ENSTROM HELICOPTER CORPORATION

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March 20,2025

ENSTROM 480B OPERATOR'S MANUAL
AND
FAA APPROVED ROTORCRAFT FLIGHT MANUAL

REPORT NO. 28-AC-023, Revision 25 Change Pages

Revision 25, dated 27 Jan 2025, applies to the Enstrom 480B Operator's and FAA Approved Rotorcraft Flight Manual. Incorporate this revision by removing and inserting the pages listed below.

Remove pages	**Insert pages**
i through xiv	i through xvi
INTRO-1 through INTRO-2	INTRO-1 through INTRO-2
INTRO-5 through INTRO-10	INTRO-5 through INTRO-10
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LOG OF REVISIONS

Rev. No.	Date	FAA Approved
1	April 10/02	Joseph C. Miess
2	Sept 05/03	Joseph C. Miess
3	Feb 2/04	Joseph C. Miess
4	Sep 9/04	Joseph C. Miess
5	Sep 27/04	Joseph C. Miess
6	Apr 11/05	Joseph C. Miess
7	Jun 6/06	Joseph C. Miess
8	Sep 17/06	Joseph C. Miess
9	Mar 6/07	Joseph C. Miess
10	Apr 11/07	Joseph C. Miess
11	Dec 5/07	Joseph C. Miess
12	Feb 14/08	Joseph C. Miess
13	Apr 23/08	Joseph C. Miess
14	Apr 16/10	Joseph C. Miess
15	Jul 16/10	Joseph C. Miess
16	Sep 20/10	Joseph C. Miess
17	Jan 25/11	Joseph C. Miess
18	Jul 15/11	M. W. Anderson
19	Jan 18/12	Joseph C. Miess
20	Jul 3/12	Joseph C. Miess
21	Jan 14/13	Joseph C. Miess
22	Aug 17/15	Ronald D. McElroy
23	May 19/16	Ronald D. McElroy
24	May 21/19	Ryan Nelson

Approved by the Manager,
Southwest Flight Test Section, AIR-713
Federal Aviation Administration
Ft. Worth, TX

LOG OF REVISIONS

REV NO	FAA APPROVAL	SUMMARY DESCRIPTION
25		General updates
	RYAN B NELSON Digitally signed by RYAN B NELSON Date: 2025.03.18 13:01:33 -05'00' FTP, AIR-712, *for*	18 Mar 2025
	Manager, Flight Test & Human Factors Branch, AIR-710 Federal Aviation Administration	Approved Date

NOTE

All revisions are indicated by a black vertical line.

EASA LOG OF REVISIONS

Rev. No.	Date	EASA Approved
1	Sep 28/03	*
2	Sep 28/03	*
3	May 29/05	2005-4677
4	May 30/05	2005-4682
5	May 29/05	2005-4678
6	Jun 1/05	Decision 2004/04/CF
7	Jun 6/06	Decision 2004/04/CF
8	Sep 17/06	Decision 2004/04/CF
9	Aug 2/07	EASA.IM.R.C.01427
10	Jan 18/08	EASA.IM.R.C.01426
11	Apr 17/08	EASA.IM.R.C.01442
12	NOT EASA APPROVED (SUPP. #10, EFIS)	
13	NOT EASA APPROVED (SUPP. #10, EFIS)	
14	Apr 4/13	EASA 10044309
15	Mar 7/13	EASA 10043956
16	Jan 27/14	EASA 10045751
17	Aug 28/13	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by G. J. Michalik♦
18	May 8/14	EASA 10044744
19	Aug 28/13	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by G. J. Michalik♦
20	Oct 10/13	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by G. J. Michalik▲
21	Jan 27/14	EASA 10045751
22	May 1/17	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by M. Javed●
23	May 1/17	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by M. Javed●
24	Jul 11/19	FAA/EASA T.I.P.; FAA Approved on Behalf of EASA by M. Javed◊
25	Mar 18/25	FAA/EASA T.I.P.; EASA Approved▼

*Article 3, Commission Regulation (EU) 748/2012

- ♦ T.I.P. Section 3.2.11
- ▲ T.I.P., Rev. 3 dated April 23, 2013, Section 3.2.11
- ● T.I.P., Rev. 5 dated September 15, 2015, Section 3.2.11
- ◊ T.I.P., Rev. 6 dated September 22, 2017, Section 3.5.12
- ▼ T.I.P., Rev. 7 dated October 19, 2023, Sections 3.3 and 3.5.12.4

LOG OF SUPPLEMENTS

Sup. No.	Description	Date	FAA Approved
1	Cargo Hook	Feb 9/01	Joseph C. Miess
2	Snow Shoes	Feb 9/01	Joseph C. Miess
3	External Fuel Filter	Feb 9/01	Joseph C. Miess
4	Baggage Box Extension	Feb 9/01	Joseph C. Miess
5	Camera Door	Feb 9/01	Joseph C. Miess
6	Emergency Floats	Sep 5/03	Joseph C. Miess
7	Air Conditioning	Sep 9/04	Joseph C. Miess
8	Nose Positioned Camera Mount	Jun 6/06	Joseph C. Miess
9	Searchlight	Jun 6/06	Joseph C. Miess
10	EFIS	Feb 14/08	Joseph C. Miess

APPROVED FOR THE MANAGER
CHICAGO AIRCRAFT CERTIFICATION OFFICE
CENTRAL REGION
FEDERAL AVIATION ADMINISTRATION

EASA LOG OF SUPPLEMENTS

Sup. No.	Description	Date	EASA Approved	FAA Approval on Behalf of EASA
1	Cargo Hook	Sep 28/03	*	N/A
2	Snow Shoes	Sep 28/03	*	N/A
3	External Fuel Filter	Sep 28/03	*	N/A
4	Baggage Box Extension	Sep 28/03	*	N/A
5	Camera Door	Sep 28/03	*	N/A
6	Emergency Floats	May 29/05	2005-4677	N/A
7	Air Conditioning	May 30/05	2005-4682	N/A
8	Nose Positioned Camera Mount	Jun 6/06	Decision 2004/04/CF	N/A
9	Searchlight	Jun 6/06	Decision 2004/04/CF	N/A
10	EFIS	NOT APPROVED		

* Article 3, Commission Regulation (EU) 748/2012

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1. Indexes, figures, and tabular data where the change cannot be readily identified.

2. Blank space resulting from the deletion of text, illustration, or a table.

3. Correction of minor errors, such as spelling, punctuation, relocation of material, etc. unless such correction changes the meaning of the material.

INTRO-7. Use of Words, Shall, Should, and May

Within this technical manual, the word "shall" is used to indicate a mandatory requirement. The word "should" is used to indicate a nonmandatory but preferred method of accomplishment. The word "may" is used to indicate an acceptable method of accomplishment.

INTRO-8. Definitions of Abbreviations

Table INTRO-1 provides definitions for abbreviations used in this manual. The same abbreviation applies for either singular or plural applications.

Table INTRO-1. List of abbreviations

ABBREVIATION	DEFINITION
ABS	Absolute
AGL	Above Ground Level
AH	Amp Hour
ALT	Altitude
B.L.	Butt Line
C	Celsius
CAS	Calibrated Airspeed
CG	Center of Gravity
C.L.	Center Line
CONF	Configuration
CONT	Continuous
END	Endurance
F	Fahrenheit
FAA	Federal Aviation Administration
FLT	Flight
FPM	Feet per Minute
F.S.	Fuselage Station
FSII	Fuel System Icing Inhibitor
FT	Foot

TABLE INTRO-1. LIST OF ABBREVIATIONS

FT/MIN	Feet per Minute
FWD	Forward
GAL	Gallon
GAL/HR	Gallon per Hour
GW	Gross Weight
HR	Hour
Hz	Hertz (Cycles per Second)
IAS	Indicated Airspeed
IGE	In Ground Effect
IN	Inch
IN-LB	Inch-Pound (Force)
IN HG	Inches of Mercury
ISA	International Standard Atmosphere
KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed
km	Kilometer
KT	Knot
l or L	Liter
LB	Pound
LB/HR	Pound per Hour
MAX	Maximum
MB	Millibars
ml or mL	Milliliter

TABLE INTRO-1. LIST OF ABBREVIATIONS

MIN	Minimum
MIN	Minute
N_1	Gas Producer Turbine Speed
N_2	Power Turbine Speed
NICAD	Nickel Cadmium
NO.	Number
NM	Nautical Mile
Nm	Newton Meter
OAT	Outside Air Temperature
OGE	Out of Ground Effect
OZ	Ounce
PT	Pint
PRESS	Pressure
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch Gauge
R/C	Rate of Climb
R/D	Rate of Decent
REV.	Revision
RFM	Rotorcraft Flight Manual
RPM	Revolutions per Minute
SHP	Shaft Horsepower
SPEC	Specification
STA	Station
SQ FT	Square Feet

TABLE INTRO-1. LIST OF ABBREVIATIONS

SUP.	Supplement
TAS	True Airspeed
TEMP	Temperature
TOT	Turbine Outlet Temperature
TRQ	Torque
V_D	Maximum Design Dive Speed
VDC	Volts, Direct Current
V_H	Maximum Level Flight Airspeed at Maximum Continuous Power
V_{NE}	Velocity Never Exceed
	(Airspeed Limitation)
V_Y	Best Rate of Climb Airspeed
WT	Weight
XMSN	Transmission

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CHAPTER 1. OPERATING LIMITATIONS

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Gas Producer Turbine (N_1)	105% Continuous
	106% for 15 seconds
Power Turbine (N_2)	See Figure 1-2

3. Engine Starting

a. Start Cycle Time. The minimum time between ground starting attempts is 30 seconds.

b. Minimum Oil Temperature. The minimum oil temperature for starting is -54°C for MIL-PRF-7808 series oil and -40°C for MIL-PRF-23699 series oil.

c. Oil Pressure During Start. A positive indication of oil pressure must be obtained when 59% N_1 is reached and must stabilize at least at 50 PSI at idle.

