

	BK1	17 C-1	
	APPROVED	BOTORCRAFT	
	FLIGHI	MANUAL	
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i na s	Valid for Model:	MBB-BK117 C-1 and MBB-BK117 C-1D	ŗ
a strange and the second second	Registration Mark:		•
	Serial No.:	7509	
	Year of Manufacture:	1994	
	IT IS THE OPERATOR'S RESPONSIBILIT	Y TO MAINTAIN THIS MANUAL IN A CURRENT STATU FFECTIVE PAGES.	JS
	This manual is part of the above designate	d helicopter. It includes the material to be furnished to the	he
	pilot as required by FAR Part 29. The "Airworthiness Limitations" section of t	he Rotorcraft Maintenance Manual shall be complied wi	th.
	THIS MANUAL MUST BE CAR	RIED IN THE HELICOPTER AT ALL TIMES.	
	Original Issue - October 02, 1992		
	Approved by:	Published by:	
		EUROCOPTER DEUTSCHLAND GmbH	
	Luftfahrt-Bundesamt Braunschweig		
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2.14 FUEL LIMITATIONS

2.14.1 Fuel Specification

NOTE Specifications apply to the latest index, latest amendment in force.

Fuel conforming to the following specification is authorised for use:

	PE OF	NAT	TO		C A stricted			HCE DH VE							
FUEL BOL			USA	USA UK		-0	AN	1	RF	С	IS				
(erosene-50 (AVTUR-FS II) F 34			34	MIL-T-83 133 JP-8	ENG.RD 2453		AIR 3405- - F-34				-	, 	YES		
K	AVTUR)	F	35	ASTM- D-1655 JET A-1	D.	ENG.RD 2494	2	AIR 2.3.23 3405- F-35			-	-	NO		
Kerosene -				ASTM- D-1655 JET A	ASTM- D-1655 -								NO		-
Ŵ	Wide-cut JP-4 (AVTAG-FS II)		F 40	MiL-T D.ENG.RD -5624 2454 JP-4			2.3.24	A	IR 3407		-		YES		
V	Wide-cut JP-4 (AVTAG) -			-		D.ENG.RD 2486		-		_				NO	
	Wide-cut	+		ASTM- D-1655 JET B		-		-	-		-			NO	
	High flash point Kerosene JP-5		F 43	-	-	D.ENG.R 2493	D	- 34 - 5		AIR 3404- F-43		-		NO	
High flash point Kerosene F JP-5		F 44	MIL- -562 JP-	т 4 5	D.ENG.F 2452	٦D	-		AIR 3404 F-44	-	-		YES	8	
(AVCAT-FS II) Kerosene TS-1, RT		-			-		-		_		GOST 10227/86		N	D	

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120

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8V DC ground

..... 1.0 ber 1.0 ber - 2.0 ber

2.0 ber - 5.0 ber

..... 5.0 bar

e range from 1.0

... 0 °C - 105 °C

..... 105 °C

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EFFECTIVITY Not for French registered helicopters

In case of contingency, the following fuels may be used as substitutes for normal fuels (add 2% of mineral oil if possible). However, their use is restricted and limited to a certain amount of time so as not to affect the engine TBO.

 Maximum time of use between overhaul:
 25 hours

 Maximum pressure altitude:
 1500 ft

 Maximum fuel temperature:
 30°C (86°F)

TYPE OF FUEL	NATO SYMBOL	S P E C I F I C A T I O N Replacement Fuels							
		USA	UK	FRANCE					
	F 12	MIL-G-5572 Grade 80/87	-	AIR 3401 80/87					
Aviation Fuel	F 18	MIL-G-5572 Grade 100/130	D.ENG RD 2485	AIR 3401 100/130					
(AVGAS)	F 22	MIL-G-5572 Grade 115/145	-	AIR 3401 115/145					
Motor car petrol Petrol for tanks	F 46	• MIL-G-3056	DEF. 2401	DCEA/2DMT80					

2.14.2 Fuel Temperature Limits



Fig. 2-4 Temperature Limits for Approved Primary Fuels

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2.14.3 Fuel Additives

Anti-icing fuel additives

When operating at fuel temperatures below -10°C (14°F) with fuels F 35, JET A, RD 2486, JET B, F43, icing protection is to be provided with anti-icing fuel additives:

- MIL-I-27686 (NATO S-748)
- ASTM D 4171

- D. ENG. RD 2451

- AL-31
- AIR 3652
- PHILLIPS PFA/55 MB

Concentration by volume: Max 0.15%, Min 0.10%

When operating with CIS fuels RT and TS-1 at the same temperatures, add additives:

- Fluid I (GOST 8313)
- Fluid IM (TU 6-10-1458)
- TGF (GOST 17477)
- TGF-M (TU 6-10-1457

Concentration by volume: Max 0.3%, Min 0.10%

Other fuel additives

Anti-static additive:	SHELL ASA 3, STADIS 450
Concentration by volume:	Max 0.00001%

Anti-static additive for CIS	fuels RT and TS-1:	SIGBOL (TU 38-101741)
Concentration by weight:		Max 0.0005%

Anti-oxidizing, de-activator of metals, anti-corrosion in conformity with approved specifications in force.

Fungicide (Biobor) limited to one treatment every 500 operating hours or every 3 months.

2.14.4 Fuel Quantities

TANK	USABI	E FUEL	UNUSABLE FUEL					
IANN	liters	kilograms	liters	kilograms				
Main	600.8	480.6	4.4	3.5				
Supply	96.6	77.3	5.8	4.6				
Totals	697.4	557.9	10.2	8.1				

Fuel mass values are based on a fuel density of 0.8 kg/liter.

The usable fuel quantity is empty when zero is indicated on the relevant fuel quantity gauge.

