CHAPTER 2

AIRCRAFT GENERAL

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ILLUSTRATIONS

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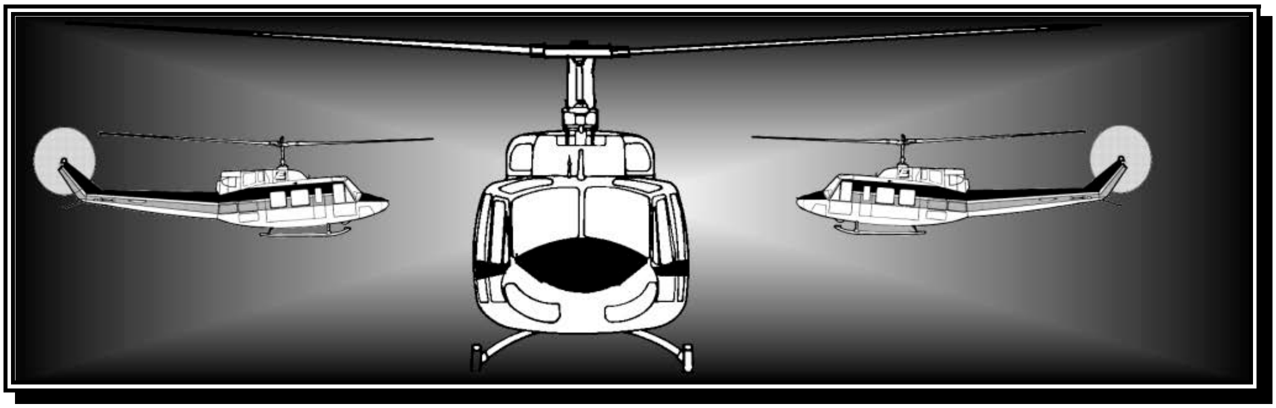
CHAPTER 2

AIRCRAFT IN GENERAL



INTRODUCTION

This training manual provides a description of the major airframe and engine systems installed in the Bell 212 Twin. This information is intended as an instructional aid only; it does not supersede, nor is it meant to substitute for any of the manufacturer's system or operating manuals. Material presented has been prepared from the basic design data. All subsequent changes in aircraft appearance or system operation will be discussed during academic training and subsequent revisions to this manual.

GENERAL

The Bell 212 is a twin turbine, two bladed single main rotor, medium lift helicopter designed to carry up to 15 persons, including the pilot(s). Thirteen passenger seats can be installed in the aft cabin, and the left pilot seat may be used for a passenger when one pilot flies the aircraft.

A Bell IFR helicopter must be operated with two pilots when operated IFR. It can be operated single-pilot when VFR.

The Model 212 is designed for high performance, low maintenance and maximum versatility. Operational reliability is improved with the twin turbo-shaft engine installation.

Special equipment allows for over water flight, transportation of external cargo, and hoist operations. The helicopter is powered by the Pratt and Whitney PT6T-3 or the PT6T-3B or the PT6T-3DF “TwinPac” power plant, 1,800, 2050, or 2260 shaft horsepower powerplant respectively driving a semirigid underslung two bladed rotor system. Campbell machines are typically powered by PT6T-3’s but there is occasionally one or more PT6T-3B powered machines in the fleet.

The main rotor is a two bladed, semi rigid, seesaw, high kinetic energy type, with preconing and under-slinging capabilities to increase stability and provide smooth control response in all modes of flight.

The main transmission is a single stage bevel gear unit; a two-stage planetary gear train and a tail rotor drive system take-off. The original transmission incorporated a freewheeling unit at the input shaft. This freewheeling unit was removed from the later model transmissions. Most upgraded transmissions (5000 hrs TBO) are now monitored by a triple zone chip detector system although some legacy models with the single chip detector remain in service.

The Bell 212 fuel system features several advanced safety features, including self-sealing, breakaway fittings and rupture resistant fuel cells.

With a standard fuel load, the 212 is designed to cruise at approximately 100 knots (3,000 feet and below) with a 200 nautical mile range. Auxiliary tanks can extend range to 340 nautical miles. There are three approved auxiliary fuel tank kits presently available. Two of the three kits are internal kits, consisting of 40 gallon and 180 gallon capacities respectively. Maximum gross weight is 11,200 pounds, with a payload of approximately 4,200 pounds for the VFR only (approx 3,800 for the IFR aircraft).

The Bell 212 Twin is certificated for single pilot operation. In basic configuration, it is approved for operation under day or night VFR, non-icing conditions. The IFR configured helicopter is certificated for Category 1 IFR operation during day or night non-icing conditions. The flight manual gives limitation procedures and performance data for Category A operations. Figure 2-1 shows the Bell 212 aircraft major sections. Figure 2-2 shows the exterior dimensions of the aircraft.

