

BHT-230-FM-1

Bell
MODEL **230**



ROTORCRAFT FLIGHT MANUAL

Bell Helicopter
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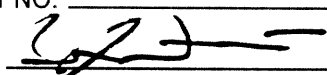
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Bell 230

MODEL

ROTORCRAFT FLIGHT MANUAL



TYPE CERTIFICATE NO. <u>H-88</u>	
REGISTRATION NO. _____	SERIAL NO. _____
APPROVED BY 	DATE <u>MARCH 12, 1992</u>
DIRECTOR — AIRCRAFT CERTIFICATION BRANCH DEPARTMENT OF TRANSPORT	
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29 JULY 1992
REVISION 5 — 6 MAY 2005

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LOG OF REVISIONS

Original	0.....	12 MAR 92	Revision.....	3.....	24 AUG 94
Reissue	0.....	29 JUL 92	Revision.....	4.....	11 MAY 95
Revision	1.....	22 APR 93	Revision.....	5.....	06 MAY 05
Revision	2.....	07 SEP 93			

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NOTE

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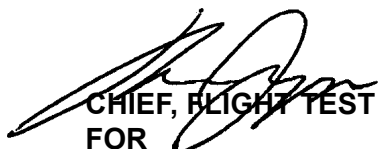
LOG OF TC APPROVED REVISIONS

Original	0.....	12 MAR 92	Revision	3	24 AUG 94
Reissue	0.....	29 JUL 92	Revision	4	11 MAY 95
Revision	1.....	22 APR 93	Revision	5	06 MAY 05
Revision	2.....	07 SEP 93			

APPROVED

DATE

6 May 2005



CHIEF, FLIGHT TEST
FOR
DIRECTOR — AIRCRAFT CERTIFICATION
TRANSPORT CANADA

LOG OF FAA APPROVED REVISIONS

Original	0.....	12 MAR 92	Revision	3	24 AUG 94
Reissue	0.....	29 JUL 92	Revision	4	11 MAY 95
Revision	1.....	22 APR 93	Revision	5	06 JUN 05
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GENERAL INFORMATION

ORGANIZATION

This Flight Manual is divided into five sections and an appendix as follows:

Section 1	LIMITATIONS
Section 2	NORMAL PROCEDURES
Section 3	EMERGENCY AND MALFUNCTION PROCEDURES
Section 4	PERFORMANCE
Section 5	CATEGORY A OPERATIONS
Appendix A	OPTIONAL EQUIPMENT SUPPLEMENTS

Sections 1 through 4 contain TC approved data necessary to operate basic helicopter in a safe and efficient manner.

Section 5 contains TC approved limitations, procedures, and performance data for Category A Operations.

Appendix A contains approved supplements for optional equipment, which shall be used in conjunction with basic Flight Manual when respective optional equipment kits are installed.

Manufacturer's Data Manual (BHT-230-MD-1) contains additional information to be used in conjunction with Flight Manual and optional equipment supplements, as applicable. BHT-230-MD-1 is divided into four sections as follows:

Section 1	WEIGHT AND BALANCE
Section 2	SYSTEMS DESCRIPTION
Section 3	OPERATIONAL INFORMATION
Section 4	HANDLING/SERVICING/ MAINTENANCE

TERMINOLOGY

WARNINGS, CAUTIONS, AND NOTES

Warnings, cautions, and notes are used throughout this manual to emphasize important and critical instructions as follows:

WARNING

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH, IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY OR LOSS OF LIFE.

CAUTION

AN OPERATING PROCEDURE, PRACTICE, ETC., WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN DAMAGE TO OR DESTRUCTION OF EQUIPMENT.

NOTE

An operating procedure, condition, etc., which is essential to highlight.

USE OF PROCEDURAL WORDS

Concept of procedural word usage and intended meaning which has been adhered to in preparing this manual is as follows:

SHALL has been used only when application of a procedure is mandatory.

SHOULD has been used only when application of a procedure is recommended.

MAY and **NEED NOT** have been used only when application of a procedure is optional.

WILL has been used only to indicate futurity, never to indicate a mandatory procedure.

ABBREVIATIONS, ACRONYMS, AND PLACARDING

Abbreviations, acronyms and placarding used throughout this manual are defined as follows:

AMP	—	Amperes	ESC	—	Environmental Control System
ATTD	—	Attitude	ECU	—	Environmental Control Unit
AUX	—	Auxiliary	ELT	—	Emergency Locator Transmitter
BAG	—	Baggage	EMERG	—	Emergency
BAT	—	Battery	ENG	—	Engine
BLO	—	Blower	F	—	Fahrenheit
BRG	—	Bearing	FAR	—	Federal Aviation Regulation
BRT	—	Bright	FT	—	Feet, Foot
C	—	Celsius	GEN	—	Generator
CAUT	—	Caution	GPU	—	Ground Power Unit
CG	—	Center of Gravity	GW	—	Gross Weight
COLL	—	Collective	H_D	—	Density Altitude
CPLT	—	Copilot	H_P	—	Pressure Altitude
DC	—	Direct Current	HTR	—	Heater
DECR	—	Decrease	HYD	—	Hydraulic
DET	—	Detector	ICS	—	Intercommunication System
DISCON	—	Disconnect	IFR	—	Instrument Flight Rules
DISENG	—	Disengage	IGE	—	In Ground Effect
DISTR	—	Distribution	INCR	—	Increase
DOT	—	Department of Transportation	INSTR	—	Instrument
			INTCON	—	Interconnect
			KCAS	—	Knots Calibrated Airspeed
			KG	—	Kilogram(s)
			KIAS	—	Knots Indicated Airspeed
			LB	—	Pound(s)
			LT	—	Light(s)
			MGT	—	Measured Gas Temperature
			MIC	—	Microphone
			N_G	—	Gas Producer RPM
			N_P	—	Power Turbine RPM
			NORM	—	Normal
			OAT	—	Outside Air Temperature
			OEI	—	One Engine Inoperative
			OGE	—	Out of Ground Effect
			OVSP	—	Overspeed
			PASS	—	Passenger
			PLT	—	Pilot
			PNL	—	Panel
			POSN	—	Position
			PRESS	—	Pressure

