



Transport
Canada

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TP 13733E
(revised 10/2004)

Study and Reference Guide

Type Rating

Helicopter

(HATRA Exam)

First Edition
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Canada

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<http://www.tc.gc.ca/CivilAviation/General/Exams/Guides.htm>

GENERAL

The conditions of issue of all flight crew licences are stated in the Canadian Aviation Regulations (CARs).

EXAMINATIONS

Applicants for the Commercial Pilot Licence in the Helicopter Category shall demonstrate their knowledge by writing a Transport Canada multiple choice examination on subjects contained in this guide.

Examination	Questions	Time Limit	Pass Mark
Air Regulations and Air Traffic Procedures, Helicopter Operations and Navigation General - Meteorology, Radio Aids to Navigation and Flight Planning – HATRA	50	3½ hours	70%

KNOWLEDGE REQUIREMENTS

Applicants for a Type Rating – Helicopter are expected to have mastered the various subjects included in this guide in addition to material required to obtain a Commercial Pilot Licence – Helicopter (see TP 2476E). All applicants must also be able to read the examination questions in either English or French without assistance.

Subjects marked with a bullet (→) are considered essential knowledge for the Type-Rating - Helicopter applicants.

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Co-ordinator
- .7 Vertical Speed Indicator (VSI)
- .8 Heading Indicator
- .9 Attitude Indicator (AI)
- .10 Radio Magnetic Indicator (RMI)
- .11 Horizontal Situation Indicator (HSI)
- .12 Flight Director

4.2 FLIGHT MANAGEMENT INSTRUMENTS

- .1 Flight Management System
(FMS)
- .2 Electronic Flight Instrument
System (EFIS)

4.3 ENGINE AND TRANSMISSION INSTRUMENTS – PRINCIPLES AND USE

- .1 N1 / N2 / Rotor Tachometer
- .2 Torquemeter or Degrees of
Pitch
- .3 Transmission
- .4 Oil Temperatures and
Pressures
- .5 Turbine Temperature
- .6 Fuel Pressure
- .7 Fuel Flow

4.4 AIRCRAFT COMPASS SYSTEMS

- 1 Construction
- 2 Use
- 3 Limitations and Faults
- 4 Gyromagnetic Remote
Indicating Compass

SECTION 5: NAVIGATION – GENERAL

5.1 NAVIGATION TERMS

- .1 Air Position
- .2 Great Circle
- .3 Rhumb Line
- .4 Greenwich Hour Angle

5.2 MAPS AND CHARTS

- .1 Lambert Conformal
- .2 Transverse Mercator
- .3 Enroute Low Altitude Charts

5.3 TIME AND LONGITUDE

- .1 Time Zones and Relation to Longitude

5.4 FLIGHT PLANNING CALCULATIONS

- .1 Heading and True Airspeed
- .2 Wind and Wind Speed
- .3 IAS – CAS – EAS – TAS
- .4 Track and Groundspeed
- .5 Time
- .6 Weight and Balance
- .7 Fuel Load / Zero Fuel Weight
- .8 Pay Load / Weight Shift
- .9 Critical Point (CP)
- .10 Point of No Return (PNR) / Radius of Action

5.5 FLIGHT PLAN FORMS

- .1 Flight Plan
- .2 Flight Itinerary

5.6 EN ROUTE NAVIGATION

- .1 Use of Aeronautical Charts
- .2 Calculation of Heading and Groundspeed
- .3 Use of Radio Aids to Determine Position and Transferring Position Lines
- .4 Gyro Steering Techniques in Areas of Compass Unreliability
- .5 Maintaining a Flight Log (Air Position)
- .6 Determination of Wind Velocity
- .7 Use of Canada Flight Supplement (CFS)

**SECTION 6: RADIO COMMUNICATIONS AND AIDS TO NAVIGATION –
BASIC PRINCIPLES AND USE**

6.1 RADIO

- .1 Elementary Theory
- .2 Wave Length and Frequency
- .3 Frequency Bands Used in Communication and Navigation
- .4 Characteristics of Low, High and Very High Frequency Radio Waves
- .5 Ground Waves and Sky Waves
- .6 Skip Distance
- .7 Reflection and Refraction
- .8 Night Effect

6.2 AIRCRAFT RADIO TRANSCEIVERS

- .1 VHF
- .2 HF
- .3 FM
- .4 DATALINK

6.3 EMERGENCY LOCATOR TRANSMITTER (ELT)

- .1 Requirements
- .2 Testing
- .3 Flight Planning
- .4 Accidental Transmissions
- .5 Pilot Response to Signals
- .6 Downed Aircraft Procedures

6.4 RADAR

- .1 Elementary Theory
- .2 Primary Returns
- .3 Secondary Returns
- .4 Weather Radar

6.5 NAVIGATION SYSTEMS

- .1 Automatic Direction Finder (ADF)
- .2 VHF Omnidirectional Range (VOR)
- .3 Distance Measuring Equipment (DME)
- .4 Co-located VOR and TACAN (VORTAC)
- .5 Long Range Area Navigation (LORAN C)
- .6 Very Low Frequency (VLF) Navigation System
- .7 Global Navigation Satellite System (GNSS-GPS)
- .8 Very High Frequency Direction Finding (VHF-DF)
- .9 Area Navigation System (RNAV)
- .10 Inertial Navigation System (INS)

6.6 APPROACH AIDS

- .1 Instrument Landing System (ILS)
- .2 Global Navigation Landing System (GNSS-GPS)
- .3 Surveillance Radar (ASR & AASR)
- .4 Precision Approach Radar (PAR)
- .5 Secondary Surveillance Radar (SSR)
- .6 Weather / Mapping Radar
- .7 VASI / PAPI

6.7 TRANSPONDERS

SECTION 7: FLIGHT OPERATIONS

7.1 ATMOSPHERIC EFFECTS ON FLIGHT

- .1 ICAO Standard Atmosphere
- .2 Temperature and Pressure / Air Density
- .3 Humidity / Rain

7.2 PERFORMANCE

- .1 Power Available and Power Required
- .2 Hovering In Ground Effect and Out of Ground Effect (IGE / OGE)
- .3 Critical Wind Envelope
- .4 Best Rate of Climb
- .5 Cruising for Range / Endurance
- .6 Effect of Changes in Weight / Temperature
- .7 Flight Performance "V" Speeds / Definition and Use
- .8 Wind Shear – Effects and Avoidance