CAUTION

Following starts in very cold ambient conditions, the oil pressure may exceed 130 PSI immediately after start up to a maximum of 150 PSI. The engine must not be accelerated from idle until the oil pressure has returned within the specified limits.

4. Ambient Temperature and Altitude Limits. The ambient temperature limits for the engine are -54°C from sea level to 20,000 feet pressure altitude, and up to +54°C from sea level to 6,000 feet then decreasing linearly to 27°C at 20,000 feet pressure altitude using primary fuels.

NOTE

The maximum operating altitude for the 480B is 13,000 feet density altitude (Refer to paragraph 1-12).

5. Fuel Operational Limits

a. Fuels shall conform to MIL-DTL-5624 (formerly MIL-T-5624) Grade JP-4 or JP-5, MIL-DTL-83133 (formerly MIL-G-83133) Grade JP-8, ASTM D1655 Jet A or A-1, or ASTM D6615 Jet B.

b. [Deleted]

c. At ambient temperatures below 4°C (40°F), all fuels used shall contain a fuel system icing inhibitor (FSII) additive conforming to MIL-DTL-85470. FSII shall be added to all commercial fuel, not already containing a FSII additive, during refueling operations.

CAUTION

Avoid using FSII additives packaged in aerosol cans. Failure to exactly follow the additive mixing procedures during refueling can result in incorrect additive concentrations, fuel system contamination, and possible engine stoppage.

6. Lubrication System Limits

a. Oil Specification. Approved oils for the engine are MIL-PRF-23699 (Formerly MIL-L-23699) or MIL-PRF-7808 (Formerly MIL-L-7808).

b. Oil Pressure Limits

94.2% N_1 and above	115-130 PSI
78.5%- 94.2% N_1	90-130 PSI
Below 78.5% N_1	50-130 PSI

1-10. Starter Limits

1. Starter limits are as follows:

a. If no TOT within the first 20 seconds:

EXTERNAL POWER	BATTERY POWER
25 seconds ON	40 seconds ON
30 seconds OFF	60 seconds OFF
25 seconds ON	40 seconds ON
30 seconds OFF	60 seconds OFF
25 seconds ON	40 seconds ON
30 minutes OFF	30 minutes OFF

b. If rise in TOT occurs during the first 20 seconds:

EXTERNAL OR BATTERY POWER
1 minute ON
1 minute OFF
1 minute ON
1 minute OFF
1 minute ON
30 minutes OFF

NOTE

Below 40°F (4°C) the starter engage time limits do not apply.

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1-13. Load Limits

1. Weight. The maximum gross weight of the helicopter is 3,000 pounds when operating at density altitudes from sea level up to 10,000 feet. The maximum gross weight of the helicopter is 2,850 pounds when operating at density altitudes from 10,000 feet to 13,000 feet.

2. Center of Gravity. The Center of Gravity Limitations Chart is presented in Chapter 6. Weight/ Balance and Loading. The limitations are as follows:

a. AFT CG is 140.9 in. at 3,000 pounds gross weight expanding linearly to 143.0 in. for all weights at and below 2,500 pounds.

b. FWD CG is 134.0 in. for all weights up to 2,200 pounds and decreasing linearly to 136.9 in. at 3,000 pounds gross weight.

3. Lateral Center of Gravity. The lateral center of gravity is expressed in terms of lateral offset moment. The lateral offset moment limits are ±7500 in-lbs.

4. The maximum allowable weight in the baggage box is 150 pounds.

5. The maximum allowable weight on the optional baggage shelf behind the pilot's seat is 50 pounds.

1-14. Maneuvers

1. Aerobatics. Aerobatic maneuvers, (over 90 degrees in pitch or roll), are prohibited.

CAUTION

The engine is approved for operation at 90 degrees pitch up and down and zero (0) g for 10 seconds only. Dwelling at these conditions longer than 10 seconds can damage the engine.

1-15. Environmental

1. Ambient Temperature. The maximum operational temperature is 106°F (41°C) at sea level to 59°F (15°C) at 13,000 ft. The minimum operational ambient temperature is -25°F (-32°C).

NOTE

For aircraft serial number 5114 and subsequent, the maximum ambient temperature limit is 122°F (50°C) at sea level to 75°F (24°C) at 13,000 ft if the aircraft is equipped with Engine Access Panels, P/N 4220150 (screened panels). For aircraft serial numbers 5087 through 5113, the maximum ambient temperature limit is 122°F (50°C) at sea level to 75°F (24°C) at 13,000 ft if the aircraft is equipped with the Increased Cooling Kit, P/N 4230031.

2. All de-ice and anti-ice systems, including the scavenge air for the particle separators and engine anti-ice, must be turned on when flying in the presence of visible moisture at outside temperatures of 40°F (4°C) or below and always during flight at night when the outside air temperature is 40°F (4°C) or below.

3. Falling or Blowing Snow. Flight in falling and blowing snow is authorized provided the following conditions are met:

a. Particle Separator scavenge air is ON continuously.

b. Engine Anti-Ice is ON continuously.

c. Prior to initial takeoff and each subsequent takeoff, the helicopter air and oil cooler inlets are inspected for possible accumulations of snow, slush, or ice and <u>all</u> accumulations are removed from the exterior of the particle separator and the cabin surface adjacent to and ahead of the inlet.

d. Prior to initial takeoff and each subsequent takeoff, the plastic particle separator ejector tubes on the aft end of the upper plenum are inspected for obstructions and snow and all such obstructions removed.

CAUTION

Restrict hover operations in heavy snow conditions (1/2 mile/.8 km visibility or less) to 10 minutes or less per flight.

1-16. Restrictions in Use of Anti-torque Pedals

1. Avoid rapid pedal reversals (hard kicks) both on the ground and in flight.

1-17. Placards

1. Placards that are to be placed in view of the pilot are:

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

(and)

THIS HELICOPTER IS APPROVED FOR OPERATIONS UNDER DAY AND NIGHT VFR-NON-ICING CONDITIONS ONLY

2. Beneath the fuel filler port on the left side of the aircraft:

CAP. 90 U.S. GAL JP-4/JET-A **USE MIL-DTL-5624 / ASTM D1655** **AT TEMPERATURES BELOW 4°C (40°F) FUEL MUST CONTAIN MIL-DTL-85470 FUEL ADDITIVE** **(SEE RFM TABLE 8-2 FOR APPROVED ALTERNATE FUELS)**

3. V_{NE} Placards: (See Figure 1-5 for the V_{NE} Placards. The placards are located overhead above the center of the forward wind screen or on top of the instrument panel).

4. Placards located inside the baggage compartment door:

MAX ALLOWABLE CARGO 150 LBS

(and)

OBSERVE C.G. AND GROSS WEIGHT LIMITATIONS

5. Placard on baggage shelf behind pilot’s seat:

MAX. LOADING – 50 LBS.

(and)

BAGGAGE MUST BE SECURED PRIOR TO TAKEOFF AND LANDING

CHAPTER 2. NORMAL PROCEDURES

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2-23. Sideward and Rearward Hovering Flight

1. From a stabilized hover, apply cyclic control pressure in the desired direction of flight to begin sideward or rearward movement. Maintain the desired heading with the pedals and height with the collective. The speed should not exceed that of a brisk walk. To return to a stationary hover, apply cyclic pressure opposite the direction of movement while coordinating collective pitch and pedals to maintain the desired height and heading.

2-24. Hover Taxi

1. From a stabilized hover, apply forward cyclic pressure to begin movement. Maintain the desired heading with the tail rotor pedals and height with the collective. The speed should not exceed that of a brisk walk. Changes in direction should be made primarily with pedal control to avoid excessive bank angles. To stop the forward movement, apply aft cyclic pressure while coordinating collective and pedals to maintain the desired height and heading.

2-25. Cyclic Trim

1. As required.

2-26. Hover Check

1. Perform the following checks at a hover:

a. Flight controls – Check flight controls for correct response.

b. Engine and transmission instruments – Check.

c. Flight instruments – Check as required.

(O) (1) Altimeter and IVSI – Check for proper indications of climb and descent.

(2) Inclinometer – Ball free in the race.

(O) (3) Turn needle, heading indicator, and magnetic compass – Check for proper turn indications left and right.

NOTE

Hover turns in excess of 30° per second will cause the RMI/HSI compass system (if installed) display of heading to be inaccurate.

(O) (4) Attitude indicator – Check for proper indications of nose high and low, and banks left and right.

(5) Airspeed indicator – Check airspeed.

d. Engine power – Check. The power assurance check will allow the pilot to determine if sufficient power is available for takeoff and to achieve the performance calculated during the preflight preparation. The check is performed by establishing a stable hover and recording the pressure altitude, OAT, torque, TOT, and N_1. The actual TOT is then compared with the TOT determined from the power assurance check chart in Chapter 4 (Figure 4-10). If the actual TOT is less than or equal to the chart TOT the pilot is assured that the helicopter will achieve flight manual calculated performance. (If the actual TOT is higher than the chart TOT, reference the Rolls-Royce Compressor Bleed Control Valve graph[1] to verify the bleed valve was closed at the time of check. The helicopter may need to be at max gross weight for an accurate TOT indication.) As a final check, the actual torque required to hover is then compared with the predicted values from the performance chart in Chapter 4.

2-27. Before Takeoff

1. Immediately prior to takeoff, the following checks shall be accomplished:

a. N_2 – 103%

b. Systems – Check engine, transmission, electrical, and fuel systems indications.