PRI	—	Primary
PSIA	—	Pounds per Square Inch Absolute
PSIG	—	Pounds per Square Inch Gauge
RLSE	—	Release
RPM	—	Revolutions per Minute
SCAV	—	Scavenge
SCHLT	—	Searchlight
STBY	—	Standby
SYS	—	System
TC	—	Transport Canada
TEMP	—	Temperature
TORQ	—	Torque
VDC	—	Volts Direct Current
VFR	—	Visual Flight Rules
V _{MINI}	—	Minimum Speed for Instrument Flight
V _{NE}	—	Never Exceed Speed
V _Y	—	Best Rate of Climb Speed
V _{YI}	—	Instrument Climb Speed
WSHLD	—	Windshield
XMSN	—	Transmission

1-18. PRESSURE

Maximum for VFR operation 20,000 feet (6096 m) H_P
 Maximum for IFR operation 15,000 feet (4572 m) H_P

NOTE

Refer to applicable operating rules for high altitude oxygen requirements.

1-19. AMBIENT AIR TEMPERATURE

Maximum ambient air temperature at sea level. 51.7°C (125°F)

Maximum temperature limit decreases at standard lapse rate of 2°C (3.6°F) per 1000 feet (305 m) H_P (Figure 1-5).

Minimum ambient air temperature (all altitudes). -45°C (-49°F)

Engine anti-ice shall be on below 4.5°C (40°F) when operating in visible moisture.



LUBRICATION OF THE TAIL ROTOR FEATHERING BEARINGS IS REQUIRED TO REDUCE TAIL ROTOR CONTROL STIFFNESS WHEN EXPOSED TO COLD TEMPERATURE. LACK OF APPLICATION OF THIS LUBRICATION CAN RESULT IN A REDUCTION IN TAIL ROTOR AUTHORITY.

For operations at ambient temperatures below -10°C (14°F) lubrication of tail rotor feathering bearings is required prior to the first start of the day and after 6 hours of flight. Tail rotor feathering bearing lubrication (when necessary) shall be recorded in the helicopter log book.

NOTE

Refer to Handling/Service Section in BHT-230-MD-1 regarding types of lubrication and application.

1-20. ENGINE START

Engine fuel control heater valve shall be on at ambient temperatures below 5°C (41°F). Valve may be turned off at ambient temperatures above 21°C (70°F).

During engine start following cold soak for an extended period (more than 5 hours) at ambient temperatures of -30°C to -40°C (-22°F to -40°F), engine oil pressure is allowed to increase to a maximum of 220 PSIG and then decrease to a minimum of 30 PSIG. Normal engine oil pressure indication shall resume after 5 minutes.

NOTE

When operating in temperatures below -40°C (-40°F), helicopter must be maintained in a heated hangar or preheated prior to starting. Transmission and tail rotor gearbox oil temperatures must be no lower than -40°C (-40°F).

1-21. MANEUVERING

Aerobatic maneuvers are prohibited.

1-22. ELECTRICAL

1-23. STARTER

Starter energizing times shall be limited as follows:

<u>External Power Start</u>	<u>Battery Start</u>
40 seconds ON	60 seconds ON
30 seconds OFF	60 seconds OFF
40 seconds ON	60 seconds ON

30 seconds OFF	60 seconds OFF
40 seconds ON	60 seconds ON
30 minutes OFF	30 minutes OFF



28 VDC GROUND POWER UNITS FOR STARTING SHALL BE LIMITED TO 500 AMPS MAXIMUM.

1-24. GENERATOR LOAD

From 0 to 5000 feet (1524 m) H_P

Continuous operation	0 to 180 amps
Maximum continuous	180 amps

Decrease maximum continuous limitation above 5000 feet (1524 m) H_P by 2 amps per 1000 feet (305 m) H_P.

Maximum allowable individual generator load during takeoff and landing shall not exceed 160 amps.

1-25. POWERPLANT

Engines	Allison 250-C30G/2
---------	--------------------

Operation in 2 1/2 minute or 30 minute OEI range is intended only for emergency use,

such as when one engine becomes inoperative due to an actual malfunction.

1-26. GAS PRODUCER RPM (N_G)

● **TWIN ENGINE OPERATION**

Continuous operation	59 to 105%
Maximum continuous	105%
Maximum transient (not to exceed 10 seconds above 105%)	106%

● **ONE ENGINE INOPERATIVE (OEI)**

Same as Twin Engine Operation.

1-27. ENGINE POWER TURBINE RPM (N_P)

Avoid steady state operation	71 to 92%
Minimum continuous	97%
Continuous operation	97 to 101%
Maximum continuous	101%
Maximum (Category A operation) (refer to paragraph 5-41)	103%

Maximum continuous	94.6%
Takeoff range (5 minutes maximum)	94.6 to 100%
Maximum transient	105%



WHEN OPERATING NEAR MAXIMUM TORQUE LIMIT, INADVERTENT OVERTORQUE MAY OCCUR DURING MANEUVERING FLIGHT CONDITIONS INVOLVING LEFT ROLLING TURNS AND/OR NOSE UP ATTITUDE CHANGES. DECREASE POWER TO PROVIDE A MINIMUM TORQUE MARGIN OF 5% PRIOR TO MANEUVERING HELICOPTER.

INTENTIONAL USE OF MAIN ROTOR TORQUE OVER 100% IS PROHIBITED.

1-39. ROTOR BRAKE

Engine starts with rotor brake engaged are prohibited. Rotor brake application is limited to ground operation and shall not be applied until both engines are shut down and ROTOR RPM has decreased to 55%. For emergency stop, apply rotor brake any time after both engines are shut down.

1-40. FUEL AND OIL

1-41. FUEL

Fuel conforming to ASTM D-6615 or (ASTM D-1655 Type B), or MIL-T-5624 Grade JP-4, is authorized for use as shown in Figure 1-7.

Fuel conforming to ASTM D-1655 Type A or Type A-1 or MIL-T-5624 Grade JP-5, or MIL-T-83133 Grade JP-8, is authorized for use as shown in Figure 1-7.

NOTE

Fuel quantity indicator shows usable fuel.

