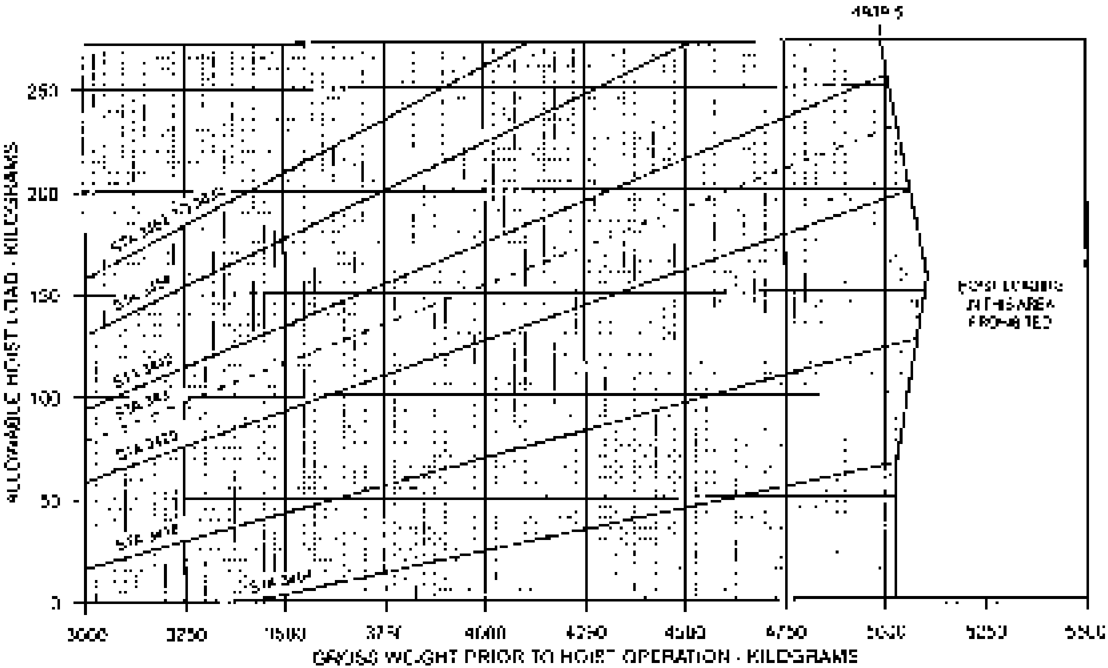
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 6 of 6)

L/H FWD POSITION

1 PILOT AND HOIST OPERATION - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM 7193 TO 11300 LBS
2 PILOT, COPILOT, AND HOIST OPERATION - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM 7900 TO 11300 LBS

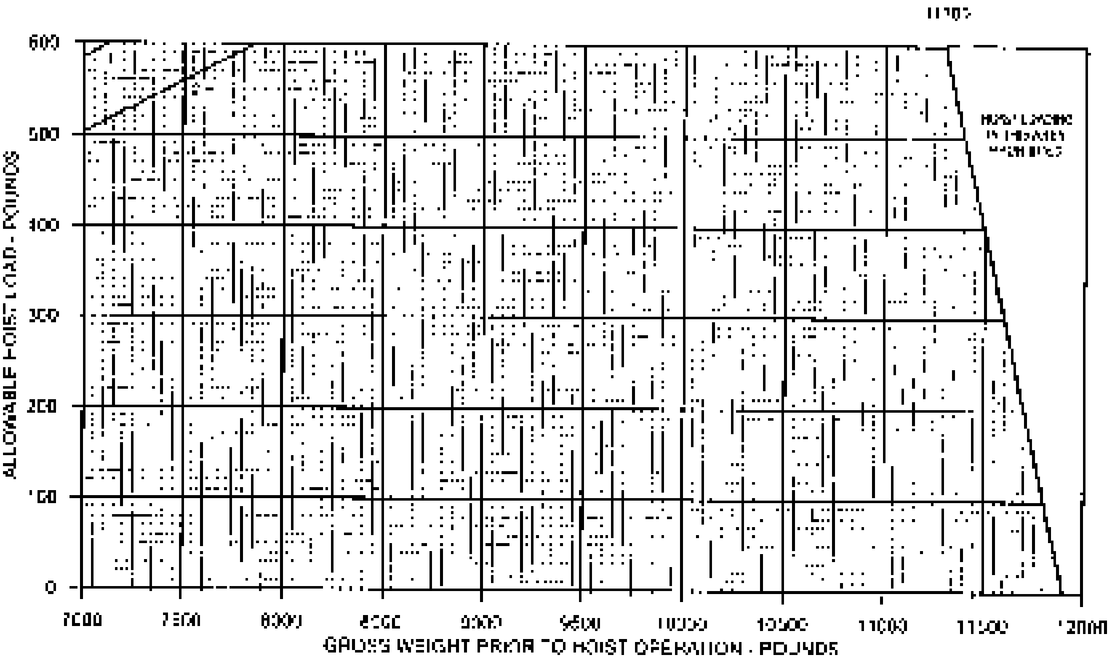


Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 1 of 6)

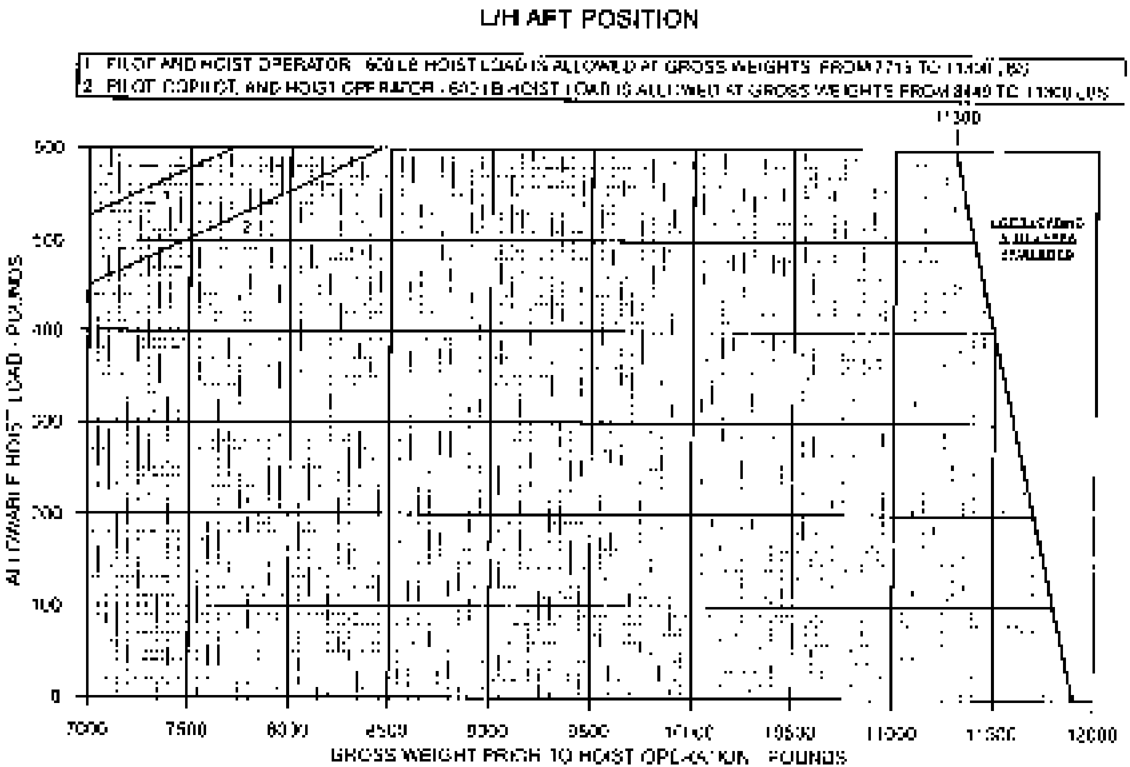
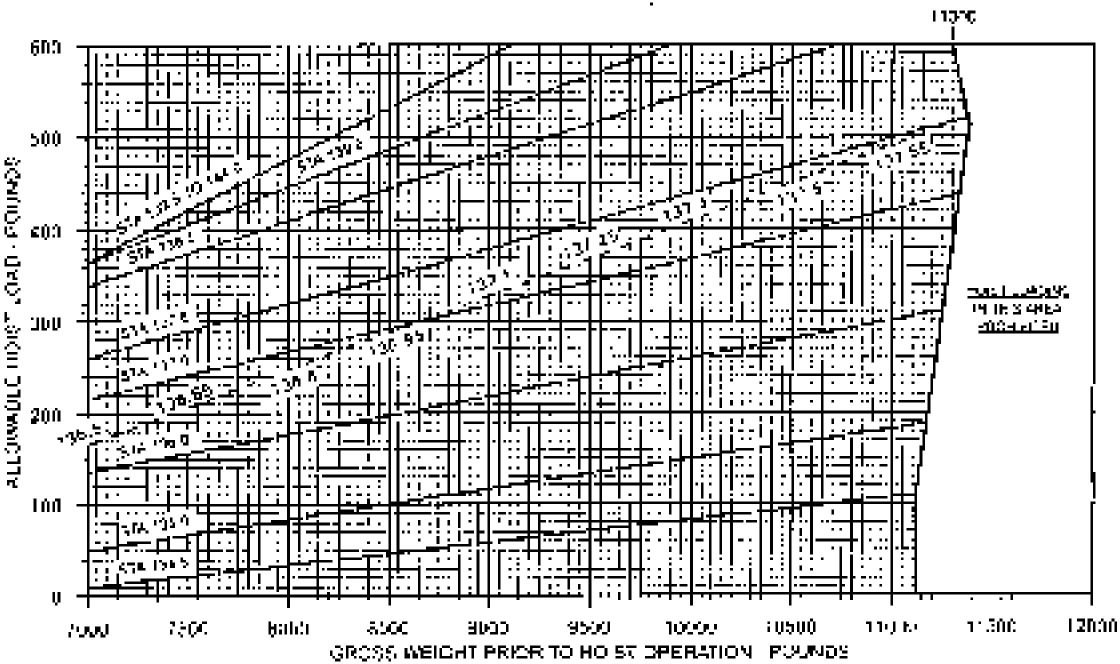


Figure 1-4 Hoist loading schedule 11,900 lb. GW (English) (Sheet 2 of 6)

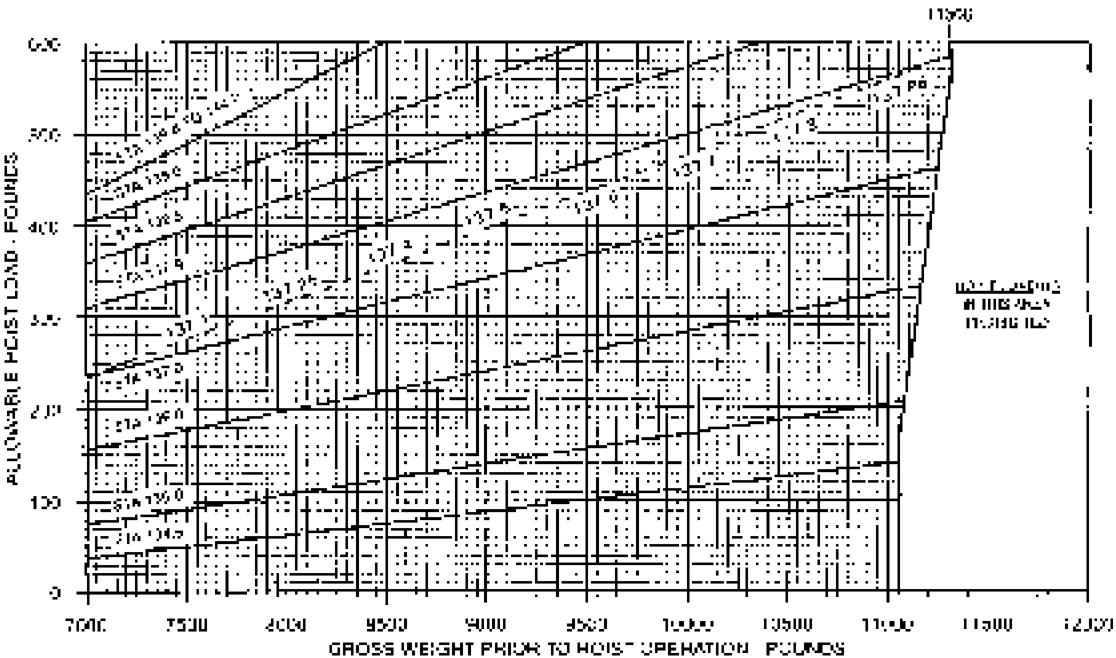
R/H FWD POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT.

Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 3 of 6)

R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR

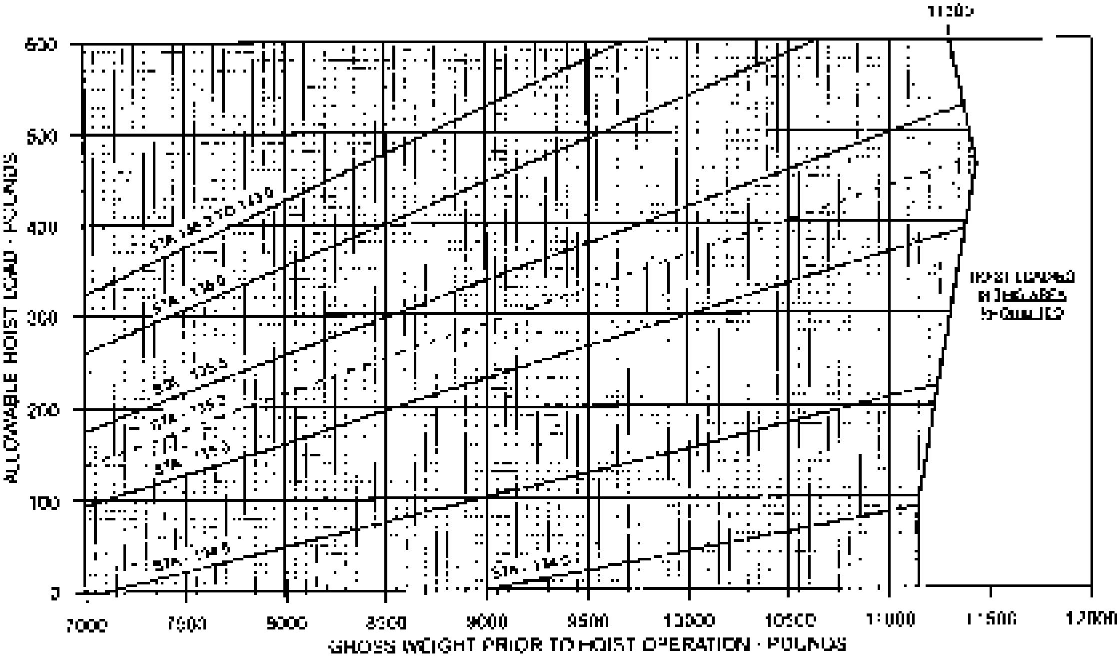


NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT.

412FS7-1-4-4

Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 4 of 6)

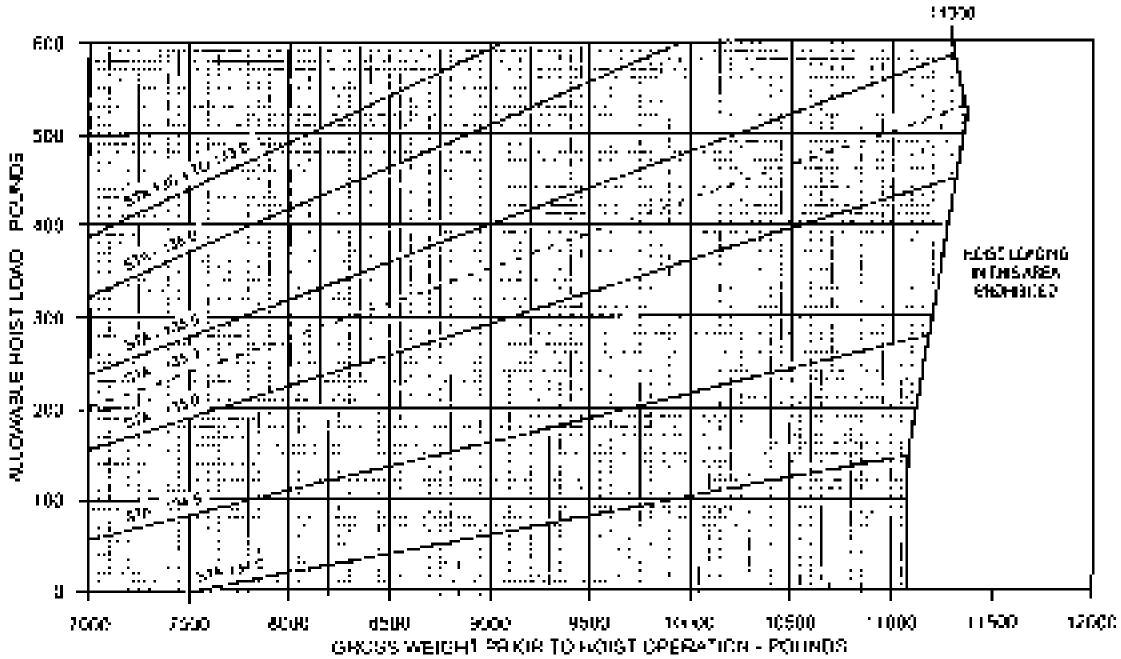
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 6 of 6)

L/H FWD POSITION

1 PILOT AND HOIST OPERATOR - 272 KG HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM [illegible] TO 5125.6 KGS
2 PILOT, COPILOT, AND HOIST OPERATOR - 272 KG HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM [illegible] TO 5125.6 KGS

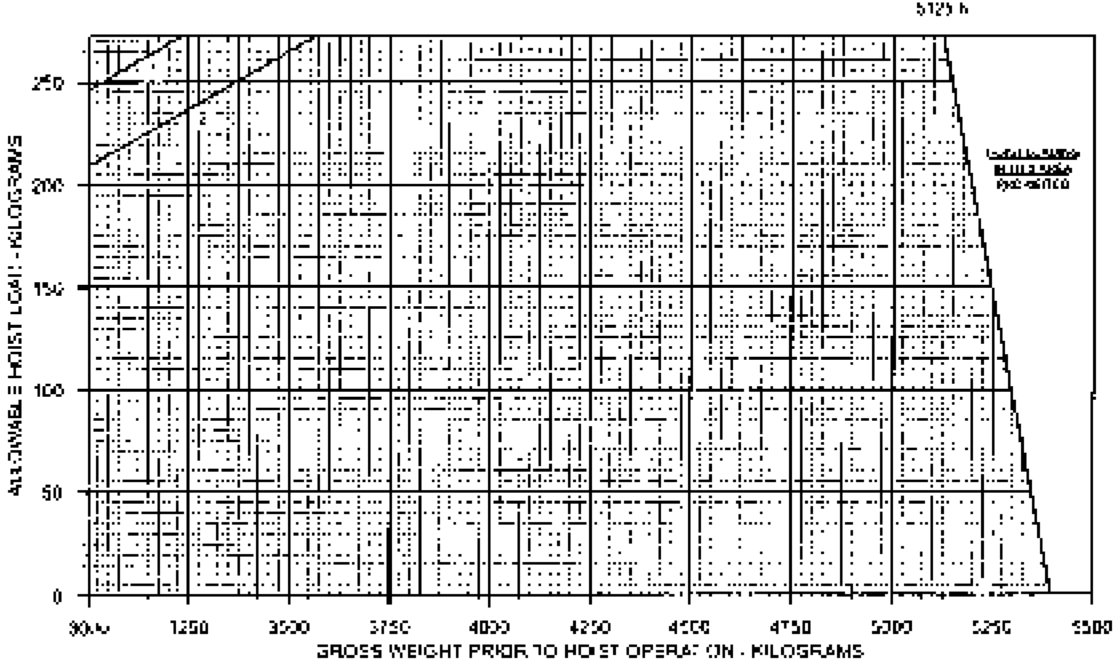


Figure 1-5. Hoist loading schedules 5397 kg GW (Metric) (Sheet 1 of 6)

L/H AFT POSITION

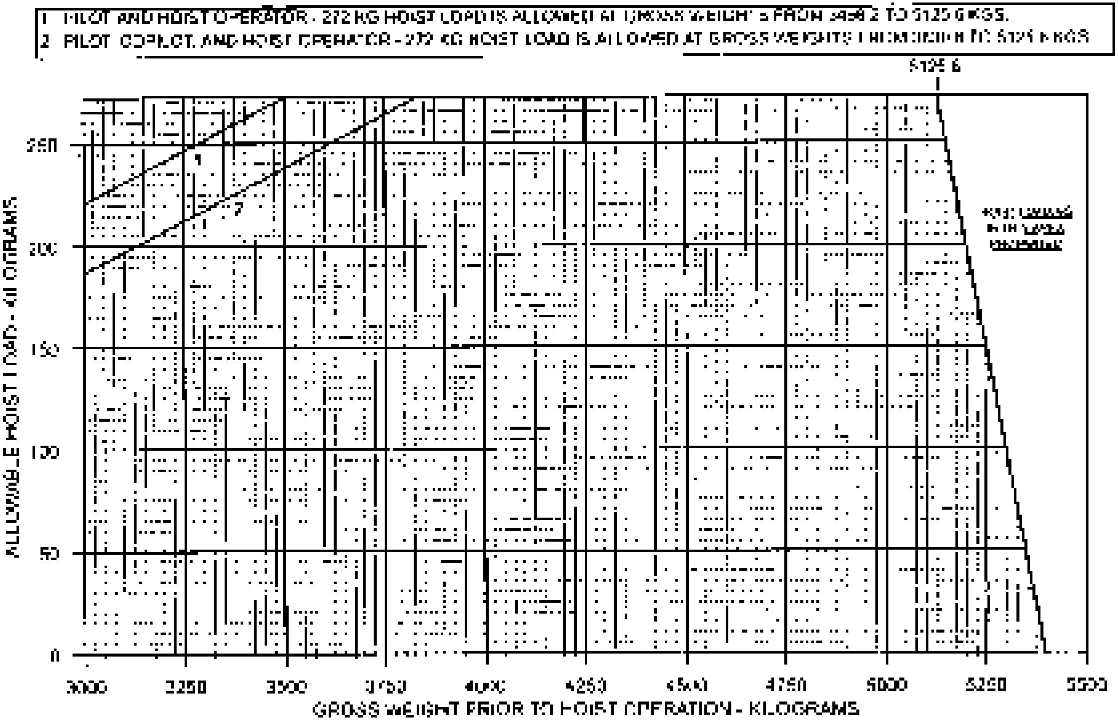
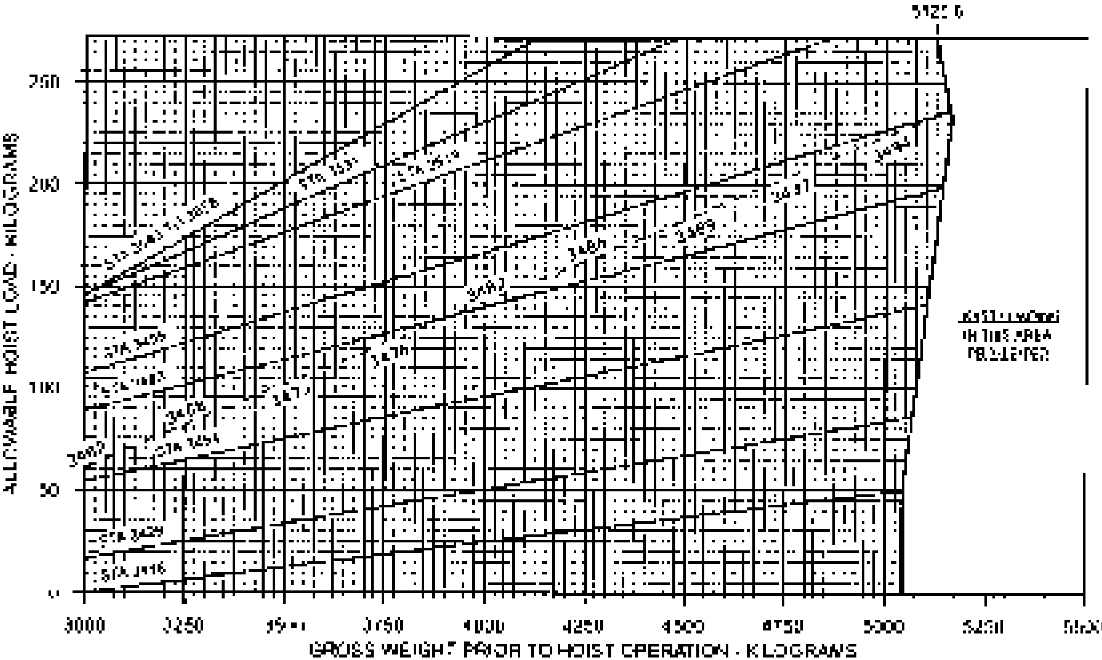


Figure 1-5. Hoist loading schedule 6387 kg. GW (Metric) (Sheet 2 of 6)

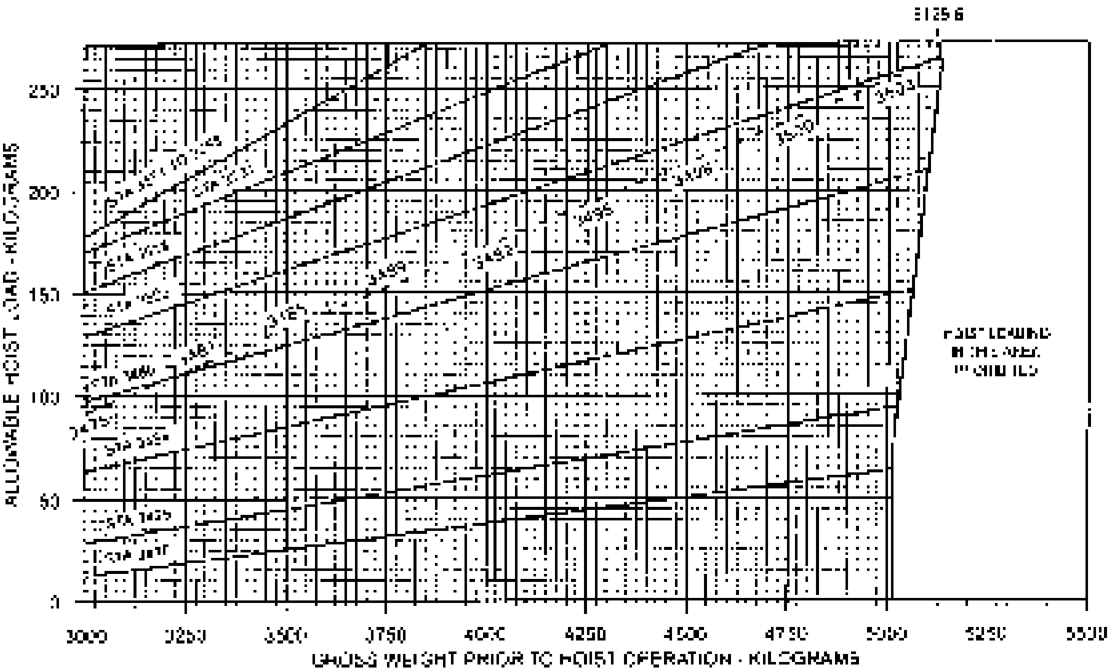
R/H FWD POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-6. Hoist loading schedules 5397 kg. GW (Metric) (Sheet 3 of 6)

R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR

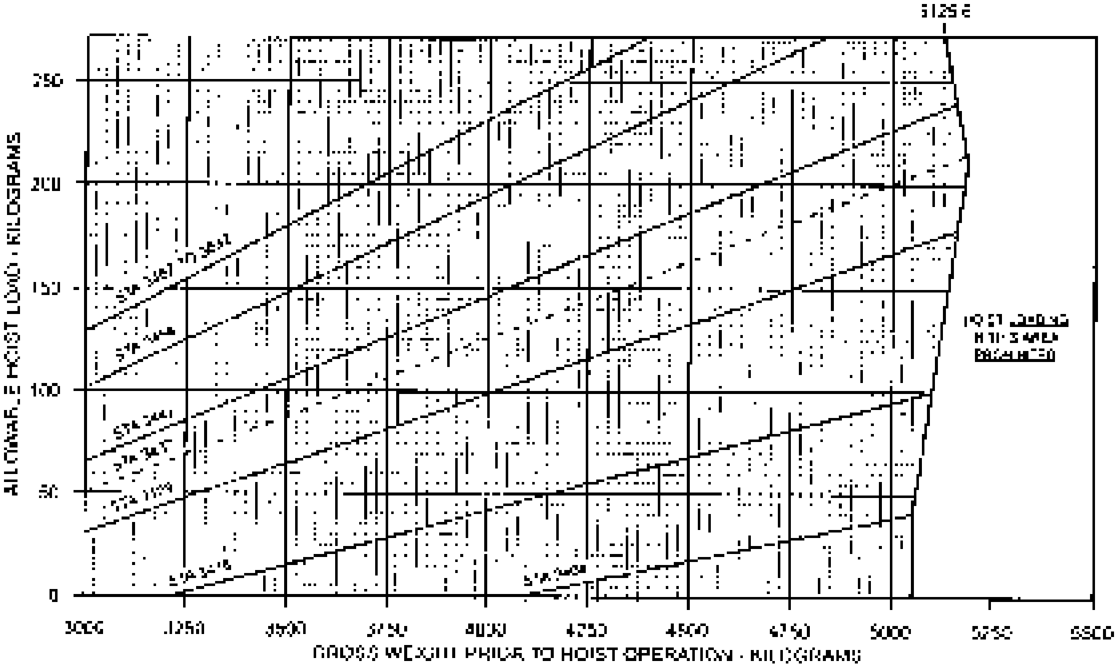


NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

412FS-7-1-8-4

Figure 1-6. Hoist loading schedules 4397 kg. GW (Metric) (Sheet 4 of 6)

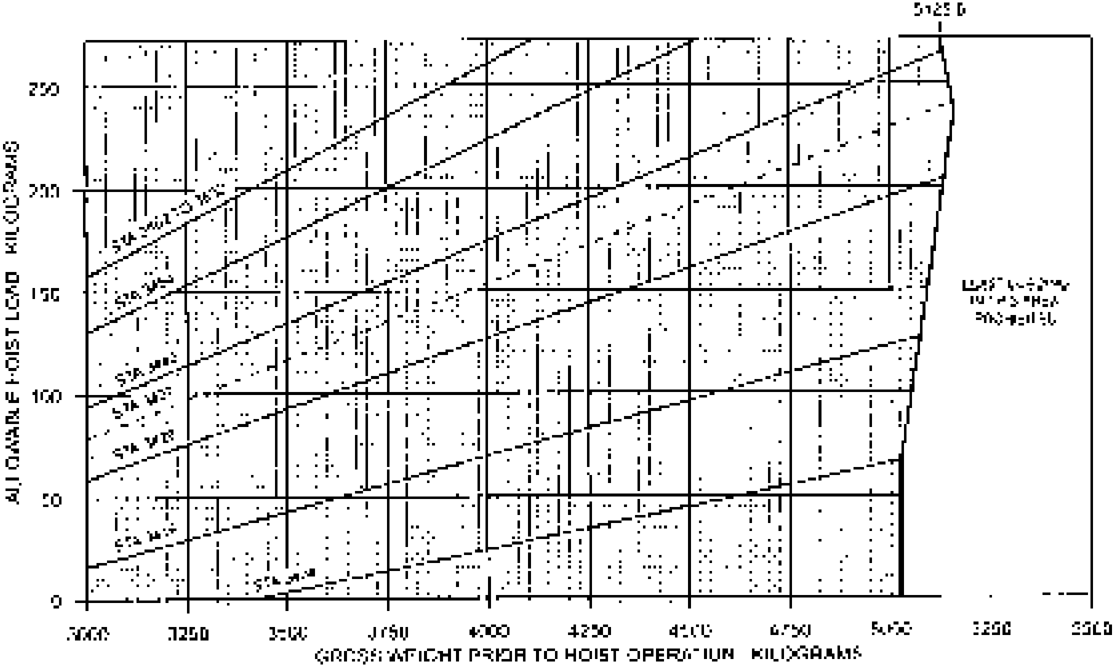
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-5. Hoist loading schedules 5397 kg - GW (Metric) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

412FS-F-1-4-5

Figure 1-5. Hoist loading schedules 5397 kg. GW (Metric) (Sheet 5 of 5)

Section 2

NORMAL PROCEDURES

2-2. FLIGHT PLANNING

WARNING

HOIST LOAD CAN CAUSE LONGITUDINAL OR LATERAL CG LIMITS TO BE EXCEEDED.GROSS WEIGHT AND CENTER OF GRAVITY SHALL BE COMPUTED TO ASSURE LOADING WITHIN APPROVED LIMITS.

CAUTION

IF ADDITIONAL LOADS ARE CARRIED DURING HOISTING OPERATIONS, LOADS SHOULD BE PLACED ON SIDE OF HELICOPTER OPPOSITE HOIST POSITION.

Gross weight and CG — Compute with and without hoist load.

2-4. INTERIOR AND PRESTART CHECK

2-4-A. HOIST INSTALLATION CHECK

NOTE

If pilot plans to operate hoist with other crewmember in passenger compartment, hoist shall be installed in forward right position.

Hoist — Installed in desired position, check roof and floor stud adapters and locking collars properly secured.

Boom actuator — Installed in proper position; all fittings secured.

AIRCRAFT POSITION switch (on hoist control box, figure 2-1) — Set in proper position.

Hook — Rotates freely on cable.

Cable — Check proper routing through guide rollers, pulleys, and drums.

Gearbox oil levels — Check sight glasses.

Hoist operators pendant — Installed; connectors secured.

Electrical power cables — Condition; connectors secured.

WARNING

ACTUATION OF *CABLE CUT* SWITCH ON PEDESTAL CAN CUT CABLE REGARDLESS OF *HOIST PWR* SWITCH POSITION. ACTUATION OF *CABLE CUT* SWITCH ON HOIST CONTROL BOX CAN CUT CABLE, EVEN IF *CABLE CUT* CIRCUIT BREAKER IS OUT.

CABLE CUT switches (pedestal and hoist) — Off; covers safetied.

Safety vests, tether straps, hoisting slings, and litters — Condition; secured or stored.

2-4-B. HOIST OPERATION CHECK

Cargo doors and hinged panels — Secured open or removed.

HOIST PWR, CONT and CABLE CUT circuit breakers — In.

BATTERY switches — ON (or connect external power).

NON ESNTL BUS switch — MANUAL.

ICS — Check intercom between pilot and hoist operator using hoist pendant ICS trigger and HOT MIC switch (right ICS box only).

HOIST PWR switch — ON; check that green (power on) light and amber 20 FOOT CAUTION lights on hoist control box illuminate.

Hoist OVERTEMP warning lights — Press to test.

CAUTION

MAINTAIN TENSION ON HOIST CABLE WHILE REELING IN AND OUT TO PREVENT SLACK.

HOIST and BOOM switches (pilot and operator) — Actuate to check all hoist functions for proper operation. Check that pilot HOIST switch overrides operator pendant HOIST switch.

Hoist cable — Check for corrosion, kinks, flat spots, fraying, or broken strands.

Up limit switch actuator - Raise while hoist is reeling in and check hoist motor stops; then release and check hoist resumes operation.

Reduce hoist speed as cable approaches up limit. Check that hoist stops when hook reaches up limit without excess tension on cable.

Hoist - Stowed for flight: hook restraint secured.

HOIST PWR switch - OFF.

NON ESNTL BUS switch - NORMAL.

BATTERY switches - OFF.

NOTE

Ground crewmember should be instructed to discharge helicopter static electricity before attaching load to hoist when possible.

2-6. SYSTEMS CHECK

Cargo doors and hinged panels - Secured open or removed.

CABLE CUT switches (pedestal and hoist) - Off; covers safetied.

HOIST PWR, CONT, and CABLE CUT circuit breakers - In.

2-6-A. BEFORE TAKEOFF

Safety vests and straps - On and secured to helicopter.

Gloves - On.

STEP switch (if installed) - STOW.

2-9. IN-FLIGHT OPERATIONS

Maximum hoist load shall be determined prior to each hoist operation.

NOTE

The Hight-Velocity Diagram is not a limitation for internal hoist operations under an appropriate operating certificate.

HOIST PWR switch - ON.

WARNING

HOIST OPERATOR SHALL BE SECURED TO HELICOPTER WITH AN APPROVED SAFETY HARNESS DURING HOIST OPERATIONS.

Establish hover over hoist operation area.

Hoist hook restraint - Removed.

BOOM switch (or pilots HOIST switch) - OUT.

NOTE

Each hoist operation performed is defined as reeling hoist cable out and then in while hovering with any weight on hoist, regardless of whether the hoist was used for training or an actual rescue.

The pilot must record each operation in the penalty CG region. For each hoist operation performed within penalty CG region, four (4) additional hours of usage must be logged against the main rotor yoke, mast and lower cone seat.

HOIST switch - DOWN.

Discharge static electricity when possible, and connect hook to load, observing allowable hoist load.

NOTE

As hook nears the up or down limits, hoist speed automatically slows.

HOIST switch - UP

CAUTION

USE CARE TO PREVENT CABLE, HOOK, AND LOAD FROM FOULING ON FUSELAGE OR LANDING GEAR.

Maintain zero ground speed until load is clear of obstructions.

BOOM switch - IN to swing hoist boom and load into cabin, if possible.

Takeoff into wind, if possible, allowing adequate hoist load clearance over obstacles if load is not internal.

CAUTION

AIRSPEED WITH EXTERNAL LOAD IS LIMITED BY CONTROLLABILITY. CAUTION SHOULD BE EXERCISED WHEN CARRYING AN EXTERNAL LOAD. HANDLING CHARACTERISTICS MAY BE AFFECTED BY THE SIZE, WEIGHT, AND SHAPE OF LOAD.

Airspeed - As required for adequate controllability, not to exceed limits for hoist operations (20 or 80 KIAS, as applicable).

2-13. LITTER HOISTING

When emergency transportation of a patient by litter is essential, every effort should be made to land the helicopter for litter loading. Litter hoisting can be hazardous and should be accomplished only when a landing is not feasible and the condition of the patient precludes the use of the personnel hoisting sling.

In addition to all other procedures contained herein, the following shall apply to litter hoisting operations.

2-13-A. EMPTY LITTER

WARNING

HOISTING OR LOWERING AN EMPTY LITTER IN OPEN POSITION IS PROHIBITED. AN EMPTY LITTER CAN OSCILLATE UNCONTROLLABLY IN ROTOR WASH AND FLY UPWARD, STRIKING FUSELAGE OR TAIL ROTOR.

Prior to hoisting or lowering an empty litter, litter shall be closed and secured with straps. Litter should be suspended in a near-vertical position and sling straps should be drawn tight.

2-13-B. LOADED LITTER

WARNING

LITTER PATIENT SHALL BE SECURED TO LITTER WITH SAFETY STRAPS.

HOIST HOOK CATCH SHALL BE SECURED WITH SAFETY PIN PRIOR TO HOISTING LITTER PATIENT.

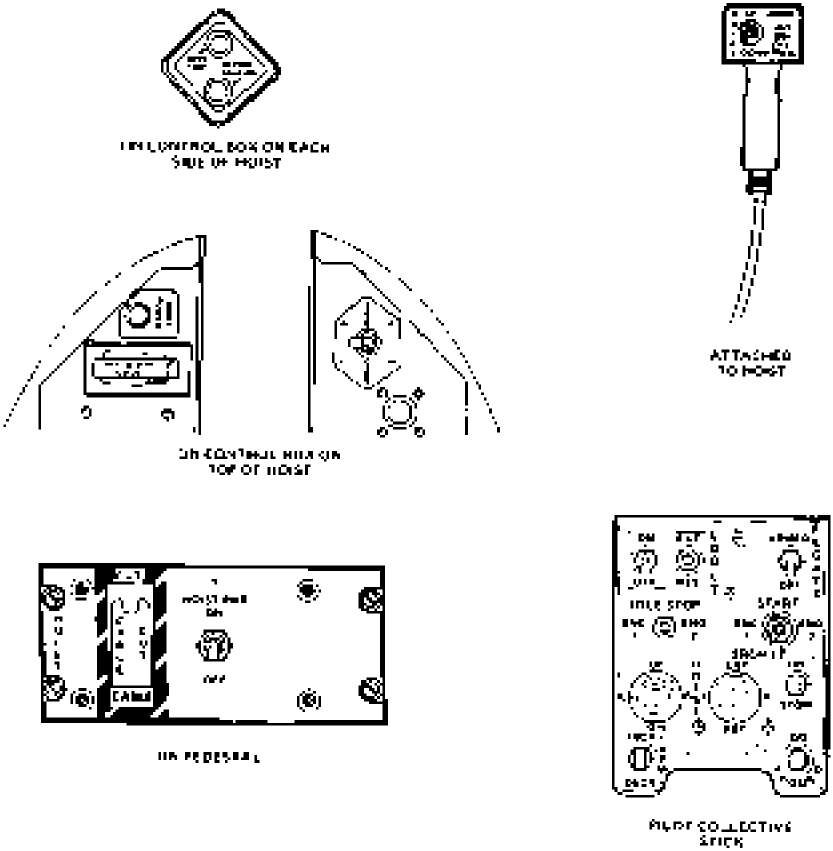
Litter sling straps should be adjusted so that litter is 24 to 28 inches (61 to 71 centimeters) below hoist hook.

NOTE

If litter is suspended too far below hook, litter cannot be loaded in helicopter with hoist hook at up limit.

CAUTION

A LOADED LITTER CAN ROTATE ABOUT CABLE DURING HOISTING. HOIST OPERATOR MAY HAVE TO GRASP LITTER SLING STRAPS TO CONTROL ROTATION AS LITTER APPROACHES LANDING GEAR.



412FM-7-4-1

Figure 2-1. Internal hoist controls

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

3-15. HOIST LOAD JETTISON

To jettison hoist load in an emergency, actuate CABLE CUT switch (located on pedestal or hoist).

In the event of failure of CABLE CUT switch, sever cable with manual cable cutter (stowed in pouch on hoist).

3-15-A. HOIST OVERTEMP WARNING LIGHT

In the event that the OVERTEMP warning light (located on hoist control box) illuminates, continue present operation until hoist is reeled in. Leave HOIST PWR switch ON (for cooling fan operation) and allow hoist to cool. When OVERTEMP light extinguishes, hoisting may be resumed as desired.

Section 4

PERFORMANCE

No change from basic manual.

Section 5

WEIGHT AND BALANCE

5-11. WEIGHT EMPTY CHART

The Weight empty chart for internal hoisting operations is shown in figure 5-1 Refer to the maintenance manual for additional information.

NOTE

Allowable hoist load must be computed when weight empty is not within specified guidelines.

NOTE

Allowable hoist loads must be computed when AUX Fuel kits are installed.

412 Weight Empty Chart for Internal Hoist Operations

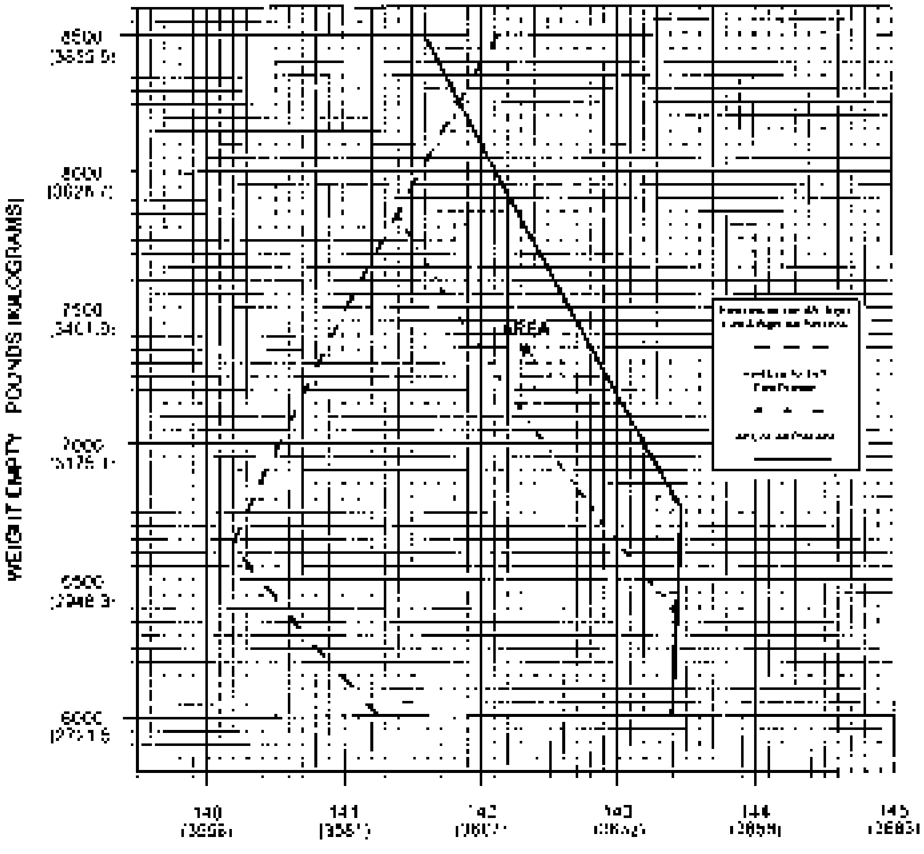


Figure 6-1. Weight empty chart

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR LITTER KIT OPERATIONS

(412-706-006)

CERTIFIED
SEPTEMBER 29, 1981

This supplement shall be attached to the Models 412 or 412EP Flight Manual when the 412-706-006 Litter Kit has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
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REISSUE — 5 OCTOBER 1994

LOG OF REVISIONS

Original . . . .0 . . .29 Sep 81
Reissue . . . .0 . .08 May 89
Reissue . 0 . . 05 Oct 94

LOG OF PAGES

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APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TEXAS 76193-0170

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The Litter Kit provides three litters and the provisions for installing up to three litters in the helicopter. A cabin attendant seat is also included in the kit.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after the litter(s) are installed and ballast readjusted if necessary, to return empty weight CG within allowable limits.

MINIMUM FLIGHT CREW

The minimum flight crew for litter operations shall consist of a pilot and a second crewmember or cabin attendant, both of whom shall be trained in and capable of assisting in litter patient emergency evacuation procedures.

Section 2

NORMAL PROCEDURES

LITTER LOADING

Secure patients to litters, then load litters aboard the helicopter in sequence from top to bottom. When only two patients are carried, they should occupy the top and center litter positions. When only one patient is carried, the center litter should be used.

LITTER UNLOADING

NOTE

Normal unloading procedures apply when either passenger door can be opened. Refer to Section 3, Emergency Procedures, for unloading procedures when cabin door cannot be opened.

Open cabin door and unload litters and patients from the helicopter in sequence from bottom to top.

Litters to be handled by one person inside cabin and one person outside cabin.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

UNLOADING THROUGH EMERGENCY EXITS

NOTE

In the event that cabin doors cannot be opened, litter patients shall be unloaded through emergency pop-out windows. After all litter patients have been removed, ambulatory patients may then exit.

Remove emergency pop-out window by pushing at corners as marked.

Unstrap patient on center litter and remove patient through window opening.

Disconnect top litter at end near open window and lower end to rest on center litter. Remove patient retention straps and slide patient down litter and out through window opening.

Raise top and center litter ends near open window and engage center litter in brackets for top litter. Disconnect bottom litter. Raise bottom litter at end near open window and rest handles on the lower surface of the window opening. Unstrap patient and slide patient up litter and through window opening.

Section 4

PERFORMANCE

No change from basic Flight Manual

Section 1 MANUFACTURER'S DATA

WEIGHT AND BALANCE

TABLE OF MOMENTS (IN-LB)

Weight (Pounds)	LITTER PATIENT Loaded Laterally F.S. 117
100	11700
110	12870
120	14040
130	15210
140	16380
150	17550
160	18720
170	19890
180	21060
190	22230
200	23400
210	24570
220	25740

TABLE OF MOMENTS $\frac{(kg \cdot mm)}{100}$

Weight (K.G.)	LITTER PATIENT Loaded Laterally 2972 mm
50	1486.0
55	1634.6
60	1783.2
65	1931.8
70	2080.4
75	2229.0
77.1	2291.4
80	2377.6
85	2526.2
90	2674.8
95	2823.4
100	2972.0
105	3120.6
110	3269.2

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

33108 — 33213
36001 — 36019

SUPPLEMENT FOR EXTERNAL CARGO OPERATION

(212-706-103)

CERTIFIED
MAY 14, 1981

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2) when the 212-706-103 External Cargo Suspension Hook has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

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REISSUE — 15 SEPTEMBER 1995

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LOG OF REVISIONS

Original	0	May 14, 1981
Revision	1	September 8, 1983
Revision	2	January 12, 1984
Revision	3	August 31, 1984
Revision	4	February 18, 1986
Revision	5	September 26, 1991
Release	6	September 15, 1995

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NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Original	0	May 14, 1981	Revision	4	February 18, 1988
Revision	1	September 6, 1983	Revision	5	September 25, 1991
Revision	2	January 12, 1984	Reissue	0	September 15, 1995
Revision	3	August 31, 1984			

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

INTRODUCTION

The External Cargo Suspension Hook, when installed, will permit the operator to utilize the helicopter for transportation of external cargo, when operated by a qualified pilot.

Section 1

LIMITATIONS

TYPE OF OPERATION

Operation of the helicopter with no load on the external cargo suspension hook is authorized under the standard airworthiness certificate under VFR or IFR conditions without removing the unit from the helicopter.

The installation and use of the rear view mirror contained in the kit is left to the operators discretion.

The rear view mirror shall be covered or removed for night flight.

VFR OPERATION

With a load attached to the suspension assembly, operation shall be conducted in accordance with appropriate operating rules for external loads under VFR conditions.

IFR OPERATION

External load operations are permitted provided the operator substantiates to the Administrator that the rotorcraft – load combination meets IFR handling requirements and insures that the Rotorcraft External Load Operator Certificate reflects same with appropriate restrictions.

WEIGHT — CG LIMITATIONS

Actual weight change shall be determined after cargo hook is installed and ballast readjusted, if necessary, to retain empty weight CG within allowable limits.

Maximum gross weight including external cargo load is 11,900 pounds (5398 kilograms). Maximum external cargo load is 4500 pounds (2041 kilograms).

AIRSPEED LIMITATIONS

VNE is 80 KIAS at or below 10,000 feet density altitude for all gross weights with external cargo on suspension unit. Above 10,000 feet decrease VNE 2.5 knots per 1000 feet.

CAUTION

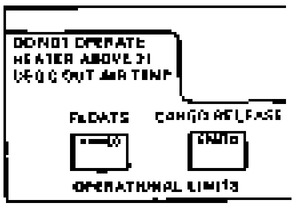
THE AIRSPEED WITH EXTERNAL CARGO IS LIMITED BY CONTROLLABILITY. CAUTION SHOULD BE EXERCISED WHEN CARRYING EXTERNAL CARGO, AS THE HANDLING CHARACTERISTICS MAY BE AFFECTED BY THE SIZE, WEIGHT, AND SHAPE OF THE CARGO LOAD.

Light weight, high drag loads require a swivel connector between the cargo hook and the sling to prevent unstable oscillations in flight above 20 KIAS.

PLACARDS AND MARKINGS

OCCUPANCY LIMITED TO CREW WITH EXTERNAL LOAD CLASS B LOADING APPROVED

(Located on forward right side of overhead console)



(Located on upper center part of instrument panel)

EXTERNAL LOAD LIMIT 4500 LBS SEE FLIGHT MANUAL FOR LOADING INSTRUCTIONS AND FLIGHT LIMITATIONS

(Located on under side of helicopter cargo suspension assembly)

412-FM9.2-1-1

Figure 1-1. Placards and markings

Section 2

NORMAL PROCEDURES

GROUND CREW INSTRUCTIONS

Instruct ground crewmember to discharge helicopter static electricity before attaching cargo by touching the airframe with a ground wire, or if a metal sling is used, the hookup ring can be struck against the cargo hook. If contact has been lost after initial grounding, the helicopter should be electrically regrounded and, if possible, contact maintained until hookup is completed.

Instruct ground personnel to check primary and secondary load rings for condition and proper size (Table 2-1). Check for proper rigging and configuration (Figure 2-1).

WARNING

USE OF INAPPROPRIATELY SIZED LOAD RINGS MAY RESULT IN LOAD HANG-UP WHEN LOAD RING IS TOO SMALL OR INADVERTENT LOAD RELEASE IF LOAD RING IS TOO LARGE.

Check that only one primary ring is captured in load beam and only one secondary ring with correct cross-section dimension is captured in primary ring.

Table 2-1. Ring Size — Cargo Hook P/N SP1709-62

PRIMARY RING INSIDE DIAMETER	PRIMARY RING CROSS-SECTION	MAXIMUM CROSS-SECTION OF SECONDARY MEMBER
3.0 to 3.1 in. (76.2 to 78.74 mm)	1.0 in. (25.4 mm)	0.625 in. (15.9 mm)
3.1 to 4.0 in. (78.74 to 101.6 mm)	1.0 in. (25.4 mm)	0.750 in. (19.0 mm)

EXTERIOR CHECK

Cargo suspension assembly — Condition and security.

Rear view mirror (if installed) — Secure and clean.

INTERIOR CHECK

CARGO HOOK REL circuit breaker — In.

Battery BUS 1 switch — ON.

CARGO REL switch (overhead) — ARM; check CARGO RELEASE ARMED caution light illuminates.

Cycle CARGO RELEASE button — Depress and hold, pull down on cargo hook; hook should open. Release button and cargo hook, hook should close and lock.

Cargo release pedal (between directional control pedals) — PUSH and hold; pull down on cargo hook; hook should open. Release pedal and cargo hook; hook should close and lock.

NOTE

The pedal release will function regardless of CARGO REL switch position.

CARGO REL switch — OFF.

Battery BUS 1 switch — OFF

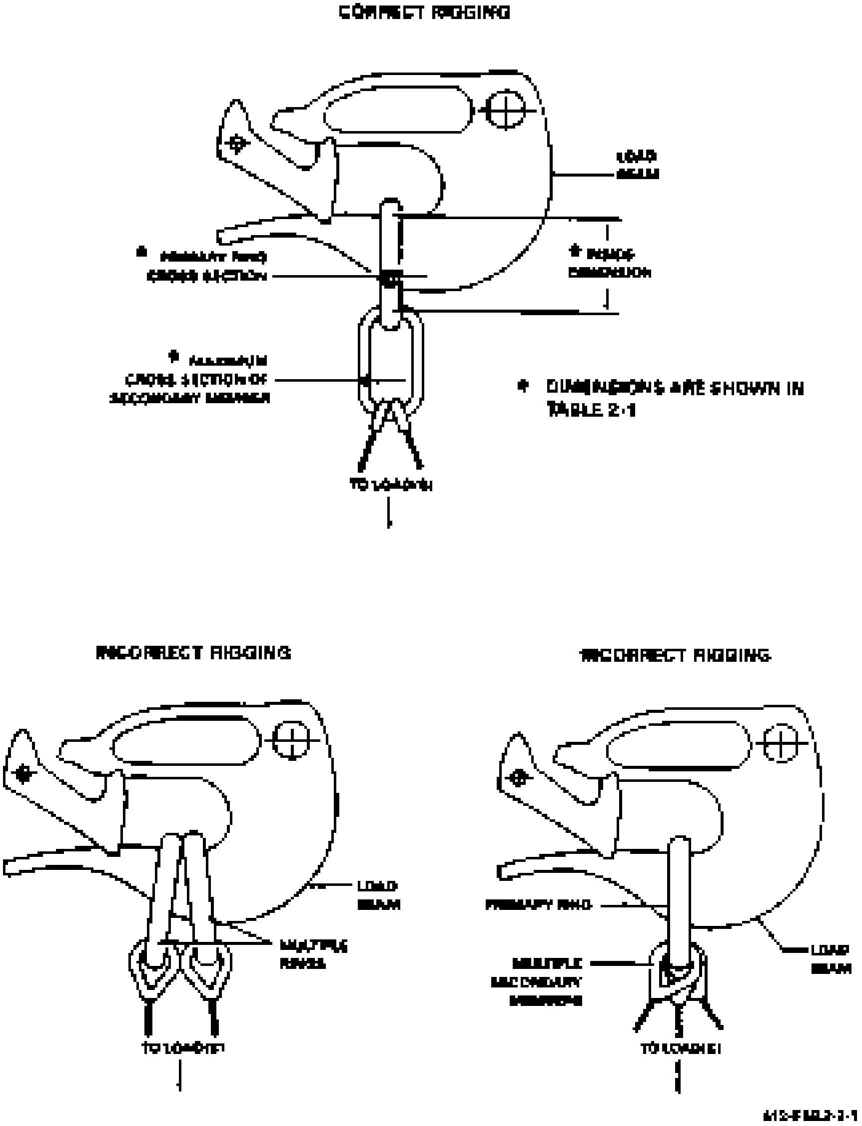


Figure 2-1. Effective loading practices

BEFORE TAKEOFF

CARGO REL switch — ARM; check CARGO RELEASE ARMED caution light illuminates.

TAKEOFF

NOTE

Better directional control may be realized by avoiding relative winds from the right front quadrant while performing external cargo operations.

Hover helicopter at sufficient height to allow crewmember to discharge static electricity and to attach cargo sling to cargo hook.

NOTE

Attachment of cargo sling to the hook can be observed by means of the rear view mirror.

Ascend vertically directly over cargo, then slowly lift cargo from surface.

Pedals — Check for adequate directional control.

Hover power — Check torque required to hover with external load.

NOTE

The Height-Velocity Diagram is not a limitation for external cargo operations under an appropriate operating certificate.

Take off into the wind if possible allowing adequate sling load clearance over obstacles.

IN-FLIGHT OPERATION

NOTE

Control movements should be made smoothly and kept to a minimum to prevent oscillation of sling load.

CARGO REL switch (overhead) — As desired.

NOTE

The pedal release will function regardless of CARGO REL switch position.

Airspeed — Within limits for adequate controllability of rotorcraft — load combination.

Flight path — As required to avoid flight with external load over any person, vehicle or structure.

DESCENT AND LANDING

CARGO REL switch (overhead) — ARM prior to final approach.

Flight path and approach angle — As required for wind direction and obstacle clearance.

Execute approach to a hover with cargo clear of the surface. When stabilized at a hover, descend slowly until cargo contacts surface. Maintain tension on sling.

Cyclic CARGO RELEASE button — Depress to release sling from hook.

NOTE

Release of sling load from the hook can be confirmed visually through rear view mirror.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

CARGO FAILS TO RELEASE ELECTRICALLY

In the event that cargo hook will not release the sling when the CARGO RELEASE button is depressed, proceed as follows:

Maintain tension on sling.

Cargo release pedal (between directional control pedals) — PUSH.

Section 4

PERFORMANCE

INTRODUCTION

No change from basic Flight Manual performance with no load attached to cargo hook.

NOTE

Performance may be affected by the size and shape of the external load.

HOVER CEILING IGE

NOTE

When using any hover ceiling chart for external cargo operations, refer to figure 4-1, critical relative wind azimuths.

In ground effect hover ceiling charts for external cargo operations are presented in figure 4-2.

HOVER CEILING OGE

Refer to basic Flight Manual for out of ground effect hover ceiling charts during external cargo operations.

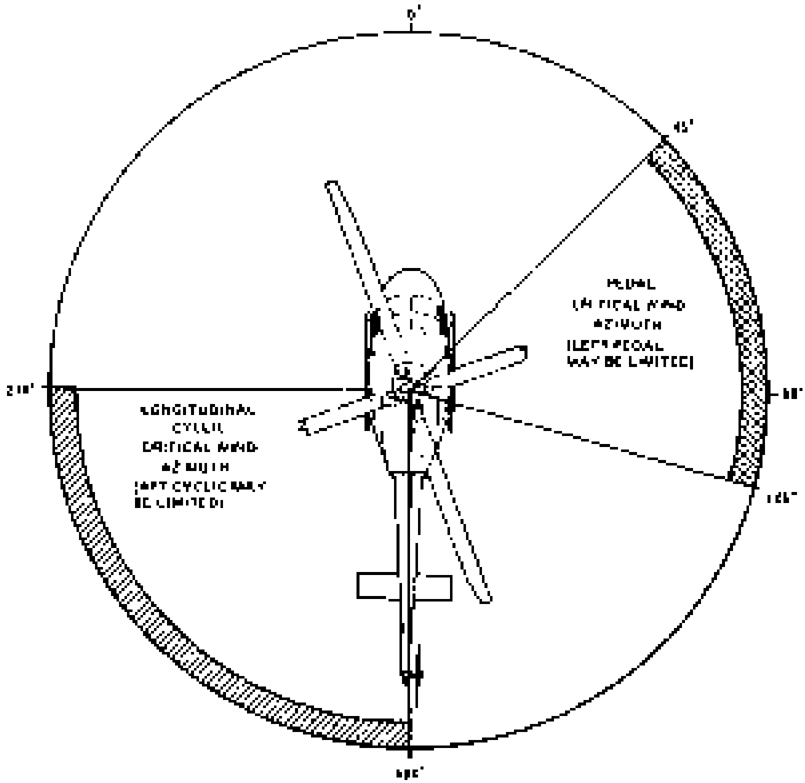


Figure 4-1 Critical relative wind azimuths

HOVER CEILING
IN GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (TA)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
-40° TO 52°C

NOTE THIS DATA VALID FOR ZERO WIND OR WIND OUT SIDE OF THE CRITICAL WIND AZIMUTH AREAS

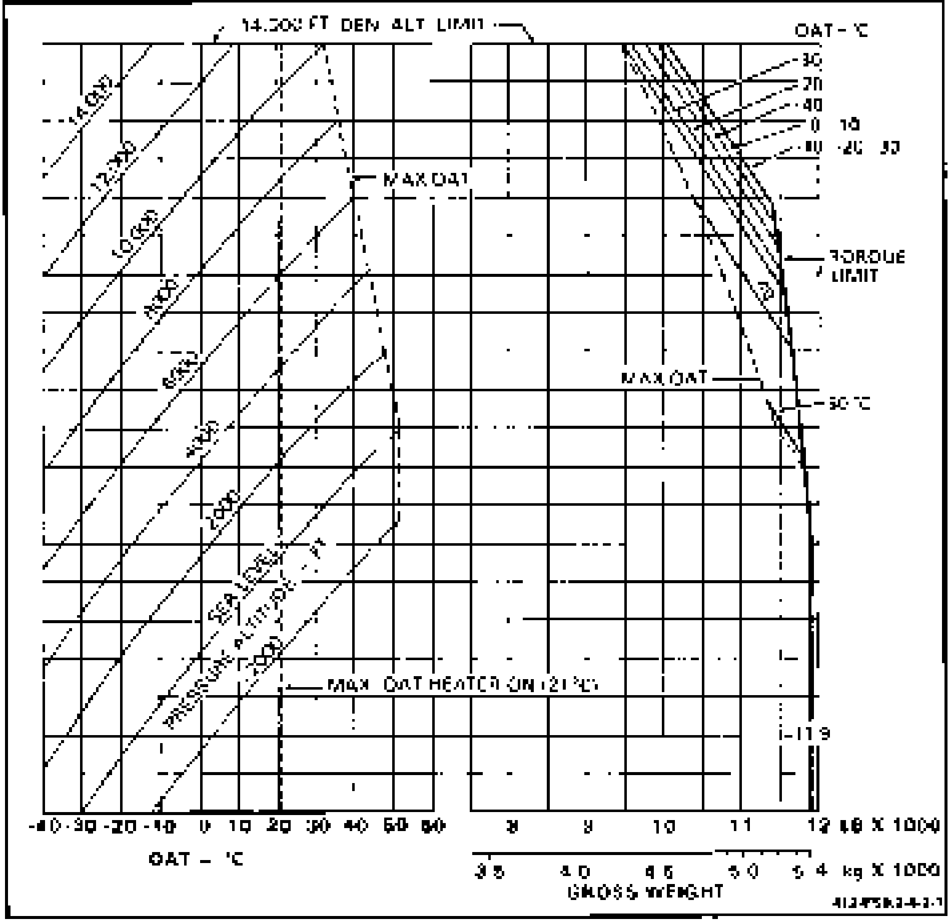


Figure 4-2 Hover ceiling in ground effect (Sheet 1 of 2)

HOVER CEILING
IN GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
-40° TO 17°C

NOTE: THIS DATA VALID FOR ZERO WIND OR WIND OUT SIDE OF THE CRITICAL WIND AZIMUTH AREAS

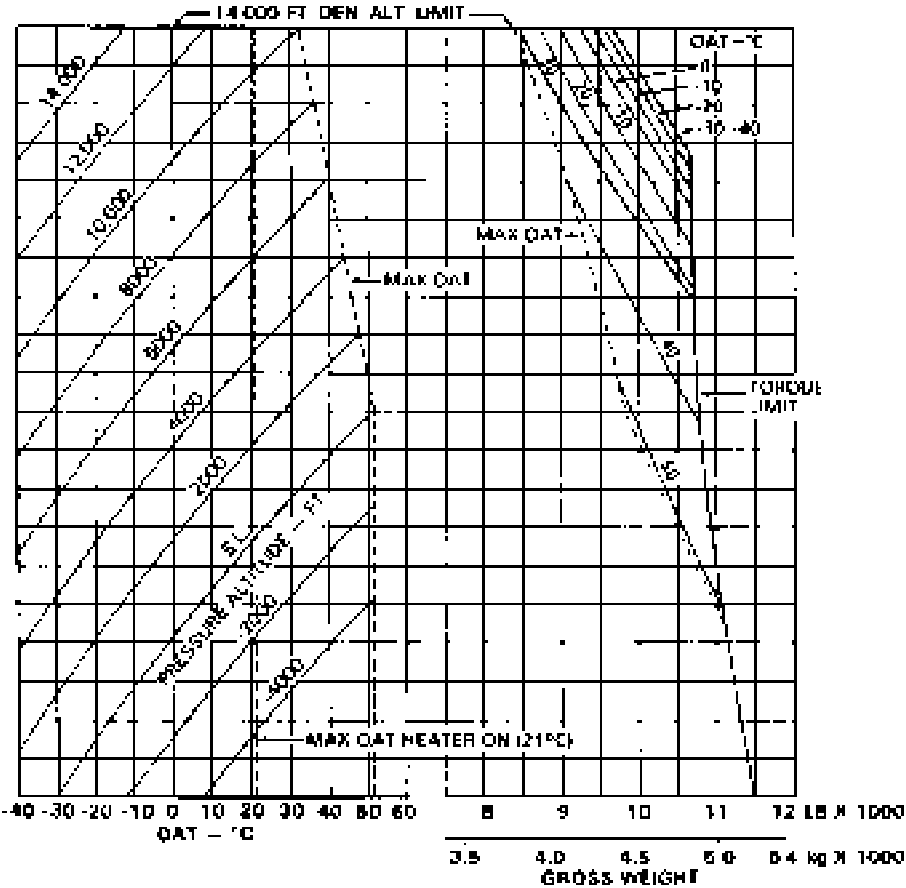


Figure 4-2. Hover ceiling in ground effect (Sheet 2 of 2)

Section 1

MANUFACTURER'S DATA

WEIGHT AND BALANCE

EXTERNAL CARGO LOADING

The External Cargo Loading Tables (tables 1-1 and 1-1M) present moments for external loads suspended from the cargo hook at fuselage station 138.0 (3505 mm).

Table 1-1. External cargo loading table (English)

EXTERNAL CARGO LOADING TABLE ENGLISH					
Cargo Weight (Lb)	Moment F.S. 138.0	Cargo Weight (Lb)	Moment F.S. 138.0	Cargo Weight (Lb)	Moment F.S. 138.0
50	6900	1800	248400	3550	489900
100	13800	1850	255300	3600	496800
150	20700	1900	262200	3650	503700
200	27600	1950	269100	3700	510600
250	34500	2000	276000	3750	517500
300	41400	2050	282900	3800	524400
350	48300	2100	289800	3850	531300
400	55200	2150	296700	3900	538200
450	62100	2200	303600	3950	545100
500	69000	2250	310500	4000	552000
550	75900	2300	317400	4050	558900
600	82800	2350	324300	4100	565800
650	89700	2400	331200	4150	572700
700	96600	2450	338100	4200	579600
750	103500	2500	345000	4250	586500
800	110400	2550	351900	4300	593400
850	117300	2600	358800	4350	600300
900	124200	2650	365700	4400	607200
950	131100	2700	372600	4450	614100
1000	138000	2750	379500	4500	621000
1050	144900	2800	386400	4550	627900
1100	151800	2850	393300	4600	634800
1150	158700	2900	400200	4650	641700
1200	165600	2950	407100	4700	648600
1250	172500	3000	414000	4750	655500
1300	179400	3050	420900	4800	662400
1350	186300	3100	427800	4850	669300
1400	193200	3150	434700	4900	676200
1450	200100	3200	441600	4950	683100
1500	207000	3250	448500	5000	690000
1550	213900	3300	455400		
1600	220800	3350	462300		
1650	227700	3400	469200		
1700	234600	3450	476100		
1750	241500	3500	483000		

412900-43

Table 1-1M. External cargo loading table (Metric)

EXTERNAL CARGO LOADING TABLE — METRIC			
Cargo Weight (kg)	Moment 3505 mm (kg × mm)/100	Cargo Weight (kg)	Moment 3505 mm (kg × mm)/100
40	1402	1240	43462
80	2804	1280	44864
120	4206	1320	46266
160	5608	1360	47668
200	7010	1400	49070
240	8412	1440	50472
280	9814	1480	51874
320	11216	1520	53276
360	12618	1560	54678
400	14020	1600	56080
440	15422	1640	57482
480	16824	1680	58884
520	18226	1720	60286
560	19628	1760	61688
600	21030	1800	63090
640	22432	1840	64492
680	23834	1880	65894
720	25236	1920	67296
760	26638	1960	68698
800	28040	2000	70100
840	29442	2040	71502
880	30844	2080	72904
920	32246	2120	74306
960	33648	2160	75708
1000	35050	2200	77110
1040	36452	2240	78512
1080	37854	2268	79493
1120	39256		
1160	40658		
1200	42060		

412936-44

Bell Model 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR NIGHTSUN SEARCHLIGHT

(212-899-333)

CERTIFIED
DECEMBER 4, 1981

This supplement shall be attached to the Model 412 Flight Manual when the 212-899-333 Nightsun Searchlight has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
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4 DECEMBER 1981
REISSUED 8 MAY 1989

LOG OF REVISIONS

Original . . 0 . . . . December 4, 1981
Released . . . . 0 . . . . May 8, 1989

LOG OF PAGES

Page	Revision No.	Page	Revision No.
Title — A	0		
i/ii	0		
1 — 2	0		
3/4	0		

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION DIRECTORATE
AIRCRAFT CERTIFICATION SERVICE
DEPARTMENT OF TRANSPORTATION
SOUTHWEST REGION, FORT WORTH, TEXAS

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The Nightsun Searchlight is a high intensity light which mounts on the lower nose of the helicopter. The xenon arc light may be started, aimed, and focused from the operator's panel inside the helicopter. The kit consists of the Nightsun Searchlight, mounts, hardware, cable, and operator's panel.

Section 1

LIMITATIONS

OPERATING LIMITATIONS

IFR operation is prohibited with Nightsun Searchlight installed.

FLIGHT CREW LIMITATIONS

Operation of the Nightsun Searchlight is restricted to the copilot or operator position.

WEIGHT/CG LIMITATIONS

Actual weight changes shall be determined after searchlight is installed and ballast readjusted, if necessary, to return empty weight CG within allowable limits.

PLACARDS AND DECALS

CAUTION

DO NOT USE NIGHTSUN SEARCHLIGHT BELOW 50 FT AGL OR IN FOG CONDITIONS MONITOR LOADMETER WHEN USING NIGHTSUN SEARCHLIGHT.

412033-5

Section 2

NORMAL PROCEDURES

EXTERIOR CHECK

Nightsun Searchlight — Security and wiring. Lens for cleanliness.

PRESTART CHECK

SCHLT PWR and SCHLT CONT circuit breakers — IN.

INFLIGHT OPERATION

NIGHTSUN SEARCHLIGHT MASTER switch — ON.

NIGHTSUN SEARCHLIGHT START switch — START, hold in start position approximately 5 seconds, or until ignition has occurred.

Aim and focus — As desired.

CAUTION

HOLDING SWITCH IN START POSITION AFTER IGNITION MAY DAMAGE EQUIPMENT.

CAUTION

DO NOT AIM THE BEAM TOWARD OTHER AIRCRAFT OR VEHICLES BECAUSE OF TEMPORARY BLINDING EFFECT.

BEFORE LANDING

NIGHTSUN SEARCHLIGHT MASTER switch — OFF.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic Flight Manual

Section 4

PERFORMANCE DATA

No change from the basic Flight Manual

Bell MODELS **412/412 EP**

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR FIXED STEP

(212-706-057)

CERTIFIED
6 FEBRUARY 1982

This supplement shall be attached to the Models 412 and 412 EP Flight Manual when the 412-706-057 fixed step has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

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REISSUE — 23 JUNE 1994

LOG OF REVISIONS

Original . . . . . 0 . . . . 06 Feb 82
Reissue . . . . 0 . . . . 22 Feb 89
Reissue . . . . 0 . . . . 23 Jun 94

LOG OF PAGES

Page	Revision No.	Page	Revision No.
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APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The fixed steps mount to the sides of the fuselage to facilitate passenger entry and exit.

Section 1

LIMITATIONS

OPERATING LIMITATIONS

The contents of this supplement shall be used in conjunction with the basic Flight Manual for helicopters equipped with the fixed step.

The 412-706-004 Emergency Float Kit shall not be installed in conjunction with the fixed step.

The 212-706-106 Passenger Step shall not be installed in conjunction with the fixed step.

The 212-706-057 Fixed Step shall be removed when the 214-706-003 Internal Hoist is installed.

WEIGHT — CG LIMITATIONS

Actual weight change shall be determined after kit is installed and ballast readjusted, if necessary, to return empty weight CG within allowable limits.

Section 2

NORMAL PROCEDURES

No change from basic Flight Manual.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic Flight Manual.

Section 4

PERFORMANCE

No change from basic Flight Manual.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

AUXILIARY FUEL SUPPLEMENT

412-706-007

33108 — 33213
36001 — 36019
AND
36020 — 36086
AND
36087 AND SUB

CERTIFIED
5 JANUARY 1984

This supplement shall be attached to Bell Helicopter Model 412 and 412EP Flight Manuals when 412-706-007 Auxiliary Fuel Kit has been installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

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REISSUE — 23 JUNE 1994

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LOG OF REVISIONS

Original	0	January 5, 1984	Reissue	0	May 9, 1991
Revision	1	May 22, 1987	Reissue	0	June 23, 1994

LOG OF PAGES

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MANUFACTURER'S DATA	
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NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Original	0	January 5, 1984	Reissue	0	May 9, 1991
Revision	1	May 22, 1987	Reissue	0	June 23, 1994

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT WORTH, TX 76193-0170

INTRODUCTION

The Auxiliary Fuel Kit provides additional fuel capacity to extend the range of the helicopter. The kit consists of a left and right auxiliary fuel tank and the hardware and wiring necessary to complete the installation. The left or right auxiliary fuel tank may be removed as operational requirements dictate.

One fuel tank provides an additional 81.7 U.S. gallons (309.2 liters) of fuel. Both fuel tanks combined, provide an additional 163.4 U.S. gallons (618.5 liters) of fuel.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight changes shall be determined after installation of auxiliary fuel tank(s), and ballast shall be readjusted, if necessary, to return empty weight CG within allowable limits.

WARNING

INDISCRIMINATE LOADING OF THE HELICOPTER MAY RESULT IN VIOLATION OF THE PERMISSIBLE CENTER OF GRAVITY LIMITATIONS WHEN THE HELICOPTER IS EQUIPPED WITH THE 412-706-007 AUXILIARY FUEL KIT.

The gross weight center of gravity limits as presented in the basic Flight Manual do not change when either or both auxiliary fuel tanks are installed.

Refer to Manufacturer's Data, Section 1, for weight and balance data and loading example.

Section 2

NORMAL PROCEDURES

IN-FLIGHT OPERATION

CAUTION

WHEN ONLY ONE CABIN MOUNTED AUXILIARY FUEL TANK IS USED, THE FUEL INTCON SWITCH MUST BE REPLACED TO OPEN WHEN A FUEL QUANTITY INDICATION OF 500 LBS. IS ON EITHER SIDE. FAILURE TO MANUALLY OPEN THE FUEL INTCON SWITCH WILL RESULT IN FUEL EXHAUSTION TO THE ENGINE OPPOSITE THE SIDE WHICH HAS THE AUXILIARY TANK. THE FEATURE WHICH AUTOMATICALLY OPENS THE INTERCONNECT VALVE WILL NOT HAVE A CHANCE TO FUNCTION WITH ONLY ONE AUXILIARY TANK INSTALLED. WITH TWO EQUALLY LOADED AUXILIARY TANKS INSTALLED, THE AUTOMATIC FEATURE WILL FUNCTION.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic Flight Manual

Section 4

PERFORMANCE

No change from basic Flight Manual.

Section 1

MANUFACTURER'S DATA

WEIGHT AND BALANCE

AUXILIARY FUEL SYSTEM

AUXILIARY FUEL SYSTEM SERVICING

The auxiliary fuel tanks are interconnected with the basic fuel system to allow gravity flow of auxiliary fuel into main fuel cells as fuel is consumed. The auxiliary fuel system is serviced simultaneously with the basic fuel system through the single filler port located on the aft right side of the fuselage.

FUEL SYSTEM CAPACITIES

BASIC SYSTEM WITH LEFT OR RIGHT AUXILIARY TANK

Total capacity:
419.1 U.S. gallons (1586.5 liters)

Usable fuel:
412.1 U.S. gallons (1560.0 liters)

BASIC SYSTEM WITH BOTH AUXILIARY TANKS

Total capacity:
500.8 U.S. gallons (1895.7 liters)

Usable fuel:
493.8 U.S. gallons (1869.2 liters)

AUXILIARY FUEL LOADING TABLES

Fuel loading tables are presented for weight and balance computations in both English and Metric units. These tables shall be used in lieu of the tables for the basic fuel system when either or both auxiliary fuel tanks are installed. Weights and moments listed herein represent total fuel on board to include that contained in basic fuel cells. Refer to table 1-1 and 1-2 for English or 1-1M and 1-2M for Metric when both left and right auxiliary tanks are installed. Tables 1-3 and 1-4 for English or 1-3M and 1-4M for Metric apply to single auxiliary tank installed on left side, and tables 1-5 and 1-6 for English or 1-5M and 1-6M Metric, apply to single auxiliary tank installed on right side.

BHT-412-FMS-17.2, 17.3 AND 17.4

Table 1-1. Fuel Loading With Left and Right Auxiliary Tanks — Longitudinal (English)

Longitudinal							
Jet B or JP-4 (6.5 Lb/U.S. Gallon)				Jet A, A1 or JP5 (6.8 Lb/U.S. Gallon)			
Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
10	65	139.4	9061	10	68	139.4	9479
20	130	139.6	18148	20	136	139.6	18986
30	195	139.8	27261	30	204	139.8	28519
40	260	139.9	36374	40	272	139.9	38053
50	325	139.9	45468	50	340	139.9	47566
58.3*	379	139.9	53023	58.3*	396	139.9	55400
60	390	141.1	55029	60	408	141.1	57569
70	455	145.5	66203	70	476	145.5	69258
80	520	148.2	77064	80	544	148.2	80621
90	585	149.8	87633	90	612	149.8	91678
100	650	151.0	98150	100	680	151.0	102680
110	715	152.1	108752	110	748	152.1	113771
120	780	152.9	119262	120	816	152.9	124766
130	845	153.7	129877	130	884	153.7	135871
140	910	154.3	140413	140	952	154.3	146894
150	975	154.8	150930	150	1020	154.8	157896
160	1040	155.3	161512	160	1088	155.3	168966
170	1105	155.8	172159	170	1156	155.8	180105
180	1170	156.1	182637	180	1224	156.1	191066
190	1235	156.4	193154	190	1292	156.4	202069
200	1300	156.8	203840	200	1360	156.8	213248
207.9*	1351	157.0	212107	207.9*	1414	157.0	221998
210	1365	156.6	213823	210	1428	156.5	223482
220	1430	153.6	219648	220	1496	153.6	229786
230	1495	151.0	225745	230	1564	151.0	236164
240	1560	148.6	231816	240	1632	148.6	242515
241.4*	1569	148.3	232786	241.4*	1639	148.3	243064
250	1625	148.8	241800	250	1700	148.8	252960
260	1690	149.3	252317	260	1768	149.3	263962
270	1755	149.8	262899	270	1836	149.8	275033
280	1820	150.2	273364	280	1904	150.2	285981
290	1885	150.7	284070	290	1972	150.7	297180
300	1950	151.1	294645	300	2040	151.1	308244
310	2015	151.5	305273	310	2108	151.5	319362
320	2080	151.9	315952	320	2176	151.9	330534
330	2145	152.2	326469	330	2244	152.2	341537
340	2210	152.5	337025	340	2312	152.5	352580
350	2275	152.8	347620	350	2380	152.8	363664
360	2340	153.1	358254	360	2448	153.1	374789
370	2405	153.3	368687	370	2516	153.3	385703
374.5*	2434	153.4	373376	374.5*	2547	153.4	390710
380	2470	152.9	377663	380	2584	152.9	395094
390	2535	151.9	385067	390	2652	151.9	402839
400	2600	151.0	392600	400	2720	151.0	410720
410	2665	150.1	400017	410	2788	150.1	418479
420	2730	149.2	407316	420	2856	149.2	426115
426.4*	2772	148.7	412196	426.4*	2900	148.7	431230
430	2795	148.8	415896	430	2924	148.8	435091
440	2860	149.1	426426	440	2992	149.1	446107
450	2925	149.4	436995	450	3060	149.4	457164
460	2990	149.7	447603	460	3128	149.7	468262
470	3055	150.0	458250	470	3196	150.0	479400
480	3120	150.2	468624	480	3264	150.2	490253
490	3185	150.5	479343	490	3332	150.5	501466
493.5*	3210	150.6	482426	493.8*	3358	150.6	505715

*Critical fuel amount for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

Table 1-1M. Fuel Loading With Left and Right Auxiliary Tanks — Longitudinal (Metric)

Longitudinal							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A1 or JP-5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	31.2	3542	110510	40	32.6	3541	115437
80	62.3	3547	220978	80	65.2	3547	231264
120	93.5	3551	332019	120	97.8	3551	347288
160	124.6	3552	442579	160	130.4	3552	463181
200	155.8	3552	553402	200	163.0	3555	579465
220.7*	171.9	3553	610761	220.7*	179.9	3553	639185
240	186.9	3605	673783	240	195.6	3635	711006
280	218.1	3727	812869	280	228.2	3727	850501
320	249.3	3783	943102	320	260.8	3783	986606
360	280.4	3825	1072530	360	293.3	3825	1121873
400	311.6	3853	1200621	400	325.9	3852	1255367
440	342.7	3877	1328648	440	358.6	3877	1390292
480	373.9	3898	1457462	480	391.1	3898	1524508
520	405.1	3915	1585967	520	423.7	3915	1658786
560	436.2	3930	1714266	560	456.3	3930	1793259
600	467.4	3944	1843426	600	488.9	3944	1928222
640	498.5	3955	1971568	640	521.5	3955	2062533
680	529.6	3965	2099864	680	554.1	3965	2197007
720	560.8	3974	2228619	720	586.7	3974	2331546
760	592.0	3982	2357344	760	619.3	3982	2466053
787.0*	613.0	3988	2444944	787.0*	641.3	3988	2557504
800	623.2	3986	2484075	800	651.9	3985	2597822
840	654.2	3887	2542875	840	684.6	3887	2661040
880	685.4	3817	2616172	880	717.0	3817	2736789
912.1*	710.6	3766	2676073	912.1*	743.4	3766	2799644
920	716.7	3770	2701959	920	749.8	3770	2826746
960	747.8	3785	2830423	960	782.2	3785	2960627
1000	778.9	3797	2957483	1000	814.4	3797	3092794
1040	810.0	3810	3086110	1040	847.4	3810	3228594
1080	841.2	3823	3215908	1080	880.0	3822	3363360
1120	872.3	3833	3343526	1120	912.9	3833	3499146
1160	903.5	3844	3473054	1160	945.2	3844	3633349
1200	934.7	3854	3602334	1200	977.8	3854	3768441
1240	965.8	3864	3731851	1240	1010.4	3864	3904186
1280	997.0	3872	3860384	1280	1043.0	3872	4038496
1320	1028.1	3880	3989028	1320	1075.6	3880	4173328
1360	1059.3	3887	4117498	1360	1108.1	3887	4307185
1400	1090.4	3896	4247408	1400	1140.7	3896	4443077
1417.6*	1104.0	3897	4302288	1417.6*	1155.1	3897	4501425
1440	1121.6	3882	4354051	1440	1173.4	3882	4555139
1480	1152.7	3866	4456338	1480	1205.9	3866	4661950
1520	1183.9	3832	4536705	1520	1238.5	3832	4745932
1560	1215.0	3808	4626720	1560	1271.1	3808	4840349
1600	1246.0	3784	4714864	1600	1303.7	3784	4933201
1614.1*	1257.3	3776	4747565	1614.1*	1315.2	3776	4966195
1640	1277.3	3781	4829471	1640	1336.3	3781	5052550
1680	1308.5	3789	4957907	1680	1368.9	3789	5186762
1720	1339.7	3797	5086841	1720	1401.4	3797	5321116
1760	1370.8	3805	5215894	1760	1434.1	3805	5456751
1800	1402.0	3813	5345826	1800	1466.7	3813	5592527
1840	1433.1	3820	5474442	1840	1499.3	3820	5727326
1869.2	1455.9	3825	5568818	1869.2	1523.3	3825	5826622

*Critical fuel amounts for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

Table 1-2 Fuel Loading With Left and Right Auxiliary Tanks — Lateral (English)

Lateral							
Jet B or JP-4 (6.5 Lb/U.S. Gallon)				Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
10	65	0	0	10	68	0	0
20	130	0	0	20	136	0	0
30	195	0	0	30	204	0	0
40	260	0	0	40	272	0	0
50	325	0	0	50	340	0	0
58.3	379	0	0	58.3	397	0	0
60	390	0.04	16	60	408	0.04	-16
70	455	0.05	-23	70	476	-0.05	-24
80	520	0.05	26	80	544	-0.05	27
90	585	0.04	24	90	612	0.04	25
100	650	0.04	26	100	680	0.04	27
110	715	-0.03	21	110	748	-0.03	22
120	780	0.03	-23	120	816	-0.03	-24
130	845	0.03	25	130	884	-0.03	27
140	910	-0.03	27	140	952	0.03	29
150	975	0.02	20	150	1020	0.02	20
160	1040	-0.02	21	160	1088	0.02	22
170	1105	0.02	-22	170	1156	-0.02	-23
180	1170	0.02	-23	180	1224	0.02	24
190	1235	-0.02	25	190	1292	-0.02	26
200	1300	0.02	26	200	1360	0.02	27
207.9	1351	0.02	-27	207.9	1414	-0.02	-28
210	1365	0.20	[illegible]	210	1428	-0.20	286
220	1430	-0.33	472	220	1496	0.33	494
230	1495	0.42	-628	230	1564	0.42	657
240	1560	0.50	780	240	1632	0.50	816
250	1625	-0.50	813	250	1700	0.50	-850
260	1690	0.48	-811	260	1768	0.48	-849
270	1755	-0.46	-807	270	1836	-0.46	845
280	1820	0.46	818	280	1904	0.46	-867
290	1885	0.44	828	290	1972	0.44	868
300	1950	0.43	839	300	2040	-0.43	-877
310	2015	-0.41	826	310	2108	-0.41	864
320	2080	0.41	-853	320	2176	0.41	892
330	2145	-0.40	858	330	2244	-0.40	-898
340	2210	0.40	884	340	2312	0.40	925
350	2275	0.40	-910	350	2380	-0.40	952
360	2340	-0.38	-917	360	2448	-0.39	955
370	2405	0.38	918	370	2516	0.38	-981
380	2470	0.36	898	380	2584	-0.36	930
390	2535	0.35	887	390	2652	0.36	928
400	2600	-0.34	884	400	2720	0.34	925
410	2665	-0.33	-879	410	2788	0.33	920
420	2730	0.31	846	420	2856	-0.31	-885
430	2795	-0.30	839	430	2924	0.30	-877
440	2860	0.30	-858	440	2992	-0.30	-898
450	2925	0.29	-848	450	3060	-0.29	887
460	2990	0.29	867	460	3128	0.29	-907
470	3055	0.28	855	470	3196	-0.28	895
480	3120	0.27	842	480	3264	0.27	881
490	3185	-0.25	796	490	3332	0.26	866
493.8	3210	-0.26	-835	493.8	3358	0.26	-873

*Critical fuel amount for most forward cg condition

NOTE All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C

Table 1-2M Fuel Loading With Left and Right Auxiliary Tanks — Lateral (Metric)

Lateral							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A1 or JP-5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	31.2	0	0	40	32.6	0	0
80	62.3	0	0	80	65.2	0	0
120	93.5	0	0	120	97.8	0	0
160	124.6	0	0	160	130.4	0	0
200	155.8	0	0	200	163.0	0	0
220.7*	171.9	0	0	220.7*	179.9	0	0
240	186.9	2	374	240	195.6	2	391
280	218.1	2	436	280	228.2	2	456
320	249.3	3	748	320	260.8	1	261
360	280.4	1	280	360	293.3	1	293
400	311.6	1	312	400	325.9	1	326
440	342.7	1	343	440	358.5	1	359
480	373.9	1	374	480	391.1	1	391
520	405.1	1	405	520	423.7	1	424
560	436.2	1	436	560	456.3	1	456
600	467.4	1	467	600	488.9	1	489
640	498.5	1	499	640	521.5	1	522
680	529.6	1	530	680	554.1	1	554
720	560.8	1	561	720	586.7	1	587
760	592.0	1	592	760	619.3	1	619
787.0	613.0	1	613	787.0	641.3	1	641
800	623.1	5	3116	800	651.9	5	3260
840	654.3	9	5889	840	684.4	9	6160
880	685.4	11	7539	880	717.0	11	7887
920	716.7	13	9317	920	749.6	13	9745
960	747.7	12	9120	960	782.2	13	10169
1000	778.9	12	9347	1000	814.8	12	9778
1040	810.0	12	9720	1040	847.4	12	10169
1080	841.2	12	10094	1080	880.0	12	10560
1120	872.3	11	9595	1120	912.6	11	10039
1160	903.5	10	9035	1160	945.2	10	9452
1200	934.7	10	9347	1200	977.8	10	9778
1240	965.8	10	9658	1240	1010.4	10	10104
1280	997.0	10	9970	1280	1043.0	10	10430
1320	1028.1	10	10281	1320	1075.6	10	10756
1360	1059.3	10	10593	1360	1108.1	10	11081
1400	1090.4	10	10904	1400	1140.7	10	11407
1440	1121.6	9	10094	1440	1173.3	9	10560
1480	1152.7	9	10374	1480	1205.9	9	10853
1520	1183.9	8	9471	1520	1238.5	8	9908
1560	1215.0	8	9720	1560	1271.1	8	10169
1600	1246.0	8	9968	1600	1303.7	8	10430
1640	1277.3	8	10218	1640	1336.3	8	10690
1680	1308.6	8	10468	1680	1368.9	8	10951
1720	1339.7	7	9378	1720	1401.5	7	9811
1760	1370.8	7	9596	1760	1434.1	7	10039
1800	1402.0	7	9814	1800	1466.7	7	10267
1840	1433.1	6	8599	1840	1499.3	6	8996
1869.2	1455.9	6	8735	1869.2	1523.0	6	9139

*Critical fuel amount for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

Table 1-3 Fuel Loading With Left Auxiliary Tank — Longitudinal (English)

Longitudinal							
Jet B or JP-4 (6.5 Lb/U.S. Gallon)				Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
10	65	139.4	9061	10	68	139.4	9479
20	130	139.6	18148	20	136	139.6	18986
30	195	139.8	27261	30	204	139.8	28519
40	260	139.9	36374	40	272	139.9	38053
50	325	139.9	45468	50	340	139.9	47566
*58.3	379	139.9	53022	*58.3	397	139.9	55540
60	390	141.1	55029	60	408	141.1	57569
70	455	145.8	66339	70	476	145.8	69401
80	520	148.7	77324	80	544	148.7	80893
90	585	150.7	88160	90	612	150.7	92228
100	650	152.3	98995	100	680	152.3	103564
110	715	153.6	109824	110	748	153.6	114893
120	780	154.7	120666	120	816	154.7	126235
130	845	155.7	131567	130	884	155.7	137639
140	910	156.5	142415	140	952	156.5	148988
150	975	157.2	153270	150	1020	157.2	160344
160	1040	157.8	164112	160	1088	157.8	171686
170	1105	158.4	175032	170	1156	158.4	183110
*173.9	1130	158.6	179218	*173.9	1183	158.6	187624
180	1170	156.2	182764	180	1224	156.2	191189
190	1235	153.1	189078	190	1292	153.1	197805
200	1300	150.1	195130	200	1360	150.1	204136
*207.1	1346	148.2	199477	*207.1	1408	148.2	208666
210	1365	148.4	202566	210	1428	148.4	211915
220	1430	149.2	213356	220	1496	149.2	223203
230	1495	150.0	224250	230	1564	150.0	234600
240	1560	150.7	235092	240	1632	150.7	245942
250	1625	151.4	246025	250	1700	151.4	257380
260	1690	152.0	256880	260	1768	152.0	268736
270	1755	152.6	267813	270	1836	152.6	280174
280	1820	153.1	278642	280	1904	153.1	291502
290	1885	153.6	289536	290	1972	153.6	302899
300	1950	154.0	300300	300	2040	154.0	314160
*308.8	2007	154.4	309881	*308.8	2100	154.4	324240
310	2015	154.2	310713	310	2108	154.2	325054
320	2080	153.0	318240	320	2176	153.0	332928
330	2145	151.8	325611	330	2244	151.8	340639
340	2210	150.7	333047	340	2312	150.7	348418
350	2275	149.7	340568	350	2380	149.7	356286
360	2340	148.6	347724	360	2448	148.6	363773
*360.7	2345	148.6	348467	*360.7	2453	148.6	364516
370	2405	149.0	358345	370	2516	149.0	374884
380	2470	149.6	369512	380	2584	149.6	386566
390	2535	150.1	380504	390	2652	150.1	398065
400	2600	150.5	391300	400	2720	150.5	409360
410	2665	150.8	401882	410	2788	150.8	420430
*412.1	2679	150.9	404261	*412.1	2802	150.9	422822

*Critical fuel amount for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary) based on nominal density at 15°C.

Table 1-2M. Fuel Loading With Left Auxiliary Tank — Longitudinal (Metric)

Longitudinal							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A1 or JP-5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	31.2	3542	110510	40	32.6	3541	115437
80	62.3	3547	220978	80	65.2	3547	231264
120	93.5	3551	332019	120	97.8	3551	347288
160	124.6	3552	442579	160	130.4	3552	463181
200	155.8	3557	553462	200	163.0	3552	578976
*220.7	171.9	3553	610761	*220.7	179.9	3553	639185
240	186.9	3635	679182	240	195.6	3636	711202
280	218.1	3739	816428	280	228.2	3730	851186
320	249.3	3800	947340	320	260.8	3800	991040
360	280.4	3848	1078919	360	293.3	3848	1128615
400	311.6	3888	1211817	400	325.9	3889	1267425
440	342.7	3923	1344412	440	358.6	3923	1406788
480	373.9	3951	1478187	480	391.1	3948	1544063
520	405.0	3971	1608255	520	423.7	3971	1682513
560	436.2	4001	1745236	560	456.3	4001	1825656
600	467.3	4006	1872004	600	488.9	4004	1957556
640	498.5	4021	2004469	640	521.5	4021	2096952
*658.0	512.5	4027	2063838	*658.3	536.5	4027	2160486
680	529.6	3973	2104101	680	554.2	3973	2201837
720	560.8	3886	2179269	720	586.7	3886	2279916
760	592.0	3809	2254928	760	619.3	3809	2358914
784.0	610.4	3763	2296936	784.0	638.9	3763	2403952
800	623.1	3772	2350333	800	651.9	3772	2458967
840	654.2	3793	2481381	840	684.4	3793	2595929
880	685.4	3815	2614801	880	717.0	3816	2736306
920	716.7	3834	2747828	920	749.8	3834	2874733
960	747.7	3852	2880140	960	782.2	3852	3013034
1000	778.9	3868	3012736	1000	814.8	3868	3151646
1040	810.0	3882	3144420	1040	847.4	3882	3289607
1080	841.2	3896	3277316	1080	880.3	3896	3429649
1120	872.3	3909	3409821	1120	912.5	3909	3566963
1160	903.5	3919	3540817	1160	945.2	3919	3704235
*1168.9	910.5	3921	3569834	*1168.9	952.5	3922	3735705
1200	934.7	3895	3640853	1200	977.8	3895	3808531
1240	965.8	3862	3730085	1240	1010.4	3863	3903175
1280	997.0	3833	3821501	1280	1043.0	3833	3997819
1320	1028.1	3805	3911821	1320	1075.6	3805	4092658
1360	1059.3	3778	4002035	1360	1108.1	3778	4186402
*1365.4	1063.5	3775	4014713	*1365.4	1112.8	3775	4200746
1400	1090.4	3787	4129346	1400	1140.7	3787	4319831
1440	1121.6	3800	4262080	1440	1173.4	3800	4458920
1480	1152.7	3812	4394092	1480	1205.9	3812	4596891
1520	1183.9	3824	4527234	1520	1238.5	3824	4736024
1560.0	1215.0	3834	4658310	1560.0	1271.0	3834	4873014

*Capacity fuel amount for most forward cg condition.

NOTE: All data shown represents total fuel on board (basic and auxiliary) based on nominal density at 15°C.

Table 1-4. Fuel Loading with Left Auxiliary Tank — Lateral (English)

Lateral							
Jet B or JP-4 (6.5 Lb/U.S. Gallon)				Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
10	65	0	0	10	68	0	0
20	130	0	0	20	136	0	0
30	196	0	0	30	204	0	0
40	260	0	0	40	272	0	0
50	325	0	0	50	340	0	0
58.4 *	379	0	0	58.4 *	397	0	0
60	390	-0.03	-12	60	408	-0.03	-12
70	455	-0.45	-205	70	476	-0.45	-214
80	520	-1.45	-754	80	544	-1.45	-789
90	585	-2.25	-1316	90	612	-2.25	-1377
100	650	-2.97	-1931	100	680	-2.97	-2020
110	715	-3.55	-2538	110	748	-3.55	-2655
120	780	-4.04	-3151	120	816	-4.04	-3297
130	845	-4.45	-3760	130	884	-4.45	-3934
140	910	-4.80	-4368	140	952	-4.80	-4570
150	975	-5.10	-4973	150	1020	-5.10	-5202
160	1040	-5.34	-5554	160	1088	-5.34	-5810
170	1105	-5.55	-6133	170	1156	-5.55	-6416
175.4 *	1140	-5.79	-6601	175.4 *	1193	-5.79	-6907
180	1170	-5.70	-6669	180	1224	-5.70	-6977
190	1235	-5.58	-6891	190	1292	-5.58	-7209
200	1300	-5.40	-7020	200	1360	-5.40	-7344
207.4 *	1348	-5.31	-7158	207.4 *	1410	-5.31	-7487
210	1365	-5.38	-7344	210	1428	-5.38	-7683
220	1430	-5.55	-7937	220	1496	-5.55	-8303
230	1495	-5.70	-8522	230	1564	-5.70	-8915
240	1560	-5.85	-9126	240	1632	-5.85	-9547
250	1625	-5.97	-9701	250	1700	-5.97	-10149
260	1690	-6.10	-10309	260	1768	-6.10	-10785
270	1755	-6.20	-10881	270	1836	-6.20	-11383
280	1820	-6.30	-11466	280	1904	-6.30	-11995
290	1885	-6.40	-12064	290	1972	-6.40	-12621
300	1950	-6.47	-12617	300	2040	-6.47	-13199
308.8 *	2007	-6.54	-13126	308.8 *	2100	-6.54	-13734
310	2015	-6.45	-12997	310	2108	-6.45	-13597
320	2080	-6.30	-13104	320	2176	-6.30	-13709
330	2145	-6.10	-13085	330	2244	-6.10	-13688
340	2210	-5.95	-13150	340	2312	-5.95	-13756
350	2275	-5.80	-13195	350	2380	-5.80	-13804
360	2340	-5.60	-13104	360	2448	-5.60	-13709
360.7 *	2345	-5.60	-13132	360.7 *	2453	-5.60	-13737
370	2405	-5.68	-13660	370	2516	-5.68	-14291
380	2470	-5.75	-14203	380	2584	-5.75	-14858
390	2535	-5.85	-14830	390	2652	-5.85	-15514
400	2600	-5.94	-15444	400	2720	-5.94	-16157
410	2665	-6.03	-16070	410	2788	-6.03	-16812
412.1	2679	-6.03	-16154	412.1	2802	-6.03	-16896

* Critical fuel amount for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary) based on nominal density at 15°C.