7.3 SPECIALTY OPERATIONS

- .1 External Loads
- .2 Heliport / Helideck

7.4 CHARTS AND GRAPHS

- .1 Weight and Balance
- .2 Take-off (including Cat A and B)
- .3 Climb
- .4 Cruise
- .5 Descent
- .6 Landing

7.5 CRITICAL SURFACE CONTAMINATION

- .1 Clean Aircraft Concept – Practices and Techniques
- .2 Frozen Contaminants Including Cold-Soaking Phenomenon
- .3 De-icing and Anti-icing Fluids
- .4 De-icing and Anti-icing Procedures
- .5 Variables that Can Influence Holdover Time
- .6 Critical Surface Inspections
- .7 Pre-take off Inspection
- .8 Health Affects
- .9 Application Guideline Tables

7.6 WAKE TURBULENCE

- .1 Causes and Effects
- .2 Avoidance Procedures
- .3 Separation Criteria and Waiver

7.7 FLIGHT MANUAL

- .1 Approved Information
- .2 Unapproved Information

SECTION 8: THEORY OF FLIGHT**8.1 FORCES ACTING ON A HELICOPTER**

- .1 Load Factor
- .2 Stability
- .3 Lift / Weight / Thrust / Drag

8.2 ROTOR DESIGN

- .1 Number / Speed of Blades
- .2 Rotor Blade Vortices
- .3 Limitations to Forward Speed and Vibrations
- .4 Autorotations
- .5 Tail Rotor
- .6 Ground Resonance

SECTION 9: HUMAN FACTORS

9.1 AVIATION PHYSIOLOGY

- .1 Hypoxia / Hyperventilation
- .2 Gas Expansion Effects
- .3 Decompression (including SCUBA diving)
- .4 Vision / Visual Scanning Techniques
- .5 Hearing
- .6 Orientation / Disorientation (including visual and vestibular illusions)
- .7 Positive and Negative "G"
- .8 Circadian Rhythms / Jet Lag
- .9 Sleep / Fatigue

9.2 THE PILOT AND THE OPERATING ENVIRONMENT

- .1 Personal Health / Exercise / Fitness
- .2 Obesity / Diet / Nutrition
- .3 Medications (prescribed and over-the-counter)
- .4 Substance Abuse (alcohol and drugs)
- .5 Pregnancy
- .6 Heat / Cold
- .7 Noise / Vibrations
- .8 Effects of Smoking
- .9 Toxic Hazards (including carbon monoxide)

9.3 AVIATION PSYCHOLOGY

- .1 The Decision-Making Process
- .2 Factors that Influence Decision-Making
- .3 Situation Awareness
- .4 Stress
- .5 Managing Risk
- .6 Attitudes
- .7 Workload (attention and information processing)

9.4 PILOT – EQUIPMENT / MATERIALS RELATIONSHIP

- .1 Controls and Displays
 - Errors in Interpretation and Control
 - Information Selection – eg. "glass" cockpits
- .2 Alerting and Warning Systems
 - Appropriate Selection and Set up
 - False Indications
 - Distractions and Responses
- .3 Standard Operating Procedures (SOPs)
- .4 Correct Use of Charts, Checklists and Manuals

9.5 INTERPERSONAL RELATIONS

- .1 Communication with
 - Flight Crew and Cabin Crew
 - Passengers
 - Company Management
 - Flight Operations
 - Maintenance Personnel
 - Air Traffic Services
- .2 Crew Problem Solving and Decision-Making
- .3 Crew Management / Small Group Dynamics
- .4 Operating Pressures
 - Family
 - Peer Group
 - Employer

EXAMINATION RESULTS – DECODING

Candidates who write an examination will be informed of the Question topics they answered incorrectly by a series of numbers related to the sections and topics contained in this Guide. Questions relating to more than one topic are shown by a slash (/) separating the series of numbers (example 3). The method of decoding these numbers is explained by the examples below.

HOW TO DECODE

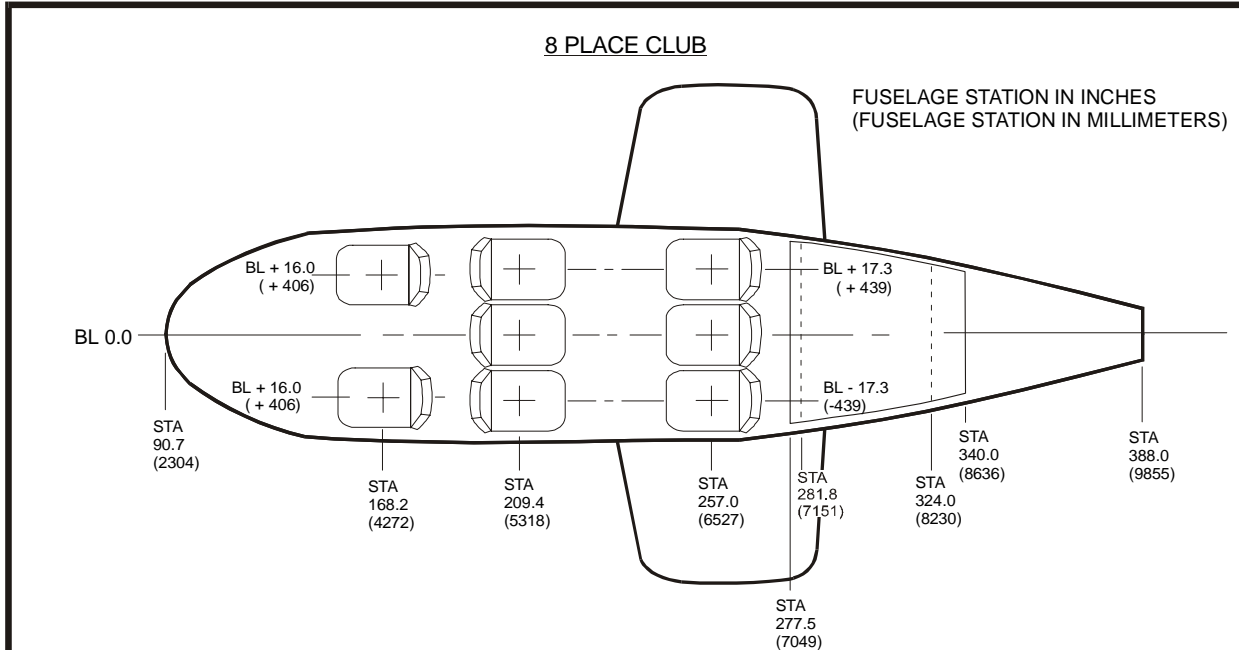
Example (1)	1.4.2.3	
Section	1.	Air Law and Procedures
Sub-section	4.	CARs Part VI – General Operating and Flight Rules
Subpart	2.	Airspace
Topic	3	Transponder Airspace
Example (2)	3.5.1	
Section	3.	Meteorology
Sub-section	5.	Moisture
Topic	1	Relative Humidity / Dewpoint
Example (3)	3.9.12/7.2.8	
Section	3.	Meteorology
Sub-section	9.	Wind
Topic	12	Wind Shear, Types and Causes
Section	7.	Flight Operations
Sub-section	2.	Performance
Topic	8	Wind Shear – Effects and Avoidance