Grade JP-4 and JP-5 type fuels, and MIL-T-83133 or later Grade JP-8 type fuels contain anti-ice additive which conforms to MIL-I-27686 or later. These fuels do not require additional additive.

1-42. ANTI-ICING FUEL ADDITIVE

Anti-icing fuel additive is required for operations at temperatures below -12°C (10°F).

1-43. ENGINE OIL

MIL-PRF-7808G (MIL-L-7808G) and subsequent suffixes may be used in engines at temperatures below 0°C (32°F).

MIL-PRF-23699C (MIL-L-23699) and subsequent suffixes may be used in engines at all ambient temperatures above -40°C (-40°F).

NOTE

Refer to Rolls Royce Operation and Maintenance Manual and to Handling/ Servicing/Maintenance section in BHT-230-MD-1 regarding mixing of oils of different brands, types and manufacturers.

1-44. TRANSMISSION AND TAIL ROTOR GEARBOX OIL

NOTE

When operating in temperatures below -40°C (-40°F), helicopter must be maintained in a heated hanger or prewarmed prior to starting. Transmission and tail rotor gearbox oil temperatures must be no lower than -40°C (-40°F).

EMERGENCY EXIT WINDOW

Location: Base of Each Emergency Exit Window (Interior)
Effective: S/N 23023 and Subsequent

EMERGENCY PUSH HERE

Location: Base of Each Emergency Exit Window (Interior and Exterior)
Effective: S/N 23023 and Subsequent

**EMERGENCY EXIT
PULL TAB TO REMOVE STRIP
PUSH WINDOW IN LOWER CORNER**

Location: Base of Each Emergency Exit Window (Exterior)
Effective: S/N 23023 and Subsequent

AVOID STEADY STATE OPERATION BETWEEN 71 & 92% (Np)

Location: Under Engine Oil Pressure Gauges

230FM_1_0001

Figure 1-8. Placards and Decals (Sheet 3 of 3)

Section 2

NORMAL PROCEDURES

2-1. INTRODUCTION

This section contains instructions and procedures for operating helicopter from planning stage, through actual flight conditions, to securing helicopter after landing.

Normal and standard conditions are assumed in these procedures. Pertinent data in other sections is referenced when applicable.

Instructions and procedures contained herein are written for purpose of standardization and are not applicable to all situations.

2-2. OPERATING LIMITATIONS

Minimum and maximum limits, and normal and cautionary operating ranges for helicopter and its subsystems are indicated by instrument markings and placards. Instrument markings and placards represent careful aerodynamic calculations that are substantiated by flight test data. Refer to Section 1 for a detailed explanation of each operating limitation.

2-3. COLD WEATHER OPERATIONS

Refer to Section 1, AMBIENT AIR TEMPERATURE.

Engine fuel control heater valve is placed in ON position for engine start at ambient temperatures below 5°C (41°F). Turn valve OFF at ambient temperatures above 21°C (70°F) as soon as practical.

Start up characteristics — Satisfactory battery starts have been demonstrated to -32°C (-25.6°F).

After an initial peak in engine oil pressure, a reduction in engine oil pressure to below 50 psig may be experienced during start up. Normal oil pressure indications per Section 1 should resume after 5 minutes at idle. Some main rotor pylon rocking may be noted at low rotor RPM and should be eliminated upon reaching flight idle.

Flight characteristics — Initial vibration level of crew and passenger stations may be higher than normal when helicopter is exposed to ambient temperatures of 0°C (32°F) or less for an extended period of time. Vibration level should diminish within 15 to 30 minutes of flight depending on time exposed to temperatures below 0°C (32°F) prior to engine start and ambient temperature at flight altitude.

2-4. FLIGHT PLANNING

Each flight should be planned adequately to ensure safe operations and to provide pilot with data to be used during flight.

Essential weight, balance, and performance information should be compiled as follows:

1. Check type of flight to be performed and destination.
2. Select appropriate performance charts to be used from Section 4.

2-5. TAKEOFF AND LANDING DATA

Refer to Section 1 for takeoff and landing weight limits and to Section 4 for takeoff and landing distance information.

2-6. RECOMMENDED AIRSPEEDS

V_{Y1} (Best instrument climb speed)	Twin engine - 75 KIAS Single engine - 60 KIAS
V_Y (Best rate of climb speed)	Twin engine - 60 KIAS
Instrument approach speed	Twin engine - 90 KIAS

2-7. WEIGHT AND BALANCE

Ascertain proper weight and balance of helicopter as follows:

1. Consult Weight and Balance section of BHT-230-MD-1 for instructions.
2. Ascertain weight of fuel, oil, payload, etc.; compute takeoff and anticipated landing gross weight (GW) and check helicopter center of gravity (CG) locations.
3. Check GW and CG limitations in Section 1 are not exceeded.

2-8. PREFLIGHT CHECK

Pilot is responsible for determining whether helicopter is in condition for safe flight.

NOTE

Preflight check is not intended to be a detailed mechanical inspection, but simply a guide to help pilot check condition of helicopter. It may be made as comprehensive as conditions warrant, at discretion of pilot.

All areas checked shall include a visual check for evidence of corrosion,

particularly when helicopter is flown near or over salt water or in areas of high industrial emissions.

2-9. BEFORE EXTERIOR CHECK

1. Mission planning — Completed.
2. Publications — Checked.
3. BAT switch — OFF.
4. Fire extinguisher switches (ENG 1 and ENG 2) — NORM.
5. Hand-held fire extinguisher(s) — Security and condition.
6. Rotor brake — Off, handle in detent (locked) position.
7. Fuel sumps — Drain samples as follows:
8. ENGINE 1 FUEL VALVE and ENGINE 2 FUEL VALVE switches — Off.
9. ENGINE 1 FUEL PRIME and ENGINE 2 FUEL PRIME switches — Off.
10. BAT switch — ON.
11. Fuel drain buttons (left and right) — Press, drain samples, then release. Check drain valves close when drain buttons are released.
12. BAT switch — OFF.
13. Ground handling equipment — Removed and clear of helicopter.