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2.19 INSTRUMENT MARKINGS

The pointers and scales of the instruments are marked as follows:

Left engine
Right engine 2 Right fuel supply tank 2
Main rotor
Minimum and maximum limits
Transient limits
Normal starting limits
Normal/continuous range

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2.19.1 Airspeed Indicator

0 kt to 30 kt	 yellow arc
30 kt to 150kt	 green arc
150 kt	 red radial
90 kt	 . red cross-hatched radial

2.19.2 Engine N_I Indicator

10% to 50%	an arc
i0% to 65% velice velic	
50% to _1 7%	
1 70/ to 0.00/	Sharc
1.1 % (U U.U%	w arc
0.0% tO 1.3% Wh	te arc
0.0%	radial
0.0%narrow-dashed green	radial
1.3% narrow-dashed red	radial

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3.2 WARNING AND CAUTION LIGHTS

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Most emergency situations will be indicated by either a red warning light or a <u>vellow</u> caution light coming on.

A red warning light indicates a hazard which may require immediate corrective action.

A vellow caution light indicates the possible need for future corrective action.

A red MASTER warning light indication in pilot's/copilot's field of view leads the pilot's / copilot's attention to the indication(s) on the annunciator panel whenever a warning or caution light has been activated there. After a response to the MASTER warning light, push the MASTER segment to reactivate the MASTER warning light for further possible emergencies.

It is always possible that a warning or caution light will come on unnecessarily. Whenever possible, check the light against its associated instrument to verify that an emergency condition has actually occured.

Following is an alphabetical listing of the warning and caution light indications with the relevant conditions, any further indications and the emergency procedures.

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Conditions/Indications

N₁ Split

- N1 indicators show difference of 10% or more

N₁ Low

- N1 60% or less
- Audio signal beeping tone
- **NOTE** ENG LOW warning light may come on during beep trim operation. Try to match N₁ until light goes off.

Procedure

1.	OE	El f	ligi	ht (сог	dit	ion		0 	an Sinta Sita I				Es	tab	llsi	ĥ			(
2.	Bl	ee(1 ai	ir c	on	şul	mer	rs					- 3	OF	F							Ð,	
3.	En	ıgiı	ne	co	ndi	tio	n		953) -				_	An	aly	se							

In case of partial power loss:

4. Continue in accordance with procedure for ENGINE UNDERSPEED-GOVERNOR FAILURE in this Section.

If no residual torque available on the affected engine:

- 4. Single engine emergency shutdown, Perform
- 5. LAND AS SOON AS PRACTICABLE

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WARNING LIGHT INDICATIONS



Conditions/Indications

N_{Ro} low

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- N_{Ro} 95% or less
 Audio signal steady tone

N_{Ro} high

- N_{Ro} 106% or more
 Audio signal none

Procedure



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WARNING LIGHT INDICATIONS

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Instrument panel

Conditions/Indications

Warning or caution light(s) on the annunciator panel on

Procedure

1. Annunciator panel

- Check and perform corresponding 'emergency procedure(s)
- 2. MASTER warning light or, if installed, MCR button on cyclic stick
- Push to reset

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If one FUEL LOW caution light remains on:

5. Expect single engine failure

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CAUTION LIGHT INDICATIONS

Conditions/Indications

Engine fuel pump inlet pressure low (below 0.35 bar)

Procedure

1. FUEL PUMP PRIME switch - ON; PRIME PUMPS caution light will come on

- OFF

If FUEL PRESS caution light goes off:

2. LAND AS SOON AS PRACTICABLE

If FUEL PRESS caution light remains on:

- 2. FUEL PUMP PRIME switch
- 3. LAND AS SOON AS PRACTICABLE

CAUTION BE PREPARED FOR ENGINE FAILURE

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CAUTION LIGHT INDICATIONS

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Conditions/Indications

Prime pump(s) in operation

Procedure

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None (normal operation prior to engine start) Prime pumps must be off during normal flight operations.

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ENGINE EMERGENCY CONDITIONS

3.3.4 Single Engine Failure - Flight

Conditions/Indications

Affected engine:

- ENG LOW warning light (N $_1$ low) and intermittent audio signal on
- FUEL PRESS caution light on
- ENG OIL P caution light on
- GEN caution light on
- OVSP F caution light on
- VAR NR caution light on
- Instruments indicate power loss

NOTE The VARTOMS will revert to the manual mode automatically.

Procedure

1. OEI flight	condition	- Establis	sh	
2. Airspeed	n an an Anna a Anna an Anna an	– 65 KIAS	\$ (V _Y)	
3. Single enç	gine emergency shutd	lown – Perform	1	
4. Rotor spe	ed	– Trim ma	anually to 98 – 1024	%
5. LAND AS	SOON AS PRACTICAE	BLE		

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ENGINE EMERGENCY CONDITIONS

3.3.5 Single Engine Landing

Conditions/Indications

One engine inoperative (OEI)

Procedure

LANDING APPROACH

- 1. Airspeed
- 2. Shallow approach

ON FINAL

- 3. Airspeed
- 4. Rate of descent

TOUCHDOWN

- 5. Airspeed
- 6. Landing attitude
- 7. Collective lever

- 65 KIAS (Vy)
- Establish
- 40 KIAS
- 300 ft/min
- Reduce, depending on power available
- Establish
- Raise as necessary to stop descent and cushion landing

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ENGINE EMERGENCY CONDITIONS

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3.3.7 Inflight Restart

- An inflight restart may be attempted after a flameout or shutdown subject to the pilot's evaluation of the cause of flameout.
 - Before attempting an inflight restart, wait for $N_1 < 30\%$
- CAUTION DO NOT ATTEMPT INFLIGHT RESTART IF THE CAUSE OF ENGINE FAILURE IS OBVIOUSLY MECHANICAL.