TABLES AND CHARTS

The following section contains examples of different tables and charts which may be used on ATPL-H examinations.

** AVAILABLE ON HARD COPY ONLY!

LOADING CONFIGURATION (Page 1 of 2)



9 PLACE SEATING - EXTREME LEFT CONFIGURATION

	Weight	Arm	Moment	Lateral Arm	Lateral Moment
* Weight Empty Condition	5202	256.3	1332876	-0.5	-2601
+ Oil	29	270.0	7831	0	0
+ Pilot	170	168.2	28594	+16.0	+2720
+ Copilot/ Passenger	170	168.2	28594	-14.0	-2380
+ Pass., Forward. Left	170	200.2	34034	-17.3	-2941
+ Pass., Mid Left	170	228.4	38828	-17.3	-2941
+ Pass., Aft Left	170	257.9	43843	-17.3	-2941
+ Fuel (247 U.S. Gal. Jet A, A - 1, or JP-5)	<u>1679</u>	263.3	<u>442081</u>	0	<u>0</u>
Take off Condition	7760	252.1	1956680	-1.4	-11084
- Fuel	<u>-1679</u>		<u>-442081</u>	0	<u>0</u>
Landing Condition (Extreme Left Lat. CG)	6081	249.1	1514599	-1.8	-11084

10 PLACE SEATING - MOST FWD. CONFIGURATION

	Weight	Arm	Moment	Lateral Arm	Lateral Moment
* Weight Empty Condition	5172	255.9	1323515	-0.4	-2069
+ Oil	29	270.0	7830	0	0
+ Pilot and Copilot	340	168.2	57188	+1.0	+340
+ Passengers (2) fwd	340	200.7	68238	-10.5	-3570
+ Passengers (3) Mid	510	229.2	116892	0	0
+ Fuel (247 U.S. Gal. Jet A, A-1, or JP-5)	<u>1679</u>	263.3	<u>442081</u>	0	<u>0</u>
Take off Condition	8070	249.8	2015744	-0.7	-5299
- Fuel	<u>-1679</u>		<u>-442081</u>		<u>0</u>
Landing Condition (Most fwd CG)	6391	246.2	1573663	-0.8	-5299

LOADING CONFIGURATION (Page 2 of 2)

FUEL LOADING TABLE (ENGLISH)							
TYPE A, A-1, AND JP-5 *(6.8 LB/U.S. GAL.)				TYPE B AND JP-4 *6.5 LB/U.S. GAL.)			
QUANTITY (U.S. GAL.)	WEIGHT (POUNDS)	C G (INCHES)	MOMENT (IN-LB)	QUANTITY (U.S. GAL.)	WEIGHT (POUNDS)	C G (INCHES)	MOMENT (IN-LB)
10	68	258.7	17592	10	64	258.7	16816
20	136	260.5	35428	20	130	260.5	33865
30	204	261.3	53305	30	195	261.3	50954
40	272	261.5	71128	40	160	261.5	67990
50	340	261.6	88944	50	325	261.6	85020
60	408	261.8	106813	60	390	261.8	102102
70	476	262.2	124807	70	455	262.2	119301
80	544	262.6	142854	80	520	262.6	136552
90	612	262.9	160895	90	585	262.9	153797
100	680	263.0	178840	100	650	263.0	170950
110	748	263.1	196799	110	715	263.1	188117
120	816	263.2	214771	120	780	263.2	205296
130	884	263.3	232757	130	845	263.3	222489
140	952	263.4	250757	140	910	263.4	239694
150	1020	263.4	268668	150	975	263.4	256815
160	1088	263.4	286579	160	1040	263.4	273936
170	1156	263.5	304606	170	1105	263.5	291168
180	1224	263.5	322524	180	1170	263.5	308295
190	1292	263.5	340442	190	1235	263.5	325423
200	1360	263.5	358360	200	1300	263.5	342550
210	1428	263.5	376278	210	1365	263.5	359678
220	1496	263.4	394046	220	1439	263.4	376663
230	1564	263.4	411958	230	1495	263.4	393783
240	1632	263.3	429706	240	1560	263.3	410748
247	1679	263.3	442081	247	1605	263.3	422597

*NOTE: All data above represents usable fuel based on nominal density at 15° C (59° F).

BAGGAGE COMPARTMENT LOADING TABLE						
LOCATION OF TIE DOWNS (FOOTMAN LOOPS)						
LONGITUDINAL FUSELAGE STATION	LATERAL B.L.					
288.7	-15.4	-4.5	+4.5	+15.4		
299.3	-20.2			+20.2		
313.2	-18.5			+18.5		
327.4	-13.0	-4.3	+4.3	+13.0		
100 LBS/SQ.FT. MAXIMUM ALLOWABLE	BAGGAGE/CARGO CENTER OF GRAVITY WITH MID-SPAN LOCATION BETWEEN TIE-DOWNS MOMENT (IN-LBS)				500 POUNDS MAXIMUM ALLOWABLE	
WEIGHT (LBS)	F.S. 294.0	F.S. 301.0	F.S. 306.3	F.S. 308.1	F.S. 313.4	F.S. 320.3
25	7350	7525	7658	7703	7835	8008
50	14700	15050	15315	15405	14670	16015
75	22050	22585	22973	23108	23505	24023
100	29400	30100	30630	30810	31340	32030
125	36750	37625	38288	38513	29175	40038
150	44100	45150	45945	46215	47010	48045