2-10. EXTERIOR CHECK**2-11. FUSELAGE — RIGHT SIDE**

1. Static ports — Unobstructed.

2-19. NOSE

1. Windshields, lower and overhead windows — Condition, security, and cleanliness.
2. Windshield wiper(s) — Condition and security.
3. Nose compartment access door — Condition and security.
4. Cabin air intakes — Clear of debris.
5. Pitot tubes — Covers removed; unobstructed.
6. Battery case drain and vent tubes — Check unobstructed.
7. External power receptacle — Check condition; door secured.

NOTE

Any findings or discrepancies found during preflight check should be discussed with qualified maintenance personnel prior to flight.

2-20. INTERIOR AND PRESTART CHECK

1. Doors — Secured.
2. Rotor brake — Off.
3. Copilot seat belt — Secured (if solo).
4. Seat belt and shoulder harness — Fastened.
5. Seats and pedals — Adjusted.
6. STBY ATTD switch (if installed) — On; check standby attitude indicator light illuminates and OFF flag retracts, then switch off.
7. BAT switch — ON.

8. EMERG LT switch — ARM.
9. BAT switch — OFF; check cabin emergency lights illuminate.
10. BAT switch — ON.
11. EMERG LT switch — OFF, then ARM.

NOTE

During an external power start, BAT switch should be ON to provide starting power in event of a GPU malfunction.

12. External power — Connected (if utilized).
13. BUS INTCON switch — On (battery start only).
14. Cockpit and interior lights — As required for proper illumination.
15. ENGINE 1 FUEL VALVE switch — On (green).
16. ENGINE 1 FUEL PRIME switch — On.
17. FUEL TANK INTCON switch — Check on, then off.
18. INVERTER switch — Off.
19. GEN 1 and GEN 2 switches — OFF.
20. ENGINE 2 FUEL VALVE switch — On (green).
21. ENGINE 2 FUEL PRIME switch — On.
22. SEAT BELTS switch — On.
23. NO SMOKE switch — On.
24. CABIN & BAG LT switch — Off.
25. CPLT VENT BLO switch — Off.
26. CPLT PITOT HTR switch — Off.

27. NO. 1 HYD SYS switch — On.
28. NO. 2 HYD SYS switch — On.
29. PILOT PITOT HTR switch — Off.
30. ANTI COLL LT switch — ON.
31. POSN LT switch — Pilot discretion.
32. PILOT VENT BLO switch — Off.
33. WSHLD DEICE switch (if installed) — Off.
34. PASS DOOR OUTLETS switch (if installed) — Off.
35. ECU FLOW switch (if installed) — Off.
36. DISTR SYS switch (if installed) — Off.
37. ENG 1 PTCL SEP switch (if installed) — Off.
38. ENG 2 PTCL SEP switch — (if installed) Off.
39. ENG 1 ANTI ICE switch — Off.
40. ENG 2 ANTI ICE switch — Off.
41. CPLT INSTR LT rheostat (if installed) — As required.
42. ECS switch (if installed) — Off.
43. WSHLD WIPER switch — OFF.
44. Interior lighting rheostats — As desired.
45. All overhead circuit breakers — In.
46. Fuses (overhead compartment) — Check; door secured.
47. EMERGENCY LIGHT — Secured.

48. Rotor brake — On; check both ROTOR BRAKE warning lights illuminate; then off and verify handle snaps into detent and lights extinguish.

WARNING

DO NOT ATTEMPT TO LOWER COLLECTIVE TO DOWN STOP WITH ROTOR NOT TURNING NOR WITHOUT HYDRAULIC BOOST AVAILABLE. COLLECTIVE SHOULD BE LOWERED TO FULL DOWN DURING FIRST ENGINE START WHEN HYDRAULIC BOOST IS AVAILABLE.

49. Flight controls — Check freedom of movement of pedals. Verify pedal, cyclic and collective actuator bypass valve operation. Center cyclic. Adjust frictions.
50. SCHLT switch — OFF.
51. Throttles — Rotate to idle stop, activate IDLE STOP release and open throttles, wait 5 seconds. Rotate to idle stop, activate IDLE STOP release and close throttles. Set throttle friction as desired.
52. RPM INCR DECR switch — DECR to minimum beep (5 to 8 seconds).
53. DEFOG/HEAT control lever — Check operation.
54. ENG CHIP TEST switch — Press. Check illumination of all engine chip light segments.
55. ICS panel — Set as desired.
56. Compass slaving switch — Set as desired.
57. FORCE TRIM switch — (if installed) — ON.

- 58. FLOAT ARM switch (if installed) — OFF.
- 59. Outside AIR TEMP indicator — Check.
- 60. Radios — Off.
- 61. CAUTION PANEL PWR TEST switch — Press; check all caution panel lights extinguish except CAUTION POWER segment and MASTER CAUTION light; release switch.
- 62. CAUTION PANEL BRT DIM switch — As required.

NOTE

PILOT INSTR LT rheostat must be rotated clockwise beyond OFF detent to achieve dimming.

- 63. CAUTION PANEL TEST switch — Press; check all caution panel lights, RPM light, MASTER CAUTION light, ENG 1 OUT, ENG 2 OUT, and all chip indicator panel lights illuminate. Release switch; check ENG 1 OIL PRESS, ENG 2 OIL PRESS, ENG 1 FUEL PRESS, ENG 2 FUEL PRESS, HYDRAULIC SYS 1, HYDRAULIC SYS 2, XMSN OIL, DC GEN 1, DC GEN 2, INV FAIL, ENG 1 OUT, and ENG 2 OUT lights remain illuminated.
- 64. BAG FIRE warning light — Press to test.
- 65. Fire extinguisher switches (ENG 1 and ENG 2) — NORM.
- 66. AGENT RLSE switch — Centered.
- 67. FIRE DET TEST switch — Press down; check FIRE ENG 1 and FIRE ENG 2 warning lights illuminate; release switch, lights extinguish.
- 68. ENG 1 and ENG 2 OVSP PANEL TEST switch — Press; no lights illuminate.
- 69. Copilot magnetic compass (if installed) — Check.
- 70. Copilot clock (if installed) — Set and running.
- 71. Copilot instruments (if installed) — Static positions.
- 72. Copilot altimeter (if installed) — Set to field elevation.
- 73. Fuel quantity gage — Check.
- 74. Propulsion instruments — Static positions.
- 75. OVER TORQ caution light — Press. Check light illuminates and rotor torque indicator reads $110 \pm 2\%$.