Table 1-4M Fuel Loading with Left Auxiliary Tank — Lateral (Metric)

Liters							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A1 or JP-5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)
40	31.2	0	0	40	32.6	0	0
80	62.3	0	0	80	65.2	0	0
120	93.5	0	0	120	97.8	0	0
160	124.6	0	0	160	130.4	0	0
200	155.8	0	0	200	163.0	0	0
220.7	171.9	0	0	220.7	179.9	0	0
240	186.9	-1	-187	240	195.6	-1	-196
280	218.1	-21	-4580	280	228.2	-21	-4792
320	249.3	-35	-8726	320	260.8	-35	-9128
360	280.4	-67	-18787	360	293.4	-67	-19657
400	311.6	-84	-26174	400	325.9	-84	-27376
440	342.7	-99	-33927	440	358.5	-99	-35492
480	373.9	-110	-41129	480	391.1	-110	-43021
520	405.0	-119	-48195	520	423.7	-119	-50420
560	436.2	-128	-55834	560	456.3	-128	-58406
600	467.3	-135	-63086	600	488.9	-135	-66002
640	498.6	-140	-69804	640	521.5	-140	-73010
664.0	517.4	-147	-75939	664.0	541.0	-147	-79527
680	529.6	-145	-76792	680	554.1	-145	-80345
720	560.8	-142	-79634	720	586.7	-142	-83311
760	592.0	-138	-81696	760	619.3	-138	-85463
784.6	610.9	-135	-82472	784.6	638.6	-136	-86711
800	623.1	-137	-85365	800	651.9	-137	-89310
840	654.2	-141	-92242	840	684.6	-141	-96530
880	685.4	-145	-99383	880	717.0	-146	-104682
920	716.7	-150	-107505	920	749.8	-150	-112470
960	747.7	-152	-113650	960	782.2	-152	-118894
1000	778.9	-155	-120730	1000	814.8	-155	-126294
1040	810.0	-158	-127980	1040	847.4	-158	-133889
1080	841.2	-161	-135433	1080	880.0	-161	-141680
1120	872.2	-163	-142165	1120	912.9	-163	-148803
1160	903.5	-166	-149981	1160	945.2	-166	-156903
1165.9	910.2	-166	-151093	1168.5	952.5	-166	-158115
1200	934.7	-162	-151421	1200	977.8	-162	-158404
1240	965.8	-157	-151631	1240	1010.4	-157	-158633
1280	997.0	-152	-151544	1280	1043.0	-152	-158536
1320	1028.1	-147	-151131	1320	1075.6	-147	-158113
1360	1059.3	-142	-150421	1360	1108.1	-142	-157350
1365.4	1063.5	-142	-151017	1365.4	1112.6	-142	-157989
1400	1090.4	-144	-157018	1400	1140.7	-144	-164261
1440	1121.6	-146	-163754	1440	1173.4	-146	-171316
1480	1152.7	-149	-171752	1480	1205.9	-149	-179679
1520	1183.9	-151	-178769	1520	1238.5	-151	-187014
1560	1215.0	-161	-195615	1560	1271.0	-161	-204631

Critical fuel amount (formost forward cg condition)

NOTE All data above represents total fuel on board (basic and auxiliary) based on nominal density at 15 °C

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Table 1-5 Fuel Loading with Right Auxiliary Tank — Longitudinal (English)

Longitudinal							
Jet B or JP-4 (6.5 Lb/U.S. Gallon)				Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
10	65	139.4	9061	10	68	139.4	9479
20	130	139.6	18148	20	136	139.6	18986
30	195	139.8	27261	30	204	139.8	28519
40	260	139.9	36374	40	272	139.9	38053
50	325	139.9	45468	50	340	139.9	47566
*58.3	379	139.9	53022	*58.3	397	139.9	55540
60	390	141.1	55029	60	408	141.1	57569
70	455	145.8	66339	70	476	145.8	69401
80	520	148.7	77324	80	544	148.7	80893
90	585	150.7	88160	90	612	150.7	92228
100	650	152.1	98865	100	680	152.1	103428
110	715	153.6	109824	110	748	153.6	114893
120	780	154.7	120666	120	816	154.7	126235
130	845	155.7	131567	130	884	155.7	137639
140	910	156.5	142415	140	952	156.5	148988
150	975	157.2	153270	150	1020	157.2	160344
160	1040	157.8	164112	160	1088	157.8	171686
170	1105	158.4	175032	170	1156	158.4	183110
173.9	1130	158.6	179218	173.9	1183	158.6	187624
180	1170	156.2	182754	180	1224	156.2	191189
190	1235	153.1	189079	190	1292	153.1	197805
200	1300	150.1	195130	200	1360	150.1	204136
207.1	1346	148.2	199477	207.1	1408	148.2	208666
210	1365	148.4	202566	210	1428	148.4	211915
220	1430	149.2	213356	220	1496	149.2	223203
230	1495	150.0	224250	230	1564	150.0	234600
240	1560	150.7	235092	240	1632	150.7	245942
250	1625	151.4	246025	250	1700	151.4	257380
260	1690	152.0	256880	260	1768	152.0	268736
270	1755	152.6	267813	270	1836	152.6	280174
280	1820	153.1	278642	280	1904	153.1	291502
290	1885	153.6	289536	290	1972	153.6	302899
300	1950	154.0	300300	300	2040	154.0	314160
308.8	2007	154.4	309881	308.8	2100	154.4	324240
310	2015	154.2	310713	310	2108	154.2	325054
320	2080	153.0	318240	320	2176	153.0	332928
330	2145	151.8	325611	330	2244	151.8	340639
340	2210	150.7	333047	340	2312	150.7	348418
350	2275	149.7	340568	350	2380	149.7	356286
360	2340	148.6	347724	360	2448	148.6	363773
360.7	2345	148.6	348467	360.7	2453	148.6	364516
370	2405	149.0	358345	370	2516	149.0	374884
380	2470	149.6	369512	380	2584	149.6	386566
390	2535	150.1	380504	390	2652	150.1	398065
400	2600	150.6	391560	400	2720	150.5	409360
410	2665	150.8	401882	410	2788	150.8	420430
412.1	2679	150.9	404261	412.1	2802	150.9	422822

* Critical fuel amount for most forward cg condition

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

Table 1-5M. Fuel Loading with Right Auxiliary Tank — Longitudinal (Metric)

Longitudinal							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A1 or JP-8 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	31.2	3642	113610	40	32.6	3541	115437
80	62.3	3642	[illegible]	80	65.2	3547	231264
120	93.5	3651	332619	120	97.8	3551	347281
160	124.6	3552	442579	160	130.4	3557	463881
200	155.8	3552	553402	200	163.0	3557	579376
*220.7	171.9	3553	610781	*220.7	179.9	3563	641185
240	186.9	3635	679382	240	195.6	3635	711006
280	218.1	3739	815476	280	228.2	3739	853240
320	249.3	3800	947340	320	260.8	3800	991040
360	280.4	3848	1079479	360	293.3	3848	1128618
400	311.6	3889	1211812	400	326.0	3889	1267426
440	342.7	3923	1344412	440	358.5	3923	1406196
480	373.9	3948	1476157	480	391.1	3948	1544061
520	405.0	3978	1634255	520	423.7	3971	1682613
560	436.2	4004	1745238	560	456.3	4001	1825666
600	467.3	4008	1872004	600	488.9	4006	1958633
640	498.5	4021	2004485	640	521.5	4021	2098863
650.3	512.5	4022	2061836	656.3	534.8	4027	2160488
680	529.6	3973	2104101	680	554.1	3973	2201435
720	560.8	3888	2180265	720	586.7	3886	2279814
760	592.0	3804	2254078	760	619.3	3809	2358814
784.0	610.4	3763	2296935	784.0	638.4	3763	2430162
800	623.1	3772	2350333	800	651.4	3772	2458863
840	654.2	3793	2481381	840	684.4	3793	2595935
880	685.4	3815	2614801	880	717.0	3816	2715944
920	716.7	3834	2747821	920	749.9	3834	2874731
960	747.8	3852	2880145	960	782.4	3852	3013081
1000	779.0	3868	3012785	1000	815.3	3868	[illegible]
1040	810.0	3882	3144420	1040	847.6	3882	3289607
1080	841.2	3896	3277313	1080	880.0	3896	3428480
1120	872.3	3909	3409821	1120	912.9	3905	3568526
1160	903.5	3919	3540817	1160	945.3	3914	[illegible]
1168.4	910.2	3922	3569034	1168.4	952.6	3922	3730715
1200	934.8	3935	3640653	1200	977.8	3895	3808638
1240	965.8	3863	3730883	1240	1010.4	3863	3903175
1280	997.0	3833	3821501	1280	1042.0	3834	3947819
1320	1028.1	3805	3611921	1320	1075.8	3805	4092658
1360	1059.3	3770	4002035	1360	1108.6	3773	[illegible]
1366.4	1063.5	3775	4014713	1366.4	1113.8	3775	4210065
1400	1090.6	3787	4129345	1400	1140.3	3787	[illegible]
1440	1121.8	3800	4267080	1440	1173.4	3800	4468920
1480	1152.7	3817	4394082	1480	1205.9	3817	4596081
1520	1183.9	3824	4527234	1520	1238.6	3824	[illegible]
1560.0	1215.2	3834	4660310	1560.0	1271.0	3834	[illegible]

* Critical fuel amount for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

Table 1-6. Fuel Loading with Right Auxiliary Tank — Lateral (English)

Lateral							
Jet B or JP-4 (6.5 Lb/U.S. Gallon)				Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
10	65	0	0	10	68	0	0
20	130	0	0	20	136	0	0
30	195	0	0	30	204	0	0
40	260	0	0	40	272	0	0
50	325	0	0	50	340	0	0
58.3	379	0	0	58.3	397	0	0
60	390	0.03	-12	60	408	-0.03	-12
70	455	0.34	155	70	476	0.34	162
80	520	1.30	676	80	544	1.30	707
90	585	2.22	1299	90	612	2.22	1359
100	650	2.90	1885	100	680	2.90	1972
110	715	3.48	2488	110	748	3.48	2603
120	780	3.96	3089	120	816	3.96	3231
130	845	4.43	3743	130	884	4.43	3916
140	910	4.71	4286	140	952	4.71	4484
150	975	5.00	4875	150	1020	5.00	5100
160	1040	5.28	5491	160	1088	5.28	5745
170	1105	5.50	6078	170	1156	5.50	6358
173.8	1130	5.60	6328	173.8	1183	5.60	6625
180	1170	5.15	6026	180	1224	5.15	6304
190	1235	4.73	5842	190	1292	4.73	6111
200	1300	4.36	5668	200	1360	4.36	5930
207.1	1346	4.12	5546	207.1	1408	4.12	5801
210	1365	4.20	5733	210	1428	4.20	5998
220	1430	4.46	6364	220	1496	4.46	6667
230	1495	4.63	6922	230	1564	4.63	7241
240	1560	4.81	7504	240	1632	4.81	7850
250	1625	5.00	8125	250	1700	5.00	8500
260	1690	5.13	8670	260	1768	5.13	9070
270	1755	5.28	9266	270	1836	5.28	9694
280	1820	5.40	9828	280	1904	5.40	10282
290	1885	5.60	10556	290	1972	5.60	11043
300	1950	5.65	11018	300	2040	5.65	11526
308.8	2007	5.74	11520	308.8	2100	5.74	12054
310	2015	5.72	11526	310	2108	5.72	12058
320	2080	5.53	11502	320	2176	5.53	12033
330	2145	5.36	11497	330	2244	5.36	12028
340	2210	5.20	11492	340	2312	5.20	12022
350	2275	5.05	11489	350	2380	5.05	12019
360	2340	4.95	11583	360	2448	4.95	12118
360.7	2345	4.92	11537	360.7	2453	4.92	12069
370	2405	5.01	12049	370	2516	5.01	12605
380	2470	5.10	12597	380	2584	5.10	13178
390	2535	5.20	13182	390	2652	5.20	13790
400	2600	5.30	13780	400	2720	5.30	14416
410	2665	5.41	14418	410	2788	5.41	15083
412.1	2679	5.43	14547	412.1	2802	5.43	15215

* Critical fuel amount for most forward cg condition

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

Table 1-6M. Fuel Loading with Right Auxiliary Tank — Lateral (Metric)

Lateral							
Jet B or JP 4 (0.779 kg/liter)				Jet A, A-1 or JP 5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)
40	31.2	0	0	40	32.6	0	0
80	62.3	0	0	80	65.2	0	0
120	93.5	0	0	120	97.8	0	0
160	124.6	0	0	160	130.4	0	0
200	155.8	0	0	200	163.0	0	0
220.7	171.9	0	0	220.7	179.9	0	0
240	186.9	-1	-187	240	195.6	-1	-196
280	218.1	18	3926	280	228.2	18	4108
320	249.3	44	10969	320	260.8	44	11475
360	280.4	66	18506	360	293.3	66	19358
400	311.6	82	25551	400	325.9	82	26724
440	342.7	97	33242	440	358.5	97	34775
480	373.9	108	40381	480	391.1	108	42239
520	405.0	118	47790	520	423.7	118	49997
560	436.2	126	54961	560	456.3	126	57494
600	467.3	133	62151	600	488.9	133	65024
640	498.5	139	69292	640	521.5	139	72489
658.3	512.5	142	72775	658.3	536.5	142	76183
680	529.6	131	69378	680	554.1	131	72587
720	560.8	120	67296	720	586.7	120	70404
760	592.0	110	65120	760	619.3	110	68123
784.0	610.6	105	64092	784.0	638.6	105	67053
800	623.1	107	66672	800	651.9	107	69753
840	654.2	114	74579	840	684.4	114	78022
880	685.4	119	81563	880	717.0	119	85323
920	716.7	124	88871	920	749.8	124	92975
960	747.7	128	95706	960	782.2	128	100122
1000	778.9	132	102815	1000	814.8	132	107554
1040	810.0	136	110160	1040	847.4	136	115246
1080	841.2	140	117768	1080	880.0	140	123200
1120	872.3	142	123867	1120	912.9	142	129632
1160	903.5	145	131008	1160	945.2	145	137054
1168.9	910.2	146	132889	1168.9	952.5	146	139065
1200	934.7	142	132727	1200	977.8	142	138848
1240	965.8	137	132316	1240	1010.4	137	138425
1280	997.0	133	132601	1280	1043.0	133	138719
1320	1028.1	129	132626	1320	1075.6	129	138752
1360	1059.3	126	133472	1360	1108.1	126	139631
1365.4	1063.5	125	132938	1365.4	1113.6	125	139035
1400	1090.4	127	138481	1400	1140.7	127	144869
1440	1121.6	130	145808	1440	1173.4	130	152542
1480	1152.7	132	152156	1480	1206.2	132	159218
1520	1183.9	135	159827	1520	1238.5	135	167198
1560	1215.0	138	167670	1560	1271.0	138	175398

[1] Critical fuel amount for most forward cg condition.

NOTE: All data above represents total fuel on board (basic and auxiliary), based on nominal density at 15°C.

LOADING EXAMPLES

The CG examples shown below apply only to helicopters with standard seating which are equipped with both tanks of the 412-706-007 Auxiliary Fuel Kit. The loadings are based on standard 170 pound people for both crew and passengers.

At empty weights below 7400 pounds there are no restrictions on passenger or fuel loadings except as imposed by the gross weight CG limits of the helicopter.

With helicopter weights at or above 7400 pounds the following procedure should be applied:

Ballast the helicopter to the most aft weight empty line.

When flying with 2 crew members and 9 passengers add weight in the baggage compartment as required to maintain C.G. within the forward limits.

Examples:

With a ballasted weight empty of 7500 pounds, 20 pounds is required in the baggage compartment.

With a ballasted weight empty of 7700 pounds, 40 pounds is required in the baggage compartment.

WARNING

BAGGAGE COMPARTMENT WEIGHT MUST BE REMOVED FOR SINGLE PILOT OPERATION

BHT-412-FMS-18.2 AND 18.3

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

33108 — 33213
36001 — 36019
AND
33214 — 33999
36020 AND SUB

SUPPLEMENT FOR LOUDHAILER OPERATIONS

412-899-143

CERTIFIED
NOVEMBER 17, 1983

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2 or -3) when the 412-899-143 Loudhailer has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON

17 NOVEMBER 1983

REISSUED — 8 OCTOBER 1991

Additional copies of this publication may be obtained by contacting:
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P.O. Box 482
Fort Worth, Texas 76101

LOG OF REVISIONS

Original ....0 ..... November 17, 1988
Reissued ....0 .... May 8, 1989
Reissued ....0 . .... October 8, 1991

LOG OF PAGES

PAGE	REVISION NO.	PAGE	REVISION NO.
Title	0		
PN	0		
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APPROVED

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT WORTH, TEXAS 76193-0170

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The Loudhailer, when installed, will permit the helicopter crew to direct ground personnel while remaining airborne. The kit contains a speaker assembly, amplifier, switches, and the necessary hardware to complete the installation. Use of Loudhailer is controlled through pilot or copilot control panel. Optional configurations allow use of a remote (hand held) microphone and/or a tape recorder.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after Loudhailer is installed and ballast readjusted if necessary to return empty weight CG within allowable limits.

OPERATING LIMITATIONS

IFR operation is prohibited with Loudhailer installed.

Section 2

NORMAL PROCEDURES

BEFORE EXTERIOR CHECK

PA SYSTEM PWR switch — OFF.

EXTERIOR CHECK

FUSELAGE

Fuselage underside — Check security and wiring connections of Loudhailer.

LOUDHAILER OPERATION

WARNING

USE EXTREME CARE DURING GROUND OPERATION OF LOUDHAILER TO PREVENT INJURY TO PERSONNEL. GROUND SUPPORT PERSONNEL IN VICINITY OF HELICOPTER SHOULD WEAR PROTECTIVE HEARING DEVICES.

PA circuit breakers — Check in.

SIREN/MOM switch — OFF.

TRILL/MOM switch — OFF

PA SYSTEM GAIN control switch — OFF

NOTE

OFF position is the minimum gain preset at the remote amplifier located in the baggage compartment.

PA SYSTEM PWR switch — PWR.

Rotate control switch on communications control panel to HAIL/AUX.

PA mode select — As desired.

PA SYSTEM PWR switch — OFF, when Loudhailer operation is completed.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic manual.

Section 4

PERFORMANCE

No change from basic manual.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

33108 — 33213
36001 — 36019
AND
36020 — 36086
AND
36087 AND SUB

SUPPLEMENT FOR SOFT INTERIOR

412-705-510

CERTIFIED
28 MARCH 1985

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2, or -3) or Model 412EP Flight Manual (BHT-412-FM-4) when the 412-705-510 Soft interior has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON

REISSUE — 5 OCTOBER 1994

Additional copies of this publication may be obtained by contacting:
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LOG OF REVISIONS

Original	0	28 Mar 85
Revision	1	08 May 89
Reissue	0	08 Oct 91
Reissue	0	05 Oct 94

LOG OF PAGES

PAGE	REVISION NO.	PAGE	REVISION NO.
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NP	0		
A/B	0		
i/ii	0		
1/2	0		

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TEXAS 76193-0170

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The soft interior, when installed, will permit the helicopter to be flown with doors off/open with an airspeed limitation of 100 KIAS.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after Soft Interior is installed and ballast readjusted if necessary to return empty weight CG within allowable limits.

DOORS OPEN OR REMOVED

Remove both seat backs from outboard facing seats on each side of transmission pylon.

Flight operation is approved for the following alternative configurations during VFR conditions only.

Both crew doors removed.

Both sliding doors locked open or removed with both hinged panels installed or removed.

In all cases, door configuration shall be symmetrical for both sides of the fuselage.

NOTE

Opening or removing doors shifts helicopter center of gravity and reduces V_{NE}. Refer to Weight and Balance section in Manufacturer's Data and to Airspeed Limitations.

AIRSPEED LIMITATIONS

V_{NE} with doors open or removed is 100 KIAS.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR

WEATHER RADAR KIT

412-899-107

CERTIFIED
16 JUNE 1986

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-1, -2 or -3) or Model 412EP Flight Manual (BHT-412-FM-4) when the 412-899-107 Weather Radar kit has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement consult the basic Flight Manual.

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REISSUE — 19 MARCH 2003

NOTICE PAGE

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Fort Worth, Texas 76101-0482

LOG OF REVISIONS

Original	0	16 JUN 86	Reissue	0	05 OCT 94
Reissue	0	08 MAY 89	Reissue	0	19 MAR 03

LOG OF PAGES

PAGE	REVISION NO.	PAGE	REVISION NO.
Title	0	C/D	0
NP	0	i/ii	0
A/B	0	1 — 6	0

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages: dispose of superseded pages.

LOG OF FAA APPROVED REVISIONS

Original	0	18 JUN 86	Reissue	0	05 OCT 94
Reissue	0	08 MAY 89	Reissue	0	19 MAR 03

APPROVED: DATE: FEB 1 5 2003

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

INTRODUCTION

The primary purpose of the system is to detect storms along the flight path and give a visual indication in colors, of their intensity so a determination to avoid the storm can be made. The secondary purpose of the system is to interrogate and locate the surface-based transponder beacons. The system can be operated in one of three modes: radar, beacon, or both. In BOTH mode, the system performs both radar (weather or terrain) detection and beacon location simultaneously.

Section 1

LIMITATIONS

Contents of this supplement shall be used in conjunction with basic Flight Manual and Sperry-RCA Primus 500 Color Radar Pilot Handbook, for helicopters equipped with Weather Radar kit.

OPERATING LIMITATIONS

The minimum slant and horizontal range versus altitude at which ground targets can be mapped is shown in Figure 1.

Targets more than nineteen degrees (maximum depression) below helicopter centerline cannot be illuminated because of antenna tilt limitations (Figure 1).

Objects closer than 3/10 mile from radar antenna will not be detected because of system limitations.

The radar beam emitted is approximately seven and one-half degrees wide. The antenna may be raised or depressed fifteen degrees from helicopter centerline.

GROUND OPERATION

Radar system shall not be operated on ground when personnel are in the DANGER AREA (Figure 2).

Radar system shall not be operated within 100 feet of any fueling operation.

Radar system shall not be operated on ground anytime a large metallic object is forward of helicopter nose, within 60 degrees of centerline, and at a distance of less than 100 feet.

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after kit is installed and ballast added if necessary, to return empty weight CG within allowable limits.

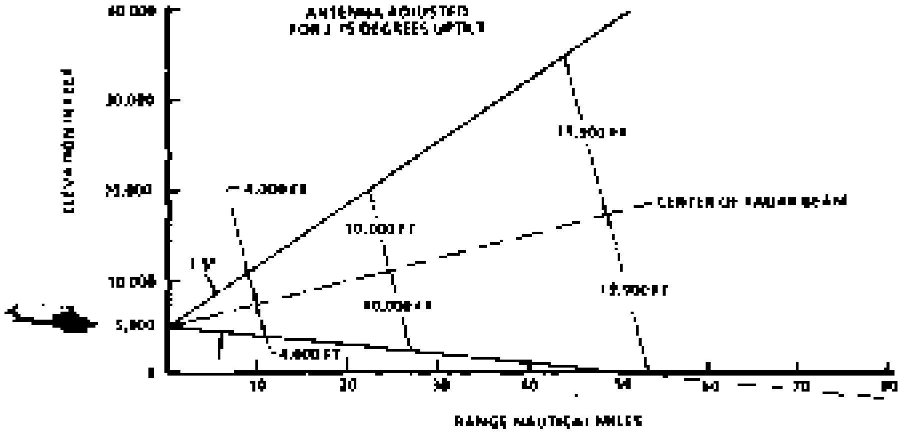

Figure 1. Radar Beam Illumination

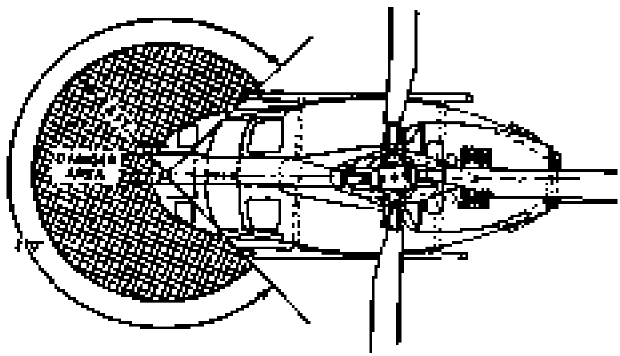

Figure 2. Personnel Danger Area

Section 2

NORMAL PROCEDURES

PREFLIGHT CHECK

1. NOSE AREA

Radome — Condition and cleanliness.

Antenna — Freedom of movement and security.

INTERIOR CHECK

INSTRUMENT PANEL

Radar OFF pushbutton - Depress.

RAD GAIN control — PRESET.

BCN GAIN control — PRESET.

Mode control selector switch — RAD.

RANGE control — TEST.

TILT control — + 15 degrees.

INT control — Midpoint.

BEFORE TAKEOFF CHECK

WARNING

DO NOT ALLOW PERSONNEL WITHIN 8 FEET AND 135 DEGREES EITHER SIDE OF THE HELICOPTER CENTERLINE DURING RADAR OPERATION (WX, CYC OR MAP PUSHBUTTONS DEPRESSED).

DO NOT OPERATE THE RADAR DURING REFUELING OPERATIONS OR WITHIN 100 FEET OF AIRCRAFT, VEHICLES, OR CONTAINERS CONTAINING FLAMMABLES OR EXPLOSIVES (WX, CYC OR MAP PUSHBUTTONS DEPRESSED).

CAUTION

DO NOT OPERATE THE RADAR IN THE DIRECTION OF LARGE METALLIC OBJECTS THAT ARE WITHIN 100 FEET OF THE HELICOPTER (WX, CYC OR MAP PUSHBUTTONS DEPRESSED).

NOTE

120 degrees scan is automatically selected when system is activated.

Radar pushbutton — Depress WX

NOTE

Radar requires approximately 60 seconds to warm-up.

SEC SCAN pushbutton — Press, check for 60 degrees antenna scan. Press SEC SCAN again, antenna should return to 120 degrees antenna scan.

Radar STBY pushbutton — Depress.

INFLIGHT OPERATION

WARNING

THE SYSTEM PERFORMS ONLY THE FUNCTIONS OF WEATHER DETECTION, GROUND MAPPING, OR BEACON LOCATION. IT SHOULD NOT BE USED OR RELIED UPON FOR PROXIMITY OR ANTI-COLLISION WARNING.

Radar pushbutton — Depress WX, CYC or MAP. (Verify correct test pattern.)

INT control — As desired.

RANGE control — As desired.

TILT control — As desired.

SEC SCAN — As desired.

BEFORE LANDING

Radar RANGE control — TEST (Verify correct test pattern.)

TILT control — + 15 degrees.

OFF pushbutton — Depress.

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

MODE FAILURE

Indication

1. Test display does not match test pattern.

Procedure:

1. OFF pushbutton — Depress.
2. INT control — Rotate clockwise.
3. WX, CYC or MAP pushbutton — Depress.

DISPLAY DOES NOT STABILIZE

Indications:

1. Display follows changes in helicopter attitude.
2. STAB OFF light illuminated.

Procedures:

1. CPLT ATT circuit breaker — Check in.
2. STAB pushbutton — Depress.

POWER FAILURE

Indication:

1. No display on indicator.

Procedure:

1. WEATHER RDR AC/DC circuit breakers — Check in.

Section 4

PERFORMANCE DATA

No change from basic manual.

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR GLOBAL NAVIGATION SYSTEM GNS-500A/S3, WITH NAV SWITCHING

(412-899-141)

CERTIFIED
JUNE 16, 1986

This supplement shall be attached to the Model 412 Flight Manual when the 412-899-141 Global Navigation System GNS-500A/S3 has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement consult the basic Flight Manual.

Bell Helicopter TEXTRON
[illegible]

[illegible]

16 JUNE 1986

REISSUED 8 MAY 1989

LOG OF REVISIONS

Original . . . . 0 . . . . 16 Jun 1988
Released . . . 0 . . . . 8 May 89

LOG OF PAGES

Page	Revision No.	Page	Revision No.
Title — A	0		
i/ii	0		
1 — 2	0		
3/4	0		

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION DIRECTORATE
AIRCRAFT CERTIFICATION SERVICE
DEPARTMENT OF TRANSPORTATION
SOUTHWEST REGION, FORT WORTH, TEXAS

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The GNS-500A/S3 is a very low frequency VLF/OMEGA radio navigation system that provides great circle point-to-point navigation on a worldwide basis. It also displays to the flight crew an assessment of its ability to navigate and will automatically revert to dead reckoning during periods of inadequate signal reception.

The GNS-500A/S3 consists of a control display unit (CDU) mounted on the pedestal, a computer receiver unit (CRU) and an optional equipment unit (OEU) located in the right avionics compartment.

A NAV-1/VLF switch is located on the pilot instrument panel next to the HSI. It is a combination 2 position pushbutton and annunciator. Pressing the pushbutton will couple the HSI to the NAV 1 receiver or GNS-500A/S3. The NAV-1 or VLF annunciator light will illuminate to identify the coupled mode. BRG PTR select switches are located on both the pilot and copilot instrument panels and allows selection of VLF or ADF bearing to be displayed on the pilot or copilot HSI.

Section 1

LIMITATIONS

OPERATIONAL LIMITATIONS

The following GNS Operators Manual must be immediately available to the flight crew whenever navigation is predicated on the use of the GNS-500A/S3.

Operator's manual Report 1080 dated 9-1-80 for the -3A Program and CRT/CDU.

Operator's Manual Report 1080 dated 1-19-81 for the -3B Program and CRT/CDU.

Provided the GNS-500A VLF/Omega navigation system is receiving usable signals from at least two Omega navigation stations, it is approved for:

VLF/IFR RNAV operation within the conterminous boundaries of the United States and Alaska in accordance with the EN ROUTE criteria of AC 90-45A or the criteria of AC 20-101B.

Operation as a means to update self-contained navigation systems, such as INS or Doppler, in accordance with AC 120-31A in the areas between Latitudes 86°N to 60°S, with the exception of the area above 45°N Latitude bounded by Longitudes 30°E and 120°N extending across the Asian Continent.

Operation as sole means of long range navigation in accordance with AC 120-37 in the areas between Latitudes 85°N to 55°S, with the exception of the area above 45°N Latitude bounded by Longitudes 30°E and 120°E extending across the Asian Continent.

During RNAV operation of the GNS-500A/S3, additional navigation equipment required for the specific type of operation must be installed and operable.

The GNS-500A/S3 position information must be checked for accuracy (reasonableness) prior to use as a means of navigation and under the following conditions:

Prior to each compulsory reporting point during IFR operation when not under radar surveillance or control.

At or prior to arrival at each enroute waypoint during IFR operation along approved RNAV routes.

Prior to requesting off-airway routing, and at hourly intervals thereafter during RNAV operation off of approved RNAV routes.

During period of Dead Reckoning, navigation shall not be predicated on the use of the GNS-500A/S3 for RNAV operation.

Following a period of Dead Reckoning, the helicopter position should be verified by visually sighting ground reference points and/or by using other navigation equipment such as VOR, DME, Tacan, NDB, or radar fix.

The GNS-500A/S3 may not be used for navigation in terminal areas or during departures from, or approaches, to, airports.

OPERATIONAL LIMITATIONS (Cont)

Enroute navigation shall not be predicated on the GNS-500A/53 during the period that DR is illuminated

Section 2

NORMAL PROCEDURES

PREFLIGHT CHECK

EXTERIOR CHECK

ENGINE AREA, AFT COMPARTMENTS AND TAILBOOM, RIGHT SIDE

Avionic compartment — Check

CDU and DEU · Condition and security

NOTE

Refer to GNS Operators Manual for systems checks and operation.

BEFORE TAKEOFF

NAV·1/VLF switch — As desired

NOTE

When the HSI is coupled to the VLF, the course set knob is disabled.

BRG PTR 1 switches — As desired.

NOTE

Selecting NAV 1, or NAV 2 will connect bearing pointer 1 to either the NAV 1 or NAV 2 receiver respectively.

BRG PTR 2 switches — As desired.

NOTE

Selecting VLF or ADF will connect bearing pointer 2 to either the VLF or ADF receiver respectively.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

GNS-500A/S3 MALFUNCTIONS

NOTE

Refer to GNS Operators Manual for system malfunction indications and procedures.

Warning flags

FAIL FLAG	FLAG LOCATION	FAULT CONDITION	CORRECTIVE ACTION
Navigation	HSI	Navigation information unavailable.	NAV-1/VLF switch — Press to change navigation modes.

Section 4

PERFORMANCE DATA

No Change

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

BHT 33108 — 33213
AND
36001 — 36019

SUPPLEMENT FOR CATEGORY A OPERATIONS FOR HELICOPTERS EQUIPPED WITH PT6T-3B OR PT6T-3BF ENGINES

VERTICAL TAKEOFF

CERTIFIED
6 JUNE 1986

This supplement shall be attached to Model 412 Flight Manual (BHT-412-FM-2) when operating in Category A conditions and PT6T-3B or PT6T-3BF engines are installed.

The information contained herein supplements information of the basic Flight Manual. For limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual or other applicable supplements.

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6 JUNE 1986
REVISION 3 — 24 NOVEMBER 1999

NOTICE PAGE

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Fort Worth, Texas 76101-0482

LOG OF REVISIONS

Original	0	6 JUN 86
Revision	1	11 NOV 89
Revision	2	23 APR 99
Revision	3	24 NOV 90

LOG OF PAGES

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NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages

LOG OF FAA APPROVED REVISIONS

Original ....0 ....6 JUN 85
Revision....................1 ....11 NOV 89
Revision....................2 ....23 APR 90
Revision....................3 ....24 NOV 99

APPROVED:

DATE: NOV 24 1999

for MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

INTRODUCTION

A "Category A" takeoff is defined as follows: operation of the helicopter in such a manner that if one engine fails at any time after the start of a takeoff, the helicopter can.

1. Return to, and safely stop on, the takeoff area; or

2. Continue the takeoff, climb out, and attain single engine forward flight.

A "Category A" landing is defined as follows: Operation of the helicopter in such a manner that if one engine fails at any point in the approach, the helicopter can —

1. Land, and stop safely on the intended landing area; or

2. Climb out from the point of failure and attain single engine forward flight.

This supplement is divided into limitations, procedures, and performance for a given set of conditions.

Section 1

OPERATING LIMITATIONS

ATTENTION

Mandatory compliance with the operating limitations in Section 1 of this Manual is required by law.

WEIGHT LIMITATIONS

Maximum Gross Weight 10,500 Pounds (4762.7 Kilograms)

TAKEOFF AND LANDING WEIGHT vs ALTITUDE LIMITATIONS

Maximum Takeoff and Landing Weight - Varies with temperature and altitude - See Gross Weight Limits for Takeoff and Landing Chart.

NOTE.

The minimum heliport width and length are 72 feet (22 meters) and 150 feet (46 meters) respectively for Category "A" vertical operations from ground level or elevated heliports.

ALTITUDE LIMIT FOR TAKE-OFF AND LANDING

The altitude limit for takeoff and landing is 2500 feet pressure altitude.

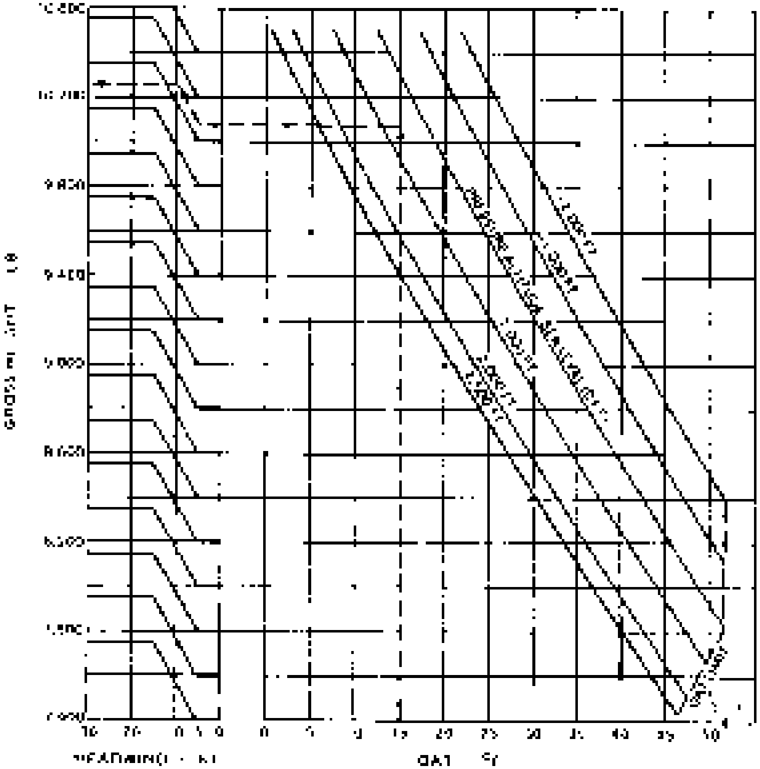
ALTIMETER (VERTICAL T. O. ALTIMETER)

For vertical takeoff procedures the Vertical takeoff altimeter must be set, 100% N2, RPM-flat pitch, doors and windows closed, heater and vent off.

NOTE

Doors and windows remain closed, heater off, vent off until CDP is reached. This is required to prevent possible errors in the Vertical takeoff altimeter.

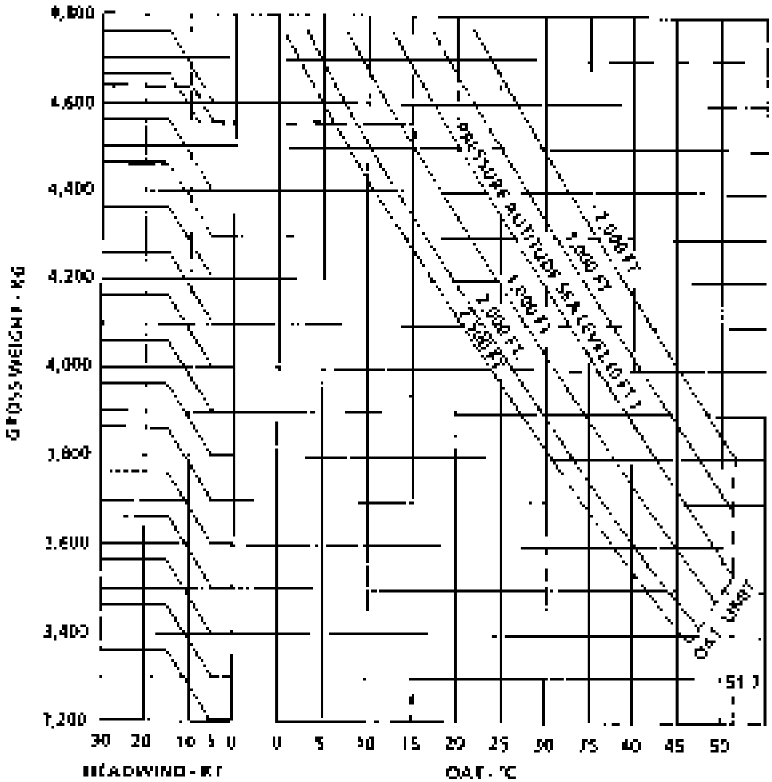
VERTICAL OPERATIONS



NOTE SEE
HEADWIND
COMPONENT
CHART SECTION 4

GROSS WEIGHT LIMITS FOR TAKEOFF AND LANDING
(ENGLISH)

VERTICAL OPERATIONS



NOTE: SEE HEADWIND COMPONENT CHART, SECTION 4

GROSS WEIGHT LIMITS FOR TAKEOFF AND LANDING (METRIC)

412090-13

AIRSPEED LIMITATIONS

No change to basic envelope. For takeoff and landing airspeed refer to Performance Section.

AMBIENT AIR TEMPERATURE — OPERATING LIMITATIONS

See Performance Section in this Supplement.

CROSSWIND LIMITATIONS

The cross wind limit is that combination of wind velocity and direction where the cross wind component exceeds 15 knots. Refer to "Headwind Component Chart" in Section 4.

TYPE OF OPERATION

Category A operation is approved for day/night VMC, non-icing conditions. Night takeoff and landing may be accomplished with adequate lighting.

FLIGHT CREW

The minimum crew for vertical type takeoff and vertical type landing operations consists of two pilots.

CONFIGURATION

Skid landing gear only. All doors on.

Pratt and Whitney PT6T-3B or PT6T-3BF engines shall be installed.

CENTER OF GRAVITY LIMITS — FOR VERTICAL OPERATIONS ONLY

Center of gravity limits are from Station 130.0 (3302.0) to Station 142.0 (3606.8). The center of gravity operational range is variable, depending upon gross weight and shall be computed from the weight and balance data.

NOTE

Station 0 (datum) is located 20 inches (508.0 millimeters) aft of the most forward point of the cabin nose.

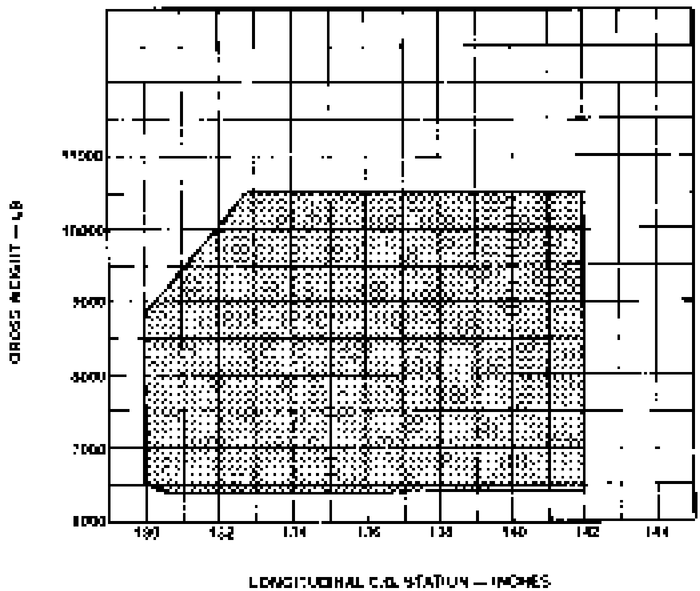
Maximum asymmetric center of gravity limits are 3.5 inches (88.9 millimeters) to the left and right from the fuselage center line.

GENERATOR AMMETER

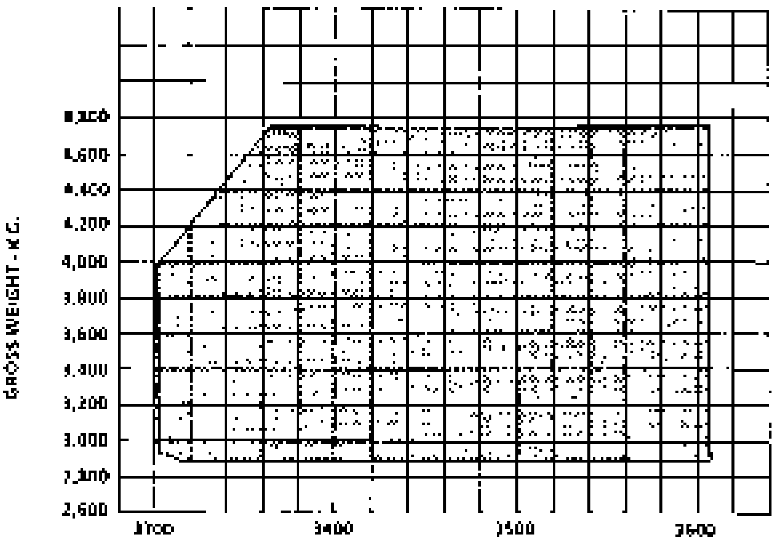
Maximum = 150 Amps per Ammeter.

REQUIRED EQUIPMENT

This supplement requires the installation of an approved copilots instrument kit, an approved dual control kit, the 212-706-029 altimeter, and one operative SCAS.



CENTER OF GRAVITY LIMITS
(ENGLISH)



CENTER OF GRAVITY LIMITS
(METRIC)

412099-14

CENTER OF GRAVITY LIMITS
(METRIC)

Section 2
NORMAL PROCEDURES

Power Assurance Check - Refer to Section 4 of this Supplement

VERTICAL TYPE TAKEOFF

NOTE

See Vertical Takeoff Profile, Vertical Takeoff Figure 1, Vertical Takeoff Figure 2 and Vertical Takeoff Figure 3

NOTE

Takeoff will be initiated with the helicopter positioned such that the takeoff index marks are directly opposite the crew doors and the helicopter centered on the heliport. This will assure that the tail rotor is within the confines of the heliport.

Triple Tachometer - 100%

Collective - Flat Pitch (full down).

Doors and Windows - Closed.

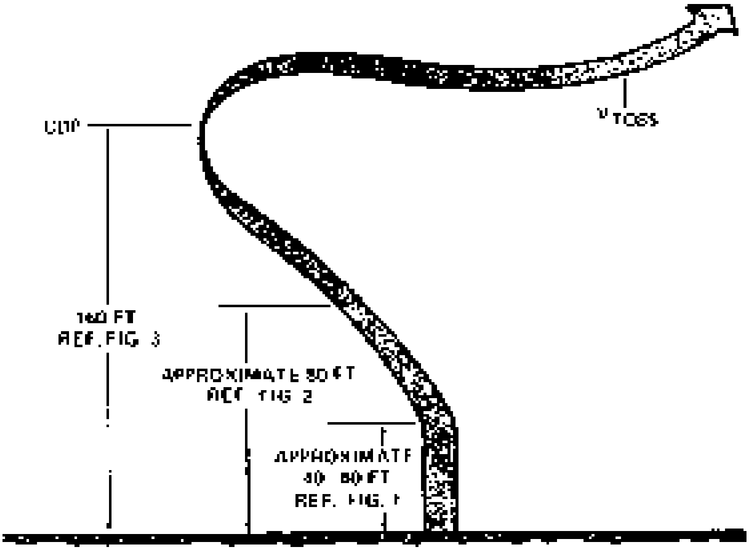
Heater and Vent Blower - Off During Takeoff

Vertical Takeoff Altimeter - Set to zero.

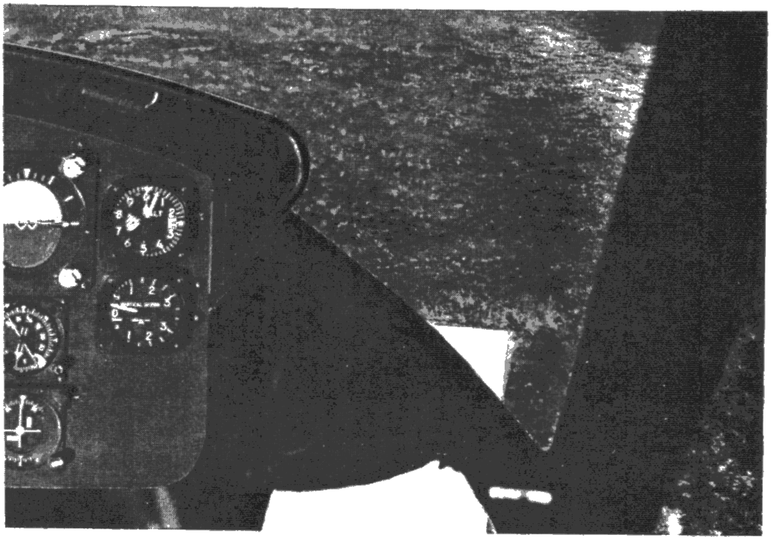
Flight Altimeter - Set to correct station pressure or elevation.

In Hover at Two to Four Feet - Note Transmission Torque.

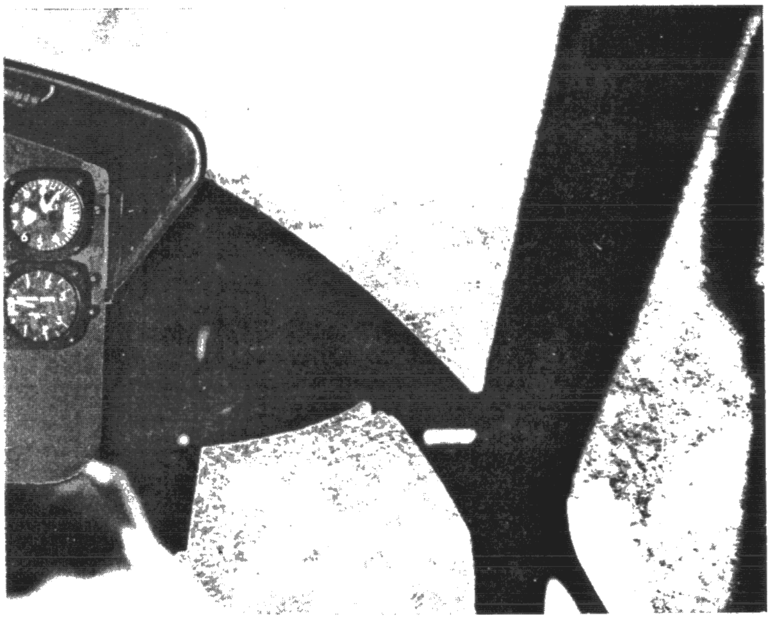
Collective - Apply smoothly to obtain a steady rate of climb along the takeoff flight path using a transmission torque not to exceed an additional 15% torque in excess of the value noted in hover.



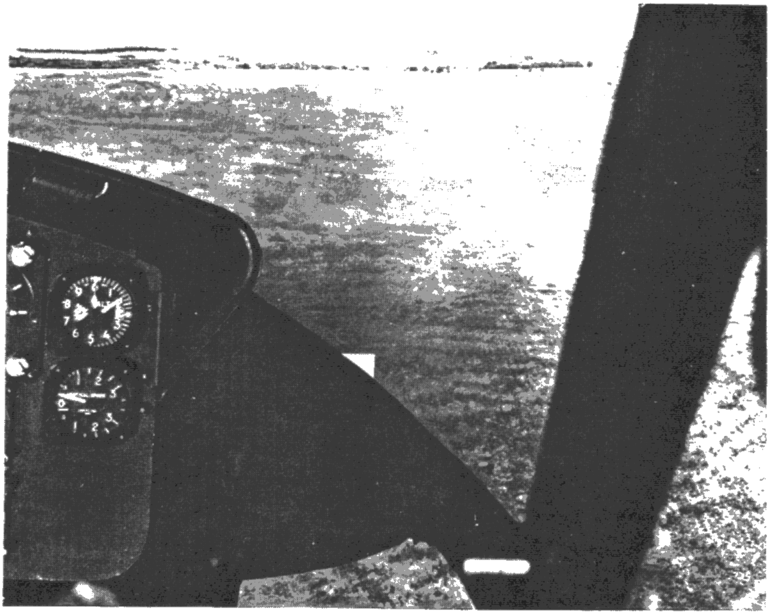
VERTICAL TAKEOFF PROFILE



VERTICAL TAKEOFF
FIGURE 1



VERTICAL TAKEOFF
FIGURE 2



VERTICAL TAKEOFF
FIGURE 3

The pilot will control the flight path by visual reference to the far right corner of the heliport and the takeoff index marks. As altitude above the heliport is increased to approximately 40 to 60 feet, it will be necessary to transition into rearward flight at a very slow speed in order to maintain visual reference with the far right corner of the heliport (see Vertical Takeoff Figure 1). The takeoff will be continued by visual reference to the far right corner of the heliport (see Vertical Takeoff Figure 2) until the critical decision point (CDP) is reached (see Vertical Takeoff Figure 3).

NOTE

Visual reference with the heliport is defined as that position where the far right corner of the heliport is aligned approximately halfway between the edge of the instrument panel and the lower corner of the windshield. The amount of heliport area visible to the pilot will vary with height above the ground. At all points in the takeoff maintain visual contact with forward right hand corner of the heliport boundary.

Copilot will call out the following altitudes from the vertical takeoff altimeter during takeoff:

a. At 60 feet indicated: "60 feet"

b. At 80 feet indicated: "80 feet"

c. At 100 feet indicated: "100 feet"

d. At 120 feet indicated: "120 feet"

e. At 140 feet indicated: "140 feet"

f. At 160 feet indicated: "CDP, ROTATE"

At the indicated Critical Decision Point (CDP), translate into forward flight to obtain takeoff safety speed (VTOSS) of 30 knots plus wind (65 knots maximum). Apply power of not less than 73% torque and climb to 200 feet above takeoff point at VTOSS. Accelerate to best rate of climb airspeed (65 knots) and climb en route. Copilot should monitor power and systems parameters.

VERTICAL TYPE LANDING

NOTE

See Vertical Landing Profile, Vertical Landing Figure 1 and Vertical Landing Figure 2

A vertical type landing is a landing that is initiated from the Landing Decision Point (LDP) which is 30 knots indicated airspeed plus reported wind velocity and at an altitude of 200 feet above the level of the heliport surface.

Flight Controls - Adjust frictions to desired levels.

Governor Switches - Automatic

Twist Grip N1 Controls - Full Open - Throttle Frictions adjusted to desired level.

Engine RPM - 100% N2.

Force Trim - As desired

Flight Altimeter - Set to nearest reporting station

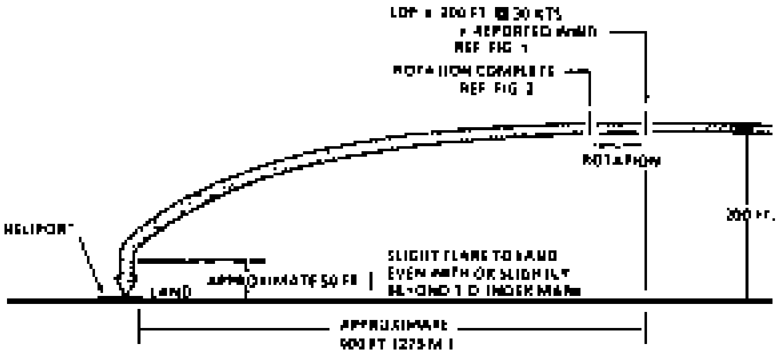
From an airspeed of 30 knots indicated plus wind speed and a height of 200 feet, the pilot will initiate the approach when the LDP is reached. The LDP is reached when the pilot obtains the correct sight picture of the heliport (see Vertical Landing Figure 1). Pilot calls "LDP" and initiates the approach.

The approach is initiated by raising the nose of the aircraft to obtain the correct approach sight picture (see Vertical Landing Figure 2) and simultaneously lowering the collective to establish the approach angle.

During the descent, visual contact is maintained with the forward right hand corner of the heliport (see Vertical Landing Figure 1 and Vertical Landing Figure 2).

NOTE

The approach angle is such that the tail rotor will clear a 25-foot (7.6-meter) obstacle on the approach end of the heliport.



VERTICAL LANDING PROFILE

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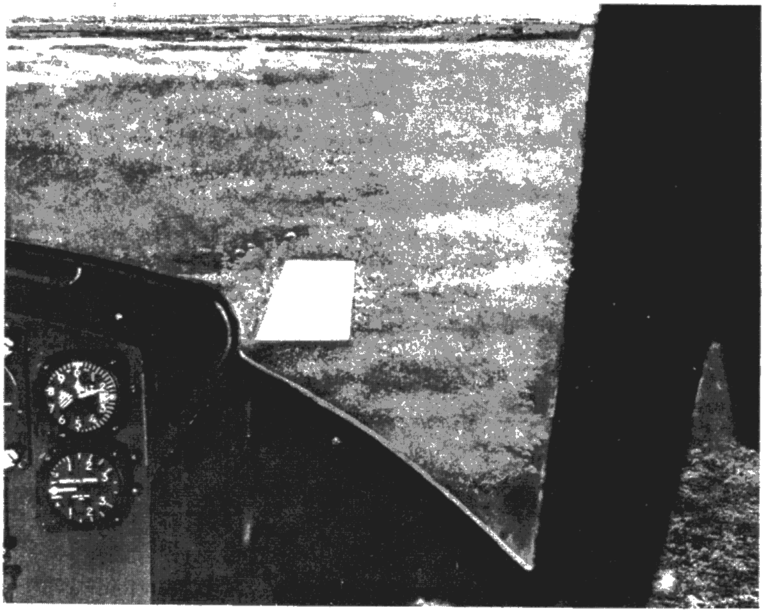
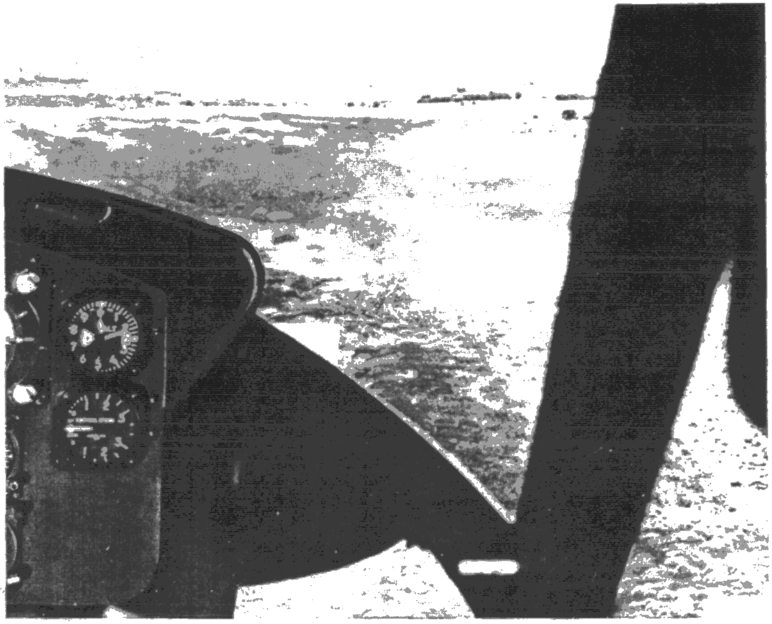


VERTICAL LANDING
FIGURE 1



VERTICAL LANDING
FIGURE 2

As the helicopter crosses the approach end of the heliport with the required tail rotor obstacle clearance, a slight flare is initiated so that the helicopter is brought to a landing with the pilot's door even with or slightly forward of the takeoff mark on the heliport.

NOTE

The copilot will call out airspeed and altitude information prior to LDP (i.e., "Airspeed High" or "Airspeed Low," and "Altitude High" or "Altitude Low") and rotor rpm, torque, and Inter Turbine Temperature (ITT) during the approach from the LDP. In the event of an engine failure after LDP, the pilot will adjust the power as soon as possible to obtain the maximum single engine power available during the descent.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

PRIOR TO CDP

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
C BOX OIL PRESS	Combining gearbox oil pressure below normal.	Land
C BOX OIL TEMP	Combining gearbox oil temperature above limit.	Land
XMSN OIL TEMP	Transmission oil temperature is above limit.	Land
XMSN OIL PRESS	Transmission oil pressure is low.	Land
BAGGAGE FIRE	Smoke in baggage compartment.	Land
FIRE 1 PULL	Fire indication in No. 1 Engine compartment.	Land, then pull No. 1 handle, select **MAIN** bottle, then **RESERVE** if necessary, close No. 1 twist grip.
FIRE 2 PULL	Fire indication in No. 2 engine compartment.	Land, then pull No. 2 handle, select MAIN bottle, then RESERVE if necessary, close No. 2 twist grip

PRIOR TO CDP(Cont)

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
ENG 1 OUT	No. 1 Engine N1 RPM abnormally low.	See Engine Out Procedure
ENG 2 OUT	No. 2 Engine N1 RPM abnormally low.	See Engine Out Procedure

AFTER CDP

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
C BOX OIL PRESS	Combining gearbox oil pressure below normal.	Accelerate to VTOSS and land as soon as practicable.
C BOX OIL TEMP	Combining gearbox oil temperature above limit	Accelerate to VTOSS and land as soon as practicable
XMSN OIL TEMP	Transmission oil Temperature is above limit	Accelerate to VTOSS and land as soon as practicable
XMSN OIL PRESS	Transmission oil pressure is low.	Accelerate to VTOSS and land as soon as practicable
BAGGAGE FIRE	Smoke in baggage compartment	Accelerate to VTOSS and land as soon as practicable
FIRE 1 PULL	Fire indication in No. 1 Engine compartment.	Accelerate to VTOSS and then pull No. 1 handle, select MAIN bottle, then RESERVE if necessary, close No. 1 twist grip.

AFTER CDP(Cont)

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
FIRE 2 PULL	Fire indication in No. 2 Engine compartment	Accelerate to VTOSS and then pull No. 2 handle, select MAIN bottle, then RESERVE if necessary, close No. 2 twist grip.
ENG 1 OUT	No. 1 Engine N1 RPM abnormally low.	See Engine Out Procedure.
ENG 2 OUT	No. 2 Engine N1 RPM abnormally low	See Engine Out Procedure.

PRIOR TO LDP

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
C BOX OIL PRESS	Combining gearbox oil pressure below normal.	Reduce power. Land as soon as practicable.
C BOX OIL TEMP	Combining gearbox oil temperature above limit.	Reduce power. Observe temperature within limits. If not land as soon as possible
XMSN OIL TEMP	Transmission oil temperature is above limit	Reduce power. Observe temperature within limits. If not land as soon as possible.
XMSN OIL PRESS	Transmission oil pressure is low.	Reduce power. Land as soon as possible
BAGGAGE FIRE	Smoke in baggage compartment.	Reduce power to minimum required. Land as soon as possible, and inspect tail boom area for damage.

PRIOR TO LDP(Cont)

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
FIRE 1 PULL	Fire indication in No. 1 Engine compartment	Pull No. 1 handle, select MAIN bottle, then RESERVE if necessary, close No. 1 twist grip
FIRE 2 PULL	Fire indication in No. 2 Engine compartment	Pull No. 2 handle, select MAIN bottle, then RESERVE if necessary, close No. 2 twist grip.
ENG 1 OUT	No. 1 Engine N1 RPM abnormally low.	See Engine Out Procedure
ENG 2 OUT	No. 2 Engine N1 RPM abnormally low.	See Engine Out Procedure

AFTER LDP

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
C BOX OIL PRESS	Combining gearbox oil pressure below normal.	Land
C BOX OIL TEMP	Combining gearbox oil temperature above limit.	Land.
XMSN OIL TEMP	Transmission oil temperature is above limit	Land
XMSN OIL PRESS	Transmission oil pressure is low.	Land.
BAGGAGE FIRE	Smoke in baggage compartment.	Land.

AFTER LDP (Cont)

SEGMENT WORDING	FAULT CONDITION	CORRECTIVE ACTION
FIRE 1 PULL	Fire indication in No. 1 Engine compartment.	Land, then pull No. 1 handle, select MAIN bottle, then RESERVE if necessary, close No. 1 twist grip.
FIRE 2 PULL	Fire indication in No. 2 Engine compartment.	Land, then pull No. 2 handle, select MAIN bottle, then RESERVE if necessary, close No. 2 twist grip.
ENG 1 OUT	No. 1 Engine N1 RPM abnormally low	See Engine Out Procedure.
ENG 2 OUT	No. 2 Engine N1 RPM abnormally low	See Engine Out Procedure.

ENGINE OUT PROCEDURE

NOTE

After an engine failure, the power on the remaining engine shall be increased to the maximum permissible power limits (2.5 minute power rating for helicopters equipped with PT6T-3B engines or 30 minute power rating for helicopters equipped with PT6T-3BF engines). The rotor speed shall be maintained within limits.

During Takeoff Prior to Critical Decision Point (CDP)

An engine failure prior to reaching CDP (160 feet above the heliport) will necessitate a landing back to the heliport. The landing is accomplished by descending back toward the takeoff surface, while maintaining 97% rotor speed. While maintaining a level attitude, increase collective pitch as necessary to cushion the landing. Perform normal shutdown procedure.

During Takeoff After Critical Decision Point (CDP)

If an engine fails during or following CDP, the helicopter shall be accelerated to takeoff safety speed (VTOSS) of 30 knots plus wind. When accelerating to VTOSS, rotor speed shall be maintained within limits. Accomplish climbout at an airspeed of 40 knots plus headwind. Use the 2.5 minute power rating (for helicopters equipped with PT6T-3B engines) or the 30 minute power rating (for helicopters equipped with PT6T-3BF engines) to 200 feet above the heliport. Then accelerate to the best rate of climb speed (65 knots). The copilot should monitor power. Shut down affected engine:

Twist Grip - Rotate to full closed.

Fuel - OFF

Boost Pump - Off

Crossfeed - Override Close

Interconnect Valve - Open

During Landing Prior to Landing Decision Point (LDP)

An emergency condition during landing prior to the LDP (200 feet above the heliport), the helicopter should be accelerated to best rate-of-climb speed for climbout, depending on the terrain and obstacles. Shut down affected engine:

Twist Grip - Rotate to full closed

Fuel - Off

Boost Pump - Off

Crossfeed - Override Close

Interconnect Valve - Open

OR, proceed to the LDP and use the procedure below.

During Landing at the Landing Decision Point (LDP)

Maintain rotor speed within limits and accomplish a climbout or accelerate to the best rate-of-climb speed of 65 knots, depending on the terrain and obstacles.

OR, proceed to a landing while using the procedure below.

During Landing After the Landing Decision Point (LDP)

If an emergency occurs after LDP, the helicopter is committed to land. The landing is accomplished using the 2.5 minute power rating (for helicopters equipped with PT6T-3B engines) or the 30 minute power rating (for helicopters equipped with PT6T-3BF engines). The rotor speed shall be maintained within limits. Visual contact with the sight picture of the two sides of the heliport shall be maintained. After landing, perform normal shutdown procedures.

MALFUNCTION PROCEDURES

Section 3   No change

Section 4

PERFORMANCE DATA

The performance data presented in this section are based on the engine manufacturer's minimum specification power for the PT6T-3B or PT6T-3BF engines with installation losses.

An engine power assurance check chart is presented which is also based on a minimum specification engine with installation losses and proper rigging of engine controls.

If engine performance does not meet that shown in the "ENGINE POWER ASSURANCE CHART" steps should be taken to ascertain the causes of engine power loss.

The minimum heliport size, using the vertical takeoff and landing procedure, is 72 feet x 150 feet (22 meters x 46 meters). A chart is presented showing the MINIMUM HELIPORT SIZE AND AN APPROVED HELIPORT MARKING. The heliport marking shown was used during the type tests.

The gross weight limits for takeoff and landing varies with the component of head wind directly opposed to the flight path. The Headwind Component Chart presents a method of obtaining the headwind component for use on the Gross Weight Limits for Takeoff and Landing Chart, Section 1. The maximum cross wind demonstrated was 15 Knots and is shown as a limit on the Headwind Component Chart.

Interpolation of all data is allowable but extrapolation is not permitted.

HOVER PERFORMANCE

The Hover Performance chart is presented to show the percent torque required to hover in-ground-effect (IGE) at a four-foot (1.2 meters) skid height, and the percent torque available as shown in the following example:

Torque Required to Hover

1. Determine Ambient Air Temperature (OAT) — 20°C
2. Determine Pressure Altitude (H_P) — 1000 ft.
3. Determine Gross Weight (G.W.) — 8500 lb (3857.6 kg)
4. Enter chart at OAT, proceed vertically upward to H_P, proceed horizontally to the right to G.W., then proceed vertically downward to the TORQUEMETER scale and read percent torque required to hover. (Transmission Torque) — 59.5%

Torque Available (Twin Engine)

1. Enter chart at OAT, proceed vertically upward to H_P, proceed horizontally to the right to the TAKEOFF POWER AVAILABLE curves, then proceed vertically downward to the TORQUEMETER scale and read percent torque available. — 100%

TAKEOFF PERFORMANCE

Takeoff Safety Speed (Vtoss)

The takeoff safety speed varies with wind: Vtoss = 30 kt. IAS + wind.

Altimeter Calibration

Takeoff performance is based on the altimeter calibration shown in the Takeoff Altimeter Calibration Chart.

Takeoff Distance

Vertical Takeoff Distance — 150 ft. (46 m)

Using the vertical takeoff procedure, the takeoff distance measured from the aft end of the heliport when in takeoff position, is the maximum distance needed to land after a rejected takeoff (one engine failure prior to or at critical decision point for the vertical takeoff procedure). This takeoff distance applies to all conditions of GROSS WEIGHT, PRESSURE ALTITUDE AND AMBIENT AIR TEMPERATURE when operating within allowable limits.

Takeoff Flight Path, Obstacle Clearance

The takeoff flight path begins at the end of the takeoff distance, at 35 feet above the takeoff surface and Vtoss. Two charts are involved in the determination of the takeoff flight path and are titled as below.

Takeoff Flight Path, Climb Index

Takeoff Flight Path, Obstacle Clearance

These charts are used as in the following example

		Example
1.	Determine Ambient Air Temperature	15°C
2.	Determine Pressure Altitude	Sea Level (0 ft)
3.	Determine VTOSS (30 kt. IAS + Headwind Component of 10 Knots)	40 kts.
4.	Determine Actual Gross Weight	8300 lbs (3765 kg)

5. Determine height above and distance from the Takeoff Surface of known obstacles along the Flight Path.

6. Check Maximum Allowable Gross Weight — 10,500 lb (4762.5 kg)

   If actual gross weight is less than allowable, proceed.

7. Enter Takeoff Flight Path, Climb Index Chart at Ambient Air Temperature.

8. Move Vertically up to Pressure Altitude.

9. Move Horizontally Right to Actual Gross Weight for Takeoff.

10. Move Vertically Down to VTOSS Correction Curves.

11. Move Diagonally, Parallel to VTOSS Correction Curves to VTOSS.

12. Move Vertically Down to Climb Index Scale and Read Climb Index. — 46.0

13. On the TAKEOFF FLIGHT PATH OBSTACLE CLEARANCE CHART locate CLIMB INDEX point, which has just been determined, at a height above takeoff surface of 200 feet. A line from this point through 35 foot height at 0 Horizontal Distance represents the minimum height flight path from the end of the takeoff distance and should be compared with the height of known obstacles along the flight path for obstacle clearance.

CLIMB PERFORMANCE

Single Engine at Minimum Vtoss (30 kts IAS)

Single engine rate of climb at minimum VTOSS (30 IAS) is shown for 7000, 8000, 9000, 10,000, and 10,500 pounds gross weight. In addition, chart is shown for 3200, 3600, 4000, 4400, and 4762.7 kilograms gross weight. These curves are for general information only, since takeoff flight path chart is presented for flight path determination.

Single Engine at Best Rate of Climb Speed (65 kts Vcal)

Single engine rate of climb at best rate of climb speed (65 kts Vcal) is unchanged from the basic Rotorcraft Flight Manual Data (Cat. B).

LANDING PERFORMANCE

Landing Distance, Vertical Procedure

Actual Landing Distance . . . . 110 ft. (33.5 m)
Scheduled Landing Distance . . . . 138 ft. (42.0 m)

Using the vertical procedure, the landing distance is the actual distance needed for the tail rotor to clear a 25 foot (8 meter) height and come to a stop on the landing surface with only one engine operating.

The actual landing distance is 110 feet (33.5 meters). For scheduled landings the landing distance is 138 feet (42.0 meters). These landing distances apply in all conditions of GROSS WEIGHT, PRESSURE ALTITUDE, AND AMBIENT TEMPERATURE when operating within allowable limits.

MODEL 412
POWER ASSURANCE CHECK (HOVER)
PT6T-3B ENGINE

HEATER/ECU — OFF

THROTTLES:
TEST ENGINE — FULL OPEN FRICTIONED
OTHER ENGINE — FLIGHT IDLE

NII RPM — 97%

COLLECTIVE PITCH — INCREASE UNTIL LIGHT ON SKIDS OR HOVERING. DO NOT EXCEED 810°C ITT OR 100.8% NI RPM.

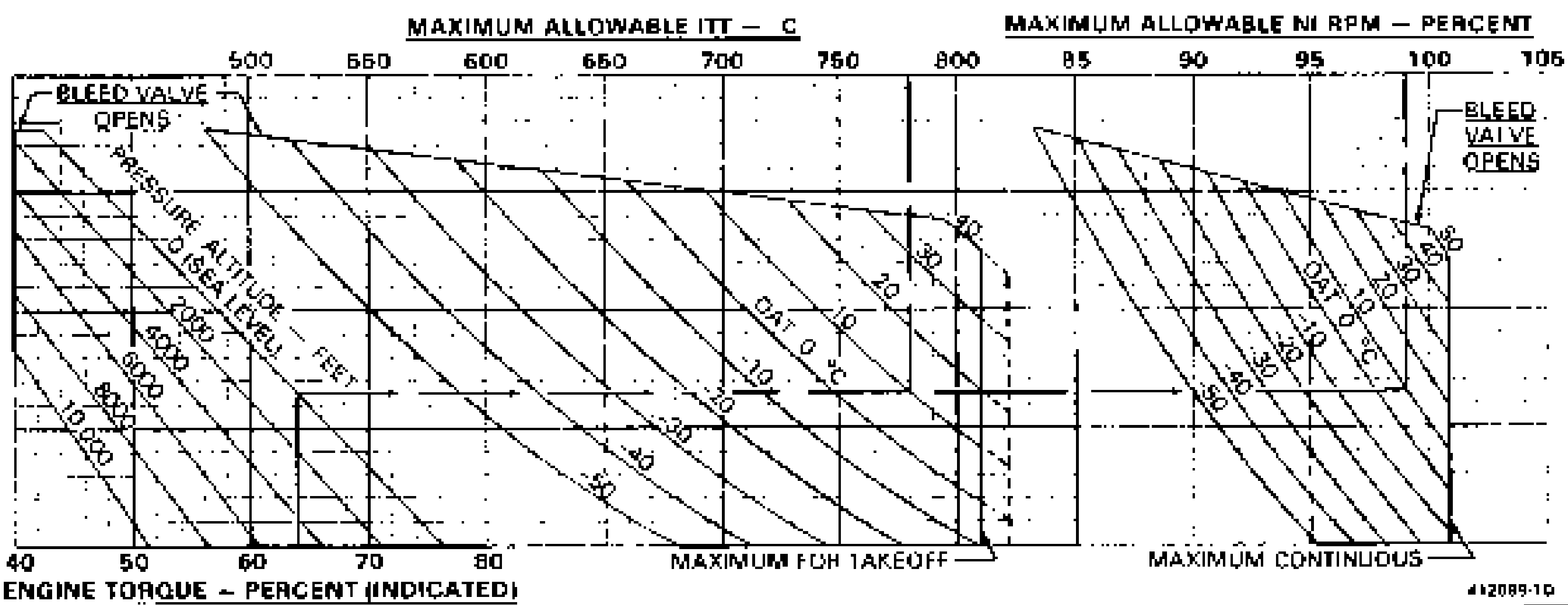
STABILIZE POWER ONE MINUTE, THEN RECORD PRESSURE ALTITUDE, OAT, ENGINE TORQUE, ITT, AND NI RPM.

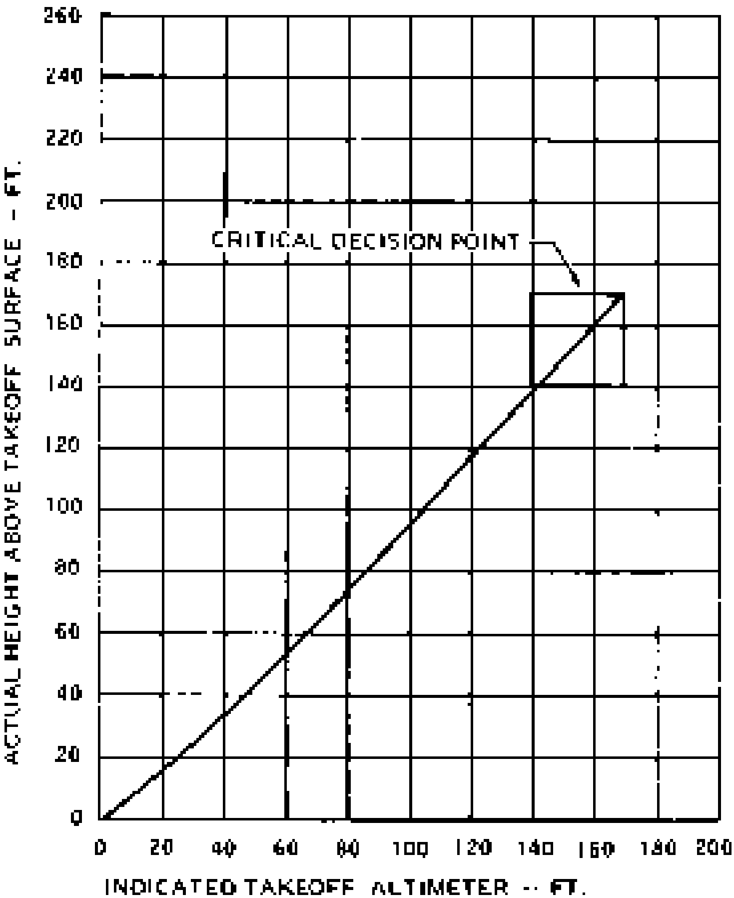
ENTER CHART AT INDICATED ENGINE TORQUE. MOVE UP TO INTERSECT PRESSURE ALTITUDE. PROCEED TO THE RIGHT TO INTERSECT OUTSIDE AIR TEMPERATURE, THEN MOVE UP TO READ VALUES FOR MAXIMUM ALLOWABLE ITT AND NI RPM.

IF INDICATED ITT OR NI RPM EXCEEDS MAX ALLOWABLE, REPEAT CHECK, STABILIZING POWER FOUR MINUTES.

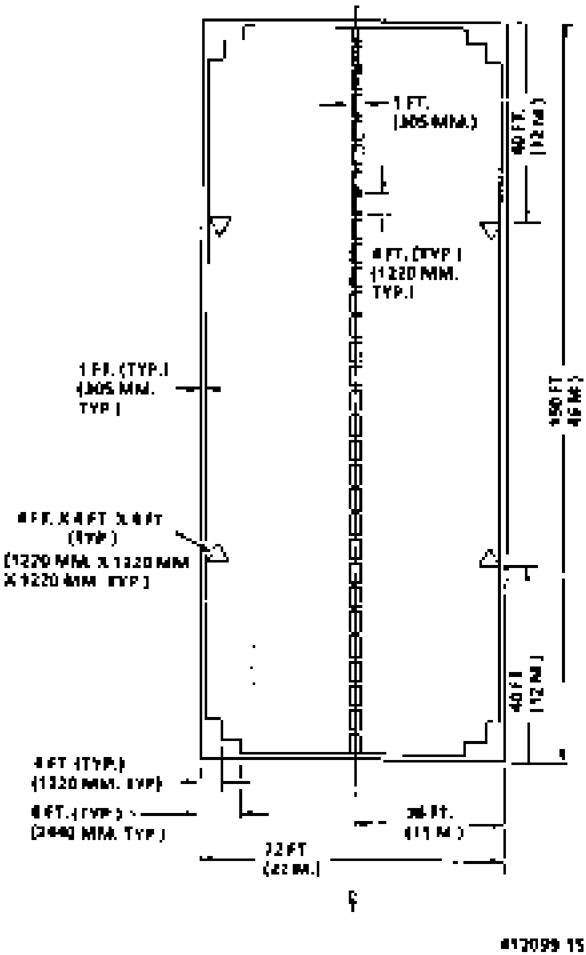
REPEAT CHECK USING OTHER ENGINE.

IF EITHER ENGINE EXCEEDS ALLOWABLE ITT OR NI RPM AFTER STABILIZING FOUR MINUTES, PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. CAUSE SHOULD BE DETERMINED AS SOON AS PRACTICAL.

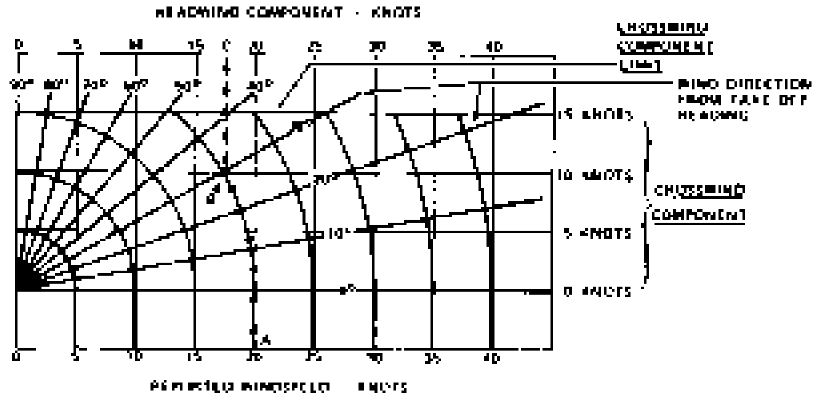




TAKEOFF ALTIMETER CALIBRATION



MINIMUM HELIPORT SIZE AND
APPROVED HELIPORT MARKING



EXAMPLE

1	TAKE OFF HEADING	170°
2	REPORTED WIND DIRECTION	200°
3	WIND DIRECTION, DEGREES FROM TAKE OFF HEADING	30°
4	REPORTED WIND SPEED	20 KNOTS
5	ENTER CHART AT REPORTED WIND SPEED, POINT A	
6	PROCEED UPWARD, FOLLOWING THE SHAPE OF THE CURVED LINES, TO WIND DIRECTION DEGREES FROM TAKE OFF HEADING, POINT B	
7	PROCEED VERTICALLY UPWARD TO THE HEADWIND COMPONENT SCALE AND READ HEADWIND COMPONENT	17.5 KNOTS

HEADWIND COMPONENT CHART

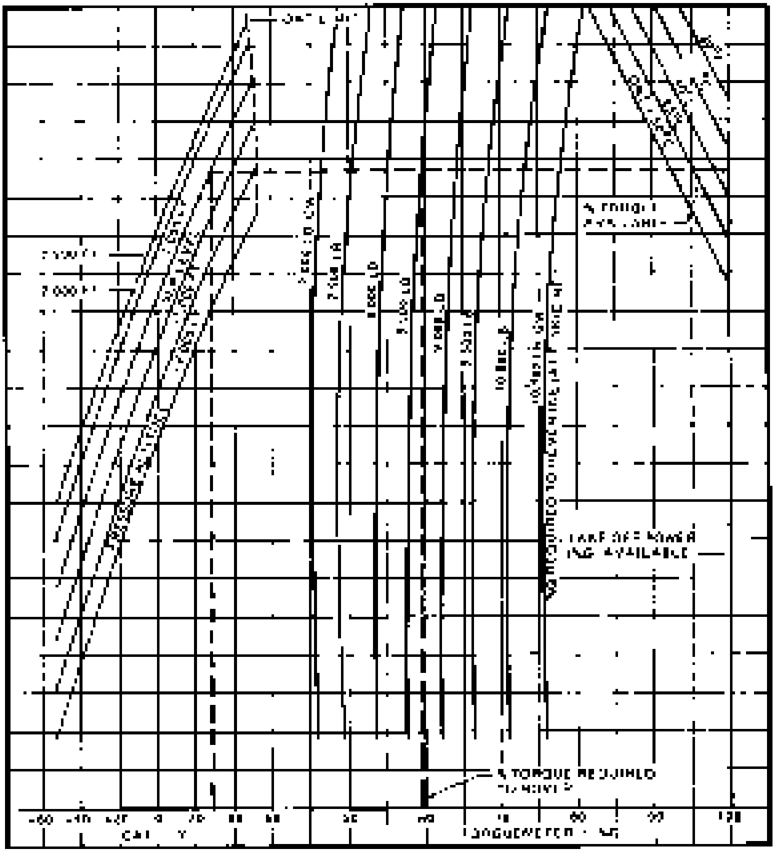
HOVER PERFORMANCE

(ENGLISH)

(IGE (4 FT. SKID HT.) POWER REQUIRED TO HOVER AND TAKE-OFF POWER AVAILABLE

ENGINE RPM 100%
GENERATOR 150 AMPS

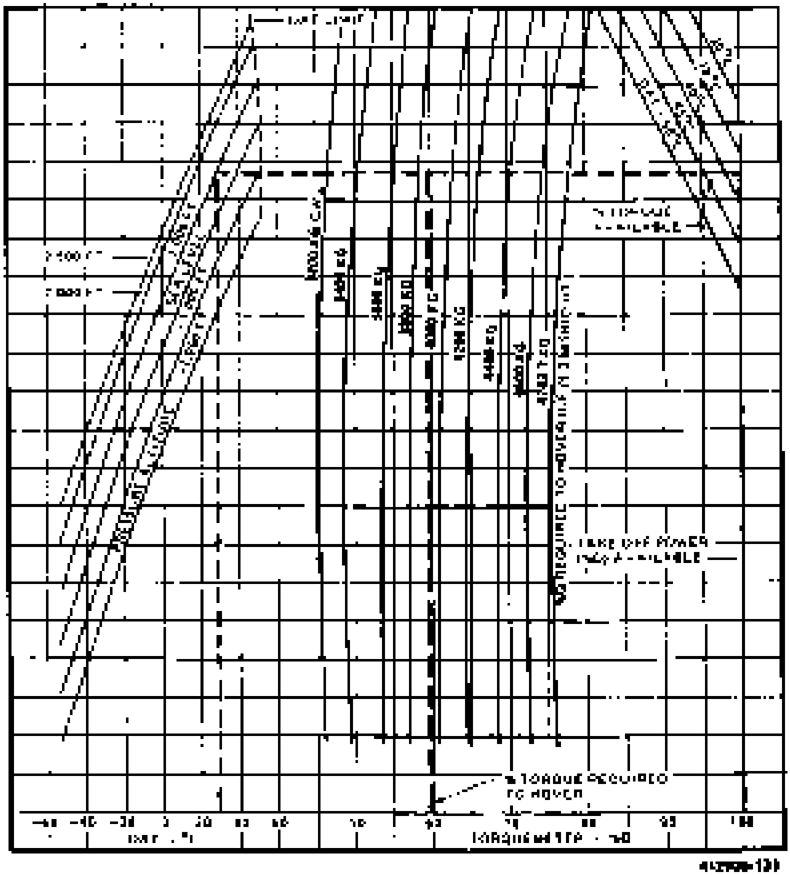
HEATER OFF
NO WIND



HOVER PERFORMANCE

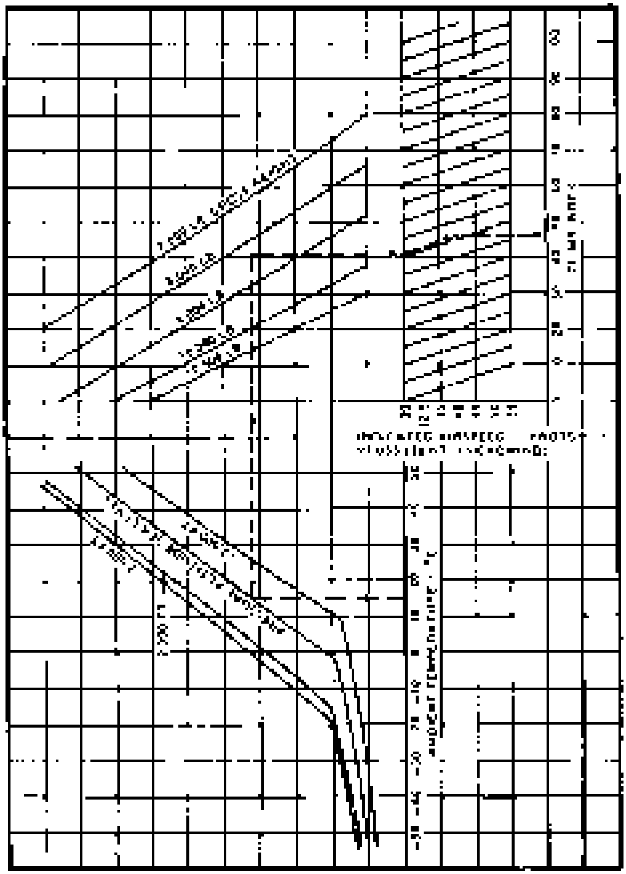
IGE (1.2 M SKID HT) POWER REQUIRED TO HOVER AND TAKE-OFF POWER AVAILABLE

ENGINE RPM 100%
GENERATOR 150 AMPS
HEATER OFF
NO WIND



PT6T-3B ENGINE TAKEOFF FLIGHT PATH (ENGLISH) CLIMB INDEX

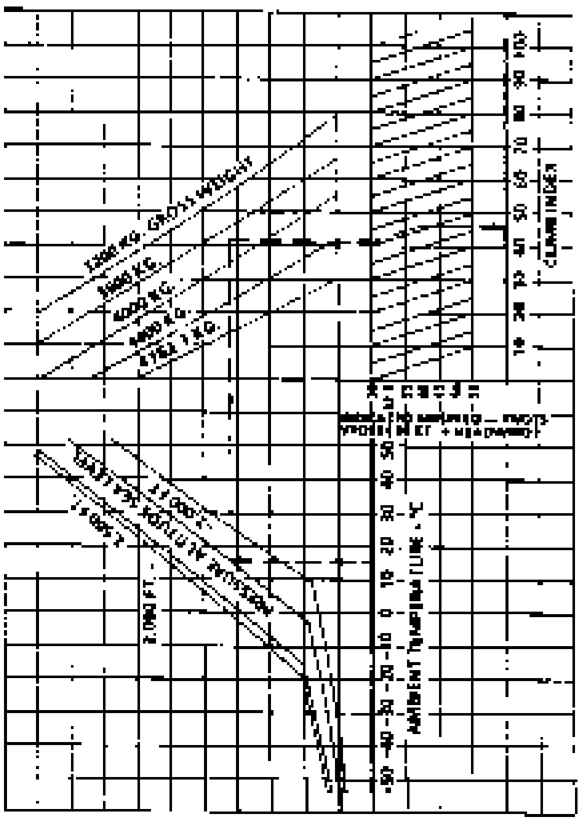
2.5 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS
HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED = VTOSS (30 KT. IAS + HEADWIND)



PT6T-3B ENGINE
TAKEOFF FLIGHT PATH
(METRIC)
CLIMB INDEX

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED = VTOSS (30 KT. IAS + HEADWIND)



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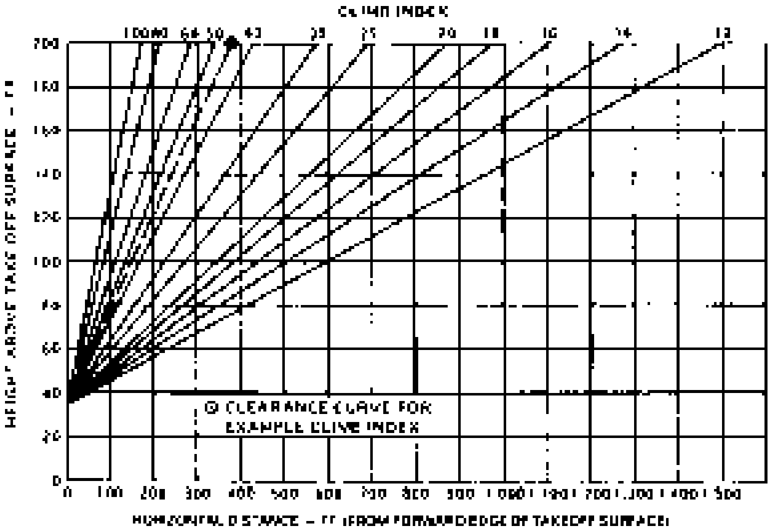
PT6T-3B ENGINE
TAKEOFF FLIGHT PATH
(ENGLISH)
OBSTACLE CLEARANCE

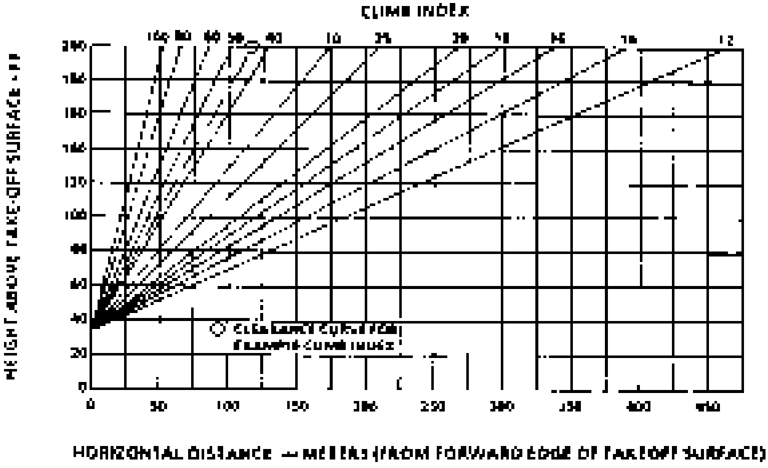
2.5 MINUTE POWER	HEATER OFF
ENGINE RPM 97%	INOPERATIVE ENGINE SECURED
GENERATOR 150 AMPS	AIRSPEED VTOSS = 30 KT. IAS + HEADWIND



PT6T-3B ENGINE
TAKEOFF FLIGHT PATH
(METRIC)
OBSTACLE CLEARANCE

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

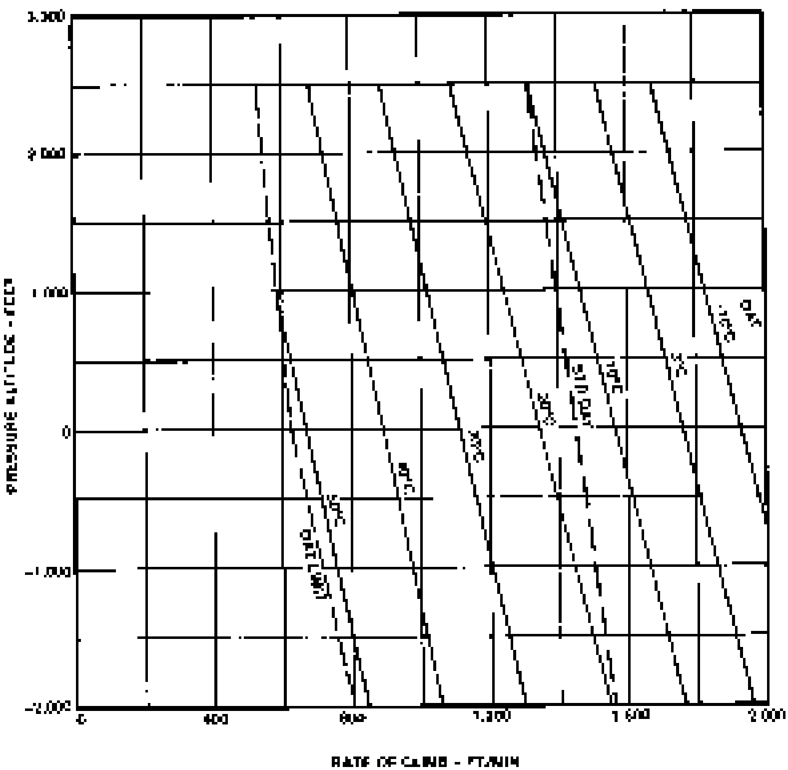
HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED VTOSS = 30 KT. IAS + HEADWIND



PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
7,000 LB. GROSS WEIGHT

2.5MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

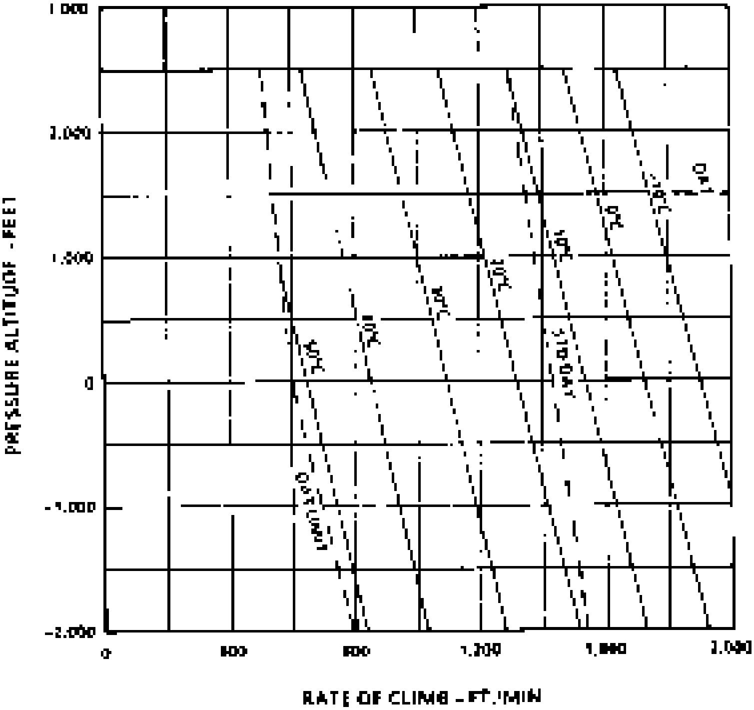
AIRSPEED VTOSS = 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
3,200 KG. GROSS WEIGHT

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

AIRSPEED VTOSS = 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED

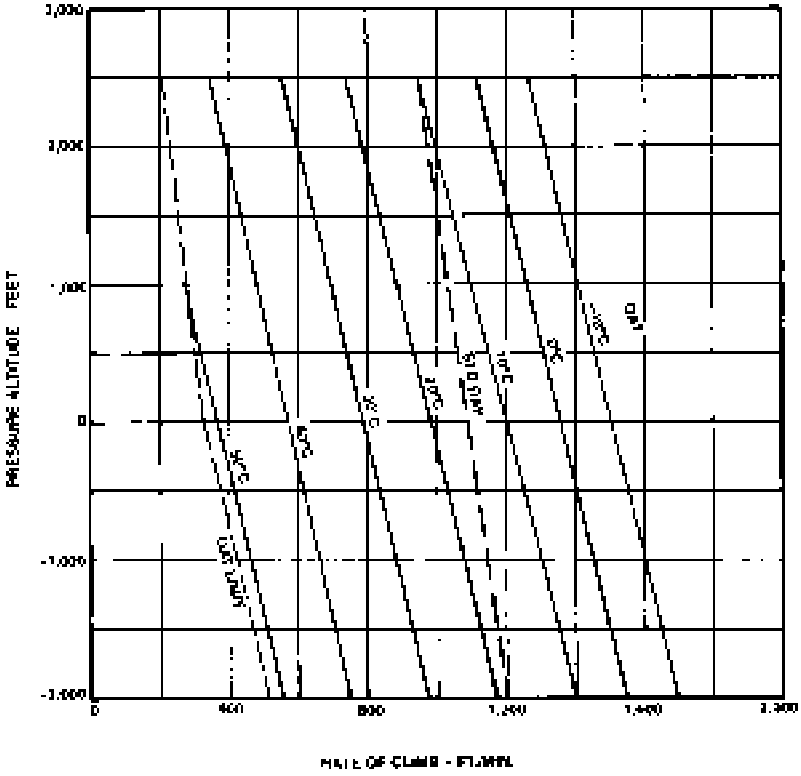


412090-18

PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
8,000 LB. GROSS WEIGHT

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

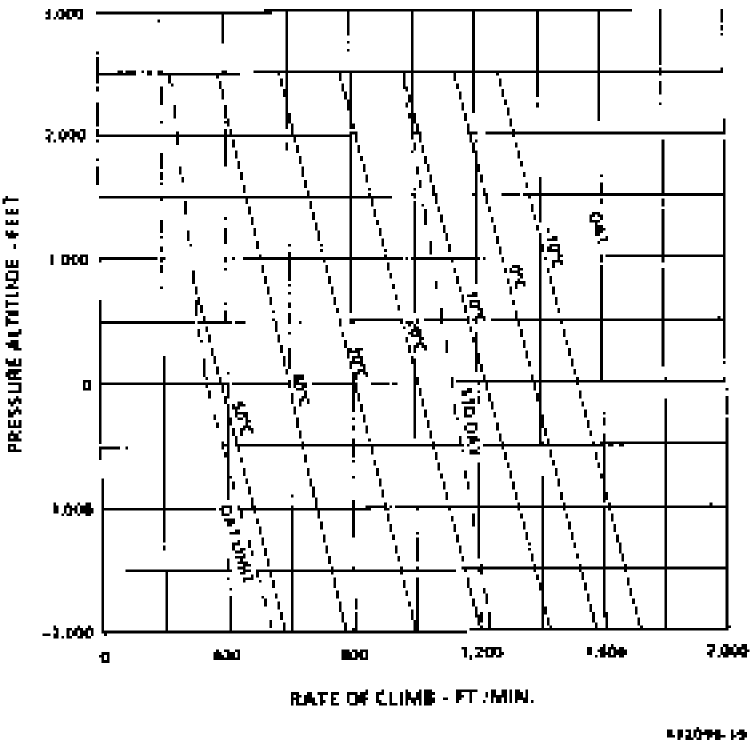
AIRSPEED VTOSS = 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
3,600 KG. GROSS WEIGHT

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

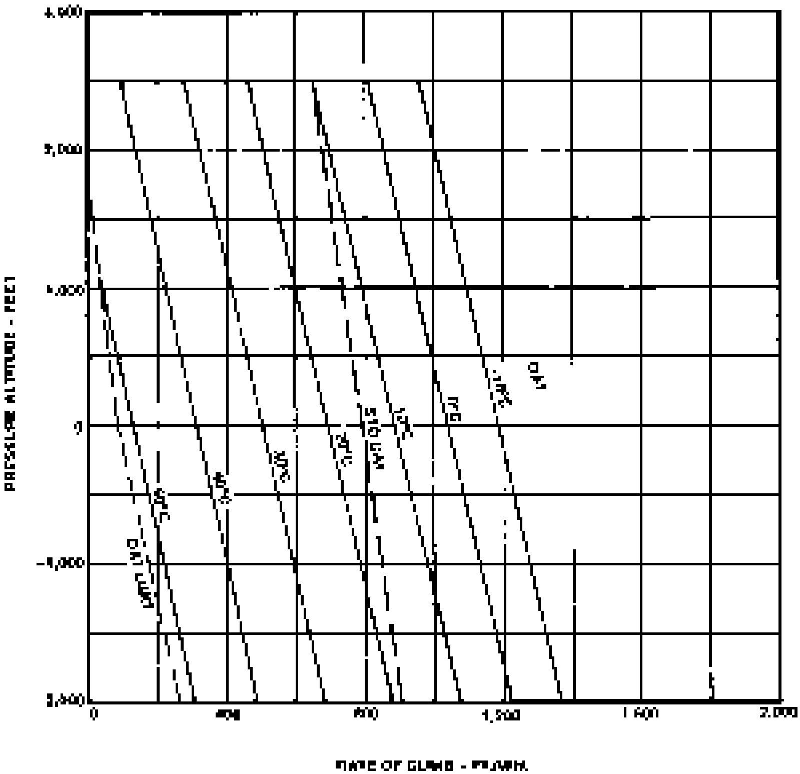
AIRSPEED VTOSS = 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
9,000 LB. GROSS WEIGHT

2-1/2 MIN. POWER
ENGINE RPM 97%
GENERATOR 1 150 AMPS

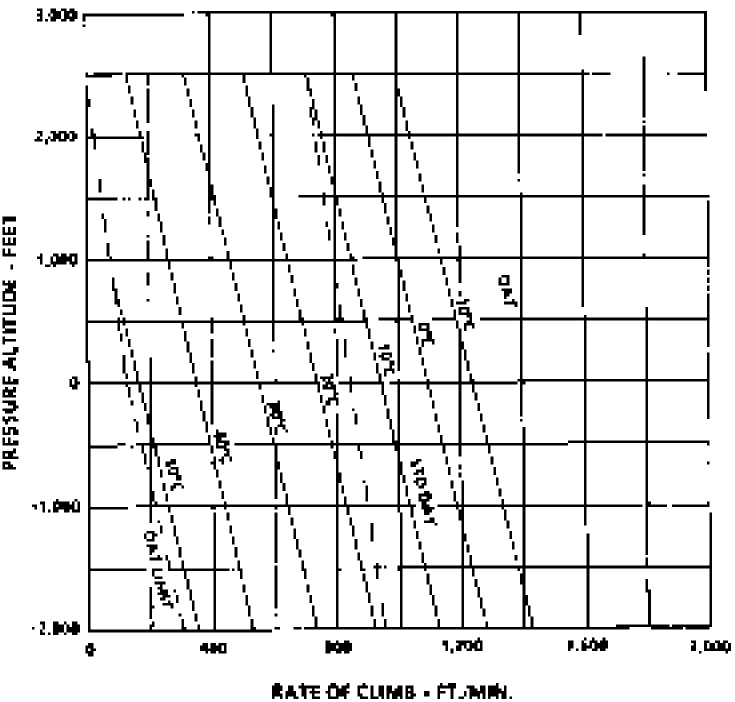
AIRSPEED VTOSS = 35 KT, IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
4000 KG. GROSS WEIGHT

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

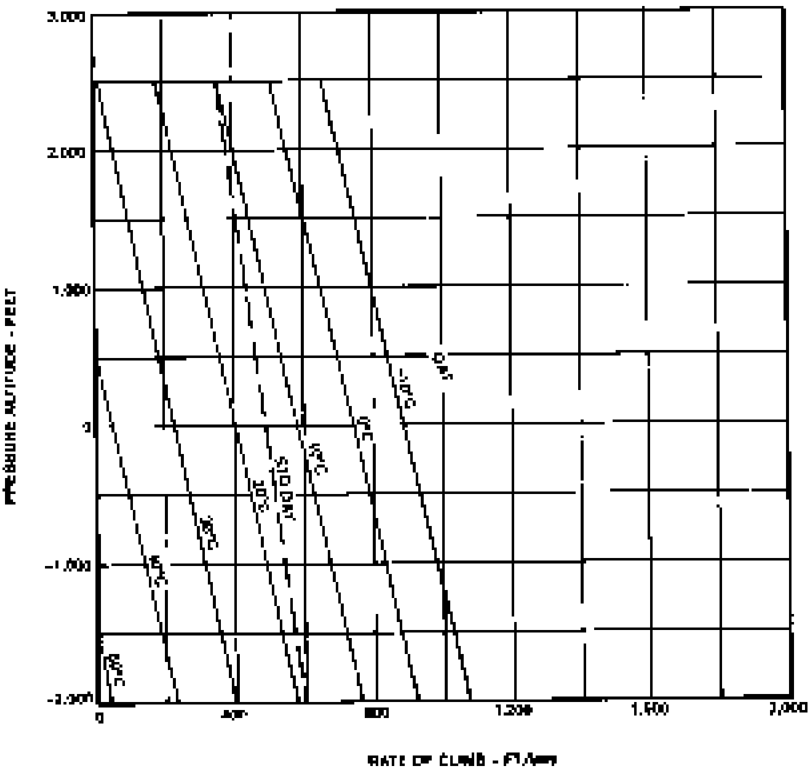
AIRSPEED VTOSS = 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



412048-30

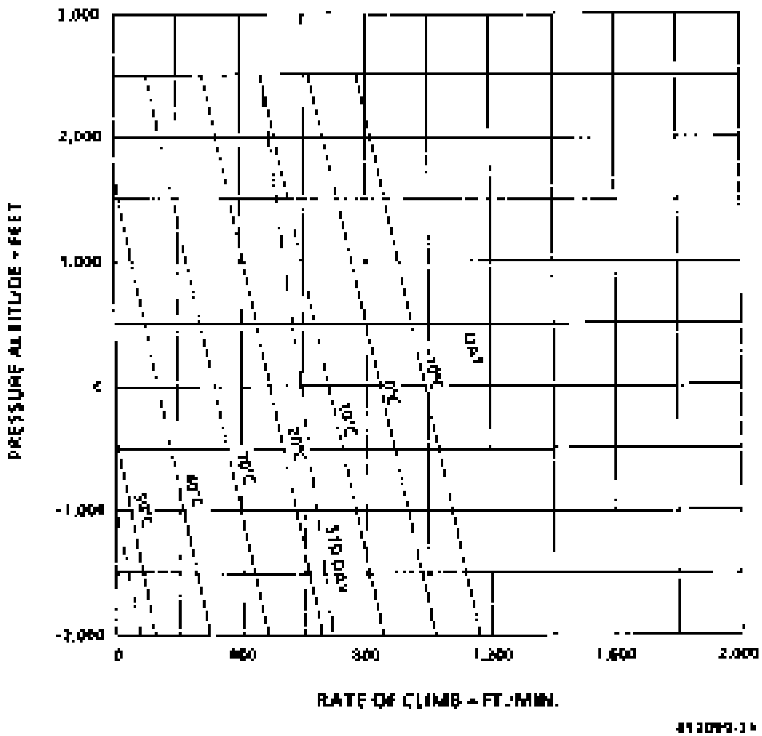
PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
10,000 LB. GROSS WEIGHT

2.5 MIN. POWER
ENGINE RPM 97%
GENERATOR 150 AMPS
AIRSPEED VTOSS = 30 KIAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
4400 KG. GROSS WEIGHT

2.5 MIN. POWER	AIRSPEED VTOSS = 30 KIAS
ENGINE RPM 97%	HEATER OFF
GENERATOR 150 AMPS	INOPERATIVE ENGINE SECURED

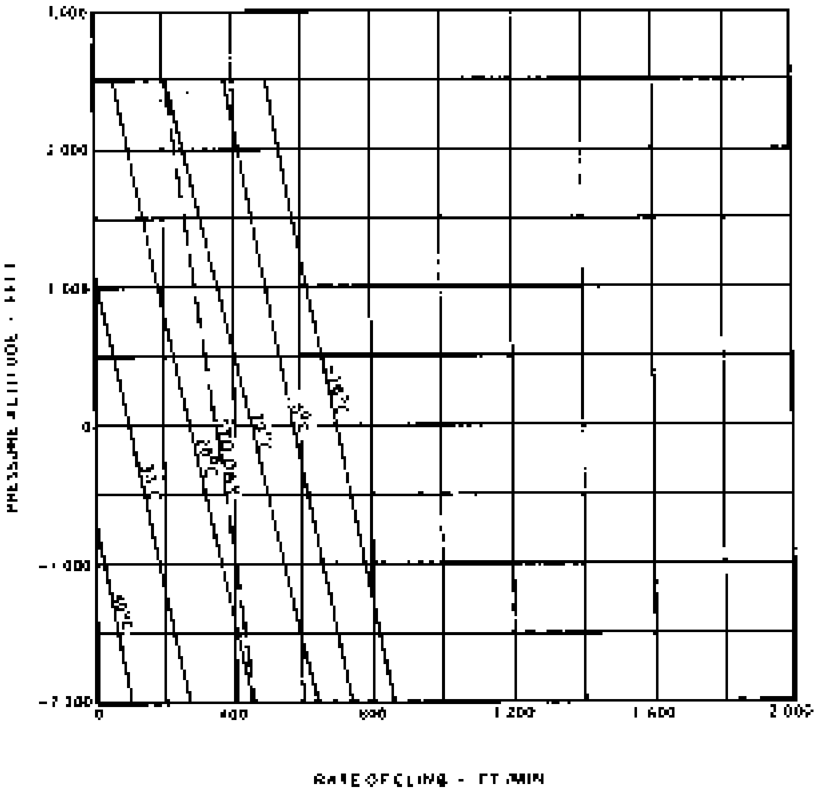


PT6T-3B ENGINE
SINGLE ENGINE RATE OF CLIMB

10,500 LB. (4762.7 KG.) GROSS WEIGHT

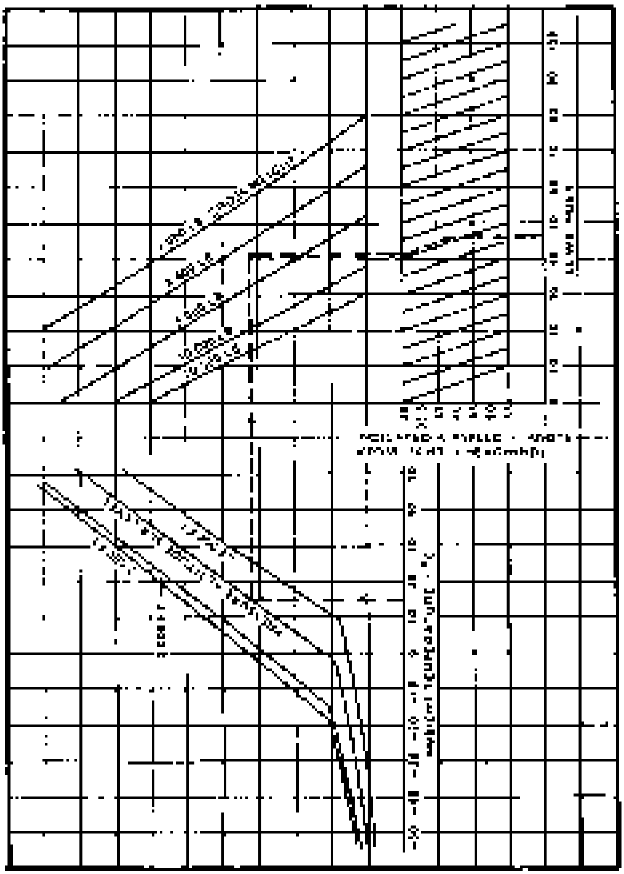
2.5 MIN POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

