ENSTROM HELICOPTER CORPORATION

ENSTROM 480 OPERATOR'S MANUAL

AND

FAA APPROVED ROTORCRAFT FLIGHT MANUAL

REPORT NO. 28-AC-022

DATED: JUNE 7, 1993

Revision 22, dated January 12, 2024, applies to the Enstrom 480 Operators and FAA Approved Rotorcraft Flight Manual, dated 7 June, 1993. Incorporate this revision by removing and inserting the pages listed below.

Remove pages	Insert pages
i	i
vi through xi	vi through xii
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LOG OF REVISIONS

REV NO	FAA APPROVAL	SUMMARY DESCRIPTION
22		Updated Record of Revisions and Table of Page Effectivity. Updated optional fuel management system information. Updated tail rotor gear box oil level checking and servicing. Updated Tables 8-1 through 8-3 for data clarification. Clarified ground handling operations note. Added autorotation RPM Check procedures for consistency with published 480B data. Added and clarified supplemental information data (bird strike and vortex ring state) for consistency with published 480B data.
	RYAN B NELSON Digitally signed by RYAN B NELSON Date: 2024.05.14 12:10:12 -05'00' *for* Manager, Flight Test & Human Factors Branch, AIR-710 Federal Aviation Administration	May 14, 2024 Approved Date

ENSTROM 480 OPERATOR'S MANUAL
EASA LOG OF REVISIONS

REV. NO.	DATE	EASA APPROVAL
1	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
2	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
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6	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
7	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
8	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
9	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
10	Sep 28/03	Article 3, Commission Regulation (EU) 748/2012
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19	May 1/17	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by M. Javed *
20	May 1/17	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by M. Javed *
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* T.I.P., Rev. 5 dated September 15, 2015, Section 3.2.11

♦ T.I.P., Rev. 6 dated September 22, 2017, Section 3.2.12

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LOG OF SUPPLEMENTS

SUPPLEMENT NO.	PAGES	DESCRIPTION	DATE	FAA APPROVAL
1	5-1-1 thru 5-1-6	Cargo Hook	6/1/94	Joseph C. Miess
2	5-2-1 thru 5-2-6	Snow Shoes	6/1/94	Joseph C. Miess
3	5-3-1 thru 5-3-6	External Fuel Filter	6/1/94	Joseph C. Miess
4	5-4-1 thru 5-4-6	Baggage Box Extension	6/1/94	Joseph C. Miess
5	5-5-i thru 5-5-6	Camera Door	8/12/96	Joseph C. Miess
6	5-6-i thru 5-6-22	Increased Rotor Speed & Torque Limits	8/12/96	Joseph C. Miess
7	5-7-i thru 5-7-8	Air Conditioning	11/27/96	Joseph C. Miess
8	5-8-i thru 5-8-8	Pop-out Floats	01/23/98	Joseph C. Miess

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7-29. Fuel Supply System

The helicopter is equipped with either "standard" fuel bladders or "crashworthy" fuel bladders designed to retain fuel in a crash and to minimize fuel spillage should the tanks separate from the aircraft or the lines separate from the fuel cells. The system shown in Figure 7.4 consists of two 45 gallon bladder type fuel cells mounted either side of the main rotor transmission. Each bladder is housed in a composite fuel cell structure and is interconnected to the other bladder through a 2.0 inch crossfeed line in the lower 1/3 of the fuel cell and a 1/2 inch overboard vent line. A 3/4 inch main fuel feed line from the lowest point in each bladder interconnects through the main fuel shutoff valve in a "tee" to provide the fuel to the engine equally from each cell. The main fuel shutoff valve is a ball type valve manually operated from the cockpit. It is activated by pushing the center button in and holding it in while pulling the knob fully out until it stops, approximately a 4 inch pull. Each fuel cell is equipped with sump drains plus the system is equipped with a low point drain before the fuel enters the engine. The capacitance fuel quantity probe is mounted in the right hand fuel cell. The fuel filler cap is located in the top of the left hand fuel cell. The right hand cell is filled by crossfeeding action during gravity refueling.