NOTE

If rotor torque indicator indicates an error greater than $\pm 2\%$ from 110% position, main rotor torque system is unreliable. Refer to BHT-230-MM-1 for calibration procedures.

- 76. MASTER CAUTION light — Press to reset.
- 77. Pilot instruments — Static positions.
- 78. Pilot altimeter — Set to field elevation.
- 79. Pilot clock — Set and running.
- 80. STATIC SOURCE switch — PRI, guard closed.
- 81. Pilot magnetic compass — Check.
- 82. Map light — Functional test and adjust.

2-21. ENGINE STARTING

1. Rotor blades — Clear and untied.

NOTE

Following procedures provide for starting engine 1 first; however, either engine may be started first. Simultaneous engine starts are not possible.

2-22. ENGINE 1 START**CAUTION**

ENSURE ROTOR BRAKE IS RELEASED PRIOR TO STARTING ENGINE.

1. ENGINE 1 FUEL VALVE switch — Check on (green).
2. ENGINE 1 FUEL PRIME switch — Check on.
3. START 1 switch — Press to start; check START caution light illuminates and N_G indicates rotation. Observe starter limitations.

CAUTION

A START ATTEMPT AT N_G SPEEDS LESS THAN 12% INCREASES POSSIBILITY OF EXCEEDING ENGINE TEMPERATURE LIMITS.

4. Engine 1 throttle — Slowly rotate at 12% N_G and modulate throttle to idle.

NOTE

Starts should be modulated to maintain 760°C to 820°C MGT during start cycle. This procedure will result in shorter duration starts and is less detrimental to engine than cooler, longer duration starts.

5. MGT — Monitor (do not exceed 10 seconds above 825.6°C or maximum of 926.7°C).

CAUTION

IF MAIN ROTOR IS NOT TURNING BY 25% GAS PRODUCER RPM (N_G), ABORT START. IF SECOND OR THIRD START IS UNSUCCESSFUL, DO NOT ATTEMPT FURTHER STARTS UNTIL CORRECTIVE MAINTENANCE ACTION HAS BEEN PERFORMED. REFER TO ROLLS ROYCE ENGINE OPERATION AND MAINTENANCE MANUAL.

6. Engine 1 ENG OIL gauge — Monitor (must have positive pressure indication by time idle is reached).
7. START caution light — Check extinguished at 58% N_G (indicating starter disengagement).
8. Collective — Lower to full down position.

CAUTION

IF ENGINE HAS BEEN SHUT DOWN FOR MORE THAN 15 MINUTES, STABILIZE AT IDLE FOR 1 MINUTE BEFORE INCREASING THROTTLE.



PROLONGED EXPOSURE TO AMBIENT TEMPERATURES OF -12°C (10°F) OR LOWER, AT 45% RELATIVE HUMIDITY OR HIGHER, MAY FREEZE MOISTURE IN ENGINE FUEL CONTROL SYSTEM. TO AVOID SPONTANEOUS AUTO ACCELERATION, RUN ENGINE AT IDLE FOR A PERIOD OF 5 MINUTES.

9. Engine 1 throttle — Idle 63 to 65% N_G . Note N_G , MGT, No. 1 N_p , ROTOR RPM, and TORQUE stabilized.

NOTE

ENG 1 OUT warning light should extinguish at $55 \pm 2\%$ N_G .

10. XMSN OIL gauge — Check temperature and pressure indicating normal.
11. Engine 1 ENG OIL gauge — Check temperature and pressure indicating normal.

NOTE

When operating in extremely low ambient temperatures, normal transmission and engine oil pressure limits may be exceeded during start. Stabilize engine at idle until normal operating limits are attained.

12. HYD OIL gauges — Check temperatures and pressures indicating normal.
13. ENGINE 1 FUEL PRIME switch — Off.

NOTE

Fuel prime pump should not be utilized as a continuous duty boost pump.

14. GEN 1 switch (battery start only) —

ON; check DC GEN 1 caution light extinguished and AMPS gauge indicating a load.

NOTE

Let generator load stabilize at 100 amps or below before second engine start.



NEVER ATTEMPT A CROSS START WHEN EXTERNAL POWER IS APPLIED. VOLTAGE INCOMPATIBILITY CAN RESULT IN SYSTEM DAMAGE. CROSS STARTS WITHOUT BATTERY ASSISTANCE SHOULD NOT BE ATTEMPTED DUE TO EXCESSIVE GENERATOR LOADS AND LOW STARTING POWER.

2-23. ENGINE 2 START

1. Utilize same procedures as for starting Engine 1 by substituting Engine 2 nomenclature.

NOTE

During generator assisted start of second engine, DC GEN caution light of operating generator will illuminate while starter is engaged.

2. Throttle — Modulate slowly above 50% N_G to ensure smooth clutch engagement. Check engine 2 N_p and TORQUE indications for engagement of engine 2.
3. External power — Disconnect (if utilized).
4. GEN 1 and GEN 2 switches — ON.
5. INVERTER switch — ON.
6. STBY ATTD switch (if Installed) — On.

7. Caution panel lights — All extinguished.
8. RPM caution light — Illuminated.
9. Flight Instruments — Check and set.
10. Lights — As required.

2-24. ELECTRICAL SYSTEM CHECK

1. BUS INTCON switch — Press; check BUS INTERCON caution light remains extinguished.
2. GEN 1 switch — OFF; check MASTER CAUTION, DC GEN 1, and ENG 1 ANTI ICE caution lights illuminate.
3. BUS INTCON switch — On; check BUS INTERCON caution light illuminates, ENG 1 ANTI ICE caution light extinguishes.
4. BUS DISCON switch — On; check BUS INTERCON caution light extinguishes, ENG 1 ANTI ICE caution light illuminates.
5. BUS INTCON switch — On; check BUS INTERCON caution light illuminates, ENG 1 ANTI ICE caution light extinguishes.
6. GEN 1 switch — ON; check BUS INTERCON and DC GEN 1 caution lights extinguish.
7. GEN 1 switch — OFF; check DC GEN 1 and ENG 1 ANTI ICE caution lights illuminate.
8. GEN 2 switch — OFF; DC GEN 1, DC GEN 2, ENG 2 ANTI ICE, and BATTERY RELAY caution lights illuminate; check instrument panel emergency light illuminates.
9. GEN 1 switch — ON; check DC GEN

1 and ENG 1 ANTI ICE caution lights extinguish.

