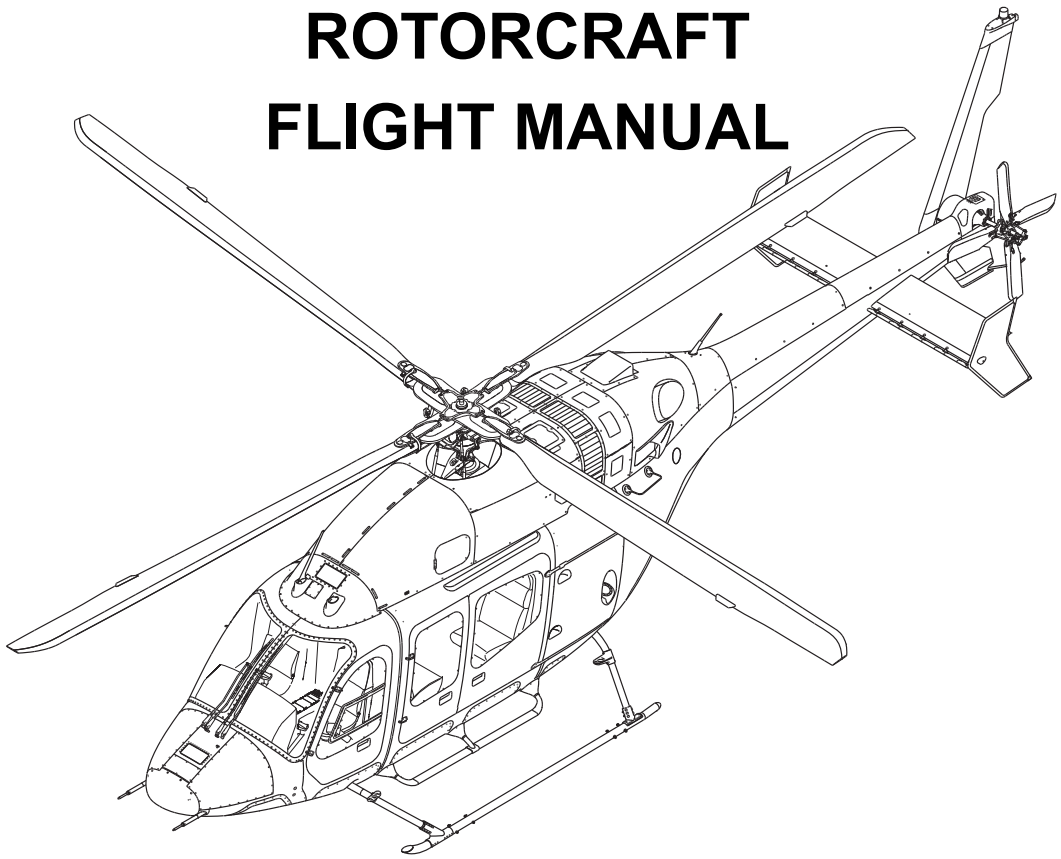
BELL 429

ROTORCRAFT
FLIGHT MANUAL



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THE AVIATION REGULATORY AUTHORITY FOR THIS FLIGHT MANUAL IS THE CANADIAN DEPARTMENT OF TRANSPORT, NATIONAL AIRCRAFT CERTIFICATION.

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THIS MANUAL SHALL BE IN THE HELICOPTER DURING ALL OPERATIONS

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NOTICE PAGE

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8/11/2021

Andreas Hartono

CHIEF, FLIGHT TEST
FOR
DIRECTOR — NATIONAL AIRCRAFT CERTIFICATION
TRANSPORT CANADA

GENERAL INFORMATION

ORGANIZATION

This Rotorcraft Flight Manual is divided into five sections and an appendix as follows:

Section 1	—	LIMITATIONS
Section 2	—	NORMAL PROCEDURES
Section 3	—	EMERGENCY AND MALFUNCTION PROCEDURES
Section 4	—	PERFORMANCE
Section 5	—	WEIGHT AND BALANCE
Appendix A	—	OPTIONAL EQUIPMENT SUPPLEMENTS

Sections 1 through 4 contain Transport Canada (TC) approved data necessary to operate basic helicopter in a safe and efficient manner.

Section 5 contains weight and balance data necessary for flight planning.

Appendix A contains a list of approved supplements for optional equipment, which shall be used in conjunction with Basic Flight Manual when respective optional equipment kits are installed.

Manufacturer's Data manual (BHT-429-MD-1) contains information to be used in conjunction with Flight Manual. Manufacturer's Data manual is divided into four sections:

Section 1	—	SYSTEMS DESCRIPTION
Section 2	—	HANDLING AND SERVICING
Section 3	—	CONVERSION TABLES
Section 4	—	EXPANDED PERFORMANCE

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

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

SHALL and MUST have 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, ACRONYMS, AND PLACARDING

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

A	—	Amperes
ANTI COLL	—	Anticollision
ADAHRS	—	Air Data Attitude Heading Reference System
ADC	—	Air Data Computer
ADF	—	Automatic Direction Finder
ADI	—	Attitude Director Indicator
ADIU	—	Aircraft Data Interface Unit
AEO	—	All Engines Operating
AFCS	—	Automatic Flight Control System
AHRS	—	Attitude Heading Reference System
AIR COND	—	Air Conditioner
ALT	—	Altimeter
ALTN	—	Alternate
AMPS	—	Amperes
ANNUNC	—	Annunciator
A/P	—	Autopilot
A/S	—	Airspeed
ATT	—	Attitude
ATTD	—	Attitude
AUTO	—	Automatic
BAL	—	Balance
BATT	—	Battery
BIT	—	Built In Test
BL	—	Butt Line
BRT	—	Bright
°C	—	Degrees Celsius
CAS	—	Crew Alerting System
CG	—	Center of Gravity
CFR	—	Code of Federal Regulations
CHFD	—	Course Heading Flight Director
CM	—	Centimeter(s)
COLL	—	Collective
COM	—	Communication
CRS	—	Course
CS	—	Certification Specification
CTR	—	Center
dB	—	Decibel
DET	—	Detector
DH	—	Decision Height
DU	—	Display Unit
ECS	—	Environmental Control System
ECU	—	Electronic Engine Control Unit
EICAS	—	Engine Indication and Crew Alerting System
ELT	—	Emergency Locator Transmitter
EMERG	—	Emergency
ENG	—	Engine
EPN	—	Effective Perceived Noise
EPNL	—	Effective Perceived Noise Level
EXT	—	External
°F	—	Degrees Fahrenheit
FAA	—	Federal Aviation Administration

FAIL	—	Failure
FD	—	Flight Director
FMM	—	Fuel Management Module
FMS	—	Flight Manual Supplement
FS	—	Fuselage Station
FT	—	Foot, Feet
FT	—	Force Trim
FWD	—	Forward
GEN	—	Generator
GPA	—	Glide Path Angle
GW	—	Gross Weight
H_D	—	Density Altitude
HDG	—	Heading
H_P	—	Pressure Altitude
HSI	—	Horizontal Situation Indicator
HTR	—	Heater
HV	—	Height-Velocity
HYD	—	Hydraulic
IAS	—	Indicated Airspeed
ICAO	—	International Civil Aviation Organization
ICS	—	Intercommunication System
IFR	—	Instrument Flight Rules
IGE	—	In ground Effect
ILS	—	Instrument Landing System
IMC	—	Instrument Meteorological Conditions
IN	—	Inch(es)
INOP	—	Inoperative
INSTR	—	Instrument
INTCON	—	Interconnect
KCAS	—	Knots Calibrated Airspeed
kg	—	Kilogram(s)
KIAS	—	Knots Indicated Airspeed
KTAS	—	Knots True Airspeed
L	—	Left
L	—	Liter(s)
LB(S)	—	Pound(s)
LCF	—	Low Cycle Fatigue
LDG	—	Landing
LMT	—	Limit
LMTG	—	Limiting
LT	—	Light
M	—	Meter
MAN	—	Manual
MAX	—	Maximum
MCP	—	Maximum Continuous Power
MD	—	Manufacturer's Data
MFD	—	Multi-Function Display
MGT	—	Measured Gas Temperature
mm	—	Millimeter(s)
NAV	—	Navigation
N_G	—	Gas Producer RPM
NORM	—	Normal
N_P	—	Power Turbine RPM
N_R	—	Rotor RPM
N-ESS	—	Non-essential
OAT	—	Outside Air Temperature
OEI	—	One Engine Inoperative
OGE	—	Out of Ground Effect
OVRD	—	Override
P	—	Pressure

PEDL STOP INOP	—	Pedal Stop Inoperative
PFD	—	Primary Flight Display
PIT	—	Pitch
PRESS	—	Pressure
PSI	—	Pounds per Square Inch
PSI	—	Power Situation Indicator
PWR	—	Power
Q	—	Engine Torque
QFE	—	Atmospheric pressure at the airport reference point
QNH	—	Atmospheric pressure at sea level, at aircraft position
QT	—	Total Torque
R	—	Right
RCCB	—	Remote Control Circuit Breaker
REL	—	Release
RLSE	—	Release
ROL	—	Roll
RPM	—	Revolutions per Minute
RTR	—	Rotor
SCAS	—	Stability Control Augmentation System
SEC	—	Second(s)
SQ	—	Square
SRCH	—	Search
STBY	—	Standby
SYS	—	System
T	—	Temperature
TC	—	Transport Canada
TOGW	—	Takeoff Gross Weight
T/R	—	Tail Rotor
TRNG	—	Training
TRQ	—	Torque
V	—	Volts
VDC	—	Volts Direct Current
VFR	—	Visual Flight Rules
VMC	—	Visual Meteorological Conditions
V_{NE}	—	Never Exceed Speed
VS	—	Vertical Speed
VSI	—	Vertical Speed Indicator
V_Y	—	Best Rate of Climb Speed
V_{YI}	—	Instrument Climb Speed
WAT	—	Weight Altitude Temperature
W/C	—	Warning/Caution
WOG	—	Weight on Gear
XFER	—	Transfer
XMSN	—	Transmission
XPNDR	—	Transponder
ZFW	—	Zero Fuel Weight
σ	—	Density Ratio

Section 1

LIMITATIONS

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Section 1

LIMITATIONS

1-1. INTRODUCTION

Compliance with limitations section is required by appropriate operating rules. Anytime an operating limitation is exceeded, an appropriate entry shall be made in helicopter logbook. Entry shall state which limit was exceeded, duration, extreme value attained, and any additional information essential in determining maintenance action required.

Intentional use of transient limits is prohibited.

Prior to takeoff, applicable maintenance action shall be taken for all warning, caution, and advisory messages.

Torque events shall be recorded. A torque event is defined as a takeoff or a load lift (internal or external).

Landings shall be recorded. Run-on landings and full autorotation landings shall be recorded separately.

A run-on landing is defined as one where there is forward ground travel of the helicopter greater than 3 feet with the weight on the skids.

1-2. BASIS OF CERTIFICATION

This helicopter is certified under Canadian Airworthiness Manual Chapters 527, Normal Category helicopter, 516 Aircraft emissions, and the relevant paragraphs of Chapter 529, Transport Category helicopter, for Category A engine isolation. These are equivalent to the corresponding 14 CFR Parts 27, 29 and 36, and CS-27, 29 and 36.

1-3. TYPES OF OPERATION

Basic configured helicopter is approved for eight place seating and certified for land operation under day or night VFR/IFR non-icing conditions.

The dual Garmin GNSS navigation system as installed has been found to comply with the following navigation specifications regarding operations: RNP-10, RNAV 5, B-RNAV, RNP-4, RNAV 2, P-RNAV, RNAV 1, RNP 1, and RNP APCH.

1-4. FLIGHT CREW

Minimum flight crew for VFR consists of one pilot. Pilot may operate helicopter from either crew seat if dual controls and left DU are installed; otherwise pilot shall operate helicopter from right crew seat.

Single pilot IFR shall be operated from right crew seat. Dual controls and left DU shall be installed for dual pilot IFR.

Left crew seat may be used for an additional pilot when approved dual controls are installed.

1-5. CONFIGURATION

Garmin GNS 430W/530W main software shall be 4.01 with GPS software 3.2, or main software 5.20 with GPS software 5.0.

Both GNS units must have the same software versions.

For flights relying on the Garmin NAVIGATION SYSTEM, verify that the navigation database is current and will remain current for the duration of the flight. GPS/SBAS based IFR enroute, oceanic, and terminal navigation is

prohibited unless the flight crew verifies and uses a valid, compatible, and current navigation database or verifies each waypoint for accuracy by reference to current approved data.

1-5-A. REQUIRED EQUIPMENT

An operative headset is required for each pilot.

1-5-A-1. AFCS

Both autopilots AP 1 and AP 2 shall be on or off for VFR flight.

Both autopilots AP 1 and AP 2 shall be engaged in ATT mode during IFR flight.

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

Minimum airspeed for coupled flight director modes:

3-axis

- HDG/NAV or APPR — 45 KIAS.
- ASPD — 30 KIAS.
- ALT/VS/GA or ALTS — 60 KIAS.

4-axis

- HDG/NAV or APPR — 45 KIAS.
- ASPD/ALT/VS/GA or ALTS — 30 KIAS.

Minimum use height for coupled flight — 50 feet.

1-5-A-2. 3-AXIS COUPLED APPROACH

When 70 KIAS or less, ASPD (SPD) mode shall be engaged upon glide slope/glide path interception. With ASPD (SPD) on the pitch axis, the missed approach segment may be initiated by increasing collective to achieve a positive rate of climb (750 ft/min) while targeting 70 KIAS.

CAUTION

WHEN GO-AROUND (GA) SELECTED, IF POWER IS INCREASED TO ATTAIN A HIGH RATE OF CLIMB ABOVE 750 FEET PER MINUTE, POSITIVE CLIMB GRADIENT WILL BE DEGRADED.

When GA selected, increase collective (power application) to target 750 feet per minute.

1-5-A-3. STEEP INSTRUMENT APPROACH PROCEDURES

NOTE

Steep instrument approaches have glide path angles greater than 3.5 degrees.

Maximum GPA is 9.0 degrees.

Minimum airspeed is Vmini.

Maximum airspeed for the final and missed approach is the lesser of 90 KIAS or as published on the instrument approach procedure.

Maximum rate of descent is 1000 feet per minute for manual and coupled steep approaches.

1-5-B. OPTIONAL EQUIPMENT

Refer to appropriate FMS for additional limitations, procedures, and performance data for optional equipment.

1-5-C. CARGO

Maximum allowable cabin and baggage floor loading for cargo is 55 pounds per square foot (269 kg/m^2).

Maximum cabin floor load (forward FS 238) for cargo is 1200 pounds (544 kg).

Maximum baggage compartment floor load (aft FS 238) is 540 pounds (245 kg).

Cargo longer than 118.4 inches (300.74 cm) shall only be loaded or unloaded through the aft cabin doors (clamshell doors) with the rotors not turning.

Cargo shall be properly secured by tie-down devices to prevent the load from shifting under flight and ground operations. Cargo must be loaded and secured so that it does not obstruct passenger access to exits.

1-5-D. DOORS OPEN/REMOVED

NOTE

With crew door(s) removed, indicated altitude may be up to 50 feet higher than actual altitude.

Any combination of aft fairing panel, crew door(s), hinged passenger door(s) removed and/or sliding door(s) secured, fully open, or removed is approved for VMC flight. With hinged passenger door removed, sliding door shall be fully open or removed.

CAUTION

ALL UNSECURED ITEMS SHALL BE REMOVED FROM CABIN WHEN ANY DOOR AND/OR AFT FAIRING PANEL IS REMOVED.

NOTE

Flight is not approved with optional aft cabin doors kit (clamshell doors) in the open position.

Opening or removing doors shifts helicopter center of gravity and affects V_{NE}. Refer to Section 5 and to airspeed limitations.

1-6. WEIGHT AND CENTER OF GRAVITY

1-6-A. WEIGHT

Maximum internal gross weight (GW) for takeoff and landing is 7000 pounds (3175 kg).

Minimum GW for flight is 4400 pounds (1996 kg).

1-6-B. CENTER OF GRAVITY

For longitudinal CG limits, refer to Gross Weight Longitudinal Center of Gravity Limits chart (Figure 1-1).

For lateral CG limits, refer to Gross Weight Lateral Center of Gravity Limits chart (Figure 1-2).

1-7. AIRSPEED

Basic V_{NE} is 155 KIAS. Decrease V_{NE} for ambient conditions in accordance with the AIRSPEED LIMITATIONS placard (Figure 1-3). Airspeed indicator displays actual V_{NE} for current conditions of temperature and altitude (H_P).

Maximum sideward and rearward flight or crosswind and tailwind hover is 35 knots.

V_{NE} for OEI operations is 140 KIAS or placarded V_{NE}, whichever is less.

V_{NE} for steady state autorotation is 100 KIAS.

V_{MINI} — Minimum IFR speed is 45 KIAS.

V_{NE} with searchlight extended (if installed) is 135 KIAS.

V_{NE} for one or both crew doors removed is 140 KIAS or placarded V_{NE}, whichever is less.

V_{NE} for any combination of aft fairing panel removed, hinged passenger door removed, and/or sliding door(s) open or removed is 90 KIAS.

V_{NE} for sliding door in transit is 90 KIAS.

V_{NE} at 104% N_R is 60 KIAS.

NOTE

V_Y/V_{YI} — 60 KIAS.

Airspeed for minimum rate of descent in autorotation — 53 KIAS.

1-8. ALTITUDE

Maximum operating pressure altitude is 20,000 feet (6096 m).

1-9. MANEUVERING

1-9-A. PROHIBITED MANEUVERS

Aerobatic maneuvers are prohibited.

1-9-B. CLIMB AND DESCENT

Maximum IFR rate of climb is 2000 feet per minute.

Maximum IFR approach slope is 9.0°.

1-9-C. SLOPE LANDINGS

CAUTION

SLOPE LANDINGS HAVE BEEN DEMONSTRATED TO THE SLOPE LANDING LIMITS. OTHER CONDITIONS INCLUDING, BUT NOT LIMITED TO, WIND DIRECTION AND VELOCITY, CENTER OF GRAVITY, AND THE CONDITION OF THE SLOPE, (LOOSE ROCK, SOFT MUD, SNOW, WET GRASS, ETC.) MAY LIMIT MAXIMUM SLOPE TO A VALUE LESS THAN THE PUBLISHED LIMITS.

CAUTION

DO NOT USE LARGE ABRUPT CYCLIC DISPLACEMENTS IN CONJUNCTION WITH LOW COLLECTIVE.

Side slope or nose up landings are limited to 10° slope, and nose down slope landings are limited to 5° slope.

1-10. NOT USED

1-11. AMBIENT TEMPERATURES

Maximum sea level ambient air temperature for operation is 51.7°C (125°F) and decreases with H_P at a standard lapse rate of 2°C (3.6°F) per 1000 feet.

Minimum ambient air temperature is -40°C (-40°F).

Refer to Ambient Air Temperature Limitations chart (Figure 1-4).

1-12. ELECTRICAL

1-12-A. GENERATOR

150 amp generator is limited to -23°C (-9.4°F) for cold soak engine starts.

Continuous (150 amp generator)	0 to 150 amps
Continuous (200 amp generator)	0 to 200 amps

NOTE

Ammeter digital display greater than limits during a generator assisted start is normal.

1-12-B. STARTER DUTY CYCLE

EXTERNAL POWER/ GENERATOR ASSISTED START	BATTERY START
40 seconds ON	60 seconds ON
30 seconds OFF	60 seconds OFF
40 seconds ON	60 seconds ON
30 seconds OFF	60 seconds OFF
40 seconds ON	60 seconds ON
30 minutes OFF	30 minutes OFF

1-12-C. GROUND POWER UNIT

28 ±0.5 VDC external power source for starting shall be at least 350 amps, limited to 500 amps.

1-13. POWER PLANT

Pratt & Whitney Canada Model PW207D1/D2 (PW207D2 incorporates fuel heater kit).

WARNING

EXCEEDANCE OF 30-SECOND OEI POWER WITH THE LIMIT OVERRIDE FEATURE IS LIMITED TO A ONE TIME USE OF LESS THAN 20 SECONDS. AFTER LANDING, THE HELICOPTER IS UNSERVICEABLE. ENGINE OVERHAUL WILL BE REQUIRED, AND TRANSMISSION OVERHAUL MAY BE REQUIRED.

NOTE

Operation in 30-second, 2-minute, and 30-minute OEI ranges are for emergency use only.

1-13-A. GAS PRODUCER RPM (N_G)

TWIN ENGINE OPERATION

Continuous	63 to 97.2%
Maximum continuous	97.2%
Takeoff (5 minutes)	97.3 to 99.8%
Maximum for takeoff	99.8%

ONE ENGINE INOPERATIVE (OEI)

Continuous	63 to 99.8%
Maximum continuous	99.8%
30 minutes	99.9 to 101.2%
2 minutes	101.3 to 102.2%
30 seconds	102.3 to 104.3%
Maximum OEI	104.3%

1-13-B. POWER TURBINE RPM (N_P)

Continuous	Idle to 100%
Maximum continuous	100%
Maximum continuous, 60 KIAS or less	104%
Transient (20 seconds)	105 to 112%

1-13-C. MEASURED GAS TEMPERATURE (MGT)

STARTING

Maximum (2 seconds)	875°C
Normal	0 to 650°C

NOTE

MGT start limit triangle is set at 875°C. If MGT exceeds 650°C, after 2 seconds it moves down scale to 750°C, then reduces linearly to 650°C. If PSI needle does not go above start limit triangle, there is no MGT exceedance during start.

TWIN ENGINE OPERATION

Continuous	350 to 850°C
Maximum continuous	850°C
Takeoff (5 minutes)	851 to 900°C
Maximum for takeoff	900°C
Transient (20 seconds)	901 to 950°C

ONE ENGINE INOPERATIVE (OEI)

Continuous	350 to 900°C
Maximum continuous	900°C
30 minutes	901 to 925°C
2 minutes	926 to 950°C
30 seconds	951 to 990°C
Maximum OEI	990°C

1-13-D. TOTAL TORQUE (QT)

NOTE

Total torque (QT) value is the sum of both engine torques.

PSI will adjust and show limiting parameter (QT, MGT, N_G).

TWIN ENGINE OPERATION

TOTAL TORQUE (QT)	
Continuous	0 to 100%
Maximum continuous	100%
Transient QT (5 seconds)	105%

ONE ENGINE (Q) INOPERATIVE (OEI)

Continuous	0 to 50%
Maximum continuous	50%
2 minutes	50 to 64%
30 seconds	64 to 66%
Maximum OEI	66%

1-13-E. ENGINE OIL PRESSURE

Minimum	20%
Continuous	21 to 80%
Maximum	80%
Maximum during warm-up, 10 minutes	99%

1-13-F. ENGINE OIL TEMPERATURE

Operation with engine oil temperature below 14°C is limited to starting and idle operation.

Continuous	14 to 127°C
Maximum	127°C

1-14. TRANSMISSION

1-14-A. TRANSMISSION OIL PRESSURE

Idle operation	25 to 80 PSI
Continuous	41 to 80 PSI
Maximum	80 PSI
Maximum during start and warm-up, 10 minutes	130 PSI

NOTE

Continued flight in 25 to 40 PSI range is permitted. Appropriate maintenance is required prior to next flight.

1-14-B. TRANSMISSION OIL TEMPERATURE

Operation with transmission oil temperature below 15°C is limited to ground operation.

Continuous	15 to 110°C
Maximum	110°C

1-15. ROTOR

1-15-A. ROTOR RPM (N_R) — POWER ON

Continuous	99 to 100%
Maximum continuous	100
Maximum continuous, 60 KIAS or less	104%

NOTE

For ground operations only, continuous rotor RPM range is 60 to 104%.

N_R/N_P excursions (100 ±3%), due to normal maneuvering or power changes, are permitted.

Use of 104% N_R is limited to 60 KIAS or less.

1-15-B. ROTOR RPM (N_R) — POWER OFF

Minimum	85%
Continuous	85 to 107%
Maximum	107%

1-16. HYDRAULIC

Hydraulic fluid MIL-PRF-87257 (NATO H-538) may be used at all ambient temperatures.

Both hydraulic systems shall be operative prior to takeoff.

1-16-A. HYDRAULIC PRESSURE

Minimum	1250 PSI
Continuous	1250 to 1800 PSI
Maximum	1800 PSI

1-16-B. HYDRAULIC TEMPERATURE

NOTE

When hydraulic oil temperature is below -20°C, rate limiting and/or AP performance degradation may occur with single hydraulic operation.

Maximum	120°C

1-17. FUEL AND OIL

1-17-A. FUEL

Anti-icing fuel additive is required for operations at fuel temperatures below 4°C. The maximum allowed concentration of fuel additives is 0.15% by volume.

NOTE

Certain fuels may be supplied with the required additives already incorporated.

Anti-icing fuel additive is not required with PW207D2 engine, which incorporates fuel heater kit.

Fuel conforming to ASTM D-6615, Jet B or MIL-DTL-5624, Grade JP-4 is authorized for use as shown in Figure 1-5.

Fuel conforming to ASTM D-1655, Jet A or A-1, or MIL-DTL-5624, Grade JP-5, or MIL-DTL-83133, Grade JP-8 is authorized for use as shown in Figure 1-5.

1-17-B. OIL

Refer to BHT/PW maintenance manual for approved oils and allowable mixing of approved oils.

1-17-B-1. OIL — ENGINE

Oils conforming to MIL-PRF-23699 (NATO O-156) may be used at all ambient temperatures.

1-17-B-2. OIL — TRANSMISSION AND TAIL ROTOR GEARBOX

Oils conforming to DOD-PRF-85734 may be used at all ambient temperatures.

1-18. ROTOR BRAKE

Rotor brake (if installed) application is limited to ground operation after both engines have been shut down and N_R has decreased to 40% or lower.

NOTE

For emergency stops, apply rotor brake anytime after both engines are shut off.

Engine starts with rotor brake engaged are prohibited.

1-19. NOT USED

1-20. INSTRUMENT MARKINGS AND PLACARDS

Refer to Figure 1-6 for Instrument Markings.

Refer to Figure 1-3 for Placards and Decals.

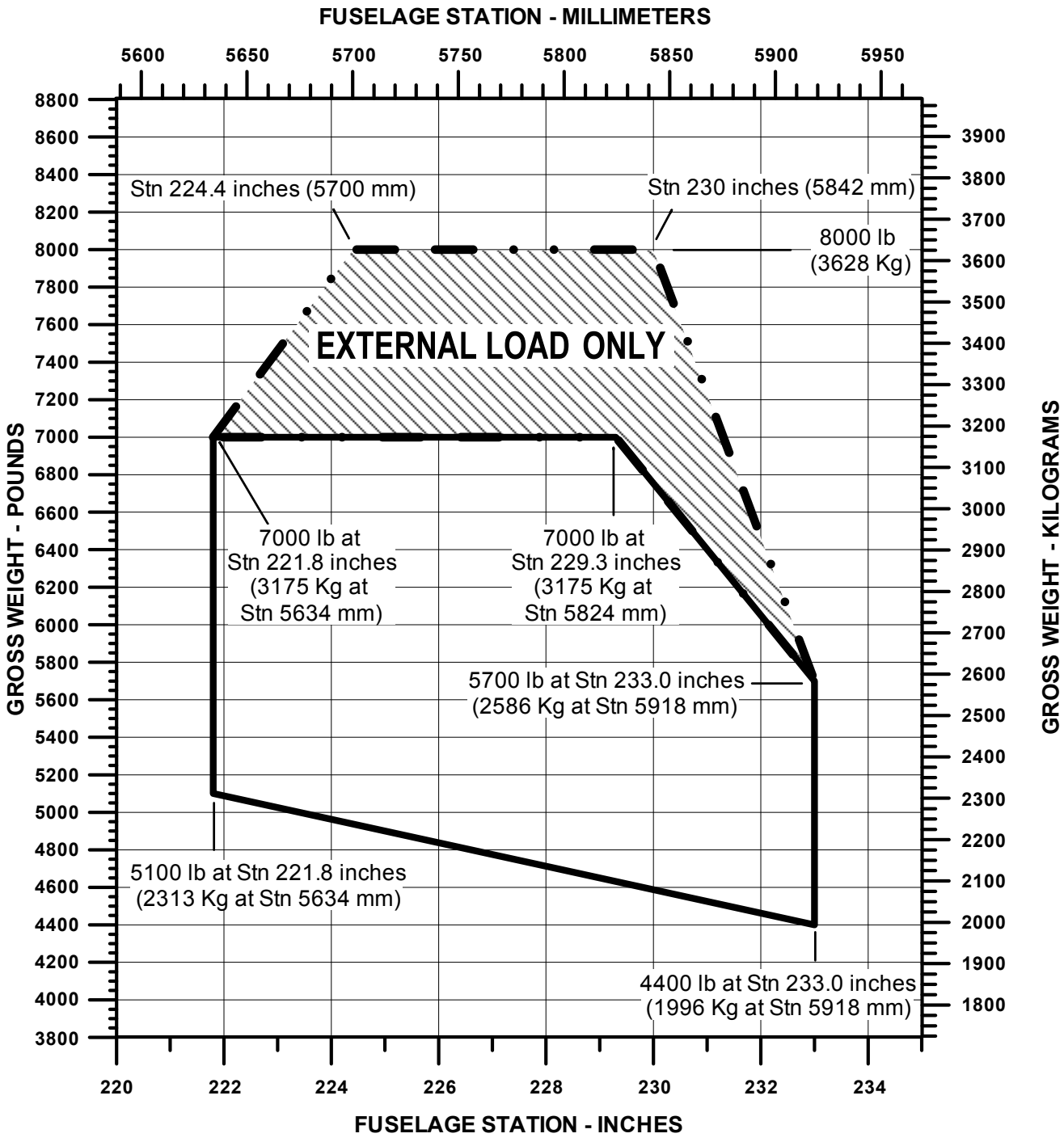


Figure 1-1. Gross Weight Longitudinal Center of Gravity Limits

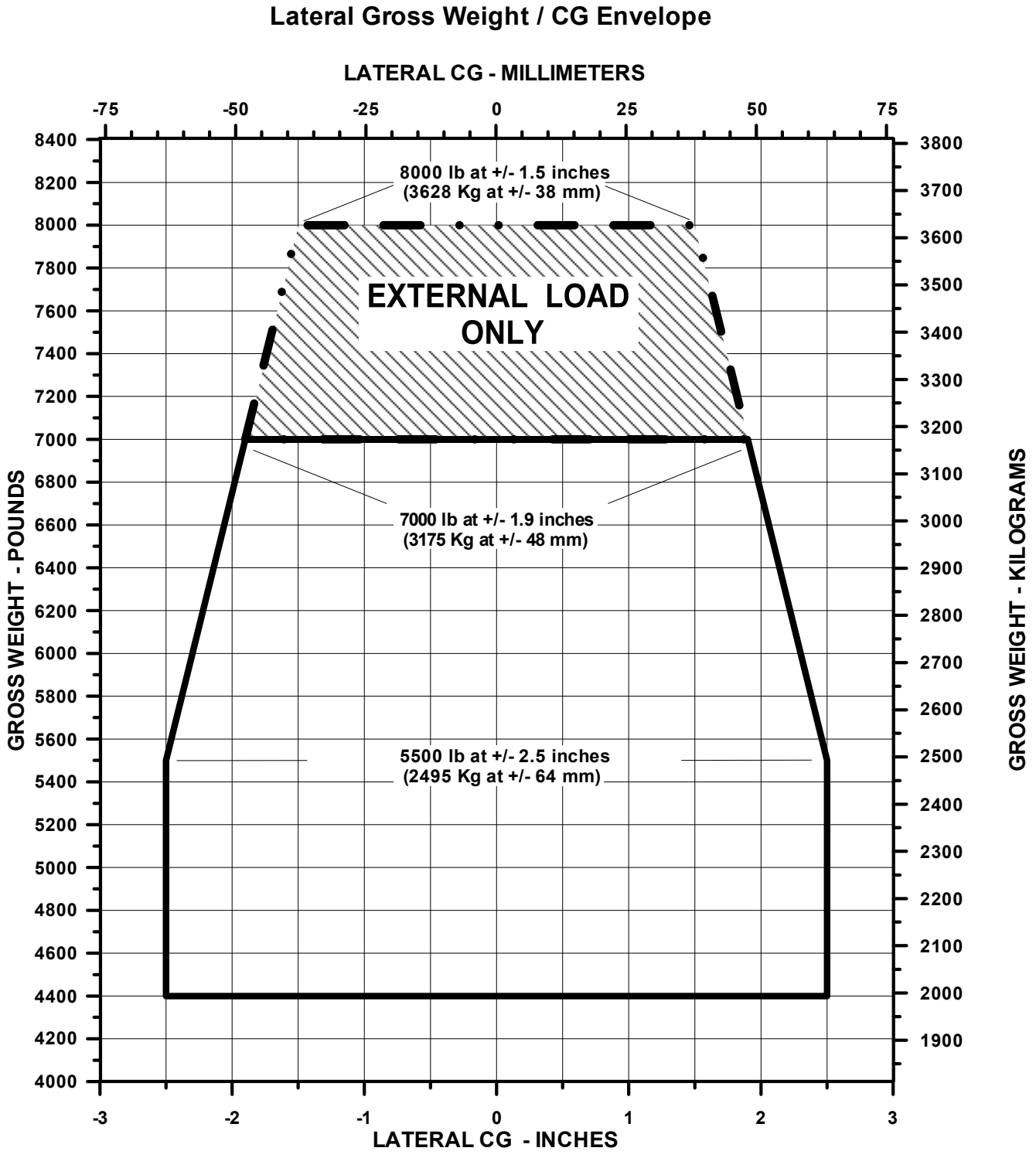


Figure 1-2. Gross Weight Lateral Center of Gravity Limits

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

Location: Instrument panel

429 AIRSPEED LIMITATIONS KIAS											
OAT °C	PRESSURE ALTITUDE x 1000 FT										
	0	2	4	6	8	10	12	14	16	18	20
52	155										
45	155	151	145								
40	155	152	146	140							
35	155	153	147	141	135						
30	155	155	149	142	136	130					
25	155	155	150	144	138	132	126	120			
20	155	155	151	145	139	133	127	121	115		
15	155	155	153	147	140	134	128	122	116	110	
10	155	155	154	148	142	136	130	124	118	112	106
0	155	155	155	151	145	139	132	126	120	114	108
-10	155	155	155	153	147	141	135	129	123	117	111
-20	155	155	151	145	140	135	129	124	120	115	110
-30	154	148	143	138	132	127	123	118	113	109	104
-40	145	139	134	129	125	120	115	111	106	102	98
MAXIMUM OEI VNE 140 KIAS											
AUTOROTATION VNE 100 KIAS											

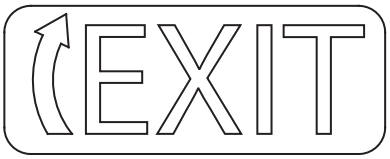
Airspeed limits shown are valid only for corresponding altitudes and temperatures. Blank areas indicate conditions which exceed approved temperature limitations.

Location: Crew headliner

Location: Crew windshield center post and passenger compartment overhead trim

429_FM_1_0010a_c01

Figure 1-3. Placards and Decals (Sheet 1 of 3)



Location: Inside of right pilot door
(Fixed EXIT plate on copilot and passenger doors)

FUEL
FUEL SYSTEM USABLE CAPACITY
BASIC AIRCRAFT 216.9 U.S. GALLONS = 821 LITERS
WITH 429-706-500 AUX FUEL KIT 256.1 U.S. GALLONS = 969 LITERS
SEE FLIGHT MANUAL FOR APPROVED FUELS

Location: Above fuel filler cap

FOR OPERATING TEMPERATURES BELOW 5°C/40°F OAT, FUEL MUST CONTAIN PFA-55MB OR MIL-DTL-27686 ADDITIVE. CONCENTRATION TO BE .06%-.15% BY VOLUME

Location: Above fuel filler cap
(S/N 57001 through 57029)
(Decal not required for PW207D2 Engine Installation)

FOR FUEL TEMPERATURES BELOW 4°C (39.2°F), FUEL MUST CONTAIN PFA-55MB OR MIL-DTL-85470 ADDITIVE. CONCENTRATION TO BE .06%-.15% BY VOLUME

Location: Above fuel filler cap
(S/N 57030 and subsequent
and S/N 57001 through 57029 Post Technical Bulletin)
(Decal not required for PW207D2 Engine Installation)

CARGO MUST BE SECURED
IN ACCORDANCE WITH
FLIGHT MANUAL INSTR

Location: Inside of baggage door

429_FM_1_0010b_c04

Figure 1-3. Placards and Decals (Sheet 2 of 3)

CAUTION
ENERGY ATTENUATING SEATS
NO OBJECTS ALLOWED UNDER SEATS

Location: Crew and passenger compartment overhead trim

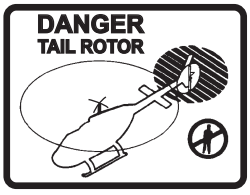
MAX ALLOWABLE FLOOR LOADING FOR CARGO:
CABIN (FWD FS 238) 1200 LBS.
BAGGAGE AREA (AFT FS 238) 540 LBS.
CABIN & BAGGAGE AREA MAX ALLOWABLE CARGO WEIGHT PER SQ. FT. 55 LBS.

Location: Inside of baggage door

PRESSURE (±10%) VS TEMPERATURE										
°C	-40	-30	-20	-10	0	10	20	30	40	50
PSIG	403	436	475	519	570	627	692	765	849	950

Location: Aft fuselage, near fire extinguisher gauge

Location: Center pedestal



Location: Passenger cabin

429_FM_1_0010c_c02

Figure 1-3. Placards and Decals (Sheet 3 of 3)

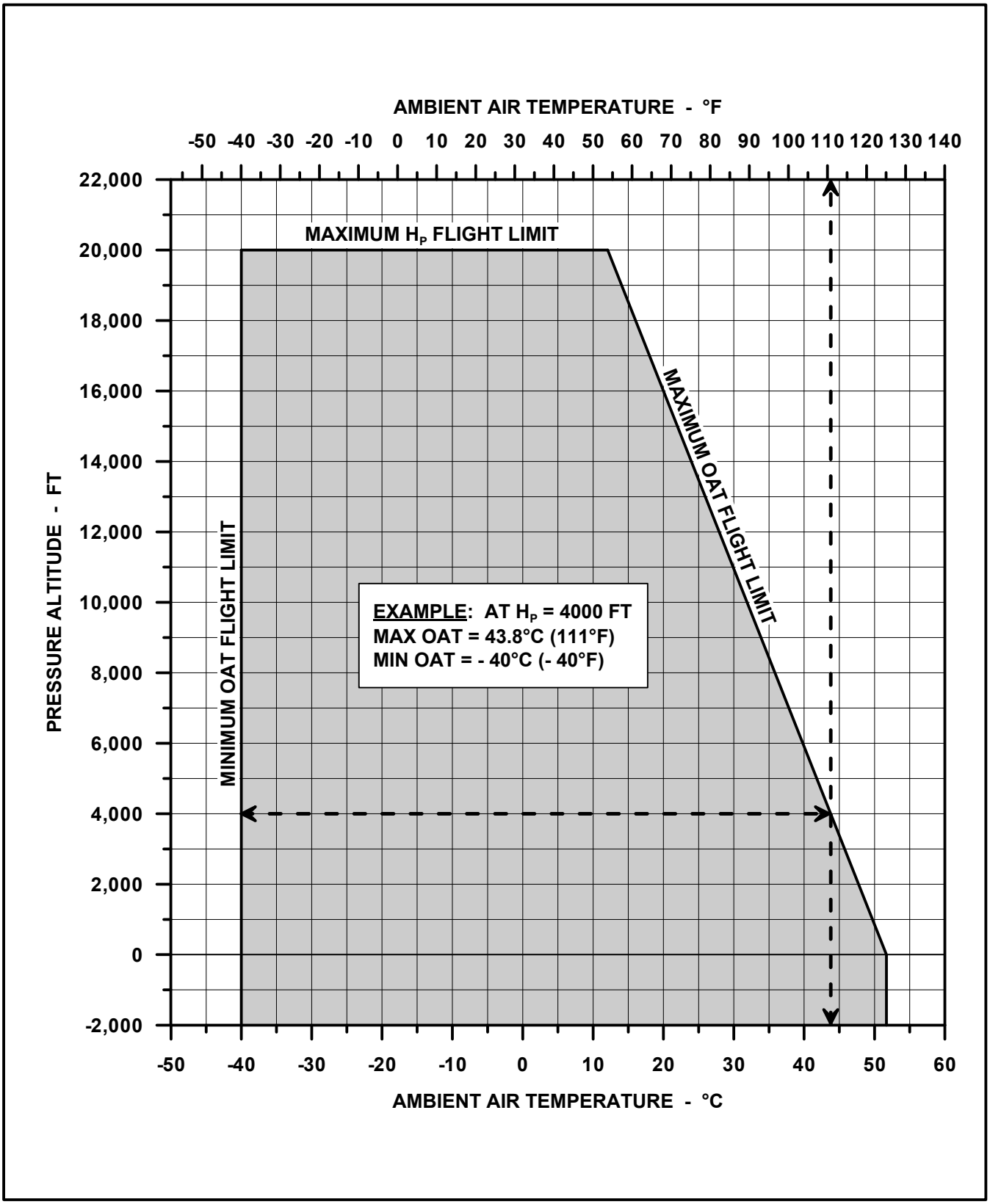


Figure 1-4. Ambient Air Temperature Limitations

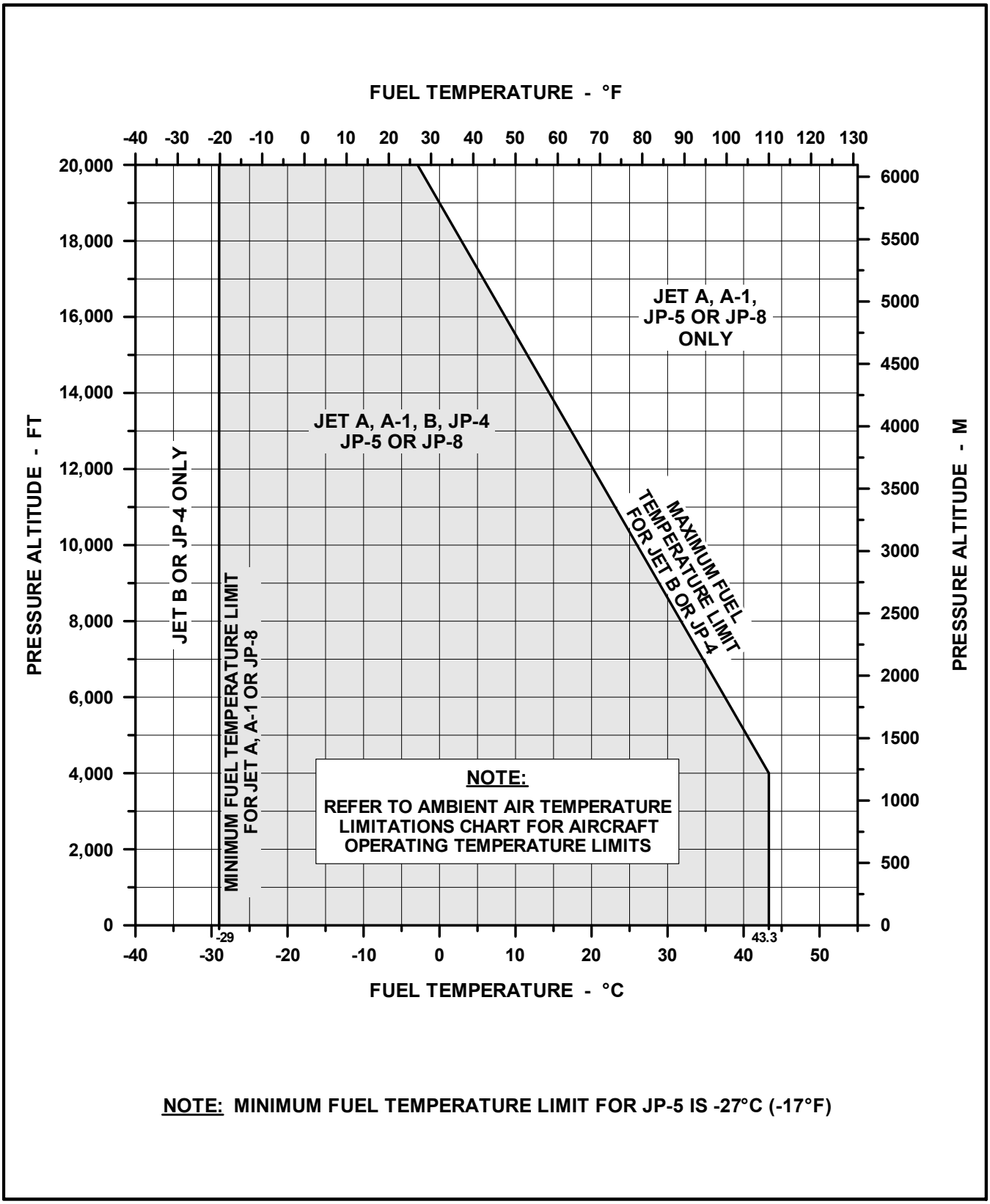
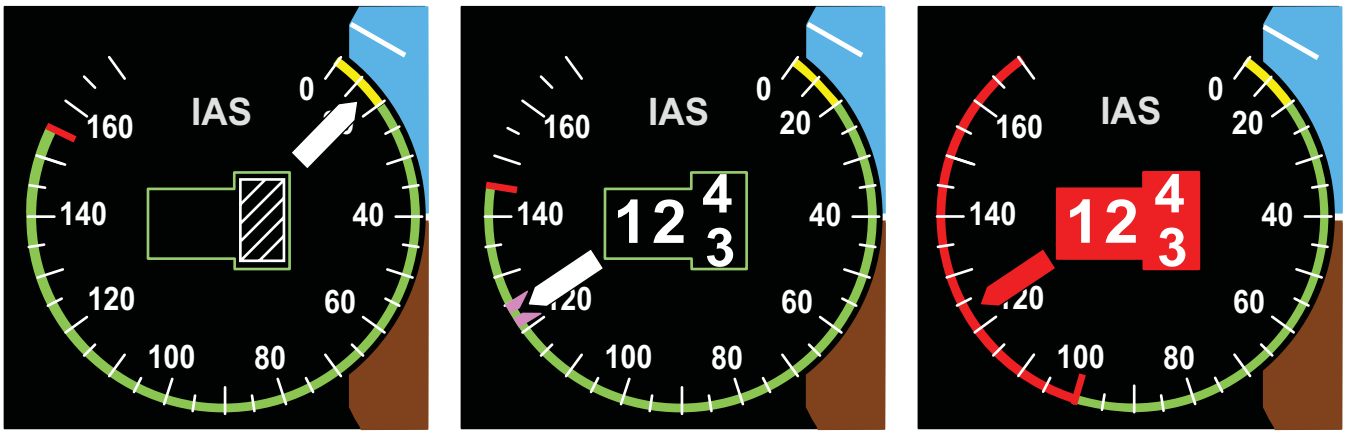


Figure 1-5. Fuel Temperature Limits for Approved Fuels



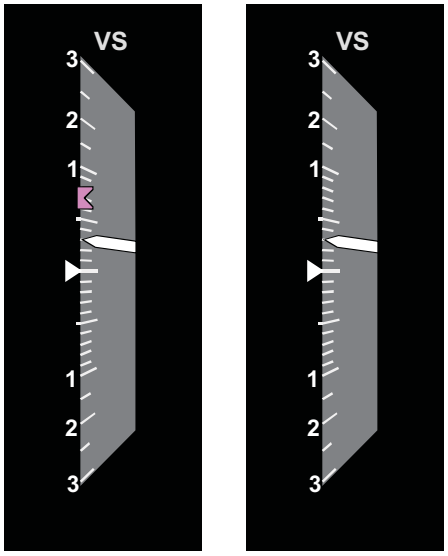
LESS THAN 20 KNOTS

VARIABLE
V_{NE} RADIAL AT 145 KNOTS

V_{NE} 100 KNOTS EXCEEDED
IN AUTOROTATION

AIRSPEED

20 to computed V_{NE}	Continuous operation
100 knots	Maximum for autorotation
V_{NE} - 155 knots	Maximum V_{NE} (variable radial)
0 to 20	Indication is unreliable
AFCS reference marking	

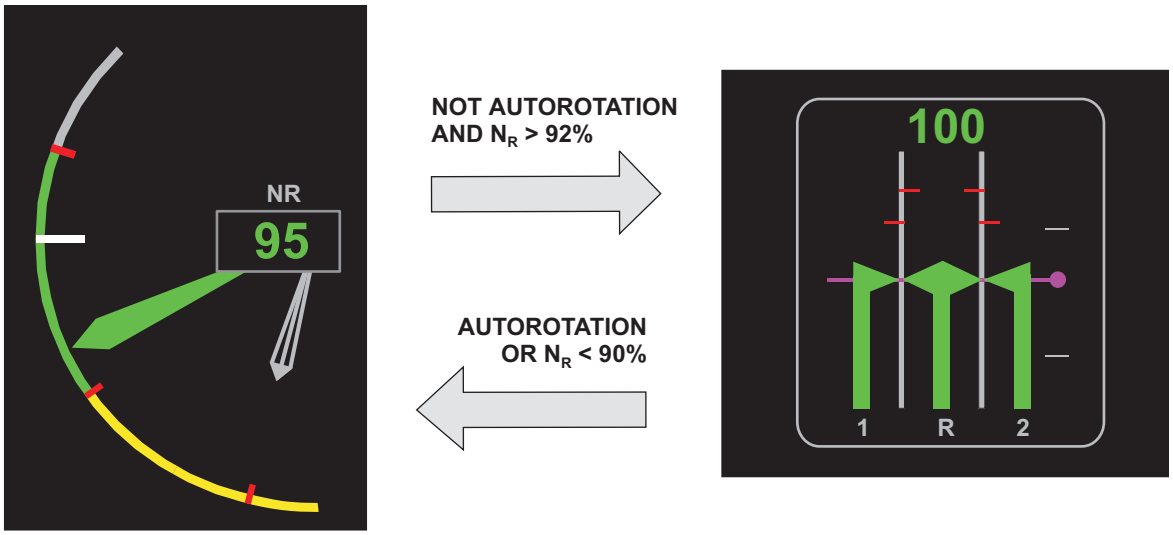


VERTICAL SPEED INDICATOR

AFCS reference marking

429_FM_1_0002_c03

Figure 1-6. Instrument Markings (Sheet 1 of 8)



POWER TURBINE RPM (N_P)