7-30. Fuel Management System

(1) The optional fuel management system consists of a fuel flow transducer and cockpit display unit (Shadin Miniflo-L or Digiflo-L).

a. The cockpit display unit is mounted in the instrument panel and consists of a six-segment digital display. The left three segments of the display are dedicated to fuel flow in pounds per hour based on 6.7 lb/gallon fuel density. The right-most three segments are switchable between displaying fuel endurance in hours and minutes, based on current fuel flow or fuel remaining, or fuel used in pounds. In addition to displaying the calculated fuel quantity in pounds, the system displays instantaneous fuel flow in pounds per hour, displays instantaneous endurance in terms of hours and minutes of flight time available at the current fuel flow, and displays fuel consumed in pounds.

b. Refer to the operation manual for the applicable fuel management system display unit installed (Shadin Miniflo-L or Digiflo-L) for functions, capabilities, and operating instructions.

(2) If an optional GPS system is installed, the fuel management system can provide the GPS system with real time fuel flow and fuel remaining through a serial port. Refer to the operation manual for the applicable GPS navigation system installed for functions, capabilities, and operating instructions for fuel management interface.

NOTE

The total fuel quantity in the fuel management system display is not automatically sensed by a fuel quantity probe; it must be manually entered at each refueling by noting the quantity displayed on the fuel quantity indicator and then entering that value into the digital display.

7-30.1. Fuel Quantity System

The capacitance probe located in the right fuel cell senses and reports actual fuel quantity on board by measuring the height of the fuel electronically and then displaying that quantity on the analog fuel quantity gage.

NOTE

The analog fuel quantity display is the primary source of fuel quantity information because it is a direct reading gage from the capacitance probe. If there is a discrepancy between the digital and analog display of fuel remaining the pilot should rely only on the analog display.

a. Low Fuel Caution Light

The low fuel cation light system consists of a float switch located near the capacitance fuel quantity probe. This switch activates the LOW FUEL light in the segmented caution panel when there are approximately five gallons of fuel or less remaining.

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8-6. Engine Oil System Servicing

The engine oil tank is located on the right side of the aircraft under the right engine access panel. Oil level is checked by removing the oil reservoir filler cap and observing the integral metal dip stick attached to the cap. Oil level should be checked within 15 minutes of engine shutdown. Refer to Table 8-1 for the capacity and the authorized oil.

The aircraft can be operated with either MIL-PRF-7808 (formerly MIL-L-7808) or MIL-PRF-23699 (formerly MIL-L-23699) oil. MIL-PRF-23699 is preferred for operation at ambient temperatures above -18EC (0EF). Table 8-2 lists the commercial products available which are approved for use in the engine.

WARNING

Mixing of oils from different series (MIL-PRF-7808 with MIL-PRF-23699) is permitted only in an emergency. The use of such mixed oils is limited to five hours total running time. Refer to the Rolls-Royce 250-C20 series Operation and Maintenance Manual.

CAUTION

Refer to the Rolls-Royce 250-C20 Series Operation and Maintenance Manual for information concerning use and mixing of approved turbine engine oils in the Rolls-Royce 250-C20W.

8-7. Main Rotor Transmission and Tail Rotor Transmission Oil Level Check and Servicing

a. Main Rotor Transmission. A sight glass located on the aft right side of the transmission housing can be viewed through the blades of the upper pulley fan by standing on the right side of the aft landing gear crosstube and looking down the tunnel under the upper plenum chamber. The oil level must be visible in the lower one half of the sight glass. If oil is visible then no additional oil is required. If oil is not visible, add oil until the oil is half way up the sight glass. Refer to Table 8-1 for the capacity and the authorized oil. Table 8-2 lists the commercial products available which are approved for use in the main rotor transmission.

b. Tail Rotor Transmission. A sight glass is provided on the aft side of the transmission. Minimum oil level is the middle of the sight glass (half-filled) with the tail cone approximately level. (If bubbles are present in the sight glass, raise and lower the tail to change the attitude of the helicopter to clear any bubbles from the sight glass.) If required, add oil until the oil begins to flow from the filler port with the aircraft sitting fairly level. The filler port for the transmission is located above the sight glass. Torque the filler plug (20 in-lb/2.3 Nm). Lockwire the filler plug and sight glass together after servicing the transmission. Refer to Table 8-2 for capacity and authorized oil. Table 8-3 lists the commercial products available which are approved for use in the tail rotor transmission.