POWER ASSURANCE CHECK (GROUND)

POWER ASSURANCE CHECK (GROUND)

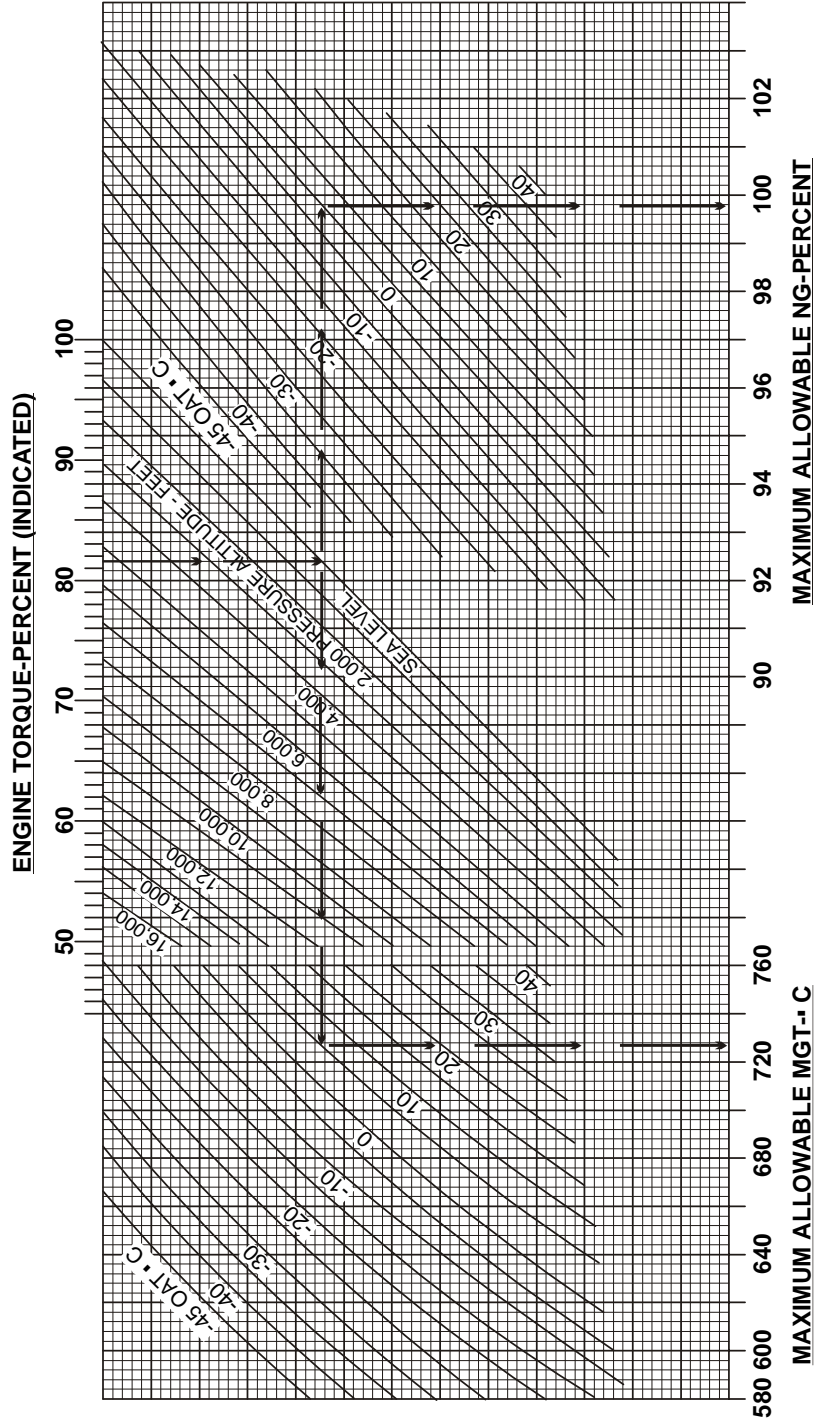
ANTI ICE - OFF
 HEATER/ECS - OFF
 GENERATOR - ON; OFF IF LOAD EXCEEDS 30 AMPS
 COLLECTIVE PITCH - FULL DOWN

NP RPM - 97%
 COLLECTIVE PITCH - INCREASE UNTIL LIGHT ON SKIDS (AT OR ABOVE 95% NG). DO NOT EXCEED 86.4% ENGINE TORQUE, 788• MGT, OR 102.9% NG.
 STABILIZE POWER ONE TO FOUR MINUTES, THEN RECORD PRESSURE ALTITUDE, OAT, TORQUE, MGT, AND NG RPM.
 REDUCE COLLECTIVE.

THRUSTLES:
 TEST ENGINE - FULL OPEN
 OTHER ENGINE - FLIGHT IDLE

ENTER CHART AT INDICATED ENGINE TORQUE. MOVE DOWNWARD TO INTERSECT PRESSURE ALTITUDE; PROCEED LEFT AND RIGHT TO INTERSECT OUTSIDE AIR TEMPERATURE; THEN MOVE DOWN TO READ MAXIMUM ALLOWABLE MGT AND NG.

REPEAT CHECK USING OTHER ENGINE. IF EITHER ENGINE EXCEEDS ALLOWABLE MGT OR NG PUBLISHED PERFORMANCE MAY NOT BE ACHIEVABLE.