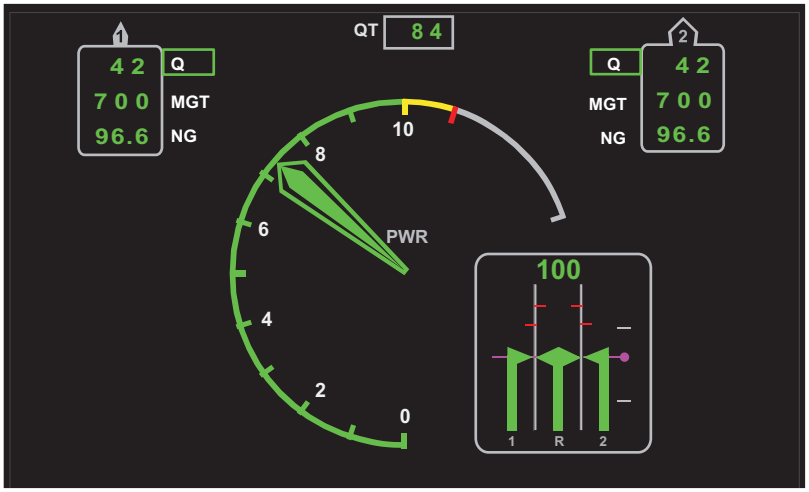
	Idle to 100%	Continuous operation
	100 to 104%	Continuous operation, 60 KIAS or less
	Greater than 104%	

ROTOR RPM (N_R)

	0 to 85%	
	49%	Idle underspeed radial
	85%	Minimum autorotation speed
	Greater than 85 to 107%	Continuous operation
	Greater than 107%	

429_FM_1_0004_c02

Figure 1-6. Instrument Markings (Sheet 2 of 8)



PSI DISPLAY

TWIN ENGINE OPERATION

TOTAL TORQUE (QT)

	0 TO 100%	**Continuous operation**
	Greater than 100%	

ENGINE TORQUE (Q)

	0 TO 50%	**Continuous operation**
	Greater than 50%	

TWIN ENGINE OPERATION

MEASURED GAS TEMPERATURE (MGT)

	350 TO 850°C	**Continuous operation**
	851 TO 900°C	**Takeoff range (5 minutes Maximum)**
	Greater than 900°C	

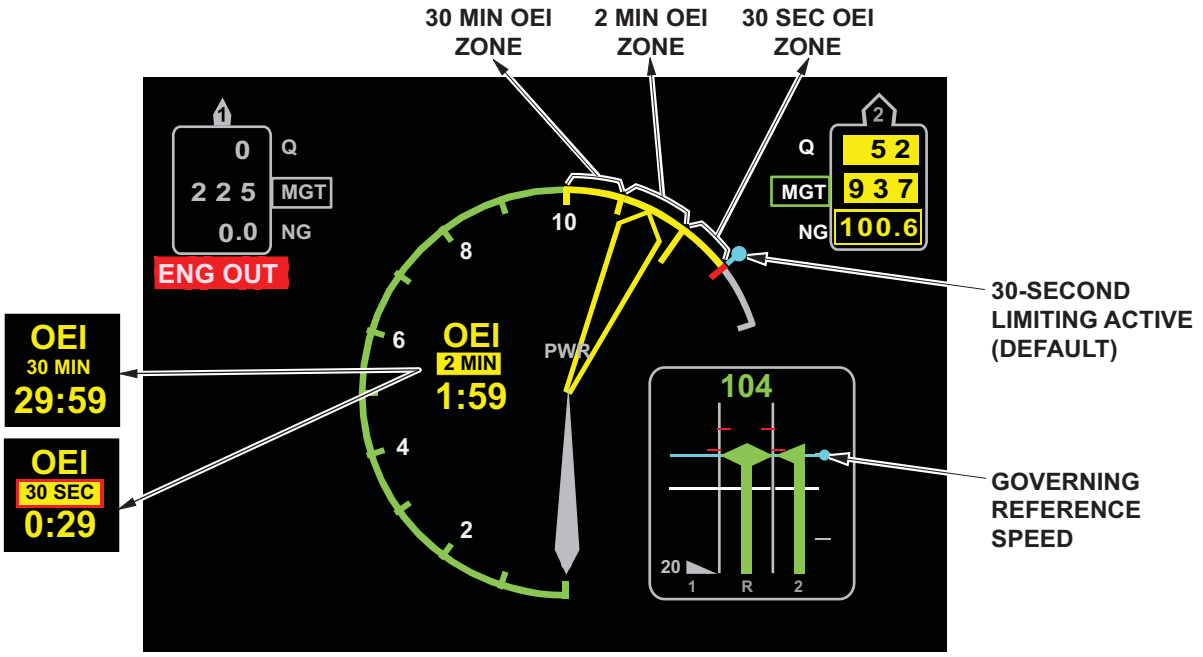
TWIN ENGINE OPERATION

GAS PRODUCER (N_G)

	63 TO 97.2%	**Continuous operation**
	97.3 TO 99.8%	**Takeoff range (5 minutes Maximum)**
	Greater than 99.8%	

429_FM_1_0012_c01

Figure 1-6. Instrument Markings (Sheet 3 of 8)



PSI DISPLAY

ONE ENGINE INOPERATIVE (OEI)

ENGINE TORQUE (Q)

0 TO 50%	Continuous OEI operation
50 TO 64%	2 minute OEI
64 TO 66%	30 second OEI
Greater than 66%	

ONE ENGINE INOPERATIVE (OEI)

MEASURED GAS TEMPERATURE (MGT)

350 TO 900°C	Continuous OEI operation
901 TO 925°C	30 minute OEI
926 TO 950°C	2 minute OEI
951 TO 990°C	30 second OEI
Greater than 990°C	

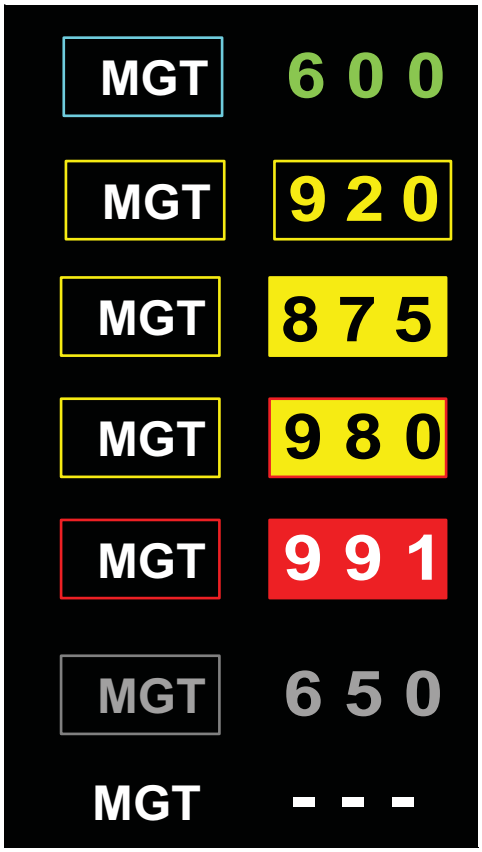
ONE ENGINE INOPERATIVE (OEI)

GAS PRODUCER (N_G)

63 TO 99.8%	Continuous OEI operation
99.9 TO 101.2%	30 minute OEI
101.3 TO 102.2%	2 minute OEI
102.3 TO 104.3%	30 second OEI
Greater than 104.3%	

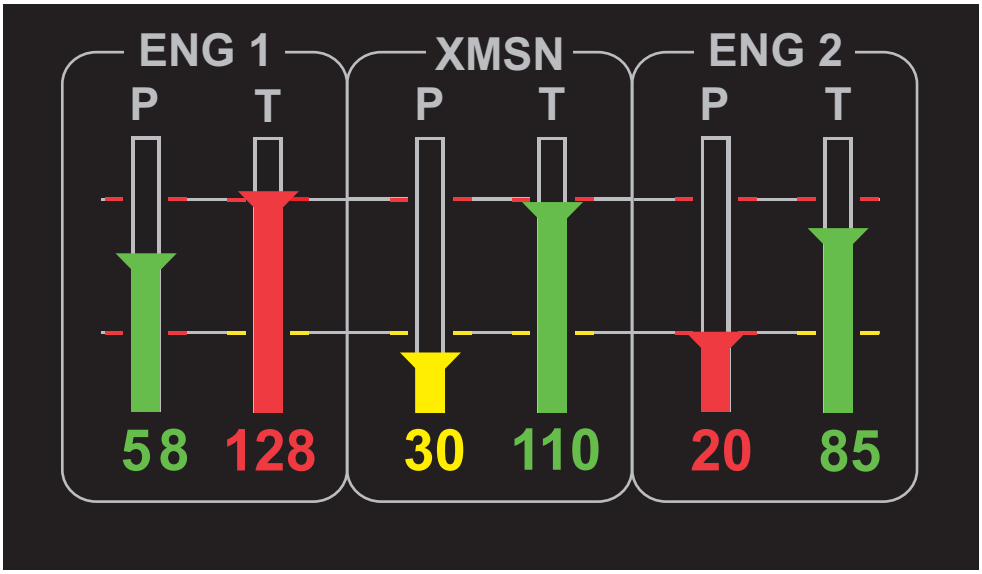
429_FM_1_0011_c03

Figure 1-6. Instrument Markings (Sheet 4 of 8)



429_FM_1_0003_c01

Figure 1-6. Instrument Markings (Sheet 5 of 8)



ENGINE OIL PRESSURE

Less than 21%	
21 to 80%	Continuous operation
Greater than 80%	

ENGINE OIL TEMPERATURE

Less than 14°C	Starting and idle
14 to 127°C	Continuous operation
Greater than 127°C	

TRANSMISSION OIL PRESSURE

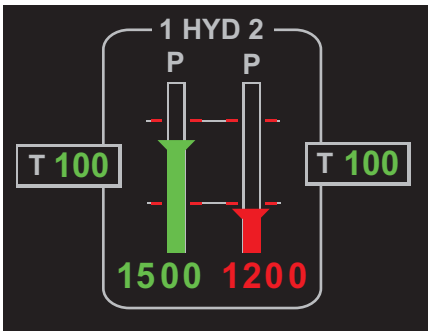
Less than 25 PSI	
25 to 40 PSI	Idle operation
41 to 80 PSI	Continuous operation, including idle
Greater than 80 PSI	

TRANSMISSION OIL TEMPERATURE

Less than 15°C	Starting and ground operation
15 to 110°C	Continuous operation
Greater than 110°C	

429_FM_1_0006_c02

Figure 1-6. Instrument Markings (Sheet 6 of 8)



HYDRAULIC FLUID PRESSURE

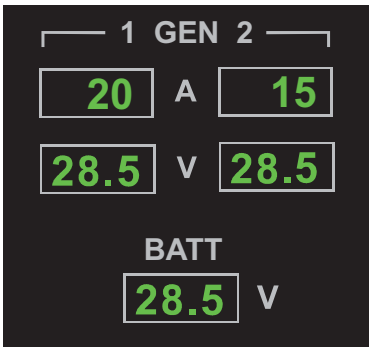
Less than 1250 PSI	
1250 to 1800 PSI	Continuous operation
Greater than 1800 PSI	

HYDRAULIC FLUID TEMPERATURE

Less than -20°C	Declutter not enabled
-20°C to 120°C	Continuous operation (declutter conditions may apply)
Greater than 120°C	

GENERATOR AMMETER

0 to 150 amps	Continuous operation
0 to 200 amps	Continuous operation (200 amp gen - if installed)
Greater than 150 amps	
Greater than 200 amps	200 amp gen (if installed)



GENERATOR VOLTMETER

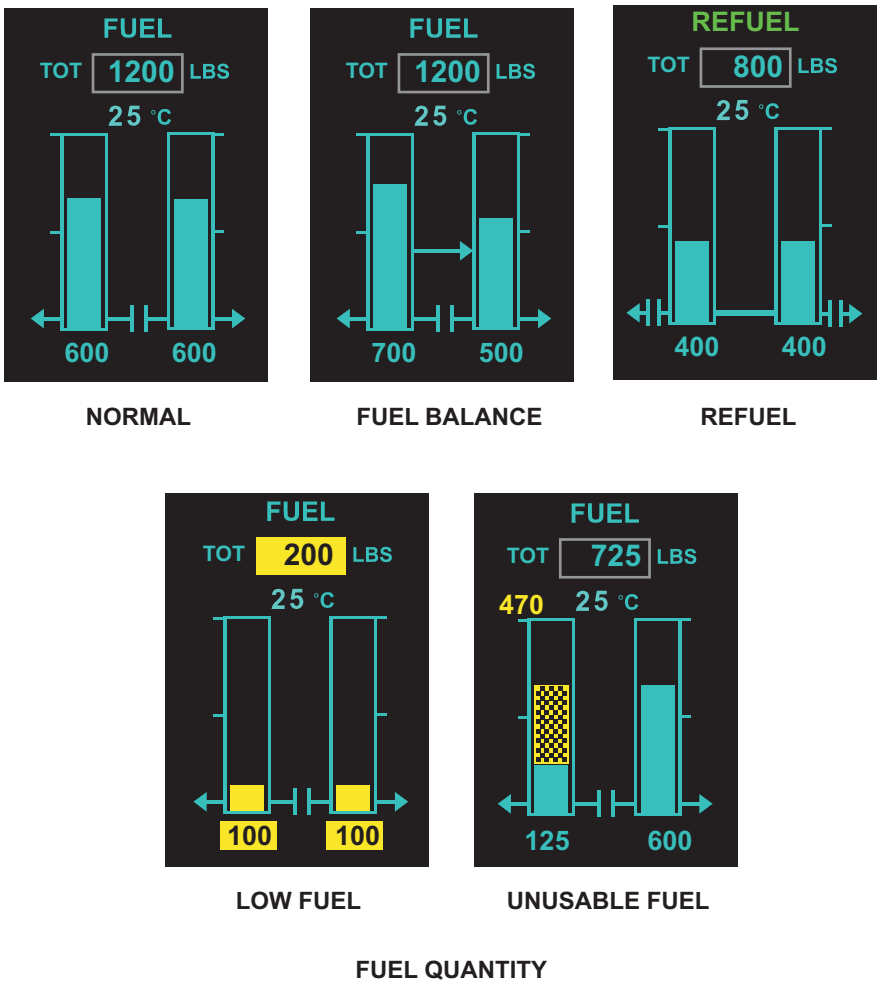
Less than 22 volts	
22 to 32 volts	Continuous operation (declutter conditions may apply)
Greater than 32 volts	

BATTERY VOLTMETER

32 volts or less	(declutter conditions may apply)
Greater than 32 volts	

429_FM_1_0007_c02

Figure 1-6. Instrument Markings (Sheet 7 of 8)



429_FM_1_0013

Figure 1-6. Instrument Markings (Sheet 8 of 8)

Section 2

NORMAL PROCEDURES

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)

LIST OF FIGURES

Section 2

NORMAL PROCEDURES

2-1. INTRODUCTION

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

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

Instructions and procedures contained herein are written for standardization purposes and are not applicable to all situations.

Refer to Garmin GNS 430W Series Quick Reference Guide, P/N 190-00356-01 or Garmin GNS 530W Series Quick Reference Guide, P/N 190-00357-01 for system operation.

2-1-A. COLD WEATHER OPERATIONS

WARNING

IF HELICOPTER HAS BEEN EXPOSED TO SNOW OR ICE CONDITIONS, ALL SNOW AND/OR ICE SHALL BE REMOVED PRIOR TO FLIGHT, ESPECIALLY FROM ROTORS AND INLETS.

Battery starts with 200 amp generators (25/53 amp-hour batteries) have been demonstrated to -38°C (-36.4°F) ambient temperatures when helicopter and battery have been cold soaked. By similarity, the 36/44 amp-hour batteries are better than the 25 amp-hour battery.

Battery starts with 150 amp generators (25/53 amp-hour batteries) have been demonstrated to -23°C (-9.4°F) ambient temperatures when helicopter and battery have been cold soaked. By similarity, the 36/44 amp-hour batteries are better than the 25 amp-hour battery.

Cold temperature starts may result in initial engine oil pressure as high as 99% and transmission oil pressure as high as 130 PSI. Normal oil pressure and temperature, as per Section 1, Limitations, should be obtained after approximately 5 minutes at idle.

If fuel heater kit (PW207D2 engine) is installed, it is normal for FUEL 1/2 COLD messages to be illuminated prior to engine start when fuel temperature is less than 4°C at fuel pump. Messages should extinguish approximately 1 minute after engines are started.

2-1-B. HOT WEATHER OPERATIONS

If fuel heater kit (PW207D2 engine) is installed, it is normal for FUEL 1/2 HOT messages to be illuminated prior to engine start if helicopter has been heat soaked in high ambient temperatures. Messages should extinguish approximately 1 minute after engines are started.

2-2. FLIGHT PLANNING

Each flight should be planned adequately to ensure safe operations and to provide pilot with data to be used during flight.

Check type of mission to be performed and destination.

Ensure helicopter weight and balance are within limits during entire mission. Utilize appropriate weight and balance charts in Section 5 and Limitations in Section 1.

Ensure that helicopter has adequate fuel and performance to complete mission, utilizing appropriate performance charts in Section 4.

2-3. PREFLIGHT CHECK

Pilot is responsible for determining whether helicopter is in condition for safe flight. Refer to Figure 2-1 for Preflight Check Sequence.

Preflight check is not intended to be a detailed mechanical inspection, but simply a guide to help pilot check condition of helicopter. It may be as comprehensive as conditions warrant, at discretion of pilot.

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

2-3-A. BEFORE EXTERIOR CHECK

1. Flight planning — Completed.
2. GW and CG — Computed.
3. Publications — Checked.
4. Helicopter servicing — Completed.
5. Main and tail rotor tie-downs — Remove and stow.
6. Pitot tube covers — Remove and stow.
7. Engine 1 and 2 air inlet covers — Remove and stow.
8. Exhaust covers — Remove and stow.
9. Ground handling wheels — Remove.

2-3-B. EXTERIOR CHECK

2-3-B-1. FUSELAGE — CABIN RIGHT SIDE

NOTE

If helicopter is not parked on a level surface, fuel sumps may not properly drain contaminants.

1. Fuel sumps — Drain fuel sample as follows:
   a. ENGINE switches — OFF.
   b. FWD XFER switch — OFF.
   c. BATT switch — ON.
   d. FWD, MID, and AFT FUEL SUMP drain buttons — Press, drain sample, then release.
2. Electrical BUS INTCON switch — OVRD ON.
3. POSITION lights switch — POSITION (on).
4. ANTI COLL light switch — ANTI COLL (on).
5. Anticollision and position lights — Check for proper operation.
6. BATT switch — OFF.
7. All main rotor blades — Condition.
8. Right static ports — Condition.
9. Right crew door — Condition and security.
10. Passenger forward hinged door — Condition and security.
11. Passenger sliding door — Condition and security.
12. Windows — Condition and security.
13. Landing gear — Condition.

2-3-B-2. FUSELAGE — CENTER RIGHT SIDE

1. Hydraulic actuators, manifolds, and lines — Condition, security, evidence of interference and leakage.
2. Hydraulic reservoir — Check fluid level indicator in the green.
3. Hydraulic system filters — Check both bypass indicators retracted.

4. Transmission oil level — Check in normal range.
5. Forward fairing access door — Secured.
6. Transmission mounts — Condition and security.
7. Rotor brake (if installed) — Condition, security, and evidence of leakage.
8. Tail rotor drive coupling — Condition and evidence of grease leakage. Check temperature dots for evidence of overheating, as indicated by black dots.
9. Generator cooling scoop (if installed) — Clear of debris; drain hole clear.
10. Engine 2 — General condition, security of attachments, and evidence of fuel and oil leakage.
11. Engine 2 main driveshaft — Condition and security.
12. Engine 2 seal drain collector — Condition and security. Empty as required.
13. Engine 2 forward mounts — Condition and security.
14. Engine 2 oil filter — Check bypass indicator retracted.
15. Engine 2 oil level — Check prismatic indicator color (black). If white, verify with engine dipstick and replenish if required.

NOTE

To reduce the possibility of filling the oil tank too much, it is recommended to check the oil level 10 minutes after engine shutdown. The correct oil level is between the MAX and MIN marks on the oil dipstick.

16. Transmission/forward engine access door — Secured.
17. Engine 2 intake — Condition, unobstructed.
18. Reserve fire bottle (if installed) — Properly charged.
19. Engine 2 combustor area — Condition and security.
20. Aft engine access door — Secured.
21. Engine 2 exhaust ejector — Condition and security.
22. Aft fairing — Secured.
23. Aft cabin doors (if installed) — Condition and security.

2-3-B-3. FUSELAGE — AFT RIGHT SIDE

1. Fuselage — Condition.
2. Baggage compartment — Contents secured, door closed and secured.
3. Tail rotor driveshaft cover — Condition and security.
4. Tailboom — Condition.
5. Horizontal stabilizer and auxiliary vertical fin — Condition and security.
6. Static wicks — Condition and security.
7. Oil cooler outlet — Unobstructed.

2-3-B-4. FUSELAGE — FULL AFT

1. Vertical fin — Condition and security.
2. Static wicks — Condition and security.
3. Tail rotor guard — Condition and security.
4. Tail rotor gearbox — Oil level, evidence of leakage, and security.
5. Tail rotor yokes — Condition and security.

6. Tail rotor controls — Condition and security.
7. Tail rotor blades:
   a. General condition and free movement.
   b. Check inboard and outboard side of each blade for any signs of impact or other damage; manually turn the rotor to allow for a thorough, up-close visual check of all four blades.
   c. Internal blade root — Clear of foreign debris.
8. Protected tail rotor system (if installed) — Condition and security.

2-3-B-5. FUSELAGE — AFT LEFT SIDE

1. Tailboom — Condition.
2. Tail rotor driveshaft cover — Condition and security.
3. Horizontal stabilizer and auxiliary vertical fin — Condition and security.
4. Static wicks — Condition and security.
5. Fuselage — Condition.
6. Aft fairing — Secured.
7. Engine 1 exhaust ejector — Condition and security.
8. Main fire bottle — Properly charged.
9. Fuel filler cap — Cap secured.
10. Engine 1 combustor area — Condition and security.
11. Aft engine access door — Secured.
12. Engine 1 intake — Condition, unobstructed.
13. Engine 1 — General condition, security of attachments, and evidence of fuel and oil leakage.
14. Engine 1 seal drain collector — Condition and security. Empty as required.
15. Engine 1 main driveshaft — Condition and security.
16. Engine 1 forward mounts — Condition and security.
17. Engine 1 oil filter — Check bypass indicator retracted.
18. Engine 1 oil level — Check prismatic indicator color (black). If white, verify with engine dipstick and replenish if required.

NOTE

To reduce the possibility of filling the oil tank too much, it is recommended to check the oil level 10 minutes after engine shutdown. The correct oil level is between the MAX and MIN marks on the oil dipstick.

19. Generator cooling scoop (if installed) — Clear of debris; drain hole clear.
20. Transmission oil filter — Check bypass indicator retracted.
21. Transmission mounts — Condition and security.
22. Transmission/forward engine access door — Secured.

2-3-B-6. CABIN ROOF

1. Main rotor hub assembly — Condition and security.
2. Main rotor yoke — Check for delamination, cracks.
3. Main rotor lead-lag dampers — Condition and security.
4. Main rotor blade retention bolts — Condition and security.
5. Main rotor blades — Condition.

6. Pitch horn bearings — Condition and security.
7. Main rotor pitch links — Condition and security of links, attachment bolts, and locking hardware.
8. Swashplate assembly — Condition, security of attached controls, and boot condition.
9. Control linkages to swashplate — Condition.
10. Transmission oil filler cap — Secured.
11. Antennas — Condition and security.

2-3-B-7. FUSELAGE — CENTER LEFT SIDE

1. Hydraulic reservoir — Check fluid level indicator in the green.
2. Hydraulic system filters — Check both bypass indicators retracted.
3. Hydraulic actuators, manifolds, and lines — Condition, security, evidence of interference and leakage.
4. Forward fairing access door — Secured.

2-3-B-8. FUSELAGE — CABIN LEFT SIDE

1. Passenger sliding door — Condition and security.
2. Passenger forward hinged door — Condition and security.
3. Left crew door — Condition and security.
4. Windows — Condition and security.
5. Landing gear — Condition.
6. Left static port — Condition.

2-3-B-9. FUSELAGE — FRONT

1. Exterior surfaces — Condition.
2. Windshields — Condition and cleanliness.
3. Wipers (if installed) — Condition and security.
4. Chin bubbles — Condition and cleanliness.
5. Battery vent lines — Clear of obstructions.
6. Battery compartment access door — Secured.
7. Pitot tubes — Clear of obstructions.
8. External power door — General condition, closed.
9. Landing light lamp — Condition.
10. Temperature probe — Condition.

2-4. INTERIOR AND PRESTART CHECK

NOTE

Display units are not compatible with use of polarized sun glasses.

1. Cabin interior — Clean, equipment secured.
2. Fire extinguisher (if installed) — Condition, security, and witness wired.
3. EMERGENCY PEDAL STOP RELEASE — Down and witness wired.
4. Cabin loading — Weight and CG within limits.
5. Passenger seat belts — Secured.
6. Seat and pedals — Adjusted.
7. Copilot seat belt — Secured.
8. Doors — Secured.
9. Pilot seat and harness — Adjust and secure.
10. Cyclic lock (if installed) — Stowed.

11. Collective control head (pilot/copilot) — Set as follows:
    a. Throttles — IDLE.
    b. FLOATS — Guard down.
    c. RPM switch — AUTO.
    d. OEI LMT switch — Guard down.
12. Electrical panel — Set as follows:
    a. EMERG BUS BATT FEED — NORM.
    b. BAL PUMP — NORM.
    c. FWD XFER — NORM.
    d. CTR-DU EMERG PWR — NORM.
    e. Electrical BUS INTCON — NORM.
    f. N-ESS BUS — NORM.
    g. BATT RELAY — NORM.
    h. BATT switch — OFF.
    i. GEN 1 and 2 — OFF.
    j. HYD — NORM.
    k. PITOT STATIC L/R — OFF.
    l. AP 1, AP 2, TRIM switches — Off (out).
13. Instrument panel — Set as follows:
    a. GARMIN 430/530 — Condition.
    b. Display units — Condition.
    c. STBY ALT — Set.
    d. STBY A/S — Condition.
    e. INSTR rheostat — OFF.
    f. INSTR ANNUNC — Spring loaded to BRT.
    g. ENGINE 2 — OFF.
    h. ENGINE 1 — OFF.
    i. START switch — Centered.
    j. FIRE AGENT REL — Centered.
    k. OEI TRNG — Centered.
14. Center pedestal — Set as follows:

ECS

    a. DEFOG/VENT — OFF.
    b. CABIN HEAT (if installed) — OFF.
    c. RADIO HEAT — OFF.
    d. WIPER (if installed) — OFF.

LIGHTING

    a. POSITION — As required.
    b. ANTI COLL — ANTI COLL (On).
    c. EMERG LT — AUTO.
    d. CABIN — OFF.

MISCELLANEOUS

    a. FOOT switch — As required.
    b. ICS — As required.
    c. ADF (if installed) — OFF.
    d. ENG 1 INTAKE BYPASS/ENG 2 INTAKE BYPASS switches (if installed) — OFF (out).
    e. TCAS switch (if installed) — OFF (out).

CAUTION

THE EXTERNAL POWER UNIT SHALL BE CAPABLE OF DELIVERING 350 AMPS MINIMUM AT 28 ±0.5 VDC, BUT LIMITED TO 500 AMPS MAXIMUM CURRENT.

15. External power — Connected (if used).

NOTE

ENGINE CONTROL 1 and 2 automatically perform BIT when electrical power is applied. ENGINE CONTROL mode switches initially display MAN and then switch to AUTO 3 seconds later, indicating successful completion of BIT.

NOTE

LTD OP and LIMIT annunciator automatically perform BIT when electric power is applied and will illuminate and extinguish, indicating successful completion of BIT.

16. **Electrical panel — Set as follows:**

    BATT switch — ON.

    Electrical BUS INTCON — OVRD ON.

NOTE

Following warning/caution and advisory lights/messages should be illuminated.

ENG OUT 1

ENG OUT 2

Left:

FUEL 1 PRESS

ENG 1 OIL PRESS

AP 1

HYD 1 PRESS

FUEL 1 CLOSED

Center:

DUAL GEN

XMSN OIL PRESS

INTCON OVRD ON

Right:

FUEL 2 PRESS

ENG 2 OIL PRESS

AP 2

HYD 2 PRESS

FUEL 2 CLOSED

FUEL 1 and 2 COLD (if fuel heater kit installed) — Helicopter cold soaked in low ambient temperature.

FUEL 1 and 2 HOT (if fuel heater kit installed) — Helicopter heat soaked in high ambient temperature.

EXT PWR ON (when external power connected and powered).

17. **Instrument panel — Set as follows:**

    a. **RPM light (between ENG OUT 1 and 2) — Push and hold for 4 seconds to test audio tones and messages.**

    b. **WARNING/CAUTION — Acknowledge (push to reset).**

    c. **Standby attitude indicator — Cage.**

    d. **Garmin 430W — As required.**

    e. **Garmin 530W (if installed) — As required.**

    f. **ELT pushbutton annunciator illuminated (if installed) — ELT ARM.**

    g. **Audio control panel — ON, selection as required.**

    h. **INSTR rheostat — As required.**

    i. **BRT/DIM ANNUNC — As required.**

    j. **ENGINE CONTROL 1 and 2 — AUTO.**

    k. **ENGINE MATCH — As required.**

    l. **FIRE AGENT REL — Centered.**

m. FIRE ENG 1 and 2 — Cycle ARM and back.

n. OEI TRNG — Centered.

o. TEST FIRE DET — Press. Verify both engine FIRE and WARNING lights illuminated along with audio tone.

p. WARNING/CAUTION — Acknowledge (push to reset).

18. Throttles 1 and 2 check as follows:

a. Rotate individually to fly, check for smooth operation.

b. FLY STOP REL — Disengage.

c. Rotate individually to MAX, check for smooth operation.

d. Rotate both back to IDLE, verify FLY STOP REL has re-engaged.

19. Fuel quantity — Check amount.

NOTE

With maximum fuel quantity, fuel quantity indications may display dashes. Cycle helicopter electrical power (OFF for 10 seconds) to regain fuel quantity indication.

a. Access FUEL/WEIGHT & BAL systems page — Verify maximum fuel quantity placard reflects fuel type in use; return to EICAS page.

NOTE

Fuel flow display accuracy is enhanced when maximum fuel quantity placard reflects fuel type in use. Fuel flow indication is an aid to flight planning only and may not provide the accuracy level upon which the pilot can solely base a decision associated with a maximum in-flight range.

20. Cockpit and interior lights — As required.

21. Rotor brake (if installed) — Apply full rotor brake, then return rotor brake handle to stowed position. Check ROTOR BRAKE message illuminates, then extinguishes.

22. Cyclic and pedals — Centered. Verify CYC CTR message extinguished.

23. Cyclic and collective friction — As required (minimum friction for ATT mode operation).

24. Force TRIM — ON.

25. Depress the cyclic force TRIM REL button and collective FORCE REL button (4-axis only) to center actuators and extinguish any active out of detent indications.

2-5. ENGINE START

CAUTION

WHEN MANIPULATING FLIGHT CONTROLS WITH FORCE TRIM SELECTED ON, DO NOT RELEASE AFFECTED FLIGHT CONTROL UNTIL THE OUT OF DETENT INDICATION EXTINGUISHES. THE FLIGHT CONTROLS MAY BE RESET BY DEPRESSING THE CYCLIC FORCE TRIM REL BUTTON AND COLLECTIVE FORCE REL BUTTON (4-AXIS ONLY) UNTIL THE OUT OF DETENT INDICATION EXTINGUISHES.

The following procedures provide for starting Engine 1 first; however, either engine may be started first:

1. Rotor brake handle (if installed) — Up and latched.

2. BATT — Check voltage (minimum 22 volts).

NOTE

Engine start attempts below 22 VDC are not recommended.

3. **Rotor blades — Clear.**

NOTE

Engine starts with throttle in FLY position are permitted.

NOTE

Engine starts with RPM switch to 104% are permitted, while ensuring transmission oil pressure remains below 80 PSI during run up.

CAUTION

IF THERE IS NO LIGHTOFF WITHIN 15 SECONDS OF STARTER ENGAGEMENT, ENGINE FAILS TO ACCELERATE BEYOND 54% N_G, OR PSI NEEDLE EXCEEDS START TRIANGLE, SHUT DOWN ENGINE.

NOTE

Upon illumination of START message, following warning/caution messages are inhibited until 50% N_G.

XMSN OIL PRESS

ENG 1 OIL PRESS

ENG 2 OIL PRESS

ENG 1 OIL HOT

ENG 2 OIL HOT

FUEL 1 PRESS

FUEL 2 PRESS

GEN 1

GEN 2

HYD 1 PRESS

HYD 2 PRESS

FWD XFR PUMP

NOTE

FWD XFR PUMP caution is inhibited during engine start, however, the associated amber crosshatched fuel display continues to be active.

2-5-A. ENGINE 1 START

1. **ENG 1 — RUN.**
2. **Verify FUEL 1 CLOSED message extinguishes.**

NOTE

N_G will not indicate until above 7%. N_R/N_P will not indicate until above 20%. Engine oil pressure will not indicate until approximately 40% N_G.

3. **START 1 — Engage.**
4. **PSI — Monitor start limitations.**
5. **START advisory — Extinguished at 50% N_G.**
6. **Engine START switch — Centered at 50% N_G.**
7. **Collective — Ensure in full down position.**
8. **ENG/XMSN OIL pressure — Check.**
9. **N_G — 66 ±1% (single engine at IDLE).**
10. **GEN 1 switch — ON (battery start only).**
11. **Check GEN 1 message extinguishes.**
12. **Check generator load.**

NOTE

Let generator load stabilize below 100 amps before attempting a generator-assisted start on second engine.

2-5-B. ENGINE 2 START

1. ENG 2 — RUN.
2. Verify FUEL 2 CLOSED message extinguishes.
3. START 2 — Engage.
4. PSI — Monitor start limitations.
5. START advisory — Extinguished at 50% N_G.
6. Engine START switch — Centered at 50% N_G.
7. ENG/XMSN OIL pressure — Check.
8. N_G — 63 ±1% (twin engine at IDLE).
   a. External power (if used) — Disconnect.
   b. GEN 1 and 2 switches ON.
   c. Check GEN 1, GEN 2, N-ESS BUS, INTCON RELAY messages extinguish.
   d. Check generator load sharing.

2-5-C. ENGINE FAILS TO START

1. Throttle — IDLE.
2. ENGINE switch — OFF.
3. START switch — Disengage when MGT is below 150°C.
4. N_G — Check 0%. Wait 30 seconds for fuel to drain from engine.
5. DRY MOTORING RUN (paragraph 2-5-D) — Accomplish.

2-5-D. DRY MOTORING RUN

The following procedure is used to clear engine, whenever necessary, of internally trapped fuel vapors or to decrease residual MGT.

1. Throttle — IDLE.
2. ENGINE switch — OFF.
3. START switch — Engage for 30 seconds.
4. START switch — Disengage.

Allow required cooling periods for starter before proceeding. Follow normal start sequence, as described in paragraph 2-5 ENGINE START.

2-6. SYSTEMS CHECK

2-6-A. FUEL BALANCE

NOTE

If the left and right fuel quantities differ by approximately 35 pounds or more, then the L4 softkey on the EICAS (center DU) will display BAL (white) to indicate that the option to balance the fuel is available. Once BAL (cyan) is activated, system will automatically stop after 5 minutes or when fuel balance is achieved.

When fuel imbalance between left and right fuel quantities exist;

1. BAL PUMP switch — NORM.
2. L4 softkey on center DU — Press — BAL (white) changes to BAL (cyan) — Arrow between tanks indicates direction of transfer.

   When fuel balanced — BAL (cyan) disappears — Arrow disappears.

2-6-B. HYDRAULIC SYSTEMS CHECK

1. Cyclic lock (if installed) — Stowed.
2. Force TRIM — Off; check TRM OFF illuminates on PFD.
3. Collective — Full down.
4. Cyclic — Centered.
5. Throttles — IDLE.
6. Cyclic and collective friction — Set to minimum.

7. Flight controls — Check freedom of movement.

NOTE

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

8. HYD switch — 1-OFF.
9. HYD 1 PRESS message — Flashing.
10. MASTER W/C light — Reset.
11. Hydraulic Pressure 1 — Verify pressure drops to less than 100 PSI.
12. Cyclic control — Check operation by moving cyclic forward and aft, then left and right (approximately 1 inch). Center cyclic.
13. Pedals — Check operation by displacing pedals slightly (approximately 1 inch) and returning to center.
14. Collective — Check operation by increasing collective slightly (approximately 1 inch). Return to full down position. Repeat as required.
15. Hydraulic Pressure 2 — Displays within limits.
16. HYD switch — 2-OFF.
17. HYD 2 PRESS message — Flashing.
18. HYD 1 PRESS message — Clears.
19. MASTER W/C light — Reset.
20. Hydraulic Pressure 2 — Verify pressure drops to less than 100 PSI.
21. Repeat step 12 through step 14.
22. Hydraulic Pressure 1 — Displays within limits.
23. HYD switch — NORM.
24. HYD 2 PRESS message — Clears.

2-6-C. AFCS CHECK

WARNING

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

NOTE

Pilot shall monitor controls during test, taking care not to restrict control movements.

Cyclic — Verify movement forward right approximately 1/2 inch, then return to neutral.

Pedals — Verify aft and forward movement approximately 1/2 inch.

Collective (4-axis only) — Verify movement up then down approximately 1/2 inch.

1. Force TRIM switch — ON; check TRM OFF extinguishes on PFD.
2. Collective force trim (4-axis only) — On.
3. Cyclic and collective friction — Set to minimum.
4. AP 1 switch — ON. AP 1 message extinguishes. AP1YAW, AP1ROLL, AP1PITCH messages and SCAS/ATT switch flashes. Observe control displacement during self-test. Upon completion of test, SCAS illuminates.
5. SCAS/ATT switch — Press to verify ATT engaged.
6. SCAS/ATT switch — Press to verify SCAS engaged.

7. AP 2 switch — ON. AP 2 message extinguishes. AP2YAW, AP2ROLL, AP2PITCH messages and SCAS/ATT switch flashes. Observe control displacement during self-test. Upon completion of test, SCAS illuminates.
8. SCAS/ATT switch — Press to verify ATT engaged.
9. SCAS/ATT switch — Press to verify SCAS engaged.
10. Depress cyclic force TRIM REL button and confirm force trim released on cyclic and pedals with button depressed.
11. Depress collective FORCE REL button (4-axis only) and confirm force trim released on collective, with button depressed.
12. Depress collective COLL TRIM OFF button (4-axis only) and confirm force trim released on collective.
13. Collective force trim — (4-axis only) — As required.

2-6-D. MISCELLANEOUS CHECKS

1. ENG OIL and XSMN temperatures and pressures — Check.

NOTE

Ensure transmission oil pressure remains below 80 PSI during run up.

2. Throttles — Increase smoothly to FLY position.
3. N_R warning audio and light — On (80 ±1% and higher); N_R warning audio and light extinguished above 95% N_R.
4. N_R stabilized at 100% — Check.
5. RPM switch — 104%.
6. N_R stabilized at 104% — Check.
7. RPM switch — AUTO.
8. N_R stabilized at 100% — Check.
9. PITOT STATIC switches — HEAT.
   a. PITOT HTR ON message — Illuminates for 3 seconds then extinguishes.
   b. Check ammeter load.
   c. If OAT is below 4°C (40°F) and visible moisture, leave on.
   d. OFF — If not required.
   e. L PITOT HTR, R PITOT HTR, L STATIC HTR, and R STATIC HTR messages — Transient illumination to confirm heaters turned off.
10. LDG LT switch — As required.
11. SRCH LT switch (if installed) — As required (ON – push, OFF – push, stow – pull aft).
12. TCAS switch (if installed) — ON.

2-7. BEFORE TAKEOFF

1. Light switches — As required.
2. Engine, transmission, and electrical instruments — Within limits.
3. Cautions and warnings — Acknowledged.
4. FUEL quantity — Note indications.
5. Navigation instruments — Check and set.
6. Radio(s) — Check and set as required.
7. Flight controls — Position and adjust frictions for takeoff (minimum friction for ATT mode operation).
8. DU — Confirm ADC, ATT, and HDG softkey in green (on side).

WARNING

THE AVIONICS SYSTEMS ARE BASED ON QNH AND DO NOT SUPPORT QFE ALTIMETER SETTINGS.

NOTE

On the ground, the altimeter will indicate zero if it is set to QFE. It will indicate airport altitude if it is set to QNH.

9. Flight instruments, check as follows:
   a. VSI — Indicator near zero.
   b. Altimeter — Set and check.
   c. HSI — Check.
   d. ADI — Check.
   e. Radar altimeter (if installed) — Zero altitude, DH set as required.
   f. OAT — Check accuracy.
10. When departing area of severe magnetic disturbance:
    a. AFCS — SCAS.
    b. CHFD heading knob — Set heading bug to desired preset value.
    c. HDG softkey — Press.
    d. SET HDG softkey — Press.
11. AFCS — SCAS or ATT, as required (ATT mode shall be used during IFR flight; SCAS mode recommended for ground operations, hover, and takeoff).

WARNING

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

NOTE

If takeoff is made within 80 seconds of last engine start, there is a compressor turbine disc cycle count penalty recorded by ECU.

2-7-A. OPERATION IN AREAS OF MAGNETIC DISTURBANCE

When operating in areas of magnetic disturbance, refer to 429-FMS-41 or 429-FMS-45.

2-8. TAKEOFF

CAUTION

WHEN MANIPULATING FLIGHT CONTROLS WITH FORCE TRIM SELECTED ON, DO NOT RELEASE AFFECTED FLIGHT CONTROL UNTIL THE OUT OF DETENT INDICATION EXTINGUISHES. THE FLIGHT CONTROLS MAY BE RESET BY DEPRESSING THE CYCLIC FORCE TRIM REL BUTTON AND COLLECTIVE FORCE REL BUTTON (4-AXIS ONLY) UNTIL THE OUT OF DETENT INDICATION EXTINGUISHES.

NOTE

When AFCS is in ATT mode, the cyclic force TRIM REL button and collective FORCE REL button (4-axis only) should be depressed before liftoff and held until desired climbout attitude is attained.

NOTE

Maintaining cyclic force TRIM REL and/or collective FORCE REL (4-axis only) button continually depressed for more than 10 minutes on cyclic or 2 minutes on collective will cause AP1 DEGRADED and AP2 DEGRADED messages to illuminate, until button released.

1. **Throttles — FLY position.**
2. **RPM switch — As required.**
3. **Area — Clear.**
4. **Collective — Increase to 4 foot hover.**
5. **Pedals — Maintain heading.**

NOTE

During takeoffs disregard CYC CTR message and position cyclic as required.

6. **Cyclic — Apply as required to accelerate smoothly.**
7. **Collective — Increase up to 5% torque above hover power (not to exceed any limits) to obtain desired rate of climb and airspeed.**
8. **When clear of HV diagram shaded area — Adjust power and airspeed, as required.**
9. **Airspeed — Within limits.**

2-9. IN-FLIGHT OPERATIONS

CAUTION

WHEN OPERATING AT HIGH POWER, INADVERTENT LIMIT EXCEEDANCE MAY OCCUR DURING MANEUVERING FLIGHT.

PRIOR TO MANEUVER, REDUCE POWER TO PROVIDE A LIMIT MARGIN.

Low collective pitch in-flight at high gross weight and/or density altitude may cause N_R to increase independent of N_P (needles split). Main rotor may be re-engaged with a smooth increase in collective pitch.

NOTE

With force trim OFF, pilot shall maintain feet on tail rotor pedals at all times.

1. **Airspeed — Within limits for flight altitude.**
2. **RPM switch — As required; select AUTO above 60 KIAS.**
3. **Engine and transmission — Within limits.**
4. **TA MUTE switch — As required, to momentarily silence traffic/terrain advisory audio.**

2-9-A. OEI TRAINING MODE

OEI training mode simulates operation of helicopter in OEI mode while providing power from both engines. OEI limits are not exceeded. All functions available in OEI are operational in OEI training mode as follows:

- **30 second OEI power with limiter**
- **2 minute OEI power with limiter**
- **Continuous OEI operations**

NOTE

OEI training mode requires that either the pilot's right display unit is set to composite format or CAT A page, or that the left display (if installed) is set to either full EICAS or composite format displaying actual engine information. Simulated training displays are always presented on the center display unit except when CAT A page is selected on pilot's right display unit.

1. **Simulate OEI operation as follows:**

   a. **OEI TRNG switch — Select either engine 1 or 2, as required.**

NOTE

Not simulated when engaging OEI training:

- **ENG OUT illumination**
- **Associated messages of engine out condition**
- **Loss of bleed air sources (heater)**
- **LIMIT/LTD OP light**

   b. **Displays — Check center display for simulated OEI condition with OEI TRNG message (OEI TRNG message appears on CAT A page, if selected).**

2. **Exit OEI training mode as follows:**

   a. **OEI TRNG switch — Centered.**

   b. **Verify OEI TRNG message extinguished.**

   c. **Center display reverts back to AEO display.**

3. **OEI training mode will also be exited by any of the following:**

CAUTION

EXITING OEI TRAINING MODE BY N_R/N_P DROOP BELOW 90% REQUIRES MONITORING OF ENGINE PARAMETERS DUE TO RAPID INCREASE IN TORQUE VALUES.

   a. **N_R/N_P droop below 90%.**

   b. **An actual OEI event.**

   c. **Failure or fault detected in an ECU, ADIU, or display.**

   d. **Throttle moved out of FLY position.**

   e. **OEI LMT switch — Selected to OVRD position.**

   f. **MAN mode selected.**

   g. **Selected right display out of composite or CAT A page when equipped with two displays.**

   h. **If equipped with third display, selection of either display resulting in no EICAS or composite display.**

2-9-B. MANEUVERING WITH AFCS IN SCAS MODE

Use normal pilot control techniques.

2-9-C. MANEUVERING WITH AFCS IN ATT MODE

Depress cyclic force TRIM REL button and maneuver as desired. Release button when desired attitude is reached. Autopilot will hold attitude until retrimmed to new attitude. Attitude may also be adjusted with cyclic ATT TRIM switch.

Depress collective FORCE REL button (4-axis only) for momentary collective changes.

Depress COLL TRIM OFF button (4-axis only) to disengage collective trim function.

For momentary attitude changes, manual cyclic movement may be used.

NOTE

When uncoupled in ATT mode, pressing the cyclic force TRIM REL button while pressing the SET HDG tab (to engage or update the Heading Preset Mode) will prevent the helicopter from rolling to the previous heading.

NOTE

When coupled in HDG mode, temporarily decouple the HDG mode to engage or update the Heading Preset Mode to prevent the helicopter from rolling while turning the HDG knob. Alternatively, the cyclic force TRIM REL button can be pressed while turning the HDG knob and pressing the SET HDG tab.

2-9-D. FLIGHT DIRECTOR OPERATIONS

CAUTION

IN 4-AXIS ONLY COUPLED FLIGHT, FOLLOWING ENGINE FAILURE, THE COLLECTIVE LIMITER WILL CONTINUE TO LIMIT THE REMAINING ENGINE TO APPROXIMATELY 90% OF OEI MCP (AFTER AN INITIAL OVERSHOOT IF TORQUE IS ABOVE 45%) UNTIL PILOT DISENGAGES COLLECTIVE COUPLING OR MANUALLY OVERRIDES COLLECTIVE LIMITING.

Above 45 KIAS, initial selection of Flight Director (FD) while in SCAS mode presents the command bars and uncoupled default modes of VS/HDG/ASPD. Initial selection of FD while in ATT mode engages the coupled default modes of HDG/VS (VS/HDG/ASPD, 4-axis only, if installed).

NOTE

Two dots on the lateral deviation bar (expanded scale) represents one dot on the Horizontal Situation Indicator (HSI) deviation scale.

NOTE

In 3-axis coupled VS mode, flight control computer will maintain airspeed to 70 KIAS and above during climbs. To optimize rate of climb performance, use of SPD mode is recommended.

NOTE

In 4-axis only coupled climb or altitude hold, flight control computer will allow commanded airspeed to decrease to 70 KIAS to preserve commanded climb rate or altitude hold as collective limit is approached. Collective limiter will limit power to approximately 90% MCP.

1. Flight controls — Ensure minimum friction for ATT mode operation.

2. AFCS — SCAS or ATT, as required (coupled FD requires ATT mode).

NOTE

When selecting coupled modes from an uncoupled FD, ensure FD command bars are centered.

3. Flight director — After reaching 65 KIAS, couple modes as required.

CAUTION

DO NOT RELY UPON THE AUTO-LEVEL FEATURE (AVAILABLE WITH RADAR ALTITUDE ON A COUPLED APPROACH) TO AUTOMATICALLY LEVEL THE HELICOPTER AT 50 FEET ABOVE THE RUNWAY.

NOTE

With ALTS (altitude select) mode engaged, monitor the level-off performance to ensure the desired altitude is captured and adjust as necessary.

4. **For 3-axis coupled approaches at 70 KIAS or less, engage ASPD (SPD) mode upon glide slope or path intersection.**

CAUTION

WITH RADALT INOPERATIVE, ILS GLIDESLOPE MUST BE TRACKED MANUALLY.

NOTE

In coupled FMS (GPS) mode, select HDG followed by APPR to transition to coupled ILS/LOC approach.

5. **During coupled approaches, pilot shall keep hands and feet on flight controls at heights less than 200 feet AGL.**

CAUTION

WHEN GO-AROUND (GA) SELECTED, IF POWER IS INCREASED TO ATTAIN A HIGH RATE OF CLIMB ABOVE 750 FEET PER MINUTE, POSITIVE CLIMB GRADIENT WILL BE DEGRADED.

NOTE

Selection of coupled GA mode requires airspeed to be above 60 KIAS (30 KIAS, 4-axis, if installed).

6. **When GA selected, increase collective (power application) to target 750 feet per minute positive rate of climb.**

NOTE

Selection of GA mode, with FD uncoupled, initially presents GA/GA/GA and then automatically reverts to VS/GA/ASPD.

Selection of GA mode, with FD coupled, initially presents GA/GA and then automatically reverts to GA/VS (GA/GA/GA reverts to VS/GA/ASPD, 4-axis only, if installed).

In GA mode, with FD coupled, heading (HDG) mode must be selected before VOR/LOC navigation (NAV) mode can be selected. Selection of FMS navigation (NAV) mode may be done directly.

NOTE

To perform any course change, other than at station passage, during NAV (VOR) or APPR modes while either armed or captured, temporarily deselect the mode. Reset the HSI for the new course and intercept heading, then re-arm for capture.

Rotation of the CRS knob during NAV (VOR) or APPR modes while either armed or captured, outside the cone of confusion, can falsely trigger the over station sensor resulting in degraded performance.

NOTE

Selection of VOR station at least 30 seconds prior to arming NAV mode and planning a course intercept of 10° or more will optimize performance of VOR tracking.

Selection of APPR mode with full deflection of localizer will optimize tracking.

2-9-E. FMS (GPS) OPERATIONS

When performing a GPS approach, illumination of a white APR indication on the vertical deviation scale denotes APPR mode is available and may be selected.

Upon crossing the missed approach point (MAP), automatic waypoint sequencing is suspended (SUSP) on the Garmin 430W/530W. To initiate a missed approach procedure, go-around (GA) may be pressed to start the climb out. Press OBS on the Garmin 430W/530W to release the suspended missed-approach flight plan, then press NAV mode to re-engage FMS.