[1] *Rolls-Royce M250-C20 Series Operation and Maintenance Manual, Figure 22, Compressor Bleed Control Valve Operation*

SECTION III. PASSENGER BRIEFING

2-41. Passenger Briefing

1. The following is a guide that should be used in accomplishing required passenger briefings. Items that do not pertain to a specific flight should be omitted.

a. Normal Procedures:

(1) Entry and exit of aircraft

(2) Seating

(3) Seat belts (briefing is required by the FAA).

(4) Internal communications

(5) Security of equipment

(6) Smoking

b. Emergency Procedures:

(1) Emergency exits

(2) Emergency equipment

(3) Emergency landing/ditching procedures

SECTION IV. ADVERSE ENVIRONMENTAL CONDITIONS

2-42. Cold Weather Operations

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

NOTE

At ambient temperatures below 4°C (40°F), it is required for the fuel to contain a fuel system icing inhibitor (FSII) additive. See Chapter 1, "Operating Limitations." Also, to ensure consistent starts at ambient temperatures below 4°C (40°F), it may be necessary to use JP-4 or Jet B. See Chapter 8, "Handling, Servicing and Maintenance."

2-43. Cold Weather Inspection

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

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SECTION III. TORQUE AVAILABLE

4-12. Description

1. The torque available chart shows the effects of altitude and temperature on engine power available.

4-13. Chart Uses

1. Figure 4-4 shows the maximum torque available as limited by either the transmission or the engine. The primary use of the chart is to provide the pilot information on the maximum power available either as a function of the helicopter limits or the flight conditions. Since both pressure altitude and outside air temperature effect engine power it is necessary that the pilot enter the chart with both values. By entering the chart at the left side at the known pressure altitude and moving right to the known OAT, then straight down to the bottom, available torque is obtained.

CAUTION

The engine power output can exceed the transmission structural limit (72 PSI) under certain conditions. Where the torque obtained from this chart is less than the transmission limit, the engine TOT will be at the 810°C (1490°F) limit at the torque obtained. It is the responsibility of the pilot to monitor and observe both the torque (transmission) and TOT (engine) limits during all operations where maximum power is required.

4-14. Conditions

1. The maximum torque available chart is based upon engine speed of 103% N_2 and main rotor speed of 372 RPM with Jet A fuel. The use of aviation gasoline will not

influence engine power. Fuel grades Jet A, A-1, JP-4 and JP-5 will all yield the same nautical miles per pound of fuel. The heavier density of the JP-5 and Jet A type fuels will only result in increased fuel weight per gallon. Because JP-4, JP-5, and Jet A have the same energy value per pound, JP-5 and Jet A fuel will increase range by approximately 3-4 percent per gallon of fuel over JP-4.

4-15. Effect of Engine Bleed Air Usage

1. Operation of the Engine Anti-Ice, Scav-Air, and/or Bleed Air Heater/Defroster results in higher TOT, N_1 speed and fuel flow to achieve the same torque setting. Because the engine power is torque limited in the 480B, torque will normally be the limiting consideration. However, in some conditions, TOT or N_1 may approach operational limits thus limiting the power available. Table 4-1 lists the approximate effect of using Engine Anti-Ice, Scav-Air, and/or Bleed Air Heater/Defroster on engine performance. This table is based on sea level standard day conditions.

Table 4-1. Effect of Engine Bleed Air Usage

TYPE OF OPERATION	APPROX. EFFECT ON PERFORMANCE (@ power levels above 78.5% N_1)
Constant TOT (810°C) (Takeoff Power)	37 SHP decrease, 1.82% N_1 decrease
Constant N_1 of 101%	13 SHP decrease, 38°C TOT increase
Constant SHP and constant collective	0.88% N_1 increase, 56°C TOT increase and up to 20% increase in fuel consumption

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CARGO HOOK

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SEARCHLIGHT

SECTION I. GENERAL

5-9-1. Introduction

1. This supplement must be attached to the Basic Flight Manual when the Searchlight Kit, P/N 4220056 is installed on the aircraft. Operation in compliance with Chapter 1, Operating Limitations, of the Basic Flight Manual is mandatory except as modified by this supplement. Other approved sections and supplemental data are recommended procedures.

5-9-2. Description

1. The Searchlight Kit, P/N 4220056, provides for installation of a SpectroLab, Inc. SX-5 Starburst® Searchlight. Two mounting options allow for either a standard mount or an elevated mount. The elevated mount must be used if the aircraft is equipped with the Emergency Floats Kit, P/N 4220091.

2. The Searchlight Kit consists of a tubular mount that attaches to the right side of the landing gear assembly aft crosstube and the associated airframe wiring installation. The SX-5 Starburst® system consists of the searchlight and gimbal assembly, junction box assembly, control box assembly, and associated wiring harnesses. The electrical power circuit for the searchlight is protected by a 40 amp current limiter (fuse) located in the keel assembly under the cabin floor or in the right side engine compartment.

NOTE

This flight manual supplement provides general operating procedures for the SX-5 Starburst® Searchlight. Always refer to the latest revision of the SX-5 Starburst® Searchlight User's Manual (Doc# 031718) for specific operating procedures.

SECTION II. OPERATING LIMITATIONS

5-9-3. General

1. Same as Basic Flight Manual.

5-9-4. Placards

1. The following placard must be installed in view of the aircraft crew (SpectroLab P/N 031751):

- MONITOR ELECTRICAL LOADMETER WITH SEARCHLIGHT ON. REDUCE ELECTRICAL LOAD AS NEEDED TO REMAIN WITHIN CONTINUOUS OPERATING LIMITS.
- MAGNETIC COMPASS UNRELIABLE WHEN SEARCHLIGHT IS OPERATING.
- TURN OFF SEARCHLIGHT WHEN ENTERING CLOUDS OR FOG. DO NOT OPERATE SEARCHLIGHT BELOW 50 FEET.
- RETURN SEARCHLIGHT TO HORIZONTAL BEFORE LANDING

2. The following placard must be installed in view of the aircraft crew if the aircraft is equipped with the emergency pop-out floats:

WARNING
TURN SEARCHLIGHT OFF
BEFORE DEPLOYING EMERGENCY
POP-OUT FLOATS

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CHELTON FLIGHT SYSTEMS EFIS

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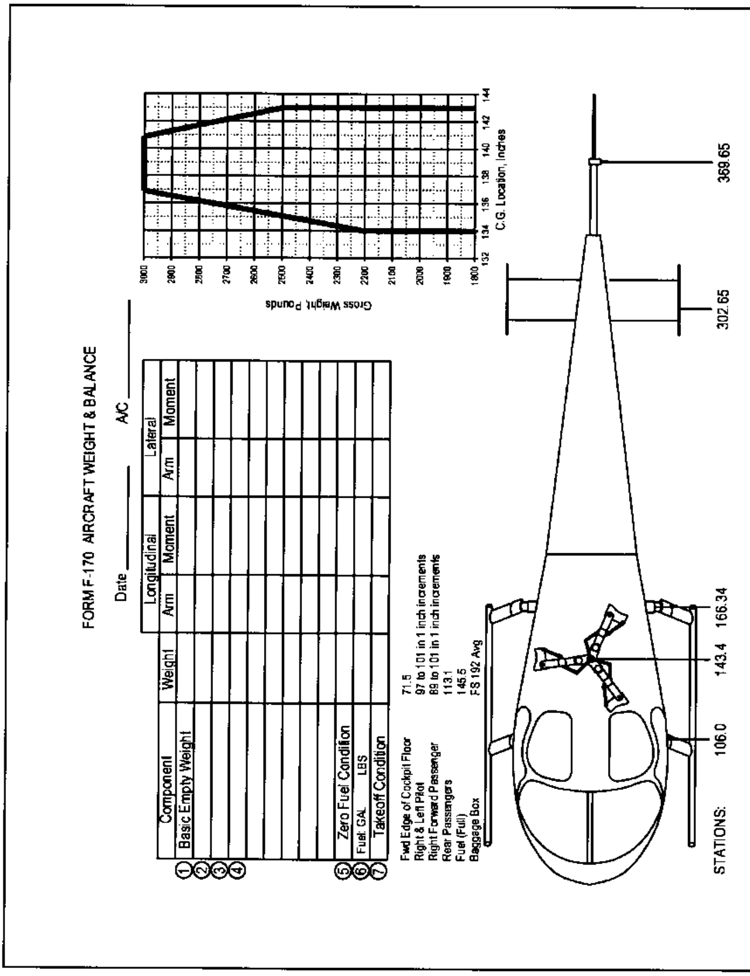
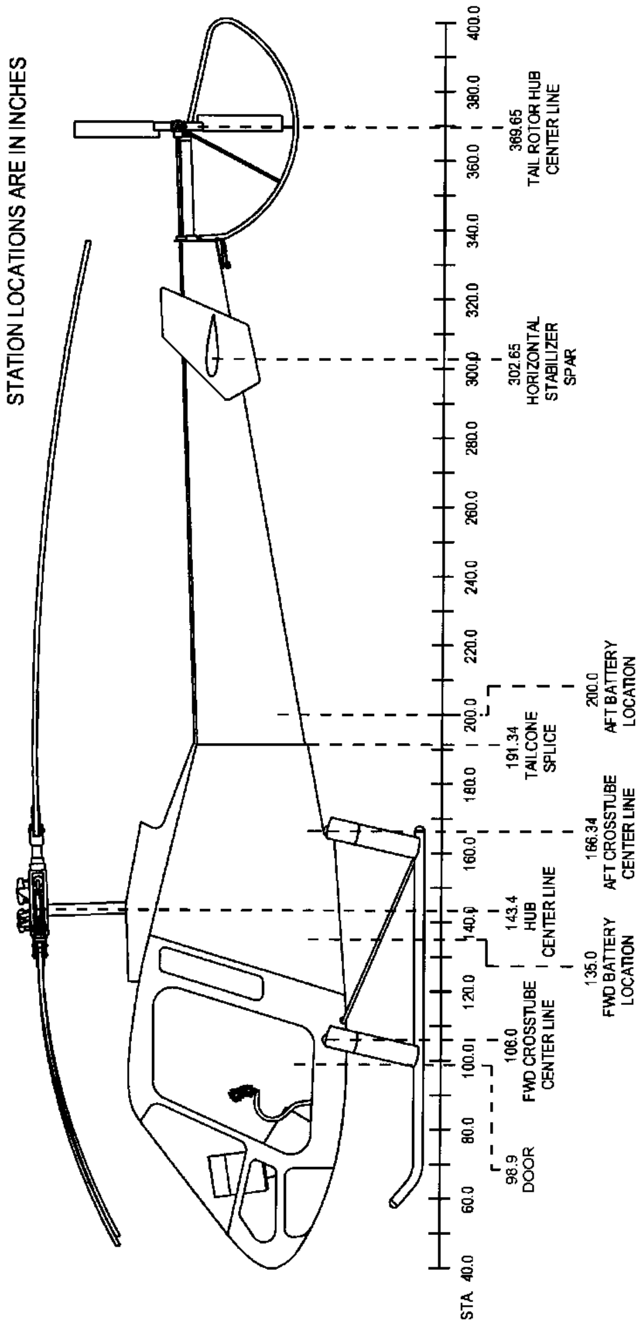