HELICOPTER - HOVER CEILING

HOVER OUT OF GROUND EFFECT

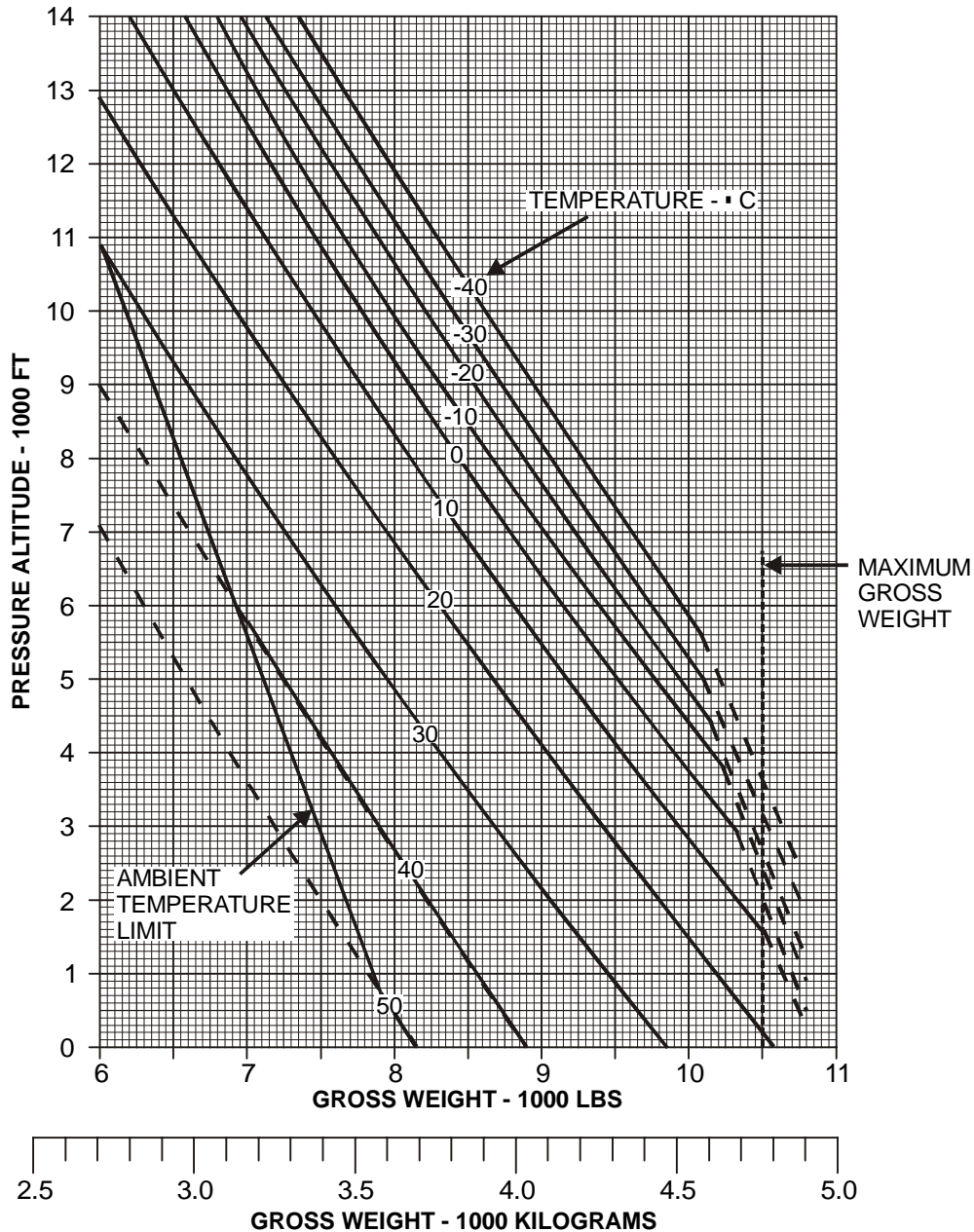
TAKEOFF POWER

100% N_r ANTI-ICE OFF NO BLEED-AIR

REDUCE GROSS WEIGHT DETERMINED FROM CHART BY AMOUNT SHOWN IN THE FOLLOWING TABLE, AS APPLICABLE:

CONFIGURATION	WEIGHT REDUCTION
EAPS INSTALLED*	150 POUNDS
ANTI-ICE ON	200 POUNDS
ANTI-ICE ON WITH EAPS INSTALLED	270 POUNDS

*EAPS SWITCH IN THE ON POSITION. NO WEIGHT REDUCTION WITH EAPS SWITCH IN THE OFF POSITION.



HELICOPTER - TAKE-OFF AND LANDING WEIGHTS - CAT. "B"

(Page 1 of 2)