Procedure

1.1

1. Collective lever friction

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- 2. Electrical consumption
- 3. Relevant power lever
- 4. Relevant FUEL PUMP PRIME switch

After 10 seconds:

- 5. Normal engine starting procedure
- 6. Power lever
- 7. Electrical consumers

If restart is not successfull:

8. LAND AS SOON AS PRACTICABLE

- Adjust to maintain position of lever when released
- Reduce
- Check OFF
- ON
- Perform
- Increase to FLY position

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- As required

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ENGINE EMERGENCY CONDITIONS

3.3.15 Double Engine Failure - Flight

Conditions/Indications

- Left yawing motion
- N_{Ro} and both N_2 decrease ROTOR RPM warning (N_{Ro} LOW) on
- Both ENG LOW and both FUEL PRESS caution lights on
- Both ENG OIL P and both GEN caution lights on
- Engine instruments (both engines) indicate power loss

Procedure

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ENGINE EMERGENCY CONDITIONS

3.3.16 Double Engine Emergency Shutdown

Procedure

• ON GROUND

Dompowerlevers
2. Both FIRE EXT/FUEL SOV switches ALABMEDICLOSED
3. PWR SELECT switch - OFF
• IN FLIGHT

1. Both power1	evers	- THE - TOFT	14 (S. 4 1)	
2. Both FIRE E	XT/FUEL SOV sw	itches — (ARI	MED/CLOSED	TTA MIL

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ENGINE EMERGENCY CONDITIONS

3.3.17 Autorotation Procedure 1. Collective lever - Full down, maintain N_{Ro} within limits 2. Airspeed - Approximately 75 KIAS NOTE Maximum range airspeed 90 KIAS Minimum rate-of-descent airspeed 60 KIAS 3. Double engine emergency shutdown - Perform AT APPROX 100-FT AGL: 4. Flare attitude - Establish (approx 15° to 20°) to reduce forward speed and rate of descent; control N_{Ro} AT APPROX 8-FT TO 12-FT AGL: 5. Flare attitude - Reduce to approx 7° 6. Heading - Maintain 7. Collective lever - Raise to stop descent and cushion landing

NOTE The appropriate values must be adjusted according to prevailing conditions of gross mass, wind and terrain.

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- OFF

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8. PWR SELECT switch

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4.3 PREFLIGHT CHECK

4.3.1 General

The preflight check shall be accomplished, according to either the Flight Manual, the Maintenance Manual or the Pilot's Checklist.

The preflight check is not a detailed mechanical inspection, but essentially a visual check of the helicopter for correct condition.

This check shall be completed <u>before each flight</u>. However, items not marked with a star (\star) need only be checked <u>before the first flight of the day</u>.

When unusual local conditions dictate, the extent and/or frequency of this check shall be increased as necessary to promote safe operation.

NOTE • The following list contains only check items for the standard configuration.

- In addition to these items, check antennas and all installed optional equipment.
- Make certain that all relevant intermediate and special inspections in accordance with the Maintenance Manual have been complied with.
- For optional equipment check items, refer to the respective Flight Manual Supplement or Maintenance Manual, Chapter 800.

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4.3.2 Exterior Check

The exterior check is laid out as a walk-around check, starting forward right at the pilot's door, proceeding clockwise to the tail boom, to the left hand side (including the upper and lower areas of the helicopter) and is completed at the helicopter nose area.

- NOTE If possible, the helicopter should be headed into wind before starting the engines.
 - The area around the helicopter should be clear of all foreign objects.
 - To avoid excessive drain on the helicopter battery, particularly during cold weather, all ground operations should be conducted using an external power unit (EPU).
 - When the battery is used, the operation of electrical equipment should be kept to a minimum.



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Cockpit Center Control Panel All switches and avionics - OFF **Collective pitch** All switches OFF or in neutral position Overhead panel: All circuit breakers In -All switches OFF Power levers OFF -Instrument panel: Both FIRE EXT/FUEL SOV switches _ NORM AGENT DISCH switch _ OFF FIRE DET TEST switch NORM -All switches and avionics - OFF Center control panel: PWR SELECT switch BAT -Voltmeter indication -Minimum 24 V DC BUS-TIE switches (2) ON Pitot tube heating (PITOT HTR) Function _ Static port heating (STATIC HTR) _ Function Lighting: Position lights Function Anti-collision light Function Strobe lights Function _ Landing lights - Function Before night flights: Instrument lights -Function Utility light Function Dome light Function Hand lamp Function Center control panel: PWR SELECT switch - OFF

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Fuselage - right side

Cockpit air intake

Lower cockpit window

Pedal area

Circuit breakers, fwd junction box (if installed)

- Pitot tube Drain port
- Static ports (2)
 - Cockpit door

Pilot seat and safety belt

- Cabin door
- Cabin top

Cockpit overhead window

- Hydraulic compartment
- Hydraulic system

Hydraulic system filter clogging indicator pins (4)

- * Hydraulic system fluid reservoirs (2) Hydraulic system outboard fittings (4) Rotor brake oil reservoir
- Hydraulic compartment cowling *
- Oil cooler air inlet screen (2) *
- Transmission oil *
- Swash plate and boot
- Main rotor head \star

Blade attachment bolts, driving link assembly and rotor hub cap

- Clear Condition -

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- .
- No foreign objects
- Check in -
- Clear, condition .
- Clear
- Clear -
- Condition, function
- Condition
- Condition, function -
- Condition
- -No leakage, no foreign objects
- Condition
- Check in
- Oil level -
- Secured -
- _ Oil level, filler cap secured
- -Closed, secured
- Clear -
- Oil level
- Condition _
- Oil level, condition .
- Condition, secured

(continued)

* To be checked before each flight

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Fus	elage - right side (continued)		
★	Rotating control rods	-	Condition, free movement
	Rotating control rod spherical bearings	-	Check for smooth operation by moving control rods by hand
	Vibration absorbers	-	Condition, free movement, no leakage
	Rotor blades and trim tabs	-	Condition, turn rotor by hand in direction of rotor rotation and check for free run
*	Maintenance steps	-	Check in
	Landing gear and step	-	Condition
	Vents and drainports	-	Clear
*	Transmission compartment	-	No leakage, no foreign objects
	Oil cooler inlet duct	-	Clear
	Transmission oil cooler block plate	-	Installed, if OAT below -35°C (recommended to be removed if OAT above +35°C)
*	Engine oil tank	-	Oil level
	Engine oil tank	-	Condition, no leakage, security of mounting, filler cap closed and secured
	Transmission	-	Condition
	Transmission struts	-	Condition, secured
	Transmission oil filter clogging indicator pin	-	Check in
	Transmission oil filler cap	-	Secured, locked
	Mixing lever assembly	-	Condition, secured
	Rotor brake system	-	Condition
★	Engine air inlet screen	-	Clear, secured
	Scavenge oil filter clogging indicator pin (if installed)	-	Check in