Figure 6-6. Aircraft Weight and Balance Computation Form



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CHAPTER 7 HELICOPTER AND SYSTEMS DESCRIPTION AND OPERATION

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5. Power and Accessory Gearbox. The main power and accessory drive gear trains are enclosed in a single gear case. The gear case serves as the structural support of the engine. All engine components, including the engine mounted accessories are attached to the case. Accessories driven by the power turbine gear train are the power turbine (N_2) tachometer generator and the power turbine governor. The gas producer gear train drives the compressor, fuel pump, gas producer (N_1) tachometer generator, gas producer fuel control, pressure and scavenge oil pumps, and the starter-generator.

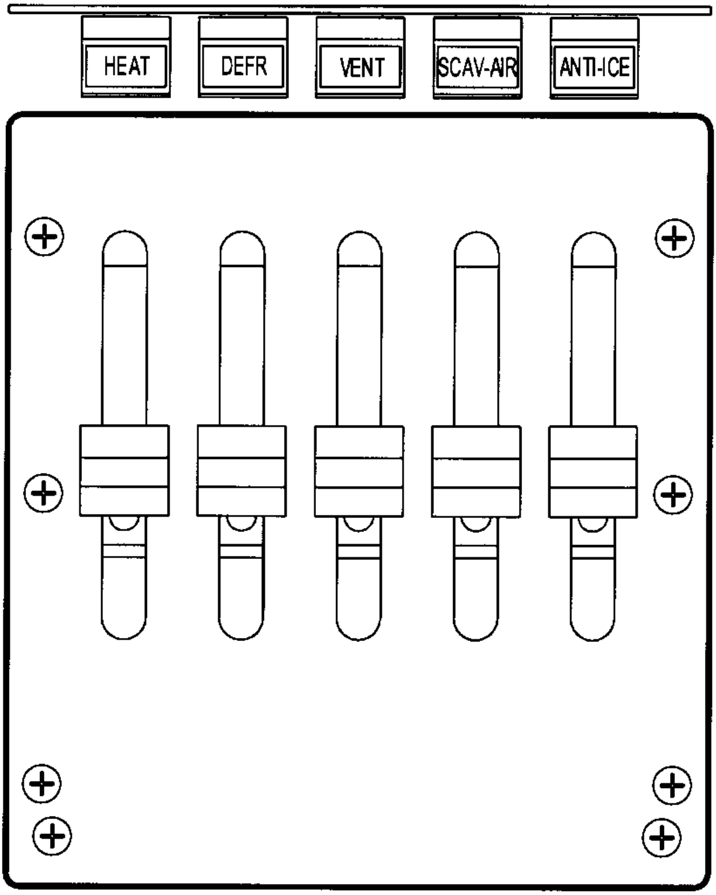
7-17. Engine Compartment Cooling

1. The engine compartment is cooled by natural convection augmented by a fan integral to the upper drive pulley.

2. Aircraft serial number 5114 and subsequent are equipped with fuselage panels/cowls that have additional holes to increase the cooling efficiency of the engine compartment and can be equipped with Engine Access Panels, P/N 4220150 (screened panels), to allow aircraft operation at an increased maximum ambient temperature limit. Serial numbers 5087 through 5113 can be equipped with the Increased Cooling Kit, P/N 4230031, for operation at the increased maximum ambient temperature limit. Refer to paragraph 1-15 for the increased maximum ambient temperature limit for properly equipped aircraft.

7-18. Air Induction System

1. The aircraft is equipped with dual full flow swirl tube inertial type particle separators. Particle laden air is directed into the upper plenum chamber through a series of swirl tubes which impart a centrifugal spin to the air as it enters the tubes, thereby inertially separating the heavier foreign matter. The particulate matter falls down into a collector and is then purged overboard through one of two bleed air driven venturi-type ejectors that exit at the aft face of the upper plenum. The scavenge ejectors are manually controlled by the **SCAV AIR** control located in the control panel mounted on the aft side of the center pedestal. During takeoff, hovering, or cruise operations in dusty atmospheric conditions, the scavenge ejectors can be turned on by moving the **SCAV AIR** control to the **ON** position (Figure 7-5).



NOTES

1. MOVE CONTROL UP FOR "ON" AND DOWN FOR "OFF"

2. "HEAT", "DEFR", AND "VENT" ARE OPTIONAL EQUIPMENT. LOCATION OF "SCAV-AIR" AND "ANTI-ICE" MAY VARY DEPENDING ON CUSTOMER SPECIFICATION.

Figure 7-5. Slide Control Panel

until reaching fully closed at approximately 93% N_1 at sea level standard conditions. The values where the bleed air valve starts to close and is fully closed will vary with altitude and temperature.

7-25. Ignition and Start System

1. The starter switch, located in the switch box on the pilot's and copilot's collective is a pushbutton type switch. When the switch is pressed, the circuit to the starter relay actuating coil and the igniter unit are energized. The switch is released when the engine starts or the starter time limit expires. The circuit is protected by the **START RLY** and **IGN EXCITE** circuit breakers. For aircraft S/N 5135 and earlier, the starter switch is located in the switch box on the pilot's collective only.

7-26. Engine Oil Supply

1. The lubrication system is a circulating dry sump type with an external reservoir, scavenge filter, and heat exchanger. A gear-type pressure and scavenge pump assembly is mounted within the gearbox. The oil filter, filter bypass valve, and pressure regulating valve are located in the lower right hand side of the gearbox housing and are accessible from the bottom of the engine. The engine oil tank is located on the right side of the aircraft in the upper engine compartment where it is easily accessible for preflight and servicing through the right hand engine access panel. The tank has a capacity of 6 quarts/5.7 liters. The engine oil cooler (heat exchanger) is upstream of the reservoir. The oil passes through the oil cooler and is cooled by air supplied by a high volume oil cooler blower. An external scavenge oil filter is installed between the oil cooler and the engine. All engine oil system lines and connections are internal except the pressure and scavenge lines to the front compressor bearing and the bearings in the gas producer and power turbine supports.

7-27. Engine Chip Caution Light

1. Magnetic chip detectors are installed at the bottom of the gearbox and at the engine oil outlet connection. The chip detectors are non-fuzz burning, connected in parallel,

and incorporate a Programmable Continuity Sensor (PCS). Any time electrical power is applied to the caution panel, the PCS will go through a 5 second continuity check to ensure that the circuit is complete. Also, if so equipped (see paragraph 7-76.3.a), any time the caution panel test switch is placed in the test position for more than three seconds, the PCS will go through the continuity check for the circuit. During that time, the **ENG CHIP** caution light will remain illuminated then extinguish. If there is a break anywhere in the circuit the caution light will not respond to the 5 second test. During normal operation, any chip detected on either plug will activate the **ENG CHIP** caution light on the caution panel.

7-28. Engine Instruments and Indicators

1. The engine instruments and indicators are mounted in the instrument panel or the caution panel. The pointer of each indicator will be at the “park” position until power is turned on. Once the system is powered, each indicator pointer will move from the “park” position to the current input signal for that indicator. Earlier aircraft may be equipped with indicators that perform a power-on self-test sequence (Refer to paragraph 7-28.9).

2. Engine Out Warning. The caution panel logic circuit senses the output from the gas producer (N_1) tachometer generator. Power is supplied through the **CAUT PNL** circuit breaker and connections are made to the **ENGINE OUT** warning light and to a tone generator which produces an oscillating tone. The warning system is activated until the N_1 reaches 58% ± 1% and is deactivated when the gas producer speed is above that value. The engine out audio is distinctly different from the low rotor audio and when activated the engine out audio tone generator produces an oscillating warble tone.

3. Audio Warning Microswitch. An audio warning microswitch is installed in the collective control system. This switch enables the pilot to disable the audio signal by lowering the collective to the full down position. The audio microswitch is located at the base of the pilot's collective on the collective torque tube.

4. Torque Indicator. The engine torque indicator (**TRQ**), located in the instrument panel, is a micro-

Engine oil temperature (**TEMP**) is displayed on the left half of the indicator and is driven by a temperature probe at the engine oil tank outlet. The indicator's microprocessor continuously monitors "sensor reasonableness" and for some earlier aircraft, may perform a power-on self-test (Refer to para. 7-28.9). The micro-processor in the indicator will illuminate the LED RED when the operating limits for engine oil temperature and/or pressure are exceeded (Refer to para. 7-76.2.c). The indicator is powered by the aircraft 28-volt electrical system through the **ENG/TEMP PRESS** circuit breaker.

NOTE

Early 480B's are not equipped with the microprocessor based indicator.