2-9-F. MAP MODE

Prior to selecting RDR/MAP MFD on L-DU and/or C-DU, deselect FMS as the cyan bearing pointer source #1 on the L-DU's EHSI, to prevent depiction of an inaccurate cyan waypoint.

To ensure proper parallel track flight path display on the DU MAP, use the ACTIVATE LEG function (do not use DIRECT-TO function) prior to activating a multiple leg Parallel Track flight plan.

2-10. DESCENT AND LANDING

1. Instruments — Normal operating range.
2. Seat belts — Fastened.
3. Flight controls — Adjust friction, as required (minimum friction for ATT mode operation).

NOTE

When in 3-axis coupled flight, AFCS yaw performance may be assisted with pedal or yaw trim adjustments.

4. Recommended approach speed — 55 to 135 KIAS.
5. Force TRIM — As required (ON for ATT mode).
6. AFCS — SCAS or ATT, as required.
7. Throttles — FLY.
8. RPM switch — As required (above 60 KIAS — AUTO).

NOTE

When uncoupled in ATT mode, pressing the cyclic force TRIM REL button while pressing the SET HDG tab (to engage or update the Heading Preset Mode) will prevent the helicopter from rolling to the previous heading.

NOTE

When coupled in HDG mode, temporarily decouple the HDG mode to engage or update the Heading Preset Mode to prevent the helicopter from rolling while turning the HDG knob. Alternatively, the cyclic force TRIM REL button can be pressed while turning the HDG knob and pressing the SET HDG tab.

9. When approaching an area of severe magnetic disturbance:
   a. AFCS — SCAS.
   b. CHFD heading knob — Set heading bug to desired preset value.
   c. HDG softkey — Press.
   d. SET HDG softkey — Press.

NOTE

During run-on or slope landings, disregard CYC CTR message and position cyclic as required. After landing is completed and collective is full down, reposition cyclic so that CYC CTR message is extinguished.

After landing:

CAUTION

WITH COPILOT COLLECTIVE INSTALLED, WHEN EXITING FROM COPILOT SEAT AND ENGINES AT IDLE, GUARD THROTTLES TO PREVENT INADVERTENT ROLL-UP OF COPILOT THROTTLES DURING EGRESS.

10. Collective — Full down, friction as required.
11. Cyclic and pedals — Centered.
12. AFCS — SCAS.

2-11. ENGINE SHUTDOWN

1. Force TRIM — ON.
2. AP 1 and AP 2 — OFF.
3. Cyclic and pedals — Centered.
4. Both throttles — IDLE (minimum of 30 seconds).
5. RPM warning light — Illuminated and audio on at 95% N_R.
6. RPM warning light — Press to mute audio.
7. Cyclic friction — Increase so that cyclic maintains centered position.
8. Cyclic lock (if installed) — Engaged.
9. ELT (if installed) — Check for inadvertent transmissions.
10. GEN 1 and 2 switches — OFF.
11. ENGINE switches — OFF. Check MGT decreasing and ENG OUT lights illuminated.

CAUTION

DO NOT APPLY COLLECTIVE OR PEDALS TO SLOW ROTOR DURING COASTDOWN.

CAUTION

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

12. Rotor brake (if installed) — Apply full rotor brake at or below 40% N_R. ROTOR BRAKE message — illuminated. Return rotor brake handle to stowed position just prior to main rotor stopping.

13. Pilot — Monitor flight controls until rotor has come to a complete stop.

14. Instrument panel — All switches OFF.

15. LIGHTING ECS panel — All switches as required.

16. Electrical panel:
PITOT STATIC switches — OFF.
FWD XFER switch — OFF.

NOTE

Prior to refueling, ensure fuel FWD XFER and fuel BAL PUMP are in REFUEL position (XFER VALVE OPEN and INTCON OPEN). REFUEL message will appear above fuel quantity display (approximately 5 seconds after switch selection).

17. BATT switch — OFF, 30 seconds after N_G reads 0% to ensure proper low cycle fatigue (LCF) data storage.

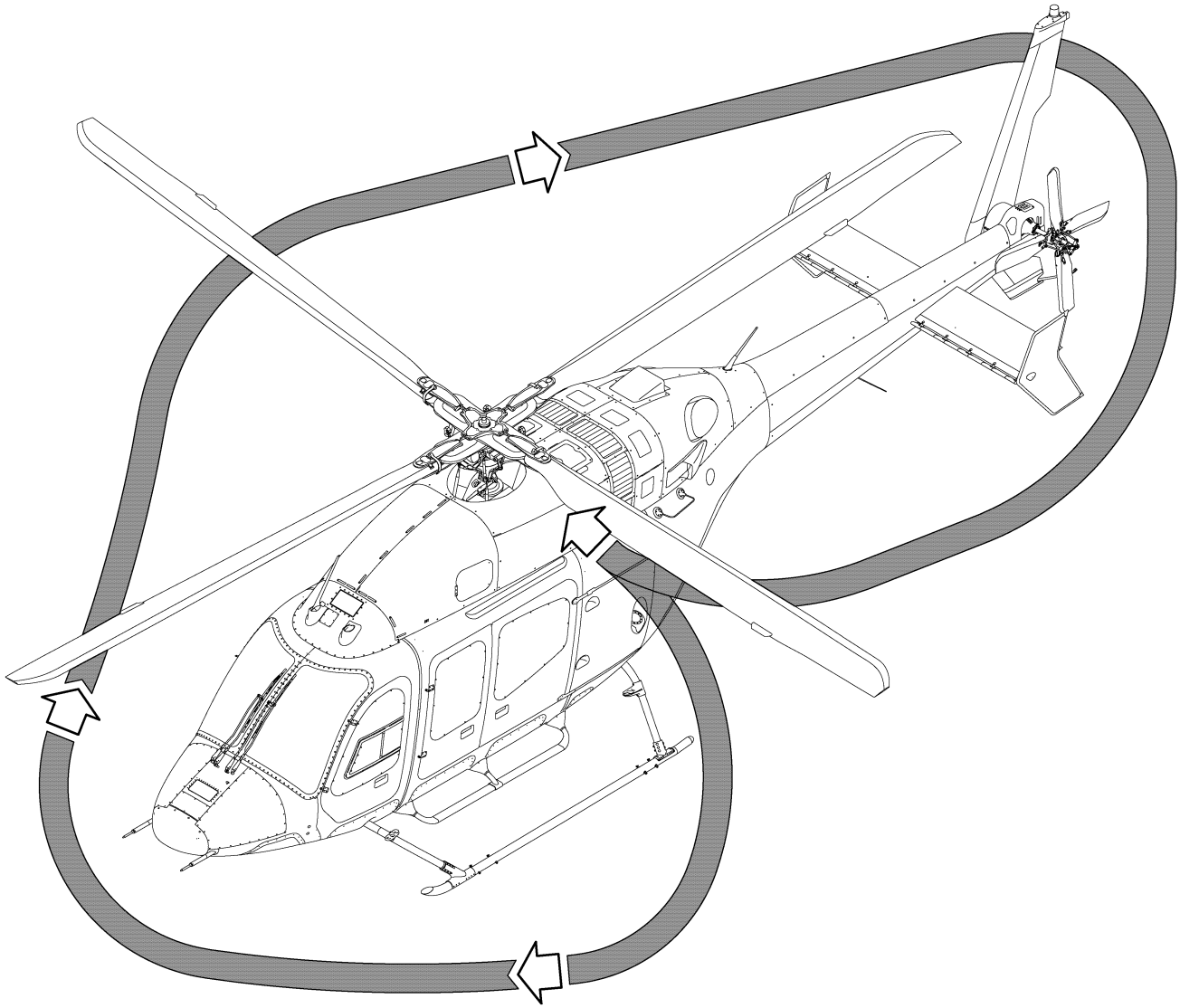
2-12. POSTFLIGHT CHECK

If any following conditions exist:

- High or gusty winds exist or are predicted.
- Other helicopters are, or are expected to be, operating in immediate area.
- Helicopter left unattended.

Following is recommended:

1. Install main rotor and tail rotor tie-downs.
2. Install exhaust covers, engine inlet protective plugs, and pitot covers.



429_FM_1_0001

Figure 2-1. Preflight Check Sequence

Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

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Section 3

EMERGENCY AND MALFUNCTION PROCEDURES

3-1. INTRODUCTION

Following procedures contain indications of failures or malfunctions which affect safety of crew, helicopter, ground personnel or property, use of emergency features of primary and backup systems, and appropriate warnings, cautions, and notes. Table 3-2 lists fault conditions and corrective actions for warning (red) lights/messages. Table 3-3 lists fault conditions and corrective actions for caution (amber) lights/messages. Table 3-4 lists system conditions and required actions for advisory (green, white, or cyan) lights/messages. MASTER W/C light flashes and a single audio tone "ping" occurs when any warning or caution message is triggered in the Crew Altering System (CAS) window. If message disappears upon depressing MASTER W/C light, fault no longer exists. All procedures listed herein assume pilot gives first priority to helicopter control and a safe flight path.

Other audios include the following:

Low Rotor RPM	—	Continuous "warble"
Airspeed above V_{NE}	—	Continuous "ting ting ting"
Autopilot Decouple	—	Double Electronic Chirp
Decision Height	—	"Two-tone chirp" followed by "Check height"
Low Altitude Callout (when radalt installed)	—	Single "ping" followed by either "One-fifty feet" or "One hundred feet"
Altitude	—	"Altitude" when altitude deviates from preselected altitude (ALTS) by ±200 feet
Landing Gear (when wheeled gear installed)	—	Single "ping" followed by "Landing gear"

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

3-2. DEFINITIONS

Following terms indicate degree of urgency in landing helicopter:

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

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

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

3-3. ENGINE

3-3-A. SINGLE ENGINE FAILURE

WARNING

IF 30 SECOND POWER IS INSUFFICIENT, SELECTION OF OEI LMT OVRD SHOULD ONLY BE UTILIZED AS A LAST RESORT. RETURN TO NORMAL OPERATING LIMITS IN LESS THAN 20 SECONDS. LAND AS SOON AS POSSIBLE.

NOTE

Failure of an engine causes operating engine to assume all power requirements. Normal control system overshoot allows good engine MGT, N_G, or engine torque to exceed OEI 30 second limits transiently. This transient overshoot does not damage good engine.

OEI LMT switch operation is inhibited during AEO conditions.

Selection of OEI LMT to 2 minute limiting (2 MIN LMTG displayed on EICAS) is accomplished by pulling switch aft (spring loaded to center) on collective.

Selection of OEI LMT to 2 MIN LMTG is enabled only when power is in 2 MIN or 30 SEC range.

Subsequent reduction in power to continuous OEI power automatically resets OEI limiter to 30 SEC limit setting.

While in 2 MIN LMTG setting, increasing power to reduce rotor RPM below 92% will automatically reset OEI limit to 30 SEC limit setting.

All bleed air systems automatically shut down following an engine failure. Heater may be regained by positioning CABIN HEAT to OVRD ON (if installed).

- **INDICATIONS:**

  ENG OUT light illuminated.

  EICAS displays OEI mode.

  PSI needle split (affected engine) decreasing.

  Engine Q/MGT/N_G (affected engine) decreasing.

  Engine oil pressure and oil temperature (affected engine) decreasing.

3-3-A-1. HOVERING IN GROUND EFFECT

- **PROCEDURE:**

  1. **Maintain heading and landing attitude.**
  2. **Collective — Adjust to control rate of descent and landing. Upon ground contact, collective shall be reduced smoothly while maintaining cyclic in neutral or centered position.**

3-3-A-2. HOVERING OUT OF GROUND EFFECT

- **PROCEDURE:**

  1. **Maintain heading and landing attitude.**
  2. **Collective — Adjust to control N_R.**

If insufficient power to fly away:

  3. **Collective — Adjust to control N_R, rate of descent, and landing. Upon ground contact, collective shall be reduced smoothly while maintaining cyclic in neutral or centered position.**

If sufficient power to fly away:

4. Collective — Adjust to begin climb.
5. Airspeed — Increase to V_Y, 60 KIAS.
6. Follow in-flight procedure, paragraph 3-3-A-3.

3-3-A-3. IN-FLIGHT

- PROCEDURE:

1. Collective — Adjust to control N_R and desired power.
2. Airspeed — Maintain V_Y (60 KIAS) or higher, not to exceed V_{NE} OEI.

NOTE

If cause of failure is known and restart is to be attempted, refer to paragraph 3-3-B, ENGINE RESTART IN-FLIGHT.

3. Throttle (affected engine) — IDLE.
4. ENGINE switch (affected engine) — OFF.
5. BAL PUMP switch — NORM.
6. N-ESS BUS switch — OVRD ON, as required.
7. AMPS — Maintain within limits.
8. CABIN HEAT switch (if installed) — OVRD ON, as required.
9. Land as soon as practical.

3-3-B. ENGINE RESTART IN-FLIGHT

CAUTION

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

3-3-B-1. ENGINE RESTART, ECU AUTOMATIC MODE

- PROCEDURE:

NOTE

At altitudes above 15,000 feet H_P, residual MGT shall be below 200°C before engaging starter.

NOTE

If time does not permit checking for proper switch and throttle position, pilot may attempt in-flight restart by simply engaging START switch to affected engine after N_G has dropped below 20%.

1. Throttle (affected engine) — FLY.
2. ENGINE switch (affected engine) — RUN.
3. ENGINE CONTROL switch (affected engine) — AUTO.
4. CABIN HEAT switch (if installed) — OFF.
5. START switch (affected engine) — START.
6. Engine instruments (both engines) — Monitor.
7. Oil pressure (affected engine) — Pressure indication above 40% N_G.
8. CABIN HEAT switch (if installed) — As required.

3-3-B-2. ENGINE RESTART, ECU MANUAL MODE

- PROCEDURE:

1. Throttle (affected engine) — FLY.
2. ENGINE switch (affected engine) — RUN.

3. ENGINE CONTROL switch (affected engine) — MAN.

4. CABIN HEAT switch (if installed) — OFF.

5. START switch (affected engine) — START.

6. Engine instruments (both engines) — Monitor.

7. Oil pressure (affected engine) — Pressure indication above 40% N_G.

NOTE

If engine start hangs at less than 50% N_G, modulate throttle beyond FLY position for fuel enrichment and return to FLY as N_G increases above 60%. MANUAL mode engine starts in either IDLE or FLY position result in 62% N_G. At completion of MAN mode engine start, increase throttle beyond FLY position to achieve N_G above 62%.

8. N_G (affected engine) — 62%.

9. FLY STOP REL — Disengage.

10. Throttle (affected engine) — Manually control.

11. CABIN HEAT switch (if installed) — As required.

3-3-C. DUAL ENGINE FAILURE

• INDICATIONS:

Left yaw.

N_R decreasing.

Both ENG OUT lights illuminated.

Both N_G below 50%.

QT, both MGT, and both N_P decreasing.

• PROCEDURE:

1. Collective pitch — Reduce and establish autorotative glide.

NOTE

Airspeed for minimum rate of descent is 53 KIAS.

2. Accomplish autorotative landing. Upon ground contact, collective shall be reduced smoothly while maintaining cyclic in neutral or centered position.

If a restart is not attempted:

3. Throttles — IDLE.

4. ENGINE switches — OFF.

5. After landing — Complete shutdown procedure.

3-3-D. ENGINE UNDERSPEED

NOTE

If one N_P is at or below selected speed, engine with low PSI needle may be experiencing an underspeed.

• INDICATIONS:

N_R possible decrease.

N_P (affected engine) decreasing.

PSI needle split (affected engine decreasing).

• PROCEDURE:

1. Throttles in FLY position — Check.

2. Collective — Adjust to maintain 100% N_R.

3. Affected engine — Identify; prepare for OEI operation.

a. Collective — Adjust to control N_R and desired power.

b. Airspeed — Maintain between V_Y and 140 KIAS.

4. Throttle (affected engine) — IDLE.

5. ENGINE CONTROL switch (affected engine) — MAN.

6. FLY STOP REL (affected engine) — Disengage.

7. Throttle (affected engine) and collective — Coordinate and adjust as necessary to maintain PSI needle of affected engine slightly below PSI needle of normal engine (two to three needle width split).

8. Land as soon as practical.

3-3-E. ENGINE OVERSPEED — ECU OR FMM

NOTE

If an N_P is above selected value, engine with higher PSI needle may be experiencing an overspeed.

- INDICATIONS:

  N_R increasing.

  N_P (affected engine) increasing.

  PSI needle split (affected engine increasing).

- PROCEDURE:

1. Collective — Increase as necessary to control N_R.

2. Affected engine — Identify; prepare for OEI operation.

   a. Collective — Adjust to control N_R and desired power.

   b. Airspeed — Maintain between V_Y and 140 KIAS.

3. Throttle (affected engine) — IDLE. (If engine remains unresponsive, shut down engine. Refer to Single engine failure paragraph 3-3-A-3, IN-FLIGHT).

4. ENGINE CONTROL switch (affected engine) — MAN.

5. FLY STOP REL (affected engine) — Disengage.

6. Throttle (affected engine) and collective — Coordinate and adjust as necessary to maintain PSI needle of affected engine slightly below PSI needle of normal engine (two to three needle width split).

7. Land as soon as practical.

3-3-F. ENGINE OVERSPEED — DRIVESHAFT FAILURE

- INDICATIONS:

  N_R initially stable.

  N_P (affected engine) rapid increase.

  PSI needle split (affected engine decreasing).

- PROCEDURE:

1. Affected engine — Identify; prepare for OEI operation.

   a. Collective — Adjust to control N_R and desired power.

   b. Airspeed — Maintain between V_Y and 140 KIAS.

2. Throttle (affected engine) — IDLE.

3. ENGINE switch (affected engine) — OFF.

4. Refer to single engine failure paragraph 3-3-A-3, IN-FLIGHT.

3-3-G. ECU FAILURE

NOTE

30 second OEI power may not be available in MANUAL mode. OEI maximum continuous power is available for all ambient conditions.

- **INDICATIONS:**

  ECU FAIL message illuminated.

  Affected engine automatically switches to manual mode.

  ENGINE CONTROL switch (affected engine) indicates MAN.

  PSI display indicates MANUAL under Q, MGT, N_G display of affected engine and PSI needle changes color to cyan.

  Possibly other ECU messages displayed.

NOTE

If ECU failure occurs at high power, collective should be reduced before reducing affected engine throttle, allowing engine in AUTO mode to remain within limits.

- **PROCEDURE:**

  1. **FLY STOP REL (affected engine) — Disengage.**
  2. **Throttle (affected engine) and collective — Coordinate and adjust as necessary to maintain PSI needle of affected engine slightly below PSI needle of normal engine (two to three needle width split).**
  3. **Land as soon as practical.**

3-3-H. ENGINE COMPRESSOR STALL

- **INDICATIONS:**

  Engine pops.

  PSI needle split with possible oscillations.

  High or erratic MGT.

  Decreasing or erratic N_G or N_P.

  Oscillating Q.

- **PROCEDURE:**

  1. **Power — Reduce.**
  2. **CABIN HEAT switch (if installed) — Single engine — OVRD; dual engine — ON.**

NOTE

Severity of compressor stalls dictate if engine should be shut down and treated as an engine failure. Violent stalls can damage engine and drive system components, and shall be handled as an emergency condition. Stalls of a less severe nature (one or two low intensity pops) may permit continued operation of engine at a reduced power level, avoiding condition that resulted in compressor stall.

If pilot elects to continue with affected engine running:

  3. **PSI — Check for normal indications.**

If pilot elects to shut down affected engine:

  4. **Prepare for OEI operation.**
     a. **Collective — Adjust to control N_R and desired power.**
     b. **Airspeed — Maintain between V_Y and 140 KIAS.**
  5. **Throttle (affected engine) — IDLE.**
  6. **ENGINE switch (affected engine) — OFF.**
  7. **Refer to single engine failure paragraph 3-3-A-3, IN-FLIGHT.**

3-3-I. ENGINE HOT START/SHUTDOWN

- **INDICATIONS:**

  Excessive MGT.

  PSI needle rising rapidly.

  Visible smoke or fire from exhaust.

- **PROCEDURE:**

  1. **ENGINE switch (affected engine) — OFF.**

  NOTE

  If starter was engaged, it remains engaged until manually disengaged.

  2. **STARTER (affected engine) — Ensure starter is motoring engine until MGT stabilizes at a normal temperature.**
  3. **Shut down helicopter.**

3-4. FIRE

3-4-A. ENGINE FIRE ON GROUND

- **INDICATIONS:**

  One ENG FIRE light illuminated.

  Visible smoke and/or fire.

- **PROCEDURE:**

  1. **ENGINE switches — OFF.**
  2. **FIRE switch (affected engine) — ARM.**
  3. **AGENT REL switch — Select MAIN.**
  4. **AGENT REL switch — Select RESERVE (if installed), as required.**
  5. **Rotor brake (if installed) — ON.**
  6. **BATT switch — OFF.**
  7. **Exit helicopter.**

3-4-B. ENGINE FIRE IN-FLIGHT

- **INDICATIONS:**

  One ENG FIRE light illuminated.

  Visible smoke and/or fire.

- **PROCEDURE:**

  1. **Emergency descent — Initiate if possible.**
  2. **Prepare for OEI operation.**
     a. **Collective — Adjust to control N_R and desired power.**
     b. **Airspeed — Less than OEI V_{NE}.**
  3. **Throttle (affected engine) — IDLE.**
  4. **FIRE switch (affected engine) — ARM and confirm ENG OUT.**

  NOTE

  Complete engine shutdown may take up to 50 seconds.

  5. **AGENT REL switch — Select MAIN.**
  6. **If second bottle installed and ENG FIRE light still illuminated:**
     a. **Deleted.**
     b. **AGENT REL switch — Select RESERVE.**
  7. **N-ESS BUS switch — OVRD ON, as required.**
  8. **Amps (A) — Maintain within limits.**
  9. **Land as soon as possible.**

3-4-C. CABIN SMOKE OR FUMES

- **INDICATIONS:**

  Smoke

  Fumes

• **PROCEDURE:**

1. **Emergency descent — Initiate if possible.**
2. **Cockpit/cabin vents — Open; ventilate cabin.**
3. **CABIN HEAT switch (if installed) — OFF.**
4. **Land as soon as possible.**

3-4-D. ELECTRICAL FIRE

• **INDICATIONS:**

Smoke, fumes, or fire.

Possible indication of abnormal amps (A).

• **PROCEDURE:**

1. **Cockpit/cabin vents — Open, as required; ventilate cabin.**
2. **Begin descent.**

NOTE

The most important consideration is to maintain safe flight conditions and land as soon as possible.

If the source of the smoke or fire can be positively identified, remove electrical power from the affected equipment by switching it off.

If the source of the smoke or fire cannot be positively identified, carry out the following procedure.

3. **FWD XFER switch — OPEN, if system 1 fuel quantity is greater than 285 pounds (129.27 kg).**
4. **CTR-DU EMERG PWR switch — OVRD ON.**
5. **BUS INTCON switch — OVRD OFF.**
6. **GEN 1 switch — OFF (loss of essential bus 1, non-essential bus, and left DU (if installed)).**

NOTE

Selection of GEN 1 switch OFF results in the following CAS messages. If coupled, AP will decouple. Recouple AP as required.

Left:

L DU (if installed)

AP 1

L FD

GEN 1

FWD XFR PUMP

Center:

AVIONICS FAN

INTCON RELAY

If smoke still persists:

NOTE

Based on having balanced No. 1/No. 2 fuel system quantities and having opened the FWD XFER switch per step 3 prior to isolating emergency bus 1, 150 pounds (68 kg) should be subtracted from No. 2 fuel system quantity to determine usable No. 1 fuel system quantity.

7. **EMERG BUS BATT FEED switch — 1-OFF (loss of emergency bus 1, center DU, Nav/Com 1, annunciation of SCAS/ATT, AUTO/MAN, MGT/TRQ, TRM, pushbutton annunciators, system 1 fuel quantity indication, utility light, and emergency lights. Cyclic force trim defaults on).**

NOTE

Selection of EMERG BUS BATT FEED switch 1-OFF results in the following additional CAS messages:

Left:

ADIU CH A

L AHRS

L ADC

EMERG BUS 1

FWD XFER VALVE

ENG 1 BYPASS (if installed)

Center:

CDU

PEDL STOP INOP

Right:

AP2 MAINT

ADIU B MAINT

GEN 2 DEGRADED

NOTE

With cyclic force trim defaulted ON, R/FD can be coupled in 3-axis only. Pedal autotrim is inoperative, manual retrim of pedal position may be required. Collective trim, if installed, is inoperative (OFF).

8. **Flight controls — Maintain feet on pedals.**

If smoke still persists:

9. **EMERG BUS BATT FEED switch — NORM.**

10. **GEN 1 switch — ON.**

11. **FWD XFER switch — NORM.**

12. **AP 1 and AP 2 switches — Cycle OFF, then ON.**

13. **GEN 2 switch — OFF (loss of essential bus 2, non-essential bus, Nav/Com 2, XPNDR, and ADF (if installed)).**

NOTE

Selection of GEN 2 switch OFF results in the following CAS messages. If coupled, AP will decouple. Recouple AP as required.

Center:

INSTR FAN

INTCON RELAY

Right:

GEN 2

If smoke still persists:

14. **EMERG BUS BATT FEED switch — 2-OFF (loss of emergency bus 2, right DU, system 2 fuel quantity indication, ICS, and audio tones).**

NOTE

Selection of EMERG BUS BATT FEED switch 2-OFF results in the following additional CAS messages. If coupled, AP will decouple. Recouple AP as required.

Left:

AP 1 DEGRADED

GEN 1 DEGRADED

ADIU A MAINT

AP1 MAINT

Center:

FUEL INTCON

Right:

ADIU CH B

R DU

AP 2

R AHRS

R ADC

R FD

EMERG BUS 2

ENG 2 BYPASS

15. N-ESS BUS switch — OVRD ON, as required.

16. If source is identified and smoke and/or fumes are cleared, land as soon as practical.

17. If source is not identified, land as soon as possible.

3-5. TAIL ROTOR

There is no single emergency procedure for all types of anti-torque malfunctions. One key to a pilot successfully handling a tail rotor emergency lies in the ability to quickly recognize type of malfunction that has occurred.

3-5-A. LOSS OF THRUST

Loss of tail rotor thrust is a break in tail rotor drive (i.e., severed driveshaft), wherein tail rotor stops turning; or total loss of tail rotor blades.

• INDICATIONS:

Right yaw.

Nose down tucking.

No response to pedal inputs.

NOTE

Severity of initial reaction of helicopter is affected by airspeed, CG, and power.

3-5-A-1. HOVERING

• PROCEDURE:

1. Altitude — Reduce to IGE, if possible.

2. Throttles — IDLE.

3. Perform hovering autorotation.

NOTE

Rotation in yaw axis may occur before and during touchdown.

3-5-A-2. IN-FLIGHT

• PROCEDURE:

1. Collective — Reduce to full down.

2. Airspeed — Maintain above 60 KIAS.

If time permits:

3. Collective — Increase slowly to check yaw controllability.

If yaw is not controllable:

4. Continue descent with throttles in FLY and utilize throttles to control yaw during touchdown.

If yaw is controllable:

5. Flight — Continue at low power and sufficient airspeed to suitable landing area.

NOTE

If engine oil temperature increases abnormally, it may indicate failure of the oil cooler blower mounted on the tail rotor driveshaft.

6. Approach — Minimum power steep approach at 50 to 60 KIAS. This may result in left yaw.

7. Deceleration — Start at approximately 35 feet.

8. Collective — Apply at 8 to 10 feet and level helicopter.

9. Throttles — Reduce as required to maintain nose alignment.

10. Landing — Cushion with collective.

11. Cyclic — If helicopter is turning during touchdown, follow turn with cyclic.

3-5-B. STUCK PEDAL (LEFT OR RIGHT) — HOVERING

• PROCEDURE:

NOTE

Do not roll throttles to IDLE when hovering unless a severe right yaw rate occurs.

1. EMERGENCY PEDAL STOP RELEASE — Pull.

2. Collective — Gradually reduce until touchdown.

3. After touchdown — Slowly and simultaneously reduce collective and throttles.

3-5-C. STUCK PEDAL — IN-FLIGHT

If unable to move pedals (stuck left or right), helicopter yaws to left when power is reduced and yaws to right when power is increased. Power and airspeed should be adjusted to minimize out-of-trim condition. Increasing airspeed normally reduces left yaw.

3-5-C-1. STUCK LEFT PEDAL

• PROCEDURE:

1. EMERGENCY PEDAL STOP RELEASE — Pull.

2. Approach — Normal approach to a low hover.

If helicopter is yawing left when in hover:

3. Level skids, ground contact should reduce yaw rate.

4. Complete landing.

If helicopter is yawing right when in hover:

5. Throttles — Reduce to slow yaw rate.

6. Complete landing.

3-5-C-2. STUCK RIGHT PEDAL

• PROCEDURE:

1. EMERGENCY PEDAL STOP RELEASE — Pull.

2. Approach — Minimum power steep approach at 50 to 60 KIAS. This should result in left yaw.

3. Deceleration — Start at approximately 35 feet.

4. Collective — Apply at 8 to 10 feet and level helicopter.

5. Throttles — Reduce as required to maintain nose alignment.

6. Complete landing.

7. Cyclic — If helicopter is turning during touchdown, follow turn with cyclic.

3-6. HYDRAULIC SYSTEM

3-6-A. LOSS OF HYDRAULIC PRESSURE

- **INDICATIONS:**

  HYD 1 PRESS or HYD 2 PRESS message illuminated.

  Hydraulic pressure on affected system below 1250 PSI.

  Possible grinding or howling noise from pump.

  Fluctuating or low hydraulic pressure on affected system.

- **PROCEDURE:**

  1. **HYD P and T — Check.**
  2. **HYD switch (affected system) — OFF.**
  3. **Land as soon as possible.**

NOTE

HYD OFF OVRD message will illuminate if pilot attempts to switch unaffected system off.

3-6-B. HYDRAULIC SYSTEM OVERTEMPERATURE

- **INDICATIONS:**

  HYD 1 HOT or HYD 2 HOT message illuminated.

  Hydraulic temperature on affected system above 120°C.

- **PROCEDURE:**

  1. **HYD P and T — Check.**
  2. **AIR COND switch (if installed) — OFF.**
  3. **If hovering, land if possible, or transition to forward flight as soon as possible.**
  4. **If caution remains illuminated — Land as soon as practical.**
  5. **If hydraulic temperature continues to rise — HYD switch (affected system) — OFF.**
  6. **Land as soon as possible.**

3-6-C. FLIGHT CONTROL ACTUATOR MALFUNCTION

- **INDICATIONS:**

  Flight controls — Uncommanded movement.

  Flight control forces — High in axis of uncommanded movement, normal in other axes.

  Control feedback — Possible in axis of uncommanded movement.

- **PROCEDURE:**

CAUTION

DO NOT TURN OFF EITHER HYDRAULIC SYSTEM.

1. **Land as soon as possible.**

3-7. ELECTRICAL SYSTEM

EICAS electrical schematic page (SYS softkey, ELECTRICAL SCHEMATIC) may be used as an aid to understand and evaluate electrical system problems. The system directly monitors power sources, the status of depicted contactors, and the presence of voltage at each electrical bus. See Table 3-1 for electrical distribution.

NOTE

Displayed bus status may not correspond to CAS messages as it will only display a message if the bus is abnormally unpowered.

3-7-A. SINGLE GENERATOR FAILURE

- INDICATIONS:

  GEN message illuminated.

  Affected generator indicates zero load.

  Loss of power to non-essential bus.

- PROCEDURE:

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

  NOTE

  If GEN message is in conjunction with associated ENG START advisory message, select BUS INTCON switch — OVRD OFF. In this condition, the NON-ESS bus may not be restorable.

If affected generator is not restored:

  2. GEN switch (affected generator) — OFF.
  3. N-ESS BUS switch — OVRD ON, as required.
  4. Amps (A) — Maintain within limits.
  5. Land as soon as practical.

3-7-B. DUAL GENERATOR FAILURE

- INDICATIONS:

  DUAL GEN message illuminated.

  Both generators indicate zero load.

  Loss of power to essential and non-essential buses.

- PROCEDURE:

  NOTE

  With generators OFF and BUS INTCON and CTR-DU EMERG PWR switches NORM, a fully charged 25 amp-hour battery provides approximately 37 minutes of power for basic helicopter emergency bus equipment (36 amp-hour battery/53 minutes; 44 amp-hour battery/65 minutes; 53 amp-hour battery/80 minutes). The listed battery capacity is based on basic and standard Bell kit configurations. Helicopters equipped with numerous kits and/or customizing may need to confirm adequate battery capacity.

  1. Both GEN switches — OFF, RESET, then ON.

If neither generator is restored:

  2. Both GEN switches — OFF.
  3. CTR-DU EMERG PWR switch — OVRD ON, if desired, to maintain center DU or to restore center DU.

  NOTE

  With a dual generator failure, battery automatically powers both emergency buses. If necessary, BUS INTCON switch may be selected to OVRD ON to restore power to essential buses; however, battery power duration will be shortened. N-ESS BUS switch may then be selected to OVRD ON to restore power to non-essential bus.

  4. BUS INTCON switch — OVRD ON, as required.
  5. N-ESS BUS switch — OVRD ON, as required.
  6. Land as soon as practical.

If one generator is restored, refer to SINGLE GENERATOR FAILURE, paragraph 3-7-A.

3-7-C. EXCESSIVE ELECTRICAL LOAD

- INDICATIONS:

  Amps (A) indicate excessive load.

Possible smoke or fumes.

- PROCEDURE:

1. Amps (A) — Monitor. Switch off unnecessary equipment as required to reduce load within limits.

If load remains excessive, proceed as follows.

2. INTCON BUS switch — OVRD OFF.
3. GEN switch (affected system) — OFF.

NOTE

Battery charging will not be provided with GEN 2 selected OFF, and INTCON BUS switch selected OVRD OFF.

4. Land as soon as practical.

3-8. FUEL

3-8-A. FUEL QUANTITY INDICATIONS MALFUNCTION

- INDICATIONS:

One fuel quantity display replaced by red "x" and digital readout replaced by white dashes.

TOT FUEL digital readout amber.

ADIU CH A or ADIU CH B message illuminated.

- PROCEDURE:

1. Assuming a balanced fuel loading prior to failure, total fuel quantity may be determined by doubling remaining fuel quantity indicated.
2. FUEL 1 LOW and FUEL 2 LOW messages operate independently of fuel quantity indicating system and are not affected by ADIU CH A or ADIU CH B failure.
3. Land as soon as practical.

3-9. AUTOMATIC FLIGHT CONTROL SYSTEM

3-9-A. SINGLE MAGNETOMETER FAILURE

- INDICATIONS:

L FD and AP 1 DEGRADED or R FD and AP 2 DEGRADED message illuminated.

HSI display (affected side) — Dashes.

FD flag — Red unfilled arrowhead pointing to affected side.

- PROCEDURE:

NOTE

With helicopter airborne and the cross-side heading source valid, display unit will automatically revert to the valid heading source.

1. HDG softkey (affected DU) — If required, select valid heading source.
2. FD — As required.

CAUTION

DO NOT UTILIZE FD CUES OR MODES THAT ARE SHOWN TO BE ACTIVE ON A FD FLAGGED AS FAILED.

3-9-B. DUAL MAGNETOMETER FAILURE

- INDICATIONS:

L FD and R FD messages illuminated.

AP 1 DEGRADED and AP 2 DEGRADED messages illuminated.

HSI displays — Dashes.

FD flag — Red.

• PROCEDURE:

1. Utilize standby compass or GPS for heading reference.

NOTE

ILS/BC course deviation is presented on ADI with LOC 1/LOC 2 NAV selection. Toggling NAV selection on DU from LOC through to LOC provides ILS course deviation information, if BC was previously presented.

3-9-C. RADAR ALTIMETER FAILURE

• INDICATIONS:

RA flag — Red.

DH legend — Blank.

• PROCEDURE:

CAUTION

THE 50-FOOT AUTO-LEVEL FEATURE ABOVE THE RUNWAY AT THE TERMINATION OF AN AFCS COUPLED ILS OR GPS/LPV APPROACH DOES NOT FUNCTION WITHOUT A RADAR ALTIMETER.

NOTE

When performing an AFCS coupled ILS approach, GS shall not be engaged. Use cyclic trim to adjust airspeed to desired approach speed. Use smooth collective inputs to follow glideslope.

1. AFCS coupled ILS approach shall be carried out with manual tracking of the glideslope.

3-9-D. TRIM RUNAWAY

• INDICATIONS:

Flight controls — Uncommanded movement.

Flight control forces — High in axis of uncommanded movement, normal in other axes.

Out of detent indication for affected axis

• PROCEDURE:

1. Cyclic force TRIM REL and/or collective FORCE REL button (4-axis only) — Depress until the out of detent indication extinguishes.
2. Flight controls — Do not release flight control if out of detent indication is present.
3. Force TRIM switch — OFF; check TRM OFF illuminates on PFD.
4. If IMC, land as soon as practical. If VMC, continue flight in SCAS.

3-10. COMMUNICATION SYSTEM

3-10-A. COMMUNICATION RADIO FAILURE

• INDICATIONS:

No reception in headset.

• PROCEDURE:

1. Verify audio control panel powered on.
2. Verify proper radio selected.
3. Verify volume properly adjusted.
4. Verify frequency properly selected.
5. Check headset connection.

NOTE

When radio frequency of 121.5 is activated per step 6, affected Garmin 430W/530W will require a power cycle to regain frequency selection capability.

6. **Depress and hold FREQ XFR switch on cyclic or Garmin Com FLIP/FLOP button for 2 seconds to activate radio frequency to 121.5 (may not be displayed).**

3-11. NOT USED

3-12. NOT USED

3-13. NOT USED

3-14. DISPLAY SYSTEM

3-14-A. DUAL DISPLAY UNIT (DU) FAILURE

- **INDICATIONS:**

  Both DU screens blank.

  With 3 DU configuration, remaining DU in composite mode with appropriate R/DU, C/DU, L/DU messages.

NOTE

Possible loss of some DU audio tones and Master W/C. ENG OUT, RPM, FIRE, LTD OP, LIMIT lights remain operational.

- **PROCEDURE:**

1. **Standby A/S, ATTD, ALT, COMPASS — Utilize as required.**
2. **LIMIT, LTD OP lights — Monitor.**
3. **Land as soon as possible.**
4. **Land as soon as practical with remaining DU in composite mode.**

3-15. WARNING, CAUTION, AND ADVISORY LIGHTS/MESSAGES

Red warning lights/messages, fault conditions, and corrective actions are presented in Table 3-2.

Amber caution lights/messages, fault conditions, and corrective actions are presented in Table 3-3.

Green, white, and cyan advisory lights/messages, conditions, and actions are presented in Table 3-4.

Table 3-1. Electrical Distribution

EMERG BUS 1	ESS BUS 1	N ESS BUS	ESS BUS 2	EMRG BUS 2
ADAHRS (Left)	AFCS 1	DU Heater (Left)	ADF	ADAHRS (Right)
ADIU Channel A	Aux Power	Light, Cabin	Auto RPM	ADIU Channel B
Bus Interconnect Relay	Avionics Fan	OEI Training Switch	ECS – Radio Heat	AFCS 2
CVFDR	DU (Center)	TCAS	ELT	Cargo Hook Power
DU (Center) Emergency Power	DU (Left)	Weather Radar	Hoist Controller	DU (Right)
ECS – Cabin Heat	DU HEATER (Center)	Windshield Wiper (Left)	Instrument Panel Fan	DU HEATER (Right)
Engine 1 ECU	ECS – Cabin Vent		Lights, Instrument	ECS – Defog/Blower
Engine 1 FIRE Light & Discharge	Fuel Balance Pump		Lights, Position	Engine 2 ECU
Engine 1 FMM	Fuel Transfer Pump		Nav/Com 2	Engine 2 FIRE Light & Discharge
Engine 1 Ignitor	Light, Search		RAD ALT	Engine 2 FMM
Engine 1 Intake Bypass	Lights, Anti-collision		Transponder	Engine 2 Ignitor
Engine 1 Starter	Non-essential Controller		Windshield Wiper (Right)	Engine 2 Intake Bypass
FDR	Pitot/Static Heater (Left)			Engine 2 Starter
Floats				Fuel Interconnect Valve
Force Trim Release				Fuel Shut-off Valve, Engine 1
Fuel Shut-off Valve, Engine 2				Generator 1 Control/Reset
Fuel Transfer Valve				Hoist Power

Table 3-1. Electrical Distribution (Cont)

EMERG BUS 1	ESS BUS 1	N ESS BUS	ESS BUS 2	EMRG BUS 2
Generator 2 Control/Reset				Hydraulic Shut-off Switch
Hoist Cable Cut				ICS
Lighting Annunciator				Light, Landing
Lighting, Emergency				Pitot/Static Heater (Right)
Nav/Com 1				Standby Attitude Indicator
Pedal Stop				
Standby Altimeter				
Standby Attitude Indicator				

Table 3-2: Warning (Red) Lights/Messages

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
DUAL GEN	Generator 1 and generator 2 offline.	1) Both GEN switches — OFF, RESET, then ON. If neither generator restored: 2) Both GEN switches — OFF. 3) CTR-DU EMERG PWR switch — OVRD ON, if desired, to maintain center DU or to restore center DU. 4) BUS INTCON switch — OVRD ON (as required). 5) N-ESS BUS switch — OVRD ON (as required). 6) See paragraph 3-7-B, DUAL GENERATOR FAILURE. 7) Land as soon as practical. NOTE Center DU will extinguish if selection of CTR-DU EMERG PWR to OVRD ON is not carried out within 30 seconds of both generators being offline.
ECU 1 FAIL ECU 2 FAIL	Respective ECU — Critical malfunction (failure will cause manual mode to automatically be engaged).	1) FLY STOP REL (affected engine) — Disengage. 2) Throttle (affected engine) and collective — Coordinate and adjust as necessary to maintain PSI needle of affected engine slightly below PSI needle of normal engine. 3) Land as soon as practical.

Table 3-2: Warning (Red) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
ENG 1 OIL HOT ENG 2 OIL HOT	Respective engine oil temperature high.	1) Power — Reduce. 2) Engine oil temperature — Check. 3) Engine oil pressure — Check. 4) Affected engine — If pilot deems necessary, shut down when practical (paragraph 3-3-A-3).
ENG 1 OIL PRESS ENG 2 OIL PRESS	Respective engine oil pressure low.	1) Power — Reduce. 2) Affected oil pressure display — Check. 3) Affected engine — If pilot deems necessary, shut down when practical (paragraph 3-3-A-3). 4) Land as soon as practical.
ENG 1 OUT ENG 2 OUT (instrument panel)	Respective engine — N_G less than 50% or ECU senses flameout.	1) Verify engine condition. 2) See paragraph 3-3-A, SINGLE ENGINE FAILURE.

Table 3-2: Warning (Red) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
FIRE (instrument panel)	Respective engine compartment fire sensors detect high temperature.	1) Emergency descent — Initiate if possible. 2) Prepare for OEI operation. a. Collective — Adjust to control N_R and desired power. b. Airspeed — Less than OEI V_{NE}. 3) Throttle (affected engine) — IDLE. 4) FIRE switch (affected engine) — ARM and confirm ENG OUT. NOTE Complete engine shutdown may take up to 50 seconds. 5) AGENT REL switch — Select MAIN. 6) If second bottle installed and ENG FIRE light still illuminated: a. AGENT REL switch — Select RESERVE. 7) N-ESS BUS switch — OVRD ON, as required. 8) Amps (A) — Maintain within limits. 9) Land as soon as possible.
FUEL 1 PRESS FUEL 2 PRESS	Respective engine fuel pressure low.	1) Altitude — Reduce, if practical. 2) Prepare for possible engine failure. 3) Land as soon as practical.

Table 3-2: Warning (Red) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
IDLE UNDERSPD	N_R speed below 49% (tail rotor driveshaft speed in avoid speed range).	1) Throttle — Increase to have N_R above lowest red radial on N_R display. Or: 2) ENGINE switch — OFF.
LIMIT (instrument panel)	Primary power parameter at or above the maximum limit (EICAS PSI needle(s) in the red range).	Power/maneuver — Adjust as required.
LMT OVRD (upper EICAS)	ECU 30 SEC limiter is disabled.	OEI LMT switch — As required.
OVRD USED	30 SEC OEI power limit has been exceeded.	1) Land as soon as possible. 2) Applicable maintenance action required prior to next flight.
ROTOR BRAKE	Rotor brake pad(s) not retracted.	1) Rotor brake — OFF (handle up and latched). 2) Land as soon as possible.
RPM (with low RPM audio)	N_R below 95%.	1) Collective — Reduce. 2) Throttles — FLY.
RPM (without audio)	N_R above 107%.	1) Collective — Increase. 2) Maneuver — Reduce severity.
XMSN OIL HOT	Transmission oil temperature above 110°C.	1) Power — Reduce. 2) XMSN T display — Verify fault. 3) Land as soon as possible.
XMSN OIL PRESS	Transmission oil pressure below 25 PSI.	1) Power — Reduce. 2) XMSN P display — Verify fault. 3) Land as soon as possible.