(continued)

To be checked before each flight *

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Fuselage - right side (continued)

- ★ Transmission access door
- Engine compartment Engine
 - Engine oil ducts
- Wiring, linkages and lines
- Hoses of engine water washing system (if installed) Engine exhaust pipe Rear bearing oil ducts
- Engine mounts
- Fire detectors (3)
- ★ Engine access door
- Maintenance step
 Battery (if located here)

Battery door

- Aft engine cowling
- Fuselage right side
 Clam shell doors
 First aid kit
 Baggage compartment
 Small baggage compartment
- ★ Clam shell doors

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- Closed, secured

- No leakage, no foreign objects
- Condition

- No leakage

- Condition, no leakage, no chafing
- Security
- Condition, secured
- No leakage
- Condition, secured
- Condition
- Closed, secured
- Closed, secured
- Condition, no electrolyte spillage, security of mounting
- Closed, secured
- Secured
- Condition
- Condition, function
- On board
- Condition
- Condition
- Closed, secured

\star To be checked before each flight

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Tail	boom		
★	Tail boom - right side	-	Condition
*	RH horizontal and vertical stabilizer, position light	-	Condition
	Vertical fin and cowling	-	Condition, secured
	Position light and anti-collision light	-	Condition
	Tail skid	-	Condition
*	Tail rotor gear box	-	Oil level, no leakage, filler cap secured
	NOTE Verification of oil level may be e	easi	er when tail skid is shaken briefly.
	Tail rotor head, shaft, bellow	•	Condition
*	Pitch links	-	Condition
	Blade attachment bolts, balance masses, dynamic masses	-	Condition, secured
	Sliding sleeve	•	Check free movement
*	Tail rotor blades	-	Condition
	Vertical fin and cowling	-	Condition, secured
*	Intermediate gear box	-	Oil level, no leakage
	NOTE Verification of oil level may be	easi	er when tail skid is shaken briefly.
	Intermediate gear box	-	Filler cap and drain screw secured
*	Vertical fin access door	-	Closed, secured
*	LH horizontal and vertical stabilizer, position light	-	Condition
*	Tail boom - left side	-	Gondition
	Flux valve cover	-	Condition

★ To be checked before each flight

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Fuselage - left side the Constant of State of State Red bursting plate for fire extinguisher system - Check undamaged * Check for correct pressure indications (2) according to the Pressure-Temperature table Fire extinguisher bottles -NOTE Engine must be cold for Pressure-Temperature table to be valid. Aft engine cowling - Secured Bleed air heater screens (2) Clear -Engine compartment No leakage, no foreign objects -Condition Engine _ Engine oil ducts No leakage -Condition, no leakage, no chafing Wiring, linkages and lines -Hoses of engine water washing Security system (if installed) Engine exhaust pipe -Condition, secured Rear bearing oil ducts -No leakage Engine mounts -Condition, secured Condition Fire detectors (3) -Engine access door -Closed, secured * Transmission compartment _ No leakage, no foreign objects * Oil cooler inlet duct Clear Transmission oil cooler block plate Installed, if OAT below -35°C -(recommended to be removed if OAT above +35°C) ¢ Oil level Engine oil tank - \star Engine oil tank Condition, no leakage, security of mounting, filler cap closed and secured

Transmission

Transmission struts

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Condition

Condition, secured

★ To be checked before each flight

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Fuselage - left side (continued)

	Transmission oil filter clogging indicator pin	•	Check
	Mixing lever assembly	-	Conditi
	Rotor brake system	-	Conditi
★	Engine air inlet screen	-	Clear,
	Scavenge oil filter clogging indicator pin (if installed)	•	Check
★	Transmission access door	-	Closed
★	Maintenance step	-	Closed
	Landing gear and step	-	Conditi
*	Fuel filler cap	-	Secure
	Vents and drainports	~	Clear
*	Fuselage - left side	-	Conditi
	Cabin door	-	Conditi
	Cockpit door	-	Conditi
	Cyclic stick	-	Secure
	Copilot seat and safety belts	-	Conditi
*	For single pilot flights: Copilot's safety belts	-	Fasten
*	Static ports (2)	-	Clear
	Drain port	-	Clear
*	Pitot tube	-	#Clear, o
*	Pedal area	-	No fore
	Lower cockpit window	-	Conditi

Cockpit air intake

in

- tion, secured
- ion
- secured
- in
- d, secured
- d, secured
- tion
- ed, locked
- tion
- tion, function
- tion, function
- ed, safety-wired
- tion
- ned, secured
- condition
- eign objects
- ion
- Clear

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Nose area

- Cockpit windshields
 - Windshield wipers
 - OAT-bulb
 - N₁ temperature sensor
 - Battery

Battery connectors (2)

- Avionic equipment
- ★ Battery/avionics access door Circuit breaker for EPU
- EPU access door
 Battery vents
 Landing light
- ★ Fuselage bottom

Miscellaneous

- ★ Baggage, cargo, loose items Hand-fire extinguisher Hand lamp
- ★ Passengers

- Condition, clean
- Condition
- Condition
- Condition
- Condition, no electrolyte spillage, security of mounting
- Connected
- Condition
- Closed, secured
- Check in
- Closed, secured
- Clear
- condition, retracted
- Condition
- Stowed, secured
- On board, check pressure
- On board
- Briefed