**CATEGORY "B"
MAXIMUM TAKEOFF AND LANDING GROSS WEIGHT
CT58-110 ENGINE
100% N_r**

WEIGHT BASED ON ABILITY TO HOVER AT 10 FEET WHEEL HEIGHT WITH TAKE-OFF POWER

NOTE: USE APPROPRIATE SCALE FOR ICE SHIELD AND/OR ANTI-ICE
MAXIMUM TAKE-OFF GROSS WEIGHT CANNOT EXCEED 19,000 LBS

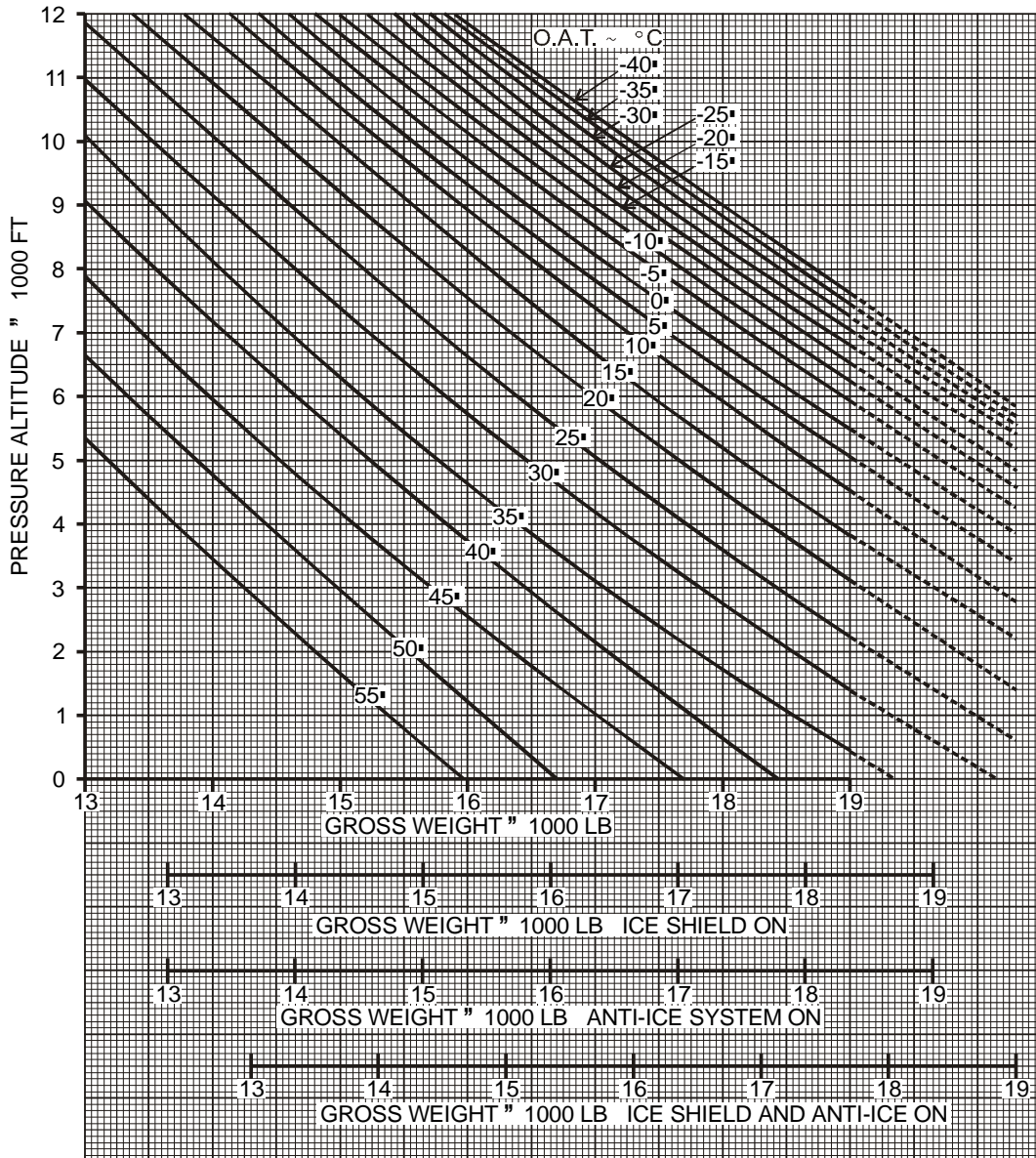


Figure 3

HELICOPTER - TAKE-OFF AND LANDING WEIGHTS - CAT "B"

(Page 2 of 2)

Category "B"

Limiting heights and corresponding speeds for safe landing after an engine suddenly becomes inoperative.

1. The curves are applicable to all altitudes and temperatures at the corresponding maximum allowable take-off gross weight as determined from Figure 3.
2. At gross weights or temperatures below the maximum allowable as determined from Figure 3, reduce the H/V diagram at the 100 feet 1 kt./2° C.
3. Do not decrease below 15 kt. IAS.

Information on Test Conditions:

1. Hard surface runway.
2. Winds calm.
3. Straight take-off and climb-out path,

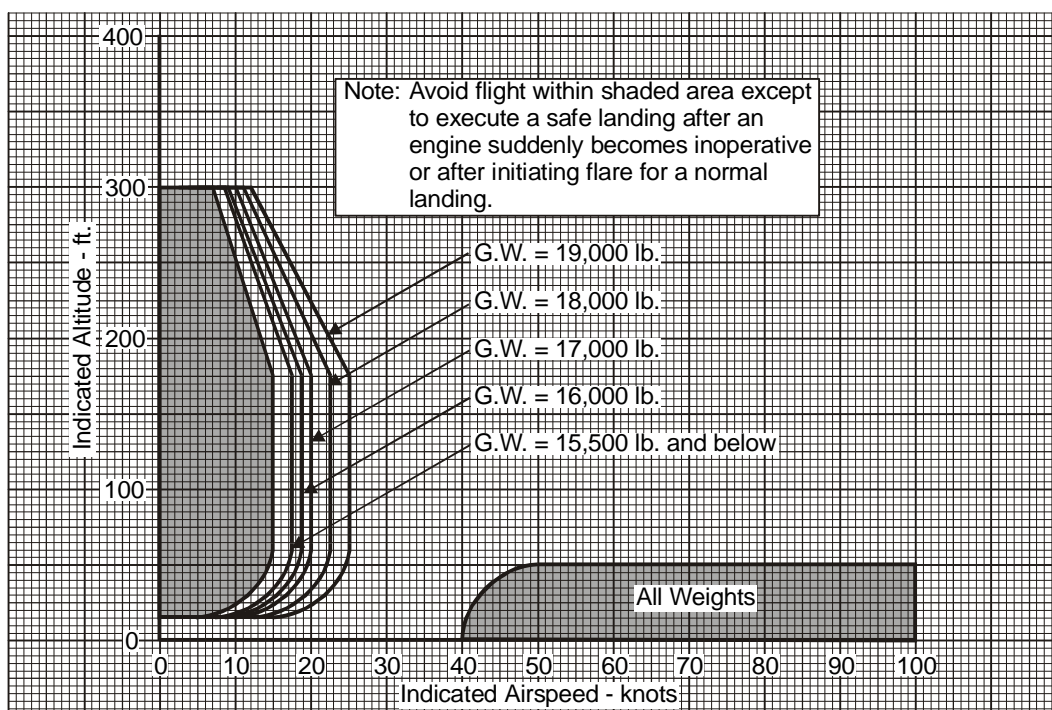
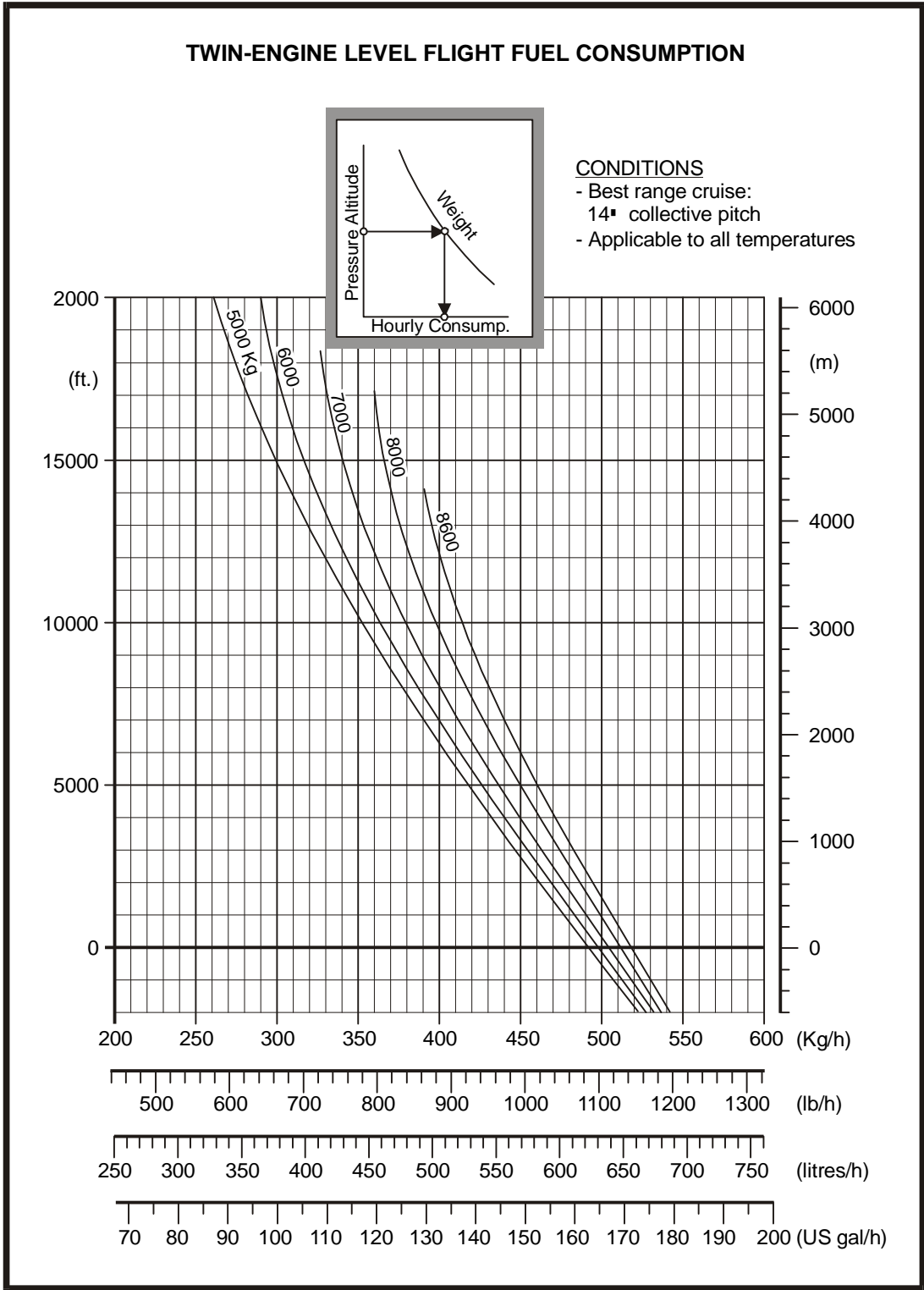


