TERMO DE ABERTURA DE VOLUME

Em 28/11/2014 o volume n.º13 do processo nº 053.000.716/2012, foi aberto com a folha n.º 2998

Rubrica	Matrícula	Setor/Órgão
	1405298	COMOF

2.14 OIL LIMITATIONS

2.14.1 Oil specifications

	Oil type	OAT limit
Engine	MIL-PRF-23699 MIL-PRF-7808	–30°C –45 to +50°C
Main transmission	MIL-PRF-23699	–40°C
Intermediate gearbox	ZF H.L 3001 or MIL-PRF-23699	–40°C
Tail rotor gearbox	ZF H.L 3001 or MIL-PRF-23699	–40°C
Main rotor hub	MIL-PRF-23699	–40°C

NOTE Do not mix different oil specifications when refill.

2.14.2 Oil quantities

	Liters	Kilograms
Engines (each unit)		
Usable (Min)	3.50	3.43
Usable (Max)	5.10	5.00
Unusable	0.40	0.35
Total	5.50	5.35
Main transmission	12.90	12.25
Intermediate gearbox	0.75	0.74
Tail rotor gearbox	0.65	0.64
Main rotor hub	1.90	1.86

Oil mass values are based on an oil density of 0.98 kg/liter (20°C)

2.15 HYDRAULIC SYSTEM LIMITATIONS

2.15.1 Hydraulic pressures

Minimum ..... 5500 kPa
Caution range ..... 5500 kPa to 6000 kPa)
Continuous operation ..... 6000 kPa to 12000 kPa)
Caution range
High pressure relief valve starts to open) ..... 12000 kPa to 12200 kPa
Maximum (max. fluid flow at High pressure relief valve) ..... 16000 kPa

2.15.2 Hydraulic system quantities

	Liters	Kilograms
Hydraulic system 1	1.0	0.85
Hydraulic system 2	1.2	1.02

2.15.3 Hydraulic fluid

Hydraulic fluid type MIL-H-5606 is authorized for use at all ambient temperatures.
Oil mass values are based on an oil density of 0.85kg/liter (20°C).

2.16 OPERATIONAL LIMITATIONS

2.16.1 Prohibited flight maneuvers

The following are prohibited:
- Aerobatic maneuvers
- Intentional full autorotation landings
- Flight into icing conditions. In case that icing conditions are entered unexpectedly, the icing zone shall be left in the quickest possible way.

2.16.2 Rotor starting and stopping in high wind

Starting and stopping the rotor is authorized in up to max. 50 kts wind from all horizontal directions.

2.16.3 Hover turns

For gross mass up to 3200 kg ..... maximum 45°/s (8 seconds for a 360° turn)
For gross mass above 3200 kg ..... maximum 30°/s (12 seconds for a 360° turn)

2.16.4 Main rotor mast moment limits

2.16.4.1 Main rotor mast moment limits indications

The mast moment indicator, displayed on the FL page, indicates the bending moment of the main rotor mast. The limit (marked with a red bar or red circle (if CPDS-Software 2005 or subsequent is installed) shall not be reached).

Linear scale:

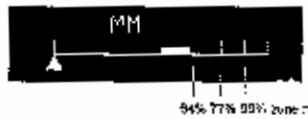

Fig. 2-4 Mast moment indicator on the FL page – linear scale

EFFECTIVITY: if CPDS-Software SW V2005 or subsequent is installed

Circular scale (displayed only if configured, N_R = 70% and MM analog signal available (MM/ES located and operative)):

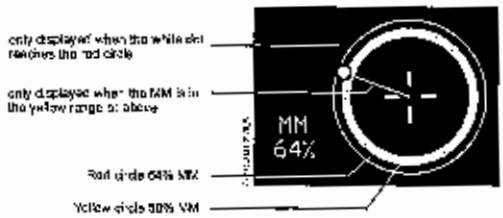

Fig. 2-5 Mast moment indicator on the FL page – circular scale

NOTE The MM indication can be configured at the configuration page (LINEAR or CIRCULAR or NIL).

The white dot indicates MM value and the pilot should, to minimize the MM value, move the cyclic stick in a manner to bring the white dot to the center of the scale.

If the MM is ≤ 85% the white dot is in center position.

If the MM is equal to or exceeds 85% the scale will grow and fill the space between the original yellow scale and the red scale. Additionally a white line is shown pointing to the dot (or MM = 85%), in order to facilitate the finding of the dot in the yellow range and above.

If the red circle is turned (64% MM), an additional white ring is shown to indicate the end of the scale: 100% MM. Between 64% and 100% the MM scale is compressed.

A numerical value of the MM magnitude is displayed below the "MM" symbol and underlined in the color which limit is exceeded.

If the angular position of the MM is unsteady the white cross will change to a thick yellow center cross.

EFFECTIVITY: All

2.16.4.2 Main rotor mast moment limits

Maximum ..... red bar/red circle
Caution range ..... yellow region/ yellow circle
Normal range ..... left side of yellow region/ ..... from yellow circle towards center

NOTE ● Upon reaching the red bar/ red circle a warning gong comes on, a red box appears around the word LIMIT, and MM or the numerical value becomes underlined red. All these signals disappear upon leaving the red bar / red circle. In case that mast moment is higher than 77% the MM EXCEED caution comes on and will not disappear until power off.

● On CPDS Flight Report page the accumulated time which has been spent in each zone (see fig 2-4 and 2-5) during flight and the max. MM will be displayed. A logbook entry and maintenance action are required whenever the limit (red bar/circle) has been exceeded.

2.16.5 Slope operations

CAUTION DO NOT EXCEED THE ALLOWABLE MAST MOMENT LIMITS.

Slope operations (takeoff/landing) are limited in the degree of existing terrain upon which the maneuver may be performed:

Ground sloping down to the left ..... max. 11°
Ground sloping down to the right ..... max. 8°
Ground sloping nose up ..... max. 8°
Ground sloping nose down (if terrain allows) ..... max. 8°

2.16.6 Operational information

Onboard HF / tactical radio transmission can influence radio navigation systems (NDB, VOR, ILS, ADF) and communication systems (VHF radio, other tactical radio). Even when the indications recover quickly after stop of transmission, the crew shall be attentive while transmitting with tactical radios.

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PROC. 053000716/2012
MAT. 1405296

2.17 INSTRUMENT MARKINGS

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

Left systems (engine, fuel,...) 1
Right systems (engine, fuel,...) 2
Main rotor ..... R
Minimum and maximum limits ..... red radial
Maximum continuous power OEI ..... dashed yellow radial
2.5 min power OEI ..... dashed red radial
Transient limits ..... red dot
Starting transient limits ..... red triangle (filled)
Normal starting limits ..... red triangle (unfilled)
Normal continuous range ..... green arc
AEO takeoff power and expanded operating rotation range ..... yellow arc
Never exceed speed - power off ..... red cross-hatched radial

2.17.1 Analogue instruments

2.17.1.1 Airspeed indicator

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

2.17.1.2 Triple tachometer

Engine RPM (N_2 power on):

95% ..... red radial
95% to 104% ..... green arc
104% ..... red radial
106% ..... red dot

Rotor RPM (power off):

80% ..... red radial
80% to 85% ..... yellow arc
85% to 104% ..... green arc
104% ..... red radial
113% ..... red dot

2.17.2 VEMD-displayed instruments

2.17.2.1 First Limit Indicator (FLI):

The first limit indicator (FLI) (Fig. 2-6) gives an analogue indication of the limiting parameter associated with the helicopter engine primary limitations for: N_1, TOT or torque. The indication is completed by the display of digital data for the three parameters. The dial scale of the analogue display is arbitrary and does not represent a percent value.

NOTE Even though the rotor is stopped it is possible that due to torque calibration tolerance, a digital torque value of up to 3% is indicated and the needle of first limit indicator is in "0" position. In that case no corrective action is necessary.

FOLHA 3000
PROC. 0530037716/2012
MAT. 14C5290

▽	Max. TOT starting (appears only during starting)
▼	TOT starting transient (appears only during starting)
▬	TOT starting range (bold white, appears only during starting)
▬	AEO takeoff power range: max. 5 min (bold yellow)
▮	AEO max. takeoff power
▯	OEI max. continuous power
▮	OEI 2.5 min. power
●	AEO transient; max. 12 sec. (torque only)
◉	OEI transient; max. 12 sec. (torque only)

Fig. 2-6 FLI marking symbology on analogue display

EFFECTIVITY: If CPCS-Software V2506 or subsequent is installed

▽	Max. TOT starting (appears only during starting)
▼	TOT starting transient (appears only during starting)
▬	TOT starting range (bold white, appears only during starting)
▬	AEO takeoff power range; max. 5 min (bold yellow)
▮	AEO max. takeoff power
▯	OEI max. continuous power
▮	OEI 2.5 min. power
●	AEO transient; max. 12 sec. (torque, ΔN_2)
◉	OEI transient; max. 12 sec. (torque only)

Fig. 2-7 FLI marking symbology on analogue display

EFFECTIVITY: All

Fig. 2-8 Digital data display

A value that is within the normal operating range is displayed as shown in Fig. 2-8 a). A solid white rectangle associated with a parameter indicates which is the limiting parameter (Fig. 2-8 b)). If operation in a yellow range is detected, a countdown timer is automatically switched on and the digital data is yellow underlined (Fig. 2-8 c)).

For the 5 min limit (AEO TOP) the counter is invisible, 5 seconds before the timer reaches zero the timer is displayed and a flashing red box appears around the word "LIMIT" (Fig. 2-8)

EFFECTIVITY: If DECS-Software V2068 or subsequent is installed

For the 5 min limit (AEO TOP) the counter is invisible, until 1 min 30 sec before timer expires. 15 seconds before the timer reaches zero a flashing red box appears around the word "LIMIT" (Fig. 2-7).

EFFECTIVITY: All

For the 2.5 min limit (OEI) counter, five seconds before the timer reaches zero a flashing red box appears around the word "LIMIT" (Fig.2-6 and 2-7). When the countdown has expired or if the limit has been exceeded, the red box is fixed and the red underlining of the digits flashes (Fig. 2-8 c)).

If one of the parameters is invalid, a yellow failure symbology replaces the information concerning the faulty parameter.

2.17.2.2 Engine / transmission oil temperature / pressure bar graph indicators

The symbology and animation logic of the bar graphs which indicate the values for engine/transmission oil temperature/pressure is as follows:

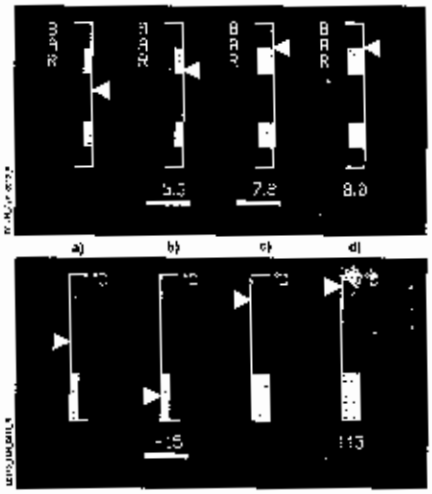

Fig. 2-9 Typical bar graph display

- If the value is in the normal operation range, the limitation display is as shown in Fig. 2-9 a). The digital value is only shown when permanent displaying is selected.
- If the value reaches the yellow region, the numeric value appears and is yellow underlined (Fig. 2-9 b)).
- The yellow and red limitation markings grow when the value gets close to the red region (Fig. 2-9 c)).
- If the value enters the red region, the numeric value is red underlined and flashes (Fig. 2-9 d)).

For further bar graph markings refer to Fig 2-10.

2.17.2.3 Engine/transmission oil pressure/temperature bar graph markings

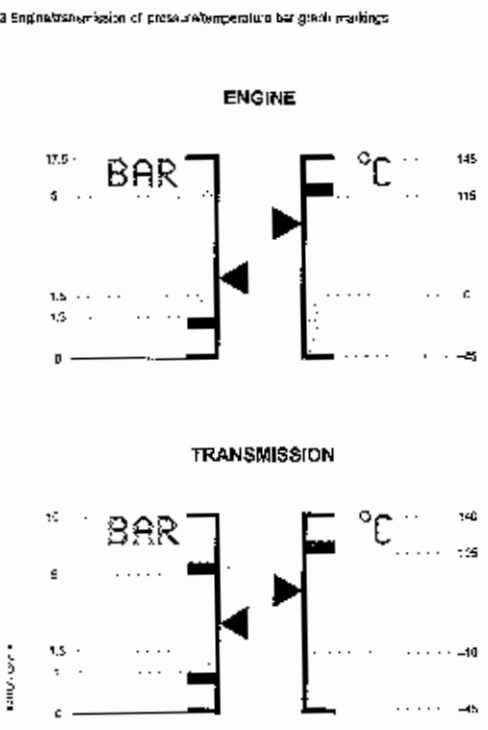

Fig. 2-10 Engine/transmission oil pressure/temperature bar graph markings

2.18 PLACARDS AND DECALS

All placards shown below are usually presented in English. However, for non-JAA-registered helicopters, markings and placards intended for emergency passenger information and instruction, and instruction for operation of passenger doors may be provided in local language.

The following illustrations of placards and decals are typical presentations. Slight format differences from the real placards and decals do not affect the information presented therein.

Placard:

THIS HELICOPTER IS
APPROVED FOR
VFR DAY AND NIGHT OPERATION

Location: Upper R- frame

Placard:

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

Location: Central spar

Placard:

MAX. PERMISS. GROSS MASS 3585 kg

Location: Below forward RH cabin door

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PROC. 053005716/2012
MAT. 1405256

Placard:

VNE OEI = 110 KIAS OR TABLE VALUE, WHICHEVER IS LESS
VNE POWER OFF = 90 KIAS OR TABLE VALUE, WHICHEVER IS LESS

Location: Central spar

Placard:

Location: Cabin roof, sliding doors and windows at the rear part of the cabin (inside, LH and RH)

Placard:

DURING GROUND OPERATION: ONLY SMALL CYCLIC STICK DISPLACEMENTS FOR FUNCTIONAL TESTS

or

FOR FUNCTIONAL TESTS DURING GROUND OPERATION APPLY ONLY SMALL CYCLIC STICK DISPLACEMENTS

Location: Upper RH wooden skid frame

Placard: (optional)

SAFETY CABLE – USE TO SECURE CREW MEMBERS (200 KG MAX.)

Location: Inside, near safety harness fitting

Placard: (optional)

USE ONLY TO SECURE PERSONS (200 KG MAX.)

Location: Inside, near safety harness fitting

Placard:

MAX. FLOOR LOAD 800 kg/m²
CARGO TO BE SECURED
MAX. LOAD PER EYE 70 kg

Location: Cabin panelling, RH

Placard:

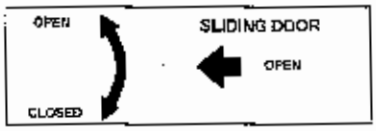
INTERCOM

Location: Below external power connection

Placard:

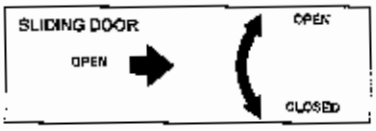
Location: Below external power connection

Placard:



Location: Sliding doors, inside (LH and outside (RH)

Placard:



Location: Sliding doors, inside (RH) and outside (LH)

Placard:

DO NOT OPERATE DOOR HANDLE DURING FLIGHT

Location: Sliding door frames, LH and RH and cockpit door LH

Placard: (colour of the symbol: RAL 3000)

Location: Sliding doors, inside, and cockpit doors, inside

Placard:

EMERGENCY EXIT
REMOVE CAP
PULL HANDLE
PUSH WINDOW INSIDE

Location: Outside, upper part LH and RH sliding door

Placard:

EMERGENCY EXIT
REMOVE CAP
PULL HANDLE
PUSH WINDOW OUTSIDE

Location: Inside, upper part LH and RH sliding door

EFFECTIVITY *A/C with S/N 9351 and subsequent or after ASB MBB BK117 C-2-56A-001 "Improvement of jettisoning function of sliding door window panel", except jettisonable sliding doors*

Placard:

EMERGENCY EXIT
REMOVE CAP
PULL HANDLE
PUSH WINDOW AT ONE
MARKING (◯) INSIDE

Location: Outside, upper part LH and RH sliding door

Placard:

EMERGENCY EXIT
REMOVE CAP
PULL HANDLE
PUSH WINDOW AT ONE
MARKING (◯) OUTSIDE

Location: Inside, upper part LH and RH sliding door

Placard:

Location: Inside, upper part LH corner and RH corner of the sliding door window

Placard:

Location: Outside, lower part LH corner and RH corner of the sliding door window

EFFECTIVITY *All*

Placard:

JET FUEL, 229 US. GALLONS		
MIL - T - 5624		JP5
ASTM - D - 1655	JET A	JET A1
FOR ADDITIONAL FUEL TYPES SEE FLIGHT MANUAL		

Location: Main fuel tank filler neck

Placard:

FOR BARREL OR GAS CAN REFUELING USE SCREEN

FOR OPERATION BELOW –10 °C (14 °F)
ADD ANTI-ICING-ADDITIVE ACC. TO FLIGHT MANUAL
ONLY TO NOT PREBLENDED FUELS

Location: Rear fuel tank filler neck

Placard:

DO NOT STOW ANYTHING
UNDER THE SEATS

Location: Beneath the seats

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PROC. 053000716/2012
MAT. 1405298

Placard:

CAUTION
HOT

Location: Inside RH and LH seat tubes support

Placard:

GROUND (EARTH) HERE

Location: Grounding socket

Placard:

NO STEP

Location: Horizontal stabilizer, upper side, LH and RH

Placard:

NO HANDLING

Location: Antenna cover on lower side of fuselage and horizontal stabilizer trailing side

Placard:

HANDLE HERE

Location: Tail skid

Placard:

NO PUSH

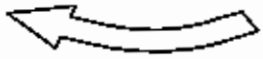
Location: Vertical fin, lower center position

Placard:

DANGER KEEP AWAY

Location: Vertical fin, lower end, LH and RH

Placard:



DIRECTION OF ROTOR ROTATION

Location: Vertical fin, upper end, LH

Placard:

OIL 12.5 L
OIL 3,3 US GAL
MIL-L-23699

Location: Main transmission filler neck

Placard:

OIL 0.75 L
OIL 0,2 US GAL
MIL-L-23699

Location: Intermediate gearbox

OR

Placard:

OIL
ZFNL 3001

Location: Intermediate gearbox

Placard:

OIL 0,66 L
OIL 0,17 US GAL
MIL-L-23699

Location: Tail rotor gearbox

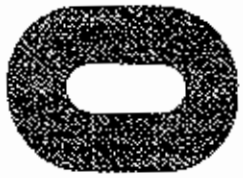
OR

Placard:

OIL
ZFNL 3001

Location: Tail rotor gearbox

Placard: (colour: RAL 2005 or 9005)



Location: LH cockpit door, RH and LH sliding cabin door, outer door handle

Placard:

Location: [illegible] panel

EFFECTIVITY *HAC up to S/N 9650 and before SB MSB BK117 C-2-25-002 "Replacement of the pressitemp correction table"*

Placard:

PRESSURE-TEMPERATURE CORRECTION TABLE					
°C TEMP	–45	–29	–14	–7	+4
°F TEMP	–49	–20	0	+20	+40
IND. PRESS	135	167	196	232	276
	154	187	217	254	300
°C TEMP	+16	+21	+27	+32	+49
°F TEMP	+60	+70	+80	+100	+120
IND. PRESS	320	360	399	438	502
	354	395	440	484	554

Location: RH fairing below exhaust pipe

EFFECTIVITY *After SB MSB BK117 C-2-25-002 "Replacement of the pressitemp correction table" or HAC with S/N 9651 and subsequent*

Placard:

PRESSURE-TEMPERATURE CORRECTION TABLE					
°C TEMP	–45	–29	–18	–7	+4
°F TEMP	–49	–20	0	+20	+40
IND. PRESS	123	148	174	207	249
	140	168	212	251	294
°C TEMP	+16	+21	+27	+38	+49
°F TEMP	+60	+70	+80	+100	+120
IND. PRESS	301	334	367	442	502
	354	395	447	482	562

Location: RH fairing near fire extinguisher bottles

EFFECTIVITY *All*

ATTENTION HOT AIR
KEEP NOZZLE FREE

Location: Air outlet beside RH/LH sliding door

EFFECTIVITY *After SB MSB BK117 C2-11-003 "Affixing of '28 V DC' placards to EMS receptacles" or HAC with S/N 9191 and subsequent*

Placard:

28V DC 15A

Location: Beside power sockets, rear cabin

Placard:

28V DC 20A

Location: Beside power sockets, rear cabin

EFFECTIVITY *All*

FOLHA 3004
PROC. 0590CD710/2012
MAT. 1405298

SECTION 3

EMERGENCY AND MALFUNCTION PROCEDURES

TABLE OF CONTENTS

SECTION 3

EMERGENCY AND MALFUNCTION PROCEDURES

3.1 GENERAL

This section contains the recommended procedures for managing various types of emergencies, malfunctions and critical situations.

WARNING AFTER AN ACTUAL EMERGENCY OR MALFUNCTION MAKE AN ENTRY IN THE HELICOPTER LOGBOOK AND, WHEN NECESSARY, THE AFFECTED SYSTEM LOGBOOK (E.G. ENGINE LOGBOOK). MAINTENANCE ACTION MAY BE REQUIRED AND NECESSARY BEFORE NEXT FLIGHT.

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

3.1.1 Basic rules

These procedures deal with common emergencies. However they do not prevent the pilot from taking additional action necessary to recover the emergency situation.

Although the procedures contained in this section are considered the best available, the pilot's sound judgement is of paramount importance when confronted with an emergency.

To assist the pilot during an in-flight emergency, three basic rules have been established:

1. Maintain aircraft control
2. Analyse the situation
3. Take proper action

NOTE It is impossible to establish a predetermined set of instructions which would provide a ready-made decision applicable to all situations.

3.1.2 Memory items

Emergency procedure steps which shall be performed immediately without reference to other this manual or the pilot's checklist are written in boldface letters on a gray background (as shown here) and shall be committed to memory.

Therefore, those emergency procedures appearing without boldface letters on a gray background may be accomplished referring to this manual and when time and situation permit.

3.1.3 Operating condition

The following terms are used in emergency procedures to describe the operating condition of a system, subsystem, assembly or component:

Affected	Fails to operate in the normal or usual manner
Normal	Operates in the normal or usual manner

3.1.4 Urgency of landing

NOTE The type of emergency and the emergency condition, combined with the pilot's analysis of the condition of the helicopter and his proficiency are of prime importance in determining the urgency of a landing.

The following terms are used to reflect the degree of urgency of an emergency landing:

LAND IMMEDIATELY

The urgency of landing is paramount. Primary consideration is to assure survival of the occupants. Landing in water, trees or other unsafe areas should be considered only as a last resort.

LAND AS SOON AS POSSIBLE (LAND ASAP)

Land without delay at the nearest adequate site (i.e. open field) at which a safe approach and landing can be made.

LAND AS SOON AS PRACTICABLE

The landing site and duration of flight are at the discretion of the pilot. Extended flight beyond the nearest approved landing area where appropriate assistance can be expected is not recommended.

3.1.5 Resetting tripped circuit breakers

General:

There is a latent danger in resetting a circuit breaker (cb) tripped by an unknown cause because the tripped condition is a signal that something may be wrong in the related circuit. Until it is determined what has caused a trip to occur, crew members have no way of knowing the consequences of resetting a tripped cb.

On-the-Ground:

A cb tripped by an unknown cause may only be reset on the ground after maintenance has determined the cause of the trip and has determined that the circuit may be safely reset. A cb may be cycled (tripped, reset) or reset, where it is required to be performed within approved maintenance inspection criteria, or as part of an approved trouble-shooting procedure unless doing so is specifically prohibited.
Resetting a cb tripped by an unknown cause should normally be a maintenance function conducted on the ground.

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In-Flight:

A tripped cb should not be reset in flight unless doing so is consistent with explicit procedures specified in the approved Flight/Maintenance Manual, its supplements and checklists used by the crew members or unless, in the judgment of the pilot-in-command, resetting the cb is necessary for the safe completion of the flight. Crew members should limit resetting of cb to one in-flight reset where the action is required.
No attempt should be made to reset a cb if it trips a second time.

Logbook entry:

A detailed logbook write-up is a proven safety practice.

3.1.6 Definition of terms

The term

"OEI flight condition ... – Establish"

is used as a leading step in some engine emergency procedures to express the following:

1. In case that power of affected engine tends to zero:

- Maintain the normal engine in the OEI limits.
- Attempt to obtain a safe single engine flight condition. If a climb is necessary to reach a safe flight altitude, attempt to obtain Vy (best rate of climb) or 45 kts (best climb practical speed).
- Continue with the remaining steps of the relevant procedure.

2. In case that affected engine still delivers power:

- If deemed necessary, try to escape from immediate danger with both engines operating.

- Establish steady level flight and determine if the situation will allow for OEI flight. As a rule of thumb, this can be done by checking that the sum of the individual engine torques is lower than the OEI torque limit. If this is fulfilled, re-check OEI power available by setting the affected engine to IDLE while maintaining the normal engine within appropriate OEI limit.
- If engine power is sufficient for OEI flight and if a safe OEI landing can be assumed, continue with the remaining steps of the relevant procedure.
- If engine power is not sufficient for OEI flight or if a safe OEI landing is not assured, LAND AS SOON AS POSSIBLE. If necessary, re-establish power of affected engine before landing. After landing perform single engine emergency shutdown of affected engine.

3.2 WARNINGS AND CAUTIONS

A red warning light on the WARNING PANEL coming on together with a gong signal or dedicated audio signal indicates an emergency condition requiring immediate corrective action.

A caution indication on the CAD and the yellow master caution lights on the instrument panel indicate malfunction or failure conditions which do not require immediate crew action but the possible need for future corrective action.

The cautions, indicated on the CAD, are divided into three sections, SYSTEM 1, MISC and SYSTEM 2. SYSTEM 1 indicates the operating conditions of the left power plant or the system 1 of a redundant system. SYSTEM 2 provides the same features for the right power plant or the system 2 of a redundant system. MISC indicates the operating conditions of the non-redundant systems.

The yellow master caution lights in the pilot's field of view warn the pilot's attention to the indication(s) on the CAD whenever a caution has been activated there.

Each caution (CAD-and caution and master caution light) must be acknowledged by the pilot (copilot) by pushing the RESET button on the cyclic stick grip or the SELECT key on the CAD. Acknowledged cautions are indicated in sequence of importance. In case of lack of space on the screen, further confirmed cautions will be stored on additional pages, which will be indicated by the "1 of 2" message on top of the middle column. They can be called up via the SCROLL key. Any new unconfirmed caution overlies the previous caution and is bordered by two flashing lines to draw the pilot's attention to the new caution.

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

Following is an alphabetical listing of the warning lights (WARNING PANEL) and caution indications (CAD) with the relevant conditions, any further indications and the emergency procedures.

3.2.1 Warning light indications

WARNING LIGHT INDICATIONS

BAT TEMP

Conditions/Indications

Battery overtemperature (above 70 °C)
– Warning gong will be activated

Procedure

● ON GROUND

1. BAT MSTR sw – OFF
2. Engines – Shut down

CAUTION BATTERY MUST BE INSPECTED OR REPLACED PRIOR TO NEXT FLIGHT.

● IN FLIGHT

Single pilot operation:

1. BAT MSTR sw – OFF
2. LAND AS SOON AS POSSIBLE
3. Engine shutdown – Perform
4. Visual inspection of battery – Perform

If visual inspection reveals no indication of battery overheating:

5. Start-up procedure – Perform
6. BAT MSTR sw – OFF

NOTE Continue flight in VMC only. On CAD the BAT DISCON caution will appear.

7. LAND AS SOON AS PRACTICABLE

Dual pilot operation:

1. BAT MSTR sw – OFF
2. LAND AS SOON AS POSSIBLE
3. PF remaining on seat – "Hands on"
4. Engines – Leave running in IDLE
5. Visual inspection of battery – Perform

NOTE Continue flight (VMC) only if visual inspection reveals no indication of battery overheating. Leave battery OFF or disconnect battery. On CAD the BAT DISCON caution will appear.

6. LAND AS SOON AS PRACTICABLE

CAUTION BATTERY MUST BE INSPECTED OR REPLACED PRIOR TO NEXT FLIGHT.

WARNING LIGHT INDICATIONS

ENG 1 FAIL or ENG 2 FAIL

Conditions/Indications

– Respective N_1 RPM below threshold value.

Procedure

1. OEI flight condition – Establish
2. Affected engine – Identify
3. Single engine emergency shutdown – Perform
4. LAND AS SOON AS PRACTICABLE

WARNING LIGHT INDICATIONS

FIRE (ENGINE 1) or FIRE (ENGINE 2)

Conditions/Indications

Overtemperature in engine compartment
– Warning bell will be activated

Procedure

● ON GROUND

1. FIRE sw (affected engine) – Raise guard, press

NOTE Affected engine will shut down automatically, ACTIVE indicator light, BOT 1 legend (both EMER OFF SW pb), and F VALVE CL caution indication (CAD) come on. FIRE legend remains on as long as overheat condition exists.

2. Both FUEL PRIME PUMPS – Check OFF
3. BOT 1/BOT 2 pb – Press; bottle 1 activated;
– EXT indicator light comes on (EMER OFF SW pb)

NOTE Extinguisher bottle will begin discharging when $N_1 < 50\%$. After discharge of bottle contents, BOT 1 legend and EXT indicator light go off, BOT 2pb legend comes on.

4. Clock stop watch – Start (after BOT 1 legend and EXT indicator light go off (EMER OFF SW pb))
5. Double engine emergency shutdown – Perform
6. Passengers – Alert/Evacuate

(continued)

If situation permits and FIRE warning is still on after 1 minute:

7. BOT 1/BOT 2 pb – Press; bottle 2 activated;
– EXT indicator light comes on (EMER OFF SW pb)
8. BAT MSTR sw – OFF

● IN FLIGHT

1. OEI flight condition – Establish
2. Airspeed – Reduce if IAS is exceeding 100 kts
3. FIRE sw (affected engine) – Raise guard, press

NOTE Affected engine will shut down automatically, ACTIVE indicator light, BOT 1 legend (both EMER OFF SW pb), and F VALVE CL caution indication (CAD) come on. FIRE legend remains on as long as overheat condition exists.

4. BOT 1/BOT 2 pb – Press; bottle 1 activated;
– EXT indicator light comes on (EMER OFF SW pb)

NOTE Extinguisher bottle will begin discharging when $N_1 < 50\%$. After discharge of bottle contents, BOT 1 legend and EXT indicator light go off, BOT 2pb legend comes on.

5. Clock stop watch – Start (after BOT 1 legend and EXT indicator light go off (EMER OFF SW pb))
6. Affected engine – Identify
7. Single engine emergency shutdown – Perform
8. Passengers – Alert
9. LAND AS SOON AS POSSIBLE

If FIRE warning is still on after 1 minute:

10. BOT 1/BOT 2 pb – Press; bottle 2 activated;
– EXT indicator light comes on (EMER OFF SW pb)

If FIRE warning remains on:

11. LAND IMMEDIATELY

WARNING LIGHT INDICATIONS

LOW FUEL 1 and/or LOW FUEL 2

Conditions/Indications

– Respective supply tank fuel quantity below 24 kg
– Warning gong will be activated

Procedure

1. Fuel quantity indication – Check

If positive fuel indication in the main tank:

2. Both fuel pump XFER sw (Fwd + Aft) – Check ON
3. Both fuel pump XFER circuit breakers (Fwd + Aft) – Check in

If both FUEL LOW warning lights remain on:

4. LAND WITHIN 10 MINUTES

If one FUEL LOW warning light remains on:

4. Expect single engine failure

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PROC. 0520007716/2012
MAT. 1465290

WARNING LIGHT INDICATIONS

ROTOR RPM

Conditions/Indications

Nrp low

- Nrp 95% or less - steady light
- Audio signal - low-pitch beating tone

Nrp high

- Nrp 106% or above - flashing light and warning gong
- Audio signal at 110% or above - flashing light and steady high-pitch tone

Procedure

Nrp low/Nrp high

1. Rotor RPM indicator — Check
2. Collective lever — Adjust as necessary to maintain Nrp within normal range

WARNING LIGHT INDICATIONS

XMSN OIL PRESS

Conditions/Indications

XMSN oil pressure is below minimum

- Transmission oil pressure indication 1 bar or less
- Warning gong will be activated

NOTE XMSN OIL PRESS warning light may come on momentarily during extreme side slip, sidewards flight, crosswind hover or dance operations.

Procedure

If one XMSN oil pressure indication is below 1.0 bar:

1. Power — Reduce
2. LAND AS SOON AS PRACTICABLE

If both indications are below 1.0 bar:

1. LAND IMMEDIATELY

NOTE Descend with minimum power

3.2.2 MASTER caution light

NOTE The MASTER caution light always comes on in conjunction with any caution indication on the CAD.

CAUTION LIGHT INDICATION

Conditions/Indications

Caution indication comes on (CAD)

Procedure

1. Caution indication (CAD) — Check and perform corresponding procedure(s)
2. RESET switch (cyclic stick) — Press

3.2.3 Caution indications

CAUTION INDICATIONS

AVION OVHT

(MISC)

Conditions/Indications

Normal operating temperature of COMMAV, FCDS or AFCS exceeded.

CAUTION THE MAX. REMAINING OPERATING TIME IS APPROX. 30 MIN

Procedure

1. INST DOOL ab — Check in

If AVIO OVHT caution indication remains on:

2. LAND AS SOON AS PRACTICABLE
3. Airspeed — Maintain as high as possible for best cooling effect

CAUTION INDICATIONS

BAT DISCH

(MISC)

Conditions/Indications

DC power is supplied by battery.

Short circuit on battery bus or on battery feeder line.

NOTE Normal during engine start.

Procedure

1. DC VOLTS, GEN AMPS and BAT AMPS — Check

If BAT DISCH caution is present while generators are functioning normal:

2. BAT MSTR sw — OFF
3. LAND AS SOON AS PRACTICABLE

If BAT DISCH caution is present while operating on battery:

2. Electrical consumption — Reduce as much as possible to save battery power
3. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

BAT DISCON

(MISC)

Conditions/Indications

Battery is off-line (normal during EPU load or when the BAT MSTR switch is in OFF position).

Procedure

1. BAT MSTR sw — Check in ON position

If BAT DISCON caution indication remains on:

2. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

BLEED AIR

(MISC)

Conditions/Indications

Bleed air shut off valve and mating valve remain open after shutting off bleed air heating.

Procedure

1. BLD HTG throttle — Turn on and lower again to OFF

If BLEED AIR caution indication disappears:

2. Continue flight

If BLEED AIR caution indication comes on again:

2. Engine performance may be degraded. Use caution, especially during takeoff and landing.

CAUTION INDICATIONS

BUSTIE OPN and/or **BUSTIE OPN**

(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

Electrical systems are separated (load sharing impossible).

If both BUSTIE OPN caution indications come on, the battery will not be charged.

Procedure

● ON GROUND

1. DC VOLTS, GEN AMPS and BAT AMPS – Check

If one or both parameters:
Voltage < 26.2 V or > 28.8 V, Current < 0 A or > 200 A

2. Respective GEN sw or BAT MSTR sw – OFF
3. Double engine emergency shutdown – Perform
4. EPU, if connected – Disconnect

If Voltage = 26.5 ± 0.3 V and Current = 0 A - 200 A

2. Respective BUSTIE sw – Reset, one time only
3. DC VOLTS, GEN AMPS and BAT AMPS – Check

If one or both parameters:
Voltage < 26.2 V or > 28.8 V, Current < 0 A or > 200 A
or BUSTIE OPN caution returns

4. Double engine emergency shutdown – Perform
5. EPU, if connected – Disconnect

If Voltage = 26.5 ± 0.3 V and Current = 0 A - 200 A

4. Continue flight

● IN FLIGHT

If GEN AMPS > 200 A:

1. GEN sw (affected generator) – OFF
2. LAND AS SOON AS PRACTICABLE

If GEN AMPS normal (0-200 A):

1. LAND AS SOON AS PRACTICABLE

CAUTION IF BUSTIE OPN APPEARS AS A RESULT OF AN ELECTRICAL FAILURE, RESETTING THE BUSTIE COULD LEAD TO ADDITIONAL DAMAGE AND ELECTRICAL FIRE. THEREFORE, A BUSTIE RESET IN FLIGHT SHOULD ONLY BE PERFORMED IF THE BUSTIE WAS DELIBERATELY SWITCHED OFF.

CAUTION INDICATIONS

CAD FAN

(MISC)

Conditions/Indications

Failure of CAD fan has been detected during CPDS actions test.

Procedure

Do not start engines.

CAUTION INDICATIONS

CAU DEGR

(MISC)

(On VEMD if CPD is inoperative or on CAD if both VEMD lines are inoperative)

Conditions/Indications

Degraded caution indications due to loss of CAD line or both VEMD lines

Procedure

see para 3.3.3 and 3.3.4

CAUTION INDICATIONS

CPDS OVHT

(MISC)

Conditions/Indications

Normal operating temperature of instrument panel exceeded

CAUTION THE MAX REMAINING OPERATING TIME IN THIS ENVIRONMENTAL CONDITION IS APPROX. 30 MIN.

Procedure

1. INST COOL cb – Check in
2. PUSH FOR AIR knob – Push
3. VENTILATION COCKPIT thumbw. – Hi
4. VENTILATION CABIN switch – ON

If caution indication remains on:

5. LAND AS SOON AS PRACTICABLE

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PROC. 053000716/2012
MAT. 1405298

CAUTION INDICATIONS

DOORS

(MISC)

Conditions/Indications

Any one of the following doors is not properly locked:

- Cockpit doors
- Cabin sliding doors
- Cabin clamshell doors

Procedure

1. Doors – Check latched

If caution indication remains on:

2. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

ENG CHIP or **ENG CHIP**

(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

Metal particles detected in engine oil.

Procedure

● ON GROUND

1. Affected engine – Identify
2. Single engine emergency shutdown – Perform

● IN FLIGHT

1. OEI flight condition – Establish
2. Affected engine – Identify

1. Alternative:

3. Single engine emergency shutdown – Perform

2. Alternative:

3. Twist grip (affected engine) – Rotate slowly to IDLE, check indications

CAUTION THE SECOND ALTERNATIVE ENABLES THE CREW TO USE THE AFFECTED ENGINE FOR LANDING IF NECESSARY. BE PREPARED FOR ENGINE FAILURE. MONITOR N1, TOT, TORQUE, OIL PRESSURE AND TEMPERATURE OF AFFECTED ENGINE CLOSELY. IF THE PARAMETERS FLUCTUATE OR THEIR LIMITS ARE EXCEEDED PERFORM SINGLE ENGINE EMERGENCY SHUTDOWN IMMEDIATELY.

4. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

ENG O FILT or **ENG O FILT**

(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

Engine oil filter contaminated.

NOTE During engine start the ENG O FILT caution indication may come on for up to two minutes.

Procedure

1. Engine oil pressure and engine oil temperature – Monitor
2. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

ENG OIL P (SYSTEM 1) or ENG OIL P (SYSTEM 2)

Conditions/Indications

Affected engine oil pressure below minimum

Procedure

1. Engine oil pressure – Check
2. OEI flight condition – Establish
3. Affected engine – Identify
4. Single engine emergency shutdown – Perform
5. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

ENG PA DIS (SYSTEM 1) and ENG PA DIS (SYSTEM 2)

Conditions/Indications

Respective parameter discrepancy between ENG 1 and ENG 2. Affected parameters indicated in yellow on FLI page.

Procedure

CAUTION
- DO NOT TRY TO MATCH NEEDLES
- AVOID USING MAXIMUM POWER.

1. Engine digital values – Compare to verify the lost parameter
2. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

ENG SPLIT (SYSTEM 1) and ENG SPLIT (SYSTEM 2)

Conditions/Indications

N_1 indication show difference of 10% or more.

NOTE ENG SPLIT caution indication may come on during base flight operation in VAR NR system MAN mode. Try to match N_1 and ENG SPLIT caution indication goes off.

Procedure

1. Collective lever – Adjust to OEI limits or below
2. Bleed air consumers – Off
3. Engines condition – Analyse
4. Continue in accordance with procedures for ENGINE UNDERSPEED - GOVERNOR FAILURE (para 3.4.11), or ENGINE OVERSPEED - GOVERNOR FAILURE (para 3.4.10), or VAR NR caution indication, whichever is applicable.

CAUTION INDICATIONS

EPU DOOR (MSG)

Conditions/Indications

External power receptable access door is open.

Procedure

● ON GROUND

After EPU stops:

EPU access door – Close

● IN FLIGHT

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

EXT POWER (MSG)

Conditions/Indications

External power is applied to the electrical distribution system.

NOTE EXT POWER caution indication going off does not indicate that the EPU cable is disconnected.

Procedure

After EPU stops:

1. EPU cable – Disconnect
2. EPU access door – Close
   Check that EPU DOOR caution indication goes off

CAUTION INDICATIONS

FIRE E TST (SYSTEM 1) and/or FIRE E TST (SYSTEM 2)

Conditions/Indications

Indicates that the fire extinguishing system has been tested

Procedure

No action necessary.

CAUTION INDICATIONS

FIRE EXT (SYSTEM 1) and/or FIRE EXT (SYSTEM 2)

Conditions/Indications

The respective extinguishing bottle is not available.

Procedure

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS (CAD & FLI)

FLI DEGR (System 1) or FLI DEGR (System 2)

Conditions/Indications

Loss of one engine parameter.

- the numerical value of the failed parameter disappears
- the parameter designation is yellow

Procedure

CAUTION
- IF THE LOST PARAMETER WAS DESIGNATED AS "FIRST LIMIT" BEFORE THE FAILURE, THE FIRST LIMIT STATUS WILL CHANGE AUTOMATICALLY TO THE NEXT LIMITING PARAMETER ON THE AFFECTED SYSTEM. THUS, A NEEDLE SPLIT MAY BE ENCOUNTERED ON THE FLI.
- DO NOT TRY TO MATCH NEEDLES
- AVOID USING MAXIMUM POWER. USE THE NEEDLE OF THE NORMAL ENGINE FOR LIMIT INDICATION. COMPARE REMAINING DIGITAL PARAMETER VALUES

LAND AS SOON AS PRACTICABLE

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MAT. 1405290

CAUTION INDICATIONS (CAD & FLI)

FLI FAIL (System 1) or **FLI FAIL** (System 2)

Conditions/Indications

Loss of two out of three signals (torque, analogue N1, TOT) of the same engine.
- the numerical value of the failed parameters disappeared
- the parameter designation is yellow (yN1 symbol will be displayed above the N1 digital value. N1 will be undefined according to fixed values)
- the needle of the respective engine disappeared

Procedure

CAUTION ▪ DO NOT TRY TO TRIM ENGINES

▪ AVOID USING MAXIMUM POWER. USE THE NEEDLE OF THE NORMAL ENGINE FOR LIMIT INDICATION. COMPARE REMAINING DIGITAL PARAMETER VALUES.

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

F PUMP FWD or **F PUMP AFT**

(MISC)

Conditions/Indications

Failure of forward or aft fuel transfer pump, or dry run.

Procedure

1. Fuel level in the main tank – Check

If there is fuel in the main tank:

2. FUEL PUMP XFER sw (-F (forward) or -A (aft), resp.) – Check ON
3. XFER PUMP circuit breaker (-F (forward) or -A (aft), resp.) – Check in

If F PUMP FWD/AFT caution indication remains on:

4. Affected FUEL PUMP XFER sw – OFF

If there is no fuel in the main tank:

2. Affected FUEL PUMP XFER sw – OFF

NOTE ▪ Each fuel transfer pump is capable of feeding more fuel than both engines will consume.

▪ In the event of a fuel transfer pump failure the main tank unusable fuel increases:

FWD pump failure: maximum 11.7 kg (10.9 l)
AFT pump failure: maximum 45.34 kg (56.3 l)

CAUTION INDICATIONS

F PUMP JET

(MISC)

Conditions/Indications

All main tank jet pump is not capable of delivering fuel to fwd main tank.

Procedure

F PUMP AFT sw – Check ON

NOTE ▪ If F PUMP JET caution indication remains on, the main tank unusable fuel increases to 24.7 lb in hover flight. This quantity can be reduced to 4.1 lb using 0° pitch attitude. Monitor supply tank indication closely.

▪ During hover flight conditions with a main tank fuel quantity indication of approx. 30 kg, the F PUMP JET caution indication may come on for a short period.

CAUTION INDICATIONS

F QTY DEGR

(MISC)

Conditions/Indications

Failure of one main tank sensor.

Procedure

Set pitch attitude between -3° and -8° before reading the approx. available fuel quantity, then calculate remaining flight endurance.

CAUTION THE DEGRADED FUEL QUANTITY INDICATION REPRESENTS THE MINIMUM FUEL LEVEL WITHIN PITCH ATTITUDE RANGES OF -3° TO -8°.

CAUTION INDICATIONS

F QTY FAIL

(MISC)

Conditions/Indications

Failure of the fuel quantity indication system.

CAUTION ▪ THE FUEL QUANTITY INDICATION SYSTEM HAS FAILED. DO NOT CALCULATE FLIGHT ENDURANCE USING THE FUEL QUANTITY INDICATION.

▪ ACCURATE FUEL QUANTITY INFORMATION IS ONLY PROVIDED BY THE LOW FUEL WARNING LIGHT ACCOMPANIED BY WARNING GONG.

Procedure

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

FUEL FILT (SYSTEM 1) or **FUEL FILT** (SYSTEM 2)

Conditions/Indications

Engine fuel filter(s) contamination.

Procedure

One caution indication:

LAND AS SOON AS PRACTICABLE

CAUTION BE PREPARED FOR SINGLE ENGINE FAILURE.

Both caution indications:

LAND AS SOON AS POSSIBLE

CAUTION BE PREPARED FOR DOUBLE ENGINE FAILURE.

CAUTION INDICATIONS

FUEL PRESS (SYSTEM 1) or **FUEL PRESS** (SYSTEM 2)

Conditions/Indications

Engine fuel pump inlet pressure low.

Procedure

1. FUEL PRIME PUMP sw (affected engine) – ON; PRIME PUMP caution indication will come on.

If FUEL PRESS caution indication goes off:

2. LAND AS SOON AS PRACTICABLE

If FUEL PRESS caution indication remains on:

2. FUEL PRIME PUMP sw – OFF
3. LAND AS SOON AS PRACTICABLE

CAUTION BE PREPARED FOR SINGLE ENGINE FAILURE.

CAUTION INDICATIONS

FUEL VALVE (SYSTEM 1) or **FUEL VALVE** (SYSTEM 2)

Conditions/Indications

Fuel valve in the position other than commanded.

NOTE A FUEL VALVE caution indication coming on for a short time while valve is in transition from open to closed position, or vice versa, indicates normal operation.

Procedure

LAND AS SOON AS PRACTICABLE

CAUTION BE PREPARED FOR SINGLE ENGINE FAILURE.

CAUTION INDICATIONS

F VALVE CL (SYSTEM 1) or F VALVE CL (SYSTEM 2)

Conditions/Indications

Fuel valve is in closed position.

The respective ACTIVE light (EMER OFF SW panel) will come on.

NOTE The F VALVE CL caution indication will come on after pressing and releasing the respective EMER OFF switch labelled "FIRE".

Procedure

No action necessary.

NOTE Before starting the engines, check that respective EMER OFF switch labelled "FIRE" is pressed and the ACTIVE light is off.

CAUTION INDICATIONS

GEN DISCON (SYSTEM 1) or GEN DISCON (SYSTEM 2)

Conditions/Indications

One generator has failed or is disconnected from the power distribution system.

Both non-essential buses are disconnected.

Procedure

NOTE Depending on the cause of the GEN DISCON, when switching of both BUSTIE switches the GEN DISCON indication could switch to the opposite side or both generators could come on with Voltage < 26.2 V or > 28.8 V, Current < 0 A or > 200 A. In this case still continue with procedure as stated.

1. DC VOLTS, GEN AMPS – Check

If one or both parameters: Voltage < 26.2 V or > 28.8 V, Current < 0 A or > 200 A

2. Both BUSTIE sw's – OFF (both BUSTIE OPN cautions present)

If voltage > 30.5 V:

3. Both GEN sw's – OFF (both GEN DISCON cautions present)
4. Generator failure isolation – Perform, refer to para 3.7.1

If Voltage = 28.5 ± 0.3 V (system supplied by at least one generator):

3. GEN sw (affected generator) – OFF
4. LAND AS SOON AS PRACTICABLE

If Voltage = 28.5 ± 0.3 V and Current = 0 A - 200 A (system supplied by at least one generator):

2. GEN sw (affected generator) – OFF
2. LAND AS SOON AS PRACTICABLE

CAUTION • SINCE ONE FUEL TRANSFER PUMP IS POWERED BY THE SHED BUS, THE AMOUNT OF UNUSABLE FUEL INCREASES ABOVE THAT STATED IN SECTION 2 WHEN PROBLEM IS IDENTIFIED ON SYS1 SIDE, BUSTIE 1 IS OPENED AND GEN 1 REMAINS OFF.

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MAT. 1499288

• WHEN GEN 2 IS DISCONNECTED AND BOTH BUSTIE SW ARE OFF, THE RADALT FUNCTION IS LOST WHICH WILL REDUCE CAPABILITIES OF THE AUTOPILOT, AS THE AUTO LEVEL OFF FUNCTION WILL BE LOST.

NOTE • Systems on SHED BUS of affected side will be lost once BUSTIE switches are OFF. Furthermore the other SHED BUS will be lost when both GEN switches are off resulting in various cautions, indicating these systems are failed.

• One generator alone will provide sufficient power for continued flight until safe landing can be made.

• If winch operation is required for safety of flight, the BUSTIE 1 switch can be momentarily switched to RESET, then NORM, winch operation attempted and when finished the BUSTIE 1 switch must be turned OFF again.

CAUTION INDICATIONS

GEN DISCON (SYSTEM 1) and GEN DISCON (SYSTEM 2)

Conditions/Indications

Both generators have failed or are disconnected from the power distribution system.

– Only ESS BUS 1 + 2 are available

Procedure

1. GEN AMPS – Check

If GEN AMPS < 0 A:

2. Both BUSTIE sw's – OFF (both BUSTIE OPN cautions present)

If both generators remain offline after turning BUS TIE sw's OFF:

3. Generator failure isolation – Perform, refer to para 3.7.1

If one generator comes online again after turning BUS TIE sw's OFF:

2. GEN sw (failed generator) – OFF
4. LAND AS SOON AS PRACTICABLE

If GEN AMPS ≥ 0 A:

NOTE If GEN AMPS > 0 A this could mean the generator is actually functioning. Still continue procedure as stated.

2 Generator failure isolation – Perform, refer to para 3.7.1

CAUTION • SINCE ONE FUEL TRANSFER PUMP IS POWERED BY THE SHED BUS, THE AMOUNT OF UNUSABLE FUEL INCREASES ABOVE THAT STATED IN SECTION 2 WHEN PROBLEM IS IDENTIFIED ON SYS1 SIDE BUSTIE 1 IS OPENED AND GEN 1 REMAINS OFF.

• WHEN GEN 2 REMAINS DISCONNECTED AND BOTH BUSTIE SW ARE OFF, THE RADALT IS LOST WHICH WILL REDUCE CAPABILITIES OF THE AUTOPILOT, AS THE AUTO LEVEL OFF FUNCTION WILL BE LOST.

NOTE • The battery will supply the ESS BUS 1 and 2.

• Systems on SHED BUS of affected side will be lost once BUSTIE switches are OFF. Furthermore the other SHED BUS will be momentarily lost when both GEN switches are off resulting in various cautions, indicating these systems are failed.

• If winch operation is required for safety of flight, the BUSTIE 1 switch can be momentarily switched to RESET, then NORM, winch operation attempted and when finished the BUSTIE 1 switch must be turned OFF again.

continued

- Flight endurance depends on battery type and loading.

Residual Battery Endurance					
Continuous load [A]	15	20	25	30	40
Time [min]	80	45	35	30	22
NOTE Calculations are based on an assumed minimum battery capacity of 15 Ah. Three minute 10 minutes landing light operation and 10 minutes radio transmission.					
WARNING TOTAL ELECTRICAL FAILURE WILL LIMIT FUEL AVAILABLE TO QUANTITY CONTAINED IN SUPPLY TANKS AT TIME OF FAILURE AND THUS RESIDUAL FLIGHT TIME					

CAUTION INDICATIONS

GEN OVHT (SYSTEM 1) or **GEN OVHT** (SYSTEM 2)

Conditions/Indications

Temperature of generator high.

Procedure

1. Affected GEN sw – OFF

CAUTION IF GEN OVHT CAUTION INDICATION REMAINS ON AND IF THERE ARE INDICATIONS OF A FIRE SUCH AS BURNING ODOR OR SMOKE, SHUT DOWN THE AFFECTED ENGINE.

If GEN OVHT caution indication remains on for more than 1 minute:

2. OEI flight condition – Establish
3. Affected engine – Identify
4. Single-engine emergency shutdown – Perform
5. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

HTG OVTEMP
(NEC)

Conditions/Indications

Overtemperature in the bleed air cool system or leakage of heating air

NOTE Bleed air shut off valve will be closed automatically.

Procedure

1. BLD HTG rheostat – OFF

If caution indication goes off

2. BLD HTG rheostat – Turn on again to a lower setting

If HTG OVTEMP caution indication comes on again:

3. BLD HTG rheostat – OFF

CAUTION INDICATIONS

HOR BAT
(MISC)

Conditions/Indications

Standby horizon is supplied by the emergency battery pack.

Procedure

No action necessary

NOTE Emergency power supply for standby horizon is ensured for minimum 30 min.

CAUTION INDICATIONS

HYD PRESS (SYSTEM 1) or **HYD PRESS** (SYSTEM 2)

Conditions/Indications

Pressure loss in the affected system, the normal system retains power.

WARNING DO NOT OPERATE HYD TEST SWITCH IN FLIGHT.

CAUTION
- AVOID HOVERING IN HIGH GROSS MASS/CALM WIND CONDITIONS, AS HYDRAULIC POWER MAY NOT BE SUFFICIENT FOR BOOSTING UPWARD COLLECTIVE INPUTS.
- IN CASE OF HYD PRESS (SYS 2) SERVO BOOST OF YAW COMMAND WILL BE LOST, ADDITIONAL INDICATION OF YAW SAS CAUTION (IF YAW SAS INSTALLED) OR ACTUATOR CAUTION (IF AFCS INSTALLED) WILL BE DISPLAYED TO INDICATE LOSS OF ELECTRICAL YAW ACTUATOR.
  PEDAL FORCES WILL INCREASE BUT YAW CONTROLLABILITY IS UNAFFECTED.

Procedure

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

INPUT FAIL
(yellow)
(MISC)

Conditions/Indications

- SPDS test has detected one or more failed caution indications (CAD) during pre-start check
- Failed caution indication(s) are flashing
- "External test" indicated (VEMD)

WARNING THE FLASHING CAUTION INDICATION(S) HAS FAILED AND WILL NOT BE INDICATED IN REAL FAILURE CASE.

NOTE After pressing the RESET pushbutton, the yellow INPUT FAIL caution appears.

Procedure

Do not start engines.

CAUTION INDICATIONS

INVERTER
(MISC)

Conditions/Indications

AT AC power sometimes lose power

Procedure

INVERTER sw – OFF

CAUTION INDICATIONS

MM EXCEED
(MISC)

Conditions/Indications

Mast moment > 77%. MM EXCEED caution indication remains on until power off.

Procedure

LAND AS SOON AS PRACTICABLE

Avoid manoeuvre causing high mast moments.

CAUTION INDICATIONS

OVSP FAIL or OVSP FAIL
(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

Loss of at least one N_2 or one N_1 sensor signal in the affected engine overspeed protection system.

CAUTION THE AFFECTED ENGINE IS NO LONGER PROTECTED AGAINST POWER TURBINE OVERSPEED.

NOTE Normal indication prior to engine start.

Procedure

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

PITOT HTR or PITOT HTR
(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

- Pitot tube and/or static port heater have failed or are not switched on
- Corresponding airspeed, altitude and vertical speed indications may give false indications in sub-freezing temperatures (≤ 4.5°C).

Procedure

1. Respective cb and sw — Check
2. Indications — Compare with normal system

CAUTION INDICATIONS

PRIME PUMP and/or PRIME PUMP
(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

Prime pump(s) in operation

Procedure

No action necessary (manual indication during engine start)

NOTE Prime pumps must be OFF during normal flight operations.

CAUTION INDICATIONS

P0 DIS
(MISC)

Conditions/Indications

Discrepancy between both P0 sensors detected.

Calculations for compensated N1 indication of both engines are affected.

W_{ac} indication is invalid.

Procedure

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

SHED EMER
(MISC)

Conditions/Indications

SHED BUS switch is switched to EMER ON.

NOTE See also caution GEN DISCON caution indication.

Procedure

1. Electrical consumers — Reduce as much as possible
2. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

STARTER or STARTER
(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

If START caution indication remains on after reaching IDLE speed a relay or electromagnetic switch blockage is evident

NOTE The START caution indication is normal during engine starting or ventilation and needs no corrective action.

Procedure

● ON GROUND

1. Respective ENG START sw — Check off

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PROC. 053000716/2012
MAT. 140529

If ENG START switch off:

2. Affected engine — Identify
3. Single engine emergency shutdown — Perform

● IN FLIGHT

1. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

TWIST GRIP or TWIST GRIP
(SYSTEM 1) (SYSTEM 2)

Conditions/Indications

Affected engine TWIST GRIP is not in FLIGHT position.

Procedure

1. Affected engine TWIST GRIP — Check FLIGHT position

If TWIST GRIP caution indication persists:

2. LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

T0 DIS
(MISC)

Conditions/Indications

FLI DEGR caution indication appears.

Discrepancy between both T0 sensors detected.

Calculations for compensated N1 indication of both engines are affected.

OAT indication is invalid.

NOTE On ground it may be possible that the T0 DIS caution indication comes on if one side of the HC is heated more than the other side due to influence of direct/indirect intensive sunlight radiation.

Procedure

● ON GROUND

If caution indication remains on more than 2 min after start up:

Normal engine shutdown — Perform

● IN FLIGHT

LAND AS SOON AS PRACTICABLE

CAUTION INDICATIONS

VEMD FAN
(MISC)

Conditions/Indications

Failure of VEMD fan has been detected during external CPCS test.

Procedure

Do not start engines.

CAUTION INDICATIONS

VAR NR
(MISC)

Conditions/Indications

- Selftest of VAR NR monitor has failed
- Rotorspeed is not within expected limits
- Torque split > 15% or
- Power supply for VAR NR system interrupted
- Failure of FCDM or ADC
- Failure of N2 trim motor system
- Failure of VEMD Lane 1

NOTE
- Indication is normal on ground.
- VAR NR caution indication could also be indicated by any engine overspeed or underspeed condition. Cross-check the relevant instruments, warning lights and caution indications to determine if such condition is evident (refer to para 3.4, Engine Emergency Conditions).
- VAR NR caution may come on momentarily during engagement of OAT A or during rapid power or airspeed changes.
- If torque split exceeds 15%, the VAR NR caution indication appears and the MAN pushbutton is yellow illuminated. Torque can be synchronized with the 4-way beep switch on the collective. Once torque split is less than 15%, VARTOMS should return automatically to normal operation.

Procedure

1. VAR NR system NORM/MAN sw — Push to select MAN mode

EFFECTIVITY: If under OAT A operation

2. Rotorspeed — Trim manually to 101% using the 4-way beep switch on the collective. Below 55 KIAS at density altitudes above 5500 ft, trim manually to 104%.

EFFECTIVITY If under CAT A operation

2. Rotorspeed – Trim manually to 101% using the 4-way beep switch on the collective. Below 55 KIAS trim manually to 104%.

EFFECTIVITY All

If rotorspeed trimming was successful:

3. Torque – Synchronize
4. Continue flight

If rotorspeed trimming was not successful:

3. Airspeed – Reduce IAS to VNE – 25 kt or below
4. Torque – Synchronize if possible
5. Continue flight

NOTE
- With lower rotorspeed, collective lever inputs should be performed carefully in order to stay within N2/NRO limits.
- With lower rotorspeed, the HOGE performance is reduced by 120 kg up to 10000 ft DA.
- With lower rotorspeed, avoid landings with crosswind from the right.

CAUTION INDICATIONS

XMSN CHIP

(MISC)

Conditions/Indications

Metal particles detected in the main transmission.

Procedure

1. XMSN oil pressure – Check in normal range
2. LAND AS SOON AS PRACTICABLE

NOTE Reduce power as much as possible.

CAUTION INDICATIONS

XMSN OIL T

(MISC)

Conditions/Indications

Transmission oil temperature above maximum.

Procedure

1. **XMSN oil temperature and oil pressure indication** – **Check**

If indications are within limits:

2. LAND AS SOON AS PRACTICABLE

If indications are above limit:

2. **Power** – **Reduce, as much as possible**

If oil temperature indication remains above limit:

3. **LAND AS SOON AS POSSIBLE**

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MAT. 1405298

3.2.4 **CPDS external test caution indications**

NOTE The **CPDS external test** is performed only once after CPDS start up.

CAUTION INDICATIONS

ENG CHP CT (SYSTEM 1) or **ENG CHP CT** (SYSTEM 2)

or

ENG OF CT (SYSTEM 1) or **ENG OF CT** (SYSTEM 2)

or

F FLT CT (SYSTEM 1) or **F FLT CT** (SYSTEM 2)

or

XMSN CHP CT (MISC)

or

XMSN OT CT (MISC)

Conditions/Indications

During **CPDS external test**, continuity check of cables and connectors to the respective detector failed.

NOTE A further indication of the respective CPDS caution (**ENG CHIP; ENG O FILT; FUEL FILT; XMSN CHIP; XMSN OIL T**) is impossible.

Procedure

Do not start engines

3.3 **CPDS MALFUNCTIONS**

CPDS MALFUNCTIONS

3.3.1 **Failure of VEMD lane 1 (upper display)**

Conditions/Indications

- Upper VEMD screen blank or abnormal data appearance
- "LANE 1 FAILED" and "PRESS OFF1" appear on the lower VEMD screen
- Increase of NR and VAR NR caution indication comes on

NOTE Detected overlimits or cautions that are not visible in the current display status will be indicated in the message zone of the FLI.

List of possible messages:

- CAUTION DETECTED
- GEN PARAM OVER LIMIT
- DC VOLT PARAM OVER LIMIT
- LOCALIZED FAILURE
- CAD BRIGHTNESS CONTROL FAILED
- VEH PARAM OVER LIMIT
- VEMD BRIGHTNESS CONTROL FAILED
- CROSS TALK FAILED PRESS OFF 1
- CROSS TALK FAILED PRESS OFF 2

Procedure

1. Procedure for **VAR NR** caution indication – Perform
2. OFF 1 button on the VEMD – Press

NOTE Pressing the OFF 1 button removes power from the faulty lane 1. The FLI appears automatically on the lower VEMD screen and replaces the ELEC/VEH page. The ELEC/VEH page may be displayed on the CAD screen by pressing the SCROLL button on the VEMD. Pressing the SCROLL button again causes the CAD screen to return to the standard CAU/FUEL page display. In case of loss of SCROLL button function, press RESET button on VEMD to return to default page.

3. LAND AS SOON AS PRACTICABLE

CPDS MALFUNCTIONS

3.3.2 Failure of VEMD lane 2 (lower display)

Conditions/Indications

- Lower VEMD screen blank or abnormal data appearance
- No audio warning in case of overlimit
- "LANE 2 FAILED" and "PRESS OFF2" appear on the upper VEMD screen
- Degraded master caution indication (only one lamp)

NOTE Detected overlimits or cautions that are not visible in the current display status will be indicated in the message zone of the FLI.

List of possible messages:

- CAUTION DETECTED
- GEN PARAM OVER LIMIT
- DC VOLT PARAM OVER LIMIT
- LOCALIZED FAILURE
- CAD BRIGHTNESS CONTROL FAILED
- VEH PARAM OVER LIMIT
- VEMD BRIGHTNESS CONTROL FAILED
- CROSS TALK FAILED PRESS OFF 1
- CROSS TALK FAILED PRESS OFF 2

Procedure

1. OFF 2 button on the VEMD – Press

NOTE Pressing the OFF 2 button removes power from the faulty lane 2. The ELEC/VEH page may be displayed on the CAD screen by pressing the SCROLL button on the VEMD. Pressing the SCROLL button again causes the CAD screen to return to the standard CAU/FUEL page display. In case of loss of SCROLL button function, press RESET button on VEMD to return to default page.

2. LAND AS SOON AS PRACTICABLE

CPDS MALFUNCTIONS

3.3.3 Failure of CAD lane

Conditions/Indications

- CAD screen blank or abnormal data appearance
- "CAD FAILED" and "PRESS OFF" appear on the FLI (message zone)
- No fuel indication available
- Degraded master caution indication (only one lamp)

NOTE Detected overlimits or cautions that are not visible in the current display status will be indicated in the message zone of the FLI.

List of possible messages:

- CAUTION DETECTED
- GEN PARAM OVER LIMIT
- DC VOLT PARAM OVER LIMIT
- LOCALIZED FAILURE
- CAD BRIGHTNESS CONTROL FAILED
- VEH PARAM OVER LIMIT
- VEMD BRIGHTNESS CONTROL FAILED
- CROSS TALK FAILED PRESS OFF 1
- CROSS TALK FAILED PRESS OFF 2

CAUTION AFTER CAD LANE FAILURE THE CAUTION INDICATIONS ON THE VEMD SCREEN ARE DEGRADED TO THE FOLLOWING:

SYSTEM 1	MISC	SYSTEM 2
ENG CHIP	XMSN CHIP	ENG CHIP
GEN DISCON	ROTOR BRAKE	GEN DISCON
FLI FAIL	P0 DIS	FLI FAIL
FLI DEGR	T0 DIS	FLI DEGR
ENG SPLIT	VAR NR	ENG SPLIT
ENG O FILT	VEMD FAN	ENG O FILT
ENG PA DIS	CAU DEGR	ENG PA DIS
TRAINING	MM EXCEED	TRAINING
	CPDS OVHT	
	TR CHIP	

Procedure

1. Procedure for **VAR NR** caution indication – Perform
2. OFF button on the CAD – Press

NOTE Pressing the OFF button removes power from the faulty lane. The CAU/FUEL page takes priority over the ELEC/VEH page and appears automatically on the lower VEMD screen. The ELEC/VEH page may be reselected on the lower VEMD screen by pressing the SCROLL button on the VEMD. Pressing twice causes SYSTEM STATUS page to appear. To return to the CAU/FUEL page, press the SCROLL button again. In case of loss of SCROLL button function, press RESET button on VEMD to return to default page.

3. LAND AS SOON AS PRACTICABLE

CPDS MALFUNCTIONS

3.3.4 Failure of both VEMD lanes

Conditions/Indications

- Abnormal FLI indication
- Degraded master caution indication (only one lamp)

CAUTION AFTER DOUBLE VEMD LANE FAILURE THE AVAILABLE CAUTION INDICATION ON THE CAD SCREEN IS DEGRADED TO THE FOLLOWING:

SYSTEM 1	MISC	SYSTEM 2
ENG OIL P	AVION OVHT	ENG OIL P
FUEL PRESS	XMSN OIL T	FUEL PRESS
FUEL FILT	YAW SAS*	FUEL FILT
ENG O FILT	AP1*	ENG O FILT
FUEL VALVE	AP2*	FUEL VALVE
F VALVE CL	F PUMP JET	F VALVE CL
PRIME PUMP	TRIM*	PRIME PUMP
HYD PRESS	F PUMP AFT	HYD PRESS
OVSP FAIL	F PUMP FWD	OVSP FAIL
GEN OVHT	F QTY DEGR	GEN OVHT
INVERTER	F QTY FAIL	INVERTER
FIRE EXT	AUX F XFER	FIRE EXT
FIRE E TST	HTG OVTEMP	FIRE E TST
BUSTIE OPN	EPU DOOR	BUSTIE OPN
STARTER	BAT DISCON	STARTER
PITOT HTR	BAT DISCH	PITOT HTR
F FILT CT	EXT POWER	F FILT CT
TWIST GRIP	SHED EMER	TWIST GRIP
	AHRS DISC*	
	HOR BAT	
	ACTUATOR*	
	BACKUP SAS*	

Failure of both VEMD lanes continued:

SYSTEM 1	MISC	SYSTEM 2
	NMS* (or NMS1/2 if AFCS installed)	
	NMS2*	
	NMS1*	
	CABLE CUT*	
	ICE D FAIL*	
	ICE DETECT*	
	CAU DEGR	
	CAD FAN	
	SAND FILT*	
	XMSN OT CT	
	DOORS	
* only if the respective optional equipment is installed		

Procedure

1. Procedure for **VAR NR** caution indication – Perform
2. OFF 1 and OFF 2 button on the VEMD – Press; refer to CAD/BACKUP page

CAUTION WHEN FLYING IN HIGH ALTITUDE N_1 COULD BE THE LIMITING PARAMETER. OBSERVE THE FOLLOWING POWER LIMITATIONS:

Pressure Altitude (ft)	Torque (%)
0	71
2000	70
4000	68
6000	66
8000	64
10000	61
12000	59
14000	56
16000	53
18000	50

3. LAND AS SOON AS PRACTICABLE

3.4 ENGINE EMERGENCY CONDITIONS

In case of a single engine failure, bleed air heating will be switched off automatically. Depending on the power margin of the remaining engine, bleed air heating may be re-engaged by selecting BLD HTG EMER/NORM sw to EMER position and switching BLD HTG rheostat ON.

NOTE If CAD message BLEED AIR remains on after single engine failure, the system must be switched off manually. Depending on the power margin of the remaining engine, the bleed air heating may be re-engaged.

ENGINE EMERGENCY CONDITIONS

3.4.1 Single engine failure - hover IGE

Conditions/Indications

- Slight jerk in the yaw axis, nose left
- Possible change in noise level

Affected engine:

- **ENG FAIL** warning light and warning gong on
- **ENG SPLIT** caution indication
- **ENG OIL P** caution indication
- **FUEL PRESS** caution indication
- **GEN DISCON** caution indication
- **OVSP FAIL** caution indication
- **VAR NR** caution indication
- NORM/MAN pb (main switch panel) MAN legend comes on (yellow)
- Instruments indicate power loss

NOTE The VAR NR system will revert to the manual mode automatically.

Procedure

1. Collective lever	**– Adjust to OEI limits or below**
2. Landing attitude	**– Establish**
3. Collective lever	**– Raise as necessary to stop descent and cushion landing**

After landing:

4. Affected engine	**– Identify**
5. Single engine emergency shutdown	**– Perform**

ENGINE EMERGENCY CONDITIONS

3.4.2 Single engine failure - hover OGE

Conditions/Indications

- Slight jerk in the yaw axis, nose left
- Possible change in noise level

Affected engine:

- **ENG FAIL** warning light and warning gong on
- **ENG SPLIT** caution indication
- **ENG OIL P** caution indication
- **FUEL PRESS** caution indication
- **GEN DISCON** caution indication
- **OVSP FAIL** caution indication
- **VAR NR** caution indication
- NORM/MAN pb (main switch panel) MAN legend comes on (yellow)
- Instruments indicate power loss

NOTE The VAR NR system will revert to the manual mode automatically.

Procedure

1. Collective lever	**– Adjust to maintain rotor RPM**
2. Airspeed	**– Increase if possible**
● FORCED LANDING	
3. Landing attitude	**– Establish**
4. Collective lever	**– Raise as necessary to stop descent and cushion landing**

After landing:

5. Affected engine	**– Identify**
6. Single engine emergency shutdown	**– Perform**
● TRANSITION TO OEI - FLIGHT	
3. Collective lever	**– Adjust to OEI-limits or below**
4. Rotor speed	**– Trim to maximum**
5. Airspeed	**– Gain, ... KIAS (V_Y)**

After reaching safe altitude:

6. Collective lever	**– Reduce to OEI MCP or below**
7. Affected engine	**– Identify**
8. Single engine emergency shutdown	**– Perform**
9. LAND AS SOON AS PRACTICABLE	

ENGINE EMERGENCY CONDITIONS

3.4.3 Single engine failure - takeoff

Conditions/Indications

- Slight jerk in the yaw axis, nose left
- Possible change in noise level

Affected engine:

- **ENG FAIL** warning light and audio gong on
- **ENG SPLIT** caution indication
- **ENG OIL P** caution indication
- **FUEL PRESS** caution indication
- **GEN DISCON** caution indication
- **OVSP FAIL** caution indication
- **VAR NR** caution indication
- NORM/MAN pb (main switch panel) MAN legend comes on (yellow)
- Instruments indicate power loss

NOTE The VAR NR system will revert to the manual mode automatically.

Procedure

1. Collective lever	**– Adjust to maintain rotor RPM**
● REJECTED TAKEOFF	
2. Landing attitude	**– Establish**
3. Collective lever	**– Raise as necessary to stop descent and cushion landing**

After landing:

4. Affected engine	**– Identify**
5. Single engine emergency shutdown	**– Perform**
● TRANSITION TO OEI - FLIGHT	
2. Collective lever	**– Adjust to OEI-limits or below**
3. Rotor speed	**– Trim to maximum**
4. Airspeed	**– Gain, 65 KIAS (V_Y)**

After reaching safe altitude:

5. Collective lever	**– Reduce to OEI MCP or below**
6. Affected engine	**– Identify**
7. Single engine emergency shutdown	**– Perform**
8. LAND AS SOON AS PRACTICABLE	

ENGINE EMERGENCY CONDITIONS

3.4.4 Single engine failure - flight

Conditions/Indications

- Slight jerk in the yaw axis, nose left
- Possible change in noise level

Affected engine:

- **ENG FAIL** warning light and warning gong on
- **ENG SPLIT** caution indication
- **ENG OIL P** caution indication
- **FUEL PRESS** caution indication
- **GEN DISCON** caution indication
- **OVSP FAIL** caution indication
- **VAR NR** caution indication
- NORM/MAN pb (main switch panel) MAN legend comes on (yellow)
- Instruments indicate power loss

NOTE The VAR NR system will revert to the manual mode automatically.

Procedure

1. OEI flight condition	**– Establish**
2. Rotor speed	**– Trim to maximum**
3. Affected engine	**– Identify**
4. Single engine emergency shutdown	**– Perform**
5. LAND AS SOON AS PRACTICABLE	

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ENGINE EMERGENCY CONDITIONS

3.4.5 Single engine failure - approach

Conditions/Indications

- Slight jerk in the yaw axis, nose left
- Possible change in noise level

Affected engine:

- **ENG FAIL** warning light and warning gong on
- **ENG SPLIT** caution indication
- **ENG OIL P** caution indication
- **FUEL PRESS** caution indication
- **GEN DISCON** caution indication
- **OVSP FAIL** caution indication
- **VAR NR** caution indication
- NORM/MAN pb (main switch panel) MAN legend comes on (yellow)
- Instruments indicate power loss

NOTE The VAR NR system will revert to the manual mode automatically.

Procedure

1. Rotor speed	**– Trim to maximum**
2. Affected engine	**– Identify**
3. Single engine emergency shutdown	**– Perform**
4. Single engine landing procedure	**– Perform**

ENGINE EMERGENCY CONDITIONS

3.4.6 Single engine landing

Conditions/Indications

One engine inoperative (OEI)

Procedure

LANDING APPROACH:

1. Rotor speed	– Check maximum
2. Bleed air heating (if installed)	– Check OFF
3. Airspeed	– 65 KIAS (V_Y)
4. Shallow approach	– Establish

ON FINAL, AT 50 FT AGL:

5. Airspeed	– 40 KIAS
6. Rate of descent	– Max. 500 ft/min

TOUCHDOWN:

7. Airspeed	– Reduce to minimum depending on power available
8. Landing attitude	– Establish
9. Collective lever	– Raise as necessary to stop descent and cushion landing

CAUTION AN OSCILLATION, WHICH COULD BE UNINTENTIONALLY INDUCED/ASSISTED BY THE PILOT (PIO/PAO) MAY BE EXPERIENCED DURING RUNNING LANDING OR HARDER VERTICAL LANDINGS.
IN CASE OF PIO/PAO, RAPIDLY INCREASE OR DECREASE COLLECTIVE LEVER, WHICHEVER THE SITUATION ALLOWS, UNTIL OSCILLATION HAS STOPPED.

AFTER LANDING:

10. Collective lever	– Lower slowly
11. Cyclic stick	– Maintain neutral position

ENGINE EMERGENCY CONDITIONS

3.4.7 Single engine emergency shutdown

NOTE • The VAR NR system will revert to the manual mode automatically.

• Before performing an inflight single engine emergency shutdown, determine if the situation will allow for OEI flight.

• Make certain that:

– the controls of the affected engine are selected, and
– the collective lever is adjusted to maintain the normal engine within the OEI limits

Procedure

1. Twist grip (affected engine)	**– Rotate slowly to IDLE, check indications, then to OFF**

Bleed air heating (if installed) will be shut down automatically, however, depending on power margin of the remaining engine, may be re–engaged as follows:

2. BLD HTG EMER/NORM sw	– EMER
3. BLD HTG rheostat	– ON

ENGINE EMERGENCY CONDITIONS

3.4.8 Inflight restart

NOTE • An inflight restart may be attempted after a flameout or shutdown subject to the pilot's evaluation of the cause of flameout.

• If OVSP FAIL caution indication of the affected engine is not on, the engine was shut down by the overspeed protection system. In this case, a restart is not possible.

• Before attempting an inflight restart, wait for $N_1 = 0$ %

CAUTION DO NOT ATTEMPT INFLIGHT RESTART IF CAUSE OF ENGINE FAILURE IS OBVIOUSLY MECHANICAL.

Procedure

1. Collective lever	– Adjust to OEI MCP or below
2. Collective lever friction	– Adjust to maintain position of lever
3. Electrical consumption	– Reduce
4. FUEL PRIME PUMP sw (affected engine)	– ON; PRIME PUMP caution comes on and FUEL PRESS caution goes off

After 10 seconds:

5. Twist grip (affected engine)	– Preselect 20° (hot engine 18°)
6. Normal engine starting procedure	– Perform
7. Twist grip (affected engine)	– Increase to FLIGHT position
8. Electrical consumers	– As required
9. FUEL PRIME PUMP sw (affected engine)	– OFF

If restart is not successful:

10. Respective Twist Grip	– Idle, then OFF
11. LAND AS SOON AS PRACTICABLE	

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ENGINE EMERGENCY CONDITIONS

3.4.9 Engine overspeed – driveshaft failure

Conditions/Indications

- **VAR NR** caution indication
- N_{RO} decrease

Affected engine:

- **ENG SPLIT** caution indication
- Torque decreases to zero
- N_1 decreases
- N_2 increases above N_{RO} and either:
  - drops back to 100% or below, or
  - increases to 123.1%, causing the overspeed protection system to shut down the engine automatically.

Normal engine:

- Torque, N_1 and TOT increase
- N_2 decreases

CAUTION WHEN AN ENGINE HAS BEEN SHUT DOWN BY ITS OVERSPEED PROTECTION SYSTEM, THE OTHER ENGINE'S SYSTEM IS INTERLOCKED TO AN INACTIVE STATUS. THUS, THE NORMAL ENGINE IS NO LONGER PROTECTED AGAINST POWER TURBINE OVERSPEED.

Procedure

1. OEI flight condition	**– Establish**
2. Affected engine	**– Identify**
3. Single engine emergency shutdown	**– Perform**

4. LAND AS SOON AS PRACTICABLE

ENGINE EMERGENCY CONDITIONS

3.4.10 Engine overspeed – governor failure

Conditions/Indications

- **ROTOR RPM** warning light may come on
- **VAR NR** caution indication may come on
- **ENG SPLIT** caution indications may come on
- N_{RO} and both N_2 increase

Affected engine:

- Torque, N_1 and TOT increase

Normal engine:

- Torque and TOT may decrease

Procedure

1. Collective lever	**– Raise as necessary to maintain N_2 and N_{RO} within limits**
2. VAR NR system NORM/MAN sw	**– Check MAN**
3. N_2 TRIM sw	**– Try to trim N_{RO} to 101% with matched torque**

If step 3. is not possible:

4. Affected engine	**– Identify**
5. Twist grip (affected engine)	**– Rotate towards IDLE until N_2 and N_{RO} stabilize in normal range and FLI needles match**

6. LAND AS SOON AS PRACTICABLE

Approach and landing recommendations

Make normal power changes to allow the normal engine to operate within limits. If more collective input is needed, adjust power of the affected engine using twist grip.

After landing: Rotate twist grip (affected engine) towards IDLE before lowering the collective lever to full-down position (maintain N_{RO} and N_2 within limits).

CAUTION N_2 RPM OVER 123.1% MAY RESULT IN AN ENGINE OVERSPEED TRIP (AUTOMATIC SHUTDOWN).

ENGINE EMERGENCY CONDITIONS

3.4.11 Engine underspeed – governor failure

Conditions/Indications

- **ROTOR RPM** warning light may come on
- **VAR NR** caution indication may come on
- **ENG SPLIT** caution indications may come on

Affected engine:

- Torque, N_1 and TOT decrease
- N_2 may decrease

Normal engine:

- N_{RO} and N_2 may decrease

Procedure

1. OEI flight condition	**– Establish**
2. Bleed air consumers	**– Off**
3. VAR NR system NORM/MAN pb	**– Check MAN**
4. Affected engine	**– Identify**
5. N_2 TRIM sw	**– Compensate N_2/N_{RO} drop and try to match torque**

If torque match is not possible:

6. Twist grip (affected engine)	**– Release stop plate and rotate towards FLIGHT until N_2 and N_{RO} stabilize in normal range and FLI needles match**

7. LAND AS SOON AS PRACTICABLE

If no residual torque (affected engine) is available:

8. Single engine emergency shutdown	**– Perform**

Approach and landing recommendations

Make normal power changes to allow the normal engine to operate within limits. If more collective input is needed, adjust power of the affected engine using twist grip.

After landing: Rotate twist grip (affected engine) towards IDLE before lowering the collective lever to full-down position (maintain N_{RO} and N_2 within limits).

CAUTION N_2 RPM OVER 123.1% MAY RESULT IN AN ENGINE OVERSPEED TRIP (AUTOMATIC SHUTDOWN).

ENGINE EMERGENCY CONDITIONS

3.4.12 Compressor stall

Conditions/Indications

- Popping sounds
- Torque and N_1 indications may decrease
- TOT may increase
- Slight yaw jerk

Procedure

1. Collective lever	**– Lower**
2. Engine instruments	**– Monitor**
3. Collective lever	**– Raise slowly**

If compressor stall returns:

4. Affected engine	**– Identify (TOT)**
5. Single engine emergency shutdown	**– Perform**

6. LAND AS SOON AS PRACTICABLE

ENGINE EMERGENCY CONDITIONS

3.4.13 Droop compensation failure

Conditions/Indications

- N_{RO} and both N_2 decrease when collective lever is raised
- N_{RO} and both N_2 increase when collective lever is lowered

Procedure

NOTE Avoid large collective lever changes.

1. Collective lever	**– Maintain N_{RO} within limits**

2. LAND AS SOON AS PRACTICABLE

ENGINE EMERGENCY CONDITIONS

3.4.14 Engine oil temperature high

Conditions/Indications

Affected engine:

– Oil temperature indication above limits

Procedure

1. OEI flight condition	**– Establish**
2. Affected engine	**– Identify**
3. Twist grip (affected engine)	**– Adjust to 20–30% torque (TWIST GRIP caution indication comes on)**
4. Oil temperature indicator (affected engine)	**– Monitor**

If engine oil temperature decreases below limit:

5. LAND AS SOON AS PRACTICABLE

If engine oil temperature still remains above limit:

6. Single engine emergency shutdown	**– Perform**

7. LAND AS SOON AS PRACTICABLE

ENGINE EMERGENCY CONDITIONS

3.4.15 Double engine failure - hover IGE

Conditions/Indications

– Yawing motion nose left
– N_{RO} and both N_2 decrease
– **ROTOR RPM** warning light (N_{RO} low) on
– Both **ENG FAIL** warning lights on
– Both **ENG OIL P** caution indications
– Both **FUEL PRESS** caution indications
– Both **GEN DISCON** caution indications
– Engine instruments (both engines) indicate power loss

Procedure

1. Right pedal	**– Apply as necessary to stop yaw**
2. Landing attitude	**– Establish**
3. Collective lever	**– Raise as necessary to cushion landing**

ENGINE EMERGENCY CONDITIONS

3.4.16 Double engine failure - flight

Conditions/Indications

– Yawing motion nose left
– N_{RO} and both N_2 decrease
– **ROTOR RPM** warning light (N_{RO} low) on
– Both **ENG FAIL** warnings lights on
– Both **ENG OIL P** caution indications
– Both **FUEL PRESS** caution indications
– Both **GEN DISCON** caution indications
– Engine instruments (both engines) indicate power loss

Procedure

Autorotation	**– Perform**

ENGINE EMERGENCY CONDITIONS

3.4.17 Double engine emergency shutdown

Procedure

● ON GROUND

1. Both Twist grips	**– OFF**
2. Both FUEL PRIME PUMP sw	**– OFF**
3. BAT MSTR sw	**– OFF**

● IN FLIGHT

1. Both Twist grips	**– OFF**

If there is an indication that the engines are still running:

2. Both EMER OFF sw	**– Press**

ENGINE EMERGENCY CONDITIONS

3.4.18 Autorotation

Procedure

1. Collective lever	**– Reduce to maintain N_{RO} within limits**
2. Airspeed	**– 75 KIAS recommended**

NOTE Maximum range airspeed ..... 90 KIAS
Minimum rate-of-descent airspeed ..... 60 KIAS

3. Double engine emergency shutdown	**– Perform**

AT APPROXIMATELY 100 FT AGL:

4. Flare attitude	– Establish (approx. 15° to 20°) to reduce forward speed and rate of descent; control N_{RO}

AT APPROXIMATELY 8 – 12 FT AGL:

5. Flare attitude	– Reduce to approx 7°
6. Heading	– Maintain
7. Collective lever	– Raise to stop descent and cushion landing
8. BAT MSTR sw	**– OFF**

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

3.5 FIRE EMERGENCY CONDITIONS

FIRE EMERGENCY CONDITIONS

3.5.1 Cabin fire

Conditions/Indications

– Smoke, burning odor, flames

Procedure

● ON GROUND

1. Double engine emergency shutdown	**– Perform**
2. Passengers	**– Alert/Evacuate**
3. Fire	**– Extinguish if possible**

● IN FLIGHT

1. Airspeed	**– 65 KIAS recommended**
2. Passengers	**– Alert**
3. Heating/air conditioning (if installed)	**– OFF**
4. Fire	**– Extinguish if possible**
5. Fumes, smoke	**– Eliminate, open sliding doors, windows and vents (fresh air)**
6. LAND AS SOON AS POSSIBLE	

After landing:

7. Double engine emergency shutdown	**– Perform**

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FIRE EMERGENCY CONDITIONS

3.5.2 Electrical fire/short circuit

Conditions/Indications

– Odor of burning insulation and/or acid smoke

Procedure

● ON GROUND

1. Double engine emergency shutdown	– Perform
2. Passengers	– Alert/evacuate
3. EPU, if connected	– Disconnect
4. Fire	– Extinguish if possible

In flight procedure see next page

ELECTRICAL FIRE/SHORT CIRCUIT continued

● IN FLIGHT

WARNING BE PREPARED FOR LOSS OF ALL ELECTRICAL SYSTEMS, EXCEPT STANDBY INSTRUMENTS.

NOTE ● If conditions require open window(s) or sliding door(s) and vents for fresh air.

● If the source of the smoke or fire can be positively identified, remove electrical power to the equipment, either by switching it off, or by pulling the associated circuit breaker.

1. Both BUS TIE sw's	– OFF (both BUSTIE OPN cautions present)
2. GEN 1 and GEN 2 sw's	– OFF (both GEN DISCON cautions and BAT DISCH caution present)
3. Electrical consumers	– Reduce as much as possible
4. Passengers	– Alert

NOTE ● If landing without electrical systems is possible, turn off all electrical power sources.

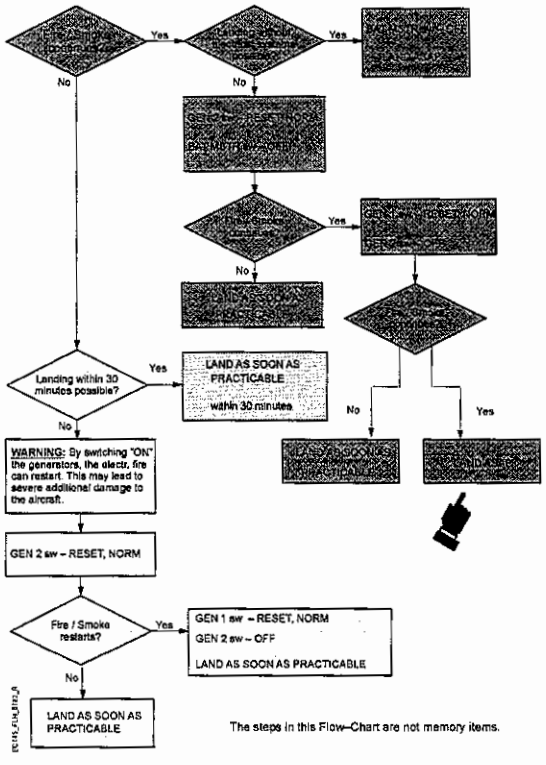
● A generator reset should only be attempted when flight safety is at risk or the source of smoke or fire is positively identified and isolated from the electrical system.

5. Follow flow chart (see next page)

NOTE ● If winch operation is required for safety of flight, the GEN 1 can be momentarily be switched to RESET, then NORM, winch operation attempted and when finished the GEN 1 must be turned OFF again.

● Flight endurance depends on battery type and loading.

Residual Battery Endurance					
Continuous load [A]	15	20	25	30	40
Time [min]	60	45	35	30	22
NOTE Calculations are based on an assumed minimum battery capacity of 15 Ah. Times include 10 minutes landing light operation and 10 minutes radio transmission.					
WARNING TOTAL ELECTRICAL FAILURE WILL LIMIT FUEL AVAILABLE TO QUANTITY CONTAINED IN SUPPLY TANKS AT TIME OF FAILURE AND THUS RESIDUAL FLIGHT TIME.					



The steps in this Flow-Chart are not memory items.

3.6 TAIL ROTOR FAILURE CONDITIONS

3.6.1 Tail rotor drive failure - hover

Conditions/Indications

Complete loss of tail rotor thrust

– Tail rotor failure in power-on flight is indicated by a yawing motion nose right; the yaw rate depends on the aircraft power at the time of failure.

Procedure

● HOVER IN GROUND EFFECT

1. Both Twist grips	– Rotate to IDLE

and simultaneously:

2. Landing attitude	– Establish
3. Collective lever	– Apply as necessary

After landing:

4. Double engine emergency shutdown	– Perform

● HOVER OUT OF GROUND EFFECT

1. Collective lever	– Reduce as required to stop rotation

If height permits:

2. Airspeed	– Gain, then proceed according to para 3.6.2 (Tail Rotor Drive Failure - Fwd. Flight / Tail Rotor Control Failure - Forward Flight)

If height does not permits:

2. Both Twist grips	– Rotate to IDLE
3. Collective lever	– Raise to stop descent and cushion landing

After landing:

4. Double engine emergency shutdown	– Perform

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TAIL ROTOR FAILURE CONDITIONS

3.6.2 Tail Rotor Drive Failure/Fixed-pitch Tail Rotor Control Failure - Forward Flight

Conditions/Indications

- No directional response after pedal inputs and/or
- Complete loss of tail rotor thrust and/or
- Locked pedals

NOTE The procedure will vary depending on flight conditions, power setting and mass of the helicopter.

Procedure

1. Collective lever	**– Reduce to obtain minimum sideslip angle**
2. Airspeed	**– Maintain 70 KIAS or higher**
3. Suitable landing area	– Select

NOTE • Landing surface should be hard (e.g. concrete, asphalt) and flat.

• Left crosswind is advantageous

4. Shallow approach with nose left	**– Perform**

If the airspeed can be reduced below 40 kts with the nose still pointing to the left:

5. Airspeed	**– Reduce close to the ground until nose is aligned with the flight direction**
6. Landing	**– Perform**

If the nose direction changes from left to right at airspeeds higher than 40 kts:

5. Airspeed	**– Increase**
6. Approach	**– Abort, climb to sufficient height for autorotation**

NOTE Headwind is advantageous

7. Autorotation	**– Perform**

NOTE • In final phase of flare the helicopter can yaw to the left due to friction effects.

• Before touchdown, the groundspeed should be reduced to a minimum

TAIL ROTOR FAILURE CONDITIONS

3.6.3 Pedal vibrations

Conditions/Indications

Impending tail rotor system failure

- Unusual pedal vibrations

Procedure

LAND AS SOON AS POSSIBLE

3.7 SYSTEM EMERGENCY/MALFUNCTION CONDITIONS

3.7.1 Generator failure isolation procedure

Conditions/Indications

- Generator 1 and / or Generator 2 failure

Procedure

1. Both GEN sw's	– OFF
2. GEN 1 sw	– RESET, then NORM
3. DC VOLTS	– Check
If voltage 28.5 V ± 2 V:	
4. LAND AS SOON AS PRACTICABLE	
If voltage < 26.5 V or > 30.5 V:	
4. GEN 1 sw	– OFF (GEN DISCON sys 1 caution present)
5. GEN 2 sw	– RESET, then NORM
6. DC VOLTS	– Check
If voltage < 26.5 V or > 30.5 V:	
7. GEN 2 sw	– OFF (GEN DISCON sys 2 caution present)
8. Electrical consumers	– Reduce as much as possible
9. LAND AS SOON AS PRACTICABLE	
If voltage 28.5 V ± 2 V:	
7. LAND AS SOON AS PRACTICABLE	

CAUTION • SINCE ONE FUEL TRANSFER PUMP IS POWERED BY THE SHED BUS, THE AMOUNT OF UNUSABLE FUEL INCREASES ABOVE THAT STATED IN SECTION 2 WHEN PROBLEM IS IDENTIFIED ON SYS1 SIDE, BUSTIE 1 IS OPENED AND GEN 1 REMAINS OFF.

• WHEN GEN 2 IS DISCONNECTED AND BOTH BUSTIE SW ARE OFF, THE RADALT FUNCTION IS LOST WHICH WILL REDUCE CAPABILITIES OF THE AUTOPILOT, AS THE AUTO LEVEL OFF FUNCTION WILL BE LOST.

NOTE • Both SHED BUS'es will be lost when both GEN switches are off resulting in various cautions, indicating these systems are failed.

• One generator alone will provide sufficient power for continued flight until safe landing can be made.

continued

• If winch operation is required for safety of flight, the BUSTIE 1 switch can be momentarily switched to RESET, then NORM, winch operation attempted and when finished the BUSTIE 1 switch must be turned OFF again.

• Flight endurance depends on battery type and loading.

Residual Battery Endurance					
Continuous load [A]	15	20	25	30	40
Time [min]	60	45	35	30	22
NOTE Calculations are based on an assumed minimum battery capacity of 15 Ah. Times include 10 minutes landing light operation and 10 minutes radio transmission.					
WARNING TOTAL ELECTRICAL FAILURE WILL LIMIT FUEL AVAILABLE TO QUANTITY CONTAINED IN SUPPLY TANKS AT TIME OF FAILURE AND THUS RESIDUAL FLIGHT TIME.					

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SYSTEM EMERGENCY/MALFUNCTION CONDITIONS

3.7.2 **Cyclic beep trim actuator failure/runaway**

Conditions/Indications

- Cyclic beep trim inoperative
- Unsymmetrical cyclic stick forces may gradually appear

Procedure

1. FTR pb (cyclic stick) – Press at least 1 sec to reduce stick forces

EFFECTIVITY *If AFCS software version 416–00297–203 is installed or S/N 9701 and subsequent*

NOTE Beep Trim will be deactivated as long as AP remains engaged

EFFECTIVITY *All*

If stick forces resume after releasing FTR pb:

2. Circuit breaker BEEP TRIM – Pull

*For **momentary** cyclic stick force reduction:*

FTR pb (cyclic stick) – Press

*For **permanent** cyclic stick force reduction:*

FTR pb (instrument panel – optional) – Press; pb legend comes on (yellow)

*To **reengage** cyclic stick forces after permanent stick force reduction:*

FTR pb (cyclic stick) – Press; pb legend goes off

CAUTION AFTER LANDING, CYCLIC STICK SHALL BE HELD IN NEUTRAL POSITION.

EFFECTIVITY *If AFCS software version 416–00297–203 is installed or S/N 9701 and subsequent*

CAUTION IF THE PILOT DESELECTS AP 1 AND 2 TRIM RUNAWAY MAY REOCCUR.

EFFECTIVITY *All*

SYSTEM EMERGENCY/MALFUNCTION CONDITIONS

3.7.3 **Cyclic force trim release failure**

Conditions/Indications

Cyclic force trim release function inoperative (either partially, i.e. in one axis, or completely)

Procedure

1. Circuit breaker FTR – Pull
2. BEEP TRIM sw (cyclic stick) – Press to adjust cyclic stick position
3. LAND AS SOON AS PRACTICABLE

SYSTEM EMERGENCY/MALFUNCTION CONDITIONS

3.7.4 **Mast moment indication failure**

Conditions/Indications

- Slope <3°
- Wind < 10 kts
- MTOW < 3300 kg
- CG in middle position

NOTE • Maximum 5 flights with mast moment indication failure are allowed.

• Pilot must be very carfull and avoid large cyclic inputs.

● TAKE–OFF

Procedure

1. Cyclic stick – Center, use cyclic stick centering device
2. FTR pb – Press continuously
3. Cyclic stick – Keep centered position
4. Collective lever – Apply

Lift–off helicopter and accept forward right movement.

Once airborne continue with normal hover flight.

● LANDING

1. FTR pb – Press during whole maneuver until cyclic stick is centered
2. Gently touch down without moving cyclic stick
3. Collective lever – Lower slowly
4. Cyclic stick – Center, use cyclic stick centering device

Continue on ground in accordance with the flight manuel. Maintenance action is required, at the latest after 5 landings with mast moment indication failure.

3.7.5 **Static system failure**

Conditions/Indications

- Indications are unrealistic
- Pointer deflections may be sluggish

Procedure

1. Static Pressure selector sw – ALTERNATE SOURCE
2. Static sytem correction (refer to para 5.1.7 FLM) – Check

SECTION 4

NORMAL PROCEDURES

TABLE OF CONTENTS

LIST OF FIGURES

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SECTION 4

NORMAL PROCEDURES

4.1 GENERAL

This section contains instructions and recommended procedures which are peculiar to the operation of this helicopter.

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

4.2 PREPERATION FOR FLIGHT

4.2.1 Flight restrictions

The minimum, normal, maximum and cautionary operation ranges for the helicopter and its subsystems are indicated by instrument markings, placards and decals.

For helicopter and subsystem restrictions refer to section 2, Limitations.

EFFECTIVITY *Helicopters equipped with dual controls (optional)*

NOTE Before helicopter operation with a passenger on copilot's seat, cyclic stick and collective pitch lever on copilot's side should be removed and the appropriate covers installed. The copilot's pedals should be adjusted to the most forward position, and the dual control pedal cover (see FMS 9.2-8) should be installed.

If the covers are not available, cyclic and collective levers shall remain installed. However, in this case, the passenger must be briefed properly before starting engines not to interfere with any pilot's control operation.

EFFECTIVITY *All*

4.2.2 Flight planning

Refer to sections 5 and 9 to determine required fuel, airspeeds and power settings for take-off, climb, cruise, hovering and landing data necessary to accomplish the mission.

NOTE Before flight it is necessary to check that the fuel grade is selected properly relative to fuel temperature/altitude limitations given in section 2.

4.2.3 Mass and balance

The takeoff and anticipated landing gross mass and balance should be obtained before takeoff and checked against mass and load limits and center of gravity restrictions (see section 2).

For pre-flight checks and flight preparations with engines running, fuel up to 20 kg in excess of the maximum gross mass can be taken on board as long as the maximum fuel quantity is not exceeded (fuel burn rate with both engines at idle is approximately 1.7 kg/min). The pilot is responsible to ensure that the aircraft mass at take-off does not exceed the maximum gross mass (see section 2).

4.3 PREFLIGHT CHECK

4.3.1 General

The preflight check shall be accomplished in accordance with 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 **before each flight.**
However, items not marked with an asterisk (*) need only be checked **before the first flight of the day or for aircraft on alert / on call status these items should be performed within a 24 hours cycle.**

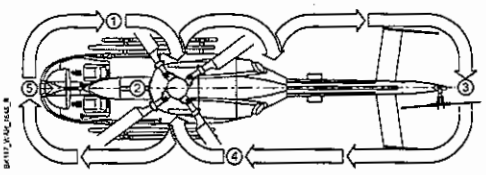
When unusual local conditions dictate, the extent and/or frequency of this check shall be increased as necessary to promote safe operation.

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 to the relevant chapter of the maintenance manual.

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 the 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.



1. Fuselage	–	Right side
2. Cabin	–	Top
3. Tail boom	–	Aft area
4. Fuselage	–	Left side
5. Cabin	–	Front

Fig. 4-1 Exterior check sequence

Before exterior check

★	Helicopter forms and documents	–	Check, complete
	Weight, CG	–	Check
	Fuel tanks	–	Drain (5 drain valves) (see sec.8, para 8.3)
	Fuselage underside	–	Condition, no fuel leaks
★	Covers and tie-downs	–	Removed
★	Ice and snow (if any)	–	Removed
★	Ground handling wheels	–	Removed
	Equipment and cargo	–	Secured

★ To be checked **before each flight**

Fuselage – right side

	NACA cockpit air intake	–	Clear
	OAT sensors (2, ADC/CPDS)	–	Condition
	Cockpit door	–	Condition, function
	BAT MSTR sw	–	Check, OFF
	Fabric glare shield (before night flights)	–	Check installed
	Pilot seat and safety belt	–	Condition
	Sliding door	–	Condition, function
	Landing gear and step	–	Condition
	Battery (if located here)	–	Connected, condition, no electrolyte spillage, security of mounting
★	Battery door	–	Closed, secured
	Battery drain port	–	Clear
	Fuselage right side	–	Condition
	Antennas on underside (if any)	–	Condition
	<u>Cabin top</u>		
	Windshield, upper part	–	Condition,clc · ·
	Cabin air intake (if installed)	–	Condition
	Antennas (if any)	–	Condition
	Hydraulic system	–	Condition, no leakage, no foreign objects
	Hydraulic reservoirs (2)	–	Condition, no leakage
	Fluid level indicator 1, 2	–	Check levels
	Sight glasses 1, 2	–	Check oil visible
	Control rods	–	Condition
★	Hydraulic access door	–	Closed, secured

★ To be checked **before each flight**

Fuselage – right side (continued)

	Hydraulic pump	–	Condition, no leakage
	Oil cooler fan inlet screen	–	Clear
	Oil cooler fan	–	Condition
	Main transmission oil level	–	Check
	Sliding door	–	Closed
★	Transmission compartment	–	Condition, no leakage, no foreign objects
	Scavenge oil filter clogging indicator pin (if installed)	–	Check in
	Oil cooler air inlet duct	–	Check, clear
	Oil cooler block plate	–	Installed, if OAT below –30°C
		–	Removed, if OAT above +35°C
	Oil cooler	–	Clear, condition
★	Engine oil level	–	Check
	Engine oil tank	–	Condition, no leakage, security of attachment, filler cap closed and secured
	Generator air intake	–	Clear
	Engine air intake	–	Clear
	Mixing lever assembly	–	Condition, secured
	Main transmission	–	Condition
	Main transmission struts	–	Condition, secured
	Main transmission oil filter clogging indicator pin	–	Check in
	Main transmission oil filler cap	–	Secured, locked
	Air opening in access door	–	Clear
★	Transmission access door	–	Closed, secured
	Swash plate and boot	–	Condition
★	Rotating control rods	–	Condition, free movement
	Rotating control rod spherical bearings	–	Check for smooth operation by moving control rods by hand

★ To be checked **before each flight**

Fuselage – right side (continued)

★	Main rotor head	–	Condition, oil level
	Blade attachment bolts, driving link assembly	–	Condition, secured
	Rotor hub cap	–	Condition, secured
	Vibration absorbers	–	Condition, free movement, no leakage
	Rotor blades and trim tabs	–	Condition, rotate rotor by hand in direction of rotation and check for free movement
	PU Erosion protective film (if fitted)	–	Condition, no seperation
	Static dischargers and bonding jumper	–	Condition
	Engine compartment	–	No leakage, no foreign objects
	Engine	–	Condition
	Engine oil ducts	–	No leakage
	Engine wiring, linkages and lines	–	Condition, no leakage, no chafing
	Engine wash system (if installed)	–	Secure
	Engine exhaust pipe (fwd part)	–	Condition, secured
	Rear bearing oil ducts	–	No leakage
	Engine mounts	–	Condition, secured
	Fire detectors (3)	–	Condition
★	Engine access door	–	Closed, secured
★	Maintenance steps (5)	–	Closed
	Bleed air heater screen	–	Clear
	Circuit breaker for EPU	–	Check in
★	EPU access door	–	Closed, secured

★ To be checked **before each flight**

Fuselage – right side (continued)

★	Fuselage – right side	– Condition
★	Static ports (2)	– Clear
	Battery (if located here)	– Connected, condition, no electrolyte spillage, security of mounting
★	Battery door	– Closed, secured
	Aft engine cowling	– Secured
	Engine exhaust pipe (rear part)	– Condition
★	Fire ext sys discharge indicator (red disk)	– Check present and undamaged
	Fire ext bottle pressure indicators (2)	– Check according to the pressure–temperature table

NOTE Engine must be cold for pressure–temperature table to be valid.

	Clam shell doors	– Condition, function
	First aid kit	– On board
	Avionic rack	– Condition, secured
★	Clam shell doors	– Closed, secured

Tail boom

★	Tail boom – right side	– Condition
	Antenna(s) (if installed)	– Condition
★	RH horizontal and vertical stabilizer, position light	– Condition
	Vertical fin and cowling	– Condition, secured
	Position light, anti-collision light (strobe light / IR flasher, if installed)	– Condition
	Tail skid	– Condition
★	Tail rotor gearbox	– Oil level, no leakage, filler cap secured

NOTE Verification of oil level may be easier when tail skid is shaken briefly

★ To be checked **before each flight**

Tail boom (continued)

	Tail rotor head, shaft, bellow	– Condition
★	Pitch links	– Condition
	Blade attachment bolts, balance masses, dynamic masses	– Condition, secured
★	Tail rotor blades	– Condition
	Vertical fin and cowling	– Condition, secured
★	Intermediate gear box	– Oil level, no leakage

NOTE Verification of oil level may be easier when tail skid is shaken briefly

	Intermediate gear box	– Filler cap and drain plug secured
★	Vertical fin access door	– Closed, secured
★	LH horizontal and vertical stabilizer, position light	– Condition
★	Tail boom – left side	– Condition
	Antenna box	– Condition
	Antennas (if installed)	– Condition
	Clam shell door windows (if installed)	– Condition, clear

Fuselage – left side

	Static ports (2)	– Clear
	Bleed air heater screen	– Clear
	Aft engine cowling	– Secured
	Engine exhaust pipe (rear part)	– Condition
	Engine compartment	– No leakage, no foreign objects
	Fire detectors (3)	– Condition
	Engine mounts	– Condition, secured
	Rear bearing oil ducts	– No leakage
	Engine exhaust pipe (forward part)	– Condition, secured

★ To be checked **before each flight**

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Fuselage – left side (continued)

	Engine wash system (if installed)	– Secure
	Engine wiring, linkages and lines	– Condition, no leakage, no chafing
	Engine oil ducts	– No leakage
	Engine	– Condition
★	Engine access door	– Closed, secured
★	Transmission compartment	– Condition, no leakage, no foreign objects
	Scavenge oil filter clogging indicator pin (if installed)	– Check in
	Generator air intake	– Clear
	Engine air intake	– Clear
	Mixing lever assembly	– Condition, secured
	Main transmission	– Condition
	Main transmission struts	– Condition, secured
	Main transmission oil filter clogging indicator pin	– Check in
★	Engine oil level	– Check
	Engine oil tank	– Condition, no leakage, security of attachment, filler cap closed and secured
	Oil cooler	– Clear, condition
	Oil cooler block plate	– Installed, if OAT below –30°C – Removed if OAT above +35°C
	Oil cooler inlet duct	– Check clear
★	Transmission access door	– Closed, secured
	Air opening in access door	– Clear
★	Maintenance steps (3)	– Closed
	Oil cooler fan inlet screen	– Clear
	Oil cooler fan	– Condition
	Hydraulic pump	– Condition, no leakage

★ To be checked **before each flight**

Fuselage – left side (continued)

★	Hydraulic compartment door	– Closed, secured
	Cockpit windshields, upper part	– Condition, clean
	Landing gear and step	– Condition
★	Fuel filler cap	– Secured, locked
★	Fuel filler access door	– Closed
	Vents and drainports (5)	– Clear
	Antennas (if any)	– Condition
★	Fuselage – left side	– Condition
	Sliding door	– Condition, function
	Cockpit door	– Condition , function
	Copilot seat and safety belt	– Condition
★	If copilot seat is unoccupied: Copilot's safety belts	– Fastened, secured
	OAT sensors (2, ADC/VAR NR)	– Condition
	NACA Cockpit air intake	– Clear
	Antennas on underside (if installed)	– Condition

Cabin – Nose area

	Windshields, front and lower part	– Condition, clean
★	Pitot tubes (2)	– Clear, condition
	Windshield wipers	– Condition
★	Pedal areas	– No foreign objects
	Landing lights	– Condition, retracted
★	Fuselage bottom	– Condition

4.3.3★ Interior check

	Baggage, cargo, loose items	– Stowed, secured

Before flights in low temperature/high humidity conditions (effective defogging of windshields by means of bleed air heating required):

	Air outlets aft cabin area	– Fully closed

★ To be checked **before each flight**

Hand fire extinguisher	– On board, check pressure
Hand lamp	– On board
Passengers	– Briefed
Seat and pedals	– Adjust
Safety belts	– Fasten, adjust
Overhead panel	
All circuit breakers	– In
All switches	– OFF or NORM, priority NORM
Switch guards	– Closed
Instrument panel	
Instruments	– Check
Clock	– Check and set
All switches	– OFF or NORM, priority NORM
Center console	
Static pressure switch	– Secured
Collective pitch levers	
All switches	– OFF or NORM, priority NORM; guarded if possible
Both twist grips	– In OFF position

★ To be checked **before each flight**

4.3.4★ **Pre-start check**

CAUTION AFTER BAT MASTER SW SWITCHED ON, THE LOW ROTOR RPM AUDIO TONE APPEARS. DO NOT PRESS RESET PB (CYCLIC) UNTIL THE END OF CPDS TEST. PRESSING THE RESET PB LEADS TO AN AUTOMATIC DELETION OF A POSSIBLE INP FAIL CAUTION.

BAT MSTR switch	– ON and ENGAGE; CPDS test starts

NOTE Do not switch CPDS off during or after flight. However, if it was switched off:

1. CAD OFF pb	– Press
2. VEMD OFF 1&2 pb	– Press each in turn
N_R/N_2 instrument	– Check full deflection
CAD	– Check no INPUT FAIL message

NOTE If INP FAIL appears in conjunction with the appropriate caution(s), this caution(s) will not be provided during flight. Abort pre-start check. Maintenance action is required.

Low N_R–RPM audio tone and CAD	– Check and reset
Before night flights	
Instrument and utility lights	– Function
Hand lamp	– Function
TEST/DSPLY sw	– W/U and hold
Warning panel	– All warning lights on
Audio	– Single warning GONG present
CAD	– F PUMP JET caution present
TEST/DSPLY sw	– Release to NORM
Audio	– Single gong mustbe replaced by low NR audio, which then can be reset
	– If single gong remains: Test is unsuccessful
TEST/DSPLY sw	– CPDS and hold
Display test image	– Check
MASTER caution lights	– Check flashing
TEST/DSPLY sw	– Release to NORM

★ To be checked **before each flight**

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★ **Pre-start check (continued)**

TEST FIRE 1 switch	– EXT
CAD	– FIRE EXT (sys 1 and sys 2) must come on; indicates the availability of bottle 1 and bottle 2 for engine 1
TEST FIRE 1 switch	– EXT WRN
Warning panel	– FIRE (EMER OFF SW 1) must come on; BOT 1, BOT 2 and EXT of sys 1 come on
Headset	– Aural warning signal must be heard
CAD	– FIRE EXT (sys 1 and sys 2) must go off
	– FIRE E TST (sys 1 and sys 2) must come on; indicates the activating test of bottle 1 and 2 for engine 1
TEST FIRE 1 switch	– OFF

Repeat above fire ext test, system 2 using TEST FIRE 2 switch.

EMER SHED BUS sw (only for battery start)	– ON
BAT HOR/EXIT sw	– TEST
EMER BAT LED	– Check green. The green LED can change to red during the test, if the red LED is immediately on, the battery is empty and must be replaced.
CAD	– Check HOR BAT caution indication on
Emer exit lights	– Check on
FUEL PUMPS XFER (A and F)	– ON, check caution (F PUMP AFT / FWD) off
FUEL PUMPS XFER (A and F)	– OFF, check caution (F PUMP AFT / FWD) on
EMER SHED BUS sw	– NORM and guarded

★ To be checked **before each flight**

★ **Pre-start check (continued)**

FUEL PRIME PUMPS (1 and 2)	– ON, PRIME PUMP (sys1/sys2) caution indication come on and both FUEL PRESS caution indications go off

NOTE Operate prime pumps a minimum of 10 seconds before starting engines.

ACOL sw	– ON
Instrument panel	
OVSP FAIL (sys1/sys2) caution indications	– Check on
CAD & VEMD brightness	– Adjust as required
CPDS	– Check units
VEMD	– DC voltage – minimum 23.5 V
	– IAS displayed in V_{NE} field
	– Select actual gross mass range for correct V_{NE}–table selection
CAD fuel indication	– Check quantity
Instruments	– Check

CAUTION WHEN MAIN TRANSMISSION OIL TEMPERATURE IS BELOW –30°C THE FOLLOWING FLIGHT CONTROLS CHECK MUST BE PERFORMED AFTER FIRST PERFORMING AN ENGINE GROUND RUN UNTIL THE MINIMUM MAIN TRANSMISSION OIL TEMPERATURE IS REACHED FOLLOWED BY AN ENGINE SHUTDOWN (SEE PARA 4.4.2.1 OR 4.4.2.2) OTHERWISE THE MOVEMENT OF THE FLIGHT CONTROLS THROUGHOUT FULL TRAVEL MAY CAUSE FLIGHT CONTROL DAMAGE.

Flight controls	– Check free movement throughout full travel
Pedals	– Parallel
Collective lever	– Lock
FORCE TRIM REL sw	– Press while making small cyclic inputs in all four directions. Check that no spring forces are present
Cyclic stick position	– Centered
Twist grips	– Slowly check free movement throughout normal range (from IDLE to FLIGHT) including IDLE stop function, then set each twist grip in 0° position

★ To be checked **before each flight**

4.4 STARTING ENGINES

NOTE At engine start-up, the **BAT DISCH** caution indication may come on (in case of battery discharge).

4.4.1 Before starting engines

Fire guard (if available)	– Posted
Rotor area	– Clear

4.4.2 Starting first engine

CAUTION IMMEDIATELY ABORT START AND, IF INDICATED, PERFORM MAINTENANCE ACTION BEFORE RESTART FOR ANY OF THE FOLLOWING:

- IGNITION DOES NOT TAKE PLACE WITHIN 15 SECONDS.
- TOT RISES ABOVE LIMITS
  (If start is aborted but TOT limits are not exceeded, wait 15 seconds after N_1 RPM has returned to zero before attempting restart. This permits excess fuel to drain from combustion chamber.)
- NO POSITIVE ENGINE OR TRANSMISSION OIL PRESSURE INDICATIONS UPON REACHING GROUND IDLE CONDITION - MAINTENANCE ACTION!
- N_2 RPM AND ROTOR RPM NEEDLES ARE NOT MATCHED AFTER REACHING STABILIZED GROUND IDLE CONDITION - MAINTENANCE ACTION!

ABORT START PROCEDURE

CAUTION DO NOT PERFORM ENGINE VENTILATION WITH FUEL VALVE CLOSED

Twist grip (affected engine)	– OFF
ENG START sw (affected engine)	– OFF
Engine ventilation	– Perform

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.

Starting first engine (continued)

CAUTION
- DO NOT EXCEED STARTER DUTY CYCLE.
- MONITOR CLOSELY TOT (STARTING TRANSIENT BETWEEN 785°C AND 865°C FOR MAXIMUM 5 SECONDS).
- ALLOW N_1 TO ACCELERATE CONTINUOUSLY IN THE 50%–65% RANGE.

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

EFFECTIVITY Only if cold weather kit P/N B654M2001051and Bleed air heating are installed:

4.4.2.1 Cold engine (engine oil temperature between –30°C and –40°C)

1. First limit indicator	– Check square on TOT and start triangles displayed (TOT–limitations for starting)
2. TWIST GRIP	– Preselect 30°
3. ENG 1 or 2 START sw	– START, simultaneously start stopwatch
4. TOT	– Monitor, as soon as TOT increases, reduce twist grip (to approx. 20°) and adjust TOT by twist grip to keep TOT within the white FLI starting range (at approx. 700°C).
5. N_1	– Check increase
6. N_2/N_{R0} increase	– Monitor
7. Respective ENG 1 or 2 START sw	– Check off at N_1= 50%
8. Respective twist grip	– Rotate to 70% ± 2% N_1
9. Engine and XMSN oil pressure	– Check positive indication

When the minimum engine oil temperature has been reached:

10. Respective twist grip	– Rotate to FLIGHT IDLE

When the minimum transmission oil temperature has been reached:

11. Engine	– Shutdown

Continue with pre–start check "Flight controls – Check free movement..." on page 4–14.

NOTE
- During start, the engine oil pressure may exceed 5 bar
- Avoid prolonging operation in the range between 50% and 65% N_1 (yellow underlining).

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4.4.2.2 Cold engine (engine oil temperature below –40°C)

1. First limit indicator	– Check square on TOT and start triangles displayed (TOT–limitations for starting)
2. TWIST GRIP	– Turn to flight idle, press idle stop button and turn twist grip back (approx. 8mm) until the idle stop button moves in completely
3. ENG 1 or 2 START sw	– START, simultaneously start stopwatch
4. TOT	– Monitor, as soon as TOT increases, reduce twist grip (to approx. 20°) and adjust TOT by twist grip to keep TOT within the white FLI starting range (at approx. 700°C).
5. N_1	– Check increase
6. N_2/N_{R0} increase	– Monitor
7. Respective ENG 1 or 2 START sw	– Check off at N_1= 50%
8. Respective twist grip	– Rotate to 70% ± 2% N_1
9. Engine and XMSN oil pressure	– Check positive indication

When the minimum engine oil temperature has been reached:

10. Respective twist grip	– Rotate to FLIGHT IDLE

When the minimum transmission oil temperature has been reached:

11. Engine	– Shutdown

Continue with pre–start check "Flight controls – Check free movement..." on page 4–14.

NOTE
- During start, the engine oil pressure may exceed 5 bar
- Avoid prolonging operation in the range between 50% and 65% N_1 (yellow underlining).

EFFECTIVITY All

4.4.2.3 Hot or cold engine (engine oil temperature down to –30°C)

1. First limit indicator	– Check square on TOT and start triangles displayed (TOT–limitations for starting)
2. TWIST GRIP	– Preselect 20° (hot engine approx.18°)
3. ENG 1 or 2 START sw	– START, simultaneously start stopwatch
4. TOT	– Monitor, check increase (if necessary adjust TOT by twist grip to keep TOT within the white FLI starting range (at approx. 700°C)).

5. N_1	– Check increase
6. N_2/N_{R0} increase	– Monitor
7. Respective ENG 1 or 2 START sw	– Check off at N_1= 40% – Check DC increase
8. Respective twist grip	– Rotate to 70% ± 2% N_1
9. Engine and XMSN oil pressure	– Check positive indication

NOTE
- During start, the engine oil pressure may exceed 5 bar
- Avoid prolonging operation in the range between 50% and 65% N_1 (yellow underlining).

Hydraulic check:

CAUTION
- HYD TEST SW MUST NOT BE OPERATED DURING FLIGHT
- OBSERVE MAST MOMENT LIMITS DURING HYDRAULIC CHECK

FORCE TRIM REL sw	– Press
Cyclic stick	– Centered
HYD TEST sw	– S–1 and hold – Check that HYD PRESS (sys 2) caution indication comes on and pressure readout (sys 2– VEMD) is underlined (yellow)
Perform small movements:	
– Cyclic stick	– Check mast moment indication and correct operation
– Collective lever	– Check correct operation
– Pedals	– Check higher than normal forces
HYD TEST sw	– S–2 and hold, check: – Check that HYD PRESS (sys 1) caution indication comes on pressure readout (sys 1– VEMD) is underlined (yellow)
Perform small movements:	
– Cyclic stick	– Check mast moment indication and correct operation
– Collective pitch	– Check correct operation
– Pedals	– Check correct operation
HYD TEST sw	– Release

EFFECTIVITY H/C up to S/N 9033 and before SB MBB BK117C-2-22-002; AFCS Retrofit Kit "2"

Cyclic trim system	– Check function

EFFECTIVITY All

4.4.3 Starting second engine

EFFECTIVITY If 27 Ah battery is installed

1. Ammeter	– Operating generator, check below 100 A (battery start only)

EFFECTIVITY All

NOTE If the start of the first engine was aborted and successfully repeated, verify that the generator current is below 100 A before attempting to start the second engine (battery start only).

2. Start second engine following **Starting first engine** procedure above.

NOTE After starting engines, do not advance twist grips to FLIGHT until the minimum engine oil temperature has been reached.

3. STBY HOR sw	– ON
4. INVERTER sw (if installed)	– ON
5. AVIO MSTR sw's	– ON
6. Both PT/ST HTG sw's	– ON
7. Both FUEL PUMPS XFER sw's	– ON
8. Both FUEL PUMPS PRIME sw's	– OFF
9. EM/EX LIGHTS sw	– ARM
10. Avionics	– Check on and set
11. Instruments	– Set and check

4.5 SYSTEM CHECKS

4.5.1 Ventilation

If OAT ≥ +35°C, the ventilation must be set to maximum as follows:

PUSH FOR AIR lever	– Push
VENTILATION CKPT rheostat	– Set to HI
PAX BLW sw	– ON

4.5.2 ★ Avionic checks

COMM/NAV equipment	– ON and check
All other instruments and equipment	– Check and set

4.5.3 Bleed air heating check

BLD HTG EMER/NORM sw	– Check NORM
BLD HTG rheostat	– Turn on – check green HEATING advisory appears
BLD HTG rheostat	– OFF – check green HEATING advisory disappears

4.5.4 ★ Miscellaneous checks

Optional equipment controls	– Set as required

CAUTION WHEN AFCS IS NOT IN USE, THE BACKUP SAS MUST BE SWITCHED OFF.

★ To be checked **before each flight**

4.5.5 Power check

Perform power check as required (see section 5)

4.6 ★ PRE-TAKEOFF CHECK

NOTE After engine start, when reaching ground idle (70%+/–2) the FLI might not always switch to TQ (depending on ambient and engine conditions). In this case the starter triangles will be visible until engines are accelerated towards FLIGHT and FLI switches to TQ.

1.First limit indicator	– Check start triangles are off and bleed valve flag indicated
2.Twist grips	– Rotate smoothly to FLIGHT
3.Cyclic stick	– Check centering device secured
4.Engine and XMSN indications	– In the normal operating range
5.Voltmeter	– Check U < 30.5 V
6.Ammeter	– Check Δ I (LH–RH) < 10 A
7.VAR NR sw	– NORM mode
8.VAR NR caution indication	– Check ON
9.Fuel quantity	– Recheck
10.All warning lights and caution, CAD and VEMD indications (except VAR NR caution indication)	– Check off
11.Standby horizon	– Release cage button, check indication
12.Optional equipment controls	– As required
13.Pilot/Copilot door	– Check properly closed (green marking on the floor visible)
14.Cabin	– Check secured
15.Collective lever	– Unlock; check correct friction

CAUTION COLLECTIVE LEVER MUST NOT INTERFERE WITH LOCKING DEVICE. CHECK ADEQUATE CLEARANCE.