★ To be checked before each flight

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4.3.3

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Interior Check * Seat and pedals Adjust _ Safety belts -Fasten, adjust Shoulder harness locks Function -Center control panel All switches and avionics OFF except: - STATIC PRESS switch PRIMARY -- GEN TRIP switch NORM -- DG switch SLAVE -Collective pitch (pilot / copilot) All switches OFF or neutral position -Instrument panel FIRE EXT/FUEL SOV switches NORM -AGENT DISCH switch OFF -FIRE DET TEST switch NORM -All switches and avionics -OFF or neutral position Clock Set -Overhead panel All switches OFF -All circuit breakers ١ħ -Power levers OFF _ HYD TEST switch NORM -OAT -Check

★ To be checked before each flight

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Pre-start check PWR SELECT switch Voltmeter indication EMER LTS switch PWR SELECT switch

PWR SELECT switch EMER LTS switch

EMER LTS switch

PWR SELECT switch:

- for battery start
- for EPU start

BUS-TIE switches (2) GENERATOR switches FUEL PUMP XFER switches FUEL PUMP XFER switches PRIME PUMPS caution light FUEL PUMP PRIME I (II) sw

FUEL PUMP PRIME I (II) sw Both FUEL PUMP PRIME switches

- FIRE DET TEST switch Mast moment indicator
- FUEL QTY indicator OVSP F caution lights
- Both N1 indicators

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, such that you have to set a

- BAT
- Minimum 24 V DC
- ARM
- OFF check emergency exit lights come on
- BAT
- ON check emergency exit lights come on
- ARM

Leave in BAT

- EXT PWR (EPU caution light must illuminate)
- ON
- ON
- ON, (F PUMP XFER caution light off)
- OFF, (F PUMP XFER caution light on)
- Check function in turn:
- ON check PRIME PUMPS caution lights comes on
- OFF
- ON check FUEL PRESS lights off

NOTE Minimum operation time of prime pumps before engine start is 10 seconds.

- Test check lights come on
- TEST
- Check quantity
- Check on
- Check bleed valve lights on

(continued)

★ To be checked before each flight

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Pre-start check (continued)

N1 indicator test buttons

- Press in turn; check that analogue needles point to 2.5 minutes limit (+1.3%) and digital indications meet the value shown on the N₁ tacho check table (\pm 0.2%) for given pressure altitude and OAT
- After 3 seconds, check that digital indication reads 188.8
- After another second, check that analogue and digital N₁ indications return to zero
- **NOTE** If incorrect values are indicated during the test and the aircraft has been exposed to the sun for an extended period, repeat the test after engine start prior to takeoff.
 - If the OAT sensor circuit is interrupted, the indication "LH" will be shown on the digital display; the code "LL" indicates a short circuit.

MASTER warning light	-	Reset
Instruments	-	Check
ANN PNL TEST switch	-	Push to test annunciator panel lights
AMM SEL switch	-	GEN II
CHIP DET TEST switch (spring-loaded)	-	CHIP 1 (foreward chip detectors) - both ENG 1 CHIP and ENG 2 CHIP caution lights must come on.
CHIP DET TEST switch	-	CHIP 2 (aft chip detectors) - both ENG 1 CHIP and ENG 2 CHIP caution lights must come on.
Power levers		Check free movement through full travel including emergency range (removable stop-pins, if installed, must be pulled), then power levers OFF (stop pins, if installed, inserted).
Trim actuator limit switches (only if DAFCS not installed)	-	Check (check full travel of stick)
Flight controls	-	Check free movement through full travel
Collective pitch	-	Lock
Rotor brake lever	-	Check fully down (to check ROTOR BRAKE caution light, pull the lever slightly and check fully down again)
Cyclic stick	-	Lock

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4.4 STARTING ENGINES

4.4.1 Before starting engines

Fire guard (if available)

Rotor area

Anti-collision light

4.4.2 Starting first engine

CAUTION

- ON IMMEDIATELY ABORT START AND, IF INDICATED, PERFORM MAINTENANCE ACTION BEFORE RESTART FOR ANY OF THE FOLLOWING:
 - TOT RISES ABOVE LIMITS (If start is aborted but TOT limits are not exceeded, wait 15 seconds after N₁ RPM has returned to zero before attempting restart. This permits excess fuel to drain from combustion chamber.)

Posted

Clear

ON

- NO POSITIVE ENGINE OR TRANSMISSION OIL PRESSURE INDICATIONS UPON REACHING GROUND IDLE CONDITION -MAINTENANCE ACTION!
- N2 RPM AND ROTOR RPM NEEDLES ARE NOT MATCHED AFTER REACHING STABILIZED GROUND IDLE CONDITION - MAINTENANCE ACTION!
- SUSPECTED BLADE STRIKE INTO VERTICAL STABILIZERS. Blade strike should be suspected if unusual noise or bang was audible during runup. Under gusty or turbulent wind conditions, especially with vertical wind components, and low rotor rpm (below 25%) main rotor blade(s) may strike the vertical stabilizer(s) - MAINTENANCE ACTION!
- OVSP F CAUTION LIGHT DOES NOT GO OFF AT 25% N_2 ON FIRST ENGINE START, OR AT 45% N_1 ON SECOND ENGINE START, RESPECTIVELY.

- OFF

ABORT START PROCEDURE (Engine ventilation)

CAUTION DO NOT PERFORM ENGINE VENTILATION WITH FUEL VALVE CLOSED

Power lever

Starter button

Depress (observe engine starter

limitations)

(continued)

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Starting first engine (continued)

- NOTE Either engine may be started first.
 - If, for any reason a starting attempt is discontinued, the entire starting sequence must be repeated from the beginning.

CAUTION • DO NOT EXCEED STARTER DUTY CYCLE.

- MONITOR CLOSELY TOT (STARTING TRANSIENT BETWEEN 785°C AND 865°C FOR MAXIMUM 5 SECONDS).
- DURING THE NEXT STEPS, IT IS IMPORTANT TO HOLD THE POWER LEVER TRIGGER DEPRESSED BECAUSE IT MAY BE NECESSARY TO MOVE THE LEVER BEHIND THE IDLE STOP (TO AVOID EXCEEDING THE TOT LIMITS).