NOTE

The quantity of oil used to service the transmission after an oil change will completely fill the sight glass. A small bubble will not be visible in the sight glass unless the aircraft is positioned in a tail high attitude.

TABLE 8-1. FUELS, LUBRICANTS, SPECIFICATIONS, AND CAPACITIES

SYSTEM	SPECIFICATION	CAPACITY
Fuel – Standard Bladders (P/N 4122052)	(See Notes 1 & 3)	91.7 gal (US) (90.0 gal (US) usable) 347.08 L (340.65 L usable) (See Note 4)
Fuel – Aerazur Bladders (P/N 4122009) (Aircraft S/N 5012 and earlier unless they have been converted to the "standard" bladders.)		90 gal (US) (89.7 gal (US) usable) 340.7 L (339.5 L usable) (See Note 4)
Engine Oil	MIL-PRF-7808 MIL-PRF-23699 (See Note 5)	12 pt (US) 5.7 L
Overrunning Clutch	MIL-PRF-23699 (See Table 8-3)	3.8 fluid oz (US) 110 ml
Overrunning Clutch with Vented Clutch Oil Reservoir (if equipped)	MIL-PRF-23699 (See Table 8-3)	6.5 fluid oz (US) 192 ml
Main Rotor Transmission	MIL-PRF-2105/API GL-5 (See Table 8-3)	6 U.S. pt (US) 2.84 L
Tail Rotor Transmission	MIL-PRF-2105/API GL-5 (See Table 8-3)	5 fluid oz (US) 0.15 L
Main Rotor Flapping Bearings	MIL-PRF-23699 (See Table 8-3)	As Required
Lower Pulley Bearings	MIL-PRF-23699 (See Table 8-3)	0.27 fluid oz (US) 8 ml

NOTES:

1. Refer to Table 8-3 and the Rolls-Royce 250-C20 Series Operation and Maintenance Manual (10W2) for a complete listing of the approved Primary, Emergency, and Cold Weather fuels.

2. [Deleted]

3. At ambient temperatures below 4°C (40°F), all fuels used shall contain Anti-Icing Additive conforming to MIL-DTL-85470. The Anti-Icing Additive shall be added to all commercial fuel, not already containing an anti-icing additive, during refueling operations. Refueling operations shall be accomplished in accordance with accepted commercial procedures. Commercial product PRIST® HI-FLASH™ conforms to MIL-DTL-85470.

4. The fuel cells for the standard fuel system are designed for a total capacity of 91.7 gallons (347.08 l) and the fuel cells for the crashworthy fuel system are designed for a total capacity of 90 gallons (340.65 l); however, differences in baffle installation in both the standard and crashworthy fuel system will result in a slight variance in total fuel capacity between aircraft.

5. The following is the recommended oil for the specified average daily temperatures:

Outside Temperature	Recommended Oil
-40°C(-40°F) and above	MIL-PRF-23699 or MIL-PRF-7808
-40°C (-40°F) and below	MIL-PRF-7808

TABLE 8-2. APPROVED COMMERCIAL OILS

MIL-PRF-7808

MANUFACTURER	MANUFACTURER'S DESIGNATION
American Oil	American PQ Lubricant 689
Castrol Inc.	Brayco 880
Mobil Oil Corporation	Mobil Avrex S Turbo 256, Mobil RM-201A, or Mobil RM-184A
Eastman Chemical Company	Turbo Oil (ETO) 2389
Exxon Company	Turbo Oil 2389
Stauffer Chemical	Stauffer Jet 1