9. Power-On Self-Tests. The TORQUE, TOT, ENGINE OIL TEMP/PRESS, and the GAS PRODUCER (N_1) TACHOMETER indicators are microprocessor based indicators. For some earlier aircraft, these indicators may perform a power-on self-test when power is supplied to the indicator. During the self-test, the LED on the indicator face illuminates RED as the pointer moves from the "park" position to the maximum indication. The LED will change to GREEN during the pointer movement. When the pointer reaches the maximum indication, the LED extinguishes and the pointer returns to the "park" position, and then it indicates the current input signal for the indicator. If the self-test fails, the LED indicator flashes RED at a 2 Hz rate for approximately 30 seconds and the pointer moves to the "park" position. The self-test will occur anytime power is disconnected from the indicator for more than 5 seconds. The microprocessor also continuously monitors "sensor reasonableness." If the microprocessor senses an input that exceeds the predefined "reasonable" limits (limits outside of the normal minimum and maximum limits), the LED indicator flashes RED at a 4 Hz rate for approximately 30 seconds and the pointer moves to the "park" position.

10. Caution Lights.

a. The **ENG INLET** caution light is discussed in the air induction system section, paragraph 7-19.

b. The **FUEL FILTER** caution light is discussed in the paragraph 7-22.

c. The **ENG CHIP** caution light is discussed in paragraph 7-27.

d. The **ENG OIL TEMP** caution light will illuminate when the engine oil temperature reaches 107°C ascending and will extinguish at 100°C descending. A set of contact closures in the dual engine oil temperature/pressure indicator send a signal to the caution panel logic circuit at each of the above set points to turn the caution light either on or off accordingly.

e. The **ENG OIL PRESS** caution light will illuminate under the following conditions:

(1) Oil pressure is below 50 psig, at any N_1 speed.

(2) Oil pressure is less than 88 psig and N_1 is above 78.5%. The light will extinguish as the pressure rises above 90 psig.

(3) Oil pressure is above 130 psig, at any N_1 speed.

f. The microprocessor in the TORQUE, TOT, ENGINE OIL TEMP/PRESS, and the GAS PRODUCER (N1) TACHOMETER indicators will illuminate the LED RED when an operating limitation is exceeded. The LED will extinguish when the indication is within normal operating limitations. Depending on which operating limitation is exceeded, the illuminated LED may or may not have a corresponding indication with the Caution and Warning Systems (Refer to para. 7-76.2.c).

NOTE

Early 480B's are not equipped with the microprocessor based indicators.

7-30. Fuel Quantity System

1. Capacitance Probe. The capacitance probe, located in the right fuel cell, senses actual fuel quantity in the fuel cell by measuring the height of the fuel electronically.

2. Fuel Quantity Indicator. The fuel quantity indicator (**FUEL QTY**), located in the instrument panel, is a microprocessor based indicator that uses the signal from the capacitance probe to indicate total fuel quantity in the fuel cells. The indicator assumes there is an equal amount of fuel in each fuel cell. The indicator and capacitance probe are powered by the aircraft 28-volt electrical system through the **FUEL QTY** circuit breaker. The indicator's microprocessor performs a power-on self-test when power is connected to the indicator and also continuously monitors "sensor reasonableness" (Refer to para. 7-28.9). The microprocessor in the indicator will illuminate the LED RED when there is less than 35 lbs/16 Kg of fuel in the cells. The fuel quantity indicator LED low fuel indication is independent of the Low Fuel Float Switch in the aircraft Caution and Warning System.

NOTE

Early 480B's are not equipped with the microprocessor based indicator.

NOTE

The fuel quantity indicator 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 fuel quantity indicator and the optional fuel management system, the pilot should rely only on the fuel quantity indicator.

3. Low Fuel Caution Light. The low fuel caution light system consists of a float switch located near the capacitance fuel quantity probe. This switch activates the **LOW FUEL** light in the caution panel when there are approximately 5 gallons/19 liters of fuel remaining.

7-31. Fuel Management System

1. The optional fuel management system consists of a fuel flow transducer and cockpit display unit.

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 Shadin Miniflo-L operation manual for the fuel management system display unit installed 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.

strength, shock resistant treated cord which provides dimensional stability and long flex life. This cord runs in a continuous fashion around the circumference of the belt and is imbedded in a fiber reinforced rubber compound for maximum cord support and adhesion. There is no splice in the belt. It is one continuous roll with an outside Kevlar® skin bonded to the belt itself for maximum strength. The belt is installed under a constant 2000 pounds/909 kg static tension and is capable of accepting well over 350 SHP/261 kW without slipping. The belt is installed over the upper and lower pulleys then tensioned by two jack screws on the H-strut.

7-48. Indicators and Caution Lights

1. Main Transmission Oil Temperature Indicator. The **XMSN OIL TEMP** indicator is a microprocessor based indicator and displays the temperature of the transmission oil in degrees Celsius. The indicator's microprocessor performs a power-on self-test when power is connected to the indicator and also continuously monitors "sensor reasonableness" (Refer to para. 7-28.9). The microprocessor in the indicator will illuminate the LED RED when the maximum oil temperature limit is exceeded (Refer to para. 7-76.2.c). The indicator is powered from the aircraft 28-volt electrical system through the **XMSN** or **XMSN TEMP** circuit breaker.

2. Main Transmission Oil Hot Caution Light. The **MAIN XMSN HOT** caution light on the caution panel will illuminate when the main transmission oil reaches a temperature of 107°C and rising, and will extinguish when the oil temperature reaches 100°C decreasing. The circuit receives its signal from a set of contact closures within the main transmission oil temperature indicator and its electrical power from the aircraft 28-volt electrical system through the **CAUT PNL** circuit breaker.

3. Drive Bearing Hot Caution Light. This caution light is discussed in paragraph 7-44.

4. Main and Tail Rotor Transmission Chip Detector Caution Lights.

a. General. Both the main and tail rotor transmissions have magnetic chip detectors installed. Whenever sufficient metal particles collect on the plugs to close the electrical circuit, the associated chip caution light will illuminate. Each caution light receives its signal from its associated chip detector and power from the aircraft 28-volt electrical system through the **CAUT PNL** circuit breaker.

b. Programmable Continuity Sensors. Incorporated in each chip detector circuit is a Programmable Continuity Sensor (PCS). Any time electrical power is applied to the caution panel, the PCS will go through a 5 second continuity check to ensure that both circuits are complete. Also, if so equipped (see paragraph 7-76.3.a), any time the caution panel test switch is placed in the test position for more than three seconds, the PCS will go through the continuity check for both circuits. During that time, the **MAIN XMSN CHIP** and **TAIL CHIP** caution lights will remain illuminated then extinguish. If there is a break in continuity anywhere in the circuit, the associated caution light in the faulty circuit will not respond to the 5 second test.

With the collective off of the down stop the low rotor RPM horn will activate generating a pulsing tone of 2900 Hz at 80-95 decibels. The system threshold can be adjusted using the potentiometer on the top of the signal conditioning unit. Power for the low rotor RPM warning system is provided by the aircraft 28-volt electrical system through the **LOW/RTR RPM** circuit breaker. There is no high rotor RPM warning.

3. The Hi/Lo Rotor RPM Warning System provides a visual and audio indication of low and high rotor RPMs. This system is essentially identical to the low rotor RPM warning system except it also indicates when the rotor RPM exceeds the upper limit. As with the low rotor RPM system, the horn is silenced when the collective is fully down. Thus, the horn will not sound if the RPM limit is exceeded during an autorotation with the collective fully down; the light will still illuminate.

7-52. Tail Rotor System

1. The tail rotor assembly is a two bladed, teetering, delta hinged rotor system. It is composed of two blade and grip assemblies mounted on a common spindle by a set of angular contact ball (thrust) bearings and a needle bearing assembly per blade and grip assembly. The center hub is teeter mounted in the spindle by two needle bearings. The center hub is splined to match the tail rotor transmission output shaft for positive mounting and driving. Pitch control of the tail rotor is accomplished through cables up to a sliding pivot yoke, then through pitch change links to the blade grips.

SECTION VIII. HEATING AND VENTILATION

7-53. Bleed Air Heater and Defroster System

1. Cabin heating and windshield defrosting can be provided by an optional bleed air type system which consists of bleed air lines, two bleed air valves, two heater ejectors, two defroster flow diverters, and associated distribution system. The heater control valve is located under the cabin floor and the heater control, labeled **HEAT,** is used to operate the valve which modulates the bleed air flow to control the amount of heat supplied to the cabin. The heater control is located on the aft side of the center pedestal (Figure 7-5). The defroster control valve is also located under the cabin floor and its control, labeled **DEFR**, is located on the aft side of the center pedestal (Figure 7-5). When turned on, the heater ejectors use hot compressor bleed air to pull cabin air into a small mixing chamber and then expel the warm air into the cabin through eyeball socket type nozzles on both sides of the center pedestal near the pilot's and copilot's feet. The nozzles can be swiveled to direct warm air as the crew desires. The defroster system diverts some of the bleed air used for the heater system and routes it to a set of two ejectors and distributors mounted forward of the instrument console at the base of each front windshield. There is a small effect on aircraft performance when the heater and/or defroster system is used which is addressed in Chapter 4, Performance Data.

7-54. Windshield Demister

1. Windshield demisting can be provided by an optional demister fan assembly. The fan assembly is powered by the aircraft 28-volt electrical system through the **DEMIST FAN** fuse (3 amp) located in the fuse panel on the left side of the center pedestal or a 1 amp circuit breaker (**DEMIST**) located on the lower pedestal. The fan is controlled by the **DEMISTER** switch located at the bottom of the center pedestal panel.

NOTE

The aircraft will either be equipped with the Bleed Air Heater and Defroster System or the Windshield Demister.