NOTE Engine starting procedure should normally be completed within 20-60 seconds

1. Starter button	 Depress and hold, simulaneously depress the power lever trigger and move lever to START position (approximately 20°). Start clock.
2. TOT	 Monitor. As soon as TOT exceeds 400°C, vary power lever position to maintain TOT at approximately 700°C.
3. N ₂ /N _{RO} increase	- Monitor
4. Starter button	- Release at N ₁ = 40%
5. OVSP F caution light	- Check off at $N_2 > 25\%$
6. Power lever	- Increase to IDLE (70% \pm 2% $N_1)$
7. Engine and XMSN oil pressure	- Check positive indication
NOTE During start, the engine oil pressure	may exceeed 5 bar
8. Cyclic stick	- Unlock, trim neutral

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4.4.3 Starting second engine

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NOTE During start of second engine the OVSP F caution light indication will go off at $N_1 > 45\%$

- BAT

Check ON

Check OFF

Check OFF

ON

Disconnected

9. Ammeter

Operating generator, check below 100 A (on battery start only)

10. Repeat items 1 to 7 of this procedure (on previous page)

11. Following an EPU-assisted start:

- PWR SELECT switch
- BUS-TIE switches (2)
- GEN I and GEN II lights
- EPU
- EPU light

12. FUEL PUMP XFER switches (2)

- 13. FUEL PUMP PRIME switches (2)
- OFF check PRIME PUMPS caution light off.

NOTE After start, do not advance engines to flight idle until the minimum oil temperature has been reached.

4.4.4 Cold weather starts

- **NOTE** When starting at low ambient temperature, oil pressure may exceed 5 bar.
 - At temperatures below -30°C it is generally recommended to preheat the battery to -20°C or above.
 - During engine start at low ambient temperature the mast moment indicator and the triple tachometer pointer movements may be sluggish. After warmup the indications are correct.
 - After abrupt temperature changes from cold to warm (parking the helicopter in a heated hangar at low ambient temperatures) a complete loss of the lubricant at the main rotor pendulum absorbers may occur.

Depending on ambient temperature, two different cold weather starting procedures are presented subsequently.

To perform cold weather starts, proceed generally in accordance with the normal engine starting procedure described in paragraphs 4.4.2 and 4.4.3 above. However, replace steps 1 to 4 of that procedure by the appropriate (entire) sequence shown below.

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Outside air temperature between -30°C and -40°C:					
1. Power lev	er	-	Preselect 30° position		
CAUTION	DURING THE NEXT STEPS, LEVER TRIGGER DEPRESSE MOVE THE LEVER BEHIND TH TOT LIMITS).	IT IS D E IE II	S IMPORTANT TO HOLD THE POWER BECAUSE IT MAY BE NECESSARY TO DLE STOP (TO AVOID EXCEEDING THE		
2. Starter bu	utton	-	Depress and hold. Simultaneously de- press and hold the power lever trigger. Start clock.		
3. TOT		-	Monitor. As soon as TOT increases, vary power lever position to maintain TOT at approximately 700°C.		
4. N ₂ /N _{RO} in	ncrease	-	Monitor		
5. Starter b	utton	-	Release at $N_1 = 50\%$		

CAUTION AFTER START, DO NOT ADVANCE ENGINES TO FLIGHT IDLE UNTIL THE MINIMUM OIL TEMPERATURE HAS BEEN REACHED.

Outside air temperature below -40°C:

Preselect FLIGHT position CAUTION DURING THE NEXT STEPS, IT IS IMPORTANT TO HOLD THE POWER LEVER TRIGGER DEPRESSED BECAUSE IT MAY BE NECESSARY TO MOVE THE LEVER BEHIND THE IDLE STOP (TO AVOID EXCEEDING THE TOT LIMITS). Starter button Depress and hold. Simultaneously depress and hold the power lever trigger. If neccesary, move power lever slowly forward. Start clock. TOT Monitor. As soon as TOT increases, vary power lever position to maintain TOT at

4. N₂/N_{BO} increase - Monitor

- 5. Starter button
- CAUTION AFTER START, DO NOT ADVANCE ENGINES TO FLIGHT IDLE UNTIL THE MINIMUM OIL TEMPERATURE HAS BEEN REACHED.

-

Release at N1 = 50%

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Ballen Plans

Move smoothly to FLY position

Check neutral in

Recheck

As required

- OFF

OFF

Unlock

OFF

As required

Check

In the green range *

4.6 * PRE-TAKEOFF CHE

- 1. Power levers
- 2. Cyclic stick
- 3. Engine and XMSN instruments
- 4. Fuel quantity
- 5. All caution and warning lights
- 6. Bleed air consumers
- 7. Optional equipment
- 8. Collective pitch

4.7 **★ TAKEOFF CHECK**

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 1. Hover flight
 Perform

 2. N₂/Rotor RPM 98-102%
 Check (when NORM mode selected)

 3. Torque
 Check synchronized

 4. Hover power
 Check

 5. Engine and XMSN instruments
 Recheck

.

-

- 6. All caution and warning lights
- After takeoff:
- 7. Bleed air consumers

4.8 **PRE-LANDING CHECK**

- **NOTE** For landing into an airfield of an elevation greater than 8000 ft under right hand side wind conditions, turbulence etc. it is recommended to operate the VARTOMS in the 104% mode.
 - 1. VARTOMS Select desired mode
 - 2. All instruments
- 3. All caution and warning lights Check
- 4. Bleed air consumers OFF

★ To be checked before each flight

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7.2.6 Mast Moment indication

The mast moment indicator system indicates any bending moments imposed on the main rotor mast. The system can be checked by means of the TEST pushbutton. When electrical power is initially applied to the system, the LIMIT warning light will come on. Pressing the TEST pushbutton should cause the needle to deflect to the limit of the scale. Releasing the button will cancel the test indications, i.e. the LIMIT warning light goes off and the needle returns to the minimum green range.

The **Mast moment warning light** begins to flash when the needle reaches the last third of the yellow arc with increasing frequence before reaching the red radial of the mast moment indicator system. It illuminates steady when reaching the red radial. It keeps steady on after exceeding the red radial and can be reset by pressing the test button.