MIL-PRF-23699

MANUFACTURER	MANUFACTURER'S DESIGNATION
Shell International Petroleum Co.	Aeroshell Turbine Oil 500
Chemtura Corporation Anderol Division	Royco Turbine Oil 500
American Oil and Supply Co.	American PQ Lubricant 6700
Air BP Lubricants	BPTO 2380
Caltex Petroleum Corp.	Caltex RPM Jet Engine Oil 5
Specialty Products Division	Castrol 5050
Chevron International Oil Co.	Chevron Jet Engine Oil 5
Eastman Chemical Company	ETO 2380
ExxonMobil	MJO II
Mobil Oil Corporation	Mobil Jet Oil II
Stauffer Chemical Company	Stauffer Jet II (Castrol 205)
NYCO America	Turbonycoil 600
Mobil Oil Corporation	Mobil Jet Oil 254 and Mobil Jet Oil 291 (HTS Oil)
Chemtura Corporation Anderol Division	Royco 560 (HTS Oil)
Shell International Petroleum Co.	Aeroshell Turbine Oil 560 (HTS Oil)
Eastman Chemical Company	ETO 2197
Air BP Lubricants	BPTO 2197

TABLE 8-2. APPROVED COMMERCIAL OILS (CONTINUED)

MIL-PRF-2105/API GL-5

MANUFACTURER	MANUFACTURER'S DESIGNATION
Exxon Mobil Corp.	Mobil 1 Synthetic Gear Lubricant LS 75W-90 Mobil Delvac 1[1] Synthetic Gear Oil 75W-90 Mobilube HD LS 80W-90 Mobilube HD Plus 80W-90
Shell Oil Company	Shell Spirax® S Gear Lubricant 75W-90 Shell Spirax® HD 80W-90
Esso	Esso Gear Oil GX 75W-90 Esso Gear Oil GX Extra 75W-90
BP Lubricants USA, Inc.	Syntorq GL-5 75W Castrol Syntrax Limited Slip 75W-90 (Syntec Gear Oil)

TABLE 8-3. APPROVED PRIMARY, EMERGENCY, AND COLD WEATHER FUELS

TYPE	SPECIFICATION	LIMITATIONS
Primary	ASTM D1655 Jet A, A-1, F-24 ASTM D6615 Jet B MIL-DTL-5624 JP-4 & JP-5 MIL-DTL-83133 JP-8 GOST 10227 Grade TS-1 or RT (Russia) STAS 5639-88, Grade TH (Romania) GB 6537, Grade No. 3 (Peoples Republic of China) GSTU 320.00149943.007-97 Grade -RT(PT) (Ukraine) GSTU 320.00149943.011-99 Grade -TS-1(TC-1) (Ukraine) Defense Standard 91-091 (Jet A-1) (UK)	With anti-ice additive **(See Note below)**
Emergency	ASTM D910 AVGAS (without TCP)	All Grades, Maximum 6 hours operation per overhaul period. With anti-ice additive
Cold Weather	MIL-DTL-5624 JP-4 ASTM D6615 Jet B ASTM D910 AVGAS-Jet fuel mixture **(See Note below)**	With anti-ice additive

[1] Mobil Delvac 1 75W-90 supersedes Mobil Delvac 75W-90 and Mobil SHC 75W-90.

NOTE

At ambient temperatures below 4°C (40°F), all fuels used shall contain Anti-Icing Additive conforming to MIL-DTL-85470. The Anti-Icing Additive shall be added to all commercial fuel, not already containing an anti-icing additive, during refueling operations. Refueling operations shall be accomplished in accordance with accepted commercial procedures. Commercial product PRIST® HI-FLASH™ conforms to MIL-DTL-85470.

NOTE

The AVGAS-jet fuel mixture is an alternate fuel which may be used if starting problems are encountered in areas where JP-4 or commercial Jet B cannot be obtained. The mixture shall be one part by volume AVGAS to two parts by volume commercial jet fuel. The AVGAS shall conform to ASTM D910, grades 80, 91, or 100LL with a maximum of 0.53 ml/liter maximum lead content. Do Not use ASTM D910 grade 100 with 1.06 ml/liter lead content. The commercial jet fuel may be JP-5, Jet A, or A1.