AIRSPEED VTOSS = 30 KT IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3BF ENGINE TAKEOFF FLIGHT PATH (ENGLISH) CLIMB INDEX

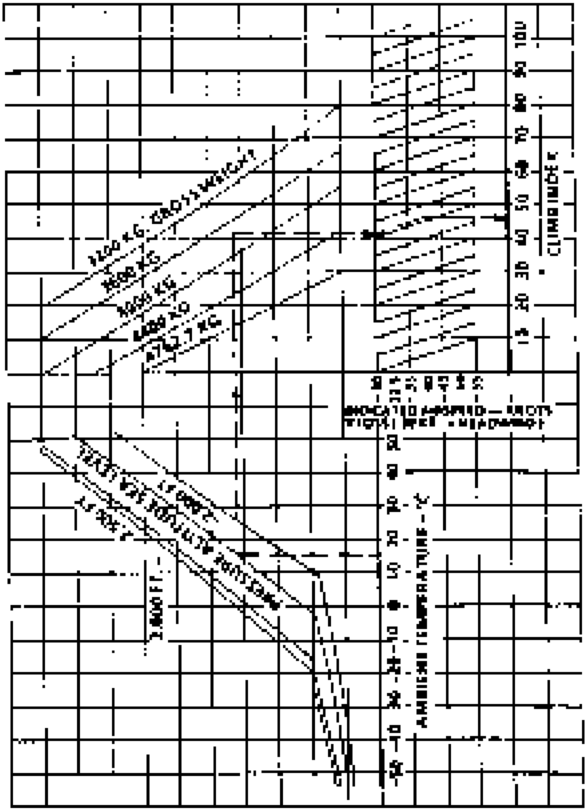
30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS
HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED = VTOSS (30 KT, IAS + HEADWIND)



PT6T-3BF ENGINE
TAKEOFF FLIGHT PATH
(METRIC)
CLIMB INDEX

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED = VTOSS (30 KT. IAS + HEADWIND)

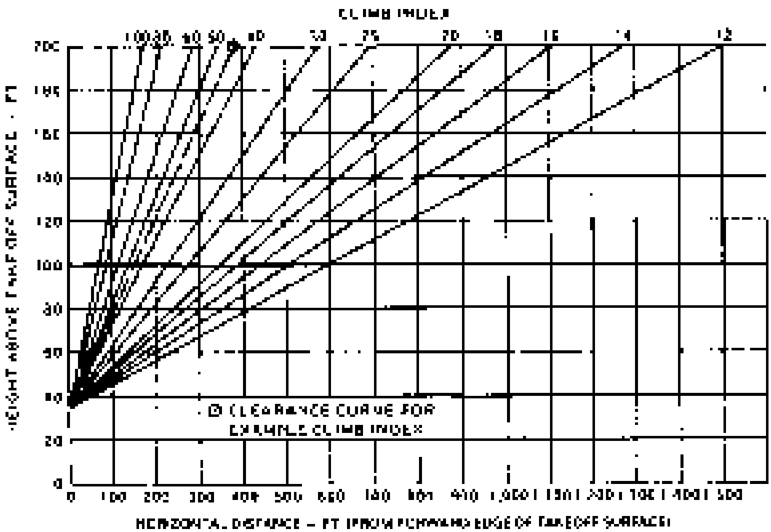


412099-16

PT6T-3BF ENGINE
TAKEOFF FLIGHT PATH
(ENGLISH)
OBSTACLE CLEARANCE

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

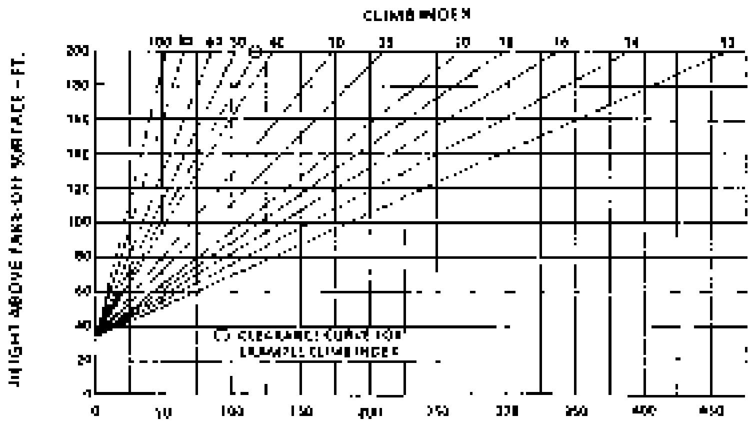
HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED VTOSS = 30 KT, IAS + HEADWIND



PT6T-3BF ENGINE
TAKEOFF FLIGHT PATH
(METRIC)
OBSTACLE CLEARANCE

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

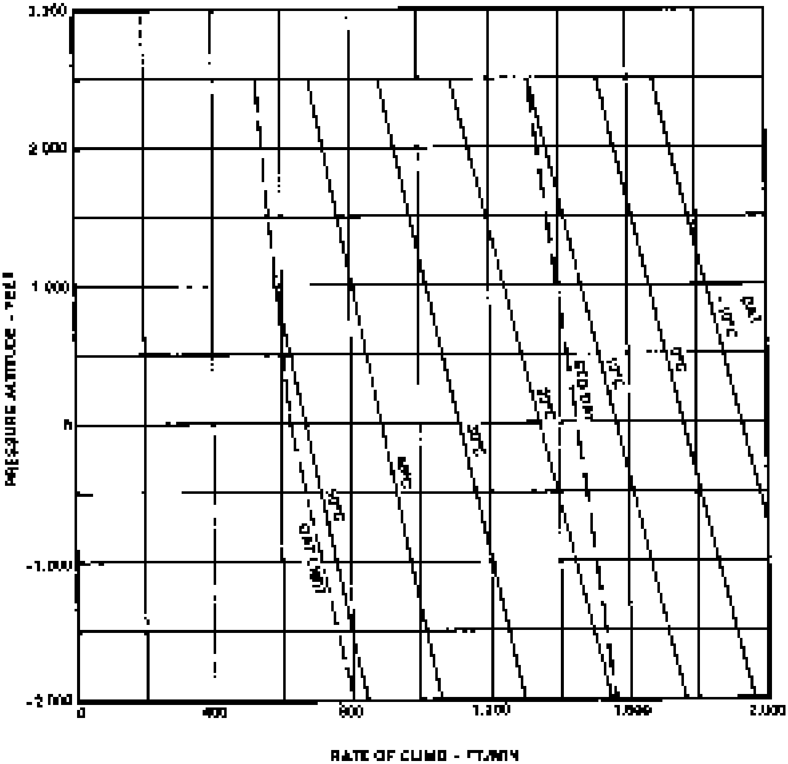
HEATER OFF
INOPERATIVE ENGINE SECURED
AIRSPEED VTOSS ± 30 KT. IAS + HEADWIND



HORIZONTAL DISTANCE — METERS (FROM FORWARD EDGE OF TAKEOFF SURFACE)

PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
7,000 LB. GROSS WEIGHT

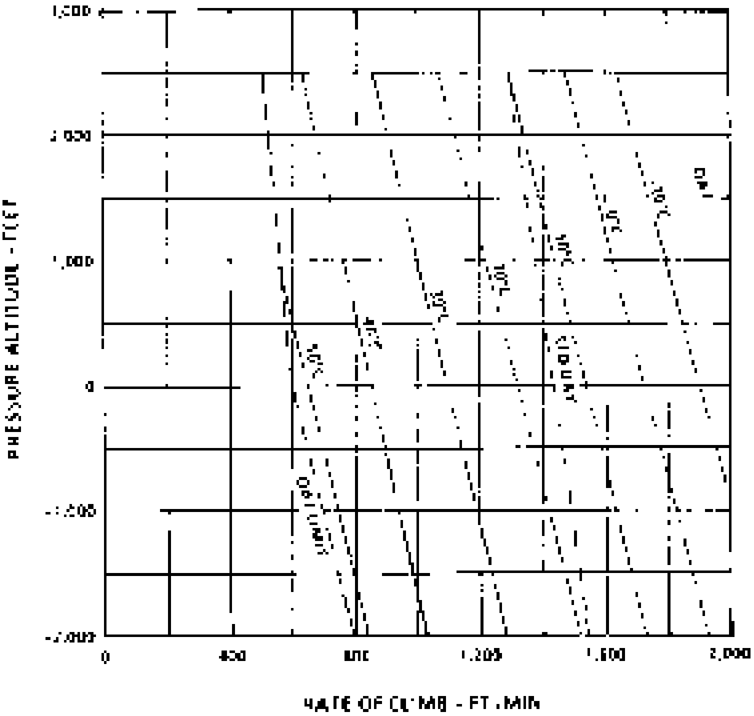
30 MINUTE POWER	AIRSPEED VTOSS = 30 KT. IAS
ENGINE RPM 97%	HEATER OFF
GENERATOR 150 AMPS	INOPERATIVE ENGINE SECURED



PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
5,200 KG. GROSS WEIGHT

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

AIRSPEED VTOSS = 50 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED

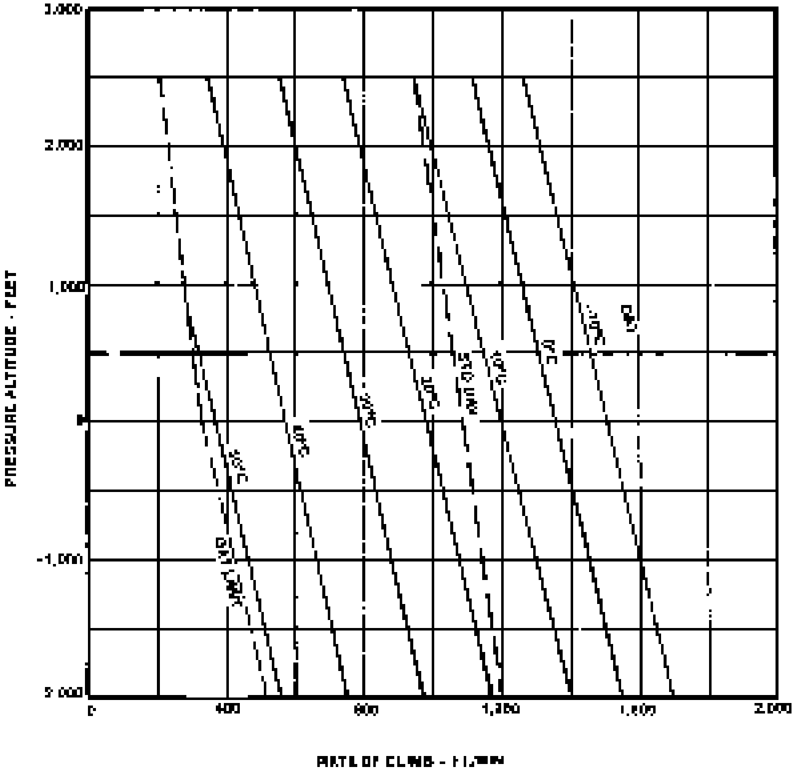


412059-18

PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
8,000 LB. GROSS WEIGHT

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

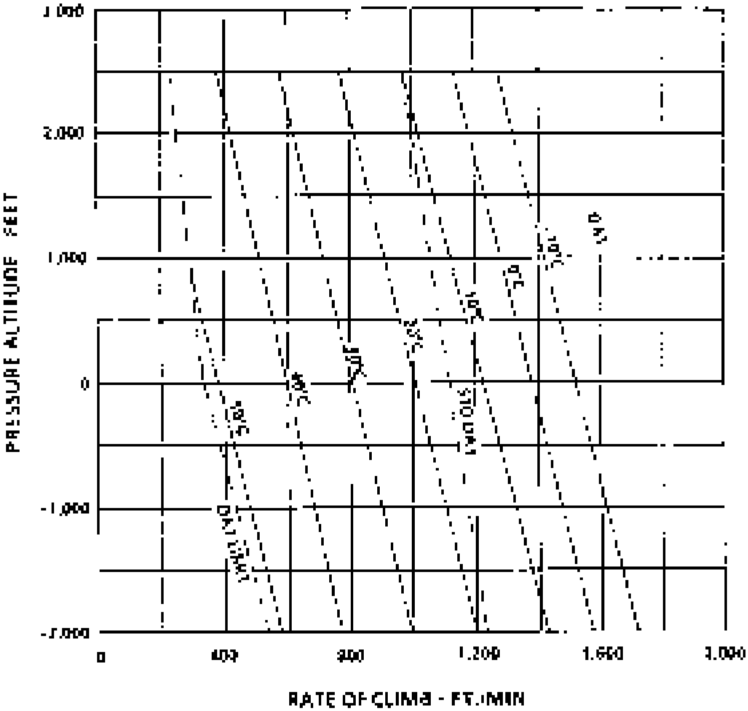
AIRSPEED VTOSS = 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
3,600 KG GROSS WEIGHT

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

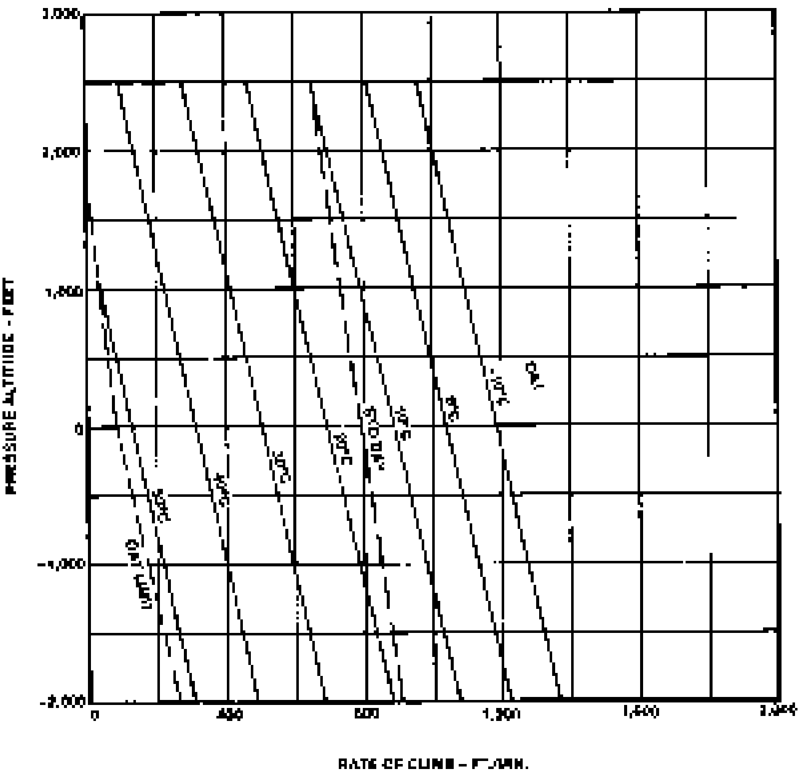
AIRSPEED VTOSS = 30 KT IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
9,000 LB. GROSS WEIGHT

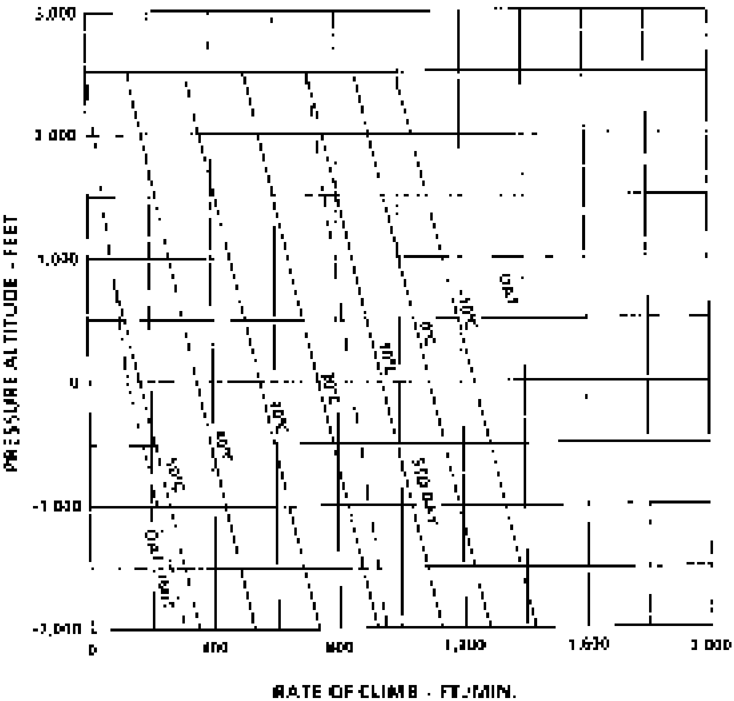
30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

AIRSPEED VTOSS = 30 KT IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
4000 KG. GROSS WEIGHT

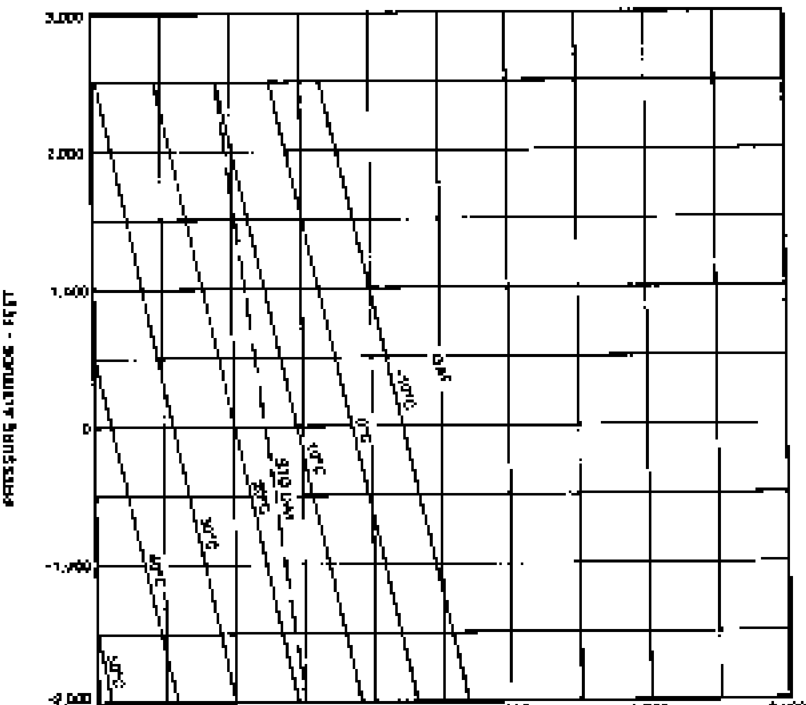
30 MINUTE POWER	AIRSPEED VTOSS = 30 KT. IAS
ENGINE RPM 97%	HEATER OFF
GENERATOR 150 AMPS	INOPERATIVE ENGINE SECURED



412099-30

PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(ENGLISH)
10,000 LB. GROSS WEIGHT

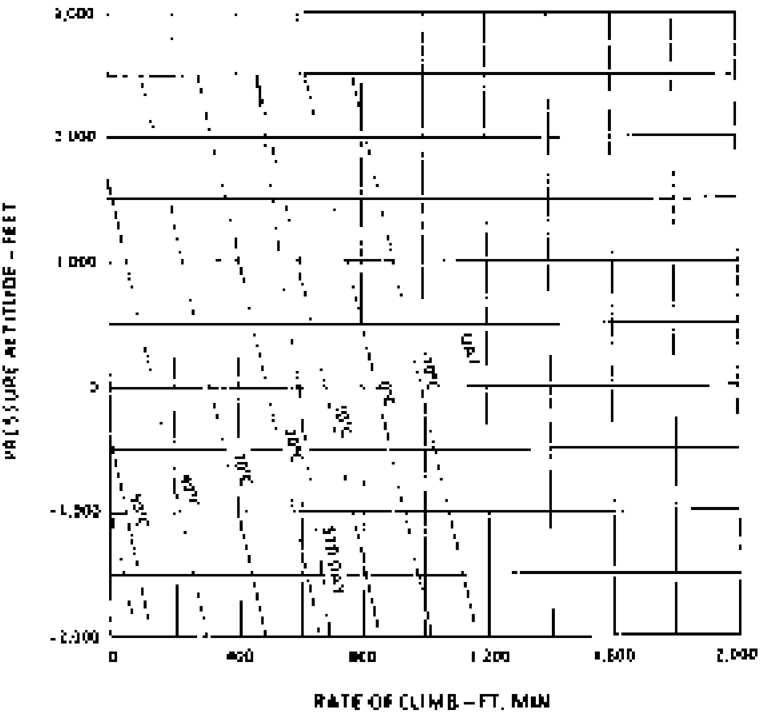
30 MINUTE POWER	AIRSPEED VTOSS = 30 KIAS
ENGINE RPM 97%	HEATER OFF
GENERATOR 150 AMPS	INOPERATIVE ENGINE SECURED



PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB
(METRIC)
4400 KG. GROSS WEIGHT

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

AIRSPEED VTOSS = 30 KIAS
HEATER OFF
INOPERATIVE ENGINE SECURED



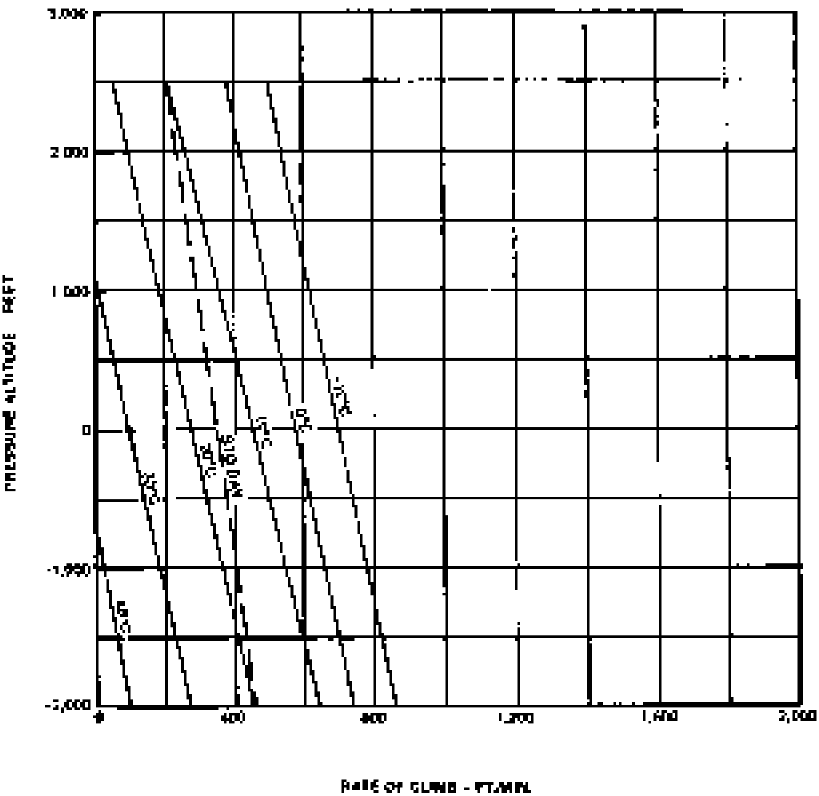
412093-71

PT6T-3BF ENGINE
SINGLE ENGINE RATE OF CLIMB

10,500 LB. (4762.7 KG.) GROSS WEIGHT

30 MINUTE POWER
ENGINE RPM 97%
GENERATOR 150 AMPS

AIRSPEED VTOSS – 30 KT. IAS
HEATER OFF
INOPERATIVE ENGINE SECURED



BHT-412-FMS-23.2

MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

COLD WEATHER OPERATION WITH KEROSENE FUELS

CERTIFIED
24 JANUARY 2005

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2) when conducting Cold Weather Operation with Kerosene Fuels.

Information contained herein supplements information in the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, refer to the basic Flight Manual.

CANADA
DEPARTMENT OF TRANSPORT
AIRCRAFT CERTIFICATION
BRANCH
JAN 24 2005
APPROVED
CERTIFICATE NO. SH05-2
ISSUE NO. 1 24.01.2005

Bell Helicopter
A Textron Company

24 JANUARY 2005

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Original .... 0...................... 24 JAN 05

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FLIGHT MANUAL		**MANUFACTURER'S DATA**	
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1 — 2	0		

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

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Original .... 0...................... 24 JAN 05

CANADA
DEPARTMENT OF TRANSPORT
AIRCRAFT CERTIFICATION
BRANCH

JAN 24 2005

APPROVED APPROVED BY:

CERTIFICATE NO. SH 05-2
ISSUE NO.

DATE JAN 24 2005

MANAGER

TRANSPORT CANADA
QUEBEC REGION
CIVIL AVIATION – AIRCRAFT CERTIFICATION

Section 1

LIMITATIONS

FUEL AND OIL

FUEL

Refer to Manufacturer's Data portion of this supplement for approved fuels list.

JET B OR JP-4

Fuel conforming to ASTM D-1655 Type B, MIL-T-5624 Grade JP-4, or NATO F-40 may be used at all ambient temperatures.

JET A, A-1, JP-5 OR JP-8 (KEROSENE TYPE FUELS)

1. Ambient Temperature Above -30°C (-22°F)

Fuel conforming to ASTM D-1655 Type A or A-1, MIL-T-5624 Grade JP-5, or NATO F-44 and MIL-T-83133 Grade JP-8, or NATO F-34 may be used without restriction.

2. Ambient Temperature Below -30°C (-22°F)

Operation with fuel conforming to ASTM D-1655 Type A is limited to ambient temperatures above -34°C (-29°F).

Operation with fuel conforming to ASTM D-1655 Type A-1, MIL-T-5624 Grade JP-5, or NATO F-44 and MIL-T-83133 Grade JP-8, or NATO F-34 is limited to ambient temperatures above -40°C (-40°F).

3. Engine Starting

Engine starting with fuel conforming to ASTM D-1655 Type A or A-1, MIL-T-5624 Grade JP-5, or NATO F-44 and MIL-T-83133 Grade JP-8, or NATO F-34 is limited to fuel temperatures above -30°C (-22°F).

Fuel temperature shall be measured by draining a quantity of fuel from the helicopter fuel tank and from the engine fuel inlet filter.

NOTE

Refer to Manufacturer's Data portion of this supplement for fuel temperature measurement procedure.

Section 2

NORMAL PROCEDURES

BEFORE EXTERIOR CHECK

Flight planning — Completed.

Gross weight and CG — Compute (refer to BHT-412-MD-2).

Publications — Checked.

Portable fire extinguishers — Condition and security.

Fuel — Measure fuel temperature as required.

NOTE

When OAT is below -30°C (-22°F), fuel temperature measurement procedure must be carried out for affected fuel types (refer to Limitations Section in this supplement). Fuel temperature measurement procedure is described in the Manufacturer's Data portion of this supplement.

Aft fuel sumps — Drain samples as follows:

FUEL TRANS switches — OFF.

BOOST PUMP switches — OFF.

ENGINE 1 and ENGINE 2 FUEL switches — OFF.

BAT BUS 1 switch — ON.

Aft fuel sump drain buttons (left and right) — Press.

NOTE

If aft sumps fail to drain, the sump valves may be operated manually.

Forward and middle fuel sumps — Drain samples as follows:

Press-to-drain valves — Press.

Fuel filters — Drain before first flight of day as follows:

BOOST PUMP switches — ON.

ENGINE 1 and ENGINE 2 FUEL switches — ON.

Fuel filter (left and right) — Drain samples.

ENGINE 1 and ENGINE 2 FUEL switches — OFF.

BOOST PUMP switches — OFF.

BAT BUS 1 switch — OFF.

Rotor tiedowns — Removed and secured.

Section 1

WEIGHT AND BALANCE

No change from basic manual.

Section 2

SYSTEMS DESCRIPTION

No change from basic manual.

Section 3

OPERATIONAL INFORMATION

No change from basic manual.

Section 4

HANDLING/SERVICING/MAINTENANCE

FUELS

Fuels conforming to the following commercial and military specifications are approved:

ASTM D-1655, Type A, A-1, or B

MIL-T-5624, Grade JP-4 or JP-5

NATO F-40 or F-44

Refer to Fuel Limitations in this supplement for ambient temperature limits.

The following fuel listing is provided for the convenience of the operator (Table 4-1 through Table 4-3). It shall be the responsibility of the operator and his fuel supplier to ensure that the fuel conforms to one of the approved specifications above.

Consult the engine manufacturer for alternate or emergency fuels.

FUEL SYSTEM SERVICING

Total capacity:

337.5 US gallons (1277.4 L).

333.7 US gallons (1262.8 L) for S/N 34001 — 34024.

Usable fuel:

330.5 US gallons (1251 L).

326.7 US gallons (1236.4 L) for S/N 34001 — 34024.

The fuel system is gravity serviced through a single filler port on the right side of aft fuselage. A grounding jack is provided below the fueling port.

NOTE

If fueling to a total of less than 1000 pounds (453.6 kg), open interconnect valve prior to fueling. Close interconnect valve prior to engine start.

Electrical/mechanical sump drain valves are located in each lower aft tank. Pushbutton switches for electrical operation of each drain valve are located on either side of the aft fuselage. To operate the drain valves, both FUEL switches must be in the OFF position and emergency dc bus 1 and essential dc bus 2 must be energized. Each lower aft tank also has a defueling valve. To drain the fuel, remove the plug and insert a standard fitting to open the spring-loaded poppet valve.

The lower forward and mid tanks have mechanical push-to-drain valves.

FUEL TEMPERATURE MEASUREMENT

Required apparatus:

- Measuring container with graduated scale
- Calibrated temperature meter with thermocouple probe suitable for measuring fuel at cold temperature

Procedure:

Perform the following prior to engine start:

1. Collect at least 250 cc fuel sample using the drain valve from either main feed fuel tank (left or right).
2. Measure fuel temperature immediately.
3. Record fuel temperature once thermocouple reading has stabilized.

If recorded fuel temperature is above -30°C (-22°F), repeat step 1 through step 3, but collecting fuel sample using the drain valve from either engine fuel inlet filter (left or right engine).

NOTE

Ensure container temperature is close to ambient and thermocouple is properly immersed in the fuel.

Table 4-1. Fuels
COMMERCIAL TYPE A AND A-1

FUEL VENDOR	ASTM D-1655, TYPE A PRODUCT NAME	ASTM D-1655, TYPE A-1 PRODUCT NAME
American Oil and Supply	American Jet Fuel Type A	American Jet Fuel Type A-1
ARCO (Atlantic Richfield)	Arcojet A	Arcojet A-1
Boron Oil	Jet A Kerosene	Jet A-1 Kerosene
British-American	B-A Jet Fuel JP-1	
British Petroleum	B.P. Jet A	B.P. A.T.K.
California-Texas		Caltex Jet A-1
Chevron	Chevron Jet A-50	Chevron Jet A-1
Cities Service	Citgo Turbine Type A	
Continental	Conoco Jet-50	Conoco Jet-60
Exxon Co. U.S.A.	Exxon Turbo Fuel A	Exxon Turbo Fuel A-1
Exxon International		Esso Turbo Fuel A-1
Gulf Oil	Gulf Jet A	Gulf Jet A-1
Mobil Oil	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet A-50	
Pure Oil	Purejet Turbine Fuel Type A	Purejet Turbine Fuel Type A-1
Shell Oil	AeroShell Turbine Fuel 640	AeroShell Turbine Fuel 650
Standard Oil of British Columbia	Chevron Jet Fuel A-50	Chevron Jet Fuel A-1
Standard Oil of California	Chevron Jet Fuel A-50	Chevron Jet Fuel A-1
Standard Oil of Indiana	American Jet Fuel Type A	American Jet Fuel Type A-1
Standard Oil of Kentucky	Standard Turbine Fuel A-50	Standard Turbine Fuel A-1
Standard Oil of New Jersey	Standard Jet A	Standard Jet A-1
Standard Oil of Ohio	Jet A Kerosene	Jet A-1 Kerosene
Standard Oil of Texas	Chevron Jet Fuel A-50	Chevron Jet Fuel A-1
Texaco	Texaco Avjet A	Texaco Avjet A-1
Union Oil	76 Turbine Fuel	

Table 4-2. Fuels
COMMERCIAL TYPE B

FUEL VENDOR	ASTM D-1655, TYPE B PRODUCT NAME
American Oil and Supply	American JP-4
ARCO (Atlantic Richfield)	Arcojet B
British-American	B-A Jet Fuel JP-4
British Petroleum	B.P. A.T.G.
California-Texas	Caltex Jet B
Chevron	Chevron Jet B
Continental	Conoco JP-4
Exxon Co. U.S.A.	Exxon Turbo Fuel 4
Exxon International	Esso Turbo Fuel 4
Gulf Oil	Gulf Jet B
Mobil Oil	Mobil Jet B
Phillips Petroleum	Philjet JP-4
Shell Oil	AeroShell Turbine Fuel JP-4
Standard Oil of California	Chevron Jet Fuel B
Standard Oil of Indiana	American JP-4
Standard Oil of Kentucky	Standard Turbine Fuel B
Standard Oil of New Jersey	Standard Jet B
Standard Oil of Texas	Chevron Jet Fuel B
Texaco	Texaco Avjet B
Union Oil	Union JP-4

Table 4-3. Fuels
MILITARY

COUNTRY	NATO F-34 (JP-8 TYPE)	NATO F-40 (JP-4 TYPE)	NATO F-44 (JP-5, JP-8 TYPE)
Belgium	BA-PF-7	BA-PF-2	3-GP-24
Canada		3-GP-22	3-GP-24
Denmark	D. Eng. R.D. 2453	MIL-T-5624, Grade JP-4	
France	AIR 3405	AIR 3407	AIR 3404
Germany		VTL 9130-006	VTL-9130-007
			VTL-9130-010
Greece		MIL-T-5624, Grade JP-4	
Italy	AA-M-C.141	AER-M-C.142	AA-M-C.143
Netherlands	D. Eng. R.D. 2453	MIL-T-5624, Grade JP-4	D. Eng. R.D. 2498
Norway		MIL-T-5624, Grade JP-4	
Portugal	AIR 3405	MIL-T-5624, Grade JP-4	
Turkey		MIL-T-5624, Grade JP-4	
United Kingdom	D. Eng. R.D. 2453	D. Eng. R.D. 2454	D. Eng. R.D. 2498
			D. Eng. R.D. 2452
United States	MIL-T-83133, Grade JP-8	MIL-T-5624, Grade JP-4	MIL-T-5624, Grade JP-5

Transport Canada   Transports Canada

Department of Transport

Supplemental Type Certificate

This approval is issued to:

Bell Helicopter Textron Canada Limited
12800, rue de l'Avenir
Mirabel, Quebec, J7J 1R4
Canada

Number: SH05-2
Issue No.: 1
Approval Date: January 24, 2005
Issue Date: January 24, 2005

Responsible Office:	Quebec
Aircraft/Engine Type or Model:	BELL 212, 412, 412 EP
Canadian Type Certificate or Equivalent:	H-86
Description of Type Design Change:	*Cold weather use of Kerosene fuels for Bell 212 & 412 helicopters*

Installation/Operating Data,
Required Equipment and Limitations:

Use of Kerosene fuels in cold weather will be permitted in accordance with Bell Helicopter Report No. 412-099-675, initial release, dated 3 January 2005, or later Transport Canada approved revision.

The applicable Rotorcraft Flight Manual Supplements are the following Bell Helicopter publications :

Model 212 :

- BHT-212-FMS-31, issue 0, dated 24 January 2005;

Model 412 :

- **BHT-412-FMS-23.1**, issue 0, dated 24 January 2005;
- **BHT-412-FMS-23.2**, issue 0, dated 24 January 2005;
- **BHT-412-FMS-23.3**, issue 0, dated 24 January 2005,

Model 412EP :

- **BHT-412-FMS-23.4**, issue 0, dated 24 January 2005,

or later Transport Canada approved revision.

- End -

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

Luiza-Mihaela Avrigeanu
For Minister of Transport

Canada

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

SEAT CUSHION KIT

412-706-019

CERTIFIED
24 JULY 1987

This supplement shall be attached to Model 412 or 412EP Flight Manual when the 412-706-019 Seat Cushion Kit has been installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

Bell Helicopter TEXTRON
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REISSUE — 8 DECEMBER 1995

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LOG OF REVISIONS

Original . . . . .0 . . . . 24 Jul 87 Reissue . . . . .0 . . . . .8 Dec 95

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APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

INTRODUCTION

The Seat Cushion Kit is installed in conjunction with the Utility Passenger Seat Kit and provides increased comfort level for passengers.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after Seat Cushion Kit is installed and ballast readjusted if necessary to return empty weight CG within allowable limits.

PLACARDS AND MARKINGS

DOORS MUST BE KEPT CLOSED DURING FLIGHT IF SEAT CUSHIONS INSTALLED

Located on inside of sliding passenger door.

Section 2

NORMAL PROCEDURES

BEFORE TAKEOFF

Passengers doors — Closed.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

33108 — 33213
36001 — 36019
AND
36020 — 36086
AND
36087 AND SUB

SUPPLEMENT FOR AUXILIARY FUEL OPERATIONS
(412-706-009)

CERTIFIED
10 MARCH 1988

This supplement shall be attached to the 412 Flight Manual (BHT-412-FM-2, -3 or -4) when the 412-706-009 Auxiliary Fuel Kit has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
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REISSUE — 23 JUNE 1994

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LOG OF REVISIONS

Original	0	10 Mar 88
Reissue	0	15 Oct 92
Reissue	0	23 Jun 94

LOG OF PAGES

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1-11/1-12	0

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Original . 0 . . . . 10 Mar 88
Reissue . . . . 0 . . . . 15 Oct 92
Reissue . . . . . 0 . . . . 23 Jun 94

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

INTRODUCTION

The Auxiliary Fuel Kit provides additional fuel capacity to extend the range of the helicopter. The kit consists of a left and right auxiliary fuel tank, and the hardware and wiring necessary to complete the installation. The left or right auxiliary fuel tank may be removed as operational requirements dictate.

One fuel tank provides an additional 16.3 U.S. gallons (61.7 liters) of fuel. Both fuel tanks combined, provide additional 32.6 U.S. gallons (123.4 liters) of fuel.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

NOTE

The contents of this supplement shall be used in conjunction with the basic Flight Manual for helicopters equipped with the 412-706-009 Auxiliary Fuel Tank Kit installed.

FUEL AND OIL LIMITATIONS

FUEL SYSTEM CAPACITIES

Basic system with left or right auxiliary tank:

Total usable fuel capacity is 346.7 U.S. gallons (1312.3 liters).

Basic system with both auxiliary tanks:

Total usable fuel capacity is 363.0 U.S. gallons (1374.1 liters).

WEIGHT AND BALANCE

Actual weight change shall be determined after kit is installed and ballast readjusted, if necessary, to retain gross weight CG within allowable limits.

Section 2

NORMAL PROCEDURES

IN-FLIGHT OPERATION

CAUTION

WHEN ONE CABIN MOUNTED AUXILIARY FUEL TANK ONLY IS USED, THE TANK INTERCONNECT SWITCH ON THE COCKPIT FUEL PANEL MUST BE PLACED IN THE OPEN POSITION WHEN THE FUEL QUANTITY INDICATION ON THE LOW SIDE WHICH DOES NOT HAVE AN AUXILIARY TANK, REDUCES TO APPROXIMATELY 500 LBS. THIS WILL ALLOW THE AUXILIARY FUEL TO BE SHARED BY BOTH ENGINE FEED TANKS AND PRECLUDE THE POSSIBILITY OF FUEL EXHAUSTION TO THE ENGINE BEING SUPPLIED BY THE SIDE WHICH DOES NOT HAVE AN AUXILIARY TANK. THE AUTOMATIC FEATURE OF THE TANK INTERCONNECT VALVE MAY NOT FUNCTION WITH ONLY ONE AUXILIARY TANK INSTALLED.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic manual.

Section 4

PERFORMANCE

No change from basic manual

Section 1 MANUFACTURER'S DATA

WEIGHT AND BALANCE

AUXILIARY FUEL SYSTEM

AUXILIARY FUEL SYSTEM SERVICING

The auxiliary fuel tanks are interconnected with the basic fuel system to allow gravity flow of auxiliary fuel into main fuel cells as fuel is consumed. The auxiliary fuel system is serviced simultaneously with the basic fuel system through the single filler port located on the aft right side of the fuselage.

AUXILIARY FUEL LOADING TABLES

Total usable fuel capacity with 412-706-009 Auxiliary Fuel Kit (both tanks) installed is 363.0 U.S. gallons (1374.1 liters).

Total usable fuel capacity with one tank (left or right) installed is 346.7 U.S. gallons (1312.3 liters).

Fuel loading tables are presented for weight and balance computations in both English and Metric units. These tables shall be used in lieu of the tables for the basic fuel system when either or both auxiliary fuel tanks are installed. Weights and moments listed herein represent total fuel on board to include that contained in basic fuel cells. Refer to table 1-1 and 1-2 for English or 1-1M and 1-2M for Metric when both left and right auxiliary tanks are installed. Tables 1-3 and 1-4 for English or 1-3M and 1-4M for Metric apply to single auxiliary tank installed on left or right.

Table 1-1. Fuel loading with left and right auxiliary tanks (two 18.3 gal.) — longitudinal (English)

Longitudinal									
Jet B or JP-4 (6.5 Lb/U.S. Gallon)						Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
	Quantity (U.S. Gal.)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)		Quantity (U.S. Gal.)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
	10	65	138.6	8061		10	68	139.4	9479
	20	130	138.6	18148		20	136	139.6	18986
	30	195	138.8	27281		30	204	139.8	28519
	40	260	138.8	36374		40	272	139.9	38053
	50	325	138.8	45468		50	340	139.9	47566
△	58.3	379	139.9	53022	△	58.3	397	139.9	55540
	60	390	141.0	54990		60	408	141.0	57528
	70	455	145.2	66157		70	476	145.4	69210
	80	520	148.4	77168		80	544	148.4	80730
	90	585	150.6	88104		90	612	150.6	92167
	100	650	152.2	98930		100	680	152.2	103496
	110	715	153.5	109753		110	748	153.5	114818
	120	780	154.7	120666		120	816	154.7	126235
	130	845	155.7	131587		130	884	155.7	137638
	140	910	156.5	142415		140	952	156.5	148988
	150	975	157.2	153270		150	1020	157.2	160344
	160	1040	157.9	164218		160	1088	157.9	171795
	170	1105	158.6	175253		170	1156	158.6	183342
*	172.6	1122	158.8	178174	*	172.6	1174	158.8	186431
	180	1170	156.2	182754		180	1224	156.2	191189
	190	1235	152.7	188585		190	1292	152.7	197288
	200	1300	149.8	194740		200	1360	149.8	203728
*	205.8	1338	148.2	198292	*	205.8	1399	148.2	207332
	210	1365	148.7	202978		210	1428	148.7	212344
	220	1430	149.9	214357		220	1496	149.9	224250
	230	1495	151.1	225895		230	1564	151.1	236320
	240	1560	152.2	237432		240	1632	152.2	248390
	250	1625	153.2	248951		250	1700	153.2	260440
	260	1690	154.0	260260		260	1768	154.0	272272
	270	1755	154.8	271674		270	1836	154.8	284213
□	275.7	1792	155.2	278118	□	275.7	1875	155.2	291000
	280	1820	154.7	281554		280	1904	154.7	294549
	290	1885	153.7	289742		290	1972	153.2	302110
	300	1950	151.9	296205		300	2040	151.9	309876
	310	2015	150.7	303661		310	2108	150.7	317676
	320	2080	149.4	310752		320	2176	149.4	325094
*	327.7	2130	148.7	316731	*	327.7	2228	148.7	331304
	330	2145	149.0	319605		330	2244	149.0	334356
	340	2210	149.7	330837		340	2312	149.7	346106
	350	2275	150.4	342160		350	2380	150.4	357952
	360	2340	151.2	353808		360	2448	151.2	370138
■	363.0	2360	151.3	357068	■	363.0	2468	151.3	373408

NOTE: All data above represents usable fuel (basic and auxiliary) based on nominal density at 15°C (59°F).

* Quantity at which CG of fuel changes direction.

△ Quantity resulting in maximum forward CG of helicopter (at any weight).

□ Quantity resulting in maximum aft CG of helicopter (weight empty 6520 lb or less).

■ Quantity resulting in maximum aft CG of helicopter (weight empty more than 6520 lb).

Table 1-1M. Fuel loading with left and right auxiliary tanks (two 61.7 liter) — longitudinal (Metric)

Longitudinal							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A-1 or JP-5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)
40	31.2	3541	110479	40	32.6	3541	115437
80	62.3	3547	220976	80	65.2	3547	231264
120	93.5	3551	332019	120	97.8	3551	347288
160	124.6	3552	442579	160	130.4	3552	463181
200	155.8	3552	553402	200	163.0	3552	578976
_ 220.7	171.9	3553	610761	_ 220.7	179.9	3553	639185
240	187.0	3632	679184	240	195.6	3632	710419
280	218.1	3726	812641	280	228.2	3726	850273
320	249.3	3795	946094	320	260.8	3795	989736
360	280.4	3848	1078979	360	293.4	3848	1129003
400	311.6	3886	1210878	400	326.0	3886	1266836
440	342.8	3917	1342748	440	358.6	3917	1404636
480	373.8	3947	1475383	480	391.2	3947	1544066
520	405.1	3973	1609462	520	423.8	3973	1683757
560	436.2	3988	1739566	560	456.4	3988	1820123
600	467.4	4008	1873338	600	489.0	4008	1959912
640	498.6	4026	2007364	640	521.6	4026	2099962
- 653.2	508.8	4033	2051990	- 653.2	532.3	4033	2146766
680	529.7	3973	2104498	680	554.2	3973	2201837
720	560.9	3879	2175731	720	586.8	3879	2276197
760	592.0	3800	2249600	760	619.4	3800	2353720
- 778.8	606.7	3765	2284226	- 778.8	634.7	3765	2389646
800	623.2	3785	2358812	800	652.0	3785	2467820
840	654.4	3815	2496536	840	684.6	3815	2611749
880	685.5	3843	2634377	880	717.2	3843	2756200
920	716.7	3874	2776496	920	749.8	3874	2904725
960	747.8	3899	2915672	960	782.4	3899	3050578
1000	779.0	3922	3055238	1000	815.0	3922	3196430
1040	810.2	3941	3192998	1040	847.6	3941	3340392
_ 1043.1	813.0	3942	3204846	_ 1043.1	850.1	3942	3351094
1080	841.3	3907	3286959	1080	880.2	3907	3438941
1120	872.5	3871	3377448	1120	912.8	3871	3533449
1160	903.6	3839	3468920	1160	945.4	3839	3629391
1200	934.8	3807	3558784	1200	978.0	3807	3723246
* 1240.2	966.1	3776	3647994	* 1240.2	1010.8	3776	3816781
1280	997.1	3800	3788980	1280	1043.2	3800	3964160
1320	1028.3	3823	3931191	1320	1075.8	3823	4112783
1360	1059.4	3838	4065977	1360	1108.4	3838	4254039
■ 1374.1	1070.4	3843	4113547	■ 1374.1	1119.9	3843	4303776

NOTE: All data above represents usable fuel (basic and auxiliary) based on nominal density at 15°C (59°F).

* Quantity at which CG of fuel changes direction.

Quantity resulting in maximum forward CG of helicopter (empty weight).

_ Quantity resulting in maximum aft CG of helicopter (weight empty 2957 kg or less).

■ Quantity resulting in maximum aft CG of helicopter (weight empty more than 2957 kg).

Table 1-2 Fuel loading with left and right auxiliary tanks (two 18.3 gal.) — lateral (English)

Lateral									
Jet B or JP-4 (6.5 Lb/U.S. Gallon)					Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)				
	Quantity (U.S. Gal.)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)		Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
	10	65	0	0		10	68	0	0
	20	130	0	0		20	136	0	0
	30	195	0	0		30	204	0	0
	40	260	0	0		40	272	0	0
	50	325	0	0		50	340	0	0
*	54.8	355	0	0	*	54.6	371	0	0
	60	390	-0.03	-12		60	408	0.03	12
	70	455	-0.06	-27		70	476	-0.06	29
*	80.0	520	0.05	26	*	80.0	544	-0.06	27
	90	585	0.04	-23		90	612	-0.04	24
	100	650	0.04	-26		100	680	0.04	27
	110	715	-0.03	-21		110	748	0.03	22
	120	780	0.03	-23		120	816	0.03	24
	130	845	0.03	25		130	884	-0.03	27
	140	910	0.03	27		140	952	0.03	29
	150	975	0.03	29		150	1020	0.03	31
	160	1040	0.02	-21		160	1088	0.02	22
	170	1105	0.02	22		170	1156	-0.02	-23
*	172.6	1122	0.02	22	*	172.6	1174	-0.02	-23
	180	1170	0.03	35		180	1224	-0.03	37
	190	1235	0.44	543		190	1292	-0.44	568
	200	1300	0.55	715		200	1360	-0.55	748
*	205.9	1337	0.60	802	*	205.8	1399	-0.60	839
►	210	1365	0.59	805	►	210	1428	0.59	843
	220	1430	0.56	801		220	1496	-0.56	838
	230	1495	0.54	-807		230	1564	-0.54	845
	240	1560	0.52	-811		240	1632	-0.52	-849
	250	1625	0.50	-813		250	1700	-0.50	-850
	260	1690	0.48	-811		260	1768	0.48	849
	270	1755	0.46	-807		270	1836	-0.46	845
	280	1820	0.44	-801		280	1904	-0.44	-838
	290	1885	0.43	-811		290	1972	-0.43	-848
	300	1950	-0.41	-800		300	2040	-0.41	836
	310	2015	0.40	-806		310	2108	-0.40	843
	320	2080	0.39	-811		320	2176	-0.39	-848
	330	2145	0.39	815		330	2244	0.38	853
	340	2210	0.36	-795		340	2312	-0.36	832
	350	2275	0.35	-796		350	2380	-0.35	833
	360	2340	0.34	-796		360	2448	-0.34	832
	363.0	2360	0.34	-803		363.0	2469	0.34	839

NOTE: All data above represents usable fuel (basic and auxiliary) based on nominal density at 15°C (59°F).
* Quantity at which CG of fuel changes direction
► Quantity resulting in maximum lateral CG of helicopter

Table 1-2M. Fuel loading with left and right auxiliary tanks (two 81.7 liter) — lateral (Metric)

Lateral									
	Jet B or JP-4 (0.779 kg/liter)					Jet A, A-1 or JP-5 (0.815 kg/liter)			
	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)		Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
	40	31.2	0	0		40	32.6	0	0
	80	62.3	0	0		80	65.2	0	0
	120	93.5	0	0		120	97.8	0	0
	160	124.6	0	0		160	130.4	0	0
	200	155.8	0	0		200	163.0	0	0
*	206.6	161.0	0	0	*	206.6	168.4	0	0
	240	187.0		187		240	195.6	1	196
	280	218.1	1	218		280	228.2	1	228
*	302.7	235.8	1	236	*	302.7	246.7	1	247
	320	249.3	1	249		320	260.8	1	261
	360	280.4	1	280		360	293.4	1	293
	400	311.6	1	312		400	326.0	1	326
	440	342.8	1	343		440	358.6	1	359
	480	373.9	1	374		480	391.2	1	391
	520	405.1	1	405		520	423.8	1	424
	560	436.2	1	436		560	456.4	1	456
	600	467.4	1	467		600	489.0	1	489
	640	498.6	1	499		640	521.6	1	522
*	653.2	508.8		509	*	653.2	532.4	1	532
	680	529.7	8	4238		680	554.2	8	4434
	720	560.9	11	6170		720	586.8	11	6455
	760	592.0	14	8288		760	619.4	14	8672
*	778.6	606.5	15	9098	*	778.6	634.5	15	9519
■	800	623.2	15	9348	■	800	652.0	15	9780
	840	654.4	14	9162		840	684.6	14	9584
	880	685.5	13	8912		880	717.2	13	9324
	920	716.7	13	9317		920	749.8	13	9747
	960	747.8	12	8974		960	782.4	12	9389
	1000	779.0	12	9348		1000	815.0	12	9780
	1040	810.2	11	8912		1040	847.6	11	9324
	1080	841.3	11	9254		1080	880.2	11	9682
	1120	872.5	11	9598		1120	912.8	11	10041
	1160	903.6	10	9036		1160	945.4	10	9454
	1200	934.8	10	9348		1200	978.0	10	9780
	1240	966.0	10	9660		1240	1010.6	10	10106
	1280	997.1	9	8974		1280	1043.2	9	9389
	1320	1028.3	9	9255		1320	1075.8	9	9682
	1360	1059.4	9	9535		1360	1108.4	9	9976
	1374.1	1070.4	9	9634		1374.1	1119.9	9	10079

NOTE: All data above represents usable fuel (basic and auxiliary) based on nominal density at 15°C (59°F).

* Quantity at which CG of fuel changes direction

■ Quantity resulting in maximum lateral CG of fuel

Table 1-3. Fuel loading with left or right auxiliary tanks (one 18.3 gal.) — longitudinal (English)

	Longitudinal								
	Jet B or JP-4 (6.5 Lb/U.S. Gallon)					Jet A, A1 or JP-5 (6.8 Lb/U.S. Gallon)			
	Quantity (U.S. Gal.)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)		Quantity (U.S. Gal.)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)
	10	56	139.4	9051		10	55	139.4	9419
	20	130	139.6	18138		20	136	139.6	18986
	30	195	138.8	27261		30	204	139.8	28519
	40	260	138.8	36314		40	272	139.9	38053
	50	325	138.9	45459		50	340	139.9	47566
..	58.7	379	138.9	53022	▲	56.3	397	139.9	55540
	60	390	140.9	54951		60	408	140.9	57487
	70	455	145.8	66339		70	476	145.8	69401
	80	520	149.0	77480		80	544	149.0	81056
	90	585	151.5	85628		90	612	151.5	92718
	100	650	153.2	99580		100	680	153.2	104176
	110	715	154.8	110682		110	748	154.8	115790
	120	780	156.0	121680		120	816	156.0	127296
	130	845	157.0	132665		130	884	157.0	138788
	140	910	160.2	143952		140	952	158.2	150606
	150	975	158.2	155220		150	1020	159.2	162384
•	156.1	1016	159.7	162255	•	156.3	1063	159.7	169761
	160	1040	158.0	164320		160	1088	158.0	171904
	170	1105	154.6	170617		170	1156	154.4	178496
	180	1170	150.8	176553		180	1224	150.9	184702
•	185.4	1231	148.1	182311	•	185.4	1298	148.1	190753
	200	1300	149.6	194480		200	1360	149.6	203456
	210	1365	150.8	205842		210	1428	150.8	215342
	220	1430	151.9	217217		220	1496	151.9	227242
	230	1495	152.9	228586		230	1564	152.9	239136
	240	1560	153.9	240084		240	1632	153.9	251165
	250	1625	154.8	251713		250	1700	154.9	263330
I I	258.4	1690	155.5	262173		259.4	1764	155.5	274302
	270	1755	154.1	270446		270	1836	154.1	282928
	280	1820	152.6	277732		280	1904	152.6	290550
	290	1885	151.2	285012		290	1972	151.2	298165
	300	1950	150.0	292500		300	2040	150.0	306000
•	311.4	2024	148.0	300156	•	311.4	2117	148.6	314585
	320	2080	149.0	310544		320	2176	149.2	324877
	330	2145	150.1	321955		330	2244	150.1	336824
	340	2210	150.9	333439		340	2312	150.9	348881
■	346.7	2254	151.4	341256	■	346.7	2358	151.4	357001

NOTE: All data shown represents usable fuel (basic and auxiliary) based on nominal density at 15°C (59°F).

- • Quantity at which CG of fuel changes direction.
- ▲ Quantity resulting in maximum forward CG of helicopter (at any weight).
- I Quantity resulting in maximum aft CG of helicopter (weight empty 6800 lb or less).
- ■ Quantity resulting in maximum aft CG of helicopter (weight empty more than 6800 lb).

Table 1-3M Fuel loading with left or right auxiliary tanks (one 617 liter) — longitudinal (Metric)

Longitudinal							
Jet B or JP-4 (0.779 kg/liter)				Jet A, A1 or JP-5 (0.815 kg/liter)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	31.2	3541	110479	40	32.6	3541	115437
80	62.3	3547	220978	80	65.2	3547	231264
120	93.5	3551	332019	120	97.9	3551	347288
160	124.6	3552	442579	160	130.4	3552	463181
200	155.8	3552	553402	200	163.0	3562	578876
_ 220.7	171.9	3553	610761	_ 220.7	179.9	3553	639185
240	187.0	3637	680119	240	195.6	3637	711397
280	218.1	3739	815478	280	228.2	3739	853240
320	249.3	3815	951080	320	260.8	3815	994952
360	280.4	3871	1085428	360	293.4	3871	1135171
400	311.6	3917	1220597	400	326.0	3917	1274942
440	342.8	3952	1354746	440	358.6	3952	1417187
480	373.9	3983	1489244	480	391.2	3983	1558110
520	405.1	4011	1625686	520	423.8	4013	1700705
560	436.2	4036	1760503	560	456.4	4036	1842036
- 591.5	460.8	4057	1889486	- 591.5	482.1	4057	1955826
600	467.4	4046	1891106	600	489.0	4046	1978494
640	498.6	3927	1958002	640	521.6	3927	2048321
680	529.7	3838	2032989	680	554.2	3838	2127020
- 717.1	558.6	3762	2101453	- 717.1	584.4	3762	2198611
720	560.9	3764	2111228	720	586.8	3764	2208715
760	592.0	3800	2249600	760	619.4	3800	2353720
800	623.2	3833	2388726	800	652.0	3833	2480114
840	654.4	3861	2526638	840	684.6	3861	2643741
880	685.5	3889	2665910	880	717.2	3889	2789191
920	716.7	3917	2807314	920	749.8	3917	2936867
960	747.8	3940	2946312	960	782.4	3940	3082666
982.0	765.0	3950	3021750	- 982.0	800.3	3950	3161186
1000	779.0	3934	3064586	1000	815.0	3934	3206710
1040	810.2	3894	3154919	1040	847.6	3894	3300504
1080	841.3	3855	3244052	1080	880.2	3856	3384061
1120	872.5	3823	3335562	1120	912.8	3823	3489634
1160	903.6	3790	3424643	1160	945.4	3790	3583066
- 1178.5	918.1	3775	3465826	- 1178.5	960.5	3775	3626888
1200	934.8	3757	3540022	1200	978.0	3787	3703686
1240	966.0	3807	3677562	1240	1010.6	3807	3847354
1280	997.1	3830	3818893	1280	1043.2	3830	3995456
■ 1312.3	1022.3	3845	3930744	■ 1312.3	1069.5	3845	4143228

NOTE: All data above represents usable fuel (basic and auxiliary) based on nominal density at 15°C (59°F).

- \- Quantity at which CG of fuel changes direction.
- _ Quantity resulting in maximum forward CG of helicopter (at any weight).
- Quantity resulting in maximum aft CG of helicopter (weight empty 3007 kg or less).
- ■ Quantity resulting in maximum aft CG of helicopter (weight empty more than 3007 kg).

Table 1-4. Fuel loading with left or right auxiliary tanks (one 16.3 gal.) — lateral (English) (Sheet 1 of 2)

Level						
Jet B or JP-4 (6.5 lb/U.S. Gallon)						
			Lateral (16.3 Left)		Lateral (16.3 Right)	
	Quantity (U.S. Gal)	Weight (Pounds)	CG (Inches)	Moment (in-lb)	CG (Inches)	Moment (in-lb)
	10	65	0	0	0	0
	20	130	0	0	0	0
	30	195	0	0	0	0
	40	260	0	0	0	0
	50	325	0	0	0	0
*	54.5	355	0	0	0	0
***	60	390	0.04	15	0.05	20
	70	455	0.43	195	0.38	173
	80	520	0.84	431	0.80	416
	90	585	1.20	702	1.15	673
	100	650	1.58	1027	1.50	975
	110	715	1.82	1301	1.77	1266
	120	780	2.07	1615	2.01	1568
	130	845	2.27	1919	2.22	1876
	140	910	2.43	2211	2.39	2175
	150	975	2.52	2457	2.49	2428
*►	152.6	992	2.53	2510	2.49	2470
**	156.3	1016	2.49	2529		
**	157.8	1026	2.67	2739		
	160	1040	2.69	2798	2.13	2215
	170	1105	2.69	2972	1.83	2022
	180	1170	2.69	3147	1.57	1837
**	182.3	1185	2.69	3194		
*	190	1235	2.67	3297	1.37	1692
	200	1300	2.54	3302	1.29	1677
	210	1365	2.42	3303	1.23	1679
	220	1430	2.30	3289	1.18	1687
	230	1495	2.20	3289	1.11	1659
	240	1560	2.11	3292	1.08	1685
	250	1625	2.03	3299	1.04	1690
	260	1690	1.95	3296	1.00	1690
	270	1755	1.88	3299	0.96	1685
	280	1820	1.81	3294	0.92	1674
	290	1885	1.75	3288	0.89	1678
	300	1950	1.69	3298	0.86	1677
	310	2015	1.64	3305	0.84	1693
	320	2080	1.58	3286	0.81	1685
	330	2145	1.54	3303	0.78	1673
	340	2210	1.49	3293	0.74	1620
	346.7	2254	1.46	3291	0.75	1691

* Quantity at which CG of fuel changes direction.

** Quantity at which CG of fuel changes direction for left auxiliary tank only.

*** Quantity at which CG of fuel changes direction for right auxiliary tank only.

\+ Quantity resulting in maximum lateral CG of helicopter for left auxiliary tank.

► Quantity resulting in maximum lateral CG of helicopter for right auxiliary tank.

Table 1-4. Fuel loading with left or right auxiliary tanks (one 16.3 gal.) — lateral (English) (Sheet 2)

		Level			
		Jet A, A-1 or JP-5 (6.8 Lb/U.S. Gallon)			
		Lateral (16.3 Left)		Lateral (16.3 Right)	
Quantity (U.S. Gal.)	Weight (Pounds)	CG (Inches)	Moment (In-Lb)	CG (Inches)	Moment (In-Lb)
10	68	0	0	0	0
20	136	0	0	0	0
30	204	0	0	0	0
40	272	0	0	0	0
50	340	0	0	0	0
* 54.6	371	0	0	0	0
*** 60	408	-0.04	-16	-0.05	-20
70	476	-0.43	-205	0.38	181
80	544	-0.84	-457	0.80	435
90	612	-1.20	-734	1.15	704
100	680	-1.58	-1074	1.50	1020
110	748	-1.82	-1361	1.77	1324
120	816	-2.07	-1689	2.01	1640
130	884	-2.27	-2007	2.22	1962
140	952	-2.43	-2313	2.39	2275
150	1020	-2.52	-2570	2.49	2540
* ◆ 152.6	1038	-2.53	-2626	2.49	2585
** 156.0	1061	-2.48	-2635		
** 157.8	1073	-2.67	-2865		
160	1088	-2.68	-2927	2.13	2317
170	1156	-2.69	-3110	1.83	2115
180	1224	-2.69	-3293	1.57	1922
** 182.8	1243	-2.68	-3331		
+ 190	1292	-2.67	-3450	1.37	1770
200	1360	-2.54	-3454	1.29	1754
210	1428	-2.42	-3456	1.23	1756
220	1496	-2.30	-3441	1.18	1765
230	1564	-2.20	-3441	1.13	1767
240	1632	-2.11	-3444	1.08	1763
250	1700	-2.03	-3451	1.04	1768
260	1768	-1.95	-3448	1.00	1768
270	1836	-1.88	-3452	0.96	1763
280	1904	-1.81	-3446	0.92	1752
290	1972	-1.75	-3451	0.89	1755
300	2040	-1.69	-3448	0.86	1754
310	2108	-1.64	-3457	0.84	1771
320	2176	-1.58	-3438	0.81	1763
330	2244	-1.54	-3456	0.78	1750
340	2312	-1.49	-3445	0.76	1757
346.5	2356	-1.46	-3443	0.75	1769

* Quantity at which CG of fuel changes direction
** Quantity at which CG of fuel changes direction for left auxiliary tank only
*** Quantity at which CG of fuel changes direction for right auxiliary tank only
\+ Quantity resulting in maximum lateral CG of helicopter for left auxiliary tank
◆ Quantity resulting in maximum lateral CG of helicopter for right auxiliary tank

Table 1-4M. Fuel loading with left or right auxiliary tanks (one 81.7 liter) — lateral (Metric) (Sheet 1 of 2)

Lateral					
Jet B or JP-4 (0.779 kg/liter)					
		Lateral (81.7 L left)		Lateral (81.7 R right)	
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	CG (mm)	Moment (kg-mm)
40	31.2	0	0	0	0
80	62.3	0	0	0	0
120	93.5	0	0	0	0
160	124.6	0	0	0	0
200	155.8	0	0	0	0
* 206.6	160.9	0	0	0	0
240	187.0	-4	-748	2	374
280	218.1	-15	-3272	14	3053
320	249.3	-26	-6482	25	6233
360	280.4	-35	-9814	34	9534
400	311.6	-43	-13399	42	13087
440	342.8	-50	-17140	49	16797
480	373.9	-56	-20938	55	20565
520	405.1	-61	-24711	60	24306
560	436.2	-64	-27917	63	27481
* ► 577.6	450.0	-64	-28800	63	28350
** 581.6	453.0	-64	-29030		
** 597.1	465.1	-68	-31627		
600	467.4	-68	-31783	55	25707
640	498.6	-68	-33905	47	23434
680	529.7	-68	-36020	40	21188
** 691.8	538.9	-68	-36645		
+ 720	560.9	-68	-38141	35	19632
760	592.0	-64	-37888	33	19536
800	623.2	-61	-38015	31	19319
840	654.4	-58	-37955	30	19632
880	685.5	-55	-37703	28	19194
920	716.7	-53	-37985	27	19351
960	747.8	-51	-38130	26	19443
1000	779.0	-49	-38171	25	19475
1040	810.1	-47	-38079	24	19445
1080	841.3	-45	-37809	23	19350
1120	872.5	-43	-37510	22	19195
1160	903.6	-42	-37951	21	18976
1200	934.8	-41	-38327	20	18631
1240	966.0	-39	-37674	20	19320
1280	997.1	-38	-37890	19	18945
1317.3	1022.0	-37	-37825	19	19474

* Quantity at which CG of fuel changes direction.
** Quantity at which CG of fuel changes direction for left auxiliary tank only.
\+ Quantity resulting in maximum lateral CG of helicopter for left auxiliary tank.
► Quantity resulting in maximum lateral CG of helicopter for right auxiliary tank.

Table 1-4M. Fuel loading with left or right auxiliary tanks (one 61.7 liter) — lateral (Metric) (Sheet 2)

Lateral					
Jet A, A1 or JP-5 (0.815 kg/liter)					
		Lateral (61.7 Left)		Lateral (61.7 Right)	
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg mm)	CG (mm)	Moment (kg mm)
40	32.6	0	0	0	0
80	65.2	0	0	0	0
120	97.8	0	0	0	0
160	130.4	0	0	0	0
200	163.0	0	0	0	0
* 208.6	168.4	0	0	0	0
240	195.6	4	782	2	391
280	228.2	15	3423	14	3195
320	260.8	26	6781	25	6520
360	293.4	35	10269	34	9976
400	326.0	43	14018	42	13692
440	358.6	50	17930	49	17571
480	391.2	56	21907	55	21516
520	423.8	61	25852	60	25428
560	456.4	64	29210	63	28753
* ++ 577.5	470.7	64	30125	63	29654
** 591.6	482.1	63	30372		
** 597.1	486.6	68	33089		
600	489.0	66	32257	55	26895
640	521.6	68	35469	47	24515
680	554.2	68	37686	40	22168
** 691.8	563.8	68	38338		
+ 720	586.8	68	39902	35	20538
760	619.4	64	39642	33	20440
800	652.0	61	39772	31	20212
840	684.6	58	39707	30	20538
880	717.2	55	39446	28	20082
920	749.8	53	39739	27	20245
960	782.4	51	39902	26	20342
1000	815.0	49	39935	25	20375
1040	847.6	47	39837	24	20342
1080	880.2	45	39609	23	20245
1120	912.8	43	39250	22	20082
1160	945.4	42	39707	21	19853
1200	978.0	41	40098	21	20538
1240	1010.6	39	39413	20	20212
1280	1043.2	38	39642	19	19821
1312.3	1069.5	37	39572	19	20321

* Quantity at which CG of fuel changes direction.

** Quantity at which CG of fuel changes direction for left auxiliary tank only.

\+ Quantity reaching maximum lateral CG of helicopter for left auxiliary tank.

\++ Quantity reaching maximum lateral CG of helicopter for right auxiliary tank.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

TWO-SPEED INTERNAL HOIST

(412-899-223)

OR

(214-706-003)

CERTIFIED

SEPTEMBER 19, 1988

This supplement shall be attached to the Model 412 & 412EP Flight Manual when the 412-899-223 or 214-706-003 Internal Hoist has been installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

REISSUE — MAY 11, 1995

NOTICE PAGE

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LOG OF REVISIONS

Original ....0 ....September 19, 1988
Revision ....1 .... May 25, 1990
Reissue ....0 ....May 11, 1995

LOG OF PAGES

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF APPROVED REVISIONS

Original .... 0 .... September 19, 1988
Revision .... 1 .... May 25, 1990
Reissue .... 0 .... May 11, 1995

APPROVED:

for MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

The Two Speed Internal Hoist enables cargo and emergency rescue operations in areas where landing cannot be accomplished. The hoist can raise or lower loads up to 600 pounds (272 kilograms). The hoist contains 250 usable feet (76.2 meters) cable. Each of the four cabin mounting locations allows the hoist to be extended 90 degrees outboard. The hoist provides two extend/retrieve speeds (HIGH and LOW). With LOW speed selected, a continuously variable speed range from zero to 125 feet/minute (38.1 meters/minute) is available. With HIGH speed selected, a continuously variable speed range from zero to 250 feet/minute (76.2 meters/minute) is available. An electrically actuated cable cutting device allows either the pilot or hoist operator to sever the cable if necessary. A manually actuated cutting device is provided for use in the event of an electrical failure.

Section 1

LIMITATIONS

1-3. TYPES OF OPERATION

Hoist operations shall be conducted under appropriate operating rules for external loads.

Passenger operations with hoist installed are approved if hoist is stowed and electrical system is deactivated.

Hoist operations are prohibited during instrument meteorological conditions.

1-4. FLIGHT CREW

A crewmember wearing an approved safety harness in passenger compartment is required during all phases of hoist operations. Crewmember shall wear protective gloves for guiding cable during operation. The hoist operator shall be familiar with hoist operating procedures and limitations.

1-5. CONFIGURATION

1-5-A. REQUIRED EQUIPMENT

Hoist cable antichafing guard shall be installed on standard or high skid landing gear (with or without floats) on same side of helicopter as hoist.

1-5-B. OPTIONAL EQUIPMENT

Fixed passenger step shall not be installed concurrently with internal hoist.

Retractable passenger steps shall be stowed during hoist operations.

Hoist operation with flight director in coupled mode is prohibited.

Hoisting or lowering an empty litter in open position (except Stokes litter) is prohibited.

Refer to appropriate Flight Manual Supplement(s) for additional limitations, procedures, and performance data.

1-6. WEIGHT AND CENTER OF GRAVITY

Actual weight change shall be determined after hoist is installed and ballast readjusted, if necessary.

For maximum gross weight, including hoist load, refer to applicable Flight Manual or BHT-412-FM-19.1 when Increased Gross Weight and Takeoff Horsepower kit is installed.

Maximum hoist load is 600 pounds (272 kilograms). This is a structural limitation only and does not ensure that longitudinal or lateral CG will remain within approved limits. Maximum allowable hoist load varies with gross weight, center of gravity, and hoist location. Refer to appropriate Hoist Loading Schedule.

NOTE

The center of gravity of hoist load in forward position is F.S. 82 (2083 mm) and B.L. 60 (1524 mm). The center of gravity of hoist load in aft position is F.S. 131 (3327 mm) and B.L. 64.4 (1636 mm).

For Longitudinal vs. Lateral CG limits with internal hoist refer to internal hoist CG envelope figure 1-1.

1-7. AIRSPEED

VNE with asymmetrical door configuration is 20 KIAS.

VNE with hinged panels locked open and cargo doors open is 20 KIAS.

VNE with hinged panels removed and cargo doors removed or secured open is 60 KIAS.

1-23. HOIST SPEED

HIGH speed — Limited to hoist loads of 300 pounds (136 kilograms) or less.

LOW speed — Limits of basic hoist (600 pounds., 272 kilograms).

1-24. HOIST DUTY CYCLE LIMITATIONS

The hoist is approved for continuous operation with loads not to exceed 600 pounds (272 kilograms).

1-25. ALLOWABLE HOIST LOAD

Select hoist loading schedules (figures 1-2 through 1-5) appropriate for position in which hoist is installed.

NOTE

Hoist loading schedules are based on most adverse loading combinations of pilot, copilot, and hoist operator, each weighing 170 or 200 pounds (77.1 or 90.7 kilograms), and on a weight empty CG of 0.3 inches (7.3 mm) to right of centerline prior to adding hoist. If lateral CG is appreciably different or crewmember weights are out of this range, allowable hoist load shall be computed. For computation, assume hoist operator in forward position to be located at F.S. 87 (2210 mm) and B.L. 40 (1016mm), and in aft position F.S. 125 (3175mm) and B.L. 40 (1016mm).

1-25-A. LEFT HOIST INSTALLATIONS

Enter appropriate schedule, figures 1-2 through 1-5 at gross weight of helicopter prior to hoisting. Proceed vertically to intersect with diagonal line representing number of crewmembers on board, top of schedule, or right cutoff line. Proceed horizontally to left to read maximum allowable hoist load. Intersecting with right cutoff line gives maximum load which does not cause helicopter to exceed gross weight limitations.

Using Weight empty chart, Section 5 and left hoist loading schedules ensures that both longitudinal and lateral limits are not exceeded during first hoist operation. However, for subsequent hoisting, additional precautions must be taken to avoid exceeding forward longitudinal limits.

1-25-A-1. LEFT FORWARD HOIST LOCATION

To continue using maximum allowable hoist capability: (Refer to figure 1-2 through 1-5)

a. put hoisted load (people or cargo) along side of island, or

b. when hoisted load is put immediately forward of island, reduce maximum hoist load to 300 pounds.

WARNING

DO NOT PUT HOISTED LOAD IN FORWARD AREA OF PASSENGER COMPARTMENT UNLESS MAXIMUM HOIST LOADS ARE COMPUTED FOR THAT CONFIGURATION.

1-25-A-2. LEFT AFT HOIST LOCATION

To continue using maximum allowable hoist capability: (Refer to figure 1-2 through 1-5)

a. put hoisted load along island or immediately forward of island, or

b. ensure empty weight CG is within Area A. Refer to Weight empty chart, Section 5.

1-25-B. RIGHT HOIST INSTALLATIONS — NORMAL OPERATIONS

Right lateral limit for hoist operations varies with longitudinal center of gravity of the helicopter. The loading schedules have been modified to account for this variation.

a. Starting with appropriate schedule for number of crewmembers on board, enter at gross weight of helicopter prior to hoisting.

b. Proceed vertically to intersect with diagonal line representing helicopter center of gravity prior to hoisting, top of schedule, or right cutoff line.

c. Proceed horizontally to left to read maximum allowable hoist load.

When helicopter center of gravity is between STA. lines, interpolate to determine CG.

Intersecting right cutoff line gives maximum load which does not cause helicopter to exceed gross weight limitations or forward longitudinal limits.

For multiple hoists during a single flight, after each hoist operation enter appropriate schedule at revised gross weight and proceed to new center of gravity to determine maximum allowable hoist load.

EXAMPLE 1: NORMAL

Determine Hoist Load when hoist is in R/H FWD POISTION and crew consist of Pilot, Copilot and Hoist Operator.

GIVEN:

Gross Weight — 9,500 lbs.

CG — STA. 135.5 before hoisting

From appropriate 11,600 lb. GW schedule obtain hoist load as follows:

Enter gross weight at 9,500 lbs.

Proceed up GW line to interpolated STA. 135.5

Proceed left to read hoist load of 310 lbs. Point (A).

EXAMPLE 2: NORMAL

Determine Hoist Load when hoist is in R/H FWD POSITION and crew consist of Pilot, Copilot and Hoist Operator.

GIVEN:

Gross Weight — 9,500 lbs.

CG — STA. 138.5 before hoisting

From appropriate 11,600 lb. GW schedule obtain hoist load as follows:

Enter gross weight at 9,500 lbs.

Proceed up GW line to STA. 138.5

Proceed left to read hoist load of 560 lbs. Point (B).

1-25-C. RIGHT HOIST INSTALLATION - PENALTY REGION OPERATION

The dashed line on schedules represents longitudinal center of gravity prior to hoisting which will result in a gross weight center of gravity at Sta. 135.2 and B.L. 4.5 during hoist operations with maximum hoist loads derived using this line. This center of gravity is the corner of but not in Penalty Region shown in Limitations.

Hoist loads derived for Normal Operations may be increased when GW/CG combinations are forward of those represented by dashed line. Loads may be increased up to but not greater than those defined by dashed line. However, this procedure will result in operations within Penalty Region. Refer to Section 1, Internal Hoist CG Envelope, for Penalty Region.

EXAMPLE 3: PENALTY REGION

Determine Hoist Load when hoist is in R/H FWD POSITION and crew consist of Pilot, Copilot and Hoist Operator.

GIVEN:

Gross Weight — 9,500 lbs.

CG — STA. 135.5 before hoisting

From appropriate 11,600 lb. GW schedule obtain hoist load as previously determined in Example 1 the maximum hoist load for normal operations is 210 lbs. Point Ⓐ.

To increase hoist load to maximum for condition without exceeding GW/CG limits, proceed up to dashed line and read left to find 435 lbs. Point Ⓒ.

The Penalty Region is any load greater than Point Ⓐ up to maximum load at Point Ⓒ.

For GW vs. CG combinations aft of the CG represented by the dashed line (see Example 2), there is no Penalty Region.

1-26. WEIGHT EMPTY CHART

The Weight empty chart for internal hoisting operations is shown in Section 5. Refer to the maintenance manual for additional information.

NOTE

Allowable hoist load must be computed when weight empty is not within specified guidelines, shown in Section 5.

NOTE

Allowable hoist loads must be computed when AUX Fuel kits are installed.

Longitudinal/Lateral C.G. Envelope for Internal Hoist Operations

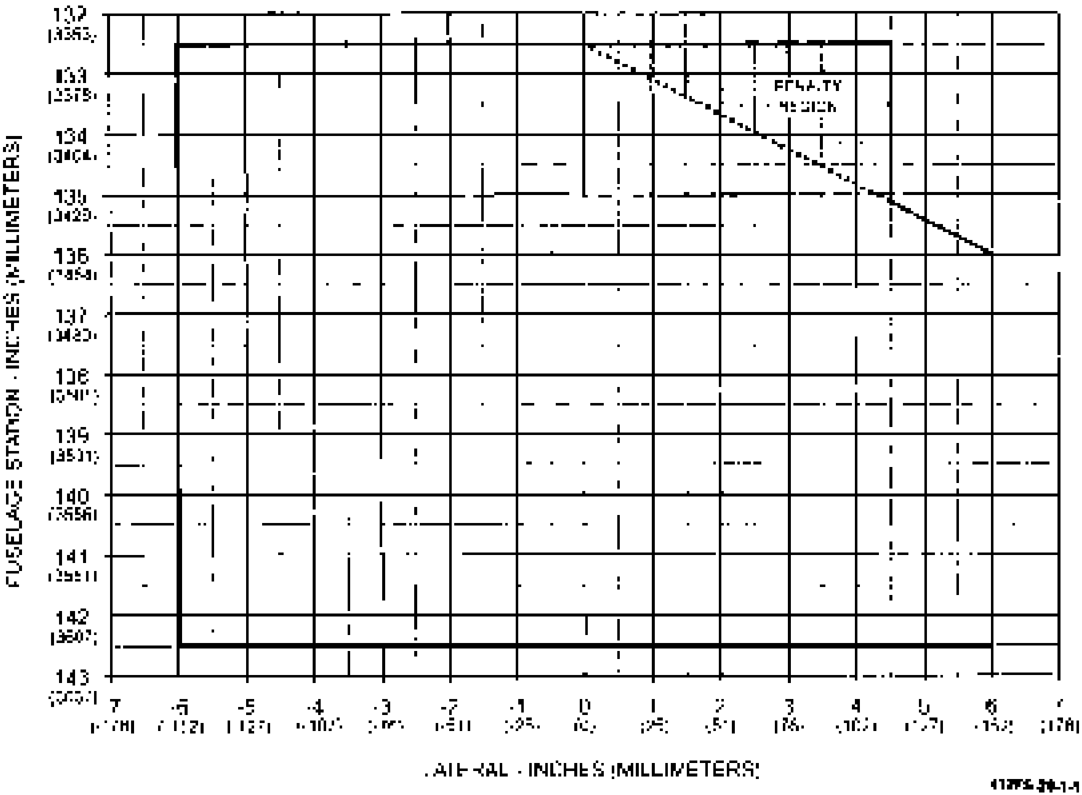


Figure 1-1. Internal hoist C.G. envelope

L/H FWD POSITION

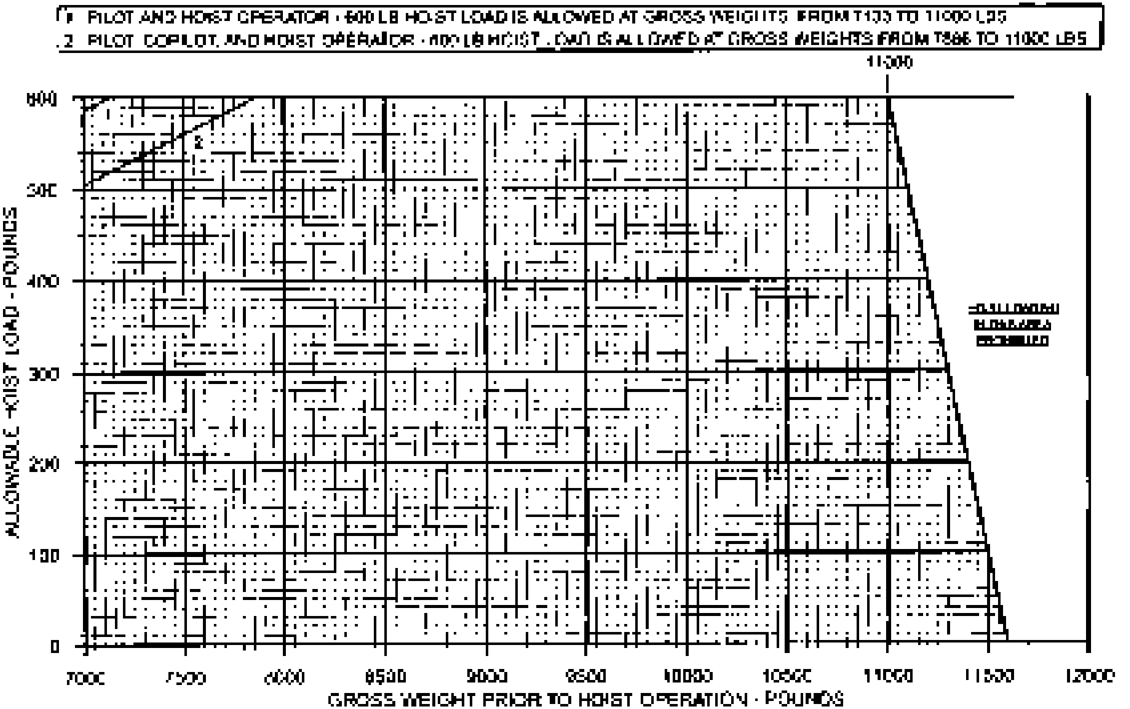


Figure 1-2. Hoist loading schedules 11,600 lb. GW (English) (Sheet 1 of 6)

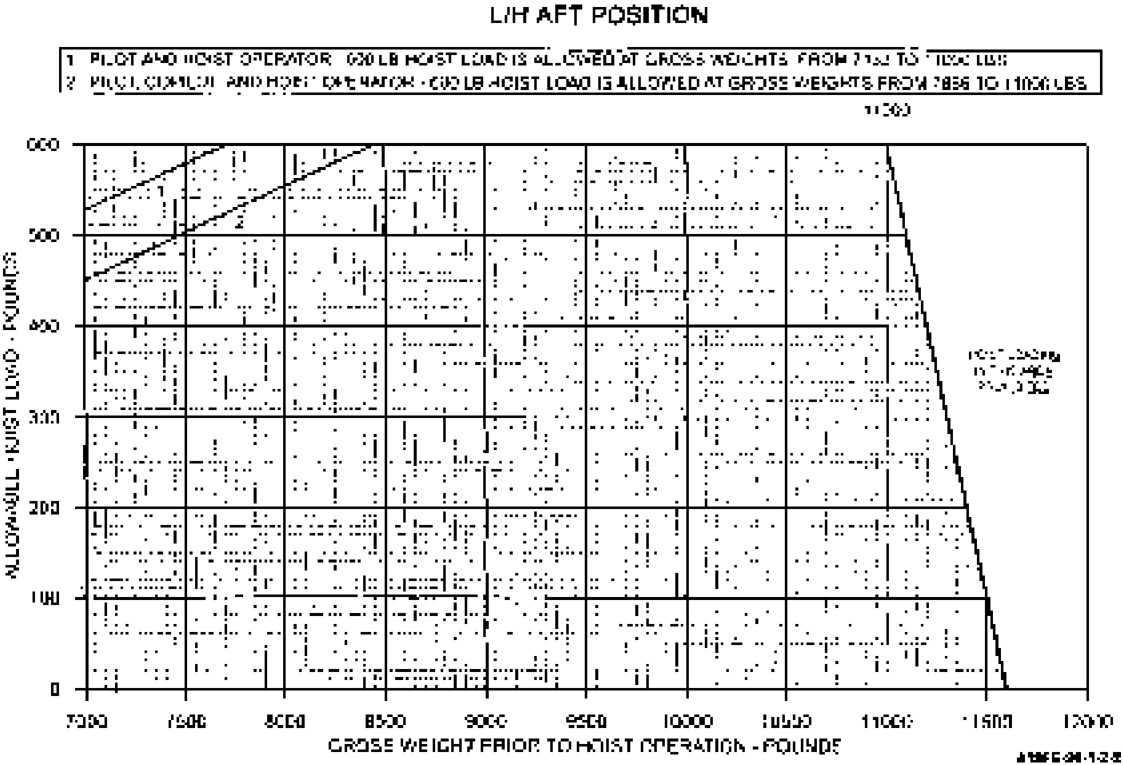
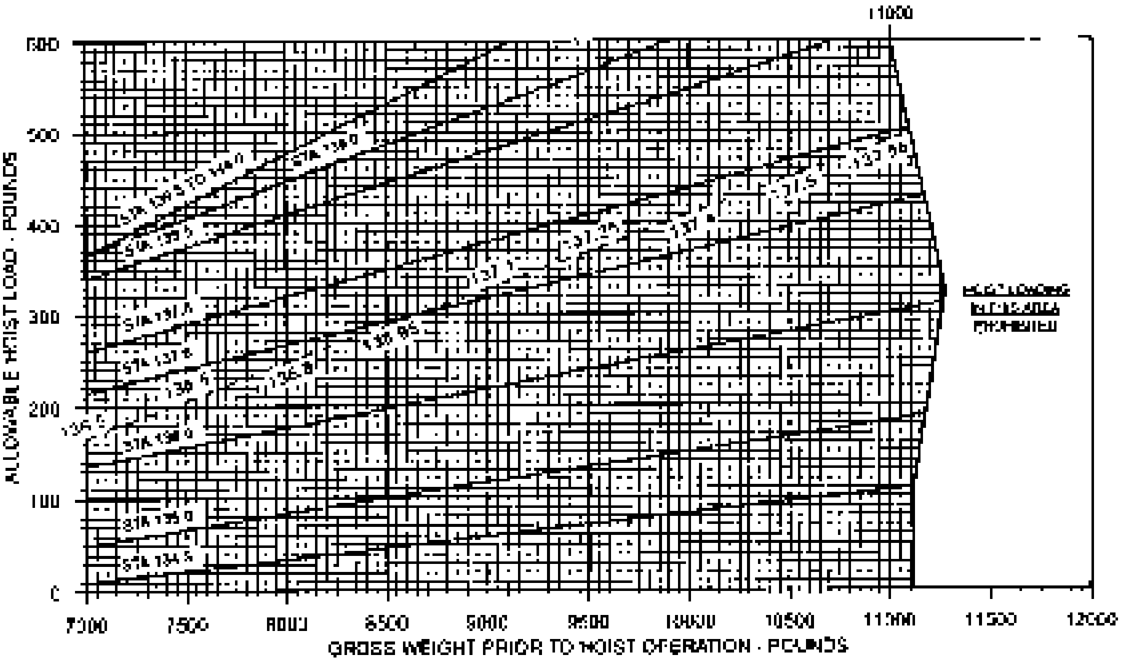


Figure 1-2. Hoist loading schedules 11,600 lb. GW (English) (Sheet 2 of 6)

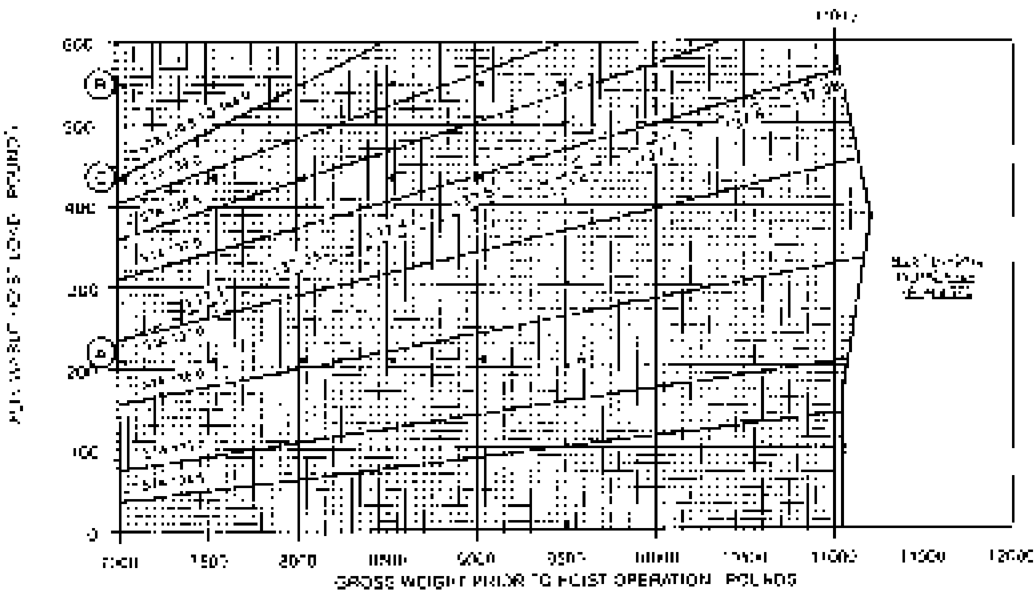
R/H FWD POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-2. Hoist loading schedule 11,600 lb. GW (English) (Sheet 3 of 6)

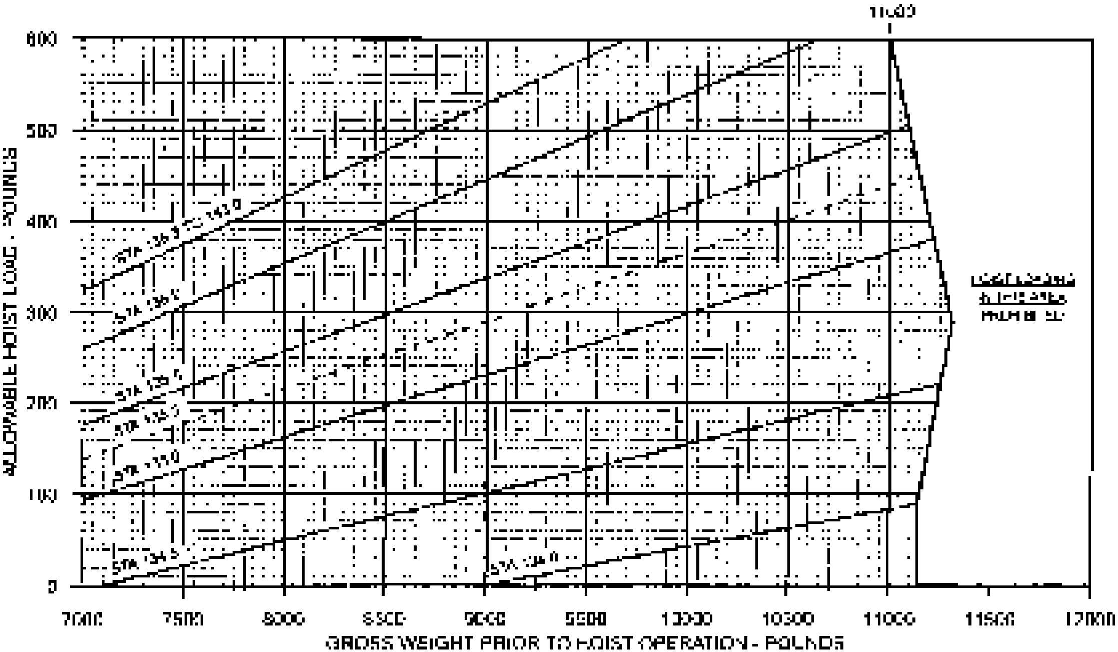
R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT.