★ To be checked **before each flight**

4.7 ★ TAKEOFF CHECK

1.Hover flight	– Perform
2.VAR NR caution indication	– Check off
3.N_2/Rotor RPM	– Check in accordance with Table 1 shown below
4.FLI needles	– Check synchronised, match if necessary
5.Hover power	– Note
6.All warning lights and caution, CAD and VEMD indications	– Check off

Density Altitude [ft]	< 3600	3600	4305	5064	5837	6500	> 6500
N_{RO} [%]	101	101	101.7	102.3	103	103.5	103.5
• For values not shown in the table, interpolate linear							
• Rotorspeed tolerance: 0.5%							

Table 1 Rotorspeed versus Density Altitude

★ To be checked **before each flight**

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4.8 TAKEOFF

CAUTION AN OSCILLATION, WHICH COULD BE UNINTENTIONALLY INDUCED/ASSISTED BY THE PILOT (PIO/PAO) MAY BE EXPERIENCED IN FLIGHT IN TURBULENT WEATHER CONDITIONS.
IN CASE OF PIO/PAO, RELEASE COLLECTIVE LEVER MOMENTARILY AND INCREASE COLLECTIVE LEVER FRICTION.

Recommended takeoff procedure:

Hover	– Perform with 3 ft skid height
Acceleration and climb	– Start a slight nose down pitch rotation and increase power smoothly (ca. 0.5 FLI more than hover power) so that the helicopter gains speed and height. Observe height–velocity–diagram as described in section 5
When reaching 50 KIAS	– Maintain airspeed until reaching 50ft AGL, then accelerate to V_Y (65 kts) and climb through 100ft AGL

NOTE At approx. 50 kts, the rotor speed will be adjusted automatically.

4.9 PRE-LANDING CHECK

1.All instruments	– Check
2.All warning lights and caution, CAD and VEMD indications	– Check
3.N2/NR	– Check increase to min. 101% when airspeed below 55 KIAS. If NR does not increase, proceed according to VAR NR caution indication in section 3.
4.Cabin	– Check secured

4.10 LANDING

4.10.1 Landing procedure in heavy turbulences

In heavy turbulences where fast collective movements may be necessary, the following landing procedure should be performed:

Landing area reconnaissance	– Perform with 40 KIAS
VAR NR system NORM/MAN sw	– Check in NORM mode
On downwind at 40 KIAS:	
VAR NR system NORM/MAN sw	– Select MAN mode
Rotorspeed	– Check ≥ 101%

Approach	– Perform
Torque	– Synchronize if necessary
After landing:	
VAR NR system NORM/MAN sw	– Select NORM mode

4.10.2 Normal Landing procedure

CAUTION AN OSCILLATION, WHICH COULD BE UNINTENTIONALLY INDUCED/ASSISTED BY THE PILOT (PIO/PAO) MAY BE EXPERIENCED DURING RUNNING LANDINGS OR HARD VERTICAL LANDINGS.
IN CASE OF PIO/PAO, RAPIDLY INCREASE OR DECREASE COLLECTIVE LEVER, WHATEVER THE SITUATION ALLOWS, UNTIL OSCILLATION HAS STOPPED.

Recommended landing procedure:

After reaching 50 ft AGL	– Descent with 300ft/min ≤ R/D < 500ft/min at 40 KIAS
Before touchdown	– Establish flare attitude to reduce ground speed and raise collective lever to cushion landing
Touchdown	– Establish with zero groundspeed
Cyclic stick	– Neutral position
Collective lever	– Lock

4.11 ENGINE SHUTDOWN

NOTE
- Check that ROTOR RPM warning light comes on with an intermittent audio signal when the rotor RPM drops below 95%. If not, a logbook entry and maintenance action are required.
- Check that ENG FAIL 1 and ENG FAIL 2 warning lights come on with a warning gong, when the N_1 RPM of the engines drop below 50%. If not, a logbook entry and maintenance action are required.
- Set stopwatch for a minimum ground idle time of 30 seconds to allow the engines to cool.

CAUTION AFTER SINGLE ENGINE LANDING, WHEN EITHER MAX. CONTINUOUS POWER OR 2.5 MINUTES POWER WAS APPLIED, A GROUND IDLE TIME OF AT LEAST 3 MINUTES IS REQUIRED BEFORE SHUTDOWN.

1.Cyclic stick position	– Check
2.Collective lever	– Lock
3.Twist grips	– IDLE (70% ± 2% N_1), start stopwatch
4.All consumers	– OFF, except anti collision sw
5.VEMD	– Select GEN AMPS
After 30 seconds at IDLE:	
6.Both twist grips	– OFF

NOTE Note gas producer deceleration time. The time required to decelerate from 30 to 0% N_2 should be approximately 40 seconds. If less than 30 seconds or abnormal noises are heard, an engine inspection is required (refer to TURBOMECA ARRIEL 1E2 maintenance manual).

7.TOT and N_1	– Monitor decrease
8.GEN AMPS	– Check
If GEN AMPS > 270 A:	
9.Both BUSTIE sw's	– OFF
When rotor has stopped:	
10.Anti-collision light	– OFF
11.VEMD	– Check FLIGHT REPORT page
12.BAT MSTR switch	– OFF

4.12 ENGINE VENTILATION

NOTE Do not vent both engines at the same time.

Respective twist grip	– OFF
Respective ENG VENT sw	– ON and hold; observe engine ventilation limitations (Section 2, para 2.12.3)

4.13 FLIGHT CHARACTERISTICS

4.13.1 Flight controls

CAUTION AVOID EXTREME CYCLIC STICK DISPLACEMENTS WHEN ON GROUND WITH ROTOR TURNING.

During ground operations with rotor turning, the cyclic stick must remain in the neutral position and the collective pitch lever in the full down position; however, for functional test purposes, minimum control movements (not more than 3 cm from neutral) are allowed.

Avoid extreme pedal movements during ground operations.

4.13.2 Lateral control characteristics

WARNING AVOID STEEP RIGHT TURNS BELOW 45 KIAS CLOSE TO THE GROUND TO MAINTAIN SUFFICIENT LATERAL CONTROL MARGIN FOR RECOVERY.

Lateral control margin can be increased by lowering collective and/or adding nose-left sideslip.

4.13.3 Recommended maximum rate-of-descent during hover or low speed flight

Any descent during hover or low speed flight (up to 20 kt) should be performed with a descent rate of not more than 600 ft/min.

4.13.4 Low speed flight in heavy turbulences

VAR NR system NORM/MAN sw	– Check in NORM mode
$V_{IAS} \leq 40$ kt:	
VAR NR system NORM/MAN sw	– Select MAN mode
Rotorspeed	– Check ≥ 101%
Torque	– Synchronize if necessary
When increasing $V_{IAS} > 40$ kt:	
VAR NR system NORM/MAN sw	– Select NORM mode

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SECTION 5

PERFORMANCE DATA

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SECTION 5

PERFORMANCE DATA

This section contains the performance data charts necessary for preflight and inflight mission planning.

Charts that apply to one-engine-inoperative condition are marked on the upper corner by a black coloured triangle.

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

5.1 APPROVED PERFORMANCE DATA

This subsection contains approved performance data charts necessary for preflight and inflight mission planning.

5.1.1 Standard performance conditions

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

1. Engine power is not greater than helicopter limits (see section 2)
2. Installation and accessory losses are included in each performance chart.
3. At low temperatures and low altitudes, the 2.5 minutes power is limited by engine internal fuel flow limitation. When operating under such conditions the FLI limits can not be reached (this limitation prevents exceeding the engine, main rotor gear box and power transmission shafts from overtorque in case that maximum power is applied following an engine failure). The relevant charts (OEI rate of climb and H-V envelope) are calculated taking into account this limiting factor.

5.1.2 Variable factors affecting performance

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

NOTE
- None of the curves presented should be extrapolated, but interpolation between given data is permissible.
- Unless otherwise authorized by operating regulations, the pilot is not authorized to credit more than the performance increase resulting from 50% of the reported headwind component.
- Performance data contained in this flight manual are not assured in the event of sand or hailstone ingestion into the engine(s).

5.1.3 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.

5.1.4 Power check

(TURBOMECA ARRIEL 1E2)

5.1.4.1 Power check procedures

Two different engine power check procedures are provided:

a) Ground power check:

This procedure shall be exercised on ground to make certain that the engine power available is within the limits established for legal use of the flight manual performance charts.

b) Inflight power check:

This procedure is provided to check the engine power levels in cruising flight to make certain that the engine power available is within the limits established for legal use of the flight manual performance charts. It is no alternative to the ground power check when a power check is required **before flight** by operational rules.

The power check diagrams (figures 5-1 to 5-6) show:
- the maximum allowable N_1 as a function of adjusted torque or
- the minimum percent torque as a function of adjusted N_1.

NOTE Observe power check procedures according to FMS 9.2-22 "SANDFILTER SYSTEM" or FMS 9.2-50 "SANDFILTER (IBF-SYSTEM)" is installed.

5.1.4.2 Power check intervals

Either ground or inflight power check shall be accomplished
- at intervals not exceeding 100 flying hours for Category B operation.
- whenever abnormal engine function is suspected.

5.1.4.3 Ground power check

To obtain correct check results, the following preconditions must be met:

- Adequate distance from buildings, trees, etc. to reduce possibility of wind vortices.
- Helicopter heading into wind.
- CSAS or DAFCS yaw axis stabilization ON, whichever is installed
- Bleed air heating (of engine to be checked, if installed) OFF
- Other bleed air consumers, if any, OFF
-
- VAR NR system operating in the MAN mode and rotor RPM adjusted to 100 %.

The **ground power check procedure** (figure 5-1 / figure 5-2 refer) shall be carried out:

- On the ground, and
- Under single engine operating condition (second engine at ground idle)

CAUTION ENGINE / TRANSMISSION POWER LIMITATIONS IN SECTION 2 ARE NOT TO BE EXCEEDED.

To perform the power check proceed as follows:

1. Before starting engines, set the barometric altimeter to 1013.2 hPa.
2. Check pressure altitude.

After starting engines:

3. Check calibrated outside air temperature as soon as OAT has stabilized (if OAT probe was heated up by sun radiation during parking).
4. BUSTIE sw (of engine to be checked) OFF

NOTE Systems on NON ESSENTIAL and SHED BUS will be momentarily lost once BUSTIE switches are OFF, resulting in various cautions, indicating these systems are failed.

5. Generator (of engine to be checked) OFF
6. Set the non-affected engine to ground idle.
7. Slowly increase collective pitch as necessary to achieve a torque value of at least 70% at 100 % rotor RPM, but not above AEO MCP. If the AEO MCP limit is reached before 70% torque, reduce collective pitch to achieve 60% torque.
8. Allow the engine to stabilize on the established power setting for at least 2 minutes
9. Note the following values:
   - Torque (%)
   - N_1 (%)
10. Set the non-affected engine to FLIGHT.
11. BUSTIE sw (of engine checked) RESET then NORM
12. Generator (of engine checked) RESET then NORM

continued

Repeat procedure for other engine (see steps 4. – 12.).

13. Use the appropriate power check diagram (fig.5-1 or fig.5-2) to determine the maximum N_1 corresponding to the prevailing ambient conditions..

14. Power is assured and all performance data contained in this manual can be achieved when each engine's indicated N_1 is equal to or less than the chart derived maximum N_1 value.

If the engine fails to pass the power check on the ground and calm wind or unsteady, direction changing wind is present, perform an inflight power check.

NOTE At low or unsteady wind velocities on ground, the engine may ingest exhaust gases causing an increase in N_1.

If the result is still unacceptable, perform maintenance actions in accordance with the maintenance manual.

15. Record power check results in the helicopter documents.

EXAMPLE: (see figure 5-1)

Determine: **N_1 margin**

Known:		
	Pressure altitude	6000 ft
	OAT	0 °C
	Indicated N_1	91 %
	N_1 margin from average trend line (see power trend monitoring)	3.7%

Solution: **N_1 margin = 3.4%**

1. Enter chart at known OAT (0°C)
2. Move vertically upwards to known pressure altitude (6000 ft)
3. Move horizontally left and read chart limit N_1 = 94.4%)
4. The N_1 margin = chart limit N_1 (94.4%) – indicated N_1 (91%) = 3.4 %.

In the example above, the N_1 margin is 3.4%. Since the N_1 margin from the average power trend line is 3.7%, N_1 margin drop down (0.3%) is permissible. The conditions for an acceptable power check are satisfied.

A continuous power trend monitoring procedure is given in paragraph 5.1.4.5 below.

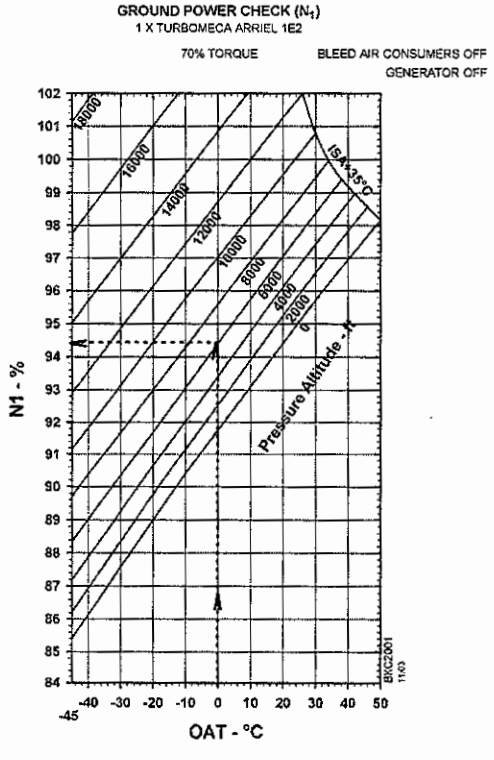

Fig. 5-1 Ground power check for engine No. 1 and No. 2 and 70% torque

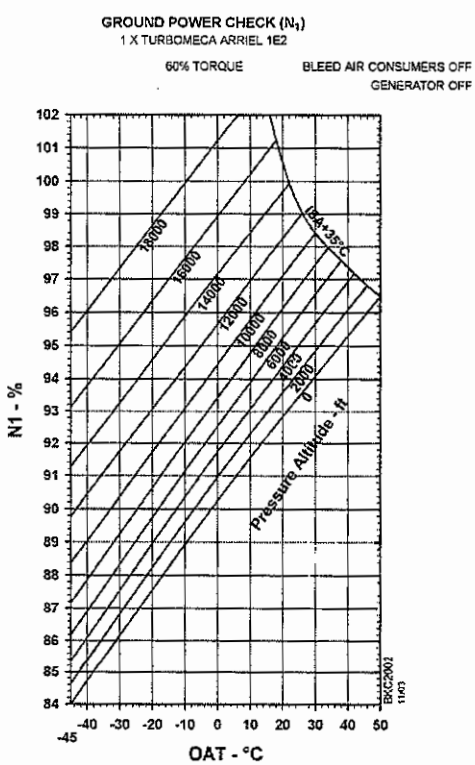

Fig. 5-2 Ground power check for engine No. 1 and No. 2 and 60% torque

5.1.4.4 Inflight power check

NOTE • The performance of engine No.1 and of engine No.2 are slightly different due to the engine intake airflow.

• The inflight power check shall be conducted only with warmed up engines, e.g. during the last flight of the day.

• The bleed valves of the engines have to be closed during the measurement.

• The inflight power check has to be conducted in NORM mode.

• The inflight power check has been established for twin engine operation only. Performing the check under single engine operating conditions, i.e. with the second engine in idle, will lead to incorrect check results!

1. Height above ground greater than 500 ft (preferably at an altitude with minimum turbulence) – Attain
2. Steady level flight – Establish (airspeed >65 kt)
3. VAR NR system – Check NORM mode
4. Bleed air heating (engine to be checked) – OFF
5. Other bleed air consumers – OFF
6. Engine torque – Set to 2 x 70% but not above AEO MCP
   – If the AEO MCP limit is reached before 70 % torque, reduce collective pitch to achieve 60 % torque
7. Electrical load – Reduce as necessary
8. BUSTIE sw (of engine to be checked) – OFF

NOTE Systems on NON ESSENTIAL and SHED BUS will be momentarily lost once BUSTIE switches are OFF, resulting in various cautions, indicating these systems are failed.

9. Generator (of engine to be checked) – OFF
10. Barometric altimeter – Set to 1013.2 hPa
11. Allow the engines to stabilize on the established power for one minute, then note:
    – Torque (%)
    – N_1 (%)
    – OAT (°C)
    – PA (feet)

continued

12. BUSTIE sw of checked engine – RESET then NORM
13. Generator of checked engine – RESET then NORM
14. Bleed air heating and other bleed air consumers – As required
15. Repeat procedure for other engine (see steps 4. – 14.)
16. Barometric altimeter – Reset to QNH (if necessary)
17. Determine limit N_1 corresponding to torque, pressure altitude and OAT from figure 5-3 (engine No.1) or figure 5-5 (engine No.1) / figure 5-4 (engine No.2) or figure 5-6 (engine No.2).
18. Compare measured N_1 with N_1 obtained from the chart. Power check is fully acceptable when measured N_1 meets or is lower than chart limit N_1.
    If measured N_1 is greater than chart limit N_1, perform a ground power check.
19. Record power check results in the helicopter documents

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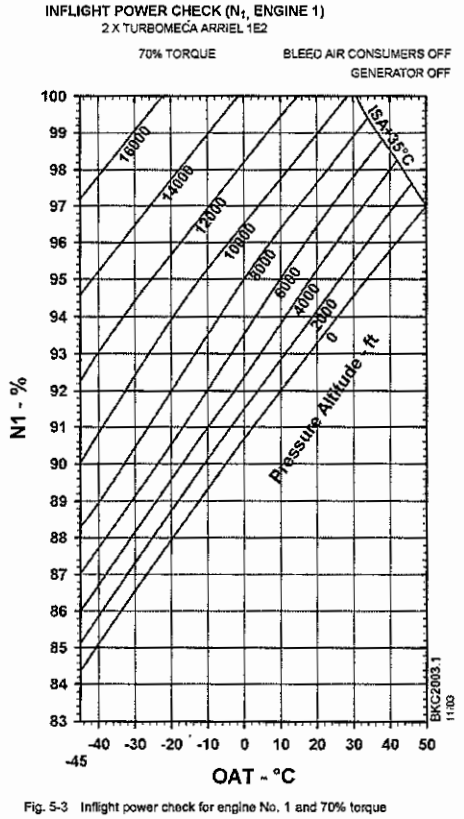

Fig. 5-3 Inflight power check for engine No. 1 and 70% torque

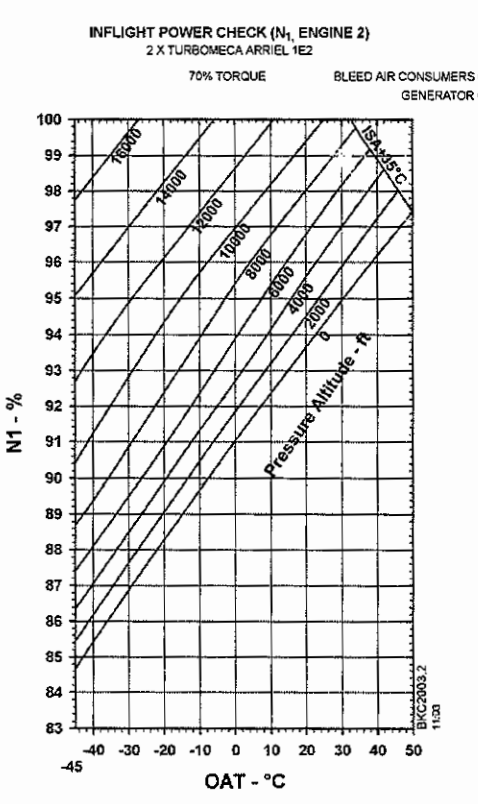

Fig. 5-4 Inflight power check for engine No. 2 and 70% torque

INFLIGHT POWER CHECK (N_1, ENGINE 1)
2 X TURBOMECA ARRIEL 1E2

60% TORQUE BLEED AIR CONSUMERS OFF
GENERATOR OFF

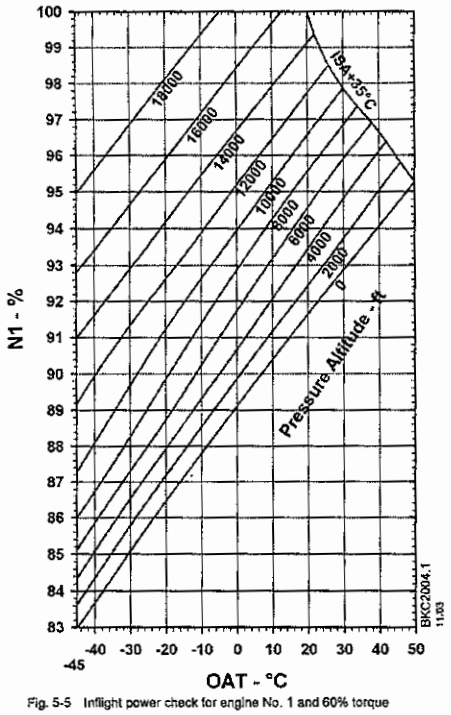

Fig. 5-5 Inflight power check for engine No. 1 and 60% torque

INFLIGHT POWER CHECK (N_1, ENGINE 2)
2 X TURBOMECA ARRIEL 1E2

60% TORQUE BLEED AIR CONSUMERS OFF
GENERATOR OFF

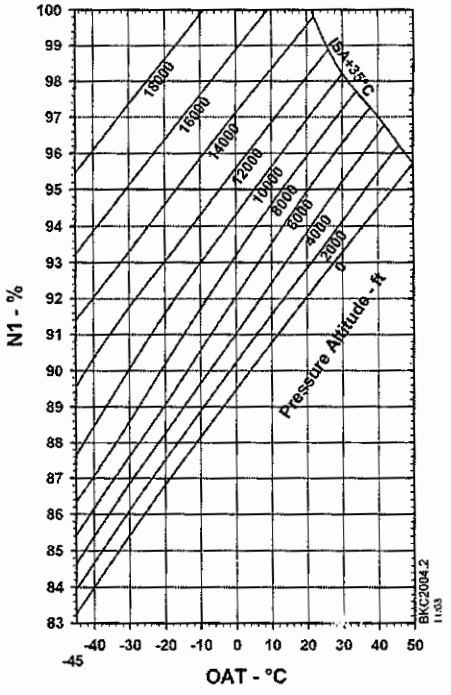

Fig. 5-6 Inflight power check for engine No. 2 and 60% torque

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5.1.4.5 Power trend monitoring

A power trend monitoring should be established to observe the deterioration of the engines with time in service as well as potential engine malfunctions. Although the results from both the ground or inflight power checks can be used for establishing a power trend chart, it is recommended to perform either always ground or always inflight power checks.

NOTE The power check preconditions and the power check procedure have to be followed very accurately, otherwise the trend monitoring will not be reliable.

To establish a power trend chart, the N_1 margin (defined as chart limit N_1 minus measured N_1) shall be recorded versus time in service.

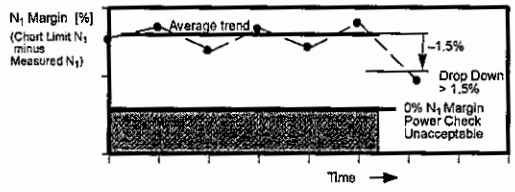

Fig. 5-7 Plotting example for power trend monitoring

For each engine, establish an average trend line based on the most recent consecutive 5 data points of operation. The maximum permissible N_1 margin drop down between a single power check result and the average trend line is 1.5%. If the change is greater, abnormal function of the engine or engine instrumentation should be assumed and maintenance action in accordance with the maintenance manual is highly recommended.

5.1.5 **Density altitude**

The density altitude chart (figure 5-8) expresses density altitude in terms of pressure altitude and temperature. The less dense the air the higher the density altitude. For standard conditions of temperature and pressure, density altitude is identical to pressure altitude. A high density altitude affects the performance of both the main rotor and the engine. When density altitude is high, less lift is developed by the rotor blades for any given power setting than at standard conditions and the power output of the engine is reduced below the output for standard conditions.

Each takeoff and landing must be separately evaluated as density altitude may change considerably in a short period of time.

The value $\frac{1}{\sqrt{\sigma}}$ is a conversion factor used to obtain true airspeed from calibrated airspeed by correcting for density altitude.

EXAMPLE: (see figure 5-8)

Determine: Density altitude (DA), true airspeed factor, and true airspeed (TAS)

Known:		
	OAT	– 14°C
	Pressure altitude	5000 ft
	CAS	100 kts

Solution:

1. Enter chart at known OAT (– 14°C)
2. Move vertically upwards to known pressure altitude (5000 ft)
3. Move horizontally left and read density altitude = **2800 ft**
4. Move horizontally right and read true airspeed factor = **1.04**
5. Multiply the known calibrated airspeed (100 kts) by true airspeed factor ($\frac{1}{\sqrt{\sigma}}$ = 1.04) to obtain true airspeed.
6. TAS = CAS x $\frac{1}{\sqrt{\sigma}}$ = 100 x 1.04 = **104 knots**

DENSITY ALTITUDE CHART

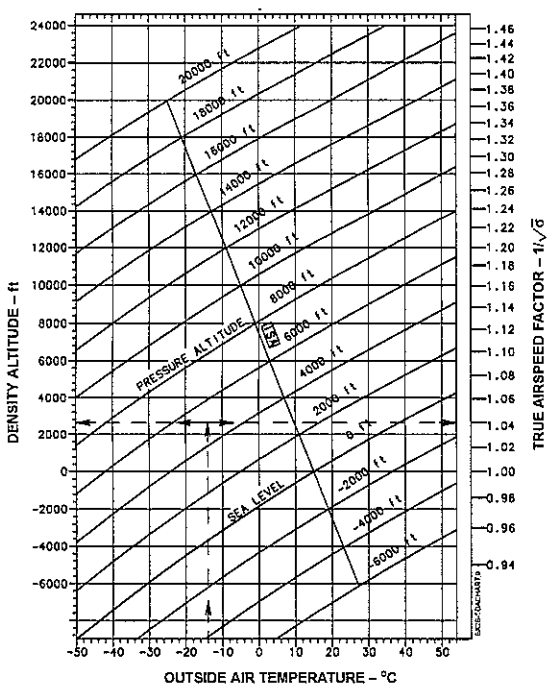

Fig. 5-8 Density altitude chart

5.1.6 Airspeed system calibration

The pilot's and copilot's airspeed system calibration charts (figures 5-9 and 5-10) provide information for determining CAS from IAS or vice versa.

The charts are provided to show the necessary position error correction for **level flight, climb** flight and **autorotation** flight.

The correction is applicable at all practical altitudes and helicopter masses.

NOTE The correction applies only when the helicopter is flown with no appreciable yaw.

EXAMPLE: (see figure 5-9)

Determine: **Calibrated airspeed (CAS)**

Known: Level flight
Indicated airspeed (IAS) (pilot's system) = 90 KIAS

Solution:

1. Enter chart at known indicated airspeed (90 KIAS)
2. Move vertically upwards to level flight line
3. Move horizontally left and read calibrated airspeed = **91 KCAS**

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AIRSPEED SYSTEM CALIBRATION
PILOT'S SYSTEM
TURBOMECA ARRIEL 1E2

CLEAN CONFIGURATION

NOTE INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR

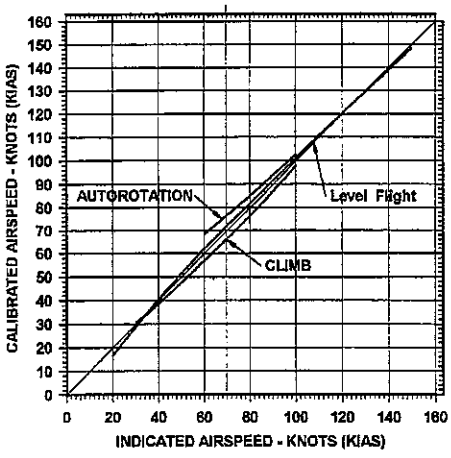

Fig. 5-9 Airspeed system calibration (pilot)

AIRSPEED SYSTEM CALIBRATION
COPILOT'S SYSTEM
TURBOMECA ARRIEL 1E2

CLEAN CONFIGURATION

NOTE INDICATED AIRSPEED ASSUMES ZERO INSTRUMENT ERROR

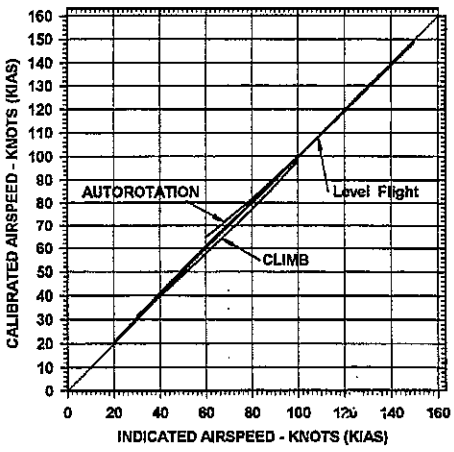

Fig. 5-10 Airspeed system calibration (copilot)

5.1.7 Static system correction

5.1.7.1 Normal static system altitude correction

With the altimeter connected to the normal static, the altimeter pressure error does not exceed 25 ft for any airspeed in level flight, climb or descent.

5.1.7.2 Alternate static system altitude and airspeed correction

When the altimeter is connected to the cabin static and the pilot's window is closed, significant errors are introduced. The corrections which apply to indicated altitude and airspeed in order to obtain true altitude and calibrated airspeed are shown on the following table (Table 5-1) for level flight.

NOTE Add ΔPA to indicated altitude to obtain calibrated altitude.

EXAMPLE: (see Table 5-1)

Determine: Calibrated airspeed and true altitude

Known:		
	Indicated pressure altitude	1000 ft
	Indicated airspeed	70 kts
	Bleed air heating (optional)	ON
	Ventilation	OFF
	Pilot's window	CLOSED

Solution: CAS = 88 kts

True altitude is 1000 ft + 50 ft = **1050 ft**

ALTERNATE STATIC SYSTEM CORRECTION

PILOT'S WINDOW	BLEED AIR HEATING	VENTI-LATION	IAS (kts)	50	70	90	110	130	150
CLOSED	OFF	OFF	CAS (kts)	53	85	105	123	141	164
			Δ PA (ft)	0	80	120	160	160	200
CLOSED	OFF	ON	CAS (kts)	64	87	105	123	141	166
			Δ PA (ft)	0	80	140	170	180	180
CLOSED	ON	OFF	CAS (kts)	61	86	105	123	141	166
			Δ PA (ft)	0	50	170	200	160	200
CLOSED	ON	ON	CAS (kts)	88	91	107	126	144	158
			Δ PA (ft)	60	120	160	200	180	220
OPEN	ON or OFF	ON or OFF	CAS (kts)/ Δ PA (ft)	NO CORRECTION NECESSARY					

ADD ΔPA TO INDICATED PRESSURE ALTITUDE TO OBTAIN CALIBRATED PRESSURE ALTITUDE.

Table 5-1 Alternate static system correction

5.1.8 Height–velocity envelope

The height-velocity envelope shown in the height-velocity diagram (figure 5-11) is the combination of indicated airspeed and height above ground as a function of gross mass, pressure altitude and outside air temperature.

The diagram shows the area which is critical for helicopter operation in the event of a single engine failure during takeoff, landing or other operations near the ground.

The curves are applicable for landing sites with smooth firm surfaces and define the conditions in which a safe landing can be made after an engine suddenly becomes inoperative.

NOTE • The helicopter configuration shall comply with the mass-altitude-temperature limits shown in section 5.

• The data presented in the height-velocity diagram (fig. 5-11) for density altitudes above 15000 ft have been established by theoretical analysis only.

EXAMPLE: (see figure 5-11)

The critical height-velocity area which should be avoided, can be defined by first determining point P, a point on the requested boundary curve.

Determine: Critical height-velocity curve

Known:		
	OAT	6 °C
	Pressure altitude	7000 ft
	Gross mass	2900 kg

Solution:

1. Enter chart at known OAT (6 °C)
2. Move vertically upwards to known pressure altitude (7000 ft)
3. Move horizontally right to known gross mass (2900kg)
4. Move vertically downwards to intersect the reference line
5. From intersection with reference line move horizontally left and read height above ground for point P = **146 ft**
6. Draw the boundary curve through point P by interpolating between the existing curves on the chart

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5.1.9 Height–velocity envelope

The height-velocity envelope shown in the height-velocity diagram (figure 5-11) is the combination of indicated airspeed and height above ground as a function of gross mass, pressure altitude and outside air temperature.

The diagram shows the area which is critical for helicopter operation in the event of a single engine failure during takeoff, landing or other operations near the ground.

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5. From intersection with reference line move horizontally left and read height above ground for point P = **146 ft**
6. Draw the boundary curve through point P by interpolating between the existing curves on the chart

HEIGHT-VELOCITY DIAGRAM

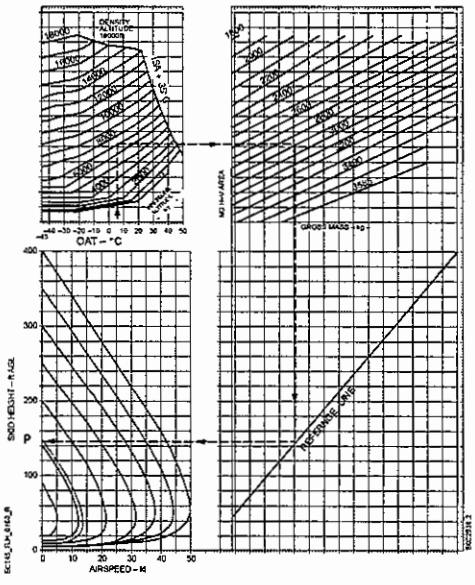

Fig. 5-11 Height-velocity diagram

5.1.10 **Hover ceiling**

The hover ceiling charts for **hover in ground effect (HIGE)** (Fig.5-12 to 5-19) are provided for AEO conditions, with takeoff power (TOP) and maximum continuous power (MCP) and various combinations of pressure altitude, outside air temperature and gross mass.

For hover in ground effect in density altitudes up to 7000 ft controllability is assured for winds up to 30 kts from all directions, above 7000 ft for winds up to 17 kts from all directions.

The hover ceiling charts for **hover out of ground effect (HOGE)** (Fig.5-20 to 5-23) are provided for AEO conditions, with takeoff power (TOP) and maximum continuous power (MCP), and various combinations of pressure altitude, outside air temperature and gross mass.

EFFECTIVITY *Before ASB C-2-67A-012*

For hover out of ground effect in density altitudes up to 7000 ft controllablity is assured for winds up to 30 kts except for winds from the right–rear side, where 20 kts are assured and except for wind from the left–rear side, where 12 kts are assured. Above 7000ft density altitudes wind up to 30 kts is assured except for winds from the right to the right–rear side, where 17 kts are assured and wind from the left–rear side, where 12 kts are assured.

EFFECTIVITY *All*

For hover out of ground effect in density altitudes up to 7000 ft controllability is assured for winds up to 30 kts from all directions, above 7000 ft for winds up to 17 kts from the right side and up to 30 kts from all other directions.

Controllability during standard type takeoff and landing has been demonstrated for flight conditions with crosswind components up to 17 kts.

EXAMPLE: (based on fig. 5-12)

Determine: **Maximum gross mass for hover in ground effect**

Known: OAT 7°C
Pressure altitude 11000 ft

Solution:

1. Enter chart at known OAT (7°C)
2. Move upwards to known pressure altitude (11000 ft)
3. Move horizontally left and read maximum takeoff and landing gross mass = **3335 kg**

EXAMPLE: (based on fig. 5-12)

Determine: **Maximum gross mass for hover in ground effect**

Known: OAT −11°C
Pressure altitude 3000 ft

Solution: **Since the given OAT / altitude combination is not shown, the gross mass limit line applies (see also footnote on the chart).**

1. Maximum gross mass ≈ **3585 kg**

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER — ZERO WIND OR HEADWIND
BLEED AIR CONSUMERS OFF

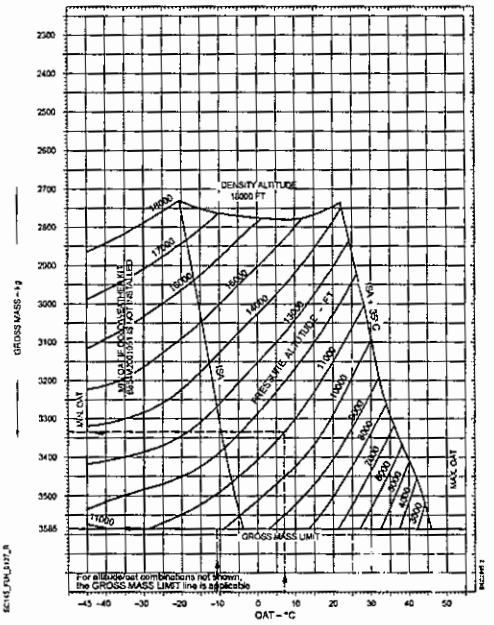

Fig. 5-12 Hover ceiling in ground effect (AEO, TOP, zero wind, bleed air off)

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER — ZERO WIND OR HEADWIND
BLEED AIR CONSUMERS ON

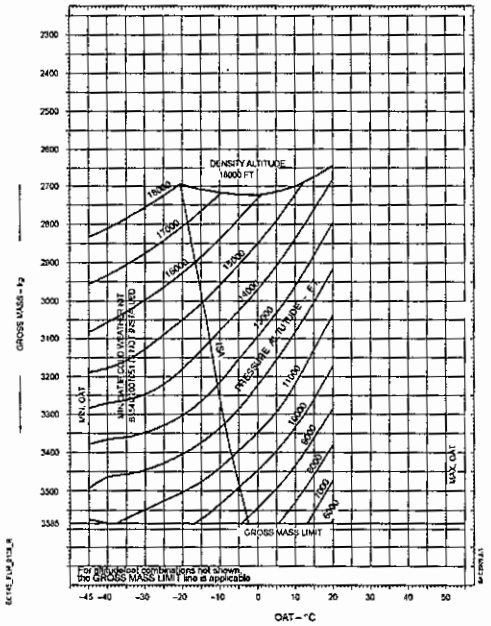

Fig. 5-13 Hover ceiling in ground effect (AEO, TOP, zero wind, bleed air on)

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER — CROSSWIND KOMPONENT 17 KTS
BLEED AIR CONSUMERS OFF

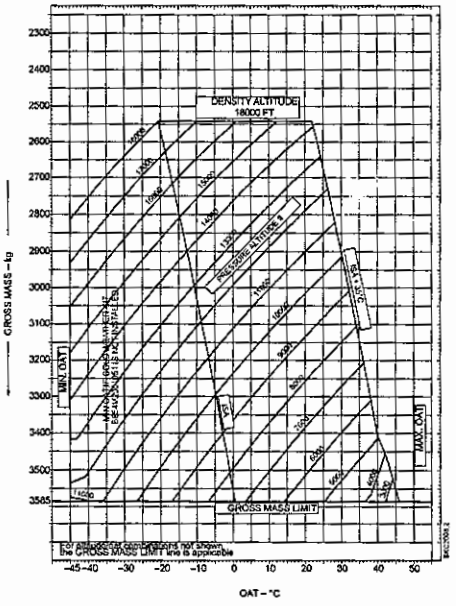

Fig. 5-14 Hover ceiling in ground effect (AEO, TOP, crosswind, bleed air off)

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

CROSSWIND KOMPONENT 17 KTS
BLEED AIR CONSUMERS ON

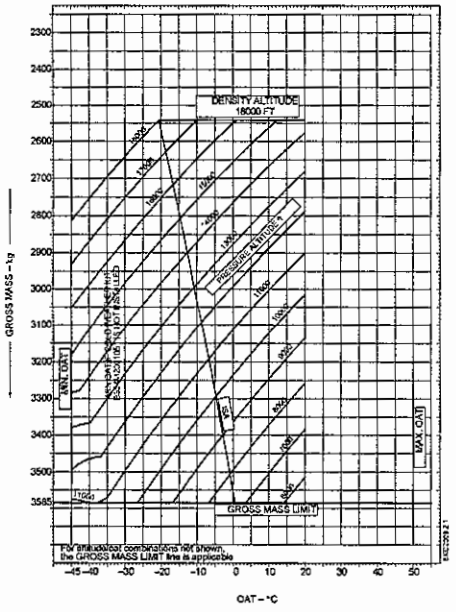

Fig. 5-15 Hover ceiling in ground effect (AEO, TOP, crosswind, bleed air on)

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

MCP

ZERO WIND OR HEADWIND
BLEED AIR CONSUMERS OFF

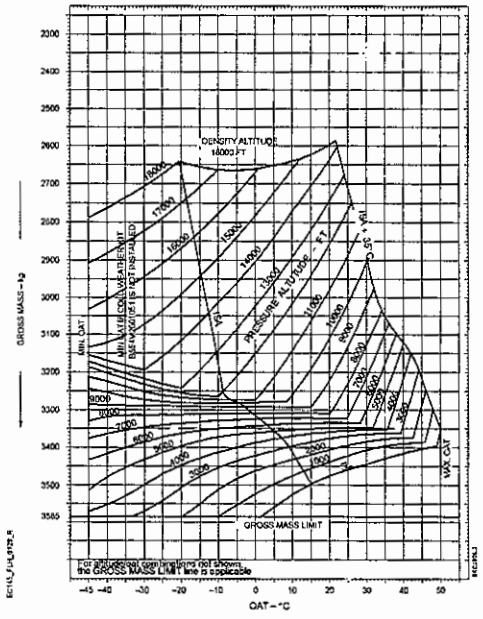

Fig. 5-16 Hover ceiling in ground effect (AEO, MCP, zero wind, bleed air off)

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HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

MCP

ZERO WIND OR HEADWIND
BLEED AIR CONSUMERS ON

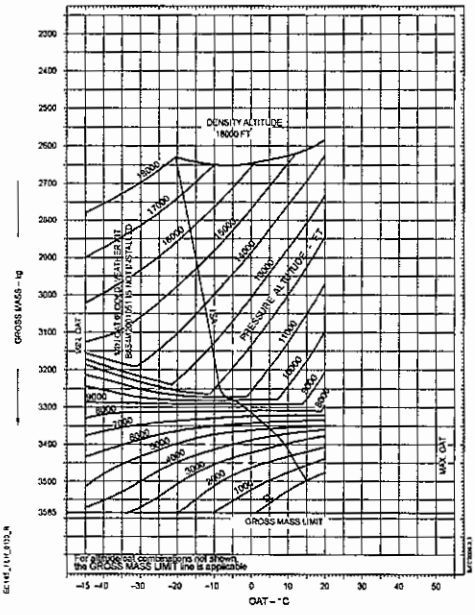

Fig. 5-17 Hover ceiling in ground effect (AEO, MCP, zero wind, bleed air on)

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

MCP

CROSSWIND KOMPONENT 17 KTS
BLEED AIR CONSUMERS OFF

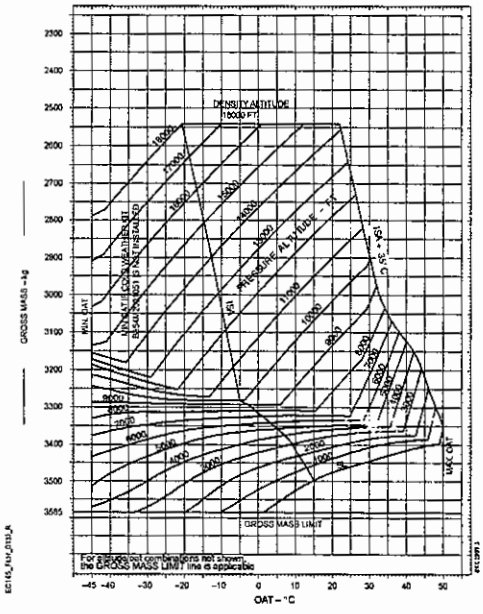

Fig. 5-18 Hover ceiling in ground effect (AEO, MCP, crosswind, bleed air off)

HOVER CEILING IN GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

MCP

CROSSWIND KOMPONENT 17 KTS
BLEED AIR CONSUMERS ON

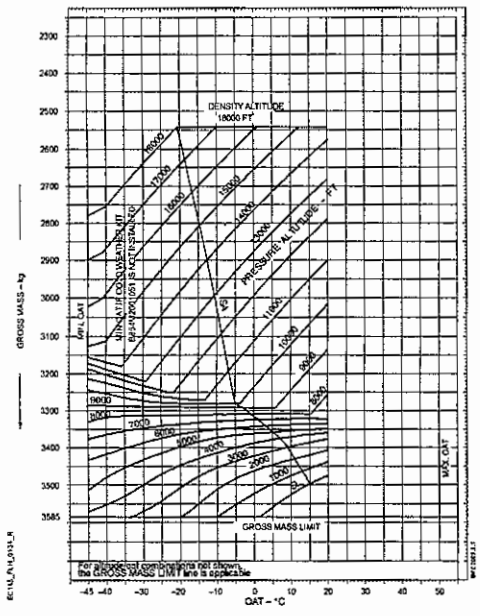

Fig. 5-19 Hover ceiling in ground effect (AEO, MCP, crosswind, bleed air on)

HOVER CEILING OUT OF GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

BLEED AIR CONSUMERS OFF

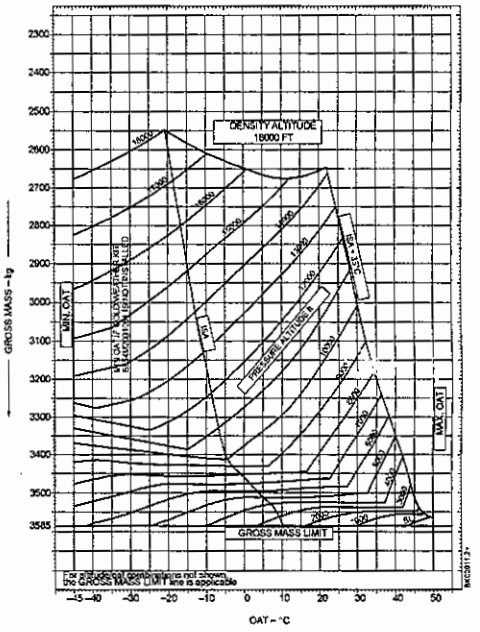

Fig. 5-20 Hover ceiling out of ground effect (AEO, TOP, bleed air off)

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HOVER CEILING OUT OF GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

BLEED AIR CONSUMERS ON

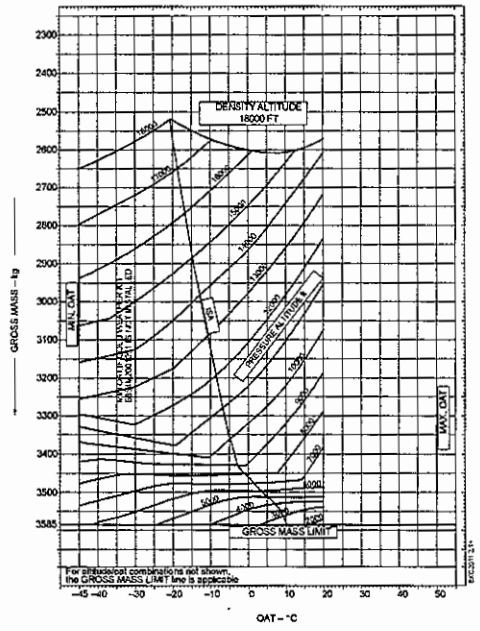

Fig. 5-21 Hover ceiling out of ground effect (AEO, TOP, bleed air on)

HOVER CEILING OUT OF GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS OFF

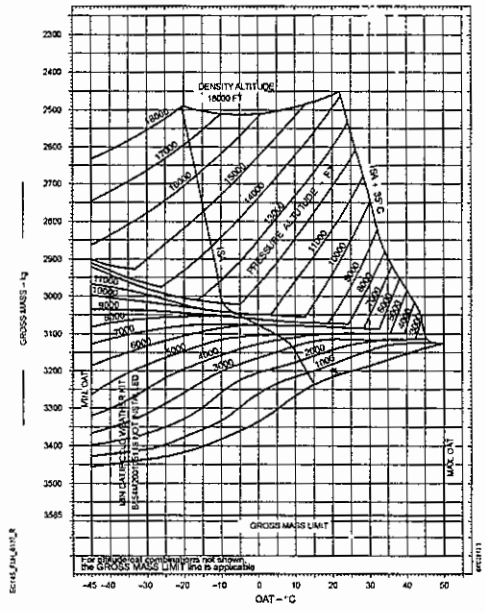

Fig. 5-22 Hover ceiling out of ground effect (AEO, MCP, bleed air off)

HOVER CEILING OUT OF GROUND EFFECT
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS ON

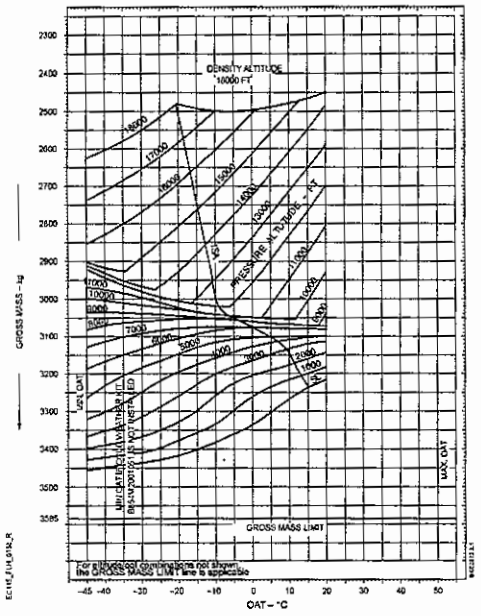

Fig. 5-23 Hover ceiling out of ground effect (AEO, MCP, bleed air on)

5.1.11 Hover out of ground effect (HOGE) - OEI Performance

For specific operations OEI hover out of ground effect capability may be required and shall be performed in accordance with national operational rules.

5.1.11.1 Bleed air consumers

Bleed air heating and other bleed air consumption is not permitted during operation which requires OEI-hover.

5.1.11.2 Wind credit chart

The wind credit chart is valid for headwind components. Operations with tailwind components should be avoided.

Wind accountability in Fig. 5-24 is UNFACTORED.

NOTE Unless otherwise authorized by operating regulations, the pilot is not authorized to credit more than the performance increase resulting from 50% of the reported headwind component.

EXAMPLE: (based on fig. 5-24)

Determine: **Maximum gross mass for hover out of ground effect**

For headwind calculation refer to the wind component chart section 1 of the FLM page 1–14.

Known:	OAT	–2°C
	Pressure altitude	2000 ft
	Headwind component	24 kt
	For calculation 50% of the headwind component	12 kt

Solution: **Maximum gross mass = 2890 kg**

1. Enter chart at known OAT (–2°C)
2. Move upwards to known pressure altitude (2000 ft)
3. From point of intersection move horizontally right to the reference line of the wind credit chart.
4. From this point follow the direction of the wind credit guide lines.
5. Enter chart at calculated headwind (12 kt)
6. Move vertically upwards to intersect tracing from above.
7. From point of intersection move horizontally right and read **max. gross mass = 2890 kg**

OEI HOGE GROSS MASS
1 X TURBOMECA ARRIEL 1E2

2.5 MIN POWER

VAR NR MODE: MAN
(BLEED AIR CONSUMPTION NOT PERMITTED!)

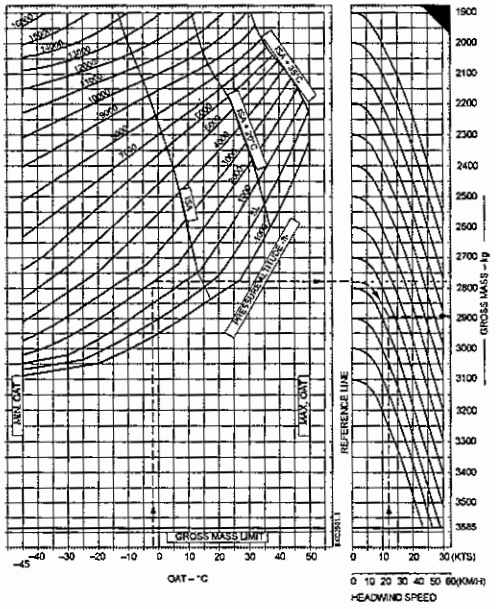

Fig. 5-24 OEI HOGE gross mass

5.1.12 Takeoff distance from hover to 50 feet height

The takeoff distance chart (figure 5-26) provides takeoff performance data utilizing a takeoff profile as shown in figure 5-25. The chart is provided for preflight planning to compute the takeoff distance to a height of 50 feet at various combinations of gross mass, pressure altitude, outside air temperature and headwind. The data provided apply when the VAR NR system is operated in the NORM mode.

The takeoff distance to a height of 50 feet is presented in Fig. 5-26.

If an engine failure occurs during takeoff, continued takeoff and climbout capability is NOT assured (FAR 29, category B provisions). The category B takeoff profile (figure 5-25) assures the capability to land safely (on a smooth level surface) from any point in the takeoff profile should an engine failure occur.

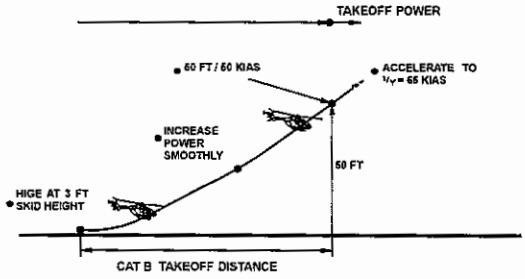

Fig. 5-25 Takeoff profile (category B)

To achieve values given in the chart, proceed as follows:

1. Hover flight with 3ft skid height – Perform
2. N_2/Rotor RPM min. 101% – Check (when NORM mode selected)

3. Torque FLI–value for HIGE	–	Note
4. Acceleration and climb	–	Start a slight nose down pitch rotation and increase power smoothly (ca. 0.5 FLI more than hover power) so that the helicopter gains speed and height.
5. When reaching 50 KIAS	–	Maintain airspeed until reaching 50 ft AGL, then accelerate to V_Y and climb through 100 ft AGL.

EXAMPLE: (see figure 5-26)

Determine: Takeoff distance required to clear a 50 ft obstacle

For headwind calculation refer to the wind component chart section 1 of the FLM page 1–14.

Known:	Pressure altitude	2000 ft
	OAT	35°C
	Headwind component	50 kt
	For calculation 50% of the headwind component.	25 kt

Solution: Takeoff distance required = 115 m

1. Enter chart at known OAT (35°C).
2. Move vertically upwards to to known pressure altitude (2000 ft).
3. From point of intersection move horizontally right to the reference line of the right chart.
4. Move vertically downwards to the reference line of the wind credit chart.
5. From this point follow the direction of the wind credit guide lines.
6. Enter chart at calculated headwind (25 kt)
7. Move horizontally to intersect tracing from above.
8. From point of intersection move downwards and read **takeoff distance = 115 m**
(The result under the assumption of no wind is 230 m)

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TAKEOFF DISTANCE FROM HOVER TO 50 FEET HEIGHT

2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER — INITIATED FROM 3 FT SKID HEIGHT IN A STABILIZED HOVER
BLEED AIR CONSUMERS ON OR OFF

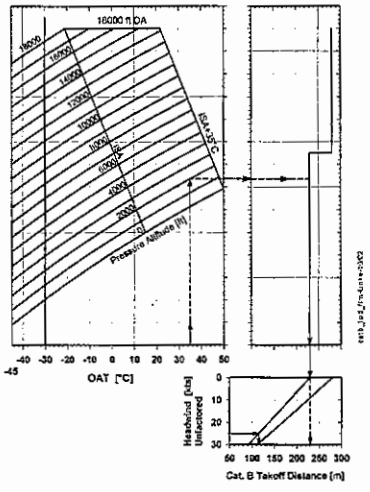

Fig. 5-26 Takeoff distance from hover to 50 ft height (AEO)

5.1.13 **Rate of climb**

The following rate of climb charts (Fig. 5-27 to 5-47) show the rate of climb in twin engine operation and in one-engine-inoperative conditions at best rate of climb speed (V_Y) with various combinations of power settings, bleed air heating, pressure altitude, outside air temperature and gross mass.

The AEO charts are calculated under the assumption that the VARTOMS is operated in the NORM-mode.

EXAMPLE: (see figure 5-27)

Determine: **Rate of climb**

Known:	Takeoff power	
	OAT	0°C
	Pressure altitude	13600 ft
	Gross mass	2100 kg

Solution: **Rate of climb = 2850 ft/minute**

1. Enter chart at known pressure altitude (13600 ft).
2. Move horizontally right to known OAT(0°C).
3. Move vertically downwards to reference line.
4. Move further downwards following the direction of the gross mass guide lines.
5. Enter chart at known gross mass (2100 kg).
6. Move horizontally right to intersect tracing from above.
7. From the point of intersection move vertically downwards and read rate of climb (**28.50x100=2850 ft/minute**).

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

V_Y = 85 KIAS
BLEED AIR CONSUMERS OFF

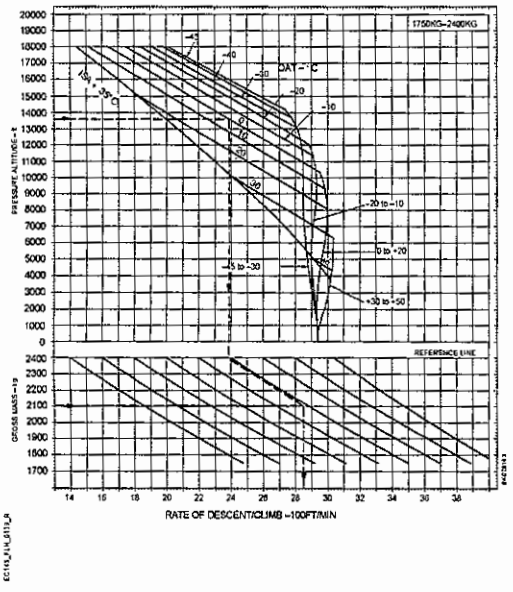

Fig. 5-27 Rate of climb (AEO, TOP, 1750 kg to 2400 kg, bleed air off)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

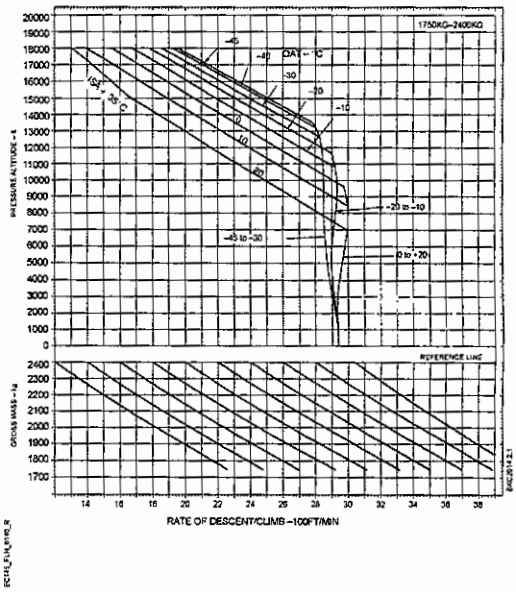

Fig. 5-28 Rate of climb (AEO, TOP, 1750 kg to 2400 kg, bleed air on)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

V_Y = 85 KIAS
BLEED AIR CONSUMERS OFF

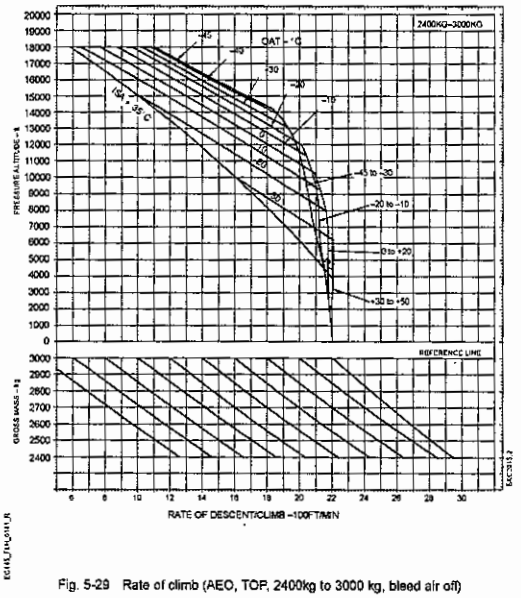

Fig. 5-29 Rate of climb (AEO, TOP, 2400kg to 3000 kg, bleed air off)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

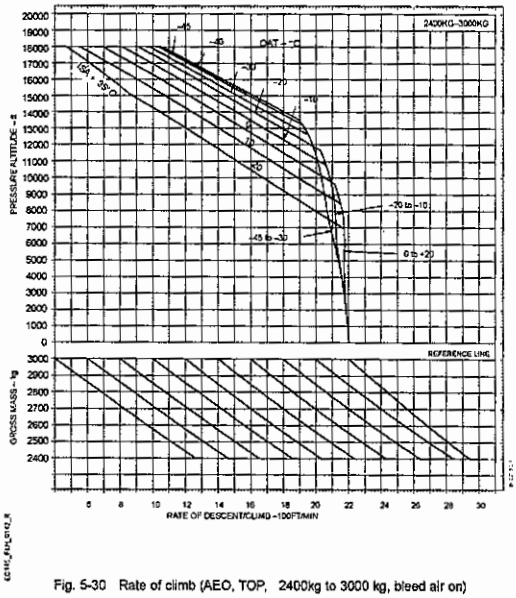

Fig. 5-30 Rate of climb (AEO, TOP, 2400kg to 3000 kg, bleed air on)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

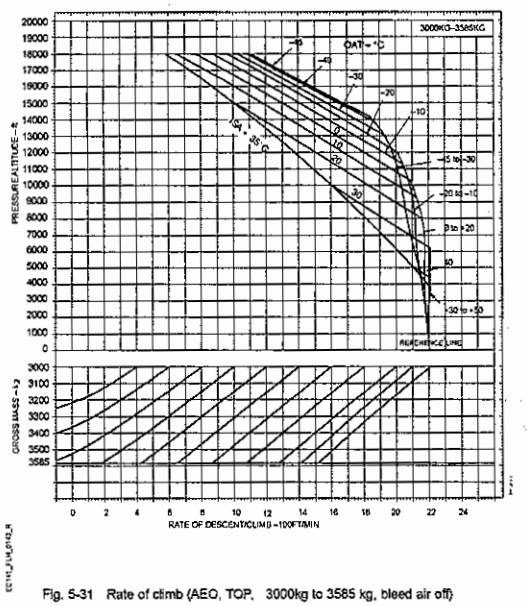

Fig. 5-31 Rate of climb (AEO, TOP, 3000kg to 3585 kg, bleed air off)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

TAKEOFF POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

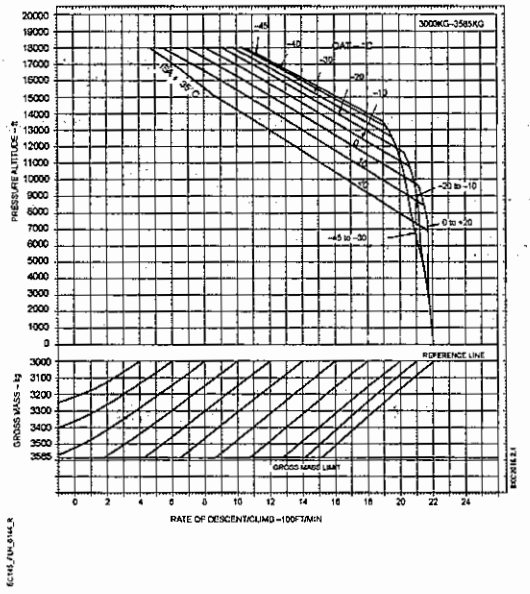

Fig. 5-32 Rate of climb (AEO, TOP, 3000kg to 3585 kg, bleed air on)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

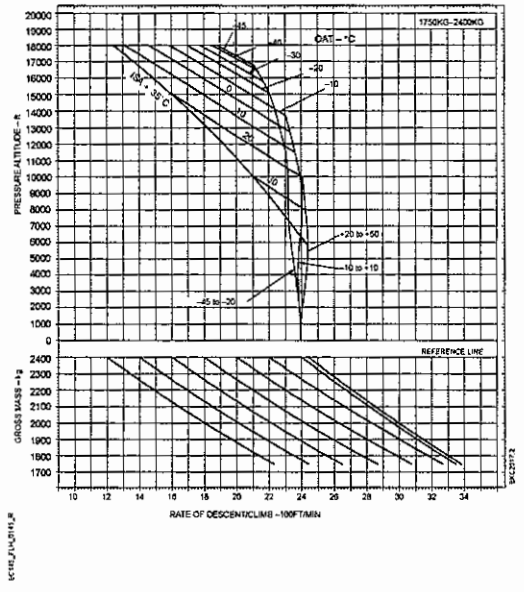

Fig. 5-33 Rate of climb (AEO, MCP, 1750 kg to 2400 kg, bleed air off)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

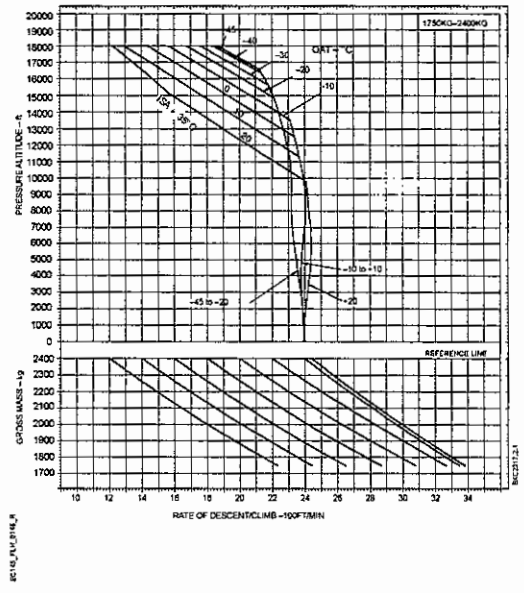

Fig. 5-34 Rate of climb (AEO, MCP, 1750 kg to 2400 kg, bleed air on)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

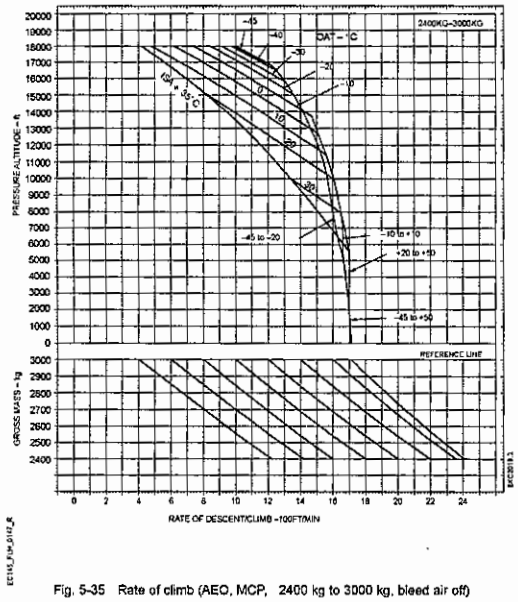

Fig. 5-35 Rate of climb (AEO, MCP, 2400 kg to 3000 kg, bleed air off)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

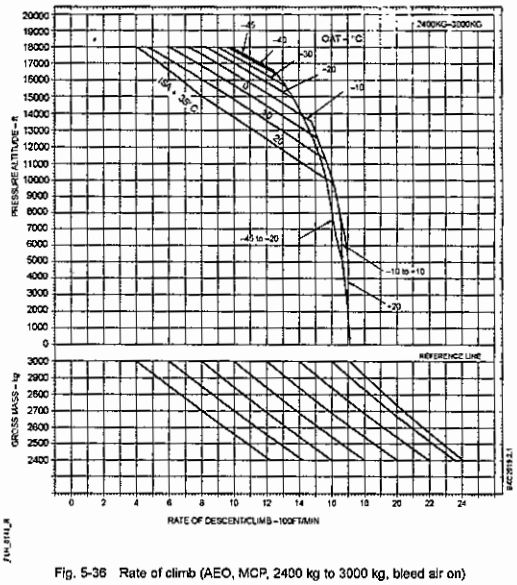

Fig. 5-36 Rate of climb (AEO, MCP, 2400 kg to 3000 kg, bleed air on)

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RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

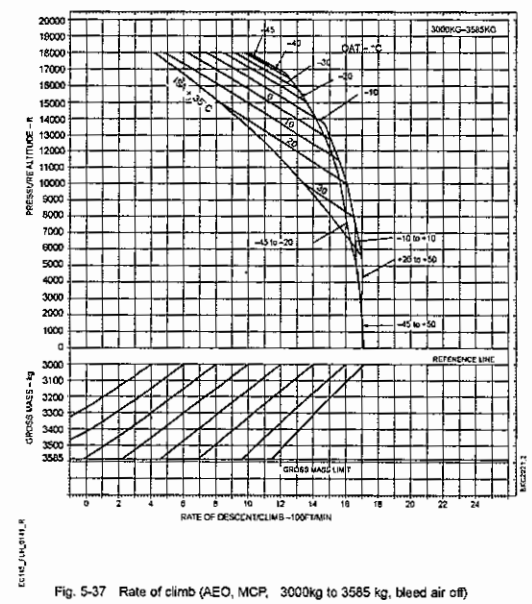

Fig. 5-37 Rate of climb (AEO, MCP, 3000kg to 3585 kg, bleed air off)

RATE OF CLIMB
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

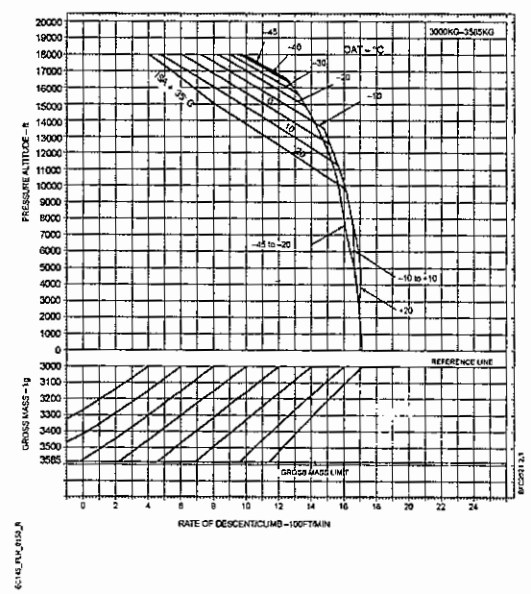

Fig. 5-38 Rate of climb (AEO, MCP, 3000 kg to 3585 kg, bleed air on)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER

V_{TOSS} = 45 KIAS
BLEED AIR CONSUMERS OFF

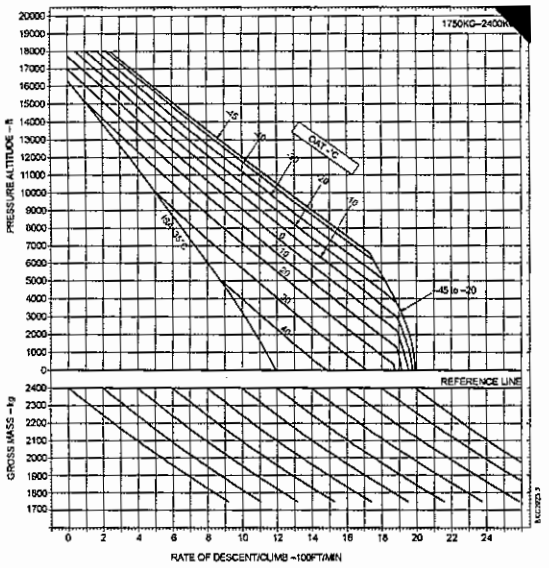

Fig. 5-39 Rate of climb (OEI, 2.5 minute power, 1750 kg to 2400 kg)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER

V_{TOSS} = 45 KIAS
BLEED AIR CONSUMERS OFF

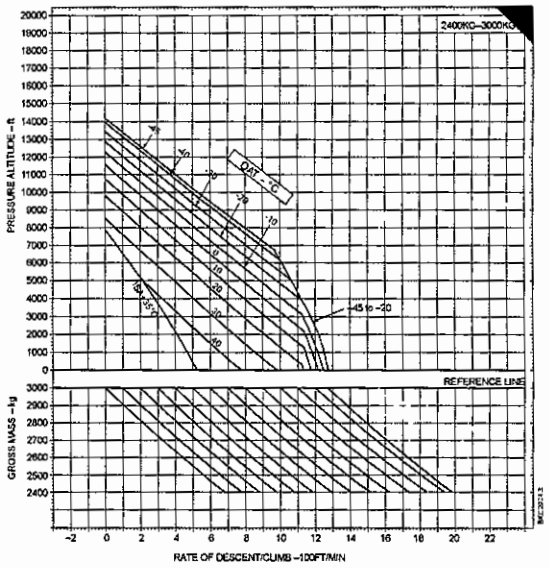

Fig. 5-40 Rate of climb (OEI, 2.5 minute power, 2400 kg to 3000 kg)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER

V_{TOSS} = 45 KIAS
BLEED AIR CONSUMERS OFF

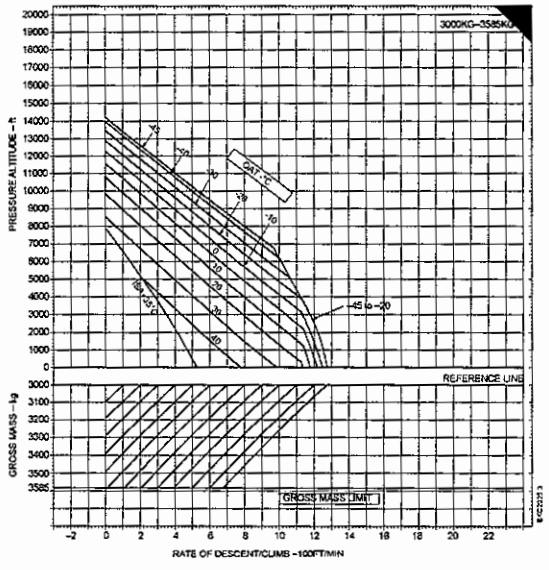

Fig. 5-41 Rate of climb (OEI, 2.5 minute power, 3000 kg to 3585 kg)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

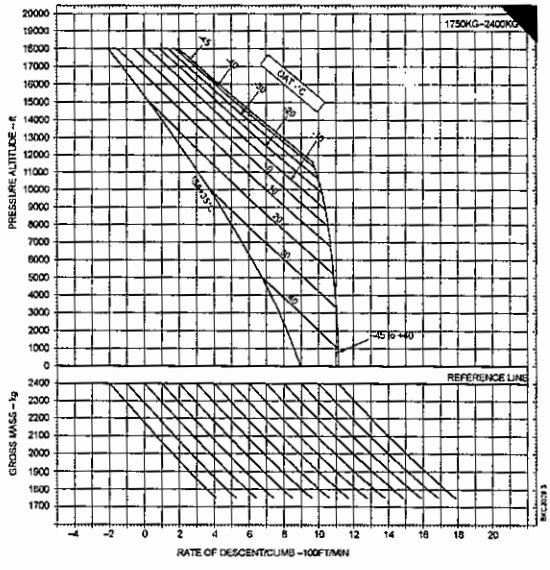

Fig. 5-42 Rate of climb (OEI, MCP, 1750 kg to 2400 kg, bleed air off)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER — V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

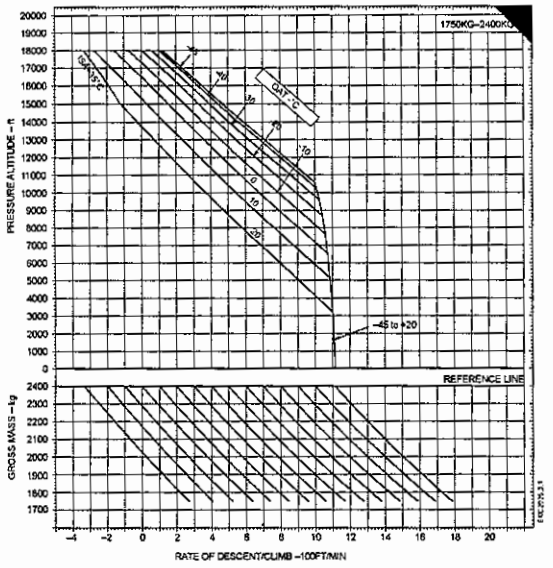

Fig. 5-43 Rate of climb (OEI, MCP, 1750 kg to 2400 kg, bleed air on)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER — V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

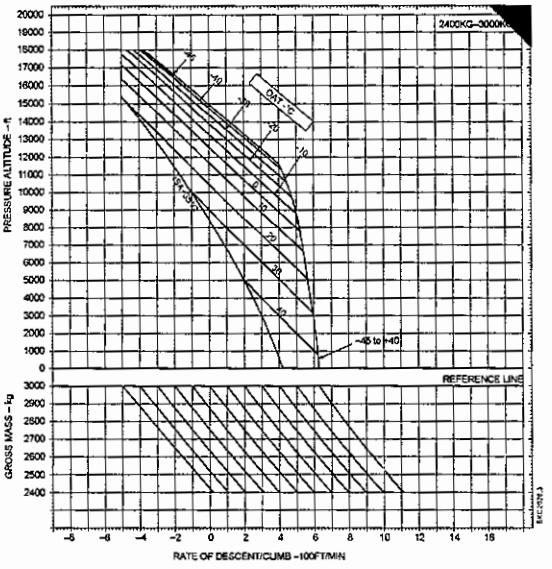

Fig. 5-44 Rate of climb (OEI, MCP, 2400 kg to 3000 kg, bleed air off)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER — V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

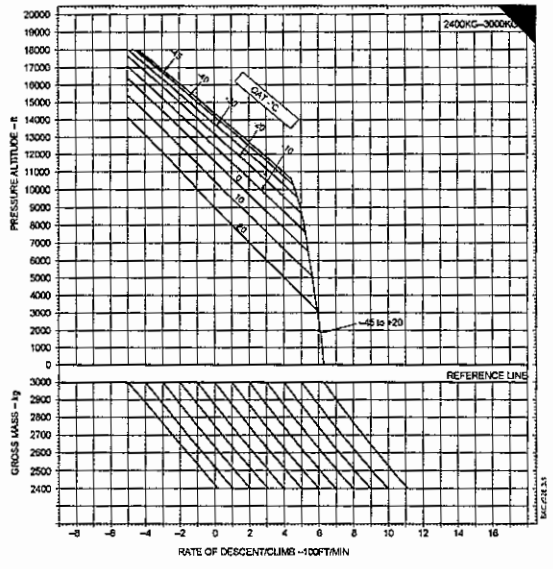

Fig. 5-45 Rate of climb (OEI, MCP, 2400 kg to 3000 kg, bleed air on)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER — V_Y = 65 KIAS
BLEED AIR CONSUMERS OFF

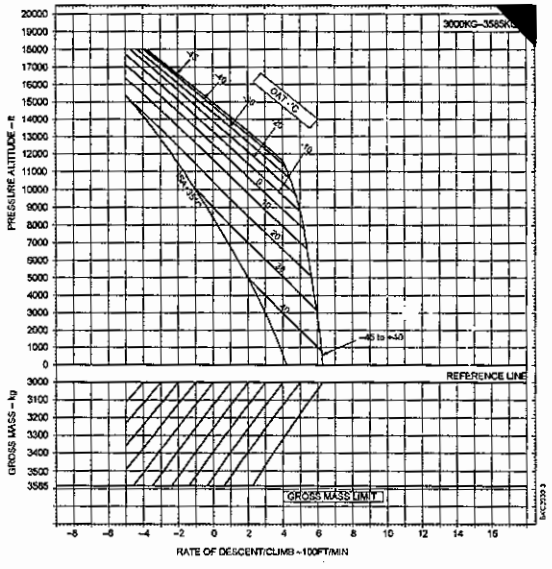

Fig. 5-46 Rate of climb (OEI, MCP, 3000 kg to 3585 kg, bleed air off)

RATE OF CLIMB
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER — V_Y = 65 KIAS
BLEED AIR CONSUMERS ON

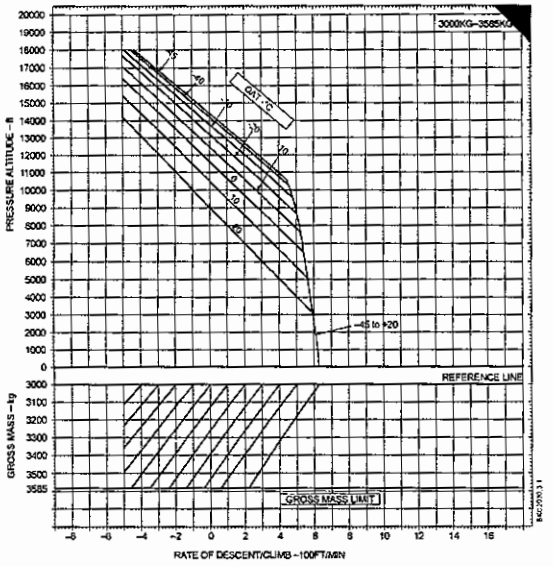

Fig. 5-47 Rate of climb (OEI, MCP, 3000 kg to 3585 kg, bleed air on)

5.1.14 **Landing distance from 50 feet height to a complete stop on the ground**
(1 x TURBOMECA ARRIEL 1E2)

The landing distance chart (figure 5-49) provides single engine landing performance data.

The category B landing profile (figure 5-48) assures the capability to land safely (on a smooth level surface) should an engine failure occur any time prior to or during an approach.

Under this certification basis (FAR 29, category B), go-around capability is NOT assured during one-engine-inoperative operation.

The chart (figure 5-49) shows the landing distance required until the helicopter comes to a complete stop on a smooth, hard and dry level surface.

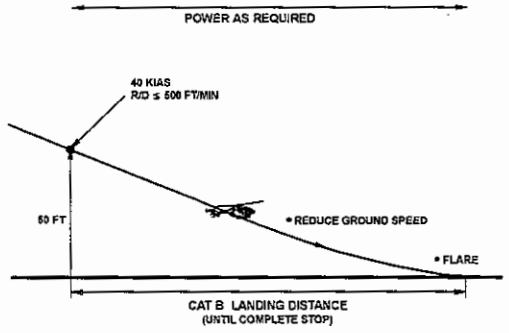

Fig. 5-48 Landing profile (category B)

To achieve values given in the chart the landing approach path at 50 ft height should be established at one-engine-inoperative power required for a descent ≤ 500 feet/minute at 40 KIAS and rotor speed trimmed to maximum.

EXAMPLE: (see figure 5-49)

Determine: Landing distance required to clear a 50 ft obstacle

For headwind calculation refer to the wind component chart section 1 of the FLM page 1–14.

Known:	OAT	35°C
	Pressure altitude	2000 ft
	Headwind component	50 kt
	For calculation 50% of the headwind component.	25 kt

Solution: **Landing distance = 198 m**

1. Enter chart at known OAT (35°C)
2. Move upwards to known pressure altitude (2000 ft)
3. From point of intersection move horizontally right to the reference line of the right chart.
4. Move vertically downwards to the reference line of the wind credit chart.
5. From this point follow the direction of the wind credit guide lines.
6. Enter chart at calculated headwind (25 kt)
7. Move horizontally to intersect tracing from above.
8. From point of intersection move downwards and read **OEI landing distance = 198 m**
(The result under the assumption of no wind is 287 m)

LANDING DISTANCE FROM 50 FEET TO A COMPLETE STOP ON THE GROUND
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED — ROD ≤ 500 FT/MIN, 40 KIAS AT 50 FT
BLEED AIR CONSUMERS OFF

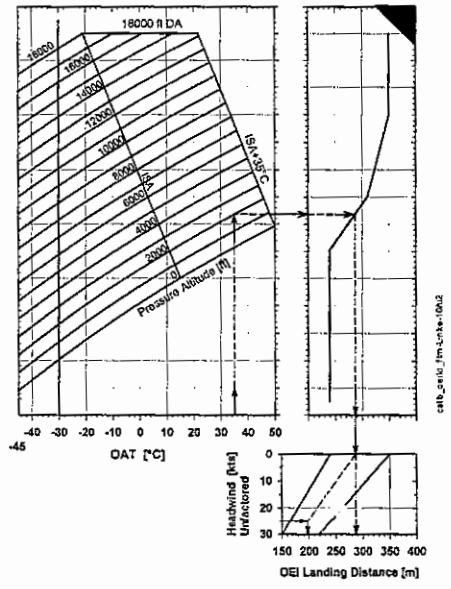

Fig. 5-49 Landing distance from 50 feet height to a complete stop on the ground (OEI)

5.1.15 **Noise levels**

Noise levels (corrected values) based on a gross mass of 3585 kg are shown in table 5-2.

Flight Phase	Noise Level iaw LSL and ICAO, Annex 16 [EPNdB]	Noise Level iaw FAR Part 36 [EPNdB]	LSL, ICAO, Annex 16 and FAR Part 36 Limits [EPNdB]
Flyover	87.2	87.2	94.5
Takeoff	88.0	87.9	95.5
Approach	91.3	91.3	96.5

Table 5-2 Noise levels

5.2 **ADDITIONAL NON-APPROVED PERFORMANCE DATA**

This subsection contains additional, non-approved performance data which are supplied by the aircraft manufacturer, useful for preflight and inflight mission planning.

5.2.1 **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. Helicopter is regarded in its clean configuration.

5.2.2 **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 the engine(s).

5.2.3 **Reading of the charts**

It is of outmost 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.

5.2.4 **Maximum cruising speed**

The diagrams (Fig.5-50 to Fig.5-55) provide maximum cruising speed data in terms of true airspeed as a function of helicopter gross mass and pressure altitude for the atmospheric conditions ISA, ISA +20°C and ISA –20°C under AEO and OEI conditions.

For information concerning the influence of optional equipment on max. cruising speed refer to subsection 9.0.

EXAMPLE: (see figure 5-50)

Determine: Maximum cruising speed

Known:		
	Atmospheric condition	ISA
	Pressure altitude	9400 ft
	Gross mass	3500 kg

Solution: Maximum cruising speed = 137 KTAS

1. Enter chart (ISA) at known pressure altitude (9400 ft).
2. Move horizontally right to known gross mass (3500 kg).
3. From this point move vertically downwards and read maximum cruising speed = 137 KTAS.

MAXIMUM CRUISING SPEED
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS AS REQUIRED

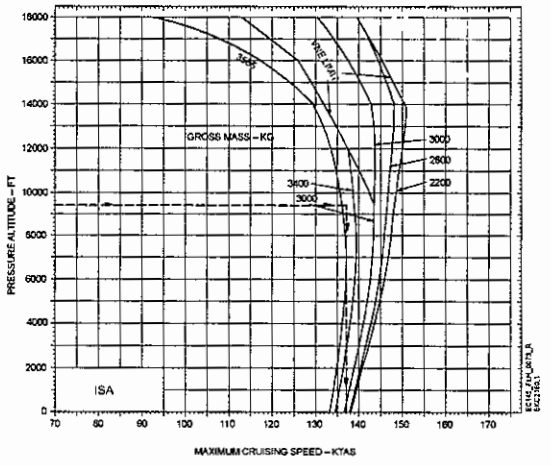

Fig. 5-50 Maximum cruising speed (AEO, ISA)

MAXIMUM CRUISING SPEED
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS AS REQUIRED

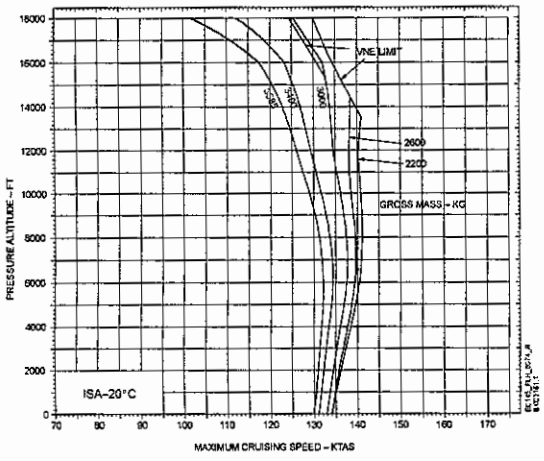

Fig. 5-51 Maximum cruising speed (AEO,ISA –20°C)

MAXIMUM CRUISING SPEED
2 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS AS REQUIRED

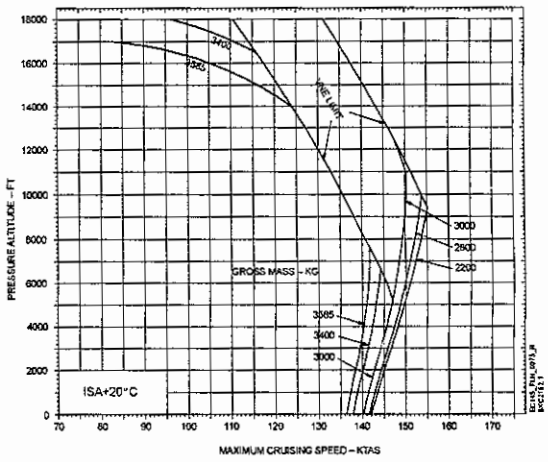

Fig. 5-52 Maximum cruising speed (AEO,ISA +20°C)

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MAXIMUM CRUISING SPEED
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS AS REQUIRED

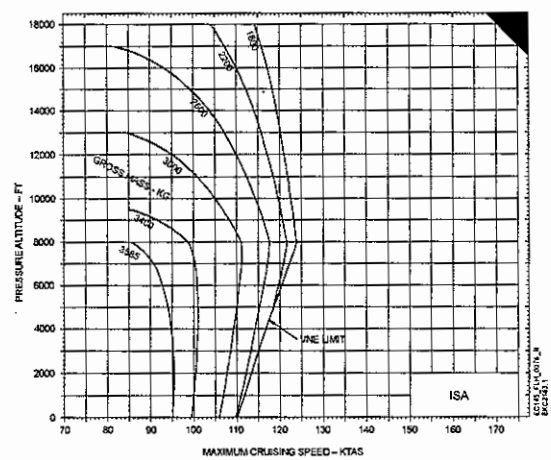

Fig. 5-53 Maximum cruising speed (OEI, ISA)

MAXIMUM CRUISING SPEED
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS AS REQUIRED

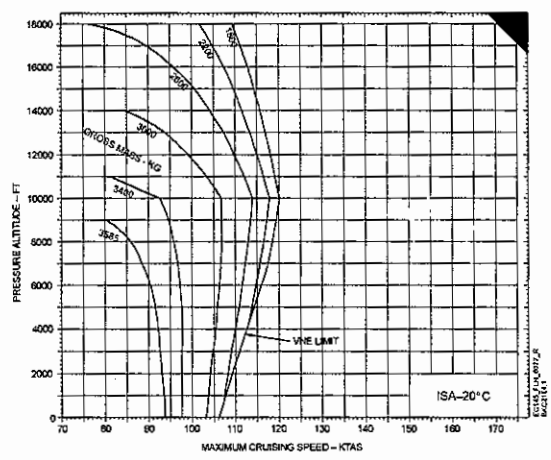

Fig. 5-54 Maximum cruising speed (OEI, ISA –20°C)

MAXIMUM CRUISING SPEED
1 X TURBOMECA ARRIEL 1E2

MAXIMUM CONTINUOUS POWER

BLEED AIR CONSUMERS AS REQUIRED

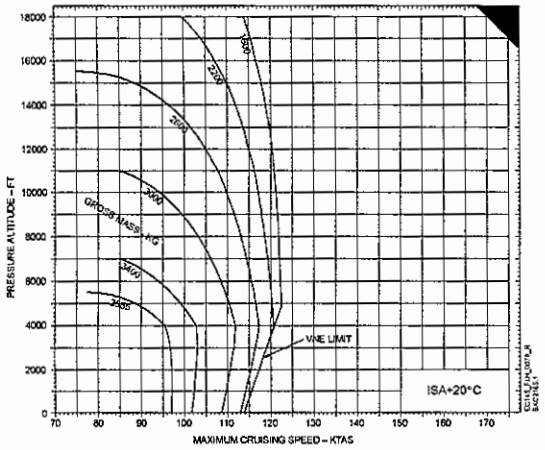

Fig. 5-55 Maximum cruising speed (OEI, ISA +20°C)

5.2.5 Specific fuel consumption

The diagrams (fig. 5-56 to 5-61) are based on the following conditions:
- fuel density is 0.8 kg/l
- bleed air heating off

With bleed air heating on, under AEO conditions (fig. 5-56 to 5-58) the fuel consumption is increased by 2%.

With bleed air heating on, under OEI conditions (fig. 5-59 to 5-61) the fuel consumption is increased by 3.5%.

For information concerning the influence of optional equipment on the specific fuel consumption refer to subsection 9.0.

EXAMPLE: (see figure 5-57 and figure 5-58)

Determine: **Specific fuel consumption**

Known:		
	OAT	20 °C
	Pressure altitude	4200 ft
	Gross mass	3000 kg
	CAS	115 KCAS
	Bleed air	Off

Solution: **Specific fuel consumption = 210 kg/h**

1. Enter chart fig.5-57 at known CAS (115 KCAS).
2. Move horizontally right to known gross mass (3000 kg).
3. Move vertically downwards to temperature reference line 0°C.
4. From this point move upwards, following the direction of the temperature guide lines.
5. Enter chart at known OAT(20°C).
6. Move horizontally right to intersect tracing.
7. From this point move vertically downwards to altitude reference line (0 ft).
8. Move further downwards, following the altitude guide lines.
9. Enter chart at known pressure altitude (4200 ft).
10. Move horizontally right to intersect tracing from above.
11. From point of intersection move vertically downwards and read reference torque = 55%.
12. Now enter chart fig. 5-58 at known torque 55%, move horizontally right to known pressure altitude (4200 ft).
13. Move vertically downwards to temperature reference line 0°C
14. From this point move upwards, following the direction of the temperature guide lines.
15. Enter chart at known OAT(20°C).
16. Move horizontally right to intersect tracing.
17. From this point of intersection move vertically downwards and read **specific fuel consumption = 210 kg/h.**

SPECIFIC FUEL CONSUMPTION
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

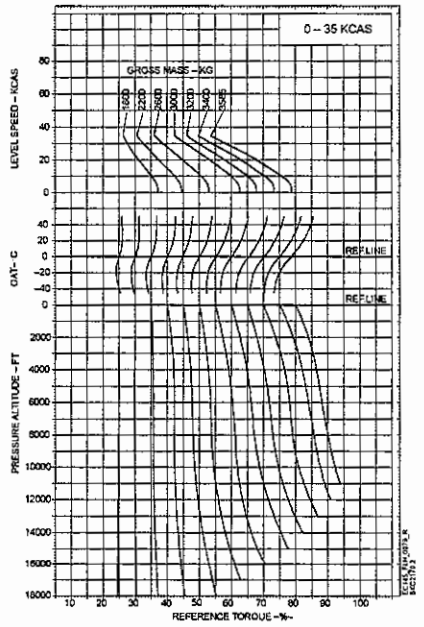

Fig. 5-56 Specific fuel consumption (AEO, level speed 0 – 35 KCAS)

SPECIFIC FUEL CONSUMPTION
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

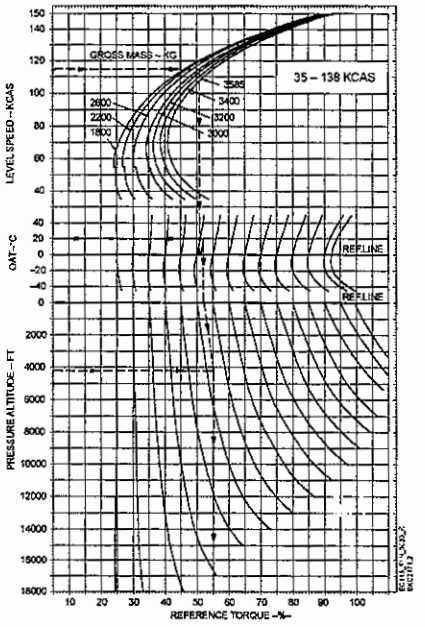

Fig. 5-57 Specific fuel consumption (AEO, level speed 35 – 138 KCAS)

SPECIFIC FUEL CONSUMPTION
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

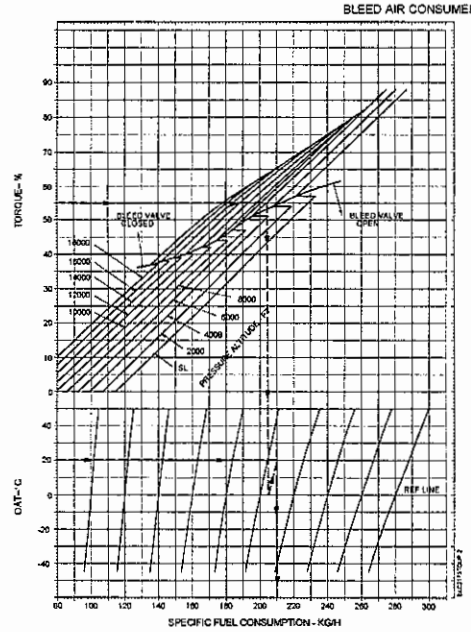

Fig. 5-58 Specific fuel consumption vs torque and temperature (AEO)

SPECIFIC FUEL CONSUMPTION
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

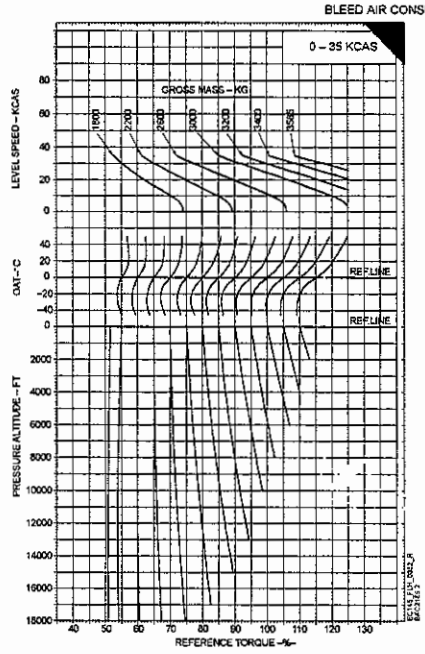

Fig. 5-59 Specific fuel consumption (OEI, level speed 0 - 35 KCAS)

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SPECIFIC FUEL CONSUMPTION
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

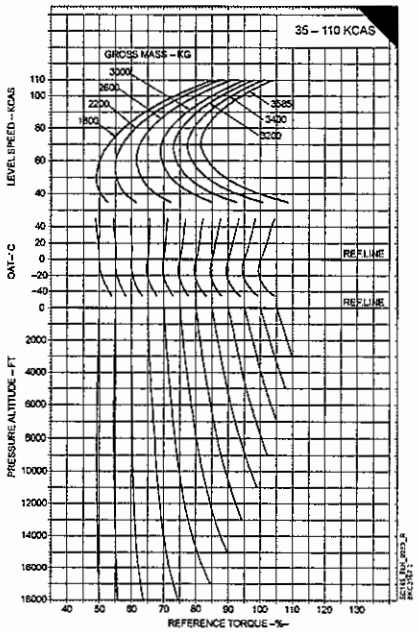

Fig. 5-60 Specific fuel consumption (OEI, level speed 35 - 110 KCAS)

SPECIFIC FUEL CONSUMPTION
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

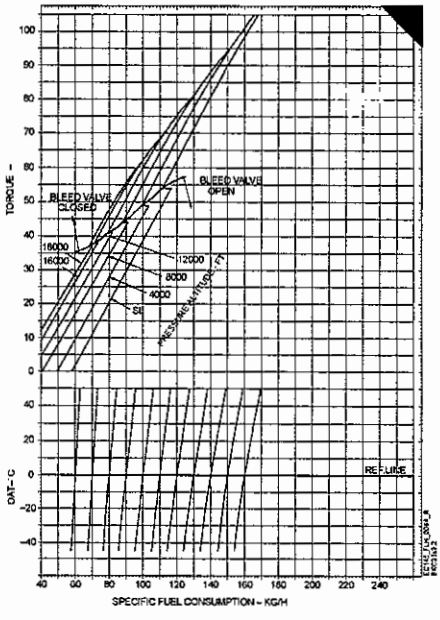

Fig. 5-61 Specific fuel consumption vs torque and temperature (OEI)

5.2.6 Maximum range

The diagrams (fig. 5-62 to 5-79) provide data for maximum range (without reserve) as a function of level speed and pressure altitude (at ISA, ISA +20°C and ISA –20°C) for 2800kg, 3200kg and 3585kg takeoff gross mass.

The diagrams are based on the following conditions:

- usable fuel is 694 kg
- level flight
- bleed air heating off

With bleed air heating on, under AEO conditions (fig. 5-62 to 5-70) the maximum range is 2% less.

With bleed air heating on, under OEI conditions (fig. 5-71 to 5-79) the maximum range is 3.5% less.

NOTE The max. range will only be achieved when both engine bleed valves are closed. If the bleed valves are open, the bleed valve flags appear on the FLI. They can be closed by gaining speed (increasing torque) until the bleed valve flags disappear.

For information concerning the influence of optional equipment on the maximum range refer to subsection 9.0.

EXAMPLE: (see figure 5-62)

Determine: Maximum range

Known:	Atmospheric condition	ISA
	Pressure altitude	1200 ft
	T/O Gross mass	2750 kg
	CAS	105 KCAS
	Bleed air	Off

Solution: Maximum range = 378 NM

1. Enter chart (ISA, 2800 kg) at known CAS (105 KCAS).
2. Move vertically up to known pressure altitude(1200 ft).
3. From this point move horizontally to the left and read maximum range = 378 NM.

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

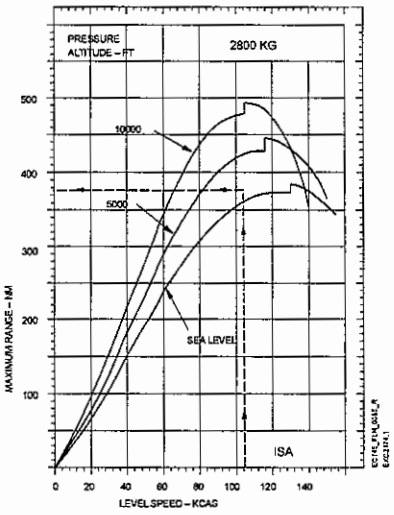

Fig. 5-62 Maximum range (2800 kg, ISA)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

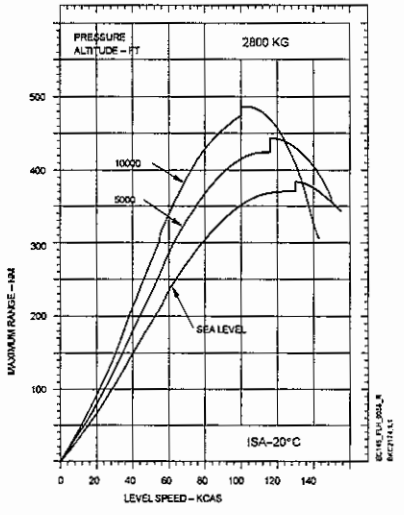

Fig. 5-63 Maximum range (2800 kg, ISA–20°C)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

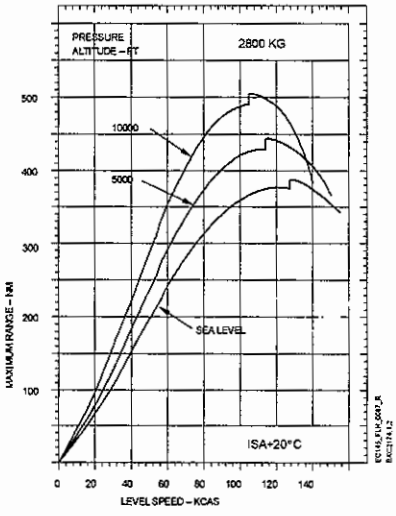

Fig. 5-64 Maximum range (2800 kg, ISA+20°C)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

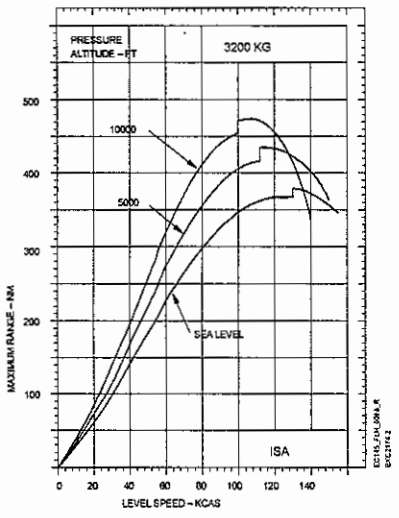

Fig. 5-65 Maximum range (3200 kg, ISA)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

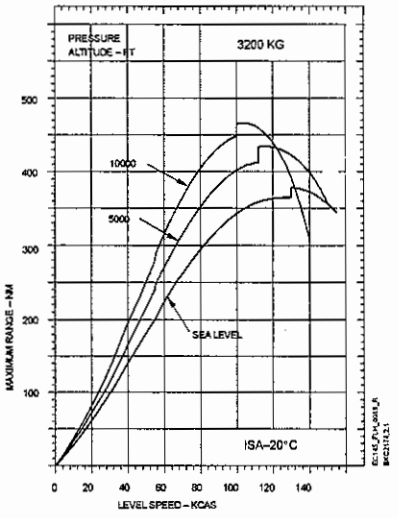

Fig. 5-66 Maximum range (3200 kg, ISA–20°C)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

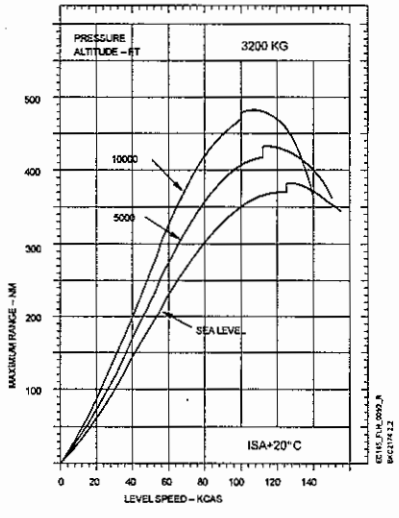

Fig. 5-67 Maximum range (3200 kg, ISA+20°C)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

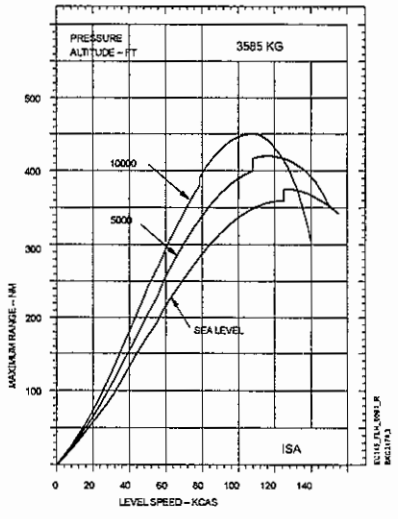

Fig. 5-68 Maximum range (3585 kg, ISA)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

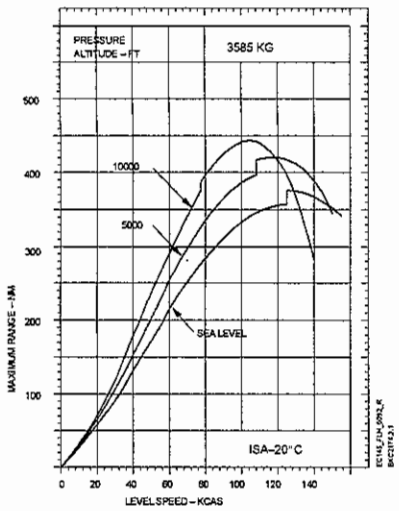

Fig. 5-69 Maximum range (3585 kg, ISA–20°C)

MAXIMUM RANGE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

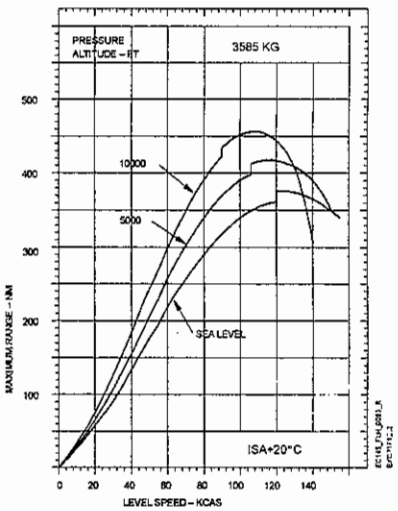

Fig. 5-70 Maximum range (3585 kg, ISA+20°C)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

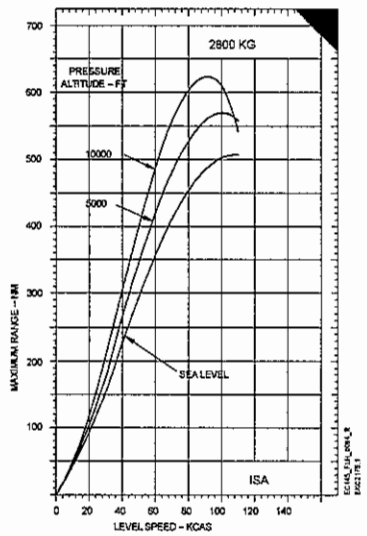

Fig. 5-71 Maximum range OEI (2800 kg, ISA)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

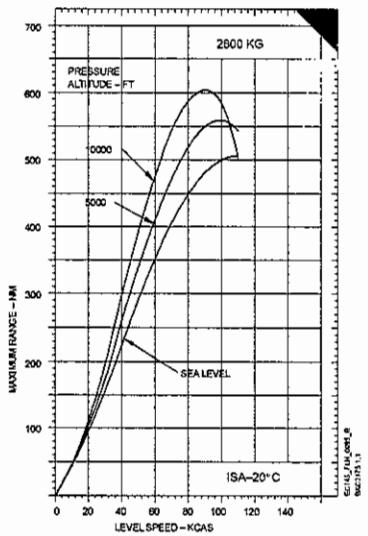

Fig. 5-72 Maximum range OEI (2800 kg, ISA–20°C)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

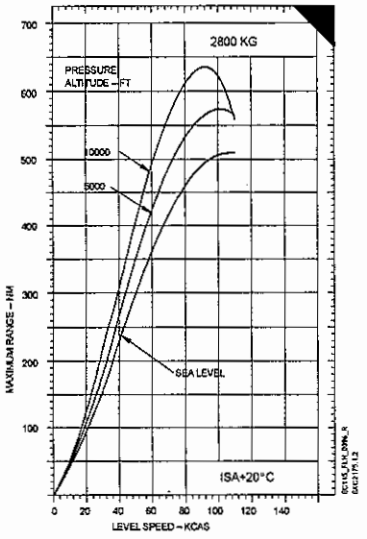

Fig. 5-73 Maximum range OEI (2800 kg, ISA+20°C)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

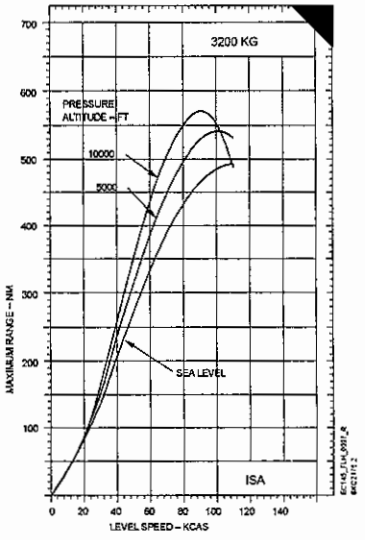

Fig. 5-74 Maximum range OEI (3200 kg, IS

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MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

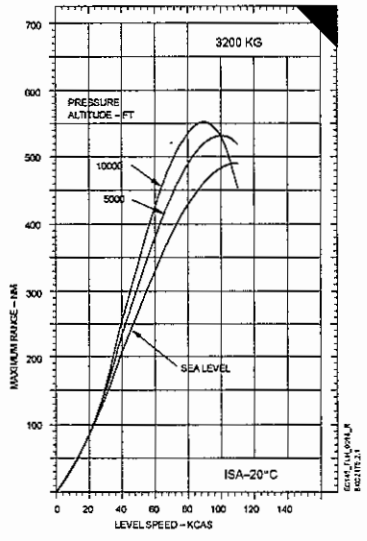

Fig. 5-75 Maximum range OEI (3200 kg, ISA–20°C)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

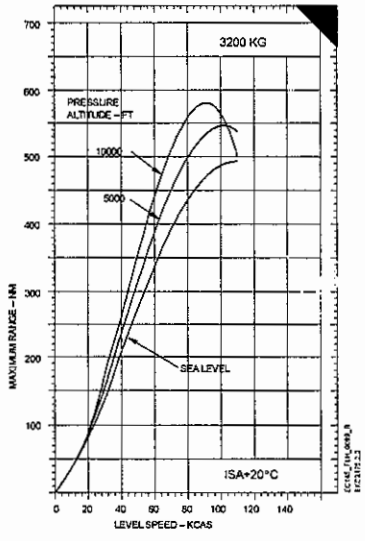

Fig. 5-76 Maximum range OEI (3200 kg, ISA+20°C)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

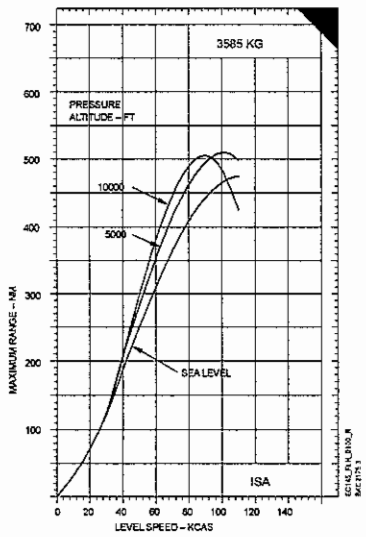

Fig. 5-77 Maximum range OEI (3585 kg, ISA)

MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

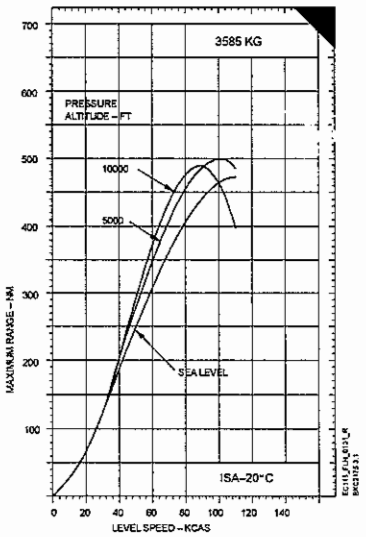

Fig. 5-78 Maximum range OEI (3585 kg, ISA–20°C)

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MAXIMUM RANGE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

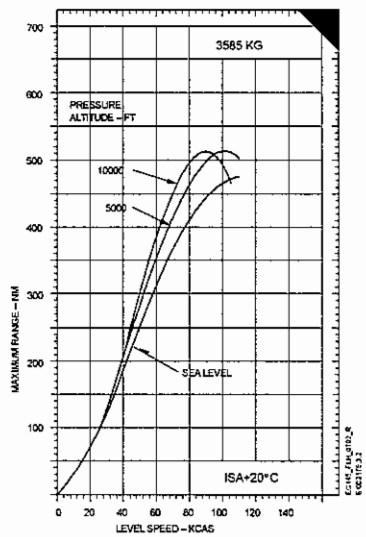

Fig. 5-79 Maximum range OEI (3585 kg, ISA+20°C)

5.2.7 Endurance

The diagrams (fig. 5-80 to 5-97) provide endurance data (without reserve) as a function of level speed and pressure altitude (at ISA, ISA +20°C and ISA –20°C) for 2800kg, 3200kg and 3585kg takeoff gross mass.

The diagrams are based on the following conditions:

- usable fuel is 694 kg
- level flight
- bleed air heating off

With bleed air heating on, under AEO conditions (fig. 5-80 to 5-88) the maximum endurance is 2% less.

With bleed air heating on, under OEI conditions (fig. 5-89 to 5-97) the maximum endurance is 3.5% less.

For information concerning the influence of optional equipment on the endurance refer to subsection 9.0.

EXAMPLE: (see figure 5-80)

Determine: **Maximum endurance**

Known:	Atmospheric condition	ISA
	Pressure altitude	5000 ft
	T/O Gross mass	2750 kg
	CAS	105 KCAS
	Bleed air	Off

Solution: **Maximum range = 3.70h = 03h 42min**

1. Enter chart (ISA, 2800 kg) at known CAS (105 KCAS).
2. Move vertically up to known pressure altitude (5000 ft).
3. From this point move horizontally to the left and read maximum endurance = 3.70h.

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

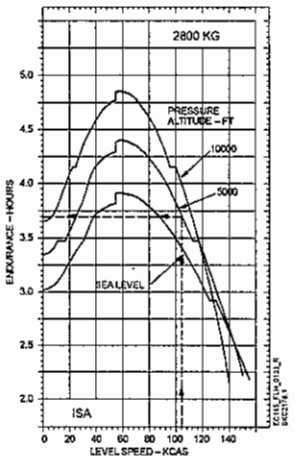

Fig. 5-80 Maximum Endurance (2800 kg, ISA)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

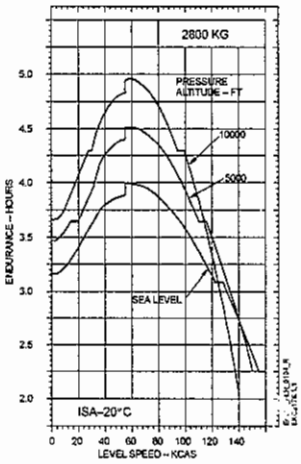

Fig. 5-81 Maximum Endurance (2800 kg, ISA–20°C)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

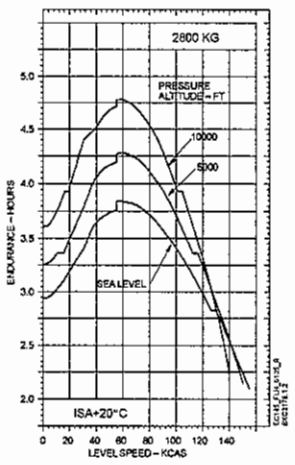

Fig. 5-82 Maximum Endurance (2800 kg, ISA+20°C)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

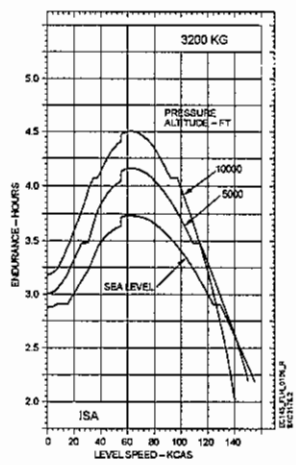

Fig. 5-83 Maximum Endurance (3200 kg, ISA)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

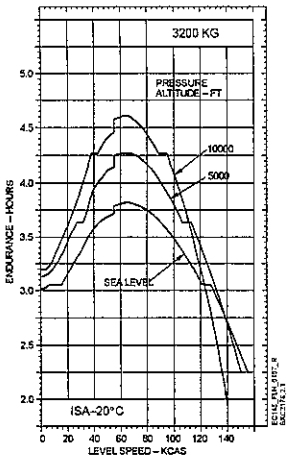

Fig. 5-84 Maximum Endurance (3200 kg, ISA–20°C)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

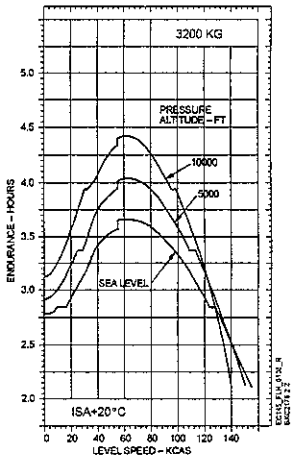

Fig. 5-85 Maximum Endurance (3200 kg, ISA+20°C)

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MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

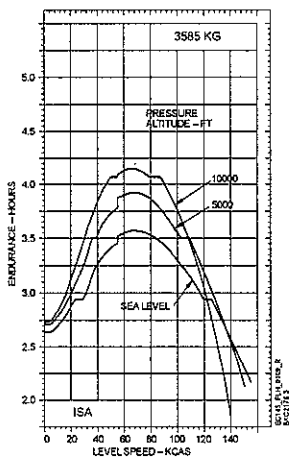

Fig. 5-86 Maximum Endurance (3585 kg, ISA)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

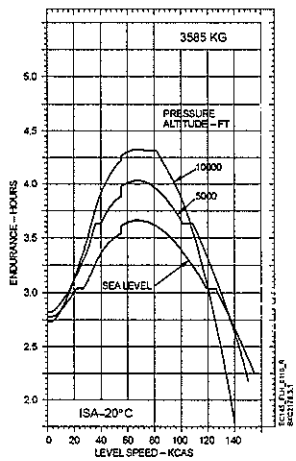

Fig. 5-87 Maximum Endurance (3585 kg, ISA–20°C)

MAXIMUM ENDURANCE
2 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

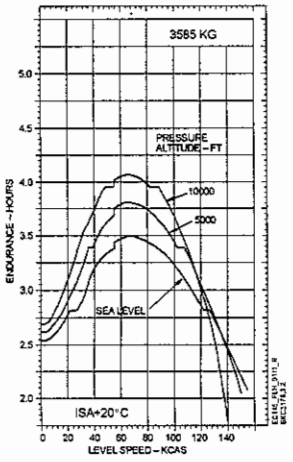

Fig. 5-88 Maximum Endurance (3585 kg, ISA+20°C)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

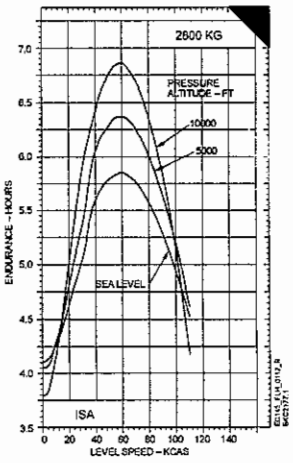

Fig. 5-89 Maximum Endurance OEI (2800 kg, ISA)

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MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

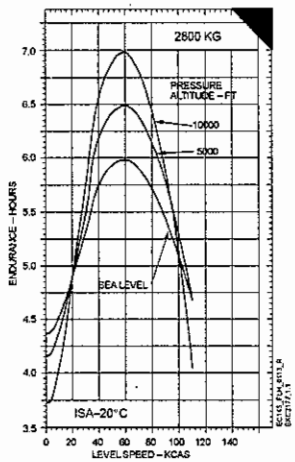

Fig. 5-90 Maximum Endurance OEI (2800 kg, ISA–20°C)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

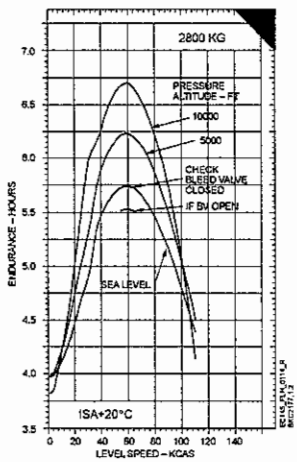

Fig. 5-91 Maximum Endurance OEI (2800 kg, ISA+20°C)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

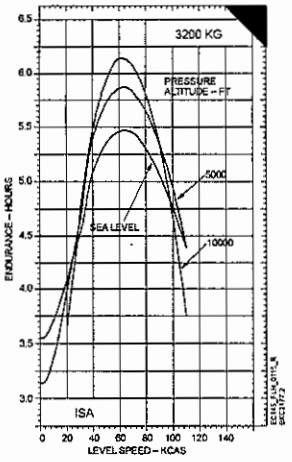

Fig. 5-92 Maximum Endurance OEI (3200 kg, ISA)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

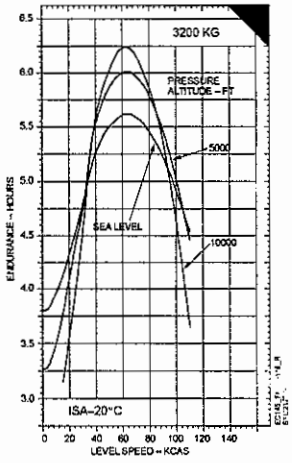

Fig. 5-93 Maximum Endurance OEI (3200 kg, ISA–20°C)

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MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

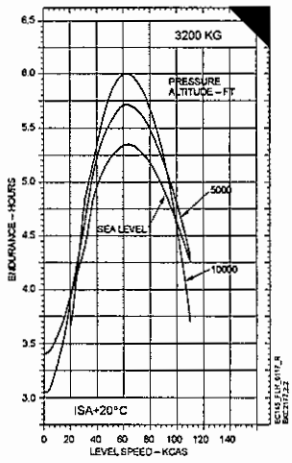

Fig. 5-94 Maximum Endurance OEI (3200 kg, ISA+20°C)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

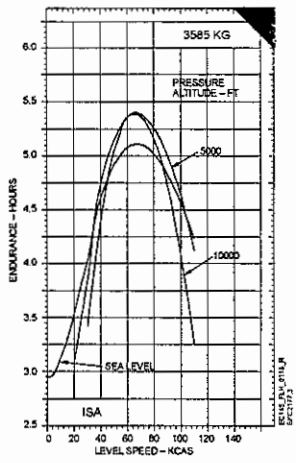

Fig. 5-95 Maximum Endurance OEI (3585 kg, ISA)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

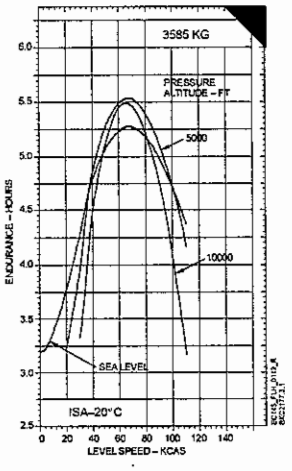

Fig. 5-96 Maximum Endurance OEI (3585 kg, ISA–20°C)

MAXIMUM ENDURANCE
1 X TURBOMECA ARRIEL 1E2

POWER AS REQUIRED

BLEED AIR CONSUMERS OFF

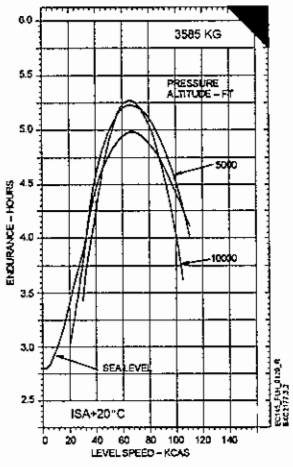

Fig. 5-97 Maximum Endurance OEI (3585 kg, ISA+20°C)

SECTION 6

MASS AND BALANCE

6.1 GENERAL

This section provides information required for helicopter loading and computing mass and balance.