SECTION VII. GROUND OPERATION

8-12. Ground Handling

Ground Handling Wheels. A set of dual ground handling wheels is provided for moving the aircraft on the ground. The ground handling wheels attach to the skids at the lugs provided near the aft oleo struts. The wheels are an over center type. The wheels must be removed from the skids prior to flight.

NOTE

Do not move aircraft by means of pushing or pulling on the stabilizers or by pushing on the nose of the cabin.

8-13. External Power

A 28-volt DC unit with a minimum output of 300 amperes is required for starting.

a. Turn the helicopter battery and Generator switches OFF.

b. Turn the external power OFF.

c. Plug the external power source cable securely into the external power receptacle.

d. Turn the external power source ON.

e. Turn the helicopter battery switch ON.

8-14. Parking

a. Retract the ground handling wheels and remove, allowing the helicopter to rest on its skids.

b. Install the main rotor tie down.

c. Install static ground.

d. Install the main rotor hub cover.

e. Install the tail rotor gearbox and hub cover.

8-15. Snow and Ice Removal

a. Remove all ice and snow accumulations from the top of the cabin, the top of the fuselage adjacent to and forward of the inlets, and from both inlet particle separator swirl tube assemblies prior to any flight.

b. The best method of unblocking swirl tubes blocked by snow is to pull the aircraft into a heated hangar, open the rear inspection panel on the upper plenum, and use a heat gun on LOW heat to blow from the inside of the plenum back through the swirl tubes until all snow has melted. Shop air can then be used to gently blow remaining moisture from the inside toward the outside of the swirl tube panel. DRY OFF the rest of the fuselage and blades and observe the following CAUTION for resumed operation:

CAUTION

Install covers over the blades and inlets prior to moving the aircraft from a heated hangar out into any precipitation where the outside air temperature is at or below freezing. Let the aircraft cool for at least 30 minutes before removing all covers for flight. Remove all ice and snow that has built up on the fuselage before removing covers. Minimize any delays in starting the engine and rotor after removing all covers to prevent snow from re-accumulating on the fuselage and flying surfaces.

SECTION VIII. AUTOROTATION RPM

8-16. Autorotation RPM Check

In order to autorotate throughout the complete range of gross weights and altitudes, the autorotation RPM must be set according to the schedule shown in Figure 8-5.

The autorotation RPM should be checked any time the blades are overhauled, or different blades are installed. Blade tracking should have a very minor effect on autorotation RPM, but eventually these minor effects could add up to a significant change, so it is recommended to check the autorotation RPM after the aircraft has been tracked several times. If required, the autorotation RPM is adjusted to comply with the autorotation RPM schedule. The autorotation RPM adjustment is a maintenance function, which is described in the maintenance manual.

A pilot may perform the autorotation RPM check as follows: (Refer to Figure 4-3 for the density altitude chart and Figure 8-5 for the autorotation RPM chart.)

NOTE

Perform the autorotation RPM check with light gross weight. At heavier gross weight, the RPM will exceed 385 with the collective fully down.

a. Determine the weight of the helicopter as it will be flown during the RPM check (reference Section 6). It is important to accurately know the gross weight of the helicopter including fuel and occupants when the RPM is recorded in step f.

b. Set the altimeter to 29.92 in Hg (1013 mbar) (pressure altitude).

c. Climb to an altitude that allows a safe recovery from autorotation. Record altitude and temperature.

WARNING

Autorotation should be entered at a high enough altitude to allow the pilot to stabilize the autorotation, record the data, and recover at a safe altitude and conducted over a suitable landing area in case of engine failure.

d. Climb an additional 500 ft (or to an altitude sufficient to permit a stabilized autorotation while descending through the previous recorded altitude).

e. Establish the helicopter in a stabilized autorotation at 60 KIAS with the collective full down. Do not allow the rotor RPM to exceed 385 RPM or to fall below 334 RPM.

f. Record rotor RPM passing through the altitude from step c.

g. Compare the rotor RPM, outside air temperature (OAT), and pressure altitude readings with the information provided in Figures 4-3 and 8-5. The actual RPM should be within ± 5 RPM of the chart.

h. If the RPM is not correct as indicated by the autorotation RPM chart, adjust the RPM as described in Paragraph 9-4 of the maintenance manual.

i. If the RPM is adjusted, re-check the RPM as described in steps a through g of this procedure.