FUSELAGE STRUCTURE

GENERAL

The primary structure of the fuselage (Figure 2-3) consists of two main sections (aluminum alooy with fiberglass panels and honeycomb structures), the forward fuselage and tail boom. The forward fuselage includes the cabin, laminated glass (or more often noe plexiglass) windshields, acrylic plastic windows, crew doors, cargo/passenger door, pylon and engine cowlings and landing gear is made of a combined semi-monocoque and reinforced shell construction with transverse bulkheads and metal covering. It has two main longitudinal beams that provide the primary supporting structure. *(Monocoque means a metal structure in which the covering absorbs part of the stresses to which the structure is subjected).*

Conversion from passenger to cargo configu- ration is accomplished by removal of the seats. Without seats, the cabin has 220 feet of cargo space.

The tail boom is an all metal semi-monocoque structure with aluminum skin. The assembly in cludes the tail rotor driveshaft covers, vertical fin, elevators, baggage compartment, and tail skid. The tail boom attaches to the fuselage by four bolts and supports the tail rotor drive shafting, tail rotor gearboxes, tail rotor, synchronized elevator and tailskid. The tail boom also incorporates a 28 cu. ft. baggage compartment. The cabin accommodates a maximum of 15 personnel, including the pilot and co-pilot.

A synchronized or sync elevator (horizontal stabilizer) is located near the aft end of the tail boom, to increase the controllability of the helicopter and effectively lengthen the CG range.

Two retractable, quickly removable ground-handling wheels attach to fittings in the skid tubes (figure 2-21). A tubular steel tailskid is attached to the aft section of the tail boom to warn the pilot of a tail-low landing.

COCKPIT

The cockpit (Figure 2-4) can accommodate a crew of two, with the pilot normally occupying the right seat. Single pilot operations are conducted from the right seat. Long Line vertical reference operations are conducted from the left seat.

Standard cockpit features include heater and ventilating systems.

The standard 212 instrument panel is normally equipped for VFR and IFR day or night flight, although VFR only options are available and are the most common Campbell variant. Engine and transmission instruments and the caution panel are grouped in the center section of the panel for easy observation from either seat. Flight and navigation instruments are grouped on the right side of the panel in front of the pilot. Additional co-pilot instruments are installed in the left side of the instrument panel for two pilot operations. The instruments have complete white lighting.