It shall be the pilot's responsibility to make certain that:

- the helicopter is properly loaded so that the entire flight is conducted within the center of gravity limits.
- all cargo is stowed and tied down properly so that in-flight shifting is impossible
- proper tie-down equipment (i.e. ropes, belts, etc.) of sufficient strength has to be used. As many tie-down fittings as possible have to be used per single cargo item in order to reduce the individual load per fitting and to avoid inadvertent in-flight shifting.

6.1.1 Mass definitions

Basic empty mass

The basic empty mass consists of the basic helicopter with required standard equipment, optional equipment, unusable fuel, and full operating fluids including transmission, gearbox and engine oils, hydraulic fluid, rotor brake oil.

Gross mass

The gross mass is the sum of the basic empty mass and the pilot/crew, the passengers, the baggage/cargo and the fuel.
This value will vary with mission.

6.1.2 Balance definitions

Locations on and within the helicopter can be determined in relation to **fuselage stations**, **buttock lines** and **waterlines**, measured in millimeters (mm) from known reference points (Fig. 6-1). Fuselage stations, buttock lines, and waterlines are planes perpendicular to each other.
Reference plane is the plane at the longitudinal centerline of the helicopter perpendicular to the cabin floor.

Fuselage stations (F.S. or STA.)

Fuselage stations are vertical planes perpendicular to, and measured along, the longitudinal axis of the helicopter.
Station 0 is an imaginary vertical plane forward of the nose of the helicopter, from which all horizontal distances are measured for balance purposes (see also "reference datum").

Buttock lines (B.L.)

Buttock lines are vertical planes perpendicular to, and measured to the left and right along the lateral axis of the helicopter.
Buttock line (0) is the plane at the longitudinal centerline of the helicopter.

Waterline (W.L.)

Waterlines are horizontal planes perpendicular to, and measured along, the vertical axis of the helicopter.
Waterline (0) is a plane below the lowest point on the fuselage of the helicopter.

Reference datum (RD)

The reference datum (RD) is station 0. It is located 3950 mm (155.5 in) in front of the leveling point (LP) (see Fig. 6-1).

Arm

The arm, for longitudinal balance purposes, is the horizontal distance from the reference datum to the center of gravity of a given item. For other purposes, fuselage stations (F.S. or STA) may be used. For the BK 117 C-2 helicopter arm and fuselage station are the same.

Moment (Massmoment)

The moment is the mass of an item multiplied by its arm.

moment (kgmm) = mass (kg) arm (mm)

Center of gravity (CG)

Center of gravity is the point about which the helicopter would balance if suspended. Distance from the RD is found by dividing the total moment by the gross mass of the helicopter.

$$\text{arm (mm)} = \frac{\text{sum of all moments (kgmm)}}{\text{sum of all masses (kg)}}$$

CG limits

CG limits are the extremes of movements to which the helicopter CG can travel. The CG of the loaded helicopter must remain within these limits at takeoff, throughout flight, and at landing.

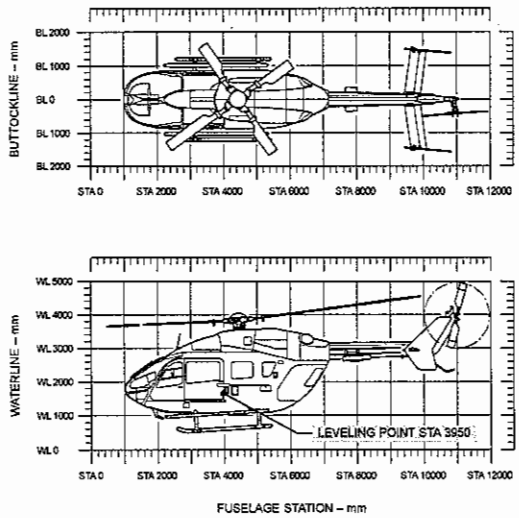

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Fig. 6-1 Station diagram

6.2 BASIC EMPTY MASS CENTER OF GRAVITY

The procedure for establishing mass and moment (relative to the reference datum) of the empty helicopter is described in the BK 117 C-2 maintenance manual (MM). The MASS AND BALANCE RECORD (Form MBR-1) appended to this section is used to maintain a continuous history of changes to the basic "as delivered" helicopter mass and balance data.

6.2.1 Mass and balance record

The basic empty mass (BEM) and center of gravity (CG) location are determined through actual weighing carried out by the helicopter manufacturer. This data is then entered on the first line of the MASS AND BALANCE RECORD, Form MBR-1 which then becomes a permanent part of the flight manual.

The MASS AND BALANCE RECORD must be updated (normally by transcribing the applicable information from the EQUIPMENT LIST) when necessary as follows:

- When additional equipment is installed on the helicopter necessitating a change in the basic empty mass (as per definition), add the new entry or entries to the previous totals of basic empty mass and moment then compute the new basic empty mass, moment and CG location (arm).
- Likewise, when equipment is removed from the helicopter, subtract the new entry or entries from the previous totals of basic empty mass and moment then compute the new basic empty mass, moment and CG location (arm).

At all times, the last mass and moment entries are considered the current basic empty mass and balance status of the helicopter.

6.2.2 Equipment list

An EQUIPMENT LIST, Form EL-1 is appended to this section and contains optional equipment of the particular helicopter when delivered. Each item on the list is provided with a number and description for identification, together with its mass, arm and moment.

These items of equipment that were installed when the particular helicopter was initially weighed are so indicated by a check (✓) mark in the „initial weighing" column. Therefore the mass, arm and moment of these items are included in the basic empty mass (BEM) data found on the MASS AND BALANCE RECORD, Form MBR.

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6.3 LOADING EXAMPLE

The following examples show the method of calculation of the longitudinal and lateral center of gravity.

NOTE The mass empty CG and massmoment is to be taken from the "empty mass and balance report" in this section.

6.3.1 Loading example for longitudinal CG

		Mass	X-STA Arm	Massmoment
		(kg)	(mm)	(kgmm)
	Mass empty	1838	4737	8706606
+	Pilot	80	2312	184960
+	Copilot	80	2312	184960
+	Fwd passengers against FD (3)	240	3250	780000
+	Mid passengers in FD (2)	160	4208	673280
+	Baggage	76	5500	418000
+	Fuel	694	4322	2999468
	Total	3168	–	13947274
	Result	–	4403*	–

*) X-STA: CG = $\frac{13947274}{3168}\ \frac{kgmm}{kg}$ = 4403 mm

The longitudinal CG is 4403 mm aft of the reference datum.

From Fig. 6-2 it can be seen, that the CG lies within the allowable CG limit.

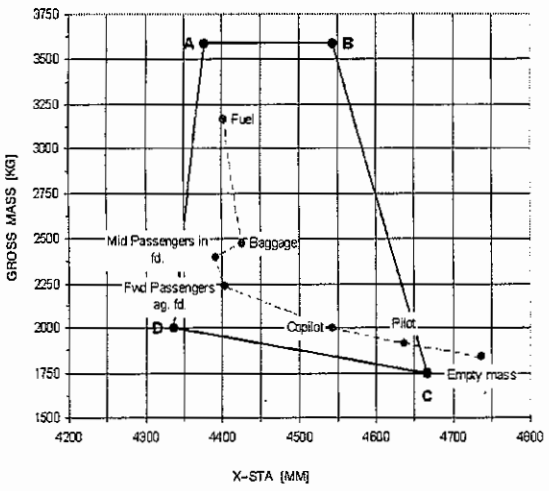


Fig. 6-2 Longitudinal CG envelope

6.3.2 **Loading example for lateral CG**

		Mass	Y-BL Arm	Y-BL Massmoment
		(kg)	(mm)	(kgmm)
	Mass empty	1838	8	14704
+	Pilot	80	390	31200
+	Copilot	80	–390	–31200
+	Fwd passengers against FD (3)	240	0	0
+	Mid passengers in FD (2)	160	0	0
+	Baggage	76	0	0
+	Fuel	694	0	0
	Total	3168	–	14704
	Result	–	5*)	–

*) $Y\text{-BL: CG} = \frac{14704}{3168} \frac{\text{kgmm}}{\text{kg}} = 5\ \text{mm}$

The lateral CG is 5 mm right of the centerline.

From Fig. 6-3 it can be seen, that the CG lies within the allowable CG limit.

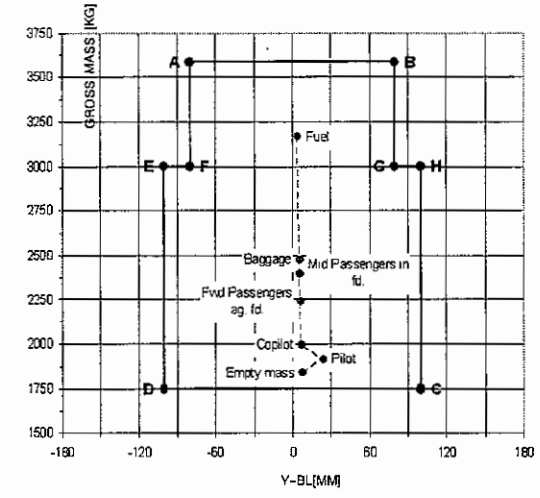


Fig. 6-3 Lateral CG envelope

6.4 **LOADING CHARTS AND TABLES**

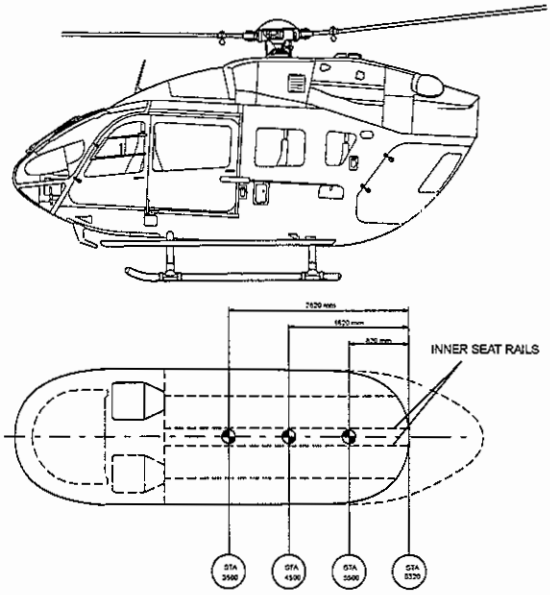
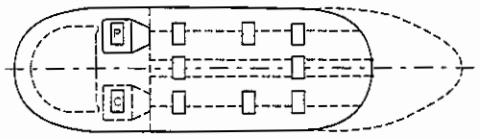


Fig. 6-4 Baggage centroids

CAUTION
- THE CARGO CENTROID IS TO BE MEASURED FROM THE REAR END OF THE INNER SEAT RAILS.
- CARGO SHOULD BE CENTERED IN THE CABIN.
- ENSURE THAT CARGO IS PROPERLY SECURED BY RESTRAINING IT FROM SHIFTING WITH TIEDOWNS.
- THE OPERATOR IS RESPONSIBLE FOR THE PROPER PLACEMENT AND SECURING OF CARGO IN ACCORDANCE WITH STANDARD OPERATING PROCEDURES AND PRACTICES.

6.4.1 CG of the pilot / copilot

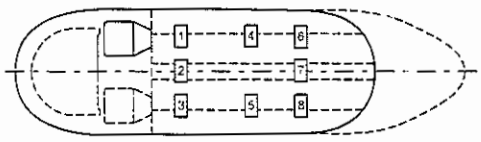


CG of pilot and copilot		X–STA	Y–BL
P	Pilot	2312	390
C	Copilot	2312	–390

Table 6-1 Crew CG table

NOTE
- For non height adjustable pilot / co–pilot seats the CG of the pilot / co–pilot is defined for the middle seat position.
- For the height adjustable pilot / co–pilot seat the CG of the pilot / co–pilot is defined for the highest middle seat position.
- The CG of the pilot / co–pilot is not equal to the CG of the seats.

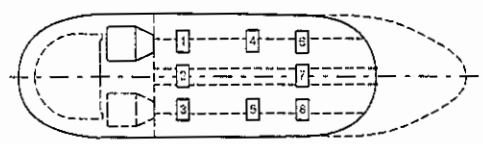
6.4.2 CG of the passengers for seat arrangement "All Forward Version" (refer also to FMS 9.2–24)



CG of passengers		X–STA	Y–BL
1	In flight direction	3116	550
2			0
3			–550
4		4208	480
5			–480
6		5072	460
7			0
8			–460

Table 6-2 Passengers CG table – "All Forward Version"

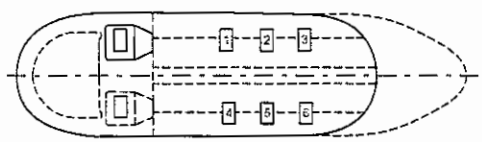
6.4.3 CG of the passengers for seat arrangement "Club Version" (refer also to FMS 9.2–24)



CG of passengers		X–STA	Y–BL
1	Against flight direction	3250	550
2			0
3			–550
4	In flight direction	4208	480
5			–480
6		5072	460
7			0
8			–460

Table 6-3 Passengers CG table – "Club Version"

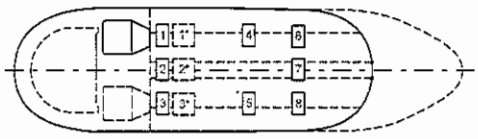
6.4.4 CG of the passengers for "Utility Seat Bench" (refer also to FMS 9.2–27)



CG of passengers	X–STA	Y–BL
1	4311	425
2	4774	
3	5236	
4	4311	–425
5	4774	
6	5236	

Table 6-4 Passengers CG table – "Utility Seat Bench"

6.4.5 CG of the passengers for "Comfort Seat Installation" – 8 seat configuration (refer also to FMS 9.2–65)

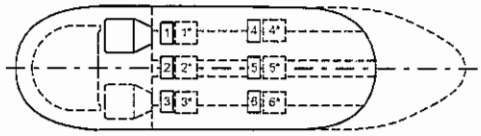


CG of passengers		X–STA	Y–BL
1	In flight direction – seat reference point HIGH	3126	550
2			0
3			–550
1	Against flight direction – seat reference point HIGH	3265	550
2			0
3			–550
1*	Against flight direction – seat reference point HIGH	3366	460
2*			0
3*			–460
1*	Against flight direction – seat reference point HIGH – alternate installation	3366	550
2*			0
3*			–550
4	In flight direction – seat reference point HIGH	4193	480
			–
5			–480
6	In flight direction – seat reference point LOW	5057	460
7			0
8			–460

NOTE *) Seat position shifted back 4 inches behind the standard seat installation

Table 6-5 Passengers CG table – "Comfort Seat Installation" – 8 seat configuration

6.4.6 CG of the passengers for "Comfort Seat Installation" – 6 seat configuration (refer also to FMS 9.2–65)



CG of passengers		X–STA	Y–BL
1	In flight direction – seat reference point HIGH	3126	550
2			0
3			–550
1	Against flight direction – seat reference point HIGH	3265	550
2			0
3			–550
1*	Against flight direction – seat reference point HIGH	3366	460
2*			0
3*			–460
1*	Against flight direction – seat reference point HIGH – alternate installation	3366	550
2*			0
3*			–550
4	In flight direction – seat reference point LOW	4168	460
5			0
6			–460
4*	In flight direction – seat reference point LOW	4422	460
5*			0
6*			–460

NOTE • 1,2,3 with *) Seat position shifted back 4 inches behind the standard seat installation

• 4,5,6 with *) Seat position shifted back 10 inches behind the seat installation

Table 6-6 Crew and Passengers – CG table "Comfort Seat Installation" – 6 seat configuration

6.5 CABIN LOADING AND FUEL LOADING TABLES

CABIN LOADING TABLE				
Mass (kg)	Massmoment (kgmm)			
	PIL/PAX	Load		
	STA 2312	STA 3500	STA 4500	STA 5500
10	23120	35000	45000	55000
20	46240	70000	90000	110000
30	69360	105000	135000	165000
40	92480	140000	180000	220000
50	115600	175000	225000	275000
60	138720	210000	270000	330000
70	161840	245000	315000	385000
80	184960	280000	360000	440000
90	208080	315000	405000	495000
100	231200	350000	450000	550000
110	254320	385000	495000	605000
120	277440	420000	540000	660000
130	300560	455000	585000	715000
140	323680	490000	630000	770000
150	346800	525000	675000	825000
160	369920	560000	720000	880000
170	393040	595000	765000	935000
180	416160	630000	810000	990000
190	439280	665000	855000	1045000
200	462400	700000	900000	1100000
210	485520	735000	945000	1155000
220	508640	770000	990000	1210000
230	531760	805000	1035000	1265000
240	554880	840000	1080000	1320000
250	578000	875000	1125000	1375000
260	601120	910000	1170000	1430000
270	624240	945000	1215000	1485000
280	647360	980000	1260000	1540000
290	670480	1015000	1305000	1595000
300	693600	1050000	1350000	1650000

continued

CABIN LOADING TABLE				
Mass (kg)	Massmoment (kgmm)			
	PIL/PAX	Load		
	STA 2312	STA 3500	STA 4500	STA 5500
310	716720	1085000	1395000	1705000
320	739840	1120000	1440000	1760000
330	762960	1155000	1485000	1815000
340	786080	1190000	1530000	1870000
350	809200	1225000	1575000	1925000
360	832320	1260000	1620000	1980000
370	855440	1295000	1665000	2035000
380	878560	1330000	1710000	2090000
390	901680	1365000	1755000	2145000
400	924800	1400000	1800000	2200000
410	947920	1435000	1845000	2255000
420	971040	1470000	1890000	2310000

Table 6-7 Cabin loading table

FUEL LOADING TABLE – VOL (L)– MASS (KG)									
Vol (ltr) *	Vol (US gal-lons) *	Mass (kg)	Arm (mm)	Mass–moment (kgmm)	Vol (ltr) *	Vol (US gal-lons) *	Mass (kg)	Arm (mm)	Mass–moment (kgmm)
12.5	3.3	10	3602	36020	462.5	122.2	370	4265	1579050
25	6.6	20	3600	72000	475	125.5	380	4269	1622220
37.5	9.9	30	3597	107910	487.5	128.8	390	4272	1666080
50	13.2	40	3595	143800	500	132.1	400	4275	1710000
62.5	16.5	50	3592	179600	512.5	135.4	410	4278	1753980
75	19.8	60	3589	215340	525	138.7	420	4280	1797600
87.5	23.1	70	3586	251020	537.5	142.0	430	4283	1841690
100	26.4	80	3583	286640	550	145.3	440	4286	1885840
112.5	29.7	90	3581	322290	562.5	148.6	450	4288	1929600
125	33.0	100	3579	357900	575	151.9	460	4290	1973400
137.5	36.3	110	3578	393580	587.5	155.2	470	4292	2017240
150	39.6	120	3577	429240	600	158.5	480	4294	2061120
162.5	42.9	130	3586	466180	612.5	161.8	490	4296	2105040
175	46.2	140	3649	510860	625	165.1	500	4298	2149000
187.5	49.5	150	3705	555750	637.5	168.4	510	4299	2192490
200	52.8	160	3754	600640	650	171.7	520	4301	2236520
212.5	56.1	170	3798	645660	662.5	175.0	530	4303	2280590
225	59.4	180	3837	690660	675	178.3	540	4304	2324160
237.5	62.7	190	3872	735680	687.5	181.6	550	4306	2368300
250	66.0	200	3905	781000	700	184.9	560	4307	2411920
262.5	69.3	210	3935	826350	712.5	188.2	570	4309	2456130
275	72.6	220	3971	873620	725	191.5	580	4310	2499800
287.5	75.9	230	4008	921840	737.5	194.8	590	4311	2543490
300	79.3	240	4042	970080	750	198.1	600	4313	2587800
312.5	82.6	250	4074	1018500	762.5	201.4	610	4314	2631540
325	85.9	260	4103	1066780	775	204.7	620	4315	2675300
337.5	89.2	270	4130	1115100	787.5	208.0	630	4316	2719080
350	92.5	280	4155	1163400	800	211.3	640	4317	2762880
362.5	95.8	290	4178	1211620	812.5	214.6	650	4318	2806700
375	99.1	300	4200	1260000	825	217.9	660	4319	2850540
387.5	102.4	310	4220	1308200	837.5	221.2	670	4320	2894400
400	105.7	320	4234	1354880	850	224.5	680	4321	2938280
412.5	109.0	330	4244	1400520	862.5	227.8	690	4322	2982180
425	112.3	340	4254	1446360	867.5	229.2	694	4322	2999468
437.5	115.6	350	4258	1490300					
450	118.9	360	4262	1534320					

Table 6-8 Fuel loading table MASS (KG)– VOL (L and US GALLONS)

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

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BK117 C–2 MASS AND BALANCE RECORD – LONGITUDINAL
(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ____ of ____

Date	Equipment List Item No. IN	Equipment List Item No. OUT	Description of Article or Modification	MASS CHANGE Added (+) Mass (kg)	MASS CHANGE Added (+) Massmoment (kgmm)	MASS CHANGE Removed (-) Mass (kg)	MASS CHANGE Removed (-) Massmoment (kgmm)	RUNNING BASIC EMPTY MASS (BEM) Mass (kg)	RUNNING BASIC EMPTY MASS (BEM) Massmoment (kgmm)	RUNNING BASIC EMPTY MASS (BEM) CG long (mm)	Signature
			AS DELIVERED								

Form MBR -1 longitudinal

BK117 C–2 MASS AND BALANCE RECORD – LONGITUDINAL
(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ____ of ____

Date	Equipment List Item No. IN	Equipment List Item No. OUT	Description of Article or Modification	MASS CHANGE Added (+) Mass (kg)	MASS CHANGE Added (+) Massmoment (kgmm)	MASS CHANGE Removed (-) Mass (kg)	MASS CHANGE Removed (-) Massmoment (kgmm)	RUNNING BASIC EMPTY MASS (BEM) Mass (kg)	RUNNING BASIC EMPTY MASS (BEM) Massmoment (kgmm)	RUNNING BASIC EMPTY MASS (BEM) CG long (mm)	Signature

Form MBR -2 longitudinal

BK117 C–2 MASS AND BALANCE RECORD – LATERAL

(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ___ of ___

Date	Equipment List Item No.		Description of Article or Modification	MASS CHANGE				RUNNING BASIC EMPTY MASS (BEM)			
				Added (+)		Removed (–)					
	IN	OUT		Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	CG lat (mm)	Signature
			AS DELIVERED								

Form MBR -1 lateral

BK117 C–2 MASS AND BALANCE RECORD – LONGITUDINAL

(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ___ of ___

Date	Equipment List Item No.		Description of Article or Modification	MASS CHANGE				RUNNING BASIC EMPTY MASS (BEM)			
				Added (+)		Removed (–)					
	IN	OUT		Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	CG long (mm)	Signature

Form MBR -3 longitudinal

BK117 C–2 MASS AND BALANCE RECORD – LATERAL

(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ___ of ___

Date	Equipment List Item No.		Description of Article or Modification	MASS CHANGE				RUNNING BASIC EMPTY MASS (BEM)			
				Added (+)		Removed (–)					
	IN	OUT		Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	CG lat (mm)	Signature

Form MBR -2 lateral

BK117 C–2 MASS AND BALANCE RECORD – LONGITUDINAL

(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ___ of ___

Date	Equipment List Item No.		Description of Article or Modification	MASS CHANGE				RUNNING BASIC EMPTY MASS (BEM)			
				Added (+)		Removed (–)					
	IN	OUT		Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	Mass (kg)	Massmoment (kgmm)	CG long (mm)	Signature

BK 117 C-2 EQUIPMENT LIST (EL)

MODELE/VARIANT : BK 117 C-2
SERIAL NO.: :
Page No.: 1 of 4

Item No.	Description of article Modification/ Part No./ FLM / FMS	Mass (kg)	Arm long. (mm)	Massmoment long. (kgmm)	Arm lat. (mm)	Massmoment lat. (kgmm)	WEIGHINGS Initial Date/Sign. Marked as required 1)	Second Date/Sign. Marked as required 1)	Third Date/Sign. Marked as required 1)

1) Required markings: ✓ = installed; 0 = not installed.

BK 117 C-2 EQUIPMENT LIST (EL)

MODELE/VARIANT : BK 117 C-2
SERIAL NO.: :
Page No.: 2 of 4

Item No.	Description of article Modification/ Part No./ FLM / FMS	Mass (kg)	Arm long. (mm)	Massmoment long. (kgmm)	Arm lat. (mm)	Massmoment lat. (kgmm)	WEIGHINGS Initial Date/Sign. Marked as required 1)	Second Date/Sign. Marked as required 1)	Third Date/Sign. Marked as required 1)

1) Required markings: ✓ = installed; 0 = not installed.

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MAT. 1403565

BK117 C-2 MASS AND BALANCE RECORD – LATERAL

(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ___ of ___

Date	Equipment List Item No. IN	Equipment List Item No. OUT	Description of Article or Modification	MASS CHANGE Added (+) Mass (kg)	Added (+) Massmoment (kgmm)	Removed (–) Mass (kg)	Removed (–) Massmoment (kgmm)	RUNNING BASIC EMPTY MASS (BEM) Mass (kg)	Massmoment (kgmm)	CG lat (mm)	Signature

Form MBR -3 lateral

BK117 C-2 MASS AND BALANCE RECORD – LATERAL

(Continuous History of Changes in Structure or Equipment Affecting Mass and Balance)

MODEL/VARIANT: _____ SERIAL NO.: _____ Page No.: ___ of ___

Date	Equipment List Item No. IN	Equipment List Item No. OUT	Description of Article or Modification	MASS CHANGE Added (+) Mass (kg)	Added (+) Massmoment (kgmm)	Removed (–) Mass (kg)	Removed (–) Massmoment (kgmm)	RUNNING BASIC EMPTY MASS (BEM) Mass (kg)	Massmoment (kgmm)	CG lat (mm)	Signature

Form MBR -4 lateral

BK 117 C-2 EQUIPMENT LIST (EL)

MODEL/VARIANT : BK 117 C-2
SERIAL NO.: :
Page No.: 3 of 4

Item No.	Description of article Modification/ Part No./ FLM / FMS	Mass (kg)	Arm long. (mm)	Massmoment long. (kgmm)	Arm lat. (mm)	Massmoment lat. (kgmm)	WEIGHINGS Initial Date/Sign.		WEIGHINGS Second Date/Sign.		WEIGHINGS Third Date/Sign.	
							Marked as required 1)		Marked as required 1)		Marked as required 1)	

1) Required markings: ✓ = installed; 0 = not installed.

BK 117 C-2 EQUIPMENT LIST (EL)

MODEL/VARIANT : BK 117 C-2
SERIAL NO.: :
Page No.: 4 of 4

Item No.	Description of article Modification/ Part No./ FLM / FMS	Mass (kg)	Arm long. (mm)	Massmoment long. (kgmm)	Arm lat. (mm)	Massmoment lat. (kgmm)	WEIGHINGS Initial Date/Sign.		WEIGHINGS Second Date/Sign.		WEIGHINGS Third Date/Sign.	
							Marked as required 1)		Marked as required 1)		Marked as required 1)	

1) Required markings: ✓ = installed; 0 = not installed.

SECTION 7

DESCRIPTION OF SYSTEMS

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SECTION 7

DESCRIPTION OF SYSTEMS

7.1 GENERAL

The BK 117 C-2 is a multi-purpose helicopter, utilizing a four-bladed hingeless main rotor system with fibre-reinforced composite blades, and a semi-rigid, two-bladed tail rotor. The pilot's seat is on the RH side.

This section contains information that applies specifically to BK 117 C-2 helicopters with Central Panel Display System (CPDS) installed .

7.2 FUSELAGE

The primary structure consists mainly of sheet metal and composite material.

The BK 117 C-2 helicopter is accessible through six doors: two hinged doors for the crew/ front occupant, two sliding doors for the rear passengers, and two aft clam shell doors for the rear compartment.

7.3 TAIL BOOM

The tail boom can be separated from the fuselage, and consists of the horizontal stabilizer, vertical stabilizer, vertical fin, intermediate gearbox, tail rotor gearbox, tail rotor and fairing (see fig. 7-21).

7.4 LANDING GEAR

The non-retractable type landing gear of the BK117 C-2 consists of two cross tubes, two skids and two boarding/maintenance steps (see fig. 7-1).

7.5 HELICOPTER DIMENSIONS

Fig. 7-1 shows a three-view drawing of the helicopter with its principal dimensions. For cabin dimensions see fig. 7-2.

Locations on and within the helicopter can be determined in relation to fuselage stations (F.S. or STA.), waterlines (W.L.), and buttock lines (B.L.), measured in millimeters from known reference points (see section 6 "Mass and balance").

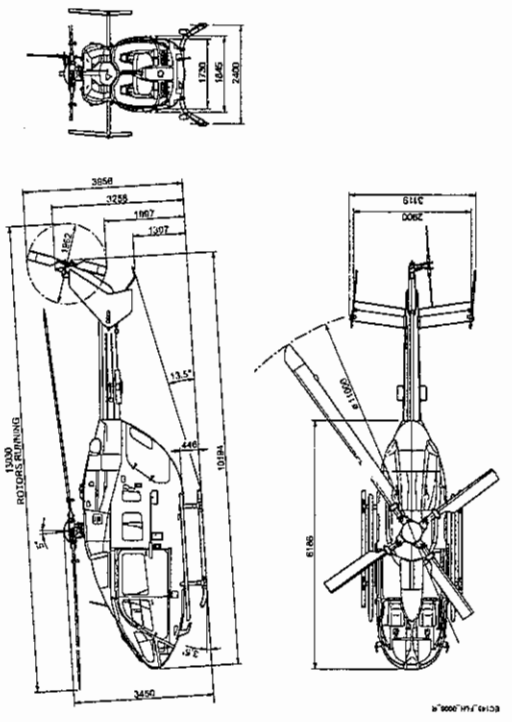


Figure 7-1 Principal dimensions

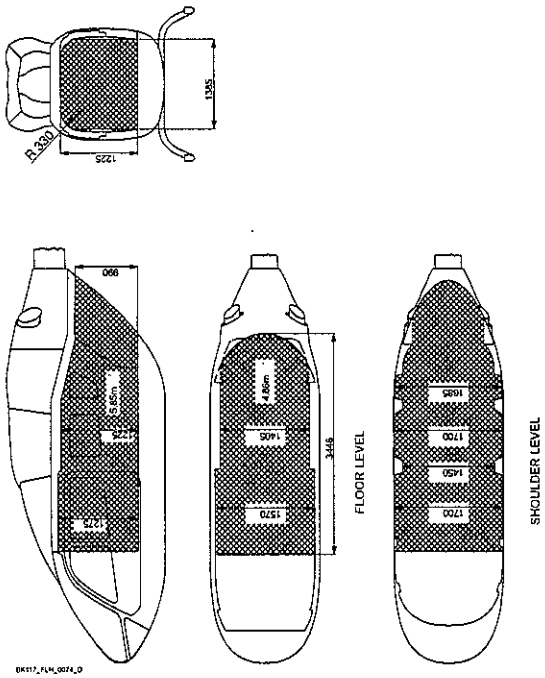
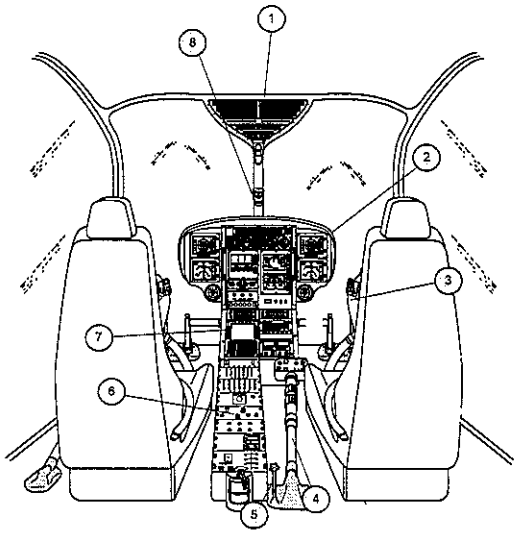


Figure 7-2 Cabin dimensions

7.6 COCKPIT ARRANGEMENT

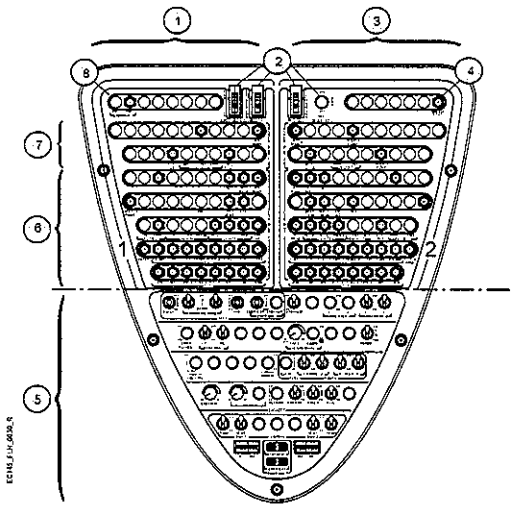


1 Overhead panel
2 Instrument panel
3 Cyclic stick
4 Collective pitch
5 Collective pitch friction brake
6 Center console
7 Slant console
8 Compass

Figure 7-3 Typical cockpit arrangement

7.6.1 Overhead panel and related systems

The overhead panel is divided in several sections in order to provide easy access to the respective circuit breakers or switches.



1 System 1 buses
2 Bus control switches
3 System 2 buses
4 AC bus 2
5 Overhead switch panel
6 Essential buses
7 Shedding buses
8 AC bus 1

Figure 7-4 Typical overhead panel

7.6.1.1 Overhead switch panel

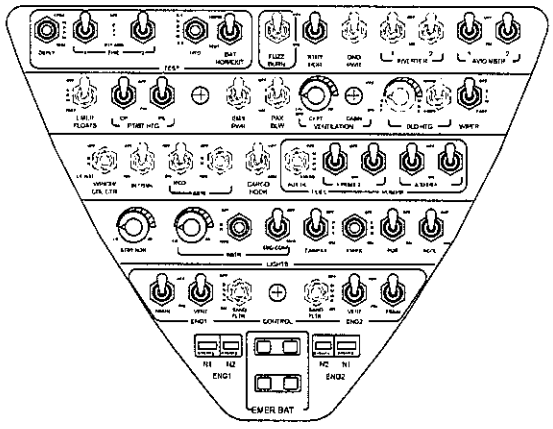
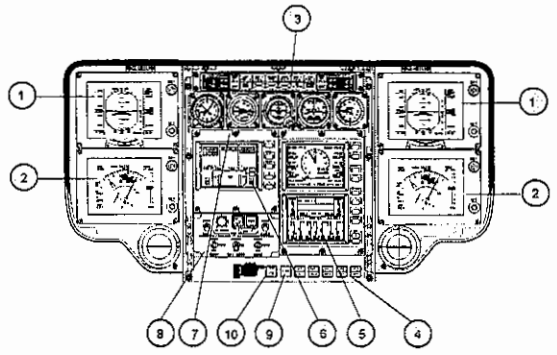


Figure 7-5 Typical overhead switch panel

7.6.2 Instrument panel and consoles

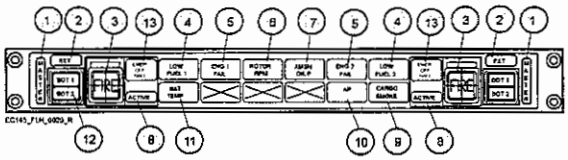


1 Primary Flight Display
2 Navigation Display
3 Warning panel
4 NMS advisory lights/pb panel
5 VEMD
6 CAD
7 Analogue instruments (Clock, Stby Horizon, etc.)
8 Main switch panel
9 FTR pb – Pressing opens both cyclic stick parallel actuator clutches permanently to release stick forces. For reset push FTR sw on cyclic stick. If AP is active, the AP overrides the FTR function (e.g. if AP is on the FTR pb is inoperative and if the FTR is pressed, the activation of the AP disengages the FTR function).
10 GND ON (ground power) switch – optional
The ground power switch provides the possibility to power up several avionic/radio systems (e.g. navigation system, communication system) without power up of the complete H/C electrical system.
This enables the crew to configurate mission equipment and radios before the flight.
The ground power switch should be switched off whenever it is not used.

Figure 7-6 Typical instrument panel arrangement

7.6.2.1 Warning panel

Emergency situations requiring immediate action will be indicated by a red warning light on the WARNING PANEL (see fig. 7-7) coming on together with a gong. The gong can be re-seted by pushing the RESET button on the cyclic stick (see fig. 7-9).



1 Master caution light
2 EXT indicates bottle discharge activation
3 FIRE warning light/EMER OFF sw
4 LOW FUEL warning supply tank 1/2
5 ENG 1/2 FAIL warning (respective N_1–RPM below threshold value)
6 ROTOR RPM warning (N_{RO} too low or too high)
7 Main transmission oil pressure warning (oil pressure below minimum)
8 ACTIVE indicates switch position for EMER OFF switch
9 Cargo smoke detection light (optional)
10 Autopilot warning (optional)
11 Battery overtemperature warning
12 BOT 1/2 pb indicates availability of fire extinguisher bottle/activates respective bottle
13 EMER OFF SW indication (system 1/2)

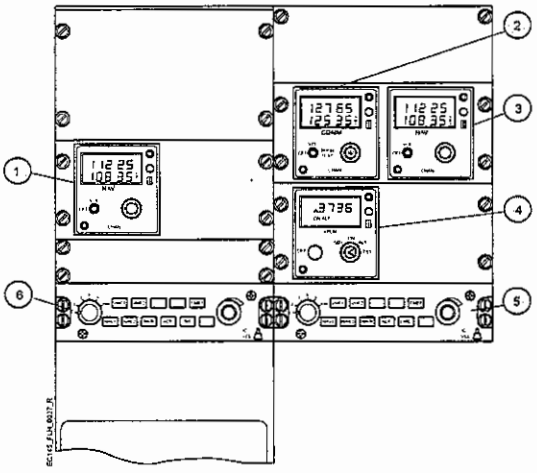
NOTE EMER OFF sw is guarded by a fence or a cover glass.

Figure 7-7 Warning panel

FIRE warning light / EMER OFF switch

When overtemperature conditions in an engine compartment are detected by sensors, the respective FIRE warning light comes on and the warning bell is activated. After opening the switch guard, pressing and releasing the FIRE switch the respective ACTIVE indication illuminates and the respective emergency shut off valve will be closed. During operation of the emergency shut off valve the caution FUEL VALVE appears on the CAD. As soon as the emergency shut off valve is in the closed position, the caution F VALVE CL appears on the CAD.

7.6.2.2 Center console



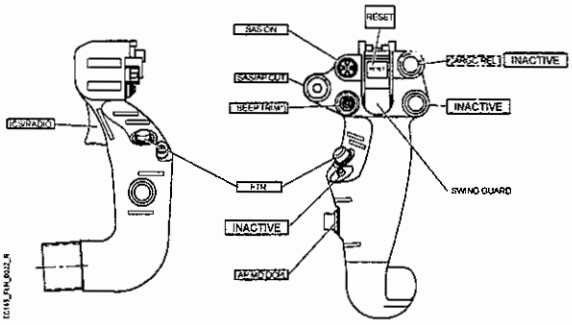
1 NAV 1 control unit
2 VHF COMM control unit
3 NAV 2 control unit
4 Transponder control unit
5 COMM/NAV control pilot
6 COMM/NAV control copilot

Figure 7-8 Typical center console

7.7 FLIGHT CONTROL SYSTEM

The control signals, applied through the cyclic stick (see fig. 7-9) and the collective lever (see fig. 7-10), are transmitted to three ball bearing control cables (flexballs). These flexballs are leading to the nose section and then up to the hydraulic boost unit on the roof (see fig. 7-11). These three ball bearing control cables are controlling the input control levers of the hydraulic boost unit. There, the control signals become force amplified (refer to para. 7.12). The amplified signals, which leave the boost unit at the output boost pistons, are transmitted via control rods to the mixing lever assembly. There, they are combined to a signal that tilts the swash plate in the desired direction (cyclic stick input), or moves the sliding sleeve up or down, which creates the desired simultaneous variation of the angle of incidence on all four rotor blades (collective lever input).

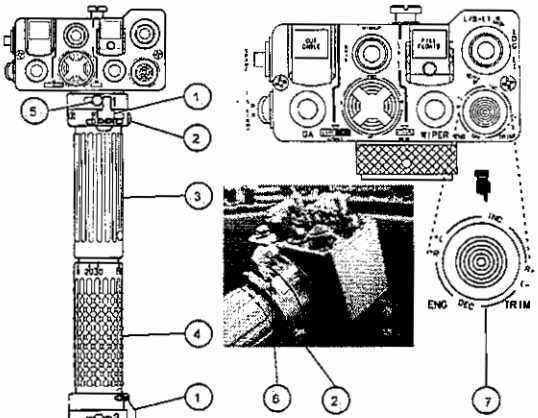
NOTE Instead of the new cyclic stick centering device (without locking possibility) in some H/C's a cyclic stick locking device is installed (observe ASB MBB–BK117–C2–67A–008). This locking device has a preset breaking point. It provides the possibility to override the locking device in case of emergency by a strong jerky force–aft movement of the cyclic stick (e.g. unintended locked cyclic stick in takeoff situation).



*)If AFCS is not installed the BEEP TRIM switch provides trimming function for the cyclic stick position. During flight the pilot can trim the stick forces to zero load.

Figure 7-9 Typical cyclic stick

The collective lever is equipped with several switches and buttons and with twist grips for manual engine control. A friction adjustment at the base of the lever is used to prevent the collective pitch setting from moving when the lever is released (see fig. 7-3).



1 EMER safety latch
2 Safety button (ground idle stop function)
3 Twist grip ENG 1
4 Twist grip ENG 2
5 Mechanical stop for position FLIGHT (ground idle lock screw)
6 Spring-loaded pin
7 ENG TRIM sw (see description on the next page)

Figure 7-10 Typical collective lever

CAUTION DO NOT DAMAGE THE SPRING–LOADED PIN ON THE SAFETY LATCH (STOP). BEFORE YOU CLOSE THE SAFETY LATCH ALWAYS PRESS IN THE SPRING–LOADED PIN (WITH YOUR FINGERNAIL). THE SPRING–LOADED PIN HOLDS THE SAFETY LATCH IN THE OPEN POSITION TO ALLOW FREE MOVEMENT WITHIN THE EMERGENCY RANGE.
WHEN THE SPRING–LOADED PIN OR ITS MATING PART IS WORN OR DAMAGED, THE SAFETY LATCH WILL NOT STAY OPEN. THE TWIST GRIP WILL BE BLOCKED AND MAY CAUSE ENGINE OVERSPEED.

The ENG TRIM switch is a 4–way toggle switch of which ergonomic installation facilitates its control. For use of the eng trim function the VARTOMS must be operated in MAN mode.

ENG TRIM function:

- INC – increases the rotor rpm
- DEC – decreases the rotor rpm
- +L/–R – proportional torque match of both engines (left engine torque increase/right engine torque decrease)
- +R/–L – proportional torque match of both engines (right engine torque increase/left engine torque decrease)

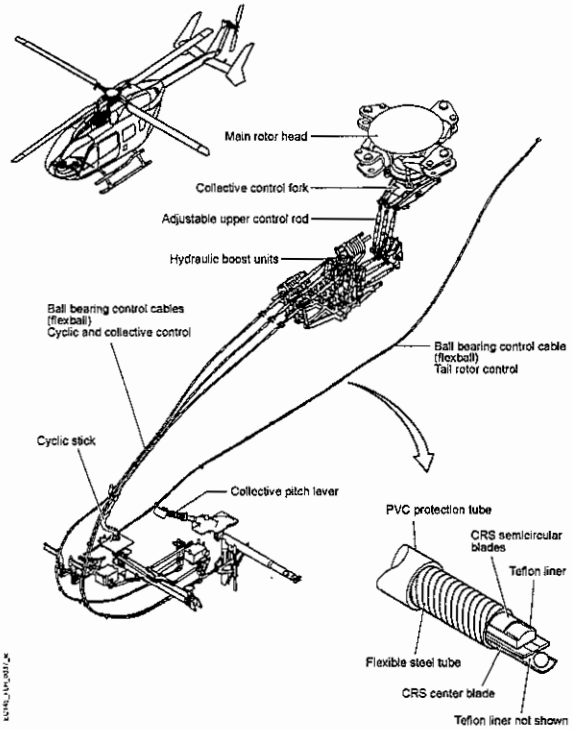


Figure 7-11 Flight control system

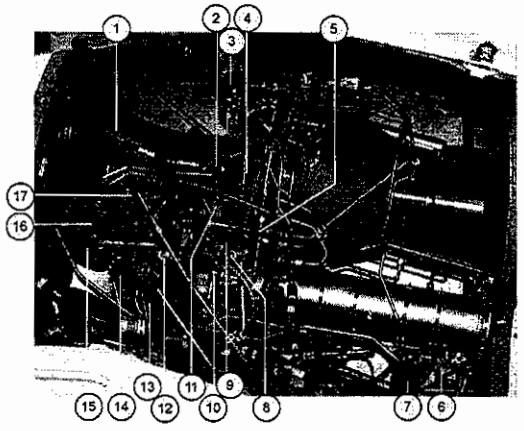
7.8 POWER PLANT AND RELATED SYSTEMS

7.8.1 Engines

The helicopter is powered by two Turbomeca ARRIEL 1E2 turboshaft engines of the free turbine type. Engine power is transmitted to the main transmission via independent drive systems.

The twin-engine reliability is complemented by a fully-separated fuel system, a tandem hydraulic system, dual electrical systems and a redundant lubrication system for the main transmission.

The engines are located in separate fireproof compartments aft of the main transmission and above the passenger/cargo compartment (see fig. 7-12). The engines are turbo shafts, with single-stage axial and centrifugal compressors, annular combustors, a two-stage gas producer and a single-stage free power turbine.



1 Compressor
2 Oil filter
3 Bleed valve
4 Oil pressure transmitter, behind: low oil pressure switch
5 Chip detector (oil scavenge)
6 Min fuel filter pre–clogging switch (low pressure sys.)
7 Fuel filter
8 Oil temperature probe
9 Oil pump
10 Chip detector (rear bearing)
11 Oil filter pre–clogging electrical switch
12 Fuel pre–clogging indicator
13 Mounting struts
14 Fuel filter
15 N_2 control
16 Fuel control unit
17 N_1 control

Figure 7-12 Power plant

7.8.2 Engine operation and control

The engines are equipped with an independently operating engine ignition system. The starting and ignition system is activated by the respective START switch (ENG1/ENG2) on the main switch panel (see fig. 7-13). Each engine gets controlled via the twist grip setting on the collective lever. The twist grips, which are adjustable through the OFF, IDLE and FLIGHT positions and EMER range, operate independently of each other.

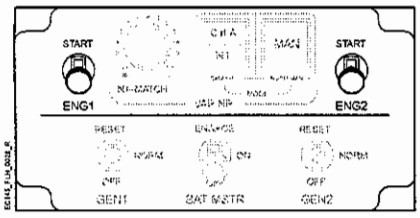


Figure 7-13 START switches on the main switch panel

Fuel flow is regulated and maintained within limits established by the parameters of the gas producer turbine speed, the power turbine speed, the compressor pressure, the position of the twist grips and the collective pitch. To stabilize the power turbine speed N_2 the N_2 governor is connected with the collective pitch through a mechanical linkage (see fig. 7-14). This prevents N_2 rpm droop and enables the increased power requirements of the helicopter to be met. Installed in the mechanical linkage are two electrical actuators which are driven by signals from a control unit so that the appropriate rotor rpm is set within the variable rotor rpm range and simultaneously, the torque of both engines is matched.

1 N_2 control Engine 2
2 N_2 control Engine 1
3 Electrical actuator Engine 1
4 Electrical actuator Engine 2
5 Linkage to collective pitch

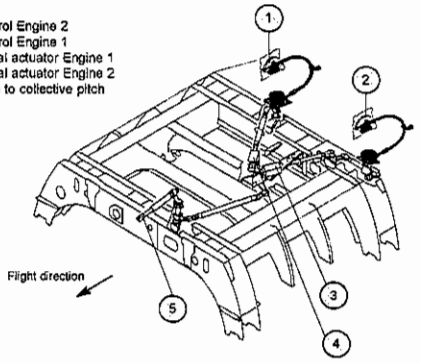


Figure 7-14 N_2 control linkage

7.8.3 Engine overspeed protection

Each engine is monitored by an engine tachometer unit, to prevent serious damage to the engine, in case of malfunction, by shut-down.

When an affected engine has been shut-down as a result of an overspeed condition, the engine tachometer unit of the normal engine will be deactivated, the respective OVSP FAIL caution indication will not come on and the affected engine cannot be re-started.

During engine operation the OVSP FAIL caution indication will come on steadily in the event of loss of one of the signals which ensure the monitoring and overspeed protection functions.

The overspeed protection function is designed to protect the power turbine against damage, when an overspeed exceeding approximately 123 % of N_2 is detected by the two N_2 power turbine rotational speed sensors, mounted underneath the turbine shaft. The engine tachometer unit energizes the engine drain and overspeed valve to interrupt fuel flow, then the affected engine will be shut-down.

7.8.3.1

7.8.4 Engine oil system (see figs. 7-12 and 7-15)

Two separate oil tanks, one for each engine, are installed on the main transmission compartment floor.

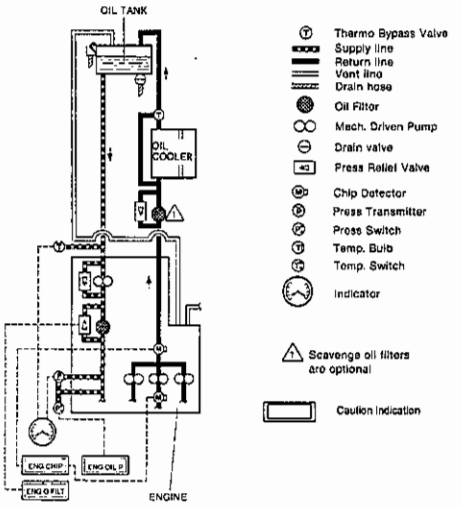


Figure 7-15 Engine oil system – schematic

7.9 FUEL SYSTEM (see fig. 7-16)

7.9.1 Storage

Fuel is stored in underfloor compartments, using bladder type, crash resistant fuel cells, comprising a main tank (forward and aft part) and a supply tank, divided in a left and a right chamber. They are interconnected by means of a flexible fuel supply and hose system (overflow channels and transfer channels). Each tank is equipped with equipment plates as attaching platforms for the operating and monitoring components. The system is equipped with 5 drain valves. The left supply tank provides fuel for the left engine, and the right supply tank for the right engine. An internal ventilation system ensures ventilation of the fuel tanks during flight and fueling. The fuel system has a usable fuel capacity of 867.5 l.

7.9.2 Supply

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. A jet pump, driven by the rear fuel transfer pump, ensures a reduced unusable fuel even in extreme flight attitudes such as hover at low fuel. Surplus fuel in the supply tank returns to the main tank via overflow channels. After starting the engines, the fuel pumps are activated by the FUEL PUMPS XFER–F/–A switches, located on the overhead switch panel (see fig. 7-5) and supplied via the XFER-F/-A PUMP circuit breaker. The prime pumps, one in each supply tank, serve to purge air from the fuel feed system and supply the engines during start. The prime pumps are activated by the FUEL PUMPS PRIME 1/2 switches, located on the overhead switch panel (see fig. 7-5). During prime pump operation the PRIME PUMP 1/2 caution indication 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 and individually operated fuel shut-off valves, one on each side of the fuselage underneath the engine deck are installed to immediately interrupt fuel supply to the related engine in case of emergency.

7.9.3 Monitoring system

Four fuel quantity sensors are installed in the fuel system; two in the main tank and one in each supply tank. All sensors are connected electrically to the CPDS in the instrument panel. Additionally two fuel low level sensors are installed in the supply tanks. If the fuel quantity in a supply tank becomes approx. 24 kg the respective warning light LOW FUEL 1/2 on the warning panel comes on. The remaining flight time is approx. 8 to 10 minutes. On low fuel pressure at the inlet of the engine fuel pump the respective caution indication FUEL PRESS 1/2 comes on.

7.9.4 Refueling and grounding

The refueling system comprises a filler neck, accessible through a lockable access cover, and a grounding connection. The filler neck, located on the left side of the fuselage, is equipped with a filler cap and a removable filter and is designed for gravity refueling. The grounding connection, located underneath the access to the filler neck, provides a means for static discharge after landing and during fueling of the helicopter. The time required to fill the tanks to max. capacity is approx. 11 minutes.

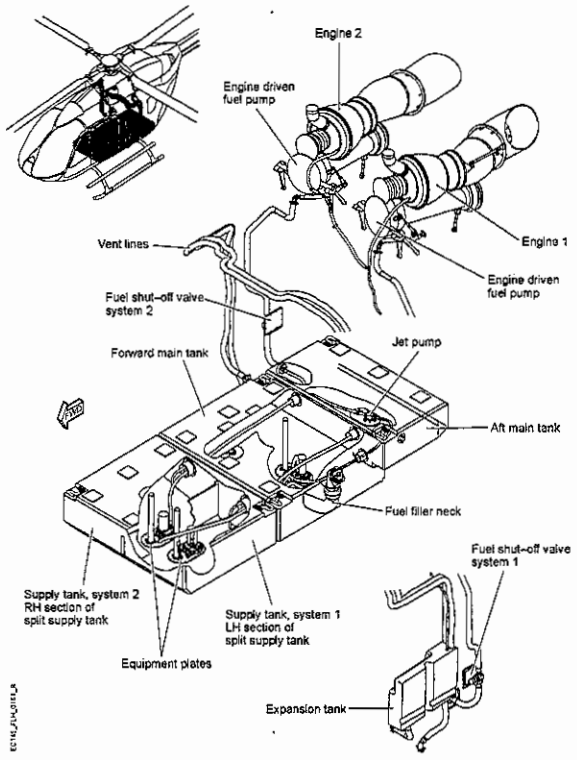


Figure 7-16 Typical fuel system

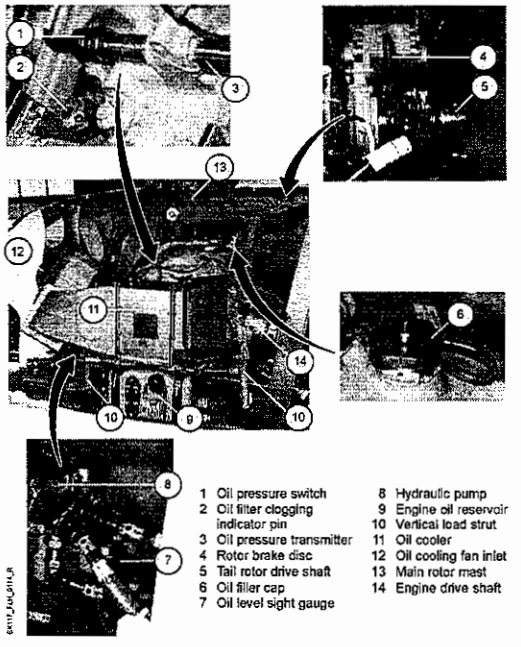
7.10 MAIN TRANSMISSION SYSTEM (see fig. 7-17)

The main transmission is a two-stage flat design gearbox.

The first stage, also called the input bevel gear stage, consists of engine drive shafts, freewheel clutches, bevel gear shafts and bevel gears to deflect the power flow.

The second stage, also called collector gear stage, consists of a collector gear, bevel gear shafts and bevel gears which form the interface to the input bevel gear stage.

The main transmission provides output power for the main rotor, the tail rotor, the hydraulic system pumps and the oil cooling fans. A freewheeling unit, located at each main transmission input, permits either one or both engines to be disengaged from the main transmission. The freewheeling units will disengage both engines during autorotation, one engine for single engine operation, or any time engine drive shaft RPM is below the RPM of the driven shaft in the main transmission.



1 Oil pressure switch
2 Oil filter clogging indicator pin
3 Oil pressure transmitter
4 Rotor brake disc
5 Tail rotor drive shaft
6 Oil filler cap
7 Oil level sight gauge
8 Hydraulic pump
9 Engine oil reservoir
10 Vertical load strut
11 Oil cooler
12 Oil cooling fan inlet
13 Main rotor mast
14 Engine drive shaft

Figure 7-17 Main transmission system

7.10.1 Main transmission oil system and indicators (see figs. 7-17 and 7-18)

The main transmission oil system lubricates and cools transmission components. A lubrication pump and a chip detector are installed on each right and left hand side of the oil sump which is integrated in the lower part of the transmission housing. In case of chip detection the XMSN CHIP caution indication comes on. Two oil pumps mounted on the bottom of the transmission, suction oil from the sump through a filter screen and feed it then to a fine mesh-filter mounted above the oil gege glass. The filter incorporates a bypass to ensure oil circulation in the event of filter clogging. Low oil pressure is indicated by the XMSN OIL PRESS warning light, high oil temperature by the XMSN OIL T caution indication.

The operating data of oil temperature and oil pressure can be monitored on the VEMD, located on the instrument panel. The indicating system comprises permanent monitoring of oil temperature and oil pressure and non permanent indications providing warnings and cautions for oil temperature, oil pressure, chip detection and oil filter contamination. The oil quantity can be checked through an oil level sight gauge.

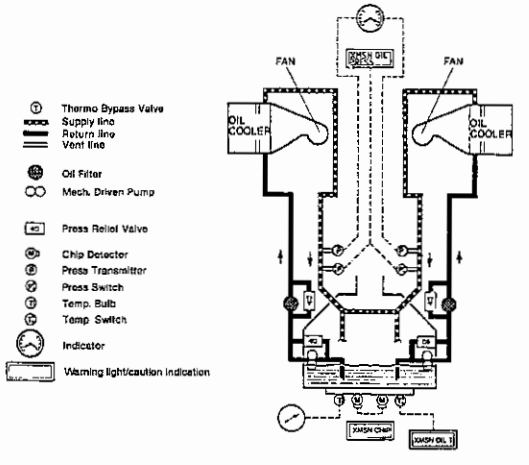


Figure 7-18 Main transmission oil system – schematic

7.11 ROTOR SYSTEMS

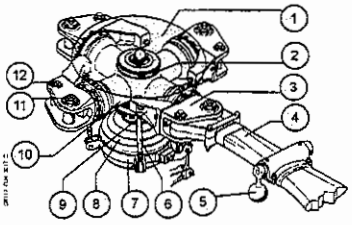
7.11.1 Main rotor system

The helicopter is equipped with a four-bladed bearingless main rotor (BMR). The inboard flexbeam enables movement of the blades in all axes.

The main rotor control linkage system is of conventional design. The hydraulic system for the main rotor controls is designed as a duplex system with tandem piston (both systems are active). In case of a failure of one system, the remaining system has sufficient power to ensure safe flight operation and a safe landing.

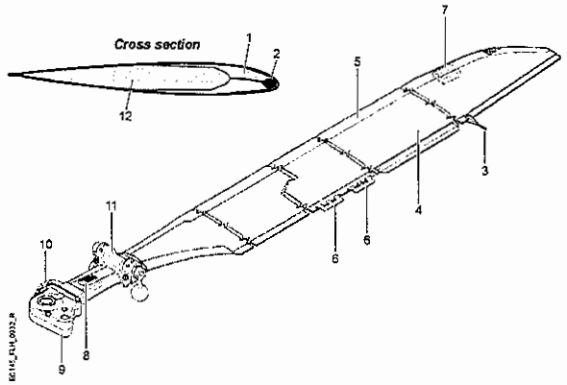
The titanium main rotor head consists of a one-piece cross-shaped drop forging (see fig. 7-19). Four titanium inner sleeve assemblies are retained within the head by flexible tension-torsion straps. They are attached to two quadruple retaining nuts each, located in the head center to take up the centrifugal forces. Lead-lag and flap is accomplished without mechanical hinges because of the feathering properties of the main rotor blades (see fig. 7-20). For aerodynamic reasons a hub cap is mounted on the top of the rotor head.

The indicating system consists of a rotor RPM indicator, a mast moment sensor and a visual and aural rotor RPM warning unit.



1 Hub cap
2 Oil reservoir
3 Inner sleeve
4 Rotor blade
5 Vibration damper
6 Rotating control rod
7 Swash plate
8 Bellow
9 Control lever
10 Rotor head
11 Primary blade bolt
12 Secondary blade bolt

Figure 7-19 Main rotor head



1 Blade spar (prepreg glass rovings)
2 Lead rod
3 Static discharger
4 Blade skin (fiberglass prepreg/carbon fiber)
5 Anti erosion strip (nickel)
6 Trim tabs
7 Balance weight
8 Blade root
9 Blade fitting assembly
10 Electrical bonding lead
11 Oil damped pendulum vibration absorber
12 Blade core (hard foam)

Figure 7-20 Main rotor blade

7.11.2 Tail rotor system

The tail rotor system consists of the tail rotor drive shaft, the intermediate transmission, the tail rotor transmission and the tail rotor (see fig. 7-21).

The tail rotor is a semi rigid two-bladed rotor with central flapping hinge. The control around the yaw axis is achieved by adjusting the angle of incidence of the two blades collectively. The direction of rotation is counter-clockwise, seen from the tail rotor transmission.

The tail rotor drive shaft transmits power from the main transmission to the intermediate transmission through the drive shaft along the top center of the tail boom. From there it is routed upward to the tail rotor transmission on top of the vertical fin. The tail rotor transmission changes the power flow to the tail rotor shaft and decreases the speed by a set of bevel gears.

At the bottom of the intermediate and the tail rotor transmission a self closing magnetic drain plug is installed. The oil level can be checked through the respective sight gauge.

The tail rotor blades are constructed similar to the main rotor blades. They are mounted to the tail rotor head by tension-torsion straps to compensate the centrifugal forces. Dynamic weights are installed on the control yoke to reduce control pedal forces. These weights are adjusted to compensate the main rotor torque at a hover.

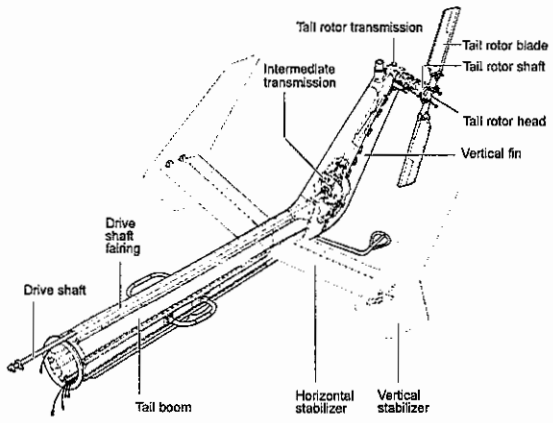


Figure 7-21 Tail unit components

7.12 DUAL HYDRAULIC BOOST SYSTEM

For redundancy reasons, the hydraulic system consists of two identical but independent pressure supply systems (see figs. 7-22 and 7-23). Both pressure supply systems and the actuators of the main rotor controls are installed on a module plate assembly, which is located on the roof in front of the main transmission. The actuators of the tail rotor controls are installed in the tail boom, underneath the tail rotor gear box.

The pumps of both systems are driven by accessory drives of the main transmission. They equally supply the actuators of the main rotor control with operating pressure. System 2 also supplies the actuator of the tail rotor control. If one of the pressure supply systems fails, the normal system continues to supply the main rotor actuators and the operating force decreases to half of the original value. On system 2 failure the tail rotor control operates without hydraulic boost. In case of low pressure in one hydraulic system the respective caution indication HYD PRESS (system 1 or system 2) comes on.

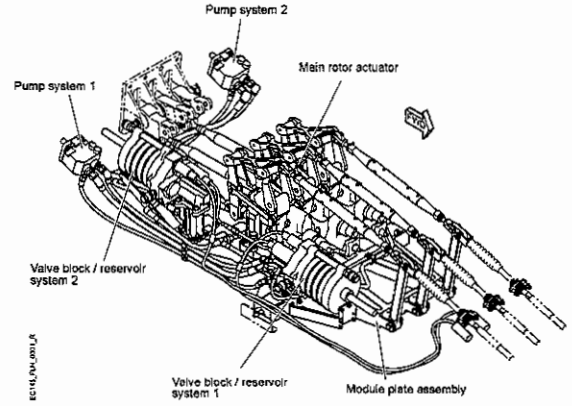


Figure 7-22 Hydraulic system

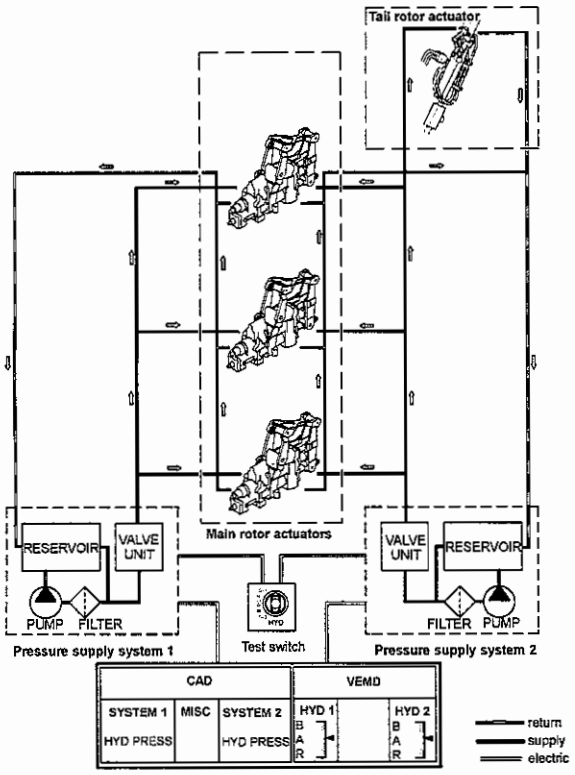


Figure 7-23 Hydraulic system – schematic

The hydraulic system can be tested on ground by means of the HYD TEST switch located on the overhead switch panel (see fig. 7-24 – see also hydraulic system check in section 4). Selecting spring loaded test switch position S–1 disengages the hydraulic supply system 2 and the respective HYD PRESS system 2 caution indication comes on. Simultaneously the pedal forces increase. Selecting spring loaded position S–2 disengages the hydraulic supply system 1 and HYD PRESS system 1 caution indication comes on.

Figure 7-24 Hydraulic system test switch

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7.13 VARTOMS - VARIABLE ROTORSPEED AND TORQUE MATCHING SYSTEM

The VARTOMS is adjusting the rotorspeed automatically in its optimum range depending on pressure altitude, air temperature, the dynamic pressure from the airspeed and the torque of the engines. The system features four modes of operation, which can be selected by two illuminated mode selector push buttons (NORM/MAN and Cat. A/N1) on the main switch panel (see fig. 7-25). Power supply takes place via circuit breakers VAR NR and N2 CONT located on the overhead panel (see fig. 7-4).

After engine start–up, the VARTOMS will always be inactive for system check reasons (see section 4, para. 4.5.2). It will automatically be activated as soon as both engines reach 20% torque.

NOTE The selected mode will always be retained, even after power supply interruption.

The modes of operation are the following:

7.13.1 NORM (normal operation)

The primary mode for normal operation (no pb was depressed/is illuminated). In the NORM mode the system performs the torque matching of both engines automatically, and the rotor speed will automatically be controlled:

- in a range of min. 101% at high air density up to a maximum of 103.5% at low air density during hover and low airspeeds (below 55 kts).
- in a range of min. 96.5% at high air density up to a maximum of 102% at low air density during forward flight (airspeed 55 kts or higher).

The NORM mode improves the helicopter power margin and flight characteristics by increasing rotor RPM at low air density (high altitude, high OAT) and reduces noise emission by decreasing rotor RPM at high air density (low altitude, low OAT). The N1–MATCH knob on the main switch panel (see fig. 7-25) is not active in this mode.

7.13.1.1 Cat. A (Depress the Cat. A/N1 pb once; "Cat. A" part of the pb will illuminate green)

The Cat. A mode is equivalent to the NORM mode, except for the rotor speed during hover and low airspeeds (below 55 kts). For maximum performance during hover and take off with high loads, the rotor speed will be kept at 103.5%, irrespectively of the prevailing air density.

NOTE The usage of VAR NR CAT. A mode is restricted to CAT. A operation. For CAT. B operation the NORM mode shall be selected.

7.13.1.2 N1 (Depress the Cat. A/N1 pb twice; "N1" part of the pb will illuminate green)

The N1 mode is to be used at high altitudes, where N1 is the limiting factor. Maximum engine performance will be utilized irrespectively of air density by matching both engine gas producer speeds using the N1–MATCH knob on the main switch panel (see fig. 7-25). The rotor speed will automatically be controlled according to the speed law of the NORM mode (see above).

Since the power characteristics may slightly differ between the engines, the torque values will not necessarily match. Once adjusted, the N_1 adjust knob should not be moved again. Only long term changes in the engines power characteristics relative to each other may require a readjustment from time to time.

7.13.1.3 Cat. A & N1 (Depress the Cat. A/N1 pb three times; pb will illuminate green)

The Cat. A & N1 mode is equivalent to the N1 mode, except for the rotor speed:

The rotor speed will automatically be controlled according to the speed law for the Cat. A mode (see previous page).

NOTE To deactivate the **Cat. A** &/or **N1** mode (return to the **NORM** mode), depress the Cat. A/N1 pb four times (no pb is then illuminated).

7.13.1.4 MAN (Depress the NORM/MAN pb once; pb will illuminate yellow/**VAR NR** caution will come up)

In the manual mode, the system is shut off and the rotor speed can be controlled by using the engine trim system (4-way beep switch on the collective). The system must be switched to the MAN-mode, if any malfunction of the system occurs or any abnormal function of the system is suspected.

If the VARTOMS is not operated in MAN mode and an engine failure or a torque split of more than 15% occurs, the VARTOMS will automatically be switched to the MAN-mode and the VAR NR caution indication will come on.

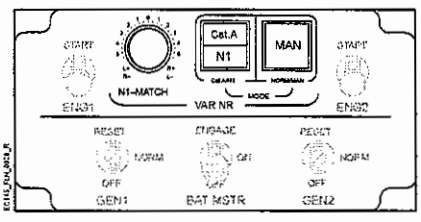


Figure 7-25 VARTOMS controls on the main switch panel

7.14 ELCTRICAL SYSTEM

7.14.1 DC power system

The fully redundant electrical DC system generates and distributes power for operation and control of helicopter systems. It is supplied by two generators and the battery (see fig. 7-27).

The electrical power supply system supplies 28V DC to the airborne electrical system, when operated by generators, and 24V DC, when operated by the on-board battery. For the power supply of some electrical subsystems or units, the airframe is acting as the return conductor or ground potential.

7.14.2 AC power system

A single AC power system (system 2) generates two different AC voltages (26 VAC and 115 VAC with 400 Hz each – see fig. 7-26).

The alternating voltages are needed for navigation instruments and for the flight control system.

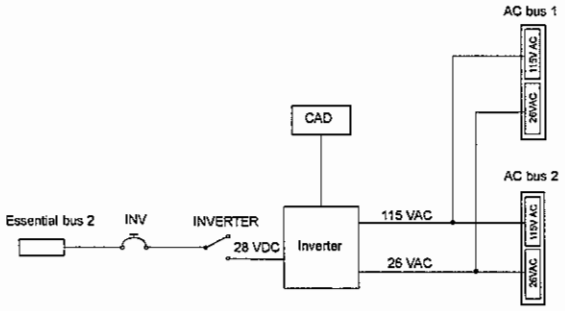


Figure 7-26 AC power system – schematic

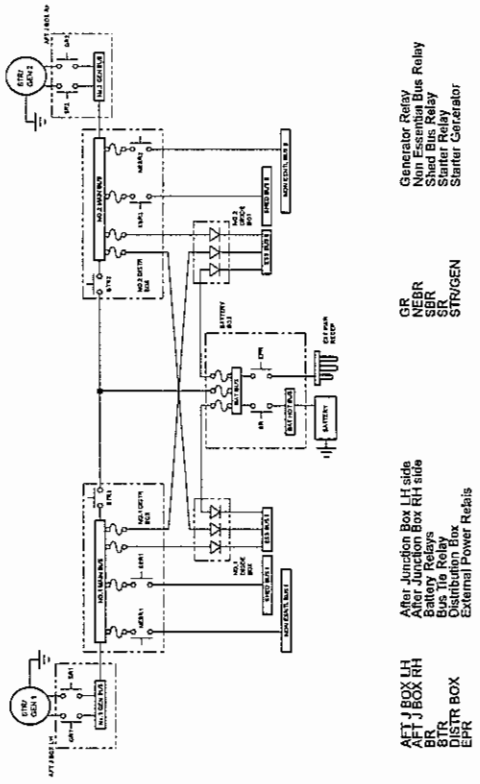


Figure 7-27 DC power distribution – schematic

7.15 HEATING/VENTILATION SYSTEM (SEE FIG. 7-28)

7.15.1 Heating system

The bleed air heating system ducted to the cabin aera is connected to the ventilation ducting system. It consists of:

- Venturi-type mixing valve assy with primary and secondary valves
- Temperature control computer
- Temperature sensors located in the cabin ceiling and in the heater supply duct
- Overtemperature switches located in the heater supply duct.
- BLD HTG rheostat and the BLD HTG EMER/NORM sw.
- Cabin air outlets

The valve position is constantly adjusted by the computer as a function of cabin air temperature, as sensed by the cabin temperature thermistor and the BLD HTG rheostat setting.The fully opened and closed position are monitored by micro switches.

The HEATING advisory indication (green) will be activated on the CAD when the BLD HTG rheostat is switched ON and the shut off valves are opened.

The BLEED AIR caution indication will become activated on the CAD in case of:

–the shut off valves remain open after shutting off the bleed air heating system.

–the shut off valves remain closed after switching on the bleed air heating system.

If a mixing valve malfunction causes an air temperature increase abouve a specific threshold value an overtemperature switch will cause the shut off valves to close and the HTG OV-TEMP caution indication to become activated on the CAD.

7.15.2 Bleed air heating operations

For maximum bleed air supply in the cockpit and defogging/deicing of the windshield proceed as follows:

PUSH FOR DEFOG lever	– Push
PUSH FOR AIR lever	– Pull
VENTILATION CKPT sw	– Set to HI
BLD HTG rheostat	– Set to HI
Pax vent blower	– OFF
Pax vent nozzles	– Close all (9)
Cabin air outlets	– Close

For maximum bleed air supply in the cabin proceed as follows:

PUSH FOR DEFOG lever	– Pull
PUSH FOR AIR lever	– Pull
VENTILATION CKPT sw	– OFF
BLD HTG rheostat	– Set to HI

Pax vent blower	– OFF
Pax vent nozzles	– Close all (9)
Pilot/copilot and cabin air outlets	– Open

7.15.3 Ventilation system

The ventilation system consists of:

- Cockpit ventilation system
- Avionics cooling system
- PAX ventilation system

7.15.3.1 Cockpit ventilation system

The cockpit ventilation system consists of:

- Two air nozzles in the instrument panel
- PUSH FOR AIR lever (aft part of the center console)
- PUSH FOR DEFOG lever (aft part of the center console)
- VENTILATION CKPT rheostat (blower speed variation)
- Pilot/Copilot air outlets (adjustable in direction and aperture)

Cockpit heating/windshield defogging/deicing is achieved by hot air admixture from bleed air heating sytem to the ventilation system.

7.15.3.2 Avionics cooling system

A thermoswitch activates the avionics cooling blower automatically depending on the temperature inside the instrument panel.

7.15.3.3 PAX ventilation system

The PAX ventilation system consists of:

- Nine pax nozzles (adjustable in direction and aperture)
- PAX BLW sw (overhead panel)

7.15.4 Ventilation operation

For maximum ventilation proceed as follows:

PUSH FOR DEFOG lever	– Pull
PUSH FOR AIR lever	– Push
VENTILATION CKPT sw	– Set to HI
BLD HTG rheostat	– OFF
Pax vent blower	– ON
Pax vent nozzles	– Open (9)

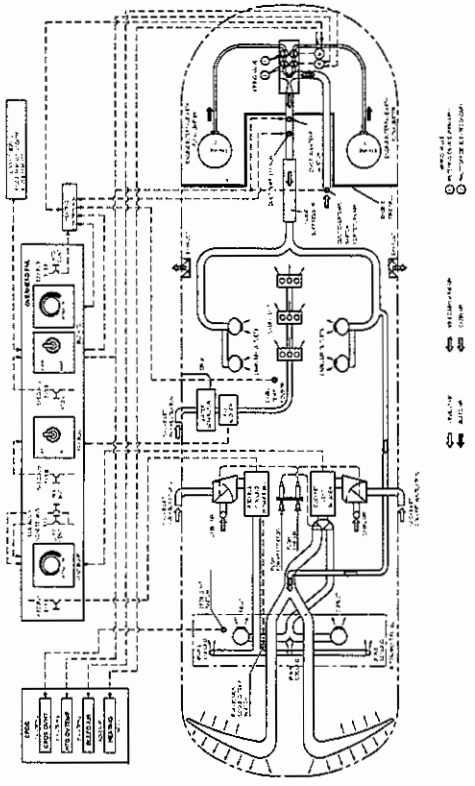


Figure 7-28 Typical heating/ ventilation system – schematic

7.16 **LIGHTING EQUIPMENT** (see fig. 7-29)

7.16.1 **Standard lights**

7.16.1.1 Emergency lighting

Three exit signs, two stairway lights and two EMER EXIT PAX lights are supplied with power via ESS BUS I and the cb EM/EX LIGHTS, located on the overhead panel. They are controlled by means of the EM/EX LIGHTS sw which is also located in the overhead panel.

Position OFF	all lights off
Position ARM	lighting will be switched on in case of:
	– activation of the impact switch
	– opened door(s)
	– EMER EXIT PAX LT sw in the cabin is activated
	– activation of the PAX LT sw (beside the EMER EXIT PAX lights)
	– ESS BUS I power supply break down (emergency power supply)
	– CAR/PAX sw ON –> EMER PAX lights on
Position ON	all lights on

NOTE Press the EM/EX LIGHTS cb and the BAT EM/EX LT cb simultaneously.

7.16.1.2 Cargo dome light

The cargo dome light receives power via SHED BUS I and the CARGO PAX LT cb located on the overhead panel. It is controlled by means of the CAR/PAX LIGHTS switch located on the overhead panel and the CARGO PAX LT sw, located beside the light.

Position OFF	cargo dome light off
Position PAX	light will be switched on in case of:
	– activation of the CARGO DOME light sw (beside the dome light)
Position ON	– Cargo dome light on
	– EMER EXIT PAX lights on

7.16.1.3 Reading lights (optional)

The six passenger reading lights are supplied with power via SHED BUS I and the CARGO PAX LT cb located on the overhead panel. They are controlled by means of the CAR/PAX LIGHTS switch also located in the overhead panel and the PAX LT switch beside each pax light.

Position OFF	all lights off
Position PAX	light will be switched on in case of:
	– activation of the PAX LT sw (beside each pax light)

Position ON	– all reading lights on
	– EMER EXIT PAX lights on
	– Cargo dome light on

7.16.2 **NVG compatible lights (optional)**

For NVG mode the INSTR LIGHTS sw (on the overhead panel) has to be in NVG position.

7.16.2.1 Emergency lighting

The two NVG compatible EMER EXIT PAX lights are supplied with power via ESS BUS II and the EM/EX LIGHTS cb located on the overhead panel. They are controlled by means of the EM/EX LIGHTS sw which is also located in the overhead panel.

Position OFF	all lights off
Position ARM	lighting will be switched on in case of:
	– activation of the impact switch
	– EMER EXIT PAX LT sw in the cabin is activated
	– activation of the PAX LT sw (beside the EMER EXIT PAX lights)
	– ESS BUS I power supply break down
Position ON	all lights on

NOTE Press the EM/EX LIGHTS cb and the BAT EM/EX LT cb simultaneously.

7.16.2.2 Cargo dome light

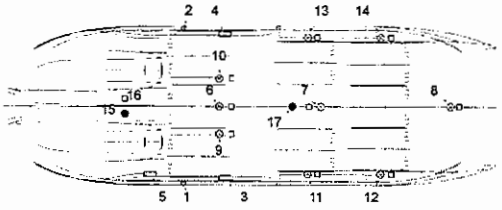
The cargo dome light receives power via SHED BUS I and the CARGO PAX LT cb located on the overhead panel. It is controlled by means of the CAR/PAX LIGHTS sw located on the overhead panel and the CAR PAX LT sw, located beside the light.

Position OFF	cargo dome light off
Position PAX	light will be switched on in case of:
	– CAR PAX LT sw is switched on (beside each pax light)
Position ON	Cargo dome light on

7.16.2.3 Reading lights (optional)

The six passenger reading lights are supplied with power via SHED BUS I and the CARGO PAX LT cb located on the overhead panel. They are controlled by means of the CARGO/PAX LIGHTS switch also located in the overhead panel and the PAX LT switch beside each pax light.

Position OFF	all lights off
Position PAX	light will be switched on in case of:
	– activation of the PAX LT sw (beside each pax light)
Position ON	– all NVG compatible reading lights on
	– Cargo dome light on



1,2	STAIRWAY LIGHT
3,4,5	EXIT SIGN LIGHT
6,7	EMER EXIT PAX LIGHT
8	CARGO DOME LIGHT
9 to 14	READING LIGHT
15	EM/EX LIGHTS sw
16	CABIN LT sw
17	EMER EXIT PAX LT sw

Figure 7-29 Typical lighting equipment

7.17 **WINDSHIELD WIPER**

The windshield wiper is installed in front of the cockpit screens. It is supplied with power via the WIPER circuit breaker, located on overhead panel (see fig. 7-4).

The wiper is controlled by the WIPER switch, located on the overhead switch panel (see fig. 7-5) with the positions OFF, SLW and FAST. In position OFF, the wiper can be activated in the slow mode through the WIPER pb, located on the collective lever grip (see fig. 7-10), as long as the pb is pressed.

7.18 NEW MAP HOLDER (OPTIONAL)

If the new map holder with dimmable green and white light is installed glare and reflections may occur (depending on dimm status) in the upper windshields.

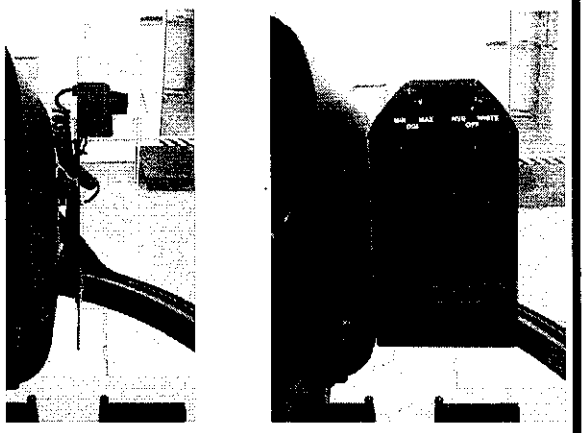
NOTE During visual final approach the map holder should be retracted and the light of the map holder should be switched off.

Two switches are installed on the map holder. One switch with dimming function and on switch with three positions:

– NVG for NVG operation

– OFF

– WHITE for normal white light operation



Retracted position

Figure 7-30 New map holder

7.19 CENTRAL PANEL DISPLAY SYSTEM (CPDS)

The Central Panel Display System (see fig. 7-31) is an electronic indicating system and presents various parameters of the on-board systems on three screens.

The CPDS consists of:

– Caution and Advisory Display (CAD)

– Vehicle and Engine Monitoring Display (VEMD)

– Control switches and circuit breakers

7.19.1 CAD

The CAD displays cautions, advisory messages and fuel system indications. If the VEMD fails the CAD displays selected parameters from it.

7.19.2 VEMD

The VEMD displays engine and dynamic system parameters. In addition, it can present data relating to on-board systems (e.g. aircraft electrical system) and optional equipment (e.g. cargo hook).

If the CAD fails, the VEMD displays selected cautions.

The duplex configuration of the VEMD provides redundancy so that each of the two processing modules are individually capable of taking over all tasks.

7.19.3 Control switches

The CPDS is switched on when the BAT MSTR sw is switched ON.

The 3-way DSPLY test sw (overhead panel) provides the following functions:

– Position "NORM" enables normal function of the CPDS

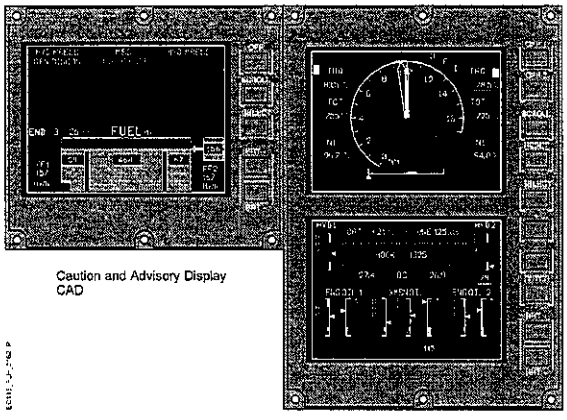
– Postion "CPDS" triggers the CPDS to display the test page with complete color spectrum and software version

– Position "WU" (warning unit) triggers the CPDS to display F PUMP JET caution together with MASTER caution light including all warnings on the warning panel.

The RESET switch (cyclic stick) is used by the pilot/copilot to:

– acknowledge displayed cautions, and

– resets the MASTER caution light and audio warnings except ROTOR RPM audio signal at 110 % or above (steady high-pitch tone).



Caution and Advisory Display
CAD

Vehicle and Engine Monitoring Display
VEMD

Figure 7-31 Central Panel Display System

7.19.4 CAD operation keys

Key	Function
OFF	Switches CAD off/on
SCROLL	Selects different screen pages and individual data fields
SELECT	Acknowledges new caution (resets MASTER caution light and deletes the flashing bars of the caution)
BRT +	Increases brightness of the screen
BRT –	Decreases brightness of the screen

7.19.5 VEMD operation keys

Key	Function
OFF 1	Switches upper screen and processing module 1 off/on
OFF 2	Switches lower screen and processing module 2 off/on
SCROLL	Cycles to next page, depending on operation mode and status
RESET	Leaves the flight report page Returns to nominal configuration/ returns to previous page in maintenance mode
SELECT	Selects a particular data field
+/–	Change of selection of a data field
ENTER	Acknowledges selection of a data field
BRT +	Increases brightness of the screen
BRT –	Decreases brightness of the screen

7.19.6 CPDS function modes

The CPDS can be operated in three modes:

– the FLIGHT mode

– the MAINTENANCE mode (only on ground)

– the CONFIGURATION mode (only on ground)

7.19.6.1 FLIGHT mode

The FLIGHT mode provides informations (displayed on both VEMD and CAD screens) to the crew in each phase of the flight.

FLIGHT mode page combinations:

– First limit page	FLI
– Engine and electrical system parameter page	ELEC/VEH
– System status and failure page	SYSTEM STATUS
– Flight report page	FLIGHT REPORT
– Caution and fuel page	CAU/FUEL
– Caution and backup page	CAU/BACKUP

<u>The First Limit Page (FLI)</u>

For description refer to section 2 of the basic FLM.

The flight report page (FLIGHT REPORT)

The flight report page is displayed automatically after engine shutdown on ground on the lower VEMD screen or, in case of screen failure on another valid screen. It is left by pressing the RESET key or switching BAT MSTR sw OFF

Flight duration is the time when the helicopter is in "Flight Status".

Flight status:

- N1 engine 1 or N1 engine 2 > 50%, and
- XMSN oil pressure 1 or XMSN oil pressure 2 > 1 bar, and
- TRQ1 + TRQ2 > 50%

The MM OVERLIMIT DETECTED will come on upon reaching the mast moment limit.

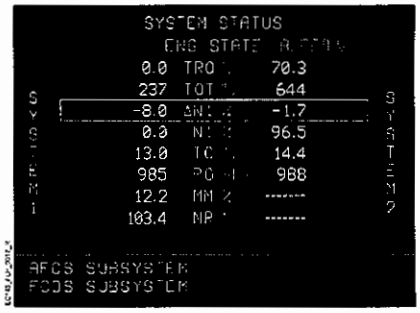
The FAILURE CPDS, FCDS, AFCS appears when the appropriate system does not work normal.

Figure 7-32 FLIGHT REPORT page

The system status and failure page (SYSTEM STATUS)

The system status page displays data from the respective engines on the VEMD lower screen and is called up by the scroll key.

A selection box is displayed automatically arround the ENG State field (high information zone) when the page is selected. The "+" and "–" keys scroll between the various present engine states in the engine states field. The SELECT key moves the selection box to the first respectivly next parameter line. The "+" and "–" keys have no effect when a parameter line is selected. On the last parameter line (NR) the SELECT key moves the selection box back to the ENG STATE field. The Low information zone shows the status of the AFCS and FCDS. When the low information zone is blank the AFCS and FCDS operate normal.



SYSTEM STATUS		
High information zone		
TRQ	%	Torque indication
TOT	°C	Turbine outlet temperature
ΔN1	%	Delta N1 indication
N1	%	Gas producer N1 RPM
T0	°C	Air temperature
P0	hPa	Ambient air pressure
MM	%	Mast moment indication
NR	%	Rotor RPM
Low information zone		

Figure 7-33 SYSTEM STATUS page

The engine and electrical system parameter page (ELEC/VEH)

The parameters of the engine , main gear box, hydraulic system, electrical system and additional indications are displayed automatically on the lower VEMD screen and may be displayed on the CAD screen in case of VEMD lane 2 failure.

The units for the various parameters and the configuration of optional equipment can be changed as described in 7.19.6.3 CONFIGURATION mode.

When the CPDS is switched on the VNE arrow is pointing up and indicates the VNE in an digital value in reference to the maximum gross mass. The VNE value in reference to the gross mass can be changed to a low gross mass (≤3000kg) by using the " +" and "–" keys.

The selectable digital values below the bar graphs will be displayed after switching on the CPDS and if the values are outside the normal operating range.

The SELECT key toggels between the VNE box, DC V box and the digital values below the bar graphs.

When a box or digital value is selected the content can be modified by pressing the " +" and "–" keys and must be confirmed by pressing ENTER key. The ENTER key must be pressed within 5 seconds otherwise the content will return to the previous state.

For detailed information about the bar graph display for temperature and pressure refer to section 2, para 2.17 of the basic FLM.

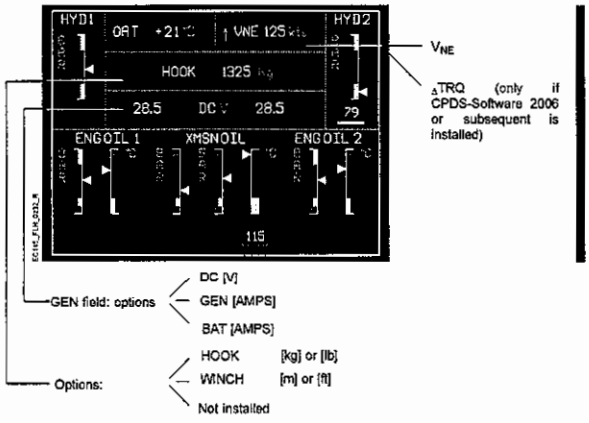


Figure 7-34 ELEC/VEH page

The ΔTRQ is the calculated difference between the actual, indicated torque and the max. torque available for TOP in hover flight, at the same OAT and pressure altitude conditions.

The ΔTRQ indication shows the value for each (one) engine.

The ΔTRQ indication is calculated under the assumption that bleed air heating is OFF.

The ΔTRQ indication is only available if:

- AEO and IAS < 50 kts (upward hysteresis 5kts), IAS must be valid
- and H/C not on ground
- and H/C P0 / T0 sensor source configured to FCDS or FCDS/AFCS

NOTE The ΔTRQ indication values are non-approved performance data (information only).

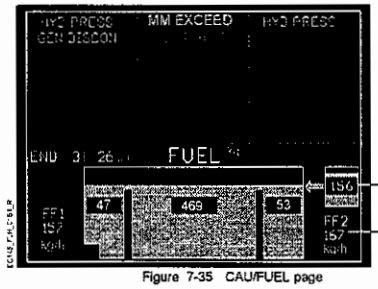
The caution and fuel page (CAU/FUEL)

The aquisition of the fuel parameters is only performed on the CAD; they are no longer available in case of CAD failure.

The units for the various parameters on this page can be changed as described in 7.19.6.3 CONFIGURATION mode.The indication of fuel flow, flight time remaining and auxiliary fuel tank content depend on installed optionals (refer to appropriate FLM supplement).

The supply tank color (see fig. 7-35) changes from blue to amber when the supply tank begins to dump fuel.

For additional informations refer to section 3 of the FLM.



If auxiliary fuel tank installed (optional)

Fuel flow indication (optional)

Figure 7-35 CAU/FUEL page

The caution and backup page (CAU/BACKUP)

The caution and backup page is displayed on the CAD screen when both VEMD lanes are not available or has been deactivated.

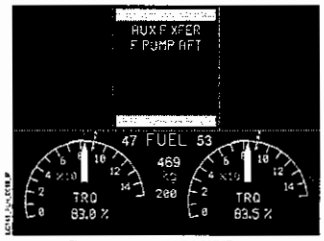
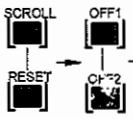


Figure 7-36 CAU/BACKUP page

7.19.6.2 MAINTENANCE mode

The maintenance mode displayed on the upper screen of the VEMD can only be activated when engine is detected in the "shut down" state.

The VEMD must switched off to activate the maintenance mode. Thereafter press and hold simultaenously SCROLL and RESET then press the OFF1 (lane 1) and OFF2 (lane2) keys (within 2 seconds), hold SCROLL and RESET until indication RELEASE KEY appears.



maintanence menue is displayed

Use SELECT key to scroll through the fields.

The ENTER key leads to submenus and the RESET key to leave the maintenance mode.

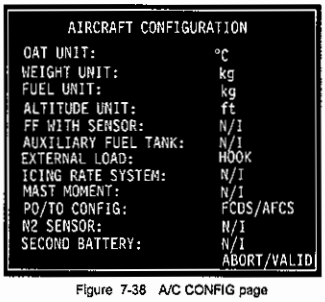
Figure 7-37 MAINTENANCE MENU page

NOTE FLIGHT REPORT is not identical to the FLIGHT REPORT page which appears after engine shutdown. It contains informations about the last 32 flights.

For detailed information concerning MAINTENANCE MENU pages refer to the respective chapter of the maintenance manual.

7.19.6.3 CONFIGURATION mode

The CONFIGURATION mode displayed on the upper screen of the VEMD can only be activated when engine is detected in the "shut down" state.

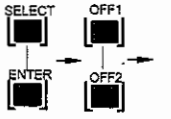


different units of measure can be selected (e.g. °C or °F...)

N/I not installed/installed

Figure 7-38 A/C CONFIG page

The VEMD must switched off to activate the configuration mode. Thereafter press and hold simultaenously SELECT and ENTER keys then press the OFF1 (lane 1) and OFF2 (lane2) keys (within 2 seconds), hold SELECT and ENTER until indication RELEASE KEY appears.



configuration menu is displayed

Procedure to modify or configure the parameters:

To scroll through the fields use SELECT key. Thereafter the "+" and "–" keys are used to modify or configure the appropriate parameters. The use of the SELECT key again leads to validation or leaving the modifcation/configuration procedure. The ENTER key leads to leave the configuration mode.

7.19.7 **CPDS malfunction modes**

For detailed description refer to the basic FLM section 3 para 3.3. .

SECTION 8

HANDLING, SERVICE, MAINTENANCE

TABLE OF CONTENTS

LIST OF FIGURES

SECTION 8

HANDLING, SERVICE, MAINTENANCE

8.1 GENERAL

This section describes ways an operator can ensure that the necessary handling, servicing and maintenance of the helicopter are accomplished.

NOTE It is the operator's responsibility to ensure that all airworthiness directives are complied with and that the handling, servicing and maintenance of the helicopter are accomplished when required and in accordance with the applicable Aviation Regulations.

In order to meet the above requirements, the helicopter operator should establish contact with the helicopter manufacturer or certified service station for service and information; and that all correspondence regarding the helicopter include the helicopter serial number found on the data plate secured to the RH fuselage structure. Helicopter and component maintenance manuals, and parts catalogs are available from the helicopter manufacturer.

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

8.2 REFUELING

8.2.1 Refueling with anti–icing additives

NOTE
- Follow the anti-icing additive manufacturer's instructions.
- Before refueling, when using anti-icing additive, it is required to have 50 kg fuel in the main tank.
- The operator must ensure that the fuel contains the permissible concentration of anti-icing additive.

Normal refueling:

- Hold or attach the tube of the additive spray at the filler neck in such a way that the additive mixes directly with the fuel flow.
- During refueling, spray the calculated additive quantity at even intervals so that the amount of additive is spread evenly throughout the fuel quantity. Stop spraying when 20kg of fuel are still to be filled.

Barrel or gas can refueling:

- Use a fuel screen.
- The procedure as for "normal refueling" is to be followed at all times.
- If "normal refueling" is not possible, barrel or can refueling with anti-icing additive is not permissible.

8.3 DRAINAGE PROCEDURE

NOTE Accomplishment of the drainage procedure is always necessary before every first flight of the day (see basic FLM, section 4).

If the helicopter is parked for longer than a week and the main tank and the supply tank still contain either fuel to which anti–ice additive has been mixed by hand or fuel which had been preblended with anti–ice additive, the following drainage procedure is to be accomplished at **least once a week.**
Additionally, in this case, the drainage procedure has to be accomplished again **before the next flight.**

8.3.1 Drainage procedure for removal of water accumulation from the main tank and from the supply tank:

WARNING
- FUEL IS TOXIC AND DAMAGING TO HEALTH IF IT COMES INTO CONTACT WITH SKIN OR EYES OR IF FUEL VAPOURS ARE INHALED. THE APPLICABLE SAFETY REGULATIONS FOR HANDLING OF HAZARDOUS AND OF TOXIC MATERIALS HAVE TO BE OBSERVED.
- TO PREVENT THE HAZARD OF FIRE AND EXPLOSION DUE TO SPARKING RESULTING FROM STATIC CHARGES, ALWAYS ESTABLISH THE SPECIFIED ELECTRICAL GROUND CONNECTIONS BEFORE STARTING DRAINING AND DO NOT REMOVE THEM UNTIL DRAINING HAS BEEN FINISHED.

- For draining purposes, park helicopter on horizontal, even ground and place a suitable grounded spillage container at the ready.
- Place a fire extinguisher at the ready near to the helicopter.
- Before starting drainage, connect ground connections from the helicopter to the grounding point and to the drain tool and, if an alternative spillage container made of electrically conducting material is used, establish a ground connection to it as well.(see Fig.1)

NOTE Drainage is to be accomplished equally on all drain valves of the main tank and of the supply tank. To make sure that all accumulations of water are completely eliminated, the quantity of fuel/water mixture tapped off should not be less than 0.4 litres per tapping point.
It is preferable to use the drain tool P/N 000.117 provided on helicopter delivery. To help determine the amount tapped off, it is useful to make a level indicator mark.
To ease identification of the drain tool, it is recommended to mark it in the course of the initial accomplishment of the drainage procedure i.a.w. the work steps described below using the drain tool P/N 000.117.
If the alternative drain tool P/N B13990 is used, the drain tool is briefly connected via a defueling hose to the drain valve by means of a bayonet catch through the openings in the forward and aft tank covers of the main tank and through those in the cover of the supply tank

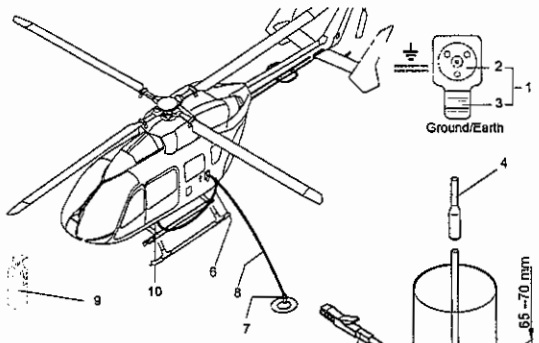
- Using a vibrograph or a permanent marking pen, mark P/N 000.117 on the underside of the baseplate. If permanent marking ink is used, apply colourless lacquer to protect the marking.

- If desired, level indication markings can be made as a measurement aid on the transparent beaker of the drain tool as follows:
  - first marking on beaker at a height of approx. 65 to 70 mm above the baseplate of the drain tool (reference datum level is the upper surface of the baseplate outside the beaker part)
  - second and, possibly third marking at a distance of approx. 50 mm respectively above the respective next lower marking.

- If drain tool (5) is not used, place a grounded spillage container, if applicable, at the ready beneath the respective drain valve and place the end of the defueling hose into this spillage container.

- Pass the pressure pin of the drain tool P/N 000.117 through the openings in the forward and aft covers of the fuel main tank and through those of the supply tank, press it upwards and tap off the fluid.
  If the alternative drain tool P/N B13990 is used, insert its connecting piece, with the defueling hose attached, into the drain valve and lock it by means of the bayonet catch. In doing this, make sure that the tapping process only runs for a short time since the flow rate is high and the desired quantity is quickly collected.
  The tapped quantity of fuel per tapping point must be at least 0.4 litres.

- Dispose of fuel/water mixture in an environmentally compatible manner.

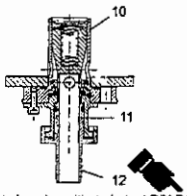


1 Ground connection on helicopter
2 Ground bushing
3 Ground connection plate
4 Extension adapter(only necessary for h/c with external cargo hook (P/N 000.117.01)
5 Drain tool (P/N 000.117)
6 Ground cable for spillage container
7 Grounding point
8 Ground cable to helicopter
9 Fire extinguisher
10 Drain valve

Minimum quantity per tapping point is 0.4 litres. This corresponds to a filling level of approx. 65 – 70 mm in drain tool P/N 000.117.

If drain tool P/N B13990 is used:

11 Defueling tool/Drain tool
12 Connection point for defueling hose



Cross–sectional view of drain valve with drain tool P/N B13990

Fig.1 Accessories and Details for Drainage Process

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SECTION 10

OPERATIONAL TIPS

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SECTION 10

OPERATIONAL TIPS

10.1 GUIDELINES FOR LOW NOISE OPERATIONS

The following guidelines are used to operate the BK 117 C-2 in noise sensitive areas. These guidelines are recommendations only. The flight procedures remain under the pilot's responsibility, according to flight manual limitations and local regulation restrictions.

NOTE The BK117 C-2 is compliant with the limitation of American National Park when flying above 720 ft AGL with 10 passengers on board (800 ft with 9 passengers).

10.1.1 General

Adopt a flight path as far as possible from sensitive areas.

Maintain as much as possible a steady flight avoiding large pedal movements or overcontrol.

For flights over sensitive areas prefer a flight path along the noisiest route (motorway, railway, etc.).

Leave the sensitive area as much as possible on the left hand side of the helicopter.

10.1.2 Operating in sensitive areas

Take-off and climb

After the shortest possible acceleration segment, once V_Y is reached, climb at Take-off Power (TOP) maintaining V_Y to reach the best rate of climb.

Overflights

When crossing noise-sensitive areas maximum V_{IAS}= 110 kts or V_{NE} whichever is less.

If possible increase the height AGL to lower the noise effect.

Where possible fly at least 1000 ft AGL.

Approach and landing on helipad

Use an V_Y = 65 kts with a rate of descent approx. 1100 ft/min. Maintain the airspeed of 65 kts as long as possible. Final approach according to FLM Section 4.

10.1.3 Take-off and landing from/to a helipad in a non sensitive area but adjacent to neighbouring sensitive areas (seaside areas for example)

If possible select a take-off flight path opposite to the sensitive area. Accelerate until V_Y is reached, then start to climb at V_Y with TOP in order to achieve the best rate of climb.

If possible for landing adopt a flight path facing the sensitive area. Use V_Y with a rate of descent close to 500 ft/min. Final approach according to FLM Section 4.

10.1.4 Maneuver near the ground (hovering)

Avoid unnecessary hovering.

Avoid quick and repetitive pedal movements

Prefer left turns.

10.1.5 Atmospheric wind effect

Adopt a flight path leading to the lee side of the sensitive area.

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SUBSECTION 9.0

EQUIPMENT COMPATIBILITY AND ADDITIONAL PERFORMANCE DATA

EQUIPMENT COMPATIBILITY

FMS	**Not compatible (bold),** *partly compatible (italic)* with FMS... (for detailed information refer to the appropriate FMS)
9.1–1 Category A operations	*9.1–2*
9.1–2 Operation with opened/removed doors	*9.1–1*
9.1–3 OEI training	
9.1–4 Hover performance/Height loss after engine failure	
9.2–1 AFCS	
9.2–2 Fuel management system	
9.2–4 Hook mirror	*9.2–13, 9.2–20, 9.2–29*
9.2–6 Dual control pedal cover	
9.2–7 Dual controls	
9.2–8 SPIFR/DPFIR operation kit (incl. AFCS)	
9.2–9 Emergency floatation systems	*9.2–23, 9.2–32, 9.2–34*
9.2–10 External cargo hook	
9.2–11 External hoist system	
9.2–12 External loudspeakers	
9.2–13 Fixed LDG light(s) 250 W (Cross tube)	*9.2–4*
9.2–14 FCDS	
9.2–15 Pulsed chip detector system	
9.2–16 Auxiliary fuel tank	
9.2–17 NMS (CMA 3000)	
9.2–18 Special cockpit lighting	
9.2–20 S&L light 400W/200W(IR)	*9.2–4*
9.2–21 Rotor brake system	
9.2–22 Sandfilter system	**9.2–50**
9.2–23 Searchlight SX-16(IR) (LH mounted)	*9.2–29, 9.2–9*
9.2–24 Seat arrangement	
9.2–25 Settling protectors	**9.2–26**

9.2–26 Snow skids	**9.2–25**
9.2–27 Utility seat bench	
9.2–28 Weather radar system RDR 1400C	*9.2–29*
9.2–29 WSPS	*9.2–4, 9.2–23, 9.2–28, 9.2–35, 9.2–46, 9.2–61, 9.2–56, 9.2–67, 9.2–70*
9.2–30 YAW SAS	
9.2–31 M'ARMS	
9.2–32 Pilot/Copilot door jettisoning	*9.2–9*
9.2–33 EMS–equipment (Aerolite)	
9.2–34 Sliding door jettisoning	*9.2–9*
9.2–35 FLIR Ultraforce II	*9.2–29*, **9.2–61, 9.2–56, 9.2–67, 9.2–70**
9.2–36 Tail floodlight	
9.2–37 GPS Freeflight 2101 I/O	
9.2–38 Dual external cargo hook	
9.2–39 EuroNav III	
9.2–40 AHRS Free Steering Mode	
9.2–41 Main Rotor Blade Folding Kit	
9.2–42 Scavenge Oil Filter	
9.2–43 Garmin GNS 430/430A	
9.2–44 HF Communication system	
9.2–45 Push out window	
9.2–46 Weather Radar system RDR1600	*9.2–29*
9.2–48 Night Vision Imaging Systems	
9.2–50 Sandfilter (IBF–System)	**9.2–22**
9.2–52 Weather Radar system RDR2000	*9.2–29*
9.2–53 EGPWS	
9.2–54 Smoke Detector	
9.2–55 HF 9000	*9.2–8*
9.2–56 EOS WESCAM MX15i/HDi	*9.2–29*, **9.2–35, 9.2–61, 9.2–67, 9.2–70**
9.2–57 Self-sealing Supply Tank	
9.2–58 Rotor Brake System for H/C S/N 9311 and subsequent	**9.2–21**
9.2–61 Centerline Camera Carrier System	*9.2–29*, **9.2–35, 9.2–67, 9.2–56, 9.2–70**
9.2–62 Keeperless External Cargo Hook	
9.2–65 Comfort seat installation	
9.2–67 EOS WESCAM MX10	*9.2–29*, **9.2–35, 9.2–61, 9.2–56, 9.2–70**
9.2–70 EOS Star Safire 380HD	*9.2–29*, **9.2–35, 9.2–61, 9.2–56, 9.2–67,**

EFFECT OF THE EQUIPMENT ON THE LEVEL FLIGHT PERFORMANCE

AEO PERFORMANCE

Equipment installed	FLM/ FMS	Max. horizontal speed			Economic cruise speed			Max. endurance	
		Speed KTAS	Fuel cons.	Range	Speed KTAS	Fuel cons.	Range	Fuel cons.	Endurance
Bleed air heating	FLM	–	+2%	–2%	–	+2%	–2%	+2%	–2%
Sandfilter system (filter mode)	9.2–22	Chart	+1.5%	–1.5%	–	+1.5%	–1.5%	+1%	–1%
Sandfilter system (bypass mode)		Chart	+1%	–1%	–	+1%	–1%	+0.5%	–0.5%
Sandfilter (BF–System) (Sandfilter–NORM)	9.2–50	Chart	+3.5%	–3.5%	–	+2.5%	–2.5%	+1.5%	–1.5%
Sandfilter (BF–System) (Sandfilter–OFF)		Chart	+2.5%	–2.5%	–	+2%	–2%	+1.5%	–1.5%
Cargo hook mirror	9.2–4	–3.5	–	–3%	–3.5	–	–3%	+1%	–1%
Emergency float. system	9.2–9	–4	–	–3%	–4	–	–3%	+1%	–1%
External hoist system	9.2–11	–2	–	–2%	–2	–	–2%	+0.5%	–0.5%
External loudspeakers	9.2–12	–3.5	–	–3%	–3.5	–	–3%	+1%	–1%
FLIR Ultraforce II	9.2–35	–2.5	–	–2%	–2.5	–	–2%	+0.5%	–0.5%
EOS WESCAM MX15/HDI	9.2–56	–4	–	–3%	–4	–	–3%	+1%	–1%
Centaline Camera Carrier System with FLIR MX15/HDI installed	9.2–61	–2.5	–	–2%	–2.5	–	–2%	+0.5%	–0.5%
EOS WESCAM MX10	9.2–67	–1	–	–1%	–1	–	–1%	–	–
EOS STAR SAFIRE 380–HD	9.2–70	–2	–	–2%	–2	–	–2%	+0.5%	–0.5%
Searchlight SX–16(IR) LH	9.2–23	–6	–	–4.5%	–5.5	–	–4.5%	+1.5%	–1.5%
hinged doors in spoiler position and sliding doors open	9.1–2	–5.5	+5.5% [1]	–5.5%	–	–	–	+1.5%	–1.5%
hinged doors removed or closed or in spoiler position and sliding doors removed	9.1–2	–5.5	–	–5.5%	–4.5	+0.5	–4.0	+1.5%	–1.5%
All doors removed	9.1–2	–8.0	–	–8.0%	–7.0	+1.0	–6.5	+1.5%	–1.5%

[1] increase of fuel consumption: only at V_{NE} limit for operation with open doors = 100 KIAS (Power required lower then AEO MCP)

NOTE All other optional equipment, presented in chapter 9.2, but not included in this lists, has no or negligible influence on the level flight performance.

OEI PERFORMANCE

Equipment installed	FLM/ FMS	Max. horizontal speed			Max. endurance	
		Speed KTAS	Fuel cons.	Range	Fuel cons.	Endurance
Bleed air heating	FLM	–	+3.5%	–3.5%	+3.5%	–3.5%
Sand filter (filter mode)	9.2–22	–6	+1.5%	–1.5%	+1%	–1%
Sand filter (bypass mode)		–4	+1%	–1%	+0.5%	–0.5%
Sand filter (BF–System) (Sandfilter–NORM)	9.2–50	Chart	+5.5%	–5.5%	+4.5%	–4.5%
Sand filter (BF–System) (Sandfilter–OFF)		Chart	+4.0%	–4%	+3.5%	–3.5%
Cargo hook mirror	9.2–4	–4	+4% [1]	–4.5%	+2%	–2%
Emergency float. system	9.2–9	–4.5	+4.5% [1]	–5%	+2%	–2%
External hoist system	9.2–11	–2.5	+2.5% [1]	–2.5%	+1%	–1%
External loudspeakers	9.2–12	–4	+4% [1]	–4.5%	+2%	–2%
FLIR Ultraforce II	9.2–35	–3	+3% [1]	–3%	+1%	–1%
EOS WESCAM MX15/HDI	9.2–56	–4.5	+4.5% [1]	–5%	+2%	–2%
Centaline Camera Carrier System with FLIR MX15/HDI installed	9.2–61	–3	+3% [1]	–3%	+1%	–1%
EOS WESCAM MX10	9.2–67	–1	+1% [1]	–1%	–	–
EOS STAR SAFIRE 380–HD	9.2–70	–2.5	+2.5% [1]	–2.5%	+1%	–1%
Searchlight SX–16(IR) LH	9.2–23	–7	–	–7.5%	+3.5%	–3.5%
Hinged doors in spoiler position and sliding doors open	9.1–2	–6	+5.5% [2]	–6.5%	+3%	–3%
Hinged doors removed or closed or in spoiler position and sliding doors removed	9.1–2	–0	–	–6.5%	+3%	–3%
All doors removed	9.1–2	–8.5	–	–8.0%	+2%	–2%

[1] increase of fuel consumption: only at V_{NE} limit for OEI condition = 110 KIAS (Power required lower than OEI MCP)

[2] increase of fuel consumption: only at V_{NE} limit for operation with open doors = 100 KIAS (Power required lower than OEI MCP)

NOTE All other optional equipment, presented in chapter 9.2, but not included in this lists, has no or negligible influence on the level flight performance.

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SUBSECTION 9.1

OPTIONAL EQUIPMENT

LOG OF SUPPLEMENTS

Note: Since September 28, 2003 all already existing FMS are certified by the new founded European Aviation Safety Agency (EASA).

NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
CAT A operation	9.1–1	LBA, Dec 2001 FAA, Jan 2004 IAC-AR, Dec 2005	Revision 13
Operation with opened/removed doors	9.1–2	LBA, Nov 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 9
OEI Training	9.1–3	LBA, Mar, 2002 FAA, Jan 2004 IAC-AR, Dec 2005	Revision 6
Hover performance/height loss after engine failure	9.1–4	LBA, Mar, 2002 FAA, pending IAC-AR, Dec 2005	Revision 6

F M S 9.1–1

SUPPLEMENT FOR

CATEGORY A OPERATIONS

When operating the helicopter in CATEGORY A, this supplement shall be attached to the BK117 C-2 Flight Manual (Section 9).

NOTE Due to the nature of its content, this supplement is divided into five separate, related subsections that first present General Data applicable to all Category A Operations and then specific data applicable to approved types of operation.

Date: 15. Jan. 02

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
	9.1-1 -1	–		9.1-1 -40	8		9.1-1 -79	8	
R	9.1-1 -2	13		9.1-1 -41	8		9.1-1 -80	9	
R	9.1-1 -3	13		9.1-1 -42	8		9.1-1 -81	8	
	9.1-1 -4	8		9.1-1 -43	8		9.1-1 -82	8	
	9.1-1 -5	8		9.1-1 -44	8		9.1-1 -83	8	
	9.1-1 -6	9		9.1-1 -45	8		9.1-1 -84	8	
	9.1-1 -7	9		9.1-1 -46	9		9.1-1 -85	8	
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A. GENERAL DATA

A.1. GENERAL

A.1.1. INTRODUCTION

The information presented in this supplement - required for Category A operations - complements the information of the approved basic sections 1 through 5. For limitations, procedures and performance data not contained herein refer to the respective preceding sections of this manual.

The information presented in this supplement are required for the following approved types of operations:

- Clear Heliport
- VTOL (1) – Surface Level or Elevated Heliport
- VTOL (2) – Short Field
- VTOL (3) – Confined Heliport

A.1.2. ABBREVIATIONS

AHE	-	Above Heliport Elevation
IP	-	Intermediate Point
LDP	-	Landing Decision Point
TDP	-	Takeoff Decision Point
MAT	-	Mass/Altitude/Temperature
TOGM	-	Takeoff Gross Mass
V_{TOSS}	-	Takeoff Safety Speed
VTOL	-	Vertical Takeoff and Landing

A.1.3. DEFINITIONS

Category A Takeoff is determined so that, if one engine fails at any time after the start of takeoff, the aircraft can

- prior to TDP return to and stop safely on the takeoff area, or
- after TDP continue the takeoff and climb out and attain single-engine forward flight.

Category A Landing is determined so that, if one engine fails at any point in the approach path, the aircraft can

- prior to LDP climb-out from the point of engine failure and attain single-engine forward flight or continue the approach and stop safely on the landing area, or
- after LDP continue the approach and stop safely on the landing area.

Takeoff Decision Point (TDP) is the first point from which a continued takeoff capability is assured and is the last point in the takeoff path from which a rejected takeoff is assured within the determined rejected takeoff distance.

Landing Decision Point (LDP) is the last point in the approach and landing path from which a balked landing can be accomplished.

Continued Takeoff Distance is the horizontal distance along the takeoff flight path from the start of the takeoff to the point at which the helicopter attains and remains at least 35 feet above the takeoff surface, attains and maintains a speed of at least V_{TOSS}, and establishes a positive rate of climb.

Rejected Takeoff Distance is the horizontal distance necessary to stop safely the helicopter when one engine becomes inoperative prior to TDP.

Clear Heliport Landing Distance Required is the horizontal distance necessary for a helicopter with one engine inoperative to land and come to a complete stop from a point 50 ft above the landing surface.

Takeoff Segment I Distance is the horizontal distance necessary to climb with V_{TOSS} from the end of the continued takeoff distance to 200 ft AGL.

Takeoff Segment II Distance is the horizontal distance necessary to climb with V_Y from 200 ft to 1000 ft AGL.

Takeoff Safety Speed (V_{TOSS}) means a referenced airspeed obtained after takeoff at which the required one–engine–inoperative climb performance can be achieved (steady R/C of at least 100 ft/min with 2.5 min power (OEI) 200 ft AHE).

V_{TOSS} = 45 KIAS

Best Rate-of-climb Speed (V_Y) means speed for best rate of climb.

V_Y = 65 KIAS

A.2. LIMITATIONS

A.2.1. POWER CHECK

Category A operations are prohibited if power check is not satisfactory. Power check shall be accomplished at intervals not exceeding 100 flying hours. A power trend monitoring shall be established.

A.2.2. CONFIGURATION

A.2.2.1. Configuration requirements

When operating the helicopter in CAT A, the below listed configuration requirements must be fullfilled.

System/Equipment Designation	Remark
Radar altimeter	
additional for night operation:	
Search and landing light	FMS 9.2-20

A.2.2.2. Operational compatibility

For Category A operations by night an optional installed Cargo Hook Mirror (FMS 9.2-4) must be removed or covered.

Category A takeoff and landing is prohibited when flying with opened/removed doors.

Cat. A operations by night are prohibited when flying with the FLIR MX-15i/HDi System on the Centerline Camera Carrier System (FMS 9.2-61)

A.2.3. ALTITUDE LIMITATIONS

Maximum operating altitude for CAT A operations is ..... **12000 ft DA or PA whichever is less**

EFFECTIVITY *If the sandfilter (IBF-system), (FMS 9.2-50), is installed*

Maximum altitude for CAT A takeoff and landing:

One or both sandfilters NORM

..... **11000 ft PA or 12000 ft DA whichever is less**

Both sandfilters OFF

..... **11000 ft PA or 12000 ft DA whichever is less**

A.2.4. TEMPERATURE LIMITATIONS

One or both sandfilters NORM

..... **-25°C up to ISA+35°C (max +50°C)**

Both sandfilters OFF

..... **-45°C up to ISA+35°C (max +50°C)**

EFFECTIVITY *All*

A.2.5. WIND LIMITATIONS

Category A takeoff and landing procedures are prohibited for flight conditions with tailwind components.

A.2.6. HEIGHT-VELOCITY ENVELOPE

The height-velocity envelope as shown in section 5 of the basic flight manual must be regarded as limitation.

A.2.7. CAT A OPERATION IN CONJUNCTION WITH IFR OPERATION

Category A takeoff:

Weather conditions must be such that the CAT A takeoff procedure can be followed and the aircraft accelerated to V_Y in VMC.

Category A landing:

Weather conditions must be such that the aircraft can be decelerated from the IFR approach minimums to the CAT A LDP conditions or abort the landing and accelerate back to V_Y in VMC.

A.2.8. FLIGHT ENVELOPE

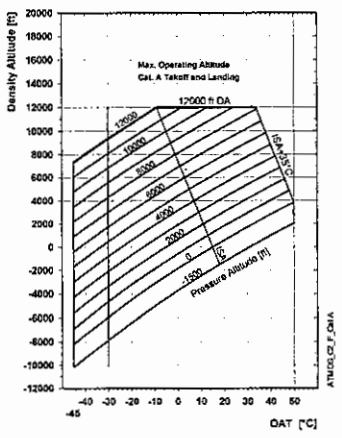

Fig. A1 Flight envelope

A.2.9. HOVER TURNS WITH VARTOMS IN CAT A MODE

The maximum yaw rate is 30deg/s. Aggressive rotational accelerations about the yaw axis are prohibited for density altitudes below 2000 ft.

A.3. EMERGENCY AND MALFUNCTION PROCEDURES

A.3.1. SINGLE ENGINE FAILURE DURING TAKEOFF

If one engine fails prior to TDP the takeoff must be rejected.

If one engine fails after TDP the takeoff must be continued.

A.3.2. SINGLE ENGINE FAILURE PRIOR TO OR DURING LANDING

If one engine fails prior to LDP the pilot may elect to balk the landing or to continue the approach.

If on engine fails after LDP the landing must be continued.

NOTE For detailed information concerning CAT A emergency procedures after an engine failure see para. 3 in the subsections (B-E) of this supplement.

A.4. NORMAL PROCEDURES

NOTE For detailed information concerning CAT A normal procedures see para. 4 in the subsections (B-E) of this supplement.

Power Check - perform as required (refer to section 5 of basic flight manual)

A.5. PERFORMANCE DATA

A.5.1. POWER CHECK

For power check diagrams refer to basic manual, Section 5.

A.5.2. WIND INFORMATION

Wind accountability is UNFACTORED.

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

Controllability for Category A takeoff and landing procedures has been demonstrated for flight conditions with crosswind components up to 17 kt.

A.5.3. OEI CLIMB PERFORMANCE

OEI climb performance charts (see also Section 5 of the basic Flight Manual) are presented for OEI/MCP and 2.5-min power ratings at different airspeeds (V_Y and V_{TOSS}). These charts show height gain data as functions of takeoff pressure altitude, outside air temperature and gross mass.

The "critical engine" in climb conditions is engine 1 (LH). "Critical engine" means the engine whose failure would most adversely affect the performance of the aircraft.

NOTE The height gain charts over a horizontal distance are based on the takeoff altitude. The read out height gains are valid in segment I from the takeoff altitude up to 200 ft above it, and for segment II from the takeoff altitude up to 1000 ft above it.