Figure 1-2. Hoist loading schedules 11,600 lb. GW (English) (Sheet 4 of 6)

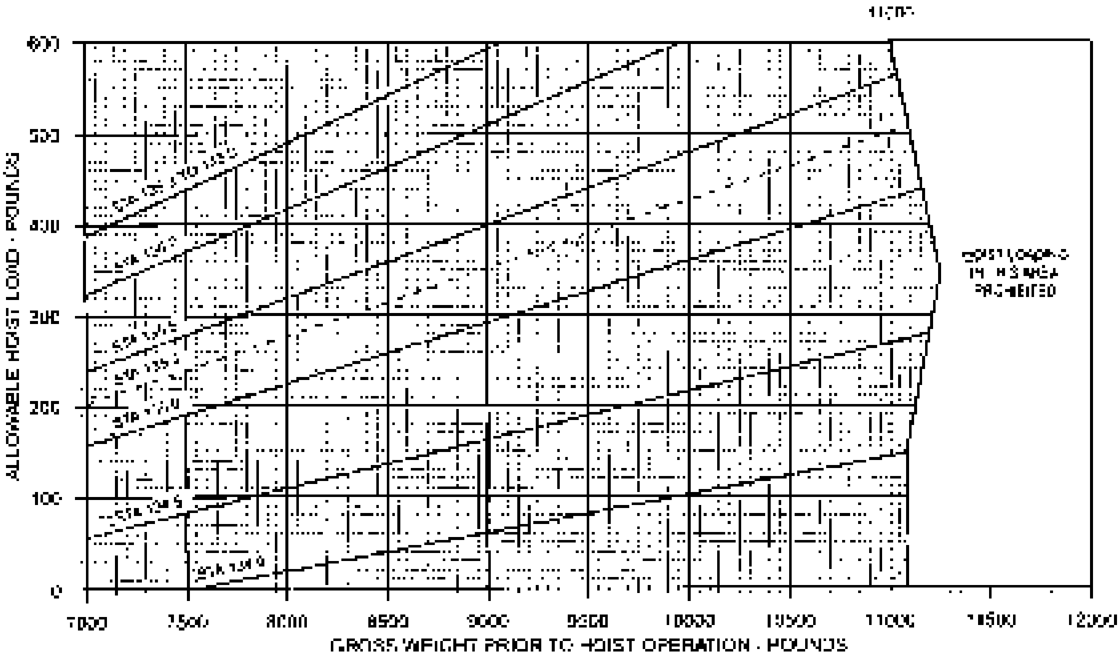
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-2. Hoist loading schedule 11,600 lb. GW (English) (Sheet 5 of 5)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-2. Hoist loading schedules 11,900 lb. GW (English) (Sheet 5 of 6)

L/H FWD POSITION

1 PILOT AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM 3233.8 TO 4989.5 KGS
2 PILOT, COPILOT, AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM 3566.5 TO 4989.5 KGS

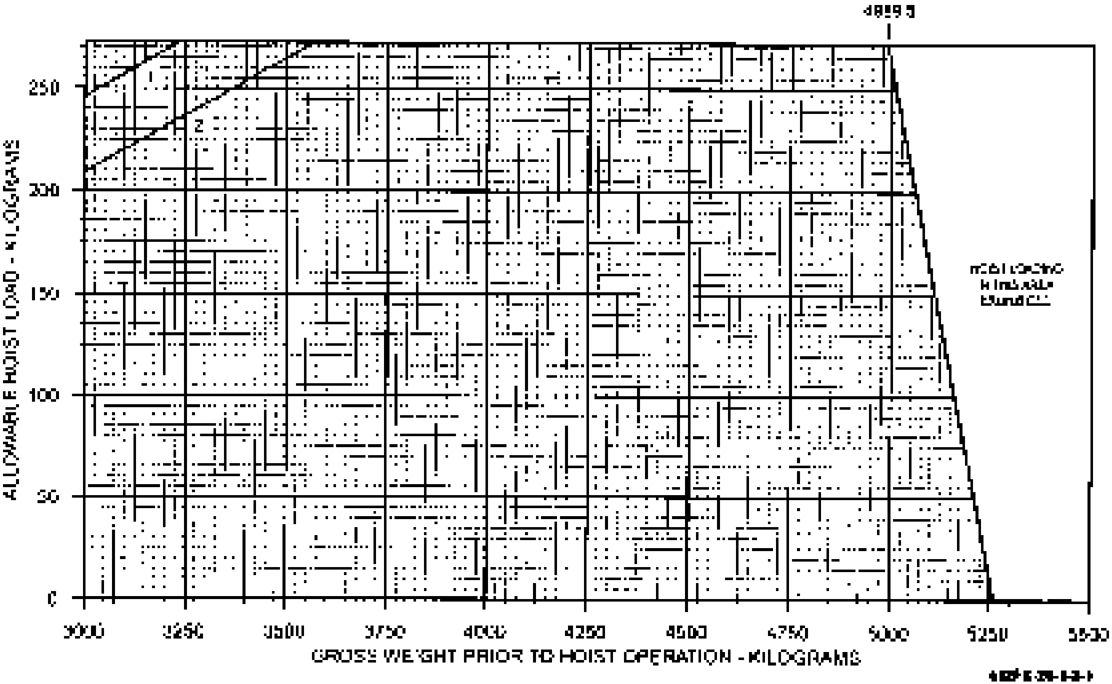


Figure 1-3. Hoist loading schedules 5261 kg GW (Metric) (Sheet 1 of 6)

L/H AFT POSITION

1	PILOT AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM [illegible] TO 4989.5 KGS
2	PILOT, COPILOT AND HOIST OPERATOR - 600 LB HOIST LOAD IS ALLOWED AT GROSS WEIGHTS FROM [illegible] TO 4989.5 KGS

4030.5

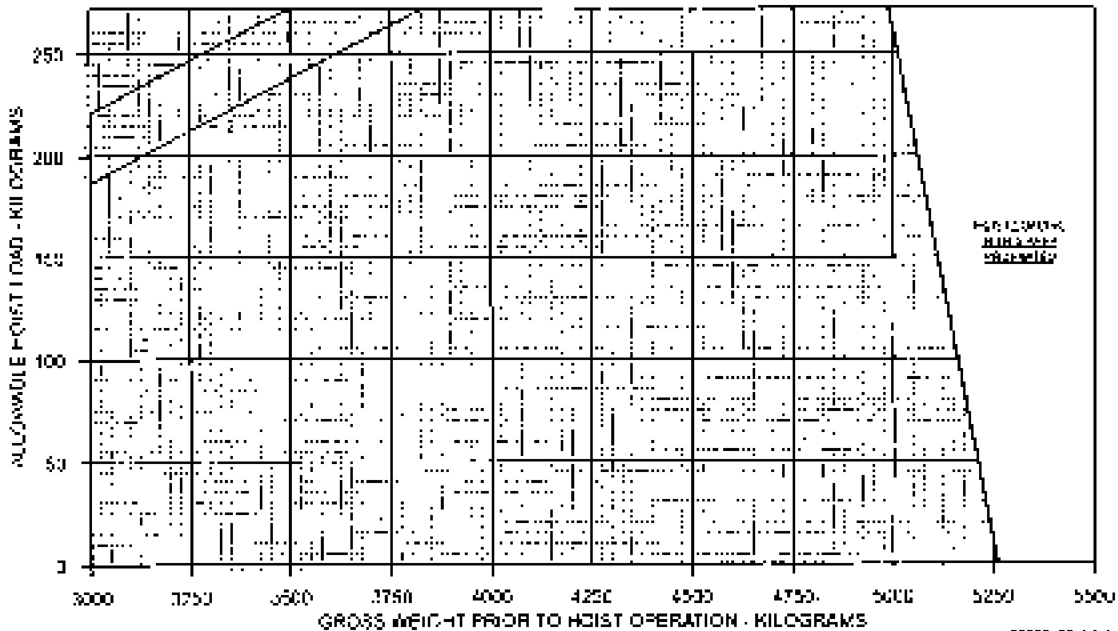
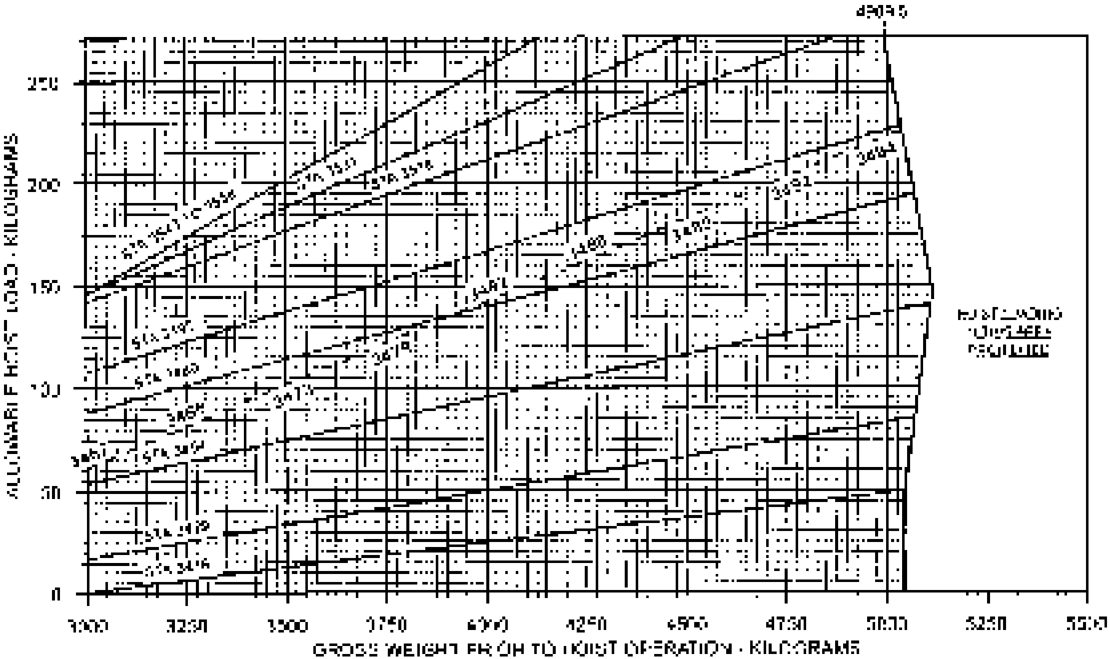


Figure 1-3. Hoist loading schedules 5261 kg GW (Metric) (Sheet 2 of 6)

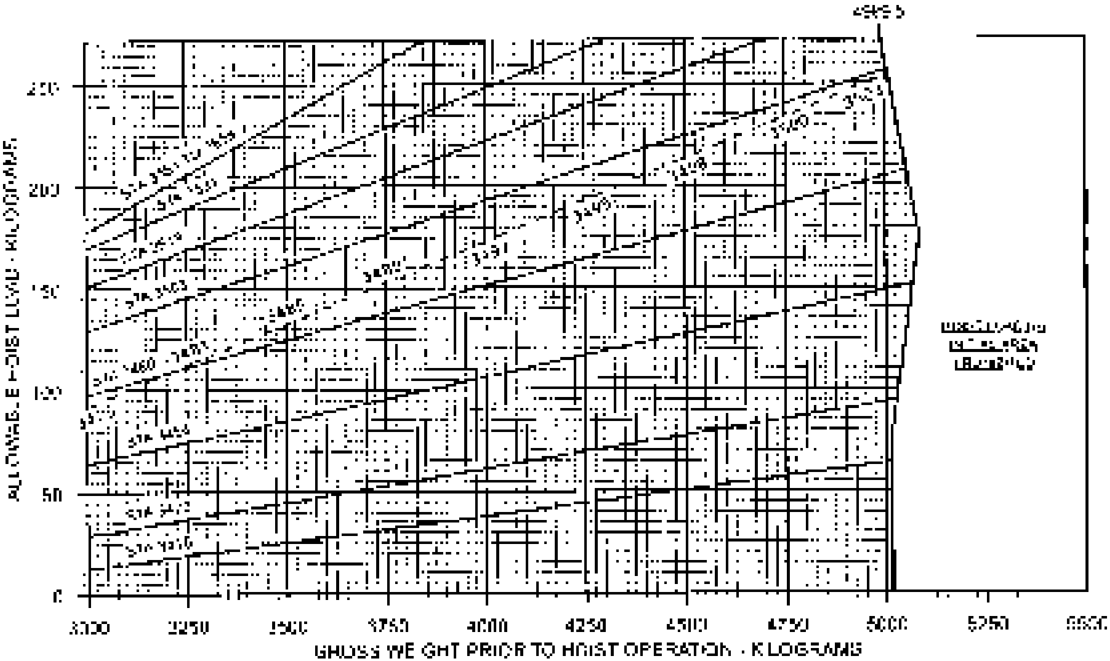
R/H FWD POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 3 of 6)

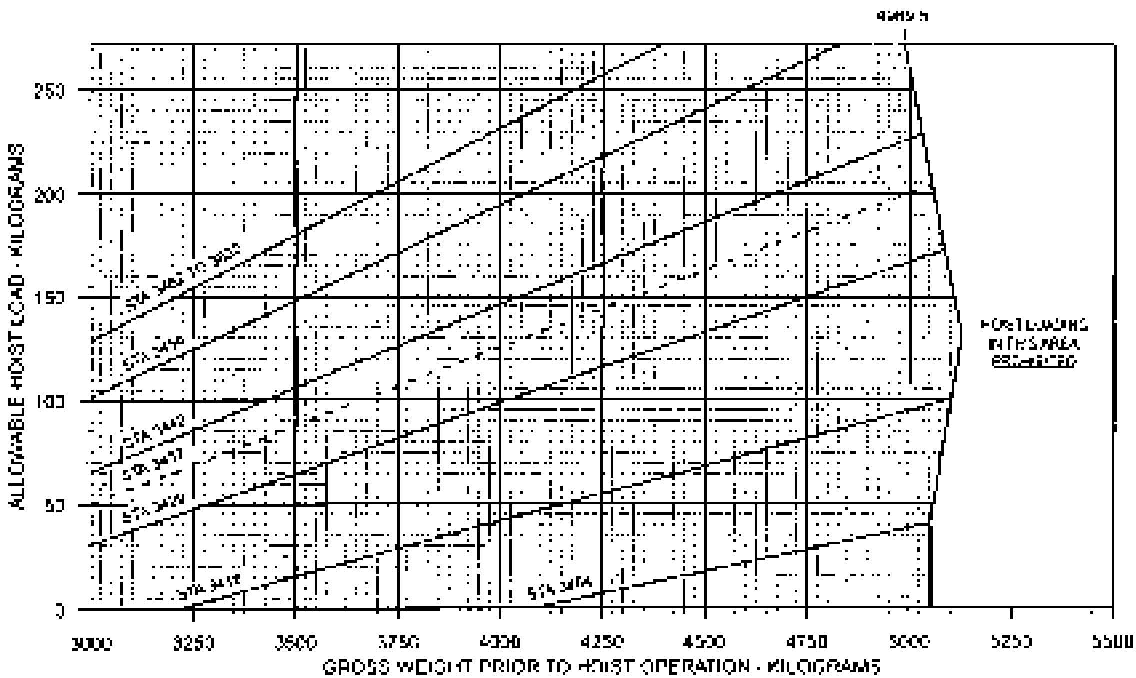
R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-3 Hoist loading schedules 5261 kg. GW (Metric) (Sheet 4 of 6)

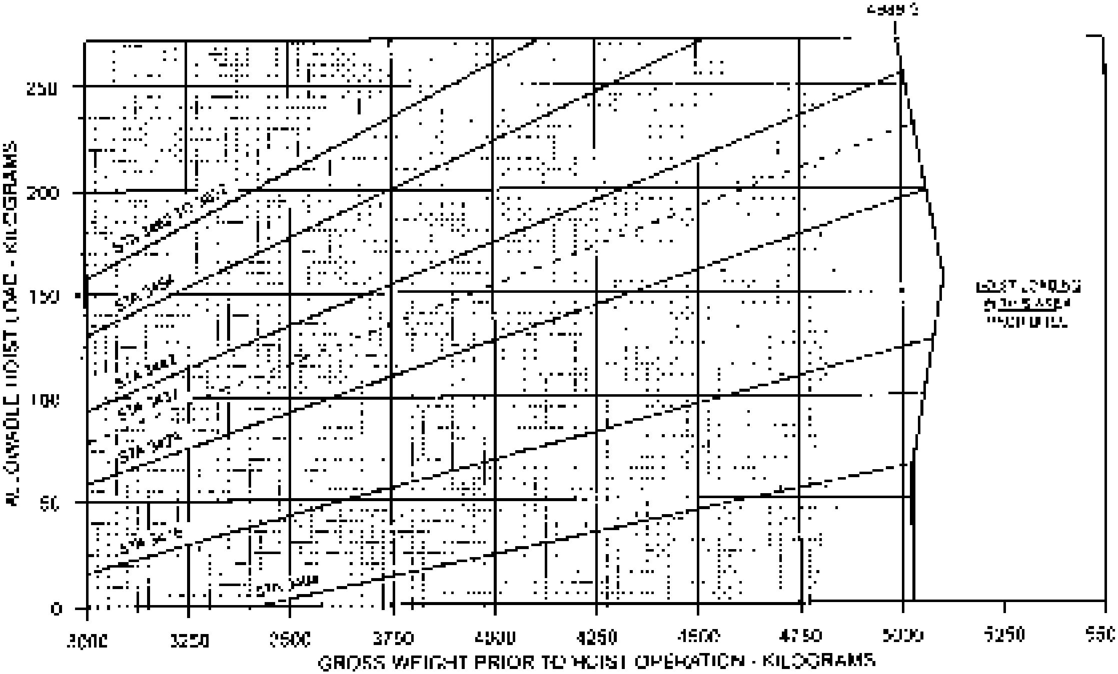
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-3. Hoist loading schedule 5261 kg. GW (Metric) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-3. Hoist loading schedules 5261 kg. GW (Metric) (Sheet 6 of 6)

L/H FWD POSITION

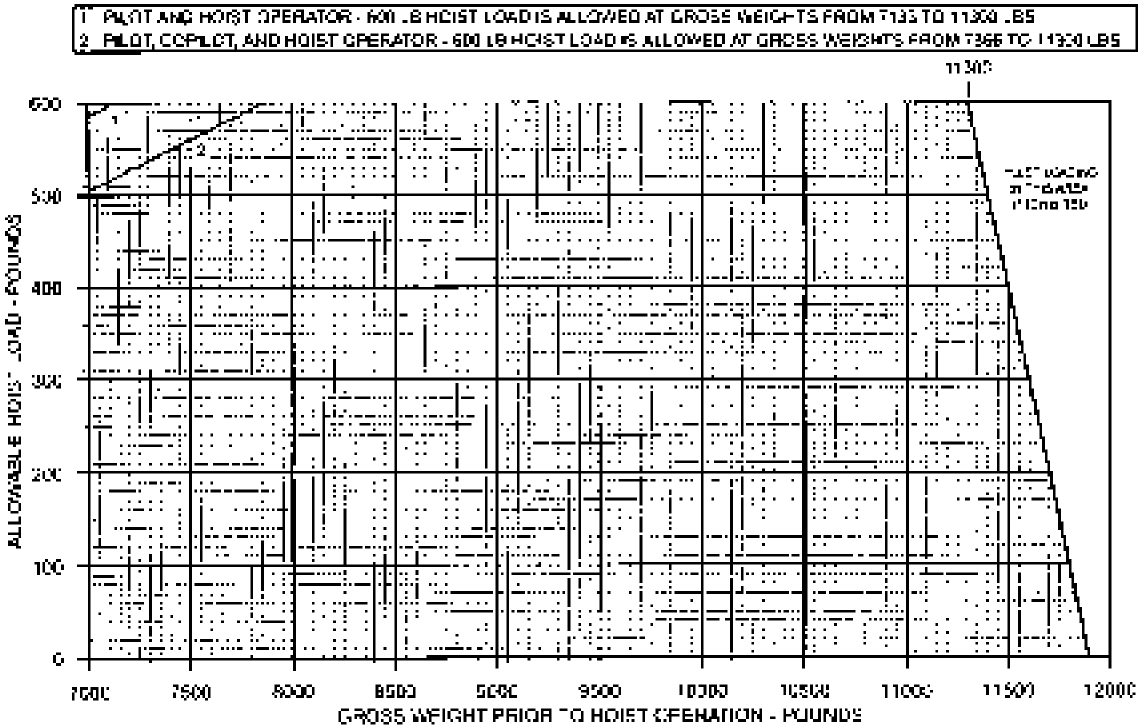


Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 1 of 5)

L/H AFT POSITION

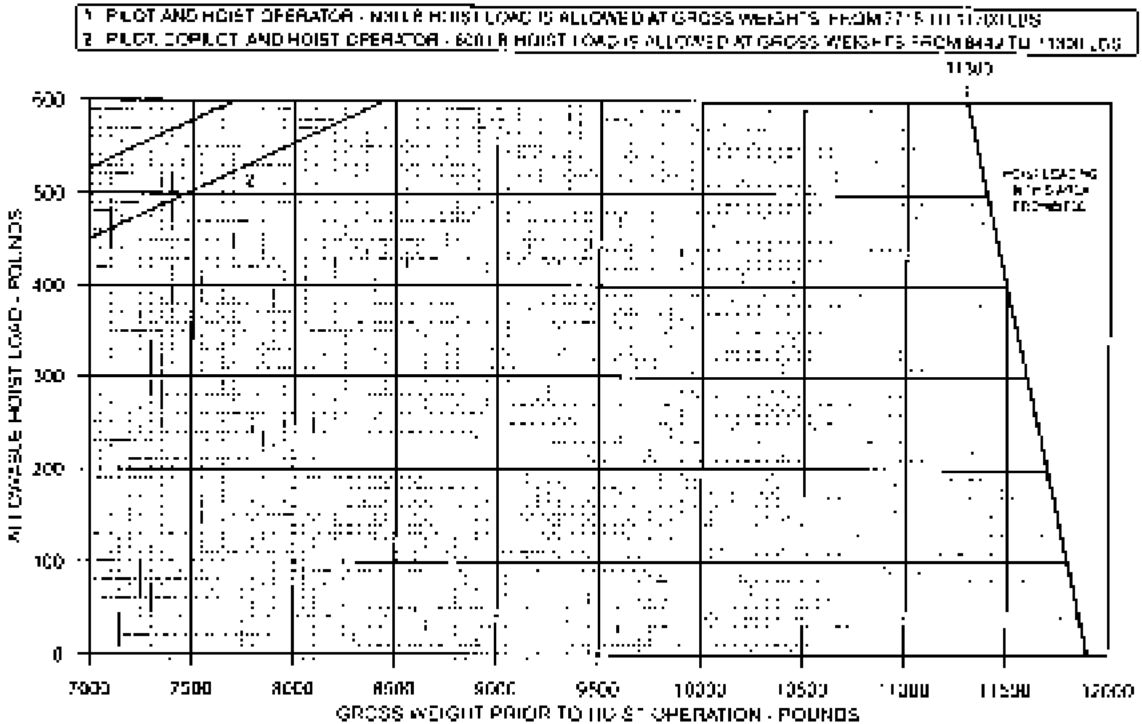
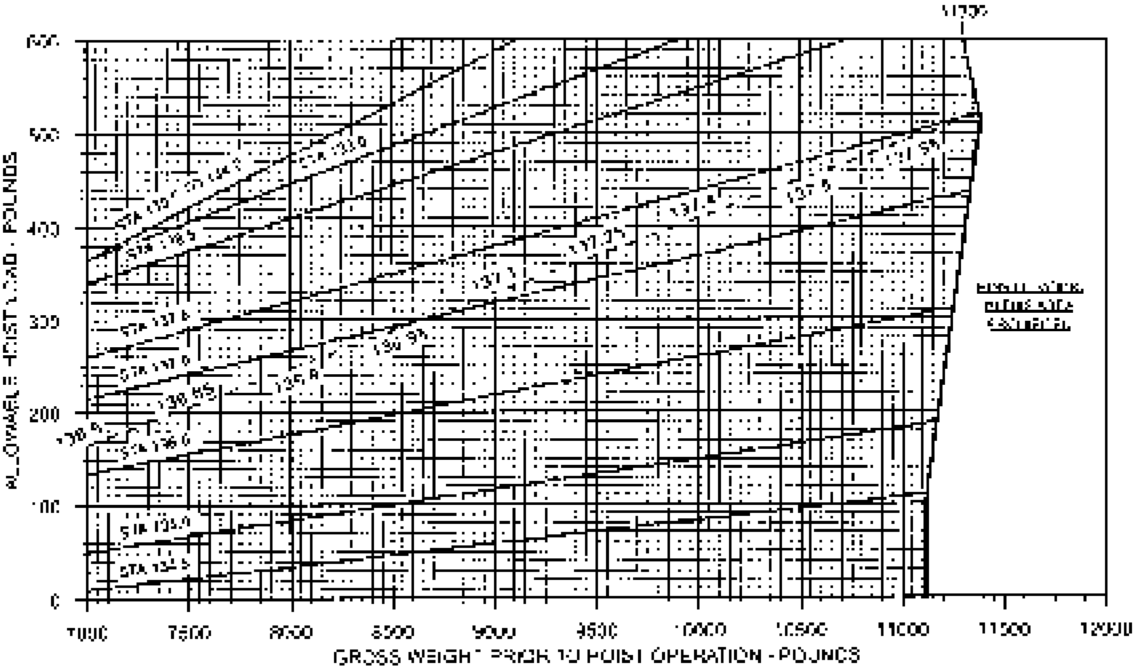


Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 2 of 6)

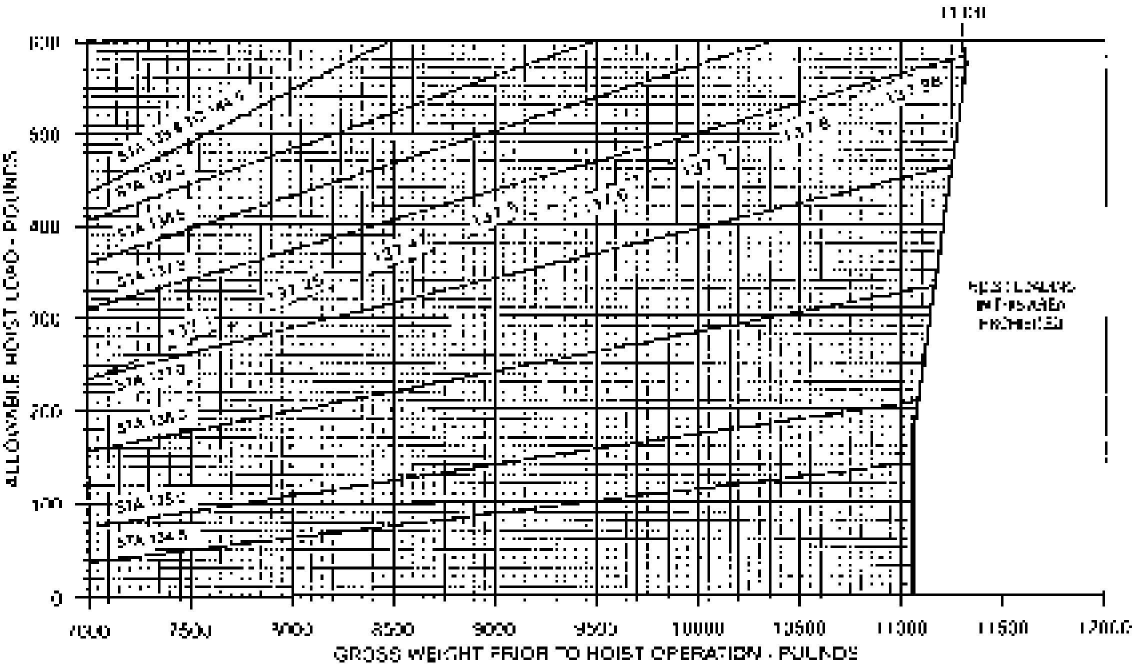
R/H FWD POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-4. Hoist loading schedule 11,900 lb. GW (English) (Sheet 3 of 6)

R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR

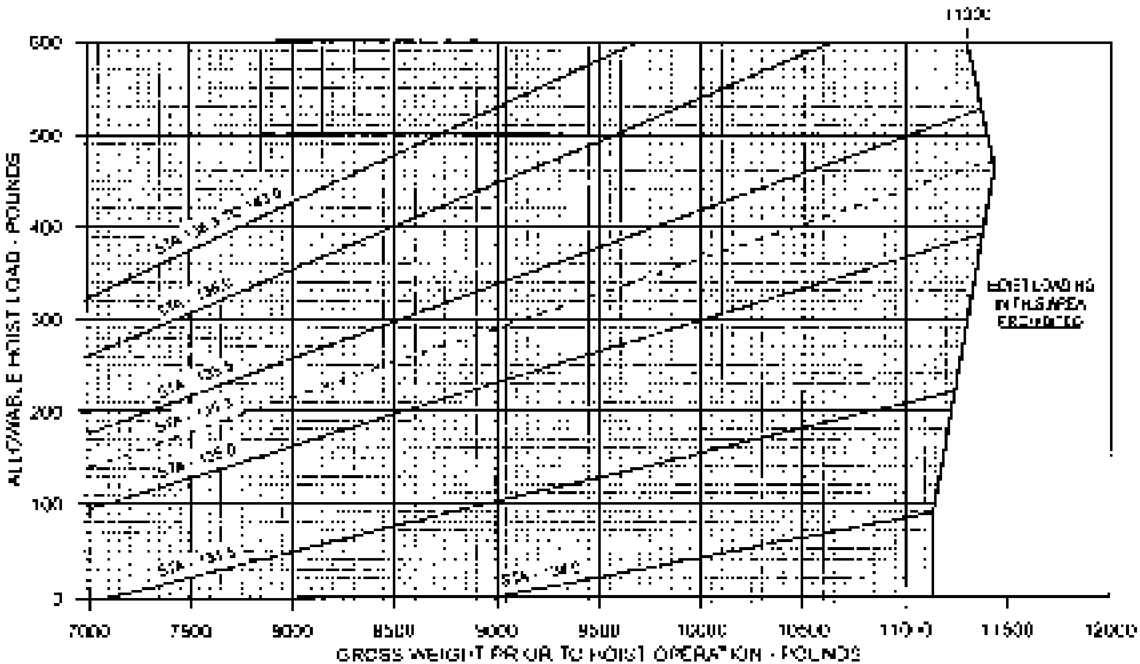


NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

412FS-26-1-4-4

Figure 1-4. Hoist loading schedule 11,900 lb. GW (English) (Sheet 4 of 6)

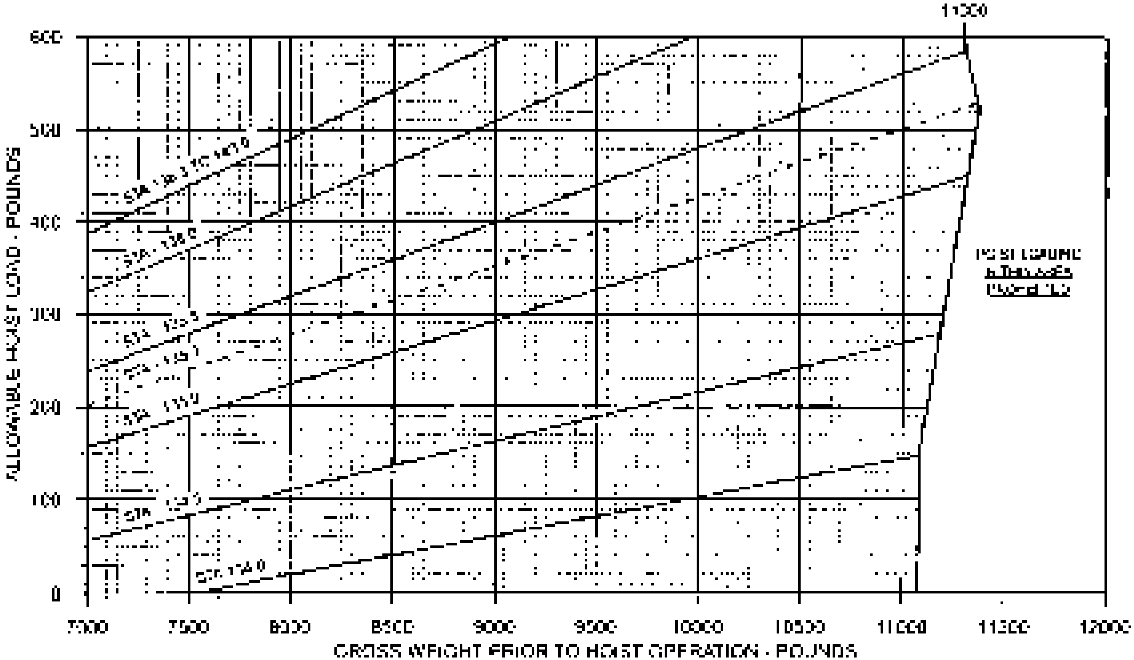
R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-4. Hoist loading schedules 11,900 lb. GW (English) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

Figure 1-4. Hoist loading schedule 11,900 lb. GW (English) (Sheet 5 of 6)

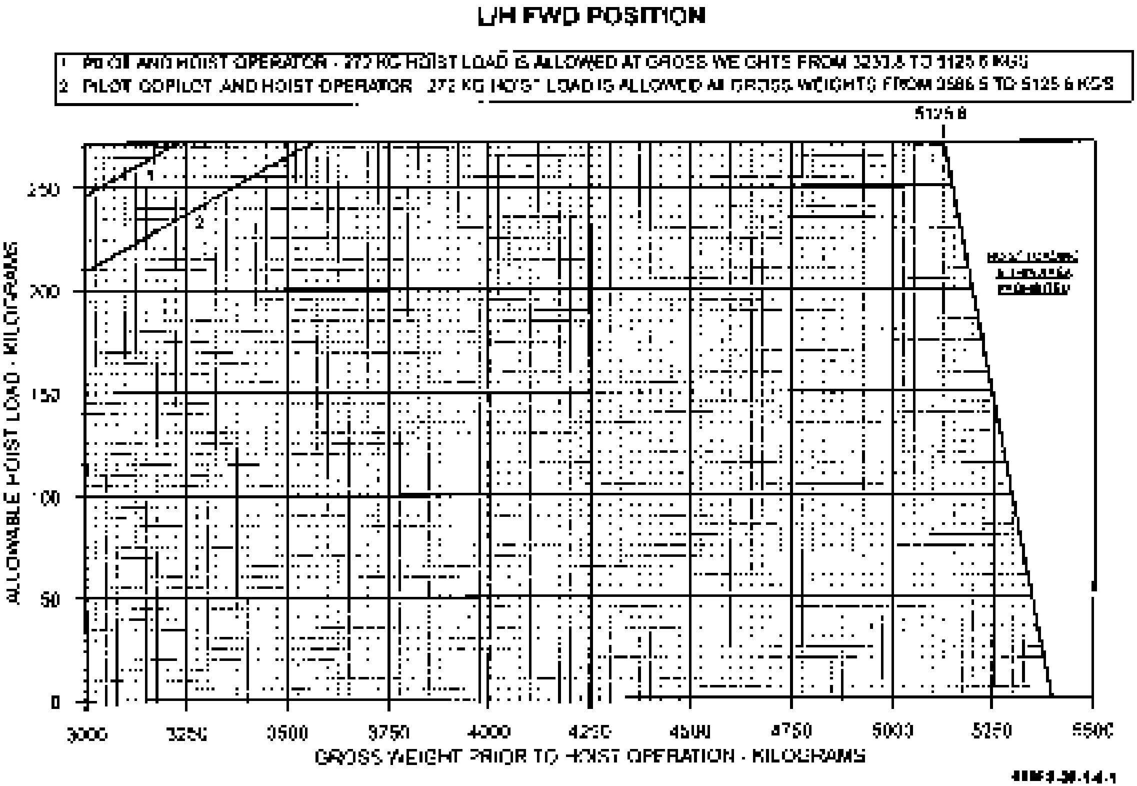
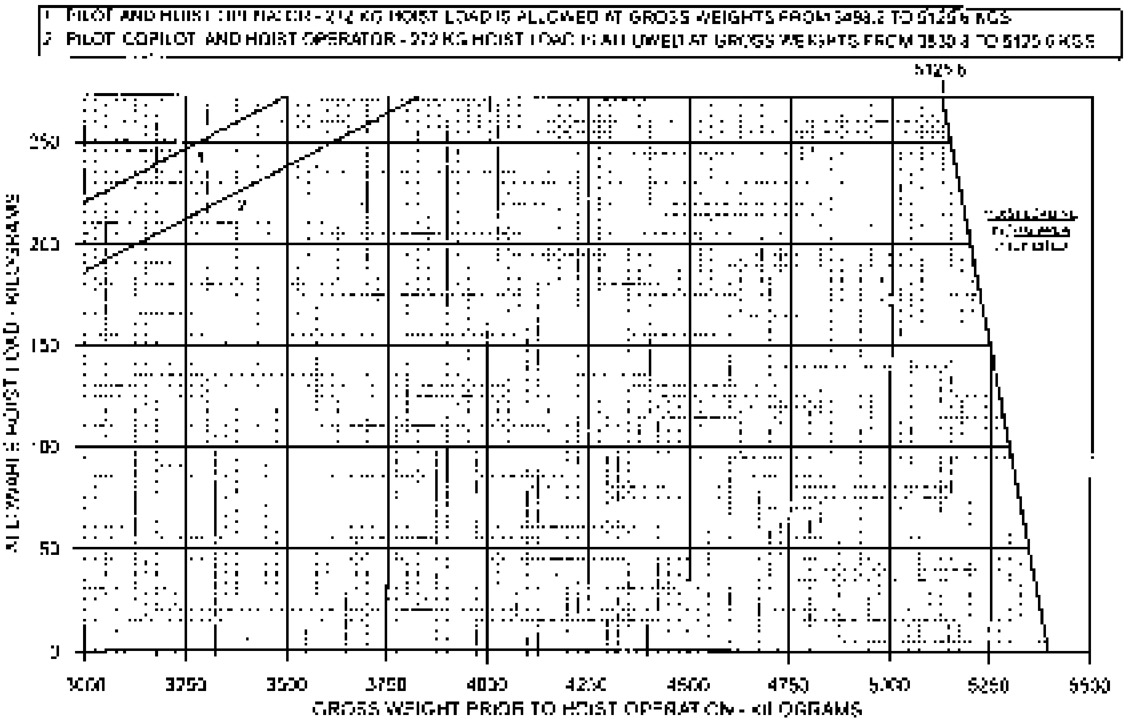


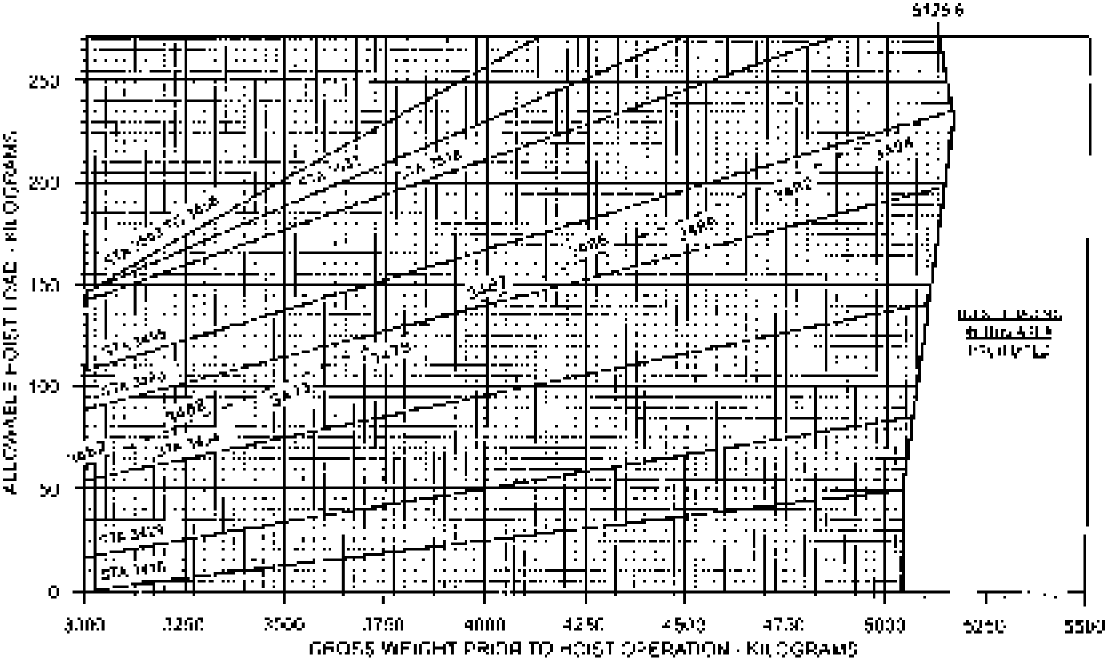
Figure 1-5 Hoist loading schedule - 5397 kg. GW (Metric) (Sheet 1 of 6)

Figure 1-5. Hoist loading schedules 5397 kg GW (Metric) (Sheet 2 of 6)

L/H AFT POSITION



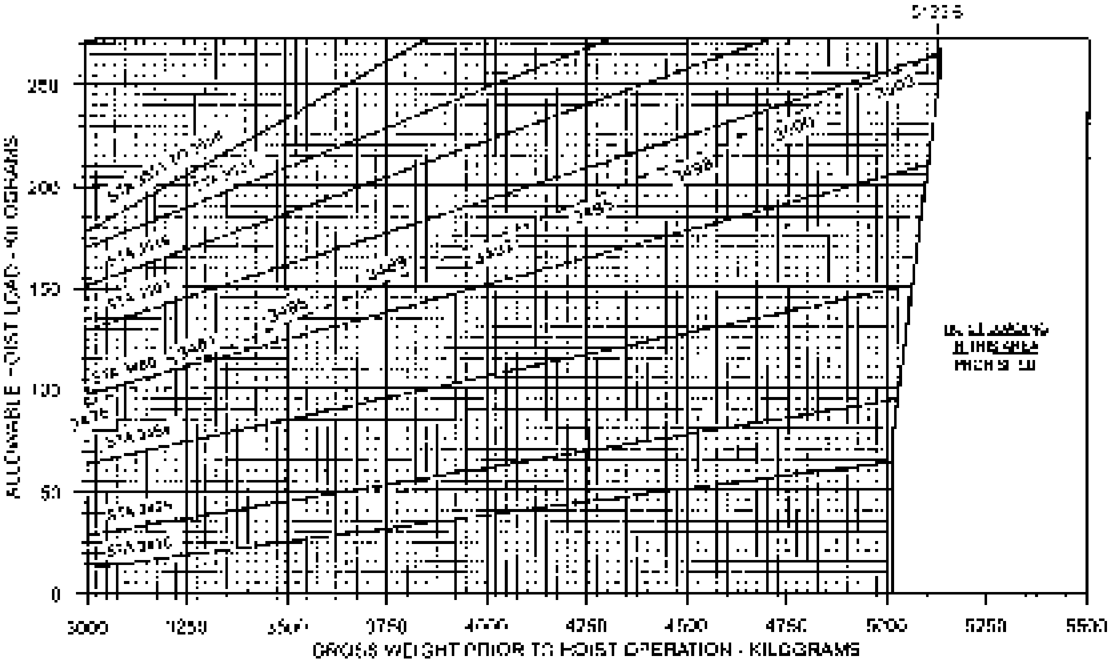
R/H FWD POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT

Figure 1-5. Hoist loading schedules 5397 kg. GW (Metric) (Sheet 3 of 6)

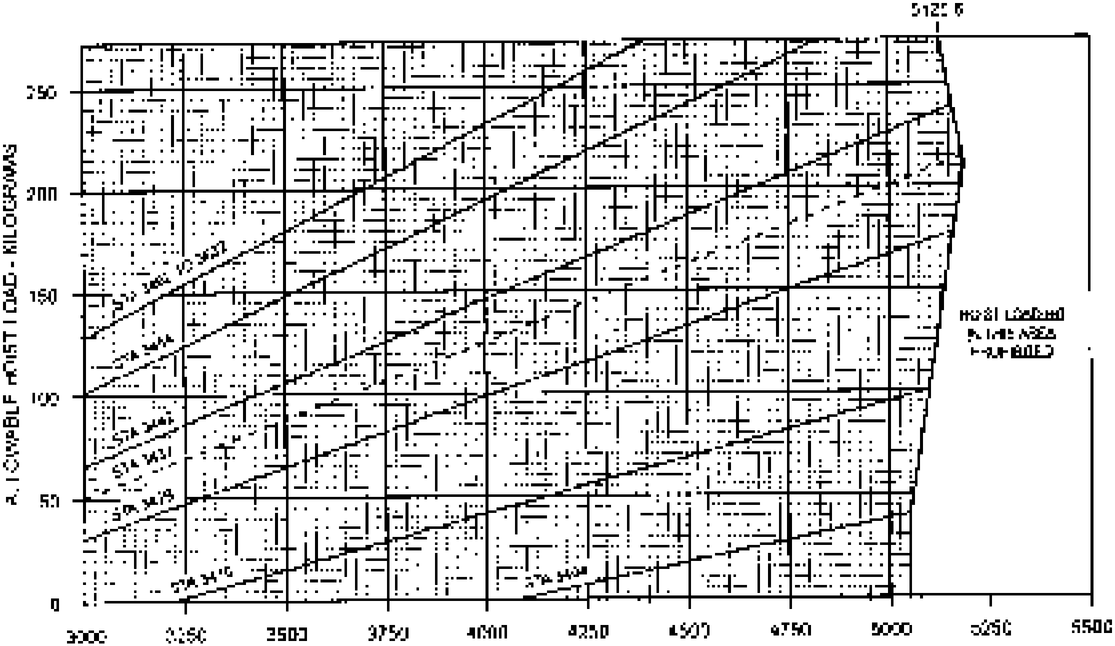
R/H FWD POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE INDICATES A DIFFERENT LONGITUDINAL C.G. FOR EACH GROSS WEIGHT.

Figure 1-8. Hoist loading schedules 5397 kg. GW (Metric) (Sheet 4 of 6)

R/H AFT POSITION - PILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS

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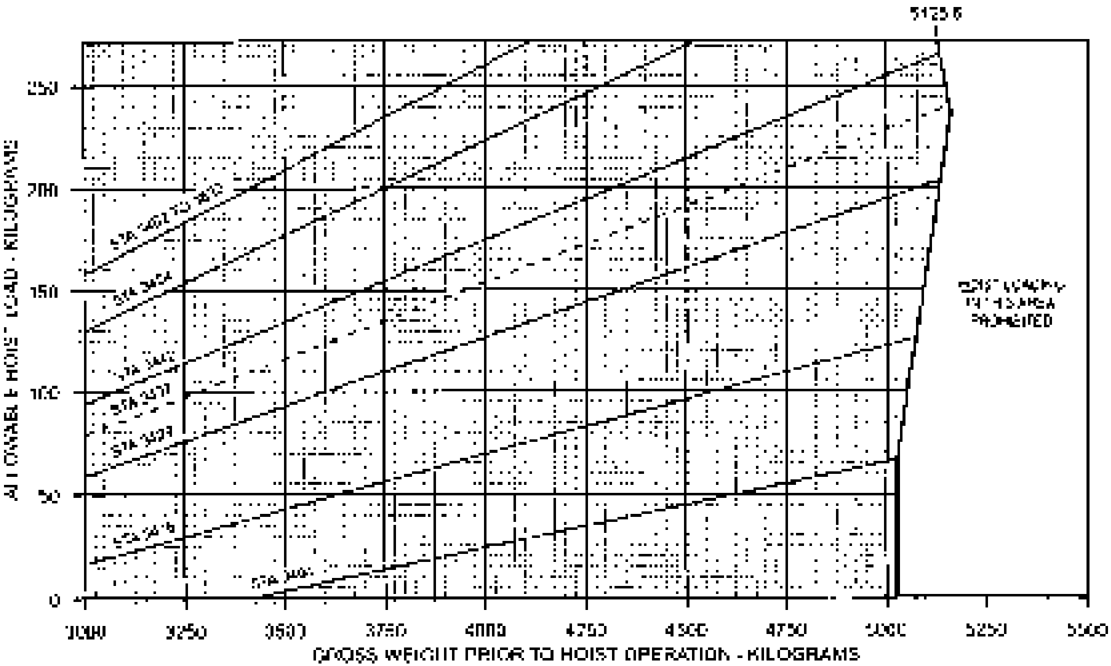
Figure 1-5. Hoist loading schedules 5397 kg GW (Metric) (Sheet 5 of 6)

R/H AFT POSITION - PILOT, COPILOT AND HOIST OPERATOR



NOTE: THE DASHED LINE IS A CONSTANT LONGITUDINAL C.G. FOR ALL GROSS WEIGHTS.

Figure 1-5. Hoist loading schedules 5397 kg. GW (Metric) (Sheet 6 of 6)

Section 2

NORMAL PROCEDURES

2-2. FLIGHT PLANNING

WARNING

HOIST LOAD CAN CAUSE LONGITUDINAL OR LATERAL CG LIMITS TO BE EXCEEDED.GROSS WEIGHT AND CENTER OF GRAVITY SHALL BE COMPUTED TO ASSURE LOADING WITHIN APPROVED LIMITS.

CAUTION

IF ADDITIONAL LOADS ARE CARRIED DURING HOISTING OPERATIONS, LOADS SHOULD BE PLACED ON SIDE OF HELICOPTER OPPOSITE HOIST POSITION.

Gross weight and CG — Compute with and without hoist load.

2-4. INTERIOR AND PRESTART CHECK

2-4-A. HOIST INSTALLATION CHECK

NOTE

If pilot plans to operate hoist with other crewmember in passenger compartment, hoist shall be installed in forward right position.

Hoist — Installed in desired position; check roof and floor stud adapters and locking collars properly secured.

Boom actuator — Installed in proper position; all fittings secured.

AIRCRAFT POSITION switch (on hoist control box, figure 2-1) — Set in proper position.

Hook — Rotates freely on cable.

Cable — Check proper routing through guide rollers, pulleys, and drums.

Gearbox oil levels — Check sight glasses.

Hoist operators pendant — Installed; connectors secured.

Electrical power cables — Condition; connectors secured.

WARNING

ACTUATION OF *CABLE CUT* SWITCH ON PEDESTAL CAN CUT CABLE REGARDLESS OF *HOIST PWR* SWITCH POSITION. ACTUATION OF *CABLE CUT* SWITCH ON HOIST CAN CUT CABLE, EVEN IF *CABLE CUT* CIRCUIT BREAKER IS OUT.

CABLE CUT switches (pedestal and hoist) — Off; covers safetied.

Safety vests, tether straps, hoisting slings, and litters — Condition; secured or stored.

2-4-B. HOIST OPERATION CHECK

Cargo doors and hinged panels — Secured open or removed.

HOIST PWR. CONT and CABLE CUT circuit breakers — In.

BATTERY switches — ON (or connect external power).

NON ESNTL BUS switch — MANUAL.

ICS — Check intercom between pilot and hoist operator using hoist pendant ICS trigger and HOT MIC switch (right ICS box only)

HOIST PWR switch — ON. Check that blue HOIST POWER light on hoist control box and amber CAUTION light on hoist pendant illuminates.

Hoist pendant CAUTION and OVER TEMP indicators — Press to test.

HOIST UP/DOWN, BOOM IN/OUT, and SPEED HIGH/LOW switches (pilot and operator) — Actuate to check all hoist functions for proper operation. Check that pilot HOIST switch overrides pendant HOIST switch.

Hoist OVERTEMP warning lights — Press to test.

CAUTION

MAINTAIN TENSION ON HOIST CABLE WHILE REELING IN AND OUT TO PREVENT SLACK.

HOIST and BOOM switches (pilot and operator) — Actuate to check all hoist functions for proper operation. Check that pilot HOIST switch overrides operator pendant HOIST switch.

Hoist cable — Check for corrosion, kinks, flat spots, fraying, or broken strands.

Up limit switch actuator - Raise while hoist is reeling in and check hoist motor stops; then release and check hoist resumes operation.

Reduce hoist speed as cable approaches up limit. Check that hoist stops when hook reaches up limit without excess tension on cable.

Hoist - Stowed for flight; hook restraint secured.

HOIST PWR switch - OFF.

NON ESNTL BUS switch - NORMAL.

BATTERY switches - OFF.

NOTE

Ground crewmember should be instructed to discharge helicopter static electricity before attaching load to hoist when possible.

2-6. SYSTEMS CHECK

Cargo doors and hinged panels - Secured open or removed.

CABLE CUT switches (pedestal and hoist) - Off; covers safetied.

HOIST PWR, CONT, and CABLE CUT circuit breakers - In.

2-6-A. BEFORE TAKEOFF

Safety vests and straps - On and secured to helicopter.

Gloves - On.

STEP switch (if installed) - STOW.

2-9. IN-FLIGHT OPERATIONS

Maximum hoist load shall be determined prior to each hoist operation.

NOTE

The Height-Velocity Diagram is not a limitation for internal hoist operations under an appropriate operating certificate.

HOIST PWR switch - ON.

WARNING

HOIST OPERATOR SHALL BE SECURED TO HELICOPTER WITH AN APPROVED SAFETY HARNESS DURING HOIST OPERATIONS.

Establish hover over hoist operation area.

Hoist hook restraint - Removed.

SPEED switch — As desired (refer to limitations).

BOOM switch (or pilots HOIST switch) - OUT.

NOTE

Each hoist operation performed is defined as reeling hoist cable out and then in while hovering with any weight on hoist, regardless of whether the hoist was used for training or an actual rescue.

The pilot must record each operation in the penalty CG region. For each hoist operation performed within penalty CG region, four (4) additional hours of usage must be logged against the main rotor yoke, mast and lower cone seat.

HOIST switch - DOWN.

Discharge static electricity when possible, and connect hook to load, observing allowable hoist load.

NOTE

As hook nears the up or down limits, hoist speed automatically slows.

HOIST switch - UP.

CAUTION

USE CARE TO PREVENT CABLE, HOOK, AND LOAD FROM FOULING ON FUSELAGE OR LANDING GEAR.

Maintain zero ground speed until load is clear of obstructions.

BOOM switch - IN to swing hoist boom and load into cabin, if possible.

Takeoff into wind, if possible, allowing adequate hoist load clearance over obstacles if load is not internal.

CAUTION

AIRSPEED WITH EXTERNAL LOAD IS LIMITED BY CONTROLLABILITY. CAUTION SHOULD BE EXERCISED WHEN CARRYING AN EXTERNAL LOAD. HANDLING CHARACTERISTICS MAY BE AFFECTED BY THE SIZE, WEIGHT, AND SHAPE OF LOAD

Airspeed - As required for adequate controllability, not to exceed limits for hoist operations (20 or 60 KIAS, as applicable)

2-13. LITTER HOISTING

When emergency transportation of a patient by litter is essential, every effort should be made to land the helicopter for litter loading. Litter hoisting can be hazardous and should be accomplished only when a landing is not feasible and the condition of the patient precludes the use of the personnel hoisting sling.

In addition to all other procedures contained herein, the following shall apply to litter hoisting operations.

2-13-A. EMPTY LITTER

WARNING

HOISTING OR LOWERING AN EMPTY LITTER IN OPEN POSITION IS PROHIBITED. AN EMPTY LITTER CAN OSCILLATE UNCONTROLLABLY IN ROTOR WASH AND FLY UPWARD, STRIKING FUSELAGE OR TAIL ROTOR.

Prior to hoisting or lowering an empty litter, litter shall be closed and secured with straps. Litter should be suspended in a near-vertical position and sling straps should be drawn tight.

2-13-B. LOADED LITTER

WARNING

LITTER PATIENT SHALL BE SECURED TO LITTER WITH SAFETY STRAPS.

HOIST HOOK CATCH SHALL BE SECURED WITH SAFETY PIN PRIOR TO HOISTING LITTER PATIENT.

Litter sling straps should be adjusted so that litter is 24 to 28 inches (61 to 71 centimeters) below hoist hook.

NOTE

If litter is suspended too far below hook, litter cannot be loaded in helicopter with hoist hook at up limit.

CAUTION

A LOADED LITTER CAN ROTATE ABOUT CABLE DURING HOISTING. HOIST OPERATOR MAY HAVE TO GRASP LITTER SLING STRAPS TO CONTROL ROTATION AS LITTER APPROACHES LANDING GEAR.

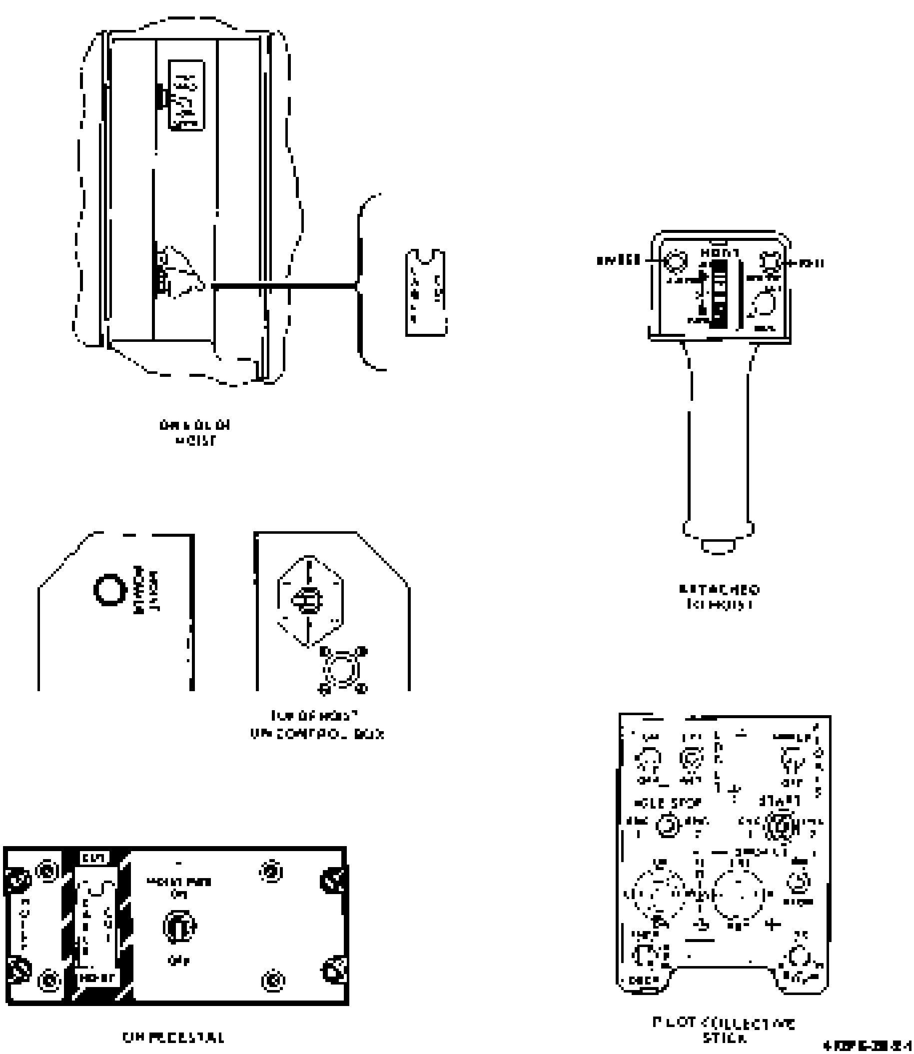


Figure 2-1. Internal hoist controls

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

3-15. HOIST LOAD JETTISON

To jettison hoist load in an emergency, actuate CABLE CUT switch (located on pedestal or hoist).

In the event of failure of CABLE CUT switch, sever cable with manual cable cutter (stowed in pouch on hoist).

3-15-A. HOIST OVERTEMP WARNING LIGHT

In the event that the OVERTEMP warning light (located on pendant) illuminates, continue present operation until hoist cable is reeled in. Leave HOIST PWR switch ON (for cooling fan operation). When OVERTEMP light extinguishes, hoisting may be resumed as desired.

Section 4

PERFORMANCE

No change from basic manual.

Section 5

WEIGHT AND BALANCE

5-11. WEIGHT EMPTY CHART

The weight empty chart for internal hoisting operations is shown in figure 5-1. Refer to the maintenance manual for additional information.

NOTE

Allowable hoist load must be computed when weight empty is not within specified guidelines.

NOTE

Allowable hoist load must be computed when AUX Fuel kits are installed.

412 Weight Empty Chart for Internal Hoist Operations

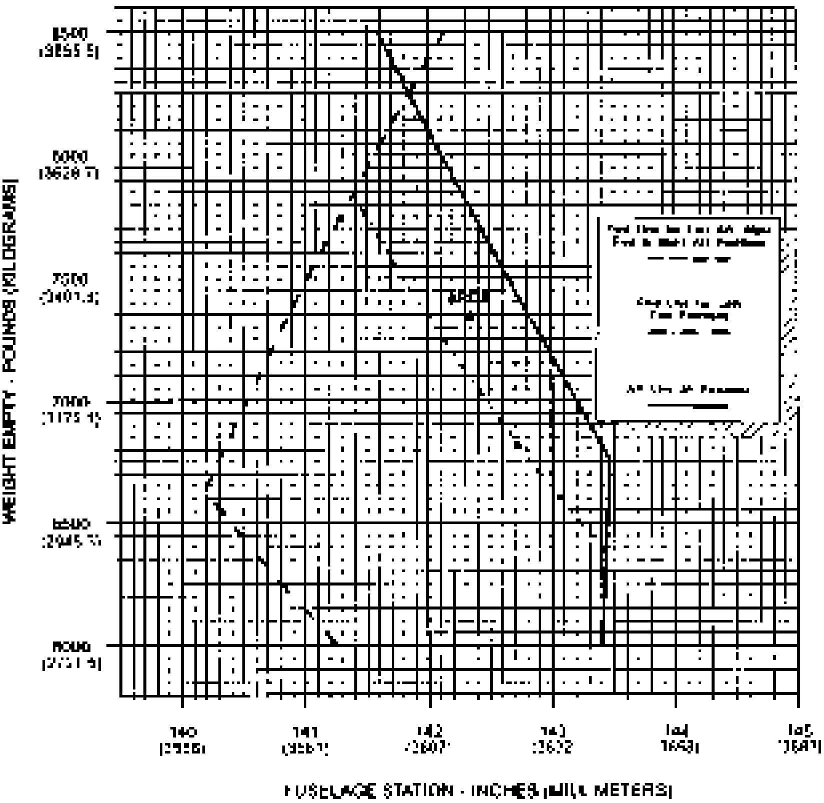


Figure 5-1. Weight empty chart

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR LITTER KIT OPERATION

(205-706-047)

CERTIFIED
14 OCTOBER 1988

This supplement shall be attached to the Models 412 and 412 EP Flight Manual when the Litter Kit 205-706-047 has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
A Subsidiary of Textron Inc.

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REISSUE — 23 JUNE 1994

LOG OF PAGES

Original . . . . 0 . . . . 14 Oct 88
Reissue . . . . . 0 . . . . 23 Jun 94

FLIGHT MANUAL

Page	Revision No.
Title	0
A	0
i/ii	0
1-1/1-2	0
2-1/2-2	0
3-1/3-2	0
4-1/4-2	0

MANUFACTURER'S DATA

Page	Revision No.
1-1/1-2	0

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The Litter Kit provides three litters and the provisions for installing up to three litters in the helicopter. A cabin attendant seat is also included in the kit.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after the litter(s) are installed and ballast readjusted if necessary to return empty weight CG within allowable limits.

MINIMUM FLIGHT CREW

The minimum flight crew for litter operations shall consist of a pilot and a second crewmember or cabin attendant, both of whom shall be trained in and capable of assisting in litter patient emergency evacuation procedures.

Section 2

NORMAL PROCEDURES

LITTER LOADING

Secure patients to litters, then load litters aboard the helicopter in sequence from top to bottom. When only two patients are carried, they should occupy the top and center litter positions. When only one patient is carried, the center litter should be used.

LITTER UNLOADING

NOTE

Normal unloading procedures apply when either passenger door can be opened. Refer to Section 3, Emergency Procedures for unloading procedures when cabin doors cannot be opened.

Open cabin door and unload litters and patients from the helicopter in sequence from bottom to top.

Litters to be handled by one person inside cabin and one person outside cabin.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

UNLOADING THROUGH EMERGENCY EXITS

NOTE

In the event that cabin doors can not be opened, litter patients shall be unloaded through emergency pop out windows. After all litter patients have been removed, ambulatory patients may then exit.

Remove emergency pop-out window by pushing at corners as marked.

Unstrap patient on center litter and remove patient through window opening.

Disconnect top litter at end near open window and lower end to rest on center litter. Remove patient retention straps and slide patient down litter and out through window opening.

Raise top and center litter ends near open window and engage center litter in brackets for top litter. Disconnect bottom litter. Raise bottom litter at end near open window and rest handles on the lower surface of the window opening. Unstrap patient and slide patient up litter and through window opening.

Section 4

PERFORMANCE

No change from basic Flight Manual.

Section 1

WEIGHT AND BALANCE

TABLE OF MOMENTS (IN LB)			TABLE OF MOMENTS $\frac{(kg \times mm)}{100}$	
	LITTER PATIENT			LITTER PATIENT
Weight (Pounds)	Loaded Laterally F.S. 117		Weight (KG)	Loaded Laterally 2972 mm
100	11700		50	1486.0
110	12870		55	1634.6
120	14040		60	1783.2
130	15210		65	1931.8
140	16380		70	2080.4
150	17550		75	2229.0
160	18720		77.1	2291.4
170	19890		80	2377.6
180	21060		85	2526.2
190	22230		90	2674.8
200	23400		95	2823.4
210	24570		100	2972.0
220	25740		105	3120.6
			110	3269.2

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

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36020 AND SUB

SUPPLEMENT FOR DUAL BATTERY INSTALLATION

(412-899-225)

CERTIFIED
APRIL 5, 1989

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2 or -3) when the 412-899-225 Dual Battery Installation has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

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APRIL 5, 1989
REISSUED — 8 OCTOBER 1991

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LOG OF REVISIONS

Original . . . . 0 . . . . April 5, 1989
Reissued . . . . . . 0 . . . . October 8, 1991

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MANUFACTURER'S DATA

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APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TEXAS 76193-0170

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

INTRODUCTION

The dual battery system consists of two 25.2 volt, 40 ampere-hour batteries located in the nose compartment. Both batteries are connected to BAT BUS NO. 1 in parallel. BATT 1 HOT and BATT 2 HOT warnings are located on the caution segment panel. Battery switches are located on the instrument panel and are labeled BATT 1 and BATT 2. There are two circuit breakers, labeled BAT 2 CB1 and BAT 2 CB2, located on the nose compartment floor, on the right side of the helicopter.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Weight change shall be determined after the dual batteries have been installed, and ballast shall be readjusted (if necessary) to return empty weight CG to within allowable limits.

ELECTRICAL LIMITATIONS

BATTERY LIMITATIONS

Maximum battery case temperature is 54.5 °C (130 °F), as indicated by illumination of BATT 1 HOT or BATT 2 HOT segment lights.

WARNING

BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATT 1 HOT OR BATT 2 HOT SEGMENT LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS

Section 2

NORMAL PROCEDURES

BEFORE EXTERIOR CHECK

Flight planning — Completed

Gross weight and CG — Compute (refer to Weight and Balance section in Manufacturer's Data BHT-412-MD).

Publications — Checked.

Portable fire extinguishers — Installed and secured.

Aft fuel sumps — Drain samples as follows:

FUEL TRANS switches — OFF.

BOOST PUMP switches — OFF

FUEL switches — OFF.

BATT 1 switch — ON.

BATTERY BUS 1 switch — ON.

Aft fuel sump drain buttons (left and right) — Depress.

NOTE

If aft sumps fail to drain, the sump valves may be operated manually.

Forward and middle fuel sumps — Drain samples as follows:

Press-to-drain valves — Press.

Fuel filters — Drain before first flight of day as follows:

BOOST PUMP switches — ON.

FUEL switches — ON.

Fuel filter (left and right) — Drain samples.

FUEL switches — OFF

BOOST PUMP switches — OFF.

BATT 1 switch — OFF

BATTERY BUS 1 switch — AUTO TRIP OFF

EXTERIOR CHECK

1 FUSELAGE — FRONT

Nose compartment — Condition, batteries connected, door secured.

NOTE

Ballast is not allowed beneath batteries.

PRESTART CHECK

NOTE

BATT 1 switch and BATT 2 switch will be ON during GROUND POWER START

NOTE

Both batteries, or either single battery may be used for engine start when properly charged. This procedure shows a dual battery start.

BATT 1 switch — ON

BATT 2 switch — ON.

BATTERY BUS 1 and BUS 2 switches — ON; check BATTERY caution light illuminates.

ENGINE STARTING

ENGINE 1 START.

N1 RPM — Check 11% minimum. BATT 2 switch — OFF.

NOTE

After start, in order to avoid excessive generator drive loads, charge only one battery at a time.

GEN 1 switch — ON: check ammeter load increases.

BATT 2 switch — ON when ammeter load drops below 200 amps.

NOTE

Before attempting generator assisted start on second engine, it is recommended that the battery be charged until ammeter load drops below 150 amps.

AMPS 1 indicator — Check at or below 150 amps.

ENGINE SHUTDOWN

Lighting and miscellaneous switches — OFF.

BATT 1 and BATT 2 switches — OFF.

NOTE

BATTERY BUS 2 switch will trip OFF automatically when BATT 1 and BATT 2 switches are turned OFF.

Collective down lock — Secured as desired.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

Table 3-1. Warning lights

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATT 1 HOT or BATT 2 HOT	Battery overheating	Affected battery switch — OFF. Land as soon as practical. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATT 1 HOT OR BATT 2 HOT LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS PRIOR TO RETURN TO SERVICE

Table 3-2 Caution lights

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATTERY	BATTERY BUS 1 and BUS 2 switches/relays in the same position.	Turn BATT BUS 1 switch ON and BATT BUS 2 switch OFF. If light remains on, reverse switches.

Section 4

PERFORMANCE

No change from basic manual

Section 6

CATEGORY A OPERATIONS

EMERGENCY PROCEDURES

Table 6-1 Warning lights -- Takeoff prior to CDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATT 1 HOT or BATT 2 HOT	Battery overheating.	Land immediately. Affected battery switch — OFF. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATT 1 HOT OR BATT 2 HOT LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.

EMERGENCY PROCEDURES

Table 6-2. Warning lights — Takeoff after CDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATT 1 HOT or BATT 2 HOT	Battery overheating	Accelerate to V_{toss}. Affected battery switch — OFF. Land as soon as practical. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATT 1 HOT OR BATT 2 HOT LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.

EMERGENCY PROCEDURES

Table 6-3. Warning lights — Landing prior to LDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATT 1 HOT or BATT 2	Battery overheating.	Affected battery switch — OFF. Land as soon as practical. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATT 1 HOT OR BATT 2 HOT LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.

EMERGENCY PROCEDURES

Table 6-4. Warning lights — Landing after LDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATT 1 HOT or BATT 2 HOT	Battery overheating.	Land immediately. Affected battery switch — OFF. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF BATT 1 HOT OR BATT 2 HOT LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.

Section 1

MANUFACTURER'S DATA

WEIGHT AND BALANCE

No change from basic manual

Section 2

MANUFACTURER'S DATA

SYSTEMS DESCRIPTION

INSTRUMENT PANEL AND CONSOLES

Incorporation of Dual Battery Installation will alter the instrument panel and dc power system as shown in figures 2-1 thru 2-3.

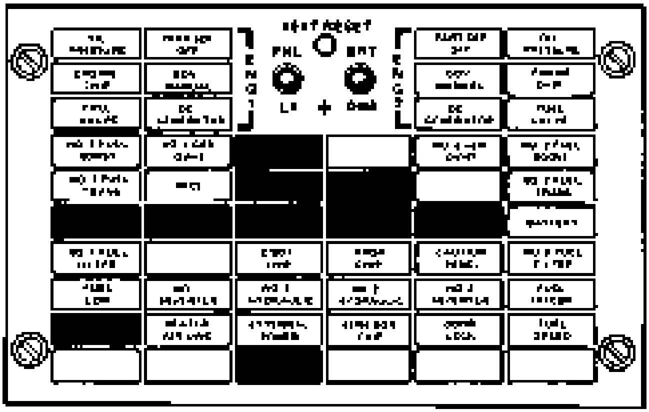


Figure 2-1. Instrument panel

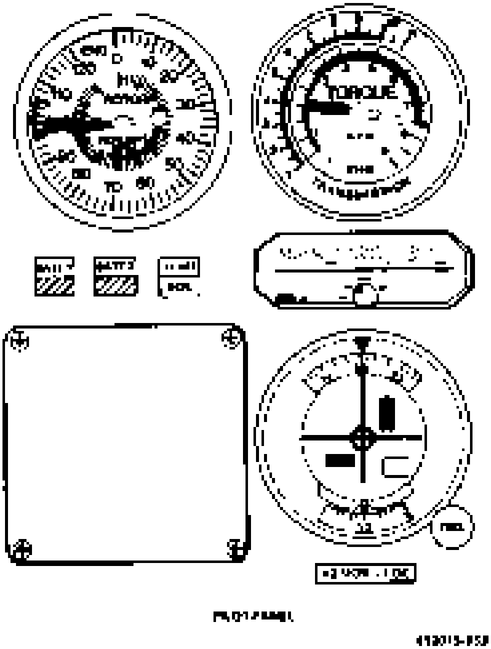
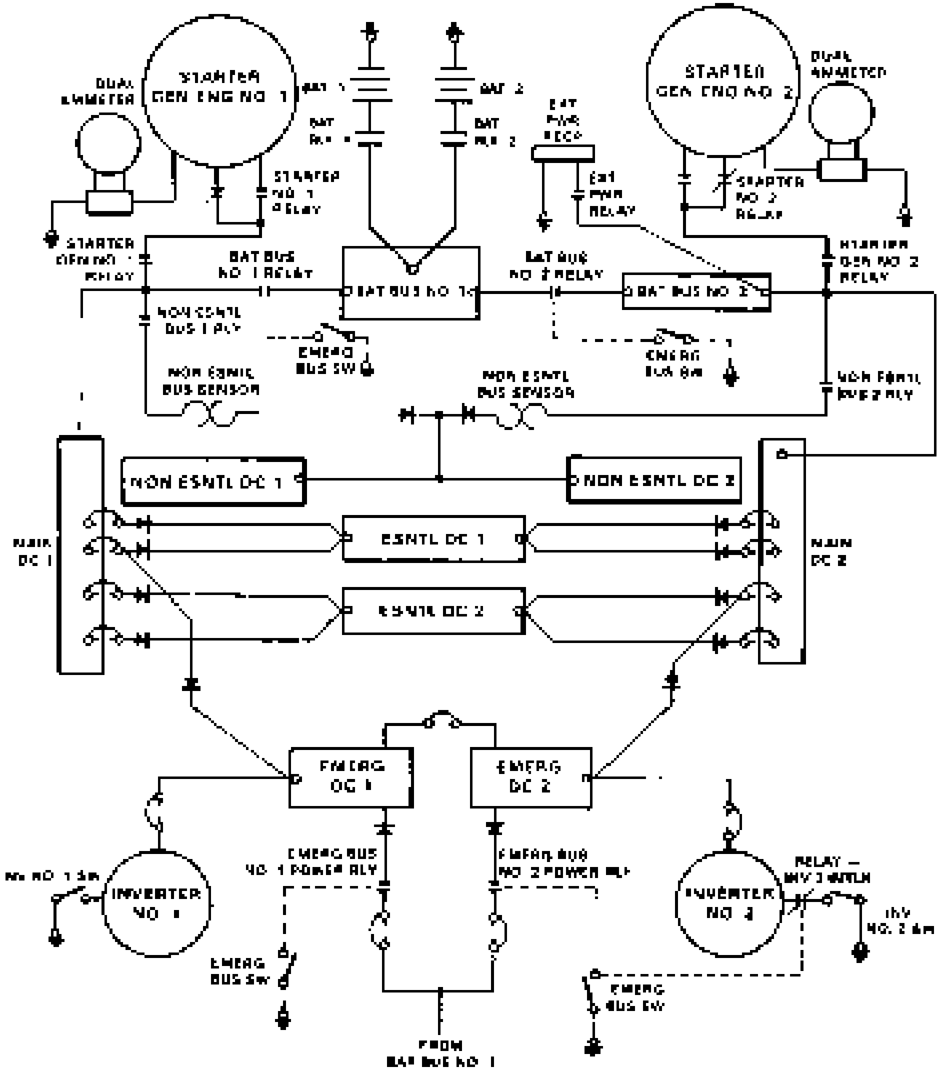
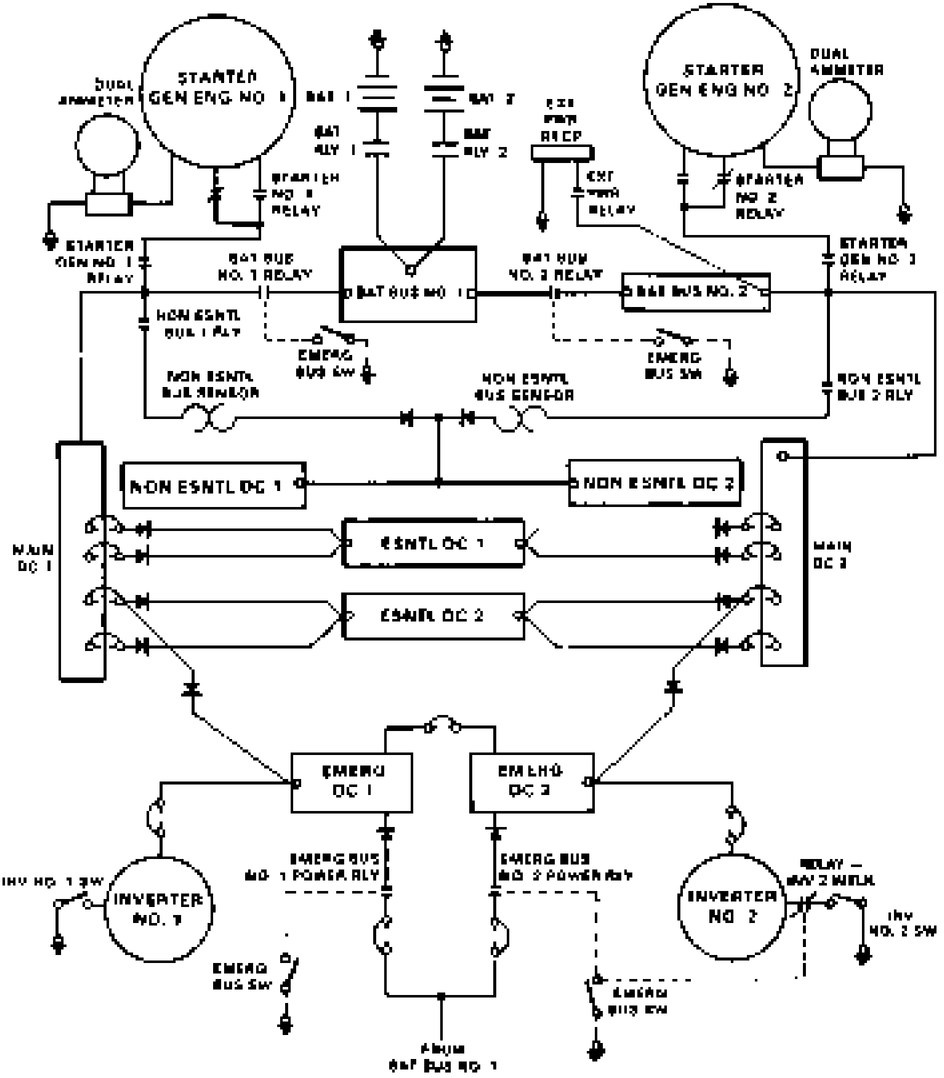


Figure 2-2. Instrument panel



EFFECTIVE S/N 33[illegible] THRU 33[illegible]
S/N 33[illegible] AND SUB
S/N 34001 AND SUB

Figure 2-3. DC electrical system (Sheet 1 of 2)



EFFECTIVE SN 33108 THRU 33129
SN 33150 THRU 33164

Figure 2-3. DC electrical system (Sheet 2)

Bell MODEL 412

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36020 AND SUB

SUPPLEMENT FOR REMOVAL OF UPPER AFT CENTER FUEL CELL

(412-899-227)

CERTIFIED
23 MAY 1989

This supplement shall be attached to the Model 412 Flight Manual (BHT-412-FM-2 or -3) when the upper aft center fuel cell has been removed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

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23 MAY 1989
REISSUED — 9 OCTOBER 1991

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LOG OF REVISIONS

Original .... 0 .... May 23, 1989
Reissued .... 0 .... October 8, 1991

LOG OF PAGES

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17/18	0
19/20	0

APPROVED:

MANAGER

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NOTE

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Section 1

LIMITATIONS

OPTIONAL EQUIPMENT

Auxiliary fuel kits shall not be installed when the aft upper center fuel cell is removed.

WEIGHT CG LIMITATIONS

Actual weight change shall be determined after the upper aft center fuel cell is removed and balance readjusted, if necessary, to retain empty weight CG within limits.

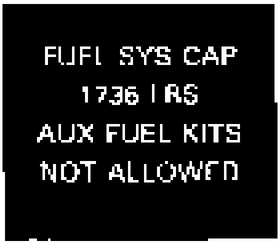

Figure 1. Placards and decals

Section 2

NORMAL PROCEDURES

No change to basic manual.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change to basic manual

Section 4

PERFORMANCE

No change to basic manual.

Section 1

MANUFACTURER'S DATA

WEIGHT AND BALANCE

WEIGHT EMPTY CENTER OF GRAVITY

With the upper aft center fuel cell removed, the total net weight and C.G. changes are depicted in Table 1.

Table 1. Weight and center of gravity changes

WEIGHT CHANGE (LBS)		LONGITUDINAL	LATERAL	VERTICAL
28.9	ARM (IN)	190.2	0.1	36.3
	MOMENT	5600.9	-2.1	-1020.6

FUEL LOADING

Due to the fuel flow sequencing between the tanks, the fuel loading CG will vary between fuselage station 139.4 and 153.9.

Critical fuel CG's are shown on fuel tables 1, 2, 2M and 3, 3M.

With normal crew and passenger loading, gross weight CG will remain within limits at any fuel quantity.

Figure 2 depicts fuel tank locations by station number.

NOTE

Station 0 (reference datum) is located 20 inches (508 millimeters) aft of the most forward point of the cabin nose.

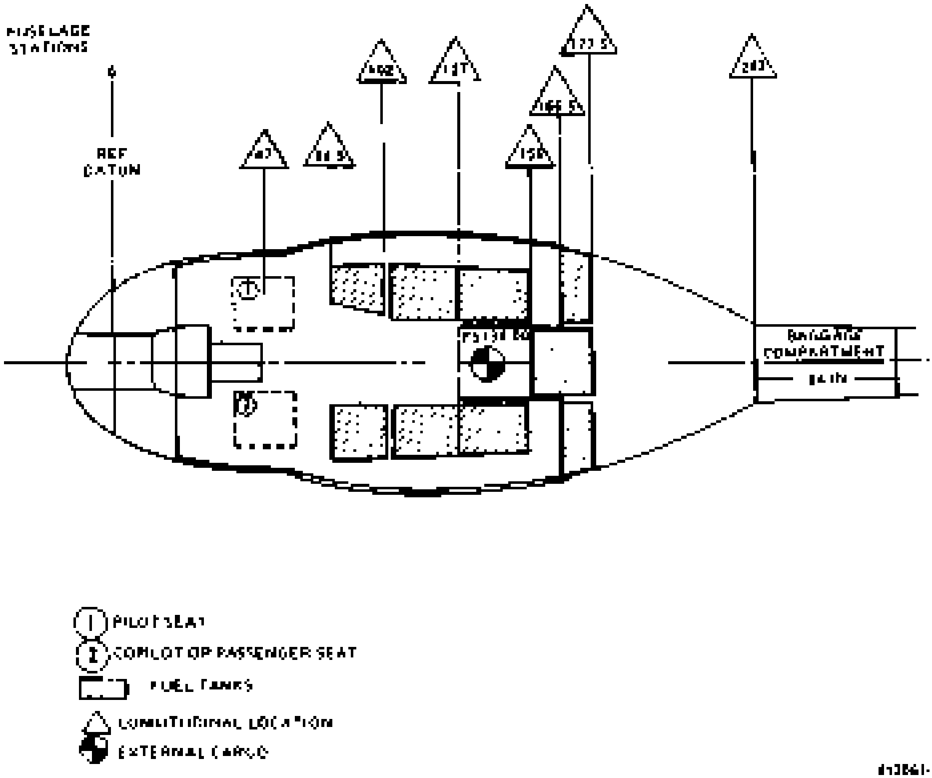

Figure 2. Internal fuel tank station location

Table 2 Fuel loading table (English)

USABLE FUEL LOADING TABLE, UPPER AFT CENTER TANK REMOVED Horizontal (English)							
Jet B, JP-4 (6.5 Lbs/Gal)				Jet A, A-1, JP-5 (6.8 Lbs/Gal)			
U.S. Gal.	Weight (Lb)	CG (in)	Moment (in-Lb)	U.S. Gal.	Weight (Lb)	CG (in)	Moment (in-Lb)
10	65	139.4	9061	10	68	139.4	9479
20	130	139.6	18148	20	136	139.6	18986
30	195	139.8	27261	30	204	139.8	28519
40	260	139.9	36374	40	272	139.9	38053
50	325	139.9	45468	50	340	139.9	47566
58.3	379	139.9	53022	58.3	397	139.9	55540
60	390	140.6	54834	60	408	140.6	57365
70	455	144.7	65838	70	476	144.7	68877
80	520	147.8	76856	80	544	147.8	80403
90	585	150.1	87809	90	612	150.1	91861
100	650	152.0	98800	100	680	152.0	103360
110	715	153.0	109424	110	748	153.6	114883
**112	728	153.9	112039	**112	762	153.9	117272
120	780	150.0	117000	120	816	150.0	122400
130	845	146.6	123877	130	884	146.5	129522
140	910	141.8	129038	140	952	141.8	134994
145.2	944	140.1	132254	145.2	987	140.1	138278
150	975	141.0	137475	150	1020	141.0	143820
160	1040	142.8	148512	160	1088	142.8	155366
170	1105	144.3	159452	170	1156	144.3	166811
180	1170	145.7	170469	180	1224	145.7	178337
190	1235	146.9	181422	190	1292	146.9	189796
***192.1	1249	147.2	183853	***192.1	1306	147.2	192243
200	1300	145.8	189540	200	1360	145.8	198288
210	1365	144.4	197106	210	1428	144.4	206203
220	1430	143.0	204490	220	1496	143.0	213928
230	1495	141.7	211842	230	1564	141.7	221619
240	1560	140.6	219338	240	1632	140.6	229459
*244.1	1587	140.1	222339	*244.1	1660	140.1	232566
250	1625	140.8	228800	250	1700	140.8	239360
260	1690	141.9	239811	260	1768	141.9	250879
267	1736	142.6	247554	267	1816	142.6	258962

Most forward C.G. condition at weight empties under 6200 pounds has no fuel.
* Most critical fuel amount for most forward C.G. condition at weight empties 6200 pounds or greater.
** Most critical fuel amount for most aft C.G. condition at weight empties up to 7600 pounds.
*** Most critical fuel amount for most aft C.G. condition at weight empties 7600 pounds or greater.

Weights given are nominal weights at 15°C

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

Table 2M. Fuel loading table (Metric)

USABLE FUEL LOADING TABLE, UPPER AFT CENTER TANK REMOVED
Horizontal (Metric)

Jet B, JP-4 (0.779 kg/L)				Jet A, A-1, JP-8 (0.815 kg/L)			
Liters	Weight (kg)	CG (mm)	Moment (kg-mm)	Liters	Weight (kg)	CG (mm)	Moment (kg-mm)
40	31.2	3541	110478	40	32.6	3541	115437
80	62.3	3547	220978	80	65.2	3547	231264
120	93.5	3551	332019	120	97.8	3551	347288
160	124.6	3552	442575	160	130.4	3552	463181
200	155.8	3552	553402	200	163.0	3552	578978
220.7	172.0	3553	611118	220.7	179.9	3553	639186
240	187.0	3617	676378	240	195.6	3617	707468
280	218.1	3708	808716	280	228.2	3708	846186
320	249.3	3785	943601	320	260.8	3785	987126
360	280.4	3838	1076176	360	293.4	3838	1126089
400	311.6	3886	1210878	400	326.0	3886	1266836
**424.1	330.4	3908	1291034	**424.1	345.6	3908	1350950
440	342.8	3866	1321837	440	358.6	3866	1382783
480	373.9	3731	1395021	480	391.2	3731	1459647
520	405.1	3625	1468468	520	423.8	3625	1536275
549.8	428.1	3560	1523180	549.8	447.9	3558	1593628
560	436.2	3589	1564786	560	456.4	3589	1628892
600	467.4	3620	1691988	600	489.0	3620	1770180
640	498.6	3683	1836372	640	521.6	3683	1810821
680	529.7	3688	1968831	680	554.2	3688	2049432
720	560.9	3734	2094401	720	586.8	3734	2191111
***727.2	566.5	3738	2117677	***727.2	592.7	3738	2216613
760	592.0	3701	2190892	760	619.4	3701	2292389
800	623.2	3683	2282782	800	652.0	3683	2388274
840	654.4	3626	2372200	840	684.6	3626	2481675
880	685.5	3592	2462318	880	717.2	3592	2576182
920	716.7	3561	2552108	920	749.8	3561	2670038
*923.7	719.6	3569	2561058	*923.7	762.8	3569	2678215
960	747.8	3588	2681611	960	782.4	3588	2805888
1000	779.0	3614	2815306	1000	815.0	3614	2945410
1010.7	787.3	3622	2851601	1010.7	823.7	3622	2983441

Most forward C.G. condition at weight empties under 2839 kilograms has no fuel.

*Most critical fuel amount for most forward C.G. condition at weight empties 2839 kilograms or greater.

**Most critical fuel amount for most aft C.G. condition at weight empties up to 3447 kilograms.

***Most critical fuel amount for most aft C.G. condition at weight empties 3447 kilograms or greater.

Weights given are nominal weights at 15°C

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

Table 3. Fuel loading table — lateral (English)

USABLE FUEL LOADING TABLE, UPPER AFT CENTER TANK REMOVED Lateral (English)							
Jet B, JP-4 (6.5 Lbs/Gal)				Jet A, A-1, JP-5 (6.8 Lbs/Gal)			
U.S. Gal	Weight (Lb)	CG (In)	Moment (In-Lb)	U.S. Gal	Weight (Lb)	CG (In)	Moment (In-Lb)
10	65	0	0	10	68	0	0
20	130	0	0	20	136	0	0
30	195	0	0	30	204	0	0
40	260	0	0	40	272	0	0
50	325	0	0	50	340	0	0
58.3	378	0	0	58.3	397	0	0
60	390	0	0	60	408	0	0
70	455	0	0	70	476	0	0
80	520	0	0	80	544	0	0
90	585	0	0	90	612	0	0
100	650	0	0	100	680	0	0
110	715	0	0	110	748	0	0
112	728	0	0	112	762	0	0
120	780	-0.46	-359	120	816	-0.46	-375
130	845	-0.63	-532	130	884	-0.63	-557
140	910	-0.77	-701	140	952	-0.77	-733
*145.2	944	-0.83	-784	*145.2	987	-0.83	-819
150	975	-0.80	-780	150	1020	-0.80	-816
160	1040	-0.75	-780	160	1088	-0.75	-816
170	1105	-0.71	-785	170	1156	-0.71	-821
180	1170	-0.67	-784	180	1224	-0.67	-820
190	1235	-0.63	-778	190	1292	-0.63	-814
200	1300	-0.60	-780	200	1360	-0.60	-816
210	1365	-0.57	-778	210	1428	-0.57	-814
220	1430	-0.54	-772	220	1496	-0.54	-808
230	1495	-0.52	-777	230	1564	-0.52	-813
240	1560	-0.50	-780	240	1632	-0.50	-816
250	1625	-0.48	-780	250	1700	-0.48	-816
260	1690	-0.46	-777	260	1768	-0.46	-813
267	1736	-0.45	-781	267	1816	-0.45	-817

*Most critical fuel amount for most lateral C.G. condition.

Weights given are nominal weights at 15°C.

NOTE

This table is invalid with auxiliary fuel tank(s) installed

Table 3M. Fuel loading table — lateral (Metric)

USABLE FUEL LOADING TABLE, UPPER AFT CENTER TANK REMOVED
Lateral (Metric)

Jet B, JP-4 (0.779 kg/L)				Jet A, A-1, JP-5 (0.815 kg/L)			
Liter	Weight (kg)	CG (mm)	Moment (kg•mm)	Liter	Weight (kg)	CG (mm)	Moment (kg•mm)
40	31.2	0	0	40	32.6	0	0
80	62.3	0	0	80	65.2	0	0
120	93.5	0	0	120	97.8	0	0
160	124.6	0	0	160	130.4	0	0
200	156.8	0	0	200	163.0	0	0
240	187.0	0	0	240	195.6	0	0
280	213.1	0	0	280	228.2	0	0
320	249.3	0	0	320	260.8	0	0
360	280.4	0	0	360	293.4	0	0
400	311.6	0	0	400	326.0	0	0
424.1	330.4	0	0	424.1	345.6	0	0
440	342.8	-10	-3428	440	358.6	-10	-3586
480	373.9	-16	[illegible]	480	391.2	-16	[illegible]
520	406.1	-18	-7887	520	423.8	-19	8062
*549.8	428.1	-21	[illegible]	*549.8	447.9	-21	-9406
560	436.2	-21	-9160	560	456.4	-21	-9584
600	467.4	19	8881	600	489.0	-19	-9291
640	498.6	-18	-8876	640	521.6	-18	-9389
680	528.7	17	9006	680	554.2	-17	9421
720	560.9	-16	-8974	720	586.8	-16	[illegible]
760	592.0	-15	-8880	760	619.4	-15	-9291
800	623.2	-14	-8726	800	652.0	-14	[illegible]
840	654.4	-14	-9162	840	684.6	-14	-9084
880	685.5	-13	-8912	880	717.2	-13	-9324
920	716.7	-12	[illegible]	920	749.8	-12	[illegible]
960	747.8	-12	-8874	960	782.4	-12	-9389
1000	779.0	-11	[illegible]	1000	815.0	-11	[illegible]
1010.7	787.3	-11	-8840	1010.7	823.7	-11	-9061

*Most critical fuel amount for most lateral C.G. condition.

Weights given are nominal weights at 15°C.

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

SAMPLE LOADING PROBLEM (ENGLISH)

The helicopter is chartered to transport nine passengers and 180 pounds of baggage on a trip that will require approximately 220 U.S. gallons of fuel one way. The helicopter will be refueled and the 190-pound pilot will return alone. Determine extreme CG conditions for both flights.

OUTBOUND FLIGHT

	LONGITUDINAL			LATERAL	
	WEIGHT (lb.)	CG (in.)	MOMENT (lb-in / 100)	CG (in.)	MOMENT (lb-in / 100)
Weight Empty	7265	142.3	1034116	-0.2	-1631
+Oil	25		4146	0	0
+Pilot	190		8930	+22.0	+4180
+Passengers. (5 man seat)	850		88450	0	0
+Passengers. (4 man seat)	680		59160	0	0
+Baggage	180		46980	0	0
Basic Operating Weight + Payload	9190	136.3	1252782	+0.3	+2549
+Takeoff Fuel (287 U.S. Gallons)	1818	142.8	258962	-0.45	-817
Takeoff Condition	11008	137.4	1511744	+0.2	+1732
Basic Operating Weight + Payload	9190	136.3	1252782	+0.3	+2549
+Critical Forward Fuel (244.1 U.S. Gallons)	1660	140.1	232566	0.49	-813
Most Forward Condition	10850	136.9	1485348	+0.2	+1736
Basic Operating Weight + Payload	9190	136.3	1252782	+0.3	+2549
+Landing Fuel (47 U.S. Gallons)	320	139.9	44768	0	0
Landing Condition	9510	136.4	1297550	+0.3	+2549

RETURN FLIGHT

	LONGITUDINAL			LATERAL	
	WEIGHT (lbs.)	CG (in.)	MOMENT (lb-in / 100)	CG (in.)	MOMENT (lb-in / 100)
Weight Empty	7265	142.3	1034116	-0.2	1831
+ Oil	25		4146	0	0
+ Pilot	190		8930	+22.0	+4180
Basic Operating Weight	7480	140.0	1047192	+0.3	+2649
+ Takeoff Fuel (267 U.S. Gallons)	1816	142.8	268982	0.45	817
Takeoff Condition	9296	140.5	1308154	+0.2	+1732
Basic Operating Weight	7480	140.0	1047192	+0.3	+2549
+ Critical Forward Fuel (244.1 U.S. Gallons)	1660	140.1	232568	-0.49	813
Most Forward Condition	9140	140.0	1279759	+0.2	+1736
Basic Operating Weight	7480	140.0	1047192	+0.3	+2549
+ Critical Aft Fuel (112 U.S. Gallons)	762	163.9	117272	0	0
Most Aft Condition	8242	141.3	1164464	+0.3	+2549
Basic Operating Weight	7480	140.0	1047192	+0.3	+2549
+ Landing Fuel (47 U.S. Gallons)	320	139.9	44768	0	0
Landing Condition	7800	140.0	1091960	+0.3	+2549

SAMPLE LOADING PROBLEM (METRIC)

The helicopter is chartered to transport nine passengers and 80 kg of baggage for a trip that will require approximately 930 liters of fuel one way. The helicopter will be refueled and the 90 kg pilot will return alone. Determine extreme CG conditions for both flights.

OUTBOUND FLIGHT

	LONGITUDINAL			LATERAL	
	WEIGHT (kg)	CG (mm)	MOMENT (kg·mm/100)	CG (mm)	MOMENT (kg·mm/100)
Weight Empty	3295.3	3614	119092.1	−6	−198
+Oil	11.3		486.3	0	0
+Pilot	90.0		1074.6	+559	+503
+Passengers, (5 man seat)	375.0		11746.0	0	0
+Passengers, (4 man seat)	300.0		6830.0	0	0
+Baggage	80.0		5296.0	0	0
Basic Operating Weight + Payload	4151.6	3462	143723.0	+7	+306
+Takeoff Fuel (1030.7 Liters)	823.7	3822	29934.4	−11	−91
Takeoff Condition	4975.3	3490	173657.4	+4	+214
Basic Operating Weight + Payload	4151.6	3462	143723.0	+7	+306
+Forward Fuel (823.7 Liters)	652.8	3559	26792.2	−12	−90
Most Forward Condition	4804.4	3477	170515.2	+4	+216
Basic Operating Weight + Payload	4151.6	3462	143723.0	+7	+306
+Landing Fuel (180.7 Liters)	147.3	3552	5233.1	0	0
Landing Condition	4298.9	3465	148956.1	+7	+306

RETURN FLIGHT

	LONGITUDINAL			LATERAL	
	WEIGHT (kg)	CG (mm)	MOMENT $\left(\frac{kg \cdot mm}{100}\right)$	CG (mm)	MOMENT $\left(\frac{kg \cdot mm}{100}\right)$
Weight Empty	3296.3	3614	119082.1	−6	−198
+Oil	11.3		495.1	0	0
+Pilot	90.0		1074.8	+559	+503
Basic Operating Weight	3398.6	3552	120652.0	+9	+306
+Takeoff Fuel (1010.7 Liters)	823.7	3622	29834.4	−11	−91
Takeoff Condition	4220.3	3566	150486.4	+5	+214
Basic Operating Weight	3398.6	3552	120652.0	+9	+306
+Forward Fuel (923.7 Liters)	752.8	3559	26792.2	12	−90
Most Forward Condition	4149.4	3553	147444.2	+5	+216
Basic Operating Weight	3398.6	3552	120652.0	+9	+306
+Critical Aft Fuel (424.1 Liters)	345.8	3809	13008.5	0	0
Most Aft Condition	3742.2	3585	134161.5	+8	+306
Basic Operating Weight	3398.6	3552	120652.0	+8	+306
+Landing Fuel (180.7 Liters)	147.3	3552	5232.1	0	0
Landing Condition	3543.9	3552	125884.1	+9	+305

Section 2

MANUFACTURER'S DATA

SYSTEMS DESCRIPTION

INSTRUMENT PANEL AND CONSOLES

When the upper aft center fuel cell is removed, a 1736 lb fuel capacity placard is mounted on the center section of the instrument panel. See figure 3.

FUEL SYSTEM

DESCRIPTION — MECHANICAL

The fuel system (figure 4) is composed of 9 crash resistant fuel cells. Six of the cells are located below the cabin floor and three are located aft of the cabin and above the level of the underfloor cells. Refer to figure 5 for fuel burn sequence. Partial cell dividers in two of the aft cells and the system interconnect valve provide 52.5 gallons (198.7 liters) isolated fuel supply for each engine.

FUEL TRANSFER AND FILLING

Each lower fuel cell is joined with its opposite (left and right), and with the upper cell interconnect system.

FUEL QUANTITY SYSTEM

The DIGITS TEST button is functionally inoperative.

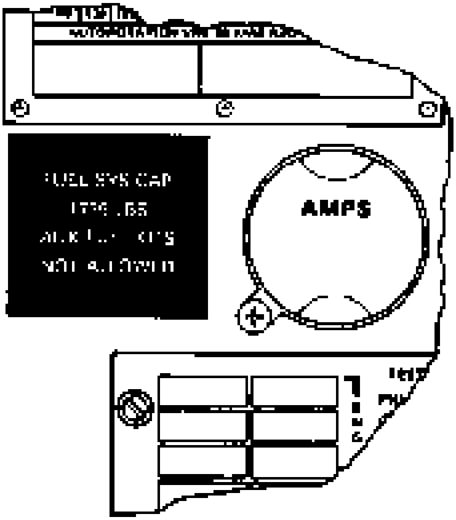

Figure 3. Instrument panel

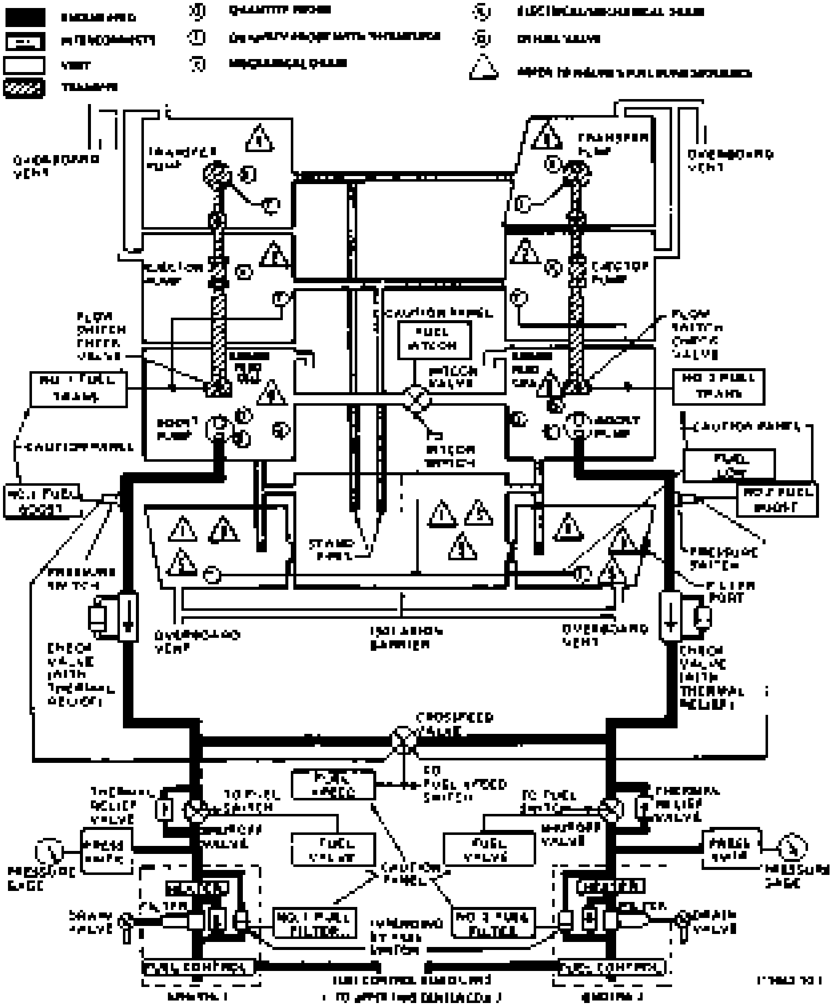

Figure 4. Fuel system schematic (Sheet 1 of 2)

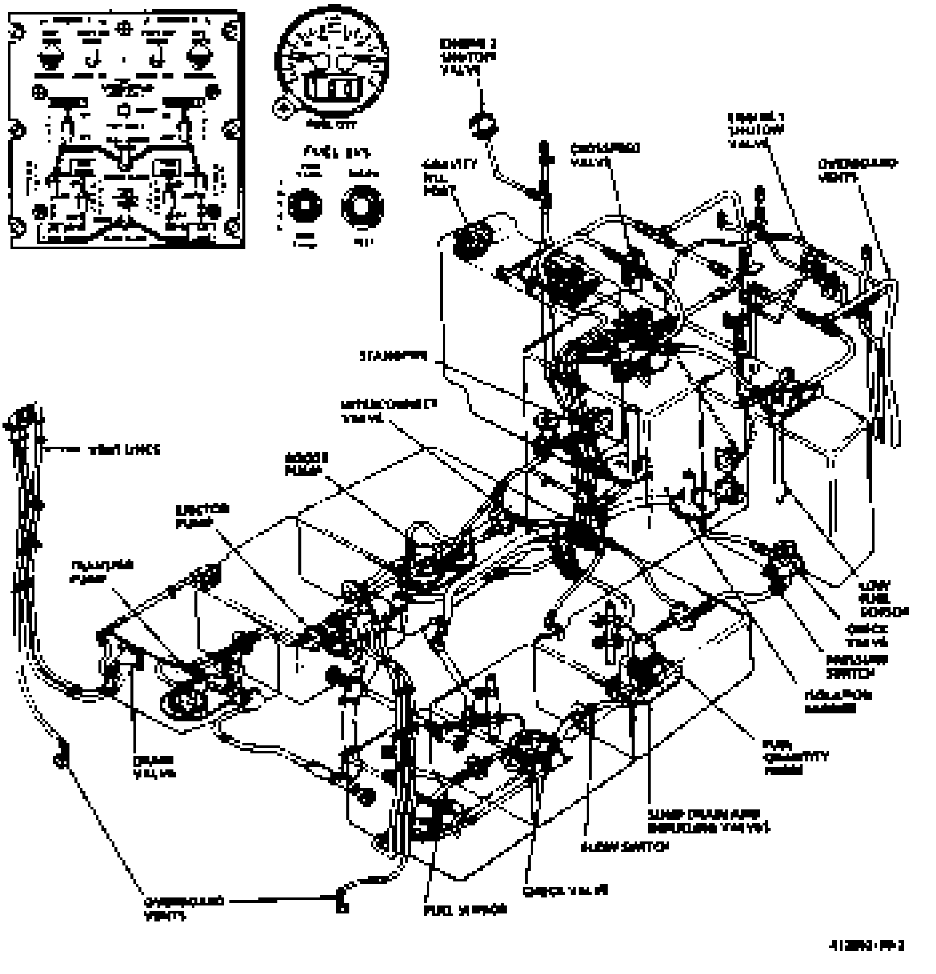

Figure 4. Fuel system schematic (Sheet 2)

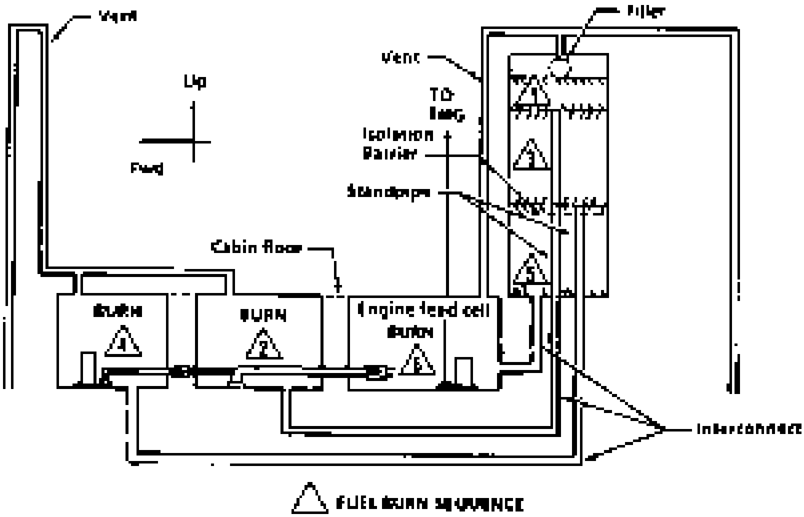

Figure 5. Fuel burn sequence

Section 4

MANUFACTURER'S DATA

HANDLING/SERVICING/MAINTENANCE

SERVICING

FUEL SYSTEM SERVICING

Total capacity:
274.7 U.S. gallons (1037.0 liters).

Usable fuel:
267.7 U.S. gallons (1010.7 liters)

BELL MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR CATEGORY B OPERATIONS WITH APPROVED CONFIGURATION OF NINE OR LESS PASSENGER SEATS

SUPPLEMENTAL TYPE CERTIFICATE NO. SH7727SW

CERTIFIED
FEBRUARY 8, 1990

This supplement shall be attached to the Model 412 Flight Manual when helicopter is equipped with an approved nine or less passenger seat configuration.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON

LOG OF REVISIONS

Original . . . . . 0 . . . . 08 FEB 90

LOG OF PAGES

Page	Revision No.	Page	Revision No.
Title	0		
A	0		
i/ii	0		
1-2	0		
3/4	0		

APPROVED

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages. Dispose of superseded pages.

INTRODUCTION:

This supplement removes the Height-velocity diagram as a limitation when helicopter is equipped with an approved configuration of nine or less passenger seats

Section 1

LIMITATIONS

TYPE OF OPERATION

Flight shall be conducted in accordance with Category B operations and an approved configuration of nine or less passenger seats.

ALTITUDE LIMITATIONS

Maximum altitude for takeoff and landing is 8000 feet density altitude.

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after approved seating is installed, and ballast shall be readjusted (if necessary) to return empty weight CG to within allowable limits.

Section 2

NORMAL PROCEDURES

TAKEOFF AND LANDING

NOTE

The Height-velocity diagram does not represent a limitation.

Refer to Performance Data, Section 4.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic Flight Manual.

Section 4

PERFORMANCE

HEIGHT-VELOCITY ENVELOPE

Operation in height-velocity envelope is critical in the event of a single engine failure during takeoff, landing, or other operation near the surface (figure 4-1). The AVOID area of the Height-velocity diagram defines the combinations of airspeed and height above ground from which a safe single engine landing on a smooth, level, firm surface cannot be assured.

The Height-velocity diagram is valid only when the Weight-Altitude-Temperature limitations are not exceeded (refer to basic Flight Manual). The diagram does not define the conditions which assure continued flight following an engine failure nor the conditions from which a safe power-off landing can be made.

HEIGHT — VELOCITY DIAGRAM

FOR SMOOTH, LEVEL, FIRM SURFACES

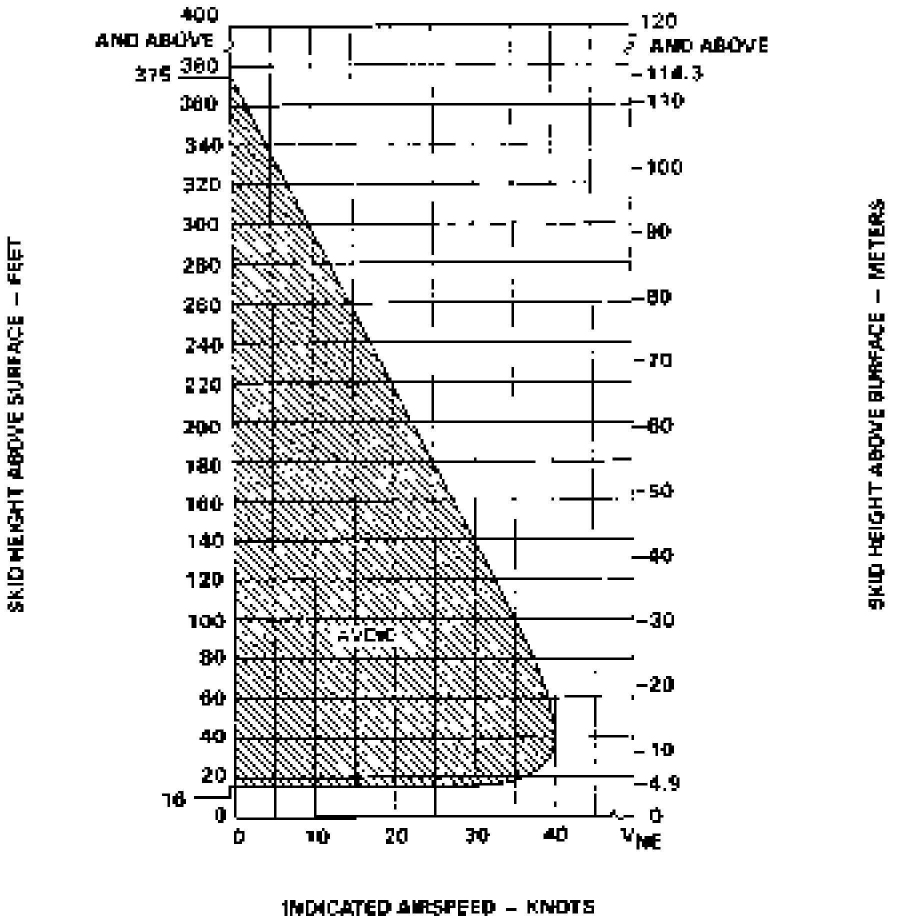

Figure 4-1. Height-velocity diagram (OEI)

Use or disclosure of data contained on this page is subject to the restriction on the title page of this document

BELL MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR LORAN C NAVIGATION SYSTEM (KING KLN-88)

412-899-231

CERTIFIED
22 JUNE 1990

This supplement shall be attached to the Model 412 Flight Manual when the Loran C Navigation System (King KLN-88) has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
A Subsidiary of Textron Inc.

POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

LOG OF PAGES

Original . . . . 0 . . . . . 22 JUNE 1990

FLIGHT MANUAL PAGES	REVISION NO.	MANUFACTURER'S DATA PAGES	REVISION NO.
Title	0		
A	0		
i/ii	0		
1	0		
2	0		
3/4	0		

APPROVED:

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

NOTE: Revised text is indicated by a black vertical line.
Insert latest revision pages. Dispose of superseded pages.

INTRODUCTION

The Loran C Navigation System is a navigation aid for use in the North American geographic area as defined in King KLN-88 Pilot Guide.

Visual navigation data, when selected, is presented on the pilot HSI in the form of L/R steering, bearing-to-waypoint, and "TO" indications. L/R steering and "TO" indications are also duplicated on the copilot HSI.

The system consists of a combined Loran C receiver and navigational computer, an antenna, a four-way annunciator, switching circuitry and associated wiring.

Section 1

LIMITATIONS

TYPE OF OPERATIONS

The Loran C system, as installed in this helicopter, is certified for operation in day or night VFR non-icing conditions.

OPERATIONAL LIMITATIONS

A KLN-88 Pilot Guide (King P/N 006-08458-0000, Operation Revision Status ORS 01) dated August 1989 or later revision, shall be accessible by the flight crew at all times during flight.

The Loran C Navigation shall be operated in accordance with the manufacturers instructions with the following exceptions:

This Loran C cannot be coupled to the flight director or helipilot.

There is no fuel management data available in this installation.

It is the responsibility of the pilot to verify that any navigation or communications data used is correct.

PLACARD AND DECALS

LORAN C APPROVED
FOR VFR ONLY

(located on instrument panel)

LATERAL MODES
EXCEPT HDG & GA
ARE INOP WHEN
LRN IS SELECTED

(located on instrument panel)

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after the Loran C is installed and ballast readjusted as required to return empty weight CG to within allowable limits.

Section 2

NORMAL PROCEDURES

EXTERIOR CHECK

7. CABIN TOP

Loran C antenna — Condition and security.

PRESTART CHECK

LORAN PWR and FAN circuit breakers — In.

Loran C unit — Verify off.

BEFORE TAKEOFF

Loran C unit — Turn on. Verify operational revision status on initial display page is identical to that of available KLN-88 Pilot Guide.

Pilot HSI CRS pointer — Align to desired course shown on Loran display.

NAV/LRN switch annunciator — Press; verify LRN segment illuminated and NAV segment extinguished.

Pilot and copilot HSI deviation bars — Verify centered and "TO" indication displayed.

Pilot HSI bearing pointer — Verify bearing to waypoint displayed.

NOTE

For additional normal procedures, except fuel management, refer to KLN-88 Pilot Guide.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

NO CHANGE

Section 4

PERFORMANCE

NO CHANGE

BELL MODEL 412 ROTORCRAFT FLIGHT MANUAL

33108 THROUGH 33213
AND
36001 THROUGH 36019

SUPPLEMENT FOR IMPROVED HOVER PERFORMANCE WITH PT6T-3BE ENGINES AND 5-MINUTE TAKEOFF POWER RATING

(412-570-001-103)

CERTIFIED
OCTOBER 12, 1990

This supplement shall be attached to the Model 412 Flight Manual when the Improved Hover Performance Modification (412-570-001-103) has been installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON
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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

REISSUE — 8 APRIL 1991

LOG OF PAGES

Original . . . . 0 . . . . . 12 October 1990
Reissued . . . 0 . . . . 6 April 1991

FLIGHT MANUAL		MANUFACTURER'S DATA	
PAGES	REVISION NO.	PAGES	REVISION NO.
Title	0		
A	0		
1 — 40	0		
41-42	0		
43 — 44	0		

APPROVED:

MANAGER

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NOTE. Revised text is indicated by a black vertical line. Insert latest revision pages. Dispose of superseded pages.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

Actual weight change shall be determined after components are installed and ballast readjusted, if necessary, to return empty weight CG to within allowable limits.