7-60. Generator Caution Light

1. Anytime that the DC generator output voltage is less than the battery voltage or the generator is OFF or otherwise disconnected from the aircraft main bus, the generator caution light, marked **DC GEN** on the caution panel, will illuminate.

7-61. Controls and Indicators

1. Volt-Ammeter. The dual indicating volt-ammeter (**DC**), located on the instrument panel, is a microprocessor based indicator and indicates the main bus voltage **(VOLT**) and the current load (**AMP**) being used. The indicator's microprocessor performs a power-on self-test when power is connected to the indicator and also continuously monitors "sensor reasonableness" (Refer to para. 7-28.9). The microprocessor in the indicator will illuminate the LED RED when the maximum operating limits are exceeded (Refer to para. 7-76.2.c). The indicator is powered by the aircraft 28-volt electrical system through the **VOLT/AMP** circuit breaker.

2. Battery Switch. The **BATT** switch is located at the top of the center pedestal panel. Battery electrical power is supplied to the helicopter's electrical system when the switch is in the **ON** position. When the switch is in the **ON** position, it closes the circuit to the battery relay coil and battery power is then connected to the main electrical bus. When the switch is placed in the **OFF** position, it opens the circuit to the battery relay coil and battery power is disconnected from the main electrical bus.

3. Generator Switch. The generator switch, labeled **MAIN GEN**, is located at the top of the center pedestal panel to the left of the battery switch. In the **ON** position the generator field is energized through the generator control unit and 28-volt generator power is supplied through the generator relay to the main electrical system bus. In the **OFF** position, the generator is disconnected from the main electrical bus.

NOTE

On S/N's 5039-5076 and 5078-5084, the generator switch will be automatically tripped OFF if the engine starter button is pushed. It must be placed ON after the engine start is complete. On S/N's 5077, 5085 and subs., the generator switch must manually be cycled to RESET then ON if the starter button is pushed with the generator switch ON.

4. N1-N2-NR-TOT Switch. The **N1-N2-NR-TOT** switch (Figure 7-10.1), located at the top right side of the instrument panel, controls the emergency electrical power circuits that provide power to the gas producer (N_1) tachometer, Dual (N_2/N_R) tachometer, and the TOT indicator in case of a complete electrical system failure. Emergency power is supplied to the indicators by moving the switch from the **BUS** position to the **BATT** position. The emergency electrical power circuits are protected by the N1, N2, NR, and TOT circuit breakers located on the right side of the back wall in the engine compartment (Figure 7-11). A yellow LED, located next to the switch, illuminates when the switch is in the **BATT** position.

NOTE

Early 480B's are equipped with a gas producer tachometer which does not require aircraft electrical power for operation. The emergency electrical power switch in these aircraft is labeled N2-NR-TOT.

5. Avionics Master Switch. The **AVI MSTR** switch (Figure 7-4), located at the top of the center pedestal panel, controls and provides electrical power to the avionics bus. Equipment such as GPS/Nav/Com, transponder, CDI, HSI, or EHSI, or other avionic units are typically connected to the avionics bus. Switching the **AVI MSTR** to the OFF position disconnects electrical power to the avionics bus.

SECTION XII. CAUTION AND WARNING SYSTEMS

7-76. Caution and Warning Systems

1. The caution system consists of a caution panel located in the instrument panel, and a remote **MASTER CAUTION** annunciator/switch, which is also a push-to-reset switch, located on the instrument panel. Additionally, microprocessor based indicators for the engine, main rotor transmission, fuel quantity, and electrical systems are equipped with an LED that illuminates RED when an operating limitation is approached or exceeded. The warning system consists of three individual red warning lights located at the top of the instrument panel. The purpose of the caution and warning system is to provide visual indication, suitable for day and night operation, that a fault condition has occurred.

NOTE

Early 480B's are not equipped with the microprocessor based indicators.

2. Caution System. The caution panel, depicted in Figure 7-13 and described in Table 7-1 is composed of 20 individually worded segments which, when illuminated, identify specific fault conditions. The worded segments are only visible when illuminated. Each segment has four LEDs wired as two pairs of independent circuits so that the failure of a single LED will produce only a dimming effect. When a fault occurs, the associated worded segment on the caution panel illuminates flashing at a 2 Hz rate, and the **MASTER CAUTION** annunciator/switch (light) also illuminates flashing at the same rate. When the pilot acknowledges the fault by pressing in on the **MASTER CAUTION** light, the **MASTER CAUTION** light will extinguish and the fault on the caution panel will reset to a steady ON condition. Each fault condition, as it occurs, is indicated by the same sequence of events as described above. In each case, only the new fault will flash until acknowledged. Only faults annunciated by the caution panel will activate the **MASTER CAUTION** light (**ROTOR RPM**, **ENGINE OUT**, and **FIRE** will not activate the **MASTER CAUTION** light). In addition, because the **ENG ANTI-ICE, LDG LIGHT ON, LDG LIGHT**

PULSE, and **CARGO HOOK ARMED** lights indicate a normal system status rather than a fault, they will not activate the **MASTER CAUTION** light, and they do not flash.

3. For aircraft S/N 5135 and earlier, the caution panel is composed of 15 individual worded segments consisting of two lamps. Failure of a single lamp will produce only a dimming effect. In addition, the **ENG ANTI-ICE** segment light is the only normal system status segment available.

a. Caution Panel Test. Pressing the **CAUT PNL** switch to the **TST** position will illuminate all of the segments of the caution panel and the **MASTER CAUTION** light, plus the **FIRE**, **ROTOR RPM**, and **ENGINE OUT** warning lights testing all of the light bulbs and the three chip detector circuits. Release of the **TST** switch to the **BRT** position resets the caution panel to its previous state before the **TST** switch was pressed. Fault conditions will not be altered as a result of the test. For S/N 5135 and prior and S/N 5256 and subsequent (if equipped with the legacy instrument panel), holding this switch in the test position for 3 seconds or longer will activate the chip detector continuity test circuits. (For aircraft S/N 5136 through S/N 5254, the test switch on the caution panel does not perform the PCS continuity check function.)

b. Caution Panel Dimming. For night flight, the **CAUT PNL** switch can be set to the **DIM** position to select a preset dim condition for the caution panel. In this condition, each fault as it occurs will trigger its associated caution segment to a full bright and flashing condition along with the **MASTER CAUTION** light. Pressing the **MASTER CAUTION** light will reset the caution panel fault segment to steady and dim. Subsequent faults will be annunciated in the same manner with only the new fault triggered to bright-flashing until it is acknowledged, not the previously acknowledged faults.

c. Indicator Caution Activation. The microprocessor based indicators will illuminate the LED, located on the instrument face, red when an operating limitation is approached or exceeded. The LED remains illuminated until the indication is within the operating limitations. The instrument LED indications are intended as an alert to call the pilot's attention to the indicator. The indicator reading is the correct indication of an exceedance. Depending on the exceeded limitation, a corresponding activation of the **MASTER CAUTION** light and a segment in the caution panel may occur, at which point the pilot may acknowledge the fault by pressing the **MASTER CAUTION** light. Refer to Table 7-3 for a description of the systems and operating limitations included with the microprocessor based indicators.

3. Warning System. The warning system consists of three independent red warning lights at the top of the instrument panel as shown in Figure 7-13 and described in Table 7-2, and one red **BATT HOT** warning light located in the caution panel and described in paragraph 7-57. Because of its location in the caution panel, the **BATT HOT** light operates in exactly the same manner as the caution lights described previously. When the optional NiCad battery is installed, the SPARE segment in the caution panel is replaced with a **BATT HOT** segment. The remainder of this paragraph applies only to the **FIRE**, **ROTOR RPM**, and **ENGINE OUT** warning lights. When each light is activated it comes on steady and full bright with no dimming capability. The warning lights are for conditions that require immediate pilot action.

2. Fire Warning System. This system is described in paragraph 7-13.

3. Engine Out Warning System. This system is described in paragraph 7-28.

4. Rotor RPM Warning. This warning system is described in paragraph 7-51.

WARNING LIGHTS

	FIRE
ENGINE OUT	ROTOR RPM

CAUTION PANEL

Aircraft S/N 5136 and Subsequent

ENG CHIP	MAIN XMSN CHIP	TAIL CHIP	FUEL FILTER
ENG OIL TEMP	MAIN XMSN HOT	DRIVE BEARING HOT	A/F FUEL FILTER
ENG OIL PRESS	MAIN XMSN PRESS	BATT TEMP	FUEL LOW
ENG INLET AIR	DC GEN	BATT HOT	SPARE
ENG ANTI-ICE	LDG LIGHT ON	LDG LIGHT PULSE	CARGO HOOK ARMED

NOTE

The wording layout of an individual segment may vary from that shown above.