A.5.3.1. Influence of significant turns during OEI climb

The performance data fig. A2 to fig. A7 apply to climbs without any significant bank angle. The following table shows the reduction in height gain over a horizontal distance of 100 ft in the takeoff climbout flight path (valid for all combinations of gross mass/altitude/OAT):

	Δ Height Gain / OEI ft / 100 ft	
	Bank angle 15°	Bank angle 30°
Segment II 65 KIAS	– 1	– 5

NOTE In segment I a turn limited to 10° bank angle is authorized without change in height gain.

A.5.3.2. OEI climb performance with optional equipment installed

Category A OEI climb performance is influenced by following externally mounted optional equipment:

Optional Equipment	Δ Height Gain GM ≤ 3000 kg	Δ Height Gain GM > 3000 kg
Cargo Hook Mirror (FMS 9.2–4)	– 0.35 ft/100 Ft	– 0.30 ft/100 Ft
Emergency Floats (FMS 9.2–9)	– 0.40 ft/100 Ft	– 0.35 ft/100 Ft
External Hoist System (FMS 9.2–11)	– 0.20 ft/100 Ft	– 0.20 ft/100 Ft
External Loudspeaker (FMS 9.2–12)	– 0.35 ft/100 Ft	– 0.30 ft/100 Ft
FLIR Ultraforce II (FMS 9.2–35)	– 0.25 ft/100 Ft	– 0.20 ft/100 Ft
Sandfilter System (FMS 9.2–22)*	– 2.50 ft/100 Ft	– 2.50 ft/100 Ft
Searchlight SX-16 (Side) (FMS 9.2–23)	– 0.60 ft/100 Ft	– 0.50 ft/100 Ft
Snow Skids (FMS 9.2–26)	–	–
Weather Radar System (FMS 9.2–28)	–	–
Sandfilter (IBF System (FMS 9.2–50)*	– 3.00 ft/100 Ft	– 2.50 ft/100 Ft
EOS Wescam MX 15i/HDI (FMS 9.2–56)	– 0.40 ft/100 Ft	– 0.35 ft/100 Ft
Centerline Camera Carrier System (FMS 9.2–61) with FLIR MX15i/HDI installed	– 0.25 ft/100 Ft	– 0.20 ft/100 Ft
EOS Wescam MX 10 (FMS 9.2–67)	– 0.10 ft/100 Ft	– 0.10 ft/100 Ft
EOS STAR SARIRE 380–HD (FMS 9.2–70)	– 0.20 ft/100 Ft	– 0.20 ft/100 Ft
*** These height gain reduction values are valid when the sandfilter ON (FMS 9.2–22) or NORM (FMS 9.2–50)**		

All results obtained from the OEI climb performance charts are to be corrected using these correction values.

A.5.3.3. HEIGHT GAIN OVER A HORIZONTAL DISTANCE

EXAMPLE: (see Fig. A2)

Determine: **OEI height gain over a horizontal distance of 100 ft (takeoff flight path segment I (35 ft to 200 ft AGL))**

Known:
- Takeoff altitude ..... 4600 ft
- OAT ..... –1 °C
- Gross mass ..... 2350 kg
- Headwind ..... 6 kt
- for calculation 50%; Headwind .. 3 kt
- Airspeed ..... V_{TOSS}
- External Optional Equipment ..... None

Solution: **Height gain = 35.2 ft**

1. Enter chart at known takeoff altitude (4600 ft)
2. Move horizontally right to known OAT (–1°C)
3. Move vertically downwards to reference line.
4. Move further downwards following the gross mass guide lines.
5. Enter chart at known gross mass (2350 kg).
6. Move horizontally right to intersect tracing from above.
7. From point of intersection move vertically downwards to reference line.
8. Move further downwards following the headwind guide lines.
9. Enter chart at known headwind (3 kt).
10. Move horizontally right to intersect tracing from above.
11. From point of intersection move vertically downwards and read height gain over a horizontal distance of 100 ft (35.2 ft).

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CATEGORY A
TAKEOFF FLIGHT PATH SEGMENT I (35 FT TO 200 FT AGL)
HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER (OEI) V_{TOSS} = 45 KIAS

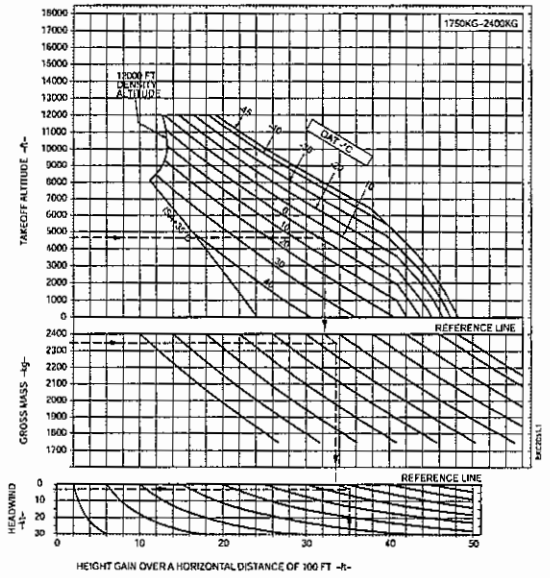

Fig. A2 Takeoff flight path segment I, 35ft to 200ft AGL, Gross Mass 1750kg to 2400kg

CATEGORY A
TAKEOFF FLIGHT PATH SEGMENT I (35 FT TO 200 FT AGL)
HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER (OEI) V_{TOSS} = 45 KIAS

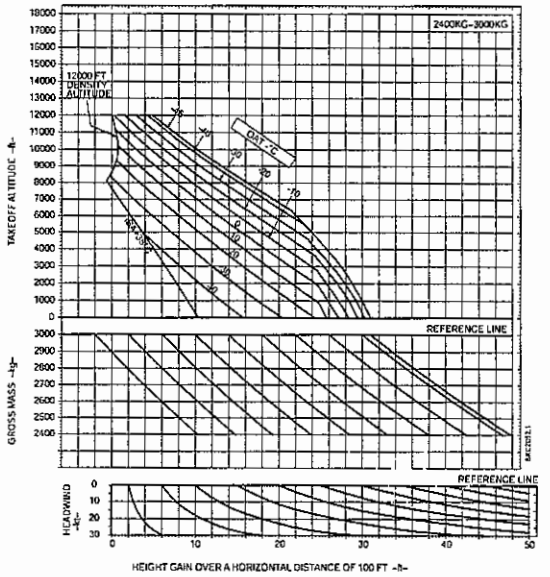

Fig. A3 Takeoff flight path segment I, 35ft to 200ft AGL, Gross Mass 2400kg to 3000kg

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EXAMPLE: Additional example to use Height Gain diagram, with the possibility to verify max. gross mass for a determined climb gradient (see Fig. A4)

Determine: **Maximum gross mass for a climb gradient of 8% (height gain 8 ft over a horizontal distance of 100ft);**
H/C operation at a public interest site

Known:
- Pressure altitude ..... 4000 ft
- OAT ..... 10 °C
- Headwind ..... 0 kt
- for calculation 50%: Headwind .. 0 kt
- Airspeed ..... V_{TOSS}
- External Optional Equipment ..... None

Solution: **Gross mass 3350kg**

1. Enter chart at known pressure altitude (4000 ft)
2. Move horizontally right to known OAT (10°C)
3. Move vertically downwards to reference line.
4. Move further downwards following the gross mass guide lines.
5. Enter lower chart ("HEADWIND/HEIGHT GAIN") at known climb gradient (8%) move vertically upwards
6. Enter lower chart at known headwind (0 kt), move horizontally right to intersect tracing from below.
7. From point of intersection move upwards following the headwind guide lines to reference line (not necessary for 0 headwind) and further vertically upwards to intersect tracing from above.
8. From point of intersection move horizontally left and read maximum gross mass 3350kg.

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CATEGORY A
TAKEOFF FLIGHT PATH SEGMENT I (35 FT TO 200 FT AGL)
HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER (OEI) V_{TOSS} = 45 KIAS

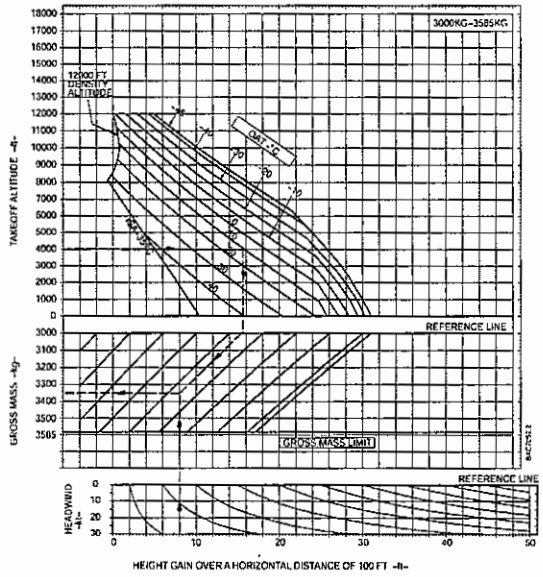

Fig. A4 Takeoff flight path segment I, 35ft to 200ft AGL, Gross Mass 3000kg to 3585kg

CATEGORY A
TAKEOFF FLIGHT PATH SEGMENT II (200 FT TO 1000 FT AGL)
HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

MCP (OEI) V_Y = 65 KIAS

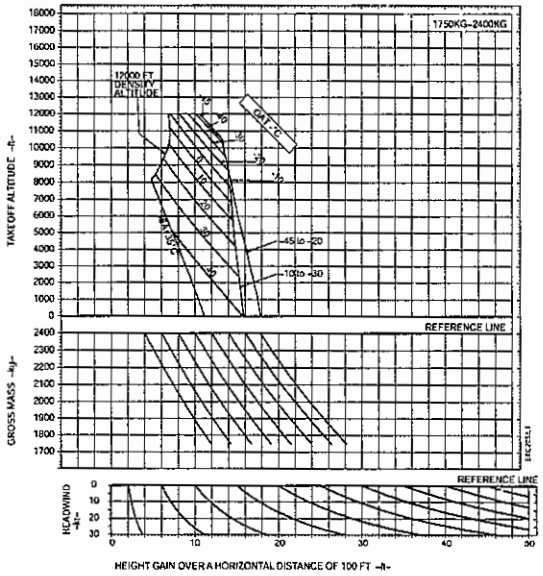

Fig. A5 Takeoff flight path segment II, 200ft to 1000ft AGL, Gross Mass 1750kg to 2400kg

CATEGORY A
TAKEOFF FLIGHT PATH SEGMENT II (200 FT TO 1000 FT AGL)
HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

MCP (OEI) V_Y = 65 KIAS

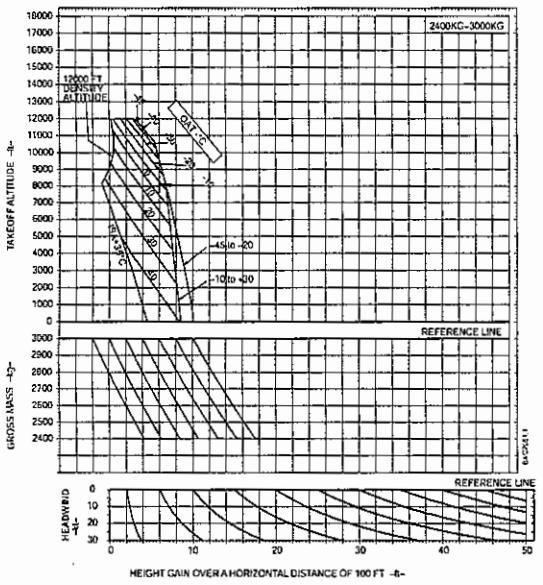

Fig. A6 Takeoff flight path segment II, 200ft to 1000ft AGL, Gross Mass 2400kg to 3000kg

CATEGORY A
TAKEOFF FLIGHT PATH SEGMENT II (200 FT TO 1000 FT AGL)
HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

MCP (OEI) V_Y = 65 KIAS

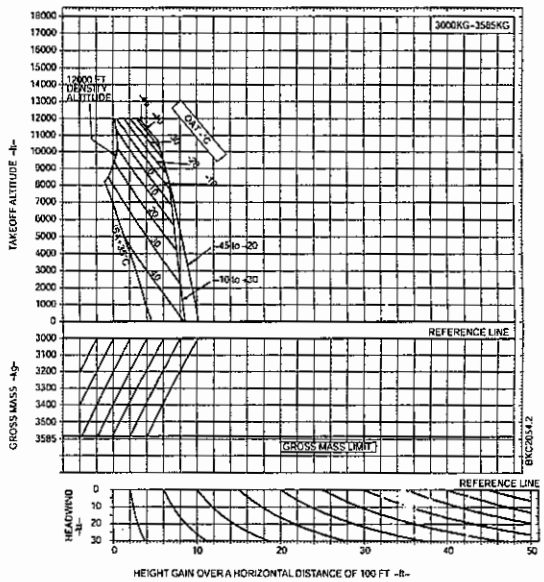

Fig. A7 Takeoff flight path segment II, 200ft to 1000ft AGL, Gross Mass 3000kg to 3585kg

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A.5.4. ADDITIONAL HEIGHT GAIN OVER A HORIZONTAL DISTANCE

ADDITIONAL HEIGHT GAIN OVER A HORIZONTAL DISTANCE OF 100 FT
1 X TURBOMECA ARRIEL 1E2

2.5 MIN. POWER (OEI) V_Y = 65 KIAS
BLEED AIR OFF

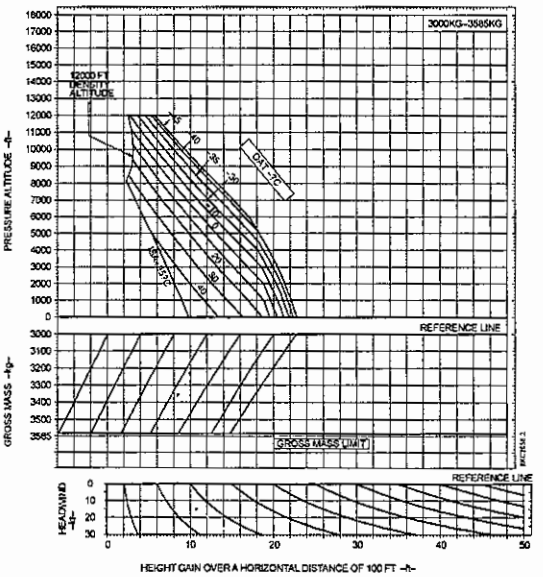

Fig. A8 Gross mass 3000 to 3585kg, bleed air off

A.5.5. EN-ROUTE FLIGHT WITH ONE ENGINE INOPERATIVE

The maximum gross mass chart (Fig. A9 or, if sandfilter is installed Fig. A10 or Fig. A11) for OEI en-route flights is presented for OEI/MCP power rating at V_Y = 65 KIAS. This chart shows the maximum gross mass that permits a rate of climb of at least 50 ft/min at an height of 1000 ft AGL.

If externally mounted optional equipment (shown below) is installed, proceed as follows:

All results obtained from maximum gross mass chart (Fig. A9 or A10 or A11) are to be corrected using these correction values.

	Δ MTOW [Kg]	
	DA ≤ 5000 ft	DA > 5000 ft
Emergency Floats (FMS 9.2–9)	–30	–40
Searchlight SX-16 (Side) (FMS 9.2–23)	–50	–60
External Loudspeaker (FMS 9.2–12)	–25	–35
External Hoist System (FMS 9.2–11)	–15	–20
Snow Skids (FMS 9.2–28)	–	–
Weather Radar System (FMS 9.2–28)	–	–
Cargo Hook Mirror (FMS 9.2–4)	–25	–35
Forward looking infrared FLIR (FMS 9.2–35)	–20	–25
EOS Wescam MX 15i/HDi (FMS 9.2–56)	–30	–40
Centerline Camera Carrier System (FMS 9.2–61) with FLIR MX15i/HDi installed	–20	–25
EOS Wescam MX 10 (FMS 9.2–67)	–10	–10
EOS STAR SAFIRE 380–HD (FMS 9.2–70)	–15	–20

If the ambient conditions (PA, OAT) are presented by a point located in the dashed area of the diagram (extrapolated beyond the upper gross mass limit), the correction value(s) may be subtracted from the gross mass value corresponding to that point.
However, the result must not exceed the upper gross mass limit of 3585 kg!

EXAMPLE: (see Fig. A9)

Determine: **Max gross mass for OEI en-route flight**

Known: OAT ..... 22 °C
Pressure altitude ..... 5000 ft

Solution: **Gross mass = 3515 kg**

1. Enter chart at known OAT (22°C)
2. Move vertically upwards to known pressure altitude (5000 ft)
3. Move horizontally left and read max. gross mass = 3515 kg

CATEGORY A EN-ROUTE FLIGHT

OEI MCP — 65 KIAS
50 FT/MIN – 1000 FT AGL — BLEED AIR HEATING: ..... OFF

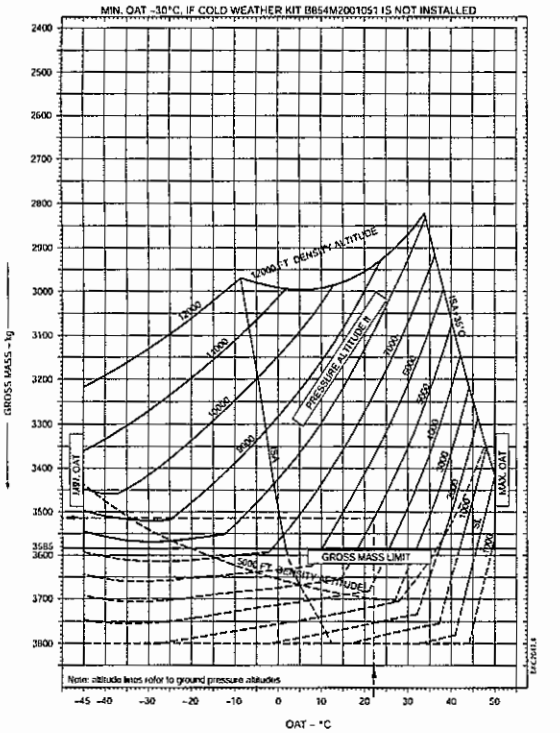

Fig. A9 Maximum Gross Mass for OEI en-route flight

CATEGORY A EN-ROUTE FLIGHT (SAND FILTER INSTALLED)

OEI MCP — 65 KIAS
50 FT/MIN – 1000 FT AGL — BLEED AIR HEATING: ..... OFF

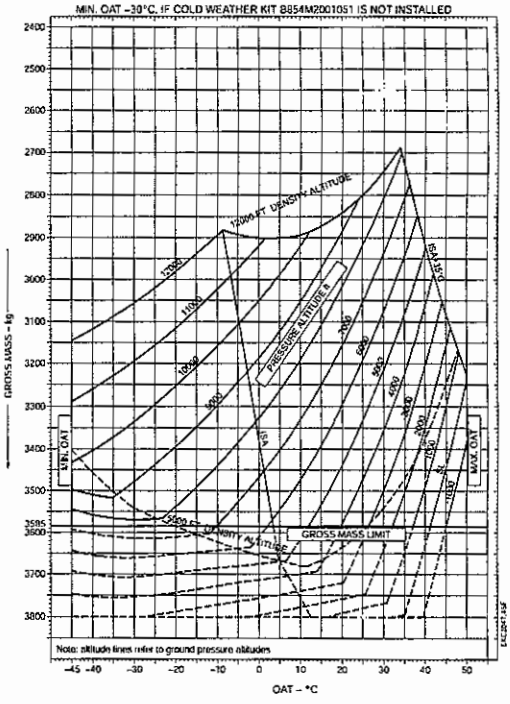

Fig. A10 Maximum Gross Mass for OEI en-route flight with **sandfilter (FMS 9.2–22)** in bypass or filter mode

CATEGORY A EN-ROUTE FLIGHT (SAND FILTER – IBF SYSTEM INSTALLED)

OEI MCP — 65 KIAS
50 FT/MIN – 1000 FT AGL — BLEED AIR HEATING: ..... OFF

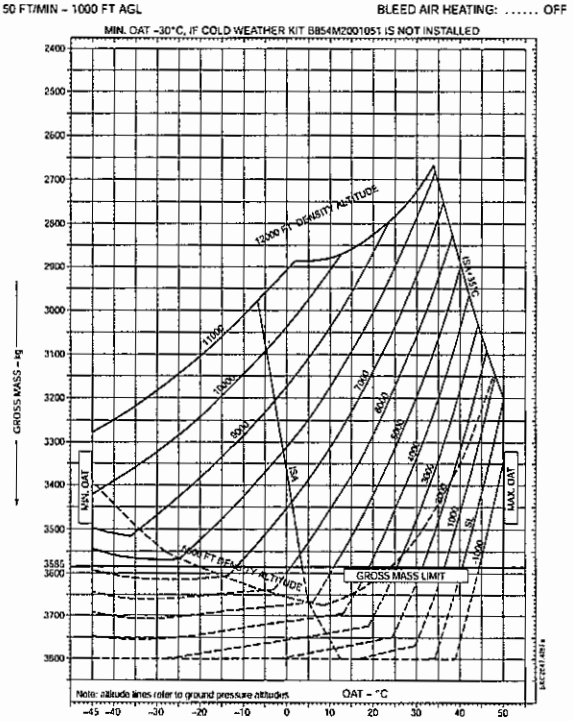

Fig. A11 Maximum Gross Mass for OEI en-route flight with **sandfilter (iBF system), FMS 9.2–50, OFF**

A.6. MASS AND BALANCE

No change in the basic Flight Manual data.

A.7. SYSTEMS DESCRIPTIONS

No change in the basic Flight Manual data.

A.8. HANDLING, SERVICING AND MAINTENANCE

No change in the basic Flight Manual data.

B. CLEAR HELIPORT

B.1. GENERAL

This subsection provides information necessary for Category A operations at clear heliports.

B.1.1. DEFINITIONS

- Takeoff Decision Point TDP ..... 20 ft/30 KIAS
- Landing Decision Point LDP ..... 100 ft/40 KIAS/ R/D< 500 ft/min

B.2. LIMITATIONS (IN ADDITION TO THE LIMITATIONS GIVEN IN PART A, "GENERAL")

B.2.1. CERTIFICATION CRITERIA

The definitions given below are related to the respective emergency and normal procedures :

- Clear heliport: A surface level heliport, certified for day and night operations, with minimum field size of a minimum field length defined by the takeoff and landing distances of this chapter and a minimum field width of 15 m.

B.2.2. MASS LIMITATIONS

For maximum takeoff and landing gross mass refer to Fig. B1 or, if sandfilter system (FMS 9.2–22) is installed to Fig. B2 or (FMS 9.2–50) to Fig. B3. However if external mounted optional equipment (shown below) is installed, proceed as follows:

All results obtained from maximum takeoff and landing gross mass chart (Fig. B1 or B2 or B3) are to be corrected using these correction values.

	Δ MTOW [Kg]	
	DA ≤ 5000 ft	DA > 5000 ft
Emergency Floats (FMS 9.2–9)	–30	–40
Searchlight SX-16 (Side) (FMS 9.2–23)	–50	–60
External Loudspeaker (FMS 9.2–12)	–25	–35
External Hoist System (FMS 9.2–11)	–15	–20
Snow Skids (FMS 9.2–26)	–	–
Weather Radar System (FMS 9.2–28)	–	–
Cargo Hook Mirror (FMS 9.2–4)	–25	–35
Forward looking infrared FLIR Ultraforce (FMS 9.2–35)	–20	–25
EOS Wescam MX 15i/HDi (FMS 9.2–56)	–30	–40
Centerline Camera Carrier System (FMS 9.2–61) with FLIR MX15i/HDi installed	–20	–25
EOS Wescam MX 10 (FMS 9.2–67)	–10	–10
EOS STAR SAFIRE 380–HD (FMS 9.2–70)	–15	–20

If the ambient conditions (PA, OAT) are presented by a point located in the dashed area of the diagram (extrapolated beyond the upper gross mass limit), the correction value(s) may be subtracted from the gross mass value corresponding to that point.
However, the result must not exceed the upper gross mass limit of 3585 kg!

EXAMPLE: For helicopter with external optional equipment installed (see Fig. B1)

Determine: Maximum takeoff and landing gross mass

Known: OAT ..... 24 °C
Pressure altitude ..... 5000 ft (> 5000ft DA)
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: Gross mass = 3305 kg

1. Enter chart at known OAT (24°C)
2. Move vertically upwards to known pressure altitude (5000 ft)
3. Move horizontally left and read max. gross mass (3340 kg)
4. Apply correction values for external optional equipment (–35 kg) as follows:

3340 kg – 35 kg = 3305 kg

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CATEGORY A (CLEAR HELIPORT) MAXIMUM TAKEOFF AND LANDING GROSS MASS

SKID HEIGHT 3 FT

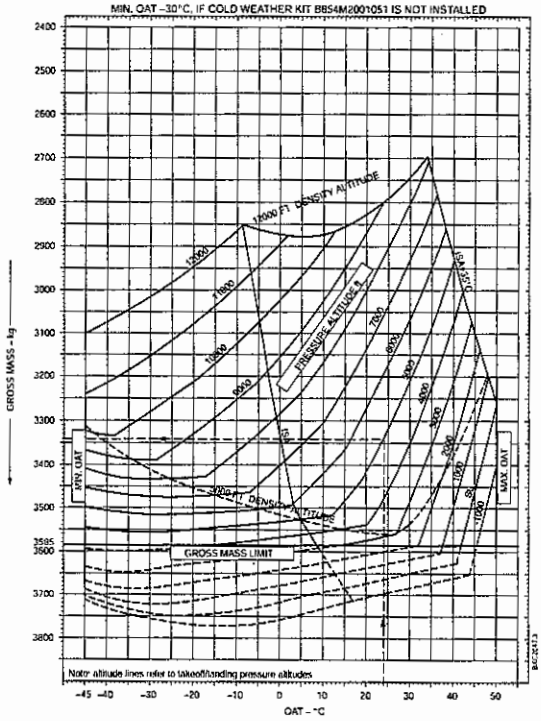


Fig. B1 Maximum Takeoff and Landing Gross Mass

CATEGORY A (CLEAR HELIPORT) MAXIMUM TAKEOFF AND LANDING GROSS MASS (SANDFILTER INSTALLED)

SKID HEIGHT 3 FT

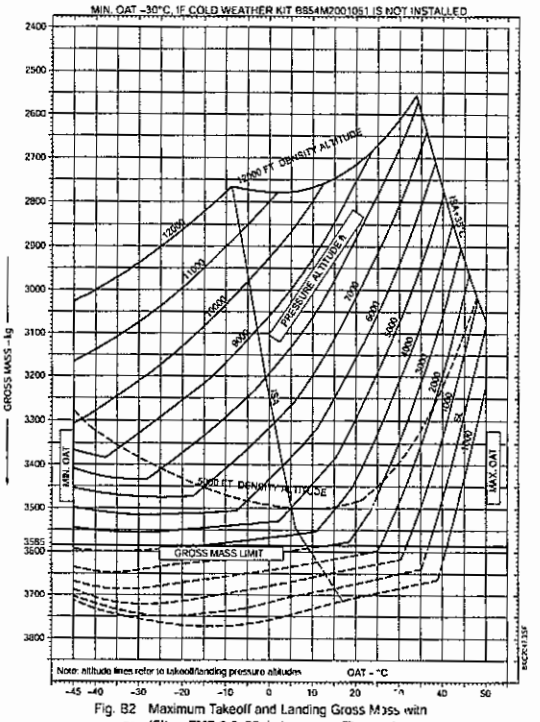


Fig. B2 Maximum Takeoff and Landing Gross Mass with sandfilter, FMS 9.2–22, in bypass or filter mode

CATEGORY A (CLEAR HELIPORT) MAXIMUM TAKEOFF AND LANDING GROSS MASS (SANDFILTER – IBF SYSTEM INSTALLED)

SKID HEIGHT 3 FT

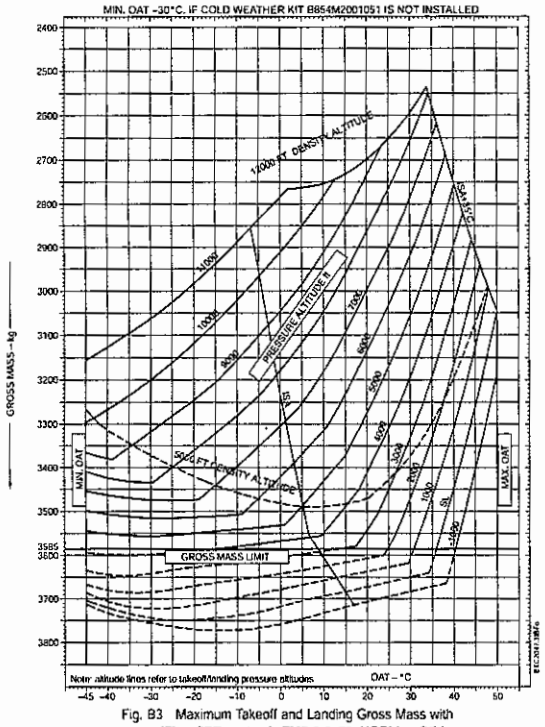


Fig. B3 Maximum Takeoff and Landing Gross Mass with sandfilter (IBF system), FMS 9.2–50, NORM or OFF

B.3. EMERGENCY AND MALFUNCTION PROCEDURES

B.3.1. SINGLE ENGINE FAILURE DURING TAKEOFF PRIOR TO TDP

Procedure

1. Collective lever	**– Adjust to OEI-limits or below**
2. Ground speed	**– Reduce**

Prior to touchdown

3. Landing attitude	**– Establish**
4. Collective lever	**– Raise as necessary to stop descent and cushion landing**

After touchdown

5. Collective lever	– Lower slowly
6. Cyclic stick	– Neutral position

NOTE Observe mast moment limits

7. Engines shutdown	– Perform

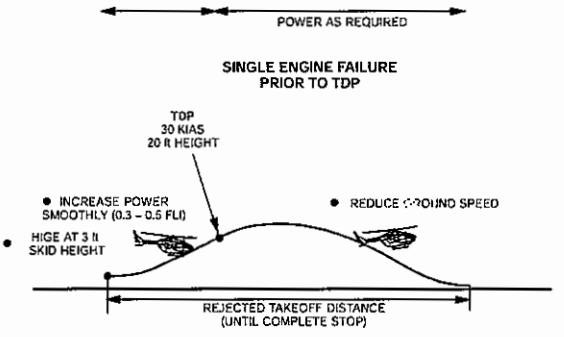


Fig. B4 OEI Rejected Takeoff Profile – Clear Heliport

B.3.2. SINGLE ENGINE FAILURE DURING TAKEOFF AFTER TDP

Procedure

1. Collective lever	**– Adjust to 2.5 min power**
2. Speed	**– Accelerate to V_{TOSS} (45 KIAS)**
3. Climb	**– Initiate with V_{TOSS}**
4. Rotor speed	**– Trim to maximum**
5. Upon reaching 200 ft AGL	**– Accelerate to V_Y (65 KIAS)**
6. Collective lever	**– Adjust to OEI MCP**
7. Climb	– Continue with V_Y to 1000 ft AGL or desired flight altitude
8. Single engine emergency shutdown	– Perform
9. LAND AS SOON AS PRACTICABLE	

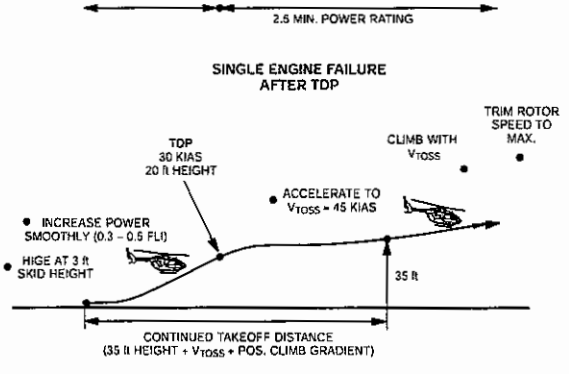


Fig. B5 OEI Continued Takeoff Profile – Clear Heliport

B.3.3. LANDING WITH ONE ENGINE INOPERATIVE PIOR TO LDP

NOTE The pilot may elect to balk the landing or to continue the approach. If the decision is to continue the approach use the procedures for **"SINGLE ENGINE FAILURE AFTER LDP"**. When commencing landing bleed air consumers must be off.

The following procedures are to be used if the decision is to **balk the landing:**

Procedure

1. Collective lever	**– Adjust to 2.5 min power**
2. Speed	**– Accelerate to V_{TOSS} (45 KIAS)**
3. Climb	**– Initiate with V_{TOSS}**
4. Rotor speed	**– Trim to maximum**
5. Upon reaching 200 ft AGL	**– Accelerate to V_Y (65 KIAS)**
6. Collective lever	**– Adjust to OEI MCP**
7. Climb	– Continue with V_Y to 1000 ft AGL or desired flight altitude
8. Single engine emergency shutdown	– Perform
9. LAND AS SOON AS PRACTICABLE	

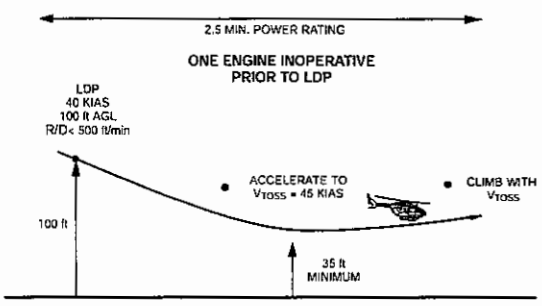


Fig. B6 OEI Balked Landing Profile – Clear Heliport

B.3.4. SINGLE ENGINE FAILURE DURING LANDING AFTER LDP

Procedure

1.	**Collective lever**	**– Adjust to OEI-limits or below**
2.	**Ground speed**	**– Reduce**

Prior to touchdown

3.	**Landing attitude**	**– Establish**
4.	**Collective lever**	**– Raise as necessary to stop descent and cushion landing**

After touchdown

5.	Collective lever	– Lower slowly
6.	Cyclic stick	– Neutral position
	NOTE Observe mast moment limits	
7.	Engines shutdown	– Perform

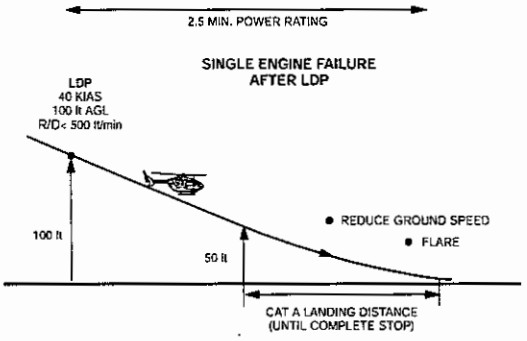
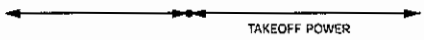


Fig. B7 OEI Continued Landing Profile – Clear Heliport

B.4. NORMAL PROCEDURES

B.4.1. TAKEOFF

B.4.1.1. Standard type takeoff path



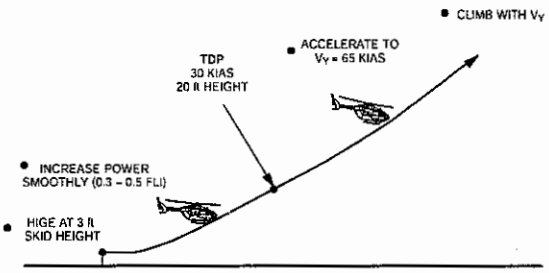


Fig. B8 Standard Type Takeoff Flight Path Profile – Clear Heliport

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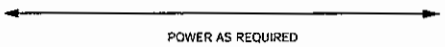
B.4.1.2. Standard type takeoff procedure

Procedure

Pre-takeoff check	– Perform
VAR NR	– CAT A mode, if OAT <–30°C: NORM mode
Radar altimeter	– TEST; set the bug to 20 ft (TDP height)
Hover	– 3 ft skid height
All instruments	– Normal operating ranges, note FLI indication
Acceleration and climb	– Start nose down pitch rotation and simultaneously increase power smoothly (use hover power plus 0.3 – 0.5 FLI, without exceeding TOP) for acceleration. Adjust pitch attitude at about 20 KIAS to achieve 30 KIAS at 20 ft height (TDP).
When TDP is reached:	
Collective lever	– Adjust to Takeoff Power simultaneously
Pitch attitude	– Nosedown accelerate to V_Y
At V_Y:	
Collective lever	– Reduce to AEO MCP
Climbout	– Continue to desired altitude
VAR NR switch	– NORM mode

B.4.2. LANDING

B.4.2.1. Standard type landing flight path profile



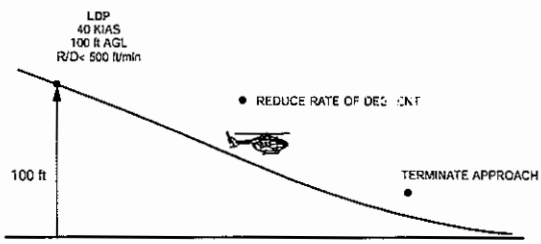


Fig. B9 Standard Type Landing Flight Path Profile – Clear Heliport

B.4.2.2. Standard type landing flight path procedure

Procedure

1. Pre-landing check	– Perform
At V_Y:	
2. VAR NR switch	– Check CAT A mode, if OAT <–30°C: NORM mode
3. Radar altimeter bug	– Set to LDP height (100 ft)
4. Landing	– Initiate to arrive at LDP with a speed of 40 KIAS and a rate of descent of not more than 500 ft/min
5. After reaching LDP	– Adjust collective pitch to maintain desired rate of descent, and to terminate approach.

B.5. PERFORMANCE DATA

B.5.1. TAKEOFF PERFORMANCE

B.5.1.1. Assured Minimum Flight Conditions

	POWER	SPEED	R/C	ALTITUDE
HIGE	T/O (AEO)	0	0	3 ft skid height
CLIMB	2.5 min (OEI)	V_{TOSS} = 45 KIAS	100ft/min	200 ft AGL
CLIMB	MCP (OEI)	VY = 65 KIAS	150 ft/min	1000 ft AGL

B.5.1.2. Takeoff distance required

The takeoff distance charts show the wind-corrected rejected takeoff distances required (Fig. B10) and continued takeoff distance required (Fig. B11). The flight planning has to be based on the rejected and continued takeoff distance chart and the respective chart for segment I and II flight path (Fig's A2 to A7).

EXAMPLE: (see Fig. B10)
Determine: Rejected Takeoff distance required
Known: OAT ..... 35 °C
Pressure altitude ..... 2000 ft
Solution: Rejected Takeoff distance = 310 m

1. Enter chart at known OAT (35°C).
2. Move vertically upwards to known pressure altitude (2000 ft).
3. Move horizontally right to the guideline of the right graph.
4. From intersection move downwards and read rejected takeoff distance = 310 m

EXAMPLE: (see Fig. B11)
Determine: Continued Takeoff distance required
Known: OAT ..... 35 °C
Pressure altitude ..... 2000 ft
Solution: Continued Takeoff distance = 355 m

1. Enter chart at known OAT (35°C).
2. Move vertically upwards to known pressure altitude (2000 ft).
3. Move horizontally right to the guideline of the right graph.
4. From intersection move downwards and read continued takeoff distance = 355 m

CATEGORY A (CLEAR HELIPORT)
REJECTED TAKEOFF DISTANCE REQUIRED
1 X TURBOMECA ARRIEL 1E2

NOTE HELICOPTER CONFIGURATION MUST COMPLY WITH THE MASS-ALTITUDE OAT LIMITS, AS SHOWN IN FIGURE B1 FOR THIS DIAGRAM TO BE VALID.

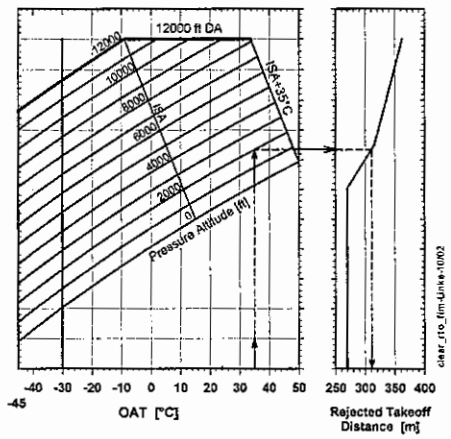


Fig. B10 Rejected Takeoff Distance Required

CATEGORY A (CLEAR HELIPORT)
CONTINUED TAKEOFF DISTANCE REQUIRED
1 X TURBOMECA ARRIEL 1E2

NOTE HELICOPTER CONFIGURATION MUST COMPLY WITH THE MASS-ALTITUDE OAT LIMITS, AS SHOWN IN FIGURE B1 FOR THIS DIAGRAM TO BE VALID.

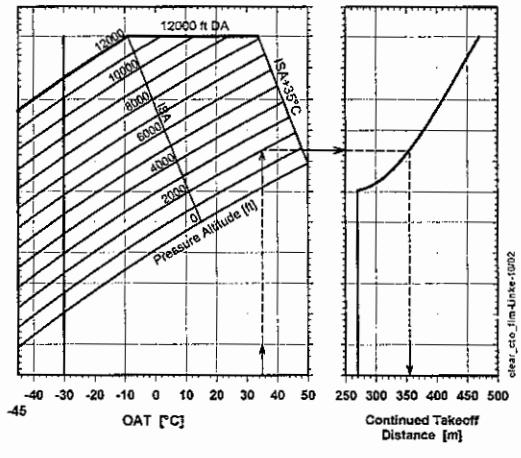


Fig. B11 Continued Takeoff Distance Required

B.5.1.3. **OEI Takeoff Flight Path**

The OEI takeoff flight path (Fig. B13) begins at the end of the "continued takeoff distance required", at 35 feet above the takeoff surface and V_{toss}, and is divided into two segments.

Takeoff flight path segments I and II (Fig's A2 to A7)

Takeoff segment I diagrams (Fig. A2 to A4) provide data for 35 ft to 200 ft AGL at 2.5 min power and V_{toss}.

Takeoff segment II diagrams (Fig. A5 to A7) provide data for 200 ft to 1000 ft AGL at MCP and V_Y.

Both chart types show the height gain over a horizontal distance of 100 ft.

The distance required for horizontal acceleration from V_{toss} to V_Y is 550m under calm wind conditions. For calculations with headwind components see Fig. B12
(e.g. known headwind: 16 kt ♦ Acceleration distance: 390m)

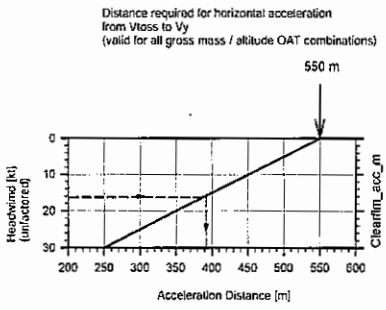


Fig. B12 Acceleration distance V_{toss} to V_Y

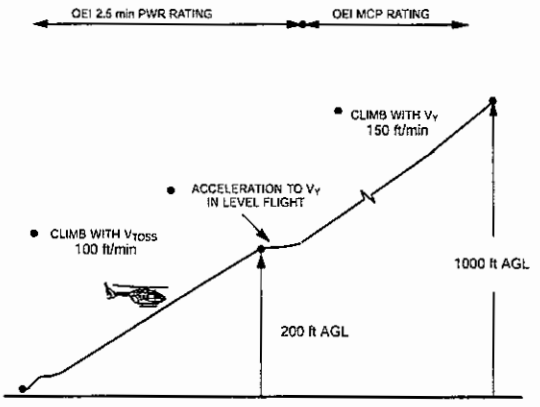


Fig. B13 OEI Takeoff Profile – Clear Heliport

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B.5.2. **LANDING PERFORMANCE**

The landing performance is determined and limited by gross mass-altitude-OAT limits (see Fig. B1)

B.5.2.1. **Landing Distance from a 50-ft Height to a Complete Stop on the Ground**

The landing distance required (Fig. B14) is the distance necessary to come to a complete stop (on a smooth, hard and dry level surface) over a 50 ft obstacle following an engine failure prior to or after LDP.

EXAMPLE: see Fig. B14

Determine: Landing distance required to clear a 50 ft obstacle

Known:	OAT	35°C
	Pressure altitude	2000 ft
	Windspeed	50 kt
	For calculation 50%: Windspeed	25 kt

Solution: **Landing distance = 187 m**

1. Enter chart at known OAT (35°C).
2. Move vertically upwards to known pressure altitude (2000 ft).
3. From point of intersection move horizontally right to the reference line of the right chart.
4. Move vertically downwards to the reference line of the wind credit chart.
5. From this point follow the direction of the wind credit guide lines.
6. Enter chart at known windspeed (25 kt)
7. Move horizontally to intersect tracing from above.
8. From point of intersection move downwards and read **OEI landing distance = 187 m**
(The result under the assumption of no wind is 270 m)

CATEGORY A (CLEAR HELIPORT)
LANDING DISTANCE FROM 50 FEET HEIGHT TO A COMPLETE STOP TO THE GROUND
1 X TURBOMECA ARRIEL 1E2

BLEED AIR HEATING: ..... OFF

NOTE HELICOPTER CONFIGURATION MUST COMPLY WITH THE MASS-ALTITUDE OAT LIMITS, AS SHOWN IN FIGURE B1 FOR THIS DIAGRAM TO BE VALID.

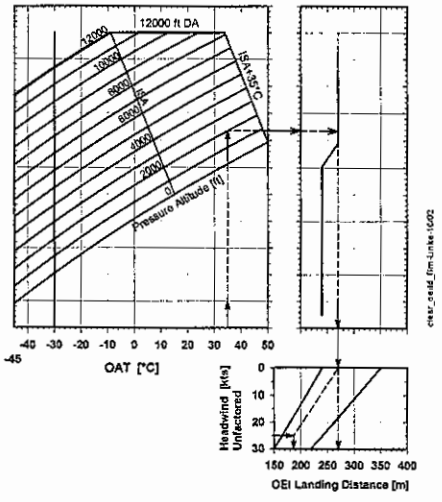

Fig. B14 Landing Distance from 50 ft Height to a Complete Stop on the Ground

B.6. **MASS AND BALANCE**

No change in the basic Flight Manual data.

B.7. **SYSTEM DESCRIPTION**

No change in the basic Flight Manual data.

B.8. **HANDLING, SERVICING AND MAINTENANCE**

No change in the basic Flight Manual data.

C. VTOL (1) – SURFACE LEVEL OR ELEVATED HELIPORTS

C.1. **GENERAL**

C.1.1. **DEFINITIONS**

- Takeoff Decision Point TDP ..... 120 ft
- Landing Decision Point LDP ..... 100 ft/30 KIAS/ R/D≤300 ft/min

C.2. **LIMITATIONS (IN ADDITION TO THE LIMITATIONS GIVEN IN PART A, "GENERAL", OF THIS SUPPLEMENT)**

C.2.1. **CERTIFICATION CRITERIA**

The definitions given below are related to the respective emergency and normal procedures :

- Surface level heliport and Elevated heliport:
  A heliport located on the ground / on the water or on raised structure, having minimum dimensions of at least 15 x 15 m or 20 m in diameter (under day and night conditions).

C.2.2. **OPERATIONAL LIMITATIONS**

C.2.2.1. **Heliport surface**

Surface shall be solid to generate ground effect.

C.2.3. **MASS LIMITATIONS**

NOTE A height–velocity danger area does not exist when using a gross mass derived from the chart Fig. C1 and following the CAT A normal takeoff and landing procedures.

C.2.3.1. **Mass limitations – Surface level**

For maximum vertical takeoff and landing gross mass refer to Fig. C1.

C.2.3.2. **Mass limitations – Elevated heliport**

For elevated heliport operations subtract 50 kg from the result obtained from Fig. C1.

C.2.3.3. **Mass limitations with optional equipment installed**

When calculating the maximum takeoff and landing gross mass for VTOL operations, first calculate the maximum gross mass for Clear Heliport operation in accordance with subsection B of this supplement under consideration of the relevant correction values listed under para B.2.2.
In the second step, calculate the maximum takeoff and landing gross mass for VTOL operations using Fig.C1 without considering those correction values.

If the sandfilter system (FMS 9.2–22) is installed, subtract 55 kg from the result obtained from Fig. C1.

If the sandfilter (IBF–system) (FMS 9.2–50) is installed subtract 100 kg (sandfilter OFF) and 200 kg (sandfilter NORM) from the result obtained from Fig. C1.

EXAMPLE: For helicopter with external optional equipment installed (see Fig. B1 and C1)

Determine: **Maximum takeoff and landing gross mass (surface level operation)**

Known: OAT ..... 24 °C
Pressure altitude ..... 5000 ft (> 5000 ft DA)
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: **Gross mass = 2800 kg**

1. Enter chart (Fig. B1) at known OAT (24°C)
2. Move vertically upwards to known pressure altitude (5000 ft)
3. Move horizontally left and read max. gross mass (3340 kg)
4. Apply correction values for external optional equipment (–35 kg) as follows: **3340 kg – 35 kg = 3305 kg**
5. Enter chart (Fig. C1) at known OAT (24°C)
6. Move vertically upwards to known pressure altitude (5000 ft)
7. Move horizontally left and read max. gross mass (2800 kg)
8. Since the gross mass limit = 2800 kg is lower than the calculated max. gross mass from clear heliport subsection (3305 kg), the result is **2800 kg.**

MAXIMUM TAKEOFF AND LANDING GROSS MASS, CATEGORY A (VTOL)

1 X TURBOMECA ARRIEL 1E2

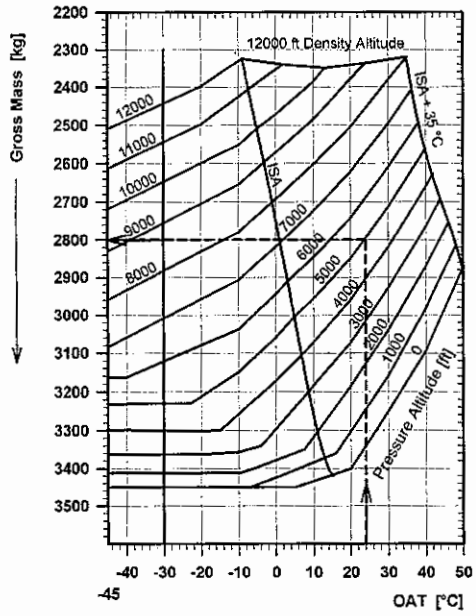

Fig. C1 Maximum takeoff and landing gross mass (VTOL)

C.3. EMERGENCY AND MALFUNCTION PROCEDURES

C.3.1. SURFACE LEVEL OR ELEVATED HELIPORT – SINGLE ENGINE FAILURE DURING TAKEOFF PRIOR TO TDP

Procedure

1. Attitude	**– Nosedown; maintain starting point in sight (Nosedown means from –6° at TDP, decreasing proportionally to no attitude change at 10 ft)**

NOTE
- Steady parts of the procedures are established with not less than 96% rotor rpm. The transient values are only allowed to cushion the landing.
- At heights lower than 40 ft, it may be not possible to reduce power, (esp. in low wind conditions) and the collective should be used to cushion the landing as required.
- At low temperatures and low altitudes, the 2.5 minutes power is limited by engine internal fuel flow limitation.

2. Collective lever	**– Adjust to 2.5-min Power**

Before touchdown:

3. Landing attitude	**– Establish for minimum ground speed**
4. Collective lever	**– Increase to cushion landing**

NOTE Plan for zero ground speed touchdown.

After touchdown:

5. Collective lever	– Lower to full down
6. Cyclic stick	– Neutral position; observe mast moment limits
7. Engines shutdown	– Perform

2.5 MIN POWER RATING

SINGLE ENGINE FAILURE PRIOR TO TDP

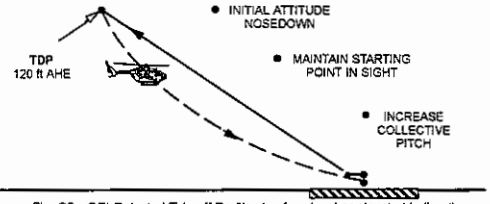

Fig. C2 OEI Rejected Takeoff Profile (surface level or elevated heliport)

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C.3.2. SURFACE LEVEL OR ELEVATED HELIPORT – SINGLE ENGINE FAILURE DURING TAKEOFF AFTER TDP

Procedure

1. Attitude	**– Nosedown –20° up to –25°**
2. Collective lever	**– Adjust to 2.5-min Power**
3. Attitude	**– After reaching 30 KIAS adjust to near level attitude while accelerating to V_{TOSS}**
4. Rotor speed	**– Trim to maximum**

When 200 ft AHE is reached:

5. Airspeed	– Accelerate to V_Y
6. Collective lever	– Adjust to Max Contin. Power
7. Climbout	– Continue with V_Y to 1000 ft AHE
8. Single engine emergency shutdown	– Perform
9. LAND AS SOON AS PRACTICABLE	

NOTE The correct application of the procedures guarantees a minimum ground clearance of 25 ft.

2.5 MIN POWER RATING

SINGLE ENGINE FAILURE AFTER TDP

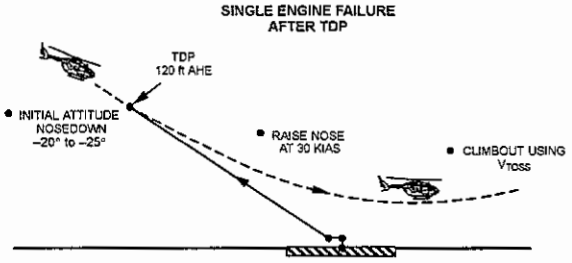

Fig. C3 OEI Continued Takeoff Profile (surface level or elevated heliport)

C.3.3. SURFACE LEVEL OR ELEVATED HELIPORT – LANDING WITH ONE ENGINE INOPERATIVE PRIOR TO LDP

NOTE The pilot may elect to balk the landing or to continue the approach. If the decision is to continue the approach use the procedure for **"SINGLE ENGINE FAILURE AFTER LDP"**. When commencing landing bleed air consumers must be off.

The following procedures are to be used if the decision is to **balk the landing:**

Procedure

1. Collective lever	**– Adjust to 2.5-min Power**
2. Airspeed	**– V_{TOSS}**
3. Rotor speed	**– Trim to maximum**

NOTE If airspeed is 65 KIAS or above use V_Y.

When 200 ft AHE is reached:

4. Airspeed	– Accelerate to V_Y
5. Collective lever	– Adjust to Max Contin. Power
6. Climbout	– Continue with V_Y to 1000 ft AHE
7. Single engine emergency shutdown	– Perform
8. LAND AS SOON AS PRACTICABLE	

NOTE The correct application of the procedures guarantees a minimum ground clearance of 35 ft.

2.5 MIN POWER RATING

ONE ENGINE INOPERATIVE PRIOR TO LDP

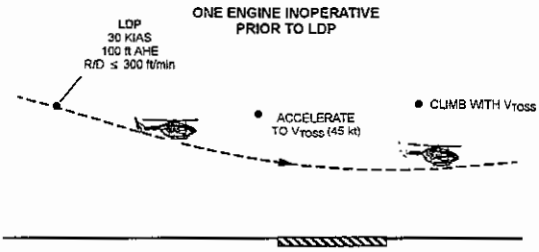

Fig. C4 OEI Balked Landing Profile (surface level or elevated heliport)

C.3.4. SURFACE LEVEL OR ELEVATED HELIPORT – SINGLE ENGINE FAILURE DURING LANDING AFTER LDP

Procedure

1. Collective lever	**– Adjust to 2.5-min Power or below**

Before touchdown:

2. Landing attitude	**– Establish for minimum ground speed**
3. Collective lever	**– Raise to cushion landing**

NOTE Plan for zero ground speed touchdown.

After touchdown:

4. Collective lever	– Lower to full down
5. Cyclic stick	– Neutral position; observe mast moment limits
6. Engines shutdown	– Perform

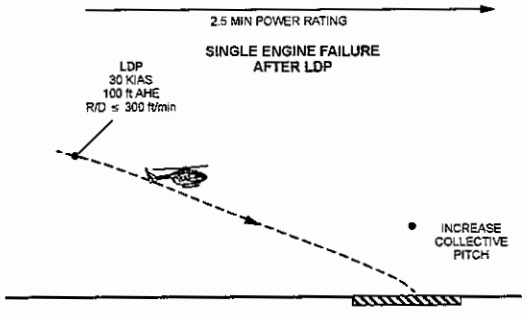

Fig. C5 OEI Continued Landing Profile (surface level or elevated heliport)

C.4. NORMAL PROCEDURES

C.4.1. SURFACE LEVEL OR ELEVATED HELIPORT – VERTICAL TAKEOFF

Takeoff flight path	– Select as nearly into wind as obstacles will permit

NOTE The heliport maneuvering area and takeoff flight path shall be clear of obstacles.

Pre-takeoff check	– Perform
VAR NR	– CAT A mode, if OAT < –30°C: NORM mode
Altimeter/Radar altimeter	– Set

For VTOL operation to or from elevated heliport the barometric altimeter is to be used as source for LDP/TDP identification.

Before starting elevated heliport operation with that particular aircraft, the TDP, indicated by the barometric altimeter should be defined as follows:

Reference is the helicopter on the elevated heliport, with engines in flight idle and low collective pitch setting (torque < 2x20%), or before engine started.

NOTE Ground running with high pitch settings or using hover in ground effect as reference will lead to erroneous results.

<u>TDP:</u>

Read the indicated baro altitude and add 160 ft to obtain the TDP height for baro altimeter indication.

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Hover	– 3-ft skid height above heliport center
All instruments	– Normal operating ranges, note FLI indication
Rearward hover	– Hover aft approx. 3 m; "H" - sign of heliport in sight (if SPIFR operation kit installed: initiate an additional left yaw 15°–20°)
Rearward climb	– Initiate (use hover power plus 0.5 – 0.7 FLI, without exceeding TOP to maintain ~300 fpm rate of climb) and maintain takeoff area in sight;

When TDP is reached:

Collective lever	– Adjust to Takeoff Power simultaneously
Pitch attitude	– Nosedown accelerate to V_Y

<u>At V_Y:</u>

Collective lever	– Reduce to AEO MCP
Climbout	– Continue to desired altitude
VAR NR	– NORM mode

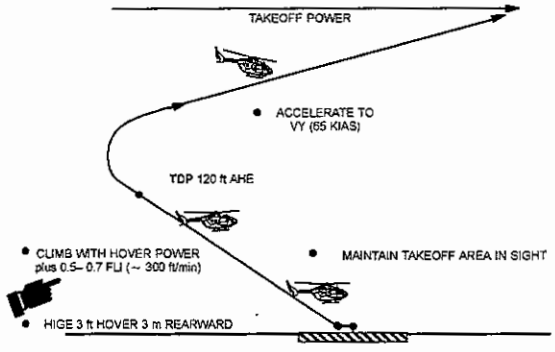

Fig. C6 Vertical Takeoff Profile (surface or elevated heliport)

Fig. C7 Heliport Sight Picture at 50 ft AHE (surface level heliport)
H/C equipped with dual FCDS

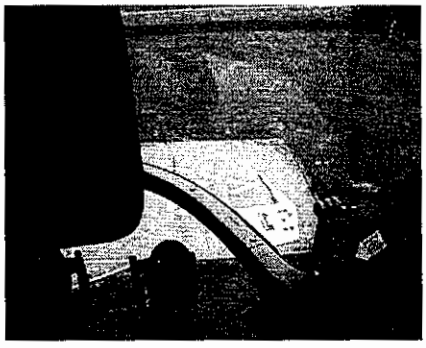

Fig. C8 Heliport Sight Picture at 50 ft AHE (surface level heliport)
H/C equipped with single FCDS

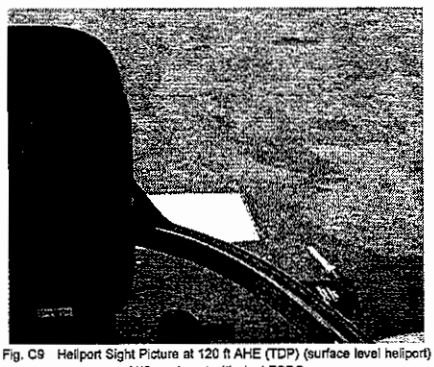

Fig. C9 Heliport Sight Picture at 120 ft AHE (TDP) (surface level heliport)
H/C equipped with dual FCDS

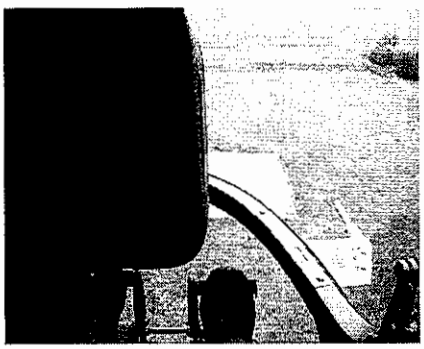

Fig. C10 Heliport Sight Picture at 120 ft AHE (TDP) (surface level heliport)
H/C equipped with single FCDS

Fig. C11 Heliport Sight Picture at 50 ft AHE (elevated heliport)
H/C equipped with dual FCDS

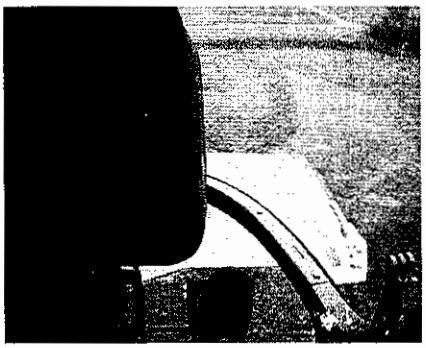

Fig. C12 Heliport Sight Picture at 50 ft AHE (elevated heliport)
H/C equipped with single FCDS

Fig. C13 Heliport Sight Picture at 120 ft AHE (TDP) (elevated heliport)
H/C equipped with dual FCDS

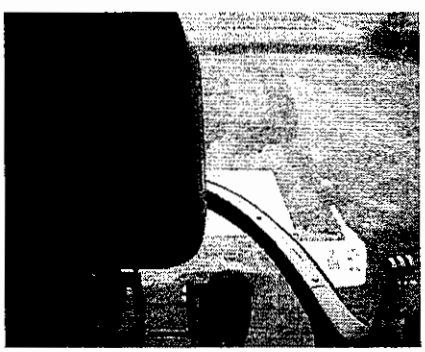

Fig. C14 Heliport Sight Picture at 120 ft AHE (TDP) (elevated heliport)
H/C equipped with single FCDS

C.4.2. SURFACE LEVEL OR ELEVATED HELIPORT – VERTIVCAL LANDING

Prelanding check	– Perform
<u>At Vy:</u>	
VAR NR	– Check CAT A mode, if OAT <–30°C: NORM mode
Landing approach	– Initiate 65 KIAS at 300 ft AHE, and plan to arrive with: – <u>40 KIAS at 200 ft AHE</u> and R/D ≤ 300 ft/min – <u>30 KIAS at LDP (100ft AHE)</u> and R/D ≤ 300 ft/min

NOTE Approach airspeeds can be increased by half of the wind speed.

After passing LDP:	
Speed	– Decrease slowly to arrive at a 3-ft hover above landing point
Slow vertical descent	– Initiate to touchdown

For VTOL operation to or from elevated heliport the barometric altimeter is to be used as source for LDP/TDP identification.

Before starting elevated heliport operation with that particular aircraft, the LDP, indicated by the barometric altimeter should be defined as follows:

<u>Prior to landing:</u>

Baro altimeter – set the accurate local QNH of the landing area

the LDP is: – indicated baro altitude plus 140 ft, if PA ≤ 5000 ft
– indicated baro altitude plus 150 ft, if PA > 5000 ft

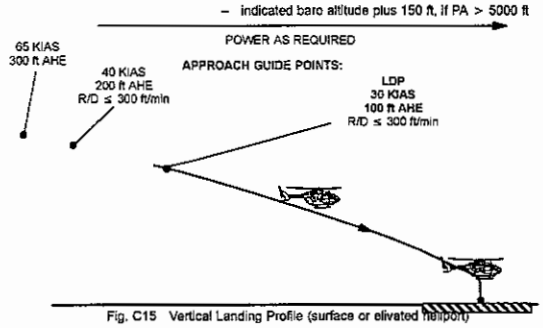

Fig. C15 Vertical Landing Profile (surface or elivated heliport)

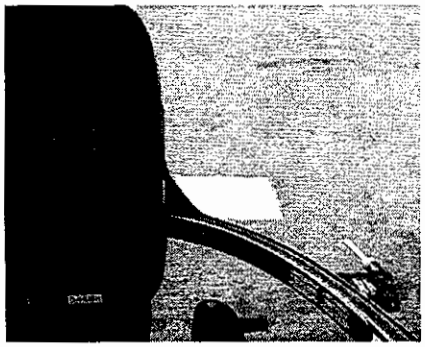

Fig. C16 Heliport Sight Picture at 100 ft AHE (LDP) - surface level heliport or elevated heliport – H/C equipped with dual FCDS

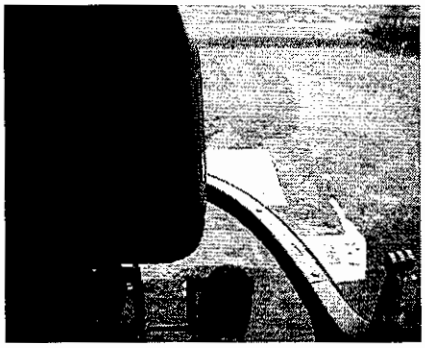

Fig. C17 Heliport Sight Picture at 100 ft AHE (LDP) - surface level heliport or elevated heliport – H/C equipped with single FCDS

C.5. PERFORMANCE DATA

C.5.1. TAKEOFF PERFORMANCE

NOTE Presented performance data apply to climbs without any significant bank angle and CAT A-mode activated. Turning during climbing will reduce climb performance.(see also A.5.3.1.)

C.5.1.1. Takeoff Flight Path (surface level or elevated heliport)

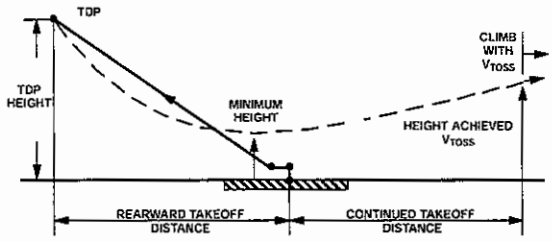

Fig. C18 Continued Takeoff Flight Path (surface level or elevated heliport)

For TDP height 120 ft:

	Surface Level Heliport	Elevated Heliport
Rearward takeoff distance	100 m	65 m
Minimum height	25 ft	25 ft
Height achieved V_{TOSS} *)	40 ft	40 ft
Continued takeoff distance	100 m	135 m

*) Height at which V_{TOSS} and a positive rate of climb is achieved.

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C.5.1.2. Takeoff flight path segments I and II

The OEI standard takeoff flight path (see Fig. C20) begins at the end of the "continued takeoff distance" and is divided into two segments:

- Segment I

  OEI climb through segment I has to be accomplished with V_{TOSS} and 2.5-min Power until reaching 200 ft AGL. Segment I climb performance data (OEI Height Gain Over a Horizontal Distance of 100 ft) are presented in Subsection A, Fig.A2 to A4.

- Segment II

  OEI climb through segment II has to be accomplished with V_Y and Max Continuous Power until reaching 1000 ft AGL. Segment II climb performance data (OEI Height Gain Over a Horizontal Distance of 100 ft) are presented in Subsection A, Fig. A5 to A7.

The distance required for horizontal acceleration from V_{toss} to V_Y is 250 m under calm wind conditions. For calculations with headwind components see Fig. C19.
(e.g. known headwind: 16 kt ♦ Acceleration distance: 177 m)

Distance required for horizontal acceleration
from Vtoss to Vy
(valid for all gross mass / altitude OAT combinations)

Acceleration distance: 250 m

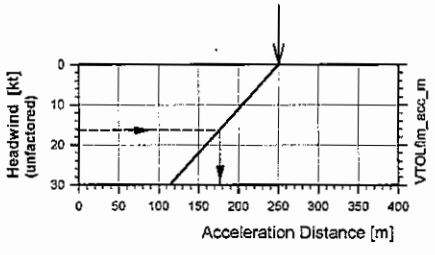

Fig. C19 Acceleration distance V_{toss} to V_Y

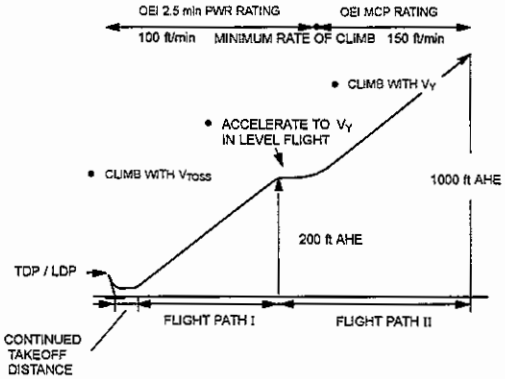

Fig. C20 OEI Takeoff Profile (VTOL)

C.5.2. LANDING PERFORMANCE

C.5.2.1. OEI Landing distance from 25 ft AHE to a complete stop

Elevated heliports ..... 30 m

C.5.3. MODIFIED FLIGHT PATH TO CLEAR HIGH OBSTACLES (SURFACE LEVEL/ELEVATED HELIPORT)

C.5.3.1. Modified takeoff flight path

Some heliports may require an increase in the standard TDP height due to obstacles in the close surroundings of the site. For this purpose, the following procedure for varying the TDP standard height is permissible.

Depending on the location of the obstacle relative to the heliport, two different procedures have been established:

C.5.3.1.1. DISTANCE FROM HELIPORT TO OBSTACLE IS LESS THAN THE CONTINUED TAKE-OFF DISTANCE REQUIRED

Establish the TDP height such that the minimum height presented in Table C1 is not lower than the obstacle height plus the minimum clearance as defined by the operational rules.

EXAMPLE: (see Fig. C18 and Table C1/C2)

Determine: **TDP height for vertical takeoff**

Known: Obstacle height ..... 50 ft
Obstacle distance ..... 50 m (in direction of departure)

Solution:

1. Add minimum clearance as defined by operational rules (e.g. 35 ft) to known obstacle height (50 ft) to obtain minimum height for takeoff (85 ft).
2. Using table C1, select for the derived minimum height (85 ft) the corresponding TDP height = 180 ft.

TDP Height (ft)	Rearward Take-off Distance (m)	Minimum Height (ft)	Height achieved VTOSS[1] (ft)	Continued Takeoff Distance (m)
120	100	25	40	100
140	120	45	60	80
160	135	65	80	65
180	150	85	100	50
200	165	105	120	35

[1] Height at which V_{TOSS} and positive rate of climb are achieved.

Table C1 Distances and Heights with Variable TDP (heliport - surface level)

TDP Height (ft)	Rearward Take-off Distance (m)	Minimum Height (ft)	Height achieved VTOSS[1] (ft)	Continued Takeoff Distance (m)
120	65	25	40	135
140	80	45	60	120
160	90	65	80	110
180	100	85	100	100
200	110	105	120	90

[1] Height at which V_{TOSS} and positive rate of climb are achieved.

Table C2 Distances and Heights with Variable TDP (heliport - elevated)

C.5.3.1.2. DISTANCE FROM HELIPORT TO OBSTACLE IS GREATER THAN THE CONTINUED TAKEOFF DISTANCE REQUIRED

First, from the "OEI Height Gain Over a Horizontal Distance of 100 ft" charts in Subsection A, determine the climbout height attainable over the distance from the heliport to the obstacle less the takeoff distance required. The height thus obtained plus the height at the end of takeoff distance from Table C1 is the attainable height above the takeoff surface when the helicopter reaches the obstacle. Select a TDP height such that this attainable height is not lower than the obstacle height plus the minimum clearance as defined by operational rules. Since the required takeoff distance reduces when the TDP height is increased (see Table C1), the calculation must be repeated until an acceptable TDP height is obtained.

EXAMPLE: (see Fig. C18 and Table C1)

Determine: **TDP height for vertical takeoff**

Known: OAT ..... 0°C
Pressure altitude ..... 3500 ft
Gross mass ..... 3150 kg
Obstacle Height: ..... 150 ft
Obstacle Distance: ..... 250 m
Supposed Takeoff Distance .. 100 m
Headwind ..... 6 kt
for calculation 50%: Headwind . 3kt

Solution:

1. With the known MAT data (3150 kg, 3500 ft, 0°C), plot the climb performance using the OEI Height Gain - Segment I Chart (see Subsection A, Fig. A4) and calculate for a horizontal distance of 150 m (250 m minus 100 m).
   Result: approx 17,8 ft per 100 ft, i.e. approx 88 ft per 150 m.
2. Calculate minimum height required at the obstacle = 185 ft:
   Obstacle height 150 ft
   Minimum clearance 35 ft
3. Calculate minimum height to achieve VTOSS (185 ft minus 88 ft = 97 ft).
4. Using Table C1, round up to the next highest line of "Height achieved VTOSS" (i.e.100 ft) giving a provisional TDP height of 180 ft.
5. Since the takeoff distance is reduced to 50 m at a TDP of 180 ft (see Table C1), repeat the calculation from step 1: the Segment I height gainover a

horizontal distance of 200 m (250 m minus 50 m) is 117 ft (using the same height gain rate as in step 1).

6. The minimum height required at the obstacle = 185 ft (see step 2)
7. Calculate minimum height to achieve V_{TOSS} (185 ft minus 117 ft, i.e. 68 ft).
8. Since the height to achieve VTOSS (100 ft for TDP = 180 ft; see Table C1) is higher than necessary (68 ft), take the next lower TDP height of 160 ft.
9. Prove the complete flight path for TDP height of 160 ft:
   - height achieved VTOSS (65 m) is 80 ft
   - height gain up to the obstacle (250 m – 65 m = 185 m) is 108 ft
   - height at obstacle is (108 ft + 80 ft) 188 ft

The minimum required height at the obstacle of 185 ft is secured.

C.5.3.1.3. DISTANCE FROM HELIPORT TO OBSTACLE (REARWARD T/O)

For the approach path after LDP and the rearward T/O path the following obstacle (heights) are allowed (see Fig. C21):

- No obstacles 6 m rearward of the heliport
- 30 ft obstacle at 120 ft TDP (100 m rearward from centre of heliport)
- 100 ft obstacle at 200 ft max. TDP (165 m rearward from centre of heliport)

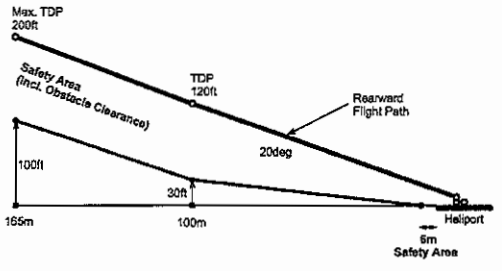

Fig. C21 Rearward Flight Path (VTOL)

C.5.3.2. **Modified landing flight path**

For varying the LDP height in order to clear obstacles when carrying out a go-around, the same procedure may be used accordingly. In this case, the speed should be increased linearly; i. e.:

150 ft/35 KIAS
200 ft/40 KIAS

NOTE Approach airspeeds can be increased by half of the wind speed.

C.6. MASS AND BALANCE

No change in the basic Flight Manual data.

C.7. SYSTEM DESCRIPTION

No change in the basic Flight Manual data.

C.8. HANDLING, SERVICING AND MAINTENANCE

No change in the basic Flight Manual data.

D. VTOL (2) – SHORT FIELD

D.1. GENERAL

D.1.1. DEFINITIONS

- Takeoff Decision Point TDP ..... 120 ft
- Landing Decision Point LDP ..... 100 ft/30 KIAS/ R/D≤300 ft/min

D.2. LIMITATIONS (IN ADDITION TO THE LIMITATIONS GIVEN IN PART A, "GENERAL", OF THIS SUPPLEMENT)

D.2.1. CERTIFICATION CRITERIA

The definitions given below are related to the respective emergency and normal procedures :

- Short field heliports: A heliport located on the ground or on the water, having dimensions of at least 75 x 15 m under day and night conditions.

D.2.2. MASS LIMITATIONS

NOTE A height–velocity danger area does not exist when using a gross mass derived from the chart Fig. D1 and following the CAT A VTOL normal takeoff and landing procedures.

For maximum vertical takeoff and landing gross mass refer to Fig. D1.

D.2.2.1. Mass limitations with optional equipment installed

When calculating the maximum takeoff and landing gross mass for VTOL operations, first calculate the maximum gross mass for Clear Heliport operation in accordance with subsection B of this supplement under consideration of the relevant correction values listed under para B.2.2.
In the second step, calculate the maximum takeoff and landing gross mass for VTOL operations using Fig. D1 without considering those correction values.

If the sandfilter system (FMS 9.2–22) is installed, subtract 55 kg from the result obtained from Fig. D1.

If the sandfilter (IBF–system) (FMS 9.2–50) is installed subtract 100 kg (sandfilter OFF) and 200 kg (sandfilter NORM) from the result obtained from Fig. D1.

EXAMPLE: (see Fig. D1)

Determine: **Maximum takeoff and landing gross mass (surface level operation)**

Known: OAT ..... 24 °C
Pressure altitude ..... 5000 ft (> 5000 ft DA)
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: **Gross mass = 2800 kg**

1. Enter chart (Fig. B1) at known OAT (24°C)
2. Move vertically upwards to known pressure altitude (5000 ft)
3. Move horizontally left and read max. gross mass (3340 kg)
4. Apply correction values for external optional equipment (–35 kg) as follows: 3340 kg – 35 kg = **3305 kg**
5. Enter chart (Fig. D1) at known OAT (24°C)
6. Move vertically upwards to known pressure altitude (5000 ft)
7. Move horizontally left and read max. gross mass (2800 kg)
8. Since the gross mass limit = 2800 kg is lower than the calculated max. gross mass from clear heliport subsection (3305 kg), the result is **2800 kg.**

MAXIMUM TAKEOFF AND LANDING GROSS MASS, CATEGORY A (VTOL)

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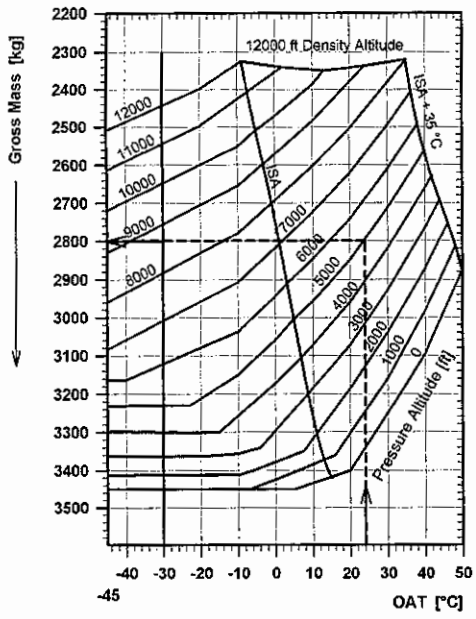

Fig. D1 Maximum takeoff and landing gross mass (VTOL)

D.3. EMERGENCY AND MALFUNCTION PROCEDURES

NOTE For OEI – and Balked Landing the procedure from part C - VTOL (1) shall be used.

D.3.1. SHORT FIELD HELIPORT - SINGLE ENGINE FAILURE DURING TAKEOFF PRIOR TO TDP

Procedure

1. Attitude	**– Nosedown (Nosedown means attitude change to –6°)**

NOTE Steady parts of the procedures are established with not less than 98% rotor rpm. The transient values are only allowed to cushion the landing.

2. Collective lever	**– Adjust to 2.5-min Power**

NOTE: At heights lower than 40 ft, it may be not possible to reduce power, (esp. in low wind conditions) and the collective should be used to cushion the landing as required.

Before touchdown:

3. Landing attitude	**– Establish for minimum ground speed**
4. Collective lever	**– Increase to cushion landing**

After touchdown:

5. Collective lever	– Lower to full down
6. Cyclic stick	– Neutral position; observe mast moment limits
7. Engines shutdown	– Perform

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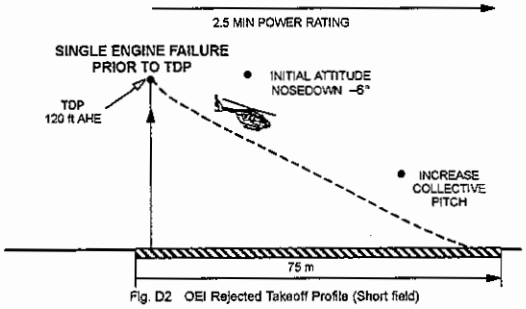

Fig. D2 OEI Rejected Takeoff Profile (Short field)

D.3.2. SHORT FIELD HELIPORT - SINGLE ENGINE FAILURE DURING TAKEOFF AFTER TDP

Procedure

1. Attitude	**– Nosedown –20° up to –25°**
2. Collective lever	**– Adjust to 2.5-min Power**
3. Attitude	**– After reaching 30 KIAS adjust to near level attitude while accelerating to V_{TOSS}**
4. Rotor speed	**– Trim to maximum**

When 200 ft AHE is reached:

5. Airspeed	– Accelerate to V_Y
6. Collective lever	– Adjust to Max Continuous Power
7. Climbout	– Continue with V_Y to 1000 ft AHE
8. Single engine emergency shutdown	– Perform
9. LAND AS SOON AS PRACTICABLE	

NOTE The correct application of the procedures guarantees a minimum ground clearance of 25 ft.

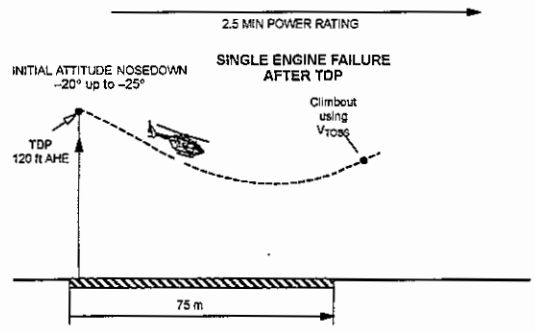

Fig. D3 OEI Continued Takeoff Profile (Short field)

D.3.3. SHORT FIELD - LANDING WITH ONE ENGINE INOPERATIVE PRIOR TO LDP

The landing procedures are unchanged to chapter VTOL (1).

D.4. NORMAL PROCEDURES

D.4.1. SHORT FIELD HELIPORT - VERTICAL TAKEOFF

Takeoff flight path	– Select as nearly into the wind as obstacles will permit

NOTE The heliport maneuvering area and takeoff flight path shall be clear of obstacles.

Pre-takeoff check	– Perform
VAR NR	– CAT A mode, if CAT < –30°C: NORM mode
Radar altimeter	– Test and set bug to 120 ft
Hover	– 3 ft skid height
All instruments	– Normal operating ranges, note FLI indication
Power Setting	– Increase power (use hover power plus 0.5 – 0.7 FLI, without exceeding TOP)
Climb	– Vertically, using appropriate outside reference (~ 300 fpm rate of climb)
When TDP is reached:	
Collective lever	– Adjust to Takeoff Power simultaneously
Pitch attitude	– Nosedown accelerate to V_Y
At V_Y:	
Collective lever	– Reduce to AEO MCP
Climbout	– Continue to desired altitude
VAR NR	– NORM mode

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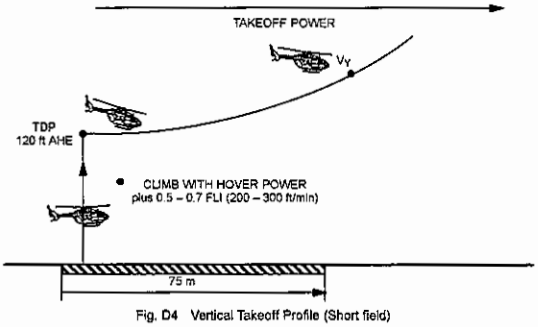

Fig. D4 Vertical Takeoff Profile (Short field)

D.4.2. SHORT FIELD - LANDING PROCEDURES

The landing procedures are unchanged to chapter VTOL (1).

D.5. PERFORMANCE DATA

D.5.1. TAKEOFF PERFORMANCE

NOTE Presented performance data apply to climbs without any significant bank angle and CAT A–mode activated. Turning during climbing will reduce climb performance.(see also A.5.3.1.)

D.5.1.1. OEI – Takeoff Flight Path (short field)

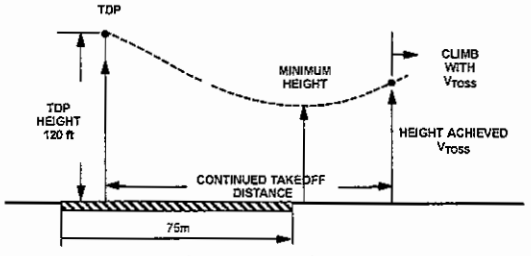

Fig. D5 Continued Takeoff Path

For TDP height 120 ft:

	Short field Heliport
Rearward takeoff distance	0 m
Minimum height	25 ft
Height achieved V_{TOSS}*)	40 ft
Continued takeoff distance	200 m

*) Height at which V_{TOSS} and a positive rate of climb is achieved.

D.5.1.2. **OEI – Takeoff flight path segments I and II**

The OEI standard takeoff flight path (see Fig. D7) begins at the end of the "continued takeoff distance" and is divided into two segments:

- Segment I

  OEI climb through segment I has to be accomplished with V_{TOSS} and 2.5-min Power until reaching 200 ft AGL. Segment I climb performance data (OEI Height Gain Over a Horizontal Distance of 100 ft) are presented in Subsection A, Fig.A2 to A4.

- Segment II

  OEI climb through segment II has to be accomplished with V_Y and Max Continuous Power until reaching 1000 ft AGL. Segment II climb performance data (OEI Height Gain Over a Horizontal Distance of 100 ft) are presented in Subsection A, Fig. A5 to A7.

The distance required for horizontal acceleration from V_{toss} to V_Y is 250 m under calm wind conditions. For calculations with headwind components see Fig. D6.
(e.g. known headwind: 16 kt ➧ Acceleration distance: 177 m)

Distance required for horizontal acceleration
from Vtoss to Vy
(valid for all gross mass / altitude OAT combinations)

Acceleration distance: 250 m

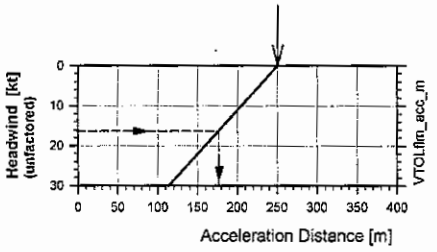

Fig. D6 Acceleration distance V_{toss} to V_Y

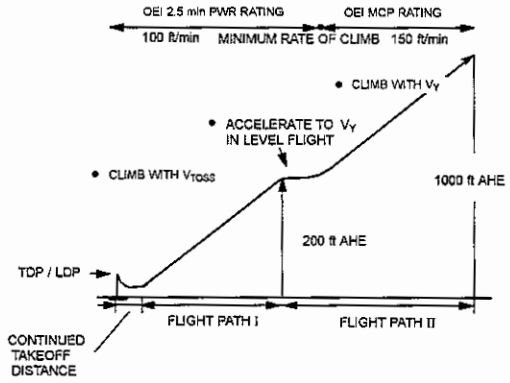

Fig. D7 OEI Takeoff Profile (short field)

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D.6. **MASS AND BALANCE**

No change in the basic Flight Manual data.

D.7. **SYSTEM DESCRIPTIONS**

No change in the basic Flight Manual data.

D.8. **HANDLING, SERVICING AND MAINTENANCE**

No change in the basic Flight Manual data.

E. VTOL (3) – CONFINED HELIPORT

E.1. GENERAL

E.1.1. DEFINITIONS

- Takeoff Decision Point TDP ..... 240 ft
- Landing Decision Point LDP ..... 240 ft/ 20 KIAS

E.2. LIMITATIONS (IN ADDITION TO THE LIMITATIONS GIVEN IN PART A, "GENERAL", OF THIS SUPPLEMENT)

E.2.1. CERTIFICATION CRITERIA

The definitions given below are related to the respective emergency and normal procedures :

- Confined heliports : A heliport located on the ground, having dimensions of at least 75 x 15 m (under day conditions).

CAUTION DO NOT USE THE VTOL–CONFINED HELIPORT PROCEDURE AS NORMAL OEI LANDING PROCEDURE.

E.2.2. MASS LIMITATIONS

For maximum vertical takeoff and landing gross mass refer to Fig. E1.

NOTE A height–velocity danger area does not exist when using a gross mass derived from the chart Fig. E1 and following the CAT A normal takeoff and landing procedures.

E.2.2.1. Mass limitations with optional equipment installed

When calculating the maximum takeoff and landing gross mass for VTOL operations, first calculate the maximum gross mass for Clear Heliport operation in accordance with subsection B of this supplement under consideration of the relevant correction values listed under para B.2.2.
In the second step, calculate the maximum takeoff and landing gross mass for VTOL operations using Fig. E1 without considering those correction values.

If the sandfilter system (FMS 9.2–22) is installed, subtract 55 kg from the result obtained from Fig. E1.

If the sandfilter (IBF–system) (FMS 9.2–50) is installed subtract 100 kg (sandfilter OFF) and 200 kg (sandfilter NORM) from the result obtained from Fig. E1.

EXAMPLE: For helicopter with external optional equipment installed (see Fig. E1)

Determine: **Maximum takeoff and landing gross mass**

Known: OAT ..... 24 °C
Pressure altitude ..... 5000 ft (> 5000 ft DA)
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: **Gross mass = 2800 kg**

1. Enter chart (Fig. B1) at known OAT (24°C)
2. Move vertically upwards to known pressure altitude (5000 ft)
3. Move horizontally left and read max. gross mass (3340 kg)
4. Apply correction values for external optional equipment (–35 kg) as follows: 3340 kg – 35 kg = **3305 kg**
5. Enter chart (Fig. E1) at known OAT (24°C)
6. Move vertically upwards to known pressure altitude (5000 ft)
7. Move horizontally left and read max. gross mass (**2800 kg**)
8. Since the gross mass limit = 2800 kg is lower than the calculated max. gross mass from clear heliport subsection (3305 kg), the result is **2800 kg.**

MAXIMUM TAKEOFF AND LANDING GROSS MASS, CATEGORY A (VTOL)

1 X TURBOMECA ARRIEL 1E2

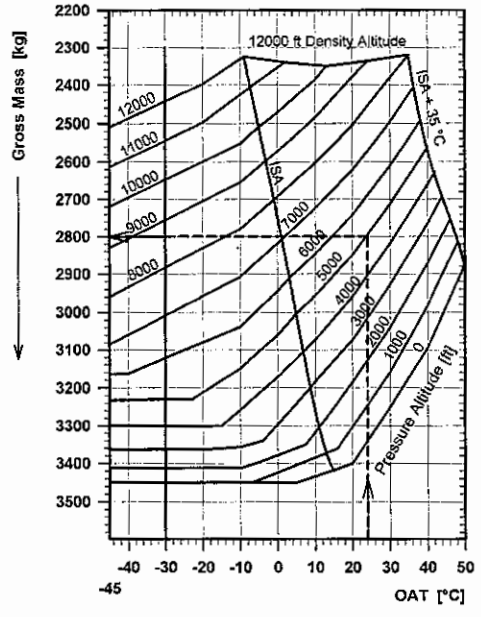

Fig. E1 Maximum takeoff and landing gross mass (VTOL)

E.3. EMERGENCY AND MALFUNCTION PROCEDURES

E.3.1. CONFINED HELIPORT – SINGLE ENG. FAILURE DURING TAKEOFF PRIOR TO TDP

Procedure

1. Attitude	**– Nosedown; maintain starting point in sight (Nosedown means to –6°)**
2. Collective lever	**– Adjust to 2.5-min Power**

NOTE: At heights lower than 40 ft, it may be not possible to reduce power, (esp. in low wind conditions) and the collective should be used to cushion the landing as required.

Before touchdown:

3. Landing attitude	**– Establish for minimum ground speed**
4. Collective lever	**– Increase to cushion landing**

After touchdown:

5. Collective lever	– Lower to full down
6. Cyclic stick	– Neutral position; observe mast moment limits
7. Engines shutdown	– Perform

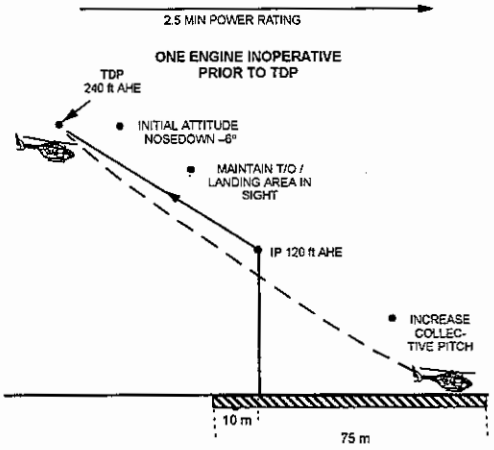

Fig. E2 OEI Rejected Takeoff Profile (confined heliport)

E.3.2. CONFINED HELIPORT– SINGLE ENG. FAILURE DURING TAKEOFF AFTER TDP

Procedure

1. Attitude	**– Nosedown –20° up to –25°**
2. Collective lever	**– Adjust to 2.5-min Power**
3. Climb	**– After reaching 30 KIAS adjust to near level attitude while accelerating to V_{TOSS}**
4. Rotor speed	**– Trim to maximum**

When 200 ft AHE is reached:

5. Airspeed	– Accelerate to V_Y
6. Collective lever	– Adjust to Max Continuous Power
7. Climbout	– Continue with V_Y to 1000 ft AHE
8. Single engine emergency shutdown	– Perform
9. LAND AS SOON AS PRACTICABLE	

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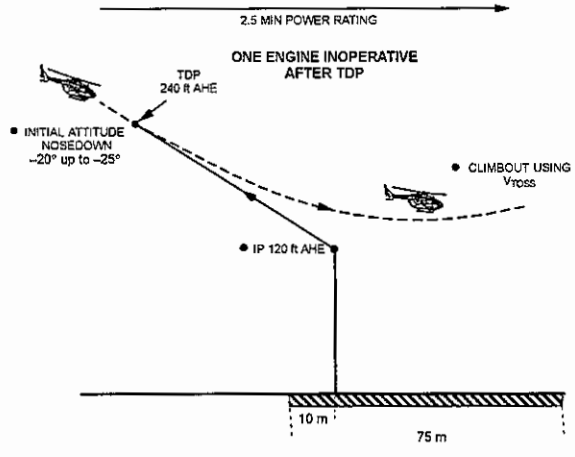

Fig. E3 OEI Continued Takeoff Profile (Confined Heliport)

E.3.3. CONFINED HELIPORT – LANDING WITH ONE ENGINE INOPERATIVE PRIOR TO LDP

NOTE The pilot may elect to balk the landing or to continue the approach. If the decision is to continue the approach use the procedure for **"SINGLE ENGINE FAILURE AFTER LDP"**. When commencing landing bleed air consumers must be off.

The following procedures are to be used if the decision is to **balk the landing:**

Procedure

1. Collective lever	**– Adjust to 2.5-min Power**
2. Airspeed	**– V_{TOSS}**
3. Rotor speed	**– Trim to maximum**

NOTE If airspeed is 65 KIAS or above use V_Y.

When 200 ft AHE is reached:

4. Airspeed	– Accelerate to V_Y
5. Collective lever	– Adjust to Max Contin. Power
6. Climbout	– Continue with V_Y to 1000 ft AHE
7. Single engine emergency shutdown	– Perform
8. LAND AS SOON AS PRACTICABLE	

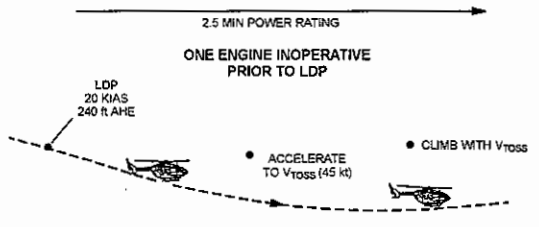

Fig. E4 OEI Balked Landing Profile (confined heliport)

E.3.4. CONFINED HELIPORT – SINGLE ENGINE FAILURE DURING LANDING AFTER LDP

Procedure

1. Collective lever	**– Adjust to 2.5-min Power or below**

Before touchdown:

2. Landing attitude	**– Establish for minimum ground speed**
3. Collective lever	**– Raise to cushion landing**

NOTE Plan for zero ground speed touchdown.

After touchdown:

4. Collective lever	– Lower to full down
5. Cyclic stick	– Neutral position; observe mast moment limits
6. Engines shutdown	– Perform

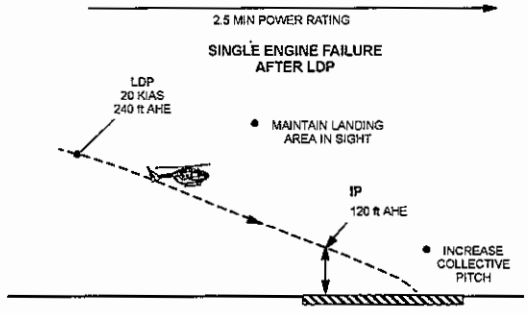

Fig. E5 OEI Landing Profile (Confined heliport)

E.4. NORMAL PROCEDURES

E.4.1. CONFINED HELIPORT – VERTICAL TAKEOFF

Procedure:

Takeoff flight path	– Select as nearly into wind as obstacles will permit

NOTE The heliport maneuvering area shall be clear of obstacles.

Pre-takeoff check	– Perform
VAR NR	– CAT A mode, if OAT <–30°C: NORM mode
Altimeter/Radar altimeter	– Set

For confined operation the barometric altimeter is to be used as source for LDP/TDP identification.

Before confined heliport operation, the TDP, indicated by the barometric altimeter should be defined as follows:

Reference:

Reference is the helicopter on the elevated heliport, with engines in flight idle and low collective pitch setting (torque < 2x20%), or before engine started.

NOTE Ground run with high pitch settings or using hover in ground effect as baro altitude reference will lead to erroneous results.

Procedure:

Read the indicated baro altitude and add 280 ft to obtain the TDP height for baro altimeter indication.

Hover	– 3-ft skid height over the beginning of T/O area
All instruments	– Normal operating ranges, note FLI indication
Power setting	– Initiate (use hover power plus 0.5 – 0.7 FLI, without exceeding TOP to maintain ~300 fpm rate of climb); maintain landing area in sight (see Fig. E6)
Climb	– Vertically, using appropriate outside reference (~300 fpm rate of climb)
	– Slow climb establish until reaching 120ft AHE

Rearward climb at Intermediate Point (IP)	– Initiate (use hover power plus 0.5 – 0.7 FLI, without exceeding TOP to maintain ~300 fpm rate of climb); maintain landing area in sight (see Fig. E7)

<u>When TDP is reached:</u>

Collective lever	– Adjust to Takeoff Power simultaneously accelerate to V_Y

<u>At V_Y:</u>

VAR NR	– NORM mode

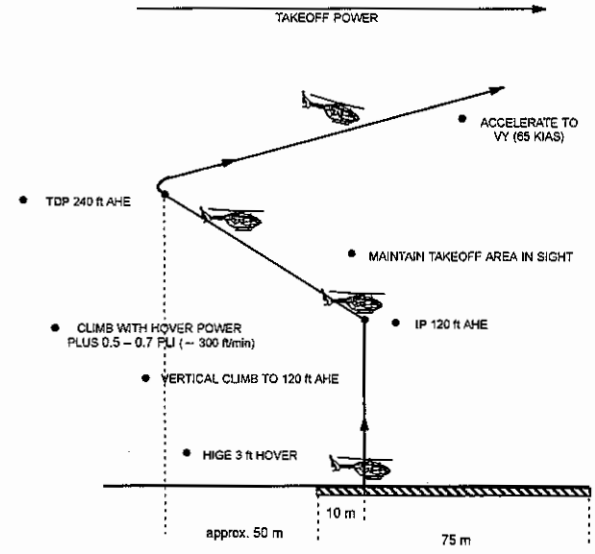

Fig. E6 Vertical/Rearward Takeoff Profile (Confined Heliport)

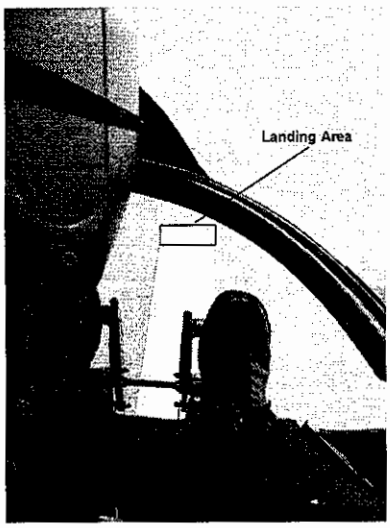

Fig. E7 Heliport Sight Picture at TDP, LDP or IP

E.4.2. CONFIINED HELIPORT – VERTICAL LANDING

Before starting confined heliport operation, the LDP, indicated by the barometric altimeter should be determined as follows:

The LDP is the indicated baro altitude plus the LDP difference baro value of the following table.

Baro altimeter	LDP difference baro value
PA ≤ 5000ft	300 ft
PA > 5000 ft	310 ft

Procedure

1. Prelanding check	– Perform
2. Baro altimeter	– Set the accurate local QNH of the landing area

At V_Y:

3. VAR NR	– CAT A mode, if OAT < –30°C: NORM mode
4. Continue landing approach	– Reduce airspeed for 20 KIAS on LDP

NOTE Approach airspeeds can be increased by half of the wind speed.

After passing LDP:

5. Approach	– Continue, check position of landing area as shown in Fig. E7
6. Speed	– Decrease slowly to arrive at a 3-ft hover above landing point
7. Slow vertical descent	– Initiate to touchdown

When on ground:

8. VAR NR	– NORM mode

NOTE An alternate procedure for determing the LDP baro altitude is, to overfly the landing area before landing to determine the baro altitude indication by comparing baro- and radar altitude.

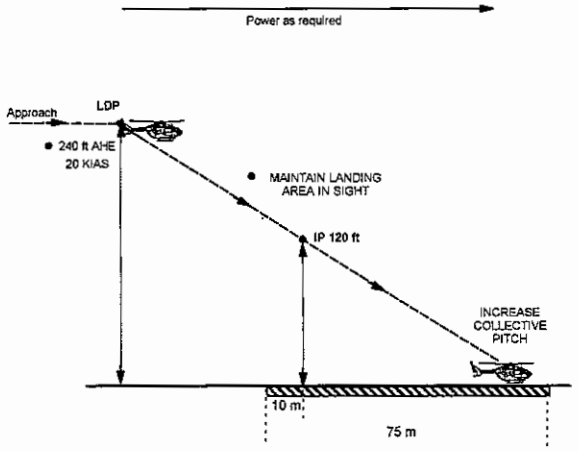

Fig. E8 Landing Profile (Confined Heliport)

E.5. PERFORMANCE DATA

E.5.1. TAKEOFF PERFORMANCE

NOTE Presented performance data apply to climbs without any significant bank angle and CAT A–mode activated. Turning during climbing will reduce climb performance.(see also A.5.3.1.)

E.5.1.1. Takeoff flight path segments I and II

The OEI standard takeoff flight path (see Fig. E10) begins at the end of the "continued takeoff distance" and is divided into two segments:

- Segment I

  OEI climb through segment I has to be accomplished with V_{TOSS} and 2.5-min Power until reaching 200 ft AGL. Segment I climb performance data (OEI Height Gain Over a Horizontal Distance of 100 ft) are presented in Subsection A, Fig.A2 to A4.

- Segment II

  OEI climb through segment II has to be accomplished with V_Y and Max Continuous Power until reaching 1000 ft AGL. Segment II climb performance data (OEI Height Gain Over a Horizontal Distance of 100 ft) are presented in Subsection A, Fig. A5 to A7.

The distance required for horizontal acceleration from V_{toss} to V_Y is 250 m under calm wind conditions. For calculations with headwind components see Fig. E9.
(e.g. known headwind: 16 kt ➧ Acceleration distance: 177 m)

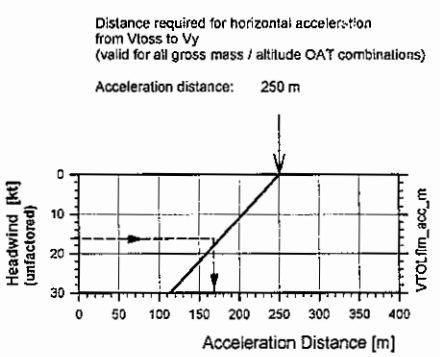

Fig. E9 Acceleration distance V_{TOSS} to V_Y

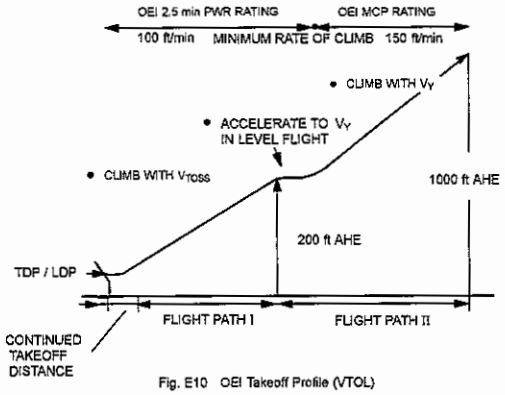

Fig. E10 OEI Takeoff Profile (VTOL)

E.5.1.2. Heights and Distances – Normal flight path VTOL Confined Heliport

NOTE The confined heliport procedures can be used in congested areas in accordance with national oporational rules.

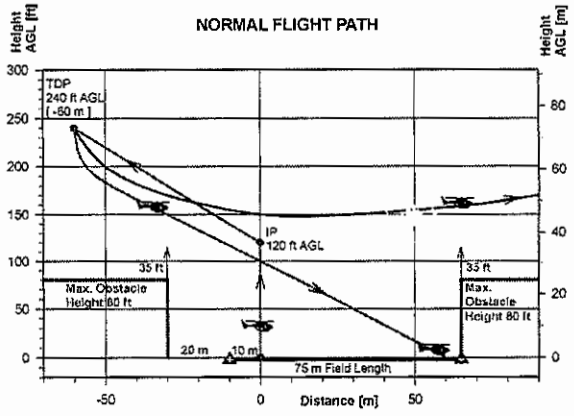

Fig. E11 Heights and distances –Normal figh path (Confined heliport)

For TDP height 240 ft :

– Rearward takeoff distance	60 m
– Height achieved V_{TOSS}	160 ft
– **Continued takeoff distance (from T/O point)**	**135 m**

E.5.1.3. Heights and Distances – Modified Flight Path for VTOL Confined Heliport

For heliports with obstacle heights of max. 40 ft a modified Confined Heliport procedure with modified flight pathes for takeoff and landing is additional defined (see Fig. E12).

These procedures are based on a heliport with 50 m field length.

– <u>TAKEOFF:</u>

– IP at 60 ft AGL

– TDP 180 ft AGL / TDP baro 220 ft

– unchanged sight picture to normal flight path

– <u>LANDING:</u>

– LDP at 160 ft / 20 kts

– unchanged sight picture to normal flight path

– <u>LDP Difference value Baro Altimeter:</u>

Baro altimeter	LDP difference baro value
PA ≤ 5000 ft	240 ft
PA > 5000 ft	250 ft

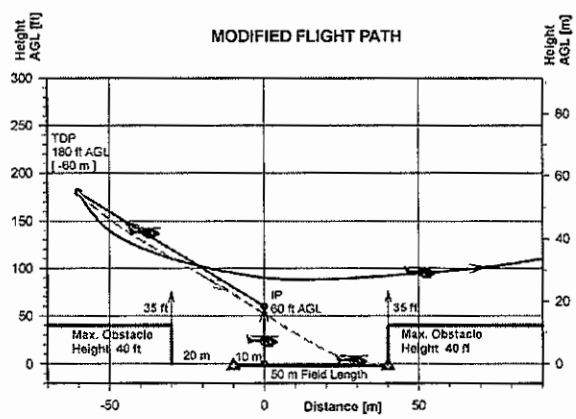

Fig. E12 Heights and distances –Modified flight path (Confined heliport)

For TDP height 180 ft :

– Rearward takeoff distance	60 m
– Height achieved V_{TOSS}	100 ft
– **Continued takeoff distance (from T/O point)**	**135 m**

E.6. MASS AND BALANCE DATA

No change in the basic Flight Manual data.

E.7. SYSTEM DESCRIPTIONS

No change in the basic Flight Manual data.

E.8. HANDLING, SERVICING AND MAINTENANCE

No change in the basic Flight Manual data.

F M S 9.1–2

SUPPLEMENT FOR

OPERATION WITH OPENED/REMOVED DOORS

This supplement shall be attached to the BK 117 C–2 Flight Manual (Section 9.1) when operating with OPENED AND/OR REMOVED DOORS.

Date: 15. Nov. 01

Approved by:
Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

LEP – EASA approved (part 1):

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
9.1-2-1	2		R 9.1-2-6	9				
R 9.1-2-2	9		R 9.1-2-7	9				
R 9.1-2-3	9		R 9.1-2-8	9				
R 9.1-2-4	9		R 9.1-2-9	9				
R 9.1-2-5	9		R 9.1-2-10	9				

LEP – manufacturer's data (part 2):

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R 9.1-2-11	9		N 9.1-2-12	9				

LOG OF REVISION

FIRST ISSUE					
ORIGINAL		NOV 2001	REVISION	5	JAN 28, 2004
REVISION	1	FEB 21, 2002	REVISION	6	MAI 28, 2010 (EASA approval no.: 10030144)
REVISION	2	JUL 05, 2002	REVISION	7 + 8	OCT 02, 2012 (EASA approval no.: 10041614)
REVISION	3	MAR 07, 2003			
REVISION	4	JUL 01, 2003	REVISION	9	(see entry below)

REVISION 9 — Approved by EASA

Date: JUL 02, 2013 — EASA approval no.: 10045517

1. GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

1.1. INTRODUCTION

For special missions the helicopter is approved to be operated with

- Opened or removed cockpit door(s) (in the following named hinged doors),
- Opened or removed sliding door(s) (also applicable for the doors mentioned in the FMS 9.2-34 "Sliding door jettisonning")
- Removed rear clamshell doors

including all possible combinations of the above mentioned configurations, when the following limitations and procedures are complied with.

2. LIMITATIONS

2.1. CONFIGURATION REQUIREMENTS

For operation with opened or removed sliding door(s) when the hinged doors are installed, a certified locking device for the hinged doors(s) and/or the sliding door(s) must be installed.

Use of EXTENSION position is only allowed when the door locking device P/N B520M4023051 and/or B520M4022051 is installed.

Flying without clamshell doors is only allowed when hinged and sliding doors are removed as well.

For operation without hinged doors, exposure to rain shall be avoided or minimized.

Cockpit curtain must be removed.

2.2. KINDS OF OPERATION

Category A takeoff / landing and flights in IMC are prohibited when flying with opened/removed door(s).

During single pilot night flight it is not allowed to open/ close the pilot's door in flight.

2.3. AIRSPEED LIMITS

		Sliding door(s)				
		Closed	Opening/ Closing	Open	One side Open/ Removed	Removed
Hinged door(s)	Closed	V_{NE}	50	50	50	V_{NE}
	Spoiler pos.: Opening/ Closing	60 or V_{NE}*	50	50	50	50
	Spoiler pos.: Open	100 or V_{NE}* rwd flt 15 kts	80 or V_{NE}* rwd flt 15 kts	100 or V_{NE}* rwd flt 15 kts	50 or V_{NE}* rwd flt 15 kts	100 or V_{NE}* rwd flt 15 kts
	Extension pos.: Opening/ Closing	30	30	30	30	30
	Extension pos.: Open	30 rwd flt 30 kts	30 rwd flt 30 kts	30 rwd flt 30 kts	30 rwd flt 30 kts	30 rwd flt 30 kts
	removed[3)]	V_{NE}	30	30[1)]	30[1)]	V_{NE}[2)]
All values are in KIAS. V_{NE}* - value from V_{NE} table, whichever is less.						

1) only valid if the sliding door is locked
2) also valid with clamshell doors removed
3) only valid with both hinged doors removed

Table 1: FLM Airspeed Limitations

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2.4. WIND LIMITS

Max. crosswindspeed for flights with open, half open or removed door(s) ..... 30 kts

2.5. SIDESLIP LIMITS

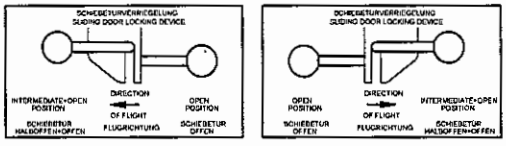
Sideslip is limited to ±1 ball for flights with open, half open or removed door(s).

2.6. OCCUPANTS

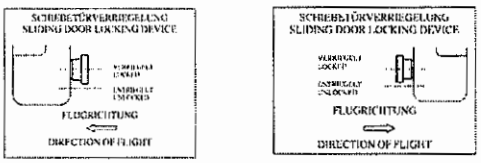
All occupants, including the flight crew, must keep their seat belts fastened or being secured in another approved manner during flight with open, half open or removed door(s).

2.7. PLACARDS

Placard:



or



Location: RH and LH Sliding Door, near door locking lever

Placard:

ACHTUNG: FLUG MIT OFFENEN TUEREN NUR GEMAESS FLH
WARNING: FLIGHT WITH OPEN DOORS ONLY ACC. TO FLM

Location: H/C doors

3. EMERGENCY AND MALFUNCTION PROCEDURES

When the optional Door Warning is installed, the caution indication "DOORS" will be activated steadily during flight with open and/or removed door(s). Consequently no indication for the secure lock of the remaining doors is available.

4. NORMAL PROCEDURES

4.1. PREFLIGHT CHECK

Loose objects, such as manuels, maps, navigation equipment etc.	– Fixed and secured
Loose objects, which are not essential for the flight	– Removed
Seat belts	– Fastened

If takeoff with open/ half open door(s) is intended:

Opened door(s)	– Check secured (by means of an certified locking device)

4.2. OPERATION

CAUTION THE OPERATOR MUST NOT RELEASE THE SLIDING DOOR WHILE OPENING OR CLOSING, UNTIL THE DOOR IS LOCKED BY MEANS OF THE FIXATION DEVICE OR COMPLETELY CLOSED AND LOCKED.

NOTE
- Avoid prolonged hover with the forward hinged door(s) in SPOILER position.
- In accordance with pilot's instructions, one or both sliding door(s) may be opened by a crew member in the cabin.
-
- For single pilot operations it is advised not to operate the hinged doors close to the ground at low airspeed.
- The door(s) may be opened/closed on ground or inflight. If opening or closing inflight is intended, proceed as follows:

▶ **Opening hinged door(s):**

Hinged door locking device	– Turn safety knob 90°
Hinged door	– Open until safety knob is latched

▶ **Closing hinged door(s):**

Hinged door locking device	– Pull safety knob and turn it 90°
Hinged door	– Close and secure

5. PERFORMANCE DATA

There is no performance data provided for the extension position as this position is only to be used in slow and hovering flight.

5.1. POSITION ERROR CORRECTION

The following tables provide position error corrections for the allowed door configurations (symmetrical and asymmetrical), both for the indicated airspeed (table 2) and altitude (table 3) with the normal static source (Norm) and the alternate static source (Alt).

EXAMPLE: Table 2

Determine: **Actual airspeed (KCAS) using PEC correction values**

Known: Indicated airspeed (IAS).....100 kts
Static source being used.....Alternate
Config.....Hinged and Sliding doors removed

Solution: **With alt source selected above 40 kts one should subtract 1.7kt per 10 kt of airspeed according table so:**
100–40= 60 kts then 1.7 x 6 = 10.2 kts.
100–10.2 = 89.8 KCAS.

Hinged door(s) \ Sliding door(s)	Closed	Open	Removed	Clamshell door(s) Removed
Closed	See basic FLM section 5	Norm: no correction Alt (IAS>50): –1 kt/10kt	Norm: no correction Alt (IAS>50): –1 kt/10kt	N/A[2]
removed[1]	Norm: no correction Alt (IAS>40): –2 kt/10kt	Norm: no correction Alt: no correction	Norm: no correction Alt (IAS>40): –1.7kt/10kt	Norm (IAS>70): –1.1 kt/10kt Alt (IAS>40): –1.4 kt/10kt

1) only valid with both hinged doors removed
2) Flying without clamshell doors is only allowed when hinged and sliding doors are removed as well

Table 2: FLM Airspeed PEC

Hinged door(s) \ Sliding door(s)	Closed	Open	Removed	Clamshell door(s) Removed
Closed	See basic FLM section 5	Norm (IAS>70): –9 ft/10kt Alt (IAS>60): –12 ft/10kt	Norm (IAS>70): –9 ft/10kt Alt (IAS>60): –12 ft/10kt	N/A[2]
removed[1]	Norm: no correction Alt (IAS>50): –20 ft/10kt	Norm: no correction Alt (IAS>40): –10 ft/10kt	Norm (IAS>80): –7 ft/10kt Alt (IAS>50): –16 ft/10kt	Norm (IAS>80): –16 ft/10kt Alt (IAS>50): –17 ft/10kt

1) only valid with both hinged doors removed
2) Flying without clamshell doors is only allowed when hinged and sliding doors are removed as well

Table 3: FLM Altitude PEC

5.2. AEO AND OEI MAXIMUM RATE OF CLIMB

All results obtained from the appropriate R/C diagrams, contained in section 5 of the basic Flight Manual, must be reduced as follows:

EFFECTIVITY *Hinged doors removed, sliding doors closed*

All Gross Masses ..... No correction required

EFFECTIVITY *Hinged doors closed + sliding doors removed*
OR
Hinged doors in spoiler position + both sliding doors closed, open or removed
OR
Hinged doors removed + sliding doors removed

Gross Mass below 2400 kg ..... – 65 ft/min

Gross Mass above 2400 kg and below 3000 kg ..... – 50 ft/min

Gross Mass 3000 kg and above ..... – 40 ft/min

EFFECTIVITY *Hinged doors closed + both sliding doors open*
OR
Hinged doors closed + one sliding door (LH or RH) open or removed
OR
Hinged doors in spoiler position + one sliding door (LH or RH) open or removed

All Gross Masses ..... – 230 ft/min

EFFECTIVITY *All doors including clamshell doors removed*

Gross Mass below 2400 kg ..... – 115 ft/min

Gross Mass above 2400 kg and below 3000 kg ..... – 90 ft/min

Gross Mass 3000 kg and above ..... – 70 ft/min

NOTE The rate of climb reduction values are independent of power rating.

5.3. **DELETED**

5.4. **DELETED**

6. MASS AND BALANCE

Refer to Equipment List entries Section 6 of the basic Flight Manual.

7. SYSTEM DESCRIPTION

The opening and closing of the sliding doors is possible in level flight, with the option to use different door positions on both sides. To be able to open the doors in flight at higher airspeeds (above 60 KIAS), the pilot's and copilot's hinged door are used as spoilers (Fig. 1), providing that the opening of the sliding doors will not results in harmful vibration for the helicopter.

When the door locking device P/N B520M4023051 and/or B520M4022051 is installed, during operations at low speed (approx. 30 KIAS) the hinged doors can be opened to an extended position (Fig. 2), allowing the pilot to look down through the opened doors (e.g. during external load operation).

A mount enables the operator to safely secure the door in the open position. This mount is designed to automatically catch the door as soon as the door bolt runs over the locking point.

The forward hinge doors can be single-handed operated by the pilot or copilot. The locking device for the spoiler position or for the SPOILER and EXTENSION positions is attached at the gas-pressure spring of the door. The design takes precaution for the emergency egress of the cockpit, as it is not altering the doors attachment in general.

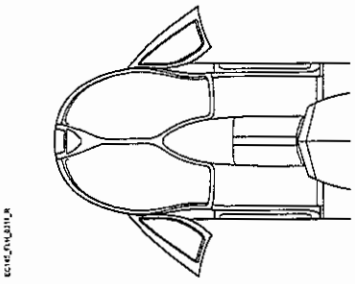


Fig. 1 Spoiler Position

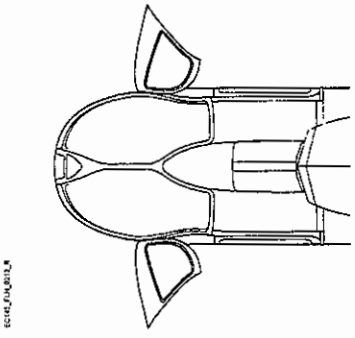


Fig. 2 Extended Position

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F M S 9.1–3

SUPPLEMENT FOR

OEI TRAINING

This supplement shall be attached to the BK 117 C–2 Flight Manual (Section 9.1) when OEI Training is intended.

NOTE Due to the nature of its content, this supplement is divided into four separate, related subsections that first present General Data applicable to all training flights and then specific Category A and Category B Operations with data applicable to approved types of operation.

Date:

11 März 02

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

LEP – EASA approved (part 1):

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
9.1-3 -1	1		R 9.1-3 -9	6		9.1-3 -17	5	
R 9.1-3 -2	6		9.1-3 -10	5		9.1-3 -18	5	
9.1-3 -3	5		9.1-3 -11	5		9.1-3 -19	4	
9.1-3 -4	1		9.1-3 -12	5		9.1-3 -20	5	
9.1-3 -5	4		9.1-3 -13	4				
9.1-3 -6	1		9.1-3 -14	5				
9.1-3 -7	4		9.1-3 -15	5				
9.1-3 -8	5		9.1-3 -16	5				

LEP – manufacturer's data (part 2):

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9.1-3 -21	5							
9.1-3 -22	5							

LOG OF REVISION

First Issue					
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			EASA approval no.: R.C.03476		
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REVISION	2	NOV 25, 2002	EASA approval no.: 10037587		
REVISION	3	AUG 26, 2003	REVISION	6	(see entry below)

REVISION 6 — Approved by EASA

Date: MAR 17, 2014 — EASA approval no.: 10048518

A. GENERAL DATA

A.1. GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

A.2. LIMITATIONS

A.2.1. MINIMUM FLIGHT CREW

The minimum flight crew consists of 2 pilots.

A.2.2. CONFIGURATION REQUIREMENTS

For OEI simulation with the training device (P/N B032M0820101) installed, the engine limitations listed below in para A.2.4. are applicable.

If the training device (P/N B032M0820101) is not installed, the engine limitations listed in para 2.11 of the basic flight manual are applicable.

A.2.3. ENGINE LIMITATION

NOTE • The following limits are for OEI training with the training device (P/N B032M0820101) installed (ENG TRAIN sw ON).

• For adjustment of the training device refer to section 7 of this supplement.

CONDITION	FLI	MAX TORQUE [%]
One engine inoperative		
Transient (max. 12 s)	14.0	125
2.5 min. Power	12.0	100
Max. Continuous Power	11.0	88

A.3. EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

A.4. NORMAL PROCEDURES

No change in the basic Flight Manual data.

A.5. PERFORMANCE DATA

Refer to section C and D of this supplement.

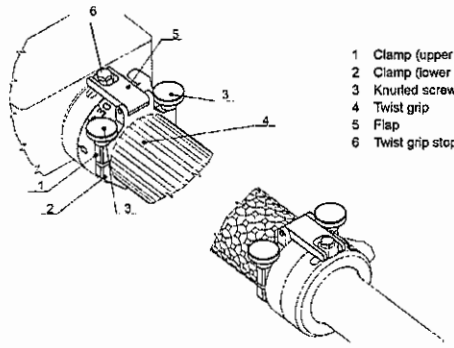
A.6. MASS AND BALANCE

No change in the basic Flight Manual data.

A.7. SYSTEMS DESCRIPTION

A.7.1. TRAINING DEVICE

The training device consists of a mechanical part (clamp with flap) and an electrical part (two TRAINING switches on the overhead panel). The simulations of the OEI rating will be conducted with reduced power. The device is a variable, adjustable stop which limits the twist grip position to an extent that prevents the engine from overloading during training maneuvers. It can be applied to either engine twist grip. For normal flight operations the flap can be turned back, allowing for free movement of the twist grip.



1 Clamp (upper half)
2 Clamp (lower half)
3 Knurled screw
4 Twist grip
5 Flap
6 Twist grip stop

Fig. A1 Training device

A.7.2. INSTALLATION/ADJUSTMENT OF THE TRAINING DEVICE

NOTE • Since the adjustment of the training device (and the resultant engine limitations) depends on ambient conditions, it must be carried out **before each** flight.

• The adjustment must be performed on the ground.

The following describes the installation of the training device for engine 1 (system 1). If it is intended to install the training device for engine 2, proceed as follows, however, substituting "engine 1" for "engine 2".