Table 3-3. Caution (Amber) Lights/Messages

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
L ADC R ADC	Respective air data computer inoperative.	ADC softkey — Select operational system.
ADIU CH A ADIU CH B	Respective aircraft data integration unit channel inoperative.	Applicable maintenance action required.
AFCS MISCOMP	Miscompare of AFCS actuator position and possible degradation of AFCS performance.	1) Flight controls — Monitor/guard. 2) AFCS — Monitor performance; guard flight controls. 3) AP switch — Select an AP OFF, if degraded AFCS performance is noted. **NOTE** If desired, AFCS SCHEMATIC page on EICAS-SYS may be accessed for system status information.
AFT XFR VALVE	Aft (system 2) fuel flapper valve preventing gravity transfer of fuel from aft tank.	Fuel quantity display — Monitor unusable fuel quantity.
L AHRS R AHRS	Respective attitude/heading reference system inoperative.	ATT and/or HDG softkey — Select operational system. **NOTE** If AHRS message clears, wait at least 2 minutes while in straight and level flight before engaging the associated flight director.
ALTN (upper EICAS)	Displayed near affected parameter on EICAS display in conjunction with ECU FAIL, ECU DATA, or ECU DEGRADED. ECU data is unavailable and ADIU data is in use.	Follow corrective action for ECU FAIL, ECU DATA, or ECU DEGRADED as appropriate.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
ALTN (upper EICAS)	Displayed near affected parameter on EICAS display in conjunction with EICAS MISCOMP. Miscompare of ECU/ADIU data.	Follow corrective action for EICAS MISCOMP message.
AP 1 AP 2	Respective autopilot offline. Possible decoupling of FD, if coupled.	1) Flight controls — Monitor/guard. 2) AP switch (affected autopilot) — OFF, then ON. If message remains, affected AP switch — OFF. 3) AFCS — Monitor performance; guard flight controls. 4) FD, as required, couple to operative AP. **NOTE** Re-selecting AP 2 and AP 1 in ATT may cause system to revert to SCAS mode. Re-select ATT mode as required. **NOTE** To allow coupling to left FD, select center DU COMP mode. Select required NAV on center DU. (Selection of center DU to COMP mode not required with third display.) **NOTE** If desired, AFCS SCHEMATIC page on EICAS-SYS may be accessed for system status information.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
AP 1 DEGRADED AP 2 DEGRADED	Respective autopilot fault detected and/or AP performance is degraded.	1) Flight controls — Monitor/guard. 2) AP switch (affected autopilot) — OFF, then ON. 3) AFCS — Monitor performance; guard flight controls. **NOTE** If desired, AFCS SCHEMATIC page on EICAS-SYS may be accessed for system status information.
AP 1 INTCON AP 2 INTCON	Respective autopilot FCC not receiving cross communication data from other FCC.	1) Flight controls — Monitor/guard. 2) AP 1 switch — OFF. 3) AFCS — Monitor performance; guard flight controls.
AP 1 PITCH AP 2 PITCH	Respective autopilot pitch actuator inoperative.	1) Flight controls — Monitor/guard. 2) AFCS — Monitor performance; guard flight controls. **NOTE** With both actuators inoperative, manually control pitch axis when in ATT mode.
AP 1 ROLL AP 2 ROLL	Respective autopilot roll actuator inoperative.	1) Flight controls — Monitor/guard. 2) AFCS — Monitor performance; guard flight controls. **NOTE** When both actuators inoperative, manually control roll axis when in ATT mode.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
AP 1 YAW AP 2 YAW	Respective autopilot yaw actuator inoperative.	1) Flight controls — Monitor/guard. 2) AFCS — Monitor performance; guard flight controls. **NOTE** When both actuators inoperative, manually control yaw axis when in ATT mode.
ARM (instrument panel)	(System condition: Fire extinguisher system armed)	Confirmation of operation.
AUTOTRIM	Autopilot trim system failure/fault detected.	1) In ATT mode — Guard flight controls for loss of trim function. 2) Cyclic, pilot friction adjustment — Verify set at minimum. 3) AFCS — Monitor performance; guard flight controls. 4) Display Unit — Monitor for RE TRM prompt. If RE TRM prompt illuminates, depress cyclic force TRIM REL button and reposition cyclic/pedals to extinguish RE TRM. **NOTE** If desired, AFCS SCHEMATIC page on EICAS-SYS may be accessed for system status information.
AVIONICS FAN	Avionics cooling fan inoperative. (Fan used to cool NAV/COMs and XPDR.)	Applicable maintenance action required.
BATT PWR OFF	BATT switch is OFF, or RCCB that provides battery power to emergency busses is inoperative.	1) BATT switch — Verify position. 2) If desired, verify system status on ELECTRICAL SCHEMATIC page of EICAS-SYS.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
BATT RELAY	Abnormal status of battery relay (contact either closed when should be open, or open when should be closed).	1) BATT RELAY switch — RESET, then NORM. 2) If desired, verify system status on ELECTRICAL SCHEMATIC page of EICAS-SYS.
CABIN HEAT HOT	Cabin heater duct over-temperature condition.	CABIN HEAT switch — OFF.
CAS MISCOMP	Caution Advisory System data miscompare between primary and redundant source.	EICAS display — Monitor; CAS data may be misleading.
CHECK DU CONFIG	Configuration settings, parameter setup settings, or calibration settings do not match between DUs.	Applicable maintenance action required prior to next flight.
COLL TRIM	Autopilot collective trim system failure/fault detected (4-axis AFCS kit).	1) Collective friction — Adjust to minimum. 2) Force TRIM switch — OFF, then ON. 3) If message does not extinguish, continue in manual collective. NOTE If desired, AFCS SCHEMATIC page on EICAS-SYS may be accessed for system status information.
CYC CTR (upper EICAS)	Cyclic stick not centered.	Cyclic stick — Reposition to extinguish. (During takeoff and in-flight — Disregard.)
DOOR	Any door ajar with N_R greater than 75%. (Advisory door message assists in determining specific door.)	Secure door.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
L DU C DU R DU	Respective display unit inoperative or not communicating with other display units.	Select composite DU mode, as required.
L DU FANS C DU FANS R DU FANS	Cooling fans of respective display unit inoperative.	1) Display unit — Reduce brightness to reduce temperature of DU. 2) Applicable maintenance action required.
ECU 1 DATA ECU 2 DATA	Respective engine control unit data unavailable. Alternate data in use on some DUs, and exceedance recording thresholds may be slightly different than what is shown on the display.	1) Power — Avoid operations requiring maximum MGT/Q/N_G. 2) Applicable maintenance action required prior to next flight.
ECU 1 DEGRADED ECU 2 DEGRADED	Respective ECU operation is degraded, which may result in a N_P lag or N_P droop.	NOTE Holding OEI LMT switch out of its default position for greater than 3 seconds will cause both ECU 1 DEGRADED and ECU 2 DEGRADED cautions to illuminate. Cycling of the ENGINE CONTROL switches, AUTO – MAN – AUTO clears the cautions. 1) Avoid rapid power changes. 2) Land as soon as practical.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
EICAS MISCOMP	Miscompare of principal engine power indication(s) between primary and redundant source. Specific parameter group indicated with ALTN on EICAS display.	NOTE At engine shutdown, EICAS MISCOMP caution may illuminate as a result of a difference in MGT indications between EEC and ADIU. Caution clears on subsequent engine start. 1) Indications — Compare with other data (cross-engine and/or alternate source data). 2) Land as soon as practical.
ELECTRIC TREND	Voltage or current approaching a limit.	1) EICAS display — Select full EICAS presentation. 2) EICAS display — Monitor system status in relation to limits.
ELT XMIT (instrument panel)	(System condition: ELT transmitting)	Confirmation of operation.
EMERG BUS 1 EMERG BUS 2	Respective emergency bus is offline.	1) Verify system status on ELECTRICAL SCHEMATIC page of EICAS-SYS. 2) Land as soon as practical.
ENG 1 BYPASS ENG 2 BYPASS	Respective engine intake filter bypass door is open (dust protection inoperative), or system not powered.	ENG INTAKE BYPASS switch (affected engine) — Verify selection.
ENG 1 CD INOP ENG 2 CD INOP	Respective chip detector inoperative.	Land as soon as practical.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
ENG 1 CHIP ENG 2 CHIP	Ferrous particles detected in respective engine oil.	No automatic burn is performed for engine detectors. 1) Power — Reduce. 2) Engine — If pilot deems necessary, shut down engine when practical (paragraph 3-3-A-3). 3) Land as soon as practical.
ENG 1 EXCEED ENG 2 EXCEED	Respective engine has recorded an exceedance.	Applicable maintenance action required prior to next flight.
ENG 1 INTAKE ENG 2 INTAKE	Respective engine intake filter air flow restricted.	ENG INTAKE BYPASS switch (affected engine) — Depress (open) if MGT power margin required. On ground: If message illuminated without engine operating, message was activated during previous flight. Applicable maintenance action required prior to next flight.
ENG 1 MANUAL ENG 2 MANUAL	Respective ECU in manual mode operation.	AUTO/MAN switch — Verify selection.
ESS BUS 1 ESS BUS 2	Respective essential bus is offline with on-side generator operating, or other essential bus has power with INTCON relay closed.	1) Verify electrical power control switches. 2) Verify system status on ELECTRICAL SCHEMATIC page of EICAS-SYS. 3) Land as soon as practical.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
L FD R FD	Respective flight director inoperative.	1) Display Unit — Respective FD deselects. 2) AFCS — If coupled to FD, system decouples. 3) FD — If no FD cues or modes are shown on ADIs, re-engage operational FD as required. If FD modes are shown on ADIs (uncoupled), press CPL to re-engage operational FD, as required. **CAUTION** DO NOT UTILIZE FD CUES OR MODES THAT ARE SHOWN TO BE ACTIVE ON A FD FLAGGED AS FAILED. **NOTE** To allow coupling to left FD, select center DU COMP mode. Select required NAV on center DU. (Selection of center DU to COMP mode not required with third display.)
FIRE DET 1 INOP FIRE DET 2 INOP	Respective engine fire detection system failed.	Land as soon as practical.
FLT MISCOMP	Flight parameter miscompare between left and right sources. Specific parameter miscompares (ATT, PIT, ROL, HDG, IAS, ALT, VS, or ILS) will be indicated on flight display.	1) Indications — Compare with other cues. 2) Valid source — Select. 3) ATT/PIT/ROL indicated on flight display — Deselect AP from the affected side. 4) IAS indicated on flight display — Pull EMERGENCY PEDAL STOP RELEASE and maintain feet on pedals.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
FUEL 1 COLD FUEL 2 COLD	Fuel temperature less than 4°C (39°F) at affected engine fuel pump.	Land as soon as practical.
FUEL 1 FILTER FUEL 2 FILTER	Respective engine fuel filter is partially blocked.	Land as soon as practical.
FUEL 1 HOT FUEL 2 HOT	Fuel temperature greater than 80°C (176°F) at affected engine fuel pump.	1) Power — Reduce, if possible. 2) Altitude — Reduce, if possible. 3) Land as soon as practical.
FUEL 1 LOW	Fuel quantity below approximately 110 pounds (49.9 kg) in MID 1 tank. NOTE During refueling, if FUEL 1 LOW message does not extinguish with greater than 120 pounds (54.4 kg) indicated in MID 1 tank, cycle helicopter electrical power or cycle FWD XFER switch to OPEN and back to NORM.	1) EICAS — Select SYS softkey. 2) FUEL/WT & BAL — Select. 3) Fuel quantity — Verify MID 1 tank. 4) Land as soon as practical.
FUEL 2 LOW	Fuel quantity below approximately 90 pounds (40.8 kg) in MID 2 tank.	1) EICAS — Select SYS softkey. 2) FUEL/WT & BAL — Select. 3) Fuel quantity — Verify MID 2 tank. 4) Land as soon as practical.
FUEL 1 VALVE FUEL 2 VALVE	Respective fuel valve is in transition, or not in commanded position, or not powered.	If condition persists, land as soon as practical.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
FUEL BAL PUMP	Fuel balance pump function not operating correctly. NOTE FUEL BAL PUMP message may momentarily illuminate at termination of fuel balance sequence.	1) BAL PUMP switch — OFF. 2) Fuel quantity display — Monitor.
FUEL IMBALANCE	Fuel distribution between systems 1 and 2 indicates fuel imbalance condition of approximately 100 pounds (45.4 kg).	1) FWD XFER switch — Verify position. 2) BAL PUMP switch — Verify position. 3) Fuel BAL, DU softkey — Verify operation.
FUEL INDICATION	Fuel quantity indications and low-level sensors do not correlate.	1) Fuel quantity display — Monitor. 2) Land as soon as practical.
FUEL INTCON	Fuel interconnect valve in transition or not in commanded position or not powered.	1) BAL PUMP switch — Verify position. 2) Fuel quantity display — Monitor.
FWD XFR PUMP	Forward (system 1) fuel transfer pump not pumping while fuel remains in forward tank or pumping while no fuel remains in forward tank.	1) FWD XFER switch — Verify position. 2) Fuel quantity display — Monitor unusable fuel quantity. 3) FWD XFER switch — NORM or OFF, if system 1 indicates less than 285 pounds (129.27 kg). 4) FWD XFER switch — OPEN, as required; majority of yellow-hatched marked fuel will be recovered as usable. Up to 150 pounds (68.04 kg) will remain hatched as unusable depending on helicopter attitude.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
FWD XFR VALVE	Forward (system 1) fuel transfer valve in transition, or not in commanded position, or not powered.	1) FWD XFER switch — Verify position. 2) Fuel quantity display — Monitor unusable fuel quantity.
GEN 1 GEN 2	Respective generator is offline.	1) GEN switch (affected generator) — OFF, RESET, then ON. NOTE If GEN message is in conjunction with associated ENG START advisory message, select BUS INTCON switch — OVRD OFF. In this condition, the NON-ESS bus may not be restorable. If affected generator is not restored: 2) GEN switch (affected generator) — OFF. 3) N-ESS BUS switch — OVRD ON, if desired. 4) Amps (A) — Maintain within limits. 5) Land as soon as practical.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
HYD 1 HOT HYD 2 HOT	Respective hydraulic oil temperature above 120°C.	1) HYD P and T — Check. 2) AIR COND switch (if installed) — OFF. 3) If hovering, land if possible, or transition to forward flight as soon as possible. 4) If cautions remain illuminated, land as soon as practical. 5) If hydraulic temperature continues to rise — HYD switch (affected system) — OFF. 6) Land as soon as possible.
HYD 1 PRESS HYD 2 PRESS	Respective hydraulic system pressure either below 1250 PSI or above 1800 PSI.	1) HYD switch — Verify position. 2) HYD switch (affected system) — OFF. 3) Land as soon as possible.
HYD TREND	Hydraulic pressure or temperature approaching a limit.	1) EICAS display — Select full EICAS presentation. 2) EICAS display — Monitor system status in relation to limits.
INSTR FAN	Instrument panel area cooling fan inoperative.	1) If OAT is greater than 47°C (116°F), land as soon as practical. 2) Applicable maintenance action required.
INTCON RELAY	Abnormal status of interconnect relay (contact either closed when should be open, or open when should be closed).	1) BUS INTCON switch — Verify position. Select OVRD OFF, if both generators are online. 2) If message remains, verify system status on ELECTRICAL SCHEMATIC page of EICAS-SYS.
LTD OP (instrument panel)	Primary power parameter in time limited range (EICAS PSI needle(s) in the yellow range).	Power/maneuver — Adjust as required.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
MAN (instrument panel)	Engine control unit in manual mode.	Select AUTO mode or proceed as per ECU failure (paragraph 3-3-G).
MAST CD INOP	Respective chip detector inoperative.	Land as soon as practical.
MAST CHIP	Ferrous particles detected in transmission oil.	Automatic burn will be attempted. If debris successfully burned, indication will clear when MASTER CAUTION reset pressed or after 3 seconds. If condition persists: 1) Power — Reduce. 2) Land as soon as possible.
MGT DEGRADED	MGT readings for both engines degraded.	Power — Avoid operations requiring maximum MGT.
N ESS BUS	Non-essential bus is offline with both generators online.	1) Verify electrical power control switches. 2) Verify system status on ELECTRICAL SCHEMATIC page of EICAS-SYS.
NG OAT LIMIT	Engine(s) N_G limited due to OAT.	Power/Altitude — Reduce.
1 OEI TIME LOW 2 OEI TIME LOW	Insufficient time remaining in either 2 minute or 30 second range.	Applicable maintenance action required prior to next flight.
1 OEI TIME USED 2 OEI TIME USED	Respective engine has recorded use of 2 MIN or 30 SEC OEI power.	Applicable maintenance action required prior to next flight.
OEI TRNG (upper EICAS)	One engine inoperative training has been selected.	Confirmation of selection.
OIL TREND	Engine or transmission oil pressure or temperature approaching a limit.	1) EICAS display — Select full EICAS presentation. 2) EICAS display — Monitor system status in relation to limits.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
PEDL STOP ENGD	Pedal stop failed in engaged position.	1) EMERGENCY PEDAL STOP RELEASE — Pull. 2) Pilot shall maintain feet on pedals.
PEDL STOP INOP	Pedal stop system is inoperative and/or pedal stop will not engage.	Additional safety afforded by pedal stop system is not available. Pilot shall maintain feet on pedals.
L PITOT HTR R PITOT HTR	Transient indication — Pitot/static heater system has been switched off. Steady indication — Respective pitot heater is inoperative.	PITOT STATIC switches — Verify position.
RPM AUTO	ADIU unable to control auto RPM selection.	Verify N_R reference on EICAS.
RTR OVERSPD	Rotor (N_R) overspeed (107%) event has occurred.	1) Power/maneuver — Adjust as required. 2) MASTER CAUTION — Depress to reset a latched message. Message will re-illuminate on shutdown if exceedance logged. Applicable maintenance action required prior to next flight.
L STATIC HTR R STATIC HTR	Transient indication — Pitot/static heater system has been switched off. Steady indication — Respective static heater is inoperative.	PITOT STATIC switches — Verify position.
THROTTLE 1 THROTTLE 2	Respective engine throttle out of FLY position for AUTO mode flight.	Throttle position — Verify.
T/R CD INOP	Respective chip detector inoperative.	Land as soon as practical.

Table 3-3. Caution (Amber) Lights/Messages (Cont)

MESSAGE	FAULT CONDITION	CORRECTIVE ACTION
T/R CHIP	Ferrous particles detected in tail rotor gearbox oil.	Automatic burn will be attempted. If debris successfully burned, indication will clear when MASTER CAUTION reset pressed or after 3 seconds. If condition persists: 1) Power — Reduce. 2) Land as soon as possible.
TRQ 1 DEGRADED TRQ 2 DEGRADED	TRQ reading degraded due to unavailability of temperature correction — Approximate correction in use.	Power — Avoid operations requiring maximum torque.
XMSN OVERTRQ	Transmission overtorque event has occurred.	1) Power/maneuver — Adjust as required. 2) MASTER CAUTION — Depress to reset a latched message. Message will re-illuminate on shutdown if exceedance logged. Applicable maintenance action required prior to next flight.
L XMSN CD INOP R XMSN CD INOP	Respective chip detector inoperative.	Land as soon as practical.
L XMSN CHIP R XMSN CHIP	Ferrous particles detected in transmission oil.	Automatic burn will be attempted. If debris successfully burned, indication will clear when MASTER CAUTION reset pressed or after 3 seconds. If condition persists: 1) Power — Reduce. 2) Land as soon as possible.

Table 3-4. Advisory (Green, White, or Cyan) Lights/Messages

MESSAGE	SYSTEM CONDITION	REQUIRED ACTION
2 MIN LMTG (upper EICAS)	ECU 2 MIN limiter is active.	OEI LMT switch — As required.
ADAHRS MAINT	Air data attitude heading reference system latent fault detected.	Applicable maintenance required.
ADIU A MAINT ADIU B MAINT	Respective aircraft data integration unit, secondary function inoperative (chip burn, trim value backup storage, etc.).	Applicable maintenance required.
ADIU MISCOMP	Aircraft Data Integration Unit data miscompare between redundant sources.	Applicable maintenance required.
AFT DOOR	In conjunction with DOOR caution; respective door ajar.	Secure door.
ALTN (upper EICAS)	Displayed near affected parameter on EICAS display in conjunction with ALTN DATA FAIL. Loss of alternate source of engine power system data.	Applicable maintenance required.
ALTN DATA FAIL	In conjunction with white ALTN indication on EICAS; loss of alternate source of engine or power system data.	Applicable maintenance required.
AP 1 MAINT AP 2 MAINT	Respective autopilot latent fault, loss of redundancy, or condition requiring maintenance.	Applicable maintenance required.
AUTO (instrument panel)	ECU is in automatic mode.	
BAG DOOR	In conjunction with DOOR caution; respective door ajar.	Secure door.
L CABIN DOOR R CABIN DOOR	In conjunction with DOOR caution; respective door ajar.	Secure door.
DATA BUS	Integrated avionics system data bus latent fault detected.	Applicable maintenance required.

Table 3-4. Advisory (Green, White, or Cyan) Lights/Messages (Cont)

MESSAGE	SYSTEM CONDITION	REQUIRED ACTION
DU FAN MAINT	One or more display unit fans inoperative.	Applicable maintenance required.
ECU 1 MAINT ECU 2 MAINT	Respective engine control unit latent fault, loss of redundancy, or condition requiring maintenance.	Applicable maintenance required.
ENG 1 START ENG 2 START	Respective engine starter engaged.	
EXT PWR ON	Electrical power applied to external power plug.	
FUEL 1 CLOSED FUEL 2 CLOSED	Respective engine airframe fuel shutoff valve closed.	
FUEL LL1 MAINT FUEL LL2 MAINT	Fault indicated in fuel low-level sensor or associated wiring.	Applicable maintenance required.
GEN 1 DEGRADED GEN 2 DEGRADED	Respective generator regulator control unit output voltage less than 25 volts or GEN reset signal stuck or start signal stuck.	Applicable maintenance required.
HYD OFF OVRD	ADIU interrupt of hydraulic OFF selection due to fault on other hydraulic system.	Applicable maintenance required.
INTCON OVRD ON	Battery relay and essential bus interconnect relay closed with both generators inoperative. BUS INTCON switch in OVRD ON or external power connected.	
LDG LT ON	Landing light ON.	
MGT (instrument panel)	Engine matching mode selected to temperature matching.	
N ESS OVRD ON	Power is detected on non-essential bus when generator(s) inoperative. N-ESS BUS switch in OVRD ON position.	

Table 3-4. Advisory (Green, White, or Cyan) Lights/Messages (Cont)

MESSAGE	SYSTEM CONDITION	REQUIRED ACTION
PITOT HTR ON	Either pitot heater current sensor detects a transition from no current to active current. Message extinguishes after 3 seconds.	
REFUEL	FWD XFER and BAL PUMP valves in REFUEL position.	
RTR BRAKE – L RTR BRAKE – R	In conjunction with ROTOR BRAKE warning; respective rotor brake puck partially engaged.	Applicable maintenance required.
RTR BRK (upper EICAS)	Rotor brake may be applied until rotor stops.	
SRCH LT ON	Search light ON.	
TRQ (instrument panel)	Engine matching mode selected to torque matching.	
WOG MAINT	Weight on gear switch inoperative.	Applicable maintenance required.
---	Respective parameter input signal invalid or out of range.	Applicable maintenance action required.

Section 4

PERFORMANCE

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Section 4

PERFORMANCE

4-1. INTRODUCTION

Performance data presented herein are based on Pratt and Whitney specification power for engine, less installation losses. These data are applicable to basic helicopter without any optional equipment that would appreciably affect lift, drag, or power available.

4-2. POWER ASSURANCE CHECK

Power Assurance Check charts (Figure 4-1) are provided to determine if engines can produce installed specification power. Both charts in Figure 4-1 must be verified to complete a power assurance check.

CAUTION

WHEN MANIPULATING FLIGHT CONTROLS WITH FORCE TRIM SELECTED ON, DO NOT RELEASE AFFECTED FLIGHT CONTROL UNTIL THE OUT OF DETENT INDICATION EXTINGUISHES. THE FLIGHT CONTROLS MAY BE RESET BY DEPRESSING THE CYCLIC FORCE TRIM REL BUTTON AND COLLECTIVE FORCE REL BUTTON (4-AXIS ONLY) UNTIL THE OUT OF DETENT INDICATION EXTINGUISHES.

Power assurance checks should be performed daily. Additional checks should be made if unusual operating conditions or indications arise. Power assurance checks can be performed on ground (light on skids) or in a hover. Either method may be selected at pilot's discretion.

NOTE

During the following procedure, anticipate possible flight conditions when light on skids. Guard/ manipulate flight controls appropriately.

To perform power assurance check, ensure AFCS is not in ATT mode, turn off bleed air heater and generator on test engine. Set test engine at FLY (100% NR). Other engine shall be IDLE or OFF. Increase collective pitch, to light on skids or hover, but do not exceed 50%Q, 850C MGT or 97.2% NG. Stabilize power for 1 minute. Record Hp, OAT, MGT, NG, and TORQUE (Q) for test engine. Repeat this procedure for second engine.

As an alternate for power assurance checks on the ground, the automated DU power assurance page may be utilized. To perform power assurance check, ensure AFCS is not in ATT mode, turn off bleed air heater and generator on test engine. Set test engine at FLY (100% N_R). Other engine shall be IDLE or OFF. Select automated power assurance page on center DU. Increase collective pitch until the timer bar becomes active on the display, but do not exceed 50%Q, 850C MGT or 97.2% N_G. Stabilize power with helicopter on ground until automatic function shows complete. Record Hp, OAT, MGT, Torque (Q), N_G margin, and MGT margin for test engine. Repeat procedure for second engine. The results are identical to those of the paper chart.

EXAMPLE:

Following information recorded from cockpit instruments:

H_P	0 foot
OAT	20°C
Indicated MGT	700°C
Indicated N_G	90.5%
Indicated TORQUE	38%

SOLUTION:

Enter Power Assurance Check — MGT chart (Figure 4-1, Sheet 1) at indicated TORQUE (38%), move vertically to intersect H_P (0 foot), move left horizontally to intersect OAT (20°C), then drop vertically to read maximum allowable MGT (750°C).

MGT Margin is then calculated as follows: maximum allowable MGT minus indicated MGT, therefore:

MGT Margin = 750 - 700 = 50°C

Next enter Power Assurance Check — N_G chart (Figure 4-1, Sheet 2) at indicated TORQUE (38%), move vertically to intersect H_P (0 foot), move left horizontally to intersect OAT (20°C), then drop vertically to read maximum allowable N_G (92.1%).

N_G Margin is then calculated as follows: maximum allowable N_G minus indicated N_G, therefore:

N_G Margin = 92.1 - 90.5 = 1.6%

If MGT Margin and N_G Margin are both equal to or greater than zero, engine performance equals or exceeds engine minimum specification power and performance data contained in this manual can be achieved.

If either of MGT Margin or N_G Margin is less than zero, engine performance is below engine minimum specification power and performance data contained in this manual may not be achievable. Determine cause of engine power loss as soon as practical.

4-3. DENSITY ALTITUDE

Density altitude (Figure 4-2) is an expression of density of air in terms of height above sea level: 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. As temperature increases above standard for any altitude, density altitude will also increase to values higher than pressure altitude.

Chart also includes inverse of square root of density ratio:

$$\frac{1}{\sqrt{\sigma}}$$

which is used to calculate true airspeed (KTAS) by relation:

$$\text{KTAS} = \text{KCAS} \times \frac{1}{\sqrt{\sigma}}$$

EXAMPLE:

If ambient temperature is -15°C (5°F) and pressure altitude is 7000 feet, find density altitude, and true airspeed for 100 KCAS.

SOLUTION:

A. Enter bottom of chart at -15°C.

B. Move vertically upward to 7000 foot pressure altitude line.

C. From intersection point, move horizontally left and read density altitude value of 5000 feet.

D. Move horizontally right and read:

$$\frac{1}{\sqrt{\sigma}}$$

E. True airspeed:

$$100 \times 1.08 = 108 \text{ KTAS}$$

4-4. HEIGHT-VELOCITY

Height-velocity information is critical in event of single engine failure during takeoff, landing, or other operations near surface. Avoid areas on Single Engine Height-velocity Diagrams (Figure 4-3) define combinations of airspeed and height above ground from which safe single engine landing on smooth, level, firm surface cannot be assured.

Figure 4-3 is applicable to all combinations of pressure altitude and gross weight up to 7000 pounds (3175 kg). Sheet 1 of Figure 4-3 applies to all ambient temperatures from -20°C to maximum OAT. Sheet 2 of Figure 4-3 applies to all ambient temperatures below -20°C.

4-5. HOVER CEILING

Satisfactory stability and control have been demonstrated in each area of hover ceiling charts with winds as depicted on Hover Ceiling Wind Accountability Charts (Figure 4-4).

For data presented up to 13,000 feet H_D, Area A (non-shaded area) of hover ceiling charts presents hover performance (relative to GW) for conditions where adequate control margins exist for all relative wind conditions up to 35 knots, or for higher wind speeds directly off nose of helicopter. Area B (lightly shaded area) of hover ceiling charts presents hover performance (relative to GW) for conditions where adequate control margins exist for all relative winds within ±30° of nose of helicopter up to 35 knots, or for higher wind speeds directly off nose of helicopter. Area C (darker shaded area) of hover ceiling charts presents hover performance (relative to GW) for any wind speed directly off nose of helicopter.

For data presented above 13,000 feet H_D, Area A (non-shaded area) of hover ceiling charts presents hover performance (relative to GW) for conditions where adequate control margins exist for all relative wind conditions up to 20 knots, or for higher wind speeds directly off nose of helicopter. Area B (lightly shaded area) of hover ceiling charts presents hover performance (relative to GW) for conditions where adequate control margins exist for all relative winds within ±30° of nose of helicopter up to 20 knots, or for higher wind speeds directly off nose of helicopter. Area C (darker shaded area) of hover ceiling charts presents hover performance (relative to GW) for any wind speed directly off nose of helicopter.

4-5-A. HOVER CEILING — IGE

Hover Ceiling IGE charts (Figure 4-5) present IGE hover performance (relative to GW) for conditions of pressure altitude (H_P) and OAT.

4-5-B. HOVER CEILING — OGE

Hover ceiling OGE charts (Figure 4-6) present OGE hover performance (relative to GW) for conditions of pressure altitude (H_P) and OAT. Sheet 5 and Sheet 6 of Figure 4-6 present OGE hover performance for single engine conditions with a wind benefit component. Crosswind/Headwind Component Chart (Figure 4-12) can be used to determine headwind component.

EXAMPLE A:

What OGE GW hover capability could be expected for following conditions:

A. H_P — 6000 feet.

B. OAT — +20°C.

C. MAX CONTINUOUS POWER.

D. HEATER — OFF.

SOLUTION A:

A. Use Hover Ceiling OGE — Maximum Continuous Power chart (Figure 4-6, Sheet 3).

B. Enter OAT scale at +20°C.

C. Move upward to 6000 feet H_P curve.

D. Move horizontally to +20°C curve.

E. Drop down to read maximum gross weight of 6800 pounds.

EXAMPLE B:

What OGE GW hover capability could be expected for following conditions:

A. H_P — 1750 feet.

B. OAT — +10°C.

C. 2 MINUTE OEI POWER.

D. WIND — 37° off the nose at 25 knots.

SOLUTION B:

A. Use Crosswind/Headwind Component Chart (Figure 4-12): Enter at 25 knots reported wind scale, follow 25 knot arc until 37°. Headwind component is 20 knots. (Factored headwind is 10 knots.)

NOTE

Unless otherwise authorized by operating regulations, pilot is not authorized to take credit for performance increase resulting from more than 50% of actual headwind component for OEI hover.

B. Use Hover Ceiling Out of Ground Effect — 2 Minute OEI Power (Figure 4-6, Sheet 5): Enter on left of chart at 1750 feet H_P. Move right following grid lines to intersect 10°C line. Move vertically down to top of Unfactored Headwind graph (at zero wind). Move parallel to trend lines to the 10 knot (Factored Headwind) graph line. Move vertically down to Gross Weight axis and read 6385 pounds.

4-6. NOT USED

4-7. CLIMB AND DESCENT

4-7-A. CLIMB

With any combination of passenger cabin door(s) open/removed, the climb performance is reduced by 200 feet per minute.

Rate of Climb charts (Figure 4-7 through Figure 4-10) are presented for various power settings including OEI operations.

Recommended best rate of climb airspeed (V_Y) for all altitudes is 60 KIAS.

Following example is for use with rate of climb chart at takeoff power. Example is typical for use with all other rate of climb charts.

EXAMPLE:

Find maximum rate of climb that can be attained using takeoff power under following conditions:

A. H_P — 9000 feet.

B. OAT — 0°C.

C. GW — 6000 pounds.

D. HEATER — ON.

SOLUTION:

A. Use Rate of Climb — Takeoff power (Figure 4-7, Sheet 4).

B. Enter pressure altitude scale at 9000 feet.

C. Proceed horizontally to intersect 0°C temperature curve.

D. From intersection, drop down vertically to read rate of climb with heater off of 2400 feet per minute.

E. Rate of climb with heater on is 2400 - 320 = 2080 feet per minute.

4-8. AIRSPEED CALIBRATION

Refer to Figure 4-11 for airspeed installation correction during level flight, climb, and autorotation.

NOTE

Figure 4-11 can be used to convert KIAS to KCAS.

4-9. NOT USED

4-10. NOISE LEVELS

V_H is defined as airspeed in level flight obtained using minimum specification engine torque corresponding to maximum continuous power available for sea level, 25°C (77°F) ambient conditions at the relevant maximum certificated weight. Value of V_H thus defined for this helicopter at gross weight of 7000 pounds (3175 kilograms) is 144 KTAS.

The certified noise levels for Model 429 are:

Flight condition	EPNL (EPNdB)
Takeoff	88.9
Flyover	89.6
Approach	91.4

4-10-A. CANADIAN AIRWORTHINESS MANUAL CHAPTER 516 AND ICAO ANNEX 16 NOISE LEVEL CERTIFICATION

The above noise levels were obtained by analysis of approved data from noise tests conducted under the provisions of Chapter 8 of ICAO Annex 16, Volume 1, Fourth Edition, Amendment 8.

This helicopter complies with the noise emission standards applicable to the helicopter as set out by the International Civil Aviation Organization (ICAO) in Annex 16, Volume 1, Chapter 8, for gross weights up to and including the certificated maximum takeoff and landing weight of 7000 pounds (3175 kg). There are no operating limitations to meet TC or ICAO takeoff, overflight, or approach noise requirements.

4-10-B. 14 CFR PART 36 NOISE CERTIFICATION

The above noise levels were obtained by analysis of approved data from noise tests conducted under the provisions of Appendix H of 14 CFR Part 36, Amendment 36-28.

This helicopter is certified as a Stage 2 helicopter as prescribed in 14 CFR Part 36, Subpart H, for gross weights up to and including certificated maximum takeoff and landing weight of 7000 pounds (3175 kg). There are no operating limitations to meet FAA takeoff, flyover, or approach noise requirements.

NOTE

No determination has been made by the certifying authorities that the noise levels of this helicopter are or should be acceptable or unacceptable for operations at, into, or out of any airport.

AFCS ATT MODE – OFF
COLLECTIVE – FULL DOWN
THROTTLES: TEST ENGINE – FLY
OTHER ENGINE – IDLE

GENERATOR – OFF (TEST ENGINE)
POWER TURBINE – 100% RPM
BLEED AIR HEATER – OFF

POWER ASSURANCE CHECK - MGT
BASIC INLET OR BARRIER FILTER – GROUND/HOVER OPERATION

COLLECTIVE – INCREASE UNTIL LIGHT ON SKIDS OR HOVER.
DO NOT EXCEED 50% Q, 850°C MGT, OR 97.2% N_G.

STABILIZE POWER 1 MINUTE. RECORD INDICATED MGT, N_G, OAT, H_P AND TORQUE.

ENTER CHART AT INDICATED TORQUE, MOVE UP TO INTERSECT H_P, MOVE LEFT TO INTERSECT OAT, AND MOVE DOWN TO READ MAXIMUM ALLOWABLE MGT.

MGT MARGIN IS CALCULATED AS FOLLOWS:
MAXIMUM ALLOWABLE MGT minus INDICATED MGT

IF MGT MARGIN IS EQUAL TO OR GREATER THAN ZERO (0), ENGINE PERFORMANCE EQUALS OR EXCEEDS MINIMUM SPECIFICATION AND PERFORMANCE DATA CONTAINED IN THIS MANUAL CAN BE ACHIEVED.

IF MGT MARGIN IS LESS THAN ZERO (0), ENGINE PERFORMANCE IS LESS THAN MINIMUM SPECIFICATION AND PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. DETERMINE CAUSE OF POWER LOSS AS SOON AS PRACTICAL.

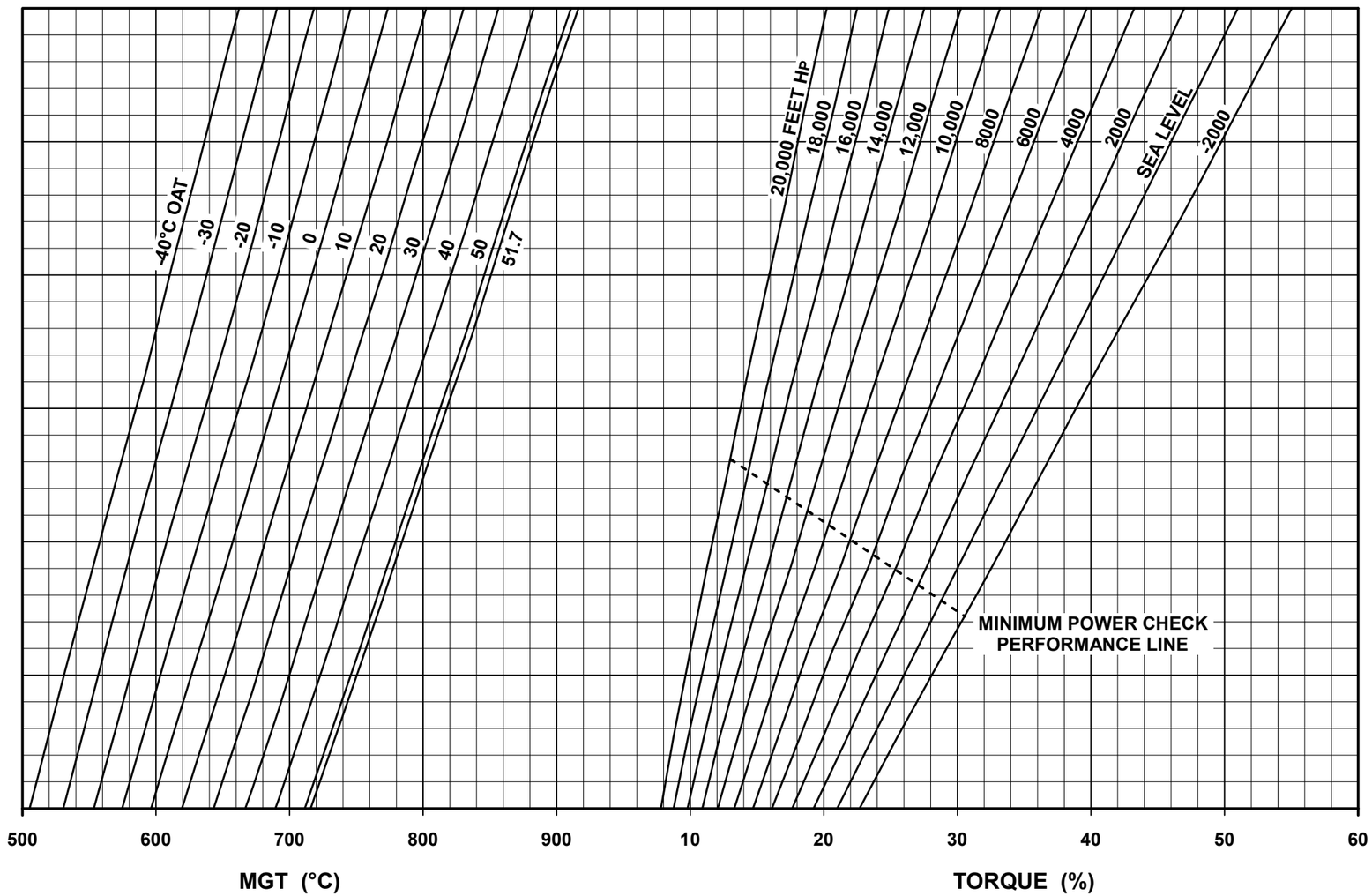


Figure 4-1. Power Assurance Check (Sheet 1 of 2)

AFCS ATT MODE – OFF
COLLECTIVE – FULL DOWN
THROTTLES: TEST ENGINE – FLY
OTHER ENGINE – IDLE

GENERATOR – OFF (TEST ENGINE)
POWER TURBINE – 100% RPM
BLEED AIR HEATER – OFF

POWER ASSURANCE CHECK - NG
BASIC INLET OR BARRIER FILTER – GROUND/HOVER OPERATION

COLLECTIVE – INCREASE UNTIL LIGHT ON SKIDS OR HOVER.
DO NOT EXCEED 50% Q, 850°C MGT, OR 97.2% NG.

STABILIZE POWER 1 MINUTE. RECORD INDICATED MGT, NG, OAT, HP AND TORQUE.

ENTER CHART AT INDICATED TORQUE, MOVE UP TO INTERSECT HP, MOVE LEFT TO INTERSECT OAT, AND MOVE DOWN TO READ MAXIMUM ALLOWABLE NG.

NG MARGIN IS CALCULATED AS FOLLOWS:
MAXIMUM ALLOWABLE NG minus INDICATED NG

IF NG MARGIN IS EQUAL TO OR GREATER THAN ZERO (0), ENGINE PERFORMANCE EQUALS OR EXCEEDS MINIMUM SPECIFICATION AND PERFORMANCE DATA CONTAINED IN THIS MANUAL CAN BE ACHIEVED.

IF NG MARGIN IS LESS THAN ZERO (0), ENGINE PERFORMANCE IS LESS THAN MINIMUM SPECIFICATION AND PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE. DETERMINE CAUSE OF POWER LOSS AS SOON AS PRACTICAL.

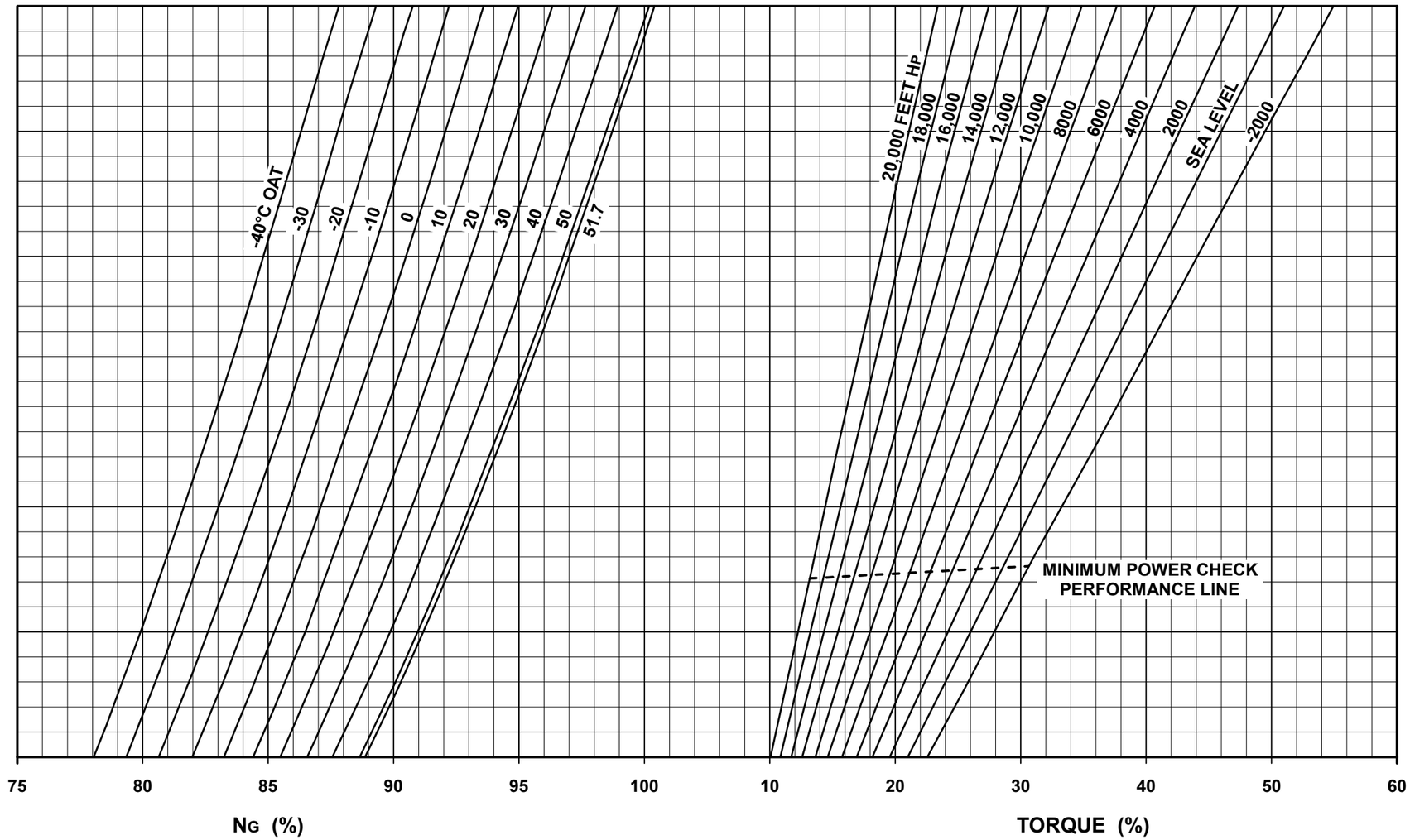


Figure 4-1. Power Assurance Check (Sheet 2 of 2)

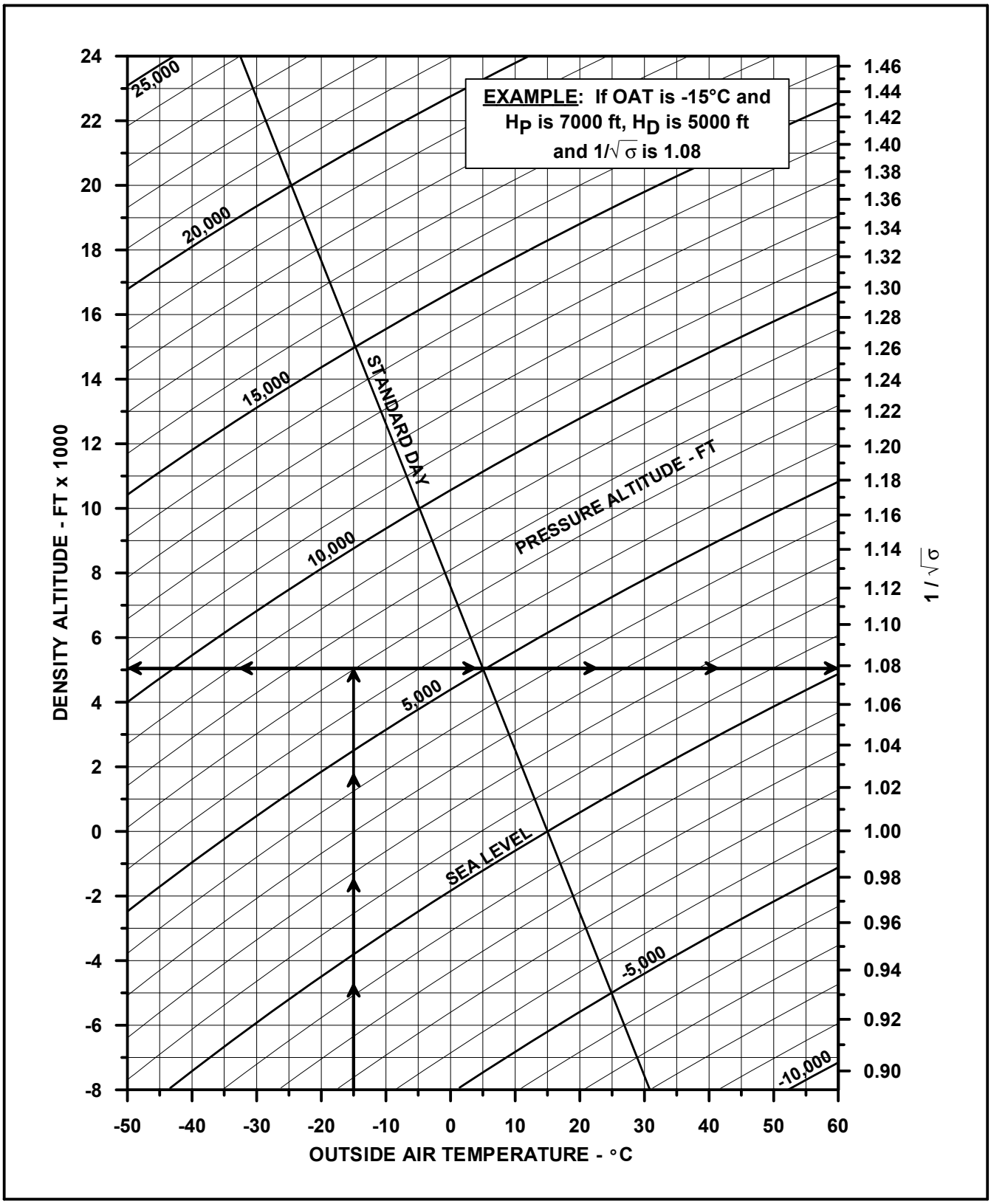
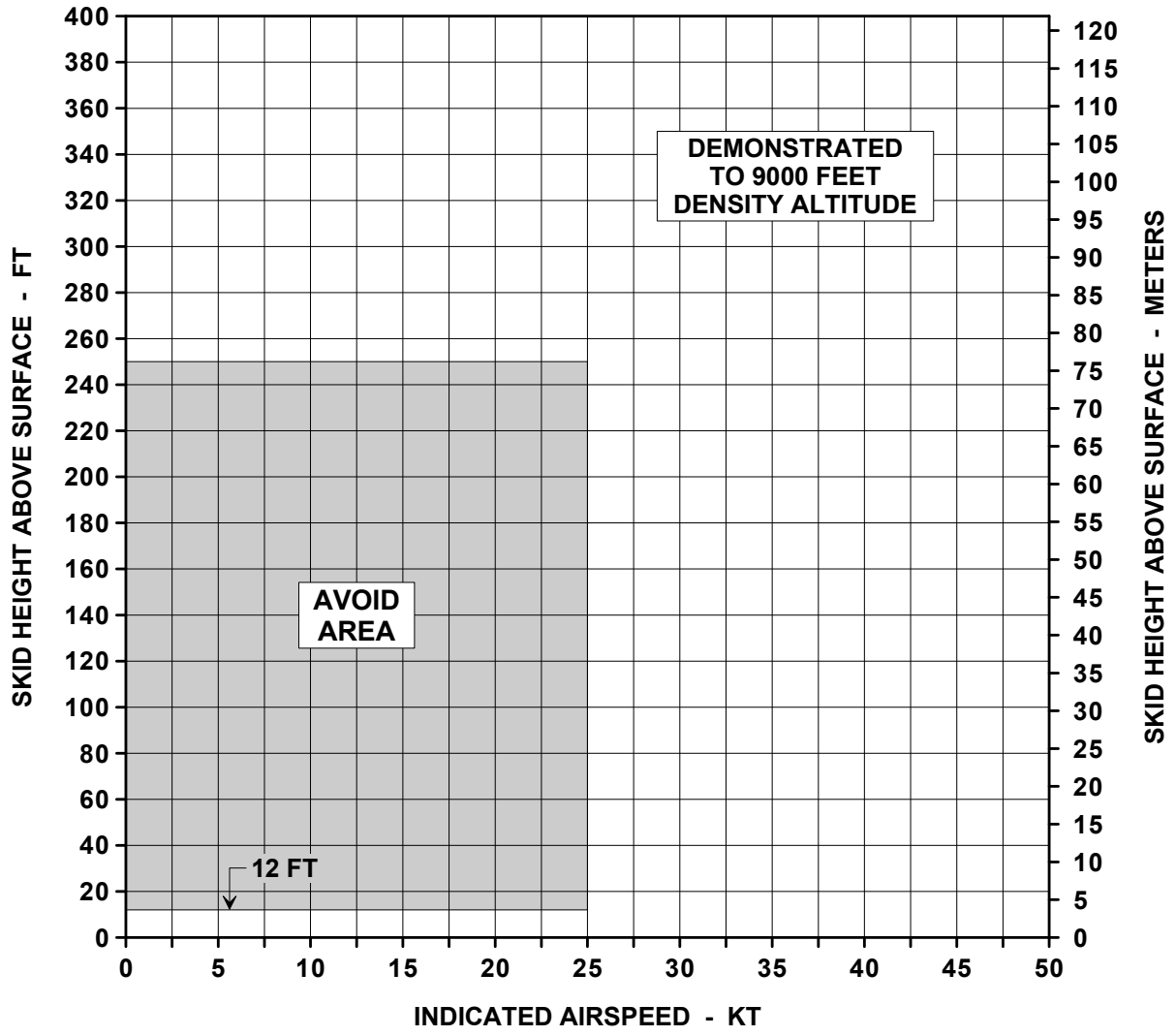


Figure 4-2. Density Altitude

SINGLE ENGINE HEIGHT-VELOCITY DIAGRAM
FROM -20°C TO MAX OAT



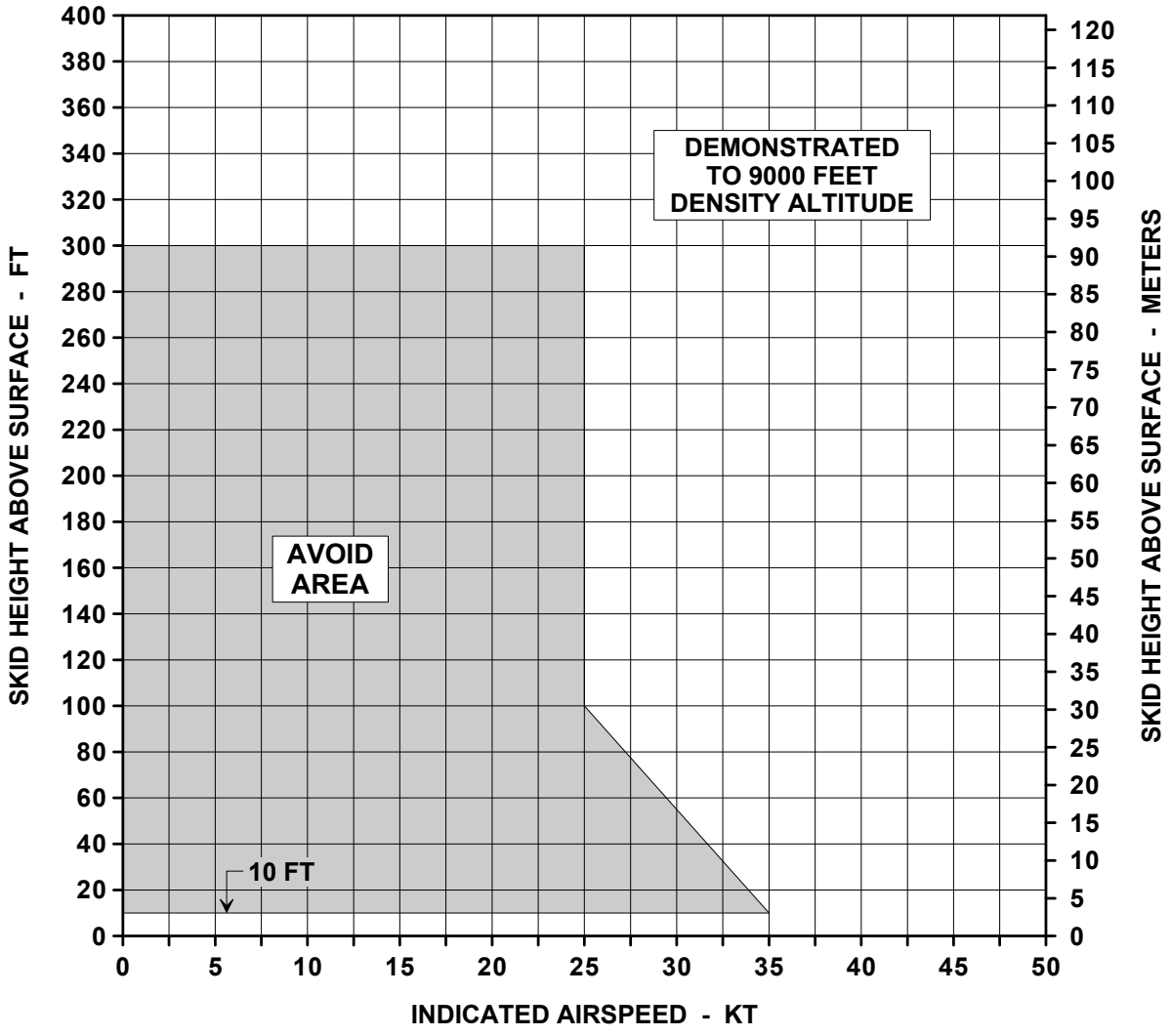
NOTES

1. The shaded AVOID AREA applies to all ambient temperatures from -20°C to maximum OAT.

2. This chart is applicable to all gross weights up to 7000 pounds and all pressure altitudes.

Figure 4-3. Single Engine Height-Velocity Diagram (Sheet 1 of 2)

SINGLE ENGINE HEIGHT-VELOCITY DIAGRAM
FOR OAT BELOW -20°C



NOTES

1. The shaded AVOID AREA applies to all ambient temperatures below -20°C.
2. This chart is applicable to all gross weights up to 7000 pounds and all pressure altitudes.