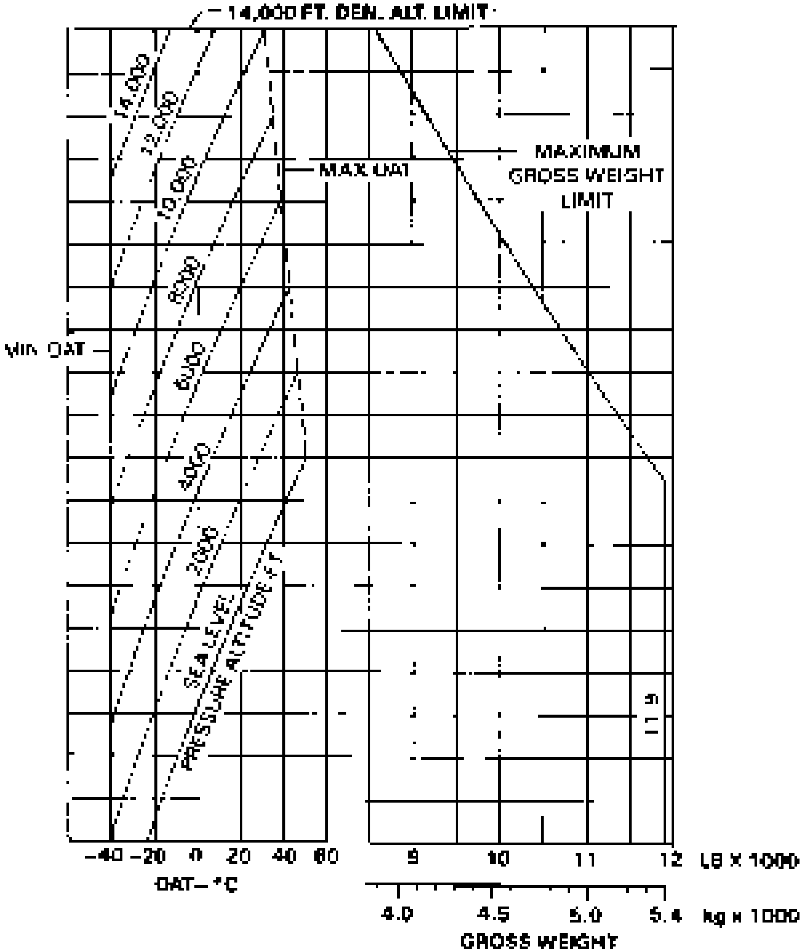
Refer to Weight-Altitude-Temperature Limitations chart for maximum allowable weight for takeoff, landing, and IGE hover operation.

AIRSPEED LIMITATIONS

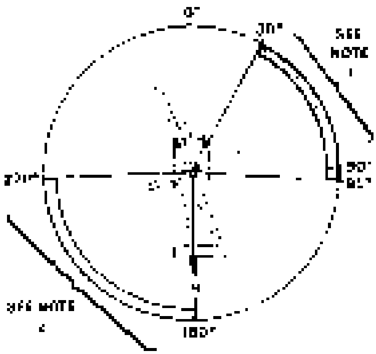
Airspeed shall not exceed 105 KIAS for placarded Vne, if less when operating above 81% mast torque.

Refer to Maximum Speed-Sideward and Rearward Flight, Crosswind and Tailwind At A Hover chart.

NOTE: ALLOWABLE GROSS WEIGHTS OBTAINED FROM THIS CHART MAY EXCEED CONTINUOUS HOVER CAPABILITY UNDER CERTAIN AMBIENT CONDITIONS. REFER TO HOVER CEILING CHARTS IN SECTION 4



Weight-altitude-temperature limitations for takeoff, landing, and in-ground-effect maneuvers



OGE CRITICAL RELATIVE WIND AZIMUTH

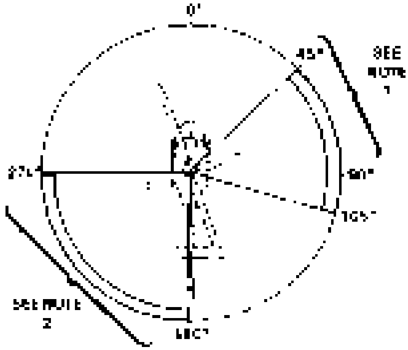
NOTES:

1. Pedal critical wind azimuth: hovering with the relative wind within these azimuth ranges can result in the following:

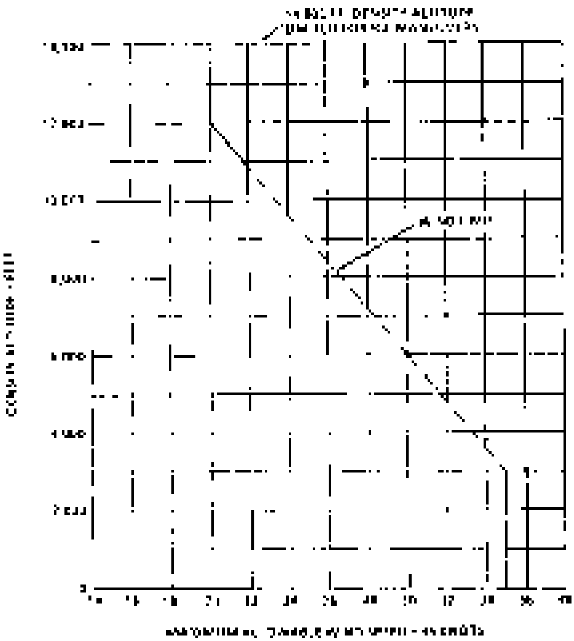
a. Inability to maintain heading due to high left pedal requirements for certain wind velocities.

b. Reduction of available left pedal control with a directional AFCS hardover.

2. Longitudinal cyclic critical wind azimuth — aft cyclic may be limited with longitudinal AFCS hardover.



IGE CRITICAL RELATIVE WIND AZIMUTH



Maximum speed — sideward and rearward flight, crosswind and tailwind at a hover

POWER PLANT LIMITATIONS

Pratt and Whitney Aircraft of Canada, Ltd PT6T-3BE.

POWER TURBINE RPM (N_2) LIMITS

Minimum in cruise	97%
Minimum for hover, takeoff, and climb	100%
Maximum continuous	100%

MAST TORQUE LIMITS

TWIN ENGINE OPERATION

Maximum continuous	81%
Takeoff range (5 minutes maximum)	81 to 100%

WARNING

TAKEOFF POWER SHALL NOT BE USED ABOVE 105 KIAS.

Maximum	100%

CAUTION

WHEN OPERATING NEAR THE MAXIMUM MAST TORQUE LIMIT, INADVERTANT OVERTORQUE MAY OCCUR DURING MANEUVERING FLIGHT CONDITIONS INVOLVING TURNS AND/OR NOSE DOWN ATTITUDE CHANGES. DECREASE POWER TO 90% MAST TORQUE PRIOR TO MANEUVERING HELICOPTER.

Intentional use of mast torque over 100% is prohibited.

TRANSMISSION TORQUE LIMITS

Deleted. See MAST TORQUE LIMITS.

ROTOR LIMITATIONS

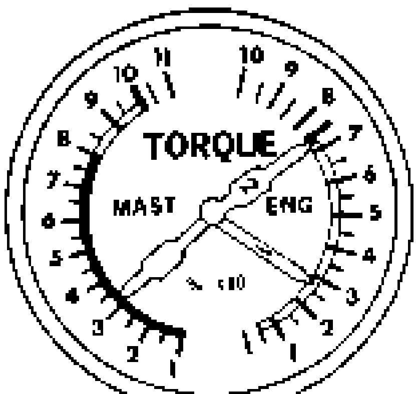
ROTOR RPM (N_R) LIMITS — POWER ON

Minimum	97%
Continuous operation	97 to 100%
Maximum continuous	100%
Operation with mast torque at or below 32%	100 to 104.5%
Maximum with mast torque at or below 32%	104.5%

FUEL AND OIL LIMITATIONS

TRANSMISSION, INTERMEDIATE AND TAIL ROTOR GEARBOX OIL

Turbine Oil 555 is the only approved oil for use in the transmission and gearboxes.



TRIPLE TORQUE INDICATOR

MAST TORQUE

GREEN	10 to 81%	Continuous operation
YELLOW	81 to 100%	5 minute takeoff range
RED	100%	Maximum

ENGINE

GREEN	5 to 58.9%	Continuous OEI operation
YELLOW	58.9 to 73.2%	30 minute OEI range
RED	73.2%	Maximum OEI

Instrument markings

Section 2

NORMAL PROCEDURES

EXTERIOR CHECK

FUSELAGE — AFT LEFT SIDE

Check OVER TRQ warning flag (cat's eye) for indication of overtorque.

PRESTART CHECK

OVER TORQ caution light — Press. Check light illuminates and MAST TORQUE indicator reads 105±1%.

CAUTION

IF MAST TORQUE INDICATOR INDICATES AN ERROR GREATER THAN ± 1% FROM THE 105% POSITION THE MAST TORQUE SYSTEM IS UNRELIABLE. MAINTENANCE ACTION IS REQUIRED.

BEFORE TAKEOFF

Throttles — Full open. Adjust frictions.

RPM switch — Minimum beep (DECR for 4-5 seconds).

RPM switch — Minimum trim (−Z for 4-5 seconds).

Nr — Check 95% or greater.

RPM switch — Adjust to obtain matching torque at 100% Nr.

Flight instruments — Check operation and set.

TAKEOFF

Area — Clear.

NOTE

As collective is increased, it may be necessary to rematch engine torques prior to reaching hover.

RPM switch — Adjust to obtain matching torque or ITT, as required, and 100% Nr.

Hover power — Check torque required to hover at four feet skid height.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

EMERGENCY PROCEDURES

Caution lights

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
OVER TORQ	Mast torque exceeds 100.5%	Reduce power or severity of maneuver. Land as soon as practical.

Section 4

PERFORMANCE

INTRODUCTION

The performance data presented herein are derived from the engine manufacturer's specification power for the engine less installation losses when used with the 412-570-001-103 Improved Hover Performance modification. These data are applicable to the basic helicopter without any optional equipment which would appreciably affect lift, drag, or power available.

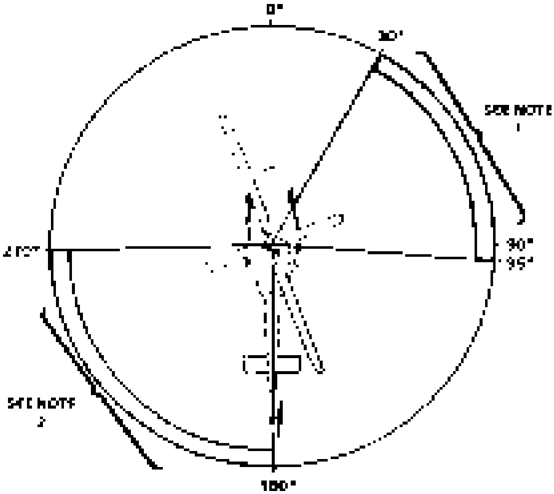
HOVER CEILING OGE.

AREA A (unshaded area) as shown on the hover ceiling charts presents hover performance for which satisfactory cyclic and directional control have been demonstrated in relative winds of 35 knots from any direction at or below 3000 feet HD. Improved control margins will be realized by avoiding winds in the critical relative wind azimuth areas.

AREA B (shaded area) as shown on hover ceiling charts presents additional hover performance which can be realized in calm winds or winds outside the critical relative wind azimuth areas.

NOTE

Tail rotor or cyclic control margin may preclude operation in AREA B of the hover ceiling charts when the relative wind is in the respective critical wind azimuth area.



NOTES:

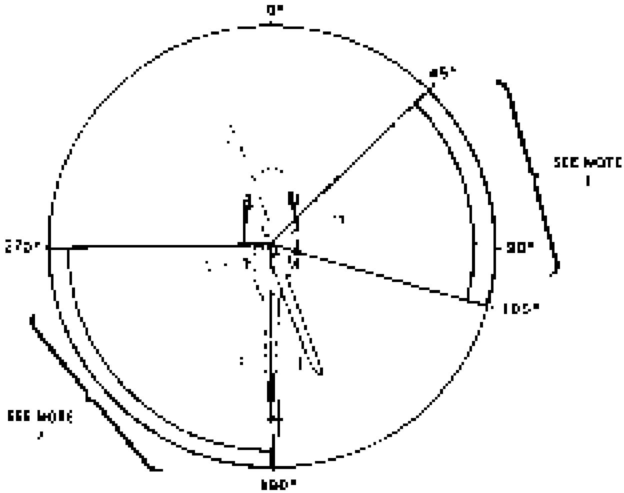
1. Pedal critical wind azimuth hovering with the relative wind within these azimuth angles can result in the following:

a. Inability to maintain heading due to large left pedal requirements for certain wind velocities.

b. Reduction of available left pedal control with a directional AFCS hardover.

2. Longitudinal critical wind azimuth — aft cyclic may be limited with longitudinal AFCS hardover.

OGE CRITICAL RELATIVE WIND AZIMUTH



IGE CRITICAL RELATIVE WIND AZIMUTH

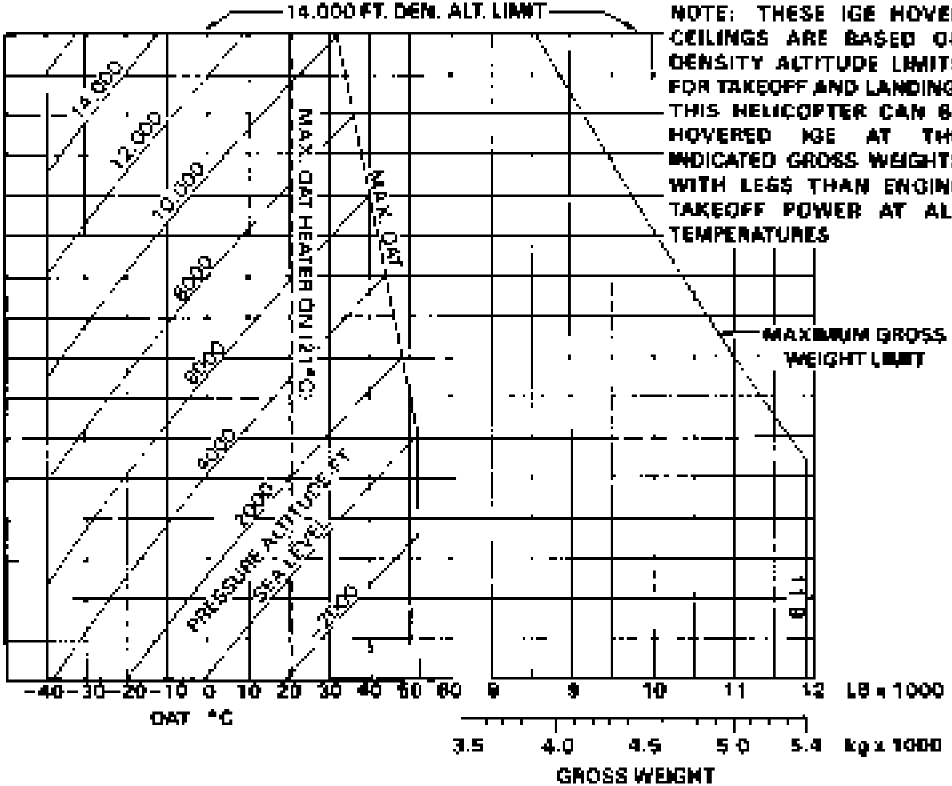
Critical relative wind azimuths

HOVER CEILING
IN GROUND EFFECT

POWER SEE NOTE BELOW
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
−40 TO 52°C

NOTE: THESE IGE HOVER CEILINGS ARE BASED ON DENSITY ALTITUDE LIMITS FOR TAKEOFF AND LANDING. THIS HELICOPTER CAN BE HOVERED IGE AT THE INDICATED GROSS WEIGHTS WITH LESS THAN ENGINE TAKEOFF POWER AT ALL TEMPERATURES



Hover ceiling (Sheet 1 of 1)

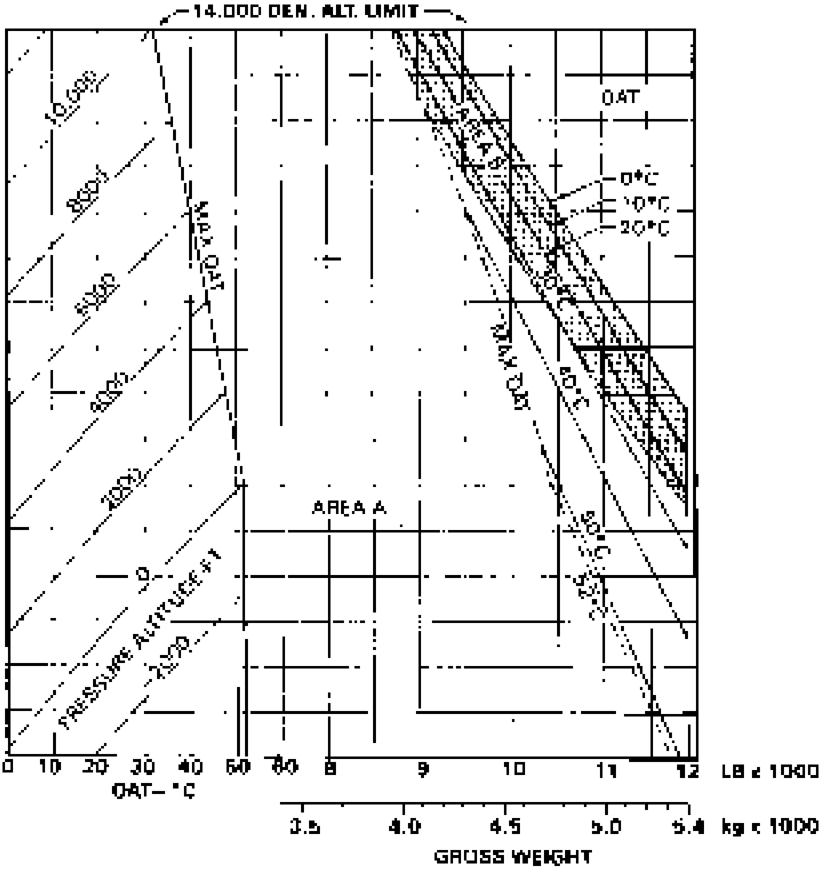
HOVER CEILING

OUT OF GROUND EFFECT

ENGINE TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER OFF
0 TO 52°C

CAUTION OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS



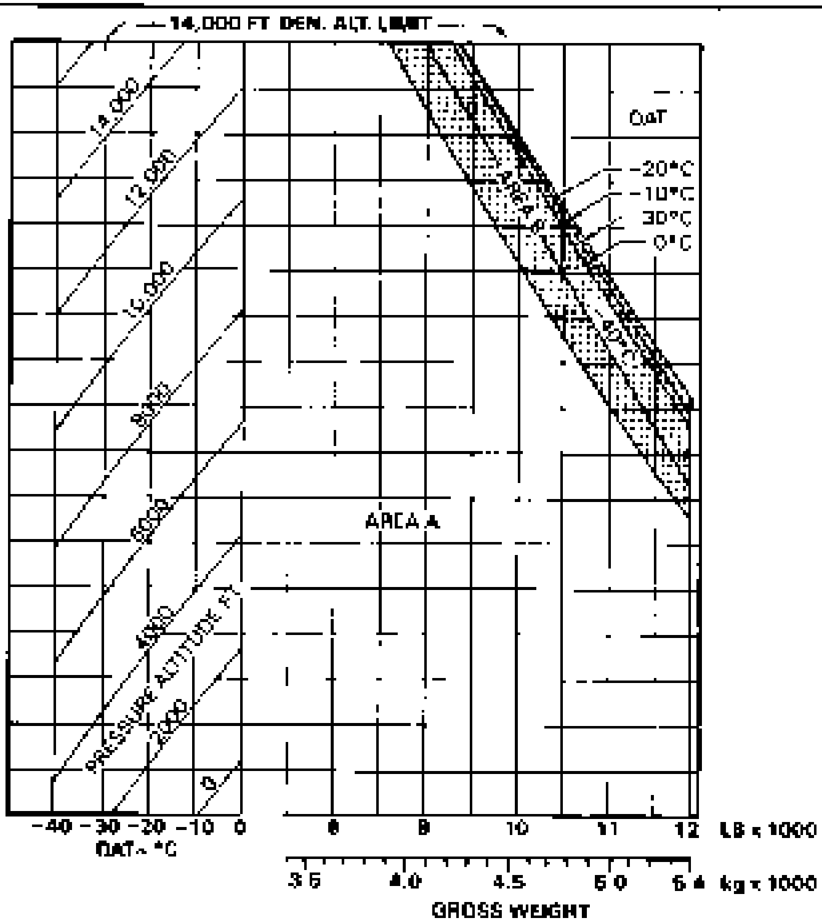
Hover ceiling (Sheet 2 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

ENGINE TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT.
HEATER OFF
−40 TO 0°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS.



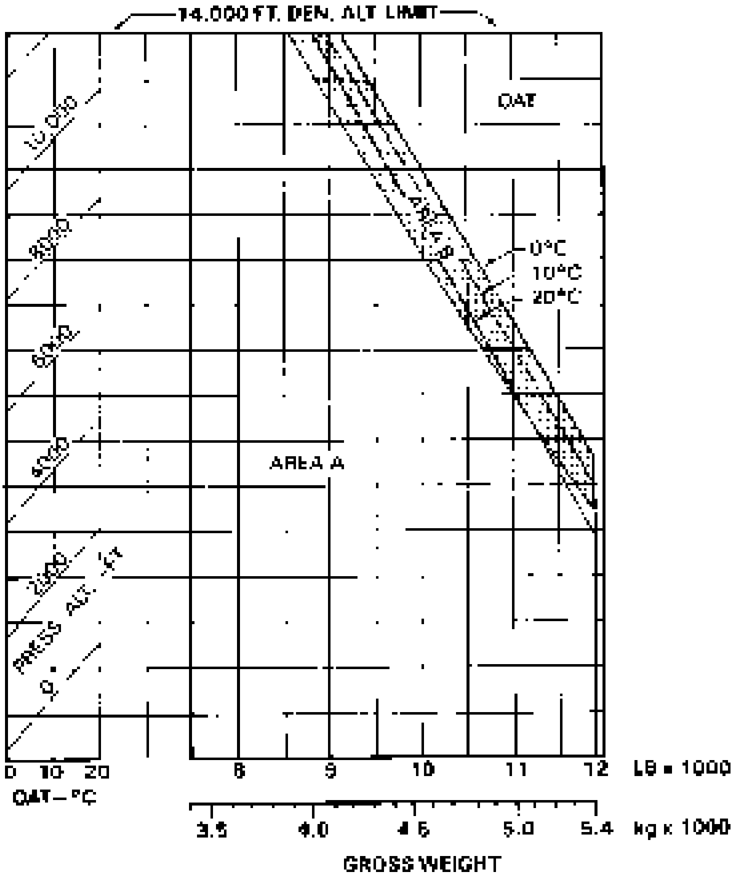
Hover ceiling (Sheet 3 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

ENGINE TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER ON
0 TO 20°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS



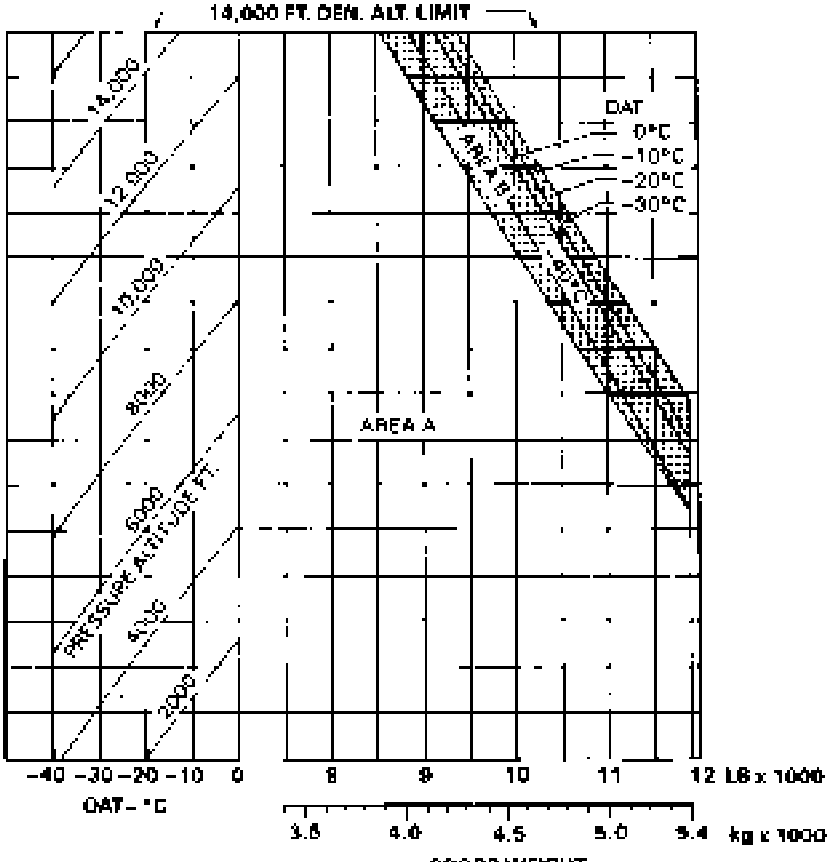
Hover ceiling (Sheet 4 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

ENGINE TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 40 FT
HEATER ON
-40 TO 0°C

CAUTION   OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS

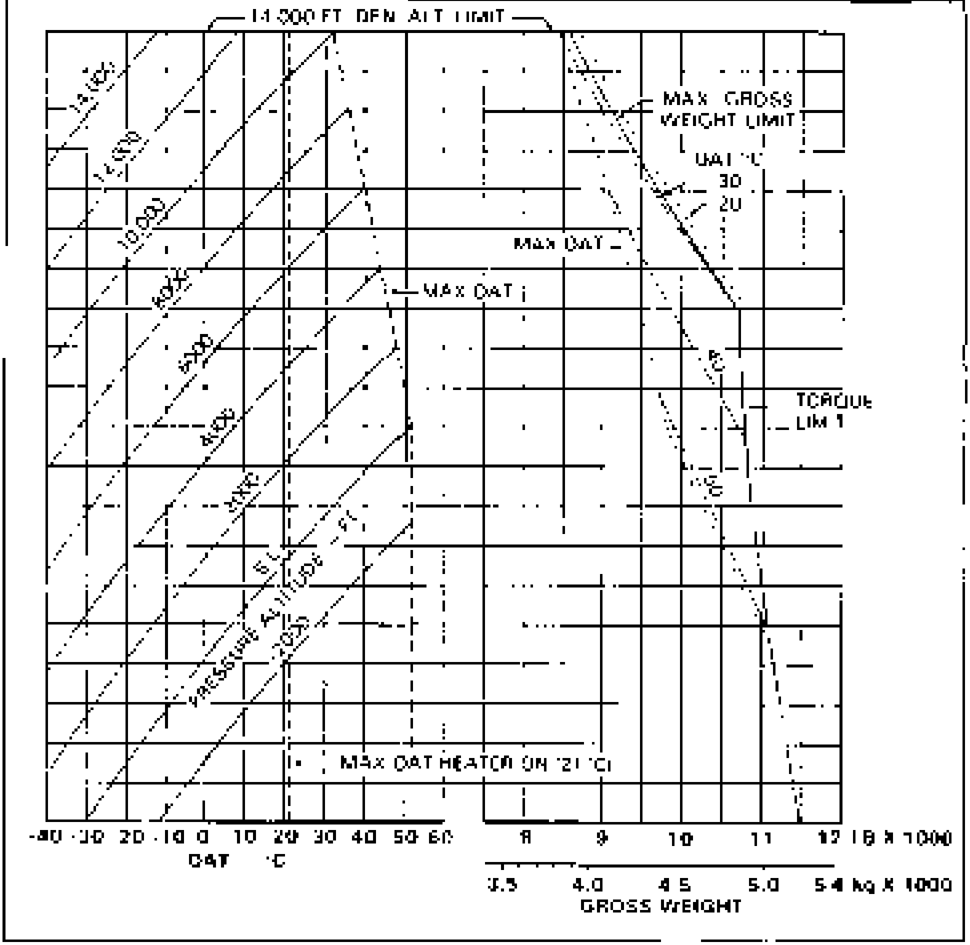


Hover ceiling (Sheet 5 of 10)

HOVER CEILING
IN GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
-40° TO 52°C



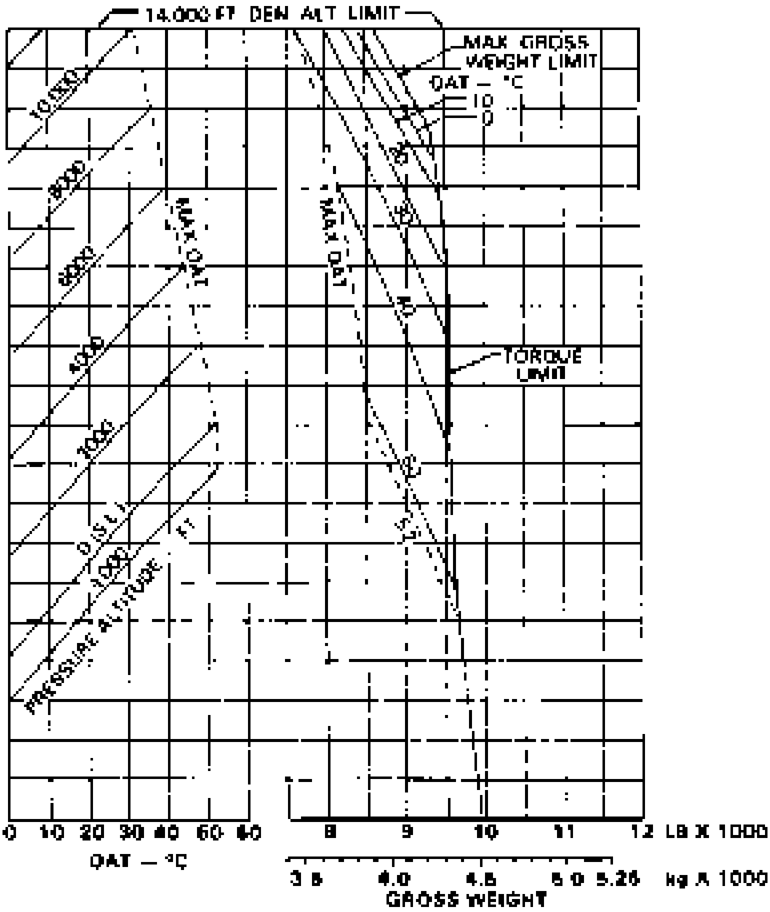
Hover ceiling (Sheet 6 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 40 FT.
HEATER OFF
0 TO 52°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS.



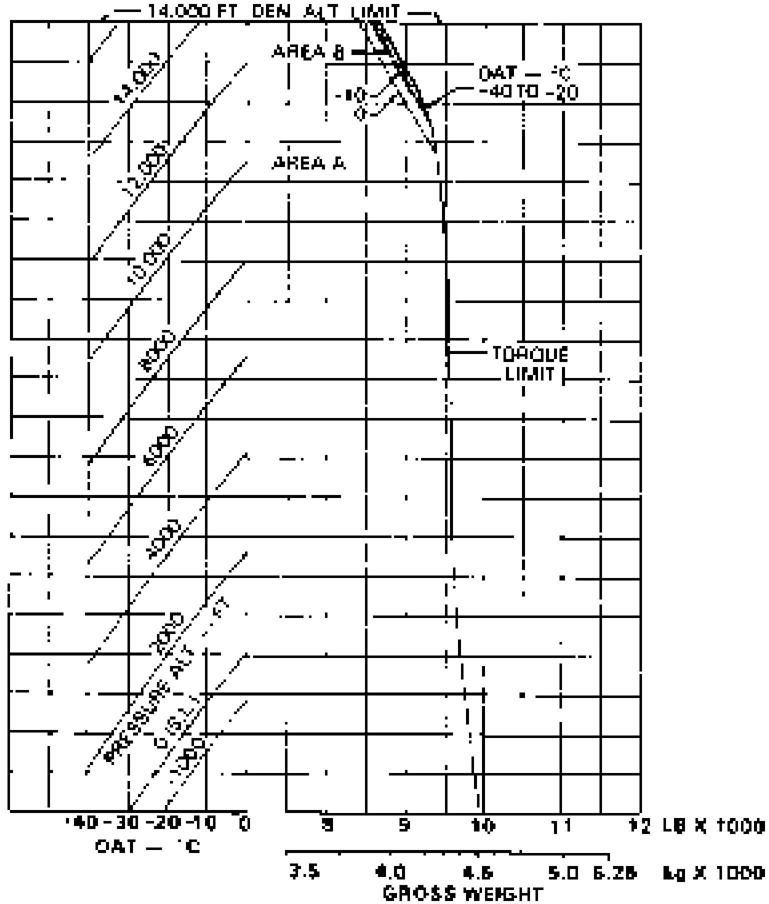
Hover ceiling (Sheet 7 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER OFF
-40 TO 0°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS



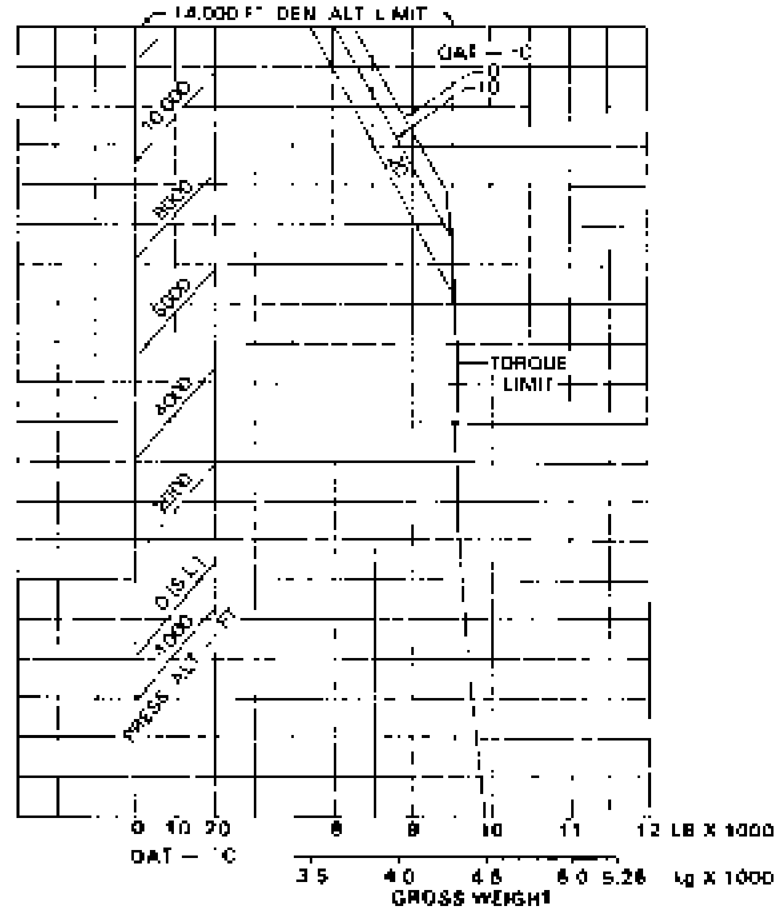
Hover ceiling (Sheet 8 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER ON
0 TO 20°C

CAUTION: OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS



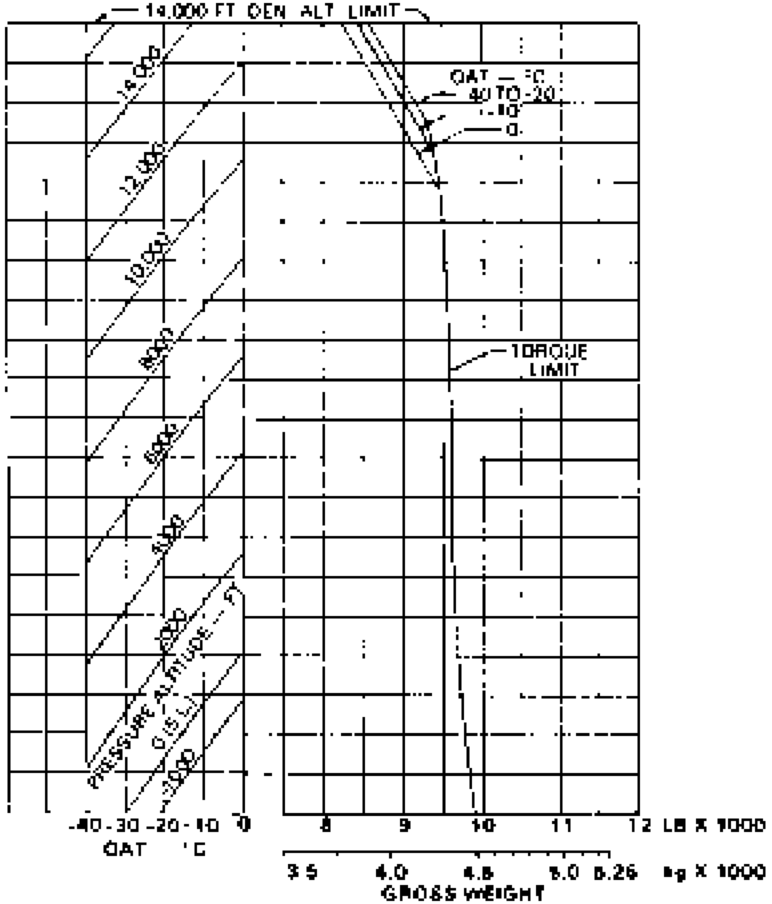
Hover ceiling (Sheet 9 of 10)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FT
HEATER ON
-40 TO 0°C

CAUTION OGE HOVER OPERATION MAY RESULT IN VIOLATION OF H-V LIMITATIONS



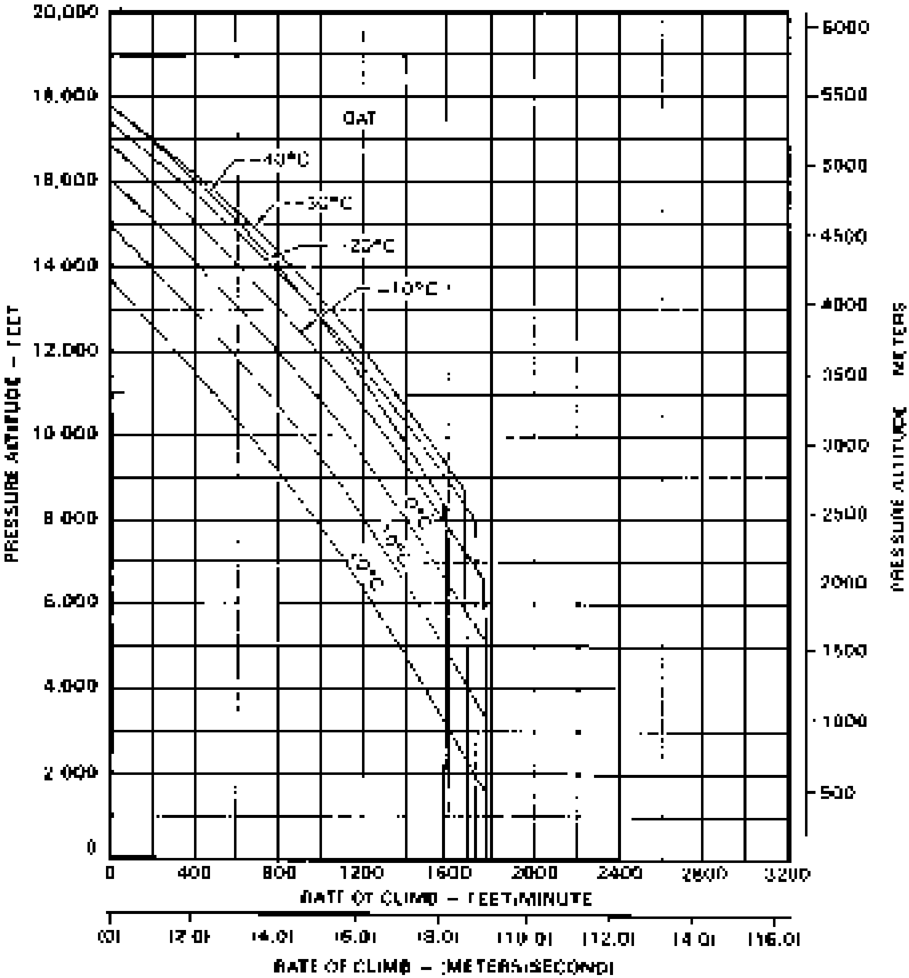
Hover ceiling (Sheet 10 of 10)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11 900 LB (5398 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED: 1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 1 of 24)

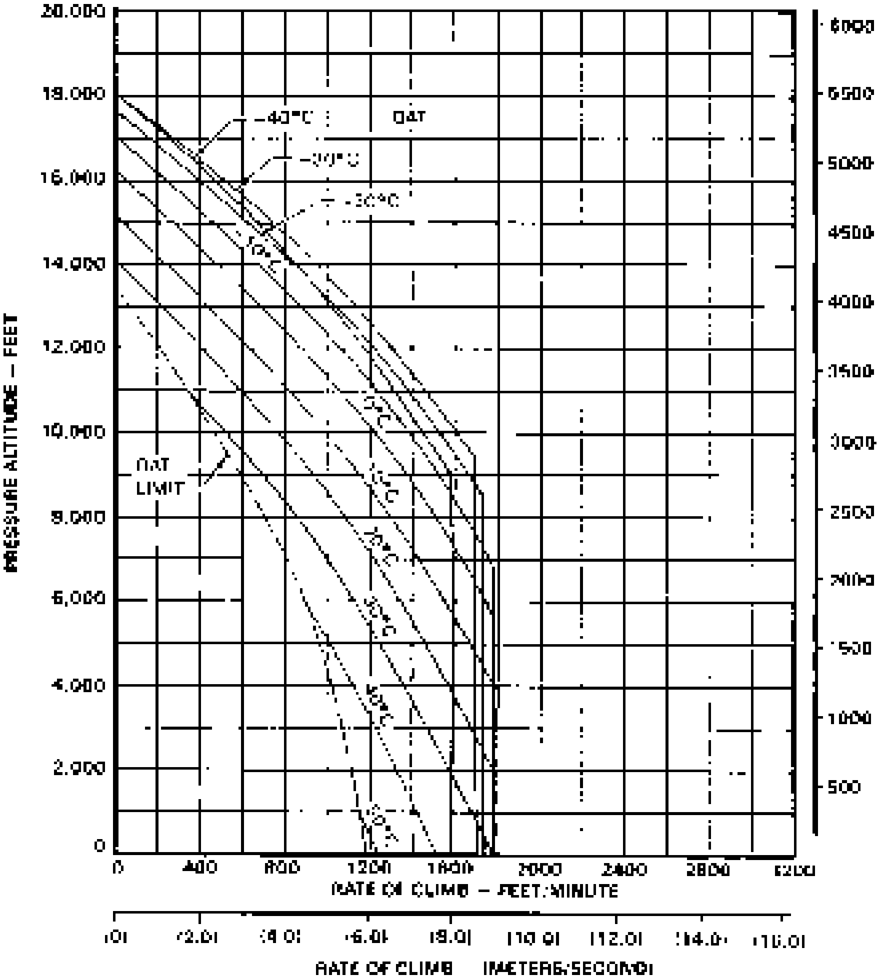
TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 11,900 LB (5398 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 2 of 24)

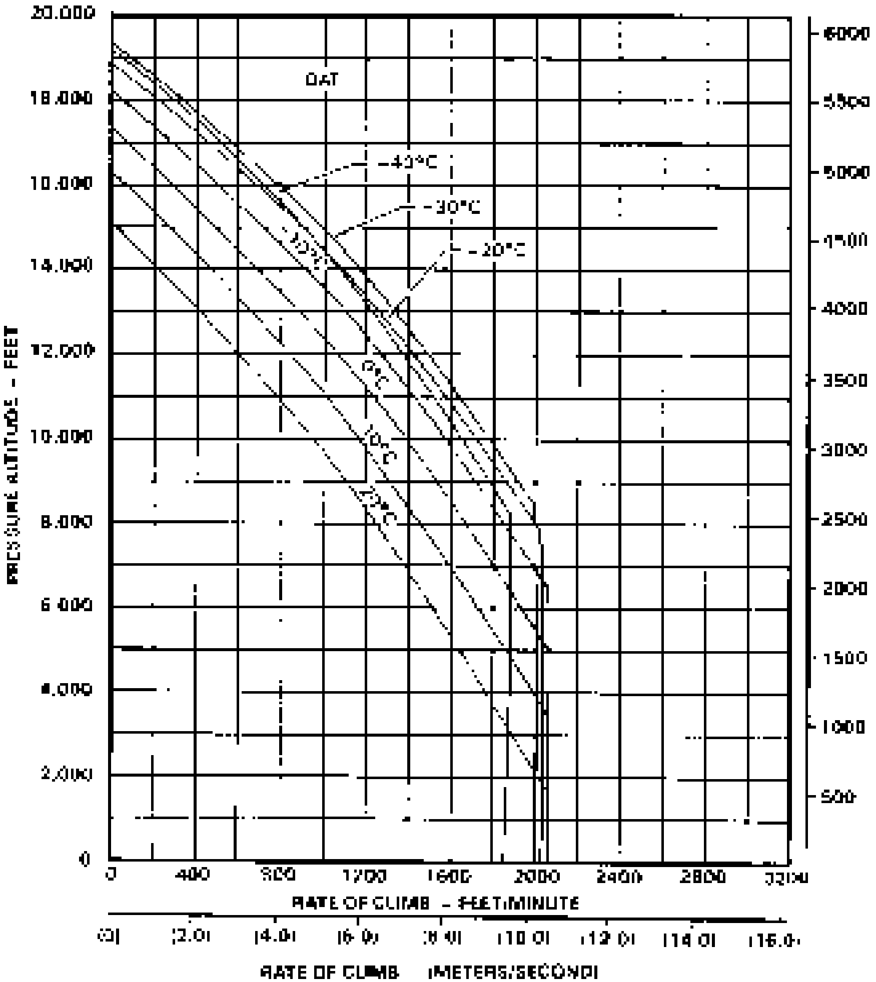
TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 11,000 LB (4990 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 3 of 24)

TWIN ENGINE RATE OF CLIMB

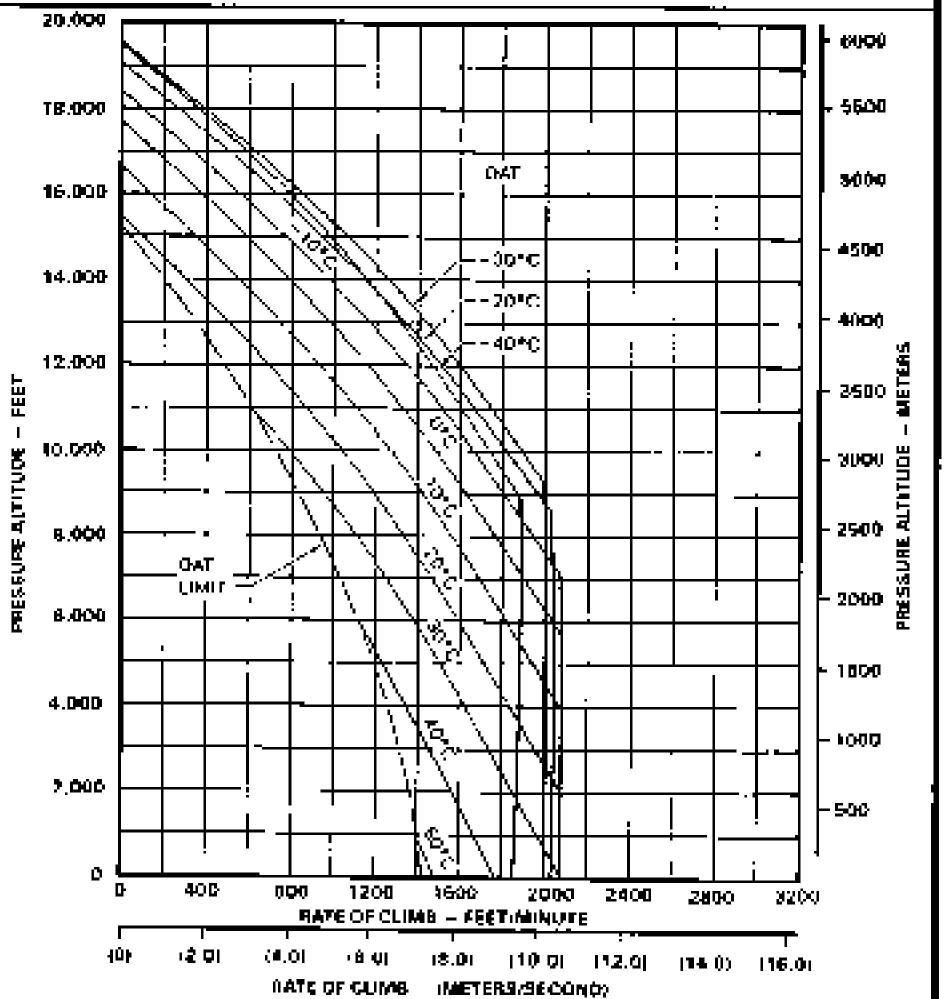
GROSS WEIGHT 11,000 LB (4990 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED

1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



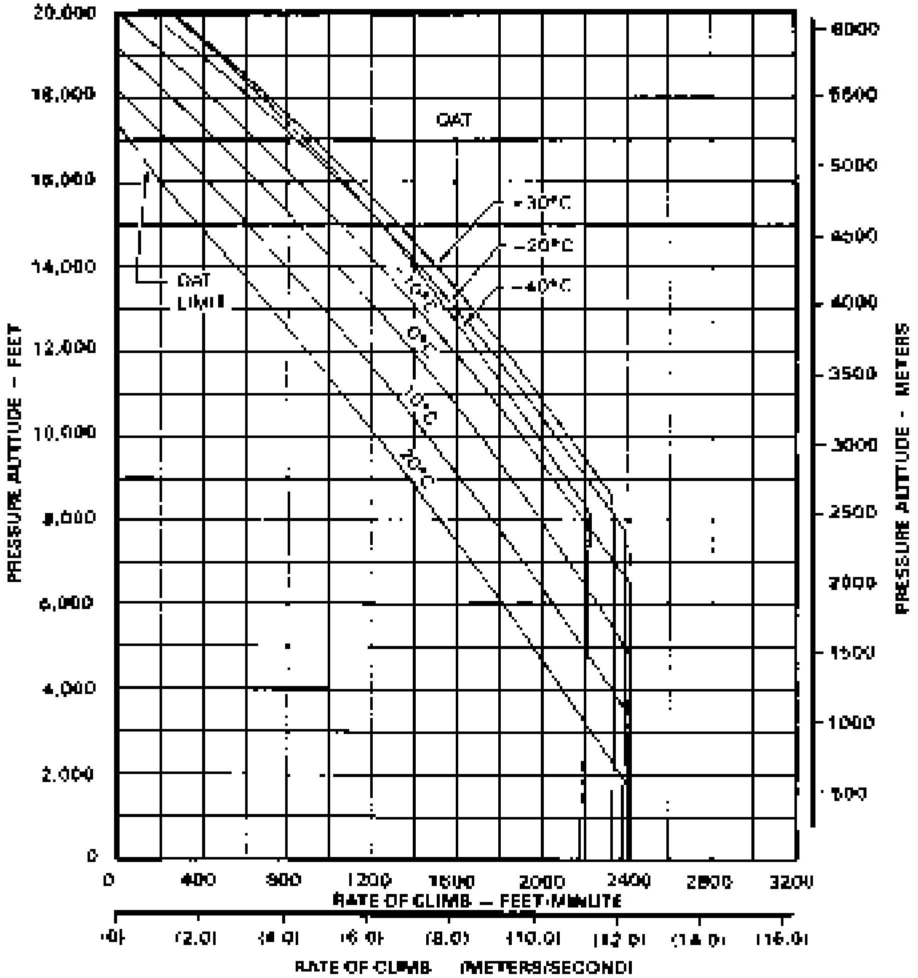
Twin engine rate of climb (Sheet 4 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 10,000 LB (4536 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN.



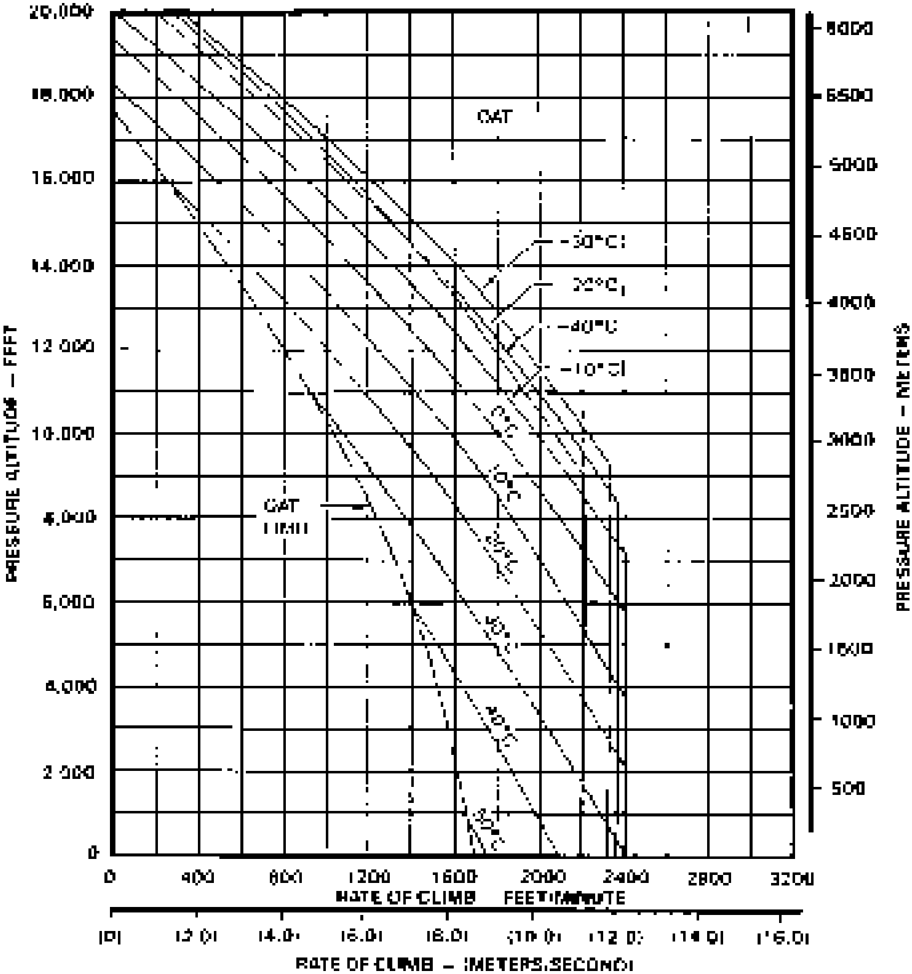
Twin engine rate of climb (Sheet 5 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 10,000 LB (4536 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED: 1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN.



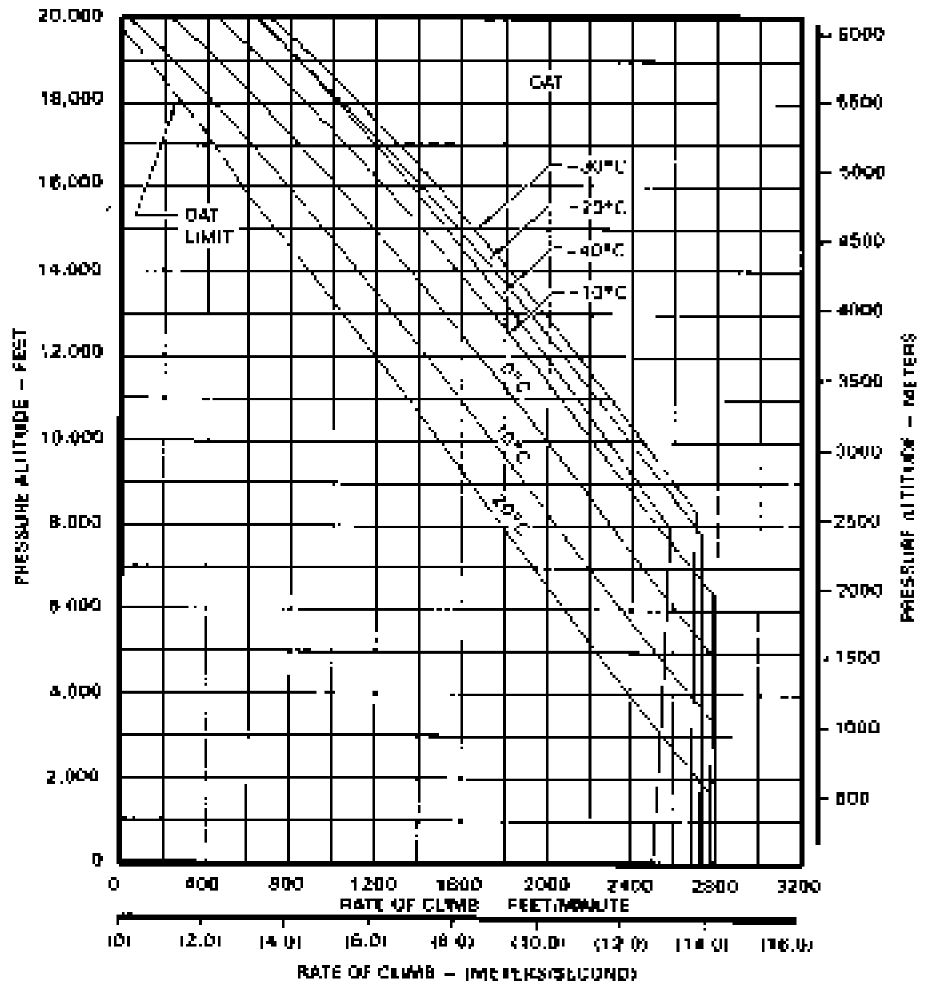
Twin engine rate of climb (Sheet 6 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 9000 LB (4082 kg)

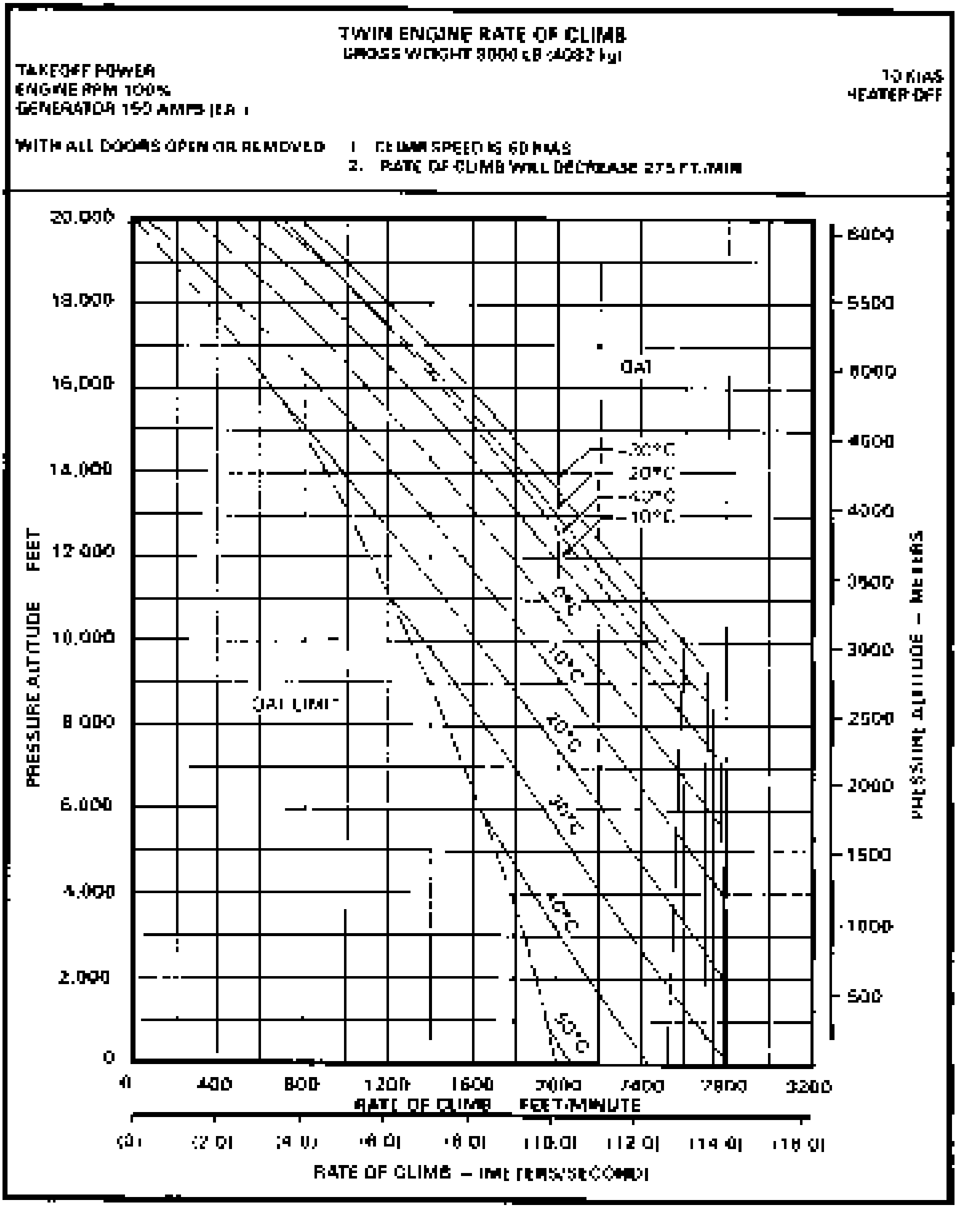
TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 80 KIAS
2. RATE OF CLIMB WILL DECREASE 270 FT/MIN



Twin engine rate of climb (Sheet 7 of 24)



Twin engine rate of climb (Sheet 6 of 24)

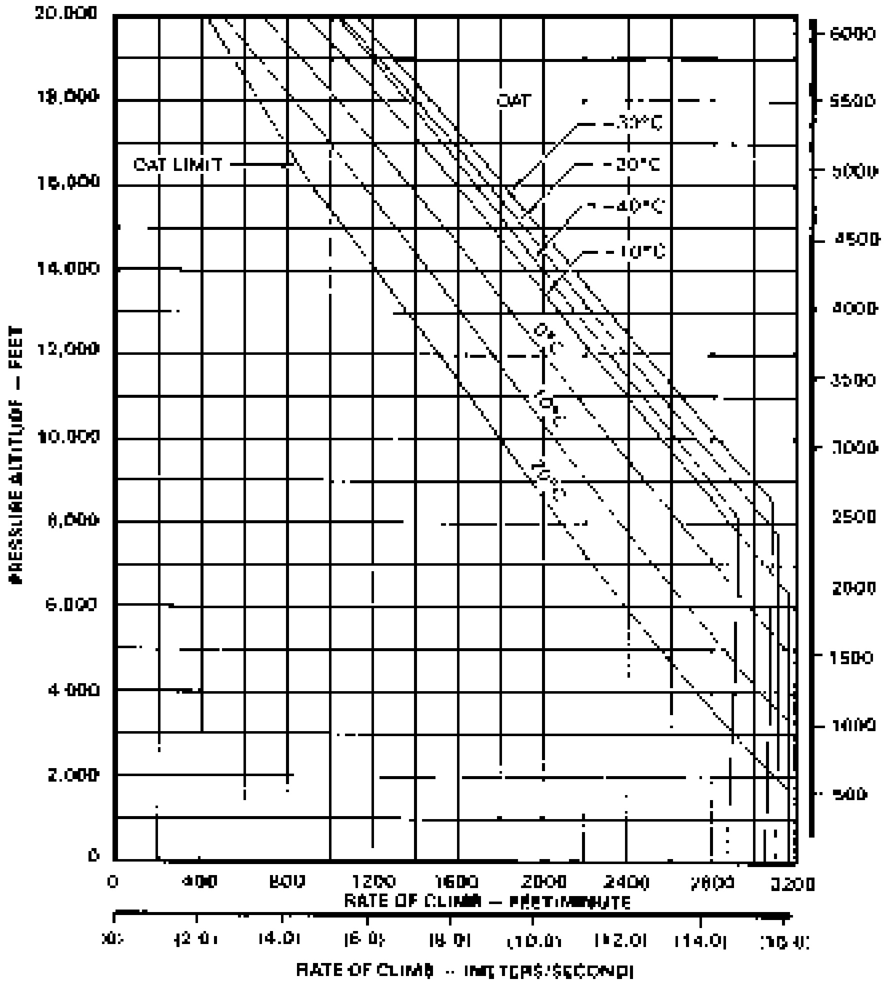
TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 8000 LB (3629 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED.
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 270 FT/MIN



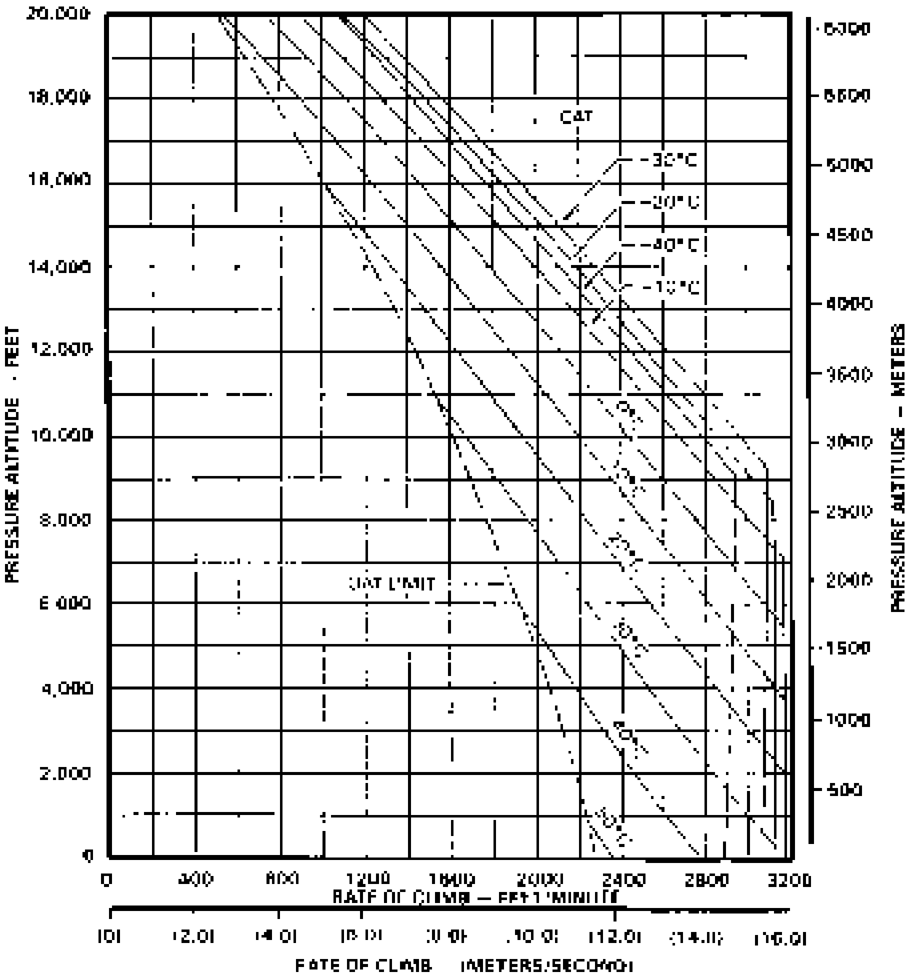
Twin engine rate of climb (Sheet 9 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 8000 LB (3629 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN.



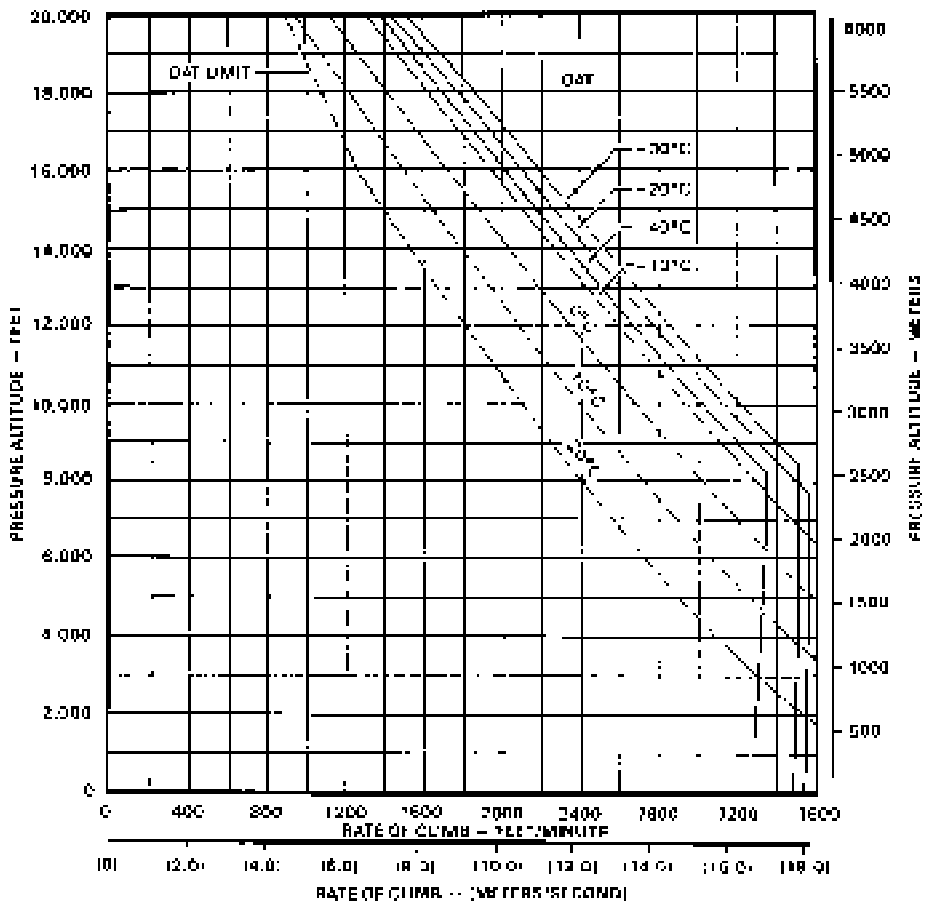
Twin engine rate of climb (Sheet 10 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 7000 LB (3175 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 276 FT./MIN.



Twin engine rate of climb (Sheet 11 of 24)

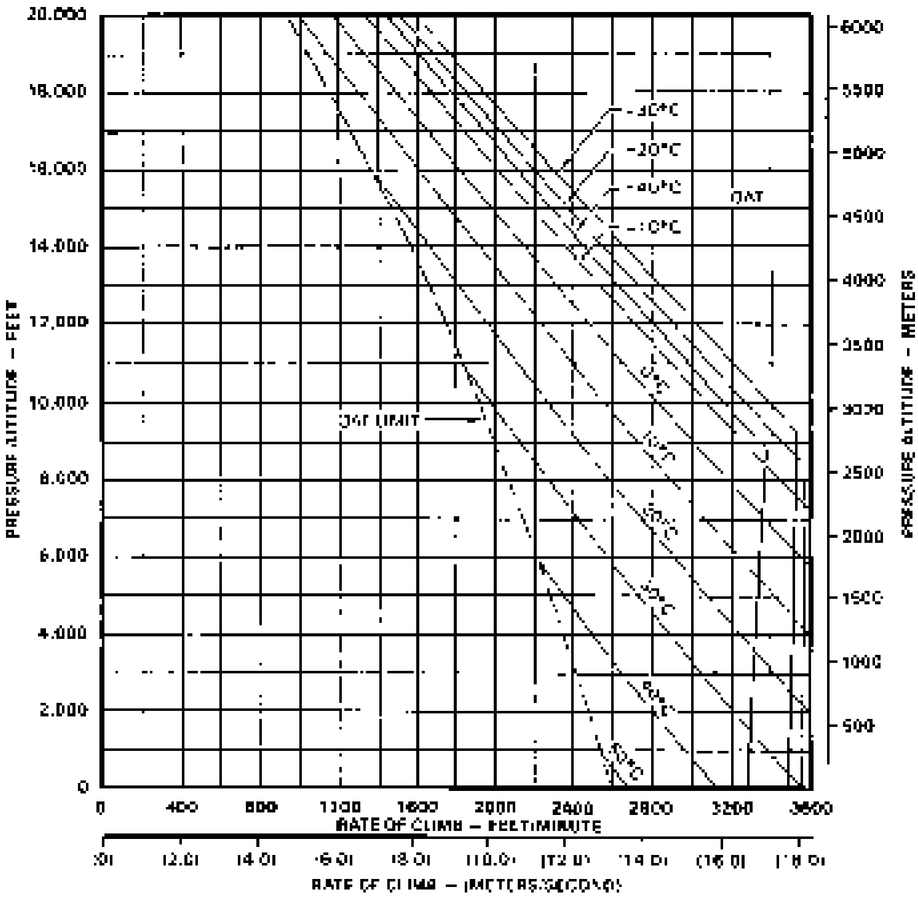
TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 7000 LB (3175 kg)

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED: 1 CLIMB SPEED IS 60 KIAS
2 RATE OF CLIMB WILL DECREASE 270 FT/MIN.



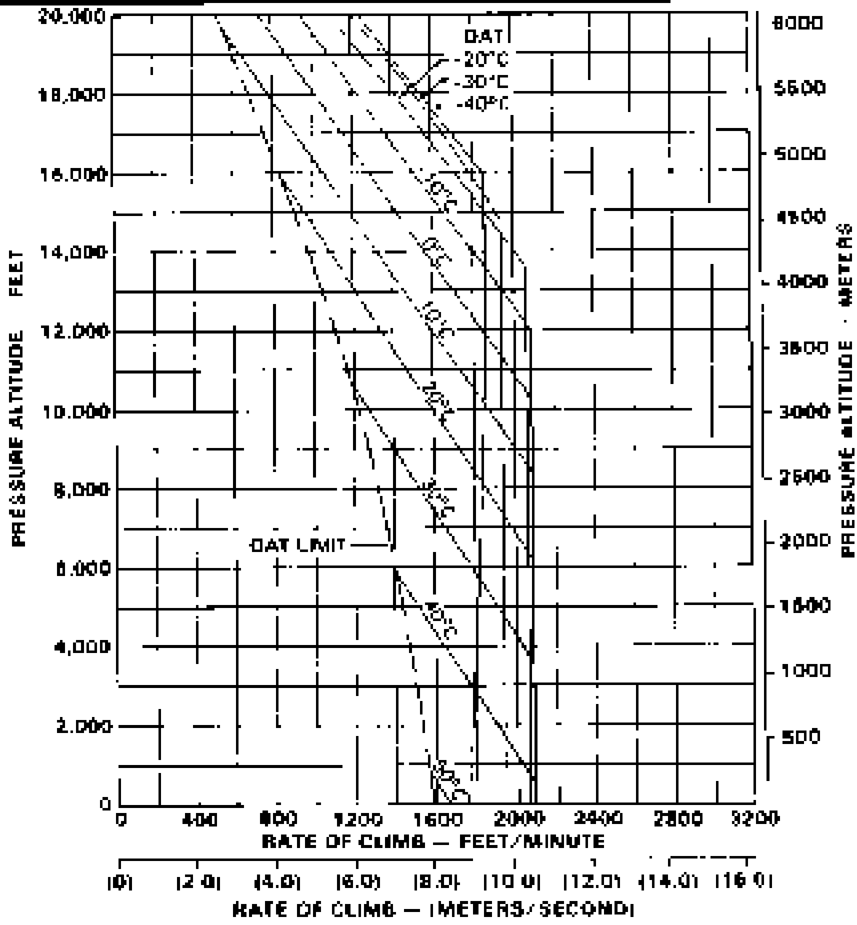
Twin engine rate of climb (Sheet 12 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 7000 LB (3175 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 270 FT/MIN



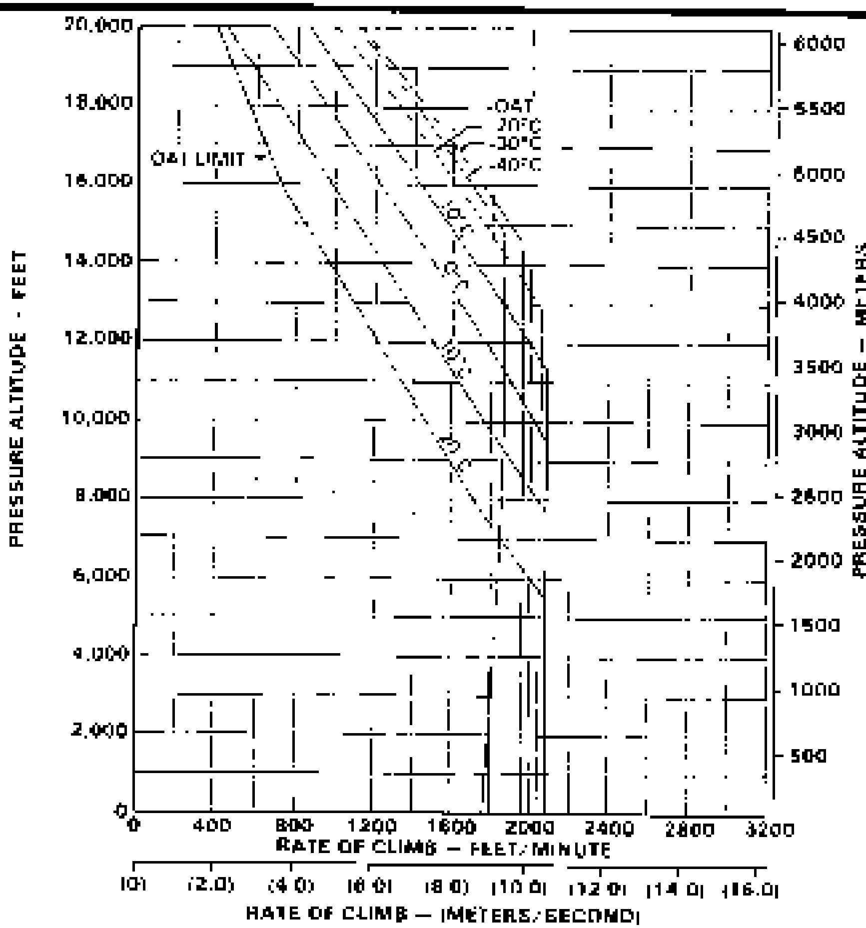
Twin engine rate of climb (Sheet 13 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 7000 LB (3175 kg)

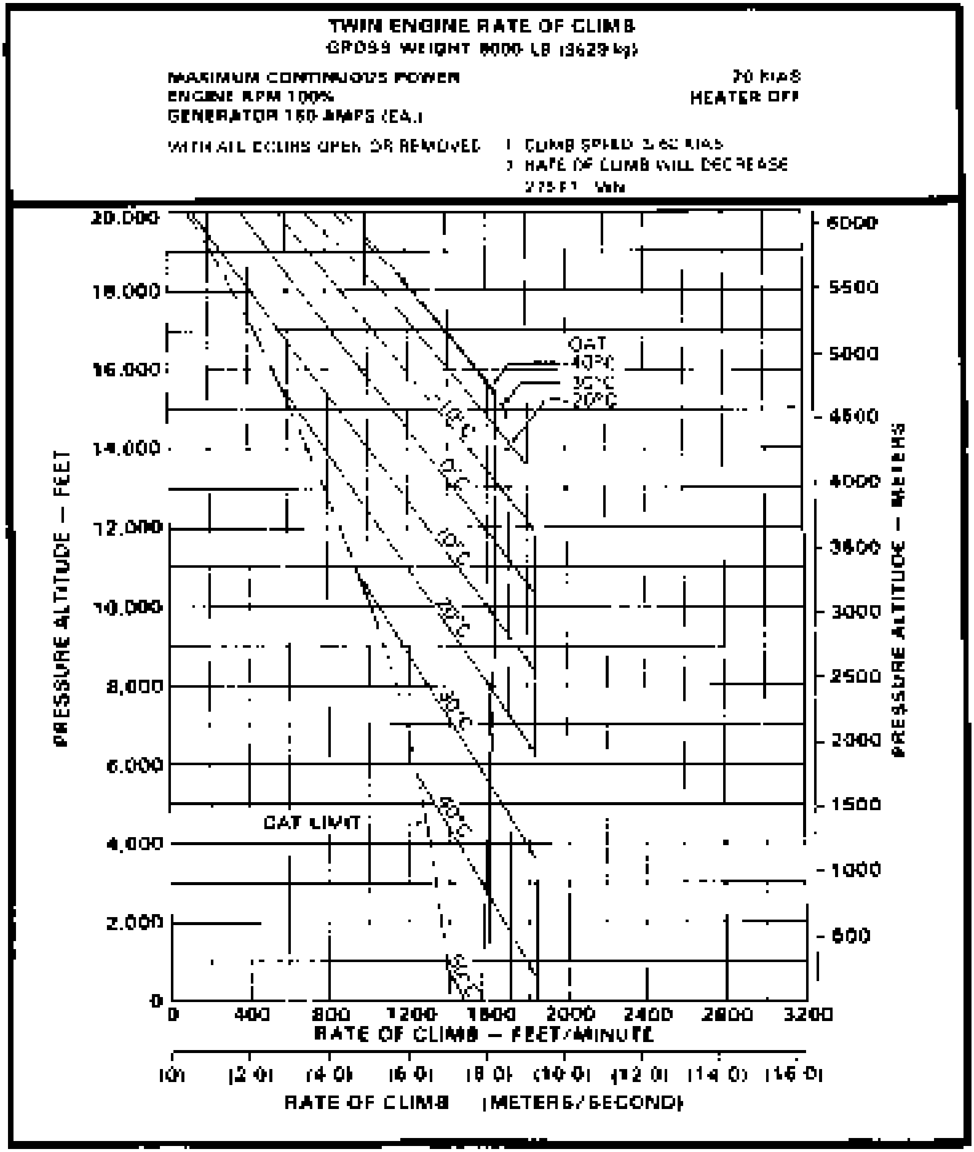
MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

20 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 50 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 14 of 24)



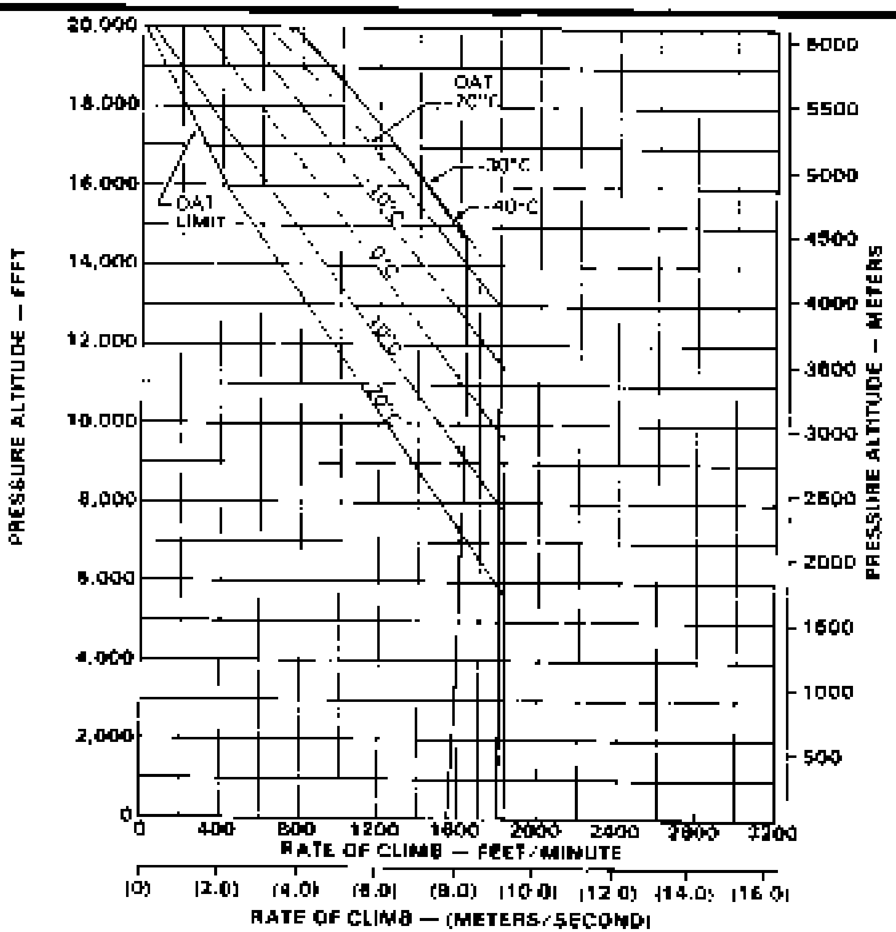
Twin engine rate of climb (Sheet 16 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 8000 LB (3629 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 375 FT/MIN



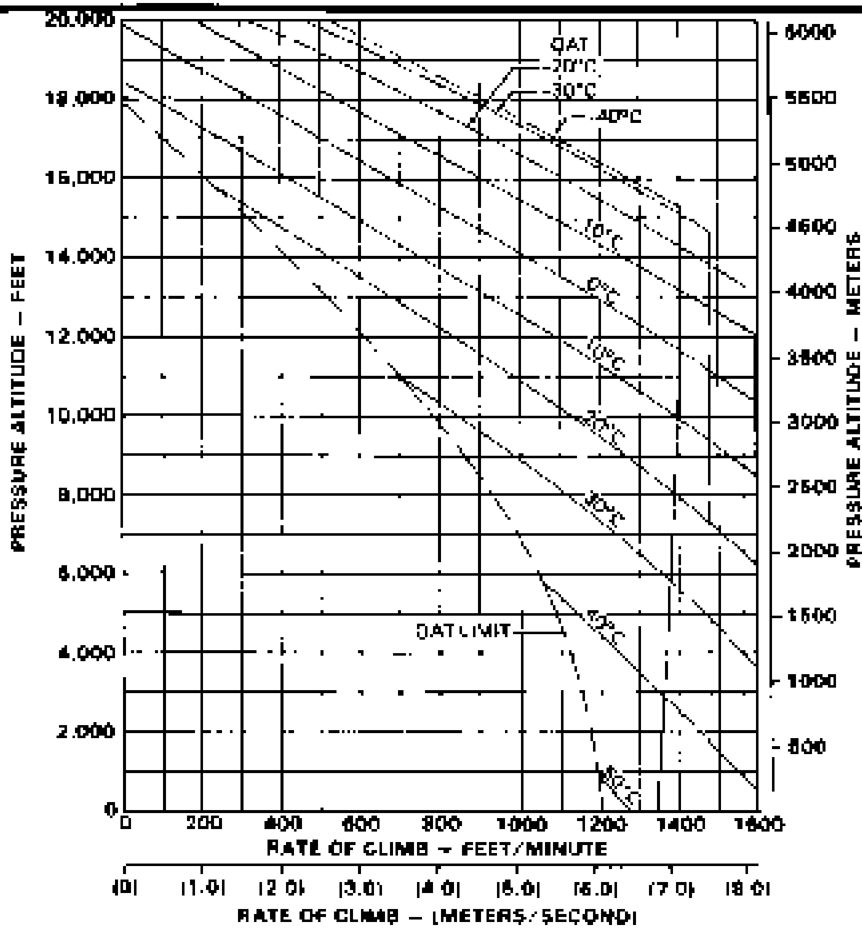
Twin engine rate of climb (Sheet 18 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 9000 LB (4082 kg)

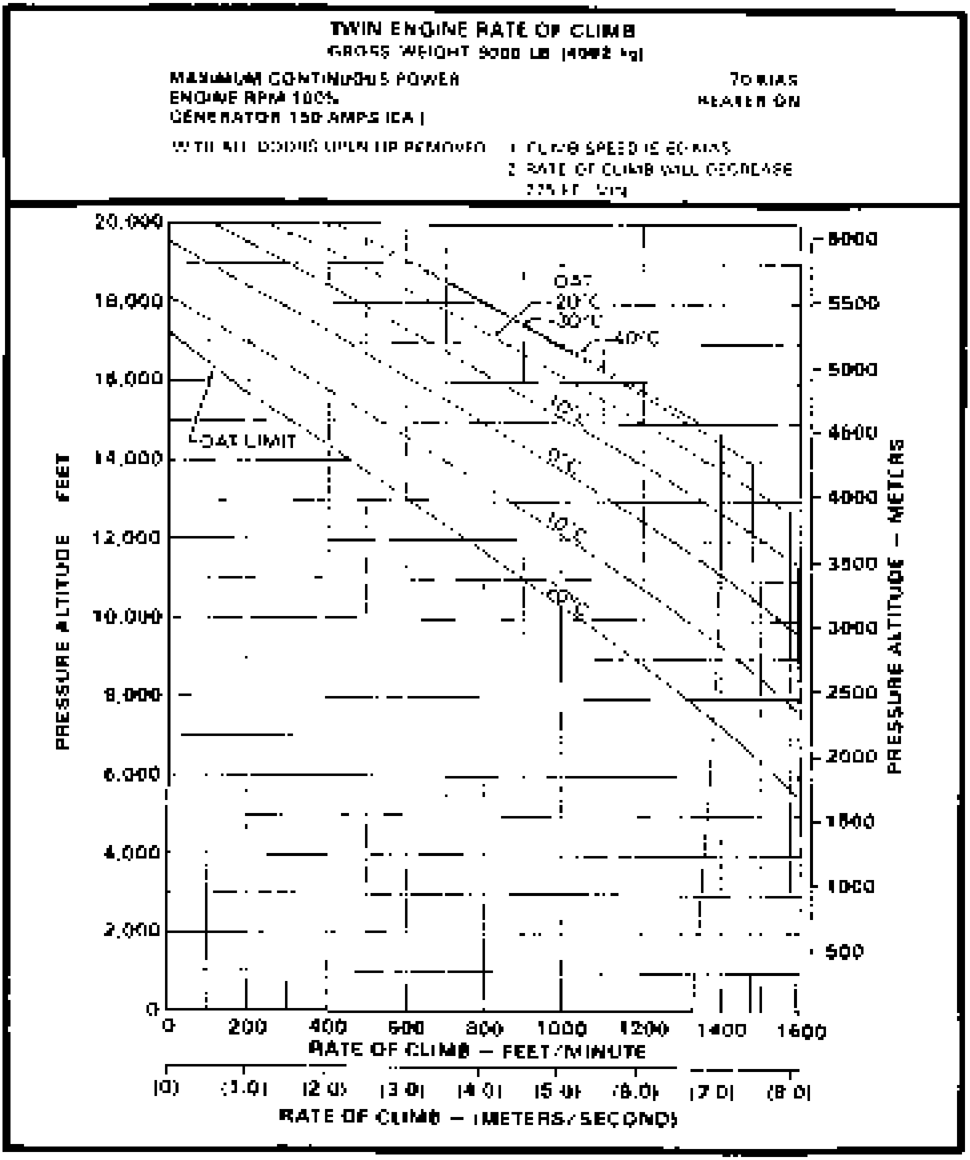
MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 17 of 24)



Twin engine rate of climb (Sheet 18 of 24)

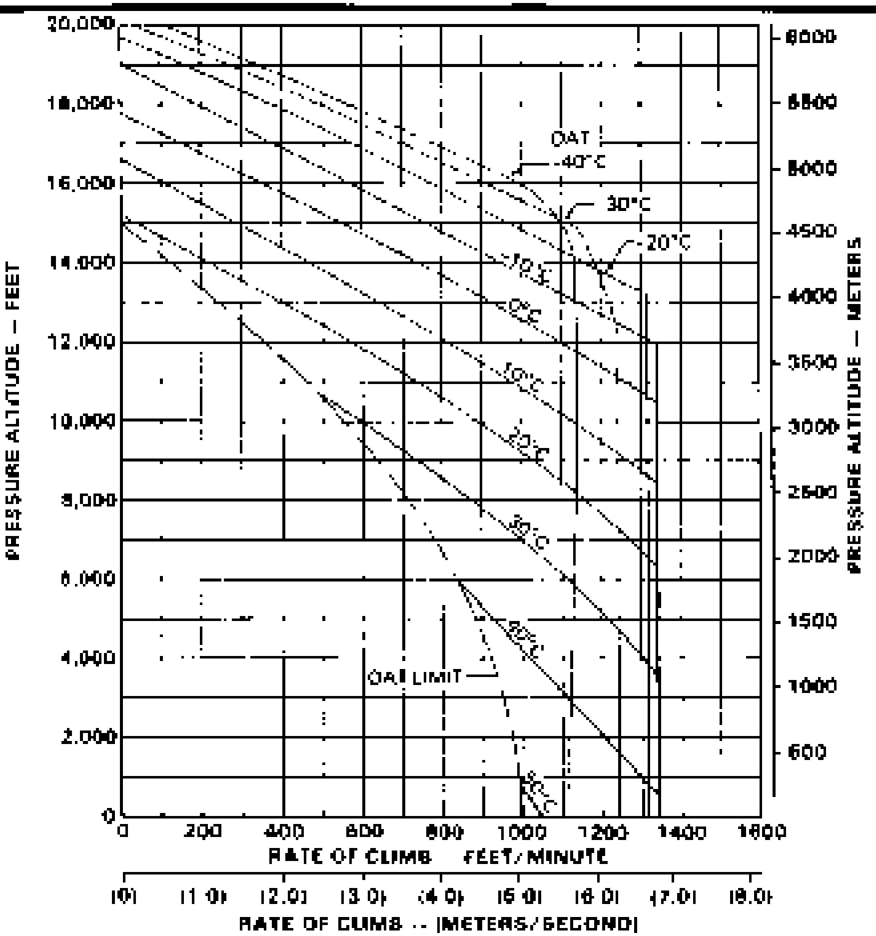
TWIN ENGINE RATE OF CLIMB

GROSS WEIGHT 10,000 LB (4536 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 80 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



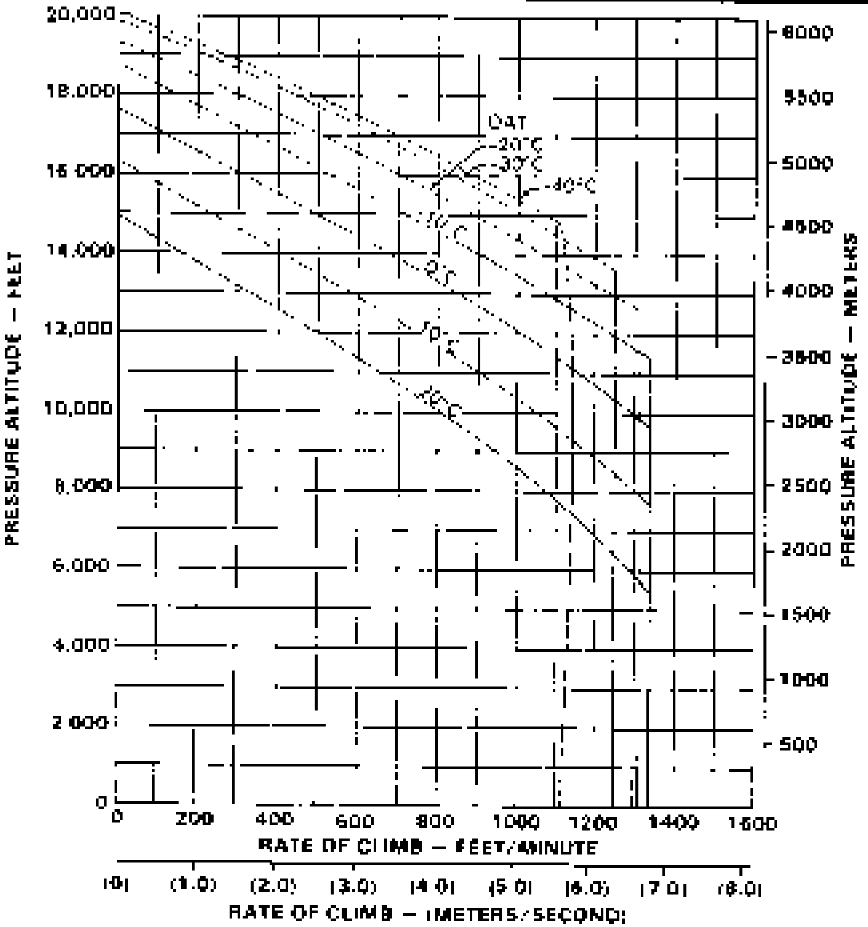
Twin engine rate of climb (Sheet 19 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 10,000 LB (4536 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



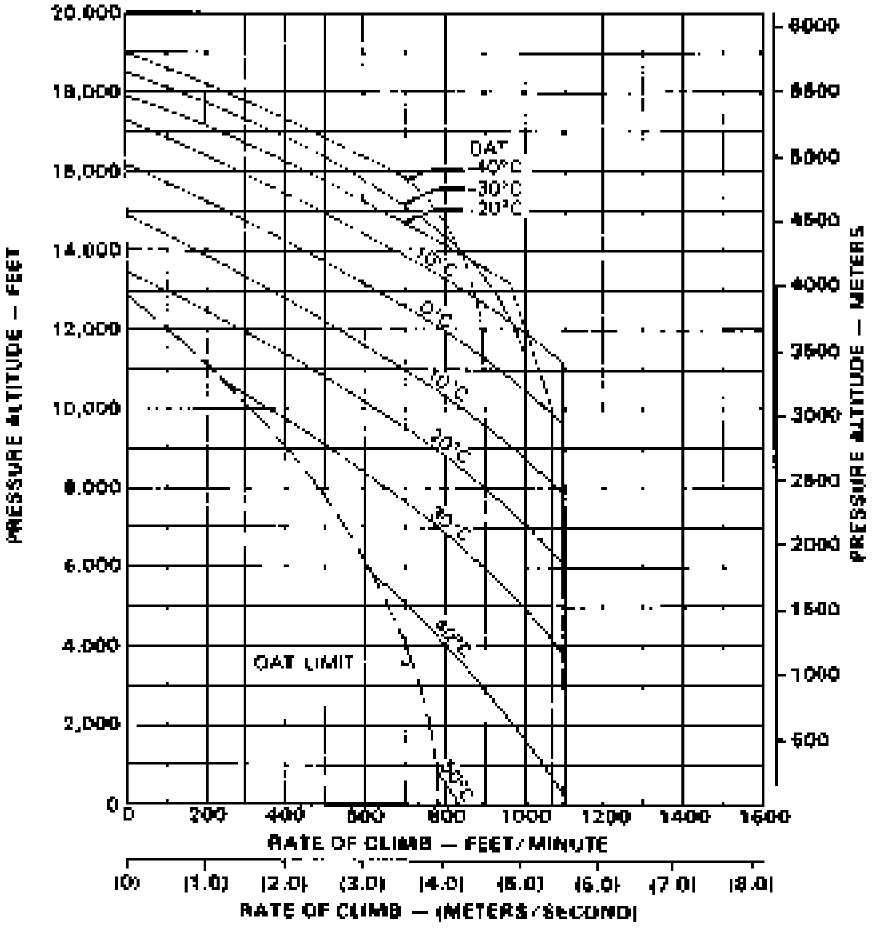
Twin engine rate of climb (Sheet 20 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11,000 LB (4990 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED: 1 CLIMB SPEED IS 60 KIAS
2 RATE OF CLIMB WILL DECREASE 275 FT/MIN.



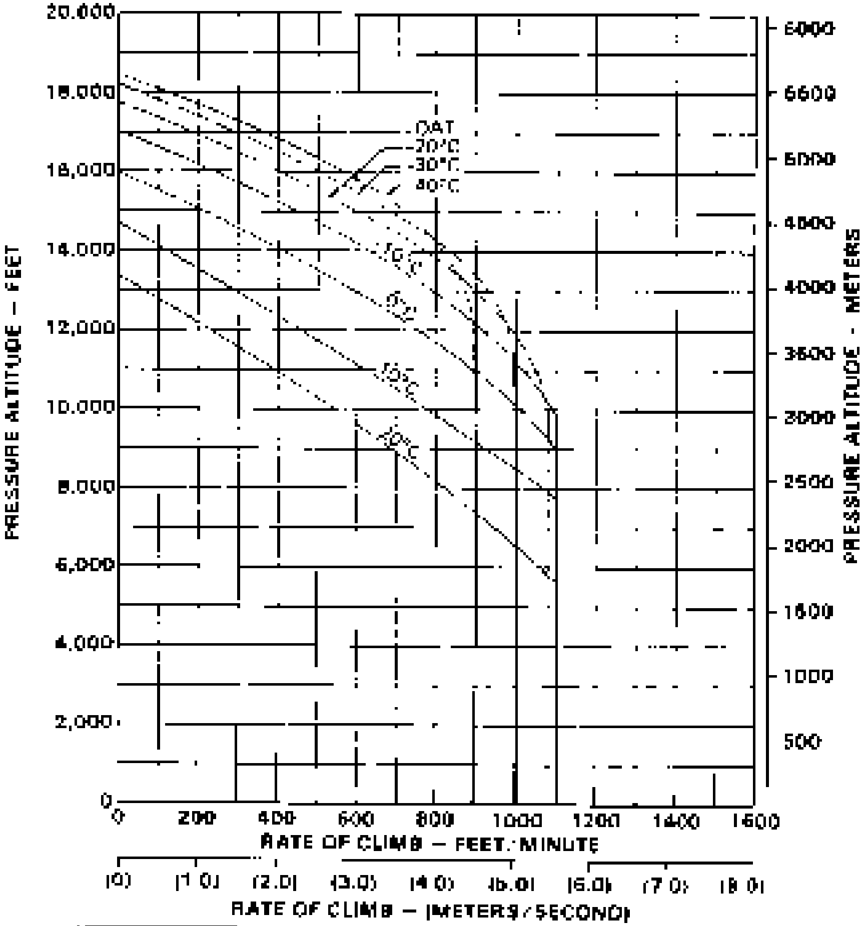
Twin engine rate of climb (Sheet 21 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11,000 LB (4990 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED:
1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 22 of 24)

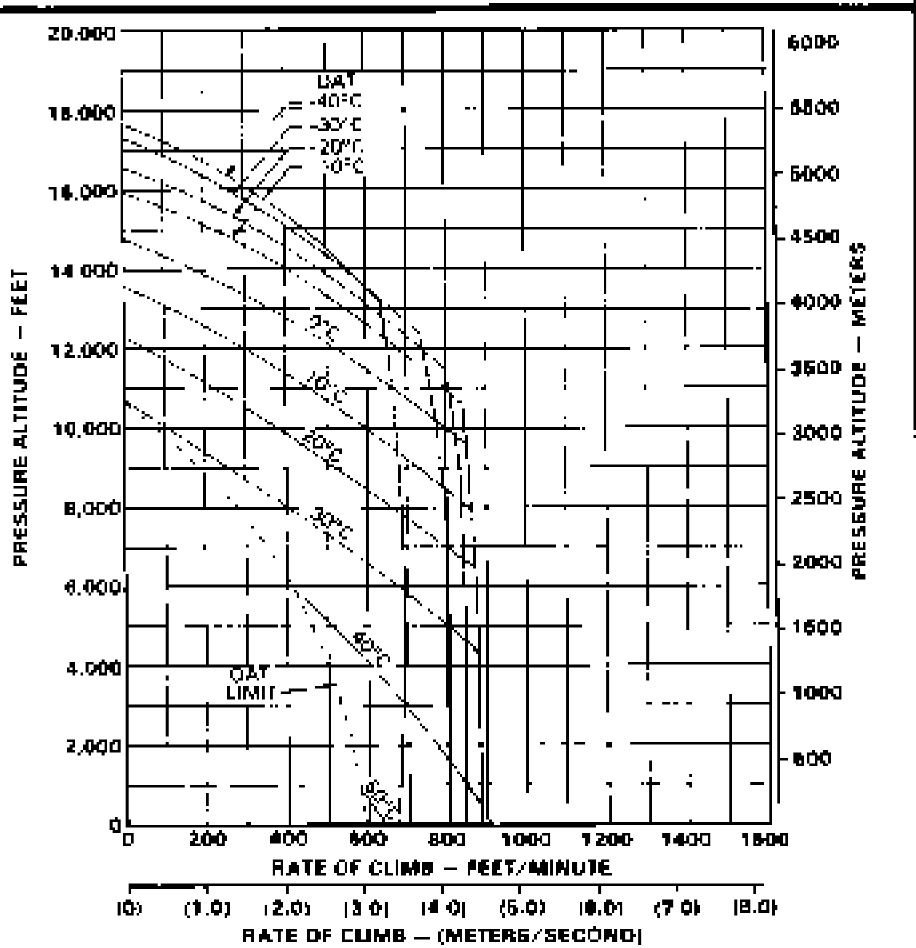
TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11,900 LB (5,398 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

70 KIAS
HEATER OFF

WITH ALL DOORS OPEN OR REMOVED

1. CLIMB SPEED IS 60 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



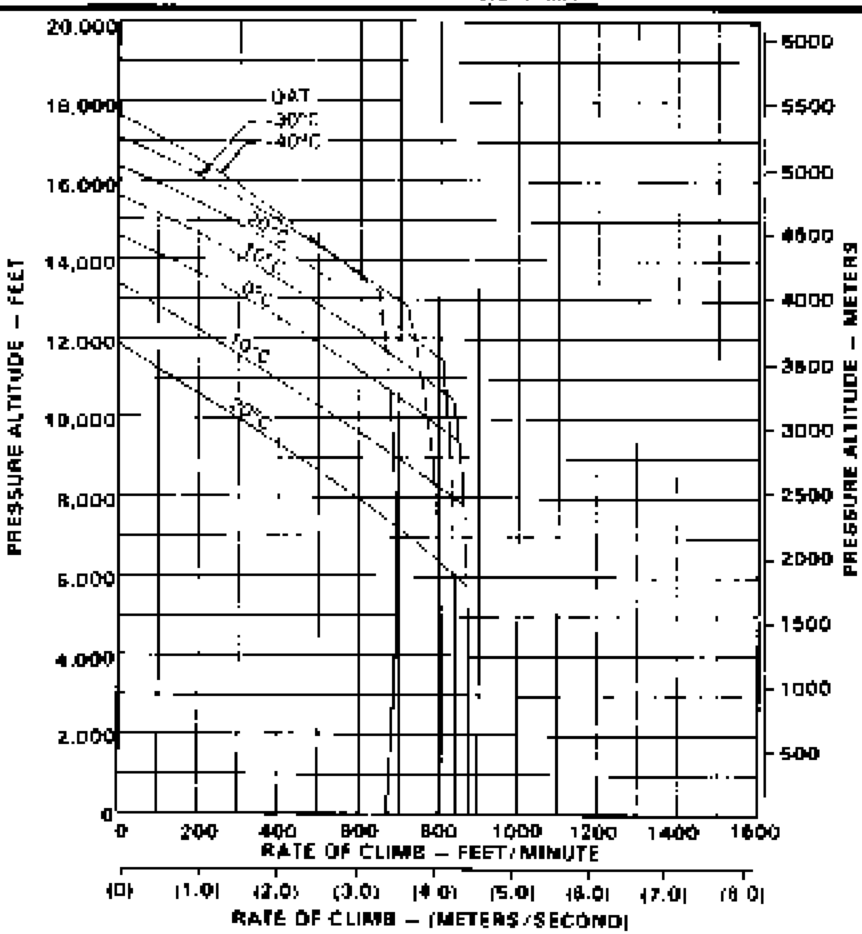
Twin engine rate of climb (Sheet 23 of 24)

TWIN ENGINE RATE OF CLIMB
GROSS WEIGHT 11 900 LB (5398 kg)

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

70 KIAS
HEATER ON

WITH ALL DOORS OPEN OR REMOVED
1. CLIMB SPEED IS 70 KIAS
2. RATE OF CLIMB WILL DECREASE 275 FT/MIN



Twin engine rate of climb (Sheet 24 of 24)

Section 1

MANUFACTURER'S DATA

WEIGHT AND BALANCE

No change from basic Flight Manual

Section 2

MANUFACTURER'S DATA

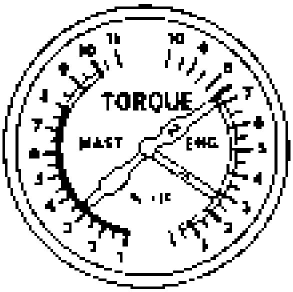
SYSTEMS DESCRIPTION

INSTRUMENT PANEL AND CONSOLES

AMBER

OVER
TORQ

(located on instrument panel)



(Replaces TRANSMISSION TORQUE page)

OVERTORQUE WARNING SYSTEM

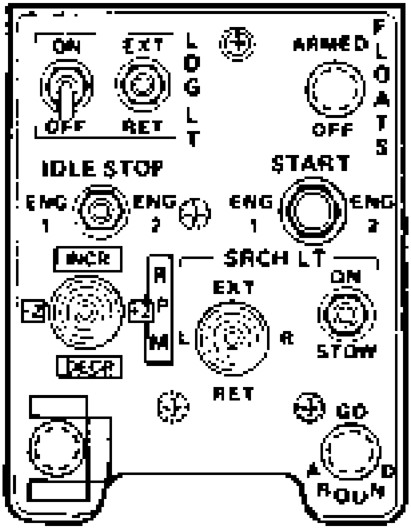
An OVER TRQ warning flag (cat's eye) is located in the lower left aft avionics compartment. If mast torque exceeds 108%, the warning flag will be tripped showing alternating black and white sections.