10. BUS INTCON switch — On; check BUS INTERCON caution light illuminates, ENG 2 ANTI ICE and BATTERY RELAY caution lights extinguish; check instrument panel emergency light extinguishes.
11. GEN 2 switch — ON; check BUS INTERCON and DC GEN 2 caution lights extinguish.
12. GEN 2 switch — OFF; check BATTERY RELAY, DC GEN 2, and ENG 2 ANTI ICE caution lights illuminate.
13. BUS INTCON switch — On; check BUS INTERCON caution light illuminates, BATTERY RELAY and ENG 2 ANTI ICE caution lights extinguish. BUS DISCON switch — On; check BUS INTERCON caution light extinguishes and BATTERY RELAY and ENG 2 ANTI ICE caution lights illuminate.
14. GEN 1 switch — OFF; DC GEN 1, DC GEN 2, and ENG 1 ANTI ICE caution lights illuminate.
15. BUS INTCON switch — On; check BUS INTERCON caution light illuminates, BATTERY RELAY, ENG 1 ANTI ICE, and ENG 2 ANTI ICE caution lights extinguish.
16. GEN 1 and GEN 2 switches — ON; check BUS INTERCON, DC GEN 1, and DC GEN 2 caution lights extinguish.
17. BAT switch — OFF; check BATTERY RELAY caution light illuminates; then switch ON; check BATTERY RELAY caution light extinguishes.

18. INVERTER switch (dual inverter installation) — OFF; check INV FAIL caution light illuminates. INVERTER switch — ON (#2 position); check INV FAIL caution light extinguishes. INVERTER switch — ON (#1 position); check INV FAIL caution light remains extinguished).

2-25. PRELIMINARY HYDRAULIC CHECK

NOTE

Sudden control movement or motoring with either hydraulic system off may indicate a hydraulic system malfunction.

1. NO. 1 HYD SYS switch — OFF, then ON.
2. NO. 2 HYD SYS switch — OFF, then ON.

NOTE

Following check shall be performed prior to first flight of day only.

2-26. ENGINE ELECTRONIC OVERSPEED CONTROL SYSTEM CHECK

1. Engine 1 and engine 2 RPM — Check N_p less than 70%; if necessary, raise collective to decrease N_p .
2. ENG 1 OVERSPEED TEST switch — Engage and hold.



DO NOT RELEASE OVERSPEED TEST SWITCH UNTIL THROTTLE HAS BEEN RETURNED TO IDLE.

3. Engine 1 — Slowly increase. N_p should not exceed 70% (indicating system is working properly) and OVSP ENG 1 light should illuminate.

Retard throttle to idle and release switch.

4. ENG 1 OVERSPEED RESET switch — Press to extinguish OVSP ENG 1 light.
5. ENG 2 OVERSPEED TEST switch — Engage and hold.



DO NOT RELEASE OVERSPEED TEST SWITCH UNTIL THROTTLE HAS BEEN RETURNED TO IDLE.

6. Engine 2 throttle — Slowly increase. N_p should not exceed 70% (indicating system is working properly) and OVSP ENG 2 light should illuminate. Retard throttle to idle and release switch.
7. ENG 2 OVSP RESET switch — Press to extinguish OVSP ENG 2 light.
8. Collective — Lower to down stop if previously raised.

NOTE

Test circuit for N_p electronic overspeed control system is equipped with a lockout switch that is activated at 80% N_p and above to prevent excessive torque fluctuations in event check circuit malfunctions or is inadvertently energized.

9. Engine 1 and engine 2 throttles — Increase to 85% N_p .
10. ENG 1 OVERSPEED TEST switch — Engage and hold. N_p should not decrease, indicating lockout switch is operating properly. Release switch.

NOTE

If N_p decreases, lockout switch is not functioning. Reduce throttle to idle and release switch. Maintenance action is required.

11. ENG 2 OVERSPEED TEST switch — Engage and hold. N_p should not decrease, indicating lockout switch is operating properly. Release switch.

NOTE

If N_p decreases, lockout switch is not functioning. Reduce throttle to idle and release switch. Maintenance action is required.

12. Engine 1 and engine 2 throttles — Retard to idle stop; check N_G 63 to 65%.
13. Radios/navaids — On, checked.

2-27. ENGINE RUNUP**NOTE**

Rotor RPM audio will come on at $78 \pm 3\%$ ROTOR RPM and will go off at $94 \pm 3\%$ ROTOR RPM. Audio can be silenced by pressing RPM caution light.

1. Throttles — Increase both to full open. Note RPM caution light extinguishes at $94 \pm 3\%$ ROTOR RPM. Check ROTOR RPM stabilizes at approximately 96%.
2. RPM INCR DECR switch — INCR slowly to maximum of 101% N_p .
3. ENG 2 TRIM switch — Adjust to obtain torque matching at 101% ROTOR RPM.
4. PLT PITOT HTR and CPLT PITOT HTR switches — On; check AMPS gauge for load indication. Turn off if not required.

5. ENG 1 ANTI ICE and 2 ANTI ICE switches — On; check ENG 1 ANTI ICE and ENG 2 ANTI ICE caution lights illuminate. Turn off if not required.

2-28. HYDRAULIC SYSTEMS CHECK**NOTE**

Hydraulic systems check is to determine proper operation of hydraulic actuators for each flight control system. If abnormal forces, unequal forces, control binding, or motoring are encountered, it may be an indication of a malfunction of a flight control actuator.