Figure 4-3. Single Engine Height-Velocity Diagram (Sheet 2 of 2)

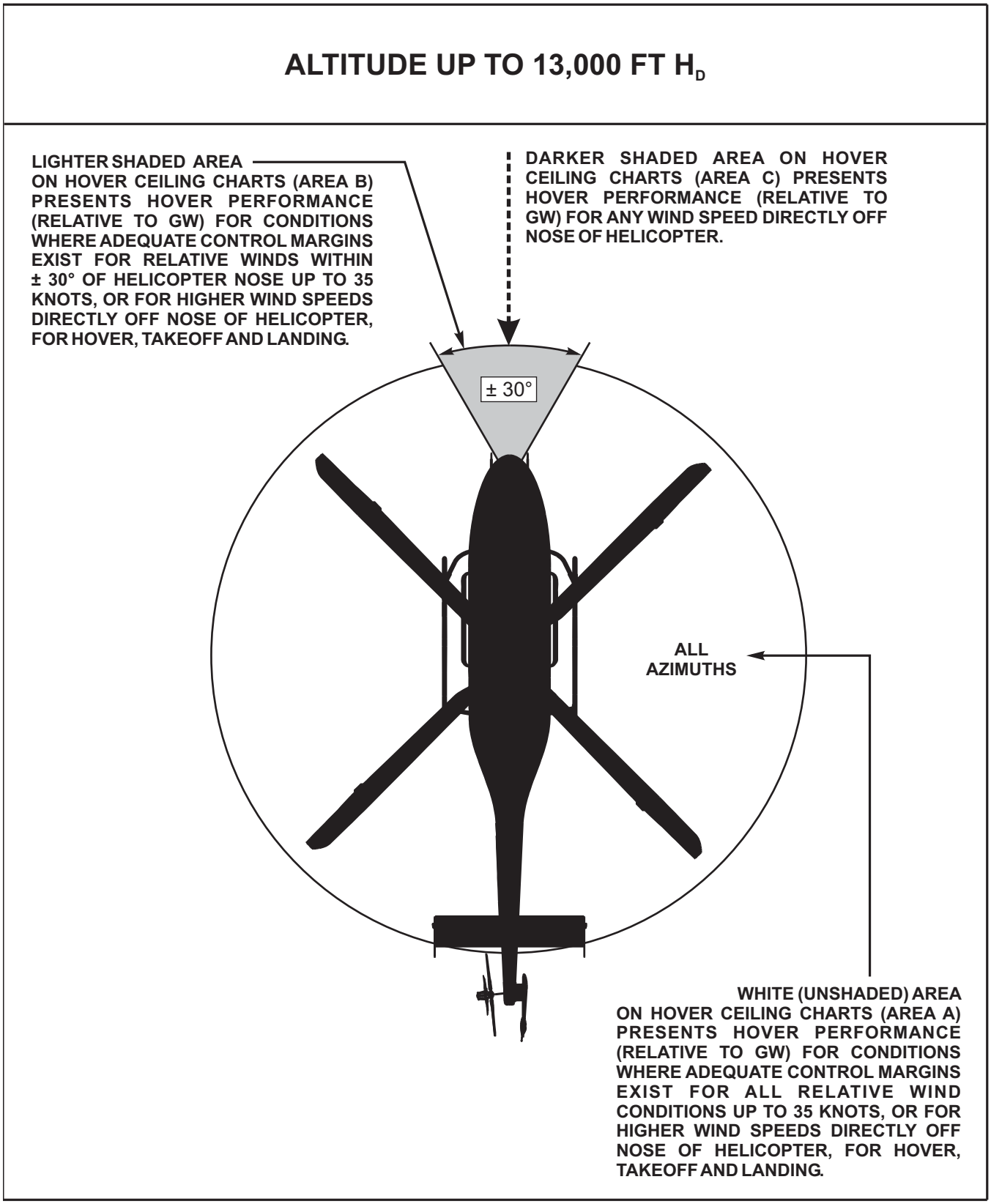


Figure 4-4. Hover Ceiling Wind Accountability Chart (Sheet 1 of 2)

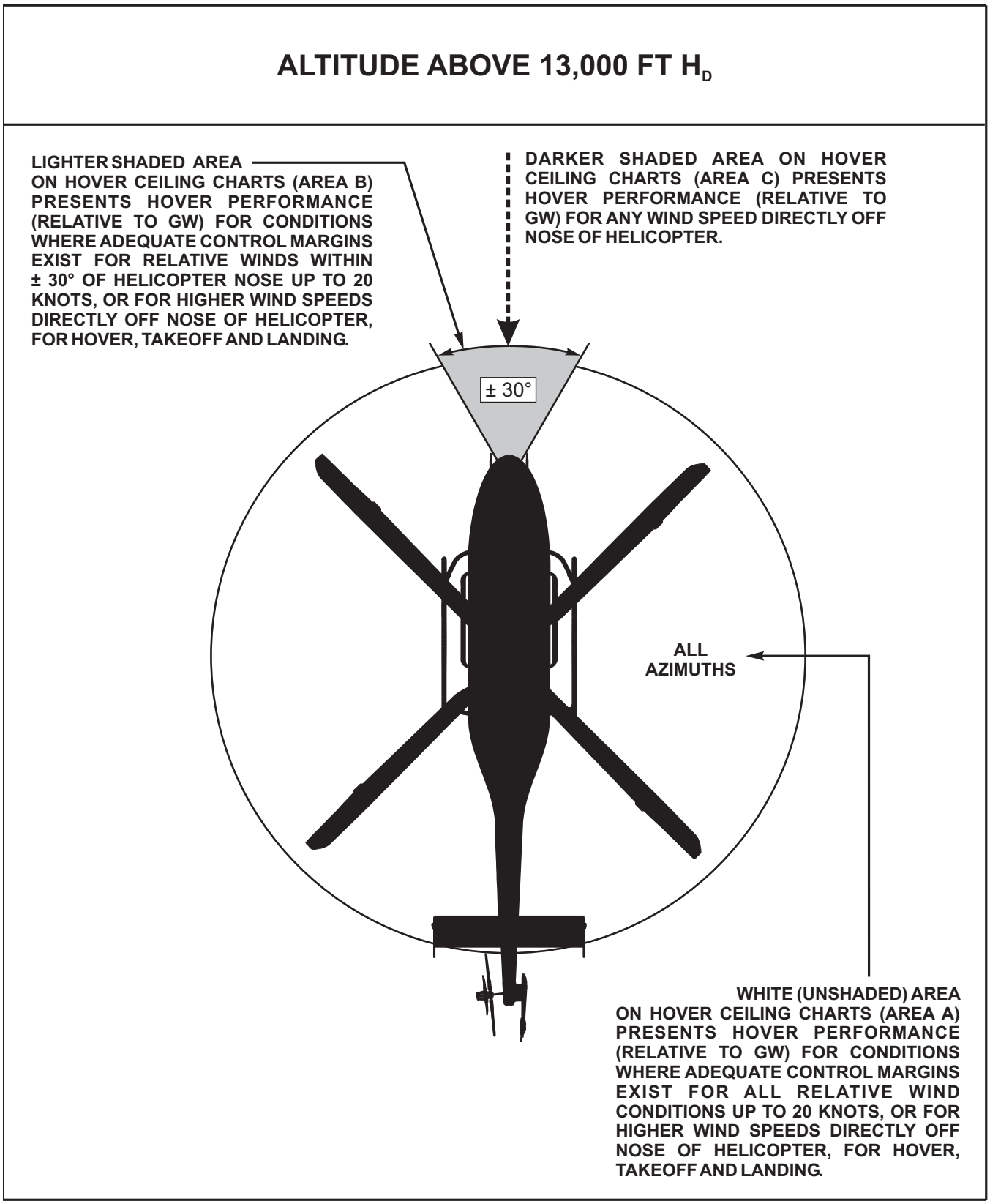


Figure 4-4. Hover Ceiling Wind Accountability Chart (Sheet 2 of 2)

HOVER CEILING
IN GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 4 FT (1.2 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

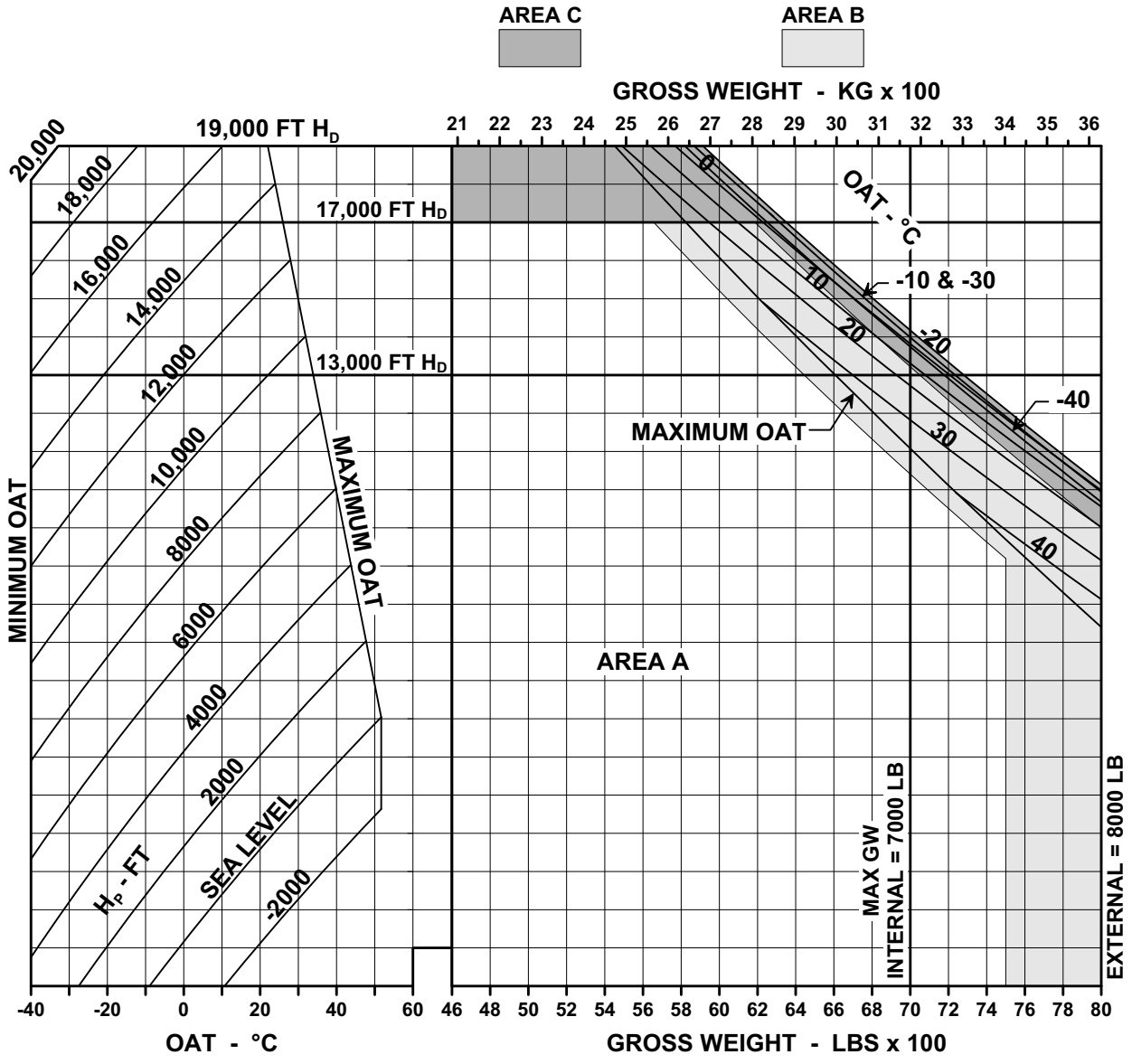


Figure 4-5. Hover Ceiling IGE (Sheet 1 of 4)

HOVER CEILING
IN GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 4 FT (1.2 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER ON

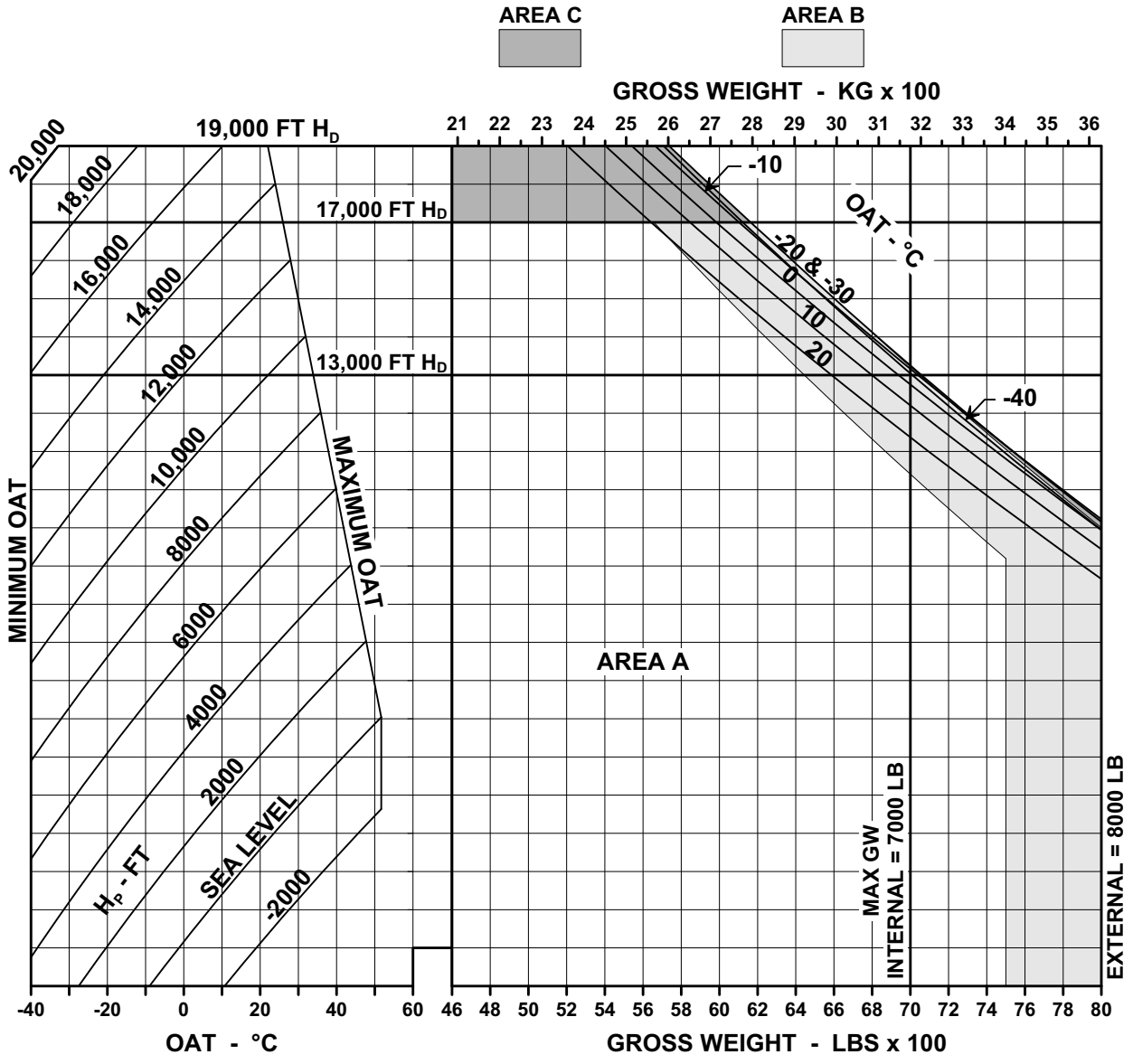


Figure 4-5. Hover Ceiling IGE (Sheet 2 of 4)

HOVER CEILING
IN GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 4 FT (1.2 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

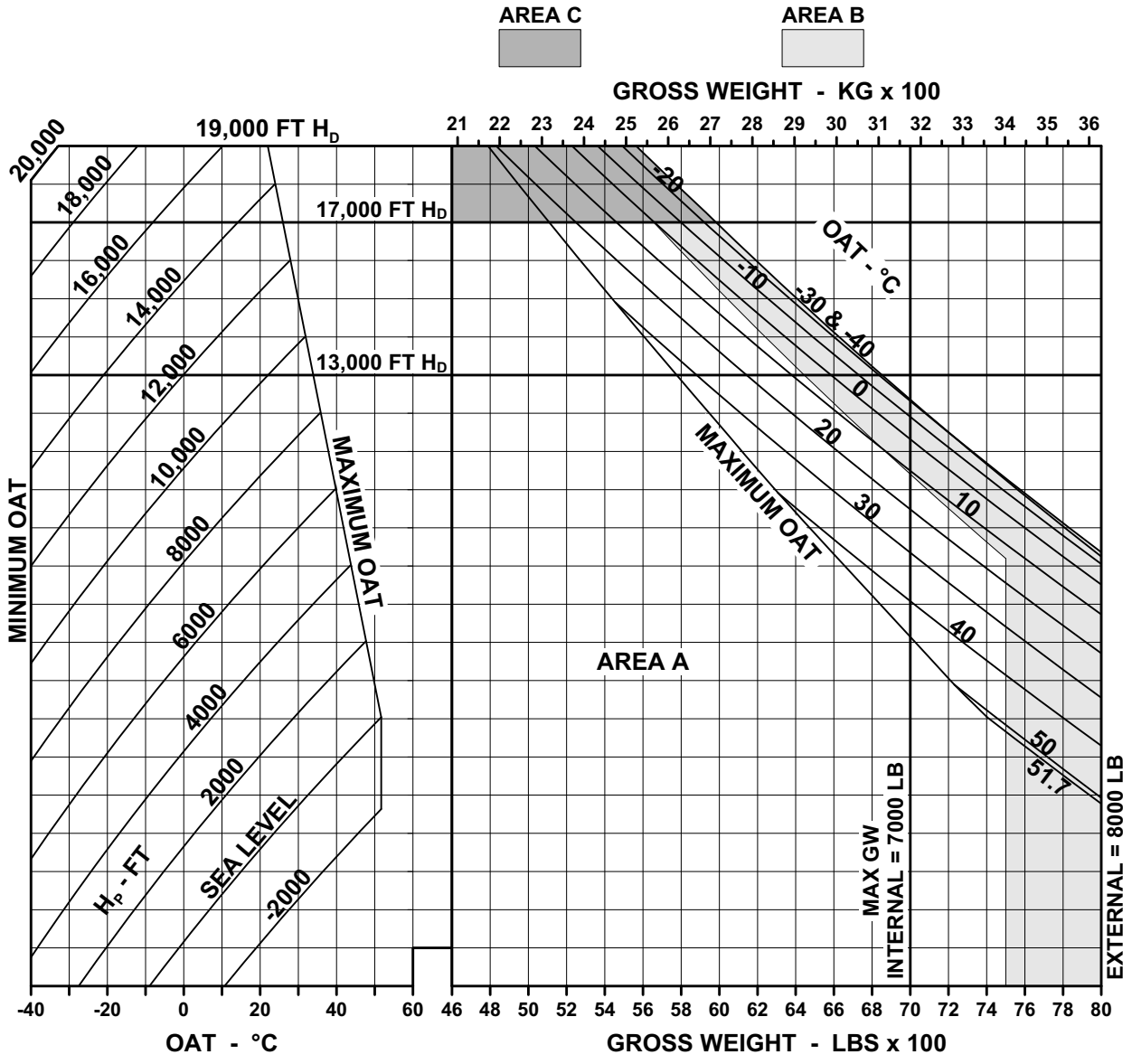


Figure 4-5. Hover Ceiling IGE (Sheet 3 of 4)

HOVER CEILING
IN GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 4 FT (1.2 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER ON

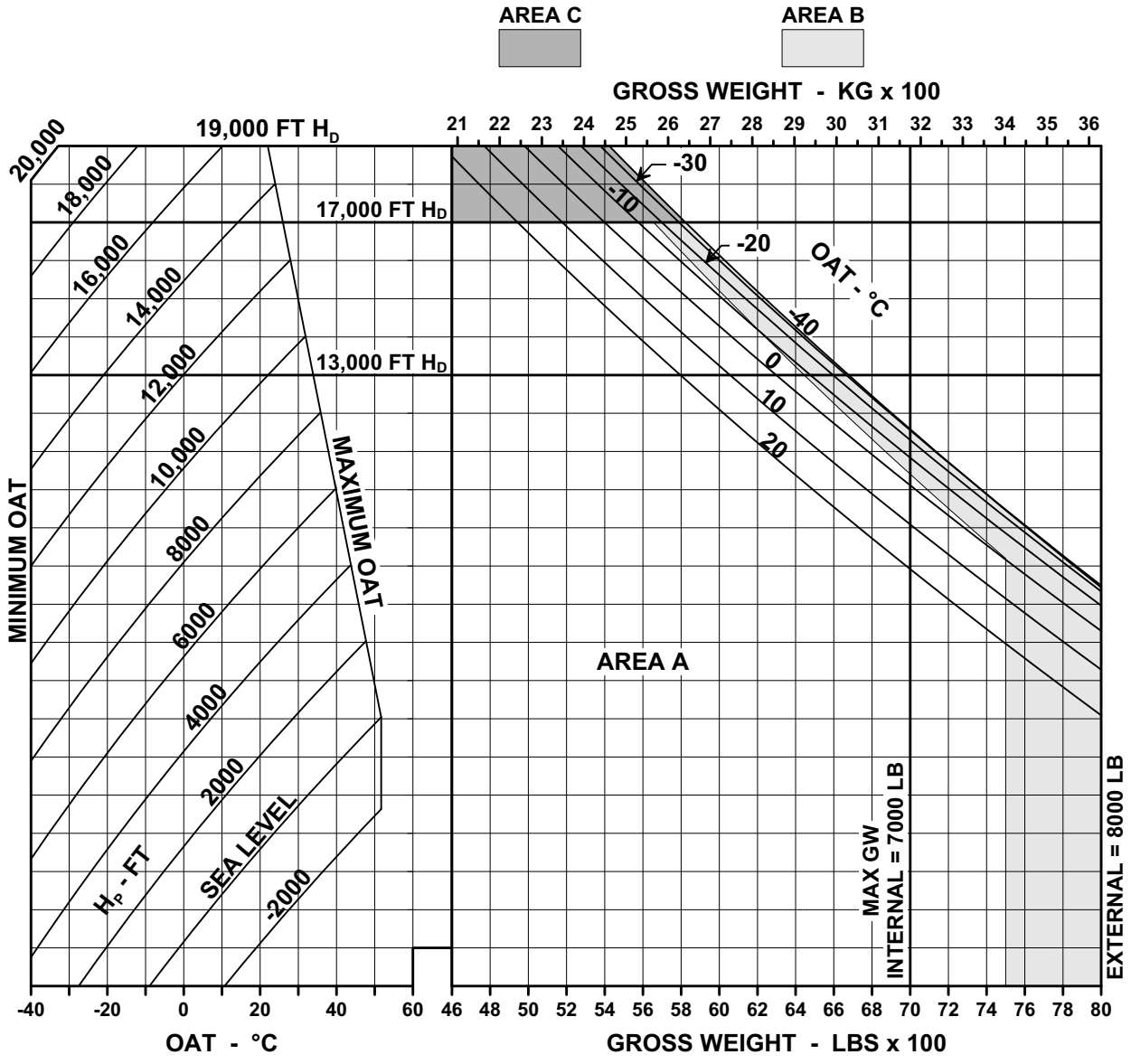


Figure 4-5. Hover Ceiling IGE (Sheet 4 of 4)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 60 FT (18.3 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

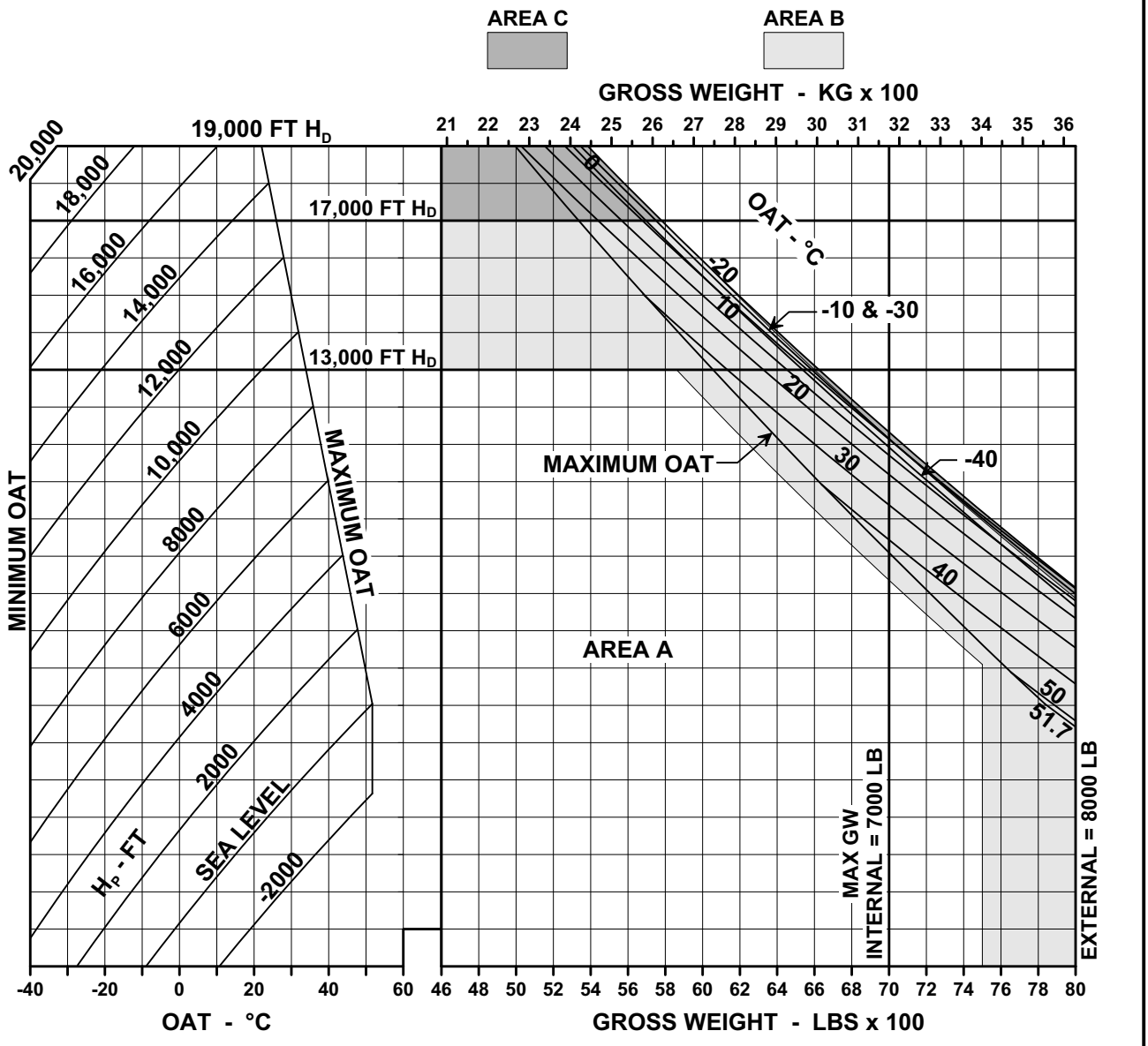


Figure 4-6. Hover Ceiling OGE (Sheet 1 of 6)

HOVER CEILING
OUT OF GROUND EFFECT

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 60 FT (18.3 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER ON

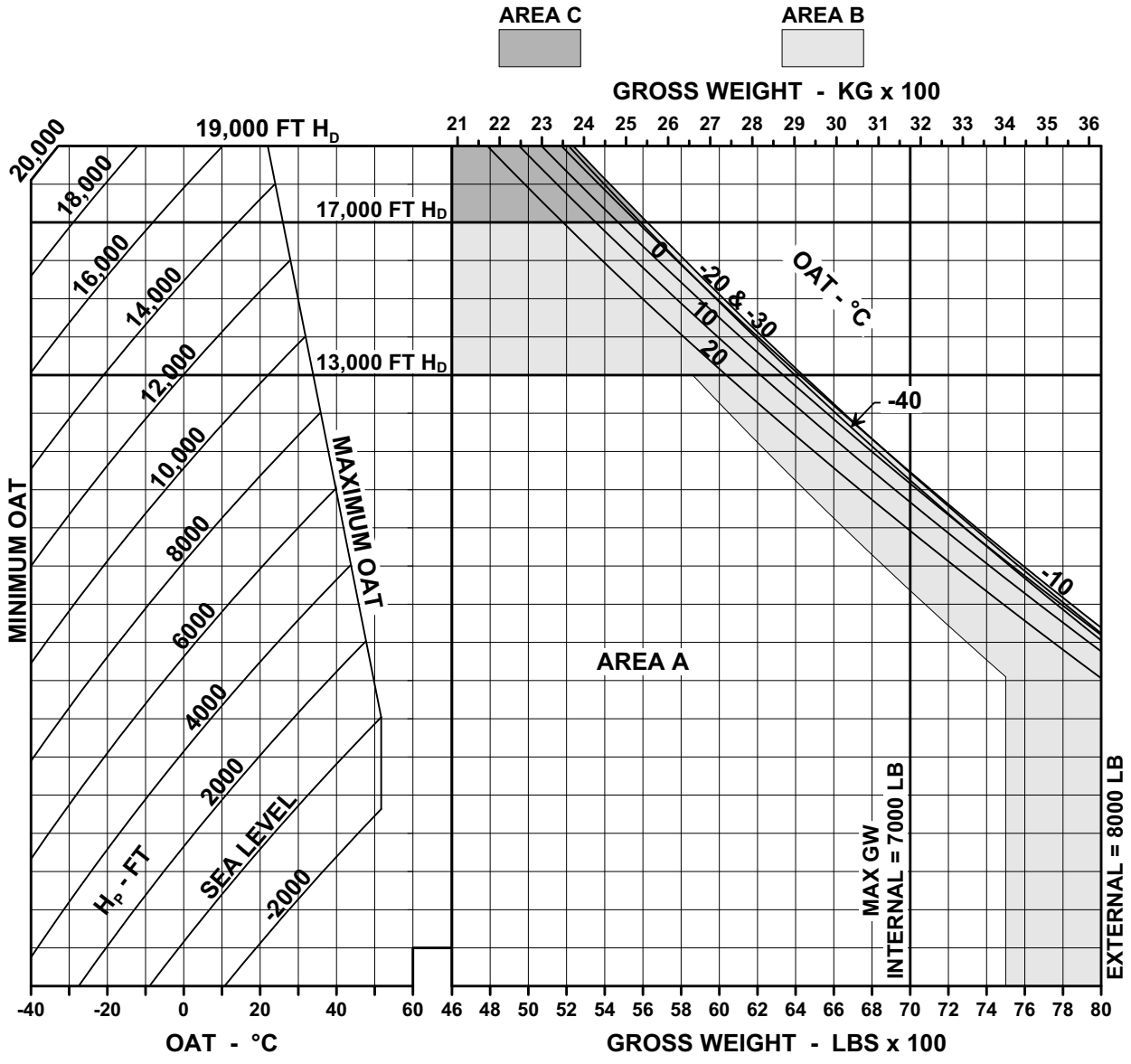


Figure 4-6. Hover Ceiling OGE (Sheet 2 of 6)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 60 FT (18.3 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

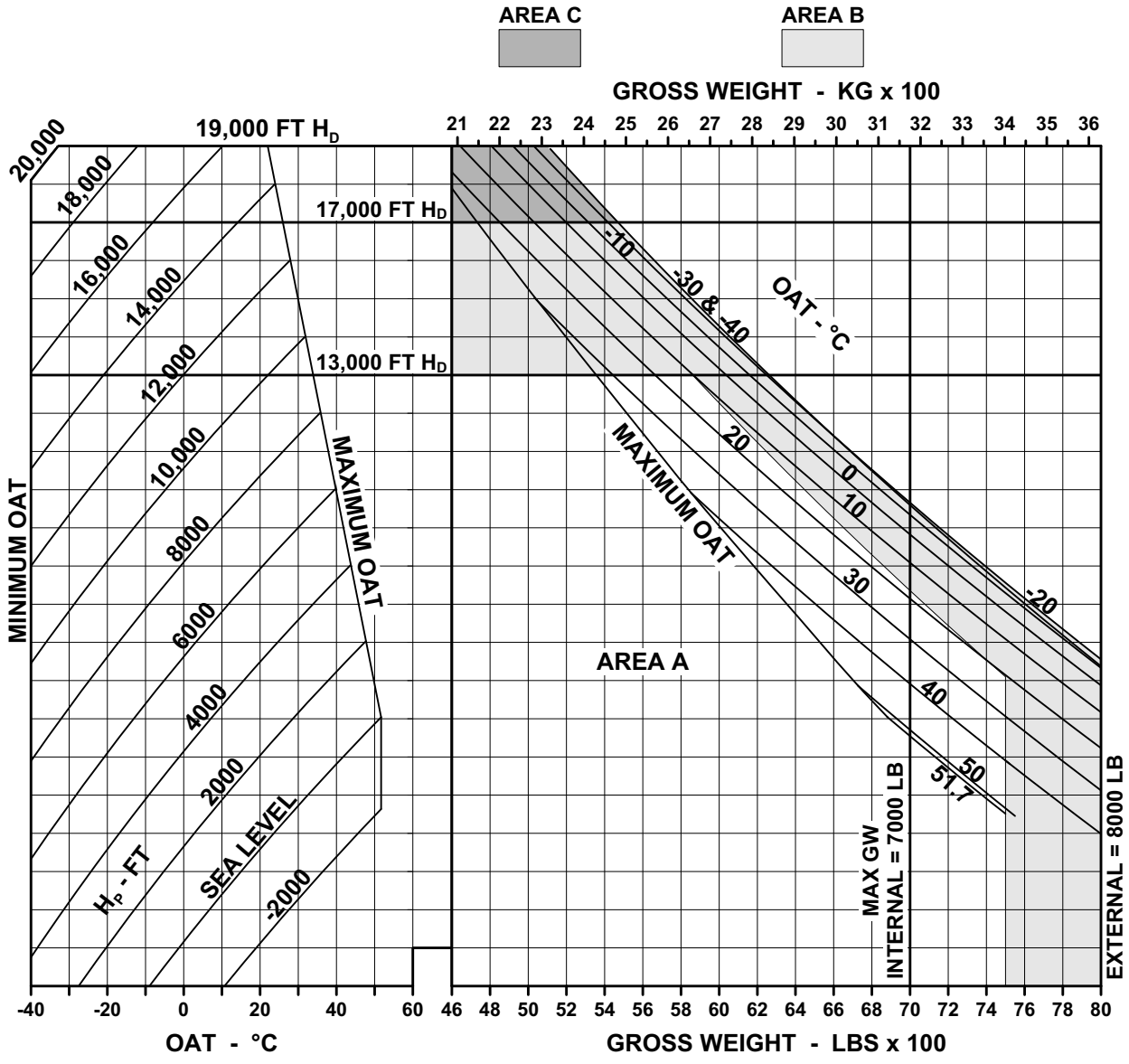


Figure 4-6. Hover Ceiling OGE (Sheet 3 of 6)

HOVER CEILING
OUT OF GROUND EFFECT

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

SKID HEIGHT 60 FT (18.3 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER ON

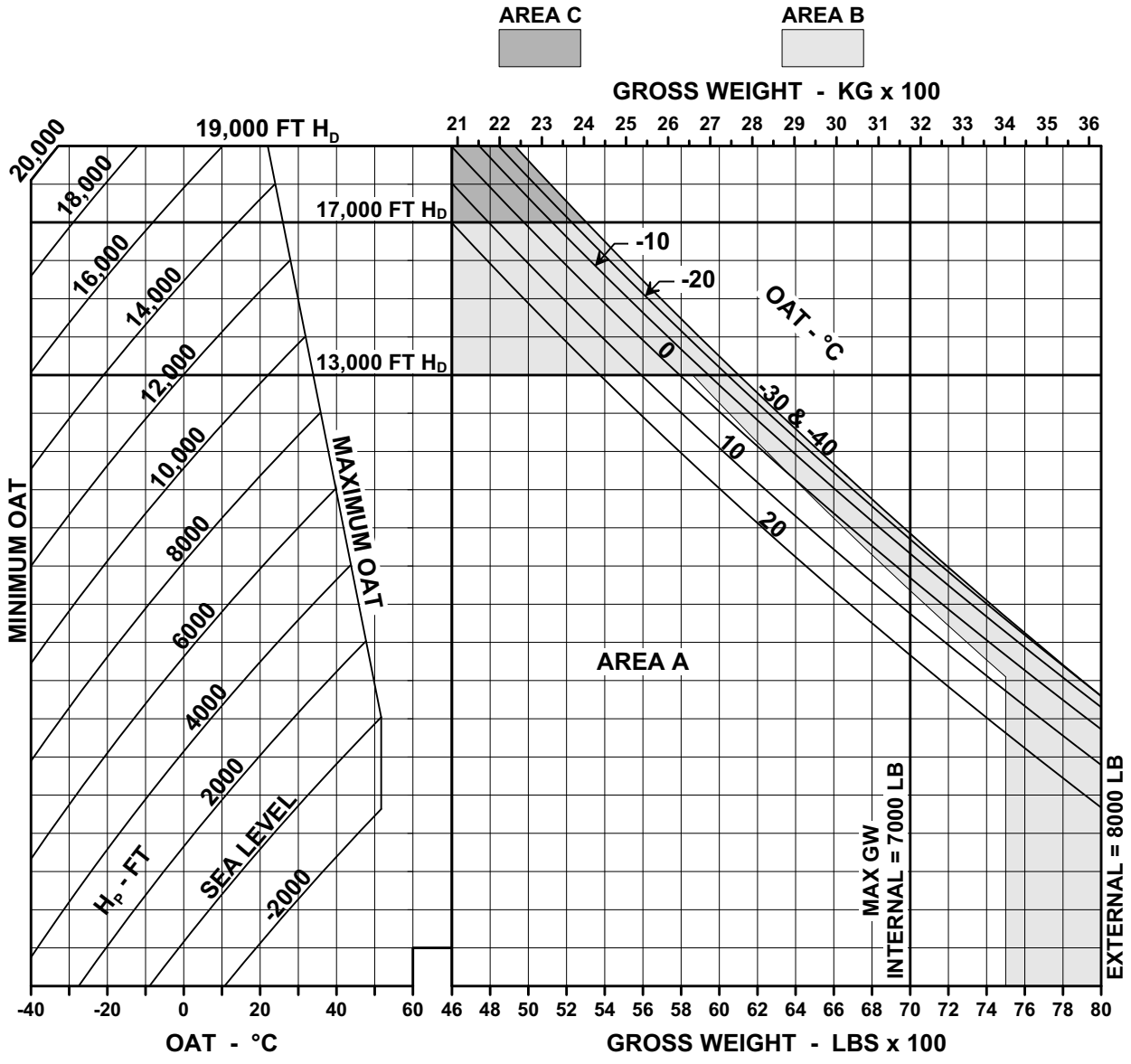


Figure 4-6. Hover Ceiling OGE (Sheet 4 of 6)

HOVER CEILING
OUT OF GROUND EFFECT

2 MINUTE OEI POWER
ENGINE RPM 104%
GENERATOR 150 AMPS

SKID HEIGHT 60 FT (18.3 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

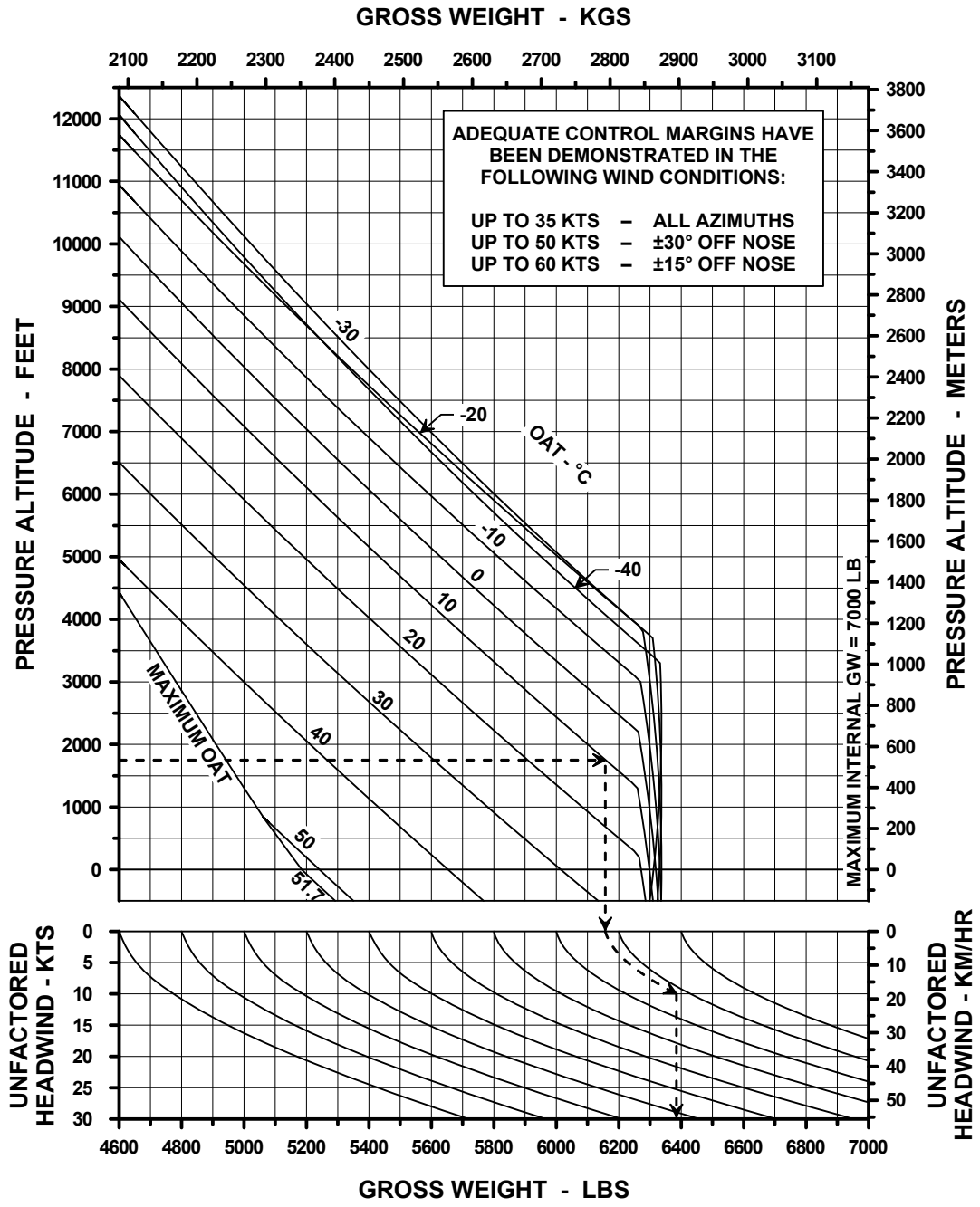


Figure 4-6. Hover Ceiling OGE (Sheet 5 of 6)

HOVER CEILING
OUT OF GROUND EFFECT

30 SECOND OEI POWER
ENGINE RPM 104%
GENERATOR 150 AMPS

SKID HEIGHT 60 FT (18.3 METER)
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

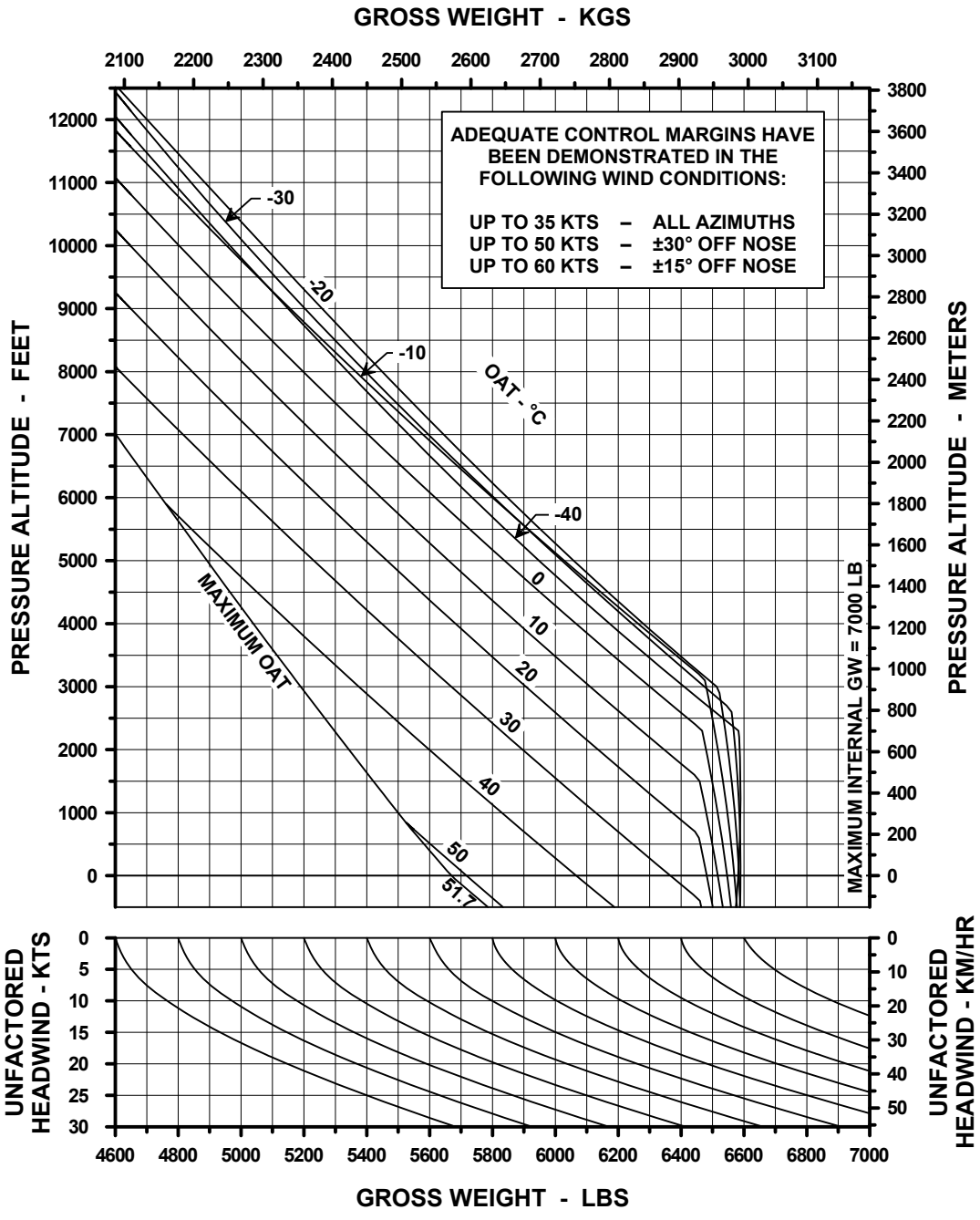


Figure 4-6. Hover Ceiling OGE (Sheet 6 of 6)

RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 430 FT/MIN (2.2 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALTITUDES ABOVE 2000 FT

Gross Weight 4500 lbs (2041 kg)

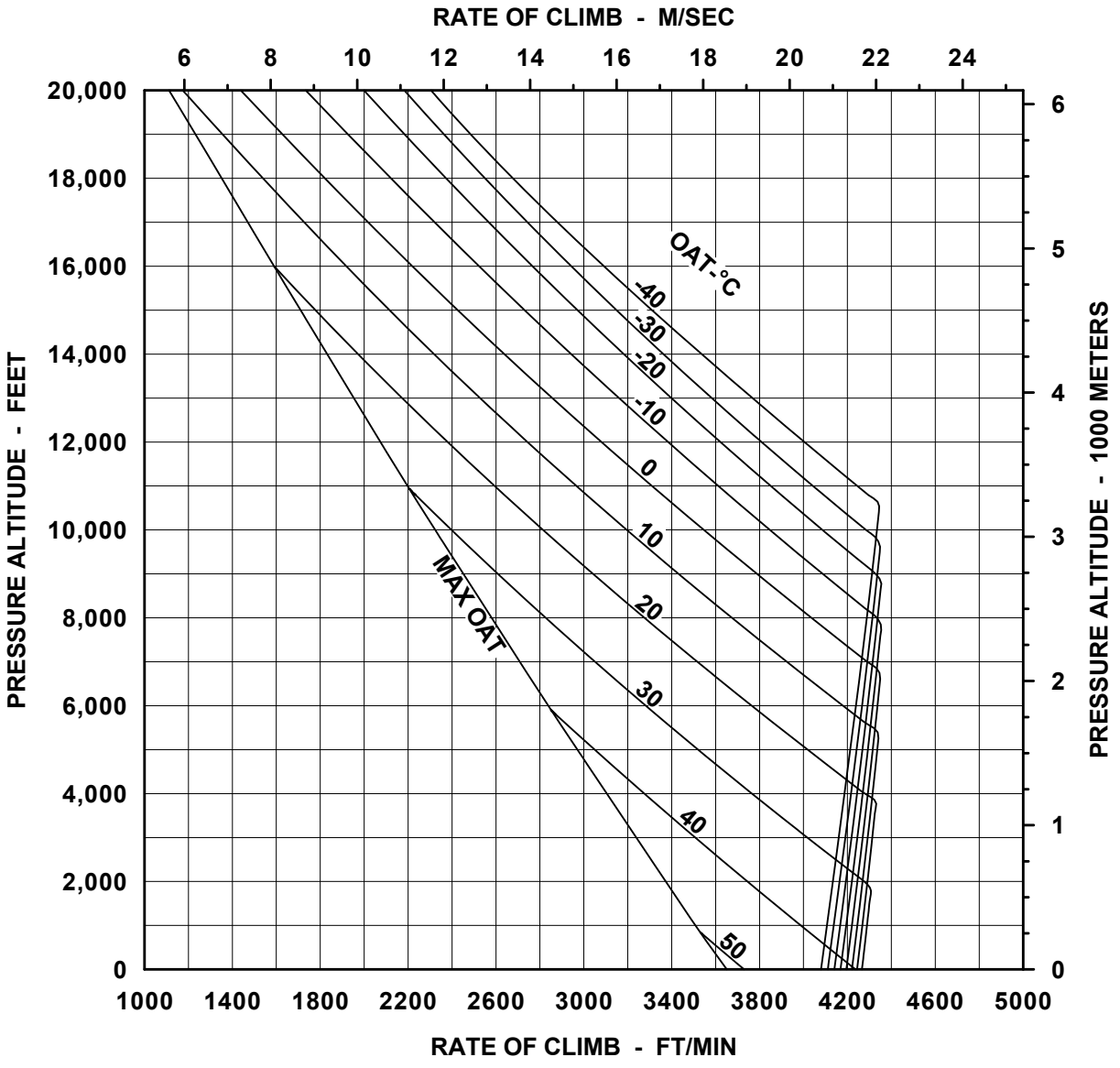


Figure 4-7. Rate of Climb — Takeoff Power (Sheet 1 of 6)

RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 385 FT/MIN (2.0 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALTITUDES ABOVE 2000 FT

Gross Weight 5000 lbs (2268 kg)

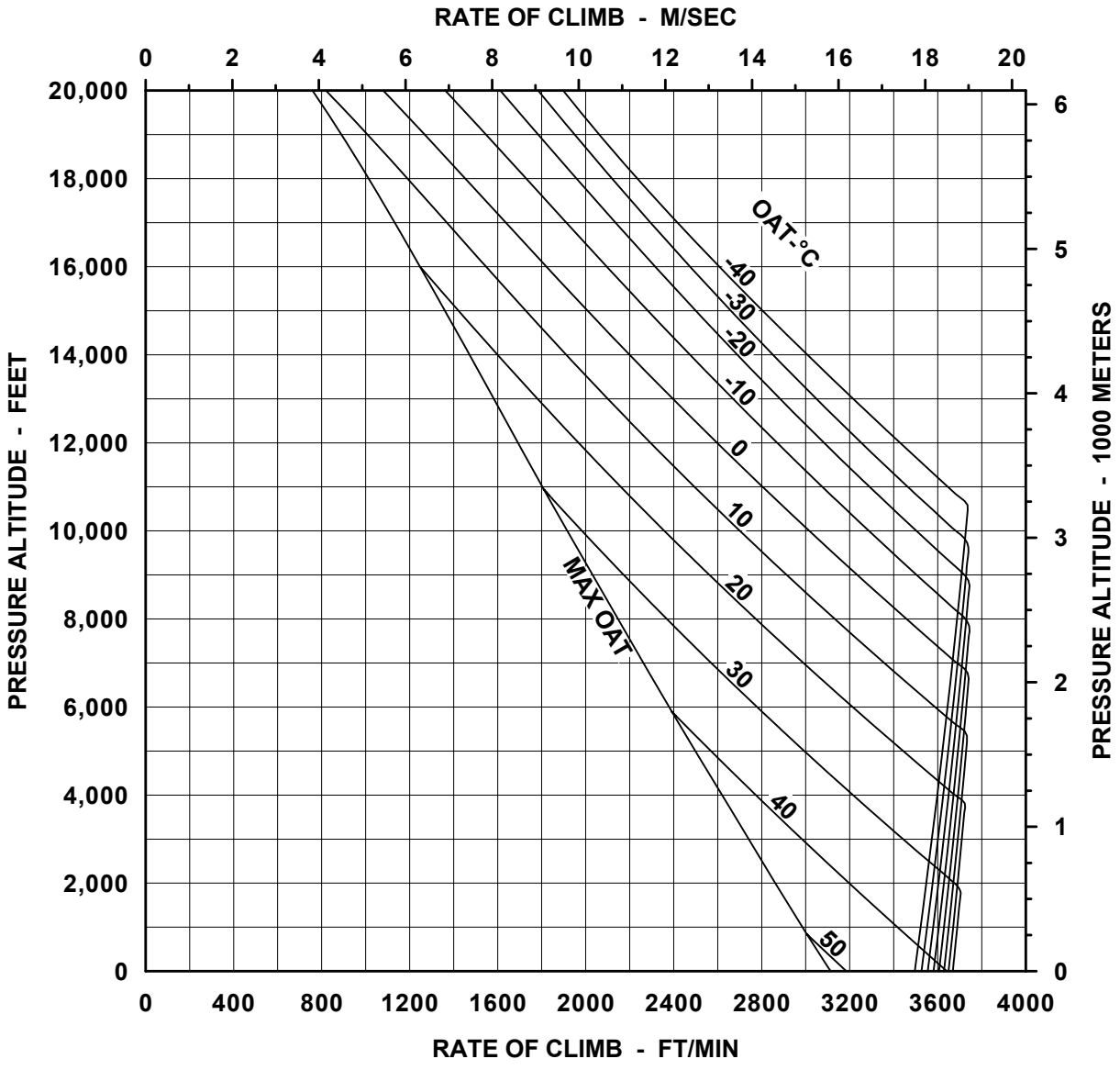


Figure 4-7. Rate of Climb — Takeoff Power (Sheet 2 of 6)

RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 350 FT/MIN (1.8 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALTITUDES ABOVE 2000 FT

Gross Weight 5500 lbs (2495 kg)

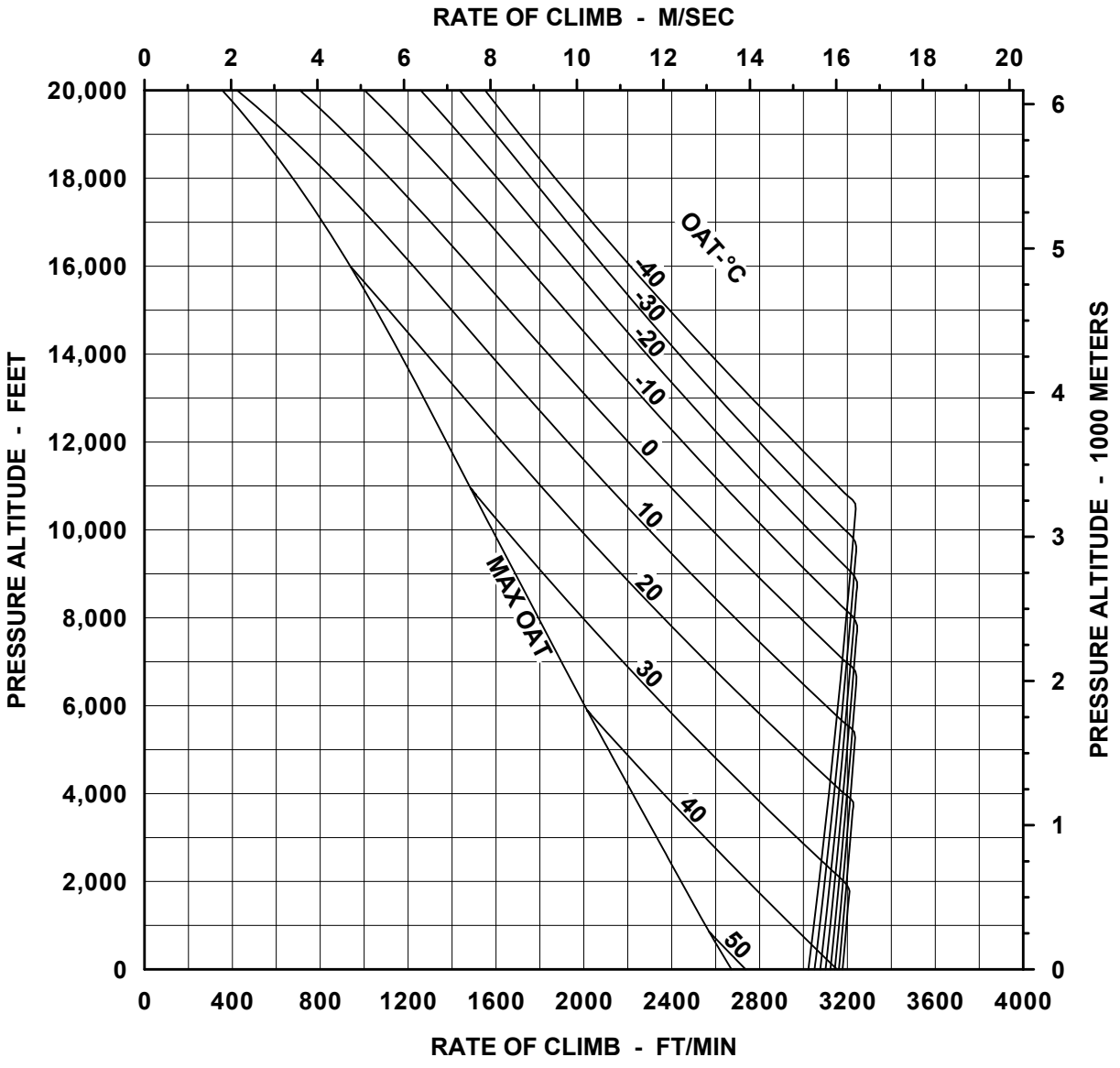


Figure 4-7. Rate of Climb — Takeoff Power (Sheet 3 of 6)

RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 320 FT/MIN (1.6 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALTITUDES ABOVE 2000 FT

Gross Weight 6000 lbs (2722 kg)

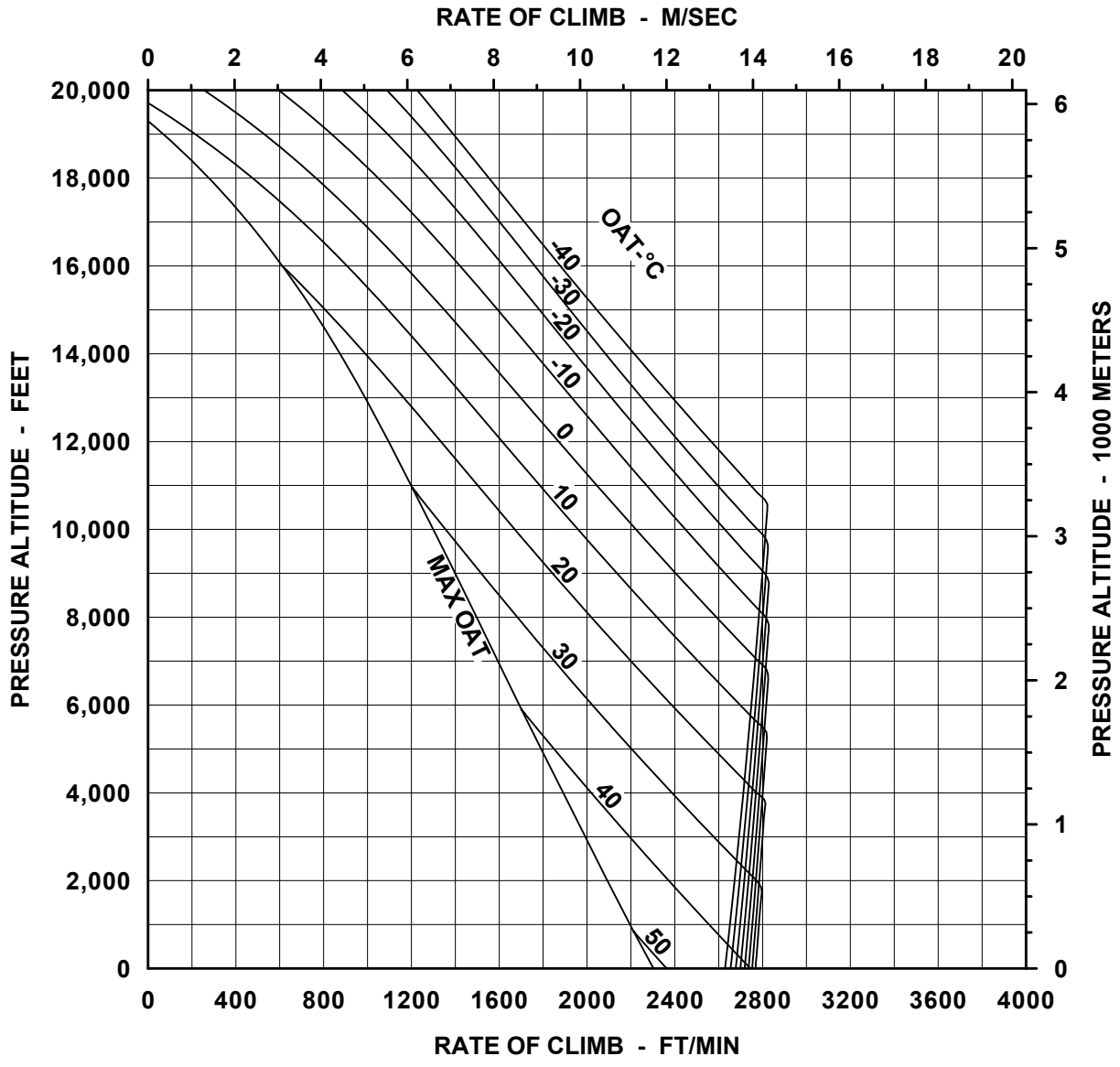


Figure 4-7. Rate of Climb — Takeoff Power (Sheet 4 of 6)

RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 295 FT/MIN (1.5 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALTITUDES ABOVE 2000 FT

Gross Weight 6500 lbs (2948 kg)

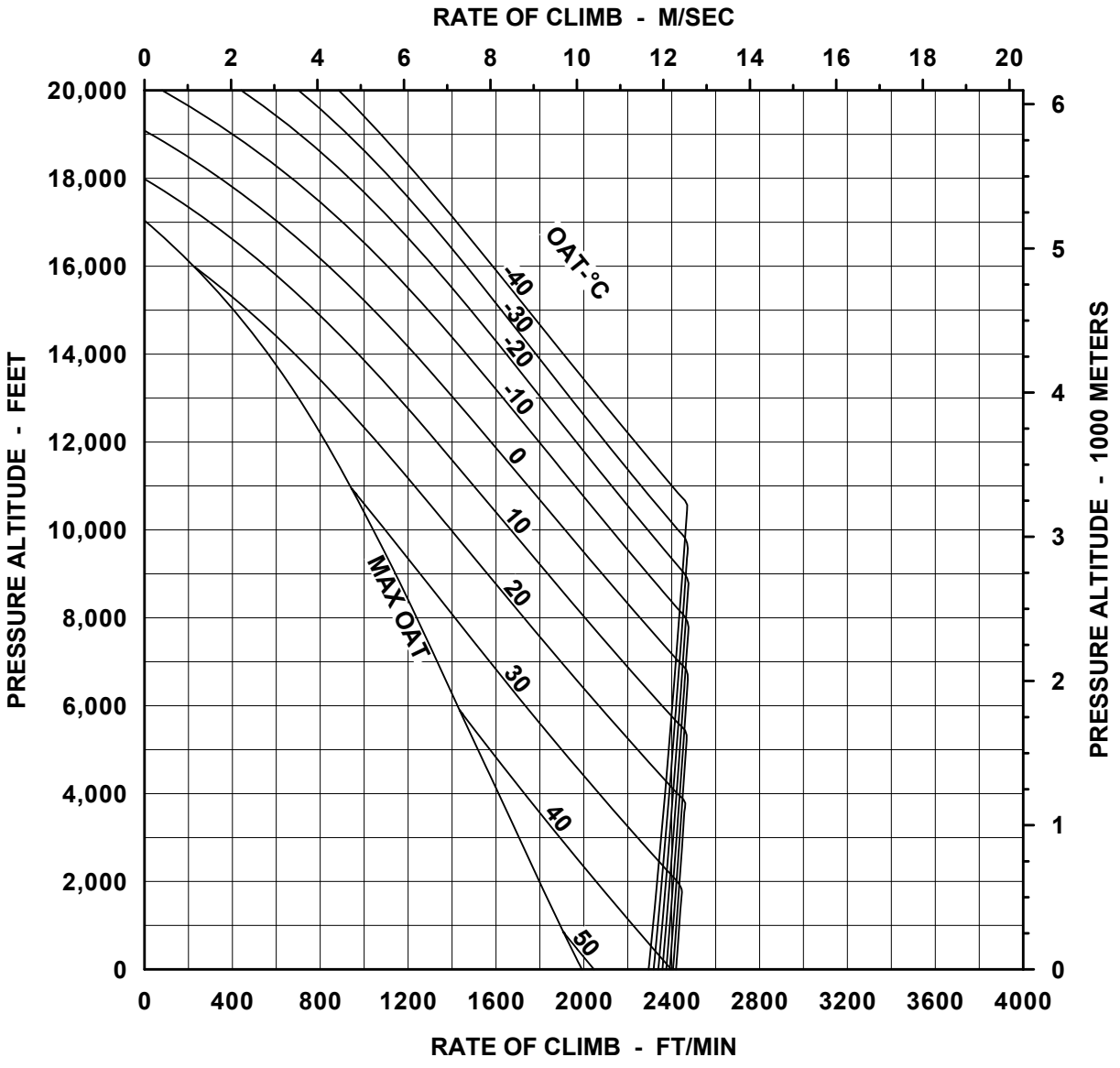


Figure 4-7. Rate of Climb — Takeoff Power (Sheet 5 of 6)

RATE OF CLIMB

TAKEOFF POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 275 FT/MIN (1.4 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALTITUDES ABOVE 2000 FT

Gross Weight 7000 lbs (3175 kg)

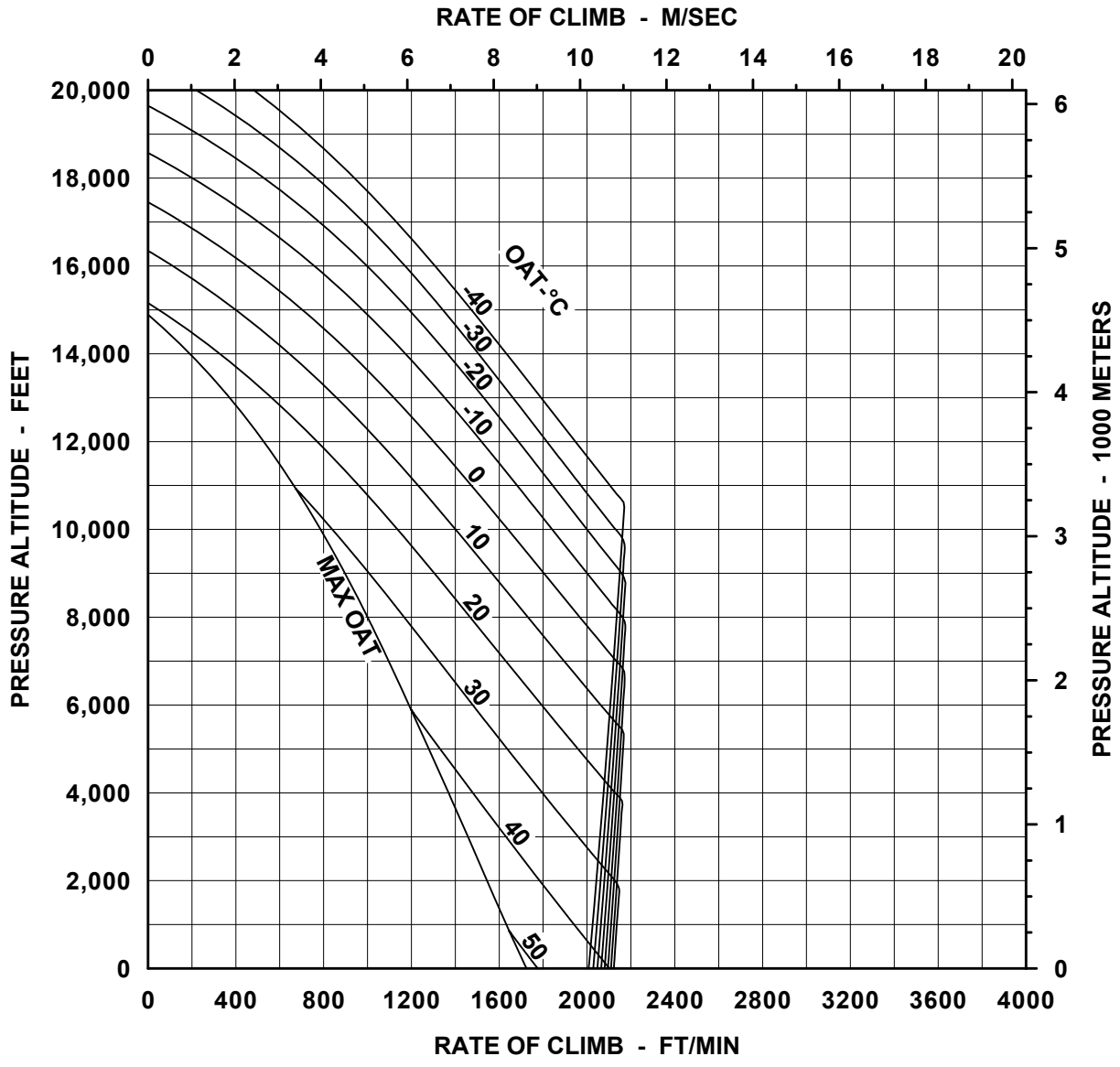


Figure 4-7. Rate of Climb — Takeoff Power (Sheet 6 of 6)

RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 485 FT/MIN (2.5 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALL ALTITUDES

Gross Weight 4500 lbs (2041 kg)

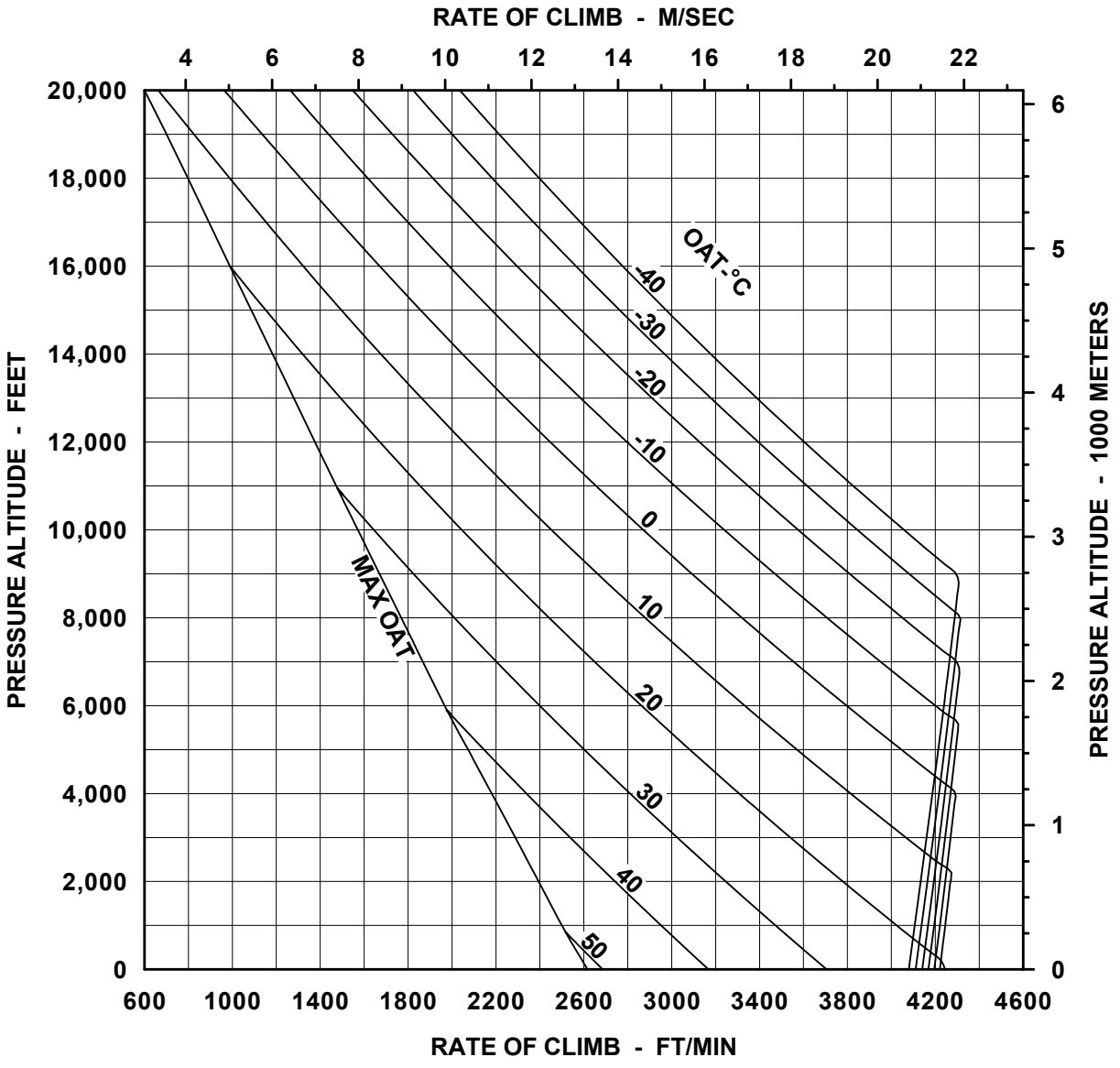


Figure 4-8. Rate of Climb — Maximum Continuous Power (Sheet 1 of 6)

RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 435 FT/MIN (2.2 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALL ALTITUDES

Gross Weight 5000 lbs (2268 kg)

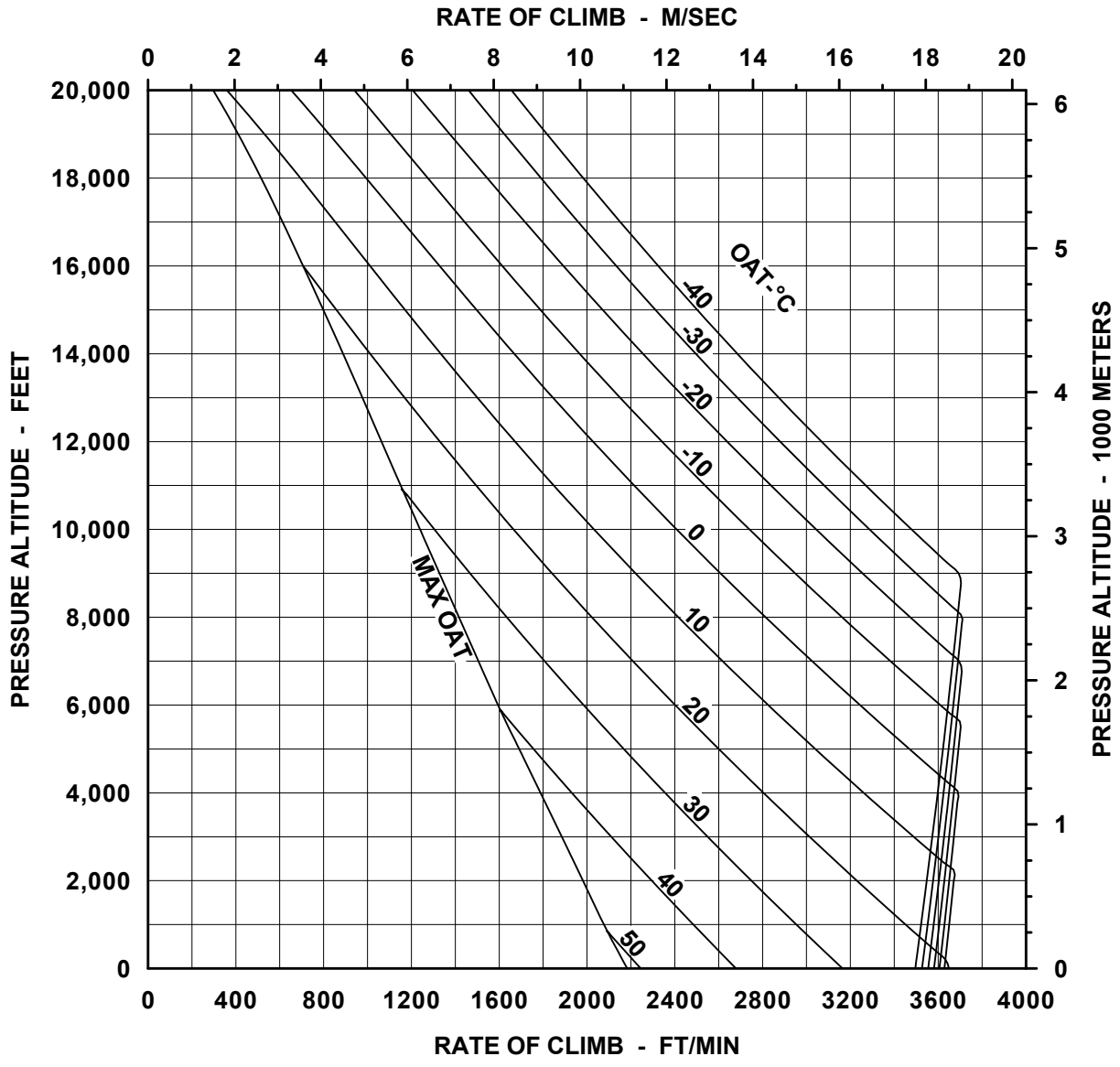


Figure 4-8. Rate of Climb — Maximum Continuous Power (Sheet 2 of 6)

RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 395 FT/MIN (2.0 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALL ALTITUDES

Gross Weight 5500 lbs (2495 kg)

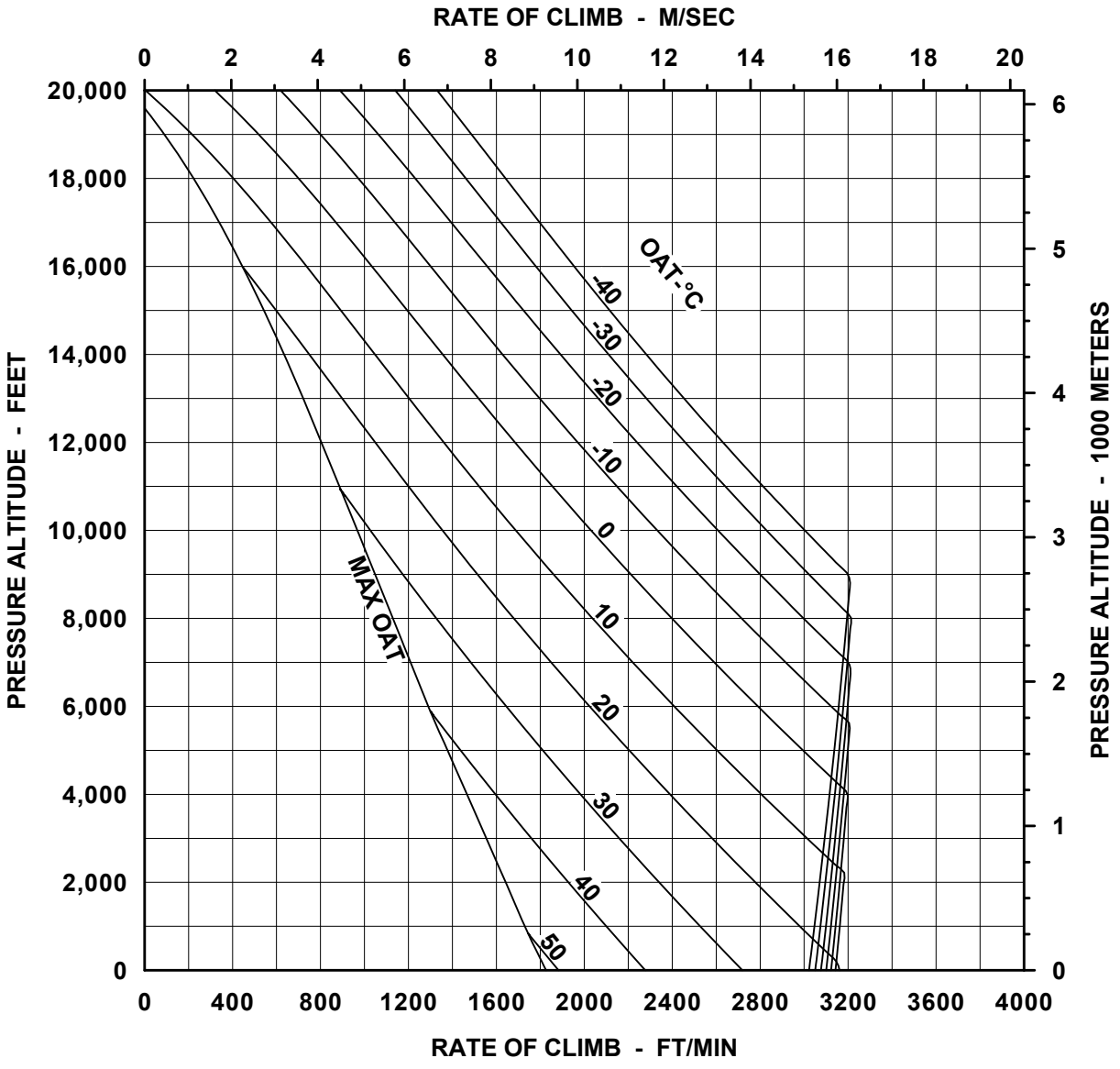


Figure 4-8. Rate of Climb — Maximum Continuous Power (Sheet 3 of 6)

RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 365 FT/MIN (1.9 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALL ALTITUDES

Gross Weight 6000 lbs (2722 kg)

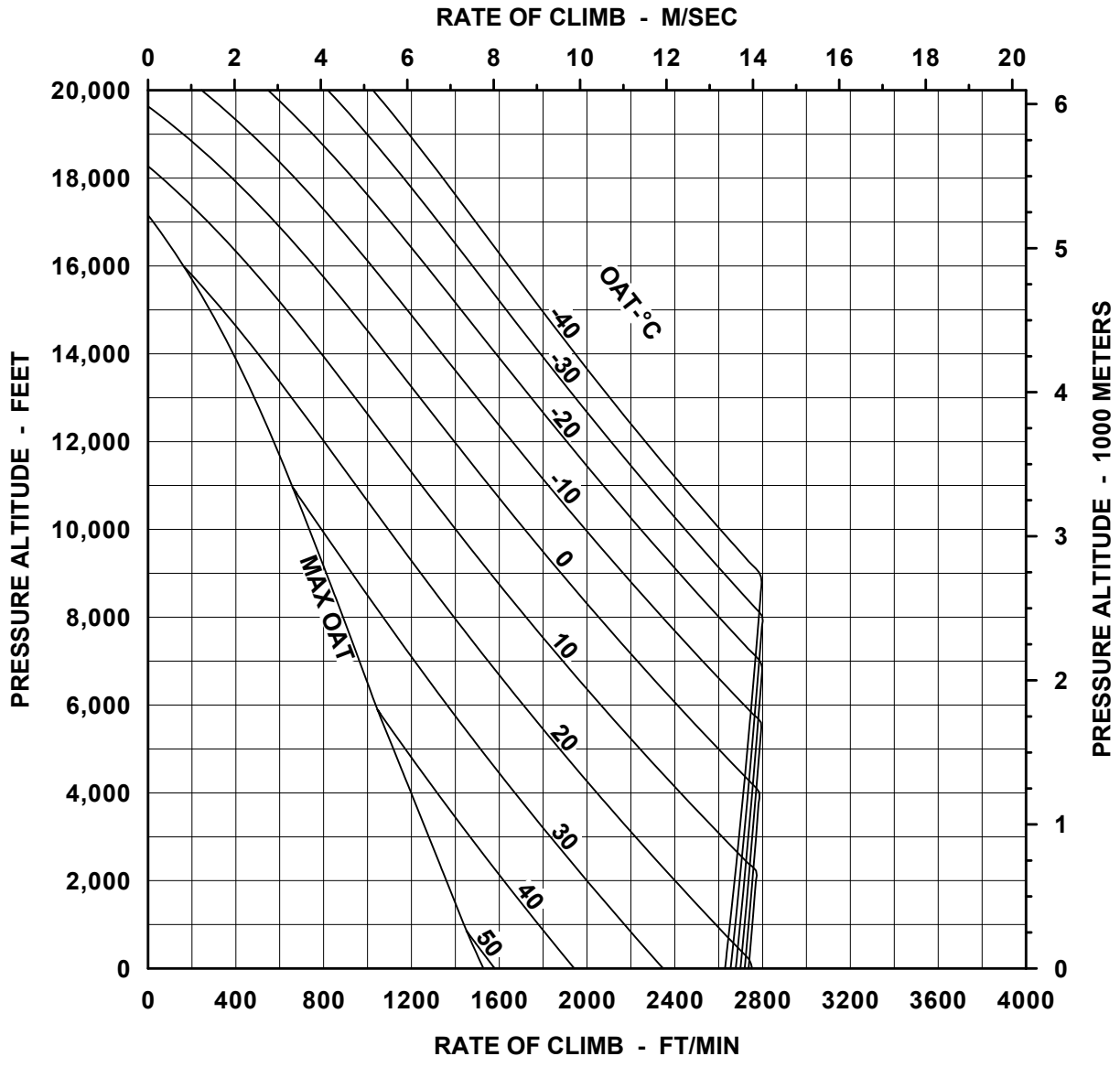


Figure 4-8. Rate of Climb — Maximum Continuous Power (Sheet 4 of 6)

RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 335 FT/MIN (1.7 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALL ALTITUDES

Gross Weight 6500 lbs (2948 kg)

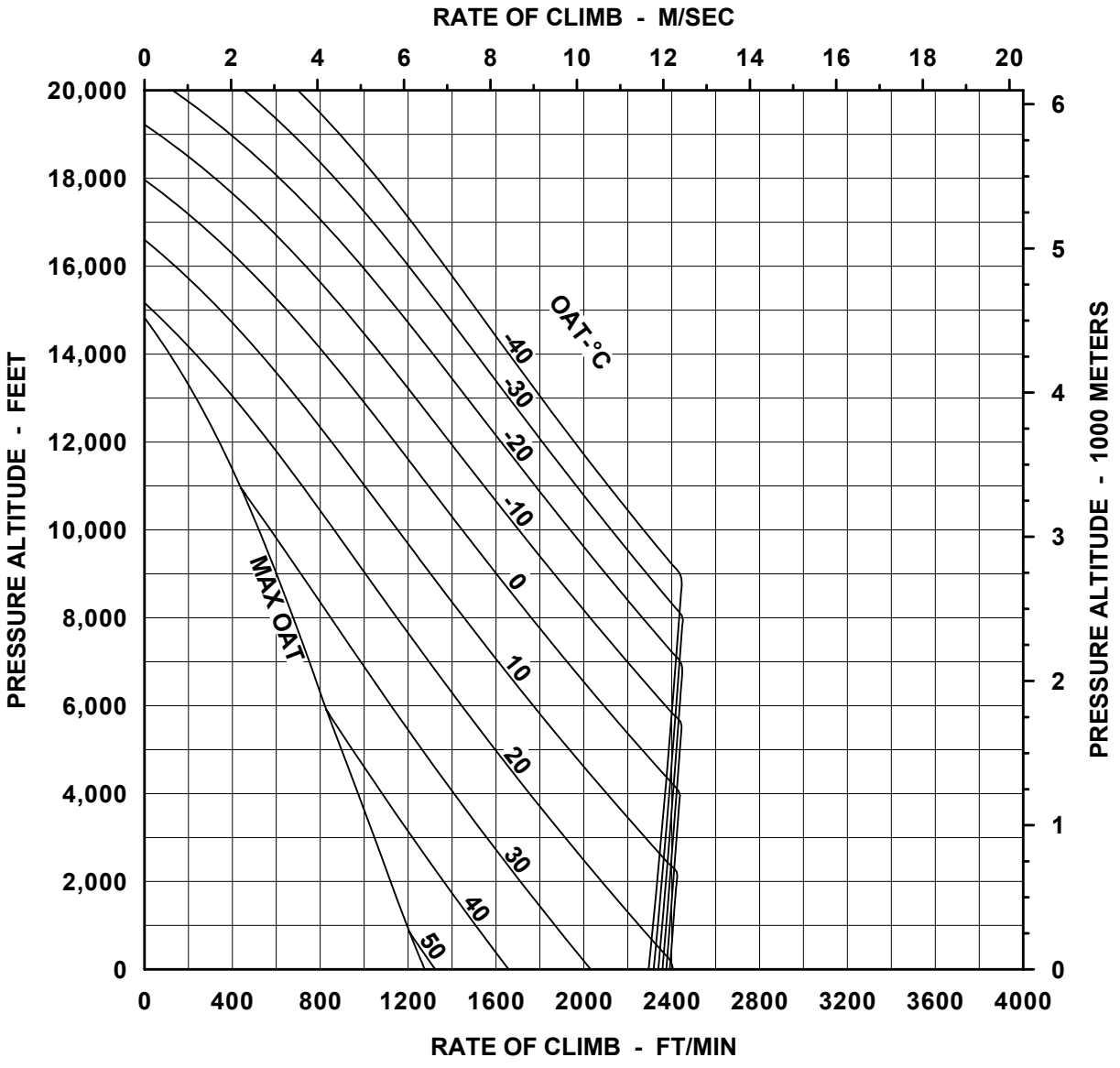


Figure 4-8. Rate of Climb — Maximum Continuous Power (Sheet 5 of 6)

RATE OF CLIMB

MAXIMUM CONTINUOUS POWER
ENGINE RPM 100%
GENERATORS 150 AMPS EACH

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

REDUCE RATE OF CLIMB 310 FT/MIN (1.6 M/SEC)
FOR HEATER ON (20°C AND COLDER) AT ALL ALTITUDES

Gross Weight 7000 lbs (3175 kg)

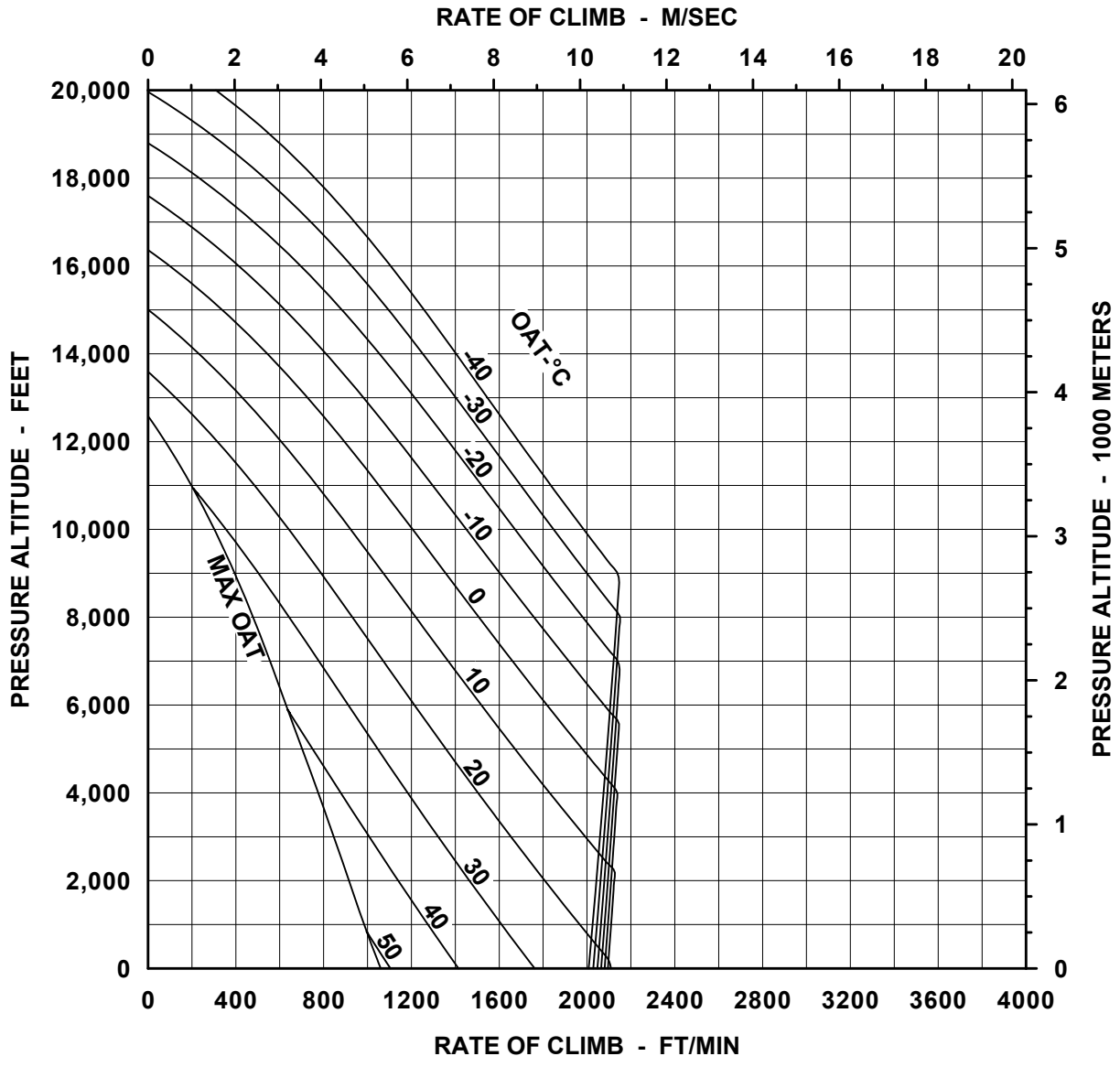


Figure 4-8. Rate of Climb — Maximum Continuous Power (Sheet 6 of 6)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 4500 lbs (2041 kg)

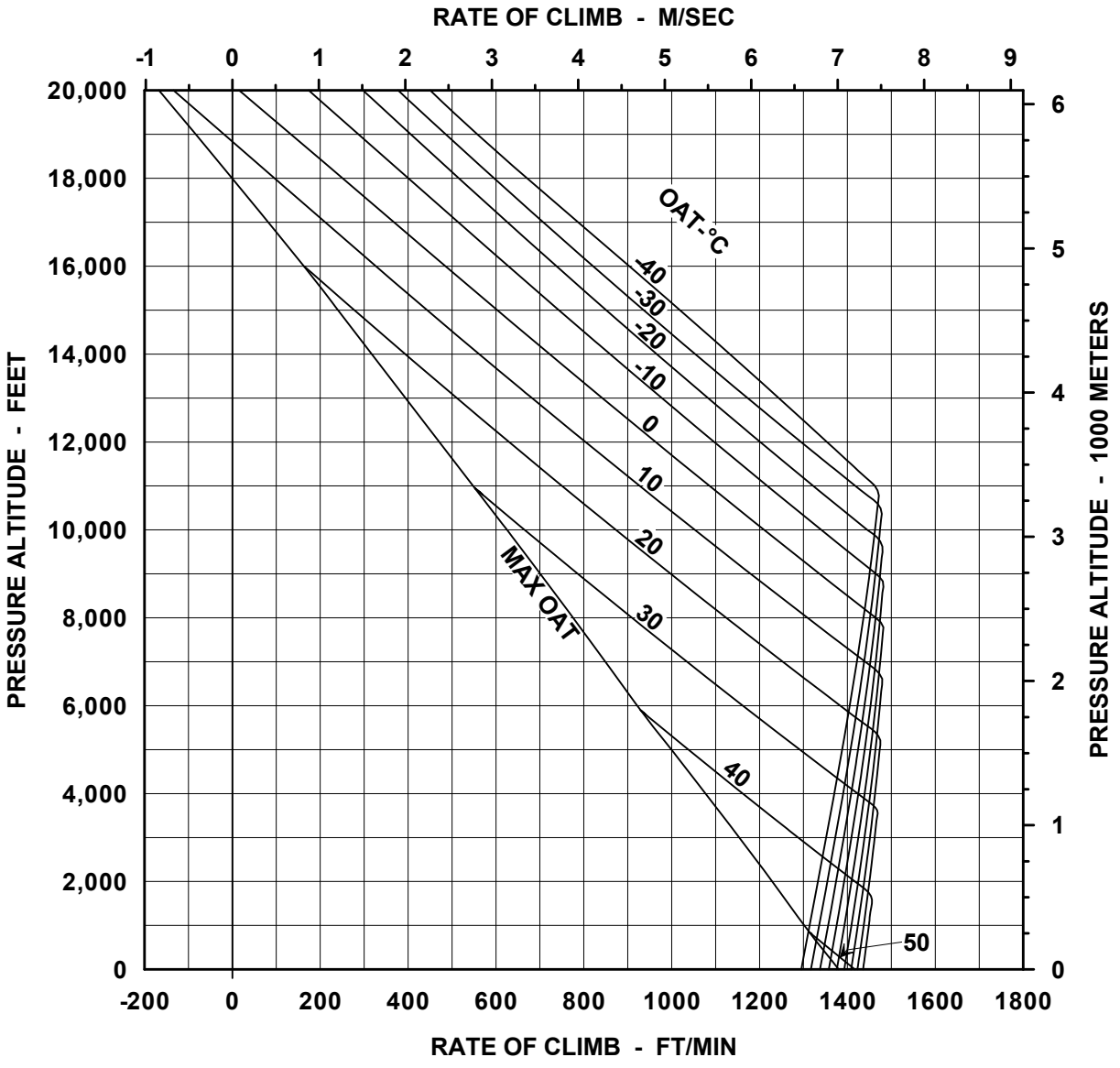


Figure 4-9. Rate of Climb — 30 Minute OEI Power (Sheet 1 of 6)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 5000 lbs (2268 kg)

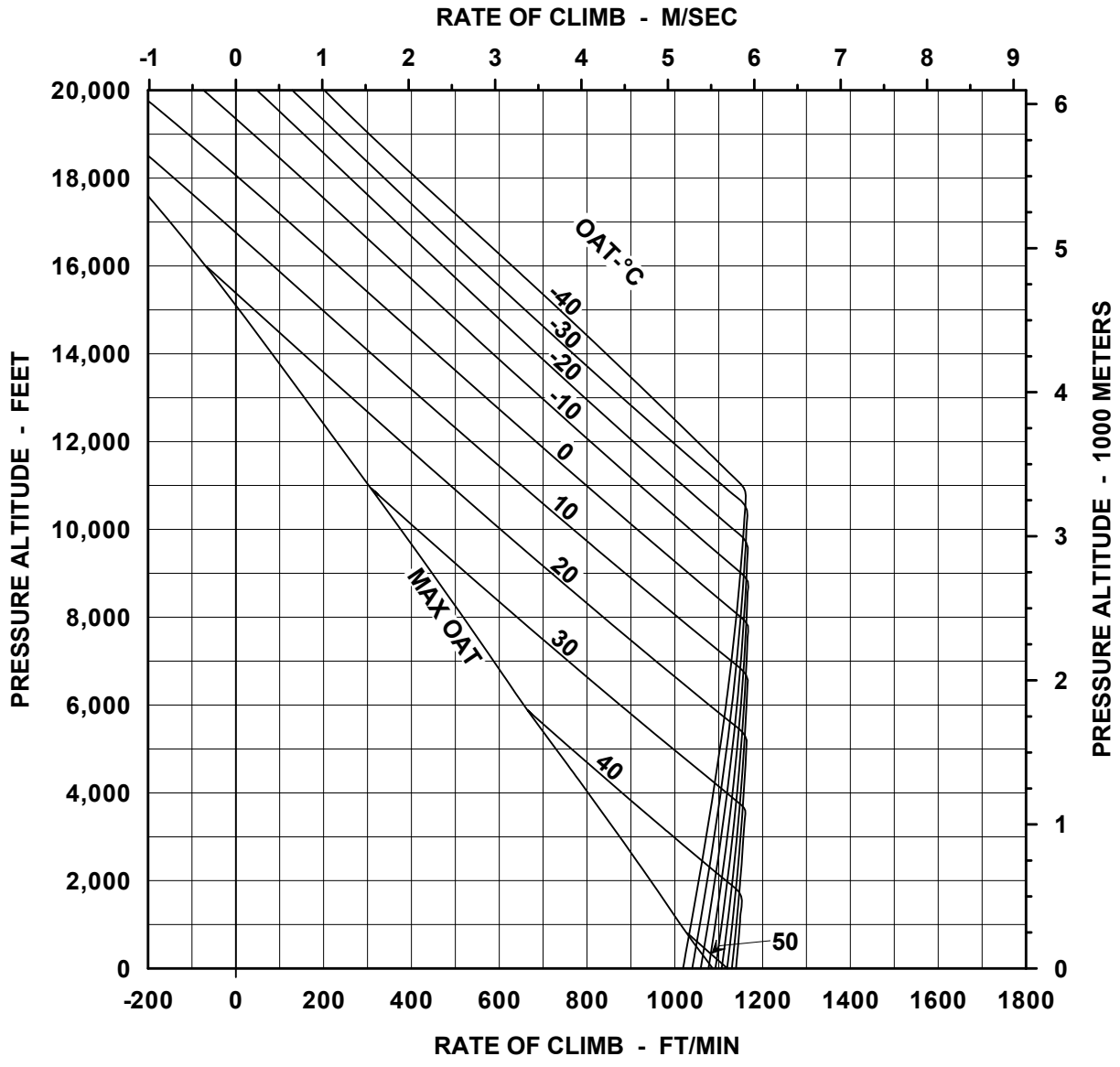


Figure 4-9. Rate of Climb — 30 Minute OEI Power (Sheet 2 of 6)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 5500 lbs (2495 kg)