POWERPLANT

The pilot RPM switch is mounted on the collective switchbox. The pilot switch is a five position momentary-on type switch. The INCR position increases engine RPM, and the DECR position decreases engine RPM. The INCR/DECR positions control the governors on both engines simultaneously. Regulated engine RPM may be adjusted in flight through the operating range of 97 to 101.5 (±0.5) % by moving the switch.

The RPM +2/−2 switch increases or decreases engine No. 2 RPM to provide torque or ITT matching. Engine 2 trim range is 2.0 — 2.5% Nr. Engine 2 governor should be at least 96% minimum trim — minimum beep.

The copilot does not have trim capability. For location of RPM switch, refer to collective control panel.



Collective control panel.

Section 3

MANUFACTURER'S DATA

OPERATIONAL INFORMATION

No change from basic Flight Manual

Section 4

MANUFACTURER'S DATA

HANDLING/SERVICING/MAINTENANCE

No change from basic Flight Manual

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

CATEGORY B OPERATIONS WHEN CONFIGURED WITH NINE OR LESS PASSENGER SEATS

33108 — 33213
34001 — 34024
36001 — 36019
AND
33001 — 33107
WHEN 412-075-008-111
TORQUEMETER IS INSTALLED
(BHT-412-FMS-19.1)
CERTIFIED
10 APRIL 1991

This supplement shall be attached to the Model 412 Flight Manual when helicopter is configured with nine or less passengers seat configuration.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, or other applicable supplements, consult basic Flight Manual.

Bell Helicopter TEXTRON
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REISSUE – 19 MARCH 2003

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LOG OF REVISIONS

Original	0	10 APR 91	Revision	1	23 APR 96
Reissue	0	10 MAY 96	Reissue	0	19 MAR 03

LOG OF PAGES

PAGE	REVISION NO.	PAGE	REVISION NO.
FLIGHT MANUAL		vii	0
Title	0	1 — 12	0
NP	0		
A — B	0		

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

LOG OF FAA APPROVED REVISIONS

Original	0	10 APR 91	Revision	1	23 APR 98
Reissue	0	10 MAY 98	Reissue	0	19 MAR 03

APPROVED:

DATE: MAR 1 9 2003

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

This supplement removes the Height-velocity diagram as a limitation and increases the density altitude limit for takeoff, landing, and in-ground-effect maneuvers when helicopter is configured with nine or less passenger seats.

Section 1

LIMITATIONS

1-3. TYPES OF OPERATION

Flights may be conducted in accordance with this supplement only when the helicopter is configured with nine or less passenger seats.

1-6. WEIGHT AND CENTER OF GRAVITY

Maximum gross weight for takeoff, landing, and in-ground-effect maneuvers is 11,900 pounds (5,398 kilograms) or as shown in Hover ceiling in ground effect (takeoff power) chart, refer to SECTION 4, whichever is less

Actual weight change shall be determined after seating is installed, and ballast shall be adjusted (if necessary) to return empty weight CG to within allowable limits.

1-8. ALTITUDE

Maximum density altitude for takeoff, landing, and in-ground-effect maneuvers is 16,000 feet. Refer to Weight-Altitude-Temperature Limitations chart (Figure 1-1).

NOTE: ALLOWABLE GROSS WEIGHTS OBTAINED FROM THIS CHART MAY EXCEED HOVER CAPABILITY UNDER CERTAIN AMBIENT CONDITIONS. REFER TO HOVER CEILING CHARTS IN SECTION 4.

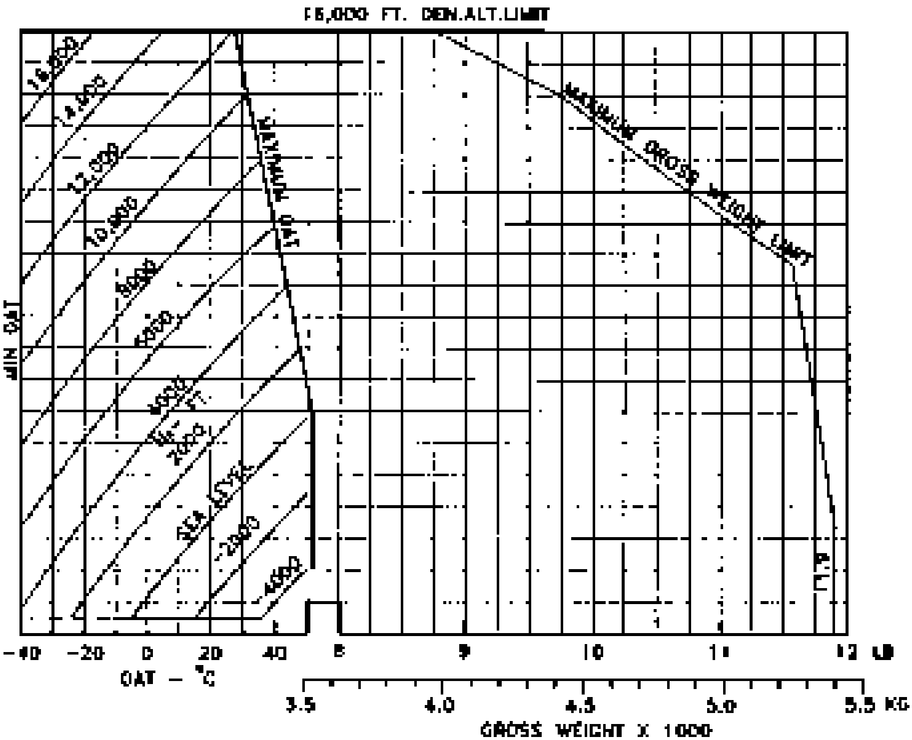


Figure 1-1. Weight-altitude-temperature limitations for takeoff, landing, and in-ground-effect maneuvers

Section 2

NORMAL PROCEDURES

2-2. FLIGHT PLANNING

NOTE

The Height-velocity diagram does not represent a limitation.

Refer to Performance Data, Section 4.

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

No change from basic manual.

Section 4

PERFORMANCE

4-4. HEIGHT - VELOCITY ENVELOPE

Operation in height-velocity envelope is critical in the event of a single engine failure during takeoff, landing, or other operation near the surface (Figure 4-1). The AVOID area of the Height-velocity diagram defines the combinations of airspeed and height above ground from which a safe single engine landing on a smooth, level, firm surface cannot be assured.

The Height-velocity diagram is valid only when the Hover Ceiling Out of Ground Effect performance envelope is not exceeded (refer to Figure 4-2). The Hover Ceiling In Ground Effect performance chart (refer to Figure 4-3) does not define the conditions which assure continued flight following an engine failure nor the conditions from which a safe power-off landing can be made.

4-5. HOVER CEILING

The Hover Ceiling In Ground Effect charts (Figures 4-3 and 4-4) provide the maximum allowable gross weights for takeoff, landing, and IGE maneuvers at all pressure altitude and outside air temperature conditions with heater on or off. Conversely, the hover ceiling altitude can be determined for any given gross weight.

Adequate cyclic and directional control are available at the gross weights allowed by the Hover Ceiling IGE charts in winds up to 35 knots from any direction at or below 3,000 feet HD (refer to Basic Flight Manual). Above 3,000 feet HD, improved control margins will be realized by avoiding winds in the critical wind azimuth area (Figure 4-5).

4-6. TAKEOFF DISTANCE

The Takeoff Distance charts (Figure 4-6) provide takeoff distances required to clear a 50-foot or 15-meter obstacle in a zero wind condition. Takeoff is initiated from a hover at 4 feet (1.2 meters) skid height with climbout of 45 knots.

NOTE

Downwind takeoffs are not recommended because the published takeoff distance performance cannot be achieved.

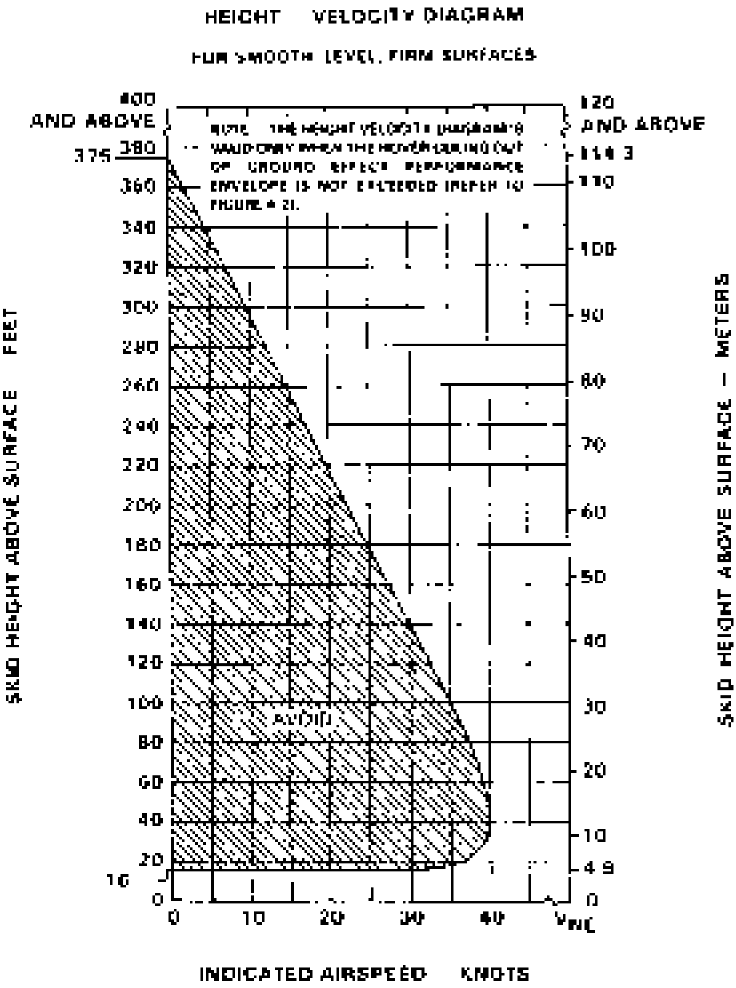


Figure 4-1. Height-velocity diagram (OEI)

HOVER CEILING OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FEET
HEATER ON OR OFF
-40°C TO 0°C

NOTE: THESE DATA VALID FOR ZERO WIND OUTSIDE OF THE CRITICAL WIND AZIMUTH AREA (REFER TO FIGURE 4-6)

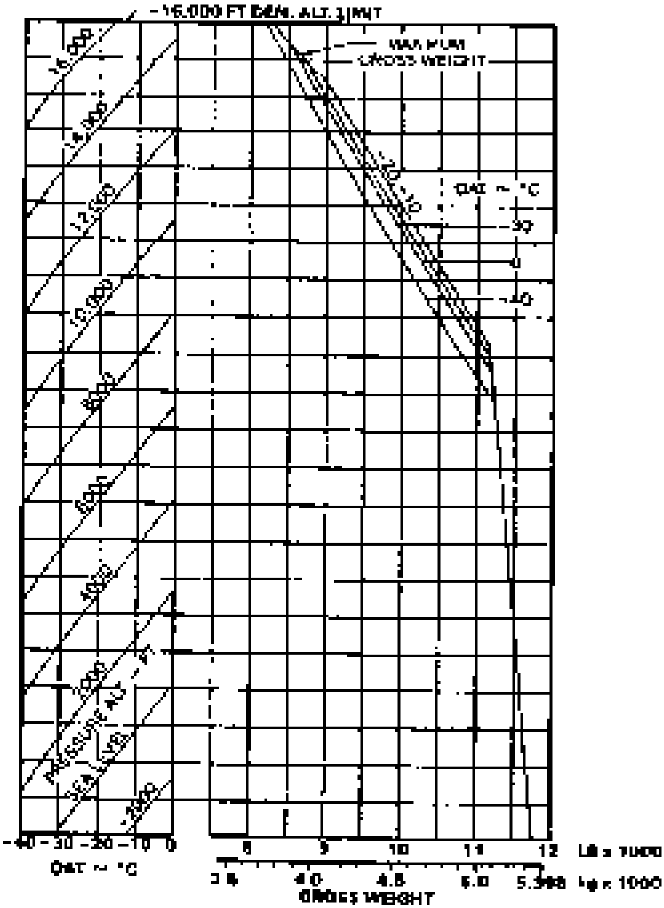


Figure 4-2. Hover ceiling out of ground effect (Sheet 1 of 2)

HOVER CEILING OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 60 FEET
HEATER ON OR OFF
0°C TO 52°C

NOTE. THESE DATA VALID FOR ZERO WIND OUTSIDE OF THE CRITICAL WIND AZIMUTH AREA (REFER TO FIGURE 4-5)

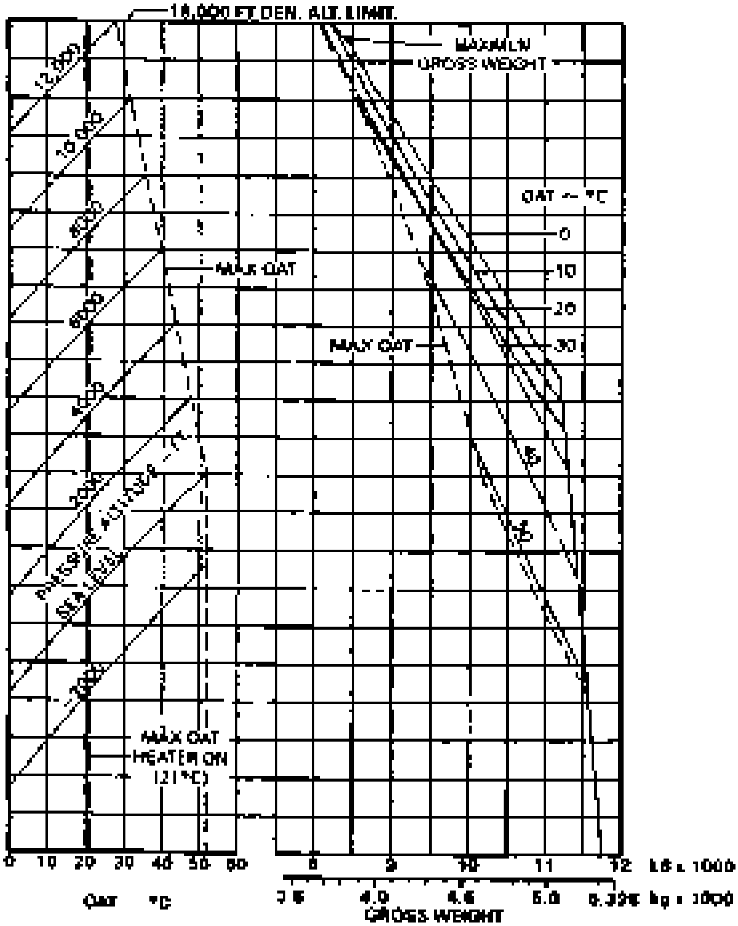


Figure 4-2. Hover ceiling out of ground effect (Sheet 2 of 2)

HOVER CEILING IN GROUND EFFECT
MAXIMUM WEIGHT FOR TAKEOFF, LANDING, AND IN-GROUND-EFFECT MANEUVERS

TAKEOFF POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
-40°C TO 62°C

NOTE: THESE DATA VALID FOR ZERO WIND OUTSIDE OF THE CRITICAL WIND AZIMUTH AREA (REFER TO FIGURE 4-5)

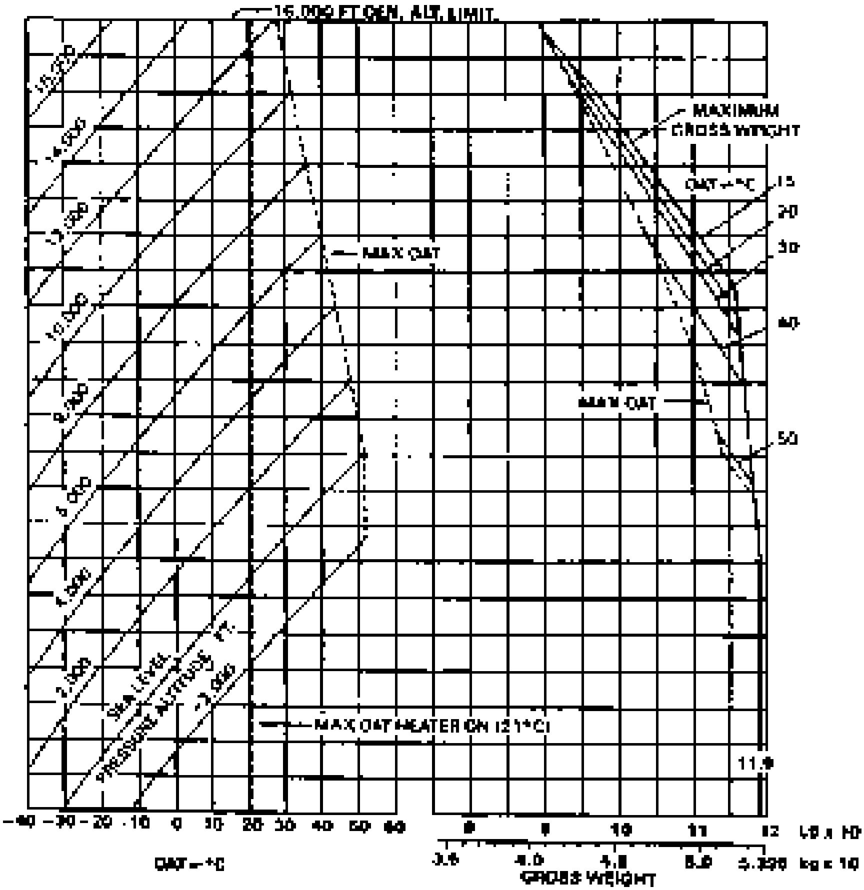


Figure 4-3. Hover ceiling in ground effect (takeoff power)

HOVER CEILING IN GROUND EFFECT MAXIMUM WEIGHT FOR TAKEOFF, LANDING, AND IN-GROUND-EFFECT MANEUVERS

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

SKID HEIGHT 4 FEET
HEATER ON OR OFF
-40°C TO 52°C

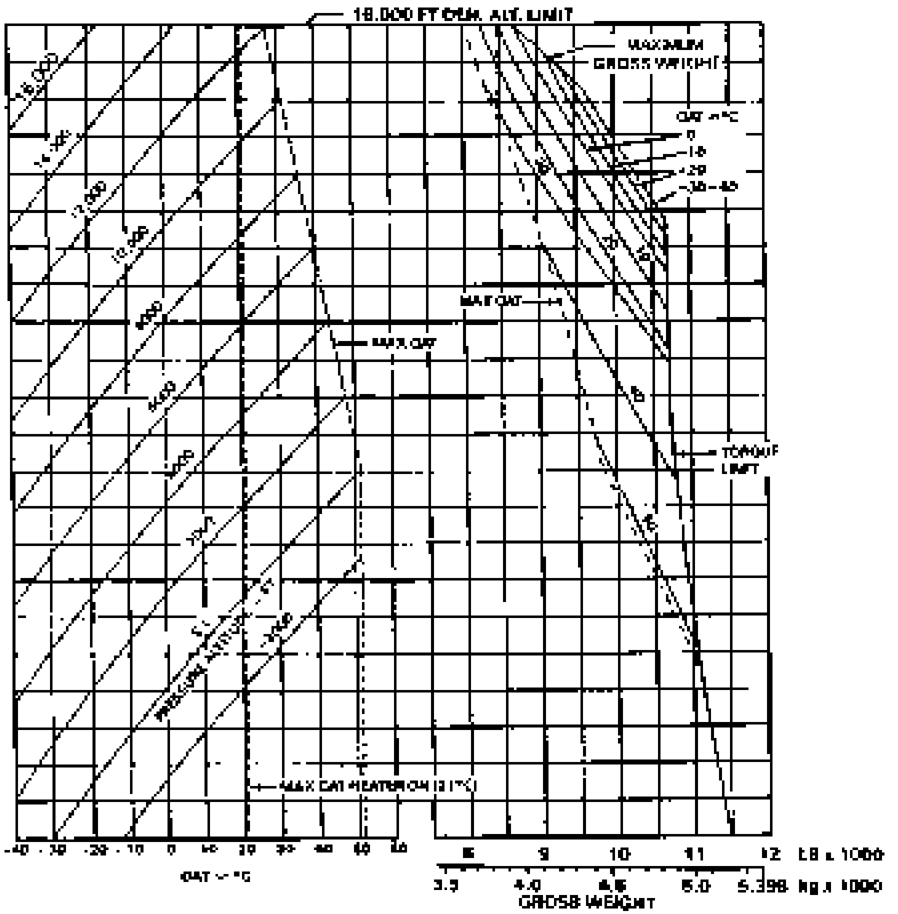
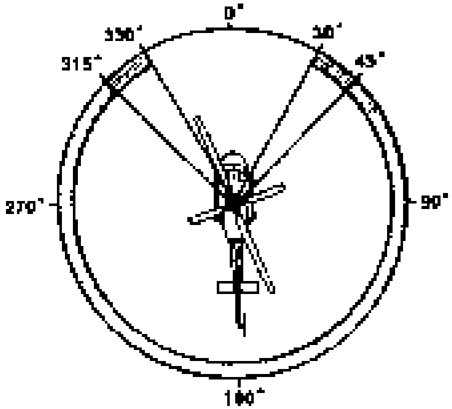
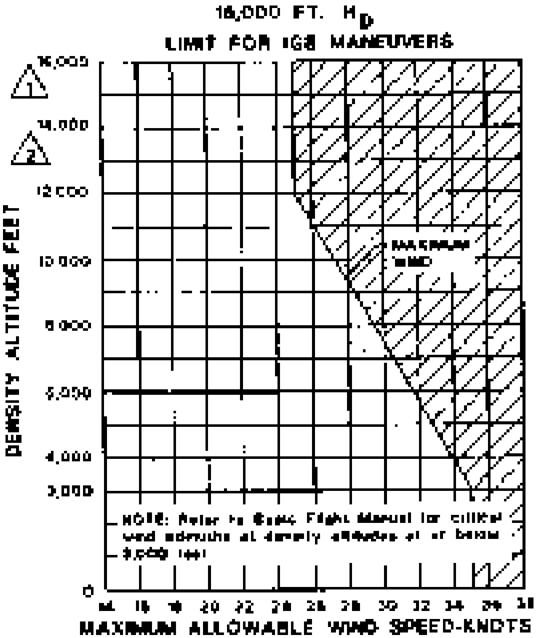


Figure 4-4. Hover ceiling in ground effect (maximum continuous power)

CRITICAL RELATIVE WIND AZIMUTH





Critical wind azimuth — hovering with the relative wind azimuth angles in shaded area can result in the following:

a. Inability to maintain heading due to large left pedal requirements for certain wind velocities.

b. Reduction of available left pedal control with a directional AFCS hardover.

c. Aft cyclic may be limited with longitudinal AFCS hardover.

d. Hover performance is valid for all headings in calm wind.

1. For H_D from 14,000 to 16,000 ft winds up to ±30° off nose for hover performance to be valid.

2. For H_D below 14,000 ft winds up to ±45° off nose for hover performance to be valid.

Figure 4-5. Critical relative wind azimuth

TAKEOFF DISTANCE
OVER 50 FOOT OBSTACLE

HOVER POWER +15% TORQUE (not to exceed limits)
ENGINE RPM 100%
GENERATOR 150 AMPS (EA)

INITIATED FROM 4FT. SKID HEIGHT
V_{TOCS} = 45 KIAS
HEATER ON OR OFF

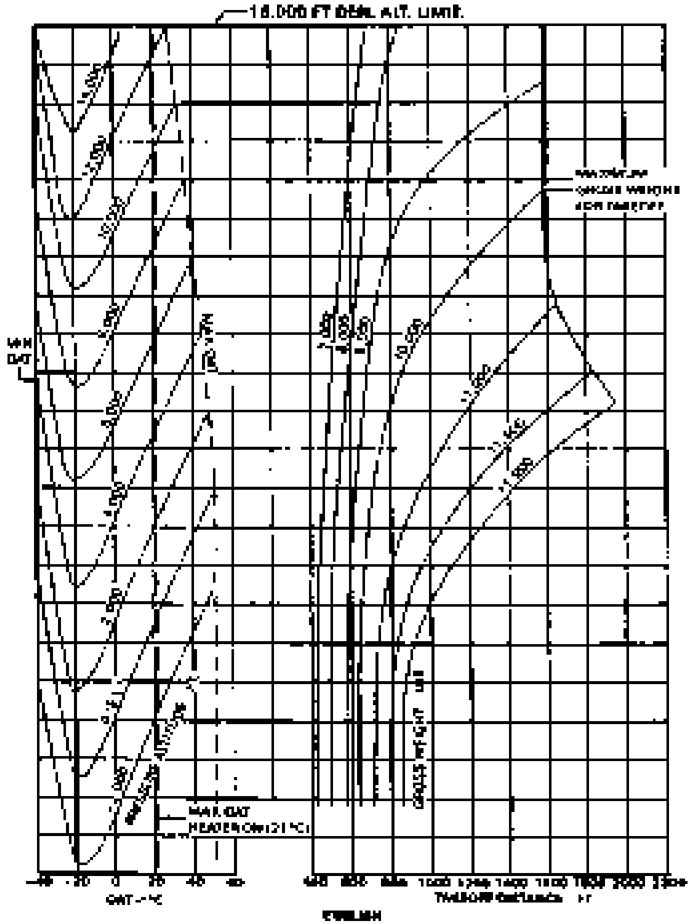


Figure 4-6. Takeoff distance (English)

TAKEOFF DISTANCE
OVER 15 METER OBSTACLE

HOVER POWER +15% TORQUE (not to exceed limits)
ENGINE RPM 100%
GENERATOR 150 AMPS (EA.)

INITIATED FROM 1.2 METER SKID HEIGHT
V_{TOCS} = 45 KIAS
HEATER ON OR OFF

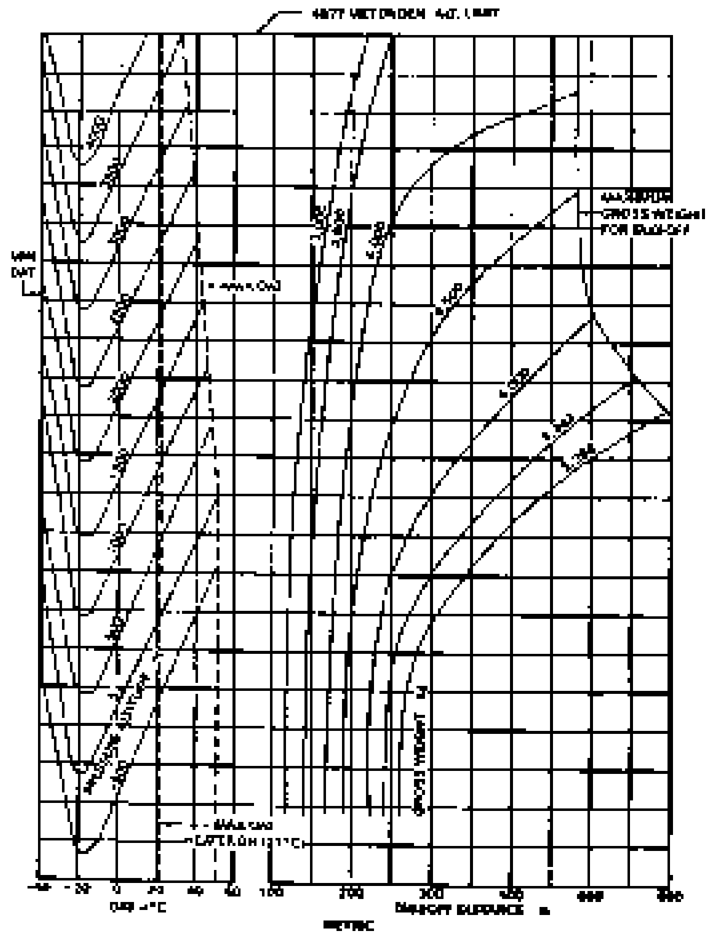


Figure 4-7. Takeoff distance (Metric)

Bell MODELS **412/412EP**

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT FOR INCREASED GENERATOR CAPACITY KIT

(412-706-026)

CERTIFIED
29 OCTOBER 1992

This supplement shall be attached to the Models 412 and 412EP Flight Manuals when the Increased Generator Capacity Kit is installed.

The information contained herein supplements the information of the basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult the basic Flight Manual.

Bell Helicopter TEXTRON

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REISSUE — 6 OCTOBER 1994

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LOG OF REVISIONS

Original	0	29 Oct 92
Reissue	0	05 Oct 94

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i/ii	0		
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MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

INTRODUCTION

The Increased Generator Capacity Kit increases the amperage limit from 150 to 200 amps on each generator. The incremental performance losses for the additional 50 amps each is presented in Section 4.

Section 1

LIMITATIONS

WEIGHT/CG LIMITATIONS

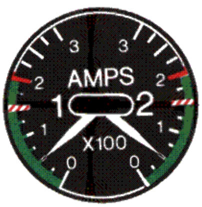
Actual weight change shall be determined after kit is installed and ballast adjusted (if necessary) to return empty weight CG within allowable limits.

GENERATOR LIMITATIONS

Continuous operation	0 to 200 amps
Maximum for operation above 15,000 feet density altitude	150 amps
Maximum	200 amps

CAUTION

DURING SINGLE GENERATOR OPERATION, ELECTRICAL LOADS SHALL BE REDUCED BEFORE RESTORING POWER TO NONESSENTIAL BUS TO ENSURE GENERATOR LOAD LIMIT IS NOT EXCEEDED.



AMMETER

0 to 200 AMPS	Continuous operation
150 AMPS	Maximum for operation above 15,000 ft H_D
200 AMPS	Maximum

INSTRUMENT MARKINGS

Section 2

NORMAL PROCEDURES

No change from basic Flight Manual.

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

ELECTRICAL POWER FAILURES

DC POWER FAILURE

INDICATIONS:

DC GENERATOR caution light illuminates.

All lighting and avionics on nonessential busses inoperative.

PROCEDURE:

GEN FIELD and GEN RESET circuit breakers — Check in.

GEN switch (affected generator) — RESET, then ON.

If generator remains inoperative, proceed as follows:

GEN switch (affected generator) — OFF.

If No. 2 Generator failed:

BATTERY BUS 2 switch — OFF.

BATTERY BUS 1 switch — ON.

If nonessential bus power is required, proceed as follows:

Switch off all unnecessary equipment.

CAUTION

DO NOT SET NON-ESNTL BUS SWITCH TO MANUAL BEFORE TURNING OFF UNNECESSARY EQUIPMENT TO ENSURE GENERATOR LOAD LIMIT IS NOT EXCEEDED.

NON-ESNTL BUS switch — MANUAL.

DC AMPS — Monitor.

Equipment switches — As desired/off as necessary to maintain generator load below maximum limit.

NOTE

During single engine operation, avoid generator load above 150 amps to attain climb performance presented in basic Flight Manual.

Section 4

PERFORMANCE

PERFORMANCE VARIATIONS

Performance variation charts are provided to determine hover and climb performance decrements due to the additional power requirements for the generators when operating at 200 amps each.

The charts are organized into three performance sections according to helicopter configuration and respective flight manual and supplements to which the charts apply.

PERFORMANCE SECTION APPLICATION

PERFORMANCE SECTION	HELICOPTER SERIAL NUMBERS	EQUIPMENT REQUIRED	FLIGHT MANUAL/ SUPPLEMENT
Section 4A	33001-33107	None	*BHT-412-FM-1
Section 4B	33108-33213 36001-36019	None	*BHT-412-FM-2
	33001-33107	Increased Gross Weight and Takeoff Horsepower (412-075-008-111)	BHT-412-FMS-19.1
Section 4C	36020 — 36086 AND 36087 AND SUB	None	*BHT-412-FM-3 *BHT-412-FM-4
	33108-33213 36001-36019	Improved Hover Performance Modification (412-570-001-103) or	BHT-412-FMS-34.2
		Increased Maximum Continuous Power Kit (412-706-029)	BHT-412-FMS-41
	33001-33107	Increased Maximum Continuous Power Kit (412-706-029)	BHT-412-FMS-41

* Basic Flight Manual or appropriate optional equipment supplement

Section 4A

BHT-412-FM-1

PERFORMANCE

TWIN ENGINE HOVER AND RATE OF CLIMB DECREASE DUE TO 200 AMP GENERATOR LOADS.

Enter appropriate chart with pressure altitude and OAT to determine whether or not performance reduction is required. If applicable, decrease performance data in basic flight manual or appropriate optional equipment supplement as indicated on chart (rate of climb reduction of 30 feet per minute or hover gross weight reduction of 50 pounds out of ground effect or 60 pounds in ground effect).

HOVER PERFORMANCE VARIATION
FOR BHT-412-FM-1

TAKEOFF POWER
GENERATOR 200 AMPS (EACH)

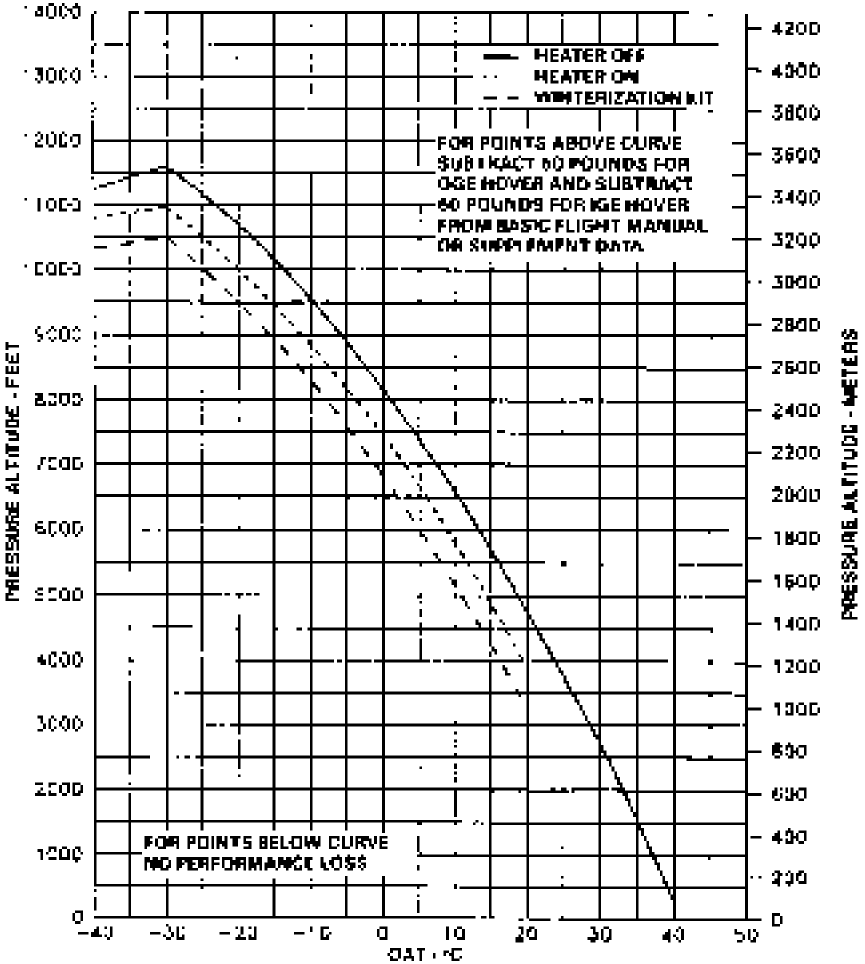


Figure 4A-1. Hover performance variation — takeoff power

HOVER PERFORMANCE VARIATION
FOR BHT-412-FM-1

MAXIMUM CONTINUOUS POWER
GENERATOR 200 AMPS (EACH)

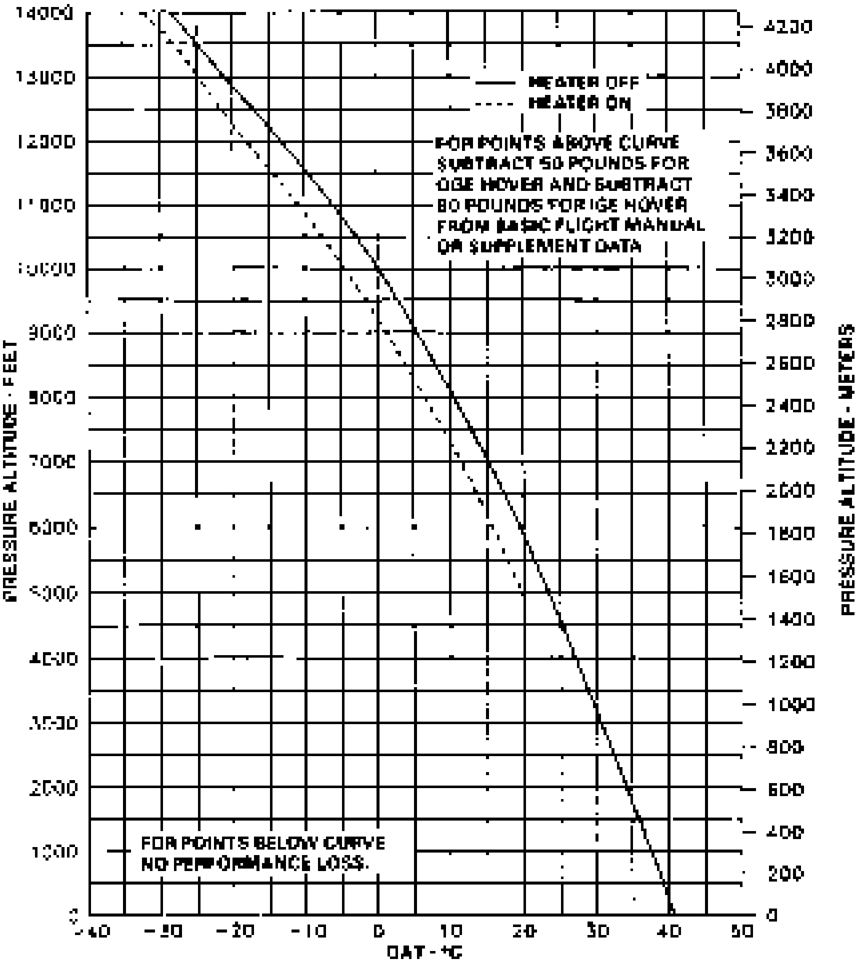


Figure 4A-2. Hover performance variation — maximum continuous power

CLIMB PERFORMANCE VARIATION
FOR BHT-412-FM-1

TAKEOFF POWER
GENERATOR 200 AMPS (EACH)

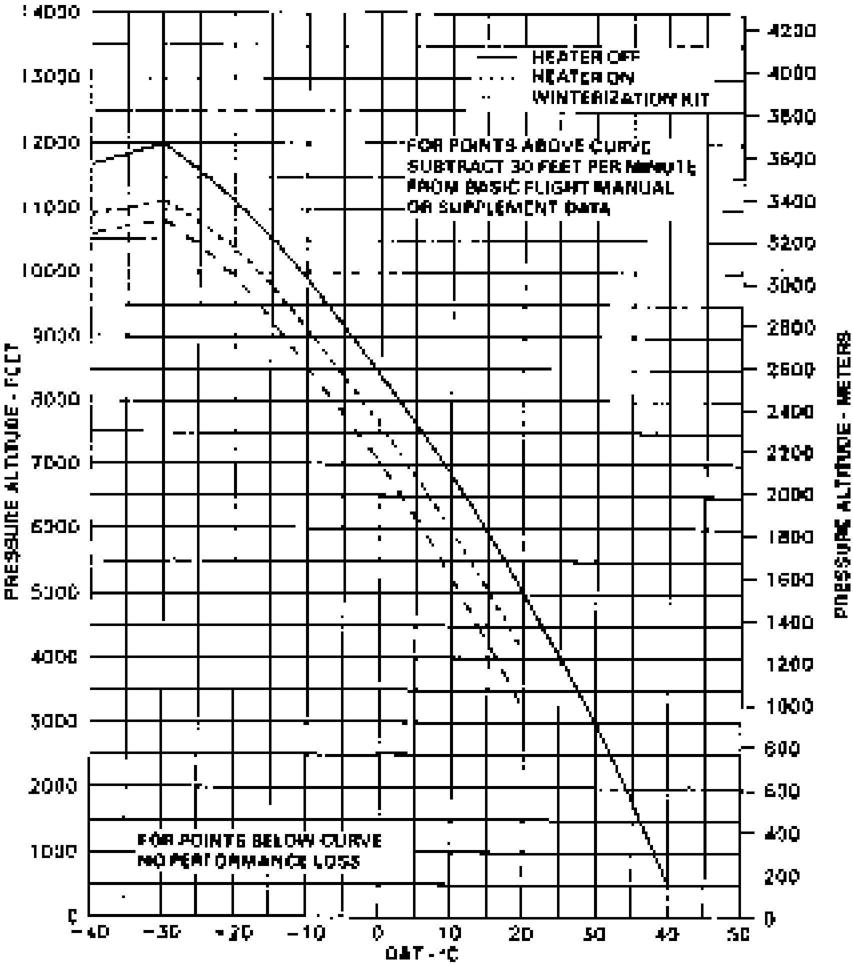


Figure 4A-3. Climb performance variation — takeoff power

CLIMB PERFORMANCE VARIATION
FOR BHT-412-FM-1

MAXIMUM CONTINUOUS POWER
GENERATOR 200 AMPS (EACH)

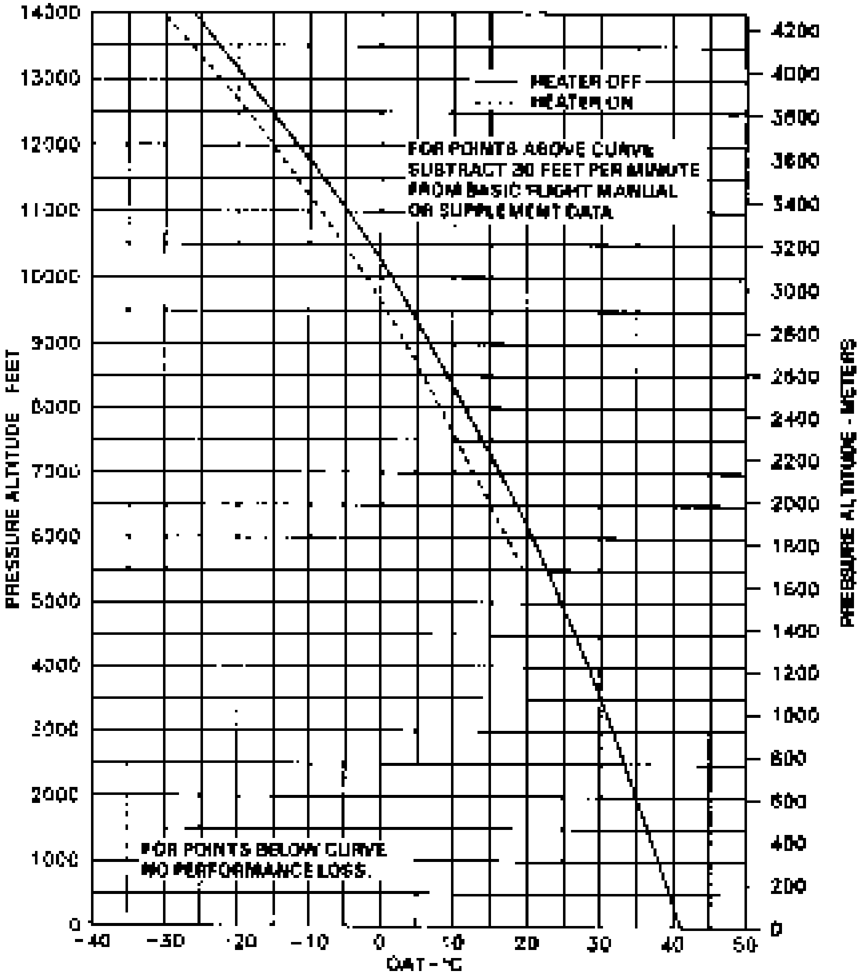


Figure 4A-4. Climb performance variation — maximum continuous power

Section 4B

BHT-412-FM-2
BHT-412-FMS-19.1

PERFORMANCE

TWIN ENGINE HOVER AND RATE OF CLIMB DECREASE DUE TO 200 AMP GENERATOR LOADS.

Enter appropriate chart with pressure altitude and OAT to determine whether or not performance reduction is required. If applicable, decrease performance data in basic flight manual or appropriate optional equipment supplement as indicated on chart (rate of climb reduction of 30 feet per minute or hover gross weight reduction of 50 pounds out of ground effect or 60 pounds in ground effect).

HOVER PERFORMANCE VARIATION
FOR BHT-412-FM-2 AND BHT-412-FMS 19.1

TAKEOFF POWER
GENERATOR 200 AMPS (EACH)

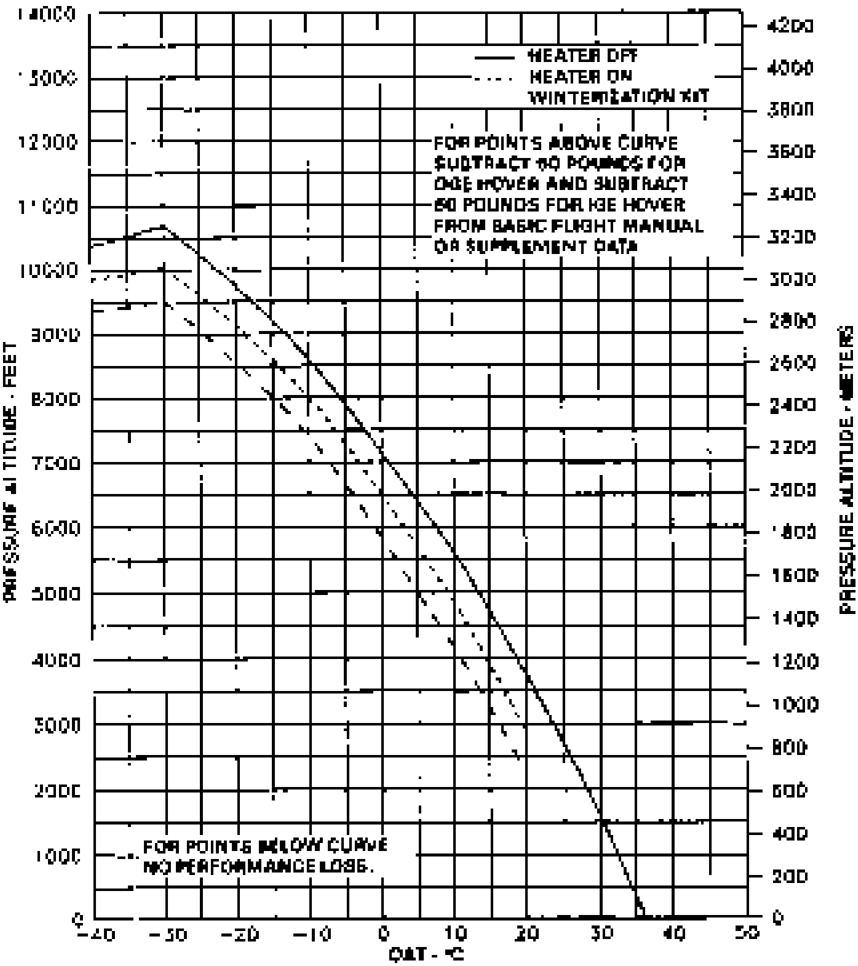


Figure 4B-1. Hover performance variation — takeoff power

HOVER PERFORMANCE VARIATION
FOR BHT-412-FM-2 AND BHT-412-FMS 19.1

MAXIMUM CONTINUOUS POWER
GENERATOR 200 AMPS (EACH)

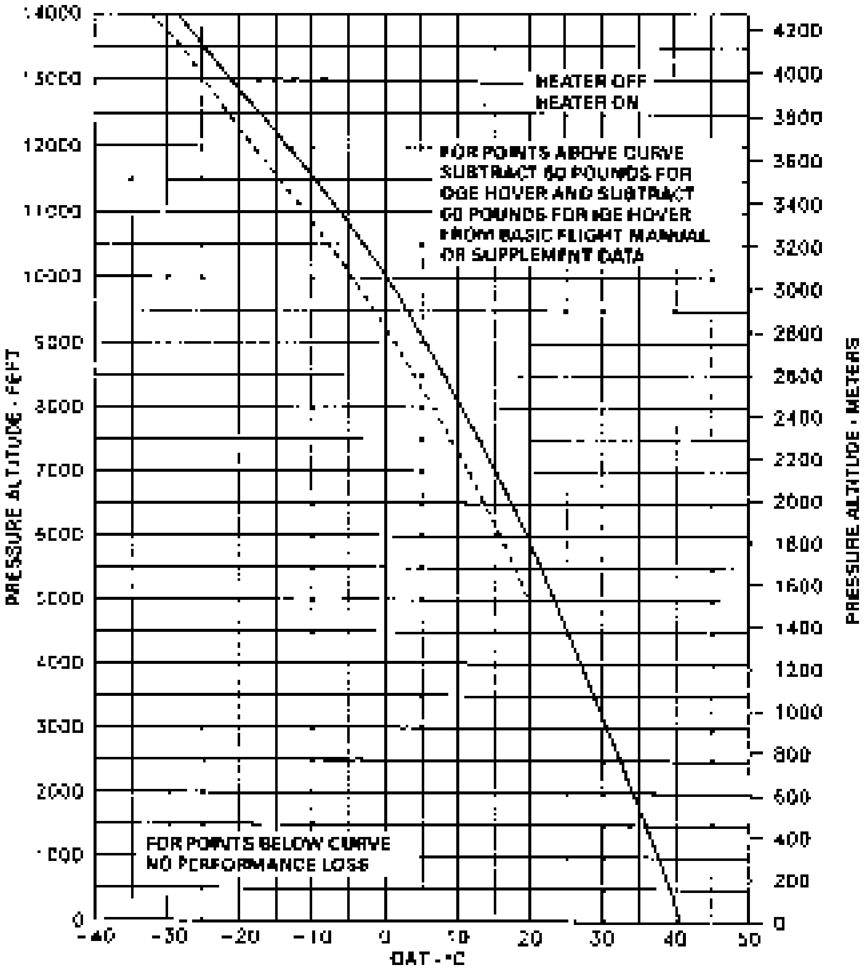


Figure 40-2. Hover performance variation — maximum continuous power

CLIMB PERFORMANCE VARIATION
FOR BHT-412-FM-2 AND BHT-412-FMS-19.1

TAKEOFF POWER
GENERATOR 200 AMPS (EACH)

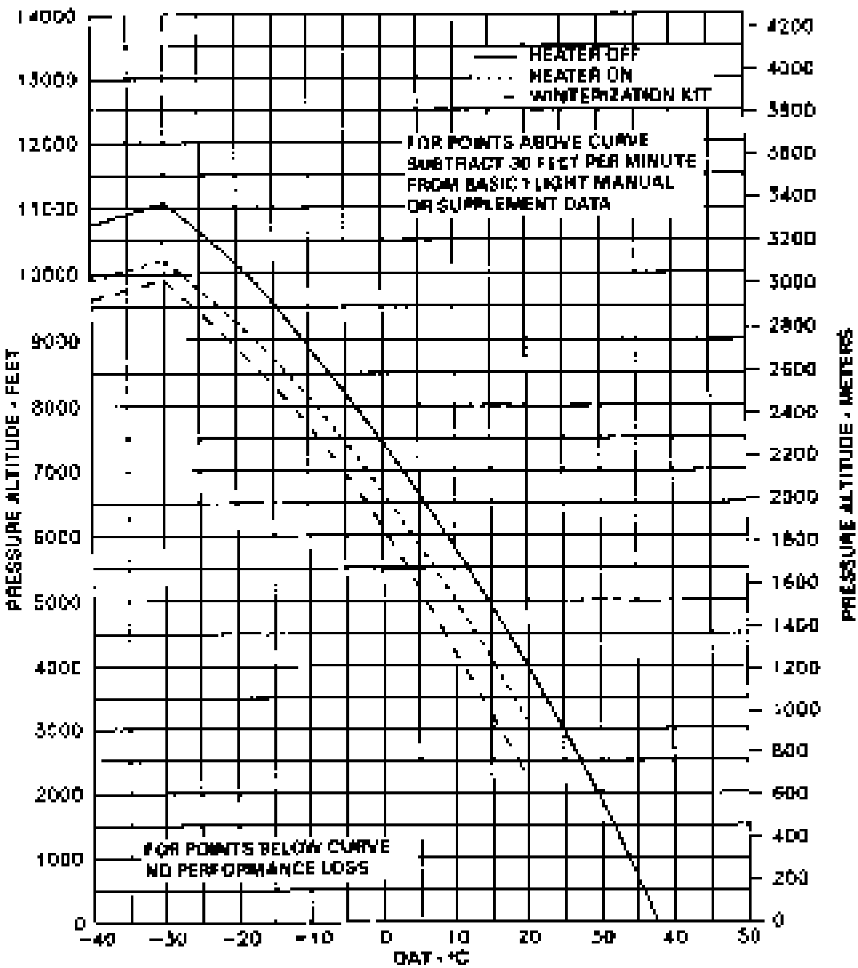


Figure 4B-3 Climb performance variation — takeoff power

CLIMB PERFORMANCE VARIATION
FOR BHT-412-FM-2 AND BHT-412-FMS-19.1

MAXIMUM CONTINUOUS POWER
GENERATOR 200 AMPS (EACH)

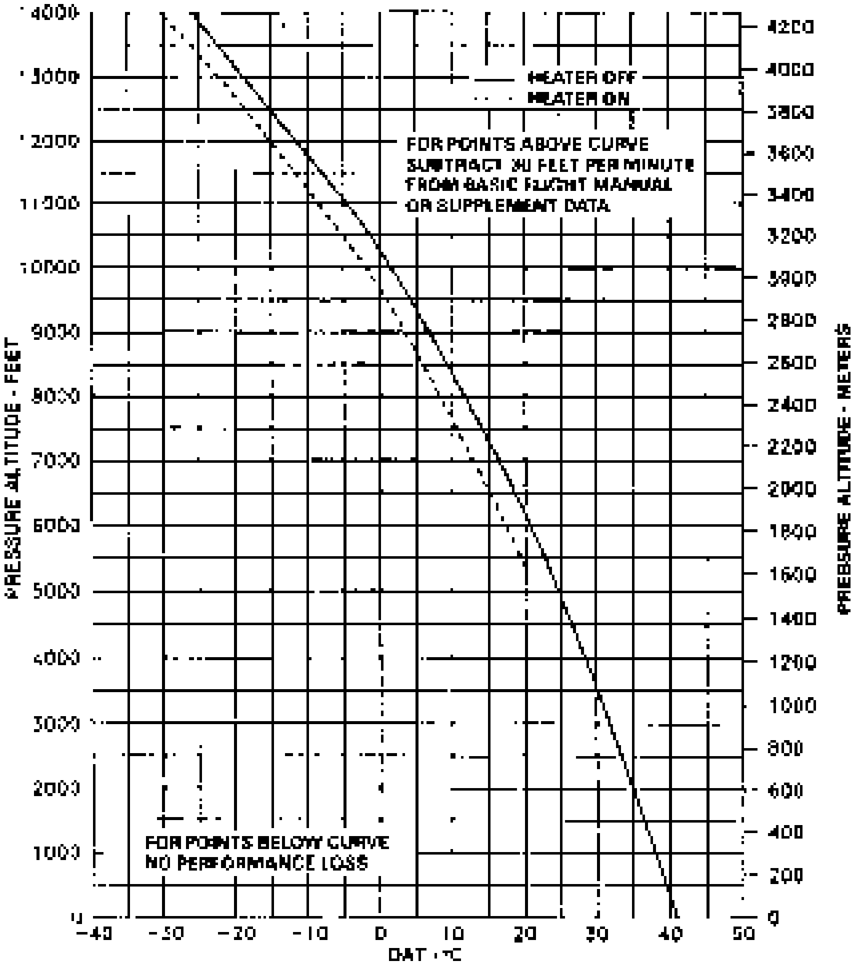


Figure 4B-4 Climb performance variation – maximum continuous power

Section 4C

BHT-412-FM-3
BHT-412-FM-4
BHT-412-FMS-34.2
BHT-412-FMS-41

PERFORMANCE

TWIN ENGINE HOVER AND RATE OF CLIMB DECREASE DUE TO 200 AMP GENERATOR LOADS.

Enter appropriate chart with pressure altitude and OAT to determine whether or not performance reduction is required. If applicable, decrease performance data in basic flight manual or appropriate optional equipment supplement as indicated on chart (rate of climb reduction of 30 feet per minute or hover gross weight reduction of 50 pounds out of ground effect or 60 pounds in ground effect).

HOVER PERFORMANCE VARIATION
FOR BHT-412-FM-3, BHT-412-FM-4, BHT-412 FMS-34.2, AND BHT-412-FMS 41

TAKEOFF POWER
GENERATOR 200 AMPS (EACH)

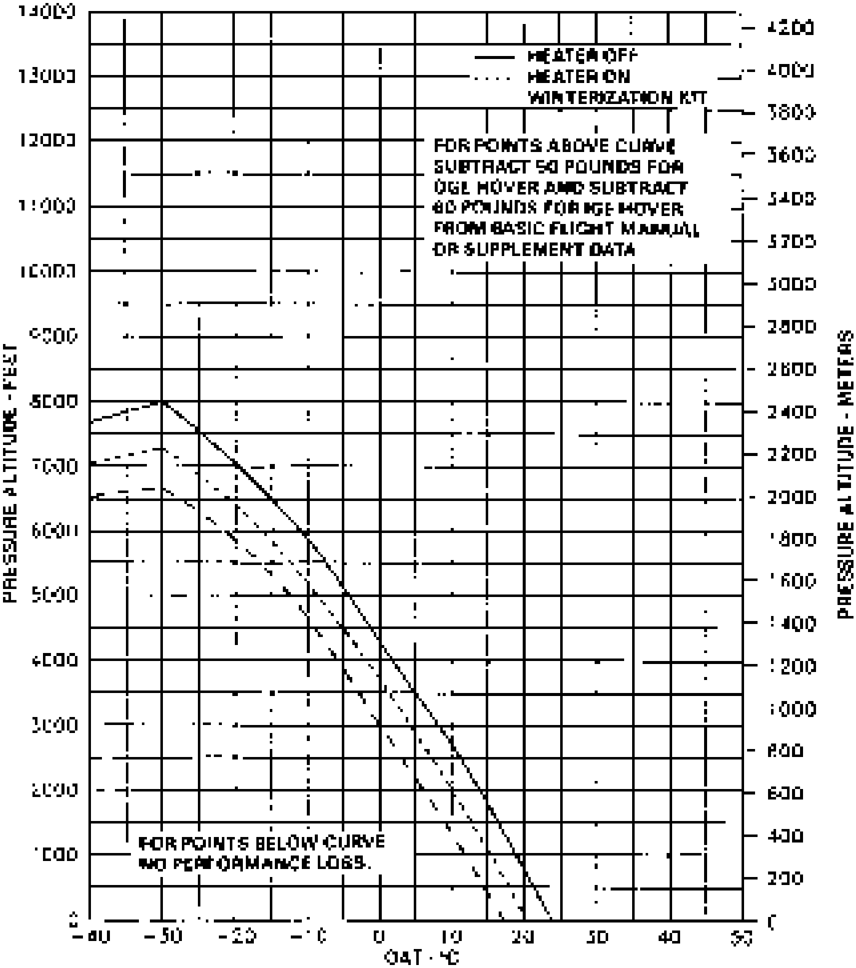


Figure 4C-1 Hover performance variation — takeoff power

HOVER PERFORMANCE VARIATION
FOR BHT-412-FM-3, BHT-412-FM-4, BHT-412-FMS-34.2, AND BHT-412-FMS-41

MAXIMUM CONTINUOUS POWER
GENERATOR 200 AMPS (EACH)

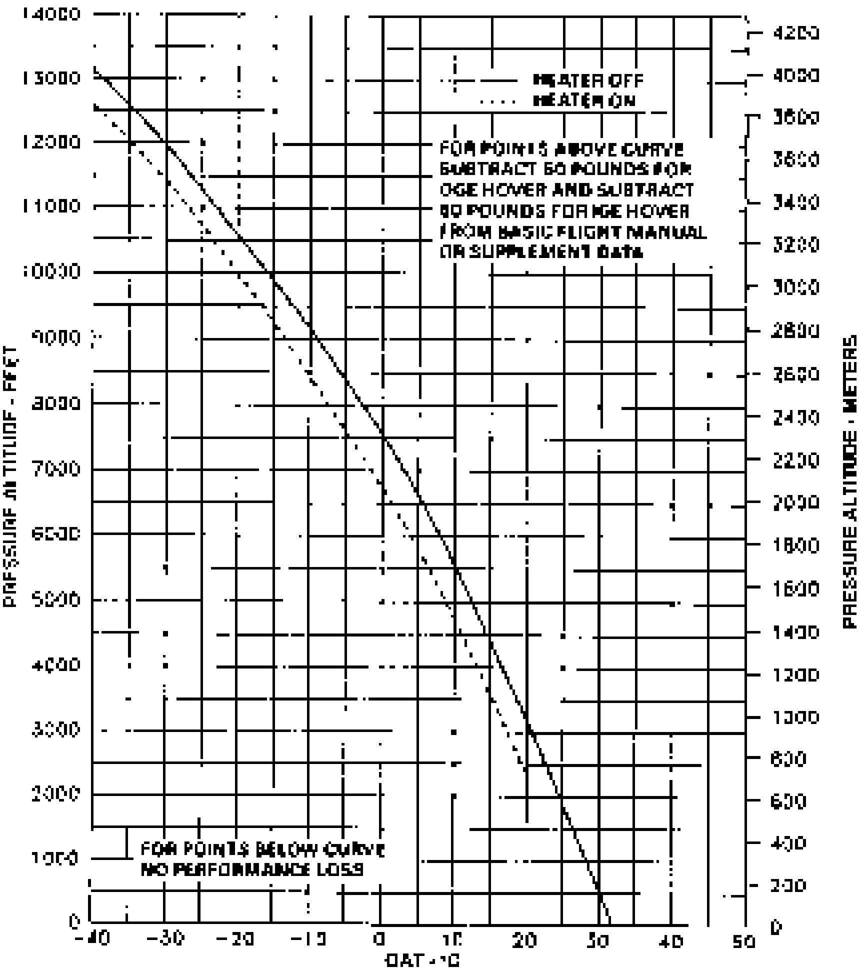


Figure 4C-2 Hover performance variation — maximum continuous power

CLIMB PERFORMANCE VARIATION
FOR BHT-412-FM-3, BHT-412-FM-4, BHT-412-FMS-34.2, AND BHT-412-FMS-41

TAKEOFF POWER
GENERATOR 200 AMPS (EACH)

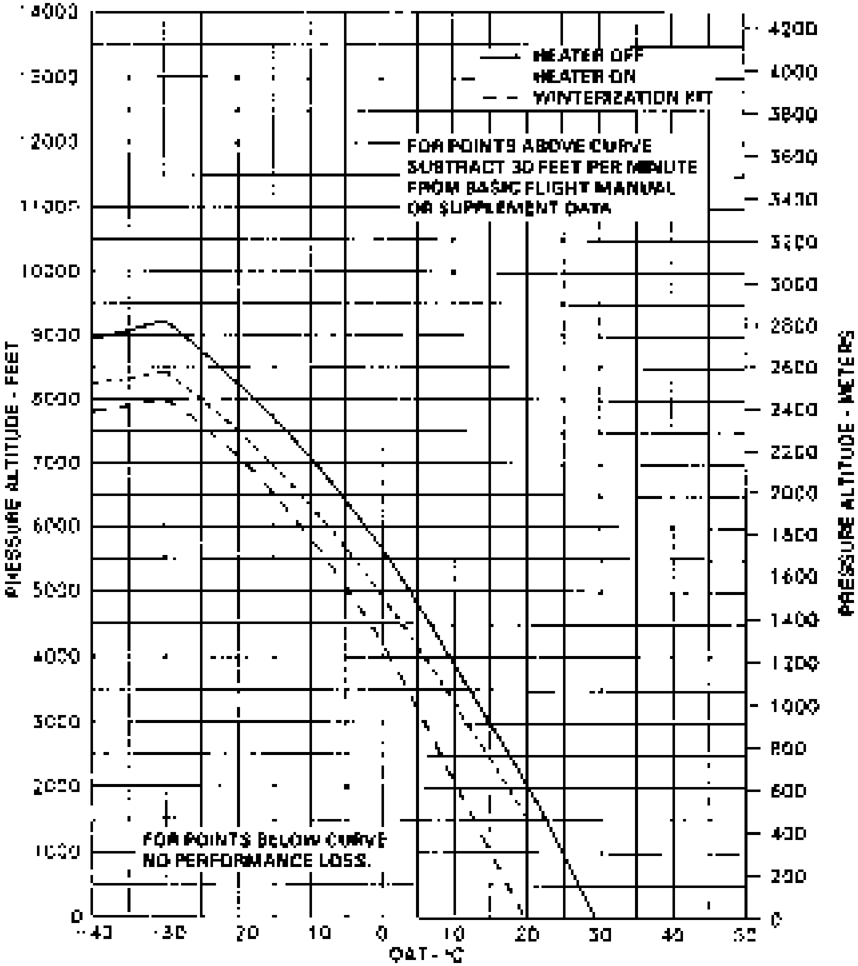


Figure 4C-3. Climb performance variation — takeoff power

CLIMB PERFORMANCE VARIATION
FOR BHT-412-FM-3, BHT-412-FM-4, BHT-412-FMS-34.2, AND BHT-412-FMS-41

MAXIMUM CONTINUOUS POWER
GENERATOR 200 AMPS (EACH)

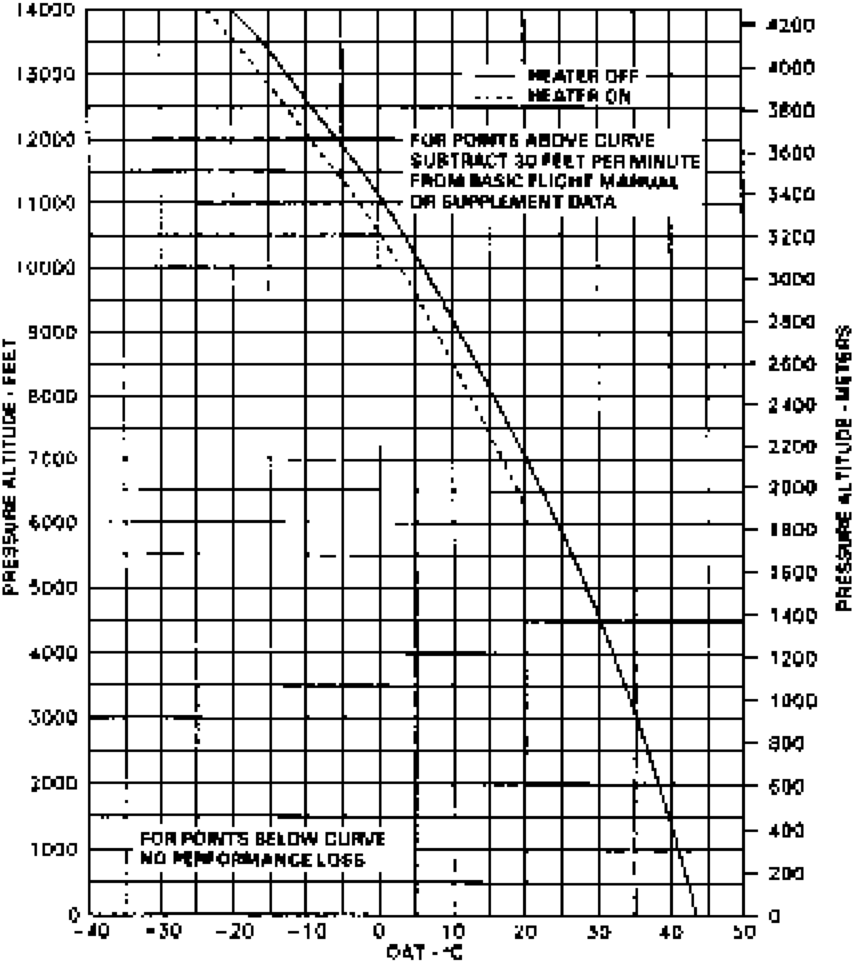


Figure 4C-4. Climb performance variation — maximum continuous power

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

FOLDING STEP

412-899-287

CERTIFIED
25 OCTOBER 1993

This supplement shall be attached to the Model 412 Flight Manual when the 412-899-287 folding step has been installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

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25 OCTOBER 1993

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FT. WORTH, TX 76193-0170

Section 1

LIMITATIONS

OPERATING LIMITATIONS

The 412-706-004 Emergency float kit shall not be installed in conjunction with the folding step.

WEIGHT — CG LIMITATIONS

Actual weight change shall be determined after kit is installed and ballast readjusted, if necessary, to return empty weight CG within allowable limits.

Section 2

NORMAL PROCEDURES

NOTE

After passenger loading/unloading, stow step (up).

EXTERIOR CHECK

2. FUSELAGE — CABIN LEFT SIDE

Folding step — Stowed (up).

6. FUSELAGE — CABIN RIGHT SIDE

Folding step — Stowed (up).

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

No change from basic Flight Manual.

Section 4

PERFORMANCE

No change from basic Flight Manual.

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT
ENGINE NO. 2 GOVERNOR TRIM SWITCH

TB 412-93-118

33001 — 33213
36001 — 36019

CERTIFIED
28 JULY 1994

This supplement shall be attached to the Bell Helicopter Model 412 Flight Manual (BHT-412-FM-1 and BHT-412-FM-2) when engine #2 governor trim switch has been installed per TB 412-93-118.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

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28 JULY 1994

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FT. WORTH, TX 76193-0170

Section 1

LIMITATIONS

No change from basic manual.

Section 2

NORMAL PROCEDURES

BEFORE TAKEOFF

Throttles — Full open. Adjust frictions.

RPM INCR/DECR switch — Minimum beep (DECR for 4-5 seconds).

RPM INCR/DECR switch — Minimum trim (-2 for 4-5 seconds).

N_R — Check 95% or greater.

RPM INCR/DECR switch — Adjust to obtain matching torque at 100% N_R.

Flight instruments — Check operation and set.

TAKEOFF

Area — Clear.

NOTE

As collective is increased, it may be necessary to rematch engine torque prior to reaching hover.

RPM INCR/DECR switch — Adjust to obtain matching torque or ITT, as required, and 100% N_R.

Hover power — Check torque required to hover at four feet skid height.

Section 3

EMERGENCY PROCEDURES

No change from basic manual.

Section 4

MALFUNCTION PROCEDURES

No change from basic manual.

Section 5

OPTIONAL EQUIPMENT SUPPLEMENTS

No change from basic manual.

Section 6

CATEGORY A OPERATIONS

No change from basic manual.

Section 1

MANUFACTURER'S DATA

Weight and Balance

No change from basic manual.

Section 2

MANUFACTURER'S DATA

SYSTEM DESCRIPTION

The +2/-2 switch allows the pilot to match engine performance and improve total engine power available.

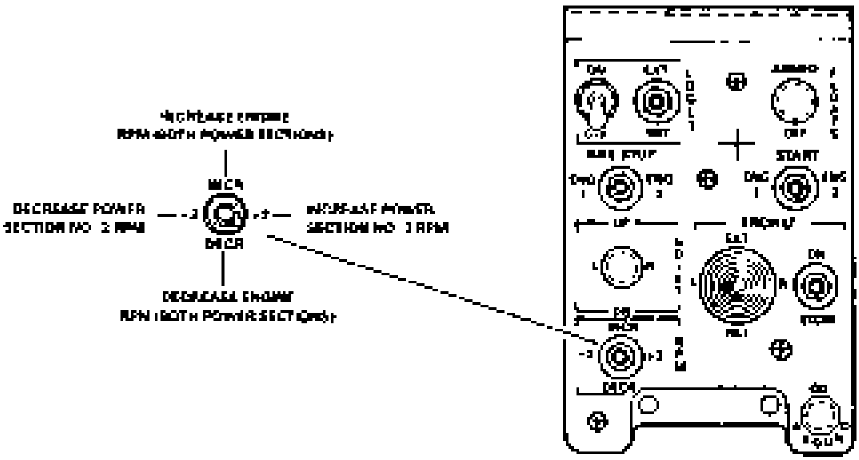

Figure 2-1. Engine RPM INCR/DECR switch.

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

SELF SEALING FUEL CELLS

412-899-175

S/N 33108 — 33213

AND

S/N 36001 — 36019

S/N 36020 — 36086

S/N 36087 AND SUB

CERTIFIED
19 SEPTEMBER 1997

This supplement shall be attached to Model 412 or 412EP Flight Manual when SELF SEALING FUEL CELLS are installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, consult basic Flight Manual.

Bell Helicopter TEXTRON
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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

19 SEPTEMBER 1997
REVISION 1 — 22 OCTOBER 1997

NOTICE PAGE

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Original . . . . 0 . . . . 19 SEP 97

APPROVED: DATE.

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

The customizing-lower cell sealing fuel cell installation minimizes the loss of fuel in the event of puncture damage by small objects.

Due to the increased wall thickness of the cell, the total and useable fuel capacities are less than those of the basic helicopter.

Section 1

LIMITATIONS

1-6. WEIGHT AND CENTER OF GRAVITY

Actual weight change shall be determined after installation and ballast readjusted, if necessary, to retain gross weight CG within allowable limits.

Section 2

NORMAL PROCEDURES

No change from basic Flight Manual.

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

No change from basic Flight Manual.

Section 4

PERFORMANCE

No change from basic Flight Manual.

Section 5

WEIGHT AND BALANCE

5-7. FUEL LOADING

Fuel loading tables lists usable fuel quantities in 10 gallon (40 liter) increments, with weights and moments in both english and metric units for balance computation. Critical fuel loading for computing most forward and aft CGs are denoted.

5-7-A. BASIC SYSTEM — SELF SEALING FUEL CELL.

Total capacity: 328.3 U.S. gallons (1242.2 liters).

Usable fuel: 321.3 U.S. gallons (1215.7 liters).

- Tables 5-1 and 5-2 - Provides longitudinal CG data for approved fuels.
- Tables 5-3 and 5-4 - Provides lateral CG data for approved fuels.

5-7-B. BASIC SYSTEM WITH ONE LONG RANGE AUXILIARY FUEL TANK (LEFT OR RIGHT).

Refer to BHT-412-FMS-17.2/17.3/17.4.

Total capacity. 410.0 U.S. gallons (1551.7 liters).

Usable fuel: 403.0 U.S. gallons (1525.7 liters).

- Table 5-5 - Provides longitudinal CG data for approved fuels.
- Table 5-6 - Provides lateral CG data for left side installation.
- Table 5-7 - Provides lateral CG data for right side installation.

5-7-C. BASIC SYSTEM WITH BOTH LONG RANGE AUXILIARY FUEL TANKS.

Refer to BHT-412-FMS-17.2/17.3/17.4.

Total capacity: 491.6 U.S. gallons (1860.9 liters).

Usable fuel: 484.6 U.S. gallons (1834.4 liters).

- Table 5-8 - Provides longitudinal CG data for approved fuels.
- Table 5-9 - Provides lateral CG data for approved fuels.

5-7-D. BASIC SYSTEM WITH ONE SEAT TYPE AUXILIARY FUEL TANK (LEFT OR RIGHT).

Refer to BHT-412-FMS-25.2/25.3/25.4.

Total capacity: 344.6 U.S. gallons (1304.2 liters).

Usable fuel: 337.6 U.S. gallons (1277.7 liters).

- Table 5-10 - Provides longitudinal CG data for approved fuels.
- Table 5-11 - Provides lateral CG data for left side installation.
- Table 5-12 - Provides lateral CG data for right side installation.

5-7-E. BASIC SYSTEM WITH BOTH SEAT TYPE AUXILIARY TANKS.

Refer to BHT-412-FMS-25.2/25.3/25.4.

Total capacity: 360.9 U.S. gallons (1365.9 liters).

Usable fuel: 353.9 U.S. gallons (1339.4 liters).

- Table 5-13 - Provides longitudinal CG data for approved fuels.
- Table 5-14 - Provides lateral CG data for approved fuels.

Table 5-1. Usable fuel loading table self-sealing tanks (English)
Jet A, A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S. GALLONS	WEIGHT (lb)	LONG CG (in.)	MOMENT (in-lb)
10	68	139.6	9486
20	136	139.7	18999
30	204	139.8	28519
40	272	139.9	38053
50	340	139.9	47566
* 54.6	371	139.9	51903
60	408	143.6	58589
70	476	148.0	70448
80	544	151.4	82362
90	612	154.1	94309
100	680	156.4	106352
110	748	158.2	118334
120	816	159.6	130234
130	884	160.8	142147
135.3	920	161.5	149711
140	952	159.6	151939
150	1020	155.0	158100
160	1088	151.0	164288
167.3	1138	147.9	168334
170	1156	149.2	172475
180	1224	150.7	184457
190	1292	152.0	196384
200	1360	153.2	208352
210	1428	154.4	220483
220	1496	155.3	232329
230	1564	156.0	243984
** 237.3	1614	156.7	252914
240	1632	156.2	254918
250	1700	154.8	263160
260	1768	153.0	270504
270	1836	151.6	278338
280	1904	150.2	285981
285.9	1944	149.5	290628
290	1972	149.8	295406
300	2040	150.7	307428
310	2108	151.5	319362
320	2176	152.3	331405
*** 321.3	2185	152.4	332994

* Most critical amount for most forward C.G. condition at weight empty is 6580 pounds or greater.
** Most critical fuel amount for most aft C.G. condition at weight empty is up to 6450 pounds.
*** Most critical fuel amount for most aft C.G. condition at weight empty is 6450 pounds or greater.
Weights given are nominal weights at 15 C.

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-63-5-1-1

Table 5-1M Usable fuel loading table self-sealing tanks (Metric)
Jet A, JP-5, JP-8 (0.815 kg/l)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg•mm/100)
40	32.6	3551	1158
80	65.2	3551	2315
120	97.8	3551	3473
160	130.4	3553	4633
200	163.0	3553	5791
* 206.7	168.5	3553	5987
240	195.6	3691	7220
280	228.2	3795	8660
320	260.8	3876	10109
360	293.4	3945	11575
400	326.0	3998	13033
440	358.6	4041	14491
480	391.2	4074	15937
515.7	420.3	4102	17241
520	423.8	4087	17321
560	456.4	3962	18083
600	489.0	3851	18831
633.2	516.1	3730	19250
640	521.6	3787	19753
680	554.2	3825	21198
720	586.8	3863	22668
760	619.4	3894	24119
800	652.0	3922	25571
840	684.6	3950	27042
880	717.2	3973	28494
** 898.2	732.0	3980	29134
920	749.8	3965	29729
960	782.4	3912	30607
1000	815.0	3871	31549
1040	847.6	3835	32505
1080	880.2	3797	33421
1082.1	881.9	3797	33486
1120	912.8	3820	34869
1160	945.4	3840	36303
1200	978.0	3861	37761
*** 1215.7	990.8	3871	38354

* Most critical amount for most forward C.G. condition at weight empty is [illegible] kilograms or greater

** Most critical fuel amount for most aft C.G. condition weight empty is up to 2925 kilograms.

*** Most critical fuel amount for most aft C.G. condition at weight empty is 2925 kilograms or greater.

Weights given are nominal weights at 15 C.

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-63-1-2

Table 5-2. Usable fuel loading table self-sealing tanks (English)
Jet B, JP-4 (6.5 Lbs/Gal)

U.S. GALLONS	WEIGHT (lb)	LONG CG (in.)	MOMENT (in-lb)
10	65	139.6	[illegible]
20	130	139.7	18161
30	195	139.8	27261
40	260	139.9	36374
50	325	139.9	45468
* 54.6	355	138.8	[illegible]
60	390	143.6	56004
70	455	148.0	67340
80	520	151.4	78728
90	585	154.1	90149
100	650	156.4	101660
110	715	158.2	113113
120	780	159.6	124488
130	845	160.8	135876
136.3	886	161.5	143088
140	910	159.6	145236
150	975	155.0	151125
160	1040	151.0	157040
167.3	1087	148.8	161746
170	1105	149.2	164866
180	1170	150.7	176319
190	1235	152.0	187720
200	1300	153.2	199160
210	1365	154.4	210756
220	1430	155.3	222079
230	1495	156.0	233220
** 237.3	1542	156.7	241631
240	1560	156.2	243672
250	1625	154.8	251550
260	1690	153.0	258570
270	1755	151.6	266058
280	1820	150.2	273364
285.9	1858	149.5	277771
290	1885	149.8	282373
300	1950	150.7	293865
310	2015	151.5	305273
320	2080	152.3	316784
*** 321.3	2088	152.4	318211

* Most critical amount for most forward C.G. condition at weight empty is 6560 pounds or greater.
** Most critical fuel amount for most aft C.G. condition at weight empty is up to 5450 pounds.
*** Most critical fuel amount for most aft C.G. condition at weight empty is 5450 pounds or greater.
Weights given are nominal weights at 15 C.

NOTE
This table is invalid with auxiliary fuel tank(s) installed

412-FMS-63-5-2-1

Table 5-2M. Usable fuel loading table self-sealing tanks (Metric)
Jet B, JP-4 (0.779 kg/l)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm/100)
40	31.2	3551	1108
80	62.3	3551	2212
120	93.5	3551	3320
160	124.6	3553	4427
200	155.8	3553	5536
* 206.7	161.0	3553	5720
240	187.0	3691	6902
280	218.1	3796	8277
320	249.3	3876	9663
360	280.4	3945	11062
400	311.6	3998	12458
440	342.8	4044	13863
480	373.9	4074	15233
515.7	401.7	4102	16478
520	405.1	4087	16558
560	436.2	3962	17282
600	467.4	3851	18000
633.2	493.3	3780	18647
640	498.6	3787	18882
680	529.7	3825	20281
720	560.9	3863	21868
760	592.0	3894	23052
800	623.2	3922	24442
840	654.4	3950	25849
880	685.5	3973	27236
** 898.2	699.7	3980	27848
920	716.7	3955	28345
960	747.8	3912	29254
1000	779.0	3871	30155
1040	810.2	3835	31071
1080	841.3	3797	31944
1082.1	843.0	3797	32009
1120	872.5	3820	33330
1160	903.6	3840	34698
1200	934.8	3851	36003
*** 1215.7	947.0	3871	36658

* Most critical amount for most forward C.G. condition at weight empty is 2844 kilograms or greater.
** Most critical fuel amount for most aft C.G. condition at weight empty is up to 2925 kilograms.
*** Most critical fuel amount for most aft C.G. condition at weight empty is 2925 kilograms or greater.
Weights given are nominal weights at 15°C.

NOTE
This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-63-5-2-2

Table 6-3. Lateral usable fuel loading table self-sealing tanks (English)
Jet A, A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	68	0	0
20	136	0	0
30	204	0	0
40	272	0	0
50	340	0	0
54.6	371	0	0
60	408	-0.06	-24
70	476	-0.05	-24
80	544	-0.05	-27
90	612	-0.04	-24
100	680	-0.04	-27
110	748	-0.04	-30
120	816	-0.03	-24
130	884	-0.03	-27
136.3	927	-0.03	-28
140	952	-0.31	-295
150	1020	-0.30	-310
160	1088	-0.63	-685
* 167.3	1138	-0.70	-796
170	1156	-0.69	-798
180	1224	-0.65	-796
190	1292	-0.61	-788
200	1360	-0.58	-789
210	1428	-0.55	-785
220	1496	-0.53	-793
230	1564	-0.51	-798
240	1632	-0.49	-800
250	1700	-0.47	-799
260	1768	-0.45	-796
270	1836	-0.43	-788
280	1904	-0.41	-787
290	1972	-0.40	-789
300	2040	-0.39	-796
310	2108	-0.37	-780
320	2176	-0.36	-783
321.3	2185	-0.36	-787

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15 C.

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-63-6-3-1

Table 5-3M. Lateral usable fuel loading table self-sealing tanks (Metric) Jet A, A-1, JP-5, JP-8 (0.815 kg/l)

LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	32.6	0	0
80	65.2	0	0
120	97.8	0	0
160	130.4	0	0
200	163.0	0	0
206.6	168.4	0	0
240	195.6	-2	-391
280	228.2	-1	-228
320	260.8	-1	-261
360	293.4	-1	-293
400	326.0	-1	-326
440	358.6	-1	-359
480	391.2	-1	-391
515.6	420.2	-1	-420
520	423.8	-6	-2543
560	456.4	-12	-5477
600	489.0	-15	-7335
* 633.0	515.9	-18	-9286
640	521.6	-18	-9389
680	554.2	-17	-9421
720	586.8	-15	-8802
760	619.4	-15	-9291
800	652.0	-14	-9128
840	684.6	-13	-8900
880	717.2	-13	-9324
920	749.8	-12	-8998
960	782.4	-12	-9389
1000	815.0	-11	-8965
1040	847.6	-11	-9324
1080	880.2	-10	-8802
1120	912.8	-10	-9128
1160	945.4	-10	-9454
1200	978.0	-9	-8802
1215.7	990.8	-9	-8917

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15 °C.

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-63-5-3-5

Table 5-4. Lateral usable fuel loading table self-sealing tanks (English)
Jet B, JP-4 (6.5 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	65	0	0
20	130	0	0
30	195	0	0
40	260	0	0
50	325	0	0
54.6	355	0	0
60	390	-0.06	-23
70	455	-0.05	-23
80	520	-0.05	-26
90	585	-0.04	-23
100	650	-0.04	-26
110	715	-0.04	-29
120	780	-0.03	-23
130	845	-0.03	-25
136.3	886	-0.03	-27
140	910	-0.31	-282
150	975	-0.50	-488
160	1040	-0.63	-655
* 167.3	1087	-0.70	-761
170	1105	-0.69	-762
180	1170	-0.65	-761
190	1235	-0.61	-753
200	1300	-0.58	-754
210	1365	-0.55	-751
220	1430	-0.53	-758
230	1495	-0.51	-762
240	1560	-0.49	-764
250	1625	-0.47	-764
260	1690	-0.45	-761
270	1755	-0.43	-755
280	1820	-0.41	-746
290	1885	-0.40	-754
300	1950	-0.39	-761
310	2015	-0.37	-746
320	2080	-0.36	-749
321.3	2088	-0.36	-752

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15°C

NOTE

This table is invalid with auxiliary fuel tank(s) installed

412-FMS-63.5-4-1

Table 5-4M. Lateral usable fuel loading table self-sealing tanks (Metric)
Jet B, JP-4 (0.779 kg/l)

LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	31.2	0	0
80	62.3	0	0
120	93.5	0	0
160	124.6	0	0
200	155.8	0	0
206.6	160.9	0	0
240	187.0	-2	-374
280	218.1	-1	-218
320	249.3	-1	-249
360	280.4	-1	-280
400	311.6	-1	-312
440	342.8	-1	-343
480	373.9	-1	-374
515.6	401.7	-1	-402
520	405.1	-6	-2430
560	436.2	-12	-5235
600	467.4	-15	-7011
633.0	493.1	-18	-8876 *
640	498.6	-18	-8974
680	529.7	-17	-9005
720	560.9	-15	-8413
760	592.0	-15	-8881
800	623.2	-14	-8725
840	654.4	-13	-8507
880	685.5	-13	-8912
920	716.7	-12	-8600
960	747.8	-12	-8974
1000	779.0	-11	-8569
1040	810.2	-11	-8912
1080	841.3	-10	-8413
1120	872.5	-10	-8725
1160	903.6	-10	-9036
1200	934.8	-9	-8413
1215.7	947.0	-9	-8523

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15°C

NOTE

This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-63-5-4-2

Table 5-5. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 81.7 GAL AUX FUEL (English)

JET A, A-1, JP-5, JP-8 (6.8 LB/GAL)					JET B, JP-4 (6.5 LB/GAL)				
	U.S. GALLON	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)		U.S. GALLON	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
	10	68	139.5	9486		10	65	139.5	9068
	20	136	139.7	18999		20	130	139.7	18161
	30	204	139.8	28519		30	195	139.8	27261
	40	272	139.8	[illegible]		40	260	139.9	36374
	50	340	139.9	47566		50	325	139.9	45468
*	54.6	371.3	139.9	51942	*	54.6	354.9	139.9	49651
	60	408	143.8	58669		60	390	143.8	56082
	70	476	147.4	70162		70	455	147.4	67067
	80	544	149.8	81491		80	520	149.8	77896
	90	612	151.8	92902		90	585	151.8	88803
	100	680	153.3	104244		100	650	153.3	99645
	110	748	154.5	115566		110	715	154.5	110468
	120	816	155.6	126970		120	780	155.6	121368
	130	884	156.4	138258		130	845	156.4	132158
	140	952	157.2	149654		140	910	157.2	143052
	150	1020	157.9	161058		150	975	157.9	153953
	160	1088	158.5	172448		160	1040	158.5	164840
	170	1156	159.0	183804		170	1105	159.0	175695
	170.2	1157.4	159.0	184027		170.2	1106.3	159.0	175902
	180	1224	155.4	190210		180	1170	155.4	181818
	190	1292	152.0	196384		190	1235	152.0	187720
	200	1360	149.2	202912		200	1300	149.2	193960
	201.2	1368.2	148.9	203719		201.2	1307.8	148.9	194731
	210	1428	149.6	213629		210	1365	149.6	204204
	220	1496	150.4	224998		220	1430	150.4	215072
	230	1564	151.1	236320		230	1495	151.1	225895
	240	1632	151.8	247738		240	1560	151.8	236808
	250	1700	152.5	259250		250	1625	152.5	247813
	260	1768	153.0	270504		260	1690	153.0	258570
	270	1836	153.6	282010		270	1755	153.6	269568
	280	1904	154.0	293216		280	1820	154.0	280280
	290	1972	154.5	304674		290	1885	154.5	291233
	300	2040	154.9	315996		300	1950	154.9	302055
**	302.0	2053.6	155.0	318308	**	303.0	1969.5	155.0	305273
	310	2108	154.1	324843		310	2015	154.1	310512
	320	2176	152.8	332493		320	2080	152.9	318032
	330	2244	151.7	340415		330	2145	151.7	325397
	340	2312	150.6	348187		340	2210	150.6	332826
	350	2380	149.5	355810		350	2275	149.5	340113
	351.6	2390.9	149.4	357197		351.6	2285.4	149.4	341439
	360	2448	149.8	366710		360	2340	149.8	350532
	370	2516	150.3	378155		370	2405	150.3	361472
	380	2584	150.8	389667		380	2470	150.8	372476
	390	2652	151.2	400982		390	2535	151.2	383292
	400	2720	151.6	412352		400	2600	151.6	394160
***	403.0	2740.4	151.7	415719	***	403.0	2619.5	151.7	397378

Most critical amount for most forward C.G. condition at a weight empty below 6750 pounds has no fuel.

* Most critical amount for most forward C.G. condition at a weight empty of 6750 pounds or greater.

** Most critical fuel amount for most aft C.G. condition at a weight empty below 6400 pounds.

*** Most critical fuel amount for most aft C.G. condition at a weight empty of 6400 pounds or greater.

Weights given are nominal weights at 15°C.

412-FMS-63-5-5-1

Table 5-[illegible]. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 300 LITERS AUX FUEL (metric)

Jet A, A-1, JP-5, JP-8 (0.815 kg/L)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
40	32.6	3543	115502
80	65.2	3546	231199
120	97.8	3551	347288
160	130.4	3553	463311
200	163.0	3553	579139
* 206.7	168.5	3553	598680
240	195.6	3691	721960
280	228.2	3772	860770
320	260.8	3830	998464
360	293.4	3876	1137218
400	326.0	3912	1275312
440	358.6	3942	1413601
480	391.2	3967	1551890
520	423.8	3988	1690114
560	456.4	4008	1829251
600	489.0	4023	1967247
640	521.6	4036	2105178
** 644.2	525.0	4038	2120043
680	554.2	3878	2149090
720	586.8	3861	2265815
760	619.4	3785	2344429
761.7	620.8	3782	2347866
800	652.0	3800	2477600
840	684.6	3823	2617226
880	717.2	3843	2756200
920	749.8	3861	2894978
960	782.4	3879	3034930
1000	815.0	3875	3158125
1040	847.6	3906	3310726
1080	880.2	3919	3449504
1120	912.8	3931	3588217
1148.7	936.2	3938	3686756
1160	945.4	3926	3711640
1200	978.0	3879	3793662
1240	1010.6	3872	3913043
1280	1043.2	3830	3995456
1320	1075.8	3801	4089116
1330.6	1084.4	3794	4114214
1360	1108.4	3805	4217462
1400	1141.0	3818	4356338
1440	1173.6	3830	4494888
1480	1206.2	3840	4631808
1520	1238.8	3851	4770619
*** 1525.2	1243.0	3852	4788162

Jet B, JP-4 (0.779 kg/L)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
40	31.2	3543	110542
80	62.3	3546	220916
120	93.5	3551	331942
160	124.6	3553	442846
200	155.8	3553	553557
* 206.7	161.0	3553	572033
240	187.0	3691	690085
280	218.1	3772	822749
320	249.3	3830	954743
360	280.4	3875	1086665
400	311.6	3912	1218975
440	342.8	3942	1351180
480	373.9	3967	1483341
520	405.1	3988	1615486
560	436.2	4008	1748455
600	467.4	4023	1880050
640	498.6	4036	2012183
** 644.2	501.8	4038	2025327
680	529.7	3890	2063394
720	560.9	3861	2165661
760	592.0	3785	2243871
761.7	593.4	3782	2244104
800	623.2	3800	2368160
840	654.4	3823	2501613
880	685.5	3843	2634453
920	716.7	3861	2767101
960	747.8	3879	2900871
1000	779.0	3875	3018625
1040	810.2	3906	3164485
1080	841.3	3919	3297130
1120	872.5	3931	3429719
1148.7	893.3	3938	3517734
1160	903.6	3926	3547491
1200	934.8	3879	3626089
1240	966.0	3872	3740197
1280	997.1	3830	3818870
1320	1028.3	3801	3908492
1330.6	1036.5	3794	3932423
1360	1059.4	3805	4031189
1400	1090.6	3818	4163911
1440	1121.8	3830	4296341
1480	1152.9	3840	4427213
1520	1184.1	3851	4559897
*** 1525.2	1188.1	3852	4576660

Most critical amount for most forward C.G. condition at a weight empty below 3062 kilograms has no *.
* Most critical amount for most forward C.G. condition at a weight empty of 3062 kilograms or greater.
** Most critical fuel amount for most aft C.G. condition at a weight empty below 2767 kilograms.
*** Most critical fuel amount for most aft C.G. condition at a weight empty of 2767 kilograms or greater.
Weights given are nominal weights at 15°C.

412-FMS-63-5-5-2

Table 5-6. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 81.7 GAL AUX FUEL (LH) (English)

Jet A, A-1, JP-5, JP-8 (6.8 lbs/Gal)				Jet B, JP-4 (6.5 lbs/Gal)			
U.S. GALLON	WEIGHT (lbs)	LAT CG (in)	MOMENT (in-lb)	U.S. GALLON	WEIGHT (lbs)	LAT CG (in)	MOMENT (in-lb)
10	68	0	0	10	65	0	0
20	136	0	0	20	130	0	0
30	204	0	0	30	195	0	0
40	272	0	0	40	260	0	0
50	340	0	0	50	325	0	0
54.6	371.3	0	0	54.6	354.9	0	0
60	408	0.13	53	60	390	0.13	51
70	476	-0.72	-343	70	455	-0.72	-328
80	544	-1.78	-968	80	520	-1.78	-926
90	612	-2.63	-1610	90	585	-2.63	-1539
100	680	-3.30	-2244	100	650	-3.30	-2145
110	748	-3.84	-2872	110	715	-3.84	-2746
120	816	-4.29	-3501	120	780	-4.29	-3346
130	884	-4.67	-4128	130	845	-4.67	-3946
140	952	-5.00	-4760	140	910	-5.00	-4550
150	1020	-5.27	-5375	150	975	-5.27	-5138
160	1088	-5.50	-5984	160	1040	-5.50	-5720
170	1156	-5.71	-6601	170	1105	-5.71	-6310
170.2	1157.4	-5.71	-6609	170.2	1106.3	-5.71	-6317
180	1224	-5.72	-7001	180	1170	-5.72	-6692
190	1292	-5.56	-7184	190	1235	-5.56	-6867
200	1360	-5.41	-7358	200	1300	-5.41	-7033
201.2	1368.2	-5.39	-7374	201.2	1307.8	-5.39	-7049
210	1428	-5.54	-7911	210	1365	-5.54	-7562
220	1496	-5.69	-8512	220	1430	-5.69	-8137
230	1564	-5.84	-9134	230	1495	-5.84	-8731
240	1632	-5.97	-9743	240	1560	-5.97	-9313
250	1700	-6.08	-10336	250	1625	-6.08	-9880
260	1768	-6.19	-10944	260	1690	-6.19	-10461
270	1836	-6.29	-11548	270	1755	-6.29	-11039
280	1904	-6.39	-12167	280	1820	-6.39	-11630
290	1972	-6.48	-12779	290	1885	-6.48	-12215
300	2040	-6.56	-13382	300	1950	-6.56	-12792
303.0	2060.4	-6.58	-13557	303.0	1969.5	-6.58	-12959
310	2108	-6.43	-13554	310	2015	-6.43	-12956
320	2176	-6.23	-13556	320	2080	-6.23	-12958
330	2244	-6.04	-13554	330	2145	-6.04	-12956
340	2312	-5.86	-13548	340	2210	-5.86	-12951
350	2380	-5.70	-13566	350	2275	-5.70	-12968
351.6	2390.9	-5.67	-13556	351.6	2285.4	-5.67	-12958
360	2448	-5.75	-14076	360	2340	-5.75	-13455
370	2516	-5.84	-14693	370	2405	-5.84	-14045
380	2584	-5.92	-15297	380	2470	-5.92	-14622
390	2652	-6.00	-15912	390	2535	-6.00	-15210
400	2720	-6.07	-16510	400	2600	-6.07	-15782
* 401.4	2730.4	-6.08	-16600	* 401.6	2610.5	-6.09	-15960

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15°C

412-FMS-63-5-6-1

Table 5-6M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 208 LITERS AUX FUEL (LH) (Metric)

JET A, A-1, JP-5, JP-8 (0.815 kg/L)				JET B, JP-4 (0.779 kg/L)			
LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)	LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	32.6	0	0	40	31.2	0	0
80	65.2	0	0	80	62.3	0	0
120	97.8	0	0	120	93.5	0	0
160	130.4	0	0	160	124.6	0	0
200	163.0	0	0	200	155.8	0	0
206.7	168.5	0	0	206.7	161.0	0	0
240	195.6	-6	-1174	240	187.0	-5	-935
280	228.2	-20	-4280	280	218.1	-25	-5453
320	260.8	-56	-14605	320	249.3	-55	-13710
360	293.4	-76	-22298	360	280.4	-75	-21030
400	326.0	-92	-29992	400	311.6	-91	-28356
440	358.6	-106	-37853	440	342.8	-106	-36330
480	391.2	-118	-46279	480	373.9	-116	-43375
520	423.8	-126	-53788	520	405.1	-126	-51040
560	456.4	-132	-60245	560	436.2	-133	-58020
600	489.0	-139	-67971	600	467.4	-140	-65436
640	521.6	-145	-75632	640	498.6	-147	-73296
644.2	525.0	-145	-76126	644.2	501.8	-145	-72766
680	554.2	-145	-80359	680	529.7	-145	-76809
720	586.8	-141	-82739	720	560.9	-141	-79084
760	619.4	-137	-84858	760	592.0	-137	-81109
781.7	629.8	-137	-85946	781.7	593.4	-137	-81291
800	652.0	-141	-91335	800	623.2	-142	-88494
840	684.6	-145	-99267	840	654.4	-146	-95537
880	717.2	-148	-106146	880	685.5	-150	-102828
920	749.8	-152	-113970	920	716.7	-152	-108935
960	782.4	-156	-122054	960	747.8	-155	-115915
1000	815.0	-158	-128770	1000	779.0	-158	-123082
1040	847.6	-161	-136464	1040	810.2	-161	-130436
1080	880.2	-164	-144353	1080	841.3	-164	-137976
1120	912.8	-166	-151525	1120	872.5	-166	-144832
1148.7	934.6	-167	-156072	1148.7	891.3	-167	-149171
1160	945.4	-165	-155991	1160	903.6	-165	-149090
1200	978.0	-160	-156480	1200	934.8	-158	-147698
1240	1010.6	-155	-156643	1240	966.0	-156	-150696
1280	1043.2	-150	-156480	1280	997.1	-150	-149565
1320	1075.8	-145	-155991	1320	1028.3	-145	-149101
1330.6	1084.4	-144	-156150	1330.6	1036.5	-144	-149261
1360	1108.4	-146	-161826	1360	1059.4	-146	-154678
1400	1141.0	-148	-168868	1400	1090.6	-149	-162499
1440	1173.6	-150	-176040	1440	1121.8	-151	-169385
1480	1206.2	-152	-183342	1480	1152.9	-153	-176397
1520	1238.8	-154	-190775	1520	1184.1	-154	-182348
* 1525.2	1243.0	-155	-192571	* 1525.2	1188.1	-155	-184150

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15 °C.

412-FMS-63-5-6.2

Table 5-3. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 55.7 GAL AUX FUEL (HH) (English)

Jet A, A-1, JP-5, JP-8 (6.8 Lb/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	68	0	0
20	136	0	0
30	204	0	0
40	272	0	0
50	340	0	0
54.6	371.3	0	0
60	408	0.01	4
70	476	0.62	295
80	544	1.68	914
90	612	2.55	1561
100	680	3.20	2176
110	748	3.77	2820
120	816	4.23	3452
130	884	4.61	4075
140	952	4.95	4712
150	1020	5.22	5324
160	1088	5.46	5940
170	1156	5.66	6543
173.2	1177.4	5.56	6551
180	1224	5.03	6157
190	1292	4.63	5982
200	1360	4.42	6011
201.2	1368.2	4.23	5787
210	1428	4.47	6383
220	1496	4.63	6926
230	1564	4.83	7554
240	1632	4.99	8144
250	1700	5.14	8738
260	1768	5.30	9370
270	1836	5.43	9969
280	1904	5.56	10586
290	1972	5.69	11221
300	2040	5.79	11812
303.0	2060.4	5.82	11992
310	2108	5.69	11985
320	2176	5.51	11990
330	2244	5.34	11983
340	2312	5.19	11999
350	2380	5.04	11995
351.6	2390.9	5.01	11978
360	2448	5.11	12509
370	2516	5.21	13108
380	2584	5.31	13721
390	2652	5.40	14321
400	2720	5.49	14933
* 403.0	2740.4	5.51	15100

Jet B, JP-4 (6.5 Lb/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	65	0	0
20	130	0	0
30	195	0	0
40	260	0	0
50	325	0	0
54.6	354.9	0	0
60	390	0.01	4
70	455	0.62	282
80	520	1.68	874
90	585	2.55	1492
100	650	3.23	2100
110	715	3.77	2696
120	780	4.23	3299
130	845	4.61	3895
140	910	4.95	4505
150	975	5.22	5090
160	1040	5.46	5678
170	1105	5.66	6254
173.2	1125.8	5.56	6259
180	1170	5.03	5885
190	1235	4.63	5718
200	1300	4.42	5746
201.2	1307.8	4.23	5532
210	1365	4.47	6102
220	1430	4.63	6621
230	1495	4.83	7221
240	1560	4.99	7784
250	1625	5.14	8353
260	1690	5.30	8957
270	1755	5.43	9530
280	1820	5.56	10119
290	1885	5.69	10726
300	1950	5.79	11291
303.0	1969.5	5.82	11462
310	2015	5.69	11465
320	2080	5.51	11461
330	2145	5.34	11454
340	2210	5.19	11470
350	2275	5.04	11466
351.6	2285.4	5.01	11450
360	2340	5.11	11957
370	2405	5.21	12530
380	2470	5.31	13116
390	2535	5.40	13689
400	2600	5.49	14274
* 403.0	2619.5	5.51	14433

* Most critical fuel amount for right side most lateral C.G. condition.
Weights given are nominal weights at 15°C.