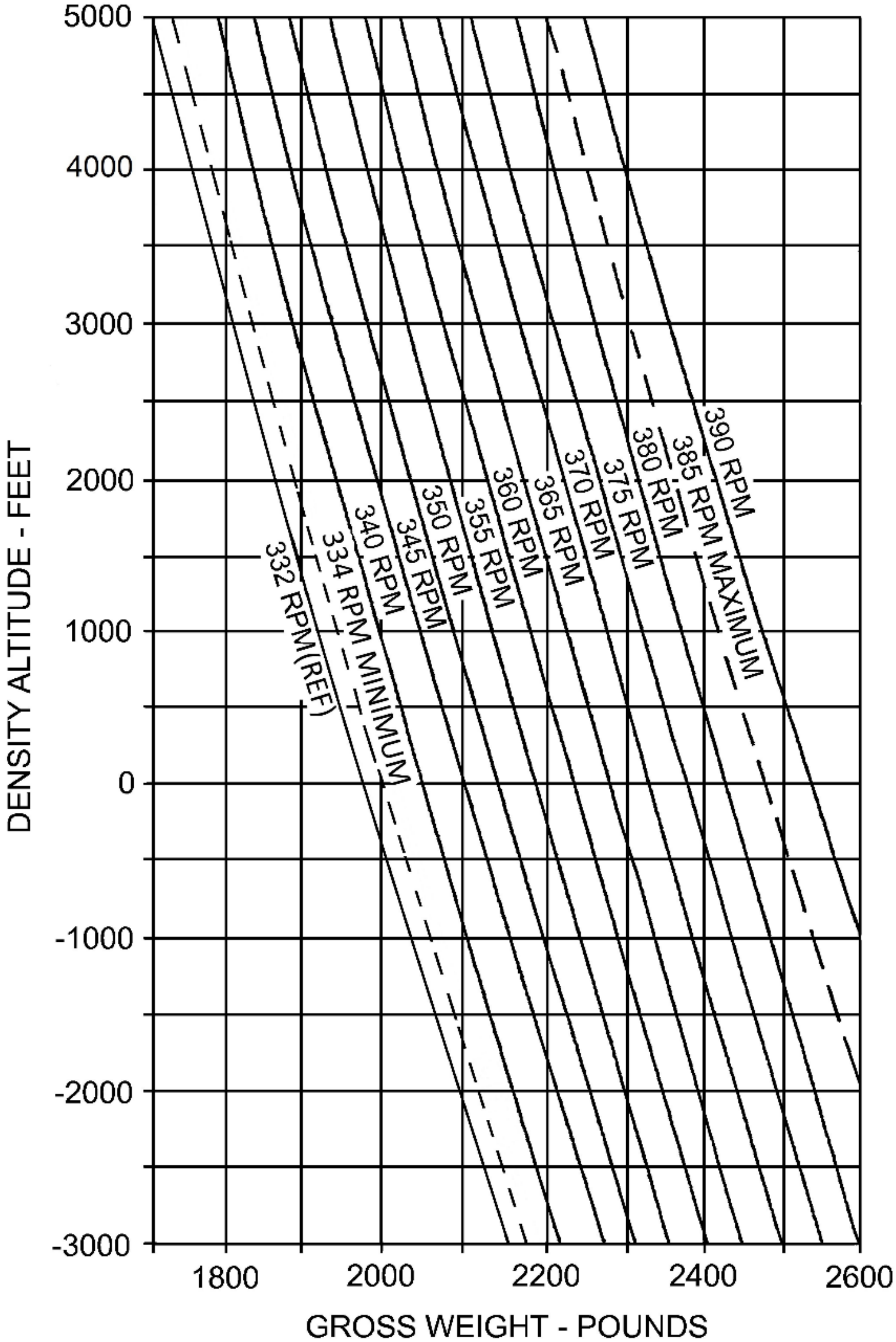

Figure 8-5. Autorotation RPM Chart

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9-1. Starting

1. The helicopter can be started in a maximum wind velocity, including peak gusts, of 45 knots. The maximum gust spread is 15 knots.