When on the ground with the collective lever full down:

1. Position clamp on forward end of engine 1 (or aft end of engine 2) twist grip and secure slightly using knurled screws; flap retracted.
2. With both engines running rotate both twist grips to the flight position. Select CAT A mode and check NR increase. Place ENG 1 TRAIN switch to ON; TRAINING (system 1) caution indication comes on.
3. Rotate engine 2 twist grip to idle position; TWIST GRIP caution indication (system 2) and an inverted triangle with "T" symbol (FLI, engine 1) comes on.
4. Rotate engine 1 twist grip into position, so that extended flap engages twist grip stop.
5. Increase collective lever slowly and monitor FLI indication. At FLI 12.0 (2.5 min. power) reduce engine 1 twist grip slowly to establish FLI 12.0 (2.5 min. power) and rotor rpm 98%.

NOTE At FLI 12.0 (2.5 min. power) check torque 100% (other torque is the limiting factor).

6. Decrease collective lever and secure clamp in this position.
7. Verify by increasing the collective lever so that at FLI 12.0 (2.5 min. power) the rotor rpm decreases to 98%.
8. Repeat adjustment procedure if indicated values are not correct.
9. Rotate engine 2 twist grip to flight position. TWIST GRIP caution indication (system 2) and the inverted triangle with "T" symbol go off.

B. CATEGORY B TRAINING

B.1. GENERAL

This subsection provides information necessary for Category B training.

B.2. LIMITATIONS

B.2.1. MASS LIMITATIONS

For determining the training takeoff and landing gross mass in order to simulate OEI conditions during Category B with one engine at IDLE, refer to the diagram of subsection "C".

B.3. EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

B.4. NORMAL PROCEDURES

No change in the basic Flight Manual data.

C. CATEGORY A - CLEAR HELIPORT

C.1. GENERAL

This subsection provides information necessary for Category A training operations at CLEAR HELIPORTS.

To simulate OEI operation with one engine at IDLE, follow the emergency procedures of Category A operations supplement (9.1–1, subsection B), however, use the GENERAL DATA, Engine Limitations (see subsection A) and the gross mass value from the TRAINING WAT curve of this subsection.

CAUTION IN SUPPLEMENT 9.1–1, SUBSECTION B, THE FIGURES "REJECTED TAKEOFF DISTANCE REQUIRED", "CONTINUED TAKEOFF DISTANCE REQUIRED", "LANDING DISTANCE FROM 50 FT HEIGHT TO A COMPLETE STOP ON THE GROUND" AND "ACCELERATION DISTANCE V_{TOSS} TO V_Y" ARE NOT VALID FOR CAT A – CLEAR HELIPORT TRAINING.

C.2. LIMITATIONS

For CAT A Training with max. training gross mass the OEI Training device must be installed and operating.

During OEI Training the Bleed Air Heating System must be switched OFF.

C.2.1. MASS LIMITATIONS

For determining the training takeoff and landing gross mass in order to simulate OEI conditions during Category A (clear heliport) with one engine at IDLE, refer to the Fig.C1, if the "Sandfilter (IBF System)" (FMS 9.2–50) is installed refer to Fig. C2 and C3 of this subsection.

C.2.2. ALTITUDE LIMITATIONS

The maximum operating altitude for OEI training is ..... **8000 ft PA**

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C.2.3. MASS LIMITATIONS WITH OPTIONAL EQUIPMENT INSTALLED

If external mounted optional equipment (shown below) is installed, proceed as follows:

All results obtained from maximum takeoff and landing gross mass chart (Fig.C1) are to be corrected using these correction values.

	Δ MTOW [Kg]	
	DA ≤ 5000 ft	DA > 5000 ft
Emergency Floats (FMS 9.2–9)	–30	–40
Searchlight SX-16 (Side) (FMS 9.2–23)	–50	–60
External Loudspeaker (FMS 9.2–12)	–25	–35
External Hoist System (FMS 9.2–11)	–15	–20
Snow Skids (FMS 9.2–26)	–	–
Weather Radar System (FMS 9.2–28)	–	–
Cargo Hook Mirror (FMS 9.2–4)	–25	–35
Sandfilter System (FMS 9.2–22)	–200	–200
Sandfilter (IBF–System) (FMS 9.2–50)	see Fig.C2 and C3	
Forward looking Infrared FLIR (FMS 9.2–35)	–20	–25
EOS Wescam MX 15i/HDi (FMS 9.2–56)	–30	–40
Centerline Camera Carrier System (FMS 9.2–61) with FLIR MX15i/HDi installed	–20	–25
EOS Wescam MX 10 (FMS 9.2–67)	–10	–10
EOS STAR SAFIRE 380–HD (FMS 9.2–70)	–15	–20

EXAMPLE: For helicopter with external optional equipment installed (see Fig.C1)

Determine: **Maximum takeoff and landing gross mass**

Known: OAT ..... 22 °C
Pressure altitude ..... 8000 ft
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: **Gross mass = 2760 kg**

1. Enter chart at known OAT (22°C)
2. Move vertically upwards to to known pressure altitude (8000 ft)
3. Move horizontally left and read max. gross mass (2760 kg)
4. Apply correction values for external optional equipment (–35 kg) as follows:

2760 kg – 35 kg = 2725 kg

TRAINING TAKEOFF AND LANDING GROSS MASS
CATEGORY A (CLEAR HELIPORT)
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING

OEI – TRAINING RATINGS — BLEED AIR HEATING – OFF

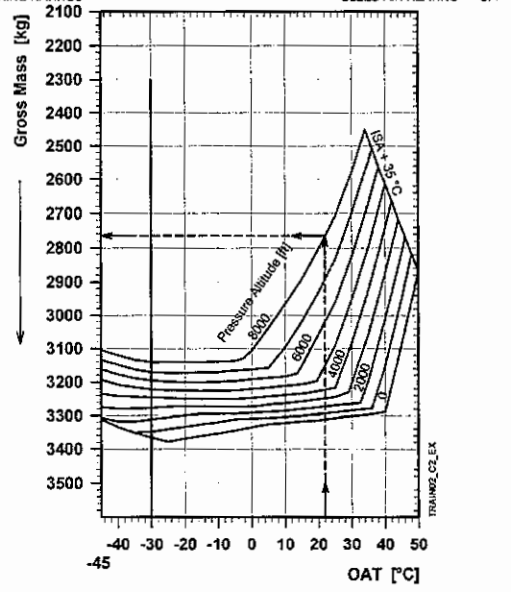


Fig. C1 Training takeoff and landing gross mass category a (clear heliport)

TRAINING TAKEOFF AND LANDING GROSS MASS
CATEGORY A (CLEAR HELIPORT)
SANDFILTER (IBF-SYSTEM) INSTALLED
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING

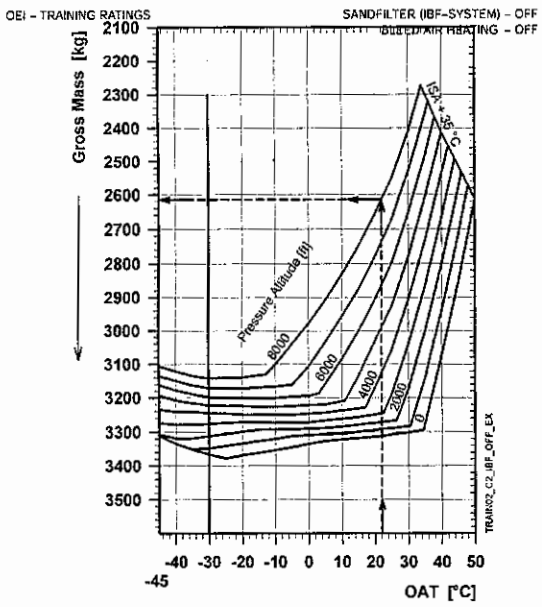
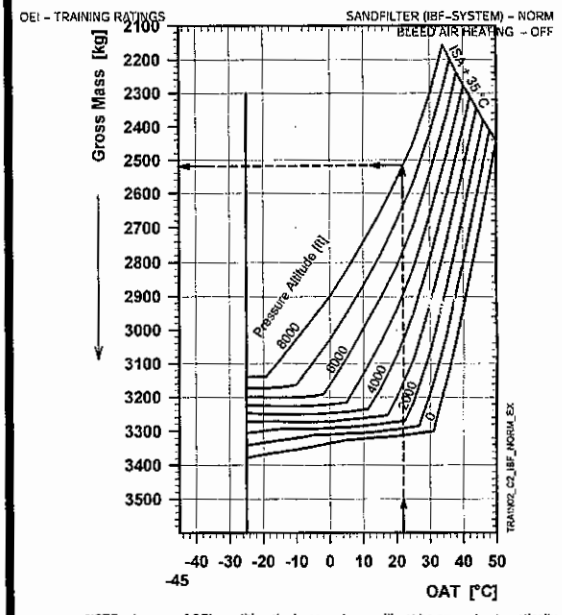


Fig. C2 Training takeoff and landing gross mass category a (clear heliport), Sandfilter (IBF-system) – OFF (FMS 9.2–50)

TRAINING TAKEOFF AND LANDING GROSS MASS
CATEGORY A (CLEAR HELIPORT)
SANDFILTER (IBF-SYSTEM) INSTALLED
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING



NOTE In case of OEI condition the bypass doors will not be opened automatically

Fig. C3 Training takeoff and landing gross mass category a (clear heliport), Sandfilter (IBF-system) – NORM (FMS 9.2–50)

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C.3. EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

C.4. NORMAL PROCEDURES

No change in the basic Flight Manual data.

C.5. PERFORMANCE DATA

No change in the basic Flight Manual data.

D. CATEGORY A – VTOL

D.1. GENERAL

This subsection provides information necessary for Category A training operations – VTOL 1 "Surface or Elivated Heliports", VTOL 2 "Short Field, VTOL 3"Confined Heliport".

To simulate OEI operation with one engine at IDLE, follow the emergency procedures of Category A operations supplement 9.1–1 subsection C, however, use the GENERAL DATA, Engine Limitations (see subsection A) and the gross mass value from the TRAINING WAT curves this subsection.

D.2. LIMITATIONS

For CAT A Training with max. training gross mass the OEI Training device must be installed and operating.

During OEI Training the Bleed Air Heating System must be switched OFF.

D.2.1. MASS LIMITATIONS

For determining the training takeoff and landing gross mass in order to simulate OEI conditions during Category A (VTOL) with one engine at IDLE, refer to the diagram (Fig. D1) of this subsection.

D.2.2. ALTITUDE LIMITATIONS

The maximum operating altitude for OEI training is ..... **5000 ft PA**

D.2.3. MASS LIMITATIONS WITH OPTIONAL EQUIPMENT INSTALLED

When calculating the maximum takeoff and landing gross mass for VTOL operations, first calculate the maximum gross mass for Clear Heliport operation in accordance with subsection C of this supplement under consideration of the relevant correction values listed under para C.2.2.

In the second step, calculate the maximum takeoff and landing gross mass for VTOL operations using Fig. D1 without considering those correction values. As an exception, if the sandfilter system (FMS 9.2–22) is installed, subtract 55 kg from the obtained value. The maximum gross mass for VTOL operations is then given by the lower resulting value.

If the "Sandfilter (IBF–System)" (FMS 9.2–50) is installed, see Fig D2 and D3.

EXAMPLE: For helicopter with external optional equipment installed (see Fig.C1)

Determine: **Maximum takeoff and landing gross mass**

Known: OAT ..... 22 °C
Pressure altitude ..... 8000 ft
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: **Gross mass = 2760 kg**

1. Enter chart (Fig. C1) at known OAT (22°C)
2. Move vertically upwards to to known pressure altitude (8000 ft)
3. Move horizontally left and read max. gross mass (2760 kg)
4. Apply correction values for external optional equipment (–35 kg) as follows: 2760 kg – 35 kg = **2725 kg**
5. Enter chart (Fig. D1) at known OAT (15°C)
6. Move vertically upwards to to known pressure altitude (4000 ft)
7. Move horizontally left and read max. gross mass (**2620 kg**)
8. Since the gross mass limit = 2620 kg is lower than the calculated max. gross mass from clear heliport subsection (2725 kg), the result is **2620 kg**.

TRAINING TAKEOFF AND LANDING GROSS MASS
CATEGORY A (VTOL)
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING

OEI – TRAINING RATINGS — BLEED AIR HEATING – OFF

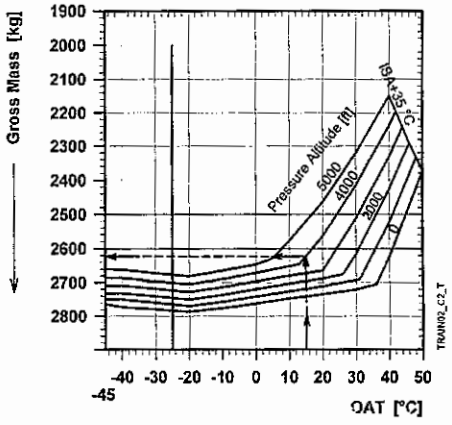

Fig. D1 Training takeoff and landing gross mass category a (VTOL)

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MAT. 1403565

TRAINING TAKEOFF AND LANDING GROSS MASS
CATEGORY A (VTOL)
SANDFILTER (IBF-SYSTEM) INSTALLED
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING

OEI – TRAINING RATINGS — SANDFILTER (IBF-SYSTEM) – OFF
BLEED AIR HEATING – OFF

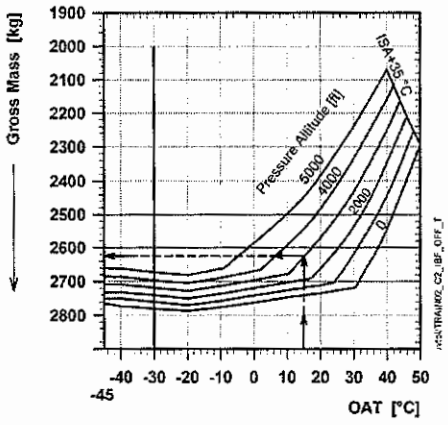
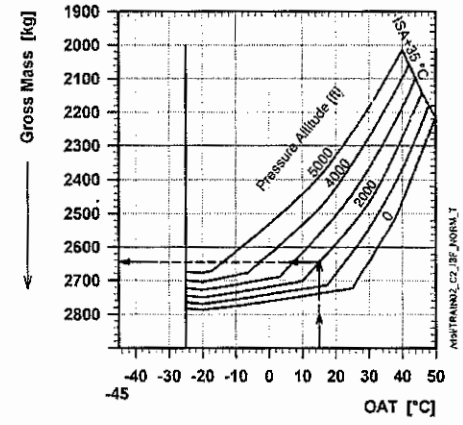


Fig. D2 Training takeoff and landing gross mass category a (VTOL)
Sandfilter (IBF-system) – OFF (FMS 9.2-50)

TRAINING TAKEOFF AND LANDING GROSS MASS
CATEGORY A (VTOL)
SANDFILTER (IBF-SYSTEM) INSTALLED
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING

OEI – TRAINING RATINGS — SANDFILTER (IBF-SYSTEM) – NORM
BLEED AIR HEATING – OFF



NOTE In case of OEI condition the bypass doors will not be opened automatically

Fig. D3 Training takeoff and landing gross mass category a (VTOL)
Sandfilter (IBF-system) – NORM (FMS 9.2-50)

D.3. EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

D.4. NORMAL PROCEDURES

After installation / adjustment of the training device according to para A.7.2, check that with that adjustment a hover flight is possible.

D.5. PERFORMANCE DATA

No change in the basic Flight Manual data.

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E. OEI SIMULATION WITH AEO

E.1. GENERAL

E.2. LIMITATIONS

NOTE The OEI simulation with AEO should be performed with VARTOMS in NORM mode.

E.2.1. MASS LIMITATIONS

For determining the maximum training takeoff and landing gross mass in order to simulate OEI conditions with AEO, refer to the diagrams of FMS 9.1–1 "CATEGORY A operations" as follows:

If CLEAR HELIPORT training is intended, refer to subsection B of this supplement.

IF VTOL training is intended, refer to subsecton C of this supplement.

NOTE The OEI simulation with AEO has been established for training with gross mass below the calculated gross.

E.3. EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

E.4. NORMAL PROCEDURES

No change in the basic Flight Manual data.

E.5. PERFORMANCE DATA

For determining the training AEO torque values, use the OEI Simulation 2.5-min power diagram (see Fig. E1). Transient torque limits as required, however, not more than Take-off Power.

E.5.1. OEI – SIMULATION (2.5–MIN POWER) WITH AEO

OEI – SIMULATION 2.5–MIN POWER
2 X TURBOMECA ARRIEL 1E2
NORM MODE
TRAINING

2.5MIN POWER

BLEED AIR HEATING -OFF

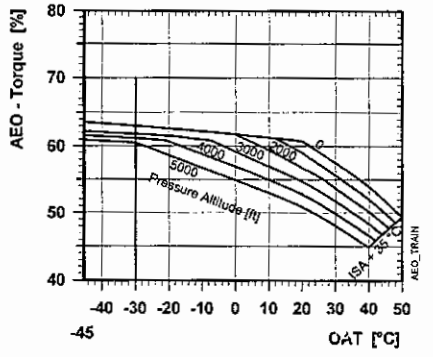

Fig. E1 OEI – Simulation (2.5–min Power) with AEO reduced power

F M S 9.1–4

SUPPLEMENT FOR

HOVER PERFORMANCE/HEIGHT LOSS AFTER ENGINE FAILURE

This supplement shall be attached to the BK 117 C–2 Flight Manual (Section 9.1.).

Date:

04. März 02

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
9.1-4 -1	–		R 9.1-4 -4	6		9.1-4 -7	4	
R 9.1-4 -2	6		9.1-4 -5	0		9.1-4 -8	2	
9.1-4 -3	5		9.1-4 -6	1				

LOG OF REVISION

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REVISION	2	NOV 25, 2003	REVISION	6	(see entry below)
REVISION	3	NOV 27, 2003			

REVISION 6

Approved by EASA

Date: MAI 28, 2010

EASA approval no.: 10030144

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PROC.053000716/2012
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1. GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

NOTE This supplement is not applicable for operation according to the Class D rotorcraft load combination.

2. LIMITATIONS

No change to the basic flight manual data.

3. EMERGENCY AND MALFUNCTION PROCEDURES

3.1. FLIGHT PROCEDURES AFTER SINGLE ENGINE FAILURE IN HOVER

Procedure

1. Attitude – Nosedown – –20°

Under wind conditions the following values are recommended:

WINDSPEED [kt]	NOSEDOWN ATTITUDE [deg]
up to 20	– 20
– 30	– 10
above 40	0

2. Collective lever – Adjust to 2.5-min Power

After reaching 30 kts:

3. Attitude – Adjust to near level attitude while accelerating to V_{TOSS} = 45 KIAS and initiate climb

4. Rotor speed – Trim to maximum

When 200 ft AGL is reached:

5. Airspeed – Accelerate to V_Y
6. Collective lever – Adjust to OEI MCP
7. Climbout – Continue with V_Y to the desired altitude
8. Single engine emergency shutdown – Perform
9. LAND AS SOON AS PRACTICABLE

NOTE In OEI flight conditions with Vy, bleed air could be set ON if performance is sufficient.

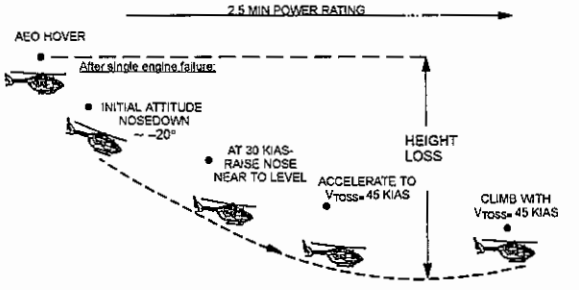

Fig. 1 Flight path after single engine failure in HOGE

4. NORMAL PROCEDURES

No change in the basic Flight Manual data.

5. PERFORMANCE DATA

5.1. HOVER FLIGHT PERFORMANCE

CAUTION THE FLM CHARTS REPRESENT THE REAL HEIGHT LOSS AND DOES NOT INCLUDE ANY SAFETY MARGIN TO THE GROUND. IT IMPLIES THAT THE ENGINE FAILURE HAS BEEN IDENTIFIED WITHOUT DELAY.

EFFECTIVITY *If the "Sandfilter (IBF–system"), FMS 9.2–50, is installed*

The follwing Δ HG (Height Gain) correction values have to be added (see Fig.2) :

GM ≥ 3000kg ..... 25 ft.

GM < 3000kg ..... 35 ft

EFFECTIVITY *All*

EXAMPLE: (see Fig.2)

Determine: Height loss after engine failure in HOGE

Known:
OAT ..... 23 °C
Pressure altitude ..... SL
Gross Mass ..... 3000 kg
Headwind ..... A.) 0 kts
B.) 30 kts

Solution: **HEIGHT LOSS = A.) 70 ft / B.) 32 ft**

A:)

1. Enter chart (Fig.2) at known OAT (23°C).
2. Move vertically upwards to known gross mass (3000 kg).
3. Move horizontally left and read height loss = **70 ft.**

B:)

1. Enter chart (Fig.2) at known OAT (23°C).
2. Move vertically upwards to known gross mass (3000 kg).
3. Move horizontally right to the reference line.
4. Move further right downwards following the height loss guide lines.
5. Reenter chart at the wind scale using known head wind (30 kts) and move vertically upwards.
6. From point of intersection move horizontally right and read height loss = **32 ft.**

NOTE When the known pressure altitude lies between two chart values, it has to be interpolated.

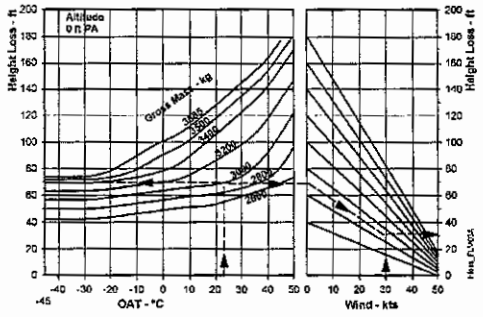

Fig. 2 Height loss chart (Altitude 0 ft PA)

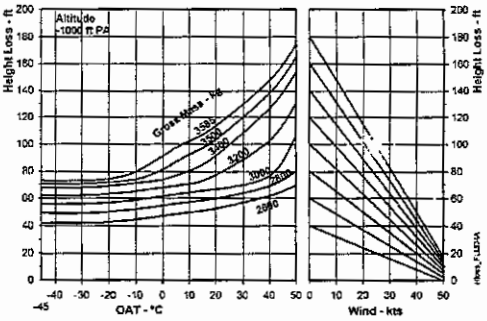

Fig. 3 Height loss chart (Altitude –1000 ft PA)

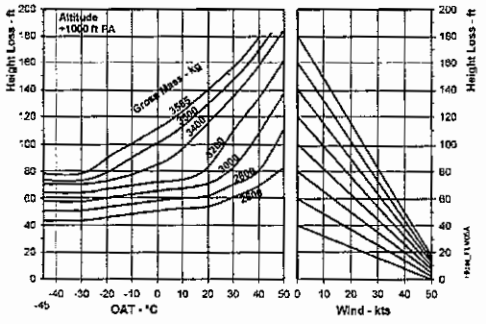

Fig. 4 Height loss chart (Altitude +1000 ft PA)

5.2. OEI CLIMB PERFORMANCE

To determine the max. gross mass which allows level flight in OEI conditions, the chart for enroute (see FMS 9.1–1, Para. A.5.3) can be used, which assures a climb reserve of 50 ft/min at 1000 ft AGL.
Using this gross mass in the defined atmospheric envelope for this special operation, it is assured that V_{TOSS} can be reached and a R/C of 100 ft/min is assured at 200 ft AGL.
The certified optional equipment from the following list are covered, if the gross mass decrements of the specific optional equipment are taken into account in the gross mass determination with the enroute chart.

Emergency Floats	FMS 9.2–9
Searchlight SX–16	FMS 9.2–23
External Loudspeaker	FMS 9.2–12
External Hoist System	FMS 9.2–11
Snow Skids	FMS 9.2–26
Weather Radar System	FMS 9.2–28
Cargo Hook Mirror	FMS 9.2–4
FLIR Ultraforce II/ LEO–II–A5	FMS 9.2–35

For determining the gross mass with 150ft/min climb reserve at 1000 ft AGL, refer to the FMS 9.1–1(Para. B2.2), which includes also the decrements for the optional equipment.

EXAMPLE: (see Fig.A8 of FMS 9.1–1, Category A operations)

Determine: **MTOW for R/C reserve of 100 ft/min**

Known:
OAT ..... 20°C
Pressure altitude ..... SL
External Optional Equipment ..... External Loudspeaker and Searchlight SX–16

Solution: **Gross mass = Gross mass limit = 3585 kg**

1. Enter chart at known OAT (20°C).
2. Move vertically upwards to to known pressure altitude (SL).
3. Move horizontally left and read max. gross mass 3800 kg.
4. For External Loudspeaker substract 25kg
   for Searchlight SX–16 substract 50kg
   (according to FMS 9.1–1, A.5.3.)

3800 kg – (25 kg+50 kg) = 3725 kg, i.e. in this example, no restrictions up to gross mass limit 3585 kg.

With this determined gross mass, it is assured that V_{TOSS} can be reached and a R/C of 100 ft/min is assured at 200 ft AGL.

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SUBSECTION 9.2

OPTIONAL EQUIPMENT

LOG OF SUPPLEMENTS

Note: Since September 28, 2003 all already existing FMS are certified by the new founded European Aviation Safety Agency (EASA).

NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
Airborne collision avoidance system (ACAS) (Rayn 9900BX/Avidyne TAS 620	9.2 -49	EASA, Jul 2008	Revision 0
AFCS	9.2 -1	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 7.1
AHRS Free steering mode	9.2 -40	EASA, May 2006	Revision 0.1
Armour protection kit (cockpit and cabin)	9.2 -64	EASA, Mar 22, 2012 FAA, May 30, 2012	Revision 0
Auxiliary Fuel Tank	9.2 -16	LBA, Jul 2002 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 2
Cargo hook mirror	9.2 -4	LBA, Dec 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 1
Centerline camera carrier system	9.2 -61	EASA, May 2010 FAA, Sep 2010	Revision 0
Comfort seat installation	9.2 -65	EASA, Mar 2012 FAA Oct 22, 2012	Revision 0

NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
Dual control pedal cover	9.2 -6	LBA, May 2001 FAA, Aug 2[illegible] IAC-AR, Dec 2005	Revision 0
Dual controls	9.2 -7	LBA, Apr 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 0
Dual external cargo hook	9.2–38	LBA, Nov 2003 FAA, Jan 2006 IAC-AR, Dec 2005	Revision 5.1
EGPWS	9.2–53	EASA, Mar 2009 FAA, Sep 2011	Revision 1
EOS Star Safire 380-HD	9.2–70	EASA, Dec 2012	Revision 0
EOS Wescam MX 10	9.2–67	EASA, Dec 2012	Revision 0
EOS Wescam MX 15i/HDi	9.2–56	EASA, Mar 2013	Revision 0.1
Emergency floatation system	9.2 -9	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 7.1
EMS equipment (AEROLITE)	9.2 -33	LBA, Nov 2001 FAA, pending IAC-AR, Dec 2005	Revision 2
Equipment for Offshore Operation	9.2 -47	EASA, Jul 2008	Revision 0
EuroNav III / IV / IV +	9.2–39	LBA, Nov 2003 FAA, pending IAC-AR, Dec 2005	Revision 3
External cargo hook	9.2 -10	LBA, Dec 2001 FAA, Aug 2003IAC- IAC-AR, Dec 2005	Revision 6

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NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
External hoist system	9.2 -11	LBA, Jan 2002 FAA, Oct , 2003 IAC-AR, Dec 2005	Revision 10.1
External loudspeakers	9.2 -12	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 0
Fixed landing light 250W (cross tube)	9.2 -13	LBA, May 2001 FAA, Aug 2003IAC- IAC-AR, Dec 2005	Revision 3
Flight control display system (FCDS)	9.2 -14	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 9
FLIR Ultraforce II	9.2–35	LBA, Nov 2003 FAA, pending	Revision 2
Fuel management system	9.2 -2	LBA, Sep 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 0
Garmin GNS 430/430A/430W/430AW	9.2 -43	LBA, May 2004 FAA, Jun 2004 IAC-AR, Dec 2005	Revision 5
GPS Freeflight 2101 I/O coupled to AFCS Plus	9.2 -37	LBA, Jul 2003 FAA, pending IAC-AR, Dec 2005	Revision 1.1
HF 9000 Communication sytem	9.2 -55	EASA, Nov 2009 FAA, pending	Revision 0
HF Communication sytem	9.2 -44	LBA, Jul 2004 FAA, Jul 26; 2012 IAC-AR, Dec 2005	Revision 0
Keeperless external cargo hook	9.2 -62	EASA, Apr 18, 2011 FAA, May 12, 2011	Revision 0

NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
Main rotor blade folding kit	9.2 -41	LBA, May 2004 FAA, Jun 2004 IAC-AR, Dec 2005	Revision 0
Medium aircraft recording and monitoring system (MARMS)	9.2 -31	LBA, Jul 2002 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 3.1
Navigation management system (NMS) CMA3000	9.2 -17	LBA, Nov 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 7
Navigation management system (NMS) CMA9000	9.2 -51	EASA, Dec 2008 FAA, Jul 2010	Revision 1
Night Vision Imaging Systems (NVIS) / NVG	9.2-48	EASA, May 2007 FAA, May 2010	Revision 4
Pilot/Copilot door jettisonning	9.2 -32	LBA, Nov 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 1
Pulsed Chip Detector System (*Mandatory for IAC-AR)	9.2 -15	LBA, Apr 2003 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 1
Push out window	9.2-45	EASA, Mar 2008 FAA, Mar 2009	Revision 0.1
Rotor brake system	9.2 -21	LBA, Dec 2000 FAA, pending IAC-AR, Dec 2005	Revision 1
Rotor Brake System for H/C S/N 9311 and subsequent	9.2 -58	EASA, Oct 29, 2009 FAA, Oct 29, 2009	Revision 0.1
Sand filter system	9.2 -22	LBA, Nov 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 3.1

NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
Sand filter (IBF–system)	9.2 -50	EASA, Apr 2008 FAA, Jun 2008	Revision 3
Scavenge oil filter	9.2-42	EASA, Jan 2005 FAA, Dec 2007 IAC-AR, Dec 2005	Revision 0
Search and landing light	9.2 -20	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 3.2
Seat Arrangement	9.2 -24	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 3.1
Self Sealing Supply Tank	9.2 -57	EASA, Nov 2009 FAA, May 2010	Revision 0
Settling Protectors	9.2 -25	LBA, Apr 2002 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 0.1
Sliding door jettisonning	9.2 -34	LBA, Dec 2002 FAA, Aug 200 IAC-AR, Dec 2005	Revision 2.1
Smoke detection system	9.2 -54	EASA, Feb 2009	Revision 0
Snow Skids	9.2 -26	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 2.1
SPIFR or SP/DPiFR operation kit	9.2 -8	LBA, Oct 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 9
Special cockpit lighting	9.2 -18	LBA, Nov 2001 FAA, Jan 2004	Revision 2

NAME OF EQUIPMENT	FMS NUMBER	FIRST APPROVAL	VALID REVISION
Searchlight SX–16 (IR) (LH mounted)	9.2 -23	LBA, Nov 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 4
Tail floodlight	9.2 -36	LBA, Dez 2002 FAA, pending IAC-AR, Dec 2005	Revision 0
Utility Seat Bench	9.2 -27	LBA, Oct 2001 IAC-AR, Dec 2005	Revision 3.1
Weather radar system RDR 1400C	9.2 -28	LBA, Nov 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 0
Weather radar system RDR 1600	9.2 -46	EASA, Oct 2005 FAA, pending IAC-AR, Dec 2005	Revision 0
Weather radar system RDR 2000	9.2 -52	EASA, May 2008 FAA, Jul 2010	Revision 0
Wire strike protection system (WSPS)	9.2 -29	LBA, May 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 1.1
Yaw stability augmentation system (Yaw SAS)	9.2 -30	LBA, May 2001 FAA, Aug 2003 IAC-AR, Dec 2005	Revision 0

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F M S 9.2-1

SUPPLEMENT FOR

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS) has been installed.

System/Equipment Designation	Effectivity
Hardware components:	
Automatic flight control system (AFCS)	up to S/N 9033 and before SB MBB–BK117C-2–22–002
AFCS (upgraded version incl. hardware upgrade B221M2001862 and sw-version 416–00297–201)	S/N 9034 and subsequent or after SB MBB–BK117C-2–22–002
Software upgrades:	
AFCS software version 416–00297–200	up to S/N 9016 and before SB MBB–BK117C-2–22–001
AFCS software version 416–00297–201	S/N 9017 and subsequent or after SB MBB–BK117C-2–22–001
AFCS software version 416–00297–202	S/N 9151 and subsequent or after SB BK117 C-2–22–007
AFCS software version 416–00297–203	S/N 9701 and subsequent or after SB BK117 C-2–22–015

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 18. Okt. 01

Approved by:
i.A.

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dis–pose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

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	9.2-1 -19	7	9.2-1 -40	7	9.2-1 -61	7		
	9.2-1 -20	7	9.2-1 -41	7	9.2-1 -62	7		
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LOG OF REVISIONS

FIRST ISSUE

ORIGINAL,	REV. 0	Oct, 2001
REVISION	1	MAR 04, 2002
REVISION	2	OCT 09, 2002
REVISION	3	JUN 13, 2003
REVISION	4	JUN 07, 2004
REVISION EASA approval no.:R.C.01614	5	JUN 29, 2007
REVISION	5.1	OCT 23, 2007
REVISION EASA approval no.: 10030144	6	MAI 28, 2010
REVISION EASA approval no.: 10048441	7	MAR 11, 2014
REVISION	7.1	(see entry below)

Revision 7.1

Date: APR 17, 2014

Revision No. 7.1 to FLM reference revision 7 , is approved under authority of DOA No. EASA. 21J.034.

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LIST OF FIGURES

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

1.1 ABBREVIATIONS AND DEFINITIONS

A	A	– Indication for: mode is armed
	ADC	– Air data computer
	AFCS	– Automatic flight control system; complete autopilot system consisting of APM, P/R SAS, actuators, sensors, Y FOG, P FOG etc.
	AHRS	– Attitude and heading reference system
	ALT	– Altitude hold
	ALT.A	– Altitude acquire
	AP	– Autopilot;
	APP	– Approach; functionality of autopilot computer (APM) and associated software
	APM	– Autopilot module; autopilot computer
	APMS	Autopilot mode selector; used to define source of control
	AP SAS	– Autopilot SAS, using rate information from FOGs
	A.TRIM	– Autopilot trim function
	ATT	– attitude hold function provided by the APM when cyclic (CYC) or YAW A.TRIM is ON
B	BC, B/C	– Back course
C	C	– Indication for mode is captured
	CAD	– Caution and advisory display
D	DH	– Decision height
	DME	– Distance measuring equipment
	D SAS	– Autopilot digital SAS, using rate information from AHRSs
F	FCDM	– Flight control display module
	FDS	– Flight display system
	FOG	– Fibre optical gyro
G	GA, G.A	– Go around
	GS, G/S	– Glide slope
	GPS	– Global positioning system
H	HDG	– Heading
I	IAS	– Indicated airspeed
	ICP	– Instrument control panel
	ILS	– Instrument landing system
	INV 1/2	– Inverter 1/2
L	LVC	– Line voltage compensation
	LOC	– Localizer
M	MMEL	– Master minimum equipment list

N	NAV	– Navigation system
	ND	– Navigation display
	NDB	– Non-directional beacon
	NMS	– Navigation management system
O	OSS	– Over station sensing
P	pb	– Push button
	PFD	– Primary flight display
R	RCU	– Reconfiguration unit
	RVDT	– Rotary variable differential transducer
S	SAS	– Stability augmentation system; SAS functionality used as backup for the autopilot (P/R/Y SAS)
	SEMA	– Smart electro-mechanical actuator
	sw	– Switch
V	VEMD	– Vehicle & engine monitoring system
	VOR	– VHF omnidirectional radio range
	VOR.A	– VOR acquire
	VS, V/S	– Vertical speed
X	XOD	– Trim actuator out of detent

NOTE The term "pilot" is used to refer to both, pilot (RH side) and copilot (LH side)

2 LIMITATIONS

2.1 AIRSPEED LIMITATIONS

EFFECTIVITY *S/N 9004 up to and including S/N 9675 and before SB BK117 C-2–22–016*

AIRSPEED LIMITATIONS		
	Hands–Off in VMC	Hands–Off in IMC
Manoeuvering, Approach	120 KIAS	100 KIAS
Climb, Cruise, Descent	100 KIAS 120 KIAS when flying attentively*)	80 KIAS 100 KIAS when flying attentively*)
*) Definition of attentive: Ready to take the controls immediately when the aircraft departs the expected flight path.		

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EFFECTIVITY *All*

2.2 MINIMUM AIRSPEED

IAS Mode:

Minimum airspeed with IAS mode engaged: **30 kts.**

ALT Mode:

NOTE In ALT mode below 80 kts the airspeed indicator shall be monitored closely.

2.3 MINIMUM HEIGHT

WARNING WHEN OPERATING NEAR THE GROUND OR IN THE VICINITY OF OBSTACLES WITH AUTOPILOT ENGAGED IN ANY MODE OF OPERATION, THE PILOT SHOULD REMAIN ATTENTIVE TO THE FLYING TASK SINCE AN AFCS MALFUNCTION COULD RESULT IN A LOSS OF ALTITUDE

Minimum height for ***hands–off*** and ***feet–off*** operation during ***T/O and approach:*** **200 ft AGL.**

Minimum height for ***hands–off*** and ***feet–off*** operation in cases ***other than T/O or approach:*** **500 ft AGL.**

2.4 OPERATIONAL LIMITATIONS

Maximum airspeed for ***hands–on*** operation in ***cruise*** following a failure: ..... **120 kts**

Maximum airspeed for ***hands–on*** operation in ***ILS approach*** following a failure: **100 kts**

If the system Pre–flight test has not been successfully accomplished before takeoff, the autopilot system must be switched off by means of the SAS/AP CUT pushbutton or maintenance action is required.

CAUTION THE 3–AXIS BACKUP SAS MUST NOT BE USED AS PRIMARY FLIGHT AID, EXCEPT AFTER COMPLETE AP FAILURE, IN ORDER TO FINISH THE FLIGHT. (REFER TO PARA 3.5.2 SECOND APM DISENGAGEMENT OR FAILURE).

The Back Course mode is not available. The respective control button (BC) on the APMS is inactive.

2.4.1 ILS approach limitations

Minimum LOC interception distance ..... **4 nm**

Maximum LOC interception angle ..... **90°**

Maximum approach angle ..... **4,6°**

GS mode shall not be engaged above the glide slope.

2.5 CONFIGURATION REQUIREMENTS

A radio altimeter (not necessary for VFR operations) and the FCDS (FMS 9.2–14) must be installed and operational.

2.6 TEMPERATURE LIMITATIONS

On ground:

Max. operating time on ground if OAT ≥ +40°C ..... **15 min.**

In flight:

Max. OAT for AFCS continuous operation in case of loss of avionics ventilation (see FAN caution in FMS 9.2–14, FCDS) ..... **+ 30°C**

Max. operating time in case of loss of avionics ventilation when OAT > + 30°C (see FAN caution in FMS 9.2–14, FCDS) ..... **30 min.**

2.7 GA LIMITATION BELOW 60KTS

Below 60kts IAS and with IAS mode engaged, use of the GA mode is prohibited.

2.8 STICK CENTERING LIMITATION

Maximum wind ..... **15 kts**

NOTE Do not use this feature on sloping surface.

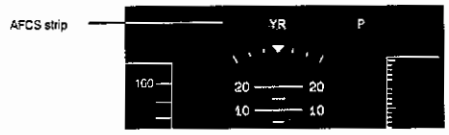
3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 AFCS WARNINGS

3.1.1 "AP" warning light

The red "AP" warning light is triggered together with an acoustic gong and indicates a request for immediate corrective action. This immediate corrective action is to put the hand on the cyclic stick as the system has switched to hands–on mode due to loss of the complete autotrim function. The "AP" warning light remains illuminated for 10 s.

3.1.2 PFD AFCS strip "immediate corrective action" indication



The PFD "immediate corrective action" indication consists of red axis labels in the displayed combination "YR" for yaw/roll and "P" for pitch which flash for 15 s on the PFD AFCS strips. It has the same meaning as the "AP" warning light and requires the pilot to take immediate action and put his hand on the cyclic stick.

3.1.3 Basic rules for AFCS warnings (immediate corrective action)

After expiration of the warning indication period the PFD AFCS strips will display the AP system state by either amber caution axes labels or "OFF" indication(s). The amber labels in combination with the generated CAD caution indications deliver more detailed information about the system degradation and guide the pilot to determine further corrective action steps.

3.2 AFCS CAUTIONS

The AFCS cautions are displayed/illuminated in amber colour.

3.2.1 Caution indications (on CAD)

The CAD displays the following AFCS related caution indications:

APM FAIL	Failure or disengagement of APM 1 or 2
YCSA	Failure of cyclic and/or yaw autotrim
AHRS DISC	AHRS discrepancy
ACTUATOR	Failure of a servo actuator
BACK UP SAS	Failure of a FOG containing the back up SAS

EFFECTIVITY *S/N 9034 and subsequent or after SB MBB–BK117C–2–22–002*

YAW SAS	Failure of the YAW SAS

EFFECTIVITY *All*

AHRS OVHT	Exceeding of normal operating temperature

"Additional indications" provides further information concerning system status and/or specific failure.

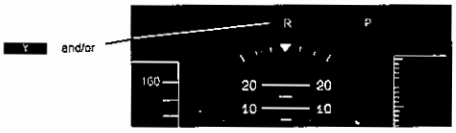
The activation of a CAD caution indication triggers the MASTER caution light indication.

3.2.2 Basic caution indication principles on the PFD

Principle 1:

The flashing red R or P symbols on the PFD indicate the loss of both servo actuators in one axis. After 15s the indication turns to steady amber.

The amber Y and/or R or P symbols on the PFD indicate a degradation of performance in the relevant axis which requires manual correction by the pilot or, as described above, 15 seconds following the loss of both servo actuators in one axis.



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Principle 2:

An amber rectangle flashing for 10s serves as attention attractor and indicates an attitude hold mode degradation or upper mode disengagement. For these 2 cases there is no axis label, only the amber rectangle will flash for 10s and extinguish afterwards.

Principle 3:

An upper mode degradation in the relevant axis without decoupling of the mode is indicated by reversion of the upper mode axis label from green to amber.

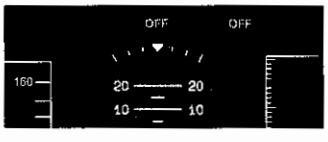
EFFECTIVITY *If AFCS software version 416–00297–203 is installed or S/N 9701 and subsequent*

If an upper mode is going to be decoupled automatically, the mode label and the box are flashing prior to decoupling. After decoupling the amber box will flash for 10 more seconds.

EFFECTIVITY *All*

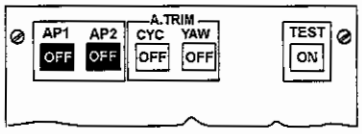
Principle 4:

The disengagement of both autopilots is displayed as follows:

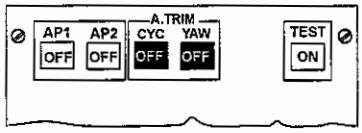


3.2.3 Caution indications on the APMS:

Illumination of the "OFF" label on the AP1 or AP2 pb indicates failure or disengagement of APM 1 or 2:



Illumination of the "OFF" label on the A.TRIM CYC or A.TRIM YAW pb indicates failure or disengagement of cyclic or yaw autotrim, respectively:



3.3 AFCS ADVISORIES

The AFCS advisories use colours different from red and amber.

3.3.1 Advisory indication principles on the PFD

Principle 1:

A normal upper mode engagement without any degradation is indicated by a green upper mode axis label as shown for the heading mode in the following example:

Principle 2:

A normal attitude hold mode engagement without any degradation is displayed by non-illuminated AFCS strips leaving the PFD black on this location as shown below:

Principle 3:

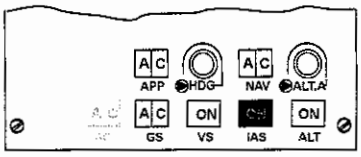
Pilot's override action during upper mode operation is indicated by a rectangle, alternately blinking amber/green as shown for the heading mode in the following example:

3.3.2 Advisories on the APMS

An engagement of an upper mode is indicated by a green advisory. An engagement of the preflight test is indicated by amber advisory.

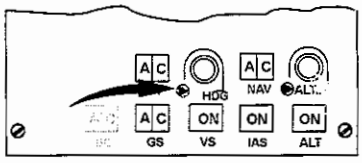
Example 1:

Illumination of the IAS button by a green ON label indicates engagement of the IAS mode:



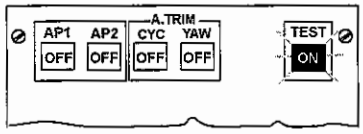
Example 2:

Illumination of the triangle next to the HDG rotary pb indicates engagement of the HDG mode:



Example 3:

A flashing amber "ON" label on the TEST button indicates: preflight test in progress.



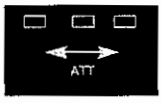
NOTE Steady illumination of the label indicates a failure of the test mode.

3.4 SENSOR DEGRADATION INDICATIONS PFD/ND

The degradation of sensors such as AHRS, rate gyros, heading sensors, ADC, ... will directly affect the functionality and/or redundancy of the autopilot. The following indications of failures are provided on the PFD to assist the identification of failures.

3.4.1 AHRS failures

An amber arrow at the PFD artificial horizon indicates either pitch/roll attitude discrepancy between both AHRSs or loss of the AHRS on the alternate side:



The red "AHRSi" label at the location but absence of the PFD artificial horizon indicates loss of the AHRS pitch and roll signal allocated to the display:

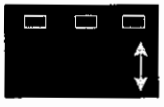
An amber arrow above the ND artificial compass rose indicates either heading discrepancy between both AHRSs or loss of the AHRS or heading sensor on the alternate side:

The red "AHRSi" label at the location but absence of the ND compass rose indicates loss of the AHRS or heading sensor allocated to the display:

3.4.2 ADC failures

An amber arrow on the IAS scale at the LH side of the PFD indicates either airspeed discrepancy between both ADCs or loss of the airspeed signal on the alternate side:

An amber arrow on the ALT scale at the RH side of the PFD indicates either altitude discrepancy between both ADCs or loss of the altitude signal on the alternate side:



The red "ADCi" label at the location, but absence of the PFD airspeed scale at the LH side of the PFD, indicates loss of the airspeed signal allocated to the display:

The red "ADCi" label at the location, but absence of the PFD altitude tape at the RH side of the PFD, indicates loss of the altitude signal allocated to the display:

3.5 AFCS MALFUNCTIONS/FAILURES

3.5.1 Exceeding of normal operating temperature

CAUTION INDICATIONS

AVIO OVHT

Conditions/Indications

Normal operating temperature of APM exceeded

CAUTION THE MAX. REMAINING OPERATION TIME IN THIS ENVIRONMENTAL CONDITION IS APPROX. 30 MIN. BE PREPARED FOR AFCS FAILURE.

Procedure

1. INST COOL cb – Check in

If AVIO OVHT caution indication remains on:

2. LAND AS SOON AS PRACTICABLE
3. Airspeed – Maintain as high as possible for best cooling effect

3.5.2 Second APM disengagement or failure

WARNING LIGHT		CAUTION INDICATIONS
AP	+	AP1 + AP2

Conditions/Indications

Second disengagement or failure of an autopilot module. Both autopilot modules are lost.

Procedure

1. Flying controls – Hands-on

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2-8*

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

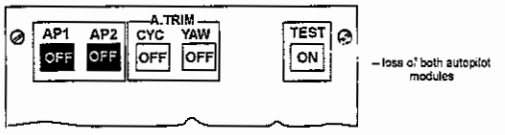
System status

The autotrim and the D SAS function are lost. The system has reconfigured to the pure rate gyro controlled backup SAS.

Additional indications:

on PFD:

on APMS:



3.5.3 APM disengagement or failure (one APM)

CAUTION INDICATIONS

AP1 or AP2

Conditions/Indications

Disengagement or failure of an autopilot module. One autopilot module is lost.

Procedure

None

System status

AFCS redundancy is degraded.

NOTE If any autopilot unit is lost, prior to its reengagement the pilot must use the AP MD DCPL sw to disengage any upper modes, and then attempt to reengage the lost autopilot like it is described in the following procedure:

Procedure

1. AP affected – Identify
2. APMD DCPL sw – Press to disengage upper modes
3. APMS – Reengage affected AP
4. APMS – Select upper modes as desired

Additional indications:

on APMS:

OFF – loss/disengagement of one APM => all selected AFCS modes still engaged

3.5.4 Total loss of one cyclic axis series actuation

WARNING LIGHT		CAUTION INDICATION
AP	+	ACTUATOR

Conditions/Indications

Total loss of series actuation in either pitch or roll axis. Loss of cyclic autotrim.

Procedure

1. Flying controls – Hands-on

EFFECTIVITY *If under SP/IFR operation according to FMS 9.2-8*

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

System status

In case of total loss of roll or pitch axis series actuation the autotrim is deactivated and can not be reactivated. The system remains in DSAS mode in the unaffected axis.

Additional indications:

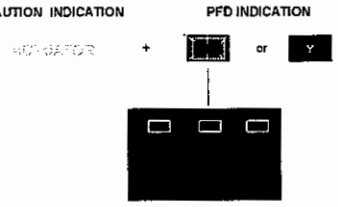
on PFD:

R or P – In case of total loss of pitch or roll axis series actuation: flashing for 15 seconds.

after 15 seconds

R or P – AFCS is in DSAS mode

3.5.5 Series actuator failure



Conditions/Indications

Failure of one series actuator

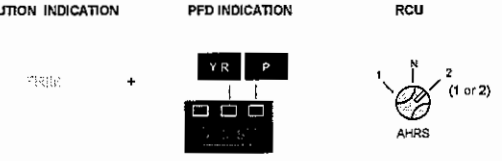
Procedure

1. System performance	– Monitor

System status

The series actuation authority on corresponding axis is reduced.

3.5.6 Second AHRS failure



Conditions/Indications

Loss of AHRS (second AHRS failure). AHRS 1 or AHRS 2 has already been reconfigured on the RCU.

Procedure

1. Flying controls	**– Hands-on**

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2-8*

2. LAND AS SOON AS POSSIBLE	

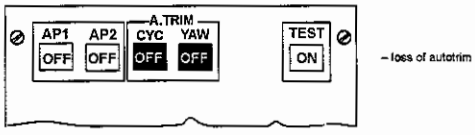
EFFECTIVITY *All*

System status

Reengagement of autotrim is not possible. The system remains in degraded AP SAS mode with rate gyro feedback only. Therefore the control performance is limited to a pure rate control on pitch, roll and yaw axis.

Additional indications:

on APMS:



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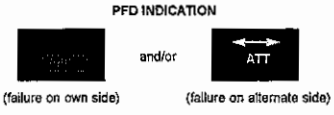
3.5.7 AHRS failure



Conditions/Indications

Failure of one AHRS (invalidity of an AHRS)

Procedure

1. Artificial horizon on PFD	– Check attitude
2. Flying controls	**– Hands-on**
3. RCU	**– Reconfigure to valid AHRS**

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2-8*

4. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

WARNING CAREFULLY DETERMINE VALID AHRS. KEEP HAND ON CYCLIC STICK DURING AHRS CONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

System status

The system remains in autotrim with all modes engaged. A second subsequent AHRS failure will lead to a degraded AP SAS mode.

Additional indications:

on PFD:

– (boxes flashing for 10 s, extinguish thereafter)
=> selected upper modes still engaged

3.5.8 Localized AHRS discrepancy

Conditions/Indications

Localized discrepancy between both AHRS and FOG

Procedure

1. Artificial horizon on PFD	– Check attitude
2. Flying controls	**– Hands-on**
3. RCU	**– Reconfigure to valid AHRS**

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2-8*

4. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

WARNING CAREFULLY DETERMINE VALID AHRS. KEEP HAND ON CYCLIC STICK DURING AHRS CONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

System status

The system falls into a degraded AP SAS mode until reconfiguration. Afterwards, all upper modes are available. A second subsequent AHRS failure will lead to a permanently degraded AP SAS mode.

Additional indications:

on PFD:

YR P – (amber boxes flashing for 10 s around P & YR amber letters, extinguish thereafter)
=> AP SAS mode engaged

3.5.9 **Rate gyro failure**

CAUTION INDICATION

BACKUP SAS

Conditions/Indications

Failure of one rate gyro

Procedure

1. System performance – Monitor

System status

The sensor redundancy is degraded.

EFFECTIVITY *S/N 9034 and subsequent or after SB MBB–BK117C–2–22–002*

3.5.10 **Yaw SAS failure**

CAUTION INDICATION

YAW SAS

Conditions/Indications

Failure of the Yaw SAS. The Yaw SAS caution indication is only active when AP 1/2 is off.

Procedure

1. System performance – Monitor

System status

No Yaw axis stabilisation.

EFFECTIVITY *All*

3.5.11 **Cyclic and yaw (double) trim failure**

CAUTION INDICATION **PFD INDICATION**

TRIM + YR P

Conditions/Indications

Loss of autotrim due to cyclic and yaw trim failure.

Procedure

1. **Flying controls** – **Hands-on**

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2–8*

2. LAND AS SOON AS PRACTICABLE

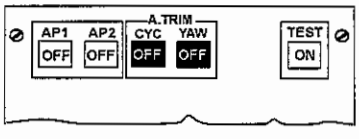
EFFECTIVITY *All*

System status

Reengagement of autotrim is not possible. The system remains in D SAS function with the SEMAs controlling the helicopter axes.

Additional indications:

on APMS:

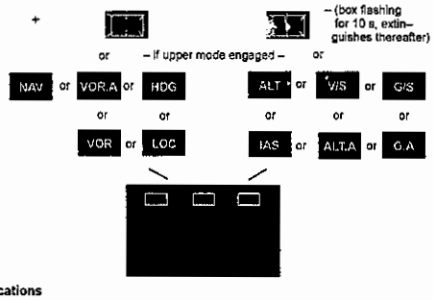


– loss of autotrim

3.5.12 **Cyclic trim failure**

CAUTION INDICATION **PFD INDICATION**

TRIM +



Conditions/Indications

Loss of cyclic autotrim due to trim failure

Procedure

1. **Flying controls** – **Fly attentive**
   – **Recenter P.R if necessary**
   – **Confirm upper modes in turbulence**

EFFECTIVITY *If under SPIFR operation according to FMS 9.2–8*

2. LAND AS SOON AS PRACTICABLE

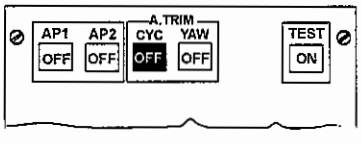
EFFECTIVITY *All*

System status

Reengagement of autotrim is not possible. The system remains in ATT or upper mode with SEMA authority axis control and upper modes engaged. In case of turbulence confirm use of upper modes.

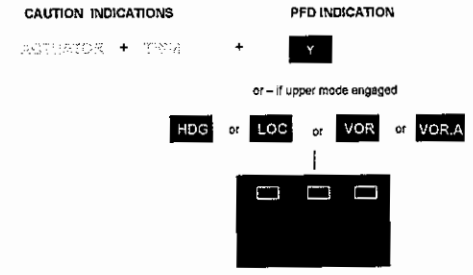
Additional indications:

on APMS:



– loss of cyclic autotrim

3.5.13 Total loss of yaw axis actuation (TRIM + SEMA)



Conditions/Indications

Failure of yaw axis actuators.

Procedure

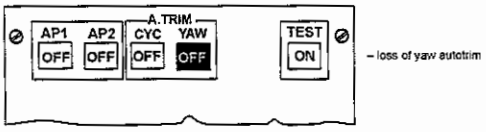
1. Yaw axis – Control using pedals

System status

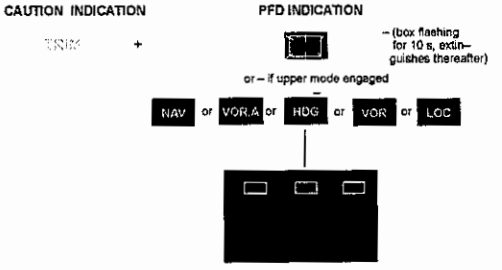
The series and parallel actuator in yaw axis is lost.

Additional indications:

on APMS:



3.5.14 Yaw trim failure



Conditions/Indications

Failure of yaw trim or yaw trim switched off.

Procedure

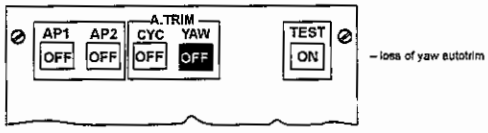
1. Pedals – Operate in case of series actuation saturation

System status

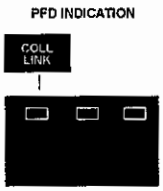
Full functionality available. Monitor recentring requests in yaw on the PFD strip.

Additional indications:

on APMS:



3.5.15 Collective lever position sensor failure



Conditions/Indications

A failure of the collective lever position sensor has been detected. Automatic compensation of collective movement effects on the other axes is degraded.

Procedure

1. Cyclic stick – Compensate for large collective pitch variations

3.5.16 Degraded reliability of displayed AFCS data

Conditions/Indications

The reliability of PFD–displayed AFCS data (such as displayed references) is degraded. Further upper mode engagement is not possible.

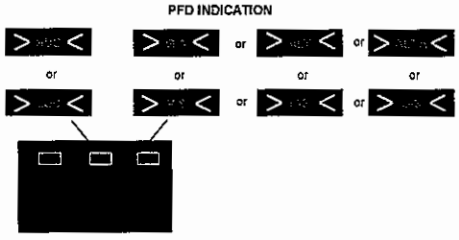
Procedure

1. Engaged references – Monitor closely (altitude, IAS, ALT etc.)

System status

The upper mode references can no longer be "trimmed". Once an upper mode is disen–gaged, it cannot be reengaged.

3.5.17 Excessive deviation



Conditions/Indications

An excessive deviation in ALT, IAS, GA, V/S, ALT.A, G/S, HDG or LOC mode from reference has been detected.

Procedure

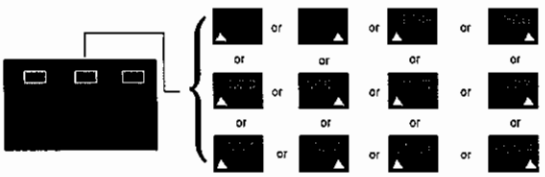
1. Deviation of helicopter from reference – Check

If deviation is critical for flight state:

2. Safe flight state or reference – Recover

3.5.18 Yaw series actuation saturation

PFD INDICATION



Conditions/Indications

Yaw series actuation momentarily in saturation.

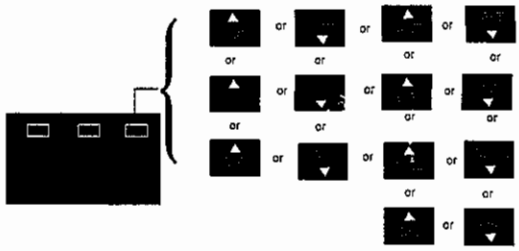
Procedure

1. Pedals
   - Feet–on if indication persists for longer time
   - When yaw TRIM OFF: push on the side indicated by the triangle until its extinction

NOTE Under extreme turbulent conditions, particularly after loss of one series actuator, the amber triangle may momentarily illuminate, indicating that use of full series actuator authority is necessary to maintain flight condition. If indication persists, reduce IAS, if possible, or divert to a different flight state with lower turbulence.

3.5.19 Pitch series actuation saturation

PFD INDICATION



Conditions/Indications

Pitch series actuation momentarily in saturation.

Procedure

1. Cyclic stick
   - Hand–on if indication persists for longer time
   - When cyclic TRIM OFF: move stick into indicated direction

NOTE Under extreme turbulent conditions, particularly after loss of one series actuator, the amber triangle may momentarily illuminate, indicating that use of full series actuator authority is necessary to maintain flight condition. If indication persists, reduce IAS, if possible, or divert to a different flight state with lower turbulence.

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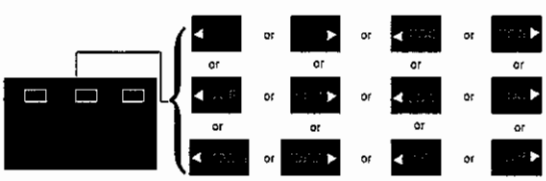
3.5.20 Roll series actuation saturation

PFD INDICATION



Conditions/Indications

Roll series actuation momentarily in saturation.

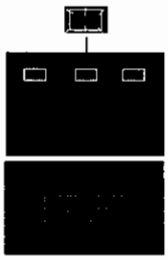
Procedure

1. Cyclic stick
   - Hand–on if indication persists for longer time
   - When cyclic TRIM OFF: move stick into indicated direction

NOTE Under extreme turbulent conditions, particularly after loss of one series actuator, the amber triangle may momentarily illuminate, indicating that use of full series actuator authority is necessary to maintain flight condition. If indication persists, reduce IAS, if possible, or divert to a different flight state with lower turbulence.

3.5.21 Roll mode (HDG, LOC, VOR, VOR.A) decoupling: Failure of selected HDG sensor

PFD/ND INDICATION



(HDG, LOC, VOR, VOR.A label and box extinguish as described in para 3.2.2)

RCU

(1 or 2)

AHRS

Conditions/Indications

AHRS1 or AHRS2 has already been reconfigured at the RCU. The HDG sensor of the selected AHRS has failed (invalidity of a HDG sensor).

Procedure

1. Standby instruments – Use as reference

WARNING RECONFIGURATION OF THE AHRS SHALL NOT BE PERFORMED AS IT HAS ALREADY BEEN RECONFIGURED BECAUSE OF A PREVIOUS FAILURE. BE AWARE THAT A NEW AHRS RECONFIGURATION AT THE RCU COULD LEAD TO AN INVALID PITCH OR ROLL ATTITUDE DEPENDING ON THE PREVIOUS FAILURE.

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2–8*

2. LAND AS SOON AS PRACTICABLE

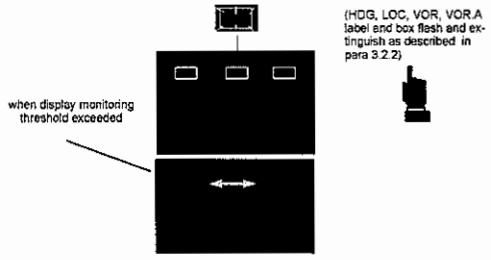
EFFECTIVITY *All*

System status

The previously engaged mode is lost and cannot be reengaged.

3.5.22 Roll mode (HDG, LOC, VOR, VOR.A) decoupling: HDG discrepancy

PFD/ND INDICATION



Conditions/Indications

A HDG discrepancy between both heading sensors has exceeded the second monitor threshold.

Procedure

In IFR or if reengagement of previously engaged or new roll mode (HDG, LOC, VOR, VOR.A) is intended:

1. Flying controls	– Hands–on
2. ND compass rose	– Compare with standby compass
3. RCU	**– Reconfigure to the AHRS that generates the same heading as standby compass**
4. APMS	– Arm/engage roll mode

If aircraft is out of a previously effective LOC/ VOR/ VOR.A capture condition:

5. Flying controls	– Bring aircraft back to capture condition
6. Mode performance	– Monitor

CAUTION IN CASE OF ROLL MODE REENGAGEMENT AFTER AHRS RECONFIGURATION CONTINUE MONITORING HDG ON PFD AND COMPARE WITH STANDBY INSTRUMENT INDICATION.

If flight shall be continued with an other mode (different from HDG, LOC, VOR, VOR.A):

1. APMS	– Select other mode or keep auto-trim

WARNING IN CASE OF AHRS RECONFIGURATION: CAREFULLY DETERMINE VALID HEADING. KEEP HAND ON CYCLIC STICK DURING AHRS RECONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

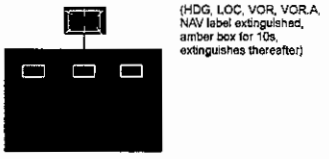
System status

There is no automatic HDG sensor monitoring after AHRS reconfiguration and reengagement of the roll mode. A second subsequent AHRS failure will lead to a degraded AP SAS mode. After AHRS reconfiguration and reengagement of the roll mode the corresponding label on the PFD AFCS strip will appear in amber.

FOLHA 3138
PROC. 053000716/2012
MAT. 1403565

3.5.23 Roll mode (HDG, LOC, VOR, VOR.A, NAV) decoupling: Airspeed too low

PFD INDICATION



Conditions/Indications

Automatic decoupling upon airspeed decrease to below 20 kts.

Procedure

In IFR or if reengagement of previously engaged or new mode is intended:

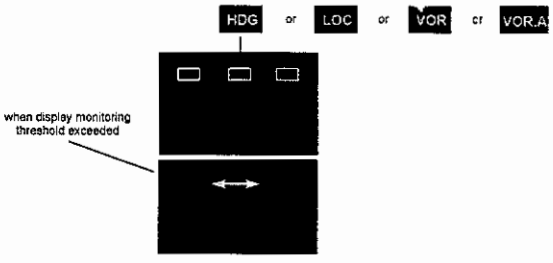
1. IAS scale on PFD	– Check/verify airspeed below 20 kts
2. APMS	– Arm/engage relevant mode at airspeed above 60 kts

If reengagement or new mode is not intended:

1. Flying controls	– Operate if necessary to maintain steady flight or hover

3.5.24 Roll mode (HDG, LOC, VOR, VOR.A) degradation: HDG discrepancy

PFD/ND INDICATION



Conditions/Indications

A discrepancy between both HDG sensors has been detected due to a HDG signal drift or an invalidity of the HDG signal on alternate side.

Procedure

In IFR or if roll mode shall be kept:

1. Flying controls	– Hands–on
2. ND compass rose	– Compare with standby compass
3. RCU	**– Reconfigure to the AHRS that generates the same heading as standby compass**
4. Mode performance	– Monitor

WARNING IN CASE OF AHRS RECONFIGURATION: CAREFULLY DETERMINE VALID HEADING. KEEP HAND ON CYCLIC STICK DURING AHRS RECONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

If flight shall be continued with another mode (different from HDG, LOC, VOR, VOR.A):

1. APMS	– Select desired mode

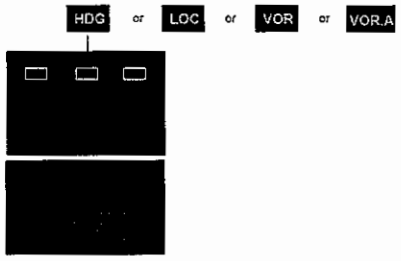
System status

A second subsequent AHRS failure will lead to a degraded AP SAS mode. After AHRS reconfiguration the roll mode label on the PFD AFCS strip will appear in amber.

NOTE The amber discrepancy arrow on the ND compass rose indicates either a discrepancy between both heading sources with first monitored threshold exceeded or the invalidity of the heading signal on the alternate side.

3.5.25 **Roll mode (HDG, LOC, VOR, VOR.A) degradation: HDG sensor failure**

PFD/ND INDICATION



Conditions/Indications

The heading sensor on own side failed.

Procedure

In IFR or if roll mode shall be kept:

1.	Flying controls	– Hands–on
2.	RCU	– Reconfigure to the AHRS of alternate side
3.	Mode performance	– Monitor

WARNING IN CASE OF AHRS RECONFIGURATION: KEEP HAND ON CYCLIC STICK DURING AHRS RECONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

If flight shall be continued with another mode (different from HDG, LOC, VOR, VOR.A):

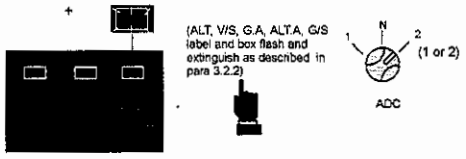
1.	APMS	– Select desired mode

System status

A second subsequent AHRS failure will lead to a degraded AP SAS mode. After AHRS reconfiguration the roll mode label on the PFD AFCS strip will appear in amber.

3.5.26 **Pitch mode (ALT, V/S, G.A, ALT.A, G/S) decoupling: ADC ALT signal failure**

PFD INDICATION + **RECONFIGURATION UNIT**



Conditions/Indications

ADC1 or ADC2 has already been reconfigured at the RCU. The ALT signal of the selected ADC has failed (invalidity of the ALT signal).

Procedure

1. Other mode or ATT – Decide and select

CAUTION RECONFIGURATION OF THE ADC SHALL NOT BE PERFORMED AS IT HAS ALREADY BEEN RECONFIGURED BECAUSE OF A PREVIOUS FAILURE. BE AWARE THAT A NEW ADC RECONFIGURATION AT THE RCU COULD LEAD TO AN ERRONEOUS ALTITUDE DEPENDING ON THE PREVIOUS FAILURE.

2. Standby instruments – Use as reference

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2–8*

3. LAND AS SOON AS PRACTICABLE

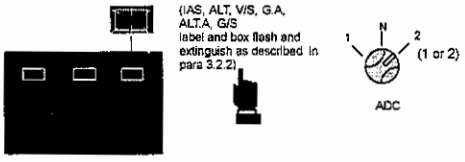
EFFECTIVITY *All*

System status

The previously engaged mode is lost and cannot be reengaged.

3.5.27 **Pitch mode (IAS, G.A, ALT, V/S, ALT.A, G/S) decoupling: ADC IAS signal failure**

PFD INDICATION + **RECONFIGURATION UNIT**



Conditions/Indications

ADC1 or ADC2 has already been reconfigured at the RCU. The IAS signal of the selected ADC has failed (invalidity of the IAS signal).

Procedure

1. Other mode or ATT – Decide and select

CAUTION RECONFIGURATION OF THE ADC SHALL NOT BE PERFORMED AS IT HAS ALREADY BEEN RECONFIGURED BECAUSE OF A PREVIOUS FAILURE. BE AWARE THAT A NEW ADC RECONFIGURATION AT THE RCU COULD LEAD TO AN ERRONEOUS AIRSPEED DEPENDING ON THE PREVIOUS FAILURE.

2. Standby instruments – Use as reference

EFFECTIVITY *If under SP/DPIFR operation according to FMS 9.2–8*

3. LAND AS SOON AS PRACTICABLE

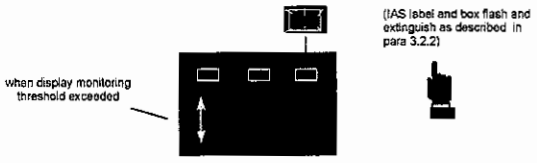
EFFECTIVITY *All*

System status

The previously engaged mode is lost and cannot be reengaged.

3.5.28 **Pitch mode (IAS) decoupling: ADC discrepancy**

PFD INDICATION



Conditions/Indications

An IAS signal discrepancy between both ADCs has exceeded the second monitor threshold.

Procedure

In IFR or if reengagement of previously engaged or new pitch mode is intended:

1. IAS tape on PFD – Compare with standby airspeed indicator
2. RCU – Reconfigure to the ADC that generates the same airspeed as the standby airspeed indicator
3. APMS – Arm/engage relevant mode

If aircraft is out of a previously effective GS capture condition:

4. Flying controls – Bring aircraft back to GS capture
5. Mode performance – Monitor

CAUTION IN CASE OF PITCH MODE REENGAGEMENT AFTER AN ADC RECONFIGURATION CONTINUE MONITORING IAS AND ALT ON PFD AND COMPARE WITH STANDBY INSTRUMENT INDICATION.

If flight shall be continued with another mode (no reengagement of a pitch mode):

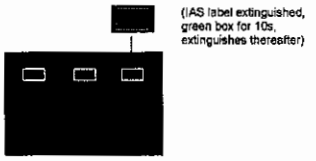
1. APMS – Select desired mode or keep autotrim

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration and reengagement of the pitch mode.

3.5.29 **Pitch mode (IAS) decoupling: Airspeed too low**

PFD INDICATION



Conditions/Indications

Automatic decoupling upon airspeed decrease to below 20 kts.

Procedure

In IFR or if reengagement of previously engaged or new pitch mode is intended:

1. IAS tape on PFD – Check/verify airspeed below 20 kts
2. APMS – Arm/engage relevant mode at airspeed above 60 kts

If reengagement or new mode is not intended:

1. Flying controls – Operate if necessary to maintain steady flight or hover.

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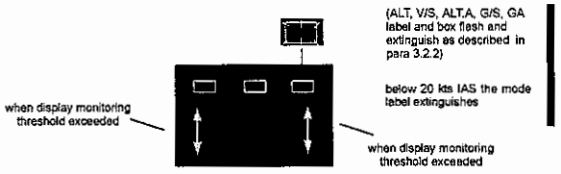
MAT.1403565

3.5.30 **Pitch mode (ALT, V/S, ALT.A, G/S, GA) decoupling: ADC discrepancy or airspeed too low**

PFD INDICATION



Conditions/Indications

Airspeed below 20 kts or IAS or ALT signal discrepancy between both ADCs has exceeded the second monitor threshold.

Procedure

In IFR or if reengagement of previously engaged or new pitch mode is intended:

1. IAS – Check on standby airspeed indicator

If IAS on standby airspeed indicator is below 20 kts:

2. Flying controls – Adjust airspeed above 60 kts

If IAS on standby airspeed indicator is above 20 kts:

2. RCU – Reconfigure to the ADC that generates the same airspeed and altitude on PFD as the standby instruments

3. APMS – Arm/engage relevant mode

If aircraft is out of a previously effective GS capture condition:

4. Flying controls – Bring aircraft back to GS capture
5. Mode performance – Monitor

CAUTION IN CASE OF PITCH MODE REENGAGEMENT AFTER ADC RECONFIGURATION CONTINUE MONITORING IAS AND ALT ON PFD AND COMPARE WITH STANDBY INSTRUMENT INDICATION.

If reengagement of a mode in the pitch axis is not intended:

1. Flying controls – Operate if necessary to maintain steady flight or hover

If a roll upper mode shall be engaged:

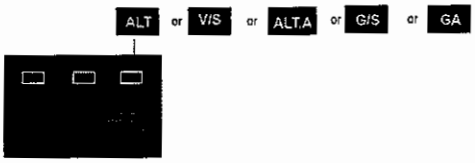
1. APMS – Engage desired upper mode at airspeed above 60 kts

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration and reengagement of the pitch mode.

3.5.31 **Pitch mode (ALT, V/S, ALT.A, G/S, GA) degradation:**
ADC ALT signal failure (own side)

PFD INDICATION



Conditions/Indications

The ALT signal on own side failed.

Procedure

In IFR or if pitch mode shall be kept:

1. RCU – Reconfigure to the ADC of alternate side
2. Mode performance – Monitor

CAUTION IN CASE OF RECONFIGURATION: CONTINUE MONITORING PITCH MODE PERFORMANCE AND COMPARE WITH STANDBY ALTIMETER INDICATION.

If flight shall be continued with another mode (other than ALT, V/S, ALT.A, G/S or GA):

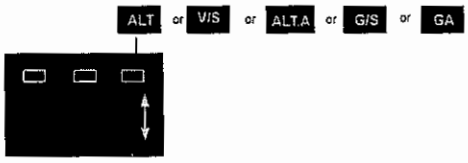
1. APMS – Select desired mode

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration.

3.5.32 **Pitch mode (ALT, V/S, ALT.A, G/S, GA) degradation:**
ADC ALT signal failure (alternate side)

PFD INDICATION



Conditions/Indications

The ALT signal on alternate side has failed.

Procedure

In IFR or if pitch mode shall be kept:

1. RCU – Reconfigure to the ADC on own side
2. Mode performance – Monitor

CAUTION IN CASE OF RECONFIGURATION: CONTINUE MONITORING PITCH MODE PERFORMANCE AND COMPARE WITH STANDBY ALTIMETER INDICATION.

If flight shall be continued with another mode (other than ALT, V/S, ALT.A, G/S or GA):

1. APMS – Select desired mode

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration.

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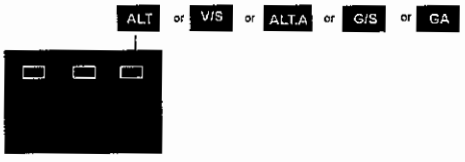
MAT.1403565

3.5.33 **Pitch mode (ALT, V/S, ALT.A, G/S, GA) degradation:**
Airspeed limitation or ADC ALT signal discrepancy

PFD INDICATION



Conditions/Indications

The pitch mode is degraded by airspeed limitation or ADC ALT signal discrepancy.

NOTE When operating beyond pitch mode airspeed limitation, the indications shown above have only advisory function and do not represent an emergency.

Procedure

In IFR or if pitch mode shall be kept:

1. PFD IAS tape – Check airspeed

If airspeed ≤ 65 kts or > V_{NE}

2. Flying controls – Adjust

If airspeed > 65 kts and < V_{NE}

2. PFD ALT indication – Compare with standby altimeter indication
3. RCU – Reconfigure to ADC that generates the same altitude as standby altimeter
4. Mode performance – Monitor

CAUTION IN CASE OF RECONFIGURATION: CONTINUE MONITORING PITCH MODE PERFORMANCE AND COMPARE WITH STANDBY ALTIMETER INDICATION.

If flight shall be continued with another mode (other than ALT, V/S, ALT.A, G/S or GA):

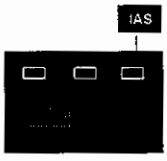
1. APMS – Select desired mode

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration.

3.5.34 **Pitch mode (IAS) degradation:**
ADC IAS signal failure (own side)

PFD INDICATION



Conditions/Indications

The IAS signal on own side has failed.

Procedure

In IFR or if pitch mode shall be kept:

1. RCU – Reconfigure to the ADC of alternate side
2. Mode performance – Monitor

CAUTION IN CASE OF RECONFIGURATION: CONTINUE MONITORING PITCH MODE PERFORMANCE AND COMPARE WITH STANDBY AIRSPEED INDICATOR.

If flight shall be continued with another mode (different from IAS):

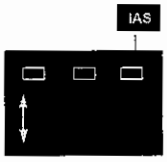
1. APMS – Select desired mode

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration.

3.5.35 **Pitch mode (IAS) degradation:**
ADC IAS signal failure (alternate side)

PFD INDICATION



Conditions/Indications

The IAS signal on alternate side has failed.

Procedure

In IFR or if pitch mode shall be kept:

1. RCU	– Reconfigure to the ADC of own side
2. Mode performance	– Monitor

CAUTION IN CASE OF RECONFIGURATION: CONTINUE MONITORING PITCH MODE PERFORMANCE AND COMPARE WITH STANDBY AIRSPEED INDICATOR.

If flight shall be continued with another mode (different from IAS):

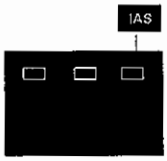
1. APMS	– Select desired mode

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration.

3.5.36 **Pitch mode (IAS) degradation:**
ADC IAS signal discrepancy

PFD INDICATION



Conditions/Indications

The pitch mode is degraded by an ADC IAS signal discrepancy.

Procedure

In IFR or if pitch mode (IAS) shall be kept:

1. PFD IAS tape	– Compare with standby airspeed indicator
2. RCU	– Reconfigure to ADC that generates the same airspeed as standby airspeed indicator
3. Mode performance	– Monitor

CAUTION IN CASE OF RECONFIGURATION: CONTINUE MONITORING PITCH MODE PERFORMANCE AND COMPARE WITH STANDBY AIRSPEED INDICATOR.

If flight shall be continued with another mode (different from IAS):

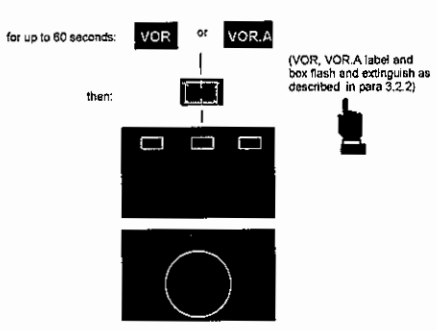
1. APMS	– Select desired mode

System status

There is no automatic ADC sensor monitoring after ADC reconfiguration.

3.5.37 **VOR/VOR.A mode degradation/decoupling:**
VOR sensor failure master side

PFD/ND INDICATION



Conditions/Indications

The VOR sensor on master side has failed. HDG mode is internally used for 60 s to track the aircraft as close as possible to the original course by compensating for an estimated drift.

Procedure

In IFR or if VOR/VOR.A mode shall be kept:

1. RCU or ICP	– Reconfigure master to the alternate side or select alternate side sensor as new NAV source
2. APMS	– Arm/engage VOR/VOR.A

If aircraft is out of VOR/ VOR.A capture condition:

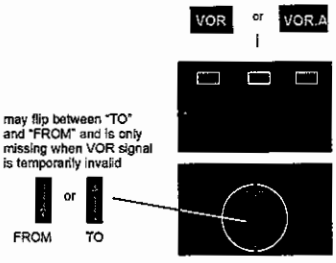
3. Flying controls	– Bring aircraft back to VOR/VOR.A capture
4. VOR/VOR.A mode performance	– Monitor

If flight shall be continued with another mode (disengagement of VOR/VOR.A):

1. APMS or GA button	– Select desired mode

3.5.38 **VOR/VOR.A mode degradation:**
Over Station Sensing (OSS) or VOR signal invalidity

PFD/ND INDICATION



Conditions/Indications

The VOR signal is temporarily not usable due to great signal variations or overflying the VOR station or invalidity of bearing signal.

Procedure

1. VOR/VOR.A mode performance	– Monitor

If overflying the station (low DME distance):

2. PFD AFCS strip	– Monitor: reverts to VOR after station passage and VOR signal stabilizes

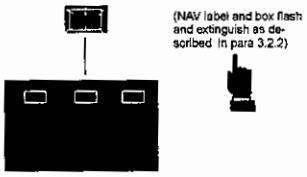
CAUTION OVER STATION CONDITION IS ONLY IDENTIFIED IN COMBINATION WITH THE CHANGE OF THE VOR COURSE DEVIATION BAR FROM 'TO' TO 'FROM'.

System status

During OSS the HDG mode is internally used to track the aircraft as close as possible to the original course by compensating for an estimated drift.

3.5.39 **NAV mode decoupling:**
Failure of NAV source signal

PFD INDICATION



Conditions/Indications

The navigation source signal (such as VOR or GPS) failed

Procedure

If reengagement of NAV mode is intended:

1. NAV source – Check

If NAV source signal can be reengaged:

2. NAV source – Reengage
3. APMS – Reengage NAV mode

If NAV source signal cannot be reengaged:

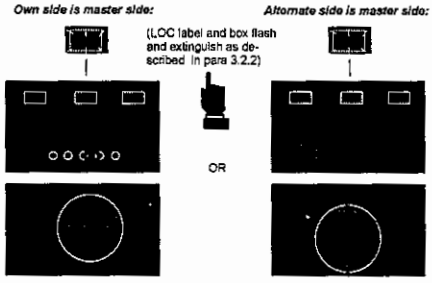
2. Select another NAV source – Choose other NAV mode (e.g. VOR)
3. APMS – Reengage NAV mode

If flight shall be continued with another mode (no reengagement of NAV mode):

1. APMS – Select desired mode or keep autotrim

3.5.40 **LOC mode decoupling:**
LOC sensor failure master side

PFD/ND INDICATION



Conditions/Indications

The LOC sensor of master side has failed.

Procedure

In IFR or if LOC mode shall be kept:

1. RCU – Reconfigure master to the alternate side
2. APMS – Arm/engage LOC mode

If aircraft is out of LOC capture condition:

3. Flying controls – Bring aircraft back to LOC capture
4. LOC mode performance – Monitor

CAUTION MONITOR LOC MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION SUCH AS LOCATOR NDB.

If flight shall be continued with another mode (disengagement of LOC):

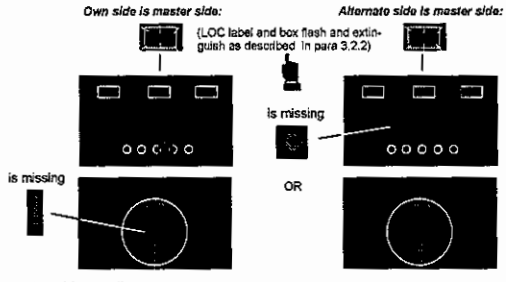
1. APMS or GA button – Select desired mode

System status

There is no automatic LOC sensor monitoring after loss of the non–master side signal.

3.5.41 **LOC mode decoupling:**
LOC signal failure master side

PFD/ND INDICATION



Conditions/Indications

The LOC signal on master side has failed

Procedure

In IFR or if LOC mode shall be kept:

1. RCU – Reconfigure master to the alternate side
2. APMS – Arm/engage LOC mode

If aircraft is out of LOC capture condition:

3. Flying controls – Bring aircraft back to LOC capture
4. LOC mode performance – Monitor

CAUTION MONITOR LOC MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION SUCH AS LOCATOR NDB.

If flight shall be continued with another mode (disengagement of LOC):

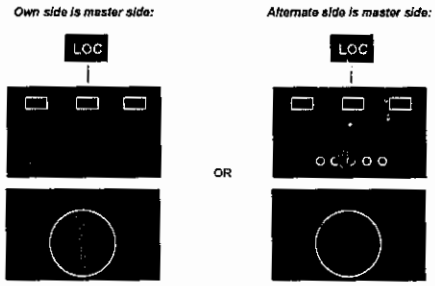
1. APMS or GA button – Select desired mode

System status

There is no automatic LOC sensor monitoring after loss of the non–master side signal.

3.5.42 **LOC mode degradation:**
LOC sensor failure non master side

PFD/ND INDICATION



Conditions/Indications

The LOC sensor on non–master side has failed

Procedure

In IFR or if LOC mode shall be kept:

1. LOC mode performance – Monitor

CAUTION MONITOR LOC MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION SUCH AS LOCATOR NDB.

If flight shall be continued with another mode (disengagement of LOC):

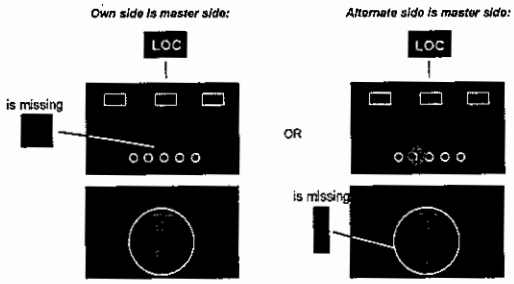
1. APMS or GA button – Select desired mode

System status

There is no automatic LOC sensor monitoring after loss of the non–master side signal.

3.5.43 **LOC mode degradation:**
LOC signal failure non master side

PFD/ND INDICATION



Conditions/Indications

The LOC signal on non–master side has failed

Procedure

In IFR or if LOC mode shall be kept:

1. LOC mode performance – Monitor

CAUTION MONITOR LOC MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION SUCH AS LOCATOR NDB.

If flight shall be continued with another mode (disengagement of LOC):

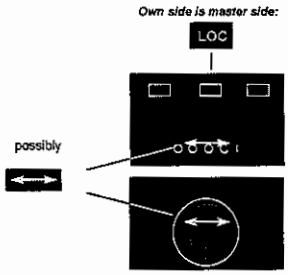
1. APMS or GA button – Select desired mode

System status

There is no automatic LOC sensor monitoring after loss of the non–master side signal.

3.5.44 **LOC mode degradation:**
LOC deviation signal discrepancy

PFD/ND INDICATION



Conditions/Indications

Discrepancy between own and alternate LOC deviation signal.

Procedure

In IFR or if LOC mode shall be kept:

1. PFD/ND LOC deviations – Check vs. LOC NDB or other NAV information

If NAV position consistent with master LOC deviation:

2. LOC mode performance – Monitor

If NAV position not consistent with master LOC deviation:

2. RCU – Reconfigure master to the other side
3. LOC mode performance – Monitor

CAUTION MONITOR LOC MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION SUCH AS LOCATOR NDB.

If flight shall be continued with another mode (disengagement of LOC):

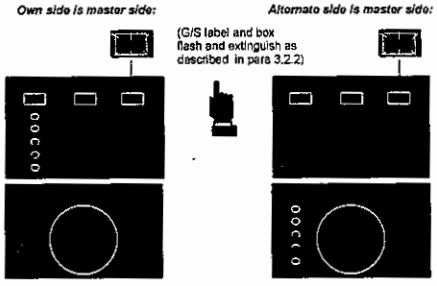
1. APMS or GA button – Select desired mode

System status

The mode will display the amber LOC label as long as the LOC deviation discrepancy exists. This is also true after a reconfiguration of the master to the other side.

3.5.45 **GS mode decoupling:**
GS sensor failure master side

PFD/ND INDICATION



Conditions/Indications

The GS sensor on master side has failed

Procedure

In IFR or if GS mode shall be kept:

1. RCU – Reconfigure master to the alternate side
2. APMS – Arm/engage GS

If aircraft is out of GS capture condition:

3. Flying controls – Bring aircraft back to GS capture
4. GS mode performance – Monitor

CAUTION MONITOR GS MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION AS ALTITUDE VS. MARKER OR DME INFORMATION.

If flight shall be continued with another mode (disengagement of GS):

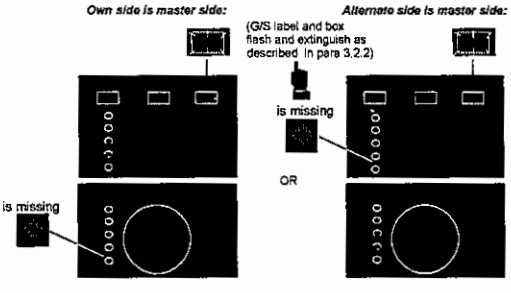
1. APMS or GA button – Select desired mode

System status

There is no automatic GS sensor monitoring after loss of the non–master side signal.

3.5.46 **GS mode decoupling:**
GS signal failure master side

PFD/ND INDICATION



Conditions/Indications

The GS signal on master side has failed

Procedure

In IFR or if GS mode shall be kept:

1. RCU – Reconfigure master to the alternate side
2. APMS – Arm/engage GS

If aircraft is out of GS capture condition:

3. Flying controls – Bring aircraft back to GS capture
4. GS mode performance – Monitor

CAUTION MONITOR GS MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION AS ALTITUDE VS. MARKER OR DME INFORMATION.

If flight shall be continued with another mode (disengagement of GS):

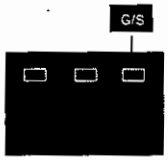
1. APMS or GA button – Select desired mode

System status

There is no automatic GS sensor monitoring after loss of the non–master side signal.

3.5.47 **GS mode degradation:**
Radio altimeter sensor failure

PFD INDICATION



Conditions/Indications

The radio altimeter has failed.

Procedure

1. GS mode – Disengage
2. Glideslope – maintain manually (use IAS mode as required)

CAUTION THE AUTOMATIC LEVELLING OFF ABOVE GROUND FUNCTION IS LOST.

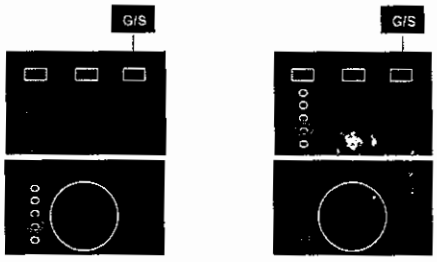
System status

There is no automatic GS mode available.

3.5.48 **GS mode degradation:**
GS sensor failure non master side

PFD/ND INDICATION

Own side is master side: *Alternate side is master side:*



Conditions/Indications

The GS sensor on non-master side has failed

Procedure

In IFR or if GS mode shall be kept:

1. GS mode performance – Monitor

CAUTION MONITOR GS MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION AS ALTITUDE VS. MARKER OR DME INFORMATION.

If flight shall be continued with another mode (disengagement of GS):

1. APMS or GA button – Select desired mode

System status

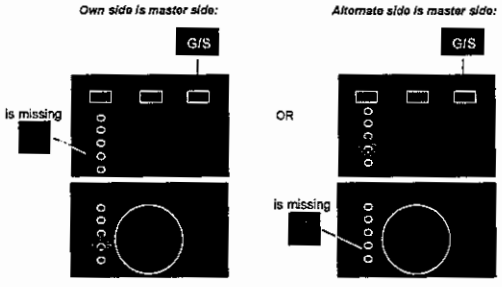
There is no automatic GS sensor monitoring after loss of the non-master side signal.

FOLHA 3145
PROC. 053000716/2012
MAT. 1403565

3.5.49 **GS mode degradation:**
GS signal failure non master side

PFD/ND INDICATION

Own side is master side: *Alternate side is master side:*



Conditions/Indications

The GS signal on non-master side has failed

Procedure

In IFR or if GS mode shall be kept:

1. GS mode performance – Monitor

CAUTION MONITOR GS MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION AS ALTITUDE VS. MARKER OR DME INFORMATION.

If flight shall be continued with another mode (disengagement of GS):

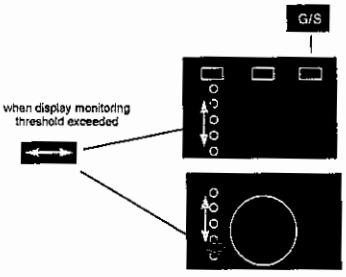
1. APMS or GA button – Select desired mode

System status

There is no automatic GS sensor monitoring after loss of the non-master side signal.

3.5.50 **GS mode degradation:**
GS deviation signal discrepancy

PFD/ND INDICATION



Conditions/Indications

Discrepancy between own and alternate GS deviation signal.

Procedure

In IFR or if GS mode shall be kept:

1. Altitude vs. marker or DME – Check

If altitude consistent with published GS

2. GS mode performance – Monitor

If altitude not consistent with published GS

2. RCU – Reconfigure master to the other side
3. GS mode performance – Monitor

CAUTION MONITOR GS MODE PERFORMANCE AND COMPARE WITH ADDITIONAL INFORMATION AS ALTITUDE VS. MARKER OR DME INFORMATION.

If flight shall be continued with another mode (disengagement of GS):

1. APMS or GA button – Select desired mode

System status

The mode will display the amber G/S label as long as the GS deviation discrepancy exists. This is also true after a reconfiguration of the master to the other side.

4 NORMAL PROCEDURES

The complete AFCS is powered up by setting the avionic master switches to ON, as mentioned in para 4.4.3 of the basic Flight Manual BK 117 C–2.

EFFECTIVITY ASB BK117C–2–22A–012 (up to and including AFCS software version 416-00297-202)

CAUTION IF THE PILOT USES THE "ALT.A" MODE OF THE AFCS THE PILOT HAS TO MONITOR THE ALTITUDE. IF THE AUTOPILOT DOES NOT LEVEL–OFF (AS DESCRIBED IN THE ASB MENTIONED ABOVE) AT THE DESIRED ALTITUDE THE PILOT HAS TO PRESS THE "ALT" MODE SELECTOR SWITCH ON THE APMS PANEL TO DISENGAGE "ALT" MODE THAT WAS ERRONEOUSLY TRIGGERED. WHEN REACHING THE DESIRED ALTITUDE, PILOT HAS TO PRESS THE "ALT" MODE SELECTOR SWITCH AGAIN TO ENGAGE "ALT" MODE AND LEVEL–OFF AT CURRENT ALTITUDE.

EFFECTIVITY All

4.1 PREFLIGHT CHECK

NOTE
- The entire system preflight check has to be performed prior to the first flight of the day (once a day). However, if for emergency reasons, the pilot wishes to interrupt the preflight test he should do so using the SAS/AP CUT OFF button.
- Perform peripheral checks and system test in conjunction with the normal preflight after completion of hydraulic checks, with both engines in IDLE and mast moment trimmed to minimum.
- During the system test routine the helicopter should not be moved nor should the pilot move or even touch the controls or the APMS as this may cause false errors to be detected by the computer (the cyclic stick will move of itself while the computer performs the test cycle).

4.1.1 Peripheral checks

Transponder	– TEST, then SBY

4.1.2 AFCS preflight check (both engines in idle)

WARNING IF A FAILURE IS DETECTED DURING PREFLIGHT CHECK MAINTENANCE ACTION IS NECESSARY.

NOTE The system test is initiated with autopilot off, collective full down and locked and cyclic stick in neutral position.

TEST pb on APMS	– Press to initiate system test (TEST and AP1 pb start blinking)
Warning panel	– Check AP warning light illuminated
PFD	– Check all AFCS–related indications in red, afterwards: ///
CAD	– Check the following caution indications during AP1 system test : – **AP1** – **TRIM** – **ACTUATOR** – **BACKUP SAS** – **AHRS DISC** During AP2 system test (AP2 pb blinking) the **AP2** caution indication appears instead of **AP1**, together with all other above mentioned caution indications
Cyclic stick and pedals	– Check small motion during AP1 system test and again during AP2 system test

If system test was successful (TEST pb extinguishes and AP1/AP2 pb are permanently illuminated on APMS):

CAD	– Check advisory AP TEST OK
AP1 and AP2 pb on APMS	– Press to engage AFCS ("OFF" illumination of the pb extinguishes)

If system test was not successful (TEST pb remains permanently illuminated indicating major failure, or continues blinking indicating minor failure):

CAD	– Check corresponding caution indication
TEST pb	– Press to acknowledge test result
AFCS	– Not (completely) available

If system test failed, perform the following checks and repeat testing:

Collective lever	– Check down
Cyclic stick and pedals	– Check in neutral position and free movement
Hydraulic pressure	– Within requirements

If a failure is detected by the test and persists, maintenance action is necessary.

4.1.3 AFCS and backup SAS cut off pb preflight check (both engines in idle)

AP1 and AP2 pb on APMS	– Press to engage AFCS ("OFF" illumination of the pb extinguishes)
SAS/AP CUT pb on cyclic stick	– Push
CAD	– Check caution indication: **BACKUP SAS + YAW SAS***
PFD	– Check axial letter indication in red, afterwards: OFF OFF
SAS ON sw on cyclic stick	– Push forward
CAD	– Check caution indication **BACKUP SAS + YAW SAS*** disappeared

Perform check in the same manner by using SAS/AP CUT pb on copilot's cyclic stick in the case that dual controls (FMS 9.2–7) are installed.

(* YAW SAS caution indication only for H/C S/N 9034 or subsequent or after SB MBB–Bk117C–2–22–002).

4.2 OPERATION

NOTE This section contains information and procedures only for typical operations of the autopilot, i. e. the sequence of AFCS mode applications shown in the following is not mandatory.
For system performance and functional principles refer to section 7 of this FMS.

4.2.1 Before takeoff

SAS ON sw	– Press to engage backup SAS (BACKUP SAS + YAW SAS* caution must not be on)

NOTE The backup SAS + YAW SAS* must be engaged before the autopilots

AP1 and AP2 pb on APMS	– Press to engage AFCS ("OFF" illumination of the pb extinguishes)

(* YAW SAS caution indication only for H/C S/N 9034 or subsequent or after SB MBB–Bk117C–2–22–002).

4.2.2 Takeoff and climbout

For engagement of HDG mode:

When IAS above 60 kts:

HDG rotary pb on APMS	– Turn and set heading bug on PCDS if necessary, press to activate heading bug (triangle next to the rotary pb illuminates green)

NOTE Engagement of NAV, VOR, VOR.A or LOC mode disengages HDG mode.

For climbout using IAS mode:

Desired airspeed for climbout	– Establish
IAS pb on APMS	– Press to engage IAS mode (pb illuminates green: "ON")

NOTE Engagement of ALT, ALT.A, VS, GA or GS mode disengages IAS mode.

For climbout or descent using VS mode:

Desired vertical speed	– Establish
VS pb on APMS	– Press to engage VS mode (pb illuminates green: "ON")

NOTE If the helicopter descends too low, the AFCS automatically reverts to ALT mode, leveling off at approx. 65 ft above ground.
Engagement of IAS, ALT, ALT.A, GA or GS mode disengages VS mode.

For climbout using ALT.A mode:

ALT.A rotary pb on APMS	– Rotate to preselect the desired altitude, then press to engage altitude acquisition (triangle next to the rotary pb illuminates green)

NOTE 300 ft before reaching the selected altitude the AFCS automatically reverts to ALT mode. Engagement of IAS, ALT, VS, GA or GS mode disengages ALT.A mode.

4.2.3 **Enroute operation**

For ALT mode

Transition to cruising flight after climbout with IAS or VS mode:

Collective lever	– Adjust for level flight after reaching desired altitude
IAS or V/S pb on APMS	– Press to disengage respective mode
ALT pb on APMS	– Press to engage ALT mode (pb illuminates green: "ON")

NOTE Engagement of IAS, ALT.A, VS, GS or GA mode disengages ALT mode.

When IAS or ALT mode is selected the respective reference values will be marked with green triangles on the FCDS.

To alter reference values use the HDG rotary pb for heading and the BEEP TRIM sw on the cyclic stick for airspeed and altitude.

For VOR.A mode:

Used to capture and track a desired course i.e. to track TO or FROM VOR station (typically 10 nm from the beacon):

MASTER sw on RCU	– Select VOR source (nominal is VOR 1 for copilot, VOR 2 for pilot)
Navigation receiver	– Set desired VOR frequency
CRS rotary knob on ICP	– Set course pointer to desired VOR track/radial
APP pb on APMS	– Press (pb illuminates amber: "A")

For VOR radial/track interception (if HDG mode is required for intersection):

HDG rotary pb on APMS	– Rotate to set heading bug to the VOR radial/track interception course on FCDS, then press to engage mode (triangle next to the rotary pb illuminates green)

NOTE • As the helicopter nears the selected VOR radial/track, the AFCS automatically disengages APP arm and HDG (if it is engaged). The APP "C" caption illuminates green on the APMS, indicating VOR radial/track capture and the helicopter turns onto the radial/track.

• Selection of the DME to a station other than the active VOR station is not recommended because VOR.A mode performance may then be degraded

For NAV (VOR) mode:

Used to capture and track a desired course i.e. to track TO or FROM VOR station:

NOTE • For short distance navigation to a VOR station the use of VOR.A mode is recommended (see previous page).

• Selection of the DME to a station other than the active VOR station is not recommended because VOR mode performance may then be degraded

The operating procedure for NAV (VOR) mode is the same as for VOR.A mode (see previous page), except for the use of the NAV pb instead of the APP pb on APMS.

For NAV (NAV) mode:

Used in combination with a navigation management system (NMS – refer to FMS 9.2-17), where available, issuing a pure roll steering command to the AFCS:

NMS	– Select suitable navigation mode such as GPS, DME/DME or VOR/DME.
MASTER sw on RCU	– Select master side for the sensor
ICP	– Select NMS as navigation source for AFCS
NAV pb on APMS	– Press (pb illuminates green: "C")

4.2.4 **Approach**

APP (LOC) mode:

Used to capture and track the inbound front course of a localizer for runway approach:

MASTER sw on RCU	– Select LOC source (nominal is LOC 1 for copilot, LOC 2 for pilot)
Navigation receiver	– Set desired LOC frequency
CRS rotary knob on ICP	– Set course pointer on ND for LOC course in order to define the intersection angle with respect to heading
APP pb on APMS	– Press (pb illuminates amber: "A")

For LOC inbound front course interception:

HDG rotary pb on APMS	– Rotate to set heading bug to the LOC radial interception course on ND, then press to engage mode (triangle next to the rotary pb illuminates green)

NOTE As the helicopter nears the selected LOC radial, the AFCS automatically disengages APP arm and HDG (if it is engaged). The APP "C" caption illuminates green on the APMS, indicating LOC radial capture and the helicopter turns onto the LOC radial.

4.2.5 **Landing**

All landings:

– press FTR switch until full touchdown or
– switch CYC and YAW TRIM OFF.

Slope landing: Ground oscillations in roll axis may be encountered. Pressing the FTR switch should damp out these oscillations.

GS mode (provides in combination with APP(LOC) mode an ILS approach):

The GS mode acquires and holds the selected glide slope in order to perform an ILS approach to an airport. At approx. 65 ft above ground, the AFCS automatically reverts to ALT mode to level off the helicopter.

MASTER sw on RCU	– Select ILS source (nominal is ILS 1 for copilot, ILS 2 for pilot)
Navigation receiver	– Set desired ILS frequency

Perform all actions to arm and/or engage APP(LOC) mode with the desired heading intersection angle (optionally supported by HDG mode) as described on previous page.

GS pb on APMS	– Press (pb illuminates amber: "A") The AFCS is now armed for automatic capture of the glide slope.

Upon ILS/LOC capture, the AFCS automatically disengages APP arm and HDG (if it is engaged). The APP "C" caption illuminates green on the APMS.

Upon ILS/GS capture, the AFCS automatically disengages GS arm and any previously activated pitch mode. The GS "C" caption illuminates green on the APMS.

Recommended values for an ILS approach:

Interception angle	45°
LOC interception distance	5 nm
Airspeed	80–125 kts
Max. crosswind	25 kts

GA mode (to abort an approach):

The GA (go around) mode, used in case of a missed approach, acquires and holds a pre-defined vertical speed of 1000 ft/min.

GA pb on collective grip	– Press (VS pb on APMS illuminates green: "ON")

NOTE • After 10 seconds, GA mode automatically reverts to VS mode.

• An initial altitude loss of up to 60ft may be encountered after engaging GA mode.

• Engagement of ALT, ALT.A, VS or IAS mode disengages GA mode.

• Below 60 kts IAS and with IAS mode engaged use of the GA mode is prohibited.

4.2.6 **Precision Hover**

EFFECTIVITY H/C with S/N 9151 or subsequent or after SB BK117 C-2-22-07

To improve the YAW control in hover the YAW TRIM function can be switched off. In this case YAW SAS only is active. If the YAW TRIM function is switched off intentionally by the pilot the YAW TRIM pb illuminates but the TRIM caution (CAD) is not displayed.

NOTE
- This function is only available if the airspeed is ≤ 40KIAS
- "FEET ON" operation is required.
- For airspeeds > 40 KIAS the turn coordination is still active.

EFFECTIVITY All

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

7.1 GENERAL

The BK117 C-2 AFCS basic version is connected to the 28 V DC power system and consists of

- two **dual electronic modules** (autopilot modules – APMs) which acquire helicopter angles and rates, compute AFCS control laws (basic stabilization und upper modes functions) and transmit them to the actuators. A built–in test is provided for preflight check. The autopilot modules are located in the avionic rack of the helicopter.
- self–monitored duplex **series actuators** of the smart electro–mechanical (SEMA) type for pitch and roll axes. Simplex SEMA is used for the directional axis.
- force–feel **parallel actuators** for pitch and roll axes, friction trim actuator for yaw
- **one autopilot mode selector (APMS)** for AFCS engagement and mode selection, located in the central console. Additional controls are located on cyclic sticks and collective levers.
- two independent **attitude & heading reference systems** (AHRS) which measure the required signals for basic stabilization, and two **air data computers** (ADC) providing necessary data for upper mode functions. These informations are shared with the FCDS.
- a 3–axis **backup SAS**, based on three independent **fibre–optic rate gyros (FOGs)** (for pitch, roll and yaw axis respectively), which compute and deliver SAS–commands to one series actuator for each axis.The SAS is designed for "hands–on" operation.

The navigation sensor information is acquired through the FCDMs which ensure data integrity and transmit the information via digital link to the processing modules (APMs).

7.2 SYSTEM COMPONENTS AND CONTROLS (see fig. 2)

7.2.1 Autopilot module (APM 2001)

The two APMs (duplex architecture) are 2–board modules. Each board includes one processing channel for control law and monitoring computation. The boards receive data from the dedicated FCDM via an ARINC line (board 1 from FCDM 1 and board 2 from FCDM 2) and cross-channel data to the opposite board. The APM modules are fitted in the avionics housing alongside other functional modules like FCDS.

The redundant operation of the APMs is based on a hot/spare principle: one APM serves as MASTER, the other as SLAVE. The MASTER APM is normally used to calculate all AFCS functions. It also carries across to the SLAVE all necessary informations for task reallocation. In case of failure, the SLAVE APM will automatically take over all functions performed by the MASTER without any loss of functionality in AFCS operation.

The APMs are directly interfaced to:
AHRS 1+2; ADC 1+2; pitch, roll and yaw FOGs, SEMAs and parallel actuators; APMS; FCDM 1+2; CPDS; RCU; warning panel

7.2.2 Series actuation

The pitch and roll SEMAs are integrated in the mechanical control rod above the cabin roof. The SEMAs operate in series with the cyclic flying controls and introduce a limited authority motion directly to the hydraulic boost without movement of the cyclic stick. The total SEMA equivalent control authority (both actuators) for roll is ± 18 %, for pitch ± 11 %. Due to safety reasons, the BACKUP SAS function uses the authority of only one SEMA actuator authority.

The yaw SEMA is installed inside the vertical tail fin structure between the end of the flexball cable and the hydraulic booster. It operates in series with the mechanical directional pedal control and provides limited authority motion directly to the hydraulic boost without movement of the pedals. The yaw SEMA equivalent control authority is ± 12%.

7.2.3 Parallel actuation

Parallel actuators with nominally 100 % control authority are used to implement the trim function in the longitudinal and lateral cyclic controls. Each parallel actuator contains the following features:

a) artificial force feel (break–out and force displacement gradient)

b) duplex detent switches to translate crew action through the artificial feel law (Used to indicate whether the pilot is hands–on)

c) duplex sensor (RVDT) to supply parallel actuator output shaft position data

d) force trim release (FTR) to release all artificial stick forces

e) stick damping, in order to minimize overshoot by e.g. FTR

f) limit stops to minimize the influence of an actuation motor failure

g) a friction trim actuator also containing a duplex sensor (RVDT) is used to implement the trim function in the yaw axis control.

7.2.4 Beep function

Beep function is provided not only in the fully functional system with ATT and/or upper modes, but also in the cases of:

a) CYCL TRIM OFF without overriding actions (standard attitude beep). The pilot beeps the attitude of the h/c and the AFCS is forcing the h/c to follow this beep.

b) CYCL TRIM OFF with upper modes engaged (upper mode beep). When an upper mode is engaged by using the beep button the pilot is changing the reference value of the engaged mode.

EFFECTIVITY S/N 9034 and subsequent or after SB MBB–BK117C–2–22–002

In case of AFCS degradation to a hands–on flying task, operational demands can still require fine adjustments of the h/c attitude. For this cases a beep function is also provided for:

c) CYCL+YAW TRIM OFF (manual beep), where the pilot is flying with short term stabilisation and full 3–axis decoupling in case of cyclic & yaw trim failure.

d) Backup SAS mode (manual beep) (after two autopilot modules have been lost), where the pilot beeps manually the trim actuator.

e) Using Yaw SAS only (manual beep), which is also a manual beep trim operation in conjuction with the yaw SAS rate damping.

EFFECTIVITY If AFCS software version 416–00297–203 is installed or S/N 9701 and subsequent

In case of a trim runaway caused by a stuck BEEP TRIM pb pressing the FTR pb for more than one second will deactivate the BEEP TRIM in the affected axis as long as AP1 and AP2 remain engaged.

In this case the beep trim switch will also be unavailable for autopilot reference changes in the affected axis. Changes then have to be made by use of the Autopilot mode selector.

EFFECTIVITY All

7.3 AUTOPILOT MODE SELECTOR (APMS 2360)

The AFCS is engaged, tested and controlled via the APMS (fig.1). The push buttons on the APMS are of the momentary push–type, whereas the push buttons for HDG and ALT A modes are rotary pb. The APMS also features illumination for mode status indication.

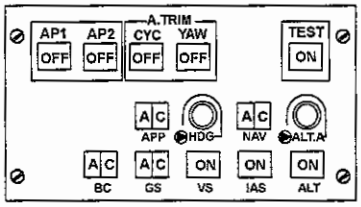


Fig. 1 Autopilot mode selector

The APMS enables the pilot to perform the following:

- preflight test
- engagement/disengagement of both APMs
- engagement/disengagement of autotrim
- engagement/disengagement of the following upper modes:
  - VOR/LOC approach (APP)
  - heading acquisition and hold (HDG)
  - navigation in combination with an NMS – refer to FMS 9.2–17 (NAV)
  - altitude acquisition (ALT.A)
  - glide slope (GS)
  - vertical speed hold (VS)
  - indicated airspeed hold (IAS)
  - altitude hold (ALT)

The backcourse sw (BC) is inactive.

NOTE Engagement of the go around mode (GA) is performed via the GA pb on the collective lever.

7.3.1 Data acquisition and management

Both ADCs and both AHRSs are directly connected to the APM in order to avoid transmission delays.

The data from AHRS 1 and AHRS 2 are consolidated and the average is used by default to calculate the control laws. AHRS1 is used to monitor AHRS 2 and vice versa (in conjunction with the backup FOGs as a third source for comparisons). In case one AHRS or ADC is detected to be faulty, the APM will be using data from the other AHRS or ADC as primary source.

In case of any hardware failure, each APM sends a discrete signal to the displays (via FCDM and APMS) in order to require a reconfiguration to the other computer which is in hot spare state.

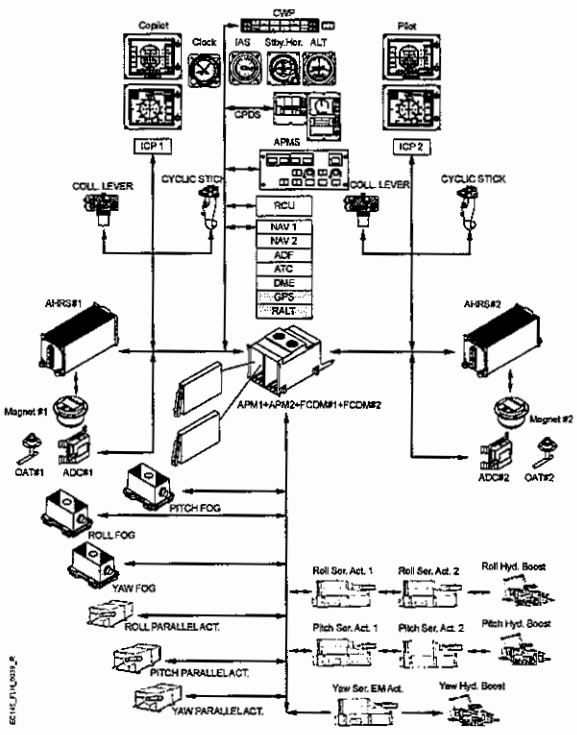


Fig. 2 AFCS – schematic

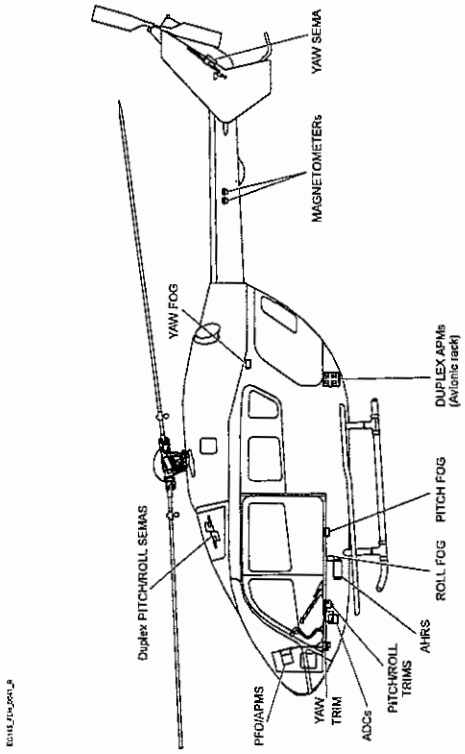


Fig. 3 AFCS – equipment locations

7.3.2 Cyclic stick/collective lever grip controls

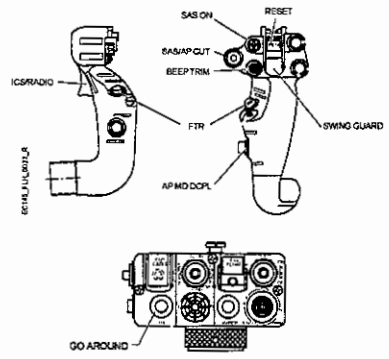


Fig. 4 Cyclic stick/collective lever grip

SAS/AP CUT	– Disengages the SAS (3–axis backup SAS) – Disengages the AFCS
SAS ON (4–way)	– (Re)engagement of P/R/Y backup SAS (press to any direction)
FTR	– Opens both cyclic stick parallel actuator clutches to release stick forces
BEEP TRIM (4–way)	– Modifies the attitude reference in ATT mode – Modifies IAS, ALT, ALT.A, HDG, GA or VS reference when the respective mode is engaged
GO AROUND	– Engages GA mode

continued

AP MD DCPL	– Cancels all upper modes and reverts to ATT mode when pressed less than 1 sec.

EFFECTIVITY *If AFCS software version 416–00297–203 is installed or S/N 9701 and subsequent*

– Cancels all pre-select upper mode references when pressed for more than 1 second.
– On ground with AP on centers cyclic stick when pressed for more than one second

EFFECTIVITY *All*

7.4 OPERATION

CAUTION WHEN SWITCHING THE MASTER RCU FROM RIGHT TO LEFT OR VICE VERSA DECOUPLING OF CERTAIN UPPER MODES WILL OCCUR. REENGAGE MODES AS REQUIRED.

For upper mode engagement the airspeed has to be above 60 kts. At an airspeed below 20 kts, any previously engaged upper mode will be automatically disengaged.

The following tables provide an operational summary for APMS controls (AP1, AP2, A.TRIM CYC/YAW) and AFCS–modes and functions:

TEST	DESCRIPTION	On pilot's request a preflight test can only be initiated before flight with autopilot off and collective lever full down and locked. Test duration is approx. 25 s.
AP1/AP2	DESCRIPTION	Provides activation/deactivation of the respective APM.
	ENGAGEMENT	Press the respective AP pb. Illumination "OFF" extinguishes.
	INITIAL CONDITIONS & LIMITATIONS	The default mode after powering up the helicopter is AP off. Both AP pb are illuminated "OFF".
	DISENGAGEMENT	Press the respective AP pb which then becomes illuminated "OFF". Pressing the SAS/AP CUT pb on the cyclic stick results in disengagement of all stabilization systems. Pilot has to fly hands-on.
TEST	ENGAGEMENT	Press TEST pb (see para 4.1.2).

A.TRIM CYC/YAW	DESCRIPTION	Provides long term attitude stabilization for hands-off operation. In addition a Follow-up Trim function is provided which uses a hysteresis disengaging above 40 kt (when accelerating) and active below 30 kt (when decelerating). The Follow-up Trim function provides an automatic trimming function to reduce cyclic stick forces especially during hover flight maneuvers.
	ENGAGEMENT	• Press the AP pb. Illumination "OFF" extinguishes and A.TRIM becomes automatically engaged. or • Press the A.TRIM pb. Illumination "OFF" extinguishes.
	INITIAL CONDITIONS & LIMITATIONS	Default mode is CYC and YAW A.TRIM engaged. Illumination "OFF" extinguished.
	OVERRIDE	Longitudinal or lateral motion of the cyclic stick temporarily overrides CYC A.TRIM mode or Press FTR pb on cyclic stick to release forces. Hold pb pressed while flying the helicopter to the new trim position. The attitude reference will synchronize to the actual attitude on release of the FTR pb. or *EFFECTIVITY* *Up to and including AFCS software version 416–00297–202 and before S/N 9701* Fore or aft motion of the BEEP TRIM sw on cyclic stick will slew the attitude reference at 2 deg/s. Left or right motion of the BEEP TRIM sw will slew the attitude reference at 4 deg/s. The helicopter will change its attitude smoothly to the new reference. This method is most useful for small attitude changes or fine adjustment. *EFFECTIVITY* *If AFCS software version 416–00297–203 is installed or S/N 9701 and subsequent* Fore or aft motion of the BEEP TRIM sw on cyclic stick will slew the attitude reference at 4 deg/s. Left or right motion of the BEEP TRIM sw will slew the attitude reference at 5 deg/s. The helicopter will change its attitude smoothly to the new reference. This method is most useful for small attitude changes or fine adjustment. *EFFECTIVITY* *All* Left or right pedal motions temporarily override YAW A.TRIM mode

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D SAS function (CYC & YAW A.TRIM OFF)	DESCRIPTION	Provides control commands to the pitch and roll SEMAs through the APM(s) in case of not cyclic and yaw trim malfunctions. Short term stabilization and gust disturbance rejection is provided. Long term attitude (trim) hold is not achievable. Can be used in aggressive hover manoeuvers when the pilot wishes to disengage the trim follow–up function.
	ENGAGEMENT	D SAS function becomes active manually by switching off the cyclic and YAW trim operation or automatically in case of cyclic and yaw trim failure.
	DISENGAGEMENT	Press both AP pb which then become illuminated "OFF". Autopilot is disengaged and reverts to backup SAS or Press the SAS/AP CUT pb on the cyclic stick. All stabilization systems are disengaged. Pilot has to fly "hands-on".
	OVERRIDE	Press FTR pb on cyclic stick to release forces.
YAW TRIM OFF	DESCRIPTION	Provides long term stabilisation only in pitch and roll but not in yaw. The pilot must control the axis and recentre the pedals manually, when prompted by the recentering arrows. The function can be used when precision tasks in yaw axis are required e.g during hover or low speed manoeuvres. For air speeds > 40KIAS turn coordination is still provided
	ENGAGEMENT	Press YAW TRIM pb
	DISENGAGEMENT	Once yaw trim off is engaged, press YAW TRIM pb to re–engage the yaw trim function
	OVERRIDE	In yaw axis **permanent pilot attention is required** for axis control and recentering actions. In pitch and roll axes full long-term attitude stabilisation is provided.

ALT	DESCRIPTION	Maintains the current barometric altitude.
	ENGAGEMENT	Press ALT pb which then becomes illuminated "ON". The reference will be synchronized to the barometric altitude at the time of engagement.
	DISENGAGEMENT	Press ALT pb. Illumination "ON" extinguishes. or Press AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode. or Engagement of GA, IAS, ALT.A, VS or GS mode.
	OVERRIDE	Fore or aft motion of the cyclic stick temporarily overrides ALT mode. or Fore or aft motion of the BEEP TRIM sw on cyclic stick will slew the altitude reference at 1500 ft/min (with or without simultaneous override). In case of simultaneous beep and override, the trim is additionally commanded to follow up the stick.
	DISPLAY	– The reference is indicated by a green bug on the PFD ALT scale. – On the AFCS strip of PFD: green ALT label is displayed in area of engaged mode axis.

HDG	DESCRIPTION	Acquires and maintains desired magnetic heading.
	ENGAGEMENT	Rotate HDG rotary pb to adjust the heading select "bug" on the FCDS and press HDG rotary pb thereafter. The triangle next to the rotary pb illuminates green. The helicopter will enter a banked turn, levelling off at the commanded heading. The mode can also be engaged at the current heading without preselection, by simply pressing the HDG rotary pb.
	DISENGAGEMENT	Press HDG rotary pb – the green triangle next to the rotary pb extinguishes. or Press AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode. or Engagement of NAV, VOR, VOR.A or LOC mode disengages HDG mode.
	OVERRIDE	Lateral motion of the cyclic stick temporarily overrides HDG mode or While HDG mode is engaged, a new heading can be selected by adjusting the heading select "bug". or Left or right motion of the BEEP TRIM sw on cyclic stick will slew the heading reference at 5°/s (with or without simultaneous override). In case of simultaneous beep and override, the trim is additionally commanded to follow–up the stick.
	DISPLAY	– HDG is displayed by means of a bug and a digital value – The heading bug will be displayed in white if the rotary HDG pb is turned and in green if the rotary HDG pb is pressed and the HDG mode is engaged. – The heading bug color changes during the evolution of the rotary heading pb with HDG mode engaged from green to white and if HDG mode is disengaged from green to white. – On the AFCS strip of the PFD: green HDG label is displayed in the area of engaged mode axis.

IAS	DESCRIPTION	Maintains indicated airspeed.
	ENGAGEMENT	Press IAS pb which then becomes illuminated "ON". The reference will be synchronized to the indicated airspeed at the time of engagement.
	INITIAL CONDITIONS & LIMITATIONS	The reference is limited from 30 kts to V_{NE}. The mode acts through the helicopter pitch axis only. The IAS will be maintained at the cost of holding altitude. The pilot must adjust the collective lever power setting if the altitude is to be held, or use the mode as a convenient method of maintaining IAS whilst independently commanding a variety of power settings (i.e. climb/descent rates).
	DISENGAGEMENT	Press IAS pb. Illumination "ON" extinguishes. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode. or Engagement of GA, ALT, ALT.A, VS or GS mode disengages IAS mode.
	OVERRIDE	Fore or aft motion of the cyclic stick temporarily overrides IAS mode or For or aft motion of the BEEP TRIM sw on cyclic stick will slew the IAS reference at 8 kts/s (with or without simultaneous override). In case of simultaneous beep and override, the trim is additionally commanded to follow–up the stick.
	DISPLAY	– The reference is indicated by a green bug on the PFD IAS scale. – On the AFCS strip of PFD: green IAS label is displayed in area of engaged mode axis.