7.2.7 Annunciator System

LH 0040_1

PITOT 1	BAT 70	PITCH	FUEL PRESS I	ENG I	RPM	ENG #	FUEL PRESS R	носк	DOOM
PITOT 2	BA7 60	CSAS ROLL	FUEL VALVE I	ENG I OIL P	XMSN OIL PRESS	ENG I	FUEL WALVE I	HYD 2	HEATER
BRAKE	BAT DISCH	CSAS YAW	FUEL LOW 1	ENG I CHIP	XMSN OIL	ENG X	FUEL	HYD 2	INV 1
PRIME PUMPS	EXT PWR		FUEL FILTER I	OIL FILTER I	XMSN OIL CHIP	OL FLTER #	FUEL FILTER #	SPAS	INV 2
BAT OFF	DG		GENI	GEN (GEN I	GEN N	F PUMP	FPUMP

Fig. 7-7 Typical annunciator panel

The advisory, caution and warning annunciator system comprises the annunciator panel, the lamp test switch and the MASTER warning light.

The annunciator panel comprises 50 individual annunciator segments with green indication in case of advisory lights that indicates the operation of electrical systems, and yellow or red indication in case of caution or warning lights respectively that indicates defect or failure of systems.

CAUTIONS PROVIDED ON THE ANNUNCIATOR PANEL					
BAT OFF	BAT 60	CSAS YAW			
DG	DOOR	EPU			
ENG I CHIP	ENG II CHIP	HEATER			
ENG I OIL P	ENG II OIL P	F.PUMP XFER FWD			
F.PUMP XFER AFT	FUEL FILTER I	FUEL FILTER II			
FUEL LOW I	FUEL LOW II	HYD 1→2			
FUEL PRESS I	FUEL PRESS II	HYD 2			
FUEL VALVE I	FUEL VALVE II	PRIME PUMPS			
GEN I	GEN II	ROTOR BRAKE			
GEN I OVHT	GEN II OVHT	SPAS			
OIL FILTER I	OIL FILTER II	XMSN CHIP			
XMSN OIL TEMP					

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WARNINGS PROVIDED ON THE ANNUNCIATOR PANEL					
ENGILOW	ENG II LOW	ROTOR RPM			
XMSN OIL PRESS	BAT 70	BAT DISCH			

Whenever a yellow caution or red warning light comes on at the annunciator panel, the MASTER warning lights on the instrument panel will come on too. If the integrated push-button in the MASTER warning light is pressed, MASTER warning lights indication will go off until the next caution or warning indication appears. The respective caution or warning light remains on. If a defective system returns to normal operation the respective caution/warning light goes off and the unacknowledged MASTER warning light too.

If the ENG I LOW or ENG II LOW warning light illuminates and the respective N1 is 60% or less a beeping tone sounds. If the ROTOR RPM warning light comes on and the rotor rpm is 95% or less a steady tone sounds.

A lamp test button ANN PNL TEST is provided on RH side below annunciator panel for functional testing of annunciator lamps (see Fig, 7-8). If pressed all lights on the annunciator panel and the OVSP F must come on.

7.2.8 Center Console



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7.2.9 Main Switch Panel / Miscellaneous Panel

The main switch panel is equipped with essential switches for the fuel system, the electrical system, the directional gyro, the VARTOM (Variable Rotorspeed and Torque Matching System) and the lights.



Main Switch Panel

Miscellaneous Panel

Fig. 7-9 Typical Panel Layout

The miscellaneous panel is equipped with switches for the heating and ventilation system.

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7.7 FUEL SYSTEM

7.7.1 Storage

Fuel is stored in underfloor compartments, using bladder type fuel cells, comprising a forward, center and aft main tank and supply tank, divided in a left and a right chamber. Center and aft main tank are connected by two upper interconnector tubes and a fuel transfer tube with break-away couplings. Each tank has one drain valve on the bottom. The left supply tank provides fuel for the left engine, and the right supply tank for the right engine. The fuel system has a usable fuel capacity of 558 kg.



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Fig. 7-18 Diagram of fuel system

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7.7.2 Supply

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The fuel supply system consists of two independent systems, one for each engine. Fuel is transferred to both chambers of the supply tank from the main tanks by two electrically driven full redundant centrifugal transfer pumps, installed in the forward main tank. Surplus fuel in the supply tanks returns to the main tank via overflow tubes. After starting the engines, the fuel pumps are activated by the XFER FWD/AFT ON/OFF switches, located on the main switch panel and supplied via the XFER-F/-A circuit breaker. The prime pumps, one in each supply tank, serves to purge air from the fuel feed system and supply the engines during start. The prime pumps are activated by the PRIME I/II ON/OFF switches. During the prime pumps operation the PRIME PUMPS caution light comes on. The prime pumps must be shut off during normal flight. The engine driven fuel pumps, mounted in the fuel control unit, transfer fuel from each supply tank to the respective engine. Two electrically operated fuel shut-off valves, one on each side of the fuselage underneath the engine deck are installed to permit fuel supply shut-off by the FIRE EXT/FUEL SOV switch in ARM position in case of an emergency.

7.7.3 Monitoring System

Three fuel quantity transmitters are installed in the fuel system; one in the forward main tanks and one in each supply tank. All transmitters are connected electrically to the triple fuel quantity indicator in the instrument panel. Additionally two fuel low level sensors are installed in the supply tanks. If the fuel in a supply tank becomes 22.4 kg or less the respective warning light FUEL LOW I/II on the annunciator panel comes on. On low fuel pressure at the inlet of the engine fuel pump the respective warning light FUEL PRESS I/II on the annunciator panel comes on.

7.7.4 Refueling and Grounding

The refueling system comprises a filler neck and a ground bushing. The filler neck, located on the left side of the fuselage, is equipped with a filler cap and a removable filter and it is designed for gravity refueling. The ground bushing, located beside the filler neck, provides a static discharge when a proper ground connection is available.