Sheet 1 of 2

Figure 7-13. Warning and Caution Lights

CAUTION PANEL

Aircraft S/N 5135 and Earlier

ENG CHIP	MAIN XMSN CHIP	TAIL CHIP
ENG OIL TEMP	MAIN XMSN HOT	DRIVE BRG HOT
ENG OIL PRESS	MAIN XMNS PRESS	SPARE
ENG INLET AIR	SPARE	DC GEN
FUEL FILTER	FUEL LOW	ENG ANTI-ICE

MASTER CAUTION ANNUNCIATOR/SWITCH

MASTER CAUTION

Sheet 2 of 2

Figure 7-13. Warning and Caution Lights

Table 7-1. Caution Panel Segments

SEGMENT	COLOR	DESCRIPTION OF FAULT
ENG CHIP	**AMBER**	Engine scavenge oil has ferrous metal fragments
MAIN XMSN CHIP	**AMBER**	Main transmission chip detector has detected ferrous metal fragments
TAIL CHIP	**AMBER**	Tail rotor transmission chip detector has detected ferrous metal fragments
FUEL FILTER	**AMBER**	Pressure drop in the fuel filter exceeds 1.3 psi and filter bypass is impending
ENG OIL TEMP	**AMBER**	Engine oil temperature is above 107°C
MAIN XMSN HOT	**AMBER**	Main transmission oil temperature is above 107°C
DRIVE BRG HOT	**AMBER**	Either the forward or aft lower pulley bearings are above 120°C
A/F FUEL FILTER*	**AMBER**	Airframe fuel filter bypass is impending
ENG OIL PRESS	**AMBER**	Engine oil pressure is below 50 psig or above 130 psig, any N_1 speed; or engine oil pressure is below 90 psig and engine N_1 RPM is above 78.5%.
MAIN XMSN PRESS	**AMBER**	Pump inlet pressure is less than 4.4-5.9 psi/30.2-40.7 kPa of vacuum
BATT TEMP**	**AMBER**	Battery temperature is at or above 63°C
FUEL LOW	**AMBER**	Fewer than 5 gallons/19 liters of fuel remaining
ENG AIR INLET	**AMBER**	Engine inlet particle separator partially blocked
DC GEN	**AMBER**	DC Generator system failure
BATT HOT**	**RED**	Battery temperature is at or above 71°C
SPARE	**AMBER**	Spare segment
ENG ANTI-ICE	**GREEN**	Engine anti-ice is activated
LDG LIGHT ON	**GREEN**	Landing light is activated
LDG LIGHT PULSE*	**GREEN**	Pulse landing light is activated
CARGO HOOK ARMED*	**GREEN**	Cargo hook electric release is armed

* Segment is only installed if the optional equipment is installed.

** Segment is only installed if the optional NiCad battery is installed.

CHAPTER 8. HANDLING, SERVICING, AND MAINTENANCE

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CHAPTER 8. HANDLING, SERVICING, AND MAINTENANCE

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CHAPTER 8

HANDLING, SERVICING AND MAINTENANCE

SECTION I. GENERAL

8-1. Location of Servicing Points

1. Servicing points are shown in Figure 8-1.

8-2. Servicing Table

1. Refer to Table 8-2 for fuel, lubricants, specifications, and capacities. Refer to Table 8-3 for approved commercial oils.

NOTE

Refer to TH-28/480 Series Maintenance Manual, Section 4, for detailed service and lubrication requirements.

SECTION II. FUEL

8-3. Fuel Types

1. The primary and cold weather fuels which can be used in the 480B helicopter are presented in Table 8-2. The following definitions apply to the approved fuels table.

a. Primary Fuels. These are the designated primary fuels adopted for worldwide use.

b. [Deleted]

c. Cold Weather Fuels. These fuels may be required to assure consistent starts at ambient temperatures below 4°C (40°F). Except for the fuel system icing inhibitor (FSII) additive requirement, there is no restriction from operating the aircraft on any primary fuels at ambient temperatures down to -32°C (-25°F), however, special provisions may be required to start the engine. (Refer to the Rolls-Royce 250-C20 Series Operation and Maintenance Manual for further information.)

8-4. Use of Fuels

1. The use of any fuels other than the fuels presented in Table 8-2 will be recorded in the Aircraft Maintenance and Inspection Record, noting the type of fuel, additives, and duration of operation.

2. Fuel Additives. At ambient temperatures below 4°C (40°F), all fuels used shall contain a FSII additive. Refer to Table 8-2 and Chapter 1, “Operating Limitations.”

CAUTION

Avoid using FSII additives packaged in aerosol cans. Failure to exactly follow the additive mixing procedures during refueling can result in incorrect additive concentrations, fuel system contamination, and possible engine stoppage.

3. The use of kerosene fuels, (JP-5 type), in turbine engines dictates the need for observance of special precautions. Both ground starts and air starts at low temperature (below 5°C) may be more difficult due to low vapor pressure. Kerosene fuels having a freezing point of −40°C or −53°C should be used with caution when the operational temperatures at the intended flight altitude approach those values and either standard fuels sought or the maximum altitudes for the intended operation limited.

4. Mixing of Fuels. When changing from one type of authorized fuel to another, for example Jet A to JP-5, it is not necessary to drain the helicopter fuel system before adding the new fuel.

8-5. Fuel System Servicing

1. Precautions in Fuel Servicing and Defueling

CAUTION

Observe the following precautions in all fuel servicing and defueling operations as applicable:

a. Position auxiliary ground power units on the windward side of the helicopter.

b. Do NOT fuel or defuel during electrical storms.

c. Do not fuel or defuel while ground radar sets are operating within 300 feet/92 meters of the helicopter.

d. Servicing personnel shall not wear metal taps on their shoes.

e. Be sure that the battery switch is in the OFF position and external power is disconnected before fueling or defueling the helicopter.

f. Ground the helicopter at the receptacle located on the top of the left engine access panel to the filler nozzle before removing the filler cap.

g. The fuel truck shall be grounded (truck to ground and truck to helicopter). The helicopter shall be grounded to the same ground point as is the fuel truck.

h. Observe the FSII additive manufacturer's instructions when adding FSII additives to fuel that is not "premixed" with FSII additives.

i. After completion of servicing, wash down and remove any spillover of jet fuel. This fuel does not evaporate as rapidly as gasoline and constitutes a fire hazard for a much longer time. Cleaning materials or clothing which have become saturated with jet fuel shall be disposed of properly.

2. Servicing

a. Ground the aircraft, truck, and nozzle.

b. Remove the fuel cap.

CAUTION

Insert nozzle carefully in a generally downward direction, avoiding contact with the inside of the fuel cell. Fuel nozzles must be hand held during servicing.

c. Position the nozzle into the fuel cell filler neck.

WARNING

In the event of major spillage of fuel, all powered equipment shall be shut down. All personnel shall leave the vicinity and be positioned to prevent any sources of possible ignition from entering the area. The appropriate authorities shall be summoned to the area to contain and disperse the spill.

d. Fill to the specified level.

NOTE

Refer to Table 8-2 for fuel tank capacity.

e. Remove the nozzle and replace the fuel cap.

f. Disconnect the nozzle ground and rewind hose.

g. Disconnect the truck and helicopter grounds.

3. Defueling

NOTE

Refer to the TH-28/480 Maintenance Manual for specific maintenance procedures.

WARNING

In the event of a major spillage of fuel, all powered equipment must be shut down. All personnel should leave the vicinity and be positioned to prevent any sources of possible ignition from entering the area. The appropriate authorities should be notified to contain and disperse the spill.

a. Pull fuel shutoff hand **OFF**.

b. Open the left side engine access panel.

CAUTION

Cap all open lines/fittings to prevent contamination of the systems.

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

1. Main Rotor Transmission. A sight glass located on the aft right side of the transmission housing can be viewed through the upper maintenance step kick-in panel located on the right side of the aircraft. The oil level must be visible in the lower one half of the sight glass. If oil is visible, no additional oil is required. If oil is not visible, add oil until the oil is half way up the sight glass. The oil service tube for the main rotor transmission is located forward and to the right of the main rotor mast. It is accessed via the opening in the top of the air duct in front of the main rotor mast. Refer to Table 8-2 for the capacity and the authorized oil. Table 8-3 lists the commercial products available which are approved for use in the main rotor transmission.

2. 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.

SECTION V. DRIVE SYSTEM

8-8. Lower Pulley Bearing Housings

1. A sight glass is provided in the lower pulley bearing housings to determine the oil level in the bearing housings. The sight glasses are located behind the left side engine access panel. The oil level in the bearing housings must be visible in the lower one half of the sight glass. Refer to Table 8-2 for the capacity and the authorized oil. Table 8-3 lists the commercial products available which are approved for use in the lower pulley bearing housings. If oil is visible then no additional oil is required. If oil is not visible, use the following procedure to service the lower pulley bearing housings.

   a. Remove the service plug(s) located above the temperature probe on the opposite side of the bearing housing(s).

   b. Add oil until the oil is half way up the sight glass.

   c. Reinstall the service plug(s).

8-8.1. Overrunning Clutch

1. A sight glass is incorporated into the overrunning clutch cover to determine the oil level in the overrunning clutch (Refer to Figure 8-0). Access to the sight glass is through the left side engine access panel.

2. For aircraft equipped with a vented clutch oil reservoir, a sight glass is incorporated into the reservoir container (Refer to Figure 8-1). Access to the reservoir sight glass is through the left side engine access panel. Since the oil reservoir sight glass and the overrunning clutch cover sight glass are at the same height, the oil level should be the same.

3. If oil fills sight glass(es) then no additional oil is required.

Table 8-2. Fuels, Lubricants, Specifications, and Capacities

SYSTEM	SPECIFICATION	CAPACITY
Fuel – Standard (P/N 4122052) (See Note 3)	ASTM D1655 Jet A or A-1 ASTM D6615 Jet B (See Note 6) MIL-DTL-5624 JP-4 (See Note 6) & JP-5 MIL-DTL-83133, Grade JP-8	91.7 gal (US) (90.0 gal (US) usable) 347.08 L (340.65 L usable) (See Note 4)
Fuel – Aerazur (P/N 4122009) (See Note 3)		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 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. [Deleted]
2. [Deleted]

NOTES (Continued):

3. At ambient temperatures below 4°C (40°F), all fuels used shall contain a fuel system icing inhibitor (FSII) additive conforming to MIL-DTL-85470. FSII shall be added to all commercial fuel, not already containing a FSII 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 standard fuel system (P/N 4122052) are designed for a total capacity of 91.7 gal (US) (347.08 L) and the fuel cells for Aerazur (P/N 4122009) fuel system are designed for a total capacity of 90 gal (US) (340.65 L); however, differences in baffle installation in both the standard and Aerazur 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

6. Approved cold weather fuel (see paragraph 8-3).

Table 8-3. Approved Commercial Oils

MIL-PRF-7808

MANUFACTURER	MANUFACTURER'S DESIGNATION
American Oil & Supply Co.	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
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
ExxonMobil	MJO II
Mobil Oil Corporation	Mobil Jet Oil II
Chemtura Corporation Anderol Division	Royco Turbine Oil 500
Stauffer Chemical Company	Stauffer Jet II (Castrol 205)
Eastman Chemical Company	Turbo Oil (ETO) 2380
NYCO S.A.	Turbonycoil 600
Mobil Oil Corporation	Mobil Jet Oil 254 and Mobil Jet Oil 291(HTS Oil)
Chemtura Corporation Anderol Division	Royco Turbine Oil 560 (HTS Oil)
Shell International Petroleum Co.	Aeroshell Turbine Oil 560 (HTS Oil)
Eastman Chemical Company	ETO 2197
Air BP Lubricants	BPTO 2197

Table 8-3. Approved Commercial Oils (Continued)

MIL-PRF-2105 Series/API GL-5

MANUFACTURER	MANUFACTURER’S DESIGNATION
Exxon Mobil Corp.	Mobil 1 Synthetic Gear Lubricant LS 75W-90 Mobil Delvac 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 8-4. [Deleted]

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8-14. Snow and Ice Removal

1. 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.