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ALT.A	DESCRIPTION	Acquires a predefined barometric altitude and executes an automatic level–off.
	ENGAGEMENT	Rotate ALT.A rotary pb to preselect desired altitude and press ALT.A rotary pb thereafter. The triangle next to the rotary pb illuminates green. The helicopter will start to climb/descend, levelling off at the commanded altitude. NOTE The ALT.A mode uses the VS mode implicitly. A vertical speed of 500 ft/min is used after ALT.A engagement. If the vertical speed is greater than 500 ft/min at the time of engagement, the current vertical speed will be used. 300 ft before reaching the selected altitude, the green triangle next to ALT.A rotary pb extinguishes and the system automatically reverts to ALT (illumination "ON" of ALT pb).
	DISENGAGEMENT	Press ALT.A rotary pb to disengage the acquisition. The green triangle next to ALT.A rotary pb extinguishes. or Press the AP MD DCPL sw on cyclic stick. Autopilot reverts to ATT mode. or Engagement of GA, IAS, ALT, VS or GS mode disengages ALT.A mode.
	OVERRIDE	Rotate the ALT.A rotary pb to set a new altitude prior to capture. or Fore or aft motion of the cyclic stick temporarily overrides the ALT.A and VS mode activity. or Fore or aft motion of the BEEP TRIM sw on cyclic stick will slew the vertical speed reference at 200 ft/min each s (with or without simultaneous override). In case of simultaneous beep and override, the trim is additionally commanded to follow–up the stick.
	DISPLAY	– The PFD displays the ALT.A reference in cyan digital letters above the altitude scale. The reference persists as long as it is inside the scale displayed on the PFD or until the helicopter achieves its desired altitude (see below). – The maximum vertical speed is indicated by a green bug that appears upon mode engagement on the vertical speed scale – On the AFCS strip of PFD: green V/S and cyan ALT.A label is displayed in area of engagement mode axis. – Upon automatic reversal to ALT mode, the ALT.A and V/S labels extinguish and ALT label is displayed in green colour in the area of engaged mode.

VS	DESCRIPTION	Maintains vertical speed. NOTE If a radio altimeter is installed and the helicopter descends too low, the system automatically reverts to ALT, levelling off at approx. 65 ft above ground, provided via the radio altimeter signal is valid.
	ENGAGEMENT	Press VS pb which then becomes illuminated "ON". The reference will be synchronized to the vertical speed at the time of engagement.
	INITIAL CONDITIONS & LIMITATIONS	The reference vertical speed is limited within the range of +/– 2200 ft/min. If a radar altimeter is installed a ground protection is in effect with a minimum distance of approx. 65 ft to the ground.
	DISENGAGEMENT	Press VS pb. Illumination "ON" extinguishes. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode. or Engagement of GA, IAS, ALT, ALT.A or GS mode disengages VS mode.
	OVERRIDE	Fore or aft motion of the cyclic stick temporarily overrides VS hold. or Fore or aft motion of the BEEP TRIM sw on cyclic stick will slew the vertical speed reference at 200 ft/min each s to a maximum of 2200 ft/min (with or without simultaneous override). In case of simultaneous beep and override, the trim is additionally commanded to follow–up the stick.
	DISPLAY	– The PFD displays the VS reference by a green bug on the vertical speed scale. – On the AFCS strip of PFD: green V/S label is displayed in area of engaged mode axis.

APP (VOR.A)	DESCRIPTION	Captures and tracks a desired course TO or FROM a VOR station. This mode is used for capture typically within a distance of 10nm from the beacon.
	ENGAGEMENT	• Select sensor master side via MASTER selector on RCU. Select VOR source via ICP: a valid selection for the VOR source is VOR1 or VOR2, in nominal mode VOR1 for copilot's, VOR2 for pilot's side. • Tune the navigation receiver to the desired VOR frequency. • Set the course pointer to the VOR radial/ track desired (ICP). • Press APP pb which then becomes illuminated "A". The system is now armed for automatic capture of the selected course. • For VOR radial/track interception, rotate the HDG rotary pb to set the heading bug to the VOR radial/track interception course on the PFD/ND. Press HDG rotary pb for HDG mode engagement (see above). **NOTE** As the helicopter nears the selected VOR radial/track, the AFCS automatically disengages APP arm and HDG (if it is engaged). The APP "C" caption illuminates green on the APMS, indicating VOR radial/track capture and the helicopter turns onto the radial/track.
	INITIAL CONDITIONS & LIMITATIONS	The VOR radial/track capture conditions are as follows: i) At an interception angle ≥ 30° the capture and tracking occurs at 10.0° course deviation. Then the mode aligns the aircraft on a heading difference of 30° down to a course deviation of 3.33°. There the helicopter is tracked to the selected radial/track. ii) At an interception angle < 30° the capture and tracking occurs at 3.33° course deviation. **NOTE** When approaching the station, an over station sensor detects erratic VOR signal fluctuations associated with the zone of confusion over the station. The over station sensor removes VOR deviation from lateral steering command. During this period, a new outbound course may be selected. After leaving the zone of confusion, the helicopter shall track the selected radial outbound.

APP (VOR.A) (cont.)	DISENGAGEMENT	Press APP pb. Illumination "A" or "C" extinguishes. or Press HDG rotary pb. VOR.A is disengaged – HDG engaged. or Select GA mode on collective lever. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode.
	OVERRIDE	Lateral motion of the cyclic stick temporarily overrides VOR.A mode.
	DISPLAY	**VOR.A armed phase:** – The ND displays the navigation source coupled with AFCS via ICP and the preselected course value. After capture: the source name and course deviation bar are green (on master side ND). – On the AFCS strip of PFD: cyan VOR.A label is displayed in area of armed mode axis. If HDG mode is used for radial interception, the green HDG label is also displayed. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected course value is permanently indicated by the course bug on ND. – The course deviation is displayed on ND. **VOR.A capture phase:** – On the AFCS strip of PFD: green VOR.A label is displayed in the area of captured/engaged mode axis. If HDG mode has been used, the green HDG label disappears. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected course is permanently indicated on ND. – After VOR capture over station sensing (OSS) detects the area of confusion during VOR station overfly. During OSS duration the green VOR.A label on PFD AFCS strip is reverted to an amber VOR.A label. After leaving the zone of confusion and expiration of an additional OSS confirmation time the green VOR.A label reappears on PFD. – The course deviation is displayed on ND.

NAV (NMS)	DESCRIPTION	Issues in combination with a navigation management system (NMS) a pure roll steering command to the autopilot.
	ENGAGEMENT	• Engage NMS with a suitable navigation mode such as GPS, DME/DME or VOR/DME. • Select sensor master side via MASTER selector on RCU. Select NMS as navigation source via ICP. • Press NAV pb which then becomes illuminated "A". The system is now armed (for NMS the mode engages immediately) for automatic capture of the selected course.
	DISENGAGEMENT	Press the NAV pb. Illumination "A" or "C" extinguishes. or Press HDG rotary pb. NAV is disengaged – HDG engaged. or Select GA mode on collective lever. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode.
	OVERRIDE	Lateral motion of the cyclic stick temporarily overrides NAV mode.
	DISPLAY	On the AFCS strip of PFD: – Green NAV label is displayed in area of captured/engaged mode axis. If HDG mode has been used for interception, the green HDG label disappears. – The reference is permanently indicated on ND.

NAV (VOR)	DESCRIPTION	Captures and tracks a desired course as selected on the ICP or flight navigation display. This mode is normally used to track TO or FROM a VOR station.
	ENGAGEMENT	• Select sensor master side via MASTER selector on RCU. Select VOR source via ICP: a valid selection for the VOR source is VOR1 or VOR2, in nominal mode VOR1 for copilot's, VOR2 for pilot's side. • Tune the navigation receiver to the desired VOR frequency. • Set the course pointer to the VOR radial/ track desired (ICP). • Press NAV pb which then becomes illuminated "A". The system is now armed for automatic capture of the selected course. • For VOR radial/track interception, rotate the HDG rotary pb to set the heading bug to the VOR radial/track interception course on the PFD/ND. Press HDG rotary pb for HDG mode engagement (see above). **NOTE** As the helicopter nears the selected VOR radial/track, the AFCS automatically disengages NAV arm and HDG (if it is engaged). The NAV "C" caption illuminates green on the APMS, indicating VOR radial/track capture and the helicopter turns onto the radial/track.
	INITIAL CONDITIONS & LIMITATIONS	The VOR radial/track capture conditions are as follows: i) At an interception angle≥ 45° the capture and tracking occurs at 4.52°course deviation. Then the mode aligns the aircraft on a heading difference of 45°down to a course deviation of 1.33°. There the helicopter is tracked to the selected radial/track. ii) At an interception angle < 45° the capture and tracking occurs at 1.33°course deviation. **NOTE** When approaching the station, an over station sensor detects erratic VOR signal fluctuations associated with the zone of confusion over the station. The over station sensor removes VOR deviation from lateral steering command. During this period, a new outbound course may be selected. After leaving the zone of confusion, the helicopter shall track the selected radial outbound.

NAV (VOR) (cont.)	DISENGAGEMENT	Press NAV pb. Illumination "A" or "C" extinguishes. or Press HDG rotary pb. VOR is disengaged – HDG engaged. or Select GA mode on collective lever. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode.
	OVERRIDE	Lateral motion of the cyclic stick temporarily overrides NAV mode.
	DISPLAY	**VOR armed phase:** – The ND displays the navigation source coupled with AFCS via ICP and the preselected course value. After capture: the source name and course deviation bar are green (on master side ND). – On the AFCS strip of PFD: cyan VOR label is displayed in area of armed mode axis. If HDG mode is used for radial interception, the green HDG label is also displayed. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected course value is permanently indicated by the course bug on ND. – The course deviation is displayed on ND. **VOR capture phase:** – On the AFCS strip of PFD: green VOR label is displayed in the area of captured/engaged mode axis. If HDG mode has been used, the green HDG label disappears. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected course is permanently indicated on ND. – After VOR capture over station sensing (OSS) detects the area of confusion during VOR station overfly. During OSS duration the green VOR label on PFD AFCS strip is reverted to an amber VOR label. After leaving the zone of confusion and expiration of an additional OSS confirmation time the green VOR label reappears on PFD. – The course deviation is displayed on ND.

APP (LOC)	DESCRIPTION	Captures and tracks the inbound front course of a localizer for runway approach.
	ENGAGEMENT	• Select sensor master side via MASTER selector on RCU. Select LOC source via ICP: a valid selection for the LOC source is ILS1 or ILS2, in nominal mode ILS1 for copilot's, ILS2 for pilot's side with identical ILS frequency on both NAV receivers. • Tune the navigation receiver to the desired LOC frequency. • Set the course pointer on the ND to the published LOC course via ICP rotary knob in order to define the intersection angle with respect to the heading. • Press APP pb which then becomes illuminated "A". The system is now armed for automatic capture of the selected course. • For LOC inbound front course interception, rotate the HDG rotary pb to set the heading bug to the LOC radial interception course on the ND. Press HDG rotary pb for HDG mode engagement (see above). **NOTE** As the helicopter nears the LOC radial, the AFCS automatically disengages HDG (if it is engaged) and APP arm. The APP "C" caption illuminates green on the APMS, indicating LOC radial capture and the helicopter turns towards the radial.
	INITIAL CONDITIONS & LIMITATIONS	For LOC radial (inbound front course) interception the conditions are as follows: i) At an interception angle ≥ 25° the capture occurs at 2.0 dots course deviation. The mode aligns the aircraft on a new limited heading difference down to a LOC deviation of 1.0 dot. Then the helicopter is tracked to the LOC inbound front course. ii) At an interception angle < 25° the capture and tracking occurs at the 1.0 dot deviation with respect to the LOC inbound front course. or ii) At an interception angle < 25 deg the capture and tracking occurs in the range 1.0 to 2.0 deg after a maximum time of 30 s even if the deviation exceeds 1.0 dot.

APP (LOC) (cont.)	DISENGAGEMENT	Press APP pb. Illumination "A" or "C" extinguishes. or Press HDG rotary pb. LOC is disengaged – HDG engaged. or Select GA mode on collective lever. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode.
	OVERRIDE	Lateral motion of the cyclic stick temporarily overrides APP mode.
	DISPLAY	**LOC armed phase:** – The ND displays the LOC source coupled with AFCS via ICP and the preselected course value. After capture: the source name and course deviation bar are green (on master side ND). – On the AFCS strip of PFD: cyan LOC label is displayed in area of armed mode axis. If HDG mode is used for radial interception, the green HDG label is also displayed. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected course value is permanently indicated by the course bug on ND. – The LOC deviation is displayed on ND. **LOC capture phase:** – On the AFCS strip of PFD: green LOC label is displayed in the area of captured/engaged mode axis. If HDG mode has been used, the green HDG label disappears. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected course is permanently indicated on ND. – The LOC deviation is displayed on the ND.

GS	DESCRIPTION	Acquires and holds the selected glide slope in order to perform an ILS approach to an airport. At approx. 65 ft above ground, the system automatically reverts to ALT mode to level off the helicopter.
	ENGAGEMENT	• Select sensor master side via MASTER selector on RCU. Select ILS source via ICP: a valid selection for the ILS source is ILS1 or ILS2, in nominal mode ILS1 for copilot's, ILS2 for pilot's side with identical ILS frequency on both NAV receivers. • Tune the navigation receiver to the desired ILS frequency. • Perform all actions to arm and/or engage APP(LOC) mode with the desired heading intersection angle (optionally supported by HDG mode) as described previously. • Press GS pb which then becomes illuminated "A". The system is now armed for automatic capture of the glide slope. **NOTE** APP and GS are engaged separately. Therefore the annunciation "A" and/or "C" varies dependent on flight status at mode engagement. As the helicopter nears the LOC radial, the AFCS automatically disengages HDG (if it is engaged) and APP arm. The APP "C" caption illuminates green on the APMS, indicating LOC radial capture and the helicopter turns towards the radial. The GS "A" caption remains illuminated as long as glide slope is not captured. After ILS/LOC capture the heading bug may be preset to the desired missed approach heading. Upon ILS/GS capture, the AFCS automatically disengages GS arm and any previously activated pitch mode. The GS "C" caption illuminates green on the APMS.
	INITIAL CONDITIONS & LIMITATIONS	Engagement/capture of GS mode is only possible after previous engagement/capture of APP(LOC) mode. Engagement of GS mode is not possible when BC, ALT A or GA mode is engaged. The GS mode captures when the GS deviation is lower than approx. 2.2 dot (depending on flight conditions).

GS (cont.)	DISENGAGEMENT	Press GS pb. Illumination "A" or "C" extinguishes.The APP arm and/or HDG mode status (if engaged and operative) will remain. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode. or Engagement of GA, IAS, ALT, ALT.A or VS mode disengages GS mode.
	OVERRIDE	Lateral motion of the cyclic stick temporarily overrides APP mode. Any motion of the cyclic stick temporarily overrides GS.

GS (cont.)	DISPLAY	**APP and GS armed phase:** – The ND displays the ILS source coupled with AFCS via ICP and the preselected LOC course value. After LOC capture: the source name and course deviation bar are green (on master side ND). After GS capture: the GS deviation symbol is green – On the AFCS strip of PFD: cyan LOC and GS labels are displayed in area of armed mode axis. If HDG mode is used for radial interception, the green HDG label is also displayed. – The selected heading is permanently indicated by the bug on PFD/ND. – The selected LOC course value is permanently indicated by the course bug on ND. – The course and glide slope deviation of the own sensor side are displayed on ND, those of the other side on PFD. **APP capture and GS armed phase:** – On the AFCS strip of PFD: green LOC label is displayed in the area of captured/engaged mode axis. If HDG mode has been used, the green HDG label disappears. – The heading bug may be preset to the desired missed approach heading. The selected heading is permanently indicated by the bug on PFD/ND. – The selected course value is permanently indicated by the course bug on ND. – On master side ND: the green LOC deviation bar is displayed. **APP and GS capture phase:** – On the AFCS strip of PFD: green GS label is displayed in the area of captured/engaged mode axis. – On master side ND: the green LOC deviation bar and the green GS deviation symbol are displayed.

GA	DESCRIPTION	Used in case of a missed approach, acquires and holds a climb with 1000 ft/min vertical speed.
	ENGAGEMENT	Press GA pb on collective lever. VS pb becomes illuminated "ON".
	INITIAL CONDITIONS & LIMITATIONS	Mode reference is 1000 ft/min rate of climb. If the vertical speed is greater than 1000 ft/min rate of climb at the time of engagement the current vertical speed will be uesed
	DISENGAGEMENT	Press VS pb. Illumination "ON" extinguishes. or Press the AP MD DCPL pb on cyclic stick. Autopilot reverts to ATT mode. or Engagement of IAS, ALT or ALT.A mode disengages GA mode.
	OVERRIDE	Fore or aft motion of the cyclic stick temporarily overrides GA mode. Fore or aft motion of the BEEP TRIM sw on cyclic stick will slew the VS reference as previously described for VS mode.
	DISPLAY	– PFD displays the VS reference bug. – On the AFCS strip of PFD: green GA label is initially displayed in area of engaged mode axis. It is replaced by VS after 10s.

F M S 9.2-2

SUPPLEMENT FOR

FUEL MANAGEMENT SYSTEM

This supplement shall be attached to the BK117 C–2 flight manual (subsection 9.2) when the FUEL MANAGEMENT SYSTEM has been installed.

System/Equipment Designation	Part No.	Effectivity
Fuel management system	B284M1001051	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 26. Sep. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
9.2-2 -1	–							
9.2-2 -2	0							
9.2-2 -3	0							
9.2-2 -4	0							

LOG OF REVISIONS

First Issue		
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CANCELADO

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

2.1 CONFIGURATION REQUIREMENTS

The indicated remaining flight time, based on main tank indication, is for information only. A possible wrong main tank indication will lead to an incorrect remaining flight time indication.

For endurance calculations use the common procedures as stated in the Basic Flight Manual.

3 EMERGENCY AND MALFUNCTION PROCEDURES

A failure of VEMD lane 1 or 2 will have no effect on fuel flow and remaining flight time indication.

In case of double VEMD lane failure no fuel flow and no remaining flight time will be provided.

In case of failure of CAD the fuel flow and remaining flight time will be indicated on the VEMD.

When **F PUMP AFT** or **F PUMP FWD** or **F PUMP JET** caution come on, the remaining flight time indication is unreliable.

4 NORMAL PROCEDURES

No change in the basic Flight Manual data.

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The fuel management system calculates fuel flow of engine I and II as well as remaining flight time and displays the data on the CAD. Therefore two fuel flow sensors, one per engine, are installed between the control unit and the pressurising valve in the high pressure area of the internal engine fuel system.

The fuel flow indication on CAD will be activated if N1 of respective engine is above 50%. Otherwise the fuel flow indication will show 0. The remaining flight time is indicated as follows : END X h XX min

in case of engine I and II OFF, the remaining flight time is shown in yellow as follows:
END

The remaining flight time calculation is based on main tank fuel quantity indication.

The fuel flow indication can be configered by means of the CPDS CONFIGURATION MODE . Possible choices for the unit are l/h, kg/h, US Gall/h, and Imp Gall/h.
The change of the fuel flow unit from volume/h into mass/h is calculated by the CPDS using the fuel density based on measured fuel temperature.

FOLHA 3155
PROC. 0530007 16/2012
MAT. 1403565

F M S 9.2-4

SUPPLEMENT FOR

CARGO HOOK MIRROR

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the CARGO HOOK MIRROR has been installed.

System/Equipment Designation	Part No.	Effectivity
Cargo hook mirror (fix provisions)	B851M1030051	All
Cargo hook mirror (detachable inst.)	B851M1031051	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 04. Dez. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
	9.2-4 -1	--							
R	9.2-4 -2	1							
R	9.2-4 -3	1							
	9.2-4 -4	0							
	9.2-4 -5/ (9.2-4 -6 blank)	0							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL		DEC 2001
REVISION	1	(see entry below)

REVISION 1

Approved by:

Date 05. Feb. 02

Luftfahrt-Bundesamt
Braunschweig

FOLHA 3156
PROC.053000716/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

2 LIMITATIONS

2.1 COMPATIBILITY WITH OTHER OPTIONAL EQUIPMENT

For night operation with the Fixed Landing Light 250W (cross tube) and/or the Search and Landing Light 400W in use the mirrors must be covered or removed.

3 EMERGENCY AND MALFUNCTION PROCEDURES

NOTE If the external mirror is installed, the airspeed indications during autorotation are on the pilot's side 6 kts higher and on the copilot's side 5 kts higher compared to the clean configuration.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

External mirror assembly, attachments and connectors	– Condition, secured
External mirror assembly	– Check electrical function

5 PERFORMANCE DATA

5.1 EXTERNAL MIRROR INSTALLATION

5.1.1 Rate of climb

NOTE If the external mirror is installed, all results obtained from the respective diagram, contained in section 5 of the basic Flight Manual, are to be corrected as follows:

Helicopter gross mass below 2400kg:	Subtract 45 ft/min
Helicopter gross mass of 2400kg and below 3000kg:	Subtract 35 ft/min
Helicopter gross mass of 3000 kg and above:	Subtract 25 ft/min

6 MASS AND BALANCE

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

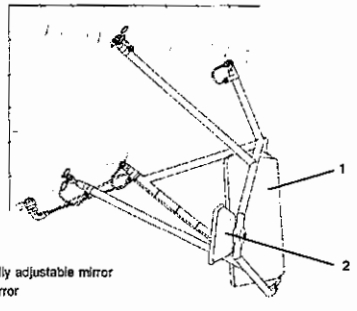
7 SYSTEM DESCRIPTION

The cargo hook mirror assy is attached to the fuselage in front of the lower right-hand nose area by means of a quickly removable four-strut construction (Fig. 1). Two external mirrors are provided, an electrically adjustable mirror with an integrated heating and a fixed mirror. Two electrically driven actuators are installed in the adjustable mirror housing to provide fully cardanic inflight adjustment by means of a control switch, located on the collective pitch lever.

The cargo hook mirror assy receives power from the No. 1 shedding bus via the LOAD HOOK MIR circuit breaker, located on the overhead panel.

The 4-way toggle switch (Fig 2), having switch positions FWD, AFT, L and R, can be used for orientation control of the adjustable mirror if selected by the 3-position switch SX16-MIR-S/L LT.

An electrically operated mirror heating is provided for inflight de-icing and de-misting. The heating is automatically controlled by a temperature sensor located at the mirror housing.



1 Electrically adjustable mirror
2 Fixed mirror

Fig. 1 Cargo hook mirror assy

1 SX16 - MIRROR - L/S LT select switch
2 Mirror orientation control

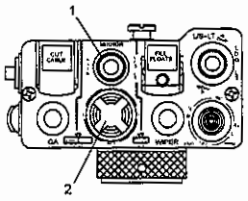


Fig. 2 Cargo hook mirror controls

7.1 Mirror adjustment

During latching and releasing the external load, the mirror should be adjusted so that the cargo hook is visible. This enables the pilot to check visually if the load is correctly latched or released.

For prolonged cruising flight operations with external load attached, the mirror can be adjusted so that the external load is visible. This allows for a constant observation of possible load oscillations or rotations.

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MAT.1403565

F M S 9.2-6

SUPPLEMENT FOR

DUAL CONTROL PEDAL COVER

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the DUAL CONTROL PEDAL COVER has been installed.

System/Equipment Designation	Part No.	Effectivity
Dual control pedal cover	L672M1812101	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 23. 5. 2001

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
9.2-6 -1	–							
9.2-6 -2	0							
9.2-6 -3	0							
9.2-6 -4	0							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL,	REV. 0	MAY, 2001

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

No change to the basic flight manual data.

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

Pedal cover – Condition/fixing

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The dual control pedal cover protects the tail rotor control system from unintentional control inputs by a person occupying the copilot's seat.

8 HANDLING, SERVICING, AND MAINTENANCE

The pedals must be adjusted to the most forward position prior to installation of the cover.

FOLHA 3158
PROC.0530007 16/2012
MAT.1403565

F M S 9.2-7

SUPPLEMENT FOR

DUAL CONTROLS

This supplement shall be attached to the BK117 C–2 flight manual (subsection 9.2) when the copilot's controls have been installed.

System/Equipment Designation	Part No.	Effectivity
Dual control system	B670M1802051	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 18.4.2001

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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9.2-7 -1	–							
9.2-7 -2	0							
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9.2-7 -4	0							
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LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL.	REV. 0	APR. 2001

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

No change to the basic flight manual data.

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

LH cyclic stick	– Secured, safety-wired
LH collective	– Secured and locked – All switches – OFF or NORM, priority NORM – Twist grip – N (neutral)

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

Each helicopter version can be equipped with dual controls as optional equipment.

The copilot's controls consist of pedals, a cyclic stick and a collective lever which are mechanically coupled with the pilot's controls. Pedals and cyclic stick are of the same type as on pilot's side.

The collective lever is equipped with twist grips and a control panel. The twist grips provide manual engine control for the copilot except for the possibilities of pushing a minimum fuel override pb (for engine shutdown) and releasing the detent for EMER range.

The following table and fig. 1 describe the switch arrangement on copilot's collective lever:

Typical copilot's collective control panel:

FUNCTION	LABEL	REMARKS
Switch for retracting the search- and landing light	LL (RETR)	standard
Operational control for search- and landing light	SELECT	standard
Directional control for search- and landing light	LL (FWD/R/AFT/L)	standard
Windshield wiper momentary	WIPER	standard
Fixed landing light	LL FIX	standard
Engine trimming	ENG TRIM	standard

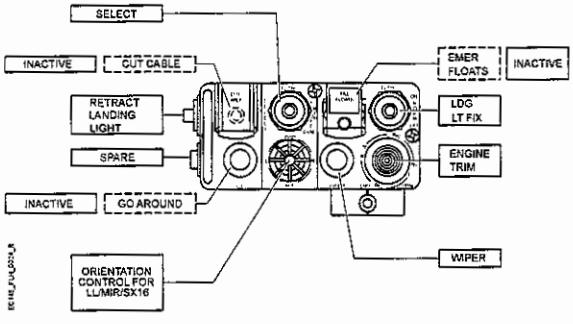

Fig. 1 Typical copilot's collective panel switches

F M S 9.2-8

SUPPLEMENT FOR

SPIFR OR SP/DPIFR OPERATION KIT

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the SPIFR/DPIFR OPERATION KIT (incl. AFCS) has been installed.

System/Equipment Designation	Effectivity
SP/DPIFR OPERATION KIT (Dual FCDS)	All
SPIFR OPERATION KIT (Single FCDS)	All

Date: 18. Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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	9.2-8 -1	6		9.2-8 -8	7		9.2-8 -15	7	
R	9.2-8 -2	9		9.2-8 -9	7		9.2-8 -16	7	
R	9.2-8 -3	9		9.2-8 -10	7		9.2-8 -17	7	
R	9.2-8 -4	8		9.2-8 -11	7		R 9.2-8 -18	9	
R	9.2-8 -5	9		9.2-8 -12	7		R 9.2-8 -19	9	
R	9.2-8 -6	8		9.2-8 -13	7		9.2-8 -20	7	
R	9.2-8 -7	8		9.2-8 -14	7				

LEP – manufacturer's data (part 2):

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
	9.2-8 -21	7		i-24blank					
	9.2-8 -22	7							
R	9.2-8 -23	9							

LOG OF REVISIONS

First Issue					
ORIGINAL		OCT, 2001	REVISION	5.1	SEP 25, 2006
REVISION	1	APR 10, 2002	REVISION EASA APPROVAL NO. R.A.01376	6	NOV 27, 2007
REVISION	2	APR 14, 2003	REVISION	6.1	FEB 14, 2008
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REVISION EASA APPROVAL NO. R.C.01221	5	AUG 31, 2005			

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MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual and relevant supplements.

This supplement pertains to the following installations:
– SP/DPIFR operations kit with dual FCDS (four screen version consisting of 4x SMD45 or three screen version consisting of 2xSMD45 and 1xSMD68).

– SPIFR operations kit with single FCDS (two screen version consisting of 2xSMD45).

2 LIMITATIONS

2.1 KIND OF OPERATION

This helicopter is approved for :

– single and dual pilot IFR operation, when the SPIFR/DPIFR OPERATION KIT (dual FCDS) is installed.

– single pilot IFR operation, when the SPIFR OPERATION KIT (single FCDS) is installed.

2.2 MINIMUM HEIGHT

WARNING WHEN OPERATING NEAR THE GROUND WITH AUTOPILOT ENGAGED IN ANY MODE OF OPERATION, THE PILOT SHOULD REMAIN ATTENTIVE TO THE FLYING TASK SINCE AN ACTUATOR RUNAWAY COULD RESULT IN A LOSS OF ALTITUDE

Minimum height for ***hands-off and feet-off*** operation during
T/O and approach: ..... **200 ft AGL.**

Minimum height for ***hands-off and feet-off*** operation in cases
other than T/O or approach: ..... **500 ft AGL.**

2.3 OPERATIONAL LIMITATIONS

Initiating an IFR flight is only permissible with AFCS engaged and fully operational.

EFFECTIVITY *For Single Pilot IFR operation with single FCDS and GARMIN GNS 430 installed*

For IFR operations, the planned alternate must have, at least, a published GPS approach procedure.

EFFECTIVITY *All*

2.4 KIT CONFIGURATION AND ADDITIONAL REQUIREMENTS

EFFECTIVITY *For Dual Pilot IFR operation the following equipment must be installed and operational (additional to the BK117 C-2 BASIC H/C configuration):*

– FCDS (FMS 9.2-14; Dual FCDS)

– An operative navigation and communication system (VHF COM1, VHF COM2 and VHF NAV1, VHF NAV2) that has demonstrated compliance with the pertinent airworthiness regulations and also meets the requirements of the applicable operating regulations (e.g. ILS Receiver, Marker Beacon, ADF, GPS, DME, Transponder mode C/S).

– Additional flight instruments for DPIFR operation according to the national regulations and operational regulations (e.g. JAR-OPS 3).

EFFECTIVITY *For Single Pilot IFR operation with dual FCDS installed the following equipment must be installed and operational (additional to the BK117 C-2 BASIC H/C configuration):*

– AFCS (FMS 9.2-1)

– FCDS (FMS 9.2-14; Dual FCDS)

– An operative navigation and communication system (VHF COM1, VHF COM2 and VHF NAV1, VHF NAV2) that has demonstrated compliance with the pertinent airworthiness regulations and also meets the requirements of the applicable operating regulations (e.g. ILS Receiver, Marker Beacon, ADF, GPS, DME, Transponder mode C/S).

– Additional flight instruments for SPIFR operation according to the national regulations and operational regulations (e.g. JAR-OPS 3).

EFFECTIVITY *For Single Pilot IFR operation with single FCDS and GARMIN GNS 430 installed the following equipment must be installed and operational (additional to the BK117 C–2 BASIC H/C configuration):*

- AFCS (FMS 9.2-1)
- FCDS (FMS 9.2-14; Single FCDS)
- –
- GARMIN GNS 430 (FMS 9.2–43)
- An operative navigation and communication system (VHF COM1, VHF COM2 and VHF NAV1, VHF NAV2 and GPS) that has demonstrated compliance with the pertinent airworthiness regulations and also meets the requirements of the applicable operating regulations (e.g. ILS Receiver, Marker Beacon, ADF, GPS, DME, Transponder mode C/S).
- Additional flight instruments for SPIFR operation according to the national regulations and operational regulations (e.g. JAR–OPS 3).

EFFECTIVITY *All*

2.5 FLIGHT CREW

For SPIFR operation with dual FCDS the pilot has to occupy the right crew seat.

2.6 AIRSPEED LIMITATIONS

2.6.1 Forward speed

Min. airspeed (V_{min}) ..... **60 kts**

Min. airspeed for IFR approach ($V_{min,APP}$) ..... **70 kts**

2.6.2 Vertical speed

Max. rate of climb/descent ..... **1500 ft/min**

2.6.3 Hands–on forward speed

Maximum airspeed for ***hands–on*** operation in ***cruise*** following a failure: ..... **120 kts**

Maximum airspeed for ***hands–on*** operation in ***ILS approach*** following a failure: **100 kts**

2.7 APPROACH ANGLE LIMITATIONS

Max. glideslope angle for approach ..... **4.6°**

2.8 BANK ANGLE LIMITATIONS

Max. bank angle (above 12000 ft) ..... **20°**

NOTE In APP mode above 12000 ft, if the bank angle tends to exceed 20°, pilot should counteract with cyclic inputs if necessary.

2.9 COMPATIBILITY WITH OTHER OPTIONAL EQUIPMENT

Onboard tactical radios must be switched off during IFR take–off / departure and approach / landing using VOR / ILS / NDB.

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2.10 TEMPERATURE LIMITATIONS

On ground:

Max. operating time on ground if OAT ≥ +40°C ..... **15 min.**

In flight:

Max. OAT for AFCS continuous operation in case of loss of avionics ventilation (see FAN caution in FMS 9.2–14) ..... **+ 30°C**

Max. operating time in case of loss of avionics ventilation when OAT > + 30°C (see FAN caution in FMS 9.2–14) ..... **30 min.**

2.11 PLACARDS AND DECALS

Placard:

THIS HELICOPTER IS APPROVED FOR VFR DAY AND NIGHT OPERATION, AND FOR IFR OPERATION IN ACCORDANCE WITH THE APPROVED FLIGHT MANUAL

Location: Upper RH frame

3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 GENERAL

Emergency procedures related to failures of basic aircraft systems are to be found in the basic flight manual except for those cases which are listed here. Emergency procedures related to AFCS and FCDS are in the relevant flight manual supplements (FMS 9.2-1, FMS 9.2-14).

3.2 URGENCY OF LANDING

In IMC the normally used terms as described in section 3, para 3.1.4 of basic flight manual "LAND AS SOON AS POSSIBLE", and "... IMMEDIATELY" are both defined as follows:

- Try to reach VMC and continue in accordance with visual flight rules (refer to basic flight manual),
- If VFR is not possible, land at the nearest IFR airfield with a published instrument approach.

The term "LAND AS SOON AS PRACTICABLE" remains unchanged.

3.3 AFCS/FCDS MALFUNCTIONS

The following condensed emergency procedures focus on AFCS/FCDS malfunctions, that require immediate pilot action. They should reduce pilot's workload, especially when operating under SPIFR. For more and detailed information about AFCS and FCDS, see FMS 9.2-1 (AFCS); FMS 9.2-14 (FCDS).

3.3.1 Second APM disengagement or failure

WARNING LIGHT: AP + CAUTION INDICATIONS: [illegible]

Conditions/Indications

Second disengagement or failure of an autopilot module. Both autopilot modules are lost.

Procedure

1. Flying controls	**– Hands-on**
2. LAND AS SOON AS PRACTICABLE	

3.3.2 Total loss of one cyclic axis series actuation

WARNING LIGHT: AP + CAUTION INDICATION: [illegible]

Conditions/Indications

Total loss of series actuation in either pitch or roll axis. Loss of cyclic autotrim.

Procedure

1. Flying controls	**– Hands-on**

EFFECTIVITY If under SPIFR operation

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY All

3.3.3 Second AHRS failure

CAUTION INDICATION: [illegible] + PFD INDICATION: YR P + RCU: N 1 2 (1 or 2) AHRS

Conditions/Indications

Failure of both AHRS.

– No attitude, heading and vertical speed data on both sides

Procedure

1. Flying controls	**– Hands-on**
2. Back-up instruments	**– Use as reference**
3. PFD	**– Select composite display**
4. LAND AS SOON AS POSSIBLE	

3.3.4 AHRS failure

PFD INDICATION: [illegible] and/or ATT

(failure on own side) (failure on alternate side)

Conditions/Indications

Failure of one AHRS

Procedure

1. PFD and ND	– Cross check with back-up instruments
2. Flying controls	**– Hands-on**
3. RCU	**– Reconfigure to valid AHRS**
4. LAND AS SOON AS PRACTICABLE	

WARNING CAREFULLY DETERMINE VALID AHRS. KEEP HAND ON CYCLIC STICK DURING AHRS CONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

3.3.5 Localized AHRS discrepancy

CAUTION INDICATION: [illegible] + PFD INDICATION: ATT

Conditions/Indications

Localized discrepancy between both AHRS and FOG

Procedure

1. PFD and ND	– Cross check with back-up instruments
2. Flying controls	**– Hands-on**
3. RCU	**– Reconfigure to valid AHRS**
4. LAND AS SOON AS PRACTICABLE	

WARNING CAREFULLY DETERMINE VALID AHRS. KEEP HAND ON CYCLIC STICK DURING AHRS CONFIGURATION. MONITOR AIRCRAFT RESPONSE WHILE CAREFULLY RELEASING CYCLIC STICK AFTER RECONFIGURATION.

3.3.6 Cyclic and yaw (double) trim failure

CAUTION INDICATION: [illegible] + PFD INDICATION: YR P

Conditions/Indications

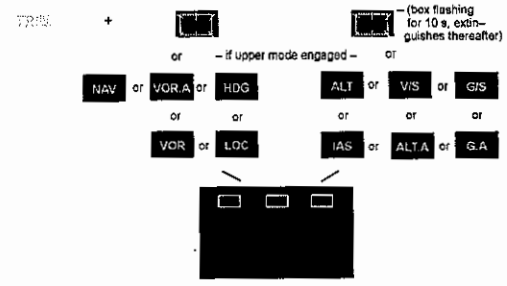
Loss of autotrim due to cyclic and yaw trim failure.

Procedure

1. Flying controls	**– Hands-on**
2. LAND AS SOON AS PRACTICABLE	

3.3.7 Cyclic trim failure

CAUTION INDICATION PFD INDICATION



Conditions/Indications

Loss of cyclic autotrim due to trim failure

Procedure

1. Flying controls	– Fly attentive – Recenter P.R if necessary – Confirm upper modes in turbulence

EFFECTIVITY *If under SPIFR operation*

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

3.4 CAD CAUTION INDICATIONS

CAUTION INDICATIONS

GEN DISCON (SYSTEM 1)	and	GEN DISCON (SYSTEM 2)

Conditions/Indications

Both generators have failed or are disconnected from the power distribution system.

– Only ESS BUS 1 + 2 are available

Procedure

1. Each GEN sw in turn	– RESET, then NORM

If both GEN DISCON caution indications remain on:

2. Both GEN sw	– OFF

NOTE The battery will supply ESS BUS 1 and 2.

3. Electrical consumers	– Reduce as much as possible; switch off all consumers on copilot's instrument panel, if install.

CAUTION AS ONE OF THE FUEL TRANSFER PUMPS IS SUPPLIED WITH POWER VIA THE SHED BUS, THE AMOUNT OF UNUSABLE FUEL IS HIGHER THAN STATED IN SECTION 2 OF THE BASIC FLIGHT MANUAL WHEN THE EMER SHED BUS SW IS NOT SWITCHED ON.

4. EMER SHED BUS sw	– ON if necessary
5. DC VOLTS and BAT AMPS	– Check – below 62 Amps during landing – below 57 Amps during cruise
6. LAND AS SOON AS POSSIBLE	

NOTE Flight endurance is depending on battery type and loading. A minimum of 30 min is ensured with use of the 250 W landing light for no more than 10 min.

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PROC.053000716/2012
MAT.1403565

CAUTION INDICATIONS

GEN DISCON (SYSTEM 1)	or	GEN DISCON (SYSTEM 2)

Conditions/Indications

Respective generator has failed or is disconnected from the power distribution system.

Both non-essential buses are disconnected

Procedure

If BUS TIE caution indication is on:

1. Electrical fire/short circuit procedure	– Perform

If BUS TIE caution indication is off:

1. Affected GEN sw	– RESET, then NORM

If GEN DISCON caution indication remains on:

2. Affected GEN sw	– OFF
3. DC VOLTS, GEN AMPS and BAT AMPS	– Check

If battery is discharged:

4. Electrical consumers	– Reduce as much as possible
5. LAND AS SOON AS PRACTICABLE	

NOTE One generator alone will provide sufficient power for normal services.

CAUTION INDICATIONS

HOR BAT
(MISC)

Conditions/Indications

Standby horizon is supplied by the emergency battery pack.

Procedure

1. STBY HOR BAT circuit breaker	– Check in
2. LAND AS SOON AS PRACTICABLE	

NOTE
- Emergency power supply for standby horizon is ensured for minimum 30 min.
- When the horizon failure flag appears, the power supply to the standby horizon fails. Standby horizon indication will remain approx. 10 minutes after appearance of the flag.

INDICATION

SHED EMER
(MISC)

Conditions/Indications

EMER SHED BUS sw is switched to ON.

NOTE See also emergency procedure for double GEN DISCON failure.

Procedure

1. Electrical consumers	– Reduce as much as possible
2. LAND AS SOON AS POSSIBLE	

3.5 SYSTEM EMERGENCY/MALFUNCTION CONDITIONS

3.5.1 Total electrical power loss

Conditions/Indications

- No more electrical power provided
- Standby artificial horizon is supplied by the emergency power supply (power supply is ensured for minimum 30 min).

Procedure

1. **LAND AS SOON AS POSSIBLE**

3.5.2 Loss of fuel information (failure of CAD lane)

Conditions/Indications

Because of failure of CAD lane, no fuel information will be provided.

NOTE LOW FUEL warning is still functional (see emergency procedure for LOW FUEL warning indication).

Procedure

NOTE • Establish visual contact with ground as soon as possible
• Divert to alternate destination if closer

1. Note last known fuel state indication and time.
2. Bleed air consumers – Switch off, if possible
3. Both transfer fuel pumps – Check ON
4. Flight – Continue, using consumption and time calculations

NOTE Depending on wind conditions consider flying at maximum range speed and increasing altitude (maximum range speed in zero wind conditions is approx. 120 kts – 2kts/1000ft).

3.5.3 ICS failure

Conditions/Indications

Loss of some intercom functions and/or transmit/receive functions.

Procedure

1. Intercom lead – Connect on copilots side, use copilots transmit button

If problem persists:

2. Spare headset – Connect and use

3.5.4 Loss of PFD and ND

EFFECTIVITY If dual FCDS is installed

Conditions/Indications

Loss of both screens on pilot's side

Procedure

1. Refer to backup instruments and/or copilot's display(s)

NOTE AP coupling is only allowed for ALT, IAS and GA mode.

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY If single FCDS is installed

Conditions/Indications

Loss of both screens on pilot's side

Procedure

1. Refer to backup instruments and GARMIN GNS 430

NOTE AP coupling is only allowed for ALT, IAS and GA mode.

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY All

4 NORMAL PROCEDURES

NOTE • Before starting engines, make sure that FCDS is not powered up yet; transient voltages which occur during engine start may induce premature failures.

• The creation of an appropriate GPS overlay procedure is recommended.

4.1 SYSTEM CHECKS

EFFECTIVITY SPIFR Operation and single FCDS (2–Screen version) installed

FCDM sw (on RCU) – Position 1 then N , check correct display indications

EFFECTIVITY All

4.2 PRE-TAKEOFF CHECK

AP1 and AP2 pb on APMS	– Press to engage AFCS ("OFF" illumination of the pb extinguishes)
Altimeter setting	– Check
Decision height	– Set as required
Course	– Set as required
NAV frequencies required for departure	– Select
Attitude indications	– Check

4.3 IFR OPERATION

NOTE • Flights into extreme turbulence (e.g. towering cumulonimbus clouds) should be avoided or conducted with appropriate precaution.

• When operating near flight envelope limitations or in turbulences, reducing airspeed by 10–15 kts may reduce pilot's workload.

• In the case of dual pilot IFR operation, the copilot is not allowed to use display images other than necessary for DPIFR (e.g. FLIR, WX Radar, Map etc.).

4.4 APPROACH UNDER IMC

Recommended approach airspeed range ..... 80 - 125 kts

4.5 AFCS OPERATION

It is recommended to couple AFCS to NAV 2.

At liftoff

FTR pb on cyclic stick	– Press and maneuver to desired attitude for climbout, then release

When IAS above 60 kts

HDG rotary pb on APMS	– Set heading bug on FCDS as required, press to activate heading mode

For climbout using IAS mode

Desired airspeed for climbout	– Establish
IAS pb on APMS	– Press to engage IAS mode (pb illuminates green: "ON")

For climbout using VS mode

Desired vertical speed	– Establish
VS pb on APMS	– Press to engage VS mode (pb illuminates green: "ON")

For climbout using ALTA mode

ALTA rotary pb on APMS	– Rotate to preselect the desired altitude, then press to engage altitude acquisition (triangle next to the rotary pb illuminates green)

For reversal to ALT mode (i.e. transition to cruising flight)

Collective lever	– Adjust for level flight after reaching desired altitude
IAS or VS pb on APMS	– Press to disengage respective mode
ALT pb on APMS	– Press to engage ALT mode (pb illuminates green: "ON")

When IAS or ALT mode is selected the respective reference values will be marked with green triangles on the FCDS.

To alter reference values use the HDG rotary pb for heading and the BEEP TRIM sw on the cyclic stick for airspeed and altitude.

NOTE For detailed information on mode display and control refer to section 7 of FMS 9.2–1.

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

No change to the basic flight manual data.

7 SYSTEM DESCRIPTION

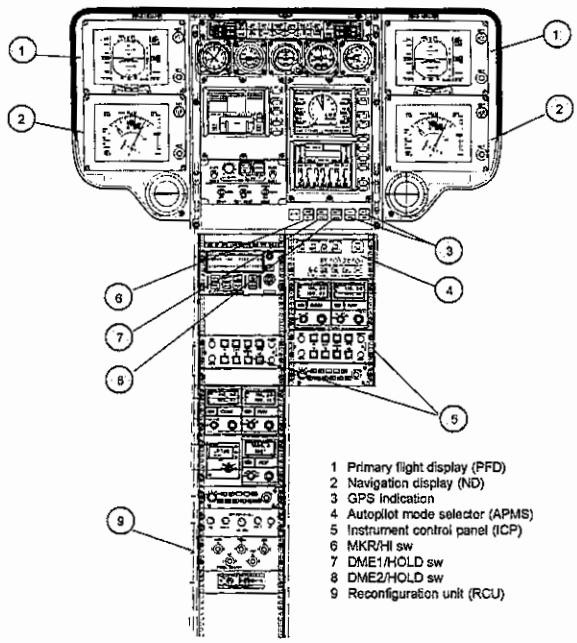

Fig. 1 Typical instrument panel arrangement for SPIFR/DPIFR with AFCS and dual FCDS (4–screen version)

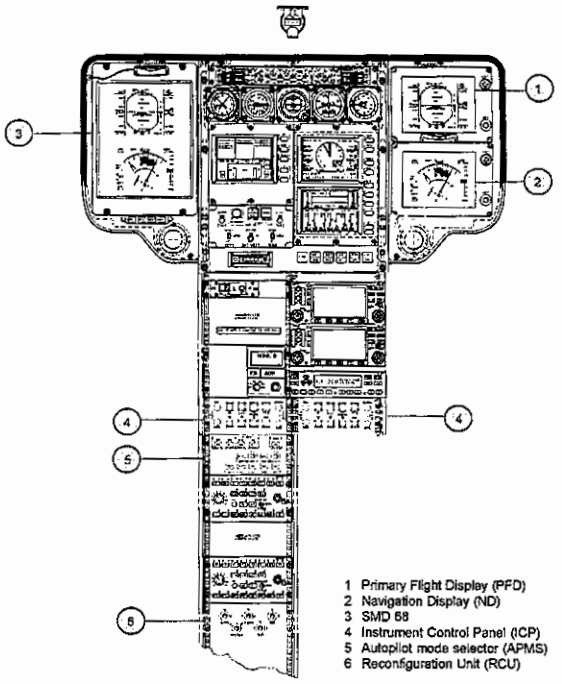

Fig. 2 Typical instrument panel arrangement for SPIFR/DPIFR with AFCS and dual FCDS (3–screen version)

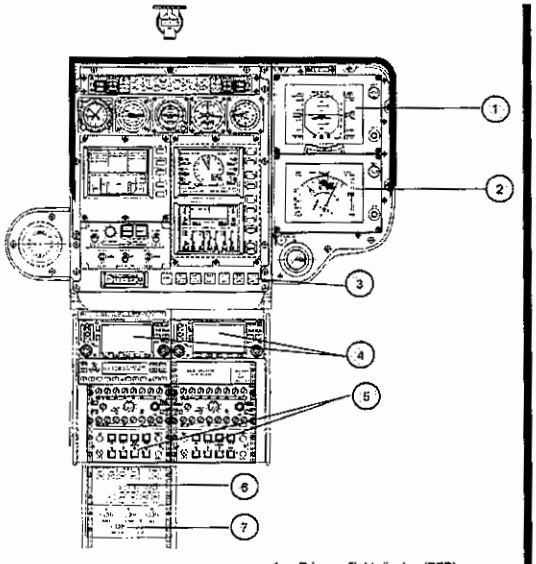

Fig. 3 Typical instrument panel arrangement for SPIFR with AFCS, single FCDS (2–screen version) and GARMIN GNS 430

F M S 9.2-9

SUPPLEMENT FOR

EMERGENCY FLOATATION SYSTEM

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the Emergency Floatation System has been installed.

System/Equipment Designation	Effectivity
Emergency floatation system	
– fixed provisions	All
– detachable parts	All
– landing gear installation	All
– modified bracket (aft, LH)	All
– modified bracket (aft, RH)	All
– hose attachment, skid tube, LH	All
– hose attachment, skid tube, RH	All
– hose attachment, snow skid, LH	All
– hose attachment, snow skid, RH	All
– modified MFC–bracket (aft, LH)	All
– modified MFC–bracket (aft, RH)	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 29. Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

LEP – EASA approved (part 1):

Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
9.2-9-1	6		R 9.2-9-5	7.1		9.2-9-9	7	
R 9.2-9-2	7.1		R 9.2-9-6	7.1				
9.2-9-3	6		9.2-9-7	7				
9.2-9-4	6		9.2-9-8	7				

LEP – manufacturer's data (part 2):

Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
R 9.2-9-10	7.1							
R 9.2-9-11 /12blank	7.1							

LOG OF REVISIONS

FIRST ISSUE

ORIGINAL		Oct, 2001	REVISION	6	NOV 09, 2010 EASA approval no.: 10032473
REVISION	1	NOV 19, 2002	REVISION	7	APR 24, 2012 EASA approval no.: 10039301
REVISION	2	FEB 11, 2003	REVISION	7.1	(see entry below)
REVISION	3	JUN 07, 2005 EASA approval no.: 2005-5811			
REVISION	4	OCT 24, 2006 EASA approval no.: R.A.01198			
REVISION	5	MAI 28, 2010 EASA approval no.: 10030144			

REVISION 7.1

Date: JUL 13, 2012

Revision No. 7.1 to FMS reference revision 7, is approved under authority of DOA No. EASA. 21J.034.

1 GENERAL

The information contained herein supplements the information in the basic flight manual. For limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

The limitations specified in the basic flight manual and the supplements used remain applicable and modified by the following limitations.

NOTE
- The system enables an emergency landing on water and keeps the helicopter afloat even on rough sea. It is not approved for intended water landings and it is not designed for takeoff after ditching.
- For over-water flights (open sea) the operating regulations of the country concerned or of the country in which the helicopter is registered must be applied (emergency equipment such as life jackets, rubber dinghy, signalling equipment etc.).
- The stowed floats are not to be stepped on except by a rescue hoist operator during the performance of his duties.

2.1 CERTIFICATION CRITERIA

The emergency floatation system is certified as ditching provision in accordance with FAR 29.

The helicopter may be certificated for ditching provided the following additional equipment are fitted and approved in accordance with the relevant airworthiness requirements:

- survival type emergency locator transmitter
- life raft installation
- life preserver

NOTE For a ditching certification a maximum of 9 passengers is permissible (refer to the Flight Manual Supplement 9.2–27).

2.2 COMPATIBILITY

The EMERGENCY FLOATATION SYSTEM is **not compatible** with sharp–angled equipment or antennas mounted in a defined area on either side of the fuselage as shown in fig. 1.

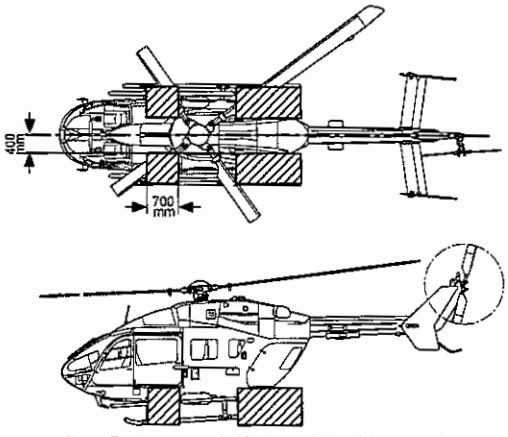

Fig. 1 Fuselage areas critical for the installation of sharp–angled equipment

2.3 ALTITUDE LIMITATION

Max. operating altitude for inflation of emergency floats ..... **5000 ft**

2.4 AIRSPEED LIMITATION

NOTE With floats inflated the airspeed indication is 5 kts higher than actual in level flight and descent.

1. Max. permissible airspeed during inflation process of emergency floats in all flight conditions ..... **80 kts**
2. Max. permissible airspeed with emergency floats inflated ..... **80 kts**

EFFECTIVITY H/C up to S/N 9500

3. Max. permissible airspeed with EMER FLOATS sw in position ARM ..... **80 kts**

EFFECTIVITY All

4. Max. touchdown speed with emergency floats inflated
   a) on calm water ..... **30 kts GS**
   b) on waves ..... **15 kts GS**

   The airspeed limitations a) and b) are based on model floatation tests.

2.5 MEASURES FOLLOWING AN INFLIGHT FLOAT INFLATION

After any inflight inflation without ditching the helicopter has to return to a landing field in the shortest way possible.

After any inflight inflation of the floats, the floats have to undergo a careful inspection by an authorized service station prior further utilization.

2.6 PLACARDS

Placard:

EMERGENCY FLOATS
DO NOT INFLATE ABOVE 5000 FT AND 80 KTS

Location: Cockpit in pilot's field of view

3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 INFLATION PROCEDURES

1. Airspeed – Reduce 80 kt or less
2. Altitude – 5000 ft or less

EFFECTIVITY H/C up to S/N 9500

3. EMER FLOATS switch – ARM, **FLOATS ARM** caution indication comes on
4. FILL FLOATS switch – Release safety catch and briefly push forward

EFFECTIVITY H/C S/N 9501 and subsequent

3. EMER FLOATS switch – ARM, **FLOATS ARM** caution indication comes on
4. FILL FLOATS pb – Release safety guard and push

EFFECTIVITY All

5. Landing – Perform

The landing procedures to be used (single engine or AR-landing) should be taken from section 3 of the basic flight manual.

CAUTION REMOVE SHOES BEFORE LEAVING THE HELICOPTER. SHARP OBJECTS WILL PUNCTURE FLOATS.

After ditching in rough seas, open sliding doors to drain excessive amount of water that may enter the cabin.

3.2 LANDING ON CALM WATER

Forward speed up to ..... **30 kts.**

Rate of descent up to ..... **300 ft/min.**

Nose-up attitude between ..... **0° and 10°.**

Preferable nose-up attitude ..... **5°.**

NOTE The rate of descent should be kept to a minimum at the instant of touchdown. The angles of roll and yaw should be kept to a minimum. At 5° nose-up attitude, yaw angles up to 15° can be tolerated at forward speeds up to 30 kts, with a rate of descent of 300 ft/min.

3.3 LANDING ON WAVES

Across wave crest:

Forward speed up to ..... **15 kts.**

Rate of descent up to ..... **300 ft/min.**

Nose-up attitude ..... **5°.**

NOTE Avoid ditching in the trough or the rising face of a wave. The landing should be made so that the helicopter contacts the crest or back of a wave.

3.4 FLOATATION STABILITY

The helicopter is most stable when heading into the waves. However, with large, breaking waves best stability is achieved when heading diagonally into the waves.

3.5 GENERAL CONSIDERATIONS

1. After water touchdown, maintain the collective pitch setting (do not lower) until the ditching procedure is completed or rotor RPM has dropped below 85 %.
2. The helicopter will normally maintain a nose-into-the-wind position after ditching.
3. Ditching in shallow waters (e. g. near sandbanks, etc.) increases the possibility of capsizing compared to ditching in open seas.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

1. Floats – Stowed
2. Float covers and lashings – Check
3. Supply lines – Firm
4. Gas cylinder – Check correct operating pressure
   – Check correct mounting and condition of clamps
5. Condition of overall system – Check

In addition, before each flight over water the following checks should be made:

6. Circuit breaker FLOATS (2) – Check both in
7. FILL FLOATS sw – Secured
8. EMER FLOATS sw – TEST
   – **FLOATS ARM** caution indication comes on, indicating that both electrical systems are functioning
9. EMER FLOATS sw – OFF
   – **FLOATS ARM** caution indication disappears

5 PERFORMANCE DATA

The installed emergency floats will slightly decrease flight performance. The following information applies to stowed floats only.

5.1 MAXIMUM RATE OF CLIMB (AEO AND OEI)

All results obtained from the appropriate diagrams in section 5 of the basic flight manual are to be reduced as follows:

for a gross mass **up to 2400 kg** ..... **by 50 ft/min**

for a gross mass **between 2400 kg and 3000 kg** ..... **by 40 ft/min**

for a gross mass of **3000 kg and above** ..... **by 30 ft/min**

NOTE The reduction in climb rate is not depending on power settings.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic Flight Manual.

7 SYSTEM DESCRIPTION (refer to fig. 2)

The emergency floatation system is provided for forced landing, even on rough sea.
It consists of two inflatable floats on each side of the helicopter, a helium–filled pressure bottle with a GO / NO GO-scale and fixed supply lines.

For redundancy reasons, the system is controlled by two independent electrical systems. It is supplied with 28 VDC through two circuit breakers (FLOATS) located on the overhead panel.

The stowed floats are arranged on a special pair of lengthened .xtic tubes.

EFFECTIVITY *H/C up to S/N 9500*

The system is normally activated by a guarded, spring-loaded switch (FILL FLOATS) on the pilot's and copilot's collective lever.

EFFECTIVITY *H/C S/N 9501 and subsequent*

The system is normally activated by a guarded red pushbutton (FILL FLOATS) on the pilot's and copilot's collective lever.

EFFECTIVITY *All*

The inflation process will then be completed within approx. 4 s.
The EMER FLOATS sw for arming (pos. ARM) or testing the system (pos. TEST) is located on the overhead panel. Upon arming of the system, the searchlight SX–16 (optional, refer to FMS 9.2–23) will be brought into its neutral position.

8 HANDLING, SERVICING, AND MAINTENANCE

For installation and removal as well as for filling of the pressure bottle refer to the maintenance manual BK117 C–2.
Stowage of the emergency floats must be performed according to the stowage procedure provided by the manufacturer.

9 OPERATIONAL INFORMATION

Flights with stowed floats will slightly increase the fuel consumption values due to higher drag. The max. cruise speed will decrease by approx. 4 kts.

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PROC.053000716/2012
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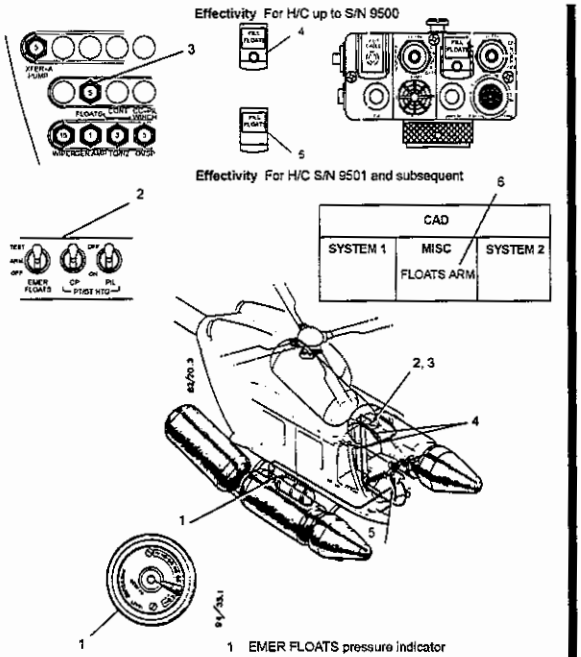

1 EMER FLOATS pressure indicator
2 EMER FLOATS sw
3 FLOATS circuit breaker
4 Guarded FILL FLOATS sw (Effectivity ... 9500)
5 Guarded FILL FLOATS pb (Effectivity ... 9501)
6 FLOATS ARM caution indication

Fig. 2 Emergency Floatation System (typical installation)

F M S 9.2-10

SUPPLEMENT FOR

EXTERNAL CARGO HOOK (SLING TYPE WITH KEEPER)

This Supplement shall be attached to the BK117 C-2 Flight Manual (Section 9.2) when the EXTERNAL CARGO HOOK (SLING TYPE WITH KEEPER) has been installed.

System/Equipment Designation	Effectivity
External cargo hook	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 04. Dez. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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R 9.2-10-3	6		R 9.2-10-9	6				
R 9.2-10-4	6		R 9.2-10-10	6				
R 9.2-10-5	6		R 9.2-10-11	6				
R 9.2-10-6	6		R 9.2-10-12	6				

LEP – manufacturer's data (part 2):

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R 9.2-10-15	6		N 9.2-10-17	6		N 9.2-10-19 (/20blank)	6	
R 9.2-10-16	6		N 9.2-10-18	6				

LOG OF REVISIONS

First Issue					
ORIGINAL, REV.	0	DEC 2001	REVISION	4	APR 23, 2007 EASA approval no.: R.C.02176
REVISION	1	MAR 15, 2002	REVISION	5	MAY 28, 2010 EASA approval no.: 10030144
REVISION	2	MAR 26, 2003	REVISION	6	(see entry below)
REVISION	3	NOV 11, 2004 EASA approval no.: 2004-11019			

REVISION 6

Approved by EASA:

Date: MAY 31, 2012

EASA approval no.: 10039899

FOLHA 3159
PROC.053000716/2012
MAT.1403565

1 GENERAL

The cargo hook assembly is provided for transportation of external cargo.

NOTE Eurocopter strongly recommends restricting cargo hook operations with persons to emergency situation only. The applicable national regulations for cargo hook operation shall be complied with.

The information contained herein supplements the information in the basic Flight Manual. For limitations, procedures, and performance data not contained in this Supplement, refer to the basic Flight Manual.

2 LIMITATIONS

2.1 TYPE OF OPERATION

The cargo hook system is approved for lifting external loads which are jettisonable and lifted free of land or water during rotorcraft operation.

Operations with a load attached to the suspension assembly have to be conducted in accordance with the appropriate operating rules for external loads.

External cargo operation of the helicopter is approved according to VFR.

Operation of the helicopter with no load suspended from the external cargo hook is authorized under normal airworthiness certificate without removing the hook from the helicopter.

2.2 CREW

Only those persons who are necessary for accomplishment of the work activity directly associated with that operation may be carried in the helicopter.

2.3 MASS AND LOAD LIMITS

Maximum combined gross mass
(Helicopter plus jettisonable external load): ..... 3585 kg

Maximum external load mass: ..... 1500 kg

Minimum external load mass: ..... 5 kg

2.4 CENTER OF GRAVITY LIMITATIONS

The inflight center of gravity of the helicopter before and after external load pick-up shall located within the CG envelope of the basic helicopter (see Section 2 of the basic Flight Manual).

The permissible over-all CG envelope of the helicopter before load pick-up depending on the external load mass is shown in Figure 1.

The helicopter cross mass used in the example below comprises basic helicopter gross mass as well as mission equipment, crew, other persons and fuel on board.

EXAMPLE: (see Figure 1)

Determine: **Maximum external load mass**

Known:
(1) H/C gross mass before load pick-up 2538 kg
Corresponding H/C CG location 4379 mm
(2) H/C gross mass before load pick-up, **but only supply tanks filled** 2350 kg
Corresponding H/C CG location 4360 mm

Solution: **Maximum external load mass = 800 kg**

1. Enter chart at known H/C gross mass (1) (2538 kg)
2. Move horizontally right
3. Enter chart at corresonding H/C CG (4379 mm)
4. Move upwards to intersect tracing from the right
5. At point of intersection read maximum external load mass (1) (1047 kg)
6. Repeat the procedure using H/C gross mass (2) (2350 kg) and corresponding CG (4360 mm)
7. At point of intersection read maximum external load mass (2) (800 kg)
8. Compare both solutions.
The smaller value is the applicable maximum external load mass. **(800 kg)**

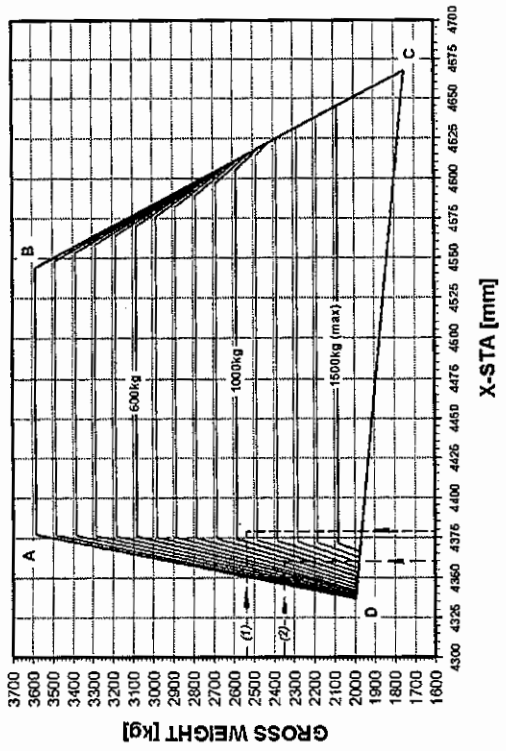

Fig. 1 Longitudinal C.G. external loading envelope

2.5 AIRSPEED LIMITATIONS

If the cargo hook is stowed to the bracket under the rear LH side of the fuselage the basic helicopter airspeed limitations apply.

Max. airspeed with external cargo hook load is ..... 100 kts

Max. airspeed with trailing unloaded cargo hook is ..... 70 kts

2.6 BANK ANGLE LIMITATION

The max. bank angle during loaded cargo hook operation is ± 30°.

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2.7 EXTERNAL LOAD OPERATIONAL LIMITS

WARNING HELICOPTER HANDLING CHARACTERISTICS MAY BE AFFECTED BY THE SIZE, MASS, AND SHAPE OF THE EXTERNAL LOAD BEING CARRIED. IN PARTICULAR, LOADS OF RELATIVELY LOW MASS GENERATING SIGNIFICANT AERODYNAMIC REACTIONS ON ACCOUNT OF THEIR SIZE AND/OR SHAPE MAY BECOME UNSTABLE.

ANY UNSTABLE LOAD MAY JUMP, OSCILLATE OR ROTATE RESULTING IN LOSS OF CONTROL, UNDUE STRESS ON AND/OR CONTACT WITH THE HELICOPTER CAUSING POSSIBLE CATASTROPHIC RESULTS.

THEREFORE, EACH OPERATOR SHALL ESTABLISH ADEQUATE OPERATIONAL LIMITS AND PROCEDURES THAT PRECLUDE THE POSSIBILITY OF THE LOAD CONTACTING THE HELICOPTER.

THE PILOT, THROUGH USE OF AN EXTERNALLY MOUNTED REAR-VIEW MIRROR, OR A TRAINED ON-BOARD OBSERVER SHALL MONITOR THE LOAD REACTION DURING FLIGHT IN ORDER TO REGAIN CONTROL SHOULD THE LOAD BECOME UNSTABLE.

Towing loads touching the ground or water surface have not been flight demonstrated.

Flight with an empty net or unballasted sling as an external load is prohibited unless approved operational limits and procedures provided by the operator allow for such an operation.

The distance between load and hook will depend on the type of load or operation, however, it shall be kept as short as possible. Cable length of approx. 10 m should be avoided for external load operations.

Immersion of a cable / rope attached to the cargo hook into water for the purpose of picking up loads is permissible within the hover speed range if obstruction clearance is fully ensured.

2.8 LOAD ATTACHMENT RING OR SHACKLE DIMENSIONS

WARNING THE USE OF A LOAD ATTACHMENT RING OR SHACKLE WITH INCORRECT DIMENSIONS MAY LEAD TO LOSS OR JAMMING OF THE LOAD.

The operator is responsible for selecting an appropriate load attachment ring or shackle. The attachment means must be capable of safely carrying the load and unable to jam, to roll out or to turn out (refer to Para 8.1 of this FMS for respective information).

EFFECTIVITY Before SB MBB BK117C2–85–030

The load shall only be attached to the hook using a fixed ring with inner diameter between 50 and 80 mm (see placard).

EFFECTIVITY After SB MBB BK117C2–85–030

The load shall only be attached to the hook using:

- a ring with dimensions as defined in Fig. 2, or
- a shackle with dimensions as defined in Fig. 3.

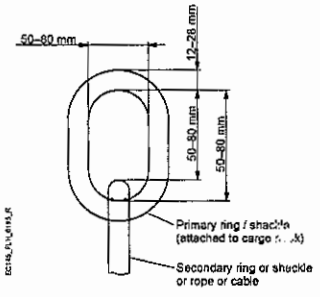


Fig. 2 Required ring dimensions

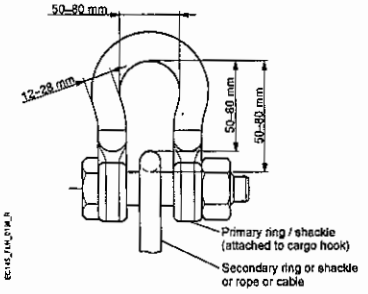


Fig. 3 Required shackle dimensions

EFFECTIVITY All

2.9 OTHER LIMITATIONS

CAUTION RUNNING LANDINGS WITH THE HOOK DEPLOYED SHALL BE AVOIDED.

2.10 PLACARDS

EFFECTIVITY Before SB MBB BK117C2-85-030

Placard:

MAX. AUSSENLAST	SIEHE FLUGHANDBUCH
MAX. EXTERNAL LOAD	SEE FLIGHT MANUAL

Location: Cargo hook

EFFECTIVITY After SB MBB BK117C2-85-030

Placard:

MAX. AUSSENLAST	1500 kg
MAX. EXTERNAL LOAD	1500 kg

Location: Cargo hook

EFFECTIVITY All

Placard:

AUSSENLASTHAKEN / EXTERNAL LOAD HOOK

DIESER HS IST ZUGELASSEN FUER DIE HUBSCHRAUBER-LASTENKOMBINATIONSKLASSE B.
NUR DIE ZUM UNMITTELBAREN EINSATZ MIT AUSSENLASTHAKEN
NOTWENDIGEN PERSONEN DUERFEN AN BORD SEIN.
ZULAESSIGE HOECHSTGESCHWINDIGKEIT:

MIT AUSSENLAST	100 KIAS
OHNE AUSSENLAST (LASTHAKEN FREIHAENGEND)	70 KIAS

THIS HELICOPTER IS APPROVED FOR ROTORCRAFT-LOAD COMBINATION CLASS B.
ONLY PERSONS DIRECTLY NECESSARY FOR THE WORK
ACTIVITY MAY BE CARRIED IN THE HELICOPTER
MAX. AIRSPEED:

WITH LOAD	100 KIAS
WITHOUT LOAD (HOOK UNSTOWED)	70 KIAS

Location: Cockpit

Placard:

HIER NUR LASTHAKEN
OHNE LAST EINHAENGEN
STOW LOAD HOOK
WITH NO LOAD ONLY

Location: Cargo hook stowage bracket on LH fuselage side.

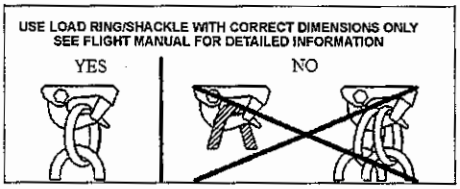
EFFECTIVITY Before SB MBB BK117C2-85-030

Placard:

Location: Cargo hook

EFFECTIVITY After SB MBB BK117C2-85-030

Placard:



Location: Cargo hook

EFFECTIVITY All

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3 EMERGENCY AND MALFUNCTION PROCEDURES

In the event of trouble in the electrical release mechanism, the external load may be mechanically released. The mechanical release is mounted at the pilot's collective pitch lever.

If one engine fails, the external load may have to be jettisoned (see diagrams for single-engine operation, Section 5 of basic Flight Manual).

3.1 EXTERNAL LOAD JETTISONING

Condition/Indications

Certain helicopter inflight emergencies (e.g. single-engine failure or loss of power) may dictate to jettisoning the external load.

Procedure

1. CARGO REL pb – Press

if unsuccessful:

2. Mechanical release lever (on collective) – Pull

4 NORMAL PROCEDURES

NOTE HOGE operations with external cargo should be performed with the H/C heading into the wind.

4.1 PREFLIGHT CHECK

1. Hook opening – Check facing forward
2. Longer cable pair – Check installed forward
3. Cargo hook, cables and attachments – Condition, secured
4. Electrical and mechanical release mechanism – Connected, secured and function
5. TEST push button on weight indicator (if weighing system installed) – Press, monitor self test sequence
6. Cargo hook – Under fuselage safely stowed

4.2 OPERATION

The cargo hook can be operated by the pilot or by the ground crew.

For **pilot's operation** are provided:

- Circuit breaker LOAD HOOK PWR (overhead panel)
- 2-way CARGO HOOK switch (overhead panel) to arm the cargo hook electrical system.
- Guarded pushbutton CARGO REL (cyclic stick grip) for normal electrical release of the cargo hook.
- Mechanical release for release in the event of trouble in the electrical release mechanism mounted on the collective pitch lever.
- Green advisory light HOOK UNLD (advisory panel CPDS) which illuminates as long as no force of more than 50 N (5 kg) acts upon the hook.

The **ground crew** can unlock the cargo hook mechanically by using the manual release (located on hook, see Fig. 5).

NOTE For opening the cargo hook a spring-force of approx. 50 N (5 kg) must be overcome. This spring-force acts permanently and closes and locks the cargo hook after opening automatically.

4.2.1 Latching the hook

NOTE
- HOGE operations with external cargo should be performed with the helicopter heading into the wind.
- The ground crew should protect themselves against static electricity when attaching cargo (allow to discharge helicopter static electricity).

1. Circuit breaker LOAD HOOK PWR – Check in
2. CARGO HOOK switch – Set to ARM
3. Establish hovering altitude at sufficient height to allow ground crew to attach cargo sling to the cargo hook.

   NOTE The load will be latched by overriding the safety-catch, if necessary the hook may be opened for this procedure by the ground crew.
4. To lift cargo from surface – Ascend slowly vertically
5. HOOK UNLD advisory light – Check off

   NOTE The HOOK UNLD advisory light indication goes off as soon as the mass of the load acts upon the hook (above 50 N (5 kg)).
6. While hovering – Check for power available, satisfactory controllability and adequate directional control

7. Enter into slow speed forward flight and determine that no condition is uncontrollable or hazardous.

4.2.2 Releasing the load

NOTE The ground crew should protect themselves against static electricity when touching the external load or cargo hook (allow to discharge static electricity).

1. Execute approach so as to arrive at cargo release point at a hover with cargo approx. 1,5 meters above surface.
2. To settle cargo – Descend vertically until cargo touches surface
3. CARGO REL pb – Press

The load is released, when its mass has overcome the springforce of the hook.

4. HOOK UNLD advisory light – Check on

WARNING ILLUMINATION OF THE **HOOK UNLD** ADVISORY LIGHT DOES NOT SAFELY INDICATE THAT THE CARGO SLING IS DETACHED FROM THE HOOK.

If cargo hook mirror installed:

5. Cargo hook mirror – Check load released

If cargo hook mirror not installed:

5. To ensure that the load is released and the cargo sling is detached from the hook. – Ascend slowly vertically up to a sufficient hover altitude.

In case of settled cargo the pilot should eventually hold the CARGO REL pushbutton in pressed position during ascending in order to remove the cargo sling from the hook.

If HOOK UNLD indication goes off:

CAUTION CARGO IS NOT RELEASED.

6. Make a new attempt to release the load by repeating steps 2 to 5

4.2.3 Stowing and releasing the cargo hook

A stowage bracket and a rubber plate are installed to the rear left side of the fuselage. The cargo hook shall be inserted to this stowage bracket when it is not used in order to prevent the cargo hook from swinging and damaging the fuselage during flight.

The cargo hook can be released from this stowing position electrically by the pilot or mechanically by the ground crew in order to bring the cargo hook in a pick-up position.

CAUTION DO NOT APPLY ANY LOAD TO THIS STOWAGE BRACKET, USE ONLY THE TRAILING CARGO HOOK.

NOTE With a trailing unloaded cargo hook the HOOK UNLD advisory light illuminates. With side inserted hook the HOOK UNLD advisory light is extinguished.

5 PERFORMANCE DATA

5.1 OPERATION WITH CARGO HOOK IN STOWED POSITION

For flights with the cargo hook in the stowed position at the rear LH side of the fuselage or the performance data given in Section 5 of the basic Flight Manual remain unchanged.

5.2 CARGO HOOK OPERATION

Climb and hover performances are slightly reduced when carrying an external load, depending on size and shape of the load.

5.3 WIND INFORMATION

Cargo hook operations have been demonstrated under the following wind conditions:

No change in the basic Flight Manual data.

6 MASS AND BALANCE

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

The **longitudinal point** of application of the external load is **4385 mm** aft of the reference datum.

The **lateral point** of application is **0 mm.**

7 SYSTEM DESCRIPTION

7.1 CARGO HOOK ASSEMBLY

The cargo hook is attached by means of four cables on the cross tubes next to the connecting points to the airframe. The electrical hook release is operated by a guarded pushbutton labelled CARGO REL on the pilot's (and copilot's) cyclic stick grip.

A mechanical release is mounted on the collective pitch lever; it is provided for use in the event of electric switching malfunction.

A green advisory light HOOK UNLD is located on the CPDS advisory panel which illuminates as long as no force of more than 50 N (5 kg) acts upon the hook.

If the cargo hook is not in use, it can be stowed by attaching it to a bracket mounted under the fuselage rear LH side.

Releasing the hook out of this bracket during flight is possible by means of the release pushbutton CARGO REL as the net mass of the hook and the cables exceeds 50 N (5 kg) and thus overcomes the spring force of the hook (see 4.2).

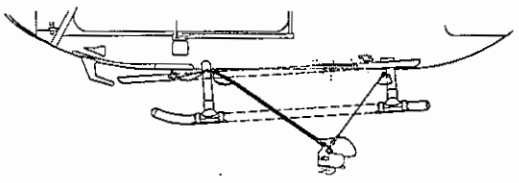
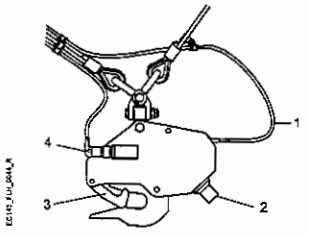
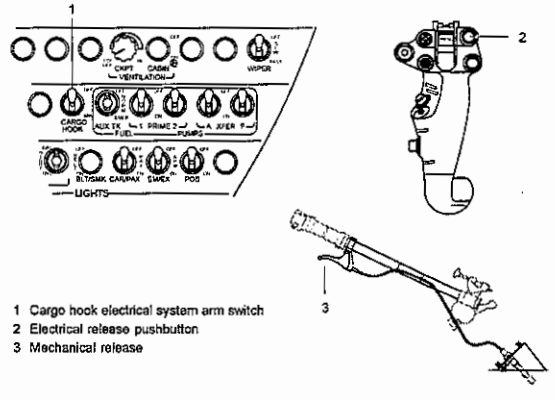


Fig. 4 Cargo hook assembly



1 Mechanical release
2 Mechanical release (ground crew)
3 Safety-catch
4 Electrical release

Fig. 5 Cargo hook



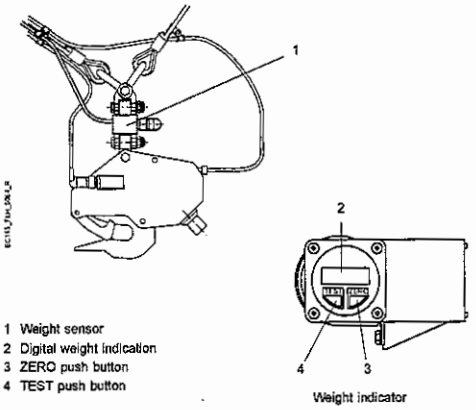
1 Cargo hook electrical system arm switch
2 Electrical release pushbutton
3 Mechanical release

Fig. 6 Cargo hook controls

7.2 WEIGHING SYSTEM (OPTIONAL)

The weighing system can be attached to the cargo hook assembly to provide external cargo weight information to the pilot during cargo hook operation. The weighing system consists of a weight sensor installed on the cargo hook and a weight indicator mounted at the pilot's door lower frame. System operation is possible when CARGO HOOK switch is set to ARM.

On the weight indicator the weight actually put on the cargo hook is displayed in relation to the zero offset. The ZERO push button allows the pilot to tare out a displayed load (set the offset to zero). The TEST push button starts an automated self test sequence.



1 Weight sensor
2 Digital weight indication
3 ZERO push button
4 TEST push button

Fig. 7 Weighing system

8 HANDLING, SERVICING AND MAINTENANCE

8.1 ROLL OUT / JAMMING / TURN OUT

The following figures show the various failure modes of the load hook attachment.

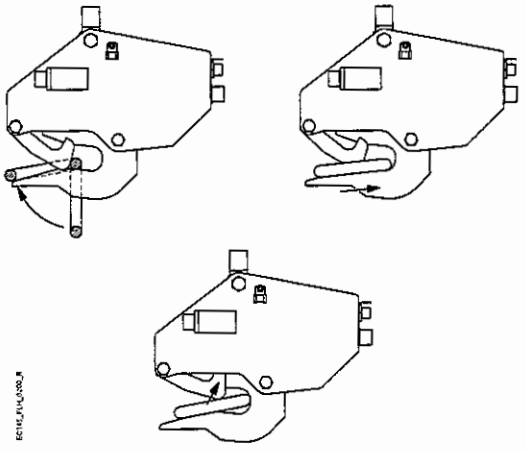


Fig. 8 Roll out

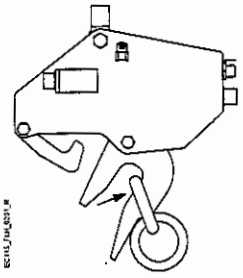


Fig. 9 Jamming

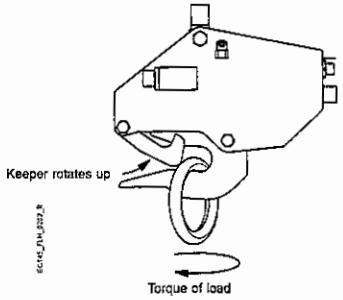


Fig. 10 Turn out

F M S 9.2-11

SUPPLEMENT FOR

EXTERNAL HOIST SYSTEM

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the External Hoist System has been installed.

System/Equipment Designation	Effectivity
External Hoist System (LH)	All
External Hoist System (RH)	All
Add External Hoist System (RH)	All
Add External Hoist System (LH)	All
Light External Hoist (LH)	All
Light External Hoist (RH)	All
Fix. prov. for rope down device (LH)	All
Fix. prov. for rope down device (RH)	All
Grab ring	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 18. Dez. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2-11 -1	10.1		9.2-11 -10	1		9.2-11 -19	10	
R	9.2-11 -2	10.1		9.2-11 -11	10		9.2-11 -20	10	
	9.2-11 -3	10		9.2-11 -12	10		9.2-11 -21	10	
	9.2-11 -4	10		9.2-11 -13	10		9.2-11 -22	10	
	9.2-11 -5	10		9.2-11 -14	10		9.2-11-23	10	
	9.2-11 -6	10	R	9.2-11 -15	10.1		9.2-11-24	10	
	9.2-11 -7	10		9.2-11 -16	10				
	9.2-11 -8	10		9.2-11 -17	10				
	9.2-11 -9	10		9.2-11 -18	10				

LOG OF REVISIONS

FIRST ISSUE		REV. 6	APR 01, 2003
ORIGINAL, REV. 0	DEC, 2001	REV. 7	MAY 27, 2003
REV. 1	JAN 24, 2002	REV. 8	NOV 24, 2003
REV. 2	MAR 11, 2002	REV. 9 EASA approval no.: 2004-11006	NOV 11, 2004
REV. 3	JUL 05, 2002	REV. 10 EASA approval no.: R.C.01419	JAN 13, 2006
REV. 4	AUG 08, 2002	REV. 10.1	(see entry below)
REV. 5	SEP 20, 2002		

Revision 10.1

Date: Aug 18, 2006

Revision No. 10.1 to FLM reference revision 10 , is approved under authority of DOA No. EASA. 21J.034'.

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual and/or the "Hoist manufacturers – OPERATION AND MAINTENANCE MANUAL".

2 LIMITATIONS

All operations are to be conducted strictly in accordance with the operating procedures and limitations laid down in the "Hoist manufacturers – OPERATION AND MAINTENANCE MANUAL".

2.1 CONFIGURATION REQUIREMENTS

If the emergency floats (or their fix provisions) are installed in conjunction with the external hoist system the respective cable deflector kit must be installed.

For operation with opened door(s) a certified locking device for the hinged door(s) and/or the sliding door(s) must be installed.

2.2 OPERATING LIMITATIONS

The use of the external hoist system is restricted to lowering or raising of loads or people.

Operation of the helicopter is approved according to VFR in "Class B rotorcraft-load combination".

> "Class B rotorcraft-load combination" means one in which the external load is jettisonable and is lifted free of land or water during the rotorcraft operation.

NOTE Hoist operations with persons shall be performed in accordance with applicable national regulations.

Landings with hoist load attached to the hook are prohibited.

CAT A takeoff and landing with opened/removed doors and/or extended hoist is prohibited.

The optional grab ring is limited for use as a hook capture aid only. The grab ring is not designed to support any load nor to be used as an attachment device.

In addition to the hoist cycle counting (in accordance with the Hoist manufacturers – OPERATION AND MAINTENANCE MANUAL), record the hoist operating time in the helicopter logbook. The hoist operating time is defined as the period of time between takeoff and landing of a flight in which a hoist operation takes place.

2.3 FLIGHT CREW

NOTE Before executing hoist operations the crew must be properly trained for this specific kind of operation.

The minimum flight crew consists of one pilot and one hoist operator.

The hoist operator must be secured to the helicopter in an approved manner.

Only persons who are necessary for hoist operation may be carried in the helicopter.

Hoist operations are permissible only when voice communication is maintained between pilot and hoist operator.

2.4 MASS AND LOAD LIMITATIONS

2.4.1 Maximum Gross Mass during hoist operation

Maximum gross mass (including external load) during hoist operation: 3585 kg

2.4.2 Hoist Load Limitation

Maximum hoist load: 272 kg / 600 lbs

2.5 CENTER OF GRAVITY LIMITATION

With hoist boom retracted and hook fully raised and unloaded, the C.G. envelope of the basic helicopter applies (see section 2 of the basic Flight Manual).

2.5.1 Longitudinal C.G.

During hoist operations the longitudinal C.G. envelope of the basic helicopter applies, except for special cases stated in Para 6.2 of this supplement.

2.5.2 Lateral C.G.

Lateral C.G. limitation remains unchanged as long as no load is attached to the hook. However, picking up loads (up to max. hoist load), resulting in an extension of lateral C.G. position is permitted, when hoisting procedure is strictly carried out in compliance with this supplement.

2.6 AIRSPEED LIMITATION

With boom retracted and hook fully raised (no load), the limitations of the basic helicopter remain unchanged.

2.6.1 Never exceed speed for hoist operation

V_{NE} for hoist operation with extended hoist boom within basic C.G envelope: 70 kt

V_{NE} for hoist operation within extended C.G. envelope (see Fig. 3): 50 kt

NOTE For lower V_{NE} with opened/removed doors during hoist operation see FMS 9.1-2 "Operation with opened/removed Doors".

2.7 BANK ANGLE

Maximum permissible bank angle with extended hoist and/or load on the hook is 30°.

2.8 HOIST LIMITATION

2.8.1 Cable length

Maximum usable hoist cable length: 90 m

2.8.2 Pendulum/deflection angle

Maximum permissible pendulum movement in any direction with respect to the vertical axis of the helicopter is 15°.

In case of forward flight a static deflection angle up to 30° to the rear is allowed. During flight operation with extended cable and no load attached to the hook, the hoist operator should guide the cable by hand or foot in order to stay within limits.

2.8.3 Hook/bumper assembly

During normal flight operations without load, the hook/bumper assembly must be in the fully raised position (limit stop activated).

2.9 PLACARDS AND DECALS

Placard:

AUSSENWINDE			EXTERNAL HOIST SYSTEM		
BETRIEBSGRENZEN:	AUF	AB	LIMITATIONS:	UP	DOWN
WINDENLAST: kg	272	272	LIMITATIONS: lbs	600	600
SEILLÄNGE:	90 m		CABLE LENGTH:	295 ft	

Location: LH and/or RH sliding door upper frame

Placard:

DIESER HUBSCHRAUBER IST FÜR HUBSCHRAUBER–LAST–KOMBINATION NACH CLASS B ZUGELASSEN WINDENBETRIEB MIT PERSONENLAST IST IN ÜBEREINSTIMMUNG MIT DEN NATIONALEN VORSCHRIFTEN DURCHZUFÜHREN BEI WINDENMISSIONEN DÜRFEN NUR DIE FÜR DEN WINDENBETRIEB ERFORDERLICHEN PERSONEN AN BORD SEIN	THIS HELICOPTER IS APPROVED FOR ROTORCRAFT–LOAD COMBINATION CLASS B THE HOISTING OF PERSONS SHALL BE PERFORMED IN ACCORDANCE WITH NATIONAL REGULATIONS DURING HOIST MISSIONS ONLY PERSONS WHO ARE NECESSARY FOR HOIST OPERATION MAY BE CARRIED IN THE HELICOPTER

Location: RH cockpit windshield frame

Placard:

NUR ZUR PERSONENSICHERUNG (MAX. 200 KG)
USE ONLY TO SECURE PERSONS (200KG MAX.)

Location: Inside cabin, near safety harness fitting (optional)

Placard:

SICHERUNGSSEIL ZUR PERSONENSICHERUNG (MAX. 200 KG)
SAFETY CABLE - USE TO SECURE CREW MEMBERS (200KG MAX.)

Location: Inside cabin, near safety cable (optional)

Placard:

DIESEN GRIFF NICHT ZUR PERSONENSICHERUNG VERWENDEN
DO NOT USE THIS HANDLE FOR SECURING PERSONS

Location: Inside cabin, near handles

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3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 CABLE CUTTING

Conditions/Indications

In the event of a severe inflight emergency, e.g. engine failure, it might be necessary to cut the cable in order to avoid hazard for the flight crew or helicopter.

Procedure

Cutting may be performed by either pilot or hoist operator.

Pilot – collective pitch switch board

1. **CUT CABLE pb guard** – **Raise**
2. **CUT CABLE pb** – **Press**

Hoist operator – Hoist control pendant

3. **CUT CABLE pb guard** – **Raise**
4. **CUT CABLE pb** – **Press**

If, for any reason the pyrotechnic cable cutting device fails to operate:

5. **Cable Cutter Shears** – **Remove and cut cable manually**

3.2 GENERATOR FAILURE

NOTE Pyrotechnic cable cutter remains operational regardless of generator status.

3.2.1 Single generator failure

1. Emergency procedure according to basic Flight Manual – Perform
2. Hoist cycle – Complete

Before starting further hoist operation, reduce electrical load of remaining generator to 50A or below (watch ammeter).

3.2.2 Dual generator failure

1. Hoist operation – Stop
2. Emergency procedure according to basic Flight Manual – Perform

Before landing:

3. Load – Set down at nearest adequate site
4. Cable – Raise manually, store cable in cabin

If manual cable raising is not possible:

5. Cable cutting – Perform according emergency procedure

3.3 HOIST MOTOR RUNAWAY

Conditions/Indications

Control of the hoist motor by the control pendant is not possible any longer.

Procedure

Hoist operator – sliding door upper frame

1. **HOIST / HOIST STBY pb** – **Push**

Pilot/copilot – overhead panel

WINCH CONT circuit breaker – Pull

NOTE Pyrotechnic cable cutter remains operational regardless of WINCH CONT circuit breaker or WINCH / WINCH STBY push button status.

3.4 SEVERE LOAD OSCILLATIONS

Conditions/Indications

Load oscillations exceed 5° cable angle with respect to vertical axis of helicopter during hover or forward flight.

Procedure

NOTE Actions of pilot and hoist operator should be done simultaneously and coordinated.

Pilot/copilot

1.	**Airspeed**	– **Establish approx. 30 kt**

Hoist operator

2.	**Control pedant**	– **stop raising load**
3.	**Load**	– **Stabilize by grasping and moving cable**

If oscillations persist:

4.	**Cable**	– **Reel-out until oscillations stop**

3.5 CAUTION LIGHT INDICATIONS

CAUTION INDICATIONS

CABLE CUT
(on CPDS)

Conditions/Indications

Hoist system electrical test has been successfully performed (A) or electrical cable cutter has been activated (B).

Procedure

(A) None (normal hoist operation)
(B) Verify that cable has been succesfully cut.

CAUTION INDICATIONS

CAUTION
(on control pendant)

Conditions/Indications

Cable length within 3 m before reaching fully reeled in or reeled out position. Hoist motor speed is reduced automatically.

Procedure

None (normal hoist motor operation)

NOTE CAUTION light flashes for two seconds to check operation of the light when hoist is initally powered-up.

CAUTION INDICATIONS

OVERHEAT
(on control pendant)

Conditions/Indications

OVERHEAT caution light on control pendant illuminates steadily when temperature limits of the hoist motor or gearbox lub oil are exceeded.

Procedure

1.	Hoist cycle	– Complete
2.	Hoist operation	– Stop; allow hoist to cool down until OVERHEAT caution light goes off

NOTE • During an overheat condition the drive motor speed is limited automatically.

• OVERHEAT light flashes for two seconds to check operation of the light when hoist is initially powered-up.

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4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

NOTE • Perform hoist system checks before any flight when hoist operation is intended. Those checks marked with an asterisk (★) are minimum required before each flight, when the hoist system is attached to the helicopter.

• For supplementary information refer to "TRW – OPERATION AND MAINTENANCE MANUAL"

★	Hoist assembly	– Condition and integrity
★	Quick-release pins	– Condition, secured
★	Electrical connectors	– Fastened and secured
	Cable cutter cartridge	– Installed and connected
	Cable deflectors on skids	– Installed as required
	Seat belts and cabin securing points	– Condition
	Retaining harness with extension belt	– Condition and integrity
	Cabin ceiling mounted lug	– Secured, extension belt attached
	Sliding door/ locking device	– Condition and function
	Cable cutting shears	– Available
	Hoist control pendant	– Condition and connected
		–
	WINCH CABLE CUT switch on collective	– Condition, safety catch closed
	Circuit breakers WINCH CONT, WINCH CC-PIL, WINCH BOOM and CC-PED WINCH	– Check in
	WINCH / CBL CTR switch	– CC TEST; check caution indication CABLE CUT and advisory WINCH on.
	WINCH / CBL CTR switch	– ON; check advisory WINCH on.
	HOIST/HOIST STBY push button	– Check (by operator) HOIST illuminated
	Control pendant BOOM toggle switch	– OUT; extend boom
	Control pendant REEL thumb wheel	– OUT, lower hook approx. 1m
	HOIST/HOIST STBY push button	– Push, check HOIST STBY illuminated and REEL OUT/IN thump wheel inoperative
	Hook assembly	– Condition and integrity, hook free to rotate
	HOIST/HOIST STBY push button	– Push
	Exposed cable	– Condition

	Control pendant REEL thumb wheel	– IN; raise hook to upper position (upper limit stop)
★	Hook assembly	– Fully raised, hook unable to move
	Control pendant BOOM toggle switch	– IN; retract boom
★	Boom	– Fully retracted
	Control pendant intercom switch	– Press; check communication
	WINCH / CBL CTR switch	– OFF; Winch advisory disappears
		–
	Loose objects, such as manuals, maps etc.	– Fixed and secured
	Loose objects which are not essential for the purpose of flight	– Removed

4.2 HOIST OPERATION

4.2.1 General remarks

WARNING WHEN USING A HOIST HOOK WITHOUT A . :C CABLE KEEPER, THE ATTACHMENT OF THE LOAD CAN ROLL OUT OF THE HOOK UNDER PARTICULAR DYNAMIC CONDITIONS.

NOTE To prevent the roll out of the load, it is recommended to use a device (ring, D-ring, snap safety hook) with a maximum inner diameter not larger than 40 mm or to apply an adequate operational procedure in compliance with national regulations.

CAUTION • CHAFING THE CABLE AGAINST THE LANDING GEAR OR EQUIPMENT COULD DAMAGE THE CABLE, WHICH MIGHT:
– SERIOUSLY REDUCE THE CABLE'S ABILITY TO WITHSTAND ITS SPECIFIED LOAD
– CAUSE CABLE -JAM WITHIN THE HOIST
– LEAD TO EXCESSIVE CABLE-WEAR AND CORROSION HENCE REDUCING CABLE-LIFETIME

• IN ORDER TO AVOID CONTACT BETWEEN CABLE AND LANDING GEAR OR EQUIPMENT:
– THE HOIST BOOM SHALL BE SWIVELLED OUT AS FAR AS PRACTICABLE
– CABLE OSCILLATIONS SHALL BE KEPT TO A MINIMUM

- WHENEVER THERE IS CONTACT BETWEEN CABLE AND LANDING GEAR OR EQUIPMENT, THE HOIST MOTOR MUST BE STOPPED IMMEDIATELY. BEFORE RESUMING, THE AFFECTED CABLE AREA SHOULD BE INSPECTED TO VERIFY INTEGRITY.

- The hoist is controlled by a hoist operator positioned in the cabin provided voice contact is maintained between pilot/copilot and hoist operator. The hoist operator should wear protective gloves.

- During hoist motor operations (lifting or lowering hook), it is recommended not to release the thumb wheel on hoist control pendant too rapidly, to prevent unintended jolt on hoist boom and aircraft and to avoid the friction disk brake pack from overheating.

- When raising loads, oscillations (especially at skid level) must be reduced by hoist operator grasping and moving cable in opposite direction of load movement. Oscillations will decrease when reeling-out and increase when reeling-in.

- When setting down several persons the pilot should be aware of sudden C.G shift due to unobserved movement inside the cabin.

- When picking up several loads, place each hoisted load along opposite cabin side.

- Connect load to hook using rigid, non-stretchable devices whenever possible.

- After each mission record hoist operation time and number of cable cycles.

- After exposure of hook/bumper assy to salt water, flush as outlined in Maintenance Manual.

4.2.2 **Standard load pick-up procedure**

WARNING
- IN FORWARD FLIGHT WITH CABLE LENGTH BETWEEN 10 AND 30 M SPONTANEOUS LOAD OSCILLATIONS CAN OCCUR.
- THE LOAD SHOULD NOT BE REELED-IN WHEN OSCILLATIONS EXCEED 5° CABLE ANGLE WITH RESPECT TO VERTICAL AXIS OF THE HELICOPTER.
  REELING-IN AN OSCILLATING LOAD INCREASES THE AMPLITUDE OF THE OSCILLATION AND COULD LEAD TO HAZARDOUS CONDITION.
- REDUCE PEDAL AND CYCLIC STICK MOVEMENTS TO A MINIMUM TO AVOID OSCILLATIONS.
- STATIC ELECTRICITY BUILD-UP ON CABLE AND HOOK SHALL BE DISCHARGED BEFORE LOAD HOOK-UP BY USE OF AN ANTISTATIC LINE OR BY DIPPING HOOK INTO WATER.
- WHEN RAISING LOAD, OSCILLATIONS (ESPECIALLY AT SKID HEIGHT) MUST BE REDUCED BY WINCH OPERATOR GRASPING AND MOVING CABLE.

Designation of affected persons, used in the following step sequence:

HO = Hoist operator
P = Pilot or copilot, respectively

P	Total electrical load (GEN 1 + GEN 2)	– Check below 100 A; otherwise reduce consumers
P	Seat belts	– Fasten
HO	Retaining harness	– Fastened, adjusted and secured to lug at cabin ceiling
HO	Cabin occupants	– Secured / seat belts fastened
P	WINCH / CBL CTR switch	– ON ; check WINCH advisory comes on
P	Airspeed	– Reduce to 70 kt or max. airspeed for opening doors (according to FMS 9.1-2 para AIR SPEED LIMITS) whichever is less
HO	Respective sliding door	– Open and lock
HO	BOOM toggle switch	– OUT; extend boom outboard as necessary
HO	REEL thumb wheel	– OUT; allow antistatic line/hook to touch ground/water at zero ground speed.
HO	Load	– Check secured to hook, ready for lifting

HO	REEL thumb Wheel	– IN; reel in cable until taut (take up any slack); helicopter vertical above load
P	Collective pitch	– Increase slightly and lift load clear of ground while checking hover power
P	Torque, TOT and N1	– Check within limits
P	MM indication	– Check within limits
HO	REEL thumb wheel	– IN; raise load to approx. skid height, reduce any oscillations

NOTE
- When wide loads are lifted, extend boom just before load reaches skid height to provide load-to-skid clearance.
- Avoid to fully reel-in the cable with hoist loads > 100 kg attached to the hook.

HO	REEL thumb wheel	– IN; allow limit switch to activate, guide hook if necessary
HO	BOOM toggle switch	– IN; retract boom, check skid free.
HO	Load	– Secure in cabin and release from hook

NOTE It may be necessary to reel out a length of cable to bring load into cabin. After securing load and releasing hook, fully reel in cable while guiding empty hook.

HO	Respective sliding door	– Close
P	WINCH / CBL CTR switch	– OFF

NOTE The hoist should be switched off, whenever it is not being operated.

5 PERFORMANCE DATA

5.1 AEO AND OEI MAXIMUM RATE OF CLIMB

For flight with retracted boom and hook fully raised, all results obtained from the respective diagram, contained in section 5 of the basic flight manual and/or the supplements are to be corrected as follows:

Helicopter gross mass below 2400kg	subtract 25 ft/min
Helicopter gross mass of 2400kg or below 3000kg	subtract 20 ft/min
Helicopter gross mass of 3000kg or above	subtract 15 ft/min

5.2 HOIST OPERATION

During hoist operations, the influence of the additional aerodynamic drag on flight performances, produced by extended boom/cable and attached load, is negligible when operating helicopter within limitations defined in section 2 of this supplement.

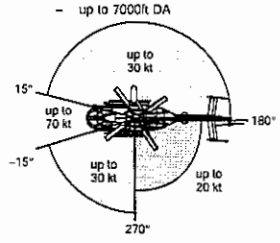
5.3 WIND INFORMATION

NOTE Hoist operations carried out at lower overall gross mass than 3585 kg and/or with hoist load less than 270 kg result in increased control margins for hover in wind conditions.

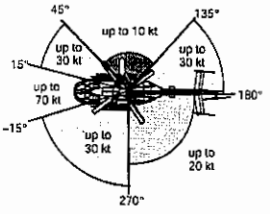
Hoist operations have been demonstrated under the following conditions:

EFFECTIVITY *External Hoist System (RH)installed.*

– up to 7000ft DA

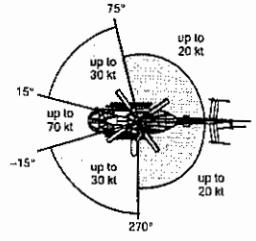


– above 7000ft DA

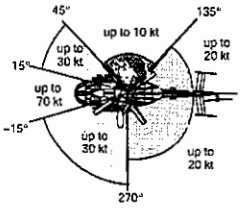


EFFECTIVITY *External Hoist System (LH) installed.*

– up to 7000ft DA



– above 7000ft DA



EFFECTIVITY *All*

Fig. 1 Demonstrated wind conditions

6 MASS AND BALANCE

6.1 MASS AND BALANCE CORRECTION

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

6.2 HOIST LOAD CHARTS (FIG. 2 AND FIG. 3)

NOTE The hoist load charts are given as an aid in determining the longitudinal C.G. shift caused by retracting hoist boom with load attached (most forward C.G. condition).

6.2.1 In-flight C.G. range for a given hoist load to be picked up

To determine if helicopter will remain within longitudinal C.G. limits when a load is picked up and the hoist boom will be retracted, first calculate helicopter in-flight C.G. and gross mass (without consideration of hoist load).

When intersection point of longitudinal in-flight C.G. with helicopter gross mass is located within inner auxiliary envelope corresponding to hoist load, the C.G. of helicopter will remain within permissible range when hoist boom is retracted after load was picked up.

EXAMPLE: Fig. 2

Determine: In-flight gross mass and C.G.

Known:

Helicopter in-flight gross mass without expected hoist load	2800 kg
In-flight C.G.	4500 mm
Expected load weight	200 kg

Solution: **Helicopter C.G. remains within permissible range when hoist load is picked up and hoist boom is retracted.**

Enter chart at known C.G. (4500 mm)

Move vertically upwards to gross mass (2800 kg)

Read the label of the smallest auxiliary envelope which encloses the intersection point = **272 kg**

Basic CG envelope for hoist operation

The broken lines indicate the maximum load which can be picked up safely to stay within longitudinal C.G limit when hoist boom will be retracted during hoist operation (most forward C.G. condition).

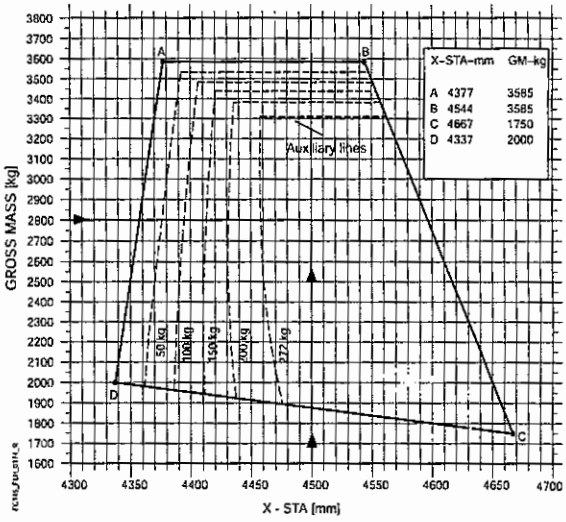


Fig. 2 Basic C.G. envelope

Extended CG envelope for hoist operation up to 50 kt with load attached to the hook

WARNING BEFORE TRANSITION INTO FORWARD FLIGHT ABOVE 50 KT MAKE SURE TO OBTAIN BASIC C.G. LIMITS.

For hoist operation in hover or up to 50 kt forward speed with load attached to the hook the extended longitudinal C.G. envelope as shown below is applicable.

The broken lines indicate the maximum load which can be picked up safely to stay within longitudinal C.G limit when hoist boom will be retracted during hoist operation with load attached to the hook (most forward C.G. condition).

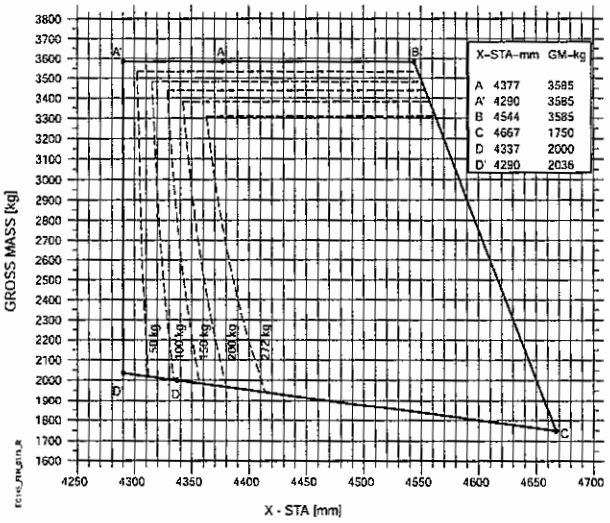


Fig. 3 Extended C.G. envelope

6.2.2 C.G. range for flights with attached hoist load or dropping of a hoist load

For calculation of the longitudinal C.G range with a load attached to the hoist or a load being dropped off, refer to the basic flight manual using the following data:

Stations for the load attached to the hoist:

Boom fully retracted	x = 3403
Boom fully extended	x = 3813

7 SYSTEM DESCRIPTION

The external hoist system is attached with quick-release pins to the LH side (P/N B851M2000051) or RH side (P/N B851M2040051) of the main gear box deck. It provides lifting capability via a boom mounted, motor driven hoist. The external hoist system consists of the winch unit, an electric driven boom, a cable cutter assembly and a control pendant. As an option a light could be attached to the external hoist system.

7.1 WINCH UNIT

The winch unit comprises of

- a main drive motor supplied with 28V DC providing continous operation up to 12000 RPM,
- an automatic load-sensitive brake assembly which controls the reel-out of the cable and holds the load in a selected position when hoist operation is interrupted,
- a level wind and storage drum assembly which ensures correct and even winding of the cable on the drum,
- a traction sheave assembly provides a constant minimum tension on the cable at all times to prevent miswrap during no-load operation.
- a dual, fail-safe aircraft hook and a steel cable with 90m (295ft) usable length. The first and the last 6.1 m (20 ft) of the cable are color coded bright orange.

The average cable speed with a hoist load of 270 kg is 0.76 m/s (150 ft/min) or 1.02 m/s (200 ft/min) with 130 kg. The maximum cable speed is 1.27 m/s (250 ft/min).

During hoist cable reel-out within approx. the first and the last 3 m (10 ft) of the cable the speed is automatically limited to 0.51 m/s (100 ft/min). During hoist cable reel-in within approx. the first and the last 3 m (10 ft) of the cable the speed is automatically limited to 0.25 m/s (50 ft/min). Additionally the speed is further reduced to 0.08 m/s (15 ft/min) when there is approx. 0.25 m (0.8 ft) cable left between cable guide and hook striker disk.

For further information refer to the "Hoist manufacturers - Operation and Maintenance Manual".

7.2 CPDS INDICATIONS

- Cable Length:
  A digital display allows a continuous monitoring of cable length reeled-out in meters (feets) during hoist operation.
- CABLE CUT (Caution light):
  Hoist system electrical test (WINCH / CBL CTR switch CC TEST) has been successfully performed or electrical cable cutter activated.
- WINCH (Advisory light):
  indicates that the external hoist system is activated (WINCH / CBL CTR switch ON) and electrical cable cutter is armed.

7.3 CABLE CUTTER

7.3.1 Pyrotechnic cable cutting device (primary)

An electrically activated pyrotechnic cable cutting device (primary) is installed at the exit of cable from winch unit for emergency use to cut off the extended portion of the cable.

7.3.2 Manually operated cable cutter (secondary)

A manually operated pair of cable cutting shears is located inside the cabin. It operates as a back-up system in case the pyrotechnic cable cutter fails to operate for any reason.

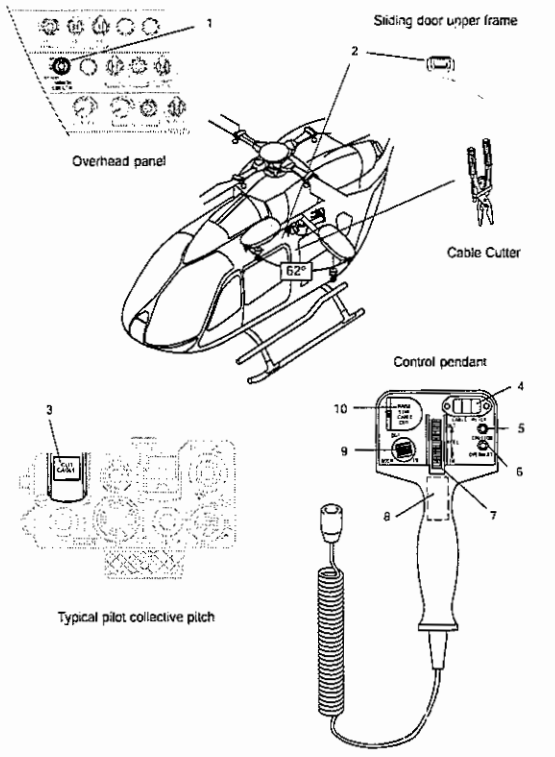


Fig. 4 External hoist system

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	SWITCH/ DISPLAY	POSITION	FUNCTION
1	WINCH / CBL CTR (3-way switch)	OFF	no power supply to the external hoist system
		ON	initiates power supply to the external hoist system
		CC TEST (momentary)	starts cable cutter electrical test
2	HOIST/HOIST STBY (push button)		causes the hoist motor to stop in case of a hoist motor runaway
3	CUT CABLE (push button, guarded)		causes the pyrotechnic cable cutter to cut cable when pressed
4	CABLE METER (digital display)		allows a continuous monitoring of cable length in meters during hoist operation
5	CAUTION (yellow light)		illuminates when the cable length is within 10 ft before fully reeled in or reeled out position. The light flashes for two seconds to check for operation when the hoist is initially powered-up.
6	OVERHEAT (red light)		illuminates if the hoist gearbox lube oil or hoist motor temperature limitations are exceeded. The light flashes for two seconds to check for operation when the hoist is initially powered-up.
7	REEL (thumb wheel, momentary, center-off)	OUT	slight rotation forward initiates hoist cable reel-out movement. Cable speed is proportional to the rotation of the thumb wheel.
		IN	slight rotation backwards initiates hoist cable reel-in movement. Cable speed is proportional to the rotation of the thumb wheel.
8	Intercom (trigger)		allows communication with pilot or other connected personnel when pressed
9	BOOM (2-way switch, momentary, center-off)	OUT	extends hoist boom
		IN	retracts hoist boom
10	RAISE FOR CABLE CUT (push button, guarded)		causes the pyrotechnic cable cutter to cut cable when pressed

Fig. 5 Controls and display functions

7.4 EXTERNAL HOIST LIGHT (OPTIONAL)

The external hoist light can be attached to the external hoist to provide sufficient lighting during hoist operation. The light is similar to the fixed landing light and clamped to the external hoist boom. It can be switched on/off by the hoist operator via a switch installed at the upper sliding door frame.

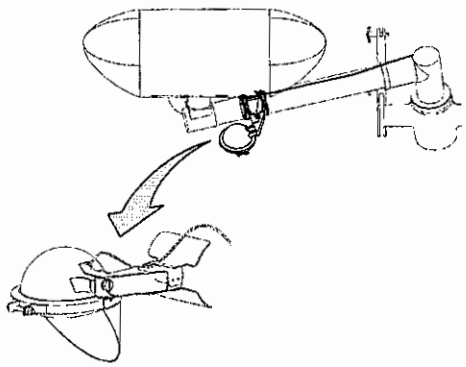

Fig. 6 External hoist light

7.5 ROPE DOWN DEVICE (OPTIONAL)

A rope down device could be attached alternatively to the lug-fittings of the external hoist system (LH/RH) when the fixed provisions for rope down devices (LH/RH) are installed.

7.6 GRAB RING (OPTIONAL)

An optional grab ring can be installed to facilitate the handling of the hoist hook. The grab ring rotates freely around the hook bumper to avoid torsional loads of the cable.

F M S 9.2-12

SUPPLEMENT FOR

EXTERNAL LOUDSPEAKERS

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the EXTERNAL LOUDSPEAKERS have been installed.

System/Equipment Designation	Part No.	Effectivity
External loudspeakers	B853M1801051	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 23. Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
9.2-12-1	–		9.2-12-5	0				
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9.2-12-3	0							
9.2-12-4	0							

LOG OF REVISIONS

FIRST ISSUE

ORIGINAL REV. 0 OCT, 2001

FOLHA 3/80
PROC.053000716/2012
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1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

Maximum continuous siren operating time ..... 15 s

NOTE Apply 15 s cool down after each siren operation (SIREN sw OFF).

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

4.1.1 Exterior check

External horn speakers	– Condition, secured
Electric plug connections	– Tightened

4.1.2 Interior check

POWER sw (control unit)	– OFF

4.1.3 System check

CAUTION BEFORE PERFORMING A SYSTEM CHECK BE SURE NO ONE WILL BE DANGEROUSLY SURPRISED BY THE LOUD AUDIO FROM THE EXTERNAL LOUDSPEAKER SYSTEM.

For system check procedure refer to 4.2 Operation.

4.2 OPERATION

4.2.1 Public address operation

COMM CONTROL selector knob (pilot/copilot/operator)	– LS or PA
POWER sw (control unit)	– ON; Check POWER ON light comes on
PA/RADIO sw (control unit)	– Check in position PA

When pressing the ICS RADIO button on the cyclic stick, any message spoken to the head set microphone will be delivered through the horn speakers for external paging.

When system operation is no longer intended:

POWER sw	– OFF
COMM CONTROL selector knob (pilot/copilot/operator)	– As desired

4.2.2 Siren operation

COMM CONTROL selector knob (pilot/copilot/operator)	– LS or PA
PA/RADIO sw (control unit)	– Check in position PA
SIREN sw	– Set as required

When system operation is no longer intended:

SIREN sw	– OFF
POWER sw	– OFF
COMM CONTROL selector knob (pilot/copilot/operator)	– As desired

5 PERFORMANCE DATA

5.1 AEO AND OEI MAXIMUM RATE OF CLIMB

All results obtained from the respective diagram, contained in section 5 of the basic flight manual, are to be corrected as follows:

GM < 2400 kg:	subtract 45 ft/min
2400 kg ≤ GM < 3000 kg:	subtract 35 ft/min
GM ≥ 3000 kg:	subtract 25 ft/min

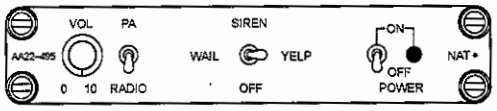
NOTE The reduction in climb rate is not depending on power settings.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The external loudspeaker system consists of two loudspeakers, mounted in a common pod, a control unit mounted in the center or slant console (see fig. 1), an audio power amplifier mounted underneath the cockpit floor and associated wiring and switches (see fig. 2). The loudspeakers are installed underneath the helicopter, attached at the forward crosstube, pointing forward and 30° downward with regard to the longitudinal axis of the helicopter. The control unit provides a central adjustment for external aircraft paging functions. When it is turned on, an activation signal is sent to the audio power amplifier.



SWITCH	POSITION	FUNCTION
POWER	ON	Switches the system on.
	OFF	Switches the system off.
SIREN	YELP	Activates a fast rate sweeping alarm signal for external paging via horn speakers
	WAIL	Activates a slow rate sweeping alarm signal for external paging via horn speakers
	OFF	Siren signal switched off
PA/RADIO sw	PA	Public address
	RADIO	Function not active
VOL	0 - 10	Rotary control knob for volume control of the siren and voice output signal. Normal position for external paging is 5–10.

Fig. 1 Control unit

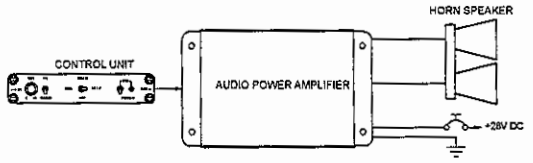


Fig. 2 System configuration

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F M S 9.2-13

SUPPLEMENT FOR

FIXED LANDING LIGHT(S) 250W (CROSS TUBE)

This supplement shall be attached to the BK117 C–2 flight manual (subsection 9.2) when the FIXED LANDING LIGHT(S) 250W (CROSS TUBE) has been installed.

System/Equipment Designation	Effectivity
Fixed landing light 250W (cross tube)	All
Landing light, parallel operation: Nose & cross tube mounted	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 9.5.2009

Approved by:
Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R 9.2-13-1	3		R 9.2-13-4	3				
R 9.2-13-2	3		9.2-13-5 /(Blank)	1				
R 9.2-13-3	3							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL,		May, 2001
Revision	1	Dec 05, 2002
Revision	2	June 10, 2004
Revision	3	(see entry below)

REVISION 3 Approved by EASA:

Date: Oct 24, 2006 EASA approval no.: R.A.01198

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

2.1 OPERATION

Fabric glare shields shall be installed for night operations with the landing light.

3 EMERGENCY AND MALFUNCTION PROCEDURES

During flight with emergency power supply (battery), reduce the use of the fixed landing light (s) to a minimum.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

Fixed landing light (s)	– Condition
Before night flights:	
Fixed landing light (s)	– Function

4.2 OPERATION

LL FIX sw	– ON, the green advisory light LDG LIGHT comes on on the CAD

NOTE Switch off landing light prior to engine shutdown.

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

EFFECTIVITY Fixed landing light 250W (cross tube)

The cross tube-mounted, fixed landing light is rigidly attached to the front cross tube at the RH side of the helicopter (see fig.1), so that the landing area is illuminated at an angle of 8°.

It receives power from No. 1 DC essential bus via LDG LIGHTS circuit breaker, located on the overhead panel (see basic flight manual, section 7, fig. 7-4).

The control switch is installed on the pilot's and on the copilot's collective lever (if dual controls have been installed), see fig.1.

EFFECTIVITY Landing light, parallel operation: Nose & cross tube mounted (LH)

In addition to the fixed landing light mounted in the nose cover, a fixed landing light 250 W is rigidly attached to the front cross tube at the LH side of the helicopter (see fig.1), so that the landing area is illuminated at an angle of 8° .

The cross tube-mounted, fixed landing light receives power from No. 1 non essential bus via an additional circuit breaker, located in the additional circuit breaker panel installed under the pilot collective grip.

The control switch is installed on the pilot's and on the copilot's collective lever (if dual controls have been installed), see fig.1 and operates both lights simultaneously.

EFFECTIVITY All

The fabric glare shields are installed in the lower part of the cockpit to reduce glare from the landing light.

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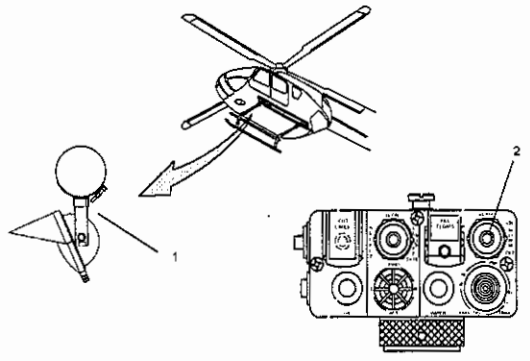

1 Fixed landing light 250W (cross tube LH or RH)
2 LL FIX switch on the collective lever

Fig. 1 Locations – light and control switch

8 HANDLING, SERVICING, AND MAINTENANCE

Clean class dome with tissue if it is dirty, or if it was touched with fingers.

F M S 9.2-14

SUPPLEMENT FOR

FLIGHT CONTROL DISPLAY SYSTEM

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the FLIGHT CONTROL DISPLAY SYSTEM is installed.

System/Equipment Designation	Effectivity
Dual FCDS	
4-screen version: 4x SMD 45H	All
3-screen version: 2x SMD 45H and 1x SMD 68	All
Single FCDS	
2x SMD 45H	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 23.5.2001

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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LEP – EASA approved (part 1):

	Page	Rev.No	Rem		Page	Rev.No	Rem	Page	Rev.No	Rem
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	9.2-14 -5	8			9.2-14 -16	8		9.2-14 -27	8	
	9.2-14 -6	8			9.2-14 -17	8		9.2-14 -28	8	
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	9.2-14 -10	8			9.2-14 -21	8				
	9.2-14 -11	8			9.2-14 -22	8				

LEP – manufacturer's data (part 2):

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9.2-14 -31	8		9.2-14 -42	8		9.2-14 -53	8	
9.2-14 -32	8		9.2-14 -43	8		9.2-14 -54	8	
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9.2-14 -37	8		9.2-14 -48	8				
9.2-14 -38	8		9.2-14 -49	8				
9.2-14 -39	8		9.2-14 -50	8				
9.2-14 -40	8		9.2-14 -51	8				

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LOG OF REVISIONS

FIRST ISSUE

ORIGINAL, REV.	0	MAY, 2001	REVISION	6	Aug 31, 2005 EASA APPROVAL NO. R.C.01221
REVISION	1	OCT 29, 2001	REVISION	7	MAY 23, 2006
REVISION	2	MAR 04, 2002	REVISION	7.1	MAY 29, 2006
REVISION	3	APR 10, 2002	REVISION	8	MAI 28, 2010 EASA APPROVAL NO. 10030144
REVISION	4	SEP 23, 2002	REVISION	9	(see entry below)
REVISION EASA APPROVAL NO. 2004-5404	5	MAY 05, 2004			

REVISION 9 — Approved by EASA

Date: JUL 11, 2012 — EASA approval no.: 10040577

TABLE OF CONTENTS

LIST OF FIGURES

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

1.1 INTRODUCTION

The flight control display system (FCDS) replaces the conventional electro-mechanical primary flight instruments and NAV indicators by electronic flight displays, utilizing 4" by 5" and 6" by 8" liquid crystal displays. The system presents primary flight data on the PFD (primary flight display) and navigational data on the ND (navigation display).
Two independently operating flight control display modules (FCDM) perform all the data processing necessary to build up the display presentations.