1. Collective — Full down, friction removed.
2. ROTOR RPM Set to 101%.
3. NO. 1 HYD SYS switch — OFF. Check HYDRAULIC SYS 1 caution light and MASTER CAUTION light illuminate and system 1 HYD OIL pressure drops below 200 psi.
4. Cyclic — Centered, friction removed. Force trim released (if installed). Check normal operation of cyclic by moving forward, aft, left, and right a slight amount (approximately 1 inch). Center cyclic, force trim on (if installed).
5. Collective — Check for normal operations by increasing slightly (1 to 2 inches). Repeat two to three times as required. Return to full down position.
6. Pedals — Displace slightly left and right. Note an increase in force required to move pedal in each direction.

NOTE

An electrical interlock prevents both hydraulic systems from being switched off at same time.

7. NO. 2 HYD SYS switch — OFF. Check system 2 remains operational.
8. NO. 1 HYD SYS switch — ON. Check HYDRAULIC SYS 1 caution light extinguishes and HYDRAULIC SYS 2 caution light illuminates. System 1 regains normal pressure, system 2 drops below 200 psi.
9. Cyclic — Force trim released (if installed), check normal operation of cyclic by moving forward, aft, left, and right approximately 1 inch. Center cyclic, force trim on (if installed).
10. Collective — Check for normal operations by increasing slightly (1 to 2 inches). Repeat two to three times as required. Return to full down position.
11. Pedals — Displace slightly left and right. Note no increase in force required to move pedals.
12. NO. 2 HYD SYS switch — ON. Check HYDRAULIC SYS 2 caution light extinguishes and system 2 pressure returns to normal.
13. Cyclic and collective friction — Set as desired.

2-29. BEFORE TAKEOFF

1. Doors — Secured.
2. Passenger seat belts — Fastened.
3. Caution and warning lights — Extinguished.

4. Fuel quantity — Check.
5. Power assurance check — As required. Refer to Section 4 for procedure.

NOTE

Ensure ENG OIL pressure and XMSN OIL pressure are within normal operating limits prior to takeoff.

2-30. TAKEOFF

1. N_p — 101%
2. Instruments — Normal operating ranges.
3. Area — Clear.
4. Hover power — Check.
5. ENG 2 TRIM switch — Adjust to obtain matching TORQUE, N_G , or MGT as desired at 101% ROTOR RPM.
6. SEAT BELTS and NO SMOKE switches — As desired.

2-31. INFLIGHT**NOTE**

It is recommended that 101% N_p be utilized in cruise flight above 100 KIAS.

2-32. BEFORE LANDING

1. N_p — 101%.
2. Instruments — Normal operating ranges.
3. SEAT BELTS and NO SMOKE switches — On.
4. Passenger seat belts — Fastened.

2-33. ENGINE SHUTDOWN

1. Collective — Full down.
2. Cyclic — Centered; friction as desired.
3. Throttles — Idle stop (63 to 65% N_G).
4. MGT — Stabilize at idle for 2 minutes prior to shutdown.
5. RPM caution light — Press to silence audio.
6. ENG 1 ANTI ICE and Eng 2 ANTI ICE switches — Off.
7. PILOT PITOT HTR and COPILOT PITOT HTR switches — Off.
8. EMERG LT switch — OFF.
9. STBY ATTD switch (if installed) — OFF.

NOTE

Failure to turn off emergency lights and standby attitude indicator will deplete self-contained batteries.

10. Radios — Off.
11. INVERTER switch — OFF.
12. GEN 1 and GEN 2 switches — OFF.
13. BUS INTCON switch — On.
14. IDLE STOP release switch — Activate.
15. Throttles — Closed.

NOTE

Allow collective to raise slightly to unload main rotor hub elastomers.

16. Rotor brake — Apply at or below 55% ROTOR RPM until rotor stops. Return brake handle to off detent position.
17. ENGINE 1 FUEL VALVE AND ENGINE 2 FUEL VALVE switches Off (white); — check ENG 1 FUEL VALVE and ENG 2 FUEL VALVE caution lights illuminate momentarily, then extinguish.
18. All light switches — OFF.
19. BAT switch — OFF.

2-34. AFTER EXITING HELICOPTER

1. Install main and tail rotor tiedown if any of following conditions exist:
 - a. High or gusty winds are predicted.
 - b. Other helicopters are operating or expected to be operating in immediate area.
 - c. Anytime helicopter is to be left unattended.
2. Install protective covers (engine inlet, oil cooler blower inlet, exhaust, and pitot tube).

Section 3

EMERGENCY/MALFUNCTION PROCEDURES

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Section 3

EMERGENCY/MALFUNCTION PROCEDURES

3-1. INTRODUCTION

Following procedures contain indications of equipment or system failure or malfunction, use of emergency features of primary and back-up systems, and appropriate warnings, cautions, and explanatory notes. Table 3-1 lists fault conditions and corrective actions required for illumination of red warning lights. Table 3-2 addresses malfunction procedures associated with yellow caution lights.

All corrective action procedures listed herein assume pilot gives first priority to helicopter control and a safe flight path.

NOTE

A tripped circuit breaker should not be reset in flight unless deemed necessary for safe completion of the flight.

If a tripped circuit breaker is deemed necessary for safe completion of the flight, it should only be reset one time.

Helicopter should not be operated following any precautionary landing until cause of malfunction has been determined and corrective action taken.

3-2. DEFINITIONS

Following terms indicate degree of urgency in landing helicopter.

LAND AS SOON AS POSSIBLE Land without delay at nearest suitable area (i.e., open field) at which a safe approach and landing is reasonably assured.

LAND AS SOON AS PRACTICAL Duration of flight and landing site are at discretion of pilot. Extended flight beyond nearest approved landing area is not recommended.

Following terms are used to describe operating condition of a system, subsystem, assembly, or component.

Affected Fails to operate in normal or usual manner.

Normal Operates in intended or usual manner.