2. 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

8-15. 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 8-3.

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 4-2 for the density altitude chart and Figure 8-3 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.

1. 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 6.

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

3. 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.

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

5. 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.

6. Record rotor RPM passing through the altitude from step 3.

7. Compare the rotor RPM, outside air temperature (OAT), and pressure altitude readings with the information provided in Figures 4-2 and 8-3. The actual RPM should be within ± 5 RPM of the chart.

8. 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.

9. If the RPM is adjusted, re-check the RPM as described in steps 1 through 7 of this procedure.

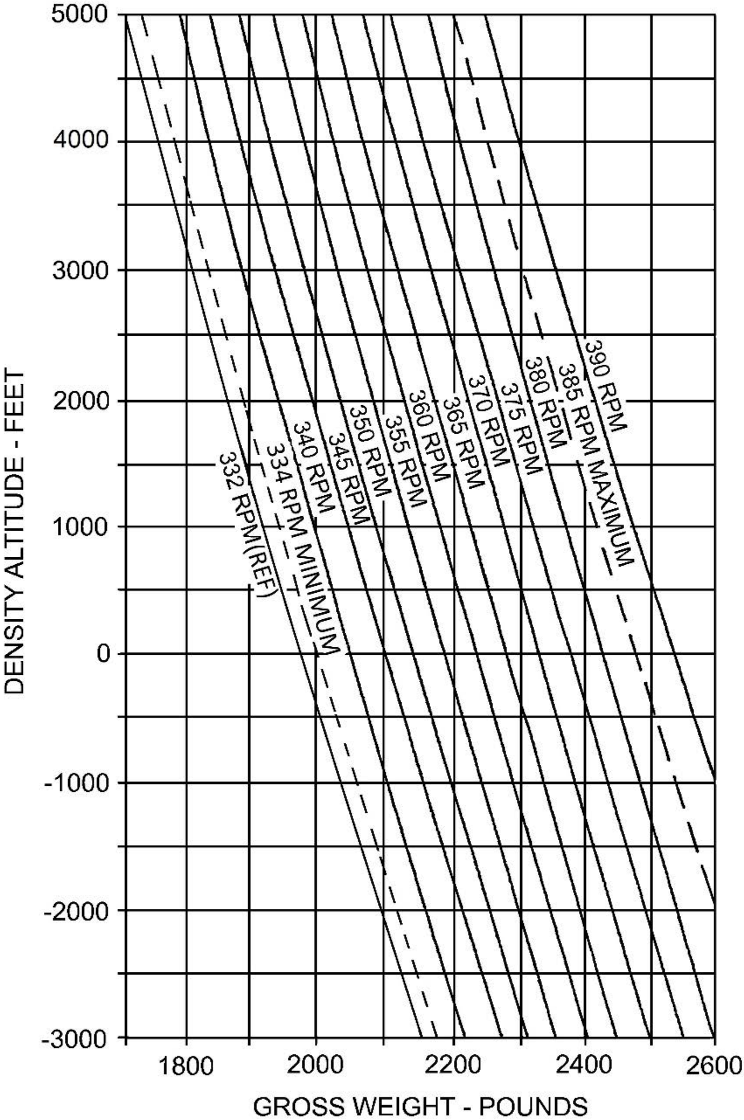

Figure 8-3. Autorotation RPM Chart

CHAPTER 9. SUPPLEMENTAL INFORMATION

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CHAPTER 9

SUPPLEMENTAL INFORMATION

SECTION I. GENERAL OPERATION

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° either side of the nose up to a maximum of 15°.

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° 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/152 meters 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, i.e., hovering over salt water or flight operations within 5 nautical miles of an ocean coastline below 500 feet/152 meters 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 climb-out, 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.

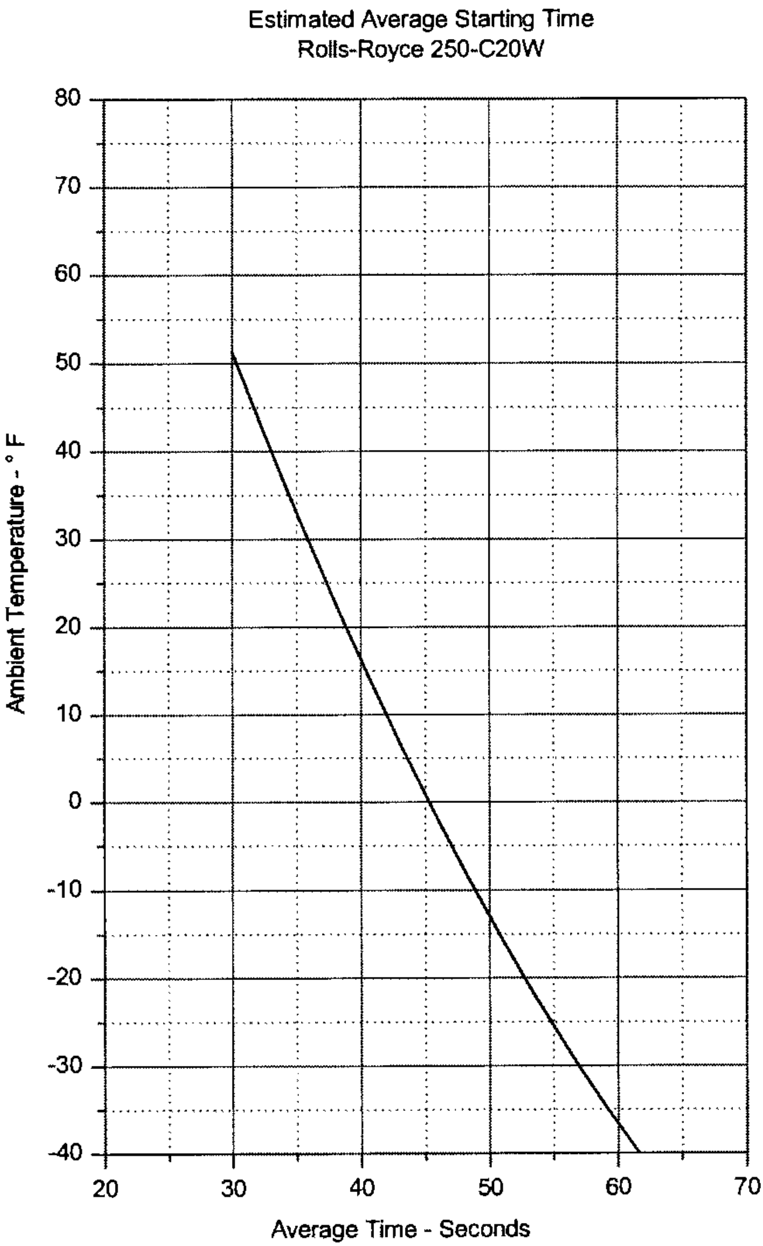

Figure 9-1. Average Engine Starting Time

SECTION II. FLIGHT CHARACTERISTICS

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 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 translational 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 should 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

1. 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 cannot 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

1. 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.

2. If severe vibrations are encountered on the ground when bringing the main rotor rpm up to operating speed, immediately turn the throttle to the 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. Leave the collective up until the rotor RPM is well below the operating range.

CHAPTER 10. ABBREVIATED CHECKLIST

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b. TOT – Below 150°C.

c. Throttle – Open to idle stop after the N_1 passes through 12-15%.

d. Monitor TOT.

e. Starter switch – Release at 58% N_1.

f. Engine oil pressure – Check.

g. Gas producer – Check 59-65% N_1.

h. N_2 – Check stabilized.

5. Ground Power Unit – Disconnect.

CAUTION

Check that the ground power unit is disconnected prior to turning the Generator switch ON.

6. MAIN GEN Switch – ON.
7. Avionics ON – AMP < 50 AMPS.

ENGINE RUNUP

1. Engine – Stabilize one minute.
2. Throttle – Full on. (see RFM)
3. GOV INCR/DECR Switch – Set to 97±1% N_2.
4. Engine and Transmission Indications – Check.

5. ENG ANTI-ICE – Check.
6. SCAV AIR – Check.

(O) 7. DEFOG and HEAT – Check.

(O) 8. PITOT HTR – Check.

(O) 9. Avionics – Check and set.

10. Altimeter – Set.

(O) 11. Heading Indicator(s) – Check.

(O) 12. Doors – Secured.

13. Seat Belts and Shoulder Harnesses – Secured.
14. Flight Controls – Check.
15. Collective Friction – Set as desired.

HOVER CHECK

1. Flight Controls – Check.
2. Engine and Transmission Instruments – Check.
3. Flight Instruments – Check.
4. Engine Power – Check.

BEFORE TAKEOFF

1. N_2 - 103% – See RFM supplement for operations with floats installed.
2. Systems – Check.