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7.15 LIGHTING EQUIPMENT

7.15.1 Position Lights

The three position lights, a red light, located outside of the left end-plate, a green light, located outside of the right end-plate and a white light, located at the upper rear end of the vertical stabilizer, are controlled by a switch marked POS located on the main switch panel. The lights receive power via the NO.1 MAIN BUS through the POS circuit breaker, located on the overhead console.

7.15.2 Anticollision Lights

The helicopter is equipped with an anticollision flash light, located on the top of the vertical stabilizer. The red anticollision light is controlled by a switch marked ANTI-COL, located on the main switch panel. It receives power from the NO.2 MAIN BUS through the ANTI-COL circuit breaker, located on the overhead console.

7.15.3 Instrument Lights

Lighting of standby horizon is controlled independent of standard instrument lighting by variable resistor HOR STAB LIGHTING located on LH side above the instrument.

The lighting of all other instruments is controlled via variable resistors, for shut on/off and to regulate light intensity. The PILOT&CSL variable resistor controls the pilots flight instruments and the console lighting, the ENG variable resistor controls the engine and transmission monitoring instruments and fuel quantity indication. If one of the variable resistors is operated, warning lights on annunciator panel and master warning light MASTER are simultaneously reduced in brightness. The system is powered via NO.2 FLT ESS BUS via circuit breaker INST LTS P&ENG located on the overhead panel.

7.15.4 Cockpit Lights

The cockpit light is a spotlight, installed RH behind the overhead console. It provides a cone of light for the crew members and is controlled by a switch, integrated in the spotlight casing. The cockpit light receives power via the NO.2 MAIN BUS through a circuit breaker marked CKPT, located on the overhead console.

A dome light is installed in the overhead panel, controlled by a push-button DOME LIGHT. Electrical power is supplied from NO.2 MAIN BUS via a circuit breaker marked DOME on the overhead panel.

7.15.5 Cabin and Cargo Compartment Lights

Above passenger seats and above the cargo compartment dome lights are installed, which can be controlled separately by the respective switches integrated in the dome light casing. The cargo compartment dome light rocker switch owns a NORM position, which illuminates the cargo dome light, if the cargo compartment doors are open. All lights receive their power from the NO. 2 MAIN BUS through a circuit breaker marked DOME, located on the overhead panel.

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SECTION 9

OPERATIONAL INFORMATION

9.1 GENERAL INFORMATION

This section deals with additional information to Section 5 (performance data), which shall give an assistance when carrying out preflight planning and may be helpful in estimating the remaining flight time or range if, for some reason, the originally intended flight plan must be changed during flight.

For definition of terms, abbreviations and symbols used in this section, refer to Section 1.

9.2 STANDARD PERFORMANCE CONDITIONS

All information in this section is based on the following conditions:

- 1. Engine power does not exceed helicopter limits (see Section 2).
- 2. Installation and accessory losses are included in each performance chart.
- 3. All performance data (diagrams) are based on the assumption that the automatic power sharing and variable rotor speed system is operated in the NORM mode.
- 4. Collective pitch lever travel is limited by the override stop.
- 5. Helicopter is regarded in its clean configuration.

9.3 VARIABLE FACTORS AFFECTING PERFORMANCE

Details of the variable factors affecting performance are given in the respective diagrams.

- **NOTE** None of the curves presented should be extrapolated, but interpolation between given data is permissible.
 - Performance data contained in this section are not assured in the event of sand or hailstone ingestion into engine(s).

9.4 READING OF THE CHARTS

It is of the utmost importance that the charts be read accurately, especially the multi-variable graphs. In this type of presentation, errors in reading can be cumulative, resulting in large final errors. Close attention should be paid to subdivisions of the grid.

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9.5 **POWER REQUIRED AND SPECIFIC FUEL CONSUMPTION**

To determine the specific fuel consumption for a particular flight mission, first determine the power required (expressed in % torque) under consideration of representative flight conditions using Fig's. 9-1 or 9-2, respectively. An average value of the specific fuel consumption can then be derived from Fig. 9-3 by entering the diagram with that torque value.

The fuel consumption diagram (Fig. 9-3) is based on the following conditions:

1. Fuel density is 0.8 kg/l (6.682 lb/U.S. gal.).

- 2. The used fuel meets one of the approved fuel types as specified in Section 2.
- 3. Bleed air heating is switched OFF.

With bleed air heating ON the fuel consumption will be increased.

Figures 9-1 and 9-2 provide data for engine power required (expressed in % torque) as a function of LEVEL SPEED, GROSS MASS, OAT and PRESSURE ALTITUDE.

Figure 9-3 provides data for specific fuel consumption as a function of TORQUE, PRESSURE ALTITUDE and OAT.

- **NOTE** After a large and rather rapid attitude change, the fuel quantity indication changes by 20 to 40 kg. However, this change is only transient and the indication turns back to the original correct value within 2 or 3 minutes.
 - During nose up flight with a small quantity of fuel in the main tank, the fuel quantity indicator of the main tank shows smaller readings than actual value.

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EXAMPLE:	(see Figure 9-3)	•
Determine:	Specific fuel consumption	
Known:	Torque	52.5%
	Pressure altitude	8000 ft
	OAT	+35 °C
	Bleed air heating	OFF

Solution: 1. Specific fuel consumption = 202 kg/h

1. Enter chart at known torque (52.5%).

2. Move horizontally right to known pressure altitude (8000 ft).

3. Move vertically downwards to temperature reference line (0 °C).

4. From this point move upwards (or downwards respectively), following the direction of the temperature guide lines.

5. Enter chart at known OAT (+35 °C).

6. Move horizontally right to intersect tracing.

 From point of intersection move vertically downwards and read specific fuel consumption (202 kg/h).

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POWER AS REQUIRED

FUEL CONSUMPTION 2 X TURBOMECA ARRIEL 1E2

BLEED AIR HEATING OFF

NOTE WITH BLEED AIR HEATING ON, THE SPEC. FUEL CONSUMPTION IS 2.0 % HIGHER.





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