The FCDS comprises the following main components:

***EFFECTIVITY** Dual FCDS*

- 4–screen version: Four SMD 45 H (smart multifunction displays) or
- 3–screen version: Two SMD 45 H and one SMD 68

***EFFECTIVITY** Single FCDS*

- Two SMD 45 H (smart multifunction displays)

***EFFECTIVITY** All*

- Dual FCDM (flight control display modules)
- Dual ICP (instrument control panels)
- One RCU (reconfiguration control unit)

The FCDS, in conjunction with AHRS (attitude and heading reference system), ADC (air data computer) and appropriate peripheral radio and navigation systems (GPS etc.), represents an integrated and interactive digital avionic system providing all necessary information for flight guidance.

Several conventional instruments (airspeed indicator, baro altimeter, stand-by horizon, triple RPM indicator) serve as back-up in case of system failure.

In conjunction with an optionally installed video radar unit (VRU) and appropriate sensors, video images such as weather radar, digital map, and FLIR can be displayed the SMD 68 and/or on the SMD 45ND.

These optional configurations are described in para. 7.9

1.2 ABBREVIATIONS USED IN THIS SUPPLEMENT

A	ADC	– Air data computer
	ADF	– Automatic direction finder
	AFCS	– Automatic flight control system
	AHRS	– Attitude and heading reference system
	ALT	– Altitude hold mode
B	BRG	– Bearing
C	CPDS	– Central panel display system
	CDI	– Course deviation indicator
D	DH	– Decision height
	DME	– Distance measurement equipment
	DST	– Distance to go
		–
F	FCDM	– Flight control display module
	FCDS	– Flight control display system
	FLIR	– Forward looking infra red
G	G/S	– Glideslope
H	HDG	– Heading hold mode
	HSI	– Horizontal situation indicator
I	IAS	– Indicated airspeed
	ICP	– Instrument control panel
	ILS	– Instrument landing system
L	LOC	– Localizer
N	NAV	– Navigation
	ND	– Navigation display
P	PFD	– Primary flight display
R	RA	– Radar altimeter
	RCU	– Reconfiguration control unit
S	SMD	– Smart multifunction display
	SMD 45 H	– SMD; 4 x 5 inches, for helicopter
	SMD 68CVN	– SMD; 8 x 6 inches (Cooling, Video, NVG)
T	TTG	– Time to go
U	UL	– Upper limit
V	V_{NE}	– Never-exceed speed
	VDA	– Video direct access
	VOR	– Very high frequency omnidirectional radio ranging
	VRU	– Video radar unit
	VS	– Vertical speed
W	WXR	– Weather radar

2 LIMITATIONS

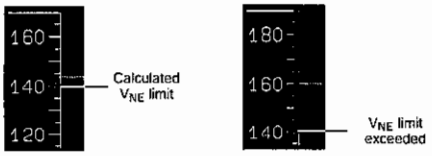
2.1 TEMPERATURE LIMITATIONS

On ground:

Max. operating time if OAT ≥ +40°C ..... **20 min.**

2.2 INSTRUMENT MARKINGS

2.2.1 Airspeed indicator



A red bar located in the airspeed scale indicates the calculated V_{NE} limit. If the airspeed overshoots the V_{NE} limit, a specific red vertical strip is displayed between the V_{NE} limit and the top of the airspeed scale.

A red/yellow dashed mark at 90 kts in the airspeed scale indicates the max. V_{NE} limit for steady autorotations.

NOTE For applicable V_{NE} limit under various atmospheric conditions refer to V_{NE}-tables in section 2 of the basic flight manual.

2.3 OPERATIONAL LIMITATIONS

Permitted page selections on FCDS for IFR–Operation

SMD 45	Non-flying pilot (*)	Flying pilot
PFD	PFD or PFD composite	PFD or PFD composite
ND	HSI or	HSI or
	Sector or	Sector or
	WXR + Sector or	WXR + Sector
	WXR only(1) or	–
	MAP only(1) or	–
	FLIR only(1)	–
SMD 68	DPIFR operation only PFD / HSI is permitted. For SPIFR any page selection is permitted.	

(*) if dual FCDS installed; (1) not permitted during DPIFR approach

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3 EMERGENCY AND MALFUNCTION PROCEDURES

CAUTION CARE MUST BE TAKEN WHEN RE–CONFIGURING SENSORS VIA THE RCU. INADVERTENT SELECTION OF A FAILED SENSOR MAY LEAD TO AN ADDITIONAL LOSS OF FLIGHT INFORMATION AND/OR AUTOPILOT FUNCTION AND AS A RESULT IT MAY LEAD TO A SIGNIFICANT INCREASE IN PILOT WORKLOAD.

3.1 CAUTION INDICATIONS (on CAD)

CAUTION INDICATIONS

FLI DEGR (SYSTEM 1) and **P0 DIS** and **FLI DEGR** (SYSTEM 2)

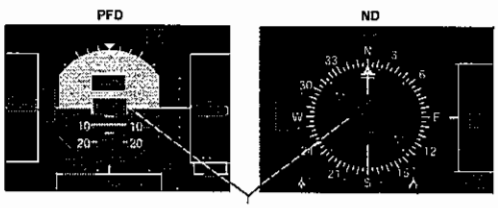
Conditions/Indications

- The three Caution Indications FLI DEGR (System 1) and P0 DIS and FLI DEGR (System 2) appear simultaneous.
- Discrepancy between both P0 sensors detected (Static system failure and/or ALTERNATE Static Pressure SOURCE selected, see also para 3.7.7 of the basic Flight Manual).
- Calculations for compensated N1 indication of both engines are affected.
- V_{NE} indication is invalid.

Procedure

1. ADC sw on the RCU – From N to the operating system

3.2 FCDS FAILURE INDICATIONS (RED)



NOTE For messages " i " indicates 1 or 2, depending on the affected side, e.g. VORi means VOR1 or VOR2.

FAILURE INDICATIONS

CHECKCONF	or	CHECKCONF
or		or
MISMATCH		MISMATCH
or		or
PINPROG		PINPROG
(Copilot*)		(Pilot)

Conditions/Indications

Major problem with configuration of the system

Procedure

System must be serviced

(* – if dual FCDS is installed)

FAILURE INDICATIONS

FCDM1 (Copilot*) or FCDM2 (Pilot)

NOTE • DME controllability (via NMS) is lost when FCDM2 is inoperative.

• ADF controllability** (via NMS) is lost when FCDM1 is inoperative.

Conditions/Indications

Failure of one FCDM. Blank PFD and ND on the associated side.

– CHECK FCDM message on other side PFD and ND, if installed.

Procedure

1. FCDM sw on the RCU – From N to the remaining system

CAUTION INADVERTENT SELECTION OF THE FAILED FCDM WILL LEAD TO AN ADDITIONAL LOSS OF FLIGHT INFORMATION AND/OR AUTOPILOT FUNCTION.

NOTE • FCDM1 (or 2; the failed one) reconfiguration message appears on all SMDs.

• Monitoring tests will concern only sensors and displays.

EFFECTIVITY *VFR operation*

2. Continue flight

EFFECTIVITY *IFR operation*

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

NOTE Due to loss of discrepancy checking, cross check with back-up instruments is recommended.

(* – if dual FCDS is installed)
(** – only applicable if ADF/DF combination is installed)

FAILURE INDICATIONS

AHRS1 (Copilot*) or AHRS2 (Pilot)

Conditions/Indications

Failure of one AHRS.

– No attitude, heading and vertical speed data of the respective system provided.

–

– ATT and HDG discrepancy message on other side SMDs, if installed.

Procedure

1. AHRS sw on the RCU – From N to the remaining system

CAUTION INADVERTENT SELECTION OF THE FAILED AHRS WILL LEAD TO AN ADDITIONAL LOSS OF FLIGHT INFORMATION AND/OR AUTOPILOT FUNCTION.

NOTE AHRS1 (or 2; the failed one) reconfiguration message appears on all SMDs.

EFFECTIVITY *VFR operation*

2. Continue flight

EFFECTIVITY *IFR operation*

2. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

NOTE Due to loss of discrepancy checking, cross check with back-up instruments is recommended.

(* – if dual FCDS is installed)

FAILURE INDICATIONS

AHRS1 (Copilot*) and AHRS2 (Pilot)

Conditions/Indications

Failure of both AHRS.

– No attitude, heading and vertical speed data

Procedure

1. Standby instruments – Use as reference
2. PFD – Select composite display

NOTE ADF bearing available on HSI. VOR course deviation available on composite.

EFFECTIVITY *VFR operation*

3. Continue flight

EFFECTIVITY *IFR operation*

3. **LAND AS SOON AS POSSIBLE**

EFFECTIVITY *All*

(* – if dual FCDS is installed)

FAILURE INDICATIONS

ADC1 (Copilot*) or ADC2 (Pilot)

Conditions/Indications

Failure of one ADC.

– No altitude and airspeed data of the respective computer provided.

– IAS and ALT discrepancy message on other side SMDs, if installed.

Procedure

If **ADC1** caution indication is displayed continue with step 2., if **ADC2** caution indication is displayed start with step 1.

1. Procedure for **VAR NR** caution indication – Perform
2. ADC sw on the RCU – From N to the remaining system

NOTE • ADC1 (or 2; the failed one) reconfiguration message appears both PFDs, if installed.

• Both side barometric pressure settings are controlled by the BARO sw on the ICP corresponding to the remaining ADC, i.e. if ADC2 failed both side baro pressure setting are controlled by ICP1. As a consequence the pressure setting on both PFDs (if installed) will be the same except when using the STD button which remains independent (STD button is presently inactive and covered).

3. Barometric pressure setting – Check
4. Continue flight

NOTE Due to loss of discrepancy checking, cross check with back-up instruments is recommended.

FAILURE INDICATIONS

ICP1 (Copilot*) or ICP2 (Pilot)

Conditions/Indications

Failure of one ICP. The FCDS can not be controlled by the failed ICP (except BARO sw).

Procedure

1. ICP sw on the RCU – From N to the remaining system

NOTE • ICP1 (or 2; the failed one) reconfiguration message appears on all SMDs.

• Barometric pressure setting for the appropriate side should still be controlled by the BARO sw on the failed ICP.

2. Continue flight

(* – if dual FCDS is installed)

FAILURE INDICATIONS

One or more of the following indications may appear if optionals are installed:

ADF and/or DF and/or VORi and/or ILSi

GSi and/or LOCi and/or RA and/or GPS and/or NMS

NOTE For messages " i " indicates 1 or 2, depending on the affected side, e.g. VORi means VOR1 or VOR2.

Conditions/Indications

Failure of associated equipment. A message is displayed on or near the concerned indicator on pilot's and copilot's side, if installed.

- ADF, DF,VORi, ILSi, GPS and NMS Failure of the nav equipment
- LOCi and GSi — Failure of the localizer and glideslope deviation
- RA — Failure of the radar altimeter

Procedure

1. Affected equipment — Check
2. Continue flight

EFFECTIVITY *If VRU is installed*

FAILURE INDICATIONS

VRU

(on video pages)

Conditions/Indications

Failure of VRU. No video images available

Procedure

1. ICP — Press ND button to change page to PFD/HSI or sector as appropriate

CAUTION ONLY FCDM, ICP AND VRU INDICATIONS ARE SHOWN ON VIDEO PAGES. TO CONFIRM ALL OTHER FAILURES SELECT PFD AND HSI/ SECTOR MODE.

EFFECTIVITY *All*

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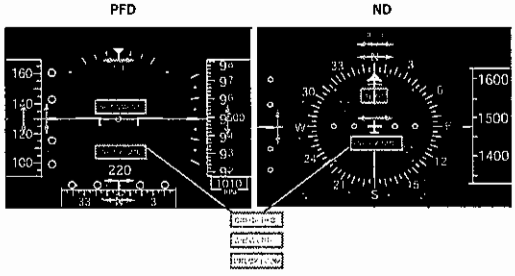
3.3 **FCDS FAILURE INDICATIONS (AMBER/WHITE)**

PFD ND



FAILURE INDICATIONS

CHECK FCDM

Conditions/Indications

Cross-talk discrepancy between both FCDMs or failure of one FCDM.

Procedure

If FCDM1(or 2) failure message on the other side SMDs, if installed:

1. Refer to respective failure procedure

If CHECK FCDM failure message on all SMDs:

1. PFD and ND — Cross check with back-up instruments
2. FCDM sw on the RCU — From N to the correct working system

NOTE FCDM1 (or 2; the failed one) reconfiguration message appears on all SMDs.

EFFECTIVITY *VFR operation*

3. Continue flight

EFFECTIVITY *DPIFR operation*

3. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

FAILURE INDICATIONS

F

(on PFD or ND on SMD 45)

Conditions/Indications

Failure of respective SMD 45.

- Failed SMD (PFD or ND) screen blank with a large white F displayed.

Procedure

1. OFF button of the failed SMD — Press twice to attempt re-set of failed SMD

NOTE SMD symbology should re-appear within 30 seconds.

If re-set is not successful:

2. OFF button of the failed SMD — Press

NOTE The remaining SMD turns automatically into the PFD COMPOSITE mode.

3. Continue flight

EFFECTIVITY *If 3– screen version installed*

FAILURE INDICATIONS

F

(on SMD 68)

Conditions/Indications

Failure of SMD 68.

- Failed SMD 68 screen blank with a large green F displayed. No reset procedure is possible.

Procedure

1. Continue flight

EFFECTIVITY *All*

FAILURE INDICATIONS

(on PFD and ND on SMD 45)

Conditions/Indications

Both SMD 45 on one side failed

Procedure

1. Standby instruments – Use as reference
2. OFF button of the failed SMDs – Press twice to attempt re-set of failed SMDs

NOTE Navigation data available on other side ND, if installed or backup CDI and DME, if single FCDS installed.

EFFECTIVITY *VFR operation*

3. Continue flight

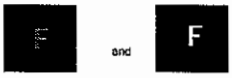
EFFECTIVITY *IFR operation*

3. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

EFFECTIVITY *If 3– screen version installed*

FAILURE INDICATIONS



(on SMD 68) (on PFD or ND on SMD 45)

Conditions/Indications

SMD 68 on copilot side and one SMD 45 on pilot side failed

NOTE The remaining SMD 45 turns automatically into the PFD COMPOSITE mode.

Procedure

1. Standby instruments – Use as reference
2. OFF button of the failed SMD45 – Press twice to attempt re-set of failed SMD45

NOTE SMD symbology should re-appear within 30 seconds.

If re-set is not successful:

EFFECTIVITY *If under VFR operation*

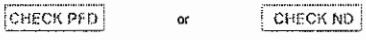
3. Continue flight

EFFECTIVITY *If under SPIFR operation according to FMS 9.2–8*

3. LAND AS SOON AS PRACTICABLE

EFFECTIVITY *All*

FAILURE INDICATIONS



(on both screens)

Conditions/Indications

Malfunction of respective SMD.

Procedure

1. OFF button of the failed SMD – Press

NOTE The remaining SMD turns automatically into the PFD COMPOSITE mode.

2. Continue flight

FAILURE INDICATIONS

Conditions/Indications

Sensor cross-talk discrepancy. An double-ended arrow is displayed on or near the concerned indicator on pilot's and copilot's side (if installed), flashing for 10 seconds, then remaining steady during time of discrepancy.

The arrows indicate discrepancy between the following sensors:

a) – attitude – heading
– airspeed – standard altitude
b) – glideslope – localizer
c) – ILS frequency

Procedure for a)

1. PFD and ND – Cross check with back-up instruments
2. Respective sw on the RCU – From N to the correct working system

NOTE Respective reconfiguration message (the failed one) appears on all SMDs.

3. Continue flight

Procedure for b)

1. Approach – Go around if necessary
2. ILS – Cross check indications and select good ILS as NAV source
3. PFD mode select pb – Select PFD composite mode
4. Continue flight

Procedure for c)

1. Approach – Go around if necessary
2. NAV 1 and 2 – Check frequency, set correct frequency on both
3. Continue flight

FAILURE INDICATIONS

CHECK SMD
(on PFD and ND)

Conditions/Indications

Cross-talk discrepancy between displays. Failed display can not be identified by FCDS.

Procedure

1. PFD and ND – Cross check with opposite PFD and ND (if installed) and back-up instruments
2. OFF button of the failed SMD – Press

NOTE The remaining SMD turns automatically into the PFD COMPOSITE mode.

3. Continue flight

FAILURE INDICATIONS

ALIGNMENT (on PFD) or ALIGN (on ND)

Conditions/Indications

AHRS in alignment phase.

– No attitude ball indication on PFD and no heading indication on ND

Procedure

● **ON GROUND**

None (normal operation during power-up procedure)

NOTE If ALIGNMENT indication does not disappear within 40 seconds a failure of AHRS equipment should be assumed.

● **IN FLIGHT**

NOTE Power supply to AHRS had been interrupted previously, e.g. AVIONIC MASTER sw(s) OFF/ON.

1. Straight and level flight – Perform for at least 90 sec
2. PFD and ND – Cross check with back-up instruments
3. Continue flight

FAILURE INDICATIONS

F A N
(on PFD and ND)

Conditions/Indications

Failure of the avionic cooling ventilation on respective side is detected after pressing the TST pushbutton on ICP during preflight procedures. A FAN failure is confirmed if the failure indication remains on after self test completion.

Procedure

1. OAT – Check
2. Continue flight

EFFECTIVITY *If VRU is installed*

FAILURE INDICATIONS

NO WXR (if weather radar installed)
NO MAP (if digital map installed)
NO FLIR (if FLIR installed)
(on video pages)

Conditions/Indications

Respective sensor failed or is not switched on.

Procedure

1. Sensor – Check on

If failure indication remains on:

2. ICP – Select other page

FAILURE INDICATIONS

CHECK MAP (if digital map installed)
(on map pages)

Conditions/Indications

Incompatible map orientation between SMD 68 and SMD 45.

Procedure

1. ICP – Select another page or a compatible map page.

FAILURE INDICATIONS

CHECK RNG (if weather radar installed)
(on WXR/WXR+sector pages)

Conditions/Indications

Range not valid for WXR.

Procedure

1. ICP – Press range select button (▲or ▼)to select a valid range

CAUTION ONLY FCDM, ICP AND VRU INDICATIONS ARE SHOWN ON VIDEO PAGES. TO CONFIRM ALL OTHER FAILURES SELECT PFD AND HSI/ SECTOR MODE.

EFFECTIVITY *All*

4 NORMAL PROCEDURES

4.1 PREFLIGHT PROCEDURES

NOTE
- Before starting engines, make sure that no power is applied to the FCDS; transient voltages as occur during engine start may induce premature failures.
- The FCDS may not power up correctly if all FCDS equipments do not power up at the same time. Ensure all FCDM, PFD and ND circuit breakers are in before applying power to the system.
- Standby horizon (if installed) should be caged before starting engines.

When power is initially applied to the FCDS (AVIONIC MASTER switches ON), a self test is performed automatically. During self test a large white T is displayed on all SMDs. After approx. 30 sec default PFD and ND images appear.

RCU controls – Check N and MASTER to R

NOTE In order not to lose flight safety provided by FCDS architecture, it is recommended to select normal configuration.

CAUTION DO NOT PUSH TST PB ON ICP IN FLIGHT.

TST pb on ICP (pilot/copilot*) – Press and hold: (rack fans will be checked);
Check white TST indication on PFD and ND come on; a FAN message may come on briefly

DH knob on ICP (pilot/copilot*) – Set DH ≥ 50 ft;
Check DH indication on PFD and audio alarm (permanent audio tone) or, as an option "DECISION HEIGHT" (once only) aural alert comes on

SMDs – Check FAN message off

TST pb on ICP (pilot/copilot*) – Release;
Check RA indicates 0 ft

DH knob on ICP (pilot/copilot*) – Set DH 0 ft;
Check DH indication on PFD and audio alarm (permanent audio tone) go off

Desired display presentation – Select

CAUTION BRIGHTNESS HAS TO BE ADJUSTED PROPERLY TO MAKE SURE THAT RED FAILURE INDICATIONS CAN BE RECOGNIZED.

BRT control knob – Adjust for desired display illumination

(* – if dual FCDS is installed)

4.2 INFLIGHT OPERATION

NOTE For detailed information on display modes and controls refer to section 7 of this supplement.

EFFECTIVITY *If VRU and AFCS are installed*

CAUTION IF HEADING INFORMATION IS NOT AVAILABLE DUE TO SELECTION OF A VIDEO PAGE, BE CAUTIOUS BEFORE ENGAGING AUTOPILOT ROLL MODES (HEADING, ETC.).

EFFECTIVITY *If DH is configured*

CAUTION PRIOR TO IFR APPROACH CHECK CORRECT DH SET. DO NOT ADJUST DH DURING APPROACH.

EFFECTIVITY *All*

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

7.1 FCDS 4 - SCREEN VERSION

The dual flight control display system is a four display arrangement, symmetrically divided in two independent but interactive subsystems (pilot's and copilot's system).

Two similar displays SMD 45 H are located - one above the other - on each side of the instrument panel in direct pilot's/copilot's view. The upper display is normally used as primary flight display (PFD) and the lower one as navigation display (ND). A conventional mechanical slip ball is installed on the lower edge of the PFD.

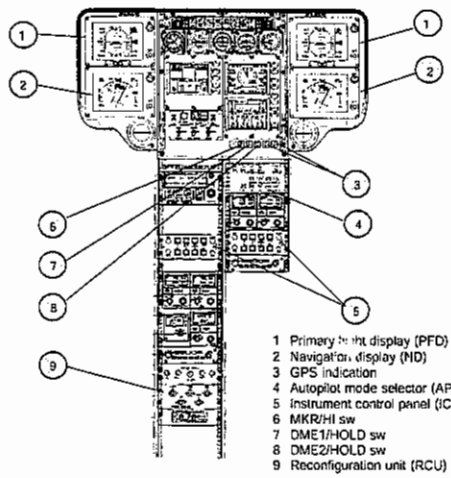


Fig. 1 Typical instrument panel arrangement for SPIFR/DPIFR 4–screen version

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7.2 FCDS 3 - SCREEN VERSION

The Flight Control Display System is a three display arrangement, divided in two independent but interactive subsystems (pilots and copilots system).

Two similar displays SMD 45 H are located - one above the other - on the right side of the instrument panel. One SMD 68 is located on the left side of the instrument panel. The upper SMD 45 display is normally used as Primary Flight Display (PFD) and the lower one as Navigation Display (ND). A conventional mechanical slip ball is installed on the lower edge of the PFD.

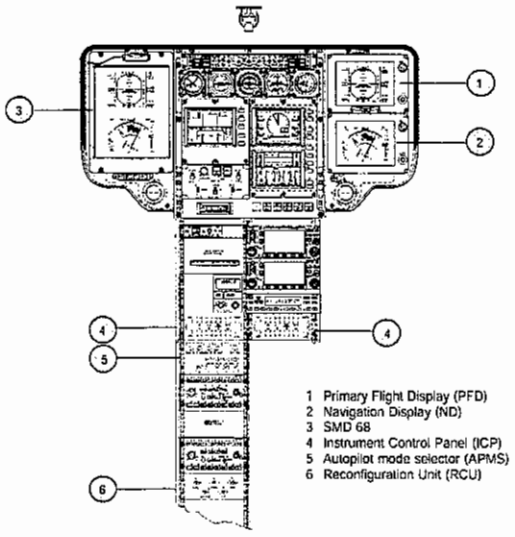


Fig. 2 Typical instrument panel arrangement for SPIFR/DPIFR 3-screen version

7.3 FCDS 2 - SCREEN VERSION

The single flight control display system is a two display arrangement, divided in two independent but interactive subsystems (pilot's channel 2 and channel 1).

Two similar displays SMD 45 H are located - one above the other - on the instrument panel in direct pilot's view. The upper display is normally used as primary flight display (PFD) and the lower one as navigation display (ND). A conventional mechanical slip ball is installed on the lower edge of the PFD.

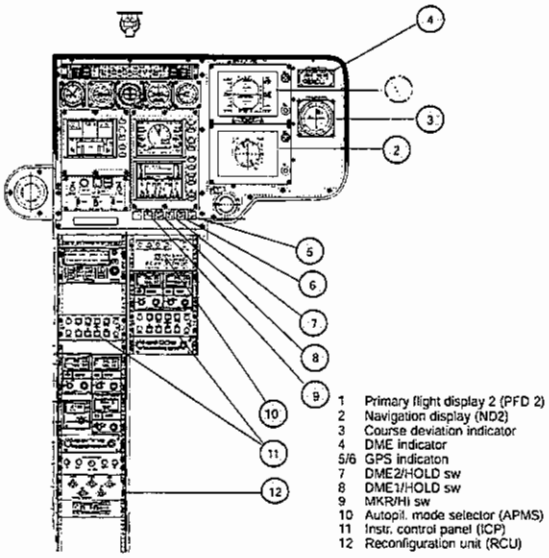


Fig. 3 Typical instrument panel arrangement for SPIFR with AFCS 2–screen version

7.4 SYSTEM ARCHITECTURE

7.4.1 FCDS 4–screen version

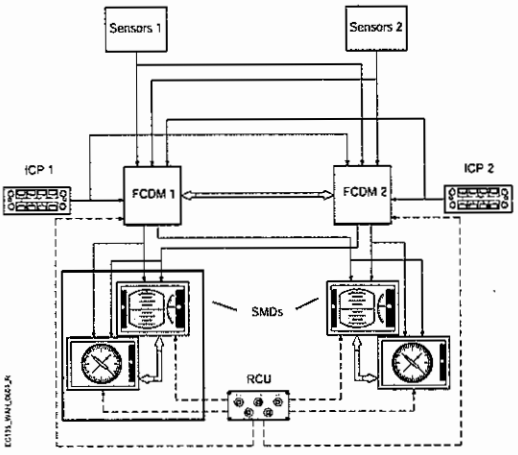


Fig. 4 FCDS system architecture 4–screen version

The dual architecture is based on two separate channels. The pilots channel is designated No. 2, the copilots channel No. 1. Each channel is composed of dedicated or shared sensors (ADC, AHRS, RA, radio-nav), one processing module (FCDM) and two displays (SMD 45 H). So, in normal operation, each crew member can see on his displays the parameters provided by his sensors where relevant. Comparisons are performed between sensors data in order to detect discrepancy and manual reconfiguration is possible in case of failure.

In order to control the display configuration, each crewmember, pilot and copilot, has an instrument control panel (ICP) at his disposal.

In case of failure of the ADC, AHRS, ICP or FCDM, the crew can select the remaining sensor on both sides by means of the RCU (reconfiguration control unit).

In case of failure of one display, a PFD COMPOSITE page on the remaining screen can be visualized by switching off the failed display.

7.4.2 FCDS 3–screen version

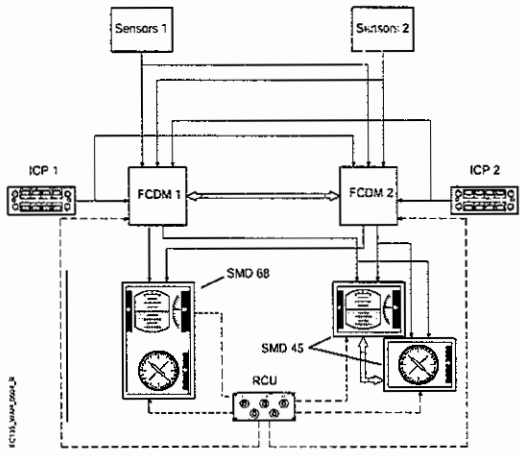


Fig. 5 FCDS 3 screen system architecture

The architecture is based on two separate channels. The pilots channel is designated No. 2, the copilots channel No. 1. Each channel is composed of dedicated or shared sensors (ADC, AHRS, RA, radio-nav), one processing module (FCDM) two displays SMD 45 H on pilot side one display SMD 68 on copilot side. So, in normal operation, each crew member can see on his displays the parameters provided by his sensors where relevant. Comparisons are performed between sensors data in order to detect discrepancy and manual reconfiguration is possible in case of failure.

In order to control the display configuration, each crewmember, pilot and copilot, has an instrument control panel (ICP) at his disposal.

In case of failure of the ADC, AHRS, ICP or FCDM, the crew can force the remaining sensor on both sides by means of the RCU (Reconfiguration control unit).

In case of failure of one SMD 45 display, a PFD COMPOSITE page on the remaining SMD 45 screen can be visualized by switching off the failed display.

7.4.3 FCDS 2–screen version

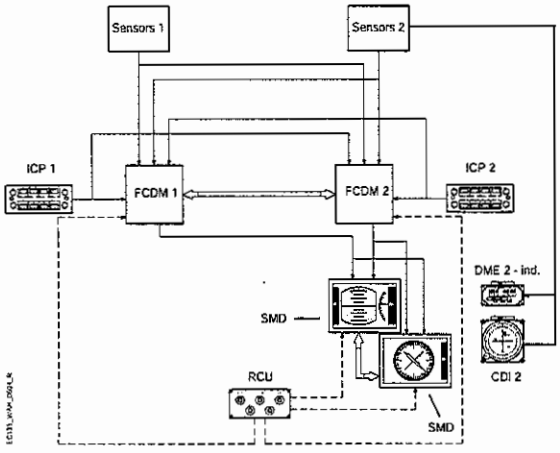


Fig. 6 FCDS 2-screen system architecture

The architecture is based on two separate channels. The pilots channel is designated No. 2. Channel No. 2 is composed of dedicated or shared sensors (ADC, AHRS, RA, radio-nav), one processing module (FCDM2) and two displays (SMD 45 H). Channel No. 1 is composed of dedicated or shared sensors (ADC, AHRS, RA, radio-nav) and one processing module (FCDM1). In normal operation, the pilot can see on his displays the parameters provided by his sensors where relevant. Comparisons are performed between sensors data in order to detect discrepancy and manual reconfiguration is possible in case of failure.

In order to control the display configuration the pilot has an instrument control panel (ICP).

In case of failure of the ADC, AHRS, ICP or FCDM, the pilot can select the remaining sensor by means of the RCU (reconfiguration control unit).

In case of failure of one display, a PFD COMPOSITE page on the remaining screen can be visualized by switching off the failed display.

7.5 ICP FUNCTIONS AND CONTROLS

During normal operation, the pilot controls his displays by means of his ICP. This control panel permits to set the necessary parameter for the flight, to select the display formats or the navigation sources. All actions on the ICP controls are shown to the crew by means of blinking of the associated symbol on the display or obvious change of page.

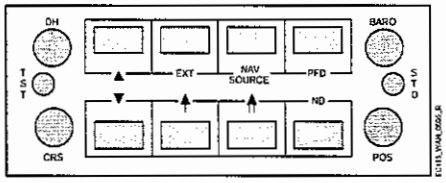


Fig. 7 Instrument control panel (ICP)

The following controls are provided:

Decision height (upper limit) knob

DH

Pressing the knob toggles between DH and UL (optional). Rotating the decision height selector knob changes the decision height/upper limit value to the desired one. The speed of change depends on the control rate-of-turn.

CAUTION CHECK THAT THE RESPECTIVE PARAMETER (UL OR DH) TO BE CHANGED IS UNDERLINED BEFORE MAKING THE CHANGE. CHECK THAT THE DH VALUE HAS NOT CHANGED AFTER CHANGING THE UL VALUE.

Test pb

T S T

Pushing the button initiates the self-test of the rack-fans and as an option the radar altimeter. The messages TST and FAN (only if the fans are not already running) appear, both fans switched on and message FAN disappears if the fans are o.k.

CAUTION DO NOT PUSH TST PB ON ICP WHEN TWIST GRIPS ARE SET TO FLIGHT POSITION.

Course selector knob

Rotating the course selector knob moves the course pointer to the desired course.
Pushing the knob slews the course pointer and the digital readout to the bearing value of the selected nav-aid (bearing station) in case of VOR mode, or to the lubber in case of ILS mode.

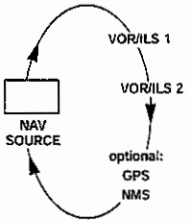
Range up pb

Is used to select the next higher range to be displayed in SECTOR or WXR mode. Range values are available from 0.25 nm up to 500 nm (equivalent to total ranges of 0.5 nm to 1000 nm on the edge of the sector) depending on the configuration.

Range down pb

Is used to select the next lower range to be displayed in SECTOR or WXR mode. Range values are available from 500 nm down to 0.25 nm depending on the configuration.

Navigation source pb

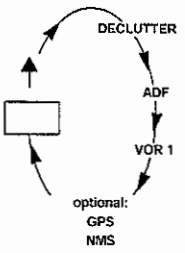


Is used to select the primary navigation sensor to be referenced. The type and the number of sensors depends on the installed configuration.

If only one sensor is installed, the sensor annunciator on the display does not show any system number.

ILS data selected by the NAV SOURCE pb are displayed on the ND. In order to have the best safety when an ILS is selected and independently of the NAV SOURCE selection, the cross side ILS and HDG data are displayed on the PFD. (ILS 1 on PFD 2 and vice versa).

Single pointer pb

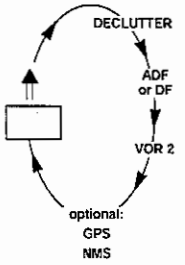


Is used to select the bearing pointer sensor of system 1 to be referenced. The type and the number of sensor are depending on the installed configuration and concern ADF or VOR.

A press of this button sequentially selects the next available sensor. It is also possible to declutter the single pointer.

If only one sensor is installed, this sensor is linked to both systems and the sensor annunciator does not show any system number.

Double pointer pb



Is used to select the bearing pointer sensor of system 2 to be referenced. The type and the number of sensor are depending on the installed configuration and concern ADF or VOR.

A press of this button sequentially selects the next available sensor. It is also possible to declutter the double pointer.

If only one sensor is installed, this sensor is linked to both systems and the sensor annunciator does not show any system number.

External source pb

Optionally this is used to scroll the ND or SMD 68 display between the different video formats . Pushing this button sequentially selects the next available display format. The formats and their order of appearance is set in the configuration file.

ND mode select pb

Is used to scroll the navigation display between the different display formats "HSI mode" and "SECTOR mode". Pushing this button sequentially selects the next available display format.

PFD mode select pb

Is used to scroll the primary flight display between the different display formats "normal PFD" and "composite PFD". Pushing this button sequentially selects the next available display format.

Pressure reference selector knob

Rotating the BARO knob manually changes the pressure setting to the desired value. If STD (see below) is selected, rotating the BARO knob automatically changes the setting from STD to the digital baro pressure value.

Standard pb

Pushing the button sets automatically the pressure setting to the standard value (1013.25 hPa). "STD" is then displayed instead of the previous digital value. Pushing the button again will change the setting back to the manually set value.

Pitch offset knob

Rotating the pitch offset selector knob changes the pitch reference to the desired value in a limited range. Pushing the knob resets the pitch reference value to 0°.

7.6 RCU FUNCTIONS

The RCU (reconfiguration control unit) permits to select a precise unit in case of failure of the nominal one. After reconfiguration some seconds are necessary before having the complete new display. All actions on the RCU controls are shown to the crew by means of specific symbology (e.g. display of the lost sensor).

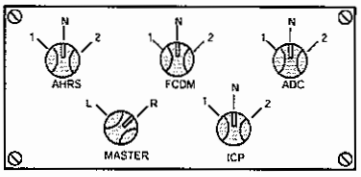


Fig. 8 Reconfiguration control unit (RCU)

The RCU includes the following controls:

- AHRS selector
- ADC selector
- FCDM selector
- ICP selector
- MASTER selector

The following positions are provided on these controls:

- N - the nominal mode; side No. 1 sensors are used for copilot's side (if installed), side No. 2 sensors are used for pilot's side
- 1 - mode to be selected in case of No. 2 failure; side No. 1 sensors are used for both sides
- 2 - mode to be selected in case of No. 1 failure; side No. 2 sensors are used for both sides

MASTER selector (only functional if AFCS is installed)

NOTE The MASTER selector determines the (left or right) source for the AFCS sensors. The switch is INACTIVE if single FCDS is installed.

NOTE • In case of failure of one FCDM, sensors used for each side are the same as in nominal mode (sensors 1 for copilot's side (if installed) and sensors 2 for pilot's side) but the discrepancy tests are no longer performed.

• In case of failure of one ICP the same display formats and the same selected sources are used on both sides but the nominal rules for AHRS and ADC parameters apply.

• In case of failure of one ICP and before reconfiguration, the last memorized modes, controls and data of the failed ICP are used.

7.7 PRIMARY FLIGHT DISPLAY (PFD)

7.7.1 General

The PFD, during normal operation, is the upper one of two SMD 45 displays located in front of the pilot and copilot (if dual FCDS is installed) or the top half of the SMD 68 display for copilot if installed. The PFD provides the following primary flight data:

- Attitude
- Pitch offset setting
- Barometric data (e.g. altitude, baro upper limit)
- AFCS modes and status (if any)
- Radar height, radar height zero, decision height
- airspeed, airspeed tendency and max v_{NE} limit
- side slip indication
- ILS indication
- Failure messages

The PFD can be operated in three formats:

- the NORMAL mode
- the NORMAL mode with ILS and
- the COMPOSITE mode (only SMD 45)

7.7.2 Display controls (SMD 45)

BRT

Rotating the brightness adjustment knob changes the brightness of the displayed symbology image.

OFF

Pushing the OFF pushbutton sequentially deactivates/activates the display.

NOTE If the PFD is deactivated, the respective ND on the same side will automatically display the PFD COMPOSITE page.

7.7.3 Display controls (SMD 68)

BRT- BRT+

Two brightness adjustment buttons are located below the SMD 68. Pushing the right (left) button increases (decreases) the brightness of the displayed symbology image.

CTR- CTR+

Two contrast adjustment buttons are located below the SMD 68. Pushing the right (left) button increases (decreases) the contrast of the displayed symbology image.

7.7.4 PFD NORMAL mode

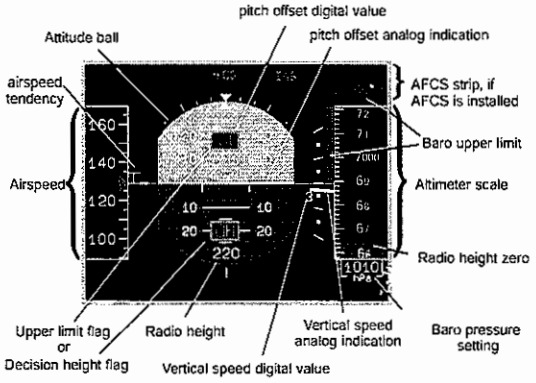


Fig. 9 Typical primary flight display (PFD)

Attitude ball

This symbol gives the current attitude of the helicopter by means of a symbology of artificial horizon type. The roll index is fixed and the roll scale is movable. Whatever the pitch value, the upper part of the horizon ball remains in cyan (sky) and the lower part remains in brown (earth).

Excessive pitch values are displayed by means of herring-bone patterns pointing downwards in the upper part and upwards in the lower part of the scale.

NOTE If the attitude sensor of the side is in alignment phase, the attitude ball is removed and the message ALIGNMENT is displayed.

Pitch offset

If the pitch offset is different of the normal value (0°), the pilot is advised by this symbol giving the value of the pitch offset. For positive pitch offset the value is above the pitch reference and for negative one the value is below the pitch reference.

Altimeter

The baro corrected altitude is displayed with a graduation every 20 ft. A digital value is associated to the graduation every 100 ft.

The baro correction setting (hPa) is displayed in a white box located beneath the altimeter.

Altitude hold mode ALT (if installed) – a triangle (ALT bug) gives an analog indication of the selected altitude. The symbol is not displayed if the ALT mode is not engaged.

Baro upper limit

The baro upper limit is displayed as vertical bar from top of altimeter scale and as digital value on top of altimeter scale on PFD and composite. The default value at power up is the value of the last flight.

The minimum / maximum displayed value is 0 ft to 7998 ft.

An **upper limit flag** is displayed in case of exceedence of selected altitude limits. The flag flashes ten seconds and then remains steady. It disappears as soon as the altitude is lower than the upper limit.

NOTE During UL alarm, the FCDS provides a signal to an audio alarm (optional).

Radio height

A copy of the radio height indication on the navigation display (ND) is displayed in a digital form in the lower part of the attitude ball.

The information is displayed in the case of

- radio height < 500 ft
- radio height ≥ 500 ft and radio height ≤ decision height + 500 ft.

Decision height flag

The decision height flag is displayed when the radio height is lower than the selected decision height. The flag flashes ten seconds and then remains steady. It disappears as soon as the radio height is greater than the decision height.

NOTE During DH alarm, the FCDS provides a signal to an audio alarm.

In addition a brown colored symbol (radio height zero) gives a graphical representation of the ground position on the baro altimeter.

Vertical speed

The vertical speed is displayed between – 9900 ft/min and + 9900 ft/min. An analog scale is given between – 2000 ft/min and + 2000 ft/min with a mark every 500 ft/min:

A digital value gives an information even if the analog information is out of range. The displayed figure is associated to 100 ft/min, e.g. "3" equals 300 ft/min.

NOTE Vertical speed indication may be unreliable in gusty conditions and at airspeeds around 30 kts during fast transition from hover flight into steep descent and from level flight to hover during rapid pull up's.

Airspeed

The airspeed is displayed with a graduation every 5 kts. A digital value is associated to the graduation every 20 kts.

The airspeed tendency indicator gives the predicted airspeed after 5 sec if the acceleration remains constant.

NOTE As airspeed values below 20 kts are unreliable, no precise graduations are shown below this figure.

The maximum V_{NE} is indicated by a red mark at 150 kts. If V_{NE} is exceeded, a vertical red bar appears on the IAS scale until IAS is reduced below V_{NE}. A red/yellow dashed mark at 90 kts in the airspeed scale indicates the max. V_{NE} limit for steady autorotations.

7.7.5 PFD NORMAL mode with ILS

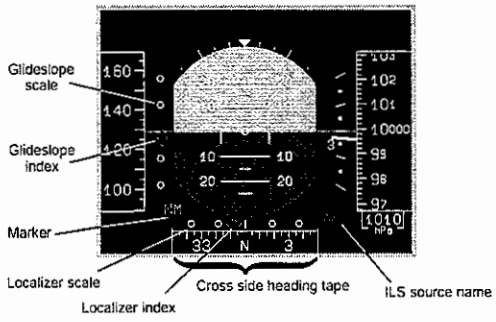
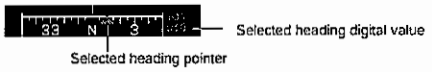


Fig. 10 Typical PFD NORMAL mode with ILS

Heading tape

The heading tape displays the heading with a graduation every 5° and a figure or letter every 30°.

The heading information is provided by the cross side sensor. This allows to display an independent heading to the one normally displayed on the ND.



The selected heading indication is controlled by the AFCS mode selector (if AFCS installed). A green analog pointer in the heading tape and a digital value right side of the heading tape are displayed if the HDG mode of the AFCS is engaged.

Localizer and glideslope

The localizer scale, two dots right and left of the median line, is situated short below the attitude ball. The localizer index is displayed in magenta.

The glideslope scale, two dots above and below the median line, is situated left of the attitude ball. The glideslope index is displayed in magenta.

Marker indication

Depending on the position on the ILS, the following marker indication is displayed if the appropriate beacon is available:

- OM Outer marker
- MM Middle marker
- IM Inner marker

NOTE The marker indication only appears if an ILS frequency is selected on the NAV receiver.

ILS source name

The ILS source name, ILS 1 or ILS 2, is displayed right side of the localizer scale.

NOTE
- ILS data selected by the "NAV SOURCE" control are displayed on the ND. In order to improve safety, when an ILS is selected and independently of the "NAV SOURCE" selection, the cross side ILS data are displayed on the PFD.
- Smaller size letters are used for the ILS source name on the PFD ILS page in order to avoid any confusion between the PFD ILS page and PFD COMPOSITE page. In addition, no course pointers are available on the heading tapes displayed on the screens.

7.7.6 PFD COMPOSITE mode (SMD 45 only)

In case of a display failure (PFD or ND) or deactivation by using the OFF button the remaining display on the same side (pilot's or copilot's (if dual FCDS installed)) changes into COMPOSITE mode, refer to fig. 11. Essential navigation data is added to the PFD NORMAL mode information. Composite mode is also available on the PFD using the PFD button on the ICP.

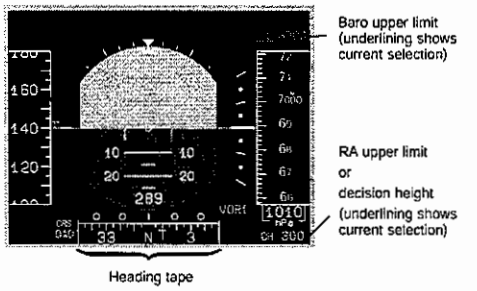


Fig. 11 Typical PFD COMPOSITE mode

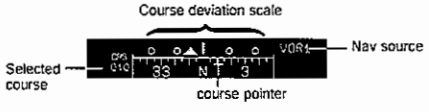
Navigation source name

The navigation source name shows the source selected by the ICP. The following sources are provided: **GPS, NMS, VOR 1, VOR 2, ILS 1, ILS 2** (if the VOR frequency is associated to an ILS).

- VOR, GPS, NMS sources are displayed in cyan.
- ILS sources are displayed in magenta.
- An abnormal configuration is displayed in amber.
- A failure is displayed in red.

NOTE
- The NAV source on the COMPOSITE screen will be the same as that selected on the same side ND.
- Bigger size letters are used for the ILS source name on the COMPOSITE page in order to avoid any confusion between the PFD COMPOSITE page and the PFD ILS page .

Course indication



The selected course is displayed by means of an analog cyan cross-shaped pointer and a digital value left side of the heading tape. The pointer flashes during evolution of the selected course.

Course deviation

A scale similar to the localizer one is displayed above the heading tape. In case of VOR the course deviation is displayed by a cyan triangle.

The TO/FROM symbol is ▲ in case of TO information and ▼ in case of FROM information.

ILS symbology

In case of ILS selection localizer and glideslope indication are the same as in NORMAL mode with ILS.

NOTE In ILS back-course situation, the localizer is not inverted and the glideslope remains displayed.

Decision height

The decision height is displayed by means of a digital value, e.g. DH 300, in the lower right corner of the display. The symbol DH flashes during evolution of the decision height.

7.8 NAVIGATION DISPLAY (NFD)

7.8.1 General

The ND, during normal operation, is the lower one of two displays located in front of the pilot and copilot (if dual FCDS installed) or the lower half of the copilot SMD 68. The ND provides visual information necessary for navigation management:

- Navigation source, heading, selected course, course deviation, bearing indication
- ILS indication
- AFCS references (if any)
- RA indication
- RA upper limit indication
- Failure messages

NOTE In case of PFD SMD45 display failure (upper display) the PFD COMPOSITE mode is provided on the ND SMD 45 (lower display).

The ND can be operated in two images:

- the HSI image (heading and steering indicator) and
- the SECTOR image (SMD 45 only)

7.8.2 Display controls

The display controls are identical to the PFD, refer to para 7.7.2

7.8.3 **ND HSI image**

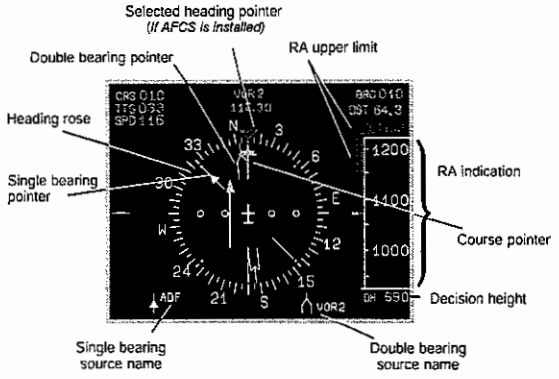


Fig. 12 Typical ND HSI image

Heading rose

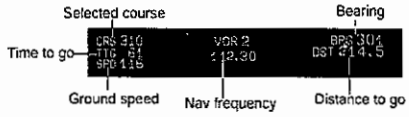
Heading information is displayed on a rotating compass card with a graduation every 5° and a figure or letter every 30°.

The selected heading pointer is controlled by the AFCS mode selector (if AFCS installed). A digital value is provided and an analog pointer is located in the scale of the heading rose. The pointer is cyan in normal mode and changes to green if the HDG mode of the AFCS is engaged.

Bearing pointer (single and double)

The beacon bearing to the selected beacon (ADF, VOR 1/2, GPS, NMS, DF) is displayed either by a single bar pointer (not VOR 2 and not DF) or by a double bar pointer (not VOR 1 and not ADF if DF is fitted). Each bearing pointer is associated to the source name provided on the bottom of the display.

Navigation zone symbology



The navigation source name selected by the ICP is displayed on top in the middle of the display. The following sources are provided: **VOR 1, VOR 2, ILS 1, ILS 2** (if the VOR frequency is associated to an ILS).

- VOR, GPS, NMS sources are displayed in cyan.
- ILS sources are displayed in magenta.
- An abnormal configuration is displayed in amber.
- A failure is displayed in red.

In NMS submode the following navigation source names may be displayed:

- VOR/DME – DME/DME – INS – GPS

In case of VOR or ILS the associated frequency is displayed below the source name. Red stars appear when NAV fails during power up. If NAV fails afterwards, source and frequency turn to red.

NOTE
- If the DME is in "hold mode", the TTG, SPD and DST labels are displayed in white and a hold message is displayed to the right of the frequency. The message is a white "H" followed by the held frequency.
- In DME "hold mode" during display power up, the red stars are not displayed but a frequency of 100.00 instead. This frequency information should be ignored.

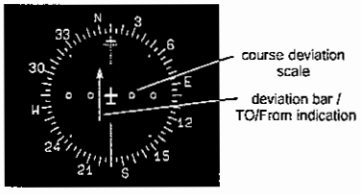
In case of VOR the bearing to the beacon is displayed in the upper right corner of the display by means of a digital value.

If the selected navigation source is a VOR/DME; additionally, ground speed (SPD), time to go (TTG) and distance to go (DST) are provided.

Selected course

The selected course is displayed by a cyan analog pointer in the heading rose and a digital value in the upper left corner of the display.

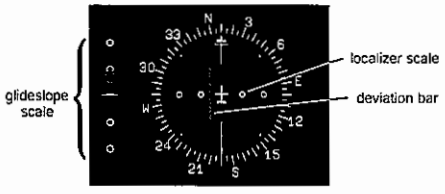
Course deviation and TO/FROM indication



The cyan course deviation bar represents the centerline of the selected navigation course. The aircraft symbol shows the aircraft position in relation to the displayed deviation. Each dot represents 5°of deviation.

The TO/FROM symbol is orientated toward the course pointer head in case of TO information and toward the course pointer tail in case of FROM information.

ILS symbology



In case of ILS selection the course deviation bar is replaced by the magenta localizer deviation bar. The bar represents the centerline of the selected localizer course. The aircraft symbol shows the aircraft position in relation to the displayed deviation.

Each dot of the localizer deviation scale represents 1°of deviation.

The TO/FROM indication is not available in ILS symbology.

Radio height and decision height

The radio height is displayed on the right side of the display in the range between 0 and 2000, 2500 or 5000 ft with following graduations:

- every 10 ft until 40 ft
- every 20 ft until 300 ft
- every 50 ft until 2000 ft
- every 100 ft until radar-altimeter limit

The decision height is displayed by means of an analog vertical amber bar left side and a digital value just below the radio height tape.

A "decision height approach indication" is displayed 500 ft before the selected value by a horizontal amber line.

If radio height > 500 ft or DH + 500 ft, the radio height indication is suppressed.

RA upper limit

The RA upper limit is displayed as vertical bar from top of radar altimeter scale and as digital value on top of radar altimeter scale on ND. In addition the digital UL or DH value is displayed on composite PFD. The default value at power up is the value of the last flight.

The minimum displayed value is 0 ft or selected DH + 50 ft

The maximum displayed value is max. RA value –1 ft.

An upper limit flag is displayed on PFD in case of exceedence of selected altitude limits. The flag flashes ten seconds and then remains steady. It disappears as soon as the altitude is lower than the upper limit.

NOTE During UL alarm, the FCDS provides a signal to an audio alarm (optional).

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7.8.4 **ND SECTOR image (SMD 45 only) (see figs. 13 and 14)**

The display rules are generally the same as on the HSI image. Therefore only different functions are mentioned below.

NOTE ILS is not managed in SECTOR mode. If an ILS frequency is selected in SECTOR mode a CHECK NAV message appears below the nav source.

Heading Sector

Heading information is displayed within a sector of 90° with a graduation every 5° and a figure or letter every 30°.

Selected range

The selected range is displayed by means of a digital value and an associated arc. The digital value shows the range at the dotted line. This is half the value at the heading sector.

Selected heading (if AFCS is installed)

The selected heading is provided by an analog pointer as same as in the HSI image or in digital form only if the analog pointer is not in view on the displayed sector .

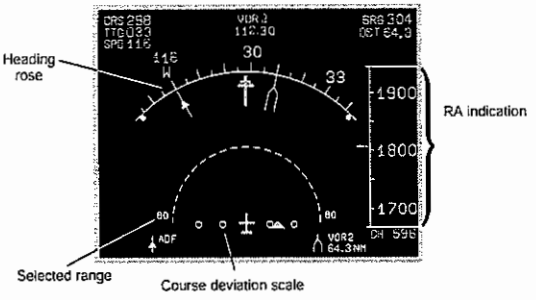

Fig. 13 Typical ND SECTOR image with VOR selected

Beacons (only if NMS/GPS is fitted)

Beacons are displayed within the sector taking into account their location and the range selection. The beacon is shown by a VOR Jeppesen code and a line is shown to indicate the course to the beacon.

- for VOR

Course deviation and TO/FROM indication

The course deviation scale is only displayed if a VOR is selected (each dot represents 5° of deviation). The course deviation pointer also functions as a TO/FROM indicator.

The TO/FROM symbol is in case of TO information and in case of FROM information.

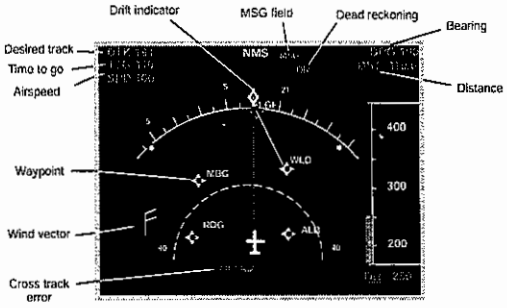

Fig. 14 Typical ND SECTOR image with NMS/GPS installed

Wind information

A wind vector provides wind information like direction and speed (valid GPS input required).

Flight plan and waypoints

The waypoints sent by the GPS or NMS are displayed taking into account their location and the range selection. Two types of symbols are used:

- VOR Jeppesen code for VOR and
- star for other waypoints.

The waypoints can be linked by legs in order to show a flight plan.

If VOR/DME is selected, a VOR Jeppesen code is displayed taking into account the bearing and the distance to go.

The current leg is cyan in normal mode and green if AFCS is engaged.

7.9 **OPTIONAL CONFIGURATIONS**

7.9.1 **VRU**

With a video radar unit (VRU) and appropriate sensors, video images such as weather radar, digital map and FLIR can be displayed on the SMD 45 ND.

7.9.2 **VDA (video direct access button)**

As an option, a VDA button is installed at the top of the center console to provide direct access to video pages as set in the configuration file. To go back to the default PFD/HSI page, the ND button on copilot's ICP shall be pressed.

7.9.3 **Mode selection rules**

7.9.3.1 PFD modes

The following **PFD** modes are selectable:

- PFD normal (default mode)
- Composite (SMD 45 only)

Each press on the PFD button of the ICP triggers a switch between modes. If ND fails or is switched off, composite mode is automatically selected on PFD.

7.9.3.2 ND modes

The following **ND** modes are selectable:

- HSI (default mode)
- Sector (SMD 45 only)

Each press on the ND button of the ICP triggers a switch between modes. If PFD fails or is switched off, composite mode is automatically selected on ND.

7.9.3.3 EXT modes

The amount of selectable EXT modes depends on the external video sources available. As a maximum, the following **EXT** modes are selectable:

- WXR + sector
- MAP + sector (currently not available)
- WXR only
- MAP only
- FLIR only

The PFD switches automatically to composite mode when a EXT video only mode (i.e MAP only, WXR only or FLIR only) is selected on the ND of that side. This does not apply to the SMD 68.

7.9.4 **Page selection**

A software configuration file is used to manage all the version dependant configurations within the same software. It can only be updated during maintenance phase on the ground, using an external computer connected to the FCDS via an EIA 485 bus. The logic implemented for the selection of the pages is described in the following examples. The number and the order of the pages could be different depending on what is selected in the configuration file.

The pages are selected by means of the ICP (see fig. 7).

7.9.4.1 Page selection for SMD 45

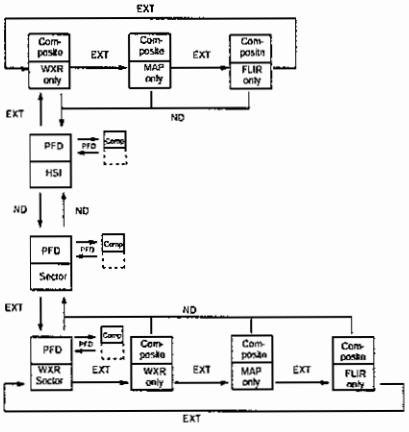

Fig. 15 Page selection for SMD 45

7.9.4.2 Page selection for SMD 68

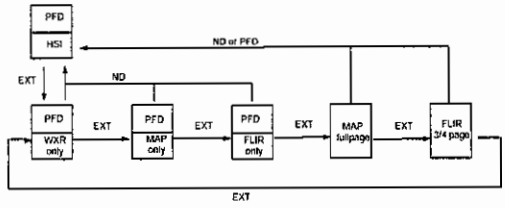

Fig. 16 Page selection for SMD 68

7.9.5 **Range setting rules**

The sector and the WXR can have their ranges set. The range setting for the sector and the WXR is done on ICP. The selectable ranges for a given image are defined in the configuration file.

EFFECTIVITY *If dual FCDS installed*

If two independent images (e.g. sector on one side and WXR on the other side) are displayed at the same time, for each image all the ranges defined in the configuration file are selectable.

If a WXR image is displayed on both sides, only weather radar images with the same range can be displayed at the same time. The priority is given to the first side selecting the WXR image. If one side selects the WXR image when it is already displayed on the opposite side and if there is a range mismatch, the range of the first side will be applied on both sides and the modified range flashes for five seconds. In case of simultaneous requests on both sides, the priority is given to the pilot.

EFFECTIVITY *All*

7.9.6 **Maintenance mode**

The maintenance mode displays the configuration file reference and maintenance data. It can be selected by the CPDS.

FOLHA 3197
PROC.053000716/2012
MAT.1403565

F M S 9.2-15

SUPPLEMENT FOR

PULSED CHIP DETECTOR SYSTEM (FUZZ BURN)

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the PULSED CHIP DETECTOR SYSTEM is installed.

System/Equipment Designation	Effectivity
Pulsed chip detector common kit	All
Pulsed chip detector	
Engines	All
Main Gear Box (MGB)	All
Tail Rotor Gear Box (TGB)/ Intermediate Gear Box (IGB)	All
Installation chip detector Tail Rotor Gear Box (TGB)/ Intermediate Gear Box (IGB)	All

Date: 14. April 03

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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R 9.2-15-1	2		R 9.2-15-4	2				
R 9.2-15-2	2		R 9.2-15-5	2				
R 9.2-15-3	2		R 9.2-15-6	2				

LEP – manufacturer's data (part 2):

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
N 9.2-15-7 (+ 8 blank)	2							

LOG OF REVISIONS

FIRST ISSUE

ORIGINAL		APR 14, 2003
REVISION	1	Feb 17, 2005
EASA approval no.: 2005-1748		
REVISION	2	(see entry below)

REVISION 2

Approved by EASA:

Date: Apr 07, 2014

EASA approval no.: 10048757

1. GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

The pulsed chip detector system is designed to clear the oil chip detectors from non-critical "normal" wear debris collection, when the relevant switch is operated.

NOTE In order to monitor abnormal wear behaviour of the MGB, TGB/GB and engines, record, in the helicopter logbook and in the logcard of the affected engine, the chip pulse activations (operation of the FUZZ BURN sw) and CHIP indications (for each engine separately).

2. LIMITATIONS

Each time a chip detector caution of a specific system (ENG 1/2, MGB, TR) illuminates (including on ground), it is allowed to activate the pulsed chip detector system. If the caution extinguishes but a chip detector caution (ENG 1/2, MGB, TR) illuminates subsequently at a later time in flight, a second activation of the system is permitted.

After activation of the FUZZ BURN sw, a logbook entry and maintenance action is required after the flight.

3. EMERGENCY AND MALFUNCTION PROCEDURES

CAUTION INDICATION

ENG CHIP (SYSTEM 1) or **ENG CHIP** (SYSTEM 2)

Conditions/Indications

Metal particles detected in engine oil.

Procedure

NOTE If the caution extinguishes but a chip detector caution (ENG 1/2, MGB, TR) illuminates subsequently at a later time in flight, a second activation of the system is permitted.

● **ON GROUND**

1. FUZZ BURN sw (spring loaded) – On (approximately 1 second)
2. Chip pulse event – Record
3. Engine parameter – Monitor

If ENG CHIP caution indication goes off:

NOTE After 1 min, if no unusual behaviour of engine is noticed, follow normal takeoff procedure.

4. Takeoff – Perform

If ENG CHIP caution indication remains on:

4. Proceed in accordance with the basic Flight Manual.

● **IN FLIGHT**

1. FUZZ BURN sw (spring loaded) – On (approximately 1 second)
2. Chip pulse event – Record
3. Engine parameter – Monitor

If ENG CHIP caution indication remains on:

4. Proceed in accordance with the basic Flight Manual.

If ENG CHIP caution indication goes off:

4. No further action required

WARNING DO NOT RESTART ENGINE WITH "ENG CHIP" CAUTION INDICATION ON.

CAUTION INDICATION

XMSN CHIP

Conditions/Indications

Metal particles detected in MGB oil.

Procedure

NOTE If the caution extinguishes but a chip detector caution (ENG 1/2, MGB, TR) illuminates subsequently at a later time in flight, a second activation of the system is permitted.

● **ON GROUND**

1. FUZZ BURN sw (spring loaded) – On (approximately 1 second)
2. Chip pulse event – Record
3. XMSN parameter – Monitor

If XMSN CHIP caution indication goes off:

4. Takeoff – Perform

If XMSN CHIP caution indication remains on:

4. Proceed in accordance with the basic Flight Manual.

● **IN FLIGHT**

1. FUZZ BURN sw (spring loaded) – On (approximately 1 second)
2. Chip pulse event – Record
3. XMSN parameter – Monitor

If XMSN CHIP caution indication remains on:

4. Proceed in accordance with the basic Flight Manual.

If XMSN CHIP caution indication goes off:

4. No further action required

CAUTION INDICATION

TR CHIP

Conditions/Indications

Metal particles detected in TGB/GB oil.

Procedure

NOTE If the caution extinguishes but a chip detector caution (ENG 1/2, MGB, TR) illuminates subsequently at a later time in flight, a second activation of the system is permitted.

● **ON GROUND**

1. FUZZ BURN sw (spring loaded) – On (approximately 1 second)
2. Chip pulse event – Record

If TR CHIP caution indication goes off:

3. Takeoff – Perform

If TR CHIP caution indication remains on:

3. Both engines – Shut down

● **IN FLIGHT**

1. FUZZ BURN sw (spring loaded) – On (approximately 1 second)
2. Chip pulse event – Record

If TR CHIP caution indication remains on:

3. Land as soon as practicable

If TR CHIP caution indication goes off:

3. No further action required

4. NORMAL PROCEDURES

No change in the basic Flight Manual data.

5. PERFORMANCE DATA

No change in the basic Flight Manual data.

6. MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7. SYSTEM DESCRIPTION

When enough metal particles collect on the magnetic detectors to close the circuit, the appropriate CHIP caution indication (ENG, TR, XMSN) comes on. The pulsed chip detector system is designed to eliminate spurious CHIP caution indications caused by "normal" wear conditions.

Normal wear (due to gear meshing, bearing rotation, etc.) creates fine metal particles. These fine metal particles collect on the magnetic chip detectors. Activation of the pulsed chip detector system sends an electrical pulse to the chip detectors to burn off these fine metal particles. However, larger metal particles, which may indicate component failure, are not burned off by the system and in this case the CHIP caution indication will remain on.

The CPDS/CAD is used for caution annuciation. Signals, indicating chips (ENG(1 and/or 2) ,TR, XMSN), are acquired from CPDS and processed in a duplex way inside VEMD. Normally caution appears on CAD, in case of CAD failure one VEMD is utilized for CAD function.

The chip detector system comprises eight detectors. The pulsed chip detector system supplies all chip detectors in parallel, because only the shortened contact absorbs electrical energy. Additionally it comprises a power module and a spring-loaded FUZZ BURN switch (see fig. 1), which is typically located on the overhead panel.

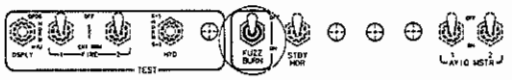

Fig. 1 FUZZ BURN switch

FOLHA 3199
PROC.053000716/2012
MAT.1403565

F M S 9.2-16

SUPPLEMENT FOR

AUXILIARY FUEL TANK

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the Auxiliary Fuel Tank has been installed.

System/Equipment Designation	Effectivity
Auxiliary Fuel Tank	All

Date: 10. Jul 02

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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9.2-16-3	0							
9.2-16-4	0							

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9.2-16-7	1.1		N 9.2-16-11	2				
9.2-16-8	0		N 9.2-16-12	2				
9.2-16-9	0							
9.2-16-10	0							

LOG OF REVISION

FIRST ISSUE		
ORIGINAL		JUL 10, 2002
REVISION	1	DEC 12, 2002
REVISION	1.1	OCT 29, 2007
REVISION	2	(see entry below)

REVISION 2 — Approved by EASA

Date: JUN 19, 2012 — EASA approval no.: 10040643

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

2 LIMITATIONS

2.1 FUEL QUANTITY

TOTAL FUEL		UNUSABLE FUEL	
liters	kilograms	liters	kilograms
222	178	3.25	2.6

Fuel mass values are based on a fuel density of 0,8 kg/liter.

2.2 PLACARDS

Placard:

VOR DEM BETANKEN DES AUX TANKS MUSS DER HAUPTTANK VOLL SEIN.
BEI FASS- ODER KANISTERBETANKUNG SIEB VERWENDEN
MAKE CERTAIN THAT THE MAIN TANK IS FULL BEFORE REFUELLING THE AUX TANK
FOR BARREL OR GAS CAN REFUELING USE SCREEN

Location: Near filler neck

Placard:

NICHT BELADEN
DO NOT LOAD

Location: Upper side of auxiliary fuel tank

Placard:

JET FUEL 222 LITER / 58.7 US. GALLONS

MIL - T - 5624		JP5
ASTM - D - 1655	JET A	JET A1

FOR ADDITIONAL FUEL TYPES SEE FLIGHT MANUAL

FOR OPERATION BELOW –10 °C (–14 °F) ADD ANTI-ICING ADDITIVE ACCORDING TO BASIC FLIGHT MANUAL.

Location: Front side of auxiliary fuel tank

FOLHA 3200
PROC.0530007 16/2012
MAT.1403565

3 EMERGENCY AND MALFUNCTION PROCEDURES

CAUTION IN CASE OF AN EMERGENCY LANDING, CHECK THAT AUX TK SWITCH ON OVERHEAD CONSOLE IS IN OFF POSITION.

CAUTION INDICATIONS

AUX F XFER

Conditions/Indications

Fuel valve is in a position other than commanded.

Procedure

1. AUX TK switch – Position EMERG or NORM as required

If the AUX F XFER caution comes on in conjunction with the AUX F XFER advisory:

1. AUX TK switch – Position OFF

CAUTION IF FUEL TRANSFER IS NOT POSSIBLE (AUX TANK FUEL QUANTITY DOES NOT DECREASE), THE ENDURANCE CALCULATION MUST BE PERFORMED WITHOUT THE AUX TANK FUEL QUANTITY.

NOTE
- If AUX F XFER caution and AUX F XFER advisory come on after a successful fuel transfer, maintenance action is required after flight.
- If manual fuel transfer is intended, it should be started by setting the AUX TK switch to EMERG position when the main tank fuel quantity is ≥ 100kg. The fuel consumption of the helicopter during fuel transfer can be higher than the simultaneously transferred fuel quantity.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

Vent-, drain lines	Condition, no leakage, no fuel visible inside the lines
Auxiliary fuel tank	Tight fit and secured, no damage, no evidence of leakage and/or spillage.
Fuel supply lines and quick disconnects	No leakage, no buckling, proper locking
Drain	Perform (refer to para 8.3 of this supplement)

Electrical connections and GND	Tight
Filler cap	Secured
AUX TK cb	Check in
AUX TK sw	Check NORM

4.2 OPERATION

Fuel is transferred automatically via CPDS control.

When fuel valve is in open position and fuel transfer works properly, AUX F XFER advisory comes and:

Aux tank fuel level indication	Check fuel transfer (decreasing of fuel level)

After accomplishment of the fuel transfer procedure the aux fuel valve will be closed automatically.

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The tank is of the bladder–type contained in a vapor–proof metal case attached to the seat rails in the cargo compartment on the RH side aft of the rear passenger seats. Installation location of the tank may vary along the longitudinal axis of the H/C (two positions possible, see fig. 2) depending upon seat configuration and H/C loading condition.

The fuel level is indicated on the CAD. The fuel is gravity transferred to the main tank system (consisting of main and supply tanks) and occurs automatically when the fuel level in the main tank has dropped below a specific value (no activity required by the pilot). Therefore it is necessary that the main tank must be filled before the aux tank during refueling operations. In case of emergency or malfunction, the fuel transfer can be controlled manually (AUX TK switch in position EMERG or OFF). The operation of the AUX–FUEL–TANK valve is indicated via an advisory/caution on the CPDS.

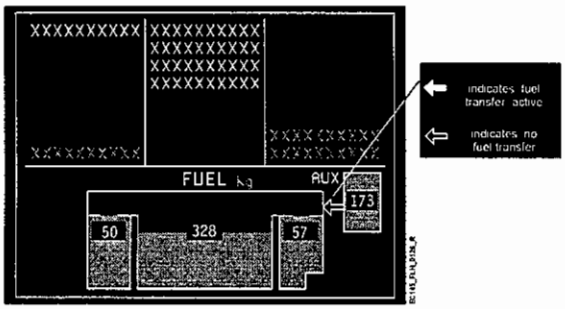


Fig. 1 Fuel indication

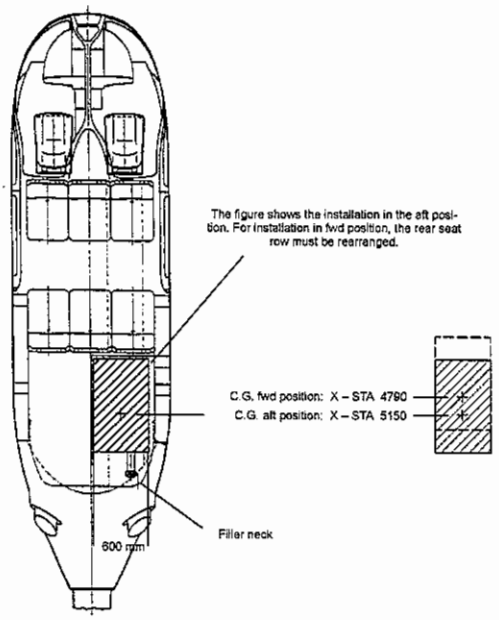


Fig. 2 Installation

FOLHA 3201
PROC. 053000716/2012
MAT. 1403565

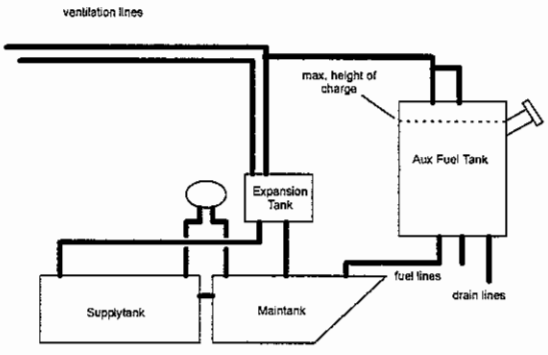


Fig. 3 Schematic diagram

8 HANDLING, SERVICING, AND MAINTENANCE

8.1 REFUELING

NOTE • Helicopter must be placed on level ground

- Main tank must be full
- Air the helicopter well during refueling (e.g. open doors)

AUX TK sw	Check NORM position
AUX F XFER advisory	Check off
Drain valve	Check closed
Auxiliary fuel tank	Ground
Spill deflector	Unlock and place in position, then refuel

NOTE If max. fuel capacity is almost reached, reduce fuel flow to avoid foaming or spillage of fuel. Spilled fuel must be wiped up immediately.

After refueling:

Auxiliary fuel tank	Disconnect ground
Spill deflector	Place in stow position and lock
Filler cap	Close and secure
Aux tank fuel indication	Check

8.2 CPDS CONFIGURATION

The installation/deinstallation of the auxiliary fuel tank must be entered in the A/C CONFIG page of the CPDS. Refer to the Maintenance Manual.

8.3 **DRAINAGE**

NOTE If the auxiliary fuel tank is installed and intended to be used, perform drainage of the auxiliary fuel tank before the first flight of the day.

8.3.1 **Drainage procedure for removal of water accululation from the auxiliary fuel tank**

WARNING
- FUEL IS TOXIC AND DAMAGING TO HEALTH IF IT COMES INTO CONTACT WITH SKIN OR EYES OR IF FUEL VAPOURS ARE INHALED. THE APPLICABLE SAFETY REGULATIONS FOR HANDLING OF HAZARDOUS AND OF TOXIC MATERIALS HAVE TO BE OBSERVED.
- TO PREVENT THE HAZARD OF FIRE AND EXPLOSION DUE TO SPARKING RESULTING FROM STATIC CHARGES, ALWAYS ESTABLISH THE SPECIFIED ELECTRICAL GROUND CONNECTIONS BEFORE STARTING DRAINING AND DO NOT REMOVE THEM UNTIL DRAINING HAS BEEN FINISHED.

– For draining purposes, park helicopter on horizontal, even ground and place a suitable grounded spillage container at the ready.

– Place a fire extinguisher at the ready near to the helicopter.

AUX TK sw	Check OFF
AUX F XFER caution	Check off

Ground H/C and servicing unit to the ground stake

Ground servicing unit to the H/C

Drainage the aux fuel tank by gravity into a suitable container

Open all doors of the H/C

Ground the drain tool to the ground receptacle on the filler neck of long range fuel tank

WARNING
- PLACE DRAIN HOSE INTO A SUITABLE CONTAINER (AT LEAST 2 L CAPACITY) PRIOR TO THE CONNECTION OF DRAIN TOOL.
- TAKE EXTREMELY PRECAUTION WHEN CONNECTING DRAIN TOOL TO DRAIN VALVE.

Remove bayonet plug from drain valve and connect the drain tool with drain hose to the drain valve thus will opening the drain valve.

Drain at least 0,4l fuel/water from the long range fuel tank. If the drained fluid does not contain any water, draining is completed. If the drained fluid contains water, dispose off the fluid and repeat the draining procedure until the drained fluid does not contain water anymore.

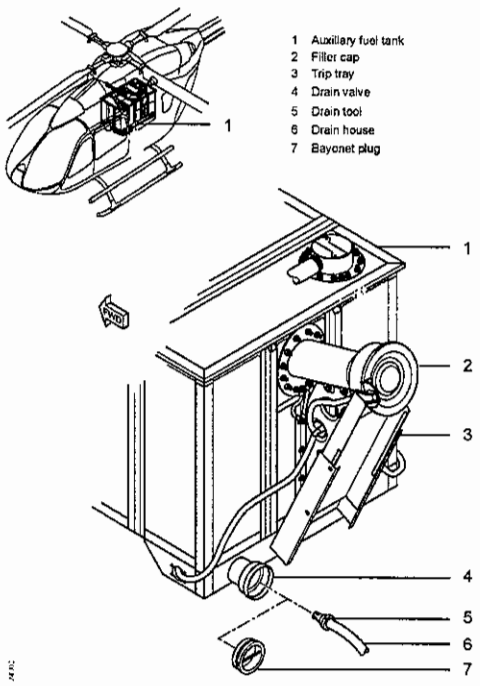
After draining of the long range fuel tank remove the drain tool with drain hose from drain valve and install bayonet plug.

Remove the ground connection from ground receptacle on the filler neck of long range fuel tank and from drain tool.

Disconnect ground connections from the helicopter.

Remove the tools and other materials and clean the work area.

Close the doors of the helicopter.



1 Auxiliary fuel tank
2 Filler cap
3 Trip tray
4 Drain valve
5 Drain tool
6 Drain house
7 Bayonet plug

Fig. 4 System configuration – typical installation

FOLHA 3202
PROC.053000716/2012
MAT. 1403565

F M S 9.2-17

SUPPLEMENT FOR

NAVIGATION MANAGEMENT SYSTEM CMA 3000

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the NAVIGATION MANAGEMENT SYSTEM - NMS - (CMA-3000) has been installed.

System/Equipment Designation	Effectivity
NMS (CMA-3000) Software 169-614000-005 P/N B346M3006051	All
NMS (CMA-3000) Software 169-614000-007 P/N B346M3801051	
NOTE Additional operating instructions and other information can be obtained from the CANADIAN MARCONI NMS (CMA 3000) operational manual.	

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 23.5.2001

Approved by

Luftfahrt-Bundesamt
Braunschweig

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R 9.2-17 -3	7		9.2-17 -10	6		R 9.2-17 -17	7	
R 9.2-17 -4	7		9.2-17 -11	6				
R 9.2-17 -5	7		9.2-17 -12	6				
9.2-17 -6	6		R 9.2-17 -13	7				
9.2-17 -7	6		R 9.2-17 -14	7				

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R 9.2-17 -18	7		R 9.2-17 -20	7		N 9.2-17 -22	7	
R 9.2-17 -19	7		N 9.2-17 -21	7				

LOG OF REVISIONS

First Issue		Rev. 4	May 15, 2003
Original	May, 2001	Rev. 5 EASA approval no.: 2004–9917	Oct 18, 2004
Rev. 1	19. Nov, 2001	Rev. 6 EASA approval no.: R.C.02409	Feb 13, 2008
Rev. 2	Oct 23, 2002		
Rev. 3	Jan 28, 2003	Rev. 7	(see entry below)

REVISION 7 — Approved by EASA

Date: MAI 28, 2010 — EASA approval no.: 10030144

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

The NMS **meets B– RNAV** (Basic Area Navigation) **and P– RNAV** (Precision Area Navigation) capability and meets **RNP–1 accuracy** requirements, provided it is receiving usable navigation information from the GPS receiver.

1.1 LIST OF ABBREVIATIONS

- **ANP** – Actual Navigation Performance
- **FAF** – Final Approach Fix
- **LSK** – Line select key
- **RNP** – Required Navigation Performance
- **TAS** – True Airspeed
- **NMS** – Navigation Management System
- **NPA** – Non Precision Approach
- **MAP** – Missed Approach Point
- **DR** – Dead Reckoning

2 LIMITATIONS

2.1 OPERATIONAL LIMITATIONS

EFFECTIVITY *If B346M3006051 (SW...–005) is installed*

Use of NMS as an AFCS coupled approach aid is limited to pure GPS stand alone approaches.

EFFECTIVITY *If B346M3801051 (SW...–007) is installed*

The use of the NMS is approved for DPIFR/SPIFR enroute, terminal and approved GPS approaches.

EFFECTIVITY *All*

Use of NMS as a primary navigation source is permitted only when a current and approved data base is used.

IFR enroute and terminal and approach navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.

Instrument approaches must be conducted in the approach mode and GPS integrity monitoring must be available at the FAF.

Traditional navigation equipment (e.g. VOR, DME and ADF) will need to be installed and be serviceable, so as to provide an alternative means of navigation.

A GPS CMA 3012 or CMA 3024 must be installed and operational.

Published non–precision instrument approaches (not approved as GPS overlay approaches) may be conducted with NMS only until reaching FAF.
Performing the approach itself must be conducted with the relevant traditional IFR equipment.

EFFECTIVITY *If B346M3006051 (SW...–005) or B346M3801051 (SW...–007) is installed*

VOR radio automatic tuning is prohibited.

Direct-To must be configured to STANDARD.

Use of the CMA–3000 not loaded with an actual CMC generated navigation database or not loaded with a database by CMC approved packing tool and process is prohibited during IFR operations.

NOTE • Use of NMS coupled during missed approach is permitted.
• For ILS Approach supported by NMS refer to para 4 .2.2

2.2 PLACARDS AND DECALS

Placard:

NMS 1

Location: Above NMS 1

Placard:

NMS 2

Location: Above NMS 2

FOLHA 3203
PROC.0530007 16/2012
MAT.1403565

EFFECTIVITY *If B346M3006051 is installed (SW...–005)*

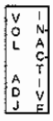
Placard:

USE OF NMS AS AN AFCS COUPLED APPROACH AID IS LIMITED TO PURE GPS STAND ALONE APPROACHES

Location: In the cockpit

EFFECTIVITY *All*

Placard:



Location: Backup control panel

3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 CAUTION INDICATION

CAUTION INDICATIONS

MSG
(on NMS and ND (only if NMS is selected NAV source))

Conditions/Indications

Failure or malfunction of a connected system (e.g. VOR).

Procedure

1. INIT REF key	– Press
2. LSK6R	– Press; check messages on MSG RECALL page(s)
3. Any functional pb (e.g. PROG)	– Press to acknowledge and exit recall page; MSG caution indication disappears
4. ON/OFF sw and/or circuit breaker of indicated system	– Check
5. Continue flight	

CAUTION INDICATIONS

FAIL (on NMS 1) and/or **NMS 1** (on CAD) and NMS 1 (pushbutton amber)

Conditions/Indications

– NMS 1 has failed or is switched off

In case of complete NMS 1 failure the NMS 1 shows random operation or the display and keyboard is frozen.

Procedure

1. NMS 1 pb on instrument panel	– Push twice to reset
If reset is possible:	
2. Continue flight	
If reset is not possible:	
3. NMS 1 pb on instrument panel	– Push to disconnect NMS 1
4. Continue flight	

CAUTION INDICATIONS

FAIL (on NMS 2) and/or **NMS 2** (on CAD) and NMS 2 (pushbutton amber)

Conditions/Indications

– NMS 2 has failed or is switched off

In case of complete NMS 2 failure the NMS 2 shows random operation or the display and keyboard is frozen.

Procedure

1. NMS 2 pb on instrument panel – Push twice to reset

If reset is possible:

2. Continue flight

If reset is not possible:

3. NMS 2 pb on instrument panel – Push to disconnect NMS 2
4. Continue flight

CAUTION INDICATIONS

FAIL (on NMS 1 and NMS 2) and/or **NMS 1 and NMS 2** (on CAD) and NMS 1 and NMS 2 (pushbutton amber)

Conditions/Indications

Both NMS or connected systems have failed. In case of complete NMS failure the NMS show random operation or the display and keyboard is frozen.

Procedure

1. NMS push buttons on instrument panel – Push twice to reset

NOTE In case only one system can be reseted, refer to the respective procedure given above.

If reset is possible:

2. Continue flight

If reset is not possible:

3. NMS push buttons on instrument panel – Push to disconnect both NMSs; use backup control panels for frequency tuning COM 2 and NAV 2
4. Continue flight

NOTE Pressing the toggle button on COM 2 back up control panel for 10 seconds, sets the 121.5 MHz emergency frequency.

CAUTION INDICATIONS

POS (on NMS) and/or **NMS 1 and/or NMS 2** (on CAD) and NMS 1 and NMS 2 (pushbutton amber)

Conditions/Indications

GPS integrity is invalid. GPS NAV LOST or GPS POS UNCERTAIN come on as system alert message.

Procedure

1. Confirm position by an alternate NAV source and check frequently the ANP in comparison of the RNP of the phase of flight.
2. Continue flight

NOTE In case of GPS NAV LOST alert message, NMS switches automatically over to next best Nav source.

3.2 SYSTEM ALERT MESSAGES

If navigation sensor is lost on one NMS, check the NAV STATUS on the other NMS. NMS will use best navigation source automatically. If a navigation sensor is deselected on one NMS, the sensor could still be used for navigation on the other NMS.

System alert messages (system cautions in amber color) are displayed on the MSG RECALL pages. The following table contains an extract of the alert messages that require pilots action and/or are not selfexplaining. For detailed information concerning the advisory messages see OPS Manual CMA 3000.

Syntax description of system alert messages:

MESSAGE	DESCRIPTION
xxx[1] FAILED	Both NMS receive invalid data from the indicated equipment at all.
xxx[1] FAILED.	Both NMS do not receive any data from the indicated equipment at all.
xxx[1] FAILED 1	The indicated NMS (e.g. NMS 1) receives invalid data from the indicated equipment. The remaining NMS receives proper data.
xxx[1] FAILED. 1	The indicated NMS (e.g. NMS 1) do not receive any data from the indicated equipment. The remaining NMS still receives data.
1) indicates the affected equipment (e.g. ADC, GPS...)	
Example: "AHRS1 FAILED 2" – The NMS 2 receives invalid data from the AHRS. The NMS 1 still receives proper data from the AHRS. (AHRS1 FAILED *"amber"*, 2 "white")	

NOTE A white number indication annunciates a single side failure, whereas no number indication annunciates a dual side failure.

MESSAGE	DESCRIPTION	PILOTS ACTION / REMARKS
ADC1 FAILED ADC2 FAILED	ADC input failure	Manual sequencing of altitude terminated legs. No GPS instrument approaches allowed.
AHRS1 FAILED AHRS2 FAILED	AHRS input failure	Wind computation unavailable
ALTITUDE FAILED	Complete loss of altitude input. DME/DME and VOR/DME navigation is degraded.	Manual sequencing of altitude terminated legs. No GPS instrument approaches allowed.
AUTO RESET	Upon an exceptional fault the NMS restarted.	Verify the flight and tuning parameters.
CHECK ANP	The NMS ANP value exceeds the RNP value.	Verify RNP/ANP values and revert to an alternate means of navigation. During approach: Perform procedure for missed approach.
DISCONTINUITY	Passing the last waypoint in the flight path prior to a route discontinuity. NMS steering becomes invalid.	Enter next waypoint or close up route discontinuity and engage AFCS when intended.
END OF ROUTE	Passing the last waypoint in the route. NMS steering becomes invalid.	Enter next waypoint and engage AFCS when intended.
FMS FAILED	Internal hardware failure detected. Only the failed NMS displays the message.	Switch off concerned NMS.
FMS1 (or 2) INDEPENDANT OP (optional configuration)	In a dual NMS installation both NMS are operating independantly from each other.	NMS1 and NMS2 data are not crosstalked. Try to synchronize via setup page. NMS operations must be performed independantly on each NMS.
FMS1 (or 2) X-TALK FAILED (optional configuration)	NMS input failure. In dual configuration the synchronized mode of operation and manual flight plan synchronization are not possible. Possible loss of ATC or DME hold channel control.	NMS1 and NMS2 data are not crosstalked. Try to synchronize via setup page. NMS operations must be performed independantly on each NMS.
FMS CLOCK FAILED	Real time clock failure detected. **NOTE:** Normal during system start.	Switch off concerned NMS.
FMS NAV IN DR	NMS in dead reckoning navigation mode	Use other means of navigation.

MESSAGE	DESCRIPTION	PILOTS ACTION / REMARKS
GPS FAILED	Failure or loss of communication with GPS sensor detected.	Use other means of navigation. P-RNAV is not longer possible.
GPS NAV LOST	GPS integrity is lost.	Use other means of navigation. NMS reverts automatically to next nav mode. P-RNAV is not longer possible.
GPS POS UNCERTAIN	NMS position integrity is lost.	Position accuracy is guaranteed for 2 minutes. Use other means of navigation. P-RNAV is not longer possible.
HIGH ARC EXIT SPEED	The combination of TAS and computed wind may cause the H/C to overshoot the next flight plan leg.	Reduce speed prior to exiting the arc.
HIGH ARC HOLDING SPEED	The combination of TAS and computed wind may cause the ICAO holding pattern protected airspace to be exceeded.	Reduce speed prior to reaching the holding fix.
MANUAL DME 1 (or 2) FAILED	Loss of distance information detected. VOR/DME nav mode no longer available.	No action required. If NMS was in VOR/DME mode it reverts automatically to the next available nav mode.
MANUAL WPT SEQUENCE	Comes in conjunction with NEXT WPT. Sequencing to the next waypoint must be initiated manually.	Press NEXT WPT (LSK6R) when requested on the PROGRESS 1/4 or LEG 1/X pages.
NO APPR INTEGRITY	The predicted or actual GPS integrity does not meet the requirements for approach.	Perform procedure for missed approach.
NOT ON INTERCEPT HDG	Current heading does not intercept desired course to fix.	Proceed to an appropriate intercept heading.
NOT ON INTERCEPT TRK	Current track does not intercept desired course to fix.	Proceed to an appropriate intercept course.
RAM SAT FAILED	A non-isolated satellite failure detected.	No action required.
ROUTE CORRUPTION	Current route is corrupted.	Reload route from company route database.
SCANNING DME1 (or 2) FAILED	Failure of DME transceiver detected. DMD/DME nav mode no longer available.	No action required.
TAS FAILED	Loss of true airspeed input.	No action required.
UNABLE FMS-FMS SYNC	In a dual NMS installation synchronization failed.	Any automatically synchronized item needs to be performed independantly on each NMS.

VERIFY RNP VALUE	A manually entered RNP value greater than the approved for the phase of flight is used.	Verify that the RNP value is appropriate for the phase of flight. Modify as necessary.

3.3 FAILURE OF NMS SYNCHRONISATION

Same databases are obligatory for synchronized mode.

If NMS fail to synchronize, verify that identical databases (NAV database, CUSTOM database and USER database) are used. The USER database includes user waypoints, user routes and map waypoints.

To compare user waypoint databases press on each NMS the following keys:

1. INIT/REF
2. NAV DATA (LSK 1R)
3. NEXT
4. WPT LIST (LSK 5L)
5. Compare USER WPT on both NMS. If non-identical data points are found, delete them and synchronize.

To compare databases press on each NMS the following keys:

1. INIT/REF
2. IDENT (LSK 1L)
3. Compare databases on both NMS. If non-identical databases are found, load the same database via A429 portable dataloader into both NMS and synchronize.

For systems with DMAP interface:

NOTE Perform transfer of DMAP waypoints from DMAP to NMS only when both NMS are synchronized.

To compare DMAP waypoints press on each NMS the following keys:

1. INIT/REF
2. DMAP WPT (LSK 4R)
3. Compare DMAP waypoints on both NMS. If non-identical data points are found, delete them and synchronize.

4 NORMAL PROCEDURES

NOTE
- For further information observe the Operator's Manual.
- If flight plan data has been entered manually before engine start up, these data could be lost during engine starting.

4.1 PREFLIGHT CHECK (applies equally to both systems)

4.1.1 Pre-start check

When power is initially applied to the NMS (AVIO MSTR switches - ON) an internal test starts:

Caution indicators/annunciators	– Initially on then off
Frequency top page	– Default start page

The internal test was successful when all caution indicators/annunciators are off and no message is displayed on the scratchpad line.

NOTE
- On ground the message SCANNING DME FAILED may appear due to missing DME reception on third channel of DME. No action is required. Message will disappear in flight at a certain altitude.
- Make sure, that both NMS are synchronized.
- Make sure, that the activated flight plans in NMS 1 and NMS 2 are identical.
- For IFR flights, ensure that a current Navigation Database is installed in the NMS.

4.2 FUNCTIONAL TEST (NOT MANDATORY)

RADIO SELFTEST USING "TEST ALL" FUNCTION (ONLY AVAILABLE ON GROUND)

1. FREQ key	– Press
2. NEXT key	– Press twice, to access RADIO SELFTEST page 3/3
3. LSK6R	– Press twice, check STARTED appears; indicates that radio tests have been started
If tests were successful:	
4. NMS Screen	– PASS message appears
If tests were not successful:	

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4. NMS Screen	– FAIL (when radio replied failure) or TIMEOUT (when radio did not reply at all) appears in conjunction with the name of the radio. – Check the radio then continue with step 3.
5. LSK6R (on both NMS)	– Press, check OFF appears, indicates that the radio tests are switched off – Perform the same on opposite NMS

NOTE
- During the test the tuning of the radios is inhibited.
- OFF is displayed by default when RADIO SELFTEST page 3/3 was accessed and after radio tests left in ARMED status.

4.3 OPERATION

4.3.1 Entering user waypoints and user routes

CAUTION THE USER ROUTES DATABASE WILL NOT AUTOMATICALLY BE UPDATED AFTER MODIFICATION OF USER WAYPOINTS.

Before activation of an approach, check correct data entry including alternate route (RTE 2).

User waypoints can not be used to perform an approach.

User waypoints and user routes should only be entered when the NMS are synchronized. Otherwise subsequent synchronization problems may occur.

4.3.2 NPA advisory

The NPA advisory light appears on final approach, when the system provides the accuracy for non-precision approaches.

4.3.3 SAR pattern

Prior to entering a SAR pattern airspeed should be appropriate to the selected pattern. For the default SAR patterns, an entry speed of 80 kts is recommended.

In order to correctly activate the desired SAR pattern (SQUARE, SECTOR or LADDER) the prompted ACTIVATE must be pressed (LSK6R) prior to execute the flight plan by pressing EXEC key.

EFFECTIVITY *If B346M3801051 (SW...007)is installed*

MARK ON TOP function in conjunction with SAR pattern:

1. INIT/REF key	– Press
2. MARK ON TOP (LSK4R)	– Press
When H/C is positioned above desired position:	
3. MARK (LSK4R)	– Press
4. DES+SAR (LSK3L)	– Press, to enter flight procedure planning pages (i.e. SAR pattern)
5. SQUARE (LSK3L) or LADDER (LSK4L) or SECTOR (LSK5L)	– Press, to select desired SAR pattern
6. LSK1L	– Press, to insert marked waypoint (i.e. WPT01/S) as Direct-To waypoint or press an other left LSK to insert between flight path leg waypoints.
7. SAR pattern parameters	– Modify (i.e. LENGTH, WIDTH, SAR BRG) if desired
8. ACTIVATE (LSK6R)	– Press, if SAR pattern setup is as desired
9. LEGS key	– Press, to verify modified flight plan (further waypoints may be added or deleted)
10. EXEC key	– Press, to execute flight plan

4.3.4 Moving waypoint

Only one moving waypoint can be activated in the flight plan. For detailed information refer to the "OPS Manual CMA 3000".

The moving waypoint will be automatically deleted after 24 hours since creating.

Delete the moving waypoint by pressing ERASE and then delete the moving waypoint from the USER WPT LIST.

EFFECTIVITY *All*

4.3.5 DME H1/H2 advisory

The DME advisory light comes on when the respective DME-channel is in hold position.

4.3.6 Advisory messages

Advisory messages are displayed in white colour. They do not request immediate action and are mostly selfexplaining. For detailed information concerning the advisory messages see OPS Manual CMA 3000.

4.3.7 **SAT deselection**

Deselection of satellites affects only the RAIM prediction but not the satellites used for GPS position calculation.

4.3.8 **KALMAN filter**

KALMAN UNAVAILABLE message may occur when Kalman filter is in NAV mode. If APIRS is in degraded heading or attitude mode KALMAN UNAVAILABLE message will occur but Kalman filter might be executable.

4.3.9 **NMS fuel calculation**

The NMS fuel calculation is for information only.

4.4 **APPROACH PROCEDURES**

Before activation of an approach mentioned below check correct data entry including alternate route (RTE 2).

4.4.1 **Approved GPS Non–Precision–Approach**

Approach activation

1. DEP/ARR key	– Press (selects the DEP/ARR INDEX page)
2. DEP/ARR INDEX page	– Select desired ARR
3. ARRIVALS PAGE	– Select APPROACH and TRANS
4. LEGS key	– Check selected approach pocedure with published procedures
5. EXEC key	– Press (activates selected routing)
6. ICP (FCDS)	– Select NMS as NAV SOURCE
7. AFCS mode selector	– Press NAV, if desired

Approach progress verification

8. At final approach fix (FAF)	– Check the NPA annunciator (on the I–panel and on the NMS) is on

NOTE The NPA advisory appears on final approach, when the system provides the accuracy for non–precision approaches. If the NPA light does not illuminate a missed approach must be executed.

Missed Approach

1. GA pb (on cyclic stick)	– Press; AFCS upper modes disengaged
or	
1. RTE or LEGS page	– Select MISSED APPR (LSK6R); AFCS upper modes remain engaged

Continue with Missed Approach procedure.

NOTE • To initiate a missed approach before the MAP, the approach should be continued above the minimum approach altitude until the MAP is reached.

• MISSED APPR displayed in inverse video will be only visible in the moment when the NMS enters approach mode.

4.4.2 **ILS Approach supported by NMS**

For ILS approaches the NMS may be used to bring the H/C prior to the FAF on the final approach course. From the Final Approach Fix (FAF) inbound, the approach must be conducted with ILS.

NOTE The NMS has no vertical guidance capability.

1. ILS approach	– Select and activate as normal Non–Precision approach (refer to para 4.4.1)
2. FREQUENCY TOP page or NAV Control unit	– Select appropriate ILS frequency
3. AFCS mode selector	– Disengage NAV mode
4. ICP (FCDS)	– Select ILS as NAV source when within LOC coverage, latest 2 nm prior to FAF
5. AFCS mode selector	– Select APP/GS mode, if desired

Missed Approach

Before a coupled missed approach is possible, the approach mode must be preselected and activated on NMS DEP/ARR page. The flight plan must be activated by the EXEC key prior to the procedure.

1. ICP (FCDS)	– Select NMS as NAV SOURCE
2. AFCS mode selector	– Press NAV

NOTE NMS will not display MISSED APPROACH during activated ILS approach. However, the NMS provides the missed approach procedure guidance.

4.5 **B–RNAV / P–RNAV OPERATIONS**

GPS status	– Check valid

5 **PERFORMANCE DATA**

No change to the basic flight manual data.

6 **MASS AND BALANCE**

Refer to equipment list entries in section 6 of the basic flight manual.

7 **SYSTEM DESCRIPTION**

The NMS (CMA-3000) is a self contained, cockpit mounted, radio and flight management system. It consists of a colour display for alphanumeric and graphic data, and a keyboard for data entry, data editing, and system control.

The NMS is capable of receiving information from external navigation sensors including DME, AHRS, GPS, NAV (VOR/ILS/MRK), ADF and ADC (e. g. through Avionique Nouvelle FCDS) equipment. It provides suitably-formatted lateral steering signals for use by an automatic flight control system for aircraft flight guidance in the horizontal plane. A loadable, internally stored database holds navigation parameters for creating flight plans. The data base may be updated via an ARINC 429 interface.

Waypoint and computed navigation guidance information is generated in both geographic and track-related reference frames for display to the pilot on the NMS display and for output to the PFDs and NDs and supports digital map applications.

Data input on either NMS is transferred to the other one. The cross–talk software automatically synchronises data in the two NMS. This provides redundancy in NMS operation.

The NMS provides manual tuning capability for COM, NAV, ADF, DME system and MODE S TRANSPONDER. The tuning is controlled by watching the readback of the manually tuned frequencies on the display.

Two NMS push buttons on the lower part of the instrument panel (NMS 1 and NMS 2) may be used for disconnecting (push once) or resetting (push twice) the respective NMS (refer to fig. 2). The lower part of the pb becomes illuminated yellow when activating the pushbutton, or in case of total power loss of NMS or when the NMS has triggered a master caution light on the warning panel.

Stand-alone VOR/DME approach capability is not implemented.

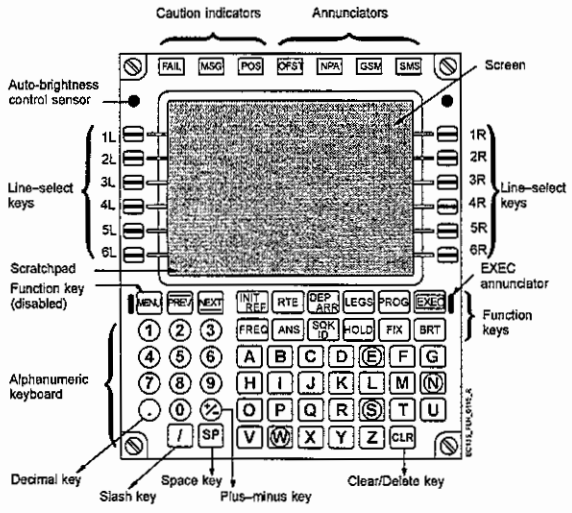

Fig. 1 NMS front panel display

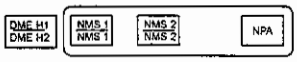

Fig. 2 NMS 1/2 pb, NPA and DME advisory light on I–panel

NMS (CMA-3000) Functional description		
Caution (amber)	**FAIL**	Illuminates when a NMS failure condition exists.
	POS	Illuminates when NMS is in DR mode.
	MSG	Flashes when system status changes result in new caution or warning messages. Messages can be recalled on dedicated message pages accessed by means of the INIT REF and LSK6R pb.
Annunciators (green)	**OFST**	Illuminates when offset (parallel track) has been initiated.
	NPA	Illuminates when non-precision-approach has been initiated.
	MENU	Currently not used.
	EXEC	Illuminates when the EXEC key is active.
Auto-brightness control sensor		Measures the ambient luminous intensity in order to adjust the brightness of the screen and annunciations automatically.
Line select keys		Identifies source or destination line and field for data entry and modification, also enables menu item selection.
Scratchpad		Scratchpad for data entry and display of messages.
Function keys	**MENU**	Not operational in this configuration.
	PREV	Proceed to previous screen page.
	NEXT	Proceed to next screen page.
	INIT REF	Provides access to pre-flight initialization pages and various reference data pages, and enables access to all NMS functions not available through the dedicated function keys, by display of main index page.
	RTE	Gives access to RTE page for display/entry of company routes and origin/destination airports.
	DEP/ARR	Provides access to listings of all departure, arrival and approach procedures and runways for selection.
	LEGS	Provides access to LEGS pages for display of all route leg data and Direct-To navigation functions.
	PROG	Provides access to PROGRESS pages for current information on progress along the active route.
	EXEC	Cause execution of modified data after verification, thus completing data entry procedures. Only active when MOD status is shown in reverse video on title line of displayed page, and EXEC annunciator is illuminated.
	FREQ	Provides access to frequency top page of the radio tuning functions.

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Function keys (continuous)	**ANS**	Function not available.
	SQK/IDT	Provides quick access to squak the ident of the active ATC transponder.
	HOLD	Provides access to holding-pattern functions
	FIX	Provides access to FIX pages for all fix and abeam waypoint functions.
	BRT	Manual control of screen and annunciator brightness.
	CLR	Provides clear and delete functions.
Keyboard		Allows entry of alphabetic and numeric data, including space (SP), +/– and decimal keys.
	Slash (/)	Separates data fields in scratchpad during data entry.
Screen		Provides 14 lines of 24 characters each for data information display of all parameters.

7.1 VERIFICATION OF SOFTWARE VERSION AND DATABASE VALIDITY

To verify the software version installed and to check the validity of the database:

1. INIT/REF key – Press
2. IDENT (LSK1L) – Press

F M S 9.2-18

SUPPLEMENT FOR

SPECIAL COCKPIT LIGHTING

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the Special Cockpit Lighting has been installed.

System/Equipment Designation	Effectivity
Special Cockpit Lighting	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 20. Nov. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

LEP – EASA approved (part 1):

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R 9.2-18 -1	2		R 9.2-18 -4	2				
R 9.2-18 -2	2							
R 9.2-18 -3	2							

LEP – manufacturer's data (part 2):

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R 9.2-18 -5 / (–6 blank)	2							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL, REV.	0	NOV 2001
REVISION	1	SEP 23, 2002
REVISION	2	(see entry below)

REVISION 2

Approved by EASA:

Date: MAY 21, 2012

EASA approval no.: 10039742

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1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

With this supplement it has been shown that the installation of the respective system does not degrade the crew member's visual cues in VFR Day and VFR Night flight.

No compliance demonstration has been performed that the installed system complies with the applicable regulations for NVIS. No changes if any have been introduced which may be necessary to comply with the applicable regulations.

2 LIMITATIONS

CAUTION IF NVG OPERATIONS ARE ENVISAGED, AN AIRWORTHINESS AND SUBSEQUENT OPERATIONAL APPROVAL BY THE COMPETENT AUTHORITY ARE NECESSARY.

NOTE Compliance demonstration for NVIS in front of the applicable airworthiness requirements has only been shown when the helicopter serial number is listed in the respective FMA referenced within the FMS 9.2-48 "Night Vision Imaging Systems (NVIS) /NVG".

3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 FAILURE OF INSRUMENT SWITCH

Indication

Limited readability of displays/instruments because of unintended NVG-mode activation

Condition

– Inadverted switch over to NVG position

or

– Malfunction of the Instrument lighting switch

Procedure

1. Instrument lighting switch	– Switch over and place to position required

If indication remains unchanged:

2. INSTR LT cb	– Pull; displays will return to normal brightness

4 NORMAL PROCEDURES

4.1 PREFLIGHT INTERIOR CHECK

★ Fabric glare shield(s)	– Check proper installation
★ INSTR lighting sw	– OFF
★ Displays	– Adjust brightness to an acceptable minimum night level
★ INSTR lighting sw	– ON or NVG
★ Displays	– Adjust brightness to an acceptable night level

★ *To be checked before each flight*

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

6 MASS AND BALANCE

No change in the basic Flight Manual data.

7 SYSTEM DESCRIPTION

Power to the instrument light circuits is controlled by a three-position INSTR lighting switch (Fig. 1) located on the overhead console. With this switch in either the ON or NVG position, 28 VDC is supplied from the essential bus 2 via the INSTR LT circuit breaker to each circuit.

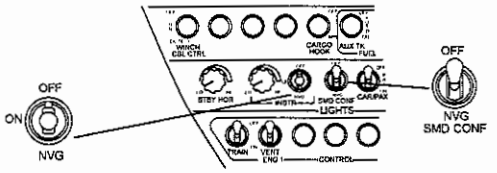


Fig. 1 Overhead console – INSTR lighting switch

The SMD CONF switch, is an additional security switch. In case of total loss of instrument lighting (position NVG) the switch provides power supply to the FCDS and CPDS displays in NVG mode. It is recommended to set the SMD CONF switch to NVG position.

NOTE
- Be aware that an optional installed weather radar system (FMS 9.2-28) is not NVG compatible and therefore it is recommended to switch off the weather radar system prior to NVG operation.
- The lightings of the following radios are not NVG compatible:
  RUBIS, CRISTAL CORAIL (ATR 427), DIAMANT (ATR 425).
  Therefore it is recommended to switch off the lighting of these radios during takeoff and landing and to reduce the use of their lighting to minimum during NVG operation.

8 HANDLING, SERVICING, AND MAINTENANCE

No change in the basic Flight Manual data.

F M S 9.2-20

SUPPLEMENT FOR

SEARCH AND LANDING LIGHT 400W/200W(IR)

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the SEARCH AND LANDING LIGHT 400W/200W(IR) has been installed.

System/Equipment Designation	Effectivity
Search and Landing Light 400W/200W(IR)	All

Date: 23. Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

LEP – EASA approved (part 1):

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
	9.2-20-1	3							
R	9.2-20-2	3.2							
	9.2-20-3	3							

LEP – manufacturer's data (part 2):

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2-20-4	3.2		N 9.2-20-7 / (-8 blank)	3.2				
R	9.2-20-5	3.2							
R	9.2-20-6	3.2							

LOG OF REVISIONS

FIRST ISSUE					
ORIGINAL	REV. 0	OCT, 2001	REVISION	3.1	NOV 25, 2010
REVISION	1	NOV 25,.2002	REVISION	3.2	(see entry below)
REVISION	2	JUN 07, 2005			
REVISION	3	Oct 24, 2006			

EASA approval no.: R.A.01198

REVISION 3.2

Date: APR 24, 2013

Revision No. 3.2 to FMS reference revision 3 is approved under authority of DOA No. EASA. 21.J.034.

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

2.1 OPERATION

Fabric glare shields shall be installed for night operations with the search and landing light.

3 EMERGENCY AND MALFUNCTION PROCEDURES

After a double generator failure the shedding buses 1 and 2 are disconnected and the search and landing light will not be provided with power. If necessary both shedding busses can be reconnected by setting the SHED BUS switch to EMER position. During flight with emergency power supply (battery) reduce the use of the search and landing light to a minimum.

4 NORMAL PROCEDURES

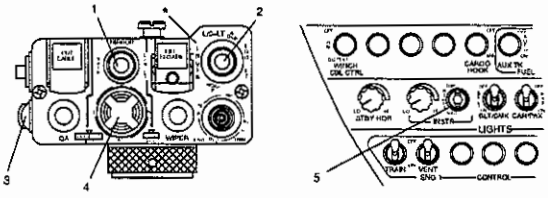
4.1 PREFLIGHT CHECK

Search and landing light	– Condition
Before nightflight:	
Circuit breakers L/S LIGHT (PWR, CONT1 and 2)	– Check in
Search and landing light	– Test

CAUTION
- IF THE HIGH INTENSITY SEARCH AND LANDING LIGHT IS SWITCHED ON WHILE THE HELICOPTER IS ON THE GROUND, IT MAY IGNITE DRY VEGETATION.
- LANDING IN DEEP SNOW WITH THE HIGH INTENSIVITY SEARCH AND LANDING LIGHT EXTENDED AND SWITCHED ON MAY SHATTER THE LIGHT DUE TO THE STRESS BROUGHT ABOUT BY ABRUPT COOLING.

5 PERFORMANCE DATA

No change in the basic Flight Manual data.



1	LT / MIR Select (3–way switch)	SX-16	selects the SX-16 for orientation control (4)
		MIRROR	selects the mirror for orientation control (4)
		S/L LT	selects the S/L light for orientation control (4)
2	L/S LT and LDG LT (4–way or 5–way toggle switch, momentary, depending on installation)	ON(forward)	switches on the S/L light
		OFF (back)	switches off the S/L light
		ON (right)	switches on the fixed landing light
		OFF (left)	switches off the fixed landing light
		* pb press (if function is installed)	switches between VIS and IR mode
3	L/S LIGHT DIM (2–way toggle switch, momentary) active only in NVG mode	forward	switches from IR to normal S/L light with light intensity increasing from 0 to 400 W.
		back	decreases light intensity and switches back to IR S/L light at 0 W.
4	LT/ MIR Orientation control (pushbutton, 4–way movement switch, momentary)	FWD	causes the lamp to extend to any position between fully retracted and fully extended
		AFT	causes the lamp to retract to any position between fully extended and fully retracted
		L	swivels the lamp to the left
		R	swivels the lamp to the right
		pb press	retracts the lamp into the fuselage.
5	DAY/NIGHT/ NVG lights switch	DAY	The S/L light can be used in normal mode (400W)
		NIGHT	
		NVG	The S/L light can be used in IR–mode (200W). S/L LIGHT DIM switch (3) is active

Fig. 2 Search and landing light 400W/200W (IR) control switches – typical installation

6 MASS AND BALANCE

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

7 SYSTEM DESCRIPTION

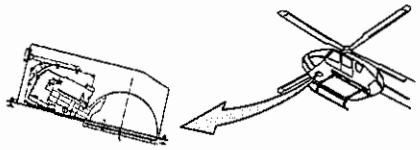


Fig. 1 Search and landing light 400W/200W (IR)

The search and landing light (Fig.1) is installed on RH side of the forward fuselage access cover. There are different configurations of this light possible with or without IR. The lighthead can be extended up to an angle of 73°. When extended more than 40°, it can be rotated up to 60° to the left and up to 90° to the right. The S/L light is operated by several switches on the collective pitch grips (Fig. 2, 3) on pilot and, optional, on copilot side.

The system receives power from the No. 1 and No. 2 DC shedding buses via the S/L LIGHT PWR and the S/L LIGHT CONT1 and 2 circuit breakers, located on the overhead panel.

After switching on the search and landing light, the advisory LDG LIGHT appears on the CPDS advisory panel. When the landing light retract button is pressed, the advisory LDG L RETR appears as long as the light is been retracted.

All search and landing light controls, mentioned in this supplement, may be installed in a variety of combinations depending on configuration.

The fabric glare shields are installed in the lower part of the cockpit to reduce glare from the landing light.

EFFECTIVITY For helicopters before SB MBB–BK117 C–2–33–020

NOTE
- For rapid switch–over from IR source to visible light source use 5–way toggle switch.
- Reversion from NVG mode with IR source selected to NIGHT mode on the overhead panel retains the IR light source. To select VIS light source, switch ON S/L light again.

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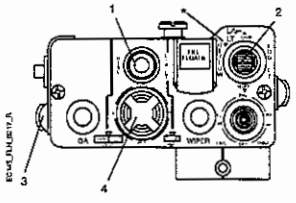
EFFECTIVITY For helicopters after SB MBB–BK117 C–2–33–020

NOTE
- For rapid switch–over from 200 W (LOW) to 400 W (HI) use 5–way toggle switch.



1	LT / MIR Select (3–way switch)	SX-16	selects the SX-16 for orientation control (4)
		MIRROR	selects the mirror for orientation control (4)
		S/L LT	selects the S/L light for orientation control (4)
2	L/S LT and LDG LT (5–way toggle switch, momentary)	ON(forward)	switches on the S/L light
		OFF (back)	switches off the S/L light
		ON (right)	switches on the fixed landing light
		OFF (left)	switches off the fixed landing light
		* pb press	switches between 200 W (LOW) and 400 W (HI)
3	L/S LIGHT DIM (2–way toggle switch, momentary) active only in 200 W (LOW) mode	forward	press and hold; 200 W (LOW) OFF; 400 W (HI) dimmed from 0 W to 400 W
		back	press and hold; 400 W (HI) dimmed down from 400 W to 0 W, at 0 W visible light automatically switched back to 200 W (LOW)
4	LT/ MIR Orientation control (pushbutton, 4–way movement switch, momentary)	FWD	causes the lamp to extend to any position between fully retracted and fully extended
		AFT	causes the lamp to retract to any position between fully extended and fully retracted
		L	swivels the lamp to the left
		R	swivels the lamp to the right
		pb press	retracts the lamp into the fuselage.

Fig. 3 Search and landing light 400W/200W control switches – typical installation

EFFECTIVITY All

8 HANDLING, SERVICING, AND MAINTENANCE

Clean class dome with tissue if it is dirty, or if it was touched with fingers.

F M S 9.2-21

SUPPLEMENT FOR

ROTOR BRAKE SYSTEM

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the ROTOR BRAKE SYSTEM has been installed.

System/Equipment Designation	Part No.	Effectivity
Rotor brake system	B635K1801051	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Original Issue - 20.12.2000

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
	9.2-21 -1	–							
R	9.2-21 -2	1							
R	9.2-21 -3	1							
R	9.2-21 -4	1							
	9.2-21 -5	0							
	9.2-21 -6	0							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL,	REV. 0	DEC, 2000
REVISION	1	(see entry below)

REVISION 1
Approved by EASA

Date: Oct 25, 2005
EASA approval no.: R.A.01041

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

2.1 ROTOR BRAKE SYSTEM LIMITATIONS

The rotor brake shall not be applied until both engines are shut down and rotor RPM has dropped below 50%.

Do not apply the rotor brake at temperatures below -30 °C.

Allow for a minimum cooling period of 10 minutes before next application of rotor brake.

NOTE If an emergency stop of the rotor is necessary, apply rotor brake any time after both engines are shut down. Before next application of the rotor brake after an emergency stop, maintenance action is required.

Do not start the engines with the rotor brake engaged.

2.2 PLACARDS AND DECALS

Placard:

ROTORBRAKE
ATTENTION! DO NOT PULL OVER 50% ROTOR RPM AND BELOW -30 °C OAT

Location: Rotorbrake lever

3 EMERGENCY AND MALFUNCTION PROCEDURES

CAUTION INDICATIONS

ROTOR BRAKE
(MISC)

Conditions/Indications

Rotor brake engaged

Procedure

1. Rotor brake lever	– Check in off position
If caution indication remains on:	
2. Failure	– Correct before next start

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

Fuselage – right side	
Rotor brake oil tank	– Check level
Fuselage – left side	
Rotor brake system	– Condition
★ **Pre-start check**	
Rotor brake lever	– Check fully down (to check ROTOR BRAKE caution indication, pull the lever slightly and check full down again)

★ To be checked **before each flight**

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PROC.053000716/2012
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4.2 ENGINE SHUTDOWN

Rotor brake	– Apply below 50% RPM

5 PERFORMANCE DATA

No change to the basic flight manual data.

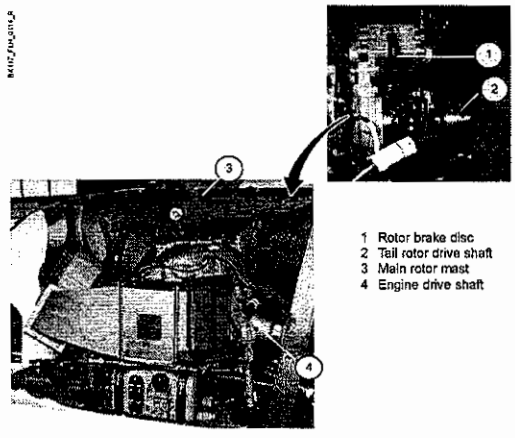
6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The rotor brake system is designed to reduce deceleration time of the rotor system after engine shut down, and to lock the rotor for a limited period of time when the helicopter is parked on ground as well. It comprises a brake lever assembly, a hydraulic cylinder, a fluid reservoir, a brake caliper and a brake disc mounted on the transmission tail rotor drive output (see fig. 1).

The rotor brake is a hydraulic disk brake with automatic brake clearance adjustment. It is activated by pulling the lock-type lever on the RH side of the pilot seat. A micro switch is then operated to activate the ROTOR BRAKE caution indication on the CAD. To let off the brake it is necessary to unlock the brake lever by pushing the respective button on the brake lever grip.



1 Rotor brake disc
2 Tail rotor drive shaft
3 Main rotor mast
4 Engine drive shaft

Fig. 1 Rotor brake system

F M S 9.2-22

SUPPLEMENT FOR

SAND FILTER SYSTEM

This Supplement shall be attached to the BK117 C-2 Flight Manual (Section 9.2) when the SAND FILTER SYSTEM has been installed.

System/Equipment Designation	Effectivity
Sand Filter System	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 23. Nov. 01

Approved by:
Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No	Rem		Page	Rev.No	Rem		Page	Rev.No	Rem
	9.2-22-1	3		R	9.2-22-14	3.1			9.2-22-27	1	
R	9.2-22-2	3.1			9.2-22-15	1			/(9.2-22-28 blank)		
	9.2-22-3	3			9.2-22-16	1					
	9.2-22-4	0			9.2-22-17	1					
	9.2-22-5	0			9.2-22-18	1					
	9.2-22-6	2			9.2-22-19	1					
	9.2-22-7	3			9.2-22-20	1					
	9.2-22-8	1			9.2-22-21	1					
	9.2-22-9	1			9.2-22-22	1					
	9.2-22-10	1			9.2-22-23	1					
	9.2-22-11	1			9.2-22-24	1					
	9.2-22-12	1			9.2-22-25	1					
	9.2-22-13	1			9.2-22-26	1					

LOG OF REVISIONS

First Issue					
ORIGINAL, REV.	0	OCT, 2001	Revision	3.1	(see entry below)
Revision	1	AUG 26, 2003			
Revision EASA Approval no.: 2004-11019	2	NOV 11, 2004			
Revision EASA Approval no.: R.A.01153	3	DEC 04, 2006			

Revision 3.1

Date: MAR 20, 2007

Revision No. 3.1 to FLM reference revision 3 , is approved under authority of DOA No. EASA. 21J.034.

FOLHA 3213
PROC.0530007 16/2012
INAT.1403565

1 GENERAL

The information contained herein supplements the information in the basic Flight Manual. For limitations, procedures, and performance data not contained in this Supplement, refer to the basic Flight Manual.

1.1 DEFINITION OF TERMS

Sand filter operation mode:

SAND FLTR sw – OFF ..... sand filter is in bypass mode

SAND FLTR sw – DOOR ..... sand filter is in filter mode, scavenge blower off

SAND FLTR sw – ON ..... sand filter is in filter mode, scavenge blower on

2 LIMITATIONS

2.1 AMBIENT AIR TEMPERATURE LIMITATIONS

The minimum ambient air temperature for helicopter operation with sandfilter improvement installed is –30°C.

The sand filter system must be switched off when the ambient temperature is below 4.5° C (40° F) and visible moisture is present.

2.2 OPERATION IN SNOW FALL

The sand filter system must be switched off in snowfall.

2.3 ELECTRICAL POWER CONSUMPTION

With the sand filter system installed, the airflow produced by the generator cooling fans is considerably reduced. To avoid overheating of the generators, the maximum electrical power consumption is limited as follows:

Flight condition	Pressure Altitude PA [ft]	Max. Generator load [A] ISA +20°C	Max. Generator load [A] ISA +35°C
Hover	≤ 4000	190	175
Hover	4000 < PA ≤ 10000	170	155
Level flight or Climb	≤ 10000		
Hover, Level flight or Climb	10000 < PA ≤ 18000	140	130

3 EMERGENCY AND MALFUNCTION PROCEDURES

3.1 BYPASS DOOR ACTUATOR FAILURE

CPDS CAUTION INDICATIONS

SAND FILT

(continuously illuminated for more than 30 seconds)

Conditions/Indications

The caution light comes on whenever the position of either switch is not in agreement with its respective bypass door actuator position.

NOTE The caution light comes on for approx. 20 seconds after placing one of the SAND FLTR switches from OFF to DOOR/ON position or vice versa. This indicates normal operation and needs no corrective action!

There could also be a failure of bypass door actuator if the caution indication does not come on at all or indication time is extremly shorter than 20 seconds.

Procedure

1. Affected SAND FLTR switch – Switch again

If the caution light remains on or still does not come on:

2. SAND FLTR 1 switch – OFF
3. SAND FLTR 2 switch – OFF

NOTE The positions of the bypass doors are not defined. Continue flight under observance of the limitations and flight performance restrictions as given in this supplement for sand filter ON condition.

3.2 ENGINE/GENERATOR FAILURE

In case of a single engine/single or dual generator failure, both scavenge blowers are automatically cut off. The bypass door actuators remain operational and can be operated by the SAND FLTR switches.

NOTE If the scavenge blowers are not available, the filter efficiency of the sand filter system is degraded.

When operating near the flight performance limit after a single engine/single or dual generator failure, open the bypass doors (SAND FLTR switches OFF) to increase the flight performance margin.

3.3 **ENGINE/GENERATOR FAILURE**

NOTE In-flight engine re-start should be performed in bypass mode (SAND FLTR switches OFF).

Procedure

1. SAND FLTR 1, then 2 switch – OFF, or check OFF
2. Engine re-start procedure (normal re-start procedure) – Perform
3. SAND FLTR 1 and 2 switches – ON (as required)

4 NORMAL PROCEDURES

NOTE
- The filter mode of the sand filter system should be used only during operation in sandy or dusty environments.
- The CPDS SAND FILT caution indication comes on whenever the bypass doors are in transition from open to close or vice versa (approx. 20 seconds).