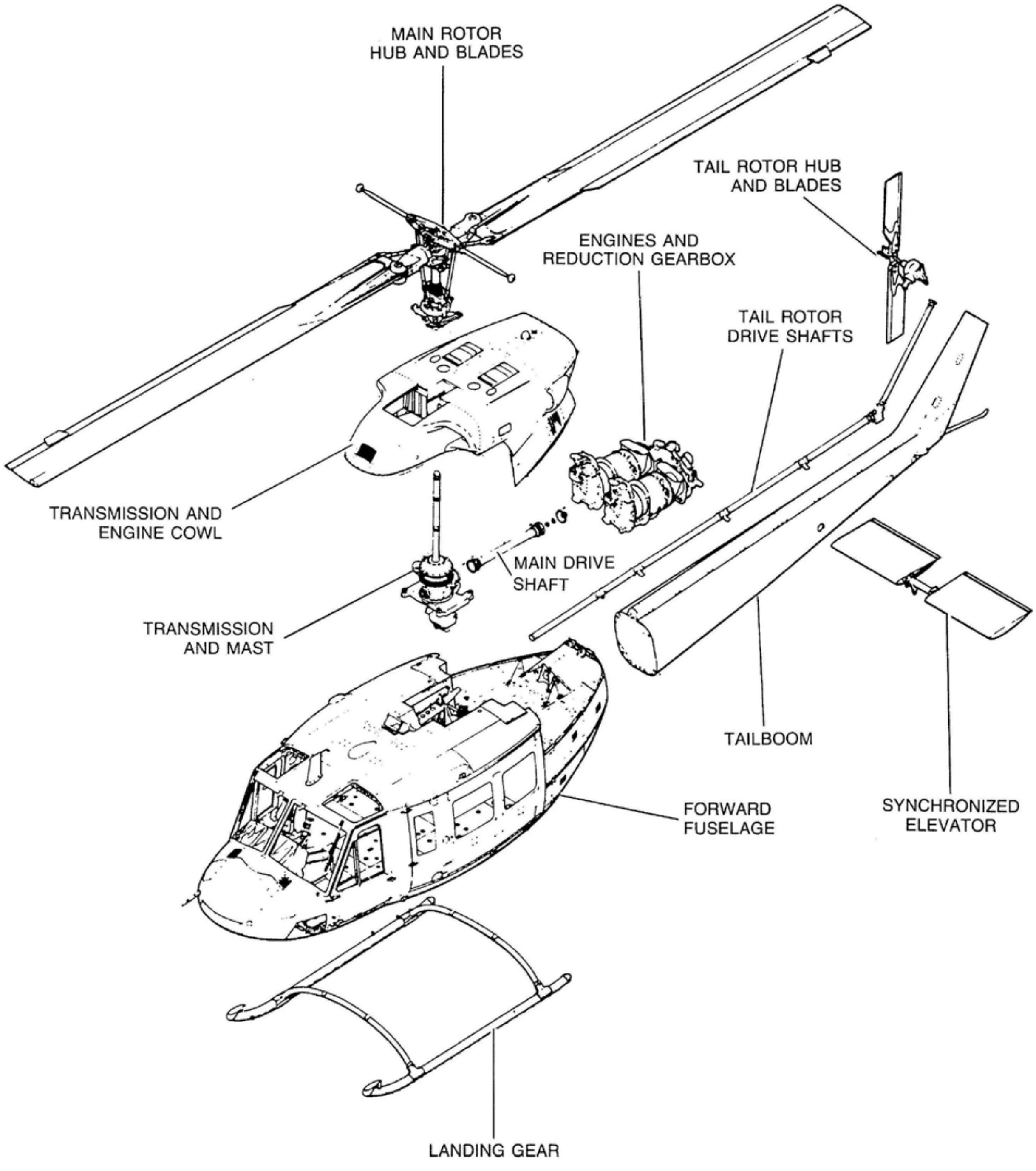


Figure 2-1 Bell 212 Major Sections

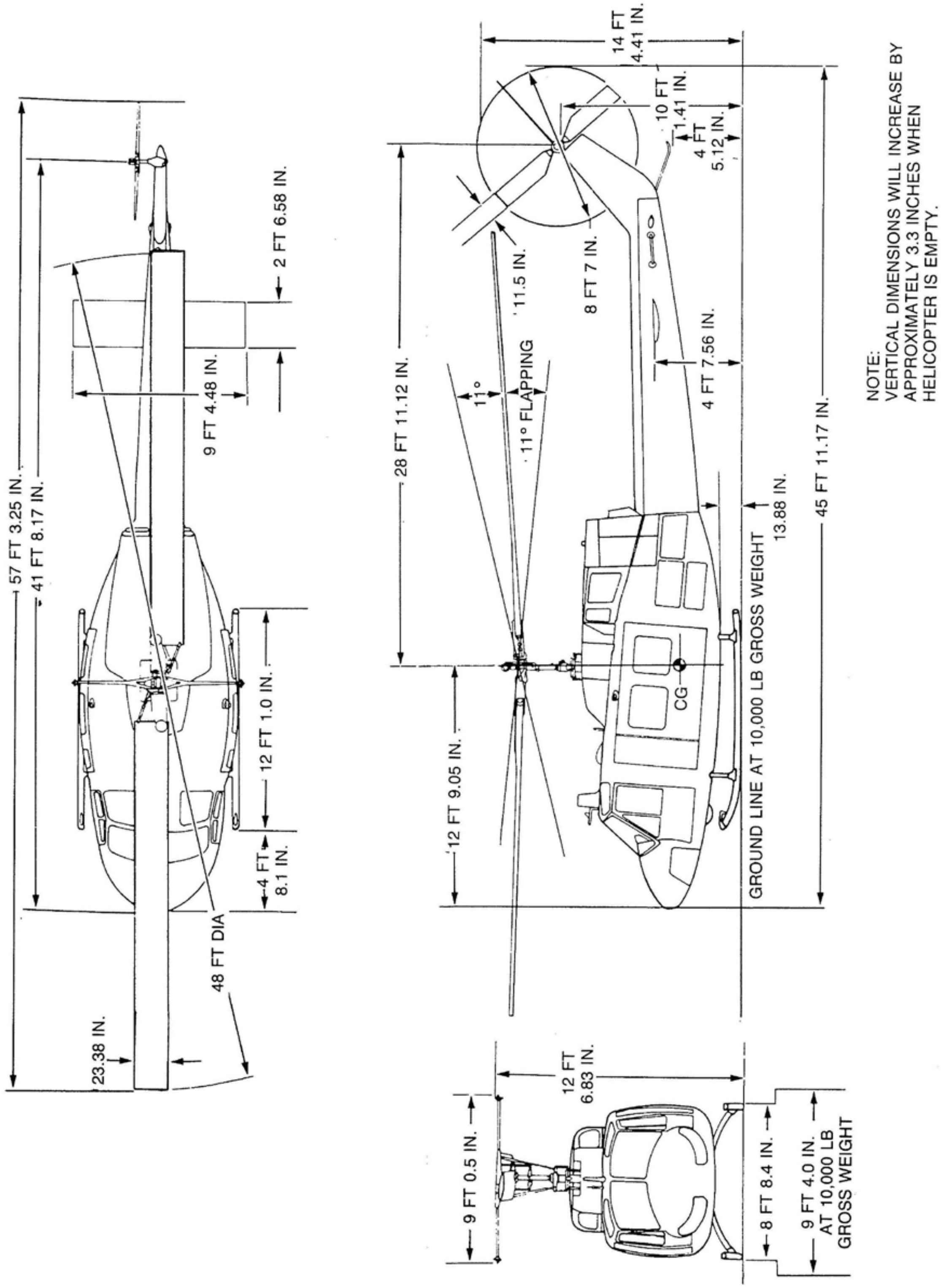


Figure 2-2 Bell 212 Exterior Dimensions