9-2. Engine Starting

1. Acceleration Time. The engine should start and accelerate to idle within the times shown in Figure 9-1. If the start time becomes significantly longer than those shown in Figure 9-1, consult maintenance personnel.

9-3. Oil Consumption

1. The maximum oil consumption allowed is 0.05 gallons/hour at normal cruise rated power. If oil consumption increases, consult maintenance personnel.

9-4. Control Movements

1. Abrupt control movements should be avoided, including rapid and repetitive anti-torque pedal reversal. This restriction in no way limits normal control application.

9-5. Slope Landings

1. Slope landings have been demonstrated with the slope 90 degrees either side of the nose up to a maximum of 15 degrees.

CAUTION

Caution must be exercised when landing on slopes that available cyclic travel is not exceeded. Also, if any droop stop pounding is encountered as the collective is lowered the landing must be aborted and a slope with less angle selected.

9-6. Minimum Transient Rotor Speed

1. The minimum allowable transient rotor speed following engine failure or sudden power reduction for practice forced landing is 300 RPM. This is a transient limit and positive corrective action (lowering the collective) must be taken immediately by the pilot to regain at least 334 RPM (minimum power off rotor RPM). Lowering the collective to full down will quickly restore rotor RPM to the normal operating range under most flight conditions. Throttle chops or engine failure from the high hover point on the Height-Velocity (H-V) curve, along with the forward cyclic displacement required to achieve 20 degrees nose down attitude for recovery, may result in the rotor speed decreasing below the minimum power off rotor RPM limit but not below the minimum transient limit of 300 rotor RPM The (H-V) curve was developed taking this characteristic into account so that proper energy is available to return the rotor to the normal operating range prior to touchdown.

9-7. Flight Over Salt Water

1. Salt spray in turbine engines may result in a deterioration in performance as well as a loss in compressor stall margin. Flight in a salt water environment below 500 feet AGL and near a large body of salt water will also have an impact on engine health. Following any exposure to a salt water environment, ie. Hovering over salt water or flight operations within 5 nautical miles of an ocean coastline below 500 feet AGL, appropriate entries should be made in the aircraft log book reflecting flight altitudes, duration of exposure, and other pertinent information so that maintenance personnel can perform an engine compressor wash and rinse the airframe with fresh water.

9-7.1. Bird Strike

1. Operating in areas of high concentrations of birds or flocking birds increases the likelihood of a damaging bird strike as airspeed increases and altitude AGL decreases. When operating at lower altitudes during takeoff and climbout, the rotorcraft should be operated at lower airspeeds to decrease the likelihood and severity of a potential bird strike. Though regional differences exist during spring and fall migration periods, operating at altitudes below 2,500 fee AGL may increase the likelihood of a damaging bird strike.

9-8. Operating Characteristics

1. The flight characteristics of this helicopter, in general, are similar to other single main rotor with a single tail rotor helicopters. This helicopter is capable of hovering in winds from any azimuth up to 35 knots.