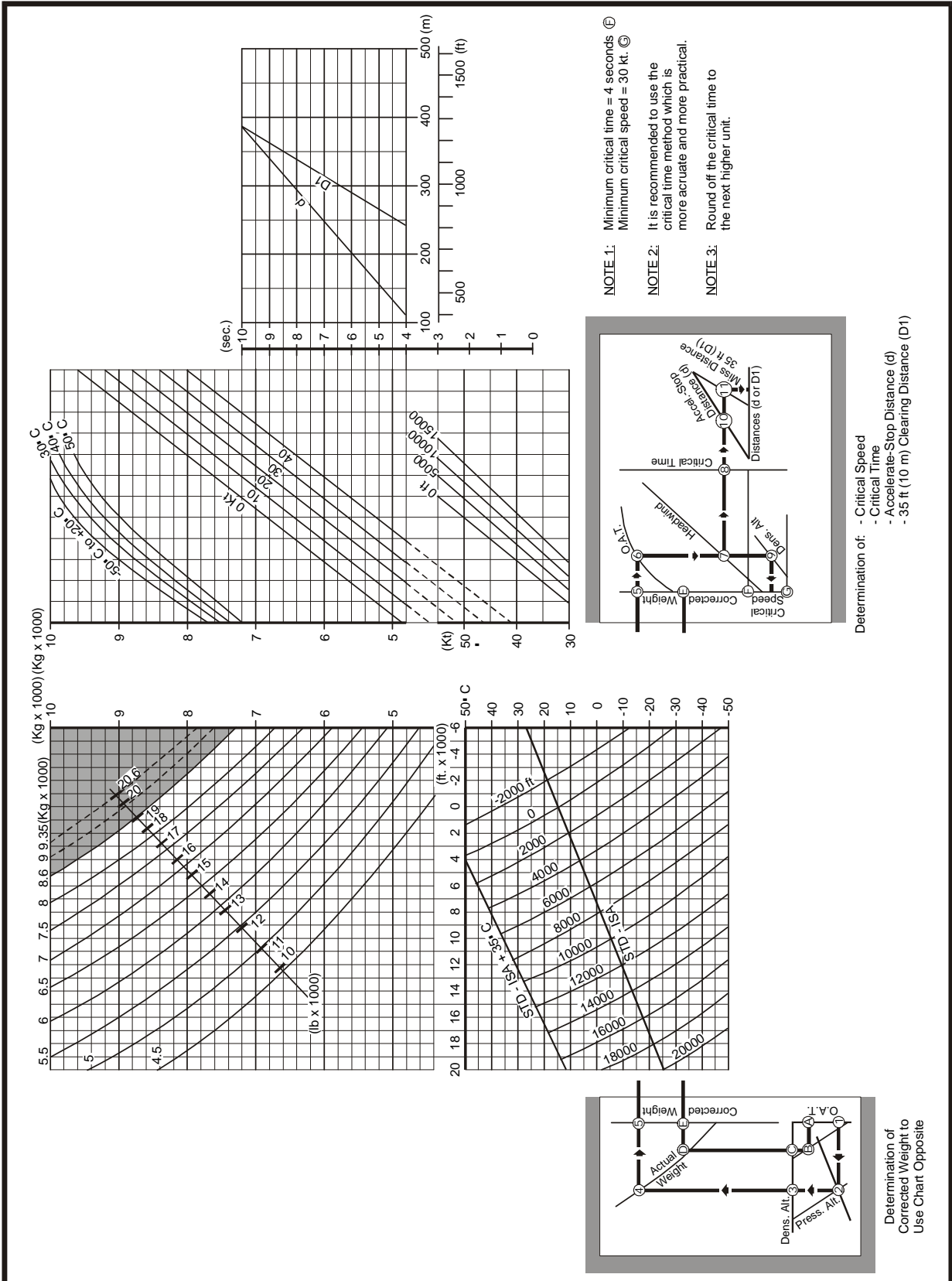
Figure 4

HELICOPTER - FUEL CONSUMPTION

TWIN-ENGINE LEVEL FLIGHT FUEL CONSUMPTION



HELICOPTER - ACCELERATE/STOP DISTANCE (Graph #1)