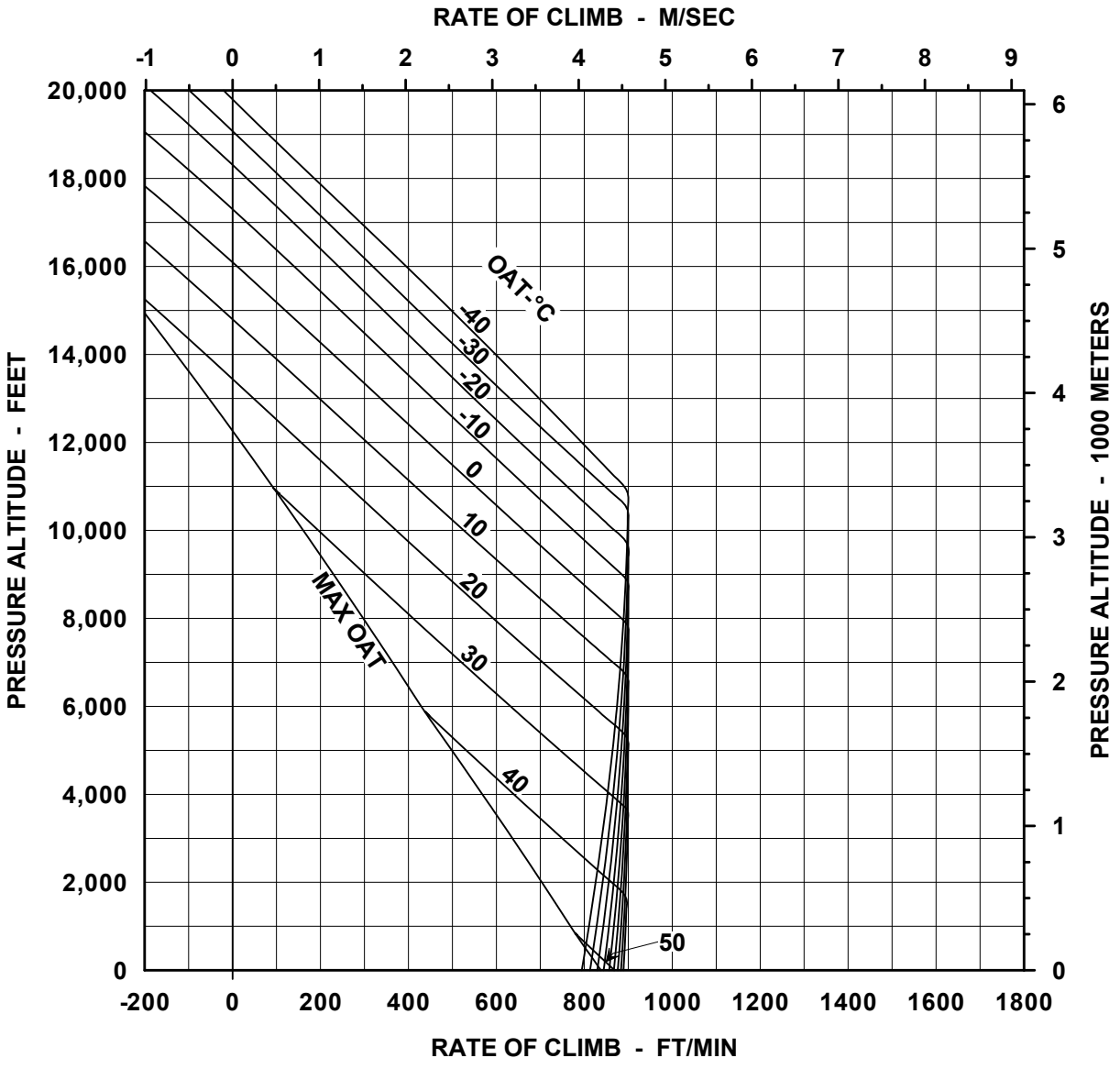


Figure 4-9. Rate of Climb — 30 Minute OEI Power (Sheet 3 of 6)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 6000 lbs (2722 kg)

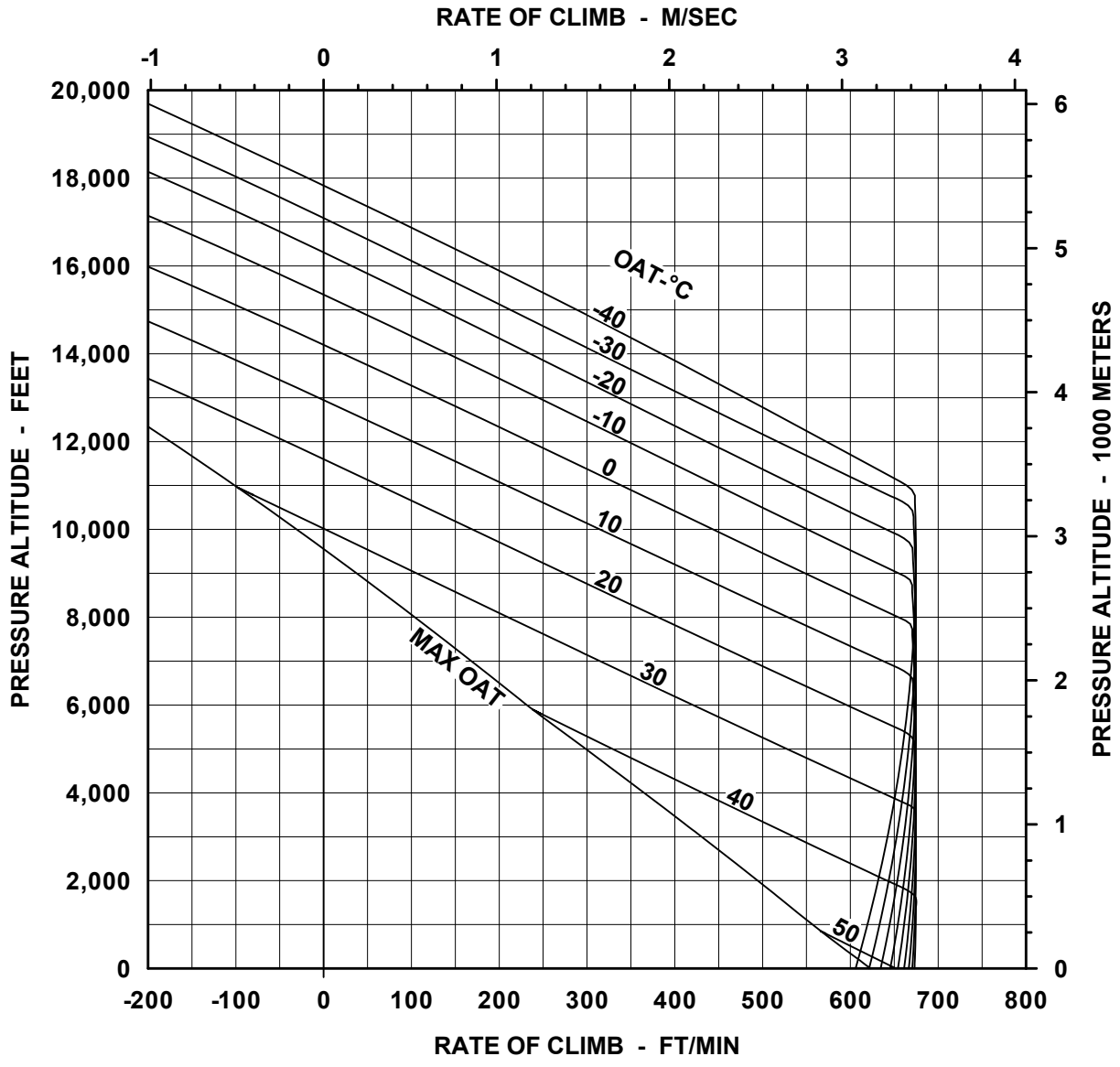


Figure 4-9. Rate of Climb — 30 Minute OEI Power (Sheet 4 of 6)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 6500 lbs (2948 kg)

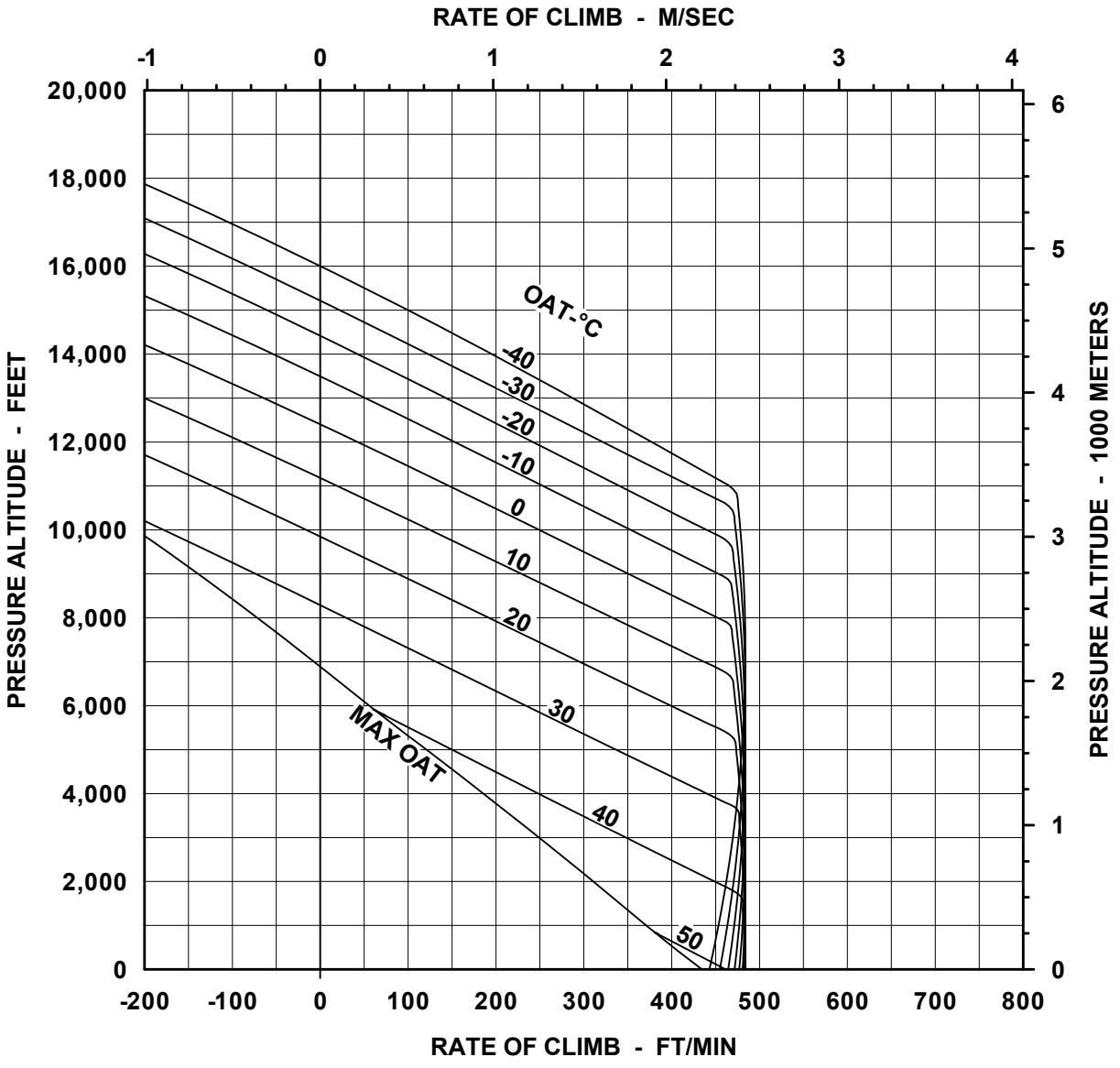


Figure 4-9. Rate of Climb — 30 Minute OEI Power (Sheet 5 of 6)

SINGLE ENGINE RATE OF CLIMB

30 MINUTE OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 7000 lbs (3175 kg)

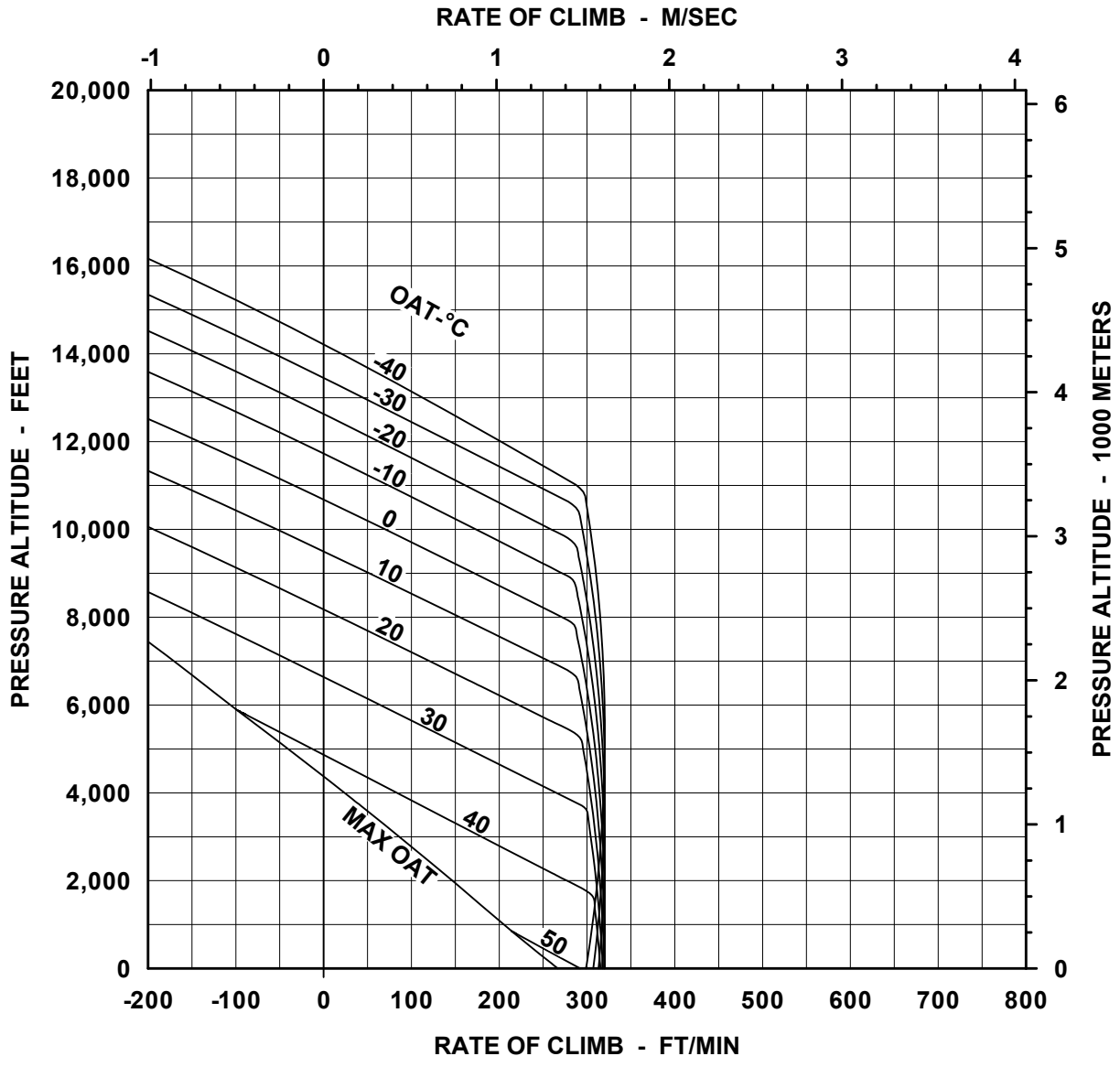


Figure 4-9. Rate of Climb — 30 Minute OEI Power (Sheet 6 of 6)

SINGLE ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 4500 lbs (2041 kg)

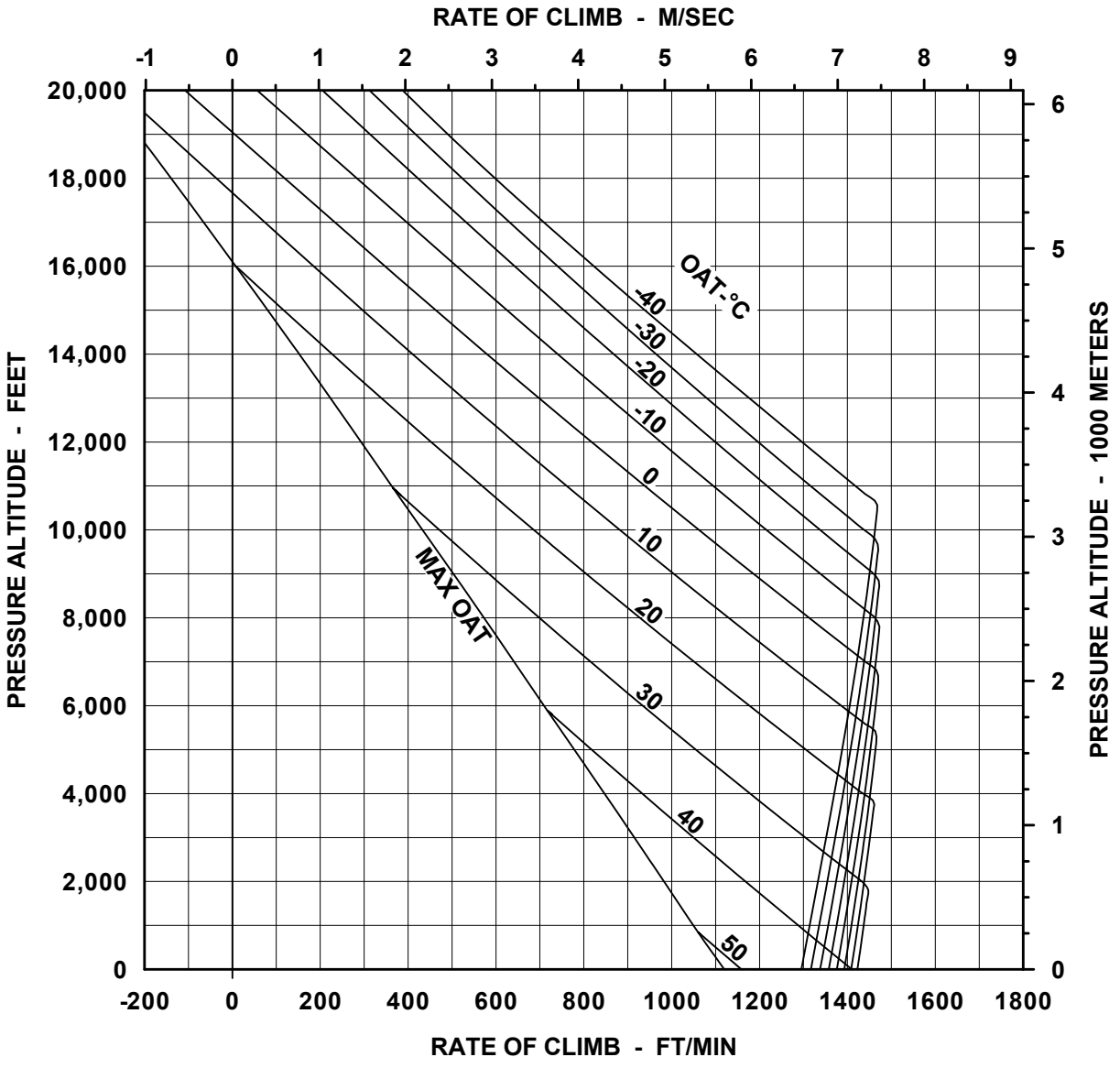


Figure 4-10. Rate of Climb — Maximum Continuous OEI Power (Sheet 1 of 6)

SINGLE ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 5000 lbs (2268 kg)

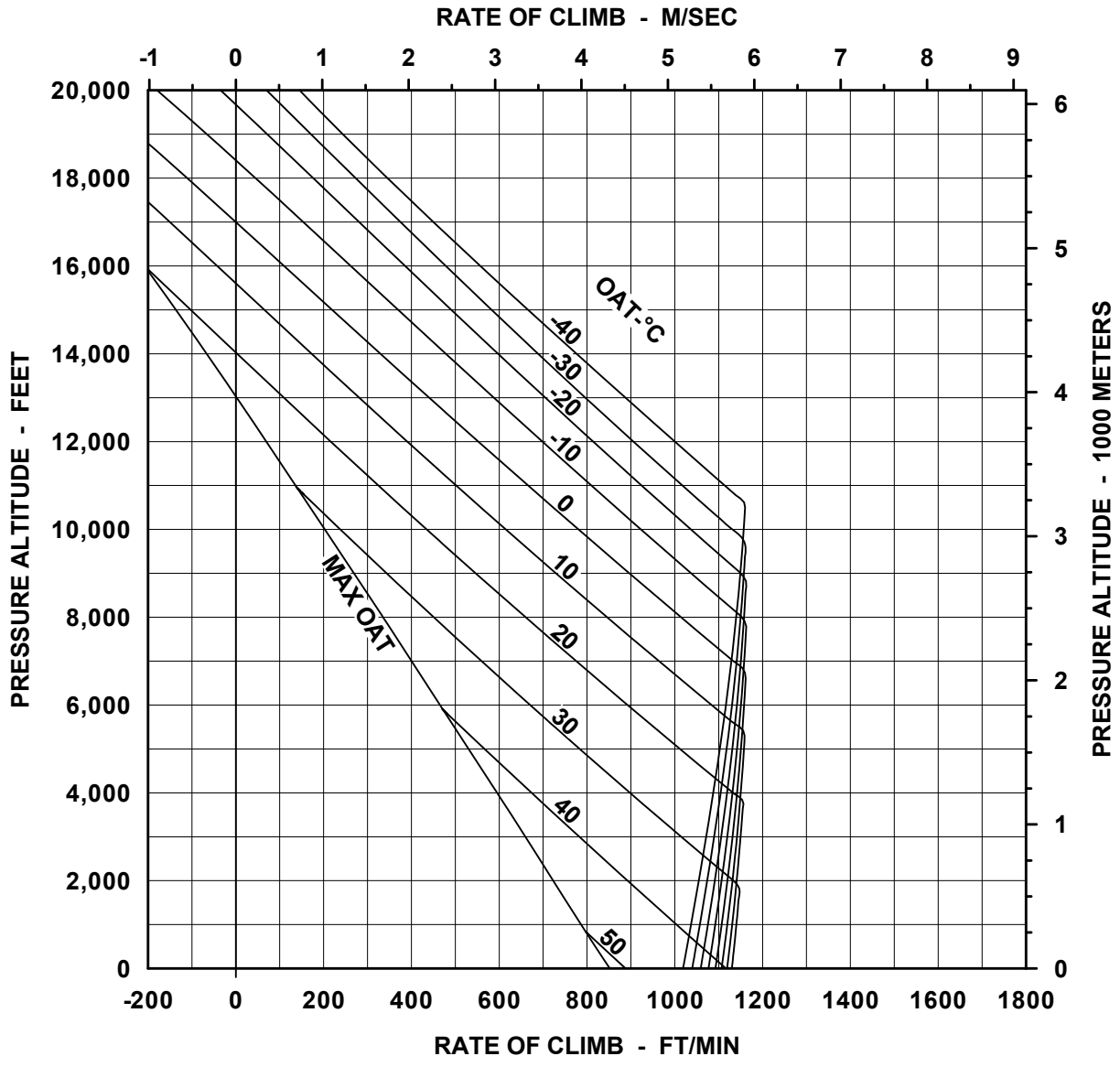


Figure 4-10. Rate of Climb — Maximum Continuous OEI Power (Sheet 2 of 6)

SINGLE ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 5500 lbs (2495 kg)

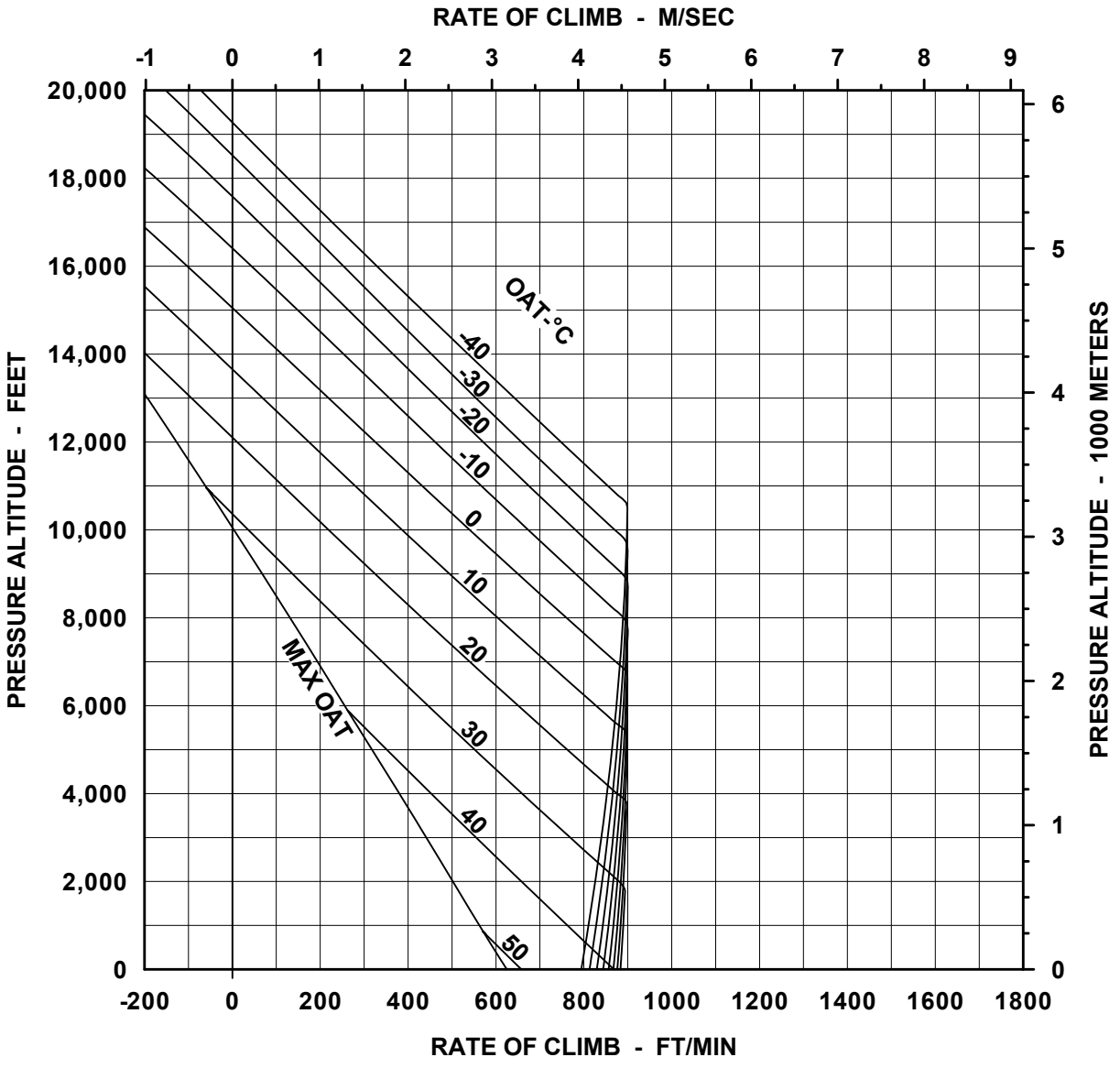


Figure 4-10. Rate of Climb — Maximum Continuous OEI Power (Sheet 3 of 6)

SINGLE ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 6000 lbs (2722 kg)

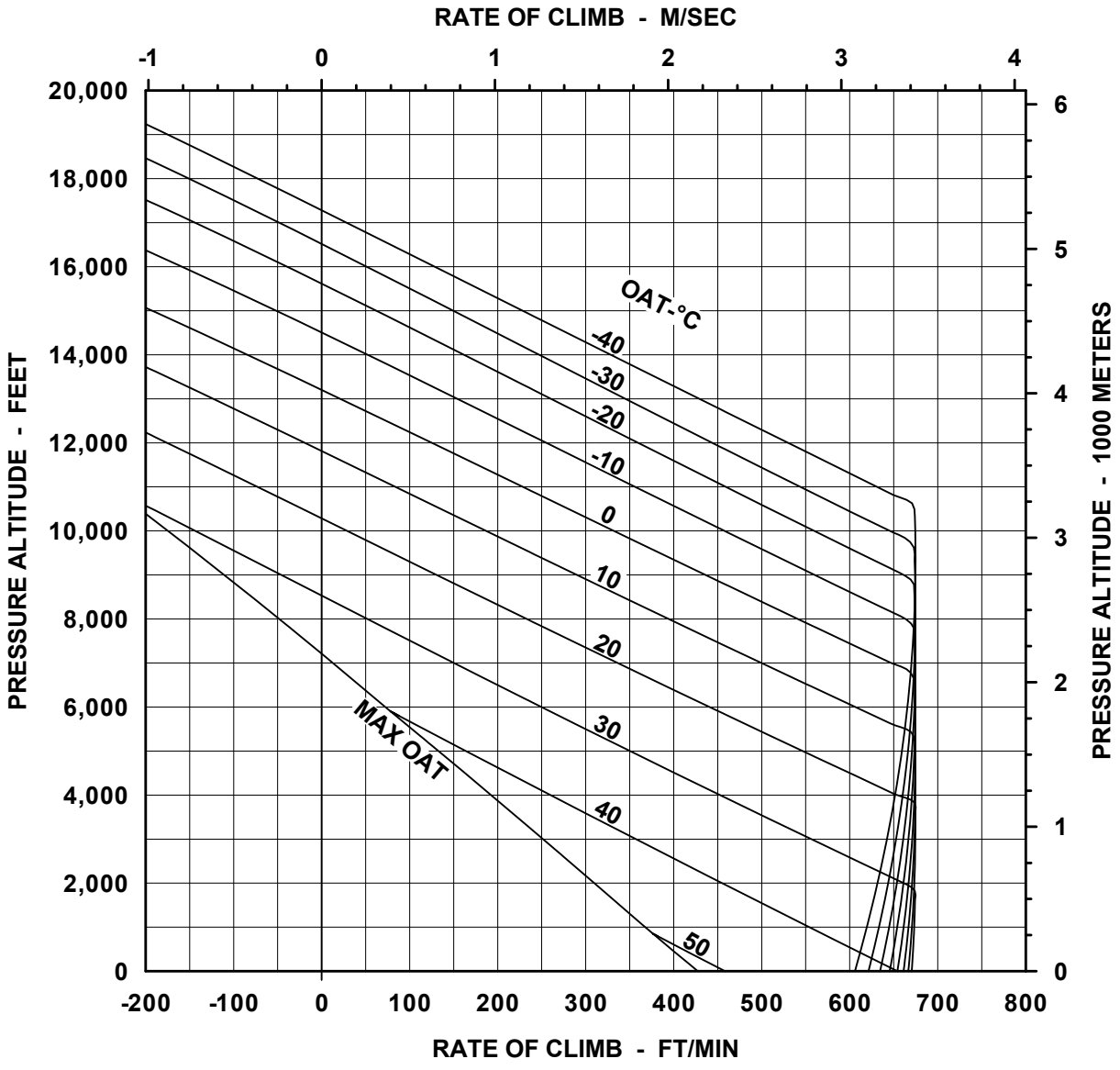


Figure 4-10. Rate of Climb — Maximum Continuous OEI Power (Sheet 4 of 6)

SINGLE ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 6500 lbs (2948 kg)

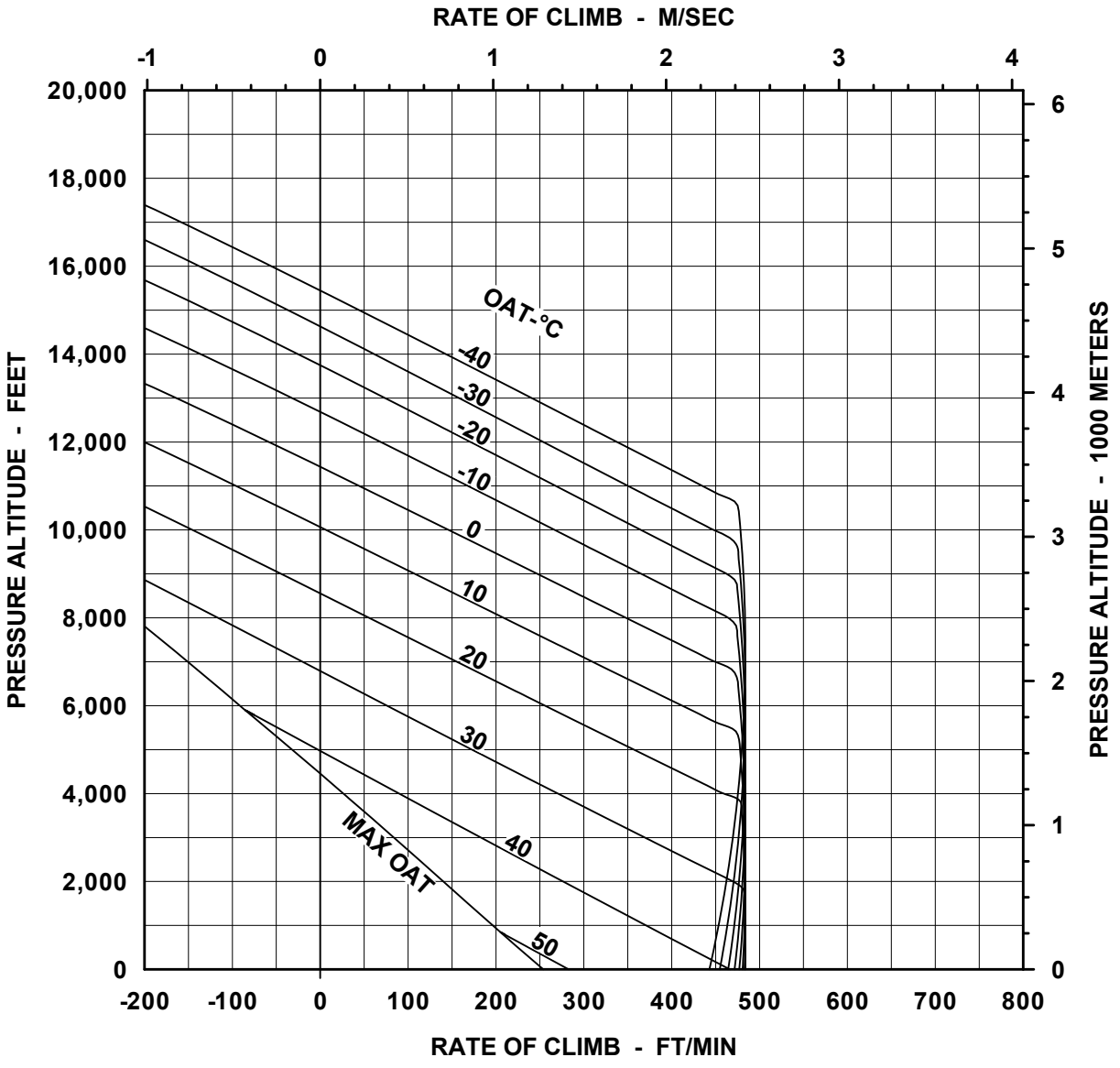


Figure 4-10. Rate of Climb — Maximum Continuous OEI Power (Sheet 5 of 6)

SINGLE ENGINE RATE OF CLIMB

MAXIMUM CONTINUOUS OEI POWER
ENGINE RPM 100%
GENERATOR 150 AMPS

60 KIAS
BASIC INLET OR BARRIER FILTER
AIR COND. OFF / HEATER OFF

Gross Weight 7000 lbs (3175 kg)

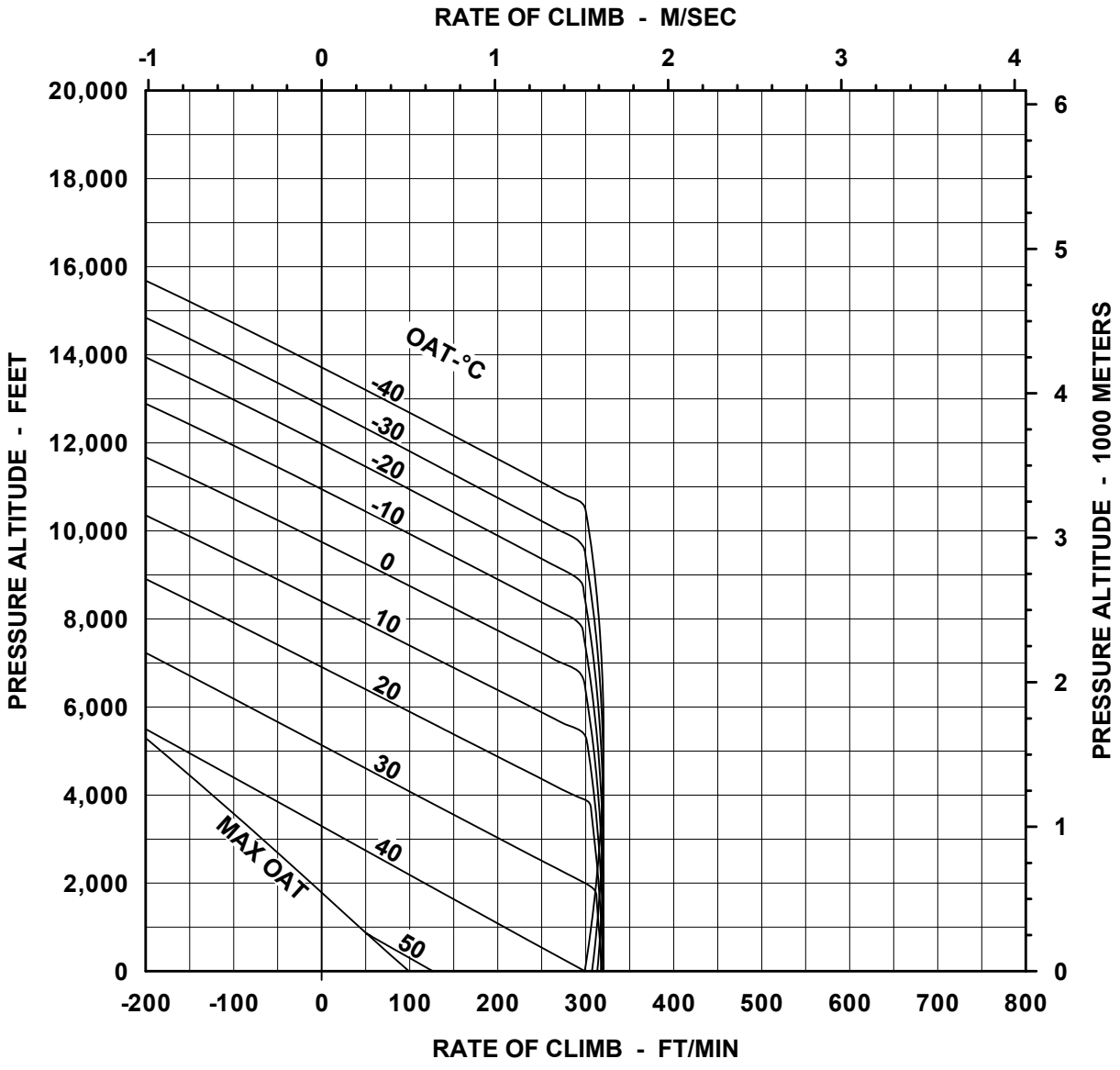


Figure 4-10. Rate of Climb — Maximum Continuous OEI Power (Sheet 6 of 6)

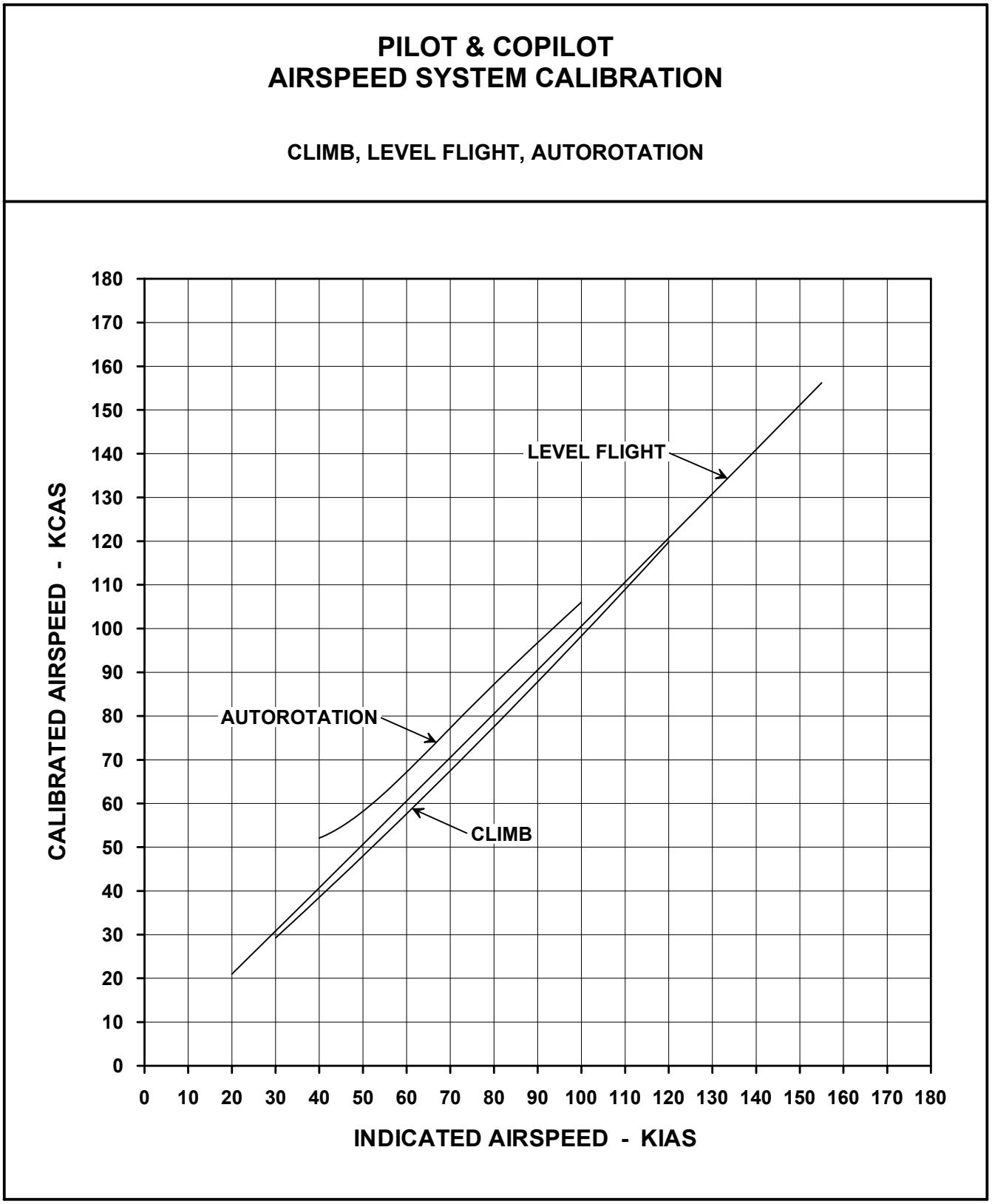
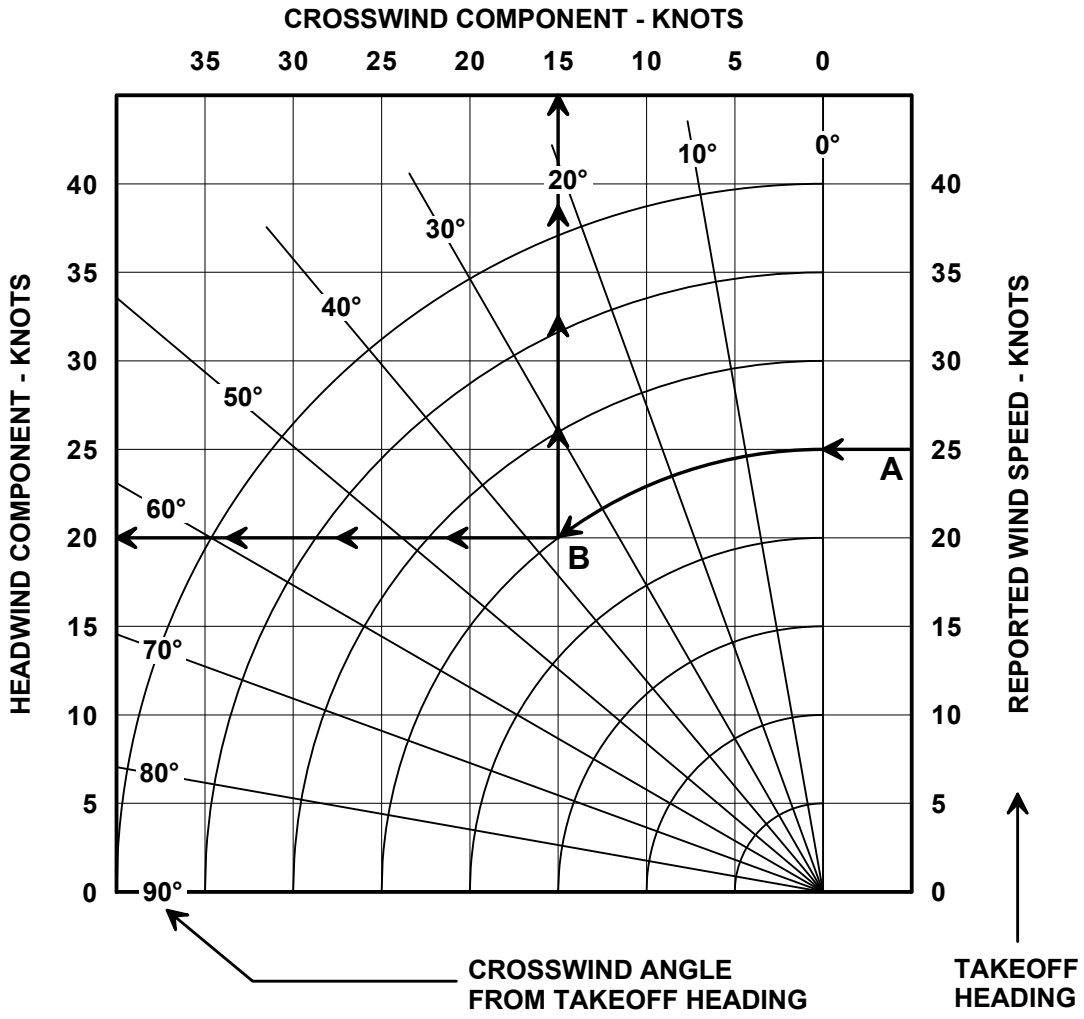


Figure 4-11. Airspeed Calibration



EXAMPLE:

1.	AIRCRAFT HEADING	163°
2.	REPORTED WIND DIRECTION	200°
3.	DIFFERENCE BETWEEN WIND DIRECTION AND AIRCRAFT HEADING	37°
4.	REPORTED WIND SPEED	25 KNOTS
5.	ENTER CHART AT REPORTED WIND SPEED, POINT A.	
6.	PROCEED LEFT, FOLLOWING SHAPE OF CURVED LINES, TO CROSSWIND ANGLE FROM AIRCRAFT HEADING, POINT B.	
7.	PROCEED VERTICALLY UPWARD TO CROSSWIND COMPONENT SCALE AND READ CROSSWIND COMPONENT	15 KNOTS
8.	PROCEED LEFT HORIZONTALLY TO HEADWIND COMPONENT SCALE AND READ HEADWIND COMPONENT	20 KNOTS

→ (NOTE: REDUCE HEADWIND COMPONENT BY APPROPRIATE APPROVED FACTOR AND USE RESULT AGAINST "UNFACTORED HEADWIND" SCALE IN PERFORMANCE CHARTS)

Figure 4-12. Crosswind/Headwind Component Chart

Section 5

WEIGHT AND BALANCE

TABLE OF CONTENTS

FIGURES

TABLES

Section 5

WEIGHT AND BALANCE

5-1. INTRODUCTION

This section provides loading information and instructions necessary to ensure that flight can be performed within the approved gross weight/center of gravity envelope, as defined in Section 1.

5-2. EMPTY WEIGHT CENTER OF GRAVITY

Empty weight configuration consists of basic helicopter with required equipment, operational and special equipment, fixed ballast, hydraulic fluid, engine oil, transmission oil, tail rotor gearbox oil, and unusable fuel. Empty weight and center of gravity are recorded on the actual weight record, a copy of which should be carried in helicopter for use in weight and balance calculations.

5-3. GROSS WEIGHT CENTER OF GRAVITY

Total weight of helicopter, with its contents, includes crew, passengers, fuel, baggage, and cargo.

5-3-A. GROSS WEIGHT CG MANAGEMENT

Pilot is responsible to ensure helicopter is properly loaded so entire flight is conducted within gross weight/center of gravity limits. (See Section 1 of this manual or appropriate Flight Manual Supplement.)

There are three methods by which this can be achieved:

5-3-A-1. USE OF EMPTY WEIGHT CENTER OF GRAVITY CHARTS

Empty weight CG charts are for use with standard seating configurations and standard fuel system. These charts can be found in the BHT-429-MM-1, together with an explanation of how to use them.