9-9. Retreating Blade Stall

1. Blade stall occurs at higher forward speeds when a portion of the retreating blade stalls because of the reduced relative velocity of airflow over the blade at high blade angles. When the airspeed of the tip of the retreating blade falls below a predetermined value, or when a relative blade angle exceeds a predetermined value, blade stall will be experienced. If blade pitch is increased (as with increased collective or forward cyclic control), or if the forward speed is increased, the stalled portion of the rotor disc increases, and the stall progresses from the tip toward the root of the retreating blade. During maneuvers that increase the g-load, such as sharp turns or high-speed flares from diving descents, where rapid application of collective or cyclic pitch control is involved, severe blade stall may be encountered. Severe blade stall may also be encountered in turbulent air by gust-induced load factors or corrective control applications by the pilot. In the stall condition, each main rotor blade will stall as it passes through the stall region, creating a three per rev vibration. When significant blade stall is encountered a mild roughness will be noted along with some cyclic control feedback that will cause the cyclic to have a tendency to displace aft of the trimmed position. The vibration due to the blade stall will increase as blade stall progresses, as will the requirement for forward force to maintain the cyclic in the initial trimmed position. Both of these cues should provide adequate warning that blade stall is being encountered. Severe turbulence or abrupt control movement at this point will increase the severity of the stall but will not cause any loss of control to occur. In this helicopter, there is not as pronounced a tendency for the fuselage to pitch up and roll left in response to the rotor stalling as may be experienced in other helicopters, but if the rotor is held in a stalled condition and the blade stall is aggravated, the helicopter will eventually exhibit this pitch and roll tendency. Even though blade stall may be encountered, the helicopter is fully controllable even in severe blade stall because of the blade design and the high rotor control power inherent in this rotor design. Blade stall may be eliminated by any or all of the following actions:

a. Gradually decrease the severity of the maneuver.

b. Gradually decrease collective pitch.

c. Gradually decrease airspeed.

d. Increase the rotor speed to maximum power on RPM by beeping the engine to 103% N_2.

9-10. Vortex Ring State (Settling With Power)

CAUTION

Flight conditions causing Vortex Ring State should be avoided at low altitudes because of the loss of altitude necessary for recovery.

1. Vortex Ring State may occur when a helicopter is flown below transitional lift with more than 20% torque applied and a decent rate over 300 feet per minute. Under this condition, the helicopter is descending through the air displaced by its own rotor system. The downwash then recirculates through the helicopter rotor system and results in reduced rotor efficiency. This condition can be recognized by increased roughness accompanied by a rapid build-up in rate of descent. Increasing collective pitch alone only tends to aggravate the situation. The Vuichard technique is very effective at recovering from settling with power. This technique uses the tail rotor thrust and the cyclic to move the advancing blade into clear air, at which point the vortex ring will dissipate. Recovery can be completed with much less altitude loss than with traditional techniques.

2. The Vuichard technique can be performed as follows: Simultaneously, apply sufficient right cyclic to cause a 10° to 20° bank, apply left pedal to maintain heading, and increase collective.

3. During approach for landings at high gross weights, conditions associated with Vortex Ring State should be avoided.

9-11. Loss of Tail Rotor Effectiveness

Loss of tail rotor effectiveness (LTE) is a phenomenon which can occur in any single main rotor/anti-torque tail rotor helicopter. Although the 480B has a very effective tail rotor and does not exhibit any tendencies for LTE, the pilot should be aware that the potential for LTE, however small, does exist. As such, pilots should be aware of the causes and recovery techniques.

There are a number of factors which reduce the effectiveness of the tail rotor or increase the thrust required from the tail rotor. These factors include high power settings, low airspeeds, left crosswinds or tailwinds, and right, yawing turns. Under exactly the right conditions, these factors can combine to make the tail rotor virtually ineffective. This LTE can be recognized by an uncommanded right yaw which can not be stopped using the tail rotor pedal alone. Recovery from LTE can be accomplished by increasing forward speed, lowering the collective if altitude permits, and applying left pedal. The longer corrective actions are delayed, the more difficult it will be to recover from LTE.

9-12. Ground Resonance

Ground resonance is an aerodynamic phenomenon associated with fully articulated rotor systems. It develops when the rotor blades move out of phase with each other and cause the rotor disc to become unbalanced. The chance of encountering ground resonance in the 480B is very remote; however, the potential does exist if the main rotor dampers or oleo struts are severely degraded or damaged.

If severe vibrations are encountered on the ground when bringing the main rotor rpm up to operating speed, immediately turn the throttle to the flight idle position. If severe vibrations are encountered when the main rotor rpm is at operating speed, immediately hover the aircraft and allow the vibrations to dampen. Attempt to land the aircraft. If severe vibrations are encountered again, immediately hover the aircraft, allow the vibrations to dampen, and perform a hovering autorotation.