4.1 PREFLIGHT CHECK

4.1.1 Exterior check

	Handle (R/H transmission cowling), if installed	– Condition
★	Particle separator frame	– Condition
★	Sealing frame	– Condition
★	Air cleaner panel	– Obstructions, damage, condition
★	Air cleaner panel	– Open
★	Hydraulic system, oil cooler and main transmission	– Check in accordance with the basic Flight Manual
	Bypass door actuators	– Damage, condition
	Bypass door actuator electrical wiring	– Damage, condition
	Scavenge duct	– Obstructions, damage, condition
★	Air cleaner panel	– Closed and secured
★	Bypass doors	– Obstructions, closed, damage
	Mast seal	– Damage, condition
	Scavenge blower and support	– Damage, condition
	Scavenge blower electrical wiring	– Damage, condition

★ To be checked **before each flight**

4.1.2 Interior check

NOTE
- Both SAND FLTR switches are always to be set to the same mode of operation.
- Under normal operating conditions, the system should not be operated in the DOOR mode for a prolonged period. It may lead to filter efficiency degradation and to filter congestion.
- Immediately after switching on the electrical power source the bypass doors will move from closed to opened position. During the door movement the SAND FILTcaution indication comes on.

After switching FUEL PUMP XFER (A and F) to OFF (see section 4 of the basic FLM):

1. SAND FLTR 1 sw – DOOR; monitor that SAND FLTR caution indication comes on for approx. 20 sec but not more than 30 sec.
2. SAND FLTR 2 sw – DOOR; monitor that SAND FLTR caution indication comes on for approx. 20 sec but not more than 30 sec.

4.2 STARTING ENGINES

WARNING WHEN OPERATING THE SCAVENGE BLOWERS, ENSURE THAT THERE IS NO MECHANIC OR CREW NEAR THE SCAVENGE BLOWERS

NOTE The engine start procedure should be performed with the bypass doors closed and the scavenge blowers are off.

1. SAND FLTR 1 and 2 switches – Check DOOR
2. Starting engines (normal procedure) – Perform

As soon as both engines have reached idle speed and both generators are on:

3. SAND FLTR 1 and 2 switches – ON; Check total ammeter readings of CPDS increase approx. 60 A (scavenge blowers functioning)
4. SAND FLTR 1 and 2 switches – Select ON or OFF depending on the atmospheric condition

4.3 OPERATION DURING TAKEOFF AND LANDING, AND IN FLIGHT

Perform the following procedure depending on the atmospheric condition.

CAUTION IF THIS SYSTEM IS OPERATED IN FILTER MODE UNDER SUCH ATMOSPHERIC CONDITION AS BLOWING GRASSES, LEAVES ETC. IN THE AIR BY DOWN WASH FROM THE ROTOR DURING HOVER OR TAXING, ENGINES AND OIL COOLING FANS MAY NOT BE PROVIDED ENOUGH AIR BECAUSE OF THE AIR CLEANER PANELS CONGESTION. THE SAND FILTER SHOULD BE OPERATED IN BYPASS MODE UNDER SUCH ATMOSPHERIC CONDITION

4.3.1 Switching sandfilter from OFF to ON in flight

1. SAND FLTR 1 and 2 switches – DOOR, then ON

The CPDS SAND FILT caution indication comes on for approx. 20 seconds but not more than 30 sec.

4.3.2 Switching sandfilter from ON to OFF in flight

1. SAND FLTR 1 and 2 switches – DOOR, then OFF

The CPDS SAND FILT caution indication comes on for approx. 20 seconds but not more than 30 sec.

4.4 ENGINE SHUT-DOWN

NOTE Ensure after engine shut-down that bypass doors are closed.

Prior to engine shut down:

1. SAND FLTR 1 and 2 switches – DOOR

The CPDS SAND FILT caution indication comes on for approx. 20 seconds but not more than 30 sec.

2. Engine shut-down (normal procedure) – Perform (refer to section 4 of the basic FLM), **do not switch off the sandfilter system**

NOTE When performing engine shutdown under sandy conditions the SAND FLTR 1 and 2 switches should remain in the DOOR position.

After switching off BAT MASTER sw:

3. SAND FLTR 1 and 2 switches – OFF

5 PERFORMANCE DATA

5.1 POWER CHECK

Power check with sand filter system should be performed inaccordance with the procedure described in basic Flight Manual paragraph 5.1.4. However, the following additional procedure and information/limitations must be observed.

5.1.1 GROUND POWER CHECK

5.1.1.1 In filter mode

1. GEN 1 and 2 switches – NORM
2. Electrical consumers – Reduce
3. Perform the engine power check, compare corrected measured N1 which is obtained by subtracting 0.3 % from read-off instrument N1 (digital) with the limit N1 obtained from section 5 of basic Flight Manual.

5.1.1.2 In bypass mode

Perform the engine power check, compare corrected measured **N1** which is obtained by subtracting 0.2 % from read-off instrument N1 (digital) with the limit N1 obtained from section 5 of basic Flight Manual.

5.1.2 INFLIGHT POWER CHECK

Inflight power checks with sand filter installed are restricted to a maximum pressure altitude of 10000 ft and have to be conducted in bypass mode only.

Perform the engine power check, compare corrected measured N1 which is obtained by subtracting 1.2 % from read-off instrument N1 (digital) with the limit N1 obtained from section 5 of basic Flight Manual.

5.1.3 Power trend monitoring

Power trend monitoring is performed using the corrected N1 as mentioned above. To obtain the correct check result, it is recommended that the power check is performed either always in filter mode or always in bypass mode.

5.2 HEIGHT-VELOCITY ENVELOPE (H–V DIAGRAM) - SANDFILTER IN BYPASS OR FILTER MODE

The helicopter configuration shall comply with the mass-altitude-temperature limits shown in section 5 of this supplement.

For determination of the H–V–boundaries, add 60 kg to the actual gross mass of the helicopter

EXAMPLE: (see figure 1)

The critical height-velocity area which should be avoided, can be defined by first determining point P, a point on the requested boundary curve.

Determine: **Critical height-velocity curve**

Known:	OAT	18 °C
	Pressure altitude	2000 ft
	Gross mass	3240 kg + 60 kg (with sand filter installed) = **3300 kg**

Solution:

Enter chart at known OAT (18 °C)

Move vertically upwards to known pressure altitude (2000 ft)

Move horizontally right to known gross mass (3300kg)

Move vertically downwards to intersect the reference line

From intersection with reference line move horizontally left and read height above ground for point P = **134 ft**

Draw the boundary curve through point P by interpolating between the existing curves on the chart

HEIGHT-VELOCITY DIAGRAM

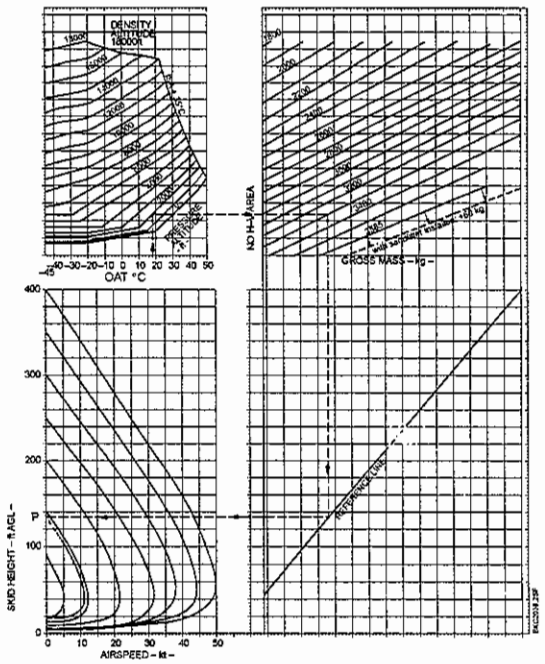


Fig. 1 Height-velocity diagram

5.3 HOVER CEILING

The hover ceiling charts for **hover in ground effect (HIGE)** (Fig.2 to 3) are provided for AEO conditions, with takeoff power (TOP) and various combinations of pressure altitude, outside air temperature and gross mass. The charts are based on a skid height of 3 ft.

For hover in ground effect in density altitudes up to 7000 ft controllability is assured for winds up to 30 kts from all directions, above 7000 ft for winds up to 17 kts from all directions.

The hover ceiling chart for **hover out of ground effect (HOGE)** (Fig.4) is provided for AEO conditions, with takeoff power (TOP) and various combinations of pressure altitude, outside air temperature and gross mass.

For determination of the HOGE OEI 2.5 min gross mass, refer to the chart "OEI HOGE gross mass", ***Fig. 5–24***, of the basic flight manual and subtract VALUE from the calculated value.

For hover out of ground effect in density altitudes up to 7000 ft controllability is assured for winds up to 30 kts from all directions, above 7000 ft for winds up to 17 kts from the right side and up to 30 kts from all other directions.

Controllability during standard type takeoff and landing has been demonstrated for flight conditions with crosswind components up to 17 kts.

EXAMPLE: (based on fig. 2)

Determine: **Maximum gross mass for hover in ground effect**

Known:	OAT	4°C
	Pressure altitude	11000 ft

Solution:

Enter chart at known OAT (4°C)

Move upwards to known pressure altitude (11000 ft)

Move horizontal left and read maximum takeoff and landing gross mass = **3330 kg**

HOVER CEILING IN GROUND EFFECT

TAKEOFF POWER — ZERO WIND OR HEADWIND
SAND FILTER (BYPASS OR FILTER MODE) — BLEED AIR CONSUMERS OFF

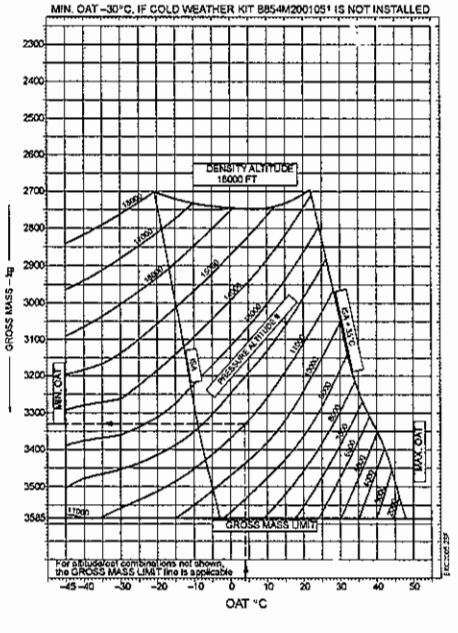


Fig. 2 Hover ceiling in ground effect (AEO, TOP, zero wind or headwind, bleed air off, sand filter (bypass or filter mode))

HOVER CEILING IN GROUND EFFECT

TAKEOFF POWER
SAND FILTER (BYPASS OR FILTER MODE)
CROSSWIND COMPONENT 17 KTS
BLEED AIR CONSUMERS OFF

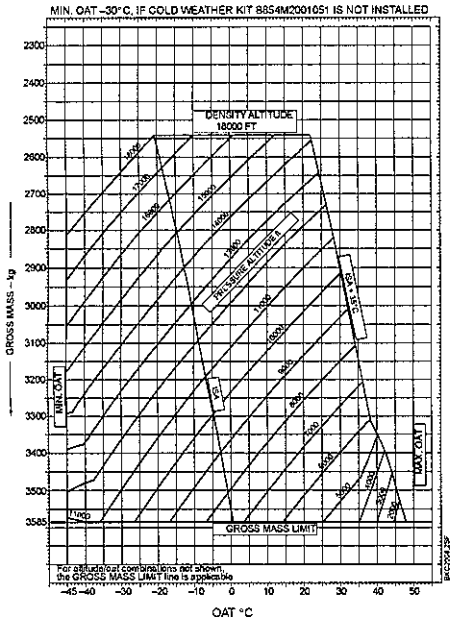


Fig. 3 Hover ceiling in ground effect (AEO, TOP, crosswind component 17 kts, bleed air off, sand filter (bypass or filter mode))

HOVER CEILING OUT OF GROUND EFFECT

TAKEOFF POWER
SAND FILTER (BYPASS OR FILTER MODE)
ZERO WIND OR HEADWIND
BLEED AIR CONSUMERS OFF

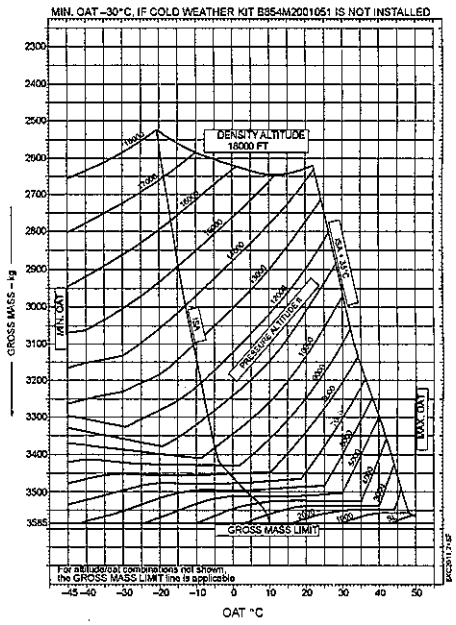


Fig. 4 Hover ceiling out of ground effect (AEO, TOP, zero wind or headwind, bleed air off, sand filter (bypass or filter mode))

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MAT. 1403565

5.4 RATE OF CLIMB

Rate of climb with sand filter system installed (bypass and filter mode) shall be determined by subtracting the correcting value given below from the read rate of climb based on the rate of climb chart described in section 5 of basic Flight Manual.

Gross Mass	AEO		OEI	
	Bypass mode	Filter mode	Bypass mode	Filter mode
1750 – 2400 kg	– 350 ft/min	– 450 ft/min	– 150 ft/min	– 190 ft/min
2401 – 3000 kg	– 300 ft/min	– 400 ft/min	– 125 ft/min	– 160 ft/min
3001 – 3585 kg	– 250 ft/min	– 350 ft/min	– 100 ft/min	– 130 ft/min

5.5 ADDITIONAL NON-APPROVED PERFORMANCE DATA

This subsection contains additional, non-approved performance data which are supplied by the aircraft manufacturer, useful for preflight and inflight mission planning.

5.5.1 Standard performance conditions

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

Engine power does not exceed helicopter limits (see Section 2 of basic FLM).

Helicopter is regarded in its clean configuration, with sand filter installed.

5.5.2 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 extrepolated, 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 the engine(s).

5.5.3 Reading of the charts

It is of outmost importance that the charts be read accuratoly. With 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.

5.5.4 **Maximum cruising speed**

The diagrams (Fig.5 to Fig.10) provide maximum cruising speed data with sand filter either in bypass mode or in filter mode, in terms of true airspeed as a function of helicopter gross mass and pressure altitude for the atmospheric conditions ISA, ISA +20°C and ISA –20°C under AEO conditions.

EXAMPLE: (see figure 5)

Determine: Maximum cruising speed (with sand filter OFF (bypass mode))

Known:	Atmospheric condition	ISA
	Pressure altitude	9400 ft
	Gross mass	3400 kg

Solution: Maximum cruising speed = 139 KTAS

Enter chart (ISA) at known pressure altitude (9400 ft).

Move horizontally right to known gross mass (3400 kg).

From this point move vertically downwards and read maximum cruising speed = **139 KTAS.**

MAXIMUM CRUISING SPEED

MAXIMUM CONTINUOUS POWER
SAND FILTER IN BYPASS MODE
BLEED AIR CONSUMERS AS REQUIRED

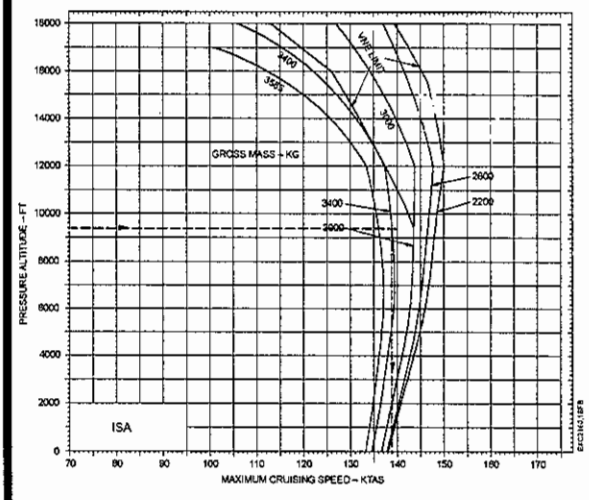

Fig. 5 Maximum cruising speed (sand filter in bypass mode, ISA)

MAXIMUM CRUISING SPEED

MAXIMUM CONTINUOUS POWER
SAND FILTER IN BYPASS MODE
BLEED AIR CONSUMERS AS REQUIRED

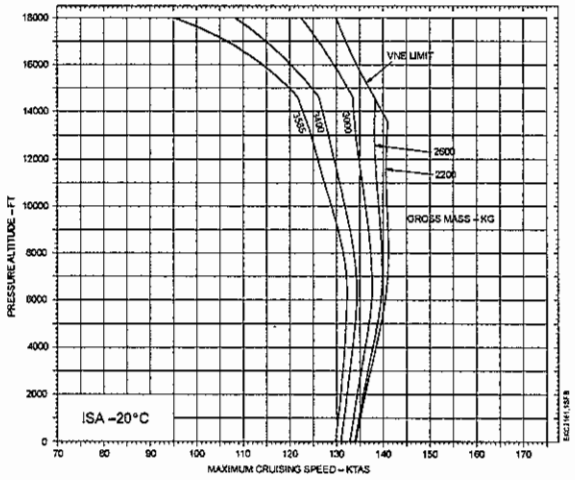

Fig. 6 Maximum cruising speed (sand filter in bypass mode, ISA –20°C)

MAXIMUM CRUISING SPEED

MAXIMUM CONTINUOUS POWER
SAND FILTER IN BYPASS MODE
BLEED AIR CONSUMERS AS REQUIRED

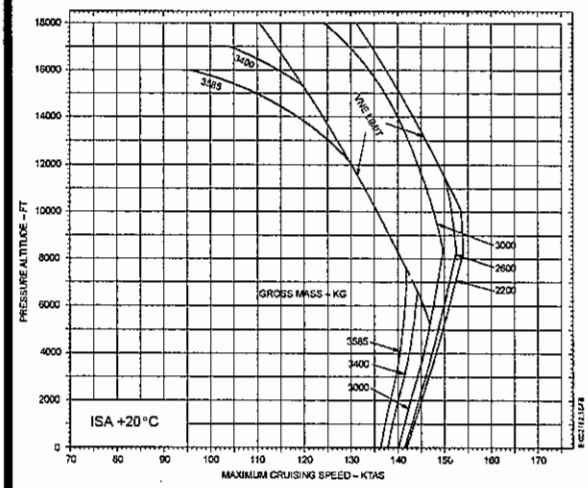

Fig. 7 Maximum cruising speed (sand filter in bypass mode, ISA +20°C)

MAXIMUM CRUISING SPEED

MAXIMUM CONTINUOUS POWER
SAND FILTER IN FILTER MODE
BLEED AIR CONSUMERS AS REQUIRED

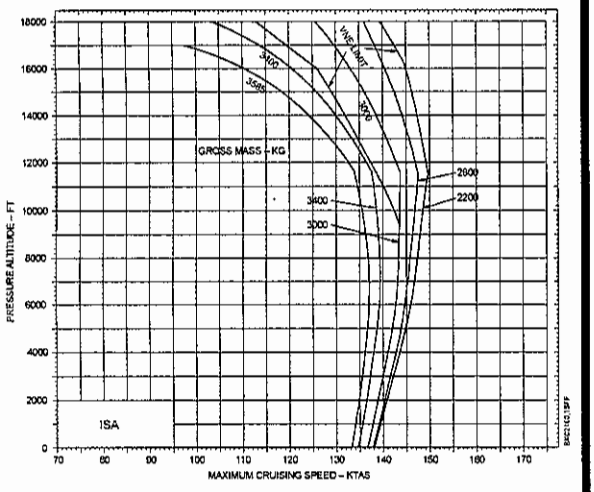

Fig. 8 Maximum cruising speed (sand filter in filter mode, ISA)

MAXIMUM CRUISING SPEED

MAXIMUM CONTINUOUS POWER
SAND FILTER IN FILTER MODE
BLEED AIR CONSUMERS AS REQUIRED

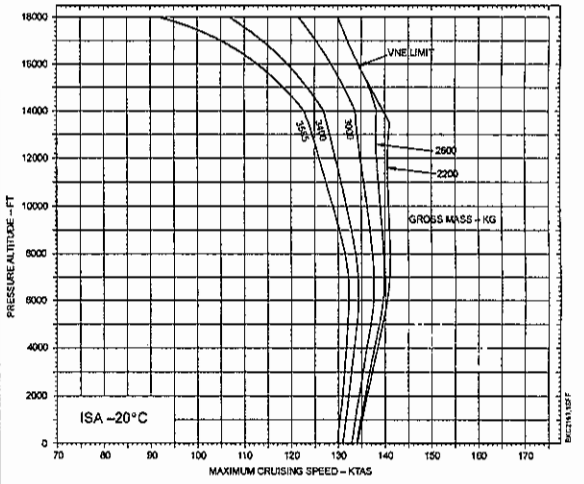

Fig. 9 Maximum cruising speed (sand filter in filter mode, ISA –20°C)

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MAXIMUM CRUISING SPEED

MAXIMUM CONTINUOUS POWER
SAND FILTER IN FILTER MODE
BLEED AIR CONSUMERS AS REQUIRED

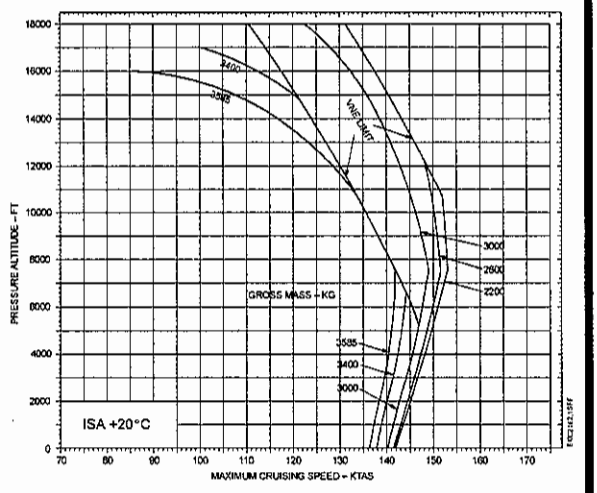


Fig. 10 Maximum cruising speed (sand filter in filter mode, ISA +20°C)

6 MASS AND BALANCE

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

7 SYSTEM DESCRIPTION

The sand filter system consists of particle separator frame, two air cleaner panels, two bypass door actuators and two bypass doors actuated thereby, two scavenge ducts, two scavenge blowers and the wiring system associated to L/H and R/H which is for controlling bypass doors and scavenge blowers.

The installation of the sand filter system is shown in figure 11.

Each air cleaner panel can be opened and closed around the hinges in order to inspect the hydraulic unit and the oil cooling fans etc.

This equipment is mounted over the hydraulic module located forward of the transmission cowling. When the sand filter system is installed, the crest cowling is removed from the airframe.

When this equipment is installed, the starter generator is cooled using the engine room air.

The sand filter system has bypass doors and scavenge blowers which are operated by the electrical circuit associated to L/H and R/H. No.1 and No.2 bypass door actuators are provided with the electrical power from 28 VDC SHED BUS 1 and SHED BUS 2 via each circuit breaker (Fig. 12). No.1 and No.2 scavenge blowers are provided with the electrical power from MAIN BUS (28 VDC) via each relay.

The sand filter system is operated by the two switches of SAND FLTR 1 and SAND FLTR 2 (Fig. 12), and each of them has three operating positions of OFF, DOOR and ON. The condition of sand filter system under the each operating position is shown as follows:

MODE OF OPERATION	SWITCH-POSITION	CONDITION/FUNCTION
Bypass mode	OFF	Bypass doors open, scavenge blowers off
Filter mode	DOOR	Bypass doors closed, scavenge blowers off
	ON	Bypass doors closed, scavenge blowers on

In bypass mode operation (SAND FLTR switch OFF), the ambient air is led to the engine air intake directly passing the bypass doors opening area, and provided to the engines and oil cooling fans.

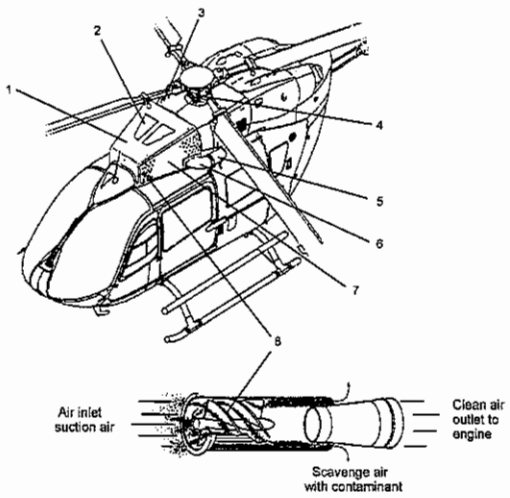
In filter mode operation (SAND FLTR switch ON), the particles (sand and dust etc.) contained in the air is separated by means of swirl of the vortex generators, and led to the scavenge duct. The separated particles are ejected overboard by the scavenge blower. Therefore, the engines and oil cooling fans are provided with the clean air which is seperated from particles.

DOOR position of SAND FLTR switch should be used only during the engine starting and shut-down.

When the SAND FLTR switch is operated from OFF to DOOR/ON position or vice versa, the bypass door actuator begin to move, and CPDS "SAND FLTR" caution indication comes on. When the actuator moved to the end of full stroke (approx. 20 seconds), the CPDS caution indication goes off. This caution informs the pilot of the following fault conditions of bypass door opening–closing mechanism:

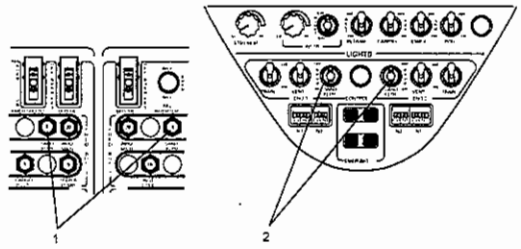
(1) Bypass door is not opened or closed completely. (The caution indication remains on more than 30 seconds.)

(2) Bypass door is inoperative. (The caution indication does not come on, or indication time is extremely shorter than 20 seconds.)



1 Particle separator assembly
2 Bypass doors
3 Handle (if installed)
4 Mast seal
5 Scavenge blowers
6 Scavenge duct
7 Air cleaner panels
8 Vortex generator

Fig. 11 Sand filter system installation



1 Sand filter circuit breakers
2 SAND FLTR switches

Fig. 12 Sand filter system controls (Overhead panel)

F M S 9.2-23

SUPPLEMENT FOR

SEARCHLIGHT SX - 16 (IR) WITH LASERPOINTER (LH MOUNTED)

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the Searchlight SX - 16 (IR) with Laserpointer has been installed.

System/Equipment Designation	Effectivity
Searchlight SX - 16 (IR)	All
Searchlight SX - 16 (w/o IR and slaving unit)	All
Optional Laserpointer	All
Optional Retrofit-Kit for Slave Mode/ Synchronisation only	All

Date: 20. Nov. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
R	9.2-23 -1	4		9.2-23 -6	3		R 9.2-23 -11	4	
R	9.2-23 -2	4		R 9.2-23 -7	4		R 9.2-23 -12	4	
R	9.2-23 -3	4		R 9.2-23 -8	4		R 9.2-23 -13	4	
	9.2-23 -4	3		R 9.2-23 -9	4		/14blank		
	9.2-23 -5	3		R 9.2-23 -10	4				

LOG OF REVISION

FIRST ISSUE

ORIGINAL		NOV 2001
REVISION	1	OCT 18, 2002
REVISION	2	NOV 17, 2003
Revision	3	JUN 27, 2004
Revision	4	(see entry below)

REVISION 4

Approved by EASA:

Date: Oct 24, 2006

EASA approval no.: R.A.01198

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1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

2 LIMITATIONS

2.1 COMPATIBILITY

For installation of the searchlight SX-16 the LH skid deflector of the WSPS (FMS 9.2-29) must be removed. Thereby the effectiveness of the WSPS is degraded.

A SX–16 without slaving unit, is not compatible with the optional equipment emergency floatation system, FMS 9.2–9.

2.2 LIMITATIONS FOR SEARCHLIGHT SX-16/LASERPOINTER OPERATION

2.2.1 Airspeed limitations

Full operation envelope of SX-16 for all directions ..... up to 80 KIAS

Full operation envelope of SX-16 but without guaranteed position holding ..... 80 KIAS < IAS ≤ 120 KIAS

SX-16 may be installed but must not be operated ..... above 120 KIAS

NOTE
- The airspeed indication on the pilot's side is 6 kts higher during autorotation compared to the helicopter without SX–16 installed.
- The airspeed indication on the copilot's side is 5 kts higher during autorotation compared to the helicopter without SX–16 installed.

2.2.2 Height limitations

The laserpointer must be switched OFF, whenever the aircraft is below 80 ft AGL.

The searchlight SX16 must be switched OFF, whenever the aircraft is below 50 ft AGL. It must not be used as a landing light.

During SX-16 operation (no IR-operation) below 200 ft AGL it is recommended to switch on a landing light, to guarantee a safe flight after a sudden failure of the SX-16.

2.2.3 Other operational limitations

The pilot flying must not operate the searchlight SX-16 remote control unit. Operation of the SX-16 system is restricted to trained crew members only.

Fabric glare shields shall be installed for night operations with the search light.

3 EMERGENCY AND MALFUNCTION PROCEDURES

CAUTION DURING EMERGENCY LANDING ON WATER THE SEARCHLIGHT SX–16 SHOULD BE SWITCHED OFF BEFORE ACTIVATION OF THE EMERGENCY FLOATS.

NOTE During emergency landing on land the searchlight SX-16 should be switched off before touchdown.

4 NORMAL PROCEDURES

WARNING
- MAKE CERTAIN THAT SEARCHLIGHT SX-16 HAS COOLED BEFORE HANDLING.
- SWITCHING "ON" THE SEARCHLIGHT SX-16 WHILE THE HELICOPTER IS ON THE GROUND MAY IGNITE DRY VEGETATION. AVOID STATIONARY FOCUSING AT OBJECTS WHILE ON THE GROUND.
- EVEN BRIEF EXPOSURE TO THE BEAM COULD CAUSE SERIOUS EYE DAMAGE. DO NOT AIM THE BEAM TOWARD PEOPLE, AIRCRAFT OR VEHICLES AT RANGES OF LESS THAN 110 m (360 ft).
- IF SX–16 WITH IR IS INSTALLED:
  THE IR LIGHT BEAM IS INVISIBLE AND POTENTIALLY HAZARDOUS TO THE EYES AND SKIN AT DISTANCES OF LESS THAN 139 m (500 ft). DO NOT TEST OR OPERATE THE IR IFCO LENS ON GROUND WITH THE SEARCHLIGHT SX-16 SWITCHED ON.
- IF LASERPOINTER IS INSTALLED:
  THE LASERPOINTER IS INVISIBLE AND POTENTIALLY HAZARDOUS TO THE EYES AND SKIN AT DISTANCES OF LESS THAN 22 m (80 ft). DO NOT TEST OR OPERATE THE LASERPOINTER ON GROUND.

4.1 PREFLIGHT CHECK

NOTE The following checks are to be carried out before every flight with the searchlight SX-16 (with optional laserpointer) installed.

1. Electric plug connections – Tight
2. Searchlight SX-16 (with laserpointer) (glass lamp cover, fastening device, reflector) – Condition
3. Attachment bracket, attachment points and searchlight housing around gimbal attachment points – Condition
4. Attachment bolts, safety pins – Correct installation
5. Multifunction step assy – Condition

4.2 **PRE-LANDING CHECK**

NOTE It is recommended that the searchlight SX-16 is returned to the most upward position before being turned off.

4.3 **SEARCHLIGHT/LASERPOINTER OPERATION**

CAUTION
- HOLD DOWN OFF-ON-IGN SWITCH SX-16 IN THE IGN POSITION FOR APPROX. 5 SECONDS, UNTIL THE SEARCHLIGHT COMES ON, AND THEN RELEASE. HOLDING DOWN ANY LONGER THEN NECESSARY CAUSES CONSIDERABLE DAMAGE TO THE LAMP AND THE EQUIPMENT.
- THE SX-16 SEARCHLIGHT MAY NOT BE SWITCHED ON WHILE THE HELICOPTER IS ON THE GROUND, EXCEPT FOR TEST PURPOSES.
- THE INDICATIONS OF THE STANDBY MAGNETIC COMPASS MAYBE UNRELIABLE DURING SX-16 SEARCHLIGHT OPERATION.

4.3.1 **Switching on the system**

OFF-ON-IGN sw	– Place and hold in IGNT until lamp ignites (approx. 5 sec), then release

4.3.2 **Inflight operation**

SX16/LL/MIR select sw	– SX-16
Directional control sw	– Operate as desired
FOCUS pb	– Operate as desired
IFCO sw (if installed)	– ON/OFF as desired; observe advisory light
LASER pb (if installed)	– Press as desired

FLIR and SX-16 slave function (optional)

NOTE The following functions can only be performed using the remote control panel with SLAVE MODE/SYNC.

SLAVE sw	– ON/OFF as desired

NOTE With the SLAVE sw in ON position and the FLIR installed, the SX-16 is automatically boresighted to the FLIR platform. The horizontal and vertical control of SX-16 can only be performed using the FLIR controls.

As the SX-16 rotating range is limited the searchlight is only slaved to the range of the SX-16. If the FLIR continues beyond this limits the searchlight will stop at the limit. If FLIR re-enters the rotating range of the SX-16, the searchlight will immediately start turning until it is boresighted again to the FLIR.

4.3.3 **Switching off the system**

CAUTION
- THE LASERPOINTER MUST BE SWITCHED OFF BELOW 80 FT AGL.
- THE SX 16 MUST BE SWITCHED OFF BELOW 50 FT AGL.

NOTE BEFORE BEING SWITCHED OFF, THE SEARCHLIGHT SX-16 SHOULD HAVE REACHED ITS FULL LUMINOUS INTENSITY.

OFF-ON-IGN sw	– OFF

NOTE When on ground/ hover or OAT > 15°C, allow the blower approx. 30 sec to cool the system by switching back in "ON" position.

LASER ON pb	– Press

5 **PERFORMANCE DATA**

5.1 **RATE OF CLIMB**

All results obtained from the respective diagram, contained in section 5 of the basic Flight Manual, are to be corrected as follows: .....

Helicopter gross mass below 2400 kg:	Subtract 80 ft/min
Helicopter gross mass of 2400 kg and below 3000 kg:	Subtract 60 ft/min
Helicopter gross mass of 3000 kg and above:	Subtract 50 ft/min

6 **MASS AND BALANCE**

	Mass (kg)	Arm (mm)	Massmoment (kgmm)
Searchlight SX - 16(IR)			
– fixed provisions	5,73	3122	17878
– detachable parts	39,93	2074	82826
Searchlight SX - 16(w/o IR...)			
– fixed provisions	5,63	3133	17639
– detachable parts	31,10	2070	64377

7 **SYSTEM DESCRIPTION**

7.1 **SEARCHLIGHT SX-16 (IR)**

The high-intensity (1600-Watt) xenon arc lamp equipped searchlight (Nightsun Searchlight, model SX-16) is mounted on a multifunction carrier on the left side of the helicopter. The mounting structure provides a quick disconnection of the searchlight SX-16 (Fig. 1).

The searchlight SX-16 assembly comprises a searchlight with optional IR-IFCO (In Flight Change Over) screen, a gimbal, a electronic box, and a control unit. Searchlight, gimbal and electronic box are secured to a quick-detachable mount.

The searchlight SX-16 receives power from the electrical master box No.2 via a 80A fuse. An additional circuit breaker is located at the overhead panel.

The control of the searchlight SX-16 is provided by two switches in the overhead panel and two switches on the pilots (and copilots) collective pitch lever as shown in Fig. 2 and Fig. 4. Additionally a remote control unit (optional) is provided to operate the searchlight by trained crew members.

An IFCO advisory light comes on at the CPDS when the IR-IFCO screen is switched ON (optional).

The fabric glare shields are installed in the lower part of the cockpit to reduce glare from the search light.

7.2 **LASER POINTER**

An infrared laser pointer is installed on the outside of the searchlight housing. The associated electronic switch box is mounted inside the electronic box.

With the laser pointer switched "ON", the view direction of the searchlight can be observed with night vision goggles, while the searchlight lamp is off.

The laserpointer is coupled to the radar altimeter and will be switched off automatically below 50 ft AGL.

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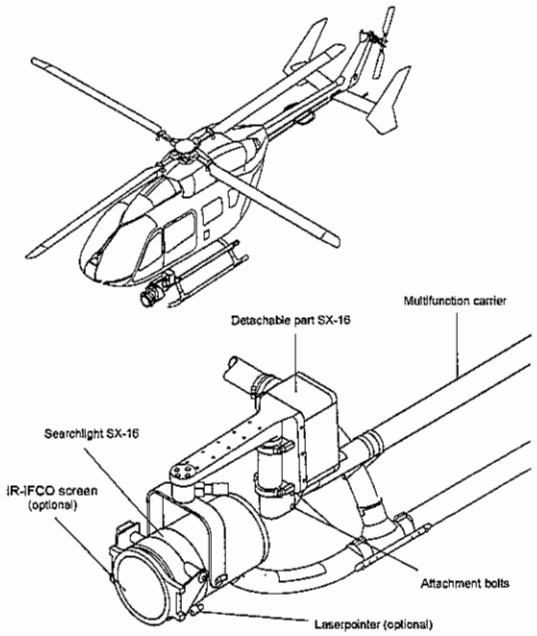

Rotating range (regarding the longitudinal axis):

vertical:	IR-IFCO not installed:	– 70° down to + 10° up
	IR-IFCO installed:	– 50° down to 0° up
horizontal:	left 90°	
	right 30°	

Fig. 1 Searchlight SX-16 (IR)

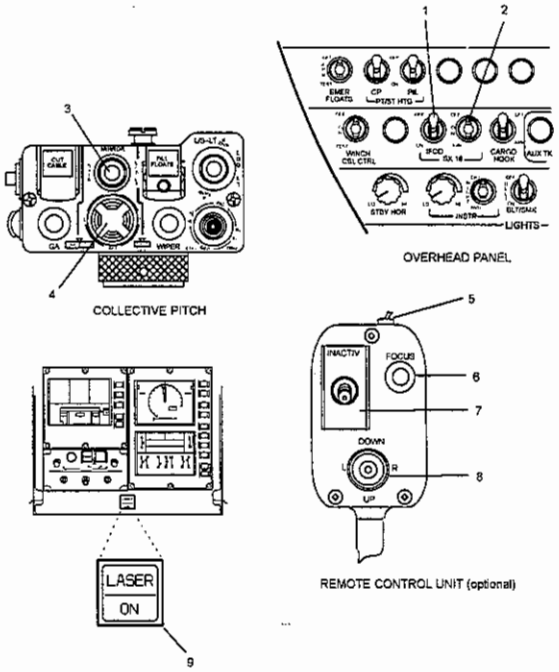

Fig. 2 Typical SX-16 control units

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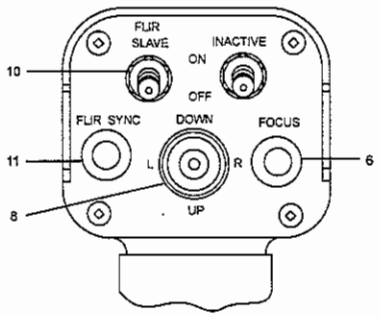

Fig. 3 Typical REMOTE CONTROL PANEL with SLAVE MODE/ SYNC. (optional)

	SWITCH	POSITION	FUNCTION
1	SX16 IFCO (2-way toggle switch) (optional)	ON / OFF	Performing an inflight changeover from normal light ("OFF") to IR-filtered light ("ON"). In ON position the IR-ON master-light comes on.
2	SX16 (3-way toggle switch)	OFF	De-energizes the entire SX16 system (except the directional control and the FOCUS) and extinguishes the light if operating.
		ON	Provides power to the fan, the lamp and directly feeds the SX16 IFCO switch. Once the lamp starts ("IGN"), the switch is released, returning to the "ON" position for continuous operation.
		IGN	A spring-loaded momentary contact position which energizes the lamp starting circuit.
3	SX16/ LT / MIR Select (3-way switch)	SX-16	selects the SX-16 for directional control (4)
		MIRROR	selects the mirror for directional control (4)
		S/L LT	selects the S/L light for directional control (4)
4	SX16/LT/ MIR Directional control (pushbutton, 4-way movement switch, momentary)	FWD	Operates the gimbal-mounted elevation motor to drive the SX16 up to max 10° (0° IR) from level.
		AFT	Operates the gimbal-mounted elevation motor to drive the SX16 max. 70° (50°) IR down from level.
		L / R	Operates the gimbal-mounted azimuth motor to drive the SX16 in the respective direction, up to 90° to the left and 30° to the right from longitudinal axis.
		FOCUS pb press	Momentary-contact type switch operates a focus-mechanism, nonreversible motor to change the light beam spread from 4° to 20° and back.
5	INACTIVE		
6	FOCUS (pushbutton, momentary)	FOCUS	Momentary-contact type switch operates a focus-mechanism, nonreversible motor to change the light beam spread from 4° to 20° and back.
7	INACTIVE		
8	Dirctional control (4-way movement switch, momentary)	DOWN	Operates the gimbal-mounted elevation motor to drive the SX16 max. 70° (50°) IR down from level.
		UP	Operates the gimbal-mounted elevation motor to drive the SX16 up to max 10° (0° IR) from level.
		L / R	Operates the gimbal-mounted azimuth motor to drive the SX16 in the respective direction, up to 90° to the left and 30° to the right from longitudinal axis.

9	Laser ON (pushbutton)	ON-OFF	When ON, pushbutton will illuminate
10	FLIR SLAVE	ON-OFF	In position ON, FLIR and SX-16 movements are synchronized. In that case directional movement of SX-16 can only be performed using the directional controls of FLIR system.
11	FLIR SYNC	press	Press 3 - 5 sec to define SX-16 neutral position offset. FLIR must point forward and SX-16 must be aimed on same target as FLIR when synchronising.

NOTE
- Light beam will continually cycle from large to small to large again as long as the FOCUS pushbutton is held in the FOCUS position.
- Mechanical stops limit searchlight travel in all directions. When a stop is reached the affected motor continues to rotate (as long as the switch is pressed) while the motor torque is absorbed by an integral friction clutch.

Fig. 4 Functions for control units

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F M S 9.2-24

SUPPLEMENT FOR

SEAT ARRANGEMENT

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when a SEAT ARRANGEMENT has been installed.

System/Equipment Designation	Effectivity
Elongated seat track of copilot seat	All
Height adjustable pilot seat	All
Height adjustable copilot seat	All
Passenger Seats (Club Version)	All
Passenger Seats (All Forward Version)	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 29. Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

LEP – EASA approved (part 1):

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2-24 -1	3.1							
R	9.2-24 -2	3.1							
	9.2-24 -3	3							
	9.2-24 -4	0							

LEP – manufacturer's data (part 2):

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2-24 -5	3.1							
R	9.2-24 -6	3.1							

LOG OF REVISIONS

First Issue

ORIGINAL	REV. 0	OCT 28, 2001
REVISION	1	MAR 21, 2002
REVISION	2	DEC 03, 2002
REVISION	3	JAN 15, 2003
REVISION	3.1	(see entry below)

REVISION 3.1

Date: NOV 18, 2011

Revision No. 3.1 to FMS reference revision 3 , is approved under authority of DOA No. EASA. 21J.034.

1. GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2. LIMITATIONS

2.1 CONFIGURATION REQUIRMENTS

When the Passenger Seats (All Forward Version), P/N B252M2017051, are installed, the pitch protection pilot/copilot and the sliding door jettisoning (FMS 9.2–34) must be installed and the installation of a center console with an extended length is prohibited.

2.2 OPERATIONAL LIMITATIONS

When the Passenger Seats (All Forward Version), P/N B252M2017051, are installed, the front passenger seats may only be occupied if the passenger's knees do not interfere with the seat in front.

2.3 PLACARDS AND DECALS

EFFECTIVITY *If elongated seat track (P/N 251M2013051) copilot side is installed.*

Placard:

USE SEAT IN FORWARD
LOCKED POSITIONS ONLY

Location: Left rail of copilot seat

Placard:

DO NOT USE SEAT IN REAR
UNLOCKED PARKING POSITION

Location: Left elongated rail of copilot seat

EFFECTIVITY *If height adjustable seat(s) (pilot and/or copilot) installed; (B251M2040051 & B251M2048051 or B251M2041051 & B251M2049051)*

Placard:

DIESER SITZ DARF NUR IN
FLUGRICHTUNG EINGEBAUT
BETRIEBEN WERDEN
THIS SEAT ONLY MAY BE
OPERATED WHEN INSTALLED
IN FLIGHT DIRECTION

Location: Left rail of pilot-/ copilot seat

EFFECTIVITY *All*

3. EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4. NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

WARNING INSTALLATION OF THE PASSENGER SEAT SYSTEMS IS ONLY ALLOWED IN POSITIONS WHERE THE ACCESSIBILITY TO THE EMERGENCY EXITS IS NOT AFFECTED. SEAT BACK REST MAY NOT INTERFERE WITH WINDOW OPENING OF SLIDING DOORS.

NOTE
- The seat systems described in section 7 enable the accessibility of the emergency exits.
- In case of more than six passengers on board a second hand fire extinguisher has to be located in the passenger compartment.

Exterior check, fuselage RH side:

Seat arrangement	– Check, accessibility to the emergency exits is not affected.

5. PERFORMANCE DATA

No change to the basic flight manual data.

FOLHA 3224
PROC.053000716/2012
MAT.1403565

6. MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7. SYSTEM DESCRIPTION

The seats are connected to the floor tracks of the passenger cabin floor via three slightly different adaptors, depending on the place of installation. The seats could be assembled in two different height versions: high and low for the front and middle row, for the aft row low only.

NOTE To satisfy the needs of different customer operational tasks various seat combinations are available. In general the seats are interchangable with each other and can be combined with any adaptor. It is possible to have one or more seat(s) removed. When the rear seat row is not installed, an additional seat may be installed in the center position of the middle seat row.

7.1 PASSENGER SEATS (CLUB VERSION)

The Passenger Seats (Club Version) consists of:

- Max. 3-Pax seat version against flight direction(front),
- Pax seat in flight direction (middel LH/RH),
- Max. 3-Pax seat version in flight direction (aft)

The 8-Pax Seats Club Arrangement consists of 8 modular single standing crashworthy seats which are arranged to three seat rows (front, middle, aft). Max. three pax seats facing against flight direction are installed directly behind the crew seats. Two single seats facing in flight direction are installed LH/RH in the middle of the passenger compartment. Max. three pax seats facing in flight direction are installed in the aft part of the passenger compartment. (Fig.1)

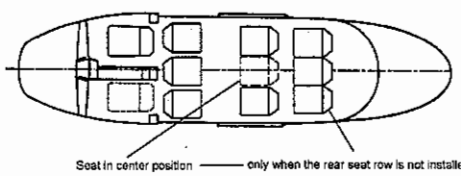

Fig. 1 8-Pax Seats Club Arrangement

7.2 PASSENGER SEATS (ALL FORWORD VERSION)

The Passenger Seats (All Forward Version) consists of:

- Max. 3-Pax seat version in flight direction (front),
- Pax seat in flight direction (middel LH/RH),
- Max. 3-Pax seat version in flight direction (aft)

The difference between the 8-Pax Seats (Club Arrangement) and the 8-Pax Seats (All Forward Version) are the three pax seats facing in flight direction, installed directly behind the crew seats.

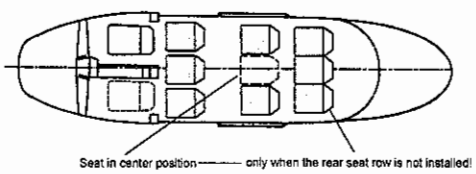

Fig. 2 8-Pax Seats (All Forward Version)

F M S 9.2-25

SUPPLEMENT FOR

SETTLING PROTECTORS

This Supplement shall be attached to the BK117 C-2 Flight Manual (Section 9.2) when the SETTLING PROTECTORS have been installed.

System/Equipment Designation	Effectivity
Settling protectors	All
Settling protectors (installed in conjunction with emergency floats)	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 04. April 02

Approved by:

Luftfahrt-Bundesamt
Braunschweig

1 GENERAL

The information contained herein supplements the information in the basic Flight Manual. For limitations, procedures, and performance data not contained in this Supplement, refer to the basic Flight Manual.

2 LIMITATIONS

2.1 COMPATIBILITY WITH OTHER OPTIONAL EQUIPMENT

The Settling protectors are not compatible with:

- Snow skids (FMS 9.2 -26)

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

1. Settling protectors – Condition

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
R	9.2-25 -1	0.1							
R	9.2-25 -2	0.1							
	9.2-25 -3	0							
R	9.2-25 -4	0.1							

LOG OF REVISIONS

First Issue		
ORIGINAL, REV.	0	APR, 2002
REVISION	0.1	(see entry below)

Revision 0.1

Date: Dec 12, 2006

Revision No. 0.1 to FLM reference revision 0 , is approved under authority of DOA No. EASA. 21J.034'.

6 MASS AND BALANCE

6.1 EQUIPMENT LIST ENTRIES

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

7.1 STRUCTURE OF THE SETTLING PROTECTORS

Settling protectors are installed to prevent the helicopter from settling into soft or unstable ground during landing or parking.

The settling protectors are constructed of machined solid metal with cover and installation hardware. They are installed to the rear end of the skid tubes with three thread bolts and secured with locknuts.

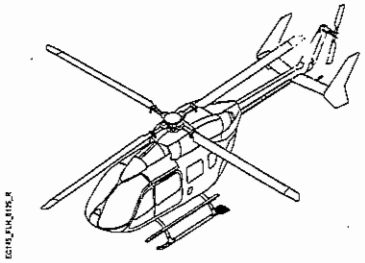

Fig. 1 Settling protectors

F M S 9.2-26

SUPPLEMENT FOR

SNOW SKIDS

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the SNOW SKIDS have been installed.

System/Equipment Designation	Effectivity
Snow skids	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 18. Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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	Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
R	9.2-26 -1	2.1							
R	9.2-26 -2	2.1							
	9.2-26 -3	2							
	9.2-26 -4	0							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL,	REV. 0	Oct, 2001
REVISION	1	Aug 08, 2002
REVISION	2	Mar 04, 2004
REVISION	2.1	(see entry below)

Revision 2.1

Date: Dec 12, 2006

Revision No. 2.1 to FLM reference revision 2, is approved under authority of DOA No. EASA. 21J.034'.

FOLHA 3226
PROC.053000716/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

Snow skids are installed to prevent the helicopter from settling into soft snow during landing or parking. During landing on hard surfaces the landing forces act on the skids – the snow skids will only be stressed during landing on soft surfaces like snow.

2 LIMITATIONS

2.1 COMPATIBILITY WITH OTHER OPTIONAL EQUIPMENT

The snow skids are not compatible with settling protectors (FMS 9.2 –25).

2.2 OPERATIONAL LIMITATION

Landing with forward speed on soft surfaces (e.g. snow) is prohibited, except in case of emergency.

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

Snow skids – Condition, securely attached

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The snow skids consist of flat duraluminum sheet bodies which are tightly fitted to the skid tubes with clamps and struts. For rescue winch operation cable deflectors are mounted to both snow skids.

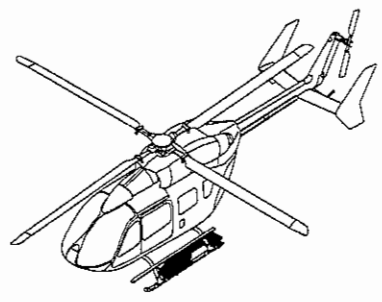

Fig. 1 Snow skids

FMS 9.2-27

SUPPLEMENT FOR

UTILITY SEAT BENCH

This supplement shall be attached to the BK 117 C-2 flight manual (section 9.2) when the UTILITY SEAT BENCHES have been installed.

System/Equipment Designation		Effectivity
Utility seat bench, LH,	detachable part floor part fixed provisions	All
Utility seat bench, RH	detachable part floor part fixed provisions	All
Installation 3–pax seats against flight direction		All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date:
12 Okt. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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	9.2-27 -1	3		9.2-27 -5	3		9.2-27 -9	3	
R	9.2-27 -2	3.1		9.2-27 -6	3		9.2-27 -10	3	
	9.2-27 -3	3		9.2-27 -7	3				
	9.2-27 -4	3		9.2-27 -8	3				

LEP – manufacturer's data (part 2):

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2-27 -11	3.1							
R	9.2-27 -12	3.1							

LOG OF REVISIONS

FIRST ISSUE

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EASA approval no.: 2005-1754

REVISION 2 Jun 07, 2005
EASA approval no.: 2005-5811

REVISION 3 (see entry below)
EASA approval no.: 10028728

REVISION 3.1 (see entry below)

REVISION 3.1

Date: NOV 18, 2011

Revision No. 3.1 to FMS reference revision 3 , is approved under authority of DOA No. EASA.21J.034.

FOLHA 3227
PROC.0530007 16/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

NOTE CAT A Operations (FMS 9.1–1) remain unchanged.

2.1 OPERATIONAL LIMITATIONS

A maximum of 11 occupants may be carried :

9 Passenger + 2 Crew Member or

10 Passenger + 1 Crew Member provided other FLM Supplements do not require a minimum crew of two.

The optional equipment "3-pax seats against flight direction" has to be installed as shown in fig. 2.

2.2 ALTITUDE LIMITATIONS

The max. takeoff and landing altitude for operation with 10 passengers will be limited to 12000 ft DA/PA

2.3 HEIGHT–VELOCITY ENVELOPE

The max. takeoff and landing altitude for operation with 10 passengers will be limited to 12000 ft DA/PA.

The height-velocity envelope shown in the height-velocity diagram (figure 1) is the combination of indicated airspeed and height above ground as a function of gross mass, pressure altitude and outside air temperature.

The diagram shows the area which is critical for helicopter operation in the event of a single engine failure during takeoff, landing or other operations near the ground.

The critical height-velocity area shall not be penetrated in flight.

The curves are applicable for landing sites with smooth firm surfaces and define the conditions in which a safe landing can be made after an engine suddenly becomes inoperative.

NOTE • The helicopter configuration shall comply with the mass-altitude-temperature limits shown in this supplement.

EXAMPLE: (see figure 1)

The critical height-velocity area which shall not be penetrated in flight, can be defined by first determining point P, a point on the requested boundary curve.

Determine: **Critical height-velocity curve**

Known:		
	OAT	6 °C
	Pressure altitude	7000 ft
	Gross mass	2900 kg

Solution:

Enter chart at known OAT (6 °C)

Move vertically upwards to known pressure altitude (7000 ft)

Move horizontally right to known gross mass (2900kg)

Move vertically downwards to intersect the reference line

From intersection with reference line move horizontally left and read height above ground for point P = **146 ft**

Draw the boundary curve through point P by interpolating between the existing curves on the chart

HEIGHT-VELOCITY DIAGRAM

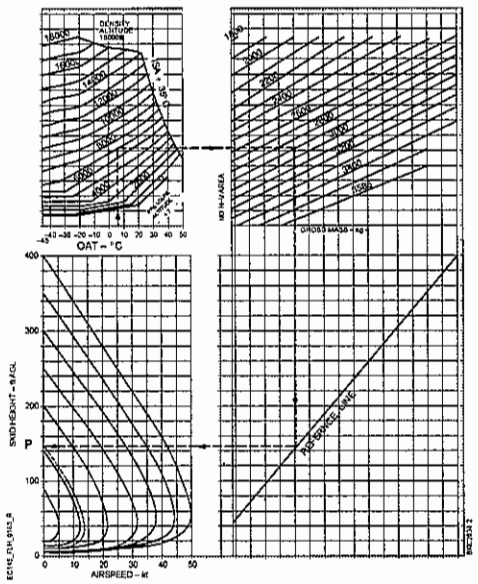

Fig. 1 Height-velocity diagram

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

1. Utility seat benches and / or 3–pax seats – Tight fit and secured
2. Safety belts – Secured

FOLHA 3228
PROC.053000716/2012
MAT.1403565

5 PERFORMANCE DATA

5.1 WEIGHT–ALTITUDE–OAT CHART FOR TAKEOFF AND LANDING

For maximum takeoff and landing gross mass refer to Fig.2 or, if sandfilter system (FMS 9.2–22) is installed to Fig.3 or (FMS 9.2–50) to Fig.4. However if external mounted optional equipment (shown below) is installed, proceed as follows:

All results obtained from maximum takeoff and landing gross mass chart (Fig.2 or 3 or 4) are to be corrected using these correction values.

	Δ MTOW [Kg]	
	DA ≤ 5000 ft	DA > 5000 ft
Emergency Floats (FMS 9.2–9)	–30	–40
Searchlight SX-16 (Side) (FMS 9.2–23)	–50	–60
External Loudspeaker (FMS 9.2–12)	–25	–35
External Hoist System (FMS 9.2–11)	–15	–20
Snow Skids (FMS 9.2–26)	–	–
Weather Radar System (FMS 9.2–28)	–	–
Cargo Hook Mirror (FMS 9.2–4)	–25	–35
Forward looking infrared FLIR (FMS 9.2–35)	–20	–25

If the ambient conditions (PA, OAT) are presented by a point located in the dashed area of the diagram (extrepolated beyond the upper gross mass limit), the correction value(s) may be subtracted from the gross mass value corresponding to that point.
However, the result must not exceed the upper gross mass limit of 3585 kg!

EXAMPLE: For helicopter with external optional equipment installed (see Fig.2)

Determine: **Maximum takeoff and landing gross mass**

Known: OAT ..... 24 °C
Pressure altitude ..... 5000 ft (> 5000ft DA)
External Optional Equipment ..... External Loudspeaker (–35 kg)

Solution: **Gross mass = 3305 kg**
Enter chart at known OAT (24°C)
Move vertically upwards to known pressure altitude (5000 ft)
Move horizontally left and read max. gross mass (3340 kg)
Apply correction values for external optional equipment (–35 kg) as follows:
3340 kg – 35 kg = **3305 kg**

MAXIMUM TAKEOFF AND LANDING GROSS MASS

SKID HEIGHT 3 FT

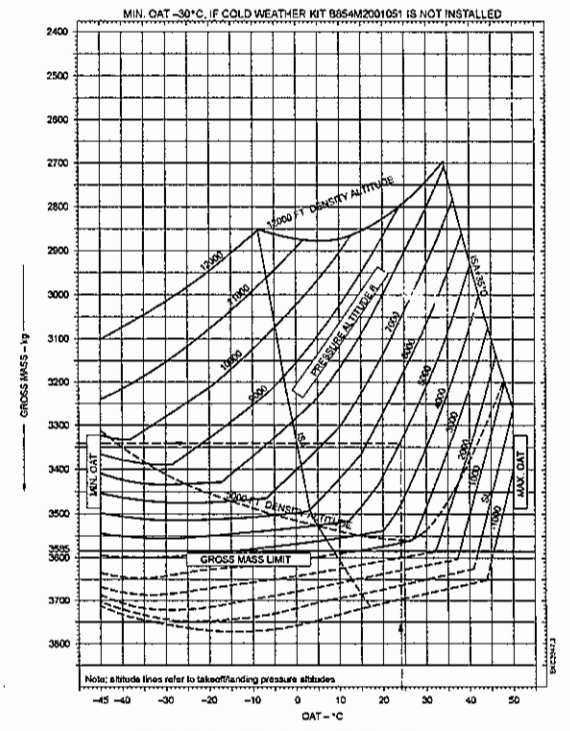

Fig. 2 Maximum Takeoff and Landing Gross Mass

MAXIMUM TAKEOFF AND LANDING GROSS MASS
(SANDFILTER INSTALLED)

SKID HEIGHT 3 FT

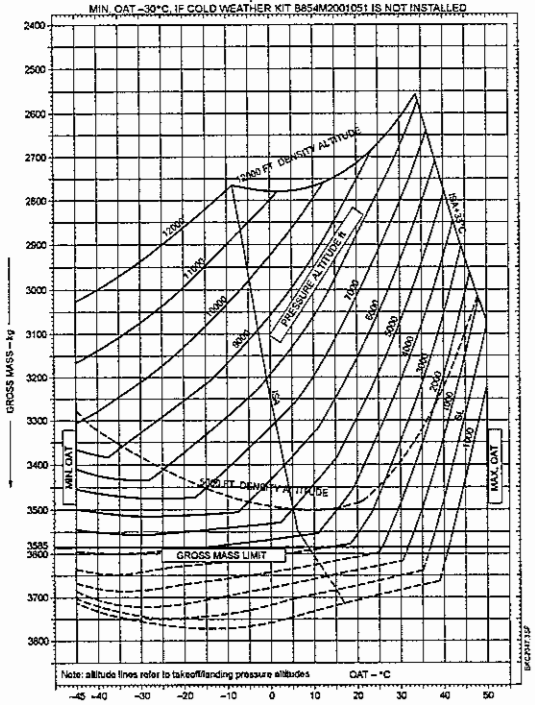

Fig. 3 Maximum Takeoff and Landing Gross Mass with **sandfilter, FMS 9.2–22,** in bypass or filter mode

MAXIMUM TAKEOFF AND LANDING GROSS MASS
(SANDFILTER – IBF SYSTEM INSTALLED)

SKID HEIGHT 3 FT

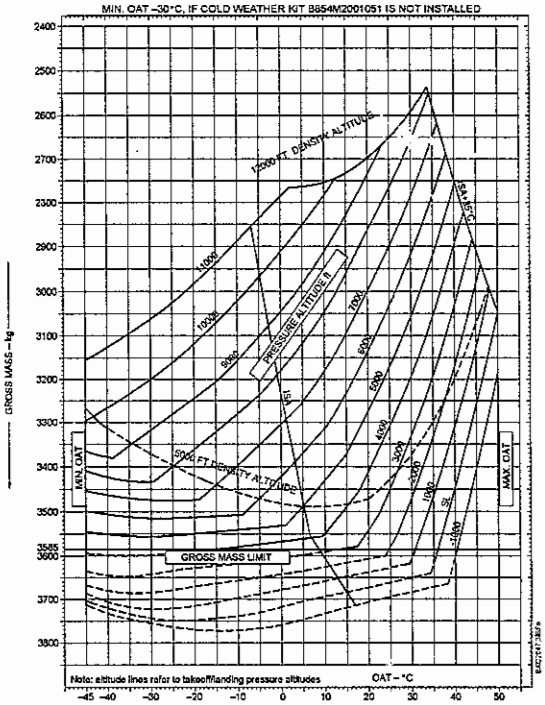

Fig. 4 Maximum Takeoff and Landing Gross Mass with **sandfilter (IBF system), FMS 9.2–50,** NORM or OFF

FOLHA 3229
PROC.053000716/2012
MAT.1403565

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual and basic flight manual data.

7 SYSTEM DESCRIPTION

7.1 UTILITY SEAT ARRANGEMENT

Two benches may be installed along the LH and RH side cabin wall, each for 3 passengers situated in 90° position to the flight direction.

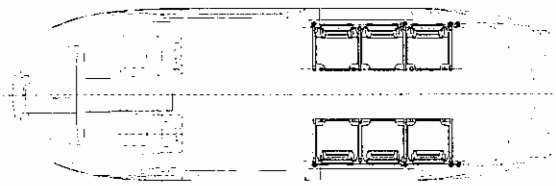

Fig. 1 Utility seat arrangement

7.1.1 Installation and removal

The seat assemblies are interchangeable and easily removable by one person without tools.

The alloy frame of the seat bolster and back rest is attached to the fuselage by quick–fasteners.

7.1.2 Structure of the utility seat

The seats consist of a tubular frame structure covered with canvas and upholstered back- and height adjustable headrests. Under each seat there is a pocket for a life vest. Safety for each passenger is given by adjustable shoulder harnesses and lap belts.

7.2 UTILITY SEAT ARRANGEMENT ADDITIONALLY WITH 3–PAX SEAT AGAINST FLIGHT DIRECTION

The 9 pax seat arrangement consists of:

- 3-Pax seat version against flight direction(front) (see also FMS 9.2–24).
- Two utility seat benches installed along the LH and RH side cabin wall, each for 3 passengers situated in 90° position to the flight direction.

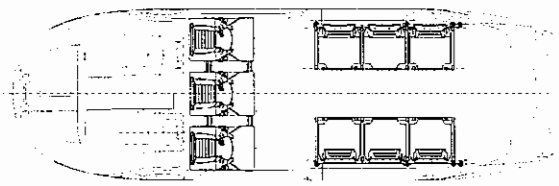

Fig. 2 Utility seats and 3-pax seats against flight direction

F M S 9.2-28

SUPPLEMENT FOR

WEATHER RADAR SYSTEM RDR 1400C

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the WEATHER RADAR SYSTEM has been installed.

System/Equipment Designation	Part No.	Effectivity
Weather radar system RDR-1400 C and VRU	B344M3001051	All

Date:

21. Nov. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
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9.2-28 -2	0		9.2-28 -6	0				
9.2-28 -3	0		9.2-28 -7/ (–8blank)					
9.2-28 -4	0							

LOG OF REVISIONS

FIRST ISSUE	
ORIGINAL	NOV 2001

FOLHA 3230
PROC. 053000716/2012
MAT. 1403565

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

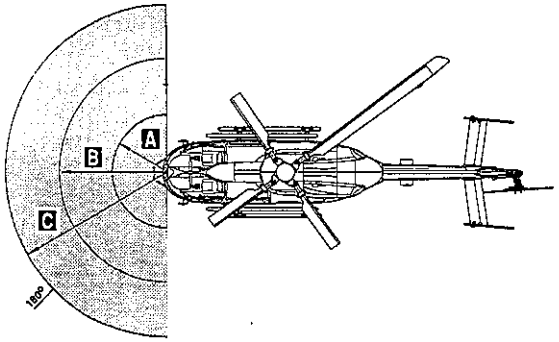
2 LIMITATIONS

2.1 CONFIGURATION REQUIREMENTS

The Radome (P/N B344M3805051) must be installed.

2.2 PRECAUTIONS

- As a rule, the national safety regulations for the operation of radar systems must be observed.
- Operation of the system on ground is only permitted by qualified personnel.
- On ground, the weather radar system may only be put into operation if the following safety distances are observed (see Fig.1)



A Safety distance from personnel ..... **15 ft (5 m)**

B Safety distance from fuel trucks, other aircraft ..... **50 ft (15 m)**

C Safety distance from refueling operations and large metallic objects (e.g. hangar doors) – **tilt antenna upward to the maximum** ..... **100 ft (30 m)**

Fig. 1 Safety Distances

2.3 OPERATIONAL SAFETY

The weather radar system must not be used during starting and shutting down of the engines.

WARNING NEVER RELY UPON WEATHER RADAR AS A PROXIMITY WARNING DEVICE OR FOR ANTI-COLLISION-PROTECTION WARNING.

2.4 OPERATIONAL LIMITATIONS

The limit for the antenna stabilisation function is ±30° for pitch and roll axis.

2.5 COMPATIBILITY

The weather radar system (i.e. Radome) degrades significantly the protective capability of an optionally installed Wire Strike Protection System.

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

4 NORMAL PROCEDURES

NOTE Additional information about the operation of the weather radar system as well as about the correct interpretation of weather maps can be obtained from the pilot's guide and other additional vendor documentation (see para 8.2).

WARNING DON'T PUT FUNCTION SELECTOR SWITCH IN ON POSITION BEFORE THE PRECAUTIONS OF PARA 2.2 HAVE BEEN TAKEN.

4.1 PREFLIGHT CHECK

Radome	– Condition
Antenna and waveguide	– Condition

4.2 SYSTEM CHECKS (POST STARTING ENGINES)

Circuit breakers WXRAD	– Check in
INV sw	– ON
Avionic master sw	– ON
ICP	– Select display for weather radar data imaging
Function selector sw	– STBY

NOTE • Operation of the weather radar is dependent upon an operational radar altimeter.

• Allow 3 minute warmup time for the radar system and the stabilization of the artificial horizon.

• No display appears in STBY position and there is no radar transmission in either STBY or TEST.

Function selector sw – TEST

- The test pattern appears and is scanned over 120°. For the test, the 80-mile range is selected.
- The color bands in the test pattern must correspond to those described in the respective vendor documentation (see para.8.2). FAULT and TEST appear on the screen.

Brightness control – Check function

Function selector sw – OFF

NOTE The TILT performance check should be performed as described in the vendor documentation.

4.3 OPERATION

NOTE If the radar altimeter has detected a height below 100 ft AGL, the Weather Radar System will be set to STBY mode automatically.

To operate the system proceed as described in para 4.2, system checks, until the function selector switch has been set to STBY, then after 3 minutes warmup time and after reaching 100 ft AGL:

Function selector sw – ON; operate the system as described in the pilot's guide.

4.4 TURN OFF THE SYSTEM

WARNING THE SYSTEM SHOULD BE INACTIVATED PRIOR TO LANDING (BY SETTING FUNCTION SELECTOR SWITCH TO OFF OR STBY POSITION).

Function selector sw – OFF

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

8.2 VENDOR DOCUMENTATION

PILOT'S GUIDE **RDR-1400C**

ADDRESS:

TELEPHONICS CORPORATION
Command Systems Division
815 Broad Hollow Road
Farmingdale, NY 11735
USA

6 MASS AND BALANCE

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

7 SYSTEM DESCRIPTION

The helicopter's weather radar system is mainly used to recognize in time "meteorological danger areas", e.g. storm fronts and areas of great turbulences. Such areas must be avoided or flown through at the right place.

It is also suitable, day and night, even under adverse conditions, as a navigation aid which indicates topographical contours, e.g. islands, coastlines, waterways, bridges and oil drilling platforms.

The weather radar system consists of a control panel, a NAV concentrator, a Receiver/transmitter, an antenna drive unit incl. antenna and an indicator (FCDS via VRU (FMS 9.2–14)).

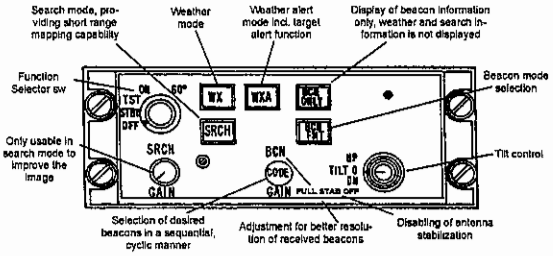


Fig. 2 WX control panel (CP 113)

8 HANDLING, SERVICING AND MAINTENANCE

8.1 HANDLING, MAINTENANCE

1. Operation on ground is only permitted when the safety distances are observed.
2. During refueling, the weather radar system must be switched off.
3. Make sure that the radar nose is clean and that the antennas and the waveguide components are clean and dry.

F M S 9.2-29

SUPPLEMENT FOR

WIRE STRIKE PROTECTION SYSTEM

This supplement shall be attached to the BK117 C–2 flight manual (subsection 9.2) when the WIRE STRIKE PROTECTION SYSTEM has been installed.

System/Equipment Designation	Effectivity
Wire strike protection system	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 11. 5. 2001

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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	Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
R	9.2-29 -1	1.1							
R	9.2-29 -2	1.1							
	9.2-29 -3	1							
	9.2-29 -4	0							

LEP – manufacturer's data (part 2):

	Page	Rev.No	Rem	Page	Rev.No	Rem	Page	Rev.No	Rem
R	9.2-29 -5	1.1							
	/-6 blank								

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL,	REV. 0	MAY, 2001
REVISION EASA APPROVAL NO. 2004-7638	1	JUL 07, 2004
REVISION	1.1	(see entry below)

Revision 1.1

Date: DEC 20, 2010

Revision No. 1.1 to FLM reference revision 1 , is approved under authority of DOA No. EASA. 21J.034.

FOLHA 3232
PROC.053000716/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic flight manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

2.1 COMPATIBILITY

The protective capability of the wire strike protection system is significantly degraded in combination with:

- Searchlight SX 16 (nose-mounted) (FMS 9.2 -23)
- External mirror assy
- Radome
- FLIR Ultraforce II/ LEO-II-AS

3 EMERGENCY AND MALFUNCTION PROCEDURES

In the event of a wire strike, LAND AS SOON AS POSSIBLE and perform engine shutdown. Do not attempt further flight until an inspection and repair is carried out by qualified personnel.

4 NORMAL PROCEDURES

4.1 PREFLIGHT CHECK

4.1.1 Exterior Check

WSPS components	– Condition, security of attachment (apply hand pressure to the component to check for looseness), deformation or mechanical damage.
Lower cutter assembly	– Condition, evidence and indication of ground contact
Cutter blades	– Condition, evidence and indication of wire strike (paint chips on deflector; damaged, missing or broken protective coating on blades, notches, etc).

NOTE If a wire strike has occurred, inspect the wire strike protection system fixed provisions (upper and lower) as well as surrounding cell structure for evidence of damage. Maintenance action is required (refer to appropriate BK 117 C–2 maintenance manual).

WARNING DURING TRANSITION TO FORWARD FLIGHT, AN EXCESSIVE NOSE-LOW ATTITUDE MAY RESULT IN THE WSPS LOWER CUTTER CONTACTING THE GROUND. WHEN TAKING OFF AND LANDING ON UNEVEN TERRAIN, EXTREME CARE SHOULD BE EXERCISED TO PREVENT CONTACT OF LOWER CUTTER WITH THE GROUND.

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

The wire strike protection system consists of an upper cutter assembly mounted on the roof, a lower cutter assembly mounted below the nose, two skid gear deflectors mounted to the skid tubes and a windshield wiper post deflector to prevent threading of wires at the driveshaft of the windshield wiper.

The wire strike protection system is designed to provide a measure of protection against horizontally strung wire impact between cockpit roof and main rotor blades and between bottom shell and skids. The protection will be achieved by deflecting or cutting the wires. Cutting the wires will be done by rigidly mounted converging blades using the kinetic energy of the flying helicopter. Deflecting the wires will be done by the skid gear deflectors and the windshield wiper post deflector.

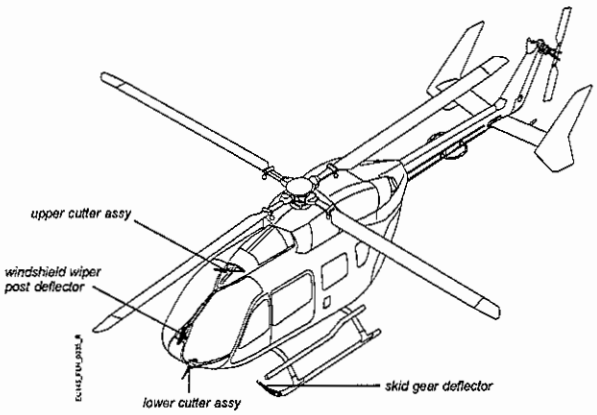


Fig. 1 Wire strike protection system – typical installation

FOLHA 3233
PROC. 05300071 6/2012
MAT. 1403565

F M S 9.2-30

SUPPLEMENT FOR

YAW SAS

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the YAW SAS is installed.

System/Equipment Designation	Part No.	Effectivity
YAW SAS	8221M5001051	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 23. 5. 2001

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
9.2-30 -1	–		9.2-30 -5	0				
9.2-30 -2	0		9.2-30 -6	0				
9.2-30 -3	0							
9.2-30 -4	0							

LOG OF REVISIONS

FIRST ISSUE		
ORIGINAL,	REV. 0	MAY, 2001

1 GENERAL

The information contained herein supplements the information in the basic flight manual. For limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

2 LIMITATIONS

2.1 TYPE OF OPERATION

The system is designed for "pedal-on" operation.

3 EMERGENCY AND MALFUNCTION PROCEDURES

NOTE After pushing the SAS/AP C/O pb on the cyclic stick the YAW SAS is disengaged. The system is reengaged by means of the SAS ON sw (press to the right).

3.1 WARNINGS AND CAUTIONS

3.1.1 Caution indications

CAUTION INDICATIONS

YAW SAS

(MISC)

Conditions/Indications

Yaw SAS inoperative

Procedure

1. SAS/AP C/O pb	– Press
2. SAS ON sw	– Reengage YAW SAS and check proper function

If still inoperative:

3. SAS/AP C/O pb	– Press

3.2 SYSTEM EMERGENCY/MALFUNCTION CONDITIONS

3.2.1 YAW actuator runaway

Conditions/Indications

- Jolt, associated with sudden yaw motion
- **YAW SAS** caution indication comes on

Procedure

CAUTION AVOID HARD AND ABRUPT LEFT/RIGHT PEDAL MOVEMENTS AFTER PRESSING SAS/AP C/O PB.

1. Yaw motion	– Counteract
2. SAS/AP C/O pb (on cyclic stick)	– Press

4 NORMAL PROCEDURES

4.1 SYSTEM CHECKS

4.1.1 YAW SAS system check

SAS/AP C/O pb	– Press
CAD	– Check caution indication: YAW SAS
SAS ON sw	– Reengage YAW SAS and check proper function

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION (refer to fig.1)

The yaw stability augmentation system (YAW SAS) is designed to improve the dynamic stability of the helicopter around the yaw axis by introducing limited authority control inputs to the tail rotor control (± 4 mm authority, directly to the tail rotor hydraulic boost). This augmentation eases directional control during flight maneuvers and reduces the effects of external disturbances such as air turbulence.

The system is designed for "pedal–on" operation, i.e. it expects pedal operation by the pilot to trim the helicopter with respect to the yaw axis. The pilot perceives enhanced handling qualities and at the same time has full authority with respect to command inputs.

The YAW SAS operates in series with the command inputs of the pilot on the non–boosted section of the tail rotor control. It operates by converting electrical signals from the yaw rate gyro into mechanical compensation commands. The boosted section of the tail rotor control transfers the compensation commands to the tail rotor system.

The Yaw SAS consists of the following primary components:

- The **fibre optical gyro** (FOG) measures the yaw rate of the helicopter. A variation in yaw rate within a specific frequency bandwidth causes the FOG to transmit an electrical compensation command to the yaw actuator. The FOG is equipped with an electrical validity control loop monitoring operational readiness of the system.
- The **YAW SAS actuator** is a smart electro–mechanical actuator (SEMA) with an internal position feed–back. It converts the compensation command produced by the FOG into a corresponding control input on the tail rotor control. Following a corrective displacement, the yaw actuator automatically recenters to prevent saturation, and to ensure full SAS control authority.

The system becomes automatically operational with power-up. It receives power from the No. 2 DC essential bus via the YAW SAS circuit breaker located on the overhead panel. The Yaw SAS becomes inoperative by pulling that circuit breaker or by pressing the SAS/AP C/O pb on the cyclic stick grip. In case of failure of the SEMA, the system becomes automatically disengaged. A caution indication YAW SAS is displayed on the CAD in case of power supply cut–off or malfunction of the FOG or SEMA. The reengagement switch SAS ON, located on the cyclic stick grip, reactivates the system by pushing it to the right.

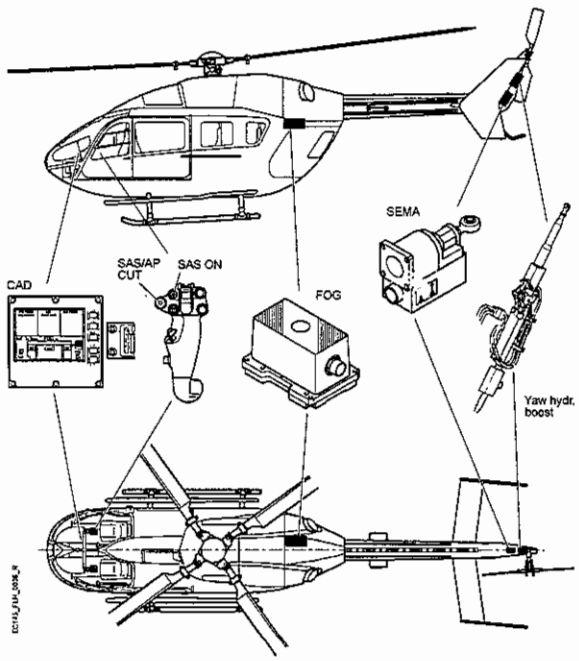


Fig. 1 Yaw stability augmentation system components

F M S 9.2-31

SUPPLEMENT FOR

MEDIUM AIRCRAFT RECORDING AND MONITORING SYSTEM

(M'ARMS)

This supplement shall be attached to the BK117 C-2 flight manual (subsection 9.2) when the MEDIUM AIRCRAFT RECORDING AND MONITORING SYSTEM is installed.

System/Equipment Designation	Part No.	Effectivity
Usage Monitoring System (UMS)	B317M1000051 or B317M1000052	All
Usage Monitoring System inclusive SSQAR	B317M1000051 and B317M1000881 and B317M2002883	All
Usage Monitoring System inclusive SSQAR	B317M1000052 and B317M2002883	All
Cockpit Voice and Flight Data Recorder	B313M2000052	All
Usage Monitoring System + Cockpit Voice and Flight Data Recorder	B317M1003051 and B317M1000881 and B317M2002883 and B313M2000052	All

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 11 Jul 12

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are new, revised or deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the record of supplement-revisions as necessary.

	Page	Rev.No.	Rem	Page	Rev.No.	Rem		Page	Rev.No.	Rem
	9.2-31 -1	3		9.2-31 -6	3		R	9.2-31 -11	3.1	
R	9.2-31 -2	3.1		9.2-31 -7	2			9.2-31 -12	3	
	9.2-31 -3	3		9.2-31 -8	2			9.2-31 -13	3	
	9.2-31 -4	3		9.2-31 -9	3			9.2-31 -14	3	
	9.2-31 -5	3		9.2-31 -10	3			9.2-31 -15/ (16blank)	3	

LOG OF REVISIONS

First Issue

ORIGINAL,	REV. 0	Jul 11, 2002
REVISION	1	Dec 02, 2002
REVISION	2	Apr 14, 2003
Revision EASA approval no. 2005-1055	3	Feb 02, 2005
Revision	3.1	(see entry below)

Revision 3.1

Date: May 23, 2006

Revision No. 3.1 to FLM reference revision 3 , is approved under authority of DOA No. EASA. 21J.034',

FOLHA 3235
PROC.053000716/2012
MAT. 1403565

1 GENERAL

The information contained herein supplements the information in the basic flight manual. For limitations, procedures, and performance data not contained in this supplement, refer to the basic flight manual.

The Medium Aircraft Recording and Monitoring System (MARMS) is built-up as a modular system. Therefore the CVFDR and UMS can be installed and operated independantly from each other, providing that the MFDAU and the CP is installed. As an option the UMS can be equipped with the Quick Access Recorder function (OAR).

1.1 ABBREVIATIONS

A	ACMS	-	Aircraft Monitoring System
C	CP	-	Control Panel
	CPDS	-	Central Panel Display System
	CVR	-	Cockpit Voice Recorder
	CVFDR	-	Cockpit Voice and Flight Data Recorder
D	DTU	-	Data Transfer Unit
F	FCDS	-	Flight Control Display System
	FDR	-	Flight Data Recorder
H	HUMS	-	Health and Usage Monitoring System
M	MARMS	-	Medium Aircraft Recording and Monitoring System
	MFDAU	-	Miscellaneous Flight Data Acquisition Unit
	MMI	-	Man-Machine Interface
N	N_1	-	Gas Generator Speed
	N_2	-	Engine Free Turbine Speed
	N_R	-	Rotor Speed
P	PCMCIA	-	Personal Computer Memory Card International Association
	PGS	-	Professional Ground Station
Q	QAR	-	Quick Access Recorder
S	SSCVFDR	-	Solid State Cockpit Voice and Flight Data Recorder
	SSQAR	-	Solid State Quick Access Recorder
U	ULB	-	Under Water Locator Beacon
	UMS	-	Usage Monitoring System

2 LIMITATIONS

No change to the basic flight manual data.

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 PRE-START CHECK

CVFDR

MARMS 1/2 circuit breakers	– Check in
Area ambiance microphone	– Check free of objects

As an option, the following aural test can be performed:

Test plug (beside control panel)	– Plug in a 600 Ω headset; all audio inputs of pilots/copilots headset and ambiance mic can be heard
Control panel	– Press TEST – a tone must come on

UMS

MARMS or HUMS 1/2 circuit breakers	– Check in

4.2 SYSTEM CHECKS

CVFDR

An initial built-in test will be performed automatically when power is applied. The test was successful, if amber CVR fail and FDR fail lights come on shortly on the control panel.

If a failure has been detected during one of the above tests, the amber FDR fail and/or CVR fail light come (see also failure procedure in section 8 of this supplement). The crew has the possibility to initialize the test again for the CVR part by pressing the TEST button on the CP.

UMS

An initial built-in test will be performed automatically when power is applied. Amber HUMS alarm caption come on shortly on the control panel which indicates that the test was successful.

An absence of dialog between MFDAU and CP, which is checked automatically, or an ACMS software failure, will result in a "NO DATA FROM HUMS" message and/or a HUMS alarm caption on the CP.

CP

The CP-test can be initiated by simultaneously pressing the ∇ Δ keys on the CP for more than 5 seconds, then follow the instructions displayed on the scratchpad zone until AUTOTEST COMPLETE appears.

4.3 OPERATION

The MARMS is energized when the aircraft on-board electrical system is switched on.

CVFDR

The CVFDR automatically starts recording the voice and flight data after successful start-up test. Failure that occurs during operation will be indicated by the illumination of the amber FDR fail and/or CVR fail light. It stops recording after the system power is cut off (or in case of crash or immersion).

UMS

The UMS starts operation when start conditions are reached (starting of first engine and reaching a specific N1 threshold). It stops operation when stop conditions are reached (both engines and rotor stopped and GROUND/FLIGHT sw in position GROUND).

4.4 POSTFLIGHT PROCEDURE

4.4.1 Postflight procedure for CVFDR

AUDIO ERASE PROCEDURE

NOTE The CVFDR audio recording can be erased after flight. This procedure requires two people. The recorded flight data can not be erased.

CAD	– Check ROTOR BRK caution on
BAT MSTR sw	– Check ON
CVR ERASE pb	– Push
simultaneously	
Safety voice erase unit (cargo compartment)	– Push (ON) and hold for at least 5 seconds

NOTE When the erase procedure was successful, an aural tone is generated and transmitted via the headset that is plugged in the CVR audio test plug.

BAT MSTR sw	– OFF

4.4.2 Postflight procedure for UMS

The CP provides one menu which contains 2 directories, FLIGHT DATA and DATA TRANSFER. Both directories are accessible only on ground, with engines and rotors stopped. In case of any anomaly, or in absence of data from the computer, the NO DATA FROM HUMS page is displayed and/or "HUMS" fail light comes on.

DATA TRANSFER

The UMS automatically downloads data to the DTU at the end of the flight, as soon as the stop conditions are reached. TRANSFER RUN is displayed on the scratchpad zone of the CP screen. As soon as the transfer is completed (duration less than 1 minute), the message TRANSFER DONE appears. In case of transfer problems, the message TRANSFER FAIL appears.

An absence of the standard PCMCIA memory card in the DTU or a DTU failure will result in the display of the message NO CARD. With a full card, FULL CARD will be displayed. In this case, to save processed data, insert a card with enough free space before power cut-off and repeat the DATA TRANSFER procedure manually through the DATA TRANSFER menu on the CP.

4.4.3 UMS with optional QAR function

An optional QAR function can be delivered with the UMS.

This function provides a continuously data recording of several flight data on the PCMCIA card. If the card is missing during a session then the flight data are definitely lost.

FLIGHT DATA

When the flight data have been transferred automatically, the data should be validated by the pilot. Therefore the pilot must change to the FLIGHT DATA menu by means of the BACK key and enter the menu by means of the ENTER key. With the ▽ △ keys the pilot goes through the flight data. Each data can be invalidated by the pilot, pressing the ENTER key (status changes from yes (Y) to no (N)). At the end of the the FLIGHT DATA menu an ACKNOWLEDGE page allows to lock the flight data by pressing the ENTER key. When the data are locked, it is impossible to go back to the FLIGHT DATA menu to modify them.

The flight data directory contains at least 9 pages and a maximum of pages dependant on the number of exceedances.

The following table shows the possible types of displayed data.

page 1/9
- Flight time ..... AIRBORNE
- Number of landings ..... LANDING

page 2/9
- N1 cycles eng 1 ..... N11CYCLE
- N2 cycles eng 1 ..... N21CYCLE

page 3/9
- N1 cycles eng 2 ..... N12CYCLE
- N2 cycles eng 2 ..... N22CYCLE

page 4/9
- First takeoff OAT ..... T/O OAT

page 5/9 – NR Exceed
- time of max. value ..... h,min, s
- max. value ..... max (%)
- exceedance duration ... min, s
- no exceedance ..... none

page 6/9 – MMO Exceed
- time of max. value ..... h,min, s
- max. value ..... max (%)
- exceedance duration ... min, s
- no exceedance ..... none

page 7/9 – TQ Exceed
(possible displayed tq exceedances):
- AEO Max.CP (5') .. TQ (1 or2) MCP
- AEO Max. TOP ... TQ (1 or2) MTOP
- AEO TRANS ..... TQ (1 or2) AETRAN
- OEI 2.5 min. ..... TQ (1 or2) OEICT
- OEI Max. ..... TQ (1 or2) OEIMX
- OEI Transient. .... TQ (1 or2) OETRAN

→
- sub type ..... see left
- time of max. value ..... h,min, s
- max. value ..... max (%)
- exceedance duration ... min, s
- no exceedance ..... none

page 8/9 – ENG Exceed
(possible displayed eng exceedances):
- TOT (1 or 2) ..... START, MCP, OEIMX
- ΔN1 (1 or 2) ..... MCP, MTOP, OEICT, OEIMX
- N1 (1 or 2) ..... TRANS
- N2 (1 or 2)

→
- sub type ..... see left
- time of max. value ..... h,min, s
- max. value ..... max (°C, %)
- exceedance duration ... min, s
- no exceedance ..... none

page 9/9
- Enables the crew to confirm the end of validation of the data recorded during the flight ..... ACKNOWLEDGE
- Validation in progress ..... ACKNOWLEDGE–RUN
- Validation completed ..... ACKNOWLEDGE–DONE
- Validation fault ..... ACKNOWLEDGE–FAIL

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

Refer to equipment list entries in section 6 of the basic flight manual.

7 SYSTEM DESCRIPTION

NOTE The CVFDR/UMS is only full operational, when CPDS, FCDS and Autopilot are installed and operational.

7.1 GENERAL

The Medium Aircraft Recording and Monitoring System (MARMS) provides the following main functions:

- the acquisition, processing and storage of crew conversations and specific parameters and data acquired during the flight by means of the Cockpit Voice and Flight Data Recorder (CVFDR)
- the usage monitoring of the rotor, the transmission and the engines, and an overall aircraft behaviour monitoring by means of Usage Monitoring System (UMS)
- **(optional)** the acquisition and storage of the most important flight parameters by means of the Quick Access Recorder function (QAR)

The CVFDR consists of

- a combined Solid State Cockpit Voice and Flight Data Recorder (SSCVFDR), located on the tail boom,
- a Safety Voice Erase Unit, located in the connector panel in the passenger compartment.

The UMS system consists of :

- on board segment, comprising:
  - a DTU which records the UMS data on a PCMCIA card, located in the middle console
- on ground segment, comprising:
  - a UMCard software: The UMCard is delivered as a basic ground analysis tool for the UMS. It is delivered on a CD–ROM and requests a PC equipped with WINDOWS XP or NT.
  - a PGS software: (delivered with the optional QAR function) PGS is delivered as basic ground tool for the analysis of the flight data continuous recording. It is delivered on a CD–ROM and requests a PC equipped with WINDOWS XP or NT.

The CVFDR and ACMS are supported and controlled by means of

- a Miscellaneous Flight Data Acquisition Unit (MFDAU) in a one slotmounting frame, located beside the connector panel in the passenger compartment on the right side.
- a Control Panel (CP) located in the middle console.

The Medium Aircraft Recording and Monitoring System is built–up as a modular system. Therefore the CVFDR and UMS can be installed and operated independantly from each other, providing that the MFDAU and the CP are installed.

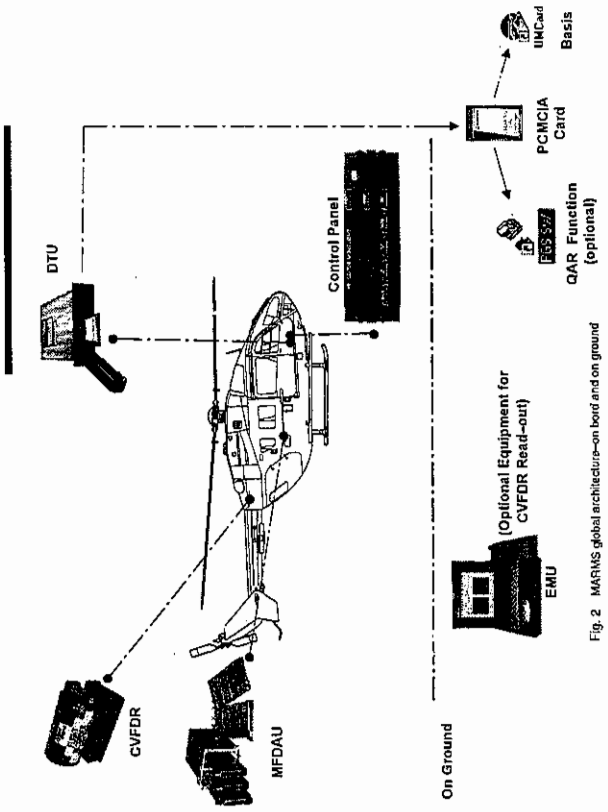


Fig. 2 MARMS global architecture–on board and on ground

7.2 COCKPIT VOICE AND FLIGHT DATA RECORDER (CVFDR)

The CVFDR acquires and records

- the audio signals in the cockpit, from pilot, copilot and passengers via the INTERCOMM system or via an additional summing amplifier or recorded by the area microphone, located in the lower left part of the instrument panel.
- the most significant flight parameters of the helicopter:
  - stick position
  - pedal position
  - collective position
  - helicopter attitude (pitch, roll, heading, accelerations...)
  - engine control panel (start, norm, vent, N1, CAT A)
  - rotor speed
  - engine parameters (N1, N2, TOT,...)
  - gear box torque
  - warnings (LOW FUEL, FIRE, RPM...)
  - important system status (hydraulic, sensors, inverter,...)
  - FCDS information (PFD/ND pages, PFD/ND status, correction,...)
  - autopilot information (failures, selected modes,...)
  - navigation (frequency selection, deviation)

The recording time for the FDR is at least 10 hours (optional 25 hours), and for the CVR 1 hour (optional 2 hours). After that time, when the memories have not been cleared, the memories will be overwritten by the consecutive records.

In case of an aircraft crash, an immersion and impact detector stops recording by cutting the power supply. An acoustic locator beacon, installed on the front panel of the recorder, emits a signal which enables to localize the SSCVFDR in case of immersion.

Safety voice erase unit

The safety voice erase unit enables to reset the cockpit voice recorder (only in conjunction with the CVR/ERASE push button). For reset procedure see para 4.4.1

NOTE The flight and voice data can be downloaded via the readout connector J72005.

7.3 USAGE MONITORING SYSTEM (UMS)

The UMS provides:

- The usage monitoring of:
  - Engine and airframe exceedances (N1,ΔN1, N2, TOT, TRQ, NR, MMO)
  - Flight time duration
  - Rotor turning time
  - Number of landings
  - Engine cycles
  - Engine operating time
  - ,Date and time of each engine start and shutdown
- The helicopter status monitoring:
  - recording of alarms, warnings, cautions and failures

The QAR provides:

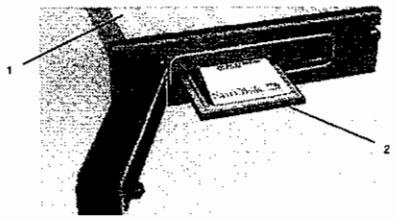
- A continous recording of the most important parameters:
  - Rotor speed
  - Torque
  - Mast moment
  - Engine parameters
  - Fuel flow (total, eng1, eng2)
  - Total fuel quantity
  - Engine oil pressure
  - Transmission oil pressure
  - Hydraulic pressure
  - VARTOMS status
  - Radar altitude
  - GPS position (latitude,longtitude)
  - Wind speed
  - Helicopter attitude (speed, pitch, roll, heading)
  - Atmospheric conditions (temperature, pressure)
  - Indicated warnings and cautions

At the end of the flight, the recorded data are stored on the standard PCMCIA memory card, which is necessary for on ground analysis. Two UMS ground analysis tools are available:

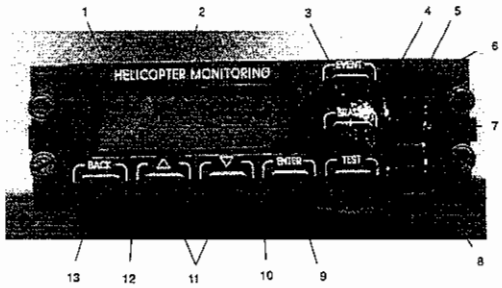
- The UMCard, delivered as standard ground analysis tool for UMS, is used to display the flight report and to store the flight data
- The PGS software is used to analyse the parameters recorded by the QAR

7.3.1 Maintenance data recorder

The maintenance data recorder is connected to the MFDAU and consists of a data transfer unit (DTU (1) and a PCMCIA standard memory card (2). It is used for the storage of UMS and QAR data and the results of inflight analyses and their subsequent transfer to the on ground analysis tool for use at the end of the flight.



7.4 CONTROL PANEL



No.	LABEL/ DESCRIPTION	Function
1	Display screen	displays: • the menus, selections and the results on two lines centered on the middle of the screen. • the number of the page displayed at the bottom RH side of the screen, • the DTU status messages in the Scratch Pad zone.
2	Menus zone	displays the menus, the selections and the results.
3	EVENT pb	used to mark an event on the flight data recording
4	ERASE pb	used to erase the audio tracks
5	TEST pb	used to trigger the CVFDR built-in test sequence
6	CVR light	indicates a voice recording fault
7	FDR light	indicates a flight data recording fault and/or MFDAU failure
8	HUMS alarm caption	indicates MARMS computer failure (MFDAU), VEMD link problems or VEMD off
9	ENTER key	provides: • management of option type (Y/N) fields • switching to a sub–directory • activation of a control
10	Scratchpad zone	on the ground only (engines and rotors stopped): • displays the status of the DTU and the memory card. • displays TRANSFER message when the last flight has not yet been transferred.

11	Koys: ▽and △	providing: – initiation of the control panel self test by simultaneously pressing both keys (for more than 5 s) – by pressing the ▽or △ keys: • switching from one field to another, • switching to the next page when positioned on the last selectable field of the page, or to the previous page when positioned on the first selectable field of the page.
12	Dashed line	permanently displayed on the screen.
13	BACK key	providing return to a directory from a sub–directory by a brief press.

8 HANDLING, SERVICE, MAINTENANCE

When the INTERCOM system is reprogrammed e.g. for new headsets, make sure that the summing amplifier is adapted in accordance with the maintenance manual.

8.1 CVFDR FAILURE PROCEDURE

If the power-up test has failed or the amber CVR fail and/or FDR fail lights come on before takeoff, proceed as follows:

Circuit breakers MARMS 1/2	– Check in
BAT MSTR sw	– Repower
Test plug (beside control panel)	– Plug in a 600 Ω headset
Control panel	– Press TEST – a tone must come on

Check if amber FDR fail or CVR fail lights come on shortly and disappear, indicating that the system operation has been recovered. If not, (FDR fail and/or CVR fail remain on), report the problem to the maintenance team. If a failure occurs during flight, continue flight and report the problem to the maintenance team.

8.2 UMS FAILURE PROCEDURE

If the power-up test has failed or the amber HUMS alarm caption or the "NO DATA FROM HUMS" message come on before both engines started, proceed as follows:

Circuit breakers MARMS or HUMS 1/2	– Check in –
BAT MSTR sw	– Repower
VEMD lane 1 and 2	– Check powered

Check if amber HUMS alarm caption comes on shortly and disappears, indicating that the system operation has been recovered. If not, (HUMS fail and/or NO DATA FROM HUMS remains on), report the problem to the maintenance team. If a failure occurs during flight, continue flight and report the problem to the maintenance team.

F M S 9.2-32

SUPPLEMENT FOR

PILOT / COPILOT DOOR JETTISONING

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the kit for Door Jettisoning has been installed.

System/Equipment Designation	Part No.	Effectivity/Remarks
Kit for pilot/copilot door jettisoning	B522M1011051 & B522M1012051	
or		
Installation pilot/copilot door jettisoning Pilot door jettisoning assy Copilot door jettisoning assy	B522M1100051 & B522M1132101 & B522M1131101	

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 15. Nov. 01

Approved by:

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

NOTE N, R, or D indicate pages which are New, Revised or Deleted respectively. Remove and dispose of superseded pages, insert the latest revision pages and complete the Record of Supplement-Revisions as necessary.

	Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2-32 -1	1		9.2-32 -4/ (–6blank)	0				
R	9.2-32 -2	1							
	9.2-32 -3	0							
	9.2-32 -4	0							

LOG OF REVISION

First Issue		
ORIGINAL		2001
Revision	1	(see entry below)

REVISION 1

Date: 30. Jan. 03

Approved by:

Luftfahrt-Bundesamt
Braunschweig

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

2 LIMITATIONS

Door jettison is only allowed after touchdown.

Door jettison is not allowed with inflated emergency floats (FMS 9.2–9).

2.1 PLACARDS AND DECALS

Placard:

TUER NOTABWURF	DOOR JETTISON
TUERE OEFFNEN	OPEN DOOR
DANN ABWURFHEBEL	THEN PUSH JETTISON
NACH UNTEN DRUECKEN	LEVER DOWNWARDS

Location: In front of pilot and copilot door

Placard:

WITH INFLATED FLOATS DO
NOT USE DOOR JETTISON
MIT AUFGEBLASENEN NOTSCHWIMMER
TUERNOTABWURF NICHT BENUTZEN

Location: Pilot's and Copilt's view

3 EMERGENCY AND MALFUNCTION PROCEDURES

Jettisoning Cockpit Doors

1. Door – Open
2. Jettison lever – Push downwards
3. Door – Push outwards

4 NORMAL PROCEDURES

4.1 PREFLIGHT INTERIOR CHECK

Door jettisoning release lever	– Check full upright position and safety wired
Quick release pins (upper and lower)	– Check correct installation

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

FOLHA 3239
PROC. 053000716/2012
MAT. 1403565

6 MASS AND BALANCE

System/Equipm.	Part No.	Mass (kg)	Arm (mm)	Mass moment (kgmm)
Kit for Door Jettisoning				
– pilot	B522M1011051	tbd	tbd	tbd
– copilot	B522M1012051	tbd	tbd	tbd

F M S 9.2-33

SUPPLEMENT FOR

EMS–EQUIPMENT (AEROLITE)

This supplement shall be attached to the BK 117 C–2 Flight Manual (Section 9.2) when the EMS–Equipment (AEROLITE) has been installed.

The FLIGHT MANUAL SUPPLEMENTS FMS–103 for EMS–Equipment, P/N 145020–501 and FMS–105 for EMS–Stretcher Installation, P/N 145015–501, issued by Aerolite Max Bucher AG, must be carried in the helicopter, when the respective EMS–equipment is installed.

System/Equipment Designation	Part No.	Effectivity/Remarks
EMS–Equipment (AEROLITE)	145020–501	
EMS–Stretcher Installation	145015–501	

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Original certification: Z 25–20–75, Z 25–20–76, issued by the Federal Office for Civil Aviation, Swiss Confoederation.

Date: 8.11.2001

Approved by:
Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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Page	Rev.No.	Rem	Page	Rev.No.	Rem	Page	Rev.No.	Rem
R 9.2-33 -1	2							
R 9.2-33 -2	2							

LOG OF REVISION

First Issue		
ORIGINAL		NOV 2001
REVISION	1	28. JAN 2002
REVISION	2	(see entry below)

REVISION 2

Date 30. April 02

Approved by:
Luftfahrt-Bundesamt
Braunschweig

F M S 9.2-34

SUPPLEMENT FOR

SLIDING DOOR JETTISONING

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the kit for Sliding door jettisoning has been installed.

System/Equipment Designation	Part No.	Effectivity/Remarks
Jettisoning sliding doors	B522M3111101 & B522M3112101	
Installation jettisoning sliding doors	B522M3100051 or B552M3300051 or B552M3300052	

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date: 12. Dez. 02

Approved by:
Luftfahrt-Bundesamt
Braunschweig

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	9.2-34 -1	2		9.2-34 -5/ (–6blank)	0				
R	9.2-34 -2	2.1							
	9.2-34 -3	2							
R	9.2-34 -4	2.1							

LOG OF REVISION

FIRST ISSUE		
ORIGINAL	REV. 0	DEZ, 2002
REVISION	1	JUL 08, 2003
REVISION EASA approval no.: 2004-11018	2	Nov 11, 2004
REVISION	2.1	(see entry below)

Revision 2.1

Date: Jul 13, 2005

Revision No. 2.1 to FLM reference revision 2 , is approved under authority of DOA No. EASA. 21J.034'.

FOLHA 321
PROC.053000716/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

2 LIMITATIONS

Sliding door jettison is only allowed after touchdown.

Sliding door jettison is not allowed with inflated emergency floats (FMS 9.2–9).

2.1 PLACARDS AND DECALS

EFFECTIVITY *H/C up to S/N 9059 and before ASB MBB BK117 C-2-52A-001*

Placard:

EMERGENCY EXIT
REMOVE CAP
PULL HANDLE
TURN DOOR HANDLE AT LEAST 90°
PUSH DOOR OUTWARDS

Location: Sliding doors inside

Placard:

EMERGENCY EXIT
REMOVE CAP
PULL HANDLE
TURN DOOR HANDLE AT LEAST 90° TOWARDS THE "OPEN" POSITION
PULL DOOR OUTWARDS

Location: Sliding doors outside

EFFECTIVITY *H/C with S/N 9060 and subsequent or after ASB MBB BK117 C-2-52A-001*

Placard:

EMERGENCY EXIT
PULL EMERGENCY HANDLE TO FULL STOP
TURN DOOR HANDLE AT LEAST 90°
PUSH DOOR OUTWARDS

Location: Sliding doors inside

Placard:

EMERGENCY EXIT
PULL EMERGENCY HANDLE TO FULL STOP
TURN DOOR HANDLE AT LEAST 90° TOWARDS THE "OPEN" POSITION
PULL DOOR OUTWARDS

Location: Sliding doors outside

EFFECTIVITY *All*

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

4 NORMAL PROCEDURES

4.1 PREFLIGHT INTERIOR CHECK

Emergency handle of jettisoning device	– Check correct position and safety wired
★ Rear sliding door	– Remove cover; Check correct position of red marked logging pin (most forward position) – Install cover

★ To be checked **before each flight**

5 PERFORMANCE DATA

No change in the basic Flight Manual data.

6 MASS AND BALANCE

System/Equipm.	Part No.	Mass (kg)	Arm (mm)	Mass moment (kgmm)
Jettisoning sliding door				
– LH	B522M3111101	tbd	tbd	tbd
– RH	B522M3112101	tbd	tbd	tbd

FOLHA 3242
PROC.053000716/2012
MAT.1403565

F M S 9.2-35

SUPPLEMENT FOR

FLIR ULTRAFORCE II

This supplement shall be attached to the Bk117 C2 Flight Manual (Section 9.2) when the FORWARD LOOKING INFRARED Ultraforce II (FLIR) has been installed.

System/Equipment Designation	Effectivity
FLIR Ultraforce II/ LEO–II–A5 or FLIR Ultraforce II EP	All

Date
27. Nov. 03

Approved by:

EASA approval no.: 2004–7846

Luftfahrt-Bundesamt
Braunschweig

LIST OF EFFECTIVE PAGES

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	Page	Rev.No.	Rem		Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2–35–1	2		R	9.2–35–5	2				
R	9.2–35–2	2								
R	9.2–35–3	2								
R	9.2–35–4	2								

LEP – manufacturer's data (part 2):

	Page	Rev.No.	Rem		Page	Rev.No.	Rem	Page	Rev.No.	Rem
R	9.2–35–6	2		R	9.2–35–9	2				
R	9.2–35–7	2			/–10blank					
R	9.2–35–8	2								

LOG OF REVISION

First Issue		
ORIGINAL		NOV 27, 2003
REVISION	1	NOV 25, 2006
REVISION	1.1	DEC 12, 2006
REVISION	2	(see entry below)

REVISION 2

Approved by EASA

Date: FEB 02, 2010

EASA approval no.: 10028810

1. GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

2. LIMITATIONS

2.1 COMPATIBILITY

For installation of the FLIR Ultraforce II/ LEO-II-AS or FLIR Ultraforce II EP the respective skid deflector of the Wire Strike Protection System (FMS 9.2-29) must be removed. Thereby the effectiveness of the WSPS is significantly degraded.

2.2 OPERATIONAL LIMITATIONS

When operating the FLIR system under night conditions or NVG conditions the cabin curtain must be installed.

One pilot and one crew member are required for FLIR operations. Operation of the FLIR system controller is restricted to trained crew members only.

The FLIR is not compatible with other FLIR Systems.

2.3 TEMPERATURE LIMITATIONS

Minimum OAT for installed Stabilized Turret Assembly (STA) –40°C

(For operation of the H/C below –35°C the cold weather kit must be installed)

3. EMERGENCY AND MALFUNCTION PROCEDURES

No change in the basic Flight Manual data.

4. NORMAL PROCEDURES

For additional information on the operations of the system incl. optional subsystems, refer to the FLIR Systems Inc. "Operation Manual".

NOTE Observe the following FLIR temperature and altitude limitations for reliable system operation:

- Minimum OAT for the FLIR system ..... –20°C
- Minimum cabin temp. for FLIR cabin equipment ..... –20°C
- Cabin temp. range for video recorder (Sony) – optional ..... 5°C to 40°C
- Cabin temp. range for video recorder (Skyquest) – optional .... –35°C to 50°C

4.1 PREFLIGHT CHECK

4.1.1 Exterior check

WARNING THE MOTORS THAT DRIVE THE STABILIZED GIMBAL ARE CAPABLE OF DEVELOPING FORCES THAT CAN INJURE PERSONNEL. USE CAUTION WHEN NEARBY THE STA TO AVOID POSSIBLE INJURY BY HAVING PART OF THE BODY OR LOOSE CLOTHING BECOME TRAPPED BETWEEN THE MOVING AND STATIONARY PARTS OF THE STABILIZED GIMBAL.

1. Attachment and connectors	– Condition, secured

4.1.2 Interior check

NOTE When the operators console is installed the pilot has to check that the emergency exits are accessible.

1. FLIR system components	– Condition, secured (seat–rail–fasteners locked)
2. Electrical cables of the FLIR system components	– Check connected

4.2 PRE-LANDING CHECK

NOTE It is recommended for protection to return the FLIR STA prior Landing in a "parking position", e.g. in a position with azimut ≈ 180° and high positive elevation so that the glass shielded sensor pack looks opposite flight direction upwards.

4.3 FLIR SWITCH OFF PROCEDURE

1. ON pb (on LCU)	– Press; – Wait 15 seconds
2. POWER ON/OFF sw (on LCU)	– OFF

5. PERFORMANCE DATA

5.1 AEO AND OEI MAXIMUM RATE OF CLIMB

All results obtained from the respective diagram, contained in section 5 of the basic Flight Manual, are to be corrected as follows:

Helicopter gross mass below 2400 kg:	Subtract 35 ft/min
Helicopter gross mass between 2400 kg and below 3000 kg: ...	Subtract 25 ft/min
Helicopter gross mass of 3000 kg and above:	Subtract 20 ft/min

6. MASS AND BALANCE

Refer to Equipment List entries in Section 6 of the basic Flight Manual.

7. SYSTEM DESCRIPTION

7.1 INSTALLATION

If sliding door jettisonning (FMS 9.2–34) is not installed:

In order to provide immediate access to the emergency exit the operator console must not be installed within the x-station range: x= 2992 to x= 3577.

7.2 FLIR ULTRAFORCE II

The FLIR working station is built up of the following devices (see Fig.1):

- Forward Looking Infrared (FLIR) Ultraforce II four axis stabilized triple sensor camera system,
- Remote control (Laptop Control Unit - LCU) for steering the Stabilized Gimbal Assembly (STA),
- Control Electronic Unit (CEU),
- One or two LCD monitor(s) (optional),
- Digital Video Recorder(s) with remote control (optional),
- Video transmission system with remote control (optional).

These devices are typically arranged in three groups:

1. The four-axis stabilized triple sensor camera system mounted outside the H/C on a carrier which is mounted on a multifunction step and connected via an external wire connector to the H/C's electrical system.

2. The optional operator console which is mounted on the seat rails behind the pilot's seat. The console contains the controls for the FLIR STA (LCU), the Digital Video Recorder(s) , the down link, a foot switch for the intercom system and one or two LCD monitor(s).

3. The FLIR rack which is mounted on the seat rails behind the operator's seat in the cargo compartment. The rack houses the CEU, Digital Video Recorder(s) and transmitter of the down link.

The controls for the FLIR could be easily removed from the operator's console, so that the FLIR system could be also operated by the co–pilot with completely removed operator console. The co–pilot uses then the cockpit display for image representation and the LCU could be stowed in the dedicated provision behind the co-pilot's seat.

The cabling from the FLIR rack to the operator console and to the connector panel at the after end of the centre console is piped in a cable duct, which is fixed to the cabin floor in the middle of the H/C.

Another connector bar is installed on the righthand side of the cowling and supplies three plugs:

- 28 V DC (supply for the FLIR rack),
- Antenna connection to the down link transmitter,
- FLIR STA connection to the FLIR CEU.

The system may be either controlled directly or in connection with the searchlight SX16 ("searchlight slave mode").

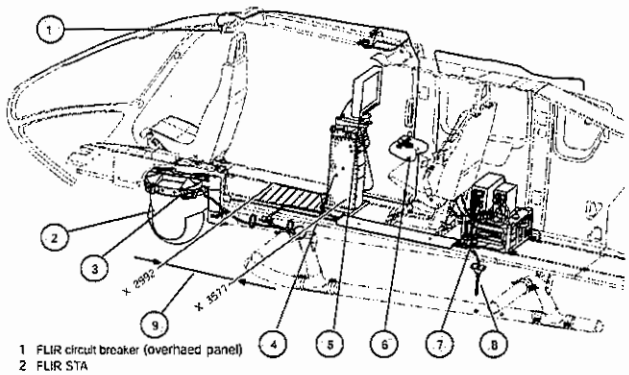
The system supports three ways of routing the video signal of the FLIR camera:

- Displaying on the LCD monitor(s)
- Recording on the Digital Video Recorder(s) . The recording data are transmitted directly to the video recorder from the CEU.
- Transmitting via down link to a ground station

The Digital Video Recorder(s) as well as its power supply is installed in the FLIR rack.

7.3 SYSTEM POWER SUPPLY

The FLIR Ultraforce II System receives power from the high load bus and is controlled by the FLIR circuit breaker, located on the overhead console.



1 FLIR circuit breaker (overhaed panel)
2 FLIR STA
3 FLIR carrier
4 Operator console
5 LCD monitor (second LCD monitor is not shown)
6 FLIR LCU
7 FLIR rack with:
-Down link
-Digital Video Recorder(s)
-CEU
8 Down link antenna
9 Area within the installation of the console is not permitted without sliding door jettisonning installed

Fig. 1 Typical installation of the FLIR-system

FOLHA 3294
PROC. 05300071 6/2012
MAT. 1403565

7.4 SECOND FLIR MONITOR (OPTIONAL)

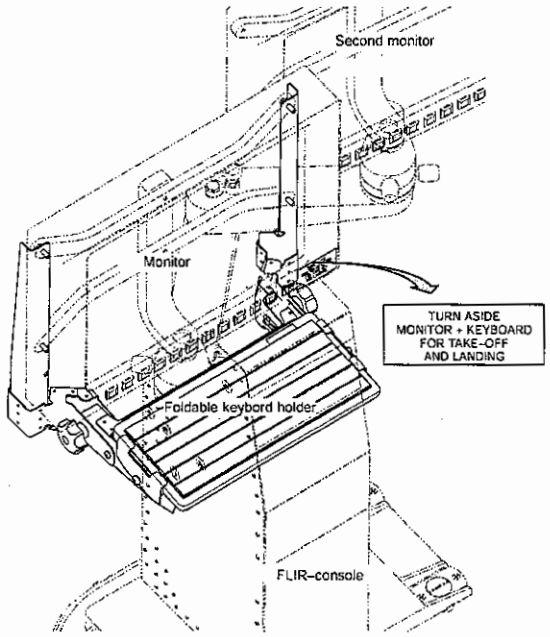


Fig. 2 Typical installation with two monitors

F M S 9.2-36

SUPPLEMENT FOR

TAIL FLOODLIGHT

This supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the Tail Floodlight has been installed.

System/Equipment Designation	Part No.	Effectivity
Tail Floodlight		
Version A	B334M7000051	
Version B	B334M7006051	

NOTE For approving authorities and respective dates of approval refer to the log of supplements.

Date:

05. Dez. 02

Approved by:

Luftfahrt-Bundesamt
Braunschweig

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9.2-36 -2	0							
9.2-36 -3	0							
9.2-36 -4	0							

LOG OF REVISION

FIRST ISSUE		
ORIGINAL	REV. 0	DEZ, 2002

FOLHA 3295
PROC.053000716/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.
The tail floodlight is provided for making the rotor visible during ground operations at night in order to keep persons alert of the danger area.

2 LIMITATIONS

No change to the basic flight manual data.

3 EMERGENCY AND MALFUNCTION PROCEDURES

No change to the basic flight manual data.

4 NORMAL PROCEDURES

4.1 OPERATION

After landing:

EM/EX light switch – ON

NOTE When actuating the tail floodlights with the EM/EX light switch the Emer Exit lights will illuminate as well.

For switching off the Tail floodlights:

EM/EX light switch – OFF or ARM

5 PERFORMANCE DATA

No change to the basic flight manual data.

6 MASS AND BALANCE

System/Equipm.	Part No.	Mass (kg)	Arm (mm)	Mass moment (kgmm)
Tail floodlight Version A	B334M7000051			
Version B	B334M7006051			

7 SYSTEM DESCRIPTION

Version A

Two floodlights are mounted on top and below the LH horizontal stabilizer, with the "top light" pointing to the tail rotor and the "bottom light" pointing to the clam shell doors.

Version B

Two floodlights are mounted on top and below the LH horizontal stabilizer, with the "top light" pointing to the tail rotor and the "bottom light" pointing to the bottom behind it.

The system is power supplied by the non essential bus via a circuit breaker.

F M S 9.2-37

SUPPLEMENT FOR

GPS FREEFLIGHT 2101 I/O COUPLED TO AFCS

This abbreviated supplement shall be attached to the BK 117 C-2 Flight Manual (Section 9.2) when the Freeflight GPS 2101 I/O has been installed.

System/Equipment Designation	Part No.	Effectivity
Freeflight GPS 2101 I/O Approach Plus (with software version 241E)	B344M2010101	All
Freeflight GPS 2101 I/O Approach Plus(with software version 241G and subsequent)	B344M2802051	All

Date
09. Juli 03

Approved by:
i.A.

Luftfahrt-Bundesamt
Braunschweig

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	9.2-37 -1	1		R	9.2-37 -7	1.1					
R	9.2-37 -2	1.1		R	9.2-37 -8	1.1					
	9.2-37 -3	0		R	9.2-37 -9	1.1					
	9.2-37 -4	1		R	9.2-37 -10	1.1					
R	9.2-37 -5	1.1		R	9.2-37 -11	1.1					
R	9.2-37 -6	1.1									

LEP – manufacturer's data (part 2):

	Page	Rev.No.	Rem		Page	Rev.No.	Rem		Page	Rev.No.	Rem
R	9.2-37 -12	1.1		R	9.2-37 -17	1.1		R	9.2-37 -22	1.1	
R	9.2-37 -13	1.1		R	9.2-37 -18	1.1		R	9.2-37 -23	1.1	
R	9.2-37 -14	1.1		R	9.2-37 -19	1.1		N	9.2-37 -24	1.1	
R	9.2-37 -15	1.1		R	9.2-37 -20	1.1					
R	9.2-37 -16	1.1		R	9.2-37 -21	1.1					

LOG OF REVISION

FIRST ISSUE					
ORIGINAL	REV. 0	JULY 2003	REVISION	REV. 1.1	(see entry below)
REVISION	REV. 1	APR 14, 2004			

REVISION 1.1

Date: JUN 11, 2010

Revision No. 1.1 to FLM reference revision 1, is approved under authority of DOA No. EASA. 21J.034.

FOLHA 3246
PROC.053000716/2012
MAT.1403565

1 GENERAL

The information contained herein supplements the information of the basic Flight Manual; for limitations, procedures, and performance data not contained in this supplement, refer to the basic Flight Manual.

1.1 ABBREVIATIONS USED IN THIS SUPPLEMENT

A	AIC	– Aeronautical Information Circular
	ADF	– Automatic direction finder
	AFCS	– Automatic flight control system
	AIRAC	– Aeronautical Information Regulation and Control
B	BRG	– Bearing
C	CPDS	– Central panel display system
D	DC	– Direct Current
	DME	– Distance measurement equipment
	DST/DIST	– Distance
	DR	– Dead Reckoning
E	EFIS	– Electronic Flight Instrument System
F	FCDS	– Flight control display system
	FLIR	– Forward looking infra red
G	G/S	– Glideslope
H	HDG	– Heading hold mode
	HSI	– Horizontal situation indicator
I	IAS	– Indicated airspeed
	IAF	– Initial Approach Fix
	ILS	– Instrument landing system
L	LOC	– Localizer
N	NAV	– Navigation
	NDB	– Non Directional Beacon
M	MAP	– Missed Approach Point
	MIA	– Missed Approach
P	PFD	– Primary flight display
R	RA	– Radar altimeter
S	SMD	– Smart multifunction display
T	TK	– Track
U	UL	– Upper limit
V	VOR	– Very high frequency omnidirectional radio ranging
X	XTRK	– Cross Track Error

2 LIMITATIONS

CAUTION
- THE CURRENT REVISION OF THE FREEFLIGHT 2101 I/O PILOT'S GUIDE MUST BE IMMEDIATELY AVAILABLE TO THE FLIGHT CREW WHENEVER NAVIGATION BY USE OF THE FREEFLIGHT 2101 IS EXPECTED. THE PILOT'S GUIDE MUST MATCH THE SOFTWARE VERSION ANNUNCIATED ON THE SELF-TEST PAGE.
- WHEN THE FREEFLIGHT 2101 I/O NAVIGATION SYSTEM IS USED THE PILOT SHOULD BE THOROUGHLY FAMILIAR WITH THE SYSTEM OPERATION.
- CHECK THAT THE GROUND BASED NAV AI' 3 ON THE ROUTE OF FLIGHT ARE OPERATIONAL AND THAT THE H/C EQUIPMENT, OTHER THAN THE GPS SUITABLE FOR THE ROUTE OF FLIGHT, IS SERVICEABLE WHEN INTEGRITY IS LOST.

2.1 OPERATIONAL LIMITATIONS

EFFECTIVITY *If software version 241E is installed*

The use of the GPS Freeflight 2101 I/O is **limited to VFR and IFR enroute operation.**

CAUTION THE **HOLD** MODE IS NOT AVAILABLE

Placard:

THE USE OF THE GPS FOR INSTRUMENT APPROACH AND SIDs/STARs IS PROHIBITED

Location: Pilot's view

EFFECTIVITY *If software version 241G and subsequent is installed*

The type of GPS Freeflight 2101 I/O Approach Plus with **software version 241G or subsequent** coupled to AFCS is approved for IFR operation.

The use of the GPS for terminal area procedures is limited to procedures approved for GPS and RNAV (standard arrival, approach, missed approach and standard instrument departure procedure).

With Jeppesen Data Base information for Non-Precision Approaches only Overlay Approaches category C and D are supported.

EFFECTIVITY *All*

The Jeppesen Database validity must be checked prior to flight. Jeppesen assures the accuracy of the database information only, if the database is current.

WARNING IF THE MESSAGE **DATA-BASE CARD TYPE NOT VALID** APPEARS, THE JEPPESEN DATABASE IS OUT-OF-DATE.

NOTE If the cabin temperature is below –20°C the GPS unit may become inoperative.

TERMO DE ENCERRAMENTO DE VOLUME

Em 28/11/2014 o volume n.º 13 do processo n.º 053.000.716/2012, foi encerrado com a folha n.º 3247 iniciando-se o volume n.º 14.

Rubrica	Matrícula	Setor/Órgão
	1403565	DICOA/CGRH/DF

FOLHA 3247
PROC. 053000716/2012
MAT. 1403565