412-FMS-83-5-3-1

Table 5-7B. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 300 LITERS AUX FUEL (RH) (Metric)

JET A, A-1, JP-5, JP-8 (0.815 kg/l)

LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	32.6	0	0
80	65.2	0	0
120	97.8	0	0
160	130.4	0	0
200	163.0	0	0
206.7	168.5	0	0
240	195.6	3	497*
280	228.2	25	5705
320	260.8	53	13822
360	293.4	74	21712
400	326.0	90	29340
440	358.6	103	36936
480	391.2	114	44597
520	423.8	123	52127
560	456.4	131	59788
600	489.0	138	67482
640	521.6	143	74589
644.2	525.0	144	75603
680	554.2	138	76938
720	586.8	117	68656
760	619.4	108	66795
761.7	620.8	107	66424
800	652.0	113	73676
840	684.6	119	81467
880	717.2	124	88933
920	749.8	128	95974
960	782.4	132	103277
1000	815.0	136	110840
1040	847.6	140	118664
1080	880.2	143	125869
1120	912.8	145	132356
1146.7	934.6	146	136015
1160	945.4	146	138028
1200	978.0	139	135942
1240	1010.6	141	142495
1280	1043.2	137	142918
1320	1075.8	128	137707
1330.6	1084.4	127	137724
1360	1108.4	129	142984
1400	1141.0	132	150612
1440	1173.6	135	158436
1480	1206.2	137	165249
1520	1238.8	140	173432
1525.2	1243.0	140	174025

JET B, JP-4 (0.779 kg/l)

LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	31.2	0	0
80	62.3	0	0
120	93.5	0	0
160	124.6	0	0
200	155.8	0	0
206.7	161.0	0	0
240	187.0	3	475*
280	218.1	25	5453
320	249.3	53	13212
360	280.4	74	20750
400	311.6	90	28044
440	342.8	103	35304
480	373.9	114	42627
520	405.1	123	49825
560	436.2	131	57142
600	467.4	138	64501
640	498.6	143	71294
644.2	501.8	144	72264
680	529.7	128	67804
720	560.9	117	65623
760	592.0	108	63940
761.7	593.4	107	63494
800	623.2	113	70422
840	654.4	119	77873
880	685.5	124	85004
920	716.7	128	91735
960	747.8	132	98715
1000	779.0	136	105944
1040	810.2	140	113432
1080	841.3	143	120308
1120	872.5	146	127387
1146.7	893.3	148	132206
1160	903.6	146	131931
1200	934.8	139	129937
1240	966.0	141	136230
1280	997.1	137	136605
1320	1028.3	127	131020
1330.6	1036.5	127	131840
1360	1059.4	129	136668
1400	1090.6	132	143959
1440	1121.8	135	151438
1480	1152.9	137	157850
1520	1184.1	140	165771
1525.2	1188.1	140	166336

* Most critical fuel amount for right side most lateral C.G. condition.
Weights given are nominal weights at 15°C.

412-FMS-63-T-2

Table 6-8. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 183.4 GAL AUX FUEL (English)

JET A, JET A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S. GALLONS	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
10	68	139.5	9486
20	136	139.7	18999
30	204	139.8	28519
40	272	139.9	38053
50	340	139.9	47566
* 54.6	371.3	139.9	51947
60	408	143.6	58589
70	476	147.3	70115
80	544	149.2	81165
90	612	150.7	92228
100	680	151.8	103224
110	748	152.8	114294
120	816	153.6	125338
130	884	154.3	136401
140	952	154.8	147370
150	1020	155.4	158508
160	1088	155.8	169510
170	1156	156.2	180567
180	1224	156.6	191678
190	1292	157.0	202844
200	1360	157.2	213792
204.1	1387.9	157.3	218314
210	1428	155.5	222054
220	1496	152.7	228439
230	1564	150.1	234756
235.2	1599.4	148.9	238145
240	1632	149.2	243494
250	1700	149.7	254490
260	1768	150.3	265730
270	1836	150.6	276502
280	1904	151.1	287694
290	1972	151.5	298758
300	2040	151.9	309876
310	2108	152.3	321048
320	2176	152.6	332058
330	2244	152.9	343108
340	2312	153.2	354198
350	2380	153.5	365330
360	2448	153.7	376258
368.6	2506.5	153.9	385747
370	2516	153.8	386961
380	2584	152.8	394835
390	2652	152.2	403574
400	2720	150.8	410176
410	2788	149.9	417921
417.2	2837.0	149.3	423564
420	2856	149.4	426686
430	2924	149.6	437430
440	2992	149.9	448501
450	3060	150.2	459612
460	3128	150.5	470764
470	3196	150.8	481957
480	3264	151.0	492864
** 484.6	3295.3	151.2	498246

JET B, JP-4 (6.5 Lbs/Gal)

U.S. GALLONS	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
10	65	139.5	9068
20	130	139.7	18161
30	195	139.8	27261
40	260	139.9	36374
50	325	139.9	45468
* 54.6	354.9	139.9	49651
60	390	143.6	56004
70	455	147.3	67022
80	520	149.2	77584
90	585	150.7	88160
100	650	151.8	98670
110	715	152.8	109252
120	780	153.6	119808
130	845	154.3	130384
140	910	154.8	140868
150	975	155.4	151515
160	1040	155.8	162032
170	1105	156.2	172601
180	1170	156.6	183222
190	1235	157.0	193895
200	1300	157.2	204360
204.1	1326.7	157.3	208682
210	1365	155.5	212258
220	1430	152.7	218361
230	1495	150.1	224400
235.2	1528.8	148.9	227638
240	1560	149.2	232752
250	1625	149.7	243263
260	1690	150.2	253838
270	1755	150.6	264303
280	1820	151.1	275002
290	1885	151.5	285578
300	1950	151.9	296205
310	2015	152.3	306885
320	2080	152.6	317408
330	2145	152.9	327971
340	2210	153.2	338572
350	2275	153.5	349213
360	2340	153.7	359658
368.6	2395.9	153.9	368729
370	2405	153.8	369889
380	2470	152.8	377416
390	2535	151.8	384813
400	2600	150.8	392080
410	2665	149.9	399484
417.2	2711.8	149.3	404872
420	2730	149.4	407862
430	2795	149.6	418132
440	2860	149.9	428714
450	2925	150.2	439335
460	2990	150.5	449995
470	3055	150.8	460694
480	3120	151.0	471120
** 484.6	3149.9	151.2	476265

* Most critical amount for most forward C.G. condition at a weight empty below 6920 pounds (no fuel).

** Most critical amount for most forward C.G. condition at a weight empty of 6920 pounds or greater.

*** Most critical fuel amount for most aft C.G. condition.

Weights given are nominal weights at 15°C.

412-FMS-63-5-6-1

Table 5-8M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 618 LITERS AUX FUEL

(Metric)

	Jet A, A-1, JP-5, JP-8 (.815 kg/l)				Jet B, JP-4 (.779 kg/l)			
	LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)	LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
	40	32.6	3543	115002	40	31.2	3543	110400
	80	65.2	3548	211330	80	62.3	3548	221111
	120	97.8	3551	347268	120	93.5	3551	331947
	160	130.4	3553	463319	160	124.6	3553	442348
	200	163.0	3651	579139	200	155.8	3653	553557
*	206.7	168.5	3553	598540	206.7	161.0	3553	572102
	240	195.6	3691	721960	240	187.0	3691	690085
	280	228.2	3764	858845	280	218.1	3764	821004
	320	260.8	3810	993844	320	249.3	3810	949757
	360	293.4	3840	1127636	360	280.4	3840	1077731
	400	326.0	3866	1260318	400	311.6	3866	1204648
	440	358.6	3894	1396348	440	342.8	3894	1334707
	480	391.2	3917	1532330	480	373.9	3917	1464645
	520	423.8	3929	1665110	520	405.1	3929	1591553
	560	456.4	3945	1800498	560	436.2	3945	1720967
	600	489.0	3957	1934873	600	467.4	3957	1848913
	640	521.6	3967	2069167	640	498.6	3967	1977788
	680	554.2	3978	2204604	680	529.7	3978	2107738
	720	586.8	3988	2340158	720	560.9	3988	2236743
	760	619.4	3993	2473264	760	592.0	3993	2364019
	777.7	633.8	3990	2510463	777.7	605.8	3996	2405325
	800	652.0	3952	2576794	800	623.2	3952	2463598
	840	684.6	3866	2646604	840	654.4	3866	2529751
	880	717.2	3797	2723708	880	685.5	3797	2602913
	890.2	725.5	3782	2743890	890.2	693.5	3782	2622898
	920	749.8	3792	2843342	920	716.7	3787	2717691
	960	782.4	3807	2978597	960	747.8	3807	2847027
	1000	815.0	3820	3113360	1000	779.0	3820	2978743
	1040	847.6	3810	3225348	1040	810.2	3810	3108719
	1080	880.2	3840	3385249	1080	841.3	3846	3235717
	1120	912.8	3856	3519757	1120	872.5	3856	3364283
	1160	945.4	3864	3653028	1160	903.6	3864	3491685
	1200	978.0	3874	3788772	1200	934.8	3874	3621415
	1240	1010.6	3882	3922149	1240	966.0	3882	3749957
	1280	1043.2	3890	4059048	1280	997.1	3890	3878797
	1320	1075.8	3897	4193393	1320	1028.3	3897	4007207
	1360	1108.4	3904	4327194	1360	1059.4	3904	4136054
	1383.3	1127.1	3910	4446014	1385.3	1080.8	3910	4218638
	1400	1141.0	3908	4582748	1400	1090.6	3908	4250994
	1440	1173.6	3678	4552344	1440	1121.8	3679	4351307
	1480	1206.2	3662	4546382	1480	1152.9	3857	4441048
	1520	1238.8	3827	4740688	1520	1184.1	3827	4531474
	1560	1271.4	3800	4813134	1560	1215.2	3800	4631458
	1579.2	1287.0	3792	4880486	1579.2	1230.2	3792	4684906
	1600	1304.0	3795	4948540	1600	1246.4	3795	4730063
	1640	1336.6	3807	5081753	1640	1277.6	3807	4857783
	1680	1369.2	3819	5225760	1680	1308.7	3819	4980143
	1720	1401.8	3820	5354176	1720	1339.9	3820	5118542
	1760	1434.4	3825	5488580	1760	1371.0	3825	5244234
	1800	1467.0	3833	5623811	1800	1402.2	3833	5374653
**	1834.4	1495.0	3840	5740926	1834.4	1429.0	3840	5487341

Most critical amount for most forward C.G. condition at a weight empty below 3139 kilograms then n

* Most critical amount for most forward C.G. condition at a weight empty of 3662 kilograms or greater

** Most critical fuel amount for most aft C.G. condition.

Weights given are nominal weights at 15°C.

412-FMS-63.6 8-2

Table 5-9. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 185.4 GAL AUX FUEL (English)

Jet A, A-1, JP-5, JP-8 (6.8 lbs/Gal)				Jet B, JP-4 (6.5 lbs/Gal)			
U.S. GALLONS	WEIGHT (lbs)	LAT CG (in.)	MOMENT (in-lb)	U.S. GALLONS	WEIGHT (lbs)	LAT CG (in.)	MOMENT (in-lb)
10	68	0	0	10	65	0	0
20	136	0	0	20	130	0	0
30	204	0	0	30	195	0	0
40	272	0	0	40	260	0	0
50	340	0	0	50	325	0	0
54.8	372.9	0	0	54.8	356.2	0	0
60	408	-0.08	-33	60	390	-0.05	-21
70	476	-0.04	-19	70	455	-0.04	-18
80	544	-0.04	-22	80	520	-0.04	-21
90	612	-0.04	-24	90	585	-0.04	-23
100	680	-0.04	-27	100	650	-0.04	-26
110	748	-0.03	-22	110	715	-0.03	-21
120	816	-0.03	-24	120	780	-0.03	-23
130	884	-0.03	-27	130	845	-0.03	-25
140	952	-0.03	-26	140	910	-0.03	-27
150	1020	-0.03	-30	150	975	-0.02	-20
160	1088	-0.02	-22	160	1040	-0.02	-21
170	1156	-0.02	-21	170	1105	-0.02	-22
180	1224	-0.02	-24	180	1170	-0.02	-23
190	1292	-0.02	-25	190	1235	-0.02	-25
200	1360	-0.02	-27	200	1300	-0.02	-26
204.1	1387.9	-0.02	-28	204.1	1326.7	-0.02	-27
210	1428	-0.25	-357	210	1365	-0.25	-341
220	1496	-0.35	-524	220	1430	-0.35	-501
230	1564	-0.45	-704	230	1495	-0.45	-673
* 236.2	1589.4	-0.50	-800	* 236.2	1526.3	-0.50	-764
240	1632	-0.48	-783	240	1560	-0.48	-749
250	1700	-0.46	-782	250	1625	-0.46	-748
260	1768	-0.44	-778	260	1690	-0.44	-744
270	1836	-0.43	-789	270	1755	-0.43	-755
280	1904	-0.42	-800	280	1820	-0.42	-764
290	1972	-0.40	-789	290	1885	-0.40	-754
300	2040	-0.39	-796	300	1950	-0.39	-761
310	2108	-0.37	-780	310	2015	-0.37	-746
320	2176	-0.37	-805	320	2080	-0.37	-770
330	2244	-0.36	-808	330	2145	-0.36	-772
340	2312	-0.34	-786	340	2210	-0.34	-751
350	2380	-0.33	-785	350	2275	-0.33	-751
360	2448	-0.32	-783	360	2340	-0.32	-749
370	2516	-0.32	-805	370	2405	-0.32	-770
380	2584	-0.31	-801	380	2470	-0.31	-766
390	2652	-0.30	-796	390	2535	-0.30	-761
400	2720	-0.30	-816	400	2600	-0.30	-780
410	2788	-0.29	-809	410	2665	-0.29	-773
420	2856	-0.28	-800	420	2730	-0.28	-764
430	2924	-0.27	-789	430	2795	-0.27	-755
440	2992	-0.26	-778	440	2860	-0.26	-744
450	3060	-0.26	-796	450	2925	-0.26	-761
460	3128	-0.25	-782	460	2990	-0.25	-748
470	3196	-0.25	-799	470	3055	-0.25	-764
480	3264	-0.24	-783	480	3120	-0.24	-749
484.6	3295.3	-0.24	-791	484.6	3149.9	-0.24	-756

* Most critical fuel amount for left side most lateral C.G. condition.

Weights given are nominal weights at 15°C.

412-FMS-63-5-9-1

Table 6-9M USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 518 LITERS AUX FUEL (Metric)

Jet A, A-1, JP-5, JP-8 (0.815 kg/l)

LITERS	WEIGHT (kg)*	LAT CG (mm)	MOMENT (kg-mm)
40	32.5	0	0
80	65.2	0	0
120	97.8	0	0
160	130.4	0	0
200	163.0	0	0
205.7	168.5	0	0
240	195.5	-1	-196
280	228.2	-1	-228
320	260.8	-1	-261
360	293.4	-1	-293
400	326.0	-1	-326
440	358.6	-1	-359
480	391.2	-1	-391
520	423.8	-1	-424
560	456.4	-1	-456
600	489.0	-1	-489
640	521.6	-1	-522
680	554.2	-1	-554
720	586.8	-1	-587
760	619.4	-1	-619
772.7	629.8	-1	-630
800	652.0	-7	-4564
840	684.6	-9	-6161
880	717.2	-12	-8606
890.2	725.5	-13	-9432
920	749.8	-12	-8998
960	782.4	-12	-9389
1000	815.0	-11	-8965
1040	847.6	-11	-9324
1080	880.2	-10	-8802
1120	912.8	-10	-9128
1160	945.4	-10	-9454
1200	978.0	-9	-8802
1240	1010.6	-9	-9095
1280	1043.2	-9	-9389
1320	1075.8	-8	-8606
1360	1108.4	-8	-8867
1365.3	1112.7	-8	-8902
1400	1141.0	-8	-9128
1440	1173.6	-8	-9389
1480	1206.2	-8	-9650
1520	1238.8	-7	-8672
1560	1271.4	-7	-8900
1579.2	1287.0	-7	-9009
1600	1304.0	-7	-9128
1640	1336.6	-7	-9356
1680	1369.2	-7	-9584
1720	1401.8	-6	-8411
1760	1434.4	-6	-8606
1800	1467.0	-6	-8802
1834.4	1495.0	-6	-8970

LITERS	WEIGHT (kg)*	LAT CG (mm)	MOMENT (kg-mm)
40	31.2	0	0
80	62.3	0	0
120	93.5	0	0
160	124.6	0	0
200	155.8	0	0
205.7	160.2	0	0
240	187.0	-1	-187
280	218.1	-1	-218
320	249.3	-1	-249
360	280.4	-1	-280
400	311.6	-1	-312
440	342.8	-1	-343
480	373.9	-1	-374
520	405.1	-1	-405
560	436.2	-1	-436
600	467.4	-1	-467
640	498.5	-1	-499
680	529.7	-1	-530
720	560.9	-1	-561
760	592.0	-1	-592
772.7	601.9	-1	-602
800	623.2	-7	-4362
840	654.4	-9	-5889
880	685.5	-12	-8226
890.2	693.5	-13	-9015
920	716.7	-12	-8600
960	747.8	-12	-8974
1000	779.0	-11	-8569
1040	810.2	-11	-8912
1080	841.3	-10	-8413
1120	872.5	-10	-8725
1160	903.6	-10	-9036
1200	934.8	-9	-8413
1240	966.0	-9	-8694
1280	997.1	-9	-8974
1320	1028.3	-8	-8226
1360	1059.4	-8	-8475
1395.2	1086.9	-8	-8695
1400	1090.6	-8	-8725
1440	1121.8	-8	-8974
1480	1152.9	-8	-9223
1520	1184.1	-7	-8289
1560	1215.2	-7	-8507
1579.2	1230.2	-7	-8611
1600	1246.4	-7	-8725
1640	1277.6	-7	-8943
1680	1308.7	-7	-9161
1720	1339.9	-6	-8039
1760	1371.0	-6	-8226
1800	1402.2	-6	-8413
1834.4	1429.5	-6	-8574

* Weights given are nominal weights at 15 °C.

Weights given are nominal weights at 15 °C.

412FMS-63-6-92

Table 5-10. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 16.5 GAL AUX FUEL (English)

Jet A, A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
10	68	139.5	9486
20	136	139.7	18999
30	204	139.8	28519
40	272	139.9	38053
50	340	139.8	47556
* 54.5	370.6	139.8	51842
60	408	143.2	58426
70	476	147.4	70162
80	544	150.5	81872
90	612	152.7	93452
100	680	154.5	105060
110	748	155.9	116613
120	816	157.1	128194
130	884	158.2	139849
140	952	159.1	151463
150	1020	159.9	163098
152.6	1037.7	160.2	166240
160	1088	157.1	170925
170	1156	153.3	177215
180	1224	150.0	183600
183.5	1247.8	148.8	185439
190	1292	149.8	193542
200	1360	151.1	205496
210	1428	152.3	217484
220	1496	153.3	229337
230	1564	154.3	241325
240	1632	155.2	253286
250	1700	156.0	265200
** 253.6	1724.5	156.3	269538
260	1768	155.2	274394
270	1836	153.7	282193
280	1904	152.3	289979
290	1972	151.0	297772
300	2040	149.8	305592
302.7	2058.4	149.5	307717
310	2108	150.2	316622
320	2176	150.9	328358
330	2244	151.7	340415
*** 337.6	2295.7	152.2	349402

Jet B, JP-4 (6.5 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
10	65	139.5	9068
20	130	139.7	18161
30	195	139.8	27261
40	260	139.9	36374
50	325	139.9	45468
* 54.5	354.3	139.8	49531
60	390	143.2	55848
70	455	147.4	67067
80	520	150.5	78260
90	585	152.7	89330
100	650	154.5	100425
110	715	155.9	111469
120	780	157.1	122538
130	845	158.2	133679
140	910	159.1	144781
150	975	159.9	155903
152.6	991.9	160.2	158902
160	1040	157.1	163384
170	1105	153.3	169397
180	1170	150.0	175500
183.5	1193.4	148.9	177697
190	1235	149.8	185003
200	1300	151.1	196430
210	1365	152.3	207890
220	1430	153.3	219219
230	1495	154.3	230679
240	1560	155.2	242112
250	1625	156.0	253500
** 253.6	1648.4	156.3	257645
260	1690	155.2	262288
270	1755	153.7	269744
280	1820	152.3	277186
290	1885	151.0	284635
300	1950	149.8	292110
302.7	1967.6	149.5	294156
310	2015	150.2	302653
320	2080	150.9	313872
330	2145	151.7	325397
*** 337.6	2194.4	152.2	333988

Most critical amount for most forward C.G. condition at a weight empty below 6580 pounds and no fuel.

* Most critical amount for most forward C.G. condition at a weight empty of 6580 pounds or greater.

** Most critical fuel amount for most aft C.G. condition at a weight empty below 6580 pounds.

*** Most critical fuel amount for most aft C.G. condition at a weight empty of 6580 pounds or greater.

Weights given are nominal weights at 15 C.

412-FMS-63-5-10-1

Table 5-10M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 62 LITERS AUX FUEL (Metric)

Jet A, A-1, JP-5, JP-8 (815 kg/m³)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
40	32.6	3543	115502
80	65.2	3548	231330
120	97.8	3551	347288
160	130.4	3553	463311
200	163.0	3553	579139
* 206.7	168.5	3553	598540
240	195.6	3679	719612
280	228.2	3777	861911
320	260.8	3850	1004080
360	293.4	3904	1145434
400	326.0	3946	1286396
440	358.6	3981	1427587
480	391.2	4010	1568712
520	423.8	4034	1709609
560	456.4	4057	1851615
— 577.4	470.6	4069	1914794
600	489.0	4005	1958445
640	521.6	3903	2035805
680	554.2	3813	2113165
694.9	566.3	3782	2141811
720	586.8	3806	2233361
760	619.4	3840	2378496
800	652.0	3871	2523892
840	684.6	3900	2669940
880	717.2	3925	2815010
920	749.8	3948	2960210
958.4	782.2	3970	3105401
960	782.4	3969	3105346
1000	815.0	3927	3200505
1040	847.6	3887	3294621
1080	880.2	3850	3388770
1120	912.8	3816	3483245
1143.8	932.2	3797	3539563
1160	945.4	3806	3598192
1200	978.0	3828	3743784
1240	1010.6	3848	3888789
— 1277.7	1041.3	3867	4026806

Jet B, JP-4 (778 kg/m³)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
40	31.2	3543	110405
80	62.3	3548	221111
120	93.5	3551	331947
160	124.5	3553	442545
200	155.6	3553	552857
* 206.7	161.0	3553	572102
240	187.0	3679	687826
280	218.1	3777	823839
320	249.3	3850	959728
360	280.4	3904	1094838
400	311.6	3946	1229574
440	342.9	3981	1364574
480	373.9	4010	1499419
520	405.1	4034	1634081
560	436.2	4057	1769836
** 577.4	449.8	4069	1830214
600	467.4	4005	1871937
640	498.8	3903	1946816
680	529.7	3811	2019627
694.9	541.3	3782	2047299
720	560.9	3806	2134785
760	592.0	3840	2273434
800	623.2	3871	2412407
840	654.4	3900	2552004
880	685.5	3925	2690588
920	716.7	3948	2829532
959.3	747.2	3970	2966384
960	747.5	3969	2966827
1000	779.0	3927	3059133
1040	810.2	3887	3149092
1080	841.3	3850	3239005
1120	872.5	3816	3329184
1143.8	891.0	3797	3383127
1160	903.6	3806	3439102
1200	934.8	3828	3578414
1240	966.0	3848	3717168
*** 1277.7	995.3	3867	3848825

— Most critical amount for most forward C.G. condition at a weight empty below 2844 kilograms has no fuel.

* Most critical amount for most forward C.G. condition at a weight empty of 2844 kilograms or greater.

** Most critical fuel amount for most aft C.G. condition at a weight empty below 3844 kilograms.

*** Most critical fuel amount for most aft C.G. condition at a weight empty of 3915 kilograms or greater.

Weights given are nominal weights at 15°C.

412-FMS-63-5-10-7

Table 6-11. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 14.3 GAL AUX FUEL (LH) (English)

Jet A, A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	68	0	0
20	136	0	0
30	204	0	0
40	272	0	0
50	340	0	0
54.6	371.3	0	0
60	408	-0.12	-49
70	476	-0.69	-328
80	544	-1.02	-555
90	612	-1.42	-869
100	680	-1.75	-1190
110	748	-2.00	-1496
120	816	-2.22	-1812
130	884	-2.40	-2122
140	952	-2.55	-2428
150	1020	-2.58	-2632
152.6	1037.7	-2.54	-2636
160	1088	-2.74	-2981
* 170	1156	-2.74	-3167
180	1224	-2.73	-3347
183.6	1248.5	-2.72	-3396
190	1292	-2.61	-3398
200	1360	-2.49	-3386
210	1428	-2.37	-3384
220	1496	-2.27	-3396
230	1564	-2.20	-3441
240	1632	-2.08	-3395
250	1700	-2.00	-3400
253.6	1724.5	-1.97	-3397
260	1768	-1.92	-3395
270	1836	-1.85	-3397
280	1904	-1.78	-3389
290	1972	-1.72	-3392
300	2040	-1.67	-3407
302.2	2055.0	-1.65	-3391
310	2108	-1.61	-3394
320	2176	-1.57	-3416
330	2244	-1.52	-3411
337.6	2295.7	-1.48	-3398

Jet B, JP-4 (6.5 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	65	0	0
20	130	0	0
30	195	0	0
40	260	0	0
50	325	0	0
54.6	354.9	0	0
60	390	-0.17	-66
70	455	-0.69	-314
80	520	-1.02	-530
90	585	-1.42	-831
100	650	-1.75	-1138
110	715	-2.00	-1430
120	780	-2.22	-1732
130	845	-2.40	-2028
140	910	-2.55	-2321
150	975	-2.58	-2516
152.6	991.9	-2.54	-2519
160	1040	-2.74	-2850
* 170	1105	-2.74	-3028
180	1170	-2.73	-3194
183.6	1193.4	-2.72	-3246
190	1235	-2.63	-3248
200	1300	-2.49	-3237
210	1365	-2.37	-3235
220	1430	-2.27	-3246
230	1495	-2.20	-3289
240	1560	-2.08	-3245
250	1625	-2.00	-3250
253.6	1648.4	-1.97	-3247
260	1690	-1.92	-3245
270	1755	-1.85	-3247
280	1820	-1.78	-3240
290	1885	-1.72	-3242
300	1950	-1.67	-3257
302.2	1964.3	-1.65	-3241
310	2015	-1.61	-3244
320	2080	-1.57	-3266
330	2145	-1.52	-3260
337.6	2194.4	-1.48	-3248

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15°C

412-FMS-63-5-1-1

Table 5-11 M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 82 LITERS AUX FUEL (LH) (METRIC)

Jet A, A-1, JP-5, JP-8 (.815 kg/l)				Jet B, JP-4 (.775 kg/l)			
LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)	LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	32.6	0	0	40	31.2	0	0
80	65.2	0	0	80	62.3	0	0
120	97.8	0	0	120	93.5	0	0
160	130.4	0	0	160	124.6	0	0
200	163.0	0	0	200	155.8	0	0
208.7	170.1	0	0	208.7	161.7	0	0
240	195.6	-8	-1565	240	187.0	-8	-1496
280	228.2	-22	-5020	280	218.1	-22	-4799
320	260.8	-31	-8085	320	249.3	-31	-7728
360	293.4	-41	-12029	360	280.4	-41	-11496
400	326.0	-48	-15648	400	311.6	-48	-14957
440	358.6	-54	-19364	440	342.8	-54	-18513
480	391.2	-60	-23472	480	373.9	-60	-22435
520	423.8	-64	-27123	520	405.1	-64	-25925
560	456.4	-66	-30122	560	436.2	-66	-28792
577.4	470.6	-64	-30117	577.4	449.8	-64	-28787
600	489.0	-70	-34230	600	467.4	-70	-32718
640	521.6	-70	-36512	640	498.6	-70	-34905
680	554.2	-69	-38240	680	529.7	-69	-36551
694.9	566.3	-69	-39078	694.9	541.3	-69	-37352
720	586.8	-67	-39316	720	560.9	-67	-37579
760	619.4	-63	-39022	760	592.0	-63	-37295
800	652.0	-60	-39120	800	623.2	-60	-37392
840	684.6	-57	-39022	840	654.4	-57	-37295
880	717.2	-54	-38729	880	685.5	-54	-37018
920	749.8	-52	-38990	920	716.7	-52	-37267
958.8	782.2	-50	-39112	958.8	747.7	-50	-37384
960	782.4	-50	-39120	960	747.8	-50	-37392
1000	815.0	-48	-39120	1000	779.0	-48	-37393
1040	847.6	-46	-38990	1040	810.2	-46	-37267
1080	880.2	-44	-38729	1080	841.3	-44	-37018
1120	912.8	-43	-39250	1120	872.5	-43	-37517
1143.8	932.2	-42	-39152	1143.8	891.0	-42	-37423
1160	945.4	-41	-38761	1160	903.6	-41	-37048
1200	978.0	-40	-39120	1200	934.8	-40	-37392
1240	1010.6	-38	-38403	1240	966.0	-38	-36707
1277.7	1041.3	-38	-39570	1277.7	995.3	-38	-37822

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15°C.

412-FMS-63-5-11-2

Table 5-12 USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 14.3 GAL AUX FUEL (RH)
(English)

Jet A, A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	68	0	0
20	136	0	0
30	204	0	0
40	272	0	0
50	340	0	0
54.6	371.3	0	0
60	408	0.06	24
70	476	0.60	286
80	544	0.93	506
90	612	1.34	820
100	680	1.67	1136
110	748	1.93	1444
120	816	2.16	1763
130	884	2.35	2077
140	952	2.50	2380
150	1020	2.53	2581
152.6	1037.7	2.49	2584
160	1088	2.05	2230
170	1156	1.77	2046
180	1224	1.53	1873
183.6	1248.5	1.45	1810
190	1292	1.40	1808
200	1360	1.33	1809
210	1428	1.27	1814
220	1496	1.21	1810
230	1564	1.16	1814
240	1632	1.11	1812
250	1700	1.07	1818
253.6	1724.5	1.05	1811
260	1768	1.02	1803
270	1836	0.99	1818
280	1904	0.95	1809
290	1972	0.92	1814
300	2040	0.89	1816
302.2	2055.0	0.88	1808
310	2108	0.86	1813
320	2176	0.83	1806
330	2244	0.80	1795
337.6	2297.7	0.79	1814

Jet B, JP-4 (6.5 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	65	0	0
20	130	0	0
30	195	0	0
40	260	0	0
50	325	0	0
54.6	354.9	0	0
60	390	0.06	23
70	455	0.60	273
80	520	0.93	484
90	585	1.34	784
100	650	1.67	1086
110	715	1.93	1380
120	780	2.16	1685
130	845	2.35	1986
140	910	2.50	2275
150	975	2.53	2467
152.6	991.9	2.49	2470
160	1040	2.05	2132
170	1105	1.77	1956
180	1170	1.53	1790
183.6	1193.4	1.45	1730
190	1235	1.40	1728
200	1300	1.33	1729
210	1365	1.27	1734
220	1430	1.21	1730
230	1495	1.16	1734
240	1560	1.11	1732
250	1625	1.07	1739
253.6	1648.4	1.05	1731
260	1690	1.02	1724
270	1755	0.99	1737
280	1820	0.95	1729
290	1885	0.92	1734
300	1950	0.89	1735
302.2	1964.3	0.88	1729
310	2015	0.86	1733
320	2080	0.83	1725
330	2145	0.80	1715
337.6	2194.4	0.79	1734

* Most critical fuel amount for right side most lateral C.G. condition.
Weights given are nominal weights at 15°C.

412-FMS-63-5-12-1

Table 6-12M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 82 LITERS AUX FUEL (RH) (Metric)

Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.779 kg/l)			
LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)	LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	32.6	0	0	40	31.2	0	0
80	65.2	0	0	80	62.3	0	0
120	97.8	0	0	120	93.5	0	0
160	130.4	0	0	160	124.6	0	0
200	163.0	0	0	200	155.8	0	0
206.7	168.5	0	0	206.7	161.0	0	0
240	195.6	5	978	240	187.0	5	935
280	228.2	19	4336	280	218.1	19	4144
320	260.8	29	7563	320	249.3	29	7229
360	293.4	39	11443	360	280.4	36	10094
400	326.0	46	14996	400	311.6	46	14334
440	358.6	53	19006	440	342.8	53	18168
480	391.2	58	22690	480	373.9	58	21687
520	423.8	62	26276	520	405.1	62	25116
560	456.4	65	29666	560	436.2	65	28353
577.4	470.6	63	29647	577.4	449.8	63	28337
600	489.0	59	28851	600	467.4	53	24772
640	521.6	46	23994	640	498.6	46	22934
680	554.2	39	21614	680	529.7	39	20658
694.9	566.3	37	20953	694.9	541.3	37	20029
720	586.8	36	21125	720	560.9	36	20192
760	619.4	34	21060	760	592.0	34	20129
800	652.0	32	20864	800	623.2	32	19942
840	684.6	31	21223	840	654.4	31	20286
880	717.2	29	20799	880	685.5	28	19194
920	749.8	28	20994	920	716.7	28	20068
959.8	782.2	27	21119	959.8	747.7	27	20188
960	782.4	27	21125	960	747.8	27	20191
1000	815.0	26	21190	1000	779.0	26	20254
1040	847.6	25	21190	1040	810.2	25	20254
1080	880.2	24	21125	1080	841.3	24	20191
1120	912.8	23	20994	1120	872.5	23	20067
1132.1	922.7	22	20298	1132.1	881.9	22	19402
1160	945.4	22	20799	1160	903.6	22	19879
1200	978.0	21	20538	1200	934.8	21	19631
1240	1010.6	21	21223	1240	966.0	21	20286
1277.7	1041.3	20	20827	1277.7	995.3	20	19906

* Most critical fuel amount for right side most lateral C.G. condition.
Weights given are nominal weights at 15 °C.

412-FMS-83-6-12-2

Table 6-13. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 32.6 GAL AUX FUEL (English)

Jet A, A-1, JP-5, JP-8 @ 6.8 Lbs/Gal

	U.S. GALLON	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
	10	68	139.5	9486
	20	136	139.7	18999
	30	204	139.8	28519
	40	272	139.9	38053
	50	340	139.9	47566
*	54.6	371.3	139.9	51942
	60	408	140.1	57161
	70	476	142.6	67878
	80	544	149.8	81491
	90	612	151.8	92902
	100	680	153.3	104244
	110	748	154.5	115566
	120	816	155.6	126970
	130	884	156.4	138258
	140	952	157.2	149654
	150	1020	157.9	161058
	160	1088	158.5	172448
	168.9	1148.5	159.2	182841
	170	1156	158.7	183457
	180	1224	155.1	189842
	190	1292	151.9	196255
	199.9	1359.3	149.0	202536
	200	1360	149.0	202640
	210	1428	150.2	214486
	220	1496	151.4	226494
	230	1564	152.5	238510
	240	1632	153.4	250349
	250	1700	154.3	262310
	260	1768	155.1	274217
**	269.9	1835.3	155.9	286128
	270	1836	155.9	286232
	280	1904	154.4	293978
	290	1972	153.0	301716
	300	2040	151.7	309468
	310	2108	150.5	317254
	318.5	2165.8	149.5	323787
	320	2176	149.6	325530
	330	2244	150.4	337498
	340	2312	151.2	349574
	350	2380	151.8	361284
***	353.9	2406.5	152.1	366029

JP-4 @ 6.5 Lbs/Gal

	U.S. GALLON	WEIGHT (lbs.)	LONG CG (in.)	MOMENT (in-lb)
	10	65	139.5	9068
	20	130	139.7	18161
	30	195	139.8	27261
	40	260	139.9	36374
	50	325	139.9	45468
*	54.6	354.9	139.9	49651
	60	390	140.1	54639
	70	455	142.6	64883
	80	520	149.8	77896
	90	585	151.8	88803
	100	650	153.3	99645
	110	715	154.5	110468
	120	780	155.6	121368
	130	845	156.4	132158
	140	910	157.2	143052
	150	975	157.9	153953
	160	1040	158.5	164840
	168.9	1097.9	159.2	174786
	170	1105	158.7	175364
	180	1170	155.1	181467
	190	1235	151.9	187597
	199.9	1299.4	149.0	193611
	200	1300	149.0	193700
	210	1365	150.2	205023
	220	1430	151.4	216502
	230	1495	152.5	227988
	240	1560	153.4	239304
	250	1625	154.3	250738
	260	1690	155.1	262119
**	269.9	1754.4	155.9	273511
	270	1755	155.9	273605
	280	1820	154.4	281008
	290	1885	153.0	288405
	300	1950	151.7	295815
	310	2015	150.5	303258
	318.5	2070.3	149.5	309502
	320	2080	149.6	311168
	330	2145	150.4	322608
	340	2210	151.2	334152
	350	2275	151.8	345345
***	353.9	2300.4	152.1	349883

Most critical amount for most forward C.G. condition at a weight empty below 6580 pounds has no fuel.

* Most critical amount for most forward C.G. condition at a weight empty of 6580 pounds or greater.

** Most critical fuel amount for most aft C.G. condition at a weight empty below 4550 pounds.

*** Most critical fuel amount for most aft C.G. condition at a weight empty of 4550 pounds or greater.

Weights given are nominal weights at 15°C.

412-FMS-63-5-13-3

Table 5-13M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 123 LITERS AUX FUEL (Metric)

Jet A, A-1, JP-5, JP-8 (.815 kg/l)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
40	32.6	3543	115502
80	65.2	3548	231330
120	97.8	3551	347288
160	130.4	3553	463311
200	163.0	3553	579139
205.7	167.6	3553	595480
240	195.6	3675	718830
280	228.2	3762	858488
320	260.8	3831	999125
360	293.4	3877	1137512
400	326.0	3913	1275638
440	358.6	3942	1413601
480	391.2	3967	1551890
520	423.8	3988	1690114
560	456.4	4006	1828338
600	489.0	4023	1967247
639.1	520.9	4040	2105963
640	521.6	4041	2107786
680	554.2	3943	2185211
720	586.8	3855	2262114
756.6	616.6	3784	2333214
760	619.4	3787	2345668
800	652.0	3830	2497160
840	684.6	3851	2636395
880	717.2	3879	2782019
920	749.8	3904	2927219
960	782.4	3927	3072485
1000	815.0	3949	3218435
1021.5	832.5	3958	3295035
1040	847.6	3940	3339544
1080	880.2	3902	3434540
1120	912.8	3866	3528885
1160	945.4	3833	3623718
1200	978.0	3802	3718356
1205.5	982.5	3797	3730436
1240	1010.6	3816	3856450
1280	1043.2	3836	4001716
1320	1075.8	3865	4157967
1338.4	1081.6	3864	4217966

Jet B, JP-4 (.779 kg/l)

LITERS	WEIGHT (kg)	LONG CG (mm)	MOMENT (kg-mm)
40	31.2	3543	110400
80	62.3	3548	221111
120	93.5	3551	331947
160	124.6	3553	442845
200	155.8	3553	553557
205.7	161.0	3553	572101
240	187.0	3675	687075
280	218.1	3762	820567
320	249.3	3831	954092
360	280.4	3877	1087205
400	311.6	3913	1219291
440	342.8	3942	1351180
480	373.9	3967	1483261
520	405.1	3988	1615459
560	436.2	4006	1747417
600	467.4	4023	1880350
639.1	497.9	4040	2012844
640	498.6	4041	2014681
680	529.7	3943	2088686
720	560.9	3856	2162192
756.6	588.4	3784	2226257
760	592.0	3787	2242056
800	623.2	3830	2386856
840	654.4	3851	2519940
880	685.5	3879	2659132
920	716.7	3904	2797919
960	747.8	3927	2936764
1000	779.0	3949	3076271
1021.5	795.7	3958	3150368
1040	810.2	3940	3192030
1080	841.3	3902	3282831
1120	872.5	3866	3373008
1160	903.6	3833	3463652
1200	934.8	3802	3554110
1205.5	939.1	3797	3565704
1240	966.0	3816	3686109
1280	997.1	3836	3824052
1320	1028.3	3865	3974302
1339.4	1043.4	3864	4031669

Most critical amount for most forward C.G. condition at a weight empty below 2884 kilograms has no fu

Most critical amount for most forward C.G. condition at a weight empty of 2884 kilograms or greater.

Most critical fuel amount for most aft C.G. condition at a weight empty below 2871 kilograms.

Most critical fuel amount for most aft C.G. condition at a weight empty of 2871 kilograms or greater.

Weights given are nominal weights at 15 °C

412-FMS-63-5-13-2

Table 6-14. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND [illegible] GAL AUX FUEL (English)

Jet A, A-1, JP-5, JP-8 (6.8 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	68	0	0
20	136	0	0
30	204	0	0
40	272	0	0
50	340	0	0
54.6	371.3	0	0
60	408	-0.06	-24
70	476	-0.04	-19
80	544	0.05	27
90	612	-0.04	24
100	680	-0.04	27
110	748	-0.03	22
120	816	-0.03	24
130	884	-0.03	-27
140	952	-0.03	-29
150	1020	-0.03	-31
160	1088	-0.03	-33
168.9	1148.5	-0.02	-23
170	1156	-0.18	-208
180	1224	0.36	441
190	1292	-0.48	-620
*199.9	1359.3	-0.56	-758
200	1360	-0.56	-760
210	1428	-0.55	-785
220	1496	-0.53	-793
230	1564	-0.51	-798
240	1632	-0.48	-783
250	1700	-0.47	-799
260	1768	-0.44	-778
269.9	1835.3	-0.43	-789
270	1836	0.43	789
280	1904	0.41	781
290	1972	0.40	789
300	2040	-0.39	-796
310	2108	-0.37	780
318.5	2165.8	-0.36	780
320	2176	-0.36	-783
330	2244	-0.35	-785
340	2312	-0.34	-786
350	2380	-0.33	-785
353.9	2406.5	-0.31	-784

Jet B, JP-4 (6.5 Lbs/Gal)

U.S. GALLON	WEIGHT (lbs.)	LAT CG (in.)	MOMENT (in-lb)
10	65	0	0
20	130	0	0
30	195	0	0
40	260	0	0
50	325	0	0
54.6	354.9	0	0
60	390	-0.06	-23
70	455	-0.04	-18
80	520	-0.05	26
90	585	-0.04	-23
100	650	-0.04	-26
110	715	-0.03	-21
120	780	-0.03	23
130	845	-0.03	25
140	910	-0.03	27
150	975	-0.03	28
160	1040	-0.03	-31
168.9	1097.8	-0.02	-22
170	1105	-0.18	-199
180	1170	-0.36	-421
190	1235	-0.48	-593
*199.9	1299.4	-0.58	-754
200	1300	0.58	-754
210	1365	0.55	-751
220	1430	0.53	-758
230	1495	0.51	762
240	1560	-0.48	-749
250	1625	-0.47	-764
260	1690	-0.44	-744
269.9	1754.4	-0.43	-754
270	1755	-0.43	-755
280	1820	-0.41	-746
290	1885	-0.40	754
300	1950	-0.39	-761
310	2015	-0.37	-746
318.5	2070.3	-0.36	745
320	2080	-0.36	749
330	2145	-0.35	751
340	2210	0.34	751
350	2275	0.33	751
353.9	2300.4	-0.33	759

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15°C

412-FMS-63-6-14-1

Table 5-14M. USABLE FUEL LOADING TABLE WITH SELF-SEALING TANKS AND 120 LITERS AUX FUEL TANK(S)

Jet A, A-1, JP-5, JP-8 (.815 kg/l)				Jet B, JP-4 (.779 kg/l)			
LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)	LITERS	WEIGHT (kg)	LAT CG (mm)	MOMENT (kg-mm)
40	32.6	0	0	40	31.2	0	0
80	65.2	0	0	80	62.3	0	0
120	97.8	0	0	120	93.5	0	0
160	130.4	0	0	160	124.6	0	0
200	163.0	0	0	200	155.8	0	0
206.7	168.5	0	0	206.7	161.0	0	0
240	195.6	-1	-196	240	187.0	-1	-187
280	228.2	-1	-228	280	218.1	-1	-218
320	260.8	-1	-261	320	249.3	-1	-249
360	293.4	-1	-293	360	280.4	-1	-280
400	326.0	-1	-326	400	311.6	-1	-312
440	358.6	-1	-359	440	342.8	-1	-343
480	391.2	-1	-391	480	373.9	-1	-374
520	423.8	-1	-424	520	405.1	-1	-405
560	456.4	-1	-456	560	436.2	-1	-436
600	489.0	-1	-489	600	467.4	-1	-467
639.1	520.9	-1	-521	639.1	497.9	-1	-498
640	521.6	-1	-522	640	498.6	-1	-499
680	554.2	-9	-4988	680	529.7	-9	-4767
720	586.8	-12	-7042	720	560.9	-12	-6731
*756.8	616.6	-15	-9249	*756.8	589.4	-15	-8841
760	619.4	-15	-9291	760	592.0	-15	-8881
800	652.0	-14	-9128	800	623.2	-14	-8725
840	684.6	-13	-8900	840	654.4	-13	-8507
880	717.2	-13	-9324	880	685.5	-13	-8912
920	749.8	-12	-8998	920	716.7	-12	-8600
960	782.4	-12	-9389	960	747.8	-12	-8974
1000	815.0	-11	-8965	1000	779.0	-11	-8569
1021.5	832.5	-11	-9158	1021.5	795.7	-11	-8753
1040	847.6	-11	-9324	1040	810.2	-11	-8912
1080	880.2	-10	-8802	1080	841.3	-10	-8413
1120	912.8	-10	-9128	1120	872.5	-10	-8725
1160	945.4	-10	-9454	1160	903.6	-10	-9036
1200	978.0	-9	-8802	1200	934.8	-9	-8413
1205.5	982.5	-9	-8842	1205.5	939.1	-9	-8452
1240	1010.6	-9	-9095	1240	965.9	-9	-8694
1280	1043.2	-9	-9389	1280	997.1	-9	-8974
1320	1075.8	-8	-8606	1320	1028.3	-8	-8226
1339.4	1091.6	-8	-8733	1339.4	1043.4	-8	-8347

* Most critical fuel amount for left side most lateral C.G. condition.
Weights given are nominal weights at 15 C

412-FMS-63-5-14-2

Bell MODELS 412/412EP

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT
TEN CELL — SELF SEALING FUEL

412-899-377

S/N 33108 — 33213

AND

S/N 36001 — 36019

S/N 36020 — 36086

S/N 36087 AND SUB

CERTIFIED
22 JUNE 1998

This supplement shall be attached to Model 412 or 412EP Flight Manual (BHT-412-FM-2, BHT-412-FM-3 and BHT-412-FM-4), when SELF SEALING FUEL CELLS are installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, or other applicable supplements, consult basic Flight Manual.

Bell Helicopter TEXTRON
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POST OFFICE BOX 482 • FORT WORTH, TEXAS 76101

22 JUNE 1998
REVISION 1 — 02 JULY 1998

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Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

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Original .... 0 .... 22 JUN 98
Revision .... 1 .... 02 JUL 98

APPROVED:

DATE: JUL 0 2 998

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

Ten Cell-Self Sealing Fuel Cells (412-899-377) replaces standard fuel cells with cells which have self-sealing capability against ballistic damage by small objects. Exterior geometry of self-sealing fuel cells are identical to standard cells. Interior geometry is slightly different since self-sealing cells have greater wall thickness. Due to increased wall thickness of cell, total and usable fuel capacities are less than those of basic helicopter.

All other components including fuel quantity gauging system are identical to standard system.

Section 1

LIMITATIONS

1-6. WEIGHT AND CENTER OF GRAVITY

Actual weight change shall be determined after installation and ballast readjusted, if necessary, to retain gross weight CG within allowable limits.

1-20. INSTRUMENT MARKINGS AND PLACARDS

Refer to figure 1-1.

BASIC FUEL CAP 2121 LBS
WITH AUX FUEL KIT 412-706-007 3236 LBS
412-706-009 2343 LBS

Location: Instrument panel

Figure 1-1. Instrument Markings and Placards

Section 2

NORMAL PROCEDURES

No change from basic manual.

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

No change from basic manual.

Section 4

PERFORMANCE

No change from basic manual.

Section 5

WEIGHT AND BALANCE

5-7. FUEL LOADING

Fuel loading tables lists usable fuel quantities in 10 gallon (40 liter) increments, with weights and moments in both english and metric units for balance computation. Critical fuel loading for computing most forward and aft CGs are denoted.

5-7-A. BASIC SYSTEM — SELF SEALING FUEL CELL.

Total capacity: 326.5 U.S. gallons (1235.9 liters).

Usable fuel: 317.3 U.S. gallons (1201.1 liters).

* Tables 5-1 - Provides longitudinal CG data for approved fuels.
* Tables 5-2 - Provides lateral CG data for approved fuels.

5-7-B. BASIC SYSTEM WITH BOTH SEAT TYPE AUXILIARY TANKS (16.3 GAL /61.7 LITRE EACH).

Refer to BHT-412-FMS-25.2/25.3/25.4

Total capacity: 359.1 U.S. gallons (1359.3 liters).

Usable fuel: 349.9 U.S. gallons (1324.5 liters).

* Table 5-3 - Provides longitudinal CG data for approved fuels.
* Table 5-4 - Provides lateral CG data for approved fuels.

5-7-C. BASIC SYSTEM WITH ONE SEAT TYPE AUXILIARY FUEL TANK (LEFT OR RIGHT).

Refer to BHT-412-FMS-25.2/25.3/25.4.

Total capacity: 342.8 U.S. gallons (1297.6 liters).

Usable fuel: 333.6 U.S. gallons (1262.8 liters).

* Table 5-5 - Provides longitudinal CG data for left side installation.
* Table 5-6 - Provides lateral CG data for left side installation.
* Table 5-7 - Provides longitudinal CG data for right side installation.
* Table 5-8 - Provides lateral CG data for right side installation.

5-7-D. BASIC SYSTEM WITH BOTH LONG RANGE AUXILIARY FUEL TANKS (81.7 GAL /309.3 LITRE EACH).

Refer to BHT-412-FMS-17.2/17.3/17.4.

Total capacity: 489.9 U.S. gallons (1854.4 liters).

Usable fuel: 480.7 U.S. gallons (1819.6 liters).

* Table 5-9 - Provides longitudinal CG data for approved fuels.
* Table 5-10 - Provides lateral CG data for approved fuels

5-7-E. BASIC SYSTEM WITH ONE LONG RANGE AUXILIARY FUEL TANK (LEFT OR RIGHT).

Refer to BHT-412-FMS-17.2/17.3/17.4.

Total capacity: 408.2 U.S. gallons (1545.2 liters).

Usable fuel: 399.0 U.S. gallons (1510.4 liters).

- Table 5-11 - Provides longitudinal CG data for left side installation.
- Table 5-12 - Provides lateral CG data for left side installation.
- Table 5-13 - Provides longitudinal CG data for right side installation.
- Table 5-14 - Provides lateral CG data for right side installation.

Table 5-1. Usable fuel loading – longitudinal – basic helicopter (English)

USABLE FUEL LOADING TABLE LONGITUDINAL CG (ENGLISH)
Basic System 317.0 US Gal

Jet A, A-1, JP-5, JP-8 (6.8 lb/Gal)				Jet B, JP-4 (6.5 lb/Gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	139.6	9494	10	65	138.6	9009
20	136	139.1	18921	20	130	139.1	18083
30	204	139.4	28438	30	195	139.5	27203
40	272	139.6	37953	40	260	139.6	36296
50	340	139.7	47498	50	325	139.7	45403
60	408	139.7	57005	60	390	139.7	54483
* 62.6	426	139.7	59456	* 62.6	407	139.7	56862
70	476	143.5	68306	70	455	143.6	65338
80	544	147.7	80322	80	520	147.7	76804
90	612	150.8	92289	90	585	150.8	88217
100	680	153.3	104245	100	650	153.0	99450
110	748	156.7	117195	110	715	155.3	111040
120	816	157.0	128153	120	780	157.0	122460
130	884	158.5	140108	130	845	158.5	133933
** 138.9	945	159.6	150708	** 138.9	903	159.6	144119
140	952	159.1	151425	140	910	159.1	144781
150	1020	154.7	157776	150	975	154.7	150813
160	1088	150.9	164128	160	1040	150.9	156936
170	1156	147.5	170487	170	1105	147.5	162988
* 171.4	1166	147.4	171868	* 173.4	1127	147.4	166120
180	1224	148.9	182257	180	1170	148.9	174213
190	1292	150.3	194191	190	1235	150.3	185621
200	1360	151.6	206144	200	1300	151.8	197340
210	1428	152.7	218037	210	1365	152.7	208436
220	1496	153.8	230048	220	1430	153.4	219362
230	1564	154.7	241949	230	1495	154.7	231277
** 237.8	1617	155.3	251054	** 237.8	1546	155.3	240094
240	1632	154.9	252760	240	1560	154.9	241644
250	1700	153.3	260521	250	1625	153.3	249113
260	1768	151.8	268395	260	1690	151.8	256542
270	1836	150.4	276081	270	1755	150.4	263952
280	1904	149.1	283836	280	1820	149.1	271362
* 286.4	1948	148.3	288808	* 286.4	1862	148.3	276136
290	1972	148.8	293429	290	1885	148.8	280488
300	2040	149.6	305172	300	1950	149.5	291525
310	2108	150.4	317051	310	2015	150.4	303056
** 317.0	2156	151.0	325703	** 317.0	2061	151.0	311211

* Critical fuel quantities for most forward CG condition [illegible]

** Critical fuel quantities for most aft CG condition

Weights given are nominal weights at [illegible]

For calculation purposes, use Weight and Moment values. CGs shown are derived from Weight and Moment values and may not [illegible]

NOTE: This table is used with [illegible] fuel [illegible]

412 FMS-65-5-1-1

Table 6-1. Usable fuel loading – longitudinal – basic helicopter (Metric)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (METRIC)							
Basic System 1251 liters							
Jet A, A-1, JP-5, JP-8 (0.815 kg/L)				Jet B, JP-4 (0.779 kg/L)			
Quantity liters	Weight kg	CG mm	Moment kg-mm	Quantity liters	Weight kg	CG mm	Moment kg-mm
40	32.6	3525	114756	40	31.2	3520	112525
80	65.2	3534	230420	80	62.3	3534	220407
120	97.8	3541	346130	120	93.5	3541	330540
160	130.4	3545	462247	160	124.6	3545	441702
200	163.0	3547	578156	200	155.8	3547	552625
* 237.0	193.1	3548	685350	* 237.0	184.6	3548	671868
240	195.6	3560	696337	240	187.0	3560	662657
280	228.2	3692	842504	280	218.1	3690	825567
320	260.8	3788	987956	320	255.7	3788	968570
360	293.4	3864	1133544	360	247.6	3864	1111310
400	326.0	3924	1279105	400	311.6	3924	1252797
440	358.6	3973	1424617	440	351.6	3973	1396584
480	391.2	4014	1570171	480	373.6	4014	1539546
520	423.8	4049	1715735	520	415.5	4046	1682070
** 525.7	428.4	4053	1736323	** 525.7	425.0	4053	1702238
560	456.4	3950	1802584	560	447.4	3950	1767290
600	489.0	3846	1870527	600	479.4	3845	1840072
640	521.5	3753	1957751	640	511.1	3753	1918825
* 644.9	525.5	3742	1966775	* 644.9	515.3	3742	1926463
680	554.2	3779	2094599	680	543.5	3779	2053470
720	586.8	3818	2240135	720	575.3	3818	2196156
760	619.4	3852	2385659	760	607.2	3852	2338828
800	652.0	3887	2531170	800	599.2	3882	2481478
840	684.5	3910	2676688	840	571.2	3910	2624121
880	717.2	3936	2822196	880	709.1	3936	2766752
** 900.2	733.7	3943	2892574	** 900.2	719.1	3943	2835796
920	749.8	3970	2919298	920	735.4	3970	2851644
960	782.4	3876	3013866	960	767.0	3876	2974305
1000	815.0	3829	3120420	1000	799.0	3839	3067013
1040	847.6	3802	3222967	1040	831.0	3807	3155094
1080	880.2	3769	3317461	1080	862.9	3769	3252323
* 1084.2	883.6	3766	3327421	* 1084.2	866.3	3766	3262107
1120	912.8	3735	3409527	1120	894.9	3738	3345652
1160	945.4	3811	3603024	1160	926.8	3811	3532275
1200	978.0	3833	3748451	1200	958.8	3833	3674877
** 1201.1	978.9	3833	3752028	** 1201.1	959.7	3833	3678539

* [illegible]

** [illegible]

[illegible]

NOTE: This table is [illegible] fuel [illegible] installed.

412-FMS-65-5-1-2

Table 5-2. Usable fuel loading – lateral – basic helicopter (English)

USABLE FUEL LOADING TABLE - LATERAL CG (ENGLISH) Fuel System: 317.3 US Gal							
JET A, JET A-1, JP-5 (6.8 LB/GAL)				JET B, JP-4 (6.5 LB/GAL)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	136	0.0	0	20	130	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.5	425	0.0	0	62.5	407	0.0	0
70	476	0.0	-13	70	455	0.0	-12
80	544	0.0	-13	80	520	0.0	-13
90	612	0.0	-13	90	585	0.0	-13
100	680	0.0	-13	100	650	0.0	-13
110	748	0.0	-13	110	715	0.0	-13
120	816	0.0	-13	120	780	0.0	-13
130	884	0.0	-13	130	845	0.0	-13
138.9	944	0.0	-13	138.9	903	0.0	-13
140	952	-0.2	-171	140	910	-0.2	-164
150	1020	-0.4	-407	150	975	-0.4	-399
160	1088	-0.5	-540	160	1040	-0.5	-516
170	1156	-0.6	-672	170	1105	-0.6	-642
* 170.4	1159	-0.6	-677	* 170.4	1107	-0.6	-647
180	1224	-0.6	-677	180	1170	-0.6	-647
190	1292	-0.5	-677	190	1235	-0.5	-647
200	1360	-0.5	-677	200	1300	-0.5	-647
210	1428	-0.5	-677	210	1365	-0.5	-647
220	1496	-0.5	-677	220	1430	-0.5	-647
230	1564	-0.4	-677	230	1495	-0.4	-647
237.5	1617	-0.4	-677	237.5	1546	-0.4	-647
240	1632	-0.4	-677	240	1560	-0.4	-647
250	1700	-0.4	-677	250	1625	-0.4	-647
260	1768	-0.4	-677	260	1690	-0.4	-647
270	1836	-0.4	-677	270	1755	-0.4	-647
280	1904	-0.4	-677	280	1820	-0.4	-647
286.4	1948	-0.3	-677	286.4	1862	-0.3	-647
290	1972	-0.3	-677	290	1885	-0.3	-647
300	2040	-0.3	-678	300	1950	-0.3	-648
310	2108	-0.3	-686	310	2015	-0.3	-650
317.3	2158	-0.3	-690	317.3	2062	-0.3	-655

* Critical fuel quantity for most lateral CG condition

Weights given are nominal weights at 15°C (59°F).
For calculation purposes, use Weight and Moment values. CGs shown are derived from Weight and Moment values and rounded to one decimal place.

NOTE: This table is invalid with auxiliary fuel tank(s) installed

412-FMS-65-5-2-1

Table 6-2. Usable fuel loading – lateral – basic helicopter (Metric)

USABLE FUEL LOADING TABLE - LATERAL CG (METRIC) Basic System - 1201.1 liters							
Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	32.6	0	0	40	32.0	0	0
80	65.2	0	0	80	63.9	0	0
120	97.8	0	0	120	95.9	0	0
160	130.4	0	0	160	127.8	0	0
200	163.0	0	0	200	159.8	0	0
237.0	193.2	0	0	237.0	189.4	0	0
240	195.6	0	24	240	191.8	0	24
280	228.2	-1	-152	280	223.7	-1	-147
320	260.8	-1	-152	320	255.7	-1	-148
360	293.4	-1	-152	360	287.6	-1	-147
400	326.0	0	-152	400	319.6	0	-148
440	358.6	0	-152	440	351.6	0	-148
480	391.2	0	-152	480	383.5	0	-147
520	423.8	0	-152	520	415.5	0	-148
525.7	428.4	0	-152	525.7	420.0	0	-147
560	456.4	-10	-4359	560	447.4	-10	-4371
600	489.0	-12	-5989	600	479.4	-12	-5872
640	521.6	-15	-7591	640	511.4	-15	-7444
*644.9	525.6	-15	-7796	*644.9	515.3	-15	-7643
680	554.2	-14	-7796	680	543.3	-14	-7643
720	586.8	-13	-7796	720	575.3	-13	-7643
760	619.4	-13	-7796	760	607.2	-13	-7643
800	652.0	-12	-7796	800	639.2	-12	-7643
840	684.6	-11	-7796	840	671.2	-11	-7643
880	717.2	-11	-7796	880	703.1	-11	-7643
900.2	733.7	-11	-7796	900.2	719.3	-11	-7643
920	749.8	-10	-7796	920	735.1	-10	-7643
960	782.4	-10	-7796	960	767.0	-10	-7643
1000	815.0	-10	-7796	1000	799.0	-10	-7643
1040	847.6	-9	-7796	1040	831.0	-9	-7643
1080	880.2	-9	-7796	1080	862.9	-9	-7643
1084.2	883.6	-9	-7796	1084.2	866.3	-9	-7643
1120	912.8	-9	-7803	1120	894.9	-9	-7649
1160	945.4	-8	-7905	1160	926.8	-8	-7750
1200	978.0	-8	-8016	1200	958.8	-8	-7857
1201.1	978.9	-8	-8018	1201.1	959.7	-8	-7860

* Critical fuel quantity for most lateral CG condition

Weights given are nominal weights at 15°C (59°F).
For calculation purposes, fuel weight and moment values in the table are rounded to 0.1 weight and moment values are rounded to whole numbers.

NOTE: This table is invalid with auxiliary fuel tank(s) installed.

412-FMS-65-5-2-9

Table 65-3. Usable fuel loading – longitudinal – w/32.6 gal aux fuel in LH and RH position (English)

USABLE FUEL LOADING TABLE — LONGITUDINAL CG — ENGLISH							
Basic Fuel + LH and RH 32.6 US Gal Aux Tanks = 349.9 US Gal							
Jet A, A-1, JP-5, JP-8 (6.8 lb/gal)				Jet B, JP-4 (6.5 lb/gal)			
Quantity (US Gal)	Weight (lb)	CG (in.)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (in.)	Moment (in-lb)
10	68	126.6	8474	10	65	126.6	8229
20	136	129.1	18921	20	130	129.1	16783
30	204	129.4	26442	30	195	129.4	27137
40	272	129.6	37262	40	260	129.6	35256
50	340	129.7	47482	50	325	129.7	45228
60	408	129.7	57305	60	390	129.7	54430
*67.5	459	129.7	59476	*67.5	439	129.7	56882
70	476	143.2	68162	70	455	143.2	65156
80	544	146.3	79511	80	520	146.3	76076
90	612	148.9	91140	90	585	148.9	87119
100	680	150.7	102487	100	650	150.7	97975
110	748	152.2	113831	110	715	152.2	108808
120	816	153.4	125151	120	780	153.4	119639
130	884	154.4	136497	130	845	154.4	130477
140	952	155.3	147835	140	910	155.3	141313
150	1020	156.1	159172	150	975	156.1	152140
160	1088	156.7	170527	160	1040	156.7	163004
170	1156	157.5	182123	170	1105	157.5	174058
**171.5	1166	157.7	183874	**171.5	1115	157.7	175762
180	1224	154.7	189269	180	1170	154.7	180947
190	1292	151.4	195547	190	1235	151.4	187011
200	1360	148.5	201997	200	1300	148.5	193085
*205.0	1394	147.7	205875	*205.0	1333	147.7	196852
210	1428	148.7	212298	210	1365	148.7	202970
220	1496	149.9	224251	220	1430	149.9	214356
230	1564	151.0	236124	230	1495	151.0	225784
240	1632	152.1	248157	240	1560	152.1	237210
250	1700	153.0	260104	250	1625	153.0	248635
260	1768	153.9	272059	260	1690	153.9	260057
270	1836	154.6	283850	270	1755	154.6	271304
**270.4	1839	154.6	284232	**270.4	1758	154.6	271692
280	1904	153.2	291675	280	1820	153.2	278807
290	1972	151.8	299440	290	1885	151.8	286232
300	2040	150.6	307211	300	1950	150.6	293657
310	2108	149.4	314974	310	2015	149.4	301078
*319.0	2169	148.4	321876	*319.0	2074	148.4	307771
320	2176	148.5	323144	320	2080	148.6	308888
330	2244	149.3	335093	330	2145	149.3	320316
340	2312	150.1	347047	340	2210	150.1	331731
**349.9	2379	150.8	358871	**349.9	2274	150.8	343035

* [illegible]

** [illegible]

[illegible]

[illegible]

[illegible]

Table 5-3. Usable fuel loading – longitudinal – w/123.4 litres aux fuel in LH and RH position (Metric)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (METRIC)
Base with LH and RH 61.7 Ltr Aux Tank = 1324.5 Liters

Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (mm-kg)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (mm-kg)
40	32.6	3520	114758	40	32.0	3520	112505
80	65.2	3534	230430	80	63.9	3534	225907
120	97.8	3541	346319	120	95.9	3541	339545
160	130.4	3545	462247	160	127.8	3545	453176
200	163.0	3547	578156	200	159.6	3547	566805
*237.4	193.5	3546	686357	*237.4	189.3	3548	671698
240	195.6	3550	694315	240	191.8	3550	680645
280	228.2	3572	815494	280	223.4	3572	821451
320	260.8	3589	937955	320	255.7	3589	917457
360	293.4	3627	1116631	360	287.6	3607	1204806
400	326.0	3850	1254959	400	319.6	3852	1230832
440	358.6	3884	1392775	440	351.6	3884	1365612
480	391.2	3912	1530431	480	383.5	3912	1500173
520	423.8	3936	1668858	520	415.5	3936	1635725
560	456.4	3959	1806874	560	447.4	3959	1771402
600	489.0	3978	1945085	600	479.4	3978	1906880
640	521.6	3996	2085479	640	511.4	3996	2044597
**649.1	529.0	4026	2118450	**649.1	518.6	4005	2078063
680	554.2	3920	2172341	680	543.3	3920	2135474
720	586.8	3844	2255530	720	575.3	3844	2211251
760	619.4	3766	2332930	760	607.2	3766	2287101
*764.2	622.8	3751	2345959	*764.2	613.9	3751	2302796
800	652.0	3730	2432046	800	639.2	3780	2415567
840	684.6	3812	2609613	840	671.2	3817	2558646
880	717.2	3842	2755527	880	703.1	3842	2701310
920	749.8	3869	2900920	920	735.1	3869	2843670
960	782.4	3894	3046421	960	767.0	3894	2986614
1000	815.0	3916	3191959	1000	799.0	3916	3129245
**1023.6	834.2	3925	3274704	**1023.6	817.8	3925	3210470
1040	847.6	3909	3313353	1040	831.0	3905	3244336
1080	880.2	3872	3407950	1080	862.9	3872	3341046
1120	912.8	3837	3502516	1120	894.9	3837	3433056
1160	945.4	3805	3597050	1160	926.8	3805	3526440
1200	978.0	3776	3681614	1200	958.8	3775	3619572
*1207.6	984.2	3769	3709555	*1207.6	964.9	3769	3636734
1240	1010.6	3757	3797230	1240	990.8	3757	3722150
1280	1043.2	3808	3972758	1280	1022.7	3808	3894205
1320	1075.8	3828	4115791	1320	1054.7	3828	4037301
**1324.5	1079.5	3830	4134642	**1324.5	1058.3	3830	4053447

* Quantities at which most forward CG occurs [illegible]

** [illegible]

Weights given are for [illegible]

For calculation purposes, use Weight and Moment values. CGs shown are derived from Weight and Moment values and rounded to whole numbers.

412-FMS-65-5-3-2

Table 5-4. Usable fuel loading — lateral — w/32.6 gal. aux fuel in LH and RH position (English)

USABLE FUEL LOADING TABLE – LATERAL (ENGLISH) Basic with LH and RH 16.3 US Gal Aux Tank = 349.9 US Gal							
Jet A, A-1, JP-5, JP-8 (6.8 lb/US Gal)				Jet B, JP-4 (6.5 lb/US Gal)			
Quantity (US Gal)	Weight (lb)	CG (in)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (in)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	136	0.0	0	20	130	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.6	426	0.0	0	62.6	407	0.0	0
70	476	0.0	-11	70	455	0.0	-10
80	544	0.0	-13	80	520	0.0	-13
90	612	0.0	-13	90	585	0.0	-11
100	680	0.0	-13	100	650	0.0	-13
110	748	0.0	-13	110	715	0.0	-13
120	816	0.0	-13	120	780	0.0	-11
130	884	0.0	-13	130	845	0.0	-12
140	952	0.0	-13	140.0	910	0.0	-13
150	1020	0.0	-13	150	975	0.0	-13
160	1088	0.0	-13	160	1040	0.0	-12
170	1156	0.0	-13	170	1105	0.0	-12
171.5	1166	0.0	-13	171	1115	0.0	-11
180	1224	-0.9	-374	180.0	1170	-0.9	-357
190	1292	-0.4	-504	190	1235	-0.4	-482
200	1360	-0.5	-637	200	1300	-0.5	-629
*203.0	1380	-0.5	-677	*201.5	1319	-0.5	-647
210	1428	-0.5	-677	210	1365	-0.5	-647
220	1496	-0.5	-677	220	1430	-0.5	-647
230	1564	-0.4	-677	230	1495	-0.4	-647
240	1632	-0.4	-677	240.0	1560	-0.4	-647
250	1700	-0.4	-677	250	1625	-0.4	-647
260	1768	-0.4	-677	260	1690	-0.4	-647
270	1836	-0.4	-677	270	1755	-0.4	-647
270.4	1839	-0.4	-677	270	1758	-0.4	-647
280	1904	-0.4	-677	280	1820	-0.4	-647
290	1972	-0.3	-677	290.0	1885	-0.3	-647
300	2040	-0.3	-677	300	1950	-0.3	-647
310	2108	-0.3	-677	310	2015	-0.3	-647
314.0	2162	-0.3	-677	314	2041	-0.3	-647
320	2176	-0.3	-677	320	2080	-0.3	-647
330	2244	-0.3	-578	330	2145	-0.3	-646
340	2312	-0.3	-485	340	2210	-0.3	-635
349.9	2379	-0.3	-596	350	2274	-0.3	-682

* [illegible]

[illegible]

412-FMS-65-5-1

Table 5-4. Usable fuel loading — lateral — w/123.4 litre aux fuel in LH and RH position (Metric)

USABLE FUEL LOADING TABLE - LATERAL CG (METRIC)
Basic with LH and RH 61.7 Litre Aux Tank - 1324.5 litres

Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.798 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm kg)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm kg)
40	32.6	0	0	40	31.9	0	0
80	65.2	0	0	80	63.9	0	0
120	97.8	0	0	120	95.8	0	0
160	130.4	0	0	160	127.8	0	0
200	163.0	0	0	200	159.8	0	0
237.0	193.1	0	0	237.0	189.3	0	0
240	195.6	0	-24	240	191.6	0	-24
280	228.2	-1	-147	280	223.6	-1	-144
320	260.8	-1	-152	320	255.7	-1	-149
360	293.4	-1	-152	360	287.6	-1	-149
400	326.0	0	-152	400	319.6	0	-149
440	358.6	0	-152	440	351.6	0	-149
480	391.2	0	-152	480	383.5	0	-149
520	423.8	0	-152	520	415.5	0	-149
560	456.4	0	-152	560	447.4	0	-149
600	489.0	0	-152	600	479.4	0	-149
640	521.6	0	-152	640	511.4	0	-149
649.1 *	529.0	0	-152	649.1 *	518.6	0	-149
680	554.2	-5	-4756	680	543.3	-5	-4572
720	586.8	-10	-5840	720	575.3	-10	-5757
760	619.4	-12	-7458	760	607.2	-12	-7312
* 768.2	626.1	-12	-7796	* 768.2	613.9	-12	-7643
800	652.0	-12	-7796	800	639.2	-12	-7643
840	684.6	-11	-7796	840	671.2	-11	-7643
880	717.2	-11	-7796	880	703.1	-11	-7643
920	749.8	-10	-7796	920	735.1	-10	-7643
960	782.4	-10	-7796	960	767.0	-10	-7643
1000	815.0	-10	-7796	1000	799.0	-10	-7643
1023.6	834.3	-9	-7796	1023.6	817.9	-9	-7643
1040	847.6	-9	-7796	1040	831.0	-9	-7643
1080	880.2	-9	-7796	1080	862.9	-9	-7643
1120	912.8	-9	-7796	1120	894.9	-9	-7643
1160	945.4	-8	-7796	1160	926.8	-8	-7643
1200	978.0	-8	-7796	1200	958.8	-8	-7643
1207.8	984.3	-8	-7796	1207.8	964.9	-8	-7643
1240	1010.6	-8	-7805	1240	990.8	-8	-7647
1280	1043.2	-8	-7875	1280	1022.7	-8	-7720
1320	1075.8	-7	-8005	1320	1054.7	-7	-7840
1324.5	1079.5	-7	-8015	1324.5	1058.3	-7	-7850

* [illegible]

Weights (kg) are nominal weights at 15°C (59°F).
For calculation purposes, use Weight and Moment values. [illegible]
and Moment values and rounded to whole numbers.

412FMS-65-5-4-3

Table 5-5. Usable fuel loading — longitudinal — w/18.3 gal aux fuel in LH position (English)

USABLE FUEL LOADING TABLE — LONGITUDINAL C.G. (ENGLISH)

Used with LH 18.3 US Gal Aux Tank 310.6 US Gal

Jet A, A-1, JP-5, JP-8 (6.8 lb/US Gal)				Jet B, JP-4 (6.5 lb/US Gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	139.5	9474	10	65	139.6	9074
20	136	139.1	18921	20	130	139.1	18086
30	204	139.4	28447	30	195	139.4	27183
40	272	139.5	37952	40	260	139.6	36296
50	340	139.7	47490	50	325	139.7	45388
60	408	139.7	57025	60	390	139.7	54490
* 62.6	426	139.7	59456	* 62.5	407	139.7	56862
70	476	142.4	66217	70	455	141.1	64227
80	544	145.2	78910	80	520	145.6	75395
90	612	148.2	91557	90	585	149.2	87547
100	680	151.1	102771	100	650	151.2	98625
110	748	153.4	114749	110	715	153.4	109606
120	816	154.5	126067	120	780	154.8	120765
130	884	155.7	137819	130	845	156.0	131830
140	952	157.0	149536	140	910	157.0	142810
150	1020	158.2	161115	150	975	158.0	154307
** 151.2	1028	158.6	163045	** 154.2	1004	158.6	159909
160	1088	155.6	169301	160	1040	156.6	162845
170	1156	152.9	176751	170	1105	152.9	168912
180	1224	149.5	183061	180	1170	149.6	174285
* 186.7	1269	147.5	187232	* 186.7	1213	147.6	179025
190	1292	148.1	191287	190	1235	148.5	182062
200	1360	149.4	203244	200	1300	149.4	194277
210	1428	150.7	215198	210	1365	150.7	205708
220	1496	151.8	227151	220	1430	151.8	217129
230	1564	152.9	239105	230	1495	152.9	228554
240	1632	153.8	251056	240	1560	153.8	239979
250	1700	154.7	263004	250	1625	154.7	251401
** 254.1	1728	154.9	267645	** 254.1	1652	154.9	255949
260	1768	154.0	272213	260	1690	154.0	260209
270	1836	152.5	279985	270	1755	152.5	267592
280	1904	151.1	287753	280	1820	151.1	275063
290	1972	149.9	295511	290	1885	149.9	282481
300	2040	148.7	303275	300	1950	148.7	289999
* 302.7	2059	148.4	305592	* 302.7	1968	148.4	291919
310	2108	149.0	314085	310	2015	149.0	300232
320	2176	149.8	326037	320	2080	149.8	311553
330	2244	150.6	337945	330	2145	150.6	323074
** 333.5	2259	150.9	340887	** 333.6	2158	150.9	325708

* Calculated quantities for most forward CG condition.

** Calculated quantities for aft-most CG condition.

Weights given are nominal weights at 15°C (59°F).

For calculation purposes, use Weight and Moment values. CG is shown as reference only; Weight and Moment values are rounded to one decimal place.

412-FMS-65-5-5-1

Table 5-5. Usable fuel loading — longitudinal — w/61.7 litre aux fuel in LH position (Metric)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (METRIC) Based with LH 61.7 litre Aux Tank - 1262.8 litres							
JET A, A-1, JP-5, JP-8 (0.815 kg/l)				JET B, JP-4 (0.799 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm-kg)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm-kg)
40	32.6	3520	114753	40	32.0	3520	112505
80	65.2	3534	230430	80	63.9	3534	225907
120	97.8	3541	346322	120	95.9	3541	339540
160	130.4	3545	462247	160	127.8	3545	453172
200	163.0	3547	578165	200	159.8	3547	566805
*235.7	192.1	3548	681561	*235.7	188.3	3545	671593
240	195.6	3560	696321	240	191.6	3560	682661
280	228.2	3579	816489	280	223.7	3578	800014
320	260.8	3768	952117	320	255.7	3766	962597
360	293.4	3820	1120861	360	287.6	3829	1101298
400	326.0	3848	1254112	400	319.6	3878	1239491
440	358.6	3919	1405207	440	351.6	3919	1377718
480	391.2	3950	1545342	480	383.5	3953	1516085
520	423.8	3982	1687364	520	415.5	3982	1654236
560	456.4	4007	1828814	560	447.4	4007	1792725
**587.4	478.7	4026	1927380	**587.4	469.3	4026	1889557
600	489.0	3991	1951824	600	479.4	3991	1913536
640	521.6	3890	2029102	640	511.4	3890	1989208
680	554.2	3801	2106636	680	543.3	3801	2065083
*705.4	574.9	3747	2157842	*705.5	564.8	3747	2115479
720	586.8	3761	2206690	720	575.3	3761	2163377
760	619.4	3798	2352342	760	607.2	3798	2306083
800	652.0	3831	2497712	800	639.2	3831	2448736
840	684.6	3861	2643290	840	671.2	3861	2591197
880	717.2	3886	2786794	880	703.1	3886	2734048
920	749.8	3913	2934290	920	735.1	3913	2876584
960	782.4	3935	3079173	960	767.0	3935	3018675
**981.9	800.2	3933	3152642	**981.9	784.5	3933	3089154
1000	815.0	3894	3173520	1000	799.0	3894	3111319
1040	847.6	3856	3268180	1040	831.0	3856	3204029
1080	880.2	3820	3362756	1080	862.9	3820	3296739
1120	912.8	3788	3457286	1120	894.9	3788	3389183
*1145.9	933.9	3767	3518494	*1145.9	915.6	3767	3449423
1160	945.4	3776	3569678	1160	926.8	3776	3499599
1200	978.0	3799	3716147	1200	958.8	3799	3642212
1240	1010.6	3820	3860613	1240	990.8	3820	3784822
**1262.8	1029.2	3832	3943575	**1262.8	1009.0	3832	3866155

* Critical fuel quantities (moment change reversal)

** Critical fuel quantities (moment reversal)

Weights given are nominal values at 15°C (59°F).

For calculation purposes, use weight and moment values. (CG shown are derived from weight and moment values and rounded to whole numbers.)

412-FMS-65-5-5-2

Table 5-6. Usable fuel – lateral – w/16.3 gal aux fuel in LH position (English)

USABLE FUEL LOADING TABLE LATERAL CG (ENGLISH)							
[illegible] 16.3 US Gal Aux Tank – 331.6 US Gal							
JET A, A-1, JP-5, JP-8 (6.8 lb/US Gal)				JET B, JP-4 (6.5 lb/US Gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	136	0.0	0	20	130	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.5	425	0.0	0	62.5	406	0.0	0
70	476	-0.3	-121	70	455	-0.3	-122
80	544	-0.8	-427	80	520	-0.8	-429
90	612	-1.1	-681	90	585	-1.1	-657
100	680	-1.5	-1019	100	650	-1.5	-974
110	748	-1.8	-1346	110	715	-1.8	-1286
120	816	-2.0	-1672	120	780	-2.0	-1595
130	884	-2.3	-1997	130	845	-2.3	-1907
140	952	-2.4	-2316	140	910	-2.4	-2213
150	1020	-2.6	-2614	150	975	-2.6	-2502
155.3	1056	-2.5	-2615	155.3	1009	-2.5	-2502
157.5	1071	-2.7	-2898	157.5	1025	-2.7	-2775
160	1088	-2.7	-2937	160	1040	-2.7	-2807
170	1156	-2.6	-3050	170	1105	-2.6	-2874
180	1224	-2.6	-3190	180	1170	-2.6	-3063
186.7	1270	-2.6	-3261	186.7	1213	-2.6	-3132
190	1292	-2.5	-3261	190	1235	-2.5	-3132
200	1360	-2.4	-3261	200	1300	-2.4	-3132
210	1428	-2.3	-3261	210	1365	-2.3	-3132
220	1496	-2.2	-3261	220	1430	-2.2	-3132
230	1564	-2.1	-3261	230	1495	-2.1	-3132
240	1632	-2.0	-3261	240	1560	-2.0	-3132
250	1700	-1.9	-3261	250	1625	-1.9	-3132
254.1	1728	-1.9	-3261	254.1	1652	-1.9	-3132
260	1768	-1.9	-3261	260	1690	-1.9	-3132
270	1836	-1.8	-3261	270	1755	-1.8	-3132
280	1904	-1.7	-3261	280	1820	-1.7	-3132
290	1972	-1.7	-3261	290	1885	-1.7	-3132
300	2040	-1.6	-3261	300	1950	-1.6	-3132
302.7	2059	-1.6	-3261	302.7	1968	-1.6	-3132
310	2108	-1.6	-3281	310	2015	-1.6	-3132
320	2176	-1.5	-3286	320	2080	-1.5	-3141
330	2244	-1.5	-3297	330	2145	-1.5	-3151
331.6	2255	-1.5	-3301	331.6	2155	-1.5	-3156

[illegible]

[illegible]

412-FMS-65-5-6-1

Table 5-8. Usable fuel — lateral — w/61.7 litre aux fuel in LH position (Metric)

USABLE FUEL LOADING TABLE - LATERAL CG (METRIC)							
Basic with LH 61.7 litre Aux Tank - 1262.8 litres							
Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.790 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm-kg)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm-kg)
40	32.6	0	0	40	32.0	0	0
80	65.2	0	0	80	63.2	0	0
120	97.8	0	0	120	95.9	0	0
160	130.4	0	0	160	127.8	0	0
200	159.0	0	0	200	159.8	0	0
237.4	193.5	0	0	237.5	188.3	0	0
240	195.6	0	-93	240	191.8	0	-32
280	228.2	-13	-2977	280	221.7	-13	-2962
320	260.8	-21	-6185	320	255.7	-21	-6775
360	293.4	-34	-9903	360	287.6	-34	-9728
400	326.0	-41	-13371	400	319.6	-41	-13599
440	358.6	-50	-17033	440	351.6	-50	-17482
480	391.2	-56	-21738	480	383.5	-56	-21261
520	423.8	-61	-25718	520	415.5	-61	-25213
560	456.4	-66	-29468	560	447.4	-65	-28990
587.4	478.7	-63	-30152	587.4	469.0	-63	-29676
*597.2	486.7	-69	-33010	*597.2	477.2	-69	-32623
600	489.0	-69	-33810	600	479.4	-69	-32921
640	521.6	-67	-35130	640	511.4	-67	-34417
680	554.2	-66	-36744	680	543.3	-66	-36023
706.6	575.9	-66	-37408	706.6	564.6	-66	-37063
720	586.8	-64	-37376	720	575.1	-64	-37063
760	619.4	-61	-37306	760	607.2	-61	-37063
800	652.0	-57	-37406	800	639.2	-58	-37063
840	684.6	-55	-37806	840	671.2	-55	-37063
880	717.2	-53	-37506	880	703.1	-53	-37063
920	749.8	-50	-37806	920	735.1	-50	-37063
960	782.4	-48	-37806	960	767.0	-48	-37063
961.9	784.0	-48	-37506	961.9	768.5	-48	-37063
1000	815.0	-46	-37406	1000	799.0	-46	-37063
1040	847.6	-45	-37806	1040	831.0	-45	-37063
1080	880.2	-43	-37506	1080	862.9	-43	-37063
1120	912.8	-41	-37806	1120	894.9	-41	-37063
1145.9	933.9	-40	-37806	1145.9	915.6	-40	-37063
1160	945.4	-40	-37896	1160	926.8	-40	-37083
1200	978.0	-38	-37828	1200	958.8	-39	-37095
1240	1010.6	-38	-37963	1240	990.8	-38	-37236
1262.8	1029.2	-37	-38025	1262.8	1029.0	-37	-37281

* Critical fuel quantities for maximum CG condition.

Weights given are calculated at [illegible]

For calculation purposes use weight and moment values [illegible]. Weight and moment values are rounded to whole numbers.

412-FMS-65.5-8.2

Table 5-7. Usable fuel – longitudinal – w/16.3 gal aux fuel in RH position (English)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (ENGLISH) Based with RH 16.3 US Gal Aux Tank							
Jet A, A-1, JP-5, JP-8 (6.8 lb/Gal)				Jet B, JP-4 (6.5 lb/Gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	138.6	9424	10	65	138.6	9009
20	136	139.1	18921	20	130	139.1	18086
30	204	139.4	28442	30	195	139.4	27187
40	272	139.6	37962	40	260	139.6	36288
50	340	139.7	47483	50	325	139.7	45388
60	408	139.7	57005	60	390	139.7	54490
* 62.6	425	139.7	59486	* 62.6	407	139.7	56862
70	476	143.4	68237	70	455	143.4	65227
80	544	146.9	79910	80	520	146.9	76389
90	612	149.7	91587	90	585	149.7	87547
100	680	151.7	103177	100	650	151.7	98625
110	748	153.4	114749	110	715	153.4	109686
120	816	154.8	126337	120	780	154.8	120763
130	884	155.6	137519	130	845	156.0	131834
140	952	155.0	148506	140	910	157.0	142910
150	1020	158.0	161115	150	975	158.0	154002
** 155.2	1055	158.6	167290	** 155.2	1009	158.4	159803
160	1088	155.8	170961	160	1040	156.6	162845
170	1156	152.9	176706	170	1105	152.9	168912
180	1224	149.6	183051	180	1170	149.6	174965
* 186.7	1270	147.6	187292	* 186.7	1213	147.6	179029
190	1292	148.1	191589	190	1235	148.1	182902
200	1360	149.4	203944	200	1300	149.4	194377
210	1428	150.7	215196	210	1365	150.7	205704
220	1496	151.8	227151	220	1430	151.8	217174
230	1564	152.9	239109	230	1495	152.9	228554
240	1632	153.8	251054	240	1560	153.8	239978
250	1700	154.3	262304	250	1625	154.7	251401
* 254.1	1728	154.9	267648	* 254.1	1652	154.9	255940
260	1768	154.0	272317	260	1690	154.0	260204
270	1836	152.5	279985	270	1755	152.5	267530
280	1904	151.1	287761	280	1820	151.1	275053
290	1972	149.9	295518	290	1885	149.9	282461
300	2040	148.7	303274	300	1950	148.7	289899
* 302.7	2058	148.4	305397	* 302.7	1968	148.4	291919
310	2108	149.0	314085	310	2015	149.0	300232
320	2176	149.8	326537	320	2080	149.8	311459
330	2244	150.4	337285	330	2145	150.6	323074
** 333.6	2268	150.9	342287	** 333.6	2168	150.9	327158

* Critical fuel quantities for most forward CG condition [illegible]

** Critical fuel quantities for most aft CG condition

Weights given are nominal weights at 15°C (59°F).

For calculation purposes use weight and moment values [illegible] one decimal place.

412-FMS-65-5-7-1

Table 6-7. Usable fuel – longitudinal – w/81.7 litre aux fuel in RH position (Metric)

USABLE FUEL LOADING TABLE – LONGITUDINAL CG (METRIC)							
Based with RH 81.7 litre Aux Tank – 1262.8 litres							
JET A, A-1, JP-5, JP-8 (0.815 kg/l)				JET B, JP-4 (0.779 kg/l)			
Quantity (litre)	Weight (kg)	CG (mm)	Moment (mm-kg)	Quantity (litre)	Weight (kg)	CG (mm)	Moment (mm-kg)
40	32.6	3520	114758	40	32.0	3520	112525
80	65.2	3534	230432	80	63.9	3534	225907
120	97.8	3541	346339	120	95.9	3541	339540
160	130.4	3545	462247	160	127.8	3545	453172
200	163.0	3547	578156	200	159.8	3547	566815
* 237.0	193.1	3545	685553	* 237.0	189.3	3546	671898
240	195.5	3560	696321	240	191.8	3560	682651
280	228.2	3672	838498	280	223.7	3672	821011
320	260.8	3766	982117	320	255.7	3766	962837
360	293.4	3829	1123351	360	287.6	3829	1101299
400	326.0	3874	1262917	400	319.6	3873	1238021
440	358.6	3919	1405307	440	351.6	3917	1377716
480	391.2	3951	1546542	480	383.5	3950	1515085
520	423.8	3982	1687704	520	415.5	3982	1654516
560	456.4	4007	1828574	560	447.4	4007	1792725
** 587.4	478.7	4026	1927390	** 587.4	469.3	4026	1889552
600	489.0	3991	1951624	600	479.4	3991	1913308
640	521.6	3890	2029139	640	511.4	3890	1989[illegible]
680	554.2	3801	2106430	680	543.3	3801	2065087
* 706.6	575.9	3747	2157847	* 706.6	564.6	3747	2115478
720	586.8	3761	2205639	720	575.3	3761	2160371
760	619.4	3798	2352948	760	607.2	3798	2306261
800	652.0	3831	2497772	800	639.2	3831	2448792
840	684.6	3861	2643296	840	671.1	3861	2591307
880	717.2	3888	2788798	880	703.1	3888	2734043
920	749.8	3912	2933092	920	735.1	3912	2875884
960	782.4	3935	3078671	960	767.0	3935	3018529
** 981.9	[illegible]	3932	3053542	** 981.9	[illegible]	3932	[illegible]
1000	815.0	3894	3173604	1000	798.9	3894	3111919
1040	847.6	3856	3268190	1040	831.0	3856	3204024
1080	880.2	3820	3362756	1080	862.9	3820	3296219
1120	912.8	3788	3457256	1120	894.9	3788	3389933
* 1146.9	933.9	3767	3518494	* 1146.9	915.8	3767	3449673
1160	945.4	3776	3569870	1160	926.0	3776	3496649
1200	978.0	3798	3715187	1200	958.8	3798	3642212
1240	1010.6	3820	3860813	1240	990.8	3820	3784877
** 1262.8	1029.2	3832	3943675	** 1262.8	1008.6	3832	3865155

* [illegible]

** [illegible]

Weights given are nominal weights at [illegible]

For calculation purposes use Weight and Moment values. CGs shown are derived from Weight and Moment values and are for reference only.

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Table 5-8. Usable fuel – lateral – w/18.3 gal aux fuel in RH position (English)

USABLE FUEL LOADING TABLE — LATERAL CG (ENGLISH)							
Based with One 18.3 US Gal Aux Tank — 333.6 US Gal							
Jet A, A-1, JP-5, JP-8 (6.8 lb/Gal)				Jet B, JP-4 (6.5 lb/Gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	[illegible]	0.0	0	20	[illegible]	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.6	426	0.0	0	62.6	407	0.0	0
70	476	0.2	101	70	455	0.2	[illegible]
80	544	0.7	401	80	520	0.7	361
90	612	1.1	664	90	585	1.1	635
100	680	1.5	991	100	650	1.5	940
110	748	1.8	1319	110	715	1.8	1256
120	816	2.0	1644	120	780	2.0	1571
130	884	2.2	1974	130	845	2.2	1880
140	952	2.4	2269	140	910	2.4	2186
*155.0	1020	2.5	2570	*150.0	975	2.5	2472
155.2	1055	2.5	2597	155.2	1009	2.5	2477
160	1088	2.1	2277	160	1040	2.1	2177
170	1156	1.9	2151	170	1105	1.9	2056
180	1224	1.6	2016	180	1170	1.6	1927
184.7	1256	1.5	1928	184.7	1201	1.5	1843
190	1292	1.5	1928	190	1235	1.5	1843
200	1360	1.4	1928	200	1300	1.4	1843
210	1428	1.3	1928	210	1365	1.4	1843
220	1496	1.3	1928	220	1430	1.3	1843
230	1564	1.2	1928	230	1495	1.2	1843
240	1632	1.2	1928	240	1560	1.2	1843
250	1700	1.1	1928	250	1625	1.1	1843
254.1	1728	1.1	1928	254.1	1652	1.1	1843
260	1768	1.1	1928	260	1690	1.1	1843
270	1836	1.1	1928	270	1755	1.1	1843
280	1904	1.0	1928	280	1820	1.0	1843
290	1972	1.0	1928	290	1885	1.0	1843
300	2040	0.9	1928	300	1950	0.9	1843
302.7	2059	0.9	1928	302.7	1968	0.9	1843
310	2108	0.9	1925	310	2015	0.9	1842
320	2176	0.9	1924	320	2080	0.9	1839
330	2244	0.9	1913	330	2145	0.9	1829
333.6	2268	0.8	1909	333.6	2168	0.8	1825

* [illegible]

[illegible]

[illegible]

[illegible]

412-FMS-65-5-8-1

Table 5-8. Usable fuel - lateral - w/81.7 litre aux fuel in RH position (Metric)

USABLE FUEL LOADING TABLE - LATERAL CG (METRIC) Based with RH 81.7 Litre Aux Tank - 1262.5 Litres							
Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (liters)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	32.6	0	0	40	32.0	0	0
80	65.2	0	0	80	63.9	0	0
120	97.8	0	0	120	95.9	0	0
160	130.4	0	0	160	127.8	0	0
200	163.0	0	0	200	159.8	0	0
237.0	193.1	0	0	237.0	189.3	0	0
240	195.6	0	10	240	191.8	0	-10
280	228.2	12	2611	280	223.7	12	2579
320	260.8	21	5591	320	255.7	21	5461
360	293.4	33	9592	360	287.6	33	9416
400	326.0	42	13667	400	319.6	42	13051
440	358.6	49	17569	440	351.6	49	17185
480	391.2	55	21464	480	383.5	55	21063
520	423.8	60	25414	520	415.5	60	24116
560	456.4	64	29184	560	447.4	64	28592
567.8	462.8	65	29864	567.4	453.3	65	29276
587.4	478.7	62	29858	587.4	469.3	62	29272
600	489.0	58	28434	600	479.4	54	25930
640	521.6	48	24950	640	511.4	48	24425
680	554.2	42	23276	680	543.3	42	22614
706.6	575.9	39	22214	718.8	584.8	38	21776
720	586.8	38	22214	720	575.3	38	21776
760	619.4	36	22214	760	607.2	36	21776
800	652.0	34	22214	800	639.2	34	21776
840	684.6	32	22214	840	671.2	32	21776
880	717.2	31	22214	880	703.1	31	21776
920	749.8	30	22214	920	735.1	30	21776
960	782.4	28	22214	960	767.0	28	21776
961.9	784.0	28	22214	961.9	768.5	28	21776
1000	815.0	27	22214	1000	799.0	27	21776
1040	847.6	26	22214	1040	831.0	26	21776
1080	880.2	25	22214	1080	862.9	25	21776
1120	912.8	24	22214	1120	894.9	24	21776
1145.9	933.9	24	22214	1145.9	915.6	24	21776
1160	945.4	23	22214	1160	926.8	23	21776
1200	978.0	23	22162	1200	958.8	23	21756
1240	1010.6	22	22068	1240	990.8	22	21602
1262.5	1029.0	21	21952	1262.5	1009.0	21	21560

* [illegible]

Weights given are nominal weights at 15°C (59°F).
[illegible]

412-FMS-65-5-8-2

Table 5-9 Usable fuel – longitudinal – w/81.7 gal aux fuel in LH and RH position (English)

USABLE FUEL LOADING TABLE – LONGITUDINAL CG (ENGLISH)
Standard and 81.7 U.S. Gal Aux Tank

Jet A, A-1, JP-5, JP-8 (6.8 lb/gal)				JP-4 (6.5 lb/gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	140.6	9558	10	65	138.6	9009
20	136	139.1	18921	20	130	139.1	18086
30	204	139.4	28442	30	195	139.4	27187
40	272	139.5	37887	40	260	139.6	36299
50	341	139.7	47485	50	325	139.7	45399
60	409	139.7	57135	60	390	139.7	54483
* 62.9	428	139.7	59456	* 62.6	407	139.7	56852
70	476	140.3	66718	70	455	143.3	65303
80	544	145.4	79555	80	520	146.4	76153
90	612	146.1	90583	90	585	146.1	[illegible]
100	681	149.5	101671	100	650	149.6	97185
110	749	150.7	112590	110	715	150.7	107749
120	819	151.5	123514	120	780	151.6	118256
130	884	152.4	134738	130	845	152.4	128754
140	952	153.1	145767	140	910	153.1	139315
150	1020	153.7	156767	150	975	153.7	149875
160	1088	154.2	167811	160	1040	154.2	160428
170	1156	154.7	178836	170	1105	154.7	170944
180	1224	155.1	189910	180	1170	155.1	181487
190	1292	155.5	200913	190	1235	155.5	192048
200	1360	155.9	212080	200	1300	155.9	202669
** 207.9	1414	155.1	220687	** 207.9	1351	155.1	210031
210	1428	155.6	222336	210	1365	155.6	212225
220	1496	152.7	228466	220	1430	152.7	218304
230	1564	150.1	234776	230	1495	150.1	224988
* 237.4	1615	147.9	238698	* 237.4	1544	147.9	228087
240	1632	147.9	241753	240	1560	147.9	230713
250	1700	148.5	252018	250	1625	148.5	241278
260	1768	149.0	262938	260	1690	149.0	251675
270	1836	149.5	274418	270	1755	149.5	262305
280	1904	150.0	285651	280	1820	150.0	272966
290	1972	150.4	296411	290	1885	150.4	283516
300	2040	150.8	307624	300	1950	150.8	294076
310	2108	151.2	318690	310	2015	151.2	304636
320	2176	151.5	330743	320	2080	151.5	315196
330	2244	151.9	340792	330	2145	151.8	325755
340	2312	152.2	351636	340	2210	152.2	336314
350	2380	152.5	362993	350	2275	152.5	346874
360	2448	152.8	373933	360	2340	152.7	357434
370	2516	153.0	384975	370	2405	153.0	367992
* 371.7	2528	153.0	386045	* 371.7	2416	153.0	369205
380	2584	152.1	393968	380	2470	152.1	375551
390	2652	151.1	400726	390	2535	151.1	383756
400	2720	150.2	408783	400	2600	150.2	390481
410	2788	149.3	416867	410	2665	149.3	397302
* 420.0	2856	148.5	423881	* 420.0	2730	148.5	405284
430	2924	148.8	434742	430	2795	148.9	415525
440	2992	149.1	446196	440	2860	149.1	426453
450	3060	149.4	451180	450	2925	149.4	437015
460	3128	149.7	458574	460	2990	149.7	447587
470	3196	150.0	473567	470	3055	150.0	458133
480	3264	150.2	483510	480	3120	150.2	468679
** 480.7	3269	150.2	491061	** 480.7	3125	150.2	469618

* Denotes [illegible] CG condition [illegible]

** Denotes [illegible] CG condition

[illegible]

[illegible]

[illegible] 412-F-[illegible]

Table 5-9. Usable fuel – longitudinal – w/309.3 litre aux fuel in LH and RH position (Metric)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (METRIC)							
Basic with LH and RH 309.3 litre Aux Tanks - 1119.6 litres							
Jet A, Jet A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (kg mm)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (kg mm)
40	32.6	3522	114756	40	31.6	3560	112505
80	65.2	3578	233316	80	63.9	3524	225207
120	97.8	3581	350218	120	95.9	3541	335540
160	130.4	3545	462241	160	127.9	3545	453172
200	163.0	3547	578158	200	158.8	3547	566476
*237.5	193.1	3548	685152	*237.0	188.3	3548	671086
240	195.6	3550	694337	240	191.8	3550	682557
280	228.2	3674	838476	280	221.7	3674	812715
320	260.8	3740	975379	320	255.7	3740	954210
360	293.4	3781	1109340	360	287.8	3781	1087424
400	326.0	3814	1243330	400	319.6	3814	1218924
440	358.6	3841	1377456	440	351.6	3841	1350490
480	391.2	3864	1511129	480	383.5	3864	1482065
520	421.8	3883	1645554	520	415.5	3884	1613661
560	456.4	3900	1779788	560	447.4	3900	1745220
600	489.0	3915	1914264	600	479.4	3915	1876611
640	521.6	3928	2048561	640	511.4	3928	2008492
680	554.2	3937	2182225	680	543.3	3937	2140010
720	586.8	3947	2317355	720	575.3	3947	2271861
760	619.4	3953	2451821	760	607.2	3954	2402557
**791.3	641.4	3964	2547574	**787.0	624.6	3964	2492656
800	652.0	3939	2567240	800	639.2	3939	2517339
840	684.6	3864	2645538	840	671.2	3862	2593101
880	717.2	3796	2722363	880	703.1	3796	2668217
*905.2	738.5	3755	2770926	*916.2	724.0	3755	2719586
920	749.8	3760	2819467	920	735.1	3760	2764112
960	782.4	3776	2951940	960	767.0	3776	2895275
1000	815.0	3790	3088844	1000	799.0	3790	3027327
1040	847.6	3802	3224470	1040	831.0	3802	3159657
1080	880.2	3814	3356949	1080	862.8	3814	3291556
1120	912.8	3826	3491057	1120	894.9	3826	3423412
1160	945.4	3836	3626063	1160	926.8	3836	3555268
1200	978.0	3846	3760955	1200	958.8	3846	3687121
1240	1010.6	3855	3895443	1240	990.8	3855	3818961
1280	1043.2	3863	4029929	1280	1022.7	3863	3950414
1320	1075.8	3871	4164415	1320	1054.7	3871	4082560
1360	1108.4	3878	4298900	1360	1086.6	3878	4214625
1400	1141.0	3886	4433380	1400	1118.6	3886	4344245
**1425.7	1149.8	3884	4450035	**1405.7	1123.1	3884	4465872
1440	1173.6	3851	4521142	1440	1150.1	[illegible]	4462177
1480	1206.2	3839	4635696	1480	1182.5	3838	4594847
1520	1238.8	3813	4720765	1520	1214.4	3813	4621542
1560	1271.4	3787	4814172	1560	1246.4	3781	4720249
*1595.7	1299.6	3775	4904891	*1549.2	1270.2	3775	4795591
1600	1304.0	3771	4917488	1600	1278.4	3773	4800988
1640	1336.6	3757	5024044	1640	1310.4	3757	4954823
1680	1369.2	3749	5148511	1680	1342.3	3789	5087771
1720	1401.8	3797	5327267	1720	1374.3	3797	5224467
1760	1434.4	3805	5457415	1760	1406.3	3805	5356274
1800	1467.0	3812	5591961	1800	1438.2	3812	5489762
**1817.6	1483.0	3815	5657186	**1817.6	1451.9	3815	5528521

* Max fuel quantities for most forward CG condition (full flight range only).

** Max fuel quantities for most aft CG condition.

Weights given are nominal weights at 15 °C (59 °F).

For calculation purposes, use weight and moment values. CG shown are derived from weight and moment values.

Moment values are rounded to whole numbers.

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Table 5-10. Usable fuel – lateral – w/163.4 gal aux fuel in LH and RH position (English)

USABLE FUEL LOADING TABLE - LATERAL CG - ENGLISH
Both 163.4 (LH and RH) U.S. Gal Aux Tanks - 480.7 U.S. Gal

Jet A, A-1, JP-5, JP-8 (6.8 lb/U.S. Gal)				Jet B, JP-4 (6.5 lb/U.S. Gal)			
Quantity (U.S. Gal)	Weight (lb)	CG (in)	Moment (in-lb)	Quantity (U.S. Gal)	Weight (lb)	CG (in)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	136	0.0	0	20	130	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.6	426	0.0	0	62.6	407	0.0	0
70	476	0.0	12	70	455	0.0	-11
80	544	0.0	-13	80	520	0.0	-11
90	612	0.0	13	90	585	0.0	-11
100	680	0.0	13	100	650	0.0	-11
110	748	0.0	-13	110	715	0.0	-11
120	816	0.0	13	120	780	0.0	-12
130	884	0.0	-13	130	845	0.0	-12
140	952	0.0	13	140	910	0.0	-12
150	1020	0.0	13	150	975	0.0	-12
160	1088	0.0	13	160	1040	0.0	-12
170	1156	0.0	13	170	1105	0.0	-12
180	1224	0.0	13	180	1170	0.0	-12
190	1292	0.0	13	190	1235	0.0	-12
200	1360	0.0	13	200	1300	0.0	-12
207.9	1414	0.0	13	207.9	1351	0.0	-12
210	1428	-0.2	257	210	1365	0.2	-245
220	1496	-0.3	419	220	1430	0.3	-401
230	1564	-0.4	553	230	1495	0.4	-529
*233.4	1587	-0.4	677	*233.4	1518	0.4	-647
240	1632	-0.4	-677	240	1560	0.4	-647
250	1700	-0.4	-677	250	1625	0.4	647
260	1768	-0.4	677	260	1690	0.4	647
270	1836	-0.4	677	270	1755	0.4	647
280	1904	-0.4	-677	280	1820	0.4	647
290	1972	-0.3	677	290	1885	0.3	647
300	2040	-0.3	-677	300	1950	0.3	647
310	2108	-0.3	-677	310	2015	0.3	647
320	2176	-0.3	-677	320	2080	0.3	647
330	2244	-0.3	677	330	2145	0.3	647
340	2312	-0.3	-677	340	2210	0.3	647
350	2380	0.3	-677	350	2275	0.3	647
360	2448	0.3	677	360	2340	-0.3	647
370	2516	0.3	677	370	2405	-0.3	-647
371.3	2525	0.3	677	371.3	2414	-0.3	-647
380	2584	0.3	677	380	2470	-0.3	-647
390	2652	0.3	677	390	2535	-0.3	-647
400	2720	0.2	677	400	2600	-0.2	-647
410	2788	0.2	677	410	2665	-0.2	-647
420.3	2858	-0.2	-677	420.0	2730	-0.2	-647
430	2924	-0.2	677	430	2795	-0.2	-647
440	2992	0.2	-677	440	2860	-0.2	-588
450	3060	0.2	580	450	2925	-0.2	-592
460	3128	0.2	580	460	2990	-0.2	-594
470	3196	0.2	[illegible]	470	3055	-0.2	-595
480	3264	0.2	530	480	3120	-0.2	-555
480.7	3269	0.2	646	480.7	3125	-0.2	-555

* Critical fuel quantity for most [illegible] CG [illegible]

Weight given are for [illegible] temperature at 15°C (59°F).
For calculation purposes, use weight and moment values; CG is [illegible] rounded from weight and moment values.

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Table 5-10. Usable fuel – lateral – w/816.5 litre aux fuel in LH and RH position (Metric)

USABLE FUEL LOADING TABLE – LATERAL CG (METRIC)

Equipment: LH and RH [illegible] Litre Aux Tank [illegible]

Jet A, Jet A-1, JP-5, JP-8 (0.815 kg/L)				Jet B, JP-4 (0.799 kg/L)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (kg·mm)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (kg·mm)
40	32.6	0	0	40	32.0	0	0
80	65.2	0	0	80	63.9	0	0
120	97.8	0	0	120	95.9	0	0
160	130.4	0	0	160	127.8	0	0
200	163.0	0	0	200	159.8	0	0
211.2	172.1	0	0	211.9	169.3	0	0
240	195.6	0	-74	240	191.8	0	-24
280	228.2	-1	-147	280	223.7	-1	-144
320	260.8	-1	-152	320	255.7	-1	-148
360	293.4	-1	-152	360	287.6	-1	-148
400	326.0	0	-152	400	319.6	0	-149
440	358.6	0	-152	440	351.6	0	-149
480	391.2	0	-152	480	383.5	0	-149
520	423.8	0	-152	520	415.5	0	-149
560	456.4	0	-152	560	447.4	0	-149
600	489.0	0	-152	600	479.4	0	-149
640	521.6	0	-152	640	511.4	0	-149
680	554.2	0	-152	680	543.3	0	-149
720	586.8	0	-152	720	575.3	0	-149
760	619.4	0	-152	760	607.2	0	-149
787.0	641.4	0	-152	787.0	628.8	0	-149
800	652.0	-5	-3564	800	639.2	-5	-3514
840	684.6	-7	-5117	840	671.2	-7	-5010
880	717.2	-9	-6749	880	703.1	-9	-6617
*906.2	738.5	-11	-7795	*906.2	724.0	-11	-7643
920	749.8	-10	-7796	920	735.1	-10	-7643
960	782.4	-10	-7796	960	767.0	-10	-7643
1000	815.0	-10	-7796	1000	799.0	-10	-7643
1040	847.6	-9	-7796	1040	831.0	-9	-7643
1080	880.2	-9	-7796	1080	862.9	-9	-7643
1120	912.8	-9	-7796	1120	894.9	-9	-7643
1160	945.4	-8	-7796	1160	926.8	-8	-7643
1200	978.0	-8	-7796	1200	958.8	-8	-7643
1240	1010.6	-8	-7796	1240	990.8	-8	-7643
1280	1043.2	-7	-7796	1280	1022.7	-7	-7643
1320	1075.8	-7	-7796	1320	1054.7	-7	-7643
1360	1108.4	-7	-7796	1360	1086.6	-7	-7643
1400	1141.0	-7	-7796	1400	1118.6	-7	-7643
1405.7	1145.6	-7	-7796	1405.7	1123.1	-7	-7643
1440	1173.6	-7	-7797	1440	1150.6	-7	-7643
1480	1206.2	-6	-7796	1480	1182.5	-6	-7643
1520	1238.8	-6	-7796	1520	1214.5	-6	-7643
1560	1271.4	-6	-7796	1560	1246.4	-6	-7643
1589.7	1295.6	-6	-7796	1589.7	1270.2	-6	-7643
1600	1304.0	-6	-7796	1600	1278.4	-6	-7643
1640	1336.6	-6	-7796	1640	1310.4	-6	-7643
1680	1369.2	-6	-7810	1680	1342.3	-6	-7657
1720	1401.8	-5	-7856	1720	1374.3	-5	-7702
1760	1434.4	-5	-7919	1760	1406.2	-5	-7754
1800	1467.0	-5	-7965	1800	1438.2	-5	-7828
1819.5	1483.0	-5	-8013	1817.6	1452.3	-5	-7880

* [illegible]

Weights given are nominal weights at [illegible]

For calculation purposes [illegible]

[illegible]

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Table 5-11. Usable fuel – longitudinal – w/81.7 gal aux fuel in LH position (English)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (ENGLISH)							
Basic w/LH 81.7 US Gal Aux Tank: 399.0 US Gal							
Jet A, A-1, JP-5, JP-8 (6.8 lb/US Gal)				Jet B, JP-4 (6.5 lb/US Gal)			
Quantity US Gal	Weight lb	CG inches	Moment in-lb	Quantity US Gal	Weight lb	CG inches	Moment in-lb
10	68	138.6	9424	10	65	138.5	9003
20	136	139.1	18921	20	130	139.1	18084
30	204	139.4	28442	30	195	139.4	27187
40	272	139.6	37962	40	260	139.6	36296
50	340	139.7	47498	50	325	139.7	45388
60	408	139.8	57038	60	390	139.7	54490
*62.6	426	139.6	59456	*62.6	407	139.7	56862
70	476	141.4	67272	70	455	143.4	65250
80	544	145.5	79148	80	520	146.2	76024
90	612	149.0	91179	90	585	149.0	87137
100	680	150.7	102448	100	650	150.7	97962
110	748	152.2	113821	110	715	152.2	108799
120	816	153.4	125177	120	780	153.4	119632
130	884	154.4	136485	130	845	154.4	130465
140	952	155.3	147842	140	910	155.3	141292
150	1020	156.0	159153	150	975	156.0	152133
160	1088	156.7	170502	160	1040	156.7	162981
170	1156	157.3	181857	170	1105	157.3	173834
*172.4	1172	157.5	185096	*172.4	1121	157.5	177502
180	1224	155.1	189891	180	1170	155.1	181521
190	1292	151.9	196246	190	1235	151.9	187588
200	1360	149.0	202640	200	1300	149.7	194562
*204.9	1393	147.7	205749	*204.9	1332	147.7	196736
210	1428	148.1	211513	210	1365	148.1	202167
220	1496	149.0	222472	220	1430	149.0	213140
230	1564	149.8	234226	230	1495	149.8	223932
240	1632	150.5	245579	240	1560	150.5	234746
250	1700	151.1	256870	250	1625	151.1	245597
260	1768	151.7	268205	260	1690	151.7	256440
270	1836	152.3	279637	270	1755	152.3	267300
280	1904	152.8	290940	280	1820	152.8	278151
290	1972	153.3	302340	290	1885	153.3	288951
300	2040	153.6	313441	300	1950	153.6	299652
**304.5	2071	153.9	318655	**304.5	1980	153.9	304596
310	2108	153.0	322664	310	2015	153.0	308425
320	2176	151.9	330571	320	2080	151.9	316045
330	2244	150.8	338399	330	2145	150.8	323467
340	2312	149.7	346105	340	2210	149.7	330891
350	2380	148.7	353906	350	2275	148.7	338311
*353.0	2400	148.5	356399	*353.0	2296	148.4	340673
360	2448	149.2	365183	360	2340	148.8	348159
370	2516	149.6	376481	370	2405	149.0	358217
380	2584	149.7	386832	380	2470	149.7	369766
390	2652	150.1	398183	390	2535	150.1	380513
**399.0	2713	150.5	408291	**399.0	2594	150.5	390378

* [illegible]

** [illegible]

[illegible]

[illegible]

[illegible]

412-FMS-65-5-11-1

Table 5-11. Usable fuel – longitudinal – w/309.3 litre aux fuel in LH position (Metric)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (METRIC)

Basic with LH 309.3 Litre Aux Tank - 1517.4 Litres

Jet A, A-1, JP-5, JP-8 (0.812 kg/l)				Jet B, JP-4 (0.793 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm-kg)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm-kg)
40	32.5	3525	114758	40	32.0	3525	112595
80	65.0	3534	230430	80	64.0	3534	225907
120	97.5	3541	345349	120	95.9	3541	339540
160	130.0	3545	462247	160	127.8	3545	453172
200	162.5	3547	578156	200	159.8	3547	566605
*237.0	192.1	3548	626363	*237.0	189.3	3548	671635
240	195.0	3550	696127	240	191.8	3550	680657
280	228.7	3653	839541	280	223.7	3650	823565
320	260.5	3754	979307	320	255.7	3754	959783
360	292.4	3807	1113151	360	287.8	3807	1094927
400	325.0	3849	1254410	400	319.6	3849	1230174
440	357.5	3853	1302777	440	351.6	3884	1365434
480	391.2	3913	1530743	480	383.5	3913	1500692
520	423.6	3937	1668711	520	415.5	3937	1635951
560	455.4	3953	1876650	560	447.4	3953	1771315
600	487.0	3977	1944127	600	479.4	3977	1906645
640	521.6	3994	2083650	640	511.4	3994	2042165
**656.2	534.9	4000	2138449	**656.3	524.4	4000	2097447
680	552.2	3943	2155216	680	543.3	3943	2142316
720	586.8	3956	2262497	720	575.3	3956	2276083
760	619.4	3774	2338857	760	607.2	3774	2293921
*775.5	612.1	3750	2369900	*775.5	619.6	3750	2323374
800	652.0	3765	2454653	800	639.2	3765	2406572
840	684.6	3787	2592884	840	671.2	3787	2541835
880	717.2	3804	2730905	880	703.1	3804	2674793
920	749.8	3827	2869193	920	735.1	3827	2812796
960	782.4	3844	3007537	960	767.0	3844	2948297
1000	815.0	3862	3146545	1000	799.0	3860	3085742
1040	847.6	3874	3283737	1040	831.0	3874	3219041
1080	880.2	3885	3421545	1080	862.9	3883	3354766
1120	912.8	3902	3561182	1120	894.9	3900	3490049
**1161.0	939.7	3902	3671304	**1153.0	921.2	3902	3594215
1160	945.4	3901	3667409	1160	926.8	3901	3615527
1200	978.0	3861	3767491	1200	958.8	3865	3705240
1240	1010.6	3836	3877084	1240	990.8	3835	3800150
1280	1043.2	3807	3971622	1280	1022.7	3807	3893453
1320	1075.8	3783	4068111	1320	1054.7	3782	3988256
*1337.0	1089.8	3768	4106161	*1337.0	1068.2	3768	4025649
1360	1108.4	3776	4185772	1360	1086.6	3776	4103336
1400	1141.0	3790	4322953	1400	1118.6	3790	4239164
1440	1173.6	3802	4462175	1440	1150.6	3802	4374514
1480	1206.2	3814	4600277	1480	1182.5	3814	4509964
**1517.4	1231.0	3822	4705202	**1517.4	1205.6	3822	4607430

* Critical fuel quantities for most forward CG condition [illegible]

** Critical fuel quantities for most aft CG condition [illegible]

Weights given are nominal weights at 15 °C (59 °F).

For calculation purposes, use weight and moment values. CGs shown are derived from weight and moment values and rounded to whole numbers.

412-FMS-65-5-11-2

Table 5-12 Usable fuel – lateral – w/81.7 gal aux fuel in LH position (English)

USABLE FUEL LOADING TABLE - LATERAL CG (ENGLISH)							
Based on [illegible] 81.7 U.S. Gal Aux Tank [illegible] U.S. Gal							
JET A, JET A-1, JP-5, JP-8 (6.8 lb/U.S. Gal)				JET B, JP-4 (6.5 lb/U.S. Gal)			
Quantity (U.S. Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (U.S. Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	136	0.0	0	20	130	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.6	426	0.0	0	62.6	407	0.0	0
70	476	-0.2	-95	70	455	-0.2	-91
80	544	-1.0	-545	80	520	-1.0	-520
90	612	-2.1	-1282	90	585	-2.1	-1226
100	680	-2.8	-1924	100	650	-2.8	-1843
110	748	-3.4	-2547	110	715	-3.5	-2475
120	816	-4.0	-3245	120	780	-4.0	-3152
130	884	-4.4	-3901	130	845	-4.4	-3730
140	952	-4.8	-4559	140	910	-4.5	-4056
150	1020	-5.1	-5213	150	975	-5.1	-4983
160	1088	-5.4	-5856	160	1040	-5.3	-5536
170	1156	-5.6	-6491	170	1105	-5.4	-5995
173.4	1179	-5.7	-6726	173.4	1127	-5.7	-6410
180	1224	-5.8	-7042	180	1170	-5.8	-6721
190	1292	-5.5	-7120	190	1235	-5.6	-6965
200	1360	-5.4	-7325	200	1300	-5.4	-6983
204.9	1393	-5.3	-7364	204.9	1332	-5.3	-7054
210	1428	-5.4	-7635	210	1365	-5.4	-7350
220	1496	-5.6	-8371	220	1430	-5.6	-7983
230	1564	-5.7	-8956	230	1495	-5.7	-8521
240	1632	-5.9	-9628	240	1560	-5.9	-9175
250	1700	-6.0	-10237	250	1625	-6.0	-9795
260	1768	-6.0	-10672	260	1690	-6.1	-10307
270	1836	-6.3	-11504	270	1755	-6.3	-10999
280	1904	-6.4	-12143	280	1820	-6.4	-11606
290	1972	-6.5	-12777	290	1885	-6.5	-12213
300	2040	-6.6	-13411	300	1950	-6.6	-12820
* 304.6	2071	-6.6	-13661	* 304.6	1980	-6.6	-13058
310	2108	-6.5	-13661	310	2015	-6.5	-13058
320	2176	-6.3	-13661	320	2080	-6.3	-13058
330	2244	-6.1	-13661	330	2145	-6.1	-13058
340	2312	-5.9	-13661	340	2210	-5.9	-13058
350	2380	-5.7	-13661	350	2275	-5.7	-13058
353.2	2402	-5.7	-13661	353.2	2296	-5.7	-13058
360	2448	-5.9	-14393	360	2340	-5.8	-13471
370	2516	-5.9	-14729	370	2405	-5.8	-14010
380	2584	-5.9	-15270	380	2470	-5.9	-14495
390	2652	-6.0	-16014	390	2535	-6.0	-15306
399.6	2717	-6.1	-16594	399.6	2597	-6.1	-15842

* [illegible]

Weight given [illegible] U.S. Gal.
For calculation purposes, use Weight and Moment values. (CG) values are derived from Weight and Moment values [illegible].

412-FMS-65-6-19-1

Table 5-12. Usable fuel – lateral — w/309.3 litre aux fuel in LH position (Metric)

USABLE FUEL LOADING TABLE - LATERAL CG (METRIC)							
Basic with LH 309.3 litre Aux Tank - 1510.4 Litres							
Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (litre)	Weight (kg)	CG (mm)	Moment (mm-kg)	Quantity (litre)	Weight (kg)	CG (mm)	Moment (mm-kg)
40	32.6	0	0	40	32.0	0	0
80	65.2	0	0	80	63.9	0	0
120	97.8	0	0	120	95.9	0	0
160	130.4	0	0	160	127.8	0	0
200	163.0	0	0	200	159.8	0	0
237.0	193.1	0	0	237.0	189.4	0	0
240	195.6	0	24	240	191.8	0	24
280	228.2	-13	-2966	280	223.7	-13	-2879
320	260.8	-39	-10172	320	255.7	-39	-10002
360	293.4	-63	-18472	360	287.6	-63	-18101
400	326.0	-81	-26520	400	319.6	-81	-25886
440	358.6	-96	-34546	440	351.6	-96	-33854
480	391.2	-108	-42547	480	383.5	-109	-41707
520	423.8	-113	-47841	520	415.5	-113	-46949
560	456.4	-128	-58427	560	447.4	-128	-57269
600	489.0	-136	-66327	600	479.4	-136	-65198
640	521.6	-142	-74112	640	511.4	-142	-72617
656.3	534.9	-144	-77260	656.3	524.4	-144	-75514
680	554.2	-146	-81033	680	543.3	-146	-79421
720	586.8	-141	-82633	720	575.3	-141	-81011
760	619.4	-136	-84240	760	607.2	-136	-82625
775.6	632.1	-134	-84914	775.6	619.8	-134	-83237
800	652.0	-137	-89610	800	639.2	-137	-87829
840	684.6	-142	-97373	840	671.2	-142	-95406
880	717.2	-147	-105412	880	703.1	-147	-103042
920	749.8	-151	-112846	920	735.1	-151	-110621
960	782.4	-154	-120574	960	767.0	-154	-118213
1000	815.0	-157	-128209	1000	799.0	-157	-125742
1040	847.6	-161	-136247	1040	831.0	-161	-133571
1080	880.2	-163	-143771	1080	862.9	-163	-140942
1120	912.8	-166	-151493	1120	894.9	-166	-148524
*1153.0	939.7	-167	-157287	*1153.0	921.2	-167	-154297
1160	945.4	-166	-157287	1160	926.8	-166	-154297
1200	978.0	-161	-157287	1200	958.8	-161	-154297
1240	1010.6	-156	-157287	1240	990.8	-156	-154297
1280	1043.2	-151	-157287	1280	1022.7	-151	-154297
1320	1075.8	-146	-157287	1320	1054.7	-146	-154297
1337.6	1089.6	-144	-157287	1337.6	1068.2	-144	-154297
1360	1108.4	-146	-161840	1360	1086.6	-146	-158642
1400	1141.0	-149	-169585	1400	1118.6	-149	-166265
1440	1173.6	-151	-177287	1440	1150.6	-151	-173905
1480	1206.2	-154	-185026	1480	1182.5	-154	-181581
1510.4	1231.0	-155	-191111	1510.4	1206.8	-155	-187420

* Critical fuel quantity [illegible]

Weights given are nominal weights at [illegible]
For [illegible]
and [illegible]

412-FMS-65-5-12-2

Table 5-13. Usable fuel – longitudinal – w/81.7 gal aux fuel in RH position (English)

USABLE FUEL LOADING TABLE – LONGITUDINAL CG (ENGLISH)							
Jet A, A-1, JP-5, JP-8 (6.8 lb/Gal)				Jet B, JP-4 (6.5 lb/Gal)			
Quantity (U.S. Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (U.S. Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	[illegible]	126.6	8620	10	65	126.8	8229
20	136	124.1	16921	20	130	124.1	16086
30	204	129.4	26447	30	195	129.4	25247
40	272	129.6	35261	40	260	129.6	36048
50	340	129.7	44098	50	325	129.7	42385
60	408	129.7	52905	60	390	129.7	54490
* 62.6	425	129.7	55136	* 62.6	407	129.7	56842
70	476	143.2	68222	70	455	143.2	65156
80	544	146.6	79748	80	520	146.6	76224
90	612	149.0	91188	90	585	149.0	87137
100	680	150.7	102488	100	650	150.7	97962
110	748	152.2	113821	110	715	152.2	108792
120	816	153.4	125152	120	780	153.4	119652
130	884	154.6	136605	130	845	154.4	130466
140	952	155.0	147510	140	910	155.0	141297
150	1020	156.0	159155	150	975	156.0	152190
160	1088	156.7	170501	160	1040	156.7	162980
170	1156	157.3	181857	170	1105	157.3	173834
** 173.4	1179	157.5	185695	** 173.4	1127	157.5	177503
180	1224	155.1	189892	180	1170	155.1	181521
190	1292	151.9	196245	190	1235	151.9	187568
200	1360	149.0	202700	200	1300	149.0	193662
* 204.2	1389	147.7	205598	* 204.2	1327	147.7	196023
210	1428	148.1	211510	210	1365	148.1	202167
220	1496	149.0	222872	220	1430	149.0	213040
230	1564	149.8	234225	230	1495	149.8	223992
240	1632	150.5	245573	240	1560	150.5	234746
250	1700	151.1	256832	250	1625	151.1	245597
260	1768	151.7	268285	260	1690	151.7	256449
270	1836	152.3	279637	270	1755	152.3	267300
280	1904	152.8	290884	280	1820	152.6	278151
290	1972	153.3	302160	290	1885	153.3	289001
300	2040	153.8	313691	300	1950	153.8	299852
** 304.6	2071	153.9	318855	** 304.6	1980	153.9	304596
310	2108	153.2	322968	310	2015	153.2	308720
320	2176	151.9	330531	320	2080	151.9	315945
330	2244	150.6	338093	330	2145	150.6	323409
340	2312	149.7	346185	340	2210	149.7	330827
350	2380	148.7	353936	350	2275	148.7	338311
* 351.2	2388	148.6	356790	* 351.2	2283	148.4	340675
360	2448	148.7	364133	360	2340	148.7	348050
370	2516	149.2	375481	370	2405	149.2	356017
380	2584	149.7	386332	380	2470	149.7	369755
390	2652	150.1	398183	390	2535	150.1	380613
* 392.6	2712	152.5	408891	* 392.6	2594	152.5	396276

* [illegible]

** [illegible]

[illegible]

412-FMS-65-5-13-1

Table 5-13. Usable fuel — longitudinal — w/309.3 litre aux fuel in RH position (Metric)

USABLE FUEL LOADING TABLE - LONGITUDINAL CG (METRIC)

Based with RH 309.3 litre Aux Tank + 15°C [illegible]

Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm kg)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (mm kg)
40	32.6	3520	114756	40	32.0	3520	[illegible]
80	65.2	3514	[illegible]	80	63.9	3534	225907
120	97.8	3541	346328	120	95.9	3531	[illegible]
160	130.4	3535	461247	160	127.8	3545	453172
200	163.0	3547	578136	200	159.8	3541	565805
* 227.0	185.0	3546	656035	* 227.0	181.3	3546	642895
240	195.6	3560	696327	240	191.8	3560	682667
280	228.2	3645	831849	280	223.7	3640	814285
320	260.8	3754	979007	320	255.7	3754	959747
360	293.4	3821	1121092	360	287.6	3807	1094927
400	326.0	3862	1259010	400	319.6	3845	1229176
440	358.6	3884	1392777	440	351.6	3884	1365434
480	391.2	3913	1530742	480	383.5	3911	1500092
520	423.8	3932	1666711	520	415.5	3932	1633951
560	456.4	3952	1803684	560	447.4	3951	1771215
600	489.0	3977	1944817	600	479.4	3977	1906646
640	521.6	3994	2083059	640	511.4	3994	2043155
** 656.3	534.9	4090	2129449	** 656.3	524.4	4090	2097447
680	554.2	3943	2185218	680	543.3	3943	2142316
720	586.8	3956	2242497	720	575.3	3956	2275980
760	619.4	3774	2525857	760	607.2	3774	2291931
* 775.5	632.1	3750	2369920	* 775.5	619.5	3750	2323374
800	652.0	3765	2454454	800	639.2	3765	2405275
840	684.6	3767	2591694	840	671.2	3767	2541795
880	717.2	3824	2701415	880	703.1	3826	2677232
920	749.8	3827	2869173	920	735.1	3827	2812705
960	782.4	3844	3007917	960	767.0	3844	2948292
1000	815.0	3860	3146848	1000	799.0	3850	3082792
1040	847.6	3874	3282747	1040	831.0	3874	3218281
1080	880.2	3898	3421946	1080	862.9	3898	3354706
1120	912.8	3920	3582142	1120	894.9	3920	3490244
** 1153.0	939.7	3937	3571304	** 1153.0	921.2	3937	3569230
1160	945.4	3931	3487404	1160	926.8	3931	3615537
1200	978.0	3856	3767498	1200	958.8	3856	3708240
1240	1010.6	3816	3877364	1240	990.8	3816	3800250
1280	1043.2	3807	3971622	1280	1022.7	3807	3893852
1320	1075.8	3785	4068113	1320	1054.7	3785	3986266
* 1337.5	1089.6	3765	4126187	* 1337.5	1068.7	3768	4025749
1360	1108.4	3776	4185272	1360	1086.6	3775	4103898
1400	1141.0	3792	4332852	1400	1118.6	3790	4239064
1440	1173.6	3802	4452119	1440	1150.5	3802	4374519
1480	1206.2	3814	4620277	1480	1182.5	3814	4509854
** 1515.4	1231.0	3822	4725207	** 1515.4	1206.8	3822	4612820

* Critical fuel quantities for most forward CG condition, includes unusable fuel.

** Critical fuel quantities for most aft CG condition.

Weights given are nominal weights at 15°C (59°F).

For calculation purposes, take weight and moment values from [illegible] the nearest [illegible] weight and moment values and round to the nearest decimal.

412-FMS-65-5-13-2

Table 5-14. Usable fuel - lateral - w/81.7 gal aux fuel in RH position (English)

USABLE FUEL LOADING TABLE - LATERAL CG (ENGLISH) Basic with RH 81.7 US Gal Aux Tank - 399.0 US Gal							
JET A, JET A-1, JP-5, JP-8 (6.8 lb/Gal)				JET B, JP-4 (6.5 lb/Gal)			
Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)	Quantity (US Gal)	Weight (lb)	CG (inches)	Moment (in-lb)
10	68	0.0	0	10	65	0.0	0
20	136	0.0	0	20	130	0.0	0
30	204	0.0	0	30	195	0.0	0
40	272	0.0	0	40	260	0.0	0
50	340	0.0	0	50	325	0.0	0
60	408	0.0	0	60	390	0.0	0
62.6	426	0.0	0	62.6	407	0.0	5
70	476	0.1	64	70	455	0.1	61
80	544	1.0	539	80	520	1.0	515
90	612	2.0	1230	90	585	2.0	1181
100	680	2.8	1902	100	650	2.8	1818
110	748	3.4	2561	110	715	3.4	2448
120	816	3.9	3219	120	780	3.9	3077
130	884	4.4	3896	130	845	4.4	3705
140	952	4.8	4570	140	910	4.8	4304
150	1020	5.1	5184	150	975	5.1	4958
160	1088	5.4	5828	160	1040	5.4	5571
170	1156	5.6	6485	170	1105	5.6	6179
173.4	1179	5.7	6660	173.4	1127	5.7	6345
180	1224	5.2	6343	180	1170	5.2	6063
190	1292	4.8	6216	190	1235	4.8	5942
200	1360	4.5	6080	200	1300	4.5	5812
204.9	1393	4.3	6016	204.9	1332	4.3	5761
210	1428	4.4	6342	210	1365	4.4	6062
220	1496	4.7	6870	220	1430	4.7	6570
230	1564	4.9	7613	230	1495	4.9	7277
240	1632	5.1	8248	240	1560	5.1	7884
250	1700	5.2	8803	250	1625	5.2	8442
260	1775	5.4	9518	260	1690	5.4	9098
270	1836	5.5	10174	270	1755	5.5	9726
280	1904	5.7	10785	280	1820	5.7	10313
290	1972	5.8	11425	290	1885	5.8	10919
300	2040	5.9	12068	300	1950	5.9	11526
*304.6	2071	5.9	12307	*304.5	1980	5.9	11764
310	2108	5.8	12307	310	2015	5.8	11764
320	2176	5.7	12307	320	2080	5.7	11764
330	2244	5.5	12307	330	2145	5.5	11764
340	2312	5.3	12307	340	2210	5.3	11764
350	2380	5.2	12307	350	2275	5.2	11764
351.2	2388	5.1	12307	351.2	2283	5.1	11764
360	2448	5.2	12740	360	2340	5.2	12178
370	2516	5.3	13374	370	2405	5.3	12784
380	2584	5.4	14005	380	2470	5.4	13395
390	2652	5.5	14635	390	2535	5.5	13989
399.0	2713	5.6	15202	399.0	2594	5.6	14531

* [illegible]

[illegible]

[illegible]

[illegible]

412-FMS-65-5-14-1

Table 6-14. Usable fuel — lateral — w/309.3 litre aux fuel in RH position (Metric)

USABLE FUEL LOADING TABLE — LATERAL CG (METRIC) Basic with RH 309.3 litre Aux Tank							
Jet A, A-1, JP-5, JP-8 (0.815 kg/l)				Jet B, JP-4 (0.799 kg/l)			
Quantity (litres)	Weight (kg)	CG (mm)	Moment (kg-mm)	Quantity (litres)	Weight (kg)	CG (mm)	Moment (kg-mm)
40	32.6	0	0	40	32.0	0	0
80	65.2	0	0	80	63.9	0	0
120	97.8	0	0	120	95.9	0	0
160	130.4	0	0	160	127.8	0	0
200	163.0	0	0	200	159.8	0	0
237.0	193.1	0	0	237.0	189.3	0	0
240	195.6	0	24	240	191.8	0	24
280	228.2	11	2509	280	223.7	11	2528
320	260.8	28	8880	320	255.7	28	7174
360	293.4	52	15166	360	287.6	52	14811
400	326.0	85	25216	400	319.6	80	25401
440	358.6	95	34712	440	351.6	95	33561
480	391.2	104	42219	480	383.5	108	41403
520	423.8	114	48217	520	415.5	119	49257
560	456.4	124	55773	560	447.4	129	57780
600	489.0	135	65063	600	479.4	135	64756
640	521.6	141	73798	640	511.4	141	72541
655.3	534.0	144	76956	656.3	524.4	144	75445
680	554.2	132	73193	680	543.3	132	71585
720	586.8	122	71582	720	575.3	122	70178
760	619.4	113	69947	760	607.2	113	68574
775.5	632.1	110	69517	776.6	619.6	110	67852
800	652.0	114	74245	800	639.2	114	72544
840	684.6	119	81766	840	671.2	119	80181
880	717.2	125	89572	880	703.1	125	87764
920	749.8	130	97254	920	735.1	130	95146
960	782.4	134	104996	960	767.0	134	102925
1000	815.0	138	112778	1000	799.0	138	110505
1040	847.6	142	120451	1040	831.0	142	118066
1080	880.2	146	128150	1080	862.9	146	125643
1120	912.8	149	135967	1120	894.8	149	133239
1153.0	939.7	151	141796	1153.2	921.2	151	139012
1160	945.4	150	141796	1160	926.8	150	139012
1200	978.0	145	141796	1200	958.8	145	139012
1240	1010.6	140	141796	1240	990.8	140	139012
1280	1043.2	136	141796	1280	1022.7	136	139012
1320	1075.8	132	141796	1320	1054.7	132	139012
1327.0	1081.6	130	141796	1327.0	1060.2	130	139012
1360	1108.4	132	146749	1360	1086.6	132	143873
1400	1141.0	135	153975	1400	1118.6	135	150947
1440	1173.6	138	161068	1440	1150.6	138	158402
1480	1206.2	140	168372	1480	1182.5	140	165990
1510.4	1231.0	142	175165	1510.4	1206.8	142	171207

[1] [illegible]

Weights shown are nominal weights at 15 °C (+59 °F).
[illegible]
[illegible]

412-FMS-65-3-14-2

Bell MODEL 412

ROTORCRAFT FLIGHT MANUAL

SUPPLEMENT

PT6T-3BF ENGINE (30 MINUTE OEI RATING)

412-706-054

S/N 33001 — 33107
33108 — 33213
AND
36001 — 36019

CERTIFIED
18 DECEMBER 1998

This supplement shall be attached to Model 412 Flight Manual (BHT-412-FM-1, BHT-412-FM-2, or BHT-412-FMS-19.1) when PT6T-3BF Engine, 30 minute OEI rating kit is installed.

Information contained herein supplements information of basic Flight Manual. For Limitations, Procedures, and Performance Data not contained in this supplement, or other applicable supplements; consult basic Flight Manual.

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LOG OF REVISIONS

Original .... 0 .... 18 DEC 98

LOG OF PAGES

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Title — NP	0	9/10	0
A — B	0		

NOTE

Revised text is indicated by a black vertical line. Insert latest revision pages; dispose of superseded pages.

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Original .... 0 .... 18 DEC 98

APPROVED DATE DEC 18 1998

MANAGER

ROTORCRAFT CERTIFICATION OFFICE
FEDERAL AVIATION ADMINISTRATION
FT. WORTH, TX 76193-0170

GENERAL INFORMATION

The PT6T-3B engine, in accordance with 412-706-054, may be redesignated as PT6T-3BF to offer an increased 30 minute OEI rating. This 30 minute OEI rating represents improved OEI capabilities while maximum continuous OEI performance is reduced from that presented in the basic Flight Manual or applicable supplement.

Section 1

LIMITATIONS

INTRODUCTION

PT6T-3BF engine offers an increased 30 minute OEI rating.

WEIGHT

Actual weight changes shall be determined after kit is installed and ballast readjusted, if necessary, to return empty weight CG to within allowable limits.

POWER PLANT

Pratt and Whitney Aircraft of Canada, Ltd. PT6T-3BF.

NOTE

Operation in an OEI range is intended for emergency use only when one engine becomes inoperative due to an actual malfunction.

Anytime an engine is operated in an OEI range, an entry shall be made in the helicopter logbook detailing the extent of operation in excess of twin engine takeoff power limits. This does not apply to approved ITT limits for starting or for power assurance checks.

GAS PRODUCER RPM (N_1)

NOTE

Gas producer indicator 212-075-037-113 (or equivalent) must be installed prior to or concurrent with kit.

TWIN ENGINE OPERATION

No change from basic manual.

ONE ENGINE INOPERATIVE (OEI)

Continuous OEI	101.8%
30 minute OEI range	101.8 to 103.4%
Maximum OEI (30 minute)	103.4%

INTERTURBINE TEMPERATURE

TWIN ENGINE OPERATION

Maximum continuous	765°C
5 minute range	765 to 810°C
Maximum	810°C
Maximum start (2 seconds maximum above 960°C)	1090°C

ONE ENGINE INOPERATIVE (OEI)

Maximum continuous OEI	810°C
30 minute OEI range	810 to 850°C
Maximum OEI	850°C

ENGINE OIL PRESSURE

No change from basic manual.

ENGINE OIL TEMPERATURE

Minimum	0°C
Continuous operation	0 to 115°C
Maximum for MIL-L-7808 oil	115°C
Maximum for MIL-L-23699 oil	120°C
Maximum for DOD-L-85734 oil	120°C

COMBINING GEARBOX OIL PRESSURE

No change from basic manual.

COMBINING GEARBOX OIL TEMPERATURE

Minimum	0°C
Continuous operation	0 to 115°C
Maximum for MIL-L-7808 oil	115°C
Maximum for MIL-L-23699 oil	120°C
Maximum for DOD-L-85734 oil	120°C

INSTRUMENT MARKINGS AND PLACARDS

Refer to figure 1-1 for instrument range markings and figure 1-2 for placards and decals.

INTERTURBINE TEMPERATURE (ITT)

300 TO 765°C	Continuous operation
765 to 810°C	5 minute range
810°C	Maximum
810 TO 850°C	30 minute OEI range
850°C	Maximum 30 minute OEI
1090°C	Maximum for starting (2 seconds maximum above 960°C)

GAS PRODUCER RPM (N1)

12%	Minimum for opening throttle during start
61%	Idle RPM
61 to 101.8%	Continuous operation
101.8%	Maximum continuous/ twin engine and OEI operations
101.8% to 103.4%	30 minute OEI range
103.4%	Maximum OEI (30 minutes)

412FS67.1-1-1-1

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

ENGINE OIL TEMPERATURE

0°C	Minimum
0 TO 115°C	Continuous operation
115°C	Maximum for MIL-L-7808 oil
120°C	Maximum for MIL-L-23699 or DOD-L-85734 oil

ENGINE OIL PRESSURE

No change from basic manual

COMBINING GEARBOX OIL TEMPERATURE

0°C	Minimum
0 TO 115°C	Continuous operation
115°C	Maximum for MIL-L-7808 oil
120°C	Maximum for MIL-L-23699 or DOD-L-85734 oil

COMBINING GEARBOX OIL PRESSURE

No change from basic manual

412FS67.1-1-1-2

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

TWIN & OEI 101.8%
30 MIN OEI 103.4%

LOCATION: INSTRUMENT PANEL

412FS67-1-1-2

Figure 1-2 Placards and decals

Section 2

NORMAL PROCEDURES

No change from basic manual.

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

No change from basic manual.

Section 4

PERFORMANCE

INTRODUCTION

Performance data presented herein are derived from engine manufacturer's specification power for PT6T-3BF engine less installation losses.

CLIMB AND DESCENT

Refer to figure 4-1 for increased single engine rate of climb - 30 minute power for helicopters with maximum gross weight of 11,600 pounds (refer to BHT-412-FM-1).

Refer to figure 4-2 for single engine rate of climb - 30 minute power for helicopters with maximum gross weight of 11,900 pounds (refer to BHT-412-FM-2 and BHT-412-FMS-18.1).

PROBLEM:

What is maximum rate of climb for following conditions?

Helicopter gross weight — 10,500 pounds

Pressure altitude — 5,500 feet.

OAT — 0°C.

EXAMPLE:

1. Enter rate of climb chart at 5,500 feet pressure altitude.

2. Move right, horizontally, to intersect 0° OAT line.

3. Descend vertically to intersect MAX GW line in lower portion of chart.

4. Follow curvature of trend lines to intersect actual helicopter gross weight line of 10,500 pounds.

5. Descend vertically to bottom of chart and read 500 feet per minute rate of climb.

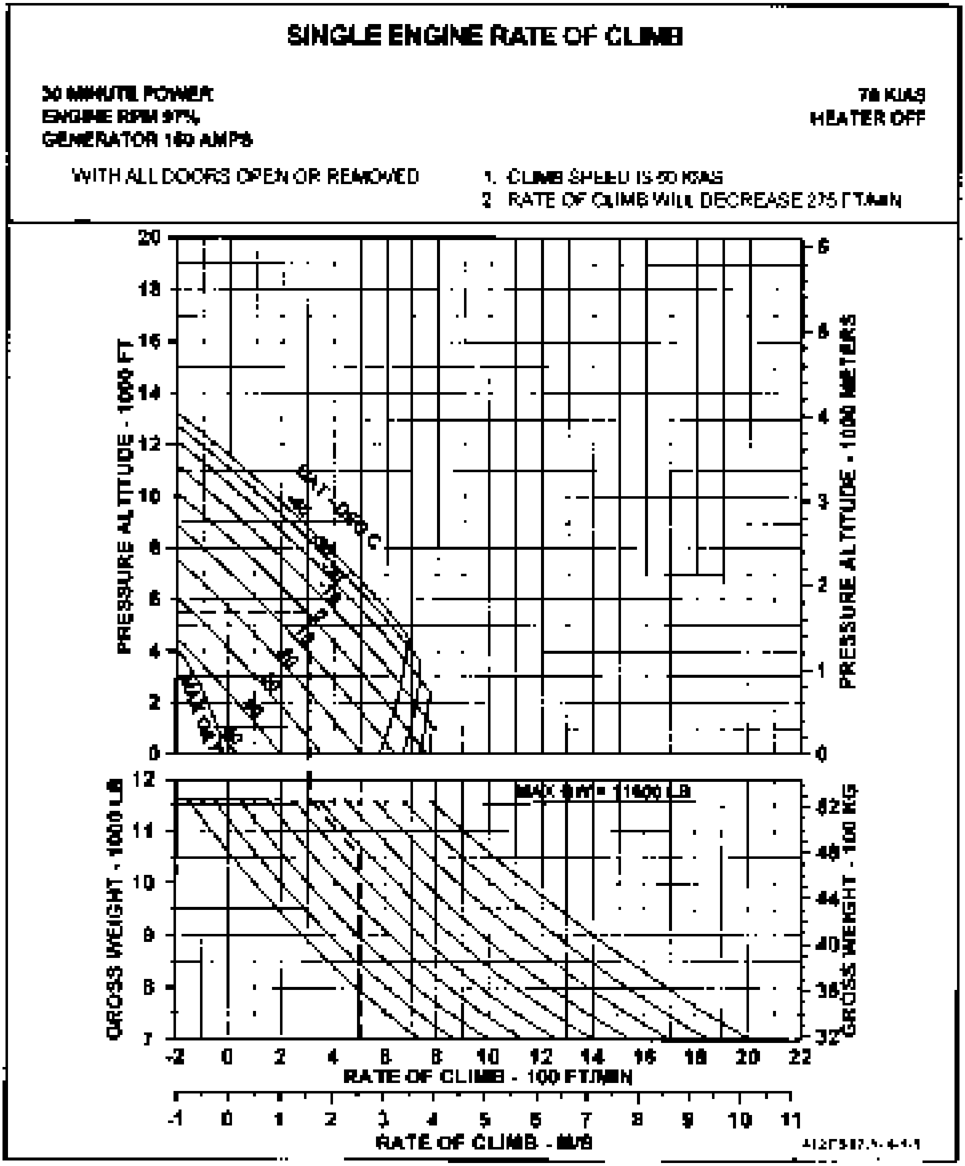

Figure 4-1. Single engine rate of climb - 30 minute power (11,600 pounds) (Sheet 1 of 2)

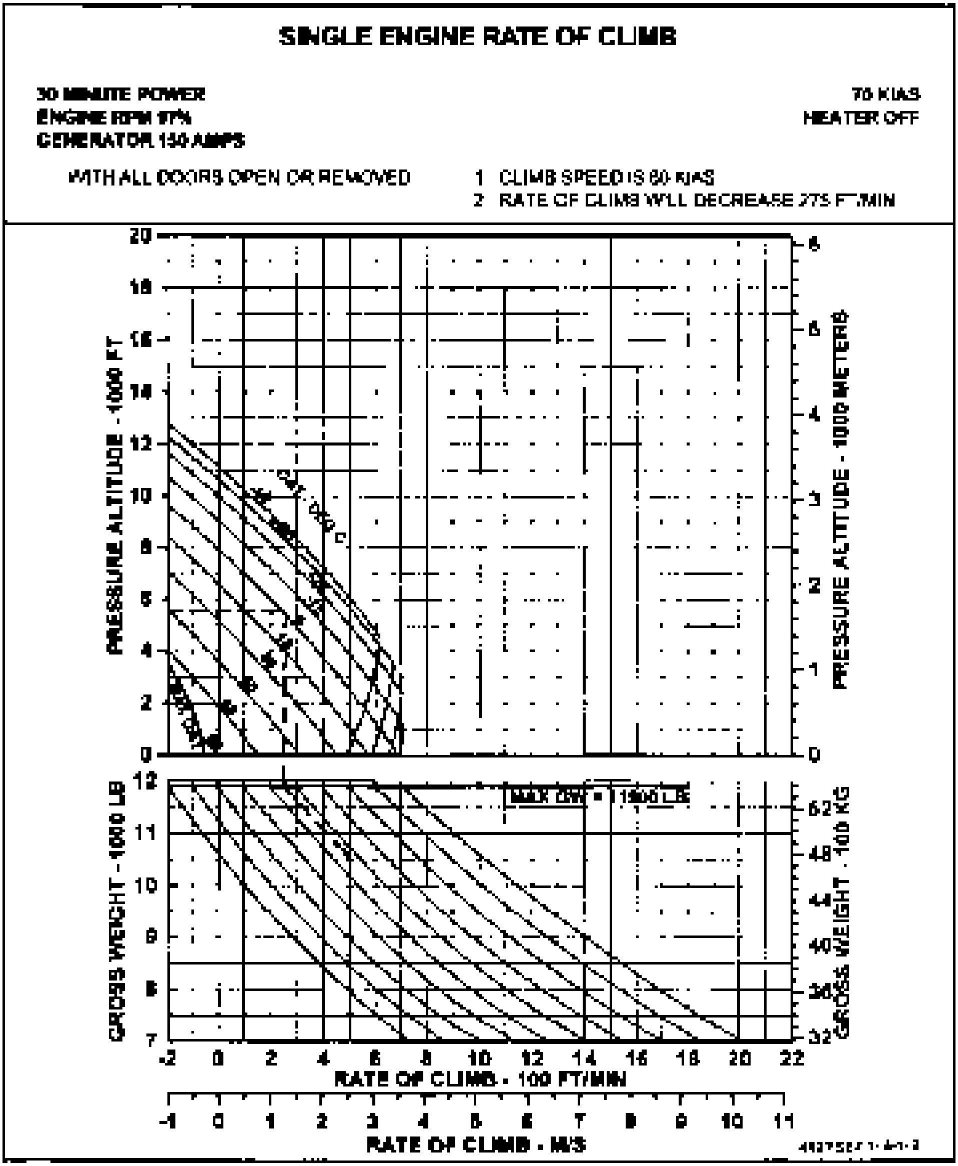

Figure 4-1. Single engine rate of climb - 30 minute power (11,900 pounds) (Sheet 2 of 2)

Section 6

CATEGORY A OPERATIONS

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Section 6

CATEGORY A OPERATIONS

GENERAL INFORMATION

ORGANIZATION

The information contained in this section is for category "A" operations. For limitations, normal procedures, emergency and malfunction procedures, and performance data not contained in this section, consult the appropriate sections of this flight manual.

DEFINITIONS:

CATEGORY "A" TAKEOFF – Operation of the helicopter in such a manner that if one engine fails at any time after the start of the takeoff, the helicopter can:

1. At or prior to CDP, return to and safely stop on the takeoff area; or

2. At or after CDP, climb out from point of failure and attain single engine forward flight.

CATEGORY "A" LANDING Operation of the helicopter in such a manner that if one engine fails at any time after the start of a landing approach the helicopter can:

1. At or after LDP, continue the approach and safely land and stop on the clear heliport; or

2. At or prior to LDP, climb out from point of failure and attain single engine forward flight.

CRITICAL DECISION POINT — The last point in the takeoff path at which a rejected takeoff can be assured, and the first point at which a completed takeoff can be assured

LANDING DECISION POINT — That point on the landing profile after which the helicopter is committed to landing.

COMPLETED TAKEOFF DISTANCE REQUIRED — The horizontal distance from the start of the prescribed takeoff procedure to a point at least 35 feet above the takeoff surface where V_{TOSS} and a positive rate of climb are attained following an engine failure occurring at or after CDP.

REJECTED TAKEOFF DISTANCE REQUIRED — The horizontal distance from the start of the prescribed takeoff procedure to the point where the helicopter is brought to a safe stop on the designated surface following an engine failure occurring at or prior to CDP.

TAKEOFF FLIGHT PATH — The distance traveled from where the aircraft reaches V_{TOSS} at or above 35 feet AGL to 1000 feet AGL.

TAKEOFF SAFETY SPEED — The airspeed that will assure the required climb performance with one engine inoperative.

LANDING DISTANCE REQUIRED — The horizontal distance necessary to achieve a takeoff flight path at V_{TOSS} and an altitude of 35 feet or higher, with one engine inoperative at or prior to LDP; or the horizontal distance necessary to land the helicopter without further incident, with one engine inoperative at or after LDP.

BALKED LANDING — The discontinuation of a landing approach and the initiation of a climbout. Category "A" balked landing capability following an engine failure is assured at or prior to LDP.

ABBREVIATIONS:

AGL — Above Ground Level

CDP — Critical Decision Point

CDT — Critical Decision Time

GROC — Gross Rate of Climb

LDP — Landing Decision Point

V_{MIN} IFR — Minimum Airspeed for IFR

V_{TOSS} (V_2) - Takeoff Safety Speed

V_Y — Best Rate of Climb Speed

WAT — Weight-Altitude-Temperature

LIMITATIONS

TAKEOFF AND LANDING WEIGHT VS ALTITUDE LIMITATIONS

Refer to Gross Weight-Altitude-Ambient Air Temperature Limits Charts (figure 5-1). Charts designated part A may be used for gross weights to 10,000 pounds (4536 kg). Part B charts may be used for gross weights to 10,800 pounds (4899 kg). Part C charts may be used for gross 1 weights to 11,900 pounds (5398 kg).

Interpolation of data between charts for different parts is not permitted. Testing has not been conducted in areas between Parts A, B, and C.

ALTITUDE LIMIT FOR TAKEOFF AND LANDING

4000 feet pressure altitude.

CROSSWIND LIMITATIONS

The crosswind limit for takeoff and landing is 20 knots. Refer to the unfactored Headwind Component Chart in PERFORMANCE subsection.

Takeoff or landing downwind or with quartering tailwinds is prohibited.

CONFIGURATION

Standard landing gear or high skid gear with or without emergency floats (floats stowed).

WEIGHT — ALTITUDE — TEMPERATURE FOR TAKEOFF AND LANDING PART A

V_{TOSS} = 40 KIAS

GW TO 10,000 LBS (4536 kg)

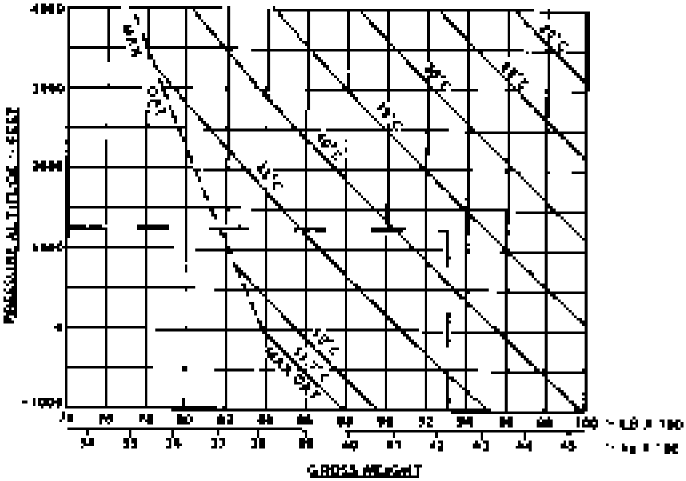


Figure 5-1. Gross weight-altitude-ambient air temperature limits charts — takeoff and landing (Sheet 1 of 3)

WEIGHT — ALTITUDE — TEMPERATURE FOR TAKEOFF AND LANDING
PART B

V_{TOSS} - 45 KIAS

GW TO 10,800 LBS (4888 kg)

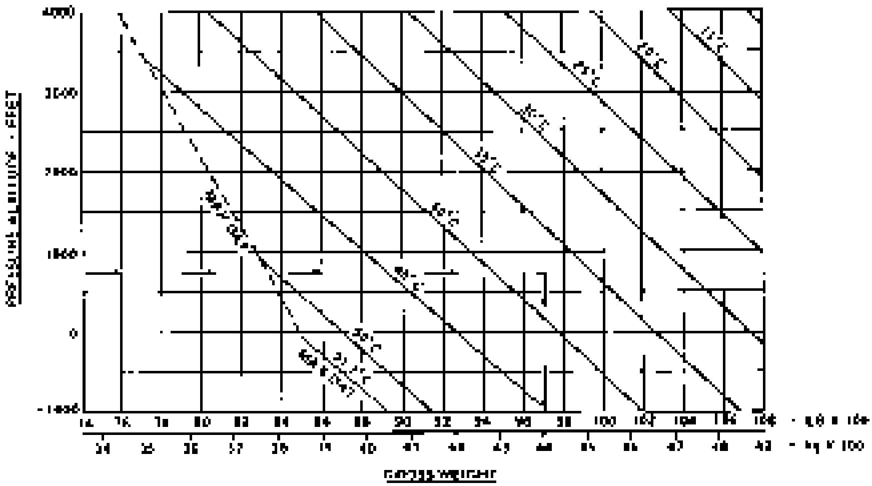


Figure 6-1. Gross weight-altitude-ambient air temperature limits charts - takeoff and landing (Sheet 2 of 3)

WEIGHT — ALTITUDE — TEMPERATURE LIMITATIONS FOR TAKEOFF AND LANDING PART C

V_{TOSS} 55 KIAS

GW TO 11,900 LBS (5398kg)

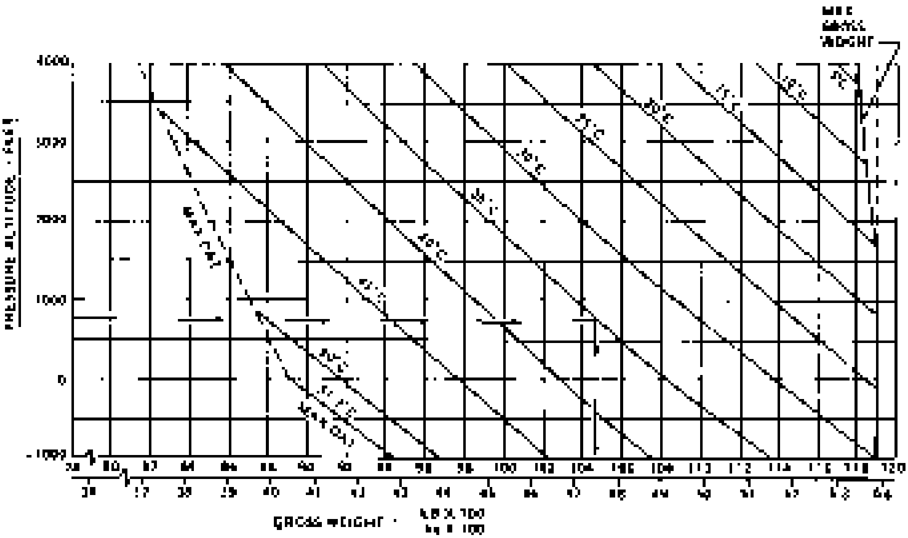


Figure 6-1. Gross weight-altitude-ambient air temperature limits charts — takeoff and landing (Sheet 3 of 3)

NORMAL PROCEDURES

PRIOR TO TAKEOFF

POWER ASSURANCE CHECK (refer to category "A" PERFORMANCE data).

STANDARD TYPE TAKEOFF

Obtain CDP Information -- Refer to figure 6-1 and 6-2.

Collective — Flat pitch.

ENG -- 100% RPM (N2).

Altimeter — Set, note indication with collective fully down.

Instruments Normal operating range

SEAT BELT and NO SMOKE switches — As desired.

Area Clear.

Hover at approximately 4 feet (1.2 meters) skid height and note torque.

Adjust ADI pitch bar to indicate level.

Initiate a takeoff from hover using a TRANSMISSION TORQUE of 10% above that required to hover and ten degrees nose down attitude.

NOTE

Do not exceed TRANSMISSION TORQUE, ITT, or GAS PROD RPM (N1) limits.

Maintain pitch attitude as the helicopter moves forward to achieve the correct Critical Decision Point (CDP) shown on the takeoff flight path profile diagram (figure 6-2).

NOTE

CDP height is determined by reference to the pilots barometric altitude. Indicated altitude with collective full down on the takeoff surface is used as a ground level reference.

After attaining CDP, accelerate the helicopter to 65 KIAS and continue the climb.

STANDARD TYPE LANDING

NOTE

A standard type landing is initiated from a Landing Decision Point (LDP) of 40 KIAS and an altitude of 100 feet (30.5 meters) above the runway, either in level flight or with a rate of descent of not more than 500 feet per minute (figure 6-3).

Flight controls -- Adjust friction to desired level.

GOV switches — AUTO.

Throttles — Fully open

ENG — 100% RPM (N2).

FORCE TRIM switch — As desired.

STEP switch — As desired.

Altimeter — Set to nearest reporting station.

SEAT BELT and NO SMOKE sign As desired.

TAKE-OFF FLIGHT PATH PROFILE

2½ MINUTE POWER RATING
AFTER POWER FAILURE THEN REDUCE
TO 30 MINUTE POWER AT 500 FT (152 m) AGL

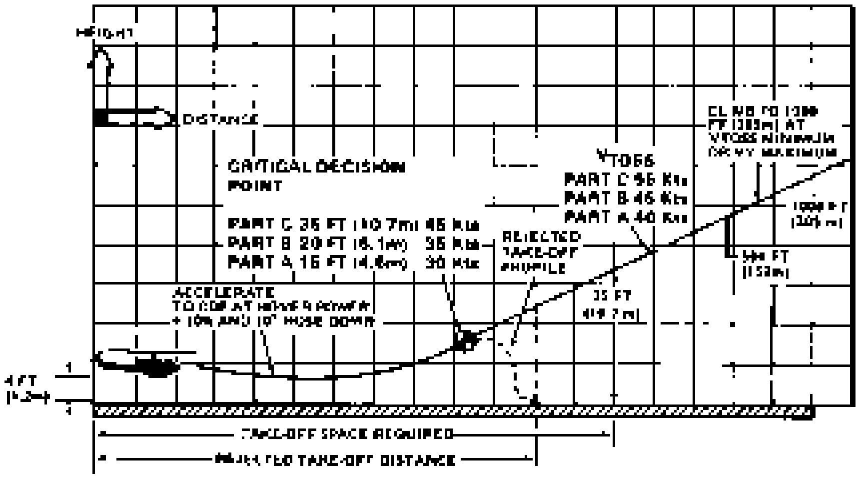


Figure 6-2. Takeoff flight path profile

LANDING FLIGHT PATH PROFILE

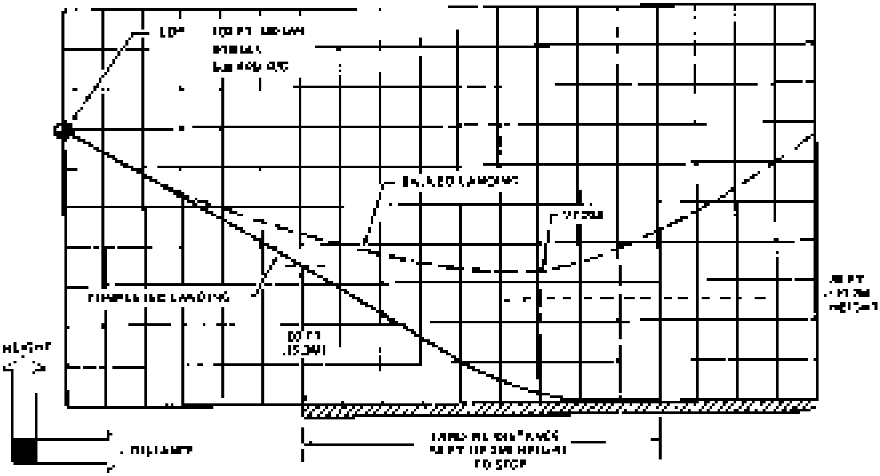


Figure 6-3. Landing flight path profile

EMERGENCY AND MALFUNCTION PROCEDURES

INTRODUCTION

Tables 6-1 through 6-4 list panel wording, fault conditions, and corrective actions for emergencies and malfunctions that might occur during takeoff prior to CDP, during takeoff after CDP, during landing prior to LDP, and during landing after LDP.

Table 6-1. Warning lights - Takeoff prior to CDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
MASTER CAUTION	Warning or caution light(s) illuminated.	Land immediately
FIRE PULL (1 or 2)	Fire indication in No. 1 or No. 2 engine compartment.	Land immediately. Pull affected FIRE PULL handle. Select MAIN fire extinguisher; if necessary, select RESERVE fire extinguisher.
BAGGAGE FIRE	Smoke in baggage compartment.	Land immediately Inspect tailboom area for damage.
ENG OUT (1 or 2)	GAS PROD abnormally low, below 53 - 2% RPM (N1), on No. 1 or No. 2 engine.	Land immediately Refer to ENGINE OUT procedures.
XMSN OIL PRESSURE	Transmission oil pressure below limit.	Land immediately
XMSN OIL TEMP	Transmission oil temperature above limit.	Land immediately.
C BOX OIL PRESSURE	Combining gearbox oil pressure below normal.	Land immediately.
C BOX TEMP	Combining gearbox temperature above limit.	Land immediately

Table 6-1. Warning lights — Takeoff prior to CDP (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATTERY TEMP	Battery case temperature above limits.	Land immediately. BATTERY BUS 1 and BUS 2 switches — OFF. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF *BATTERY TEMP* LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.
ROTOR BRAKE	Rotor brake linings not retracted.	Land immediately.

Table 6-2. Warning lights — Takeoff after CDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
MASTER CAUTION	Warning or Caution light(s) illuminated.	Accelerate to V_{TOSS}. Reset MASTER CAUTION light; take appropriate corrective action as required by illuminated segment(s).
FIRE PULL (1 or 2)	Fire indication in No. 1 or No. 2 engine compartment.	Accelerate to V_{TOSS}. Pull affected FIRE PULL handle. Select MAIN fire extinguisher. Close throttle of affected engine. Select RESERVE fire extinguisher if necessary. Land as soon as possible.
BAGGAGE FIRE	Smoke in baggage compartment.	Land immediately. Inspect tailboom area for damage.
ENG OUT (1 or 2)	GAS PROD abnormally low, below 53 ± 2% RPM (N1), on No. 1 or No. 2 engine.	Accelerate to V_{TOSS}. Secure appropriate engine. Refer to ENGINE OUT procedure. Land as soon as possible.

Table 6-2. Warning lights — Takeoff after CDP (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
XMSN OIL PRESSURE	Transmission oil pressure below limit.	Accelerate to V_{TOSS}. Reduce power; verify fault on XMSN OIL pressure gage. Land immediately.
XMSN OIL TEMP	Transmission oil temperature above limit.	Accelerate to V_{TOSS}. Reduce power; verify fault on XMSN OIL temperature gage. Land as soon as possible.
C BOX OIL PRESSURE	Combining gearbox oil pressure below normal.	Accelerate to V_{TOSS}. Reduce power; verify fault on GEAR BOX pressure gage. Land immediately.
C BOX TEMP	Combining gearbox oil temperature above limit.	Accelerate to V_{TOSS}. Reduce power; verify fault on GEAR BOX temperature gage. Land as soon as possible.
BATTERY TEMP	Battery case temperature above limits	Accelerate to V_{TOSS}. BATTERY BUS 1 and BUS 2 switches OFF. Land as soon as practical. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF *BATTERY TEMP* LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.
ROTOR BRAKE	Rotor brake linings not retracted.	Accelerate to V_{TOSS}. Check rotor brake handle fully up in detent. If light remains on, land as soon as possible.

Table 6-3. Warning lights — Landing prior to LDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
MASTER CAUTION	Warning or caution light(s) illuminated.	Reset MASTER CAUTION light; take appropriate corrective action as required by illuminated segment.
FIRE PULL (1 or 2)	Fire indication in No. 1 or No. 2 engine compartment.	Pull affected FIRE PULL handle. Select MAIN fire extinguisher. Close throttle of affected engine. Select RESERVE fire extinguisher, if necessary. Land as soon as possible.
BAGGAGE FIRE	Smoke in baggage compartment.	Land immediately. Inspect tailboom area for damage.
ENG OUT (1 or 2)	GAS PROD abnormally low, below 53 ± 2% RPM (N1), on No. 1 or No. 2 engine.	Maintain V_{TOSS}. Secure appropriate engine. Land as soon as possible. Refer to ENGINE OUT procedure.
XMSN OIL PRESSURE	Transmission oil pressure below limit.	Reduce power. Verify fault on XMSN OIL pressure gage. Land immediately.
XMSN OIL TEMP	Transmission oil temperature above limit.	Reduce power. Verify fault on XMSN OIL temperature gage. Land as soon as possible.
C BOX OIL PRESSURE	Combining gearbox oil pressure below normal.	Reduce power. Verify fault on GEAR BOX pressure gage. Land as soon as possible
C BOX OIL TEMP	Combining gearbox oil temperature above limit	Reduce power. Verify fault on GEAR BOX temperature gage. Land as soon as possible.

Table 6-3. Warning lights -- Landing prior to LDP (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
BATTERY TEMP	Battery case temperature above limits.	BATTERY BUS 1 and BUS 2 switches — OFF. Land as soon as practical. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF *BATTERY TEMP* LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.
ROTOR BRAKE	Rotor brake linings not retracted.	Check rotor brake handle fully up in detent. If light remains on, land as soon as possible.

Table 6-4. Warning lights Landing after LDP

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
MASTER CAUTION	Warning or caution light(s) illuminated.	Land immediately.
FIRE PULL (1 or 2)	Fire indication in No. 1 or No. 2 engine compartment.	Land immediately. Pull affected FIRE PULL handle. Close throttle of affected engine. Select MAIN fire extinguisher; if necessary, select RESERVE fire extinguisher.
BAGGAGE FIRE	Smoke in baggage compartment	Land immediately. Inspect tailboom area for damage.
ENG OUT (1 or 2)	GAS PROD abnormally low, below 53 ± 2% RPM (N1), on No. 1 or No. 2 engine.	Land immediately. Refer to ENGINE OUT procedures.
XMSN OIL PRESSURE	Transmission oil pressure below limit.	Land immediately.

Table 6-4. Warning lights — Landing after LDP (Cont)

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
XMSN OIL TEMP	Transmission oil temperature above limit.	Land immediately.
C BOX OIL PRESSURE	Combining gearbox oil pressure below normal.	Land immediately.
C BOX TEMP	Combining gearbox temperature above limit.	Land immediately.
BATTERY TEMP	Battery case temperature above limits.	Land immediately. BATTERY BUS 1 and BUS 2 switches — OFF. **WARNING** BATTERY SHALL NOT BE USED FOR ENGINE START AFTER ILLUMINATION OF *BATTERY TEMP* LIGHT. BATTERY SHALL BE REMOVED AND SERVICED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS PRIOR TO RETURN TO SERVICE.
ROTOR BRAKE	Rotor brake linings not retracted.	Land immediately.

ENGINE OUT

DURING TAKEOFF PRIOR TO CRITICAL DECISION POINT (CDP)

An engine failure prior to reaching CDP will necessitate a landing back to the takeoff surface. If height permits, a positive deceleration to reduce forward airspeed is required. As the helicopter descends, it should be leveled and the collective should be used as required to cushion the landing. Some forward ground speed is normally required at touchdown.

Maintain control of the helicopter.

Collective — Adjust to maintain ROTOR RPM and OEI power limits.

Flare to reduce ground speed.

Assume landing attitude before touchdown.

Throttle (affected engine) — Closed.

Complete shutdown of affected engine.

DURING TAKEOFF AFTER CRITICAL DECISION POINT (CDP)

In the event of an engine failure following CDP, airspeed should be increased to the takeoff safety speed (V_{TOSS}) or maintained, whichever is higher. Climb out to 500 feet (152 meters) above the takeoff surface and accelerate to 65 KIAS. Reduce power to 30 minute limit.

CAUTION

DURING COLD WEATHER OPERATIONS, CAREFULLY MONITOR TORQUE OF THE NORMAL ENGINE WHEN ONE ENGINE FAILS OR IS SHUT DOWN IN FLIGHT.

NOTE

During takeoff, after CDP, it is permissible to droop ROTOR RPM to 91% during the transition from twin engine to single engine flight following an engine failure. ROTOR RPM should be regained to normal operating range at or before attaining appropriate best rate of climb speed.

Maintain control of the helicopter.

Collective — Adjust to maintain ROTOR RPM and OEI power limits.

Airspeed — If below V_{TOSS}, smoothly increase to V_{TOSS} and initiate a climb.

Throttle (affected engine) — Close

Complete shutdown of affected engine.

ENG (unaffected engine) — Set to 100% RPM (N2).

DURING LANDING PRIOR TO LANDING DECISION POINT (LDP)

Execute the same procedures as for single engine failure on takeoff after CDP or proceed to LDP and use the procedure below.

DURING LANDING AFTER THE LANDING DECISION POINT (LDP)

The helicopter, with an emergency, is committed to land after LDP. The landing is accomplished using up to the maximum power of the remaining engine while maintaining rotor speed within limits.

Maintain control of the helicopter.

Collective — Adjust to maintain ROTOR RPM and OEI power limits.

Flare to reduce speed.

Assume landing attitude before touchdown.

Throttle (affected engine) — Closed.

Complete shutdown of affected engine.

PERFORMANCE

CATEGORY "A" PERFORMANCE

The power performance data presented in this section is based on engine manufacturers minimum specification power for the PT6T-3B engine with installation losses.

The takeoff and landing data presented in this section is based on tests performed on a level asphalt running 75 feet wide. The minimum runway length for standard takeoff and landing procedures varies with wind, gross weight, pressure altitude, and temperature.

POWER ASSURANCE CHECKS

Refer to Section 4 for power assurance charts to determine if the engine (power sections) can produce installed specification power.

The hover check is peformed prior to takeoff. The in-flight check is provided for in-flight monitoring of engine performance. If either engine (power section) does not meet the requirements of the hover or in-flight power assurance check, category "A" performance will not be achievable. The cause of engine power loss, or excessive interturbine temperature (ITT) or GAS PROD RPM (N1) shall be determined as soon as practical. Refer to appropriate engine maintenance manual.

HEADWIND COMPONENT

The Unfactored Headwind Component chart (figure 6-4) is provided with an example to determine critical crosswind and corrected headwind for category "A" takeoff and landings. The headwind component, as calculated from the headwind component chart, is applied to parts A, B, and C of the Takeoff Space Required charts.

REJECTED TAKEOFF DISTANCE REQUIRED

The rejected takeoff distance required is the space necessary to takeoff, climb to CDP, encounter an engine failure at CDP, return to takeoff surface, and stop safely. The rejected takeoff distance required is obtained from either part A, B, or C of the Rejected Takeoff Distance Required charts (figure 6-5).

TAKEOFF SPACE REQUIRED

The takeoff space required is the horizontal distance required to takeoff, climb to CDP, encounter an engine failure, accelerate to V_{TOSS}, and climb to 35 feet (10.7 meters) AGL above the takeoff space. Takeoff space required is obtained from either part A, B, or C of the Takeoff Space Required charts (figure 6-6) using the headwind component from the Unfactored Headwind Component chart (figure 6-4).

TAKEOFF FLIGHT PATH

The takeoff flight path begins at the end of Takeoff Space Required, at 35 feet (10.7 meters) AGL or higher, above the takeoff space and at V_{TOSS}. Parts A, B, and C of the Takeoff Flight Path charts (figure 6-7) provide data for 35 to 500 feet (10.7 to 152 meters) and 500 to 1,000 feet (152 to 305 meters) AGL. These charts provide altitude gain for each 100 feet (30.5 meters) horizontal distance traveled.

LANDING SPACE REQUIRED

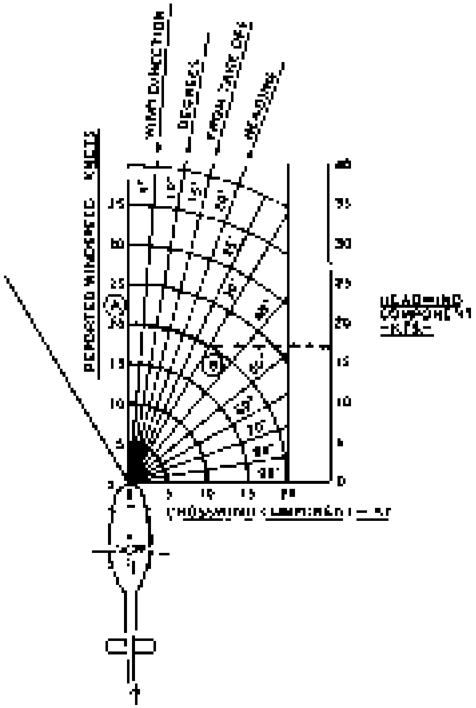
Landing space required is the distance necessary to come to a stop from LDP with one engine inoperative.

Landing space required is obtained from the Landing Space Required chart (figure 6-8).

CORRECTED LANDING DISTANCE

Corrected landing distance from LDP is landing distance corrected for wind factor.

The headwind component is obtained from calculation of the Unfactored Headwind Component chart (figure 6-4), and applied to the Landing Space Required chart (figure 6-8) to obtain corrected landing distance.



	EXAMPLE	
1.	TAKE OFF HEADING	170°
2.	REPORTED WIND DIRECTION	200°
3.	WIND DIRECTION, DEGREES FROM TAKE-OFF HEADING	30°
4.	REPORTED WIND SPEED	20 KNOTS
5.	ENTER CHART AT REPORTED WIND SPEED, POINT A	
6.	FOLLOW THE SHAPE OF THE CURVED LINES TO WIND DIRECTION, DEGREES FROM TAKE OFF HEADING, POINT B	
7.	PROCEED HORIZONTALLY TO THE HEADWIND COMPONENT SCALE AND READ HEADWIND COMPONENT	17 KNOTS
8.	TAILWINDS HAVE NOT BEEN DEMONSTRATED	

Figure 5-4. Unfactored headwind component chart

REJECTED TAKE-OFF DISTANCE REQUIRED

PART A

GW 7,500 TO 10,000 LB (3402 TO 4536 kg)

V_{TOSS} = 40 KIAS CDP = 30 KIAS AT 15 FT (4.6m)

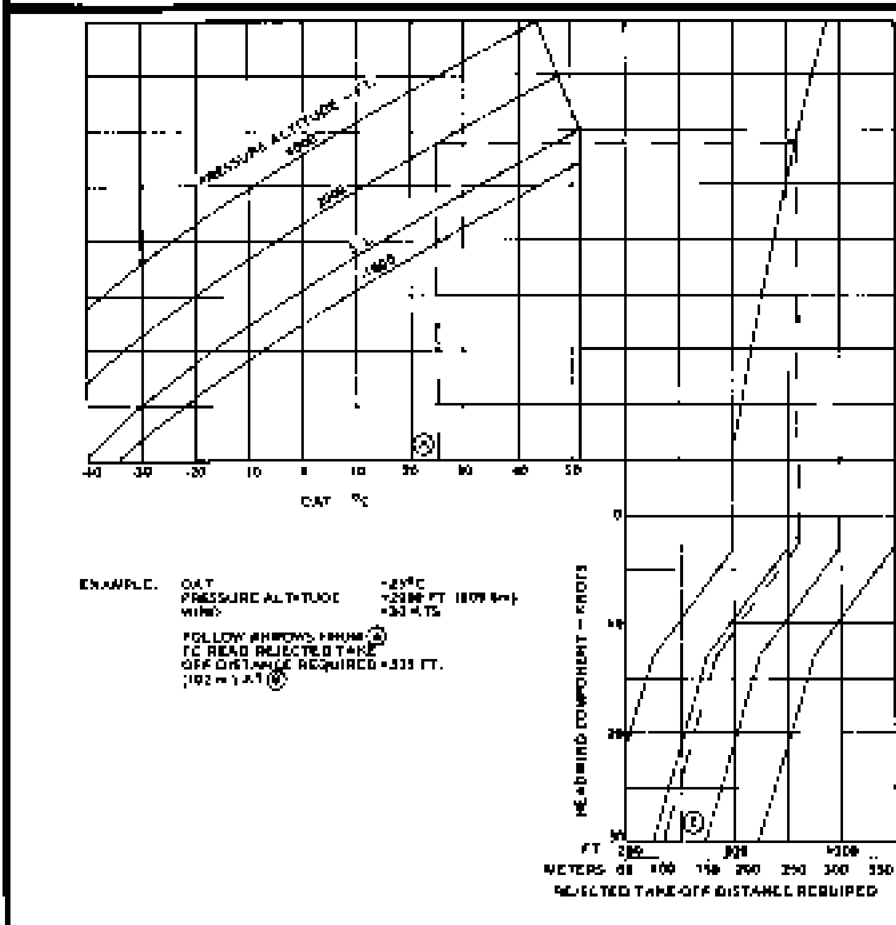


Figure 6-5. Rejected takeoff distance required (Sheet 1 of 3)

REJECTED TAKE-OFF DISTANCE REQUIRED

PART I

GW 7,500 TO 10 800 LB (3402 TO 4899 Kg)

V_{TOSS} = 45 KIAS   CDP 35 KIAS AT 20 FT (6.1 m)

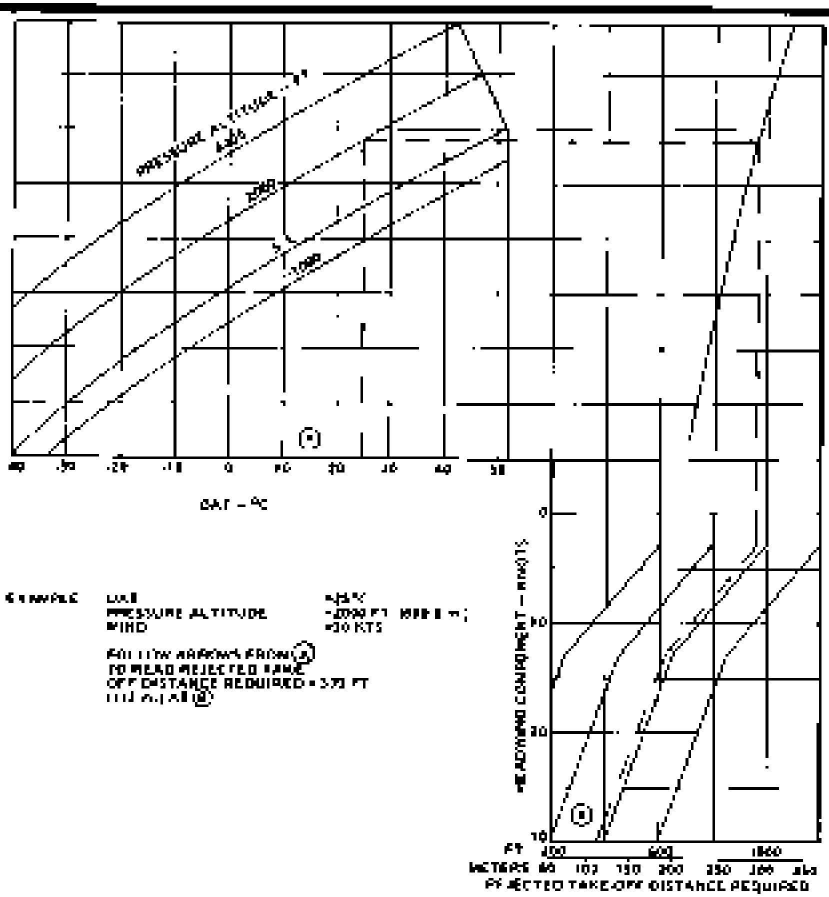


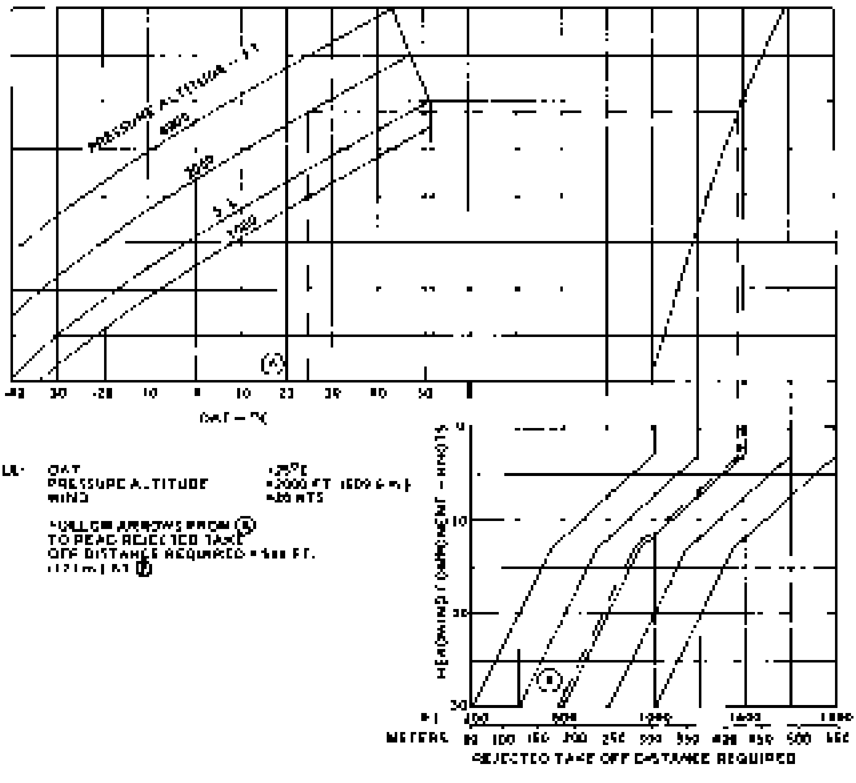
Figure 6-5. Rejected takeoff distance required (Sheet 2 of 3)

REJECTED TAKE-OFF DISTANCE REQUIRED

PART C

GW 7,000 TO 11,900 LB (3402 TO 5398 Kg)

V_{TOSS} = 55 KIAS   CDP = 40 KIAS AT 35 FT (10.7 m)



EXAMPLE: OAT +25°C
PRESSURE ALTITUDE +2000 FT (609.6 m)
WIND +20 KTS

FOLLOW ARROWS FROM (A)
TO READ REJECTED TAKE
OFF DISTANCE REQUIRED = [illegible] FT.
([illegible] m) AT (B)

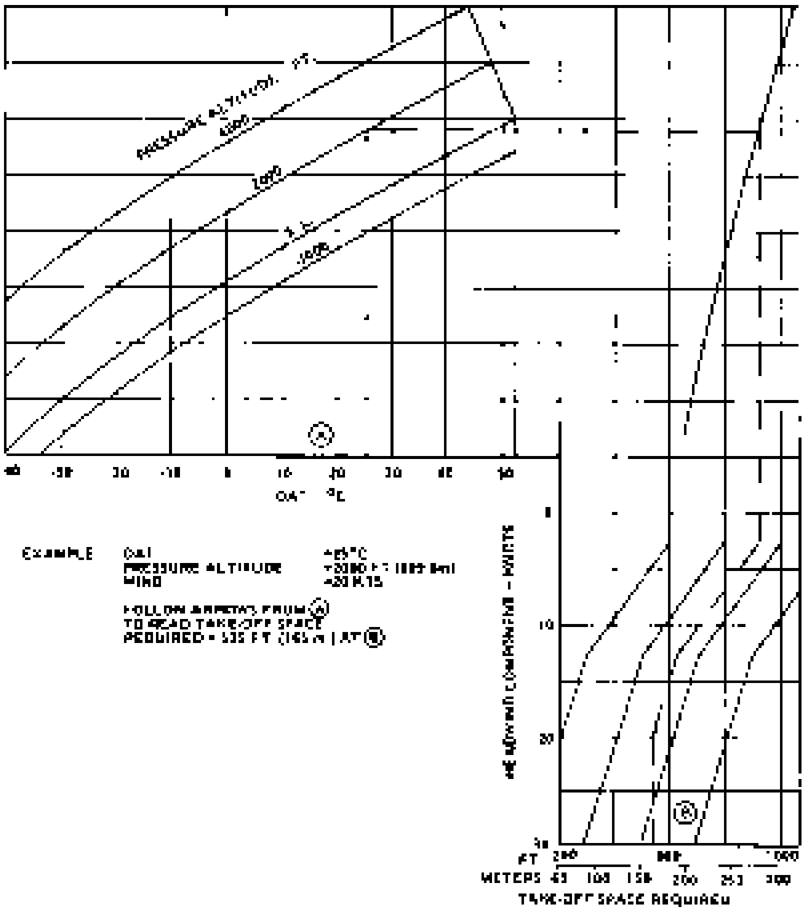
Figure 6-5. Rejected takeoff distance required (Sheet 3 of 3)

TAKE-OFF SPACE REQUIRED

PART A

GW 7,500 TO 10,000 LB (3402 TO 4536 kg)

V_{TOSS} = 40 KIAS CDP = 30 KIAS AT 15 FT (4.6m)



EXAMPLE
OAT +25°C
PRESSURE ALTITUDE +2000 FT (609.6m)
WIND +20 KTS

FOLLOW ARROWS FROM (A)
TO READ TAKE-OFF SPACE
REQUIRED = 535 FT (163 m) AT (B)

Figure 6-6. Takeoff space required chart (Sheet 1 of 3)

TAKE-OFF SPACE REQUIRED

PART B

GW 7,500 TO 10,800 LB (3402 TO 4899 Kg)

V_{TOSS} 45 KIAS   CDP - 35 KIAS AT 20 FT (6.1 m)

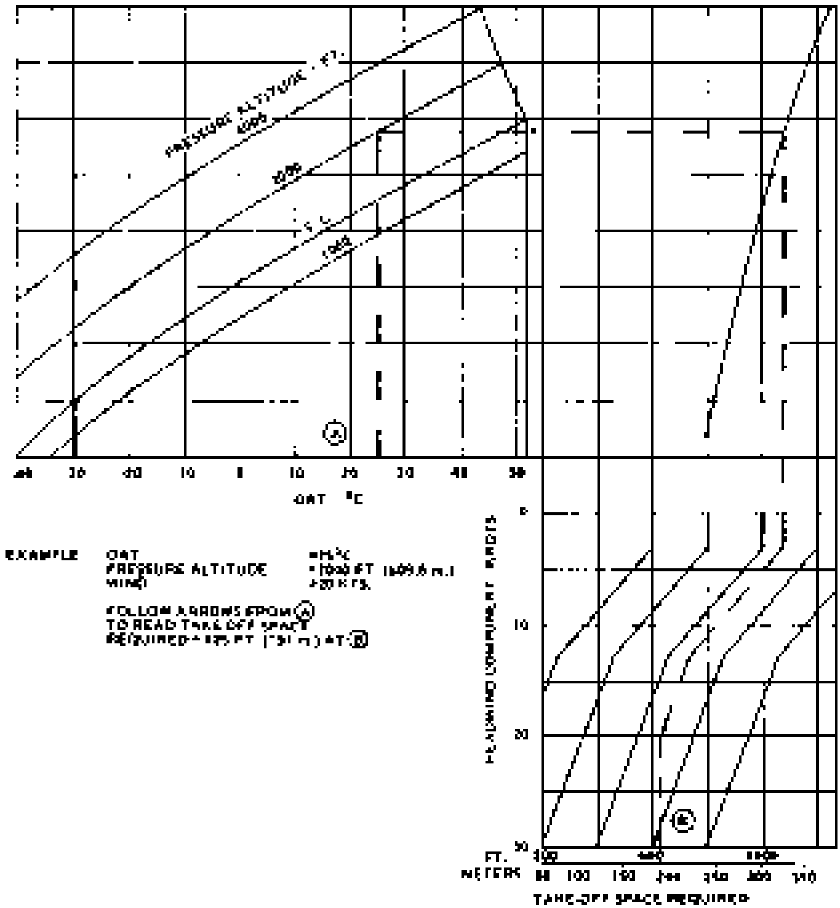


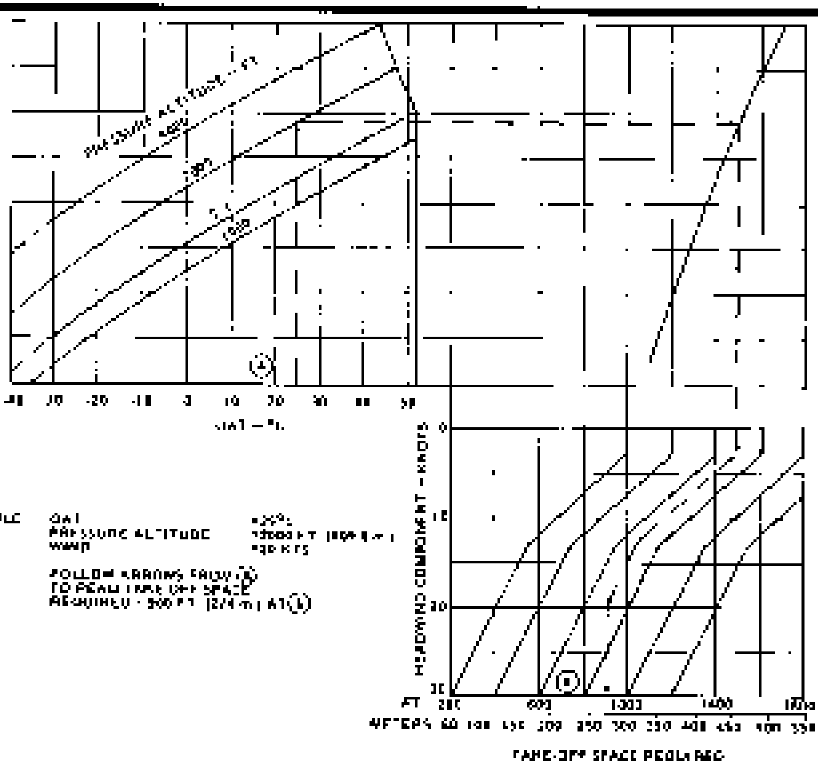
Figure 6-6. Takeoff space required chart (Sheet 2 of 3)

TAKE-OFF SPACE REQUIRED

PART C

GW 7,500 TO 11,900 LB (3402 TO 5398 Kg)

V_{TOSS} = 55 KIAS   CDP = 45 KIAS AT 35 FT (10.7 m)



EXAMPLE

OAT +25°C
PRESSURE ALTITUDE [illegible]
WIND 20 KTS

FOLLOW ARROWS FROM (A) TO READ TAKE-OFF SPACE REQUIRED = 900 FT (274 m) AT (B)

Figure 6-6. Takeoff space required chart (Sheet 3 of 3)

TAKEOFF FLIGHT PATH 35 TO 500 FEET AGL
PART A

2.5 MINUTE OEI POWER
NR – 97% RPM (N2)
GENERATOR 150 AMPS

V_{TOSS} = 40 KIAS
HEATER AND ANTI-ICE OFF
INOPERATIVE ENGINE SECURED

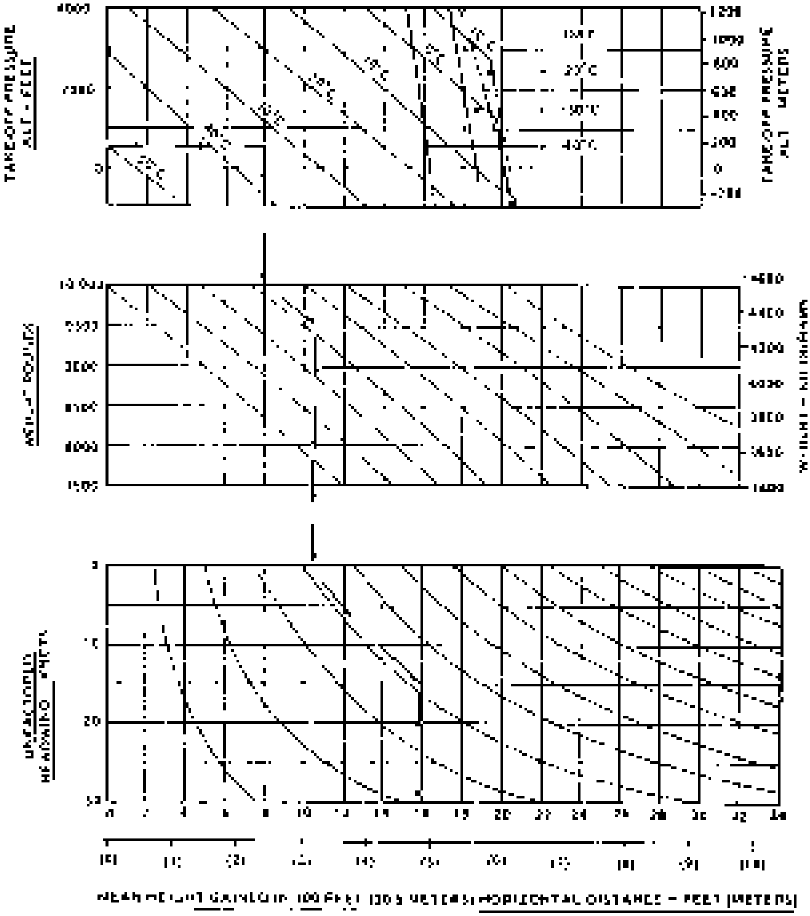


Figure 5-7. Takeoff flight path (Sheet 1 of 6)

TAKEOFF FLIGHT PATH 500 TO 1000 FEET AGL
PART A

30 MINUTE OEI POWER
ENG — 97% RPM (N2)
GENERATOR 150 AMPS

V_{1000} — 40 KIAS
HEATER AND ANTI-ICE OFF
INOPERATIVE ENGINE SECURED

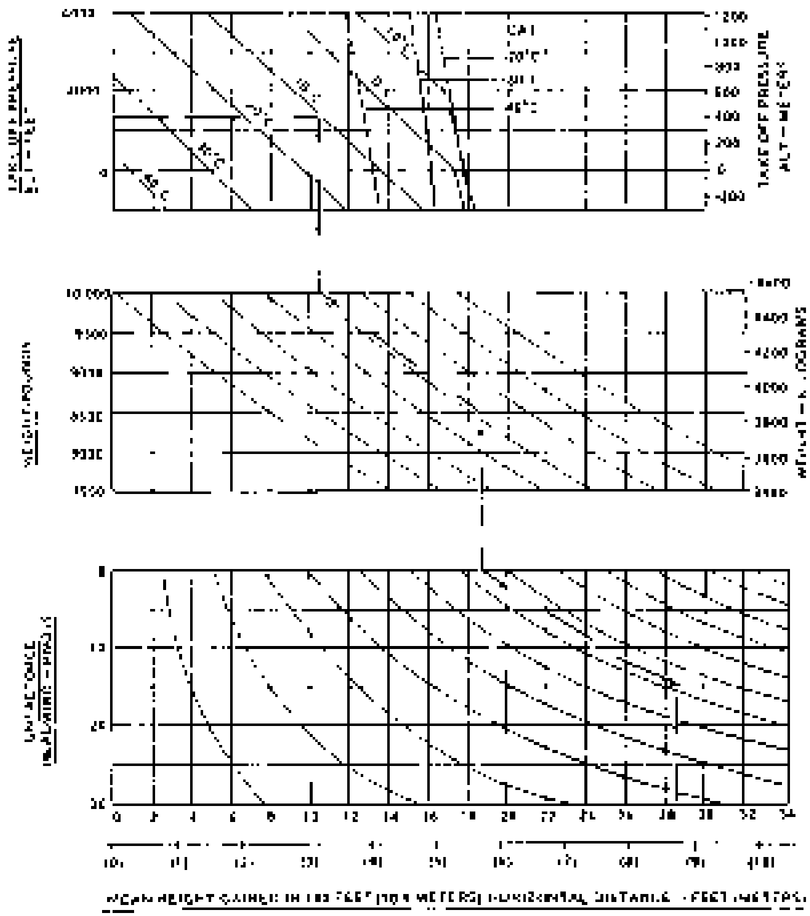


Figure 8-7. Takeoff flight path (Sheet 2 of 9)

TAKEOFF FLIGHT PATH 35 TO 500 FEET AGL
PART 6

2.5 MINUTE OEI POWER
ENG — 97% RPM (N2)
GENERATOR 150 AMPS

V 45 KIAS
HEATER AND ANTI ICE OFF
INOPERATIVE ENGINE SECURED

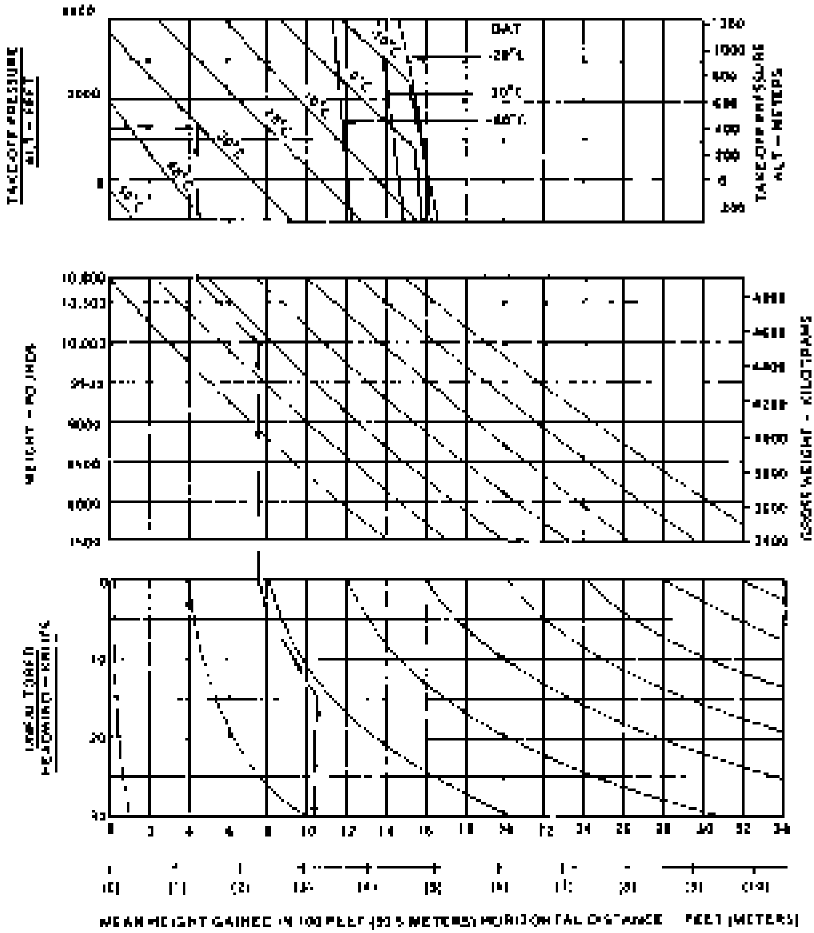


Figure 6-7. Takeoff flight path (Sheet 5 of 6)

TAKEOFF FLIGHT PATH 500 TO 1000 FEET AGL
PART B

30 MINUTE OEI POWER
ENG — 97% RPM (N2)
GENERATOR 150 AMPS

V_{TOSS} = 45 KIAS
HEATER AND ANTI ICE OFF
INOPERATIVE ENGINE SECURED

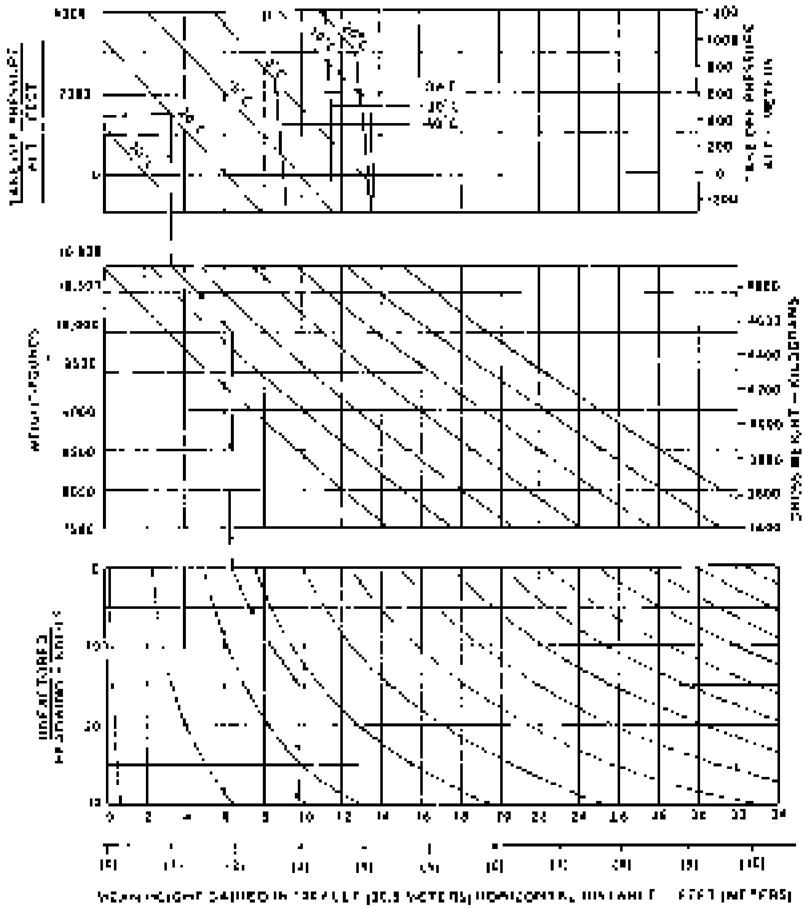


Figure 5-7. Takeoff flight path (Sheet 4 of 6)

TAKEOFF FLIGHT PATH 35 TO 500 FEET AGL
PART C

2.5 MINUTE OEI POWER
ENG — 97% RPM (N2)
GENERATOR 150 AMPS

V_{TOSS} = 55 KIAS
HEATER AND ANTI-ICE OFF
INOPERATIVE ENGINE SECURED

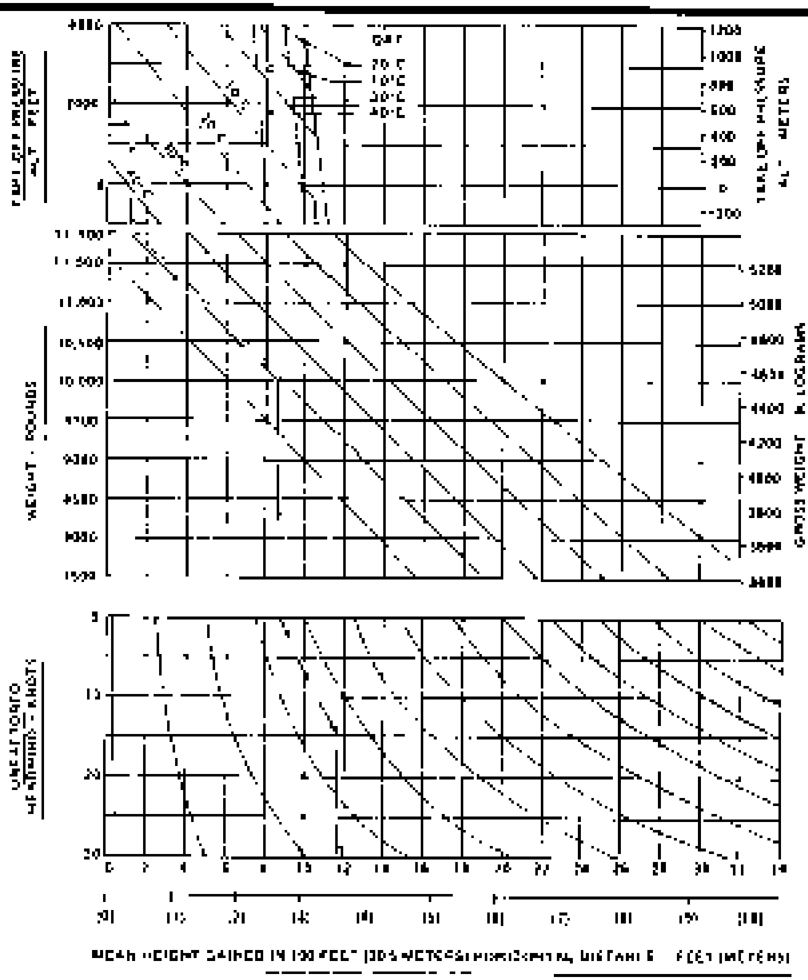


Figure 5-7. Takeoff flight path (Sheet 5 of 5)

TAKEOFF FLIGHT PATH 500 TO 1000 FEET AGL
PART C

30 MINUTE OEI POWER
ENG — 97% RPM (N2)
GENERATOR 150 AMPS

V_{TOSS} 55 KIAS
HEATER AND ANTI-ICE OFF
INOPERATIVE ENGINE SECURED

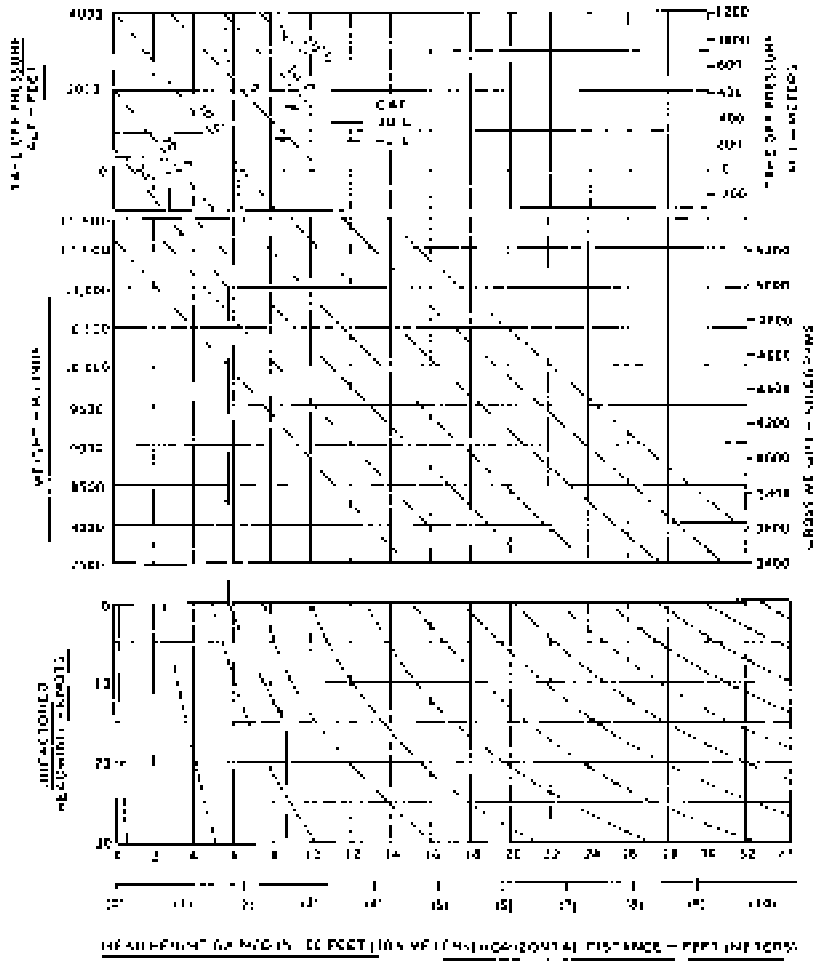


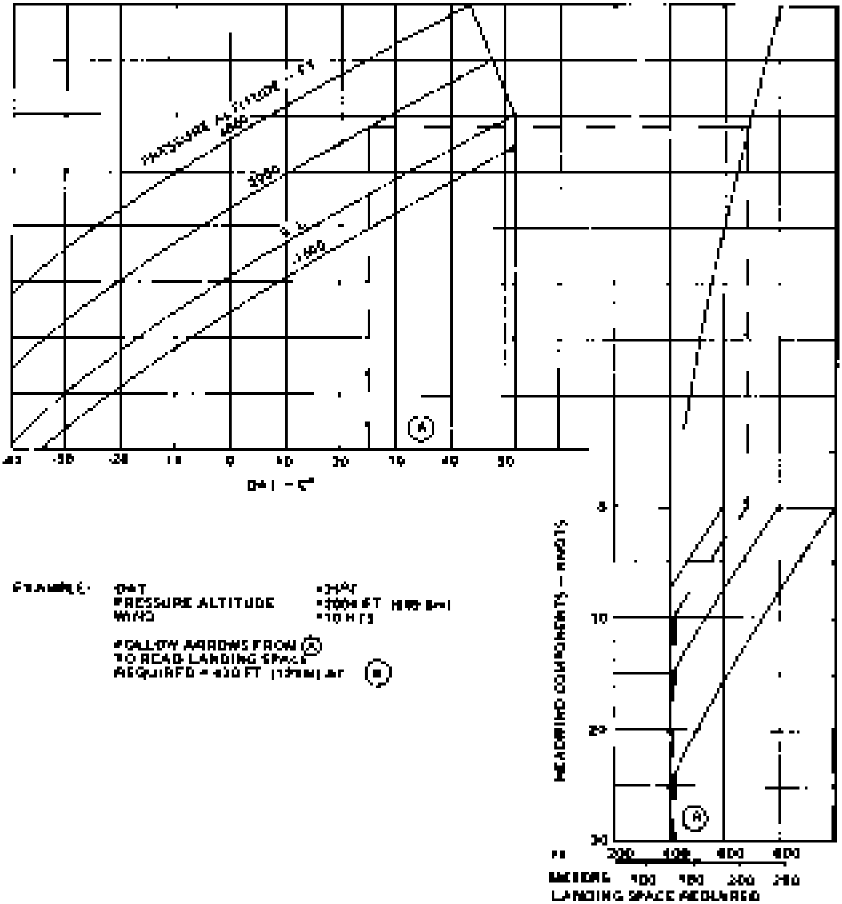
Figure 6-7. Takeoff flight path (Sheet 6 of 6)

LANDING SPACE REQUIRED — 50 FT HEIGHT TO STOP

GW 7,500 TO 11,900 LB (3402 TO 5398 Kg)

LANDING DECISION POINT 100 FEET (30.5 METERS) @ 40 KIAS

RATE OF DESCENT 500 FT/MIN



EXAMPLE: OAT = [illegible]
PRESSURE ALTITUDE = [illegible] FT [illegible]
WIND = 10 KTS

FOLLOW ARROWS FROM (A) TO READ LANDING SPACE REQUIRED = 400 FT ([illegible] M) AT (B)

Figure 6-8. Landing space required chart