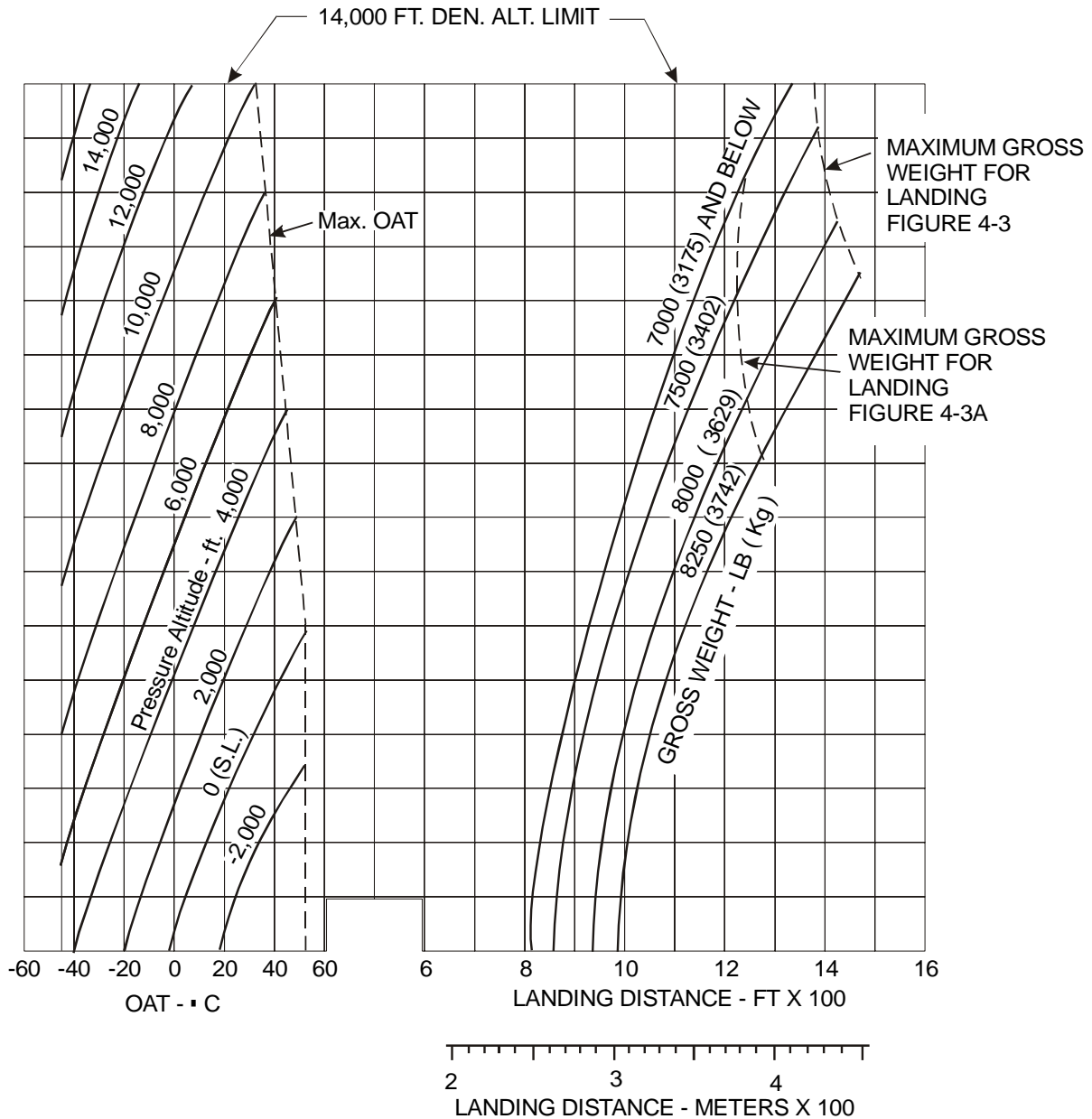


SINGLE ENGINE LANDING DISTANCE
OVER 50 FOOT (15 METER) OBSTACLE

POWER AS REQUIRED
 ENGINE RPM 97%
 GENERATOR 105 AMPS

RATE OF DESCENT 500 FT/ MIN
 HARD SURFACED RUNWAY
 40 KIAS AT 50 FEET
 HEATER/ ECS OFF
 ANTI-ICE OFF OR ON

INOPERATIVE ENGINE SECURED



RECOMMENDED STUDY MATERIAL

- List of Civil Aviation Publications (TP 3680E) - Contains titles, reference numbers, source and cost.
- When in Doubt... Small and Large Aircraft - Aircraft Critical Surface Contamination Training (TP 10643E).
- Air Command Weather Manual (TP 9352E)
- Air Command Weather Manual (Supplement) (TP 9353E)
- Human Factors for Aviation - Advanced Handbook (TP 12864E)
- Heliport and Helideck Standards and Recommended Practices (TP 2586E)
- AWARE (Aviation Weather... Playing by the Rules) Aeronautical Information Publication (A.I.P. Canada) (TP 2300E)
- *Canadian Aviation Regulations* (CARs)
- Radiotelephone Operator's Restricted Certificate Guide (Aeronautical)
- The Pilot's Guide to Medical Human Factors
- Canada Flight Supplement (CFS)
- Charts: - VFR Navigation (VNC)/VFR Terminal Area (VTA)/Enroute Low Altitude

Information on text books and other publications produced by commercial publishers can be obtained through local flying training organizations, bookstores and similar sources.

Publications used in pilot training in the United States are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (<http://www.access.gpo.gov/index.html>).

ENQUIRIES

Information concerning the location of pilot training organizations and matters pertaining to flight crew licensing may be obtained by contacting the appropriate Regional Offices. A complete listing may be found at: <http://www.tc.gc.ca/CivilAviation/General/Exams/Centres.htm>