Table 3-1. Red Warning Lights

PANEL WORDING	FAULT CONDITION	CORRECTIVE ACTION
FIRE ENG 1/ FIRE ENG 2	Fire in engine compartment	Affected engine throttle to idle. If fire is verified, refer to ENGINE FIRE IN FLIGHT.
BAG FIRE	Smoke in baggage compartment.	Inflight — VFR — Land as soon as possible. Refer to BAGGAGE COMPARTMENT FIRE. Inflight — IFR — Declare an emergency. Land as soon as possible. Refer to BAGGAGE COMPARTMENT FIRE.
ENG 1 OUT/ ENG 2 OUT	Engine NG below $55 \pm 2\%$.	Verify engine condition. Accomplish applicable single engine emergency procedures.
XMSN OIL	Transmission oil pressure below minimum (30 psig).	Reduce power. Verify fault on XMSN OIL gauge. Inflight — VFR — Land as soon as possible. Inflight — IFR — Declare an emergency. Land as soon as possible.
	or	
	Transmission oil temperature above maximum (110°C).	Reduce power. Verify fault on XMSN OIL gauge. Inflight — VFR — Land as soon as possible. Inflight — IFR — Declare an emergency. Land as soon as possible.
ROTOR BRAKE	Rotor brake engaged.	Check rotor brake handle in off detent. If light remains illuminated, correct problem before engine start. Inflight — VFR — Check rotor brake handle in off detent. Land as soon as possible.

- a. If visual reference is achievable, land as soon as possible.
 - b. If visual reference is not achievable, proceed to step 9.
9. GEN 1 switch — OFF.
10. Unnecessary equipment — Off.

NOTE

Refer to BHT-230-MD-1 for bus loading.

11. If smoke and/or fumes are not eliminated, proceed to step 12. If smoke and/or fumes are eliminated, land as soon as practical.
12. GEN 1 switch — ON and GEN 2 switch — OFF.
13. If fumes are not eliminated, proceed to step 14. If smoke and/or fumes are eliminated, land as soon as practical.

NOTE

Battery will not be recharged in this condition.

14. Both GEN switches — OFF. Pull EMERG BUS 1 PWR and EMERG BUS 2 PWR circuit breakers individually to determine affected circuit.
15. If smoke and/or fumes are not eliminated, proceed to step 17. If smoke and/or fumes are eliminated, proceed to step 16.
16. Unaffected GEN switch — ON and reset unaffected EMERG BUS PWR circuit breaker. Land as soon as practical.

17. EMERG BUS 1 PWR and EMERG BUS 2 PWR circuit breakers — Reset and land as soon as possible.

3-4. BAGGAGE COMPARTMENT FIRE

● **INDICATIONS:**

- 1. Visible smoke or fire.
- 2. Fumes.
- 3. BAG FIRE warning light illuminated.

● **PROCEDURES:**

- 1. Yaw or turn to check for visible smoke trailing helicopter.
- 2. If fire is verified, land as soon as possible.
- 3. If fire cannot be verified, continue to monitor for indications of baggage compartment fire. Land as soon as possible.

3-5. ENGINE FIRE DURING START OR SHUTDOWN

● **INDICATIONS:**

- 1. Excessive MGT.
- 2. Visible smoke or fire.
- 3. FIRE ENG 1 and/or FIRE ENG 2 warning light illuminated.

● **PROCEDURES:**

- 1. Throttles — Closed.
- 2. ENGINE 1 FUEL VALVE and/or ENGINE 2 FUEL VALVE switches — Off.

Appendix A

OPTIONAL EQUIPMENT SUPPLEMENTS

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Appendix A

OPTIONAL EQUIPMENT SUPPLEMENTS

A-1. OPTIONAL EQUIPMENT

Bell Helicopter Textron's policy is one of continuous product improvement and Bell reserves the right to incorporate changes, make additions to and improve its products without imposing any obligation upon the company to furnish for or install such

changes, additions, improvement, etc., on its products previously manufactured.

The following items may be installed on the basic helicopter by authorized personnel. Only the optional equipment listed in [Table A-1](#) require a Flight Manual Supplement.

Table A-1: Flight Manual Supplements for Optional Equipment

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-230-FMS-1 Retractable Landing Gear	230-705-001	12 MAR 92	Rev. 3 24 AUG 94
BHT-230-FMS-2	Reserved		
BHT-230-FMS-3 Litters	222-706-202	29 JUL 92	Original
BHT-230-FMS-4 Environmental Control System (Cabin Temperature Control)	222-706-018	29 JUL 92	Rev.1 22 APR 93
BHT-230-FMS-5 Heated Windshield	222-706-206 and 222-706-404	29 JUL 92	Original
BHT-230-FMS-6 High Skid Gear	230-705-002	20 SEP 95	Original
BHT-230-FMS-7	Reserved		
BHT-230-FMS-8 300 Pound Hoist	222-899-110	29 JUL 92	Rev. 1 14 JUL 94
BHT-230-FMS-9	Reserved		
BHT-230-FMS-10 Cargo Hook	222-706-904	29 JUL 92	Reissue 11 MAY 95
BHT-230-FMS-11 Partical Separator, Engine Air Induction System	230-706-501	29 JUL 92	Rev. 2 17 JUN 94

Table A-1: Flight Manual Supplements for Optional Equipment (Cont)

NAME OF EQUIPMENT	KIT NUMBER	DATE CERTIFIED	CURRENT REVISION
BHT-230-FMS-12 Emergency Flotation	222-706-093	3 JUN 93	Reissue 19 OCT 94
BHT-230-FMS-13 Upper Auxiliary Fuel Kit	222-706-204	29 JUL 92	Rev. 2 13 MAY 97
BHT-230-FMS-14 Honeywell Primus 700 Weather Radar	230-899-110	27 MAY 93	Original
BHT-230-FMS-15	Reserved		
BHT-230-FMS-16	Reserved		
BHT-230-FMS-17 Global Positioning System	230-899-105	26 FEB 93	Original
BHT-230-FMS-18 Bendix/King RDS 82 Weather Radar	230-899-103	26 FEB 93	Original
BHT-230-FMS-19	Reserved		
BHT-230-FMS-20 Snow Baffle Kit	230-706-502	29 JUL 92	Rev. 2 17 JUN 94
BHT-230-FMS-21	Reserved		
BHT-230-FMS-22 Loran Navigation	230-705-503	18 AUG 92	Original
BHT-230-FMS-23 Crew Doors Off	STC SH8651SW	25 JUN 93	Reissue 14 JUL 95
BHT-230-FMS-24 Left and/or Right Side Sliding Door Installation	STC SH8713SW	28 OCT 93	Reissue 29 SEP 95