This method allows for indiscriminate passenger loading with no seating restrictions, based on crew/passenger weight of 170 pounds (77 kg). This method will ensure helicopter remains within GW/CG limits provided following requirements are met and maximum GW is not exceeded:

Empty weight/CG within relevant empty weight/CG limits.

Baggage compartment is empty.

No cargo is carried.

5-3-A-2. USE OF ACTUAL WEIGHT RECORDS WITH FLIGHT MANUAL LIMITS

This method can be used in all loading cases. Weight and moment of each component of helicopter loading is calculated for critical fuel loadings and verified to be within GW/CG limits.

Table 5-1 and Table 5-1M are examples for computation of GW/CG which can be utilized as a guide for these calculations. GW, longitudinal and lateral CG must be calculated for each flight from following:

Actual Weight Record.

Diagrams and loading tables in this section.

Diagrams and loading tables in appropriate Flight Manual Supplements.

Effects of fuel consumption and addition/deletion of passengers, baggage, or cargo should be checked prior to flight to ensure helicopter is within GW/CG limits for entire flight.

Significant fuselage stations and buttock lines are shown in Figure 5-1 and Figure 5-2 to aid in weight and balance calculations.

5-3-A-3. USE OF WEIGHT AND BALANCE NOMOGRAPH

Loading chart (Figure 5-3) is a quick and simple method of checking weight and longitudinal balance for specific loadings. It can provide a permanent record of a particular flight or loading condition. Use of this method is detailed in paragraph 5-9-C.

5-4. DOORS OPEN OR REMOVED

When one or more cabin doors are removed, helicopter may exceed gross weight center of gravity limits during flight. If using Empty Weight Center of Gravity Limits chart, refer to BHT-429-MM-1, a ballast adjustment to offset moment change may be necessary (Table 5-2 and Table 5-2M). Otherwise, gross weight center of gravity should be computed for each flight.

5-4-A. DOOR WEIGHTS AND MOMENTS

Following table presents weight and moment adjustments for cabin doors. Sign convention for buttock lines used to compute lateral moments are:

1. Left is negative.
2. Right is positive.

ACTION	MOMENT CHANGE	
	LEFT DOOR	RIGHT DOOR
Remove	Positive (+)	Negative (-)
Install	Negative (-)	Positive (+)

Example:

When removing a left door only, subtract positive weight value and negative moment value shown in table. Net effect on helicopter is a reduction in weight and a shift in lateral CG to right (positive direction).

5-5. COCKPIT AND CABIN LOADING

Cabin floor is structurally designed for 55 pounds per square foot (269 kg/m^2).

Loading tables (Table 5-3 and Table 5-3M) provide weights and moments for each passenger location and baggage compartment in both U.S. and metric units.

5-6. BAGGAGE COMPARTMENT LOADING

Baggage compartment is structurally designed for 55 pounds per square foot (269 kg/m^2) for a total weight of 540 pounds (245 kg).

Baggage on auxiliary fuel tank is structurally designed for 55 pounds per square foot (269 kg/m^2), not to exceed 125 pounds (56.7 kg).

Loading of baggage compartment should be from front to rear. Load shall be secured to tie-down fittings.

NOTE

Tables and examples assume items in baggage compartment have longitudinal CG at midpoint of door opening. Tables and examples should only be used if this reflects actual loading conditions.

5-7. FUEL LOADING

Longitudinal CG of fuel shifts as it is consumed, causing helicopter CG to shift as well.

Fuel Density Versus Temperature table (Table 5-4) is provided to calculate fuel densities for specific temperatures in both U.S. and metric units.

Fuel loading tables (Table 5-5 and Table 5-5M) list usable fuel quantities, weights, and moments for Jet A and Jet B fuels at 15°C in both U.S. and metric units.

Critical fuel quantities for calculating extreme CG cases are also presented in Table 5-5 and Table 5-5M.

5-8. ENGINE OIL

Consumption of engine oil has negligible effect on helicopter weight and CG and is not included in weight and balance calculations.

5-9. SAMPLE LOADING PROBLEM

EXAMPLE:

A helicopter is to transport four passengers plus pilot and baggage on a trip with following weight and performance values:

Helicopter empty weight = 4558 pounds

Helicopter CG = FS 236.9, BL - 0.1

One pilot = 180 pounds

One fwd-passenger (co-pilot) = 220 pounds

1 mid-passenger (aft facing) = 200 pounds

2 aft-passengers = 360 pounds

Baggage = 54 pounds (in baggage compartment)

Fuel (Jet A) at engine start = 1428 pounds (fueled to maximum gross takeoff weight)

Fuel consumed during flight = 100 gallons

5-9-A. EMPTY WEIGHT CG CHART METHOD

Nonstandard crew/passenger weights and baggage mean that this method cannot be used.

5-9-B. ACTUAL WEIGHT RECORDS METHOD

Compute weight and CG at takeoff and landing, and determine extreme CG conditions for flight. Refer to Table 5-1.

1. Sum all weights and moments of payload items and helicopter empty weight to obtain gross weight and CG at Zero Fuel Weight (ZFW). (Table 5-3 presents weights, CG, and moment for crew, passengers, and baggage).
2. Add appropriate fuel weight and moment as read directly from fuel loading table (Table 5-5 and Table 5-5M) to obtain gross weight and CG at takeoff. Verify these are within gross weight/CG limits.
3. Add most forward critical fuel weight and obtain gross weight and CG at most forward CG condition. Verify these are within gross weight/CG limits.
4. Add most aft critical fuel weight and moment to ZFW (step 1) to obtain gross weight and CG at most aft CG condition. Verify these are within gross weight/CG limits.
5. Add weight and moment of fuel remaining to ZFW (step 1) to obtain gross weight and CG at landing condition. Verify these are within gross weight/CG limits.

5-9-C. WEIGHT AND BALANCE NOMOGRAPH METHOD

An index value is calculated for helicopter empty weight to which payload weight and

fuel values are added by simple graphical means. Results are transferred to a representation of gross weight/CG limits chart which enables pilot to verify that helicopter CG will remain within limits. Refer to Figure 5-4 or Figure 5-4M.

1. Enter helicopter empty weight and CG and complete lines (a), (b), and (c) in Empty weight longitudinal index section to calculate longitudinal index.

NOTE

Empty weight longitudinal index will not change unless helicopter empty weight and/or CG changes.

2. Enter helicopter empty weight and all payload weights in Weight section and sum them to obtain the ZFW. ZFW = 5572 pounds (2527 kg).

3. In Longitudinal index adjustments section against empty weight, draw a vertical line at Empty weight longitudinal index (115.7) and extend it down until it intersects sloping graduations of Pilot and copilot scale.

4. From intersection point of drawn vertical line and sloping graduations, extend line in direction indicated by arrow (left). Line length is 8 graduations (pilot and copilot weigh 400 pounds (182 kg) ÷ 50 pound (23 kg) increments = 8). Project end of line vertically downward until it intersects sloping graduations of mid row — aft facing scale.

5. From intersection of drawn vertical line and sloping graduation, extend line in direction indicated by arrow (left). Line length is 3.6 graduations (passenger midrow weighs 200 pounds (91 kg) ÷ 50 pound (23 kg) increments = 4). Project end of line vertically downward until it intersects sloping graduations of baggage compartment scale.

NOTE

It is not necessary to adjust longitudinal index for passengers in the aft row.

6. From intersection of drawn vertical line and sloping graduation, extend line in direction indicated by arrow (right). Line length is 1 graduation (baggage weighs 54 pounds (24 kg) ÷ 50 pound (23 kg) increments = 1). Project end of line vertically downward through ZFW index scale onto Gross weight/center of gravity chart and mark point where it intersects with horizontal line for ZFW (5572 pounds (2527 kg)). This point is longitudinal CG for ZFW.

7. Use Jet A column of Fuel index section to determine fuel index for 1428 pounds (648 kg). Fuel index = 12.5.

8. Sum ZFW and fuel weight to obtain takeoff gross weight (TOGW). TOGW = 7000 pounds (3175 kg).

9. Move back up vertical line from ZFW to Fuel index and weight scale. Move horizontally in direction indicated by arrow (left) 12.5 graduations (determined in step 7). Project line vertically downward onto Gross weight/center of gravity chart and mark point where it intersects horizontal line for TOGW (7000 pounds (3175 kg)). This point is longitudinal CG for TOGW.

10. If the auxiliary tank is installed, from ZFW move back up the vertical line to Fuel index and weight scale. Determine the fuel index required for the auxiliary fuel, move horizontally in the direction indicated by the arrow (left). Project line vertically downward onto Gross weight/center

of gravity chart and mark point where it intersects horizontal line for TOGW. This point is longitudinal CG for TOGW replacing the point found in step 9, which is now the most forward extreme CG condition.

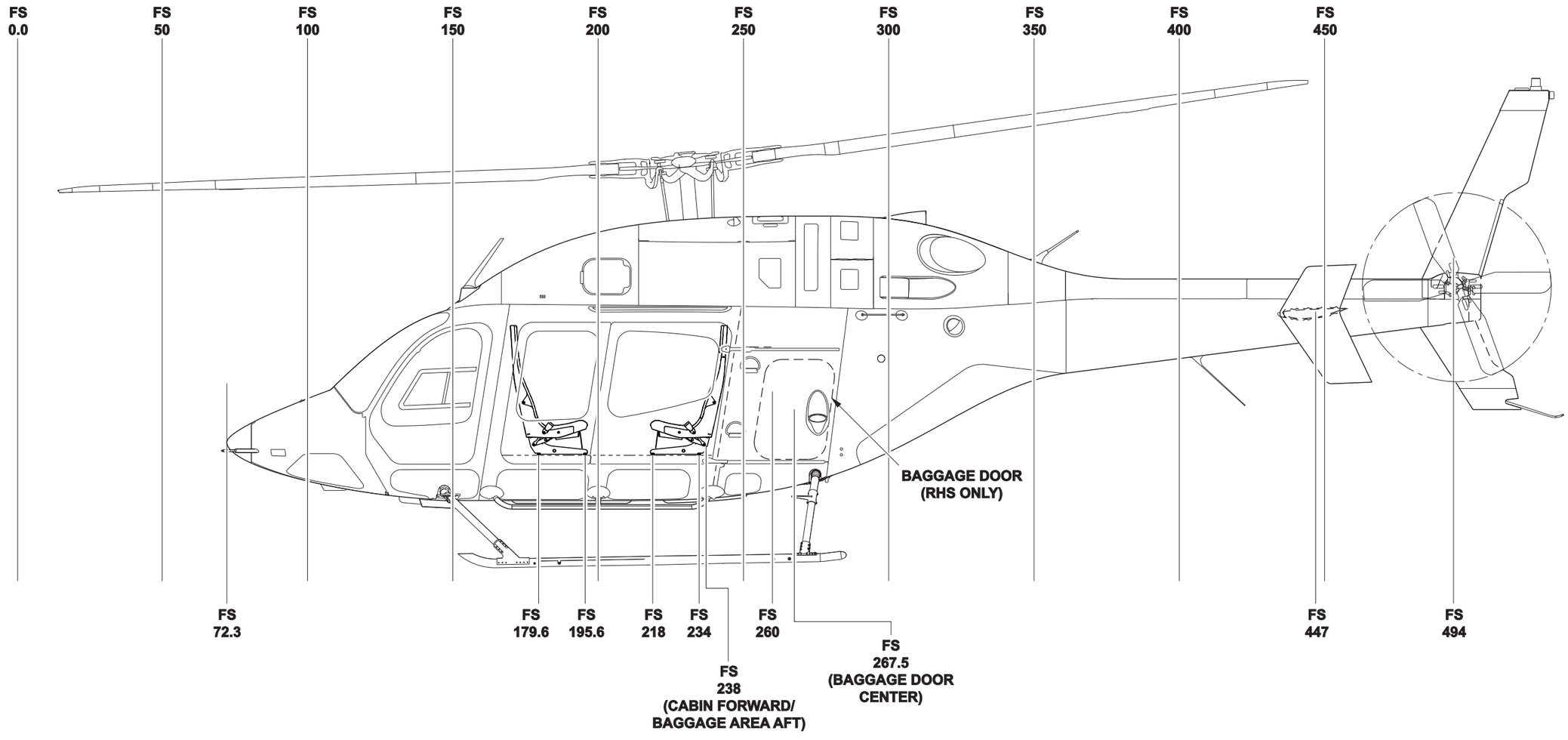


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Figure 5-1. Fuselage Stations

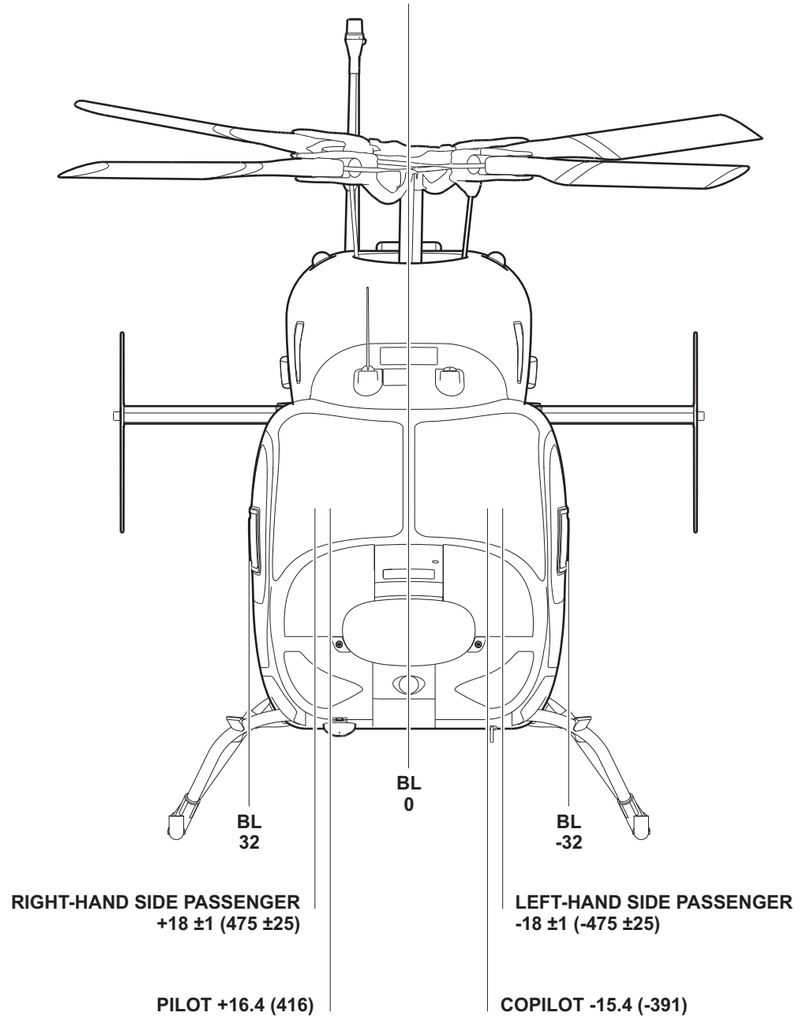

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Figure 5-2. Buttock Lines

MODEL 429 LOADING CHART

Aircraft Serial No. _____

Registration No. _____

Date _____

This loading is based on Actual Weight Record dated _____

EMPTY WEIGHT LONGITUDINAL INDEX

$$= \left[\frac{\text{EMPTY WEIGHT} \times (\text{CG} - 230.0)}{2000} \right] + 100$$

Empty Weight CG _____ - 230.0 = _____ (a)

Empty Weight _____ / 2000 = _____ (b)

(a) _____ x (b) _____ = _____ (c)

(c) _____ + 100 = _____ = Empty Weight Longitudinal Index

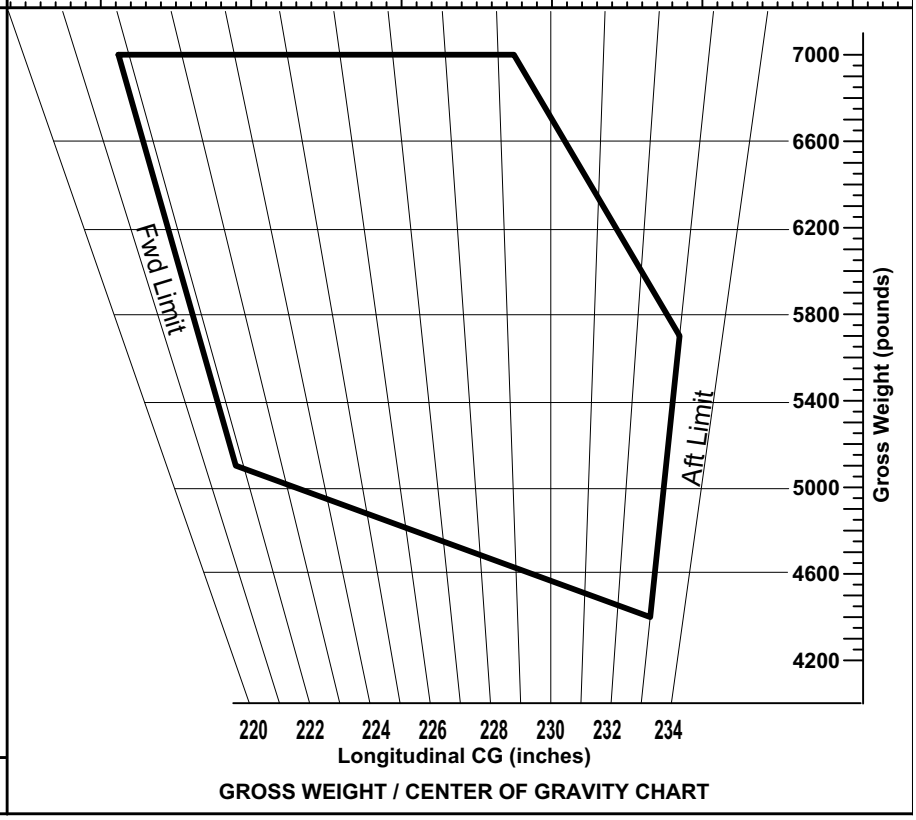
Weight	(lb.)	LONGITUDINAL INDEX ADJUSTMENTS
Empty Weight		70 80 90 100 110 120
Pilot & Fwd Pass. (Copilot)		(50 lb) ←
Passengers : Mid Row		(50 lb) ←
Passengers : Aft Row		No Index Adjustment required
Baggage Compartment (1)		(50 lb) →
Zero Fuel Weight (ZFW)		
Fuel Index & Weight		←
CG Check:Fuel Burn		
Take-Off Gross Weight		

FUEL INDEX

Jet A (6.8 lb/US Gal) Weight	Index	Jet B (6.5 lb/US Gal) Weight	Index
100	0.7	100	0.7
200	1.3	200	1.3
300	2.1	300	2.1
400	3.2	400	3.3
500	4.2	500	4.3
600	5.2	600	5.2
700	6.2	700	6.2
800	7.1	800	7.2
900	8.1	900	8.1
1000	9.1	1000	9.1
1100	10.0	1100	10.0
1200	10.9	1200	10.9
1292	11.7	1235	10.9
1300	11.7	1300	11.5
1400	12.4	1400	12.2
1475 *	12.8	1410 *	12.2
ONLY REQUIRED WHEN AUX FUEL TANK INSTALLED			
1500	12.5	1500	11.1
1600	11.2	1600	9.6
1741	9.6	1665	8.5

* Most forward extreme CG condition.

NOTE: (1) Assumes longitudinal CG of items in centre of Baggagge Bay.



GROSS WEIGHT / CENTER OF GRAVITY CHART

Figure 5-3. Loading Chart (U.S.)

MODEL 429 LOADING CHART
(Metric)

Aircraft Serial No. _____

Registration No. _____

Date _____

This loading is based on Actual Weight Record dated _____

EMPTY WEIGHT LONGITUDINAL INDEX

$$= \left[\frac{\text{EMPTY WEIGHT} \times (\text{CG} - 5842)}{23037} \right] + 100$$

Empty Weight CG _____ - 5842 = _____ (a)

Empty Weight _____ / 23037 = _____ (b)

(a) _____ x (b) _____ = _____ (c)

(c) _____ + 100 = _____ = Empty Weight Longitudinal Index

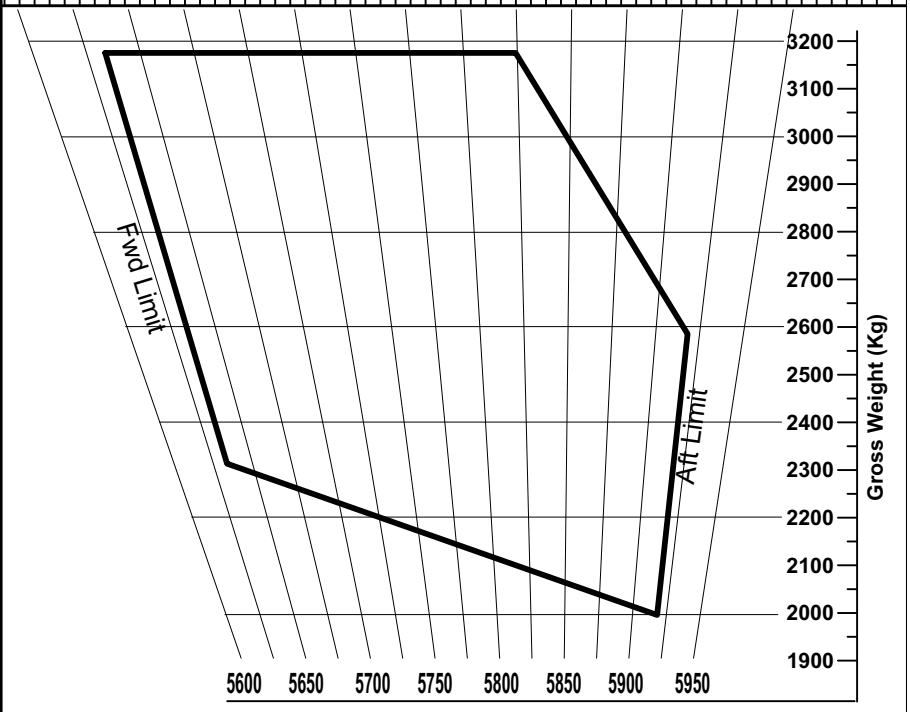
Weight	(Kg)	LONGITUDINAL INDEX ADJUSTMENTS
Empty Weight		70 80 90 100 110 120
Pilot & Fwd Pass. (Copilot)		(23 Kg) ←
Passengers : Mid Row		(23 Kg) ←
Passengers : Aft Row		No Index Adjustment required
Baggage Compartment (1)		(23 Kg) →
Zero Fuel Weight (ZFW)		
Fuel Index & Weight		←
CG Check:Fuel Burn		
Take-Off Gross Weight		

FUEL INDEX

Jet A (0.815 Kg / Liter) Weight	Index	Jet B (0.779 Kg / Liter) Weight	Index
50	0.7	50	0.7
100	1.5	100	1.5
150	2.4	150	2.4
200	3.6	200	3.7
250	4.7	250	4.8
300	5.8	300	5.8
350	6.8	350	6.9
400	8.0	400	8.0
450	9.0	450	9.0
500	10.0	500	10.0
550	11.0	550	11.0
586	11.7	560	11.7
600	11.9	600	10.7
650	12.6	639.6 *	12.2
669 *	12.8		
ONLY REQUIRED WHEN AUX FUEL TANK INSTALLED			
700	12.0	700	10.5
750	10.4	755	8.5
790	9.6		

* Most forward extreme CG condition.

NOTE: (1) Assumes longitudinal CG of items in centre of Baggagge Bay.



GROSS WEIGHT / CENTER OF GRAVITY CHART

Figure 5-3M. Loading Chart (Metric)

MODEL 429 LOADING CHART

Aircraft Serial No. **Example**

Registration No. _____

Date _____

This loading is based on Actual Weight Record dated _____

EMPTY WEIGHT LONGITUDINAL INDEX

$$= \left[\frac{\text{EMPTY WEIGHT} \times (\text{CG} - 230.0)}{2000} \right] + 100$$

Empty Weight CG	236.9	- 230.0 =	6.9	(a)	
Empty Weight	4558.0	/ 2000 =	2.3	(b)	
(a) 6.9	x (b)	2.3	=	15.7	(c)
(c) 15.7	+ 100 =	115.7	=	Empty Weight Longitudinal Index	

Weight	(lb.)
Empty Weight	**4558**
Pilot & Fwd Pass. (Copilot)	**400**
Passengers : Mid Row	**200**
Passengers : Aft Row	**360**
Baggage Compartment (1)	**54**
Zero Fuel Weight (ZFW)	**5572**
Fuel Index & Weight **(12.5)**	**1428**
CG Check:Fuel Burn	
1428 lb (12.5)	**(7000)**
Take-Off Gross Weight	**7000**

FUEL INDEX

Jet A (6.8 lb/US Gal) Weight	Index	Jet B (6.5 lb/US Gal) Weight	Index
100	0.7	100	0.7
200	1.3	200	1.3
300	2.1	300	2.1
400	3.2	400	3.3
500	4.2	500	4.3
600	5.2	600	5.2
700	6.2	700	6.2
800	7.1	800	7.2
900	8.1	900	8.1
1000	9.1	1000	9.1
1100	10.0	1100	10.0
1200	10.9	1200	10.9
1292	11.7	1235	10.9
1300	11.7	1300	11.5
1400	12.4	1400	12.2
1475 *	12.8	1410 *	12.2
ONLY REQUIRED WHEN AUX FUEL TANK INSTALLED			
1500	12.5	1500	11.1
1600	11.2	1600	9.6
1741	9.6	1665	8.5

* Most forward extreme CG condition.

NOTE: (1) Assumes longitudinal CG of items in centre of Baggagge Bay.

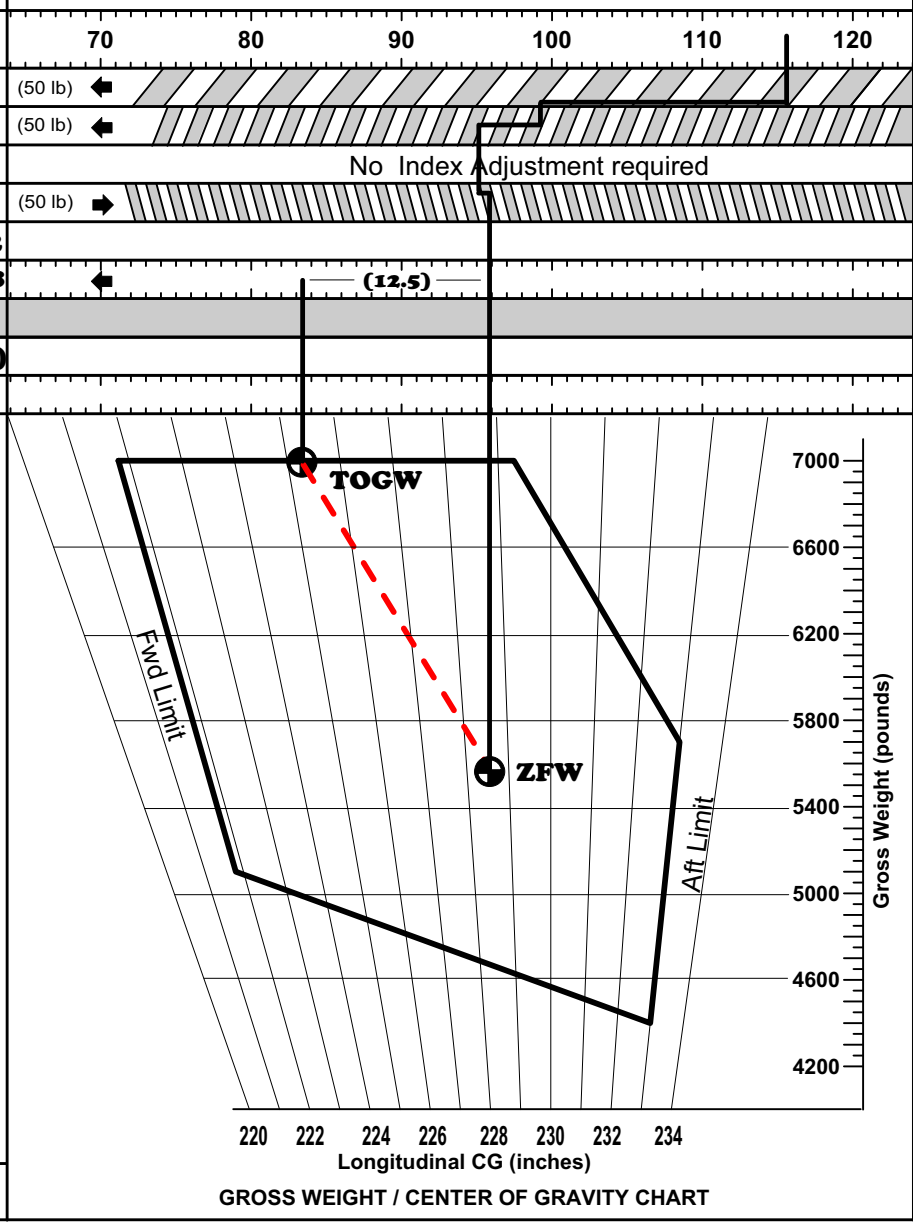


Figure 5-4. Loading Chart Example (U.S.)

MODEL 429 LOADING CHART
(Metric)

Aircraft Serial No. **Example**

Registration No.

Date

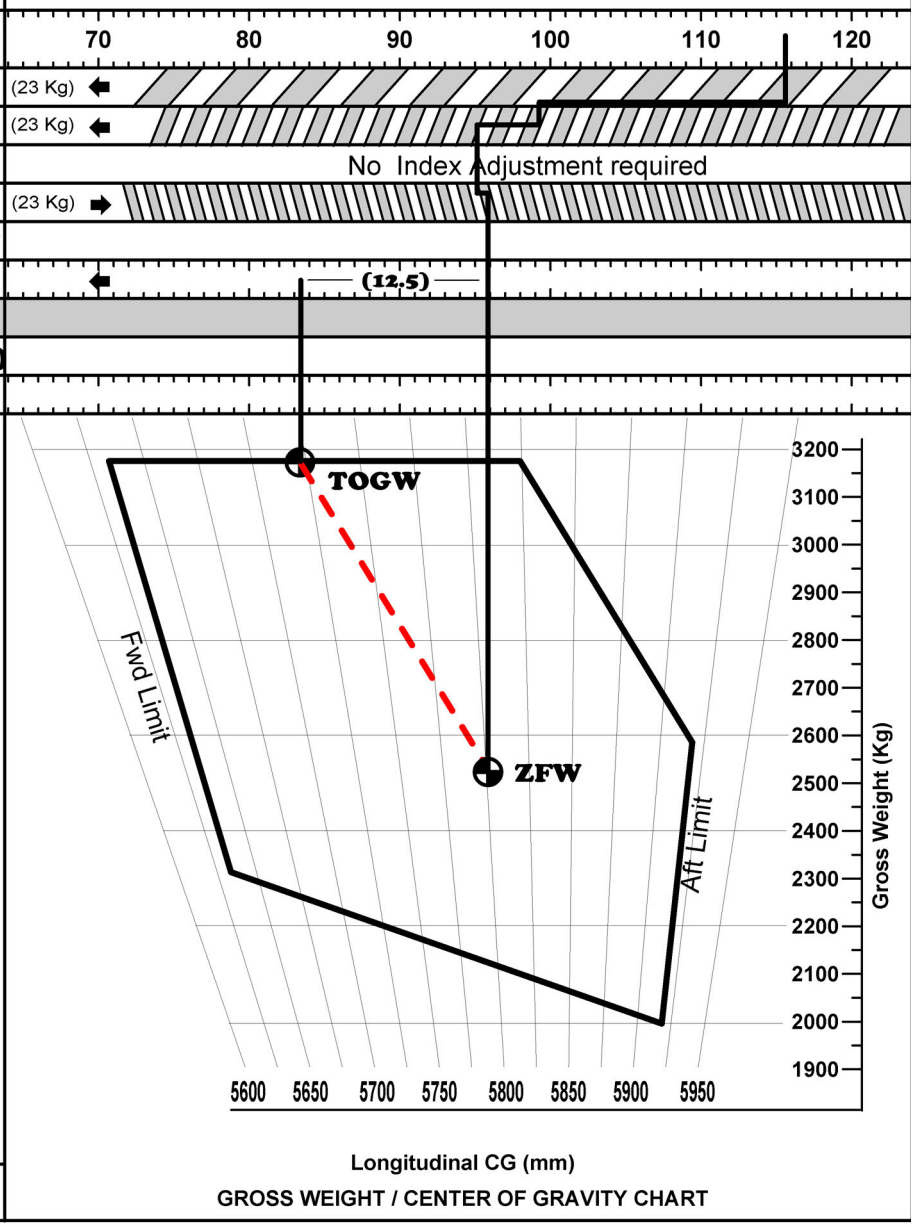
This loading is based on Actual Weight Record dated

EMPTY WEIGHT LONGITUDINAL INDEX

$$= \left[\frac{\text{EMPTY WEIGHT} \times (\text{CG} - 5842)}{23037} \right] + 100$$

Empty Weight CG	6017	- 5842 =	175.3	(a)
Empty Weight	2067	/ 23037 =	0.09	(b)
(a) 175.3	x (b) 0.09	=	15.7	(c)
(c) 15.7	+ 100 =	115.7	=	Empty Weight Longitudinal Index

Weight	(Kg)
Empty Weight	2067
Pilot & Fwd Pass. (Copilot)	182
Passengers : Mid Row	91
Passengers : Aft Row	163
Baggage Compartment (1)	24
Zero Fuel Weight (ZFW)	2527
Fuel Index & Weight (12.5)	648
CG Check:Fuel Burn	
648 Kg (12.5)	(3175)
Take-Off Gross Weight	3175



GROSS WEIGHT / CENTER OF GRAVITY CHART

FUEL INDEX

Jet A (0.815 Kg / Liter) Weight	Index	Jet B (0.779 Kg / Liter) Weight	Index
50	0.7	50	0.7
100	1.5	100	1.5
150	2.4	150	2.4
200	3.6	200	3.7
250	4.7	250	4.8
300	5.8	300	5.8
350	6.8	350	6.9
400	8.0	400	8.0
450	9.0	450	9.0
500	10.0	500	10.0
550	11.0	550	11.0
586	11.7	560	11.7
600	11.9	600	10.7
650	12.6	639.6 *	12.2
669 *	12.8		
ONLY REQUIRED WHEN AUX FUEL TANK INSTALLED			
700	12.0	700	10.5
750	10.4	755	8.5
790	9.6		

* Most forward extreme CG condition.

NOTE: (1) Assumes longitudinal CG of items in centre of Baggage Bay.

Figure 5-4M. Loading Chart Example (Metric)

Table 5-1. Example for Computation of GW/CG (U.S.)

A helicopter is chartered to transport 4 passengers plus pilot and 54 pounds of baggage on a trip that will require approximately 100 gallons of Jet A fuel (one way).

		CENTER OF GRAVITY AND MOMENTS			
		LONGITUDINAL		LATERAL	
Item Description	Weight (LB)	Arm (IN)	Moment (IN-LB)	Arm (IN)	Moment (IN-LB)
Empty Weight[1]	4558.0	236.9	1079790	-0.1	-456
+Pilot	180.0	147.0	26460	16.4	2952
+Passenger Fwd (Copilot)	220.0	147.0	32340	-15.4	-3388
+Passenger (1) Mid (Facing Aft)	200.0	186.0	37200	0.0	0
+Passenger (2) Aft	360.0	229.0	82440	0.0	0
+Baggage	54.0	260.0	14040	0.0	0
Gross Weight at Zero Fuel	5572.0	228.3	1272270	-0.2	-892
+Fuel (210 gal) to Max GTOW	1428.0	212.4	303307	0.0	0
Gross Takeoff Weight (GTOW)	7000.0 ✓	225.1 ✓	1575577	-0.1 ✓	-892
Gross Weight at Zero Fuel	5572.0	228.3	1272270	-0.2	-892
+Critical Fuel for Most Forward[2]	1428.0	212.4	303307	0.0	0
Most Forward CG Condition	7000.0 ✓	225.1 ✓	1575577	-0.1 ✓	-892
Gross Weight at Zero Fuel	5572.0	228.3	1272270	-0.2	-892
+Critical Fuel for Most Aft	0.0	0.0	0	0.0	0
Most Aft CG Condition	5572.0 ✓	228.3 ✓	1272270	-0.2 ✓	-892
Gross Weight at Zero Fuel	5572.0	228.3	1272270	-0.2	-892
+Fuel at Landing (110 gal)	748.0	212.2	158726	0.0	0
Most Aft CG Condition	6320.0 ✓	226.4 ✓	1430996	-0.1 ✓	-892

[1] Example only. Refer to Actual Weight Record for Empty Weight data.

[2] Critical fuel for most forward is Max Fuel.

✓ A check of weight and CG values against gross weight center of gravity limits chart shows that the loading will be within limits throughout flight. In lateral calculations, - is left side and + is right side.

Table 5-1M. Example for Computation of GW/CG (Metric)

A helicopter is chartered to transport 4 passengers plus pilot and 24 kilograms of baggage on a trip that will require approximately 407 liters of Jet A fuel (one way).

		CENTER OF GRAVITY AND MOMENTS					
		LONGITUDINAL			LATERAL		
Item Description	Weight (kg)		Arm (mm)	Moment (kg•mm)	Arm (mm)		Moment (kg•mm)
Empty Weight[1]	2067.0		6017	12437139	-3		-6201
+Pilot	82.0		3734	306188	417		34194
+Passenger Fwd (Copilot)	100.0		3734	373400	-391		-39100
+Passenger (1) Mid (Aft Facing)	91.0		4724	429884	0		0
+Passenger (2) Aft	163.0		5817	948171	0		0
+Baggage	24.0		6604	158496	0		0
Gross Weight at Zero Fuel	2527.0		5799	14653278	-4		-11107
+Fuel (876 L) to Max GTOW	648.0		5395	3495960	0		0
Gross Takeoff Weight (GTOW)	3175.0	✓	5716	18149238	-3	✓	-11107
Gross Weight at Zero Fuel	2527.0		5799	14653278	-4		-11107
+Critical Fuel for Most Forward[2]	648.0		5395	3495960	0		0
Most Forward CG Condition	3175.0	✓	5716	18149238	-3	✓	-11107
Gross Weight at Zero Fuel	2527.0		5799	14653278	-4		-11107
+Critical Fuel for Most Aft	0.0		0.0	0	0		0
Most Aft CG Condition	2527.0	✓	5799	14653278	-4	✓	-11107
Gross Weight at Zero Fuel	2527.0		5799	14653278	-4		-11107
+Fuel at Landing (449 liters)	339.0		5390	1827210	0		0
Most Aft CG Condition	2866.0	✓	5750	16480488	-4	✓	-11107

[1] Example only. Refer to Actual Weight Record for Empty Weight data.

[2] Critical fuel for most forward is Max Fuel.

✓ A check of weight and CG values against gross weight center of gravity limits chart shows that the loading will be within limits throughout flight. In lateral calculations, - is left side and + is right side.

Table 5-2. Door Weight and Moment (U.S.)

	LONGITUDINAL			LATERAL	
DOOR	WEIGHT (LB)	CG (IN.)	MOMENT (IN•LB)	CG (IN.)	MOMENT (IN•LB)
One crew door	17.5	144	2520	±30	±525
Both crew doors	35	144	5040	0	0
One hinged passenger door	16	185	2960	±31	±496
Both hinged passenger doors	32	185	5920	0	0
One sliding passenger door	21	216	4536	±31	±651
Both sliding passenger doors	42	216	9072	0	0
Aft fairing	14.5	318	4611	0	0
Rear door kit (429-706-002)	19	314	5966	0	0
Sliding passenger door open (one): Moment change	–	–	677	–	–

Table 5-2M. Door Weight and Moment (Metric)

	LONGITUDINAL			LATERAL	
DOOR	WEIGHT (KG)	CG (MM)	MOMENT (KG•MM)	CG (MM)	MOMENT (KG•MM)
One crew door	7.9	3658	29034	±762	±6020
Both crew doors	15.8	3658	57885	0	0
One hinged passenger door	7.3	4699	34103	±787	±5745
Both hinged passenger doors	14.6	4699	68676	0	0
One sliding passenger door	9.5	5486	52261	±787	±7477
Both sliding passenger doors	19.0	5486	104494	0	0
Aft fairing	6.6	8077	53125	0	0
Rear door kit (429-706-002)	8.6	7976	68736	0	0
Sliding passenger door open (one): Moment change	–	–	7803	–	–

Table 5-3. Cabin and Baggage Loading (U.S.)

CABIN AND BAGGAGE COMPARTMENT TABLE OF MOMENTS (INCH-POUNDS)					
WEIGHT (LB)	PILOT AND COPILOT FS 147.0	FWD ROW CLUB (AFT FACING) FS 186.0	FWD ROW AIRLINE (FWD FACING) FS 190.0	AFT ROW ALL (FWD FACING) FS 229.0	BAGGAGE CENTER FS 260.0
100	14700	18600	19000	22900	26000
110	16170	20460	20900	25190	28600
120	17640	22320	22800	27480	31200
130	19110	24180	24700	29770	33800
140	20580	26040	26600	32060	36400
150	22050	27900	28500	34350	39000
160	23520	29760	30400	36640	41600
170	24990	31620	32300	38930	44200
180	26460	33480	34200	41220	46800
190	27930	35340	36100	43510	49400
200	29400	37200	38000	45800	52000
210	30870	39060	39900	48090	54600
220	32340	40920	41800	50380	57200
230	33810	42780	43700	52670	59800
240	35820	44640	45600	54960	62400
250	36750	46500	47500	57250	65000
260	38220	48360	49400	59540	67600
270	39690	50220	51300	61830	70200
280	41160	52080	53200	64120	72800
290	42630	53940	55100	66410	75400
300	44100	55800	57000	68700	78000
310	45570	57660	58900	70990	80600
320	47040	59520	60800	73280	83200
330	48510	61380	62700	75570	85800
340	49980	63240	64600	77860	88400
350	51450	65100	66500	80150	91000
360	52920	66960	68400	82440	93600
370	54390	68820	70300	84730	96200
380	55860	70680	72200	87020	98800
390	57330	72540	74100	89310	101400
400	58800	74400	76000	91600	104000
410	60270	76260	77900	93890	106600
420	61740	78120	79800	96180	109200
430	63210	79980	81700	98470	111800
440	64680	81840	83600	100760	114400
450	66150	83700	85500	103050	117000
460	67620	85560	87400	105340	119600
470	69090	87420	89300	107630	122200
480	70560	89280	91200	109920	124800
490	72030	91140	93100	112210	127400
500	73500	93000	95000	114500	130000
510	74970	94860	96900	116790	132600
520	76440	96720	98800	119080	135200
530	77910	98580	100700	121370	137800
540	79380	100440	102600	123660	140400
550	80850	102300	104500	125950	–

Table 5-3M. Cabin and Baggage Loading (Metric)

CABIN AND BAGGAGE COMPARTMENT TABLE OF MOMENTS (KG•MM)					
WEIGHT (KG)	PILOT AND COPILOT	FWD ROW		AFT ROW ALL	BAGGAGE
		CLUB (AFT FACING)	AIRLINE (FWD FACING)	(FWD FACING)	CENTER
	3734 MM	4724 MM	4826 MM	5817 MM	6604 MM
50	186700	236200	241300	290850	330200
55	205370	259820	265430	319935	363220
60	224040	283440	289560	349020	396240
65	242710	307060	313690	378105	429260
70	261380	330680	337820	407190	462280
75	280050	354300	361950	436275	495300
80	298720	377920	386080	465360	528320
85	317390	401540	410210	494445	561340
90	336060	425160	434340	523530	594360
95	354730	448780	458470	552615	627380
100	373400	472400	482600	581700	660400
105	392070	496020	506730	610785	693420
110	410740	519640	530860	639870	726440
113	421942	533812	545338	657321	746252
115	429410	543260	554990	668955	759460
120	448080	566880	579120	698040	792480
125	466750	590500	603250	727125	825500
130	485420	614120	627380	756210	858520
135	504090	637740	651510	785295	891540
140	522760	661360	675640	814380	924560
145	541430	684980	699770	843465	957580
150	560100	708600	723900	872550	990600
155	578770	732220	748030	901635	1023620
160	597440	755840	772160	930720	1056640
165	616110	779460	796290	959805	1089660
170	634780	803080	820420	988890	1122680
175	653450	826700	844550	1017975	1155700
180	672120	850320	868680	1047060	1188720
185	690790	873940	892810	1076145	1221740
190	709460	897560	916940	1105230	1254760
195	728130	921180	941070	1134315	1287780
200	746800	944800	965200	1163400	1320800
205	765470	968420	989330	1192485	1353820
210	784140	992040	1013460	1221570	1386840
215	802810	1015660	1037590	1250655	1419860
220	821480	1039280	1061720	1279740	1452880
225	840150	1062900	1085850	1308825	1485900
230	858820	1086520	1109980	1337910	1518920
235	877490	1110140	1134110	1366995	1551940
240	896160	1133760	1158240	1396080	1584960
245	914830	1157380	1182370	1425165	1617980
249.5	931633	1178638	1204087	1451342	–
250	–	1181000	1206500	1454250	–

Table 5-4. Fuel Density Versus Temperature

Temperature (°F)	Density lb/Gallon JET A	Density lb/Gallon JET B	Temperature (°C)	Density kg/Liter JET A	Density kg/Liter JET B
120	6.59	6.27	40	0.797	0.759
100	6.66	6.35	30	0.805	0.767
80	6.73	6.42	20	0.812	0.775
60*	6.80	6.50	15.56*	0.815	0.779
40	6.87	6.58	10	0.820	0.784
20	6.94	6.65	0	0.827	0.792
0	7.01	6.73	-10	0.835	0.800
-20	7.08	6.80	-20	0.842	0.808
-40	7.15	6.88	-30	0.850	0.816
			-40	0.857	0.824

* Standard density, used to derive fuel burn curves.

Table 5-5. Fuel Loading (U.S.)

Quantity	Jet A	Longitudinal		Quantity	Jet B	Longitudinal	
	Weight	CG	Moment		Weight	CG	Moment
(U.S. GAL)	(LB)	(IN.)	(IN•LB)	(U.S. GAL)	(LB)	(IN.)	(IN•LB)
0*	0	215.9	0	0*	0	215.9	0
10	68	215.9	14681	10	65	215.9	14034
20	136	216.5	29444	20	130	216.5	28145
30	204	216.8	44227	30	195	216.8	42276
40	272	216.8	58970	40	260	216.8	56368
50	340	215.2	73168	50	325	215.2	69940
60	408	213.8	87230	60	390	213.8	83382
70	476	213.3	101531	70	455	213.3	97052
80	544	212.9	115818	80	520	212.9	110708
90	612	212.6	130111	90	585	212.6	124371
100	680	212.4	144432	100	650	212.4	138060
110	748	212.2	158726	110	715	212.2	151723
120	816	212.1	173074	120	780	212.1	165438
130	884	212.0	187408	130	845	212.0	179140
140	952	211.9	201729	140	910	211.9	192829
150	1020	211.8	216036	150	975	211.8	206505
160	1088	211.8	230438	160	1040	211.8	220272
170	1156	211.8	244841	170	1105	211.8	234039
180	1224	211.9	259366	180	1170	211.9	247923
190	1292	212.0	273904	190	1235	212.0	261820
200	1360	212.1	288456	200	1300	212.1	275730
210	1428	212.4	303307	210	1365	212.4	289926
216.9**	1475	212.6	313568	216.9**	1410	212.6	299734
256.1	1741	219.8	382777	256	1665	219.8	365890

* Most critical fuel amount for most aft CG condition.

** Most critical fuel amount for most forward CG condition.

Table 5-5M. Fuel Loading (Metric)

Quantity	Jet A	Longitudinal		Quantity	Jet B	Longitudinal	
	Weight	CG	Moment		Weight	CG	Moment
(LITERS)	(KG)	(MM)	(KG•MM)	(LITERS)	(KG)	(MM)	(KG•MM)
0*			0	0*			0
20	16.3	5484	89387	20	15.6	5484	85439
40	32.6	5485	178802	40	31.2	5485	170904
60	48.9	5493	268597	60	46.7	5493	256732
80	65.2	5500	358598	80	62.3	5500	342758
100	81.5	5504	448575	100	77.9	5504	428761
120	97.8	5507	538557	120	93.5	5507	514768
140	114.1	5507	628317	140	109.1	5507	600563
160	130.4	5498	716875	160	124.6	5498	685209
180	146.7	5476	803334	180	140.2	5476	767849
200	163.0	5456	889328	200	155.8	5456	850045
220	179.3	5437	974892	220	171.4	5437	931829
240	195.6	5426	1061365	240	187.0	5426	1014482
260	211.9	5419	1148390	260	202.5	5419	1097664
280	228.2	5414	1235426	280	218.1	5414	1180855
300	244.5	5408	1322359	300	233.7	5408	1263948
320	260.8	5404	1409416	320	249.3	5404	1347160
340	277.1	5400	1496389	340	264.9	5400	1430291
360	293.4	5397	1583611	360	280.4	5397	1513660
380	309.7	5395	1670758	380	296.0	5395	1596958
400	326.0	5392	1757818	400	311.6	5392	1680172
420	342.3	5390	1844873	420	327.2	5390	1763382
440	358.6	5388	1932243	440	342.8	5388	1846892
460	374.9	5387	2019569	460	358.3	5387	1930361
480	391.2	5386	2106851	480	373.9	5386	2013788
500	407.5	5384	2194090	500	389.5	5384	2197173
520	423.8	5383	2281285	520	405.1	5383	2180516
540	440.1	5382	2368436	540	420.7	5382	2263818
560	456.4	5380	2455543	560	436.2	5380	2347078

Table 5-5M. Fuel Loading (Metric) (Cont)

Quantity	Jet A	Longitudinal		Quantity	Jet B	Longitudinal	
	Weight	CG	Moment		Weight	CG	Moment
(LITERS)	(KG)	(MM)	(KG•MM)	(LITERS)	(KG)	(MM)	(KG•MM)
580	472.7	5380	2542994	580	451.8	5380	2430665
600	489.0	5380	2630683	600	467.4	5380	2514481
620	505.3	5380	2718373	620	483.0	5380	2598297
640	521.6	5380	2806062	640	498.6	5380	2682113
660	537.9	5381	2894346	660	514.1	5381	2766498
680	554.2	5382	2982797	680	529.7	5382	2851042
700	570.5	5384	3071292	700	545.3	5384	2935628
720	586.8	5385	3159831	720	560.9	5385	3020256
740	603.1	5386	3248414	740	576.5	5386	3104925
760	619.4	5388	3337282	760	592.0	5388	3189869
780	635.7	5392	3427665	780	607.6	5392	3276259
800	652.0	5396	3518156	800	623.2	5396	3362753
821**	669.2	5400	3613482	821**	639.6	5400	3453868
969	790.1	5583	4411034	969	755.2	5583	4216190

* Most critical fuel amount for most aft CG condition.

** Most critical fuel amount for most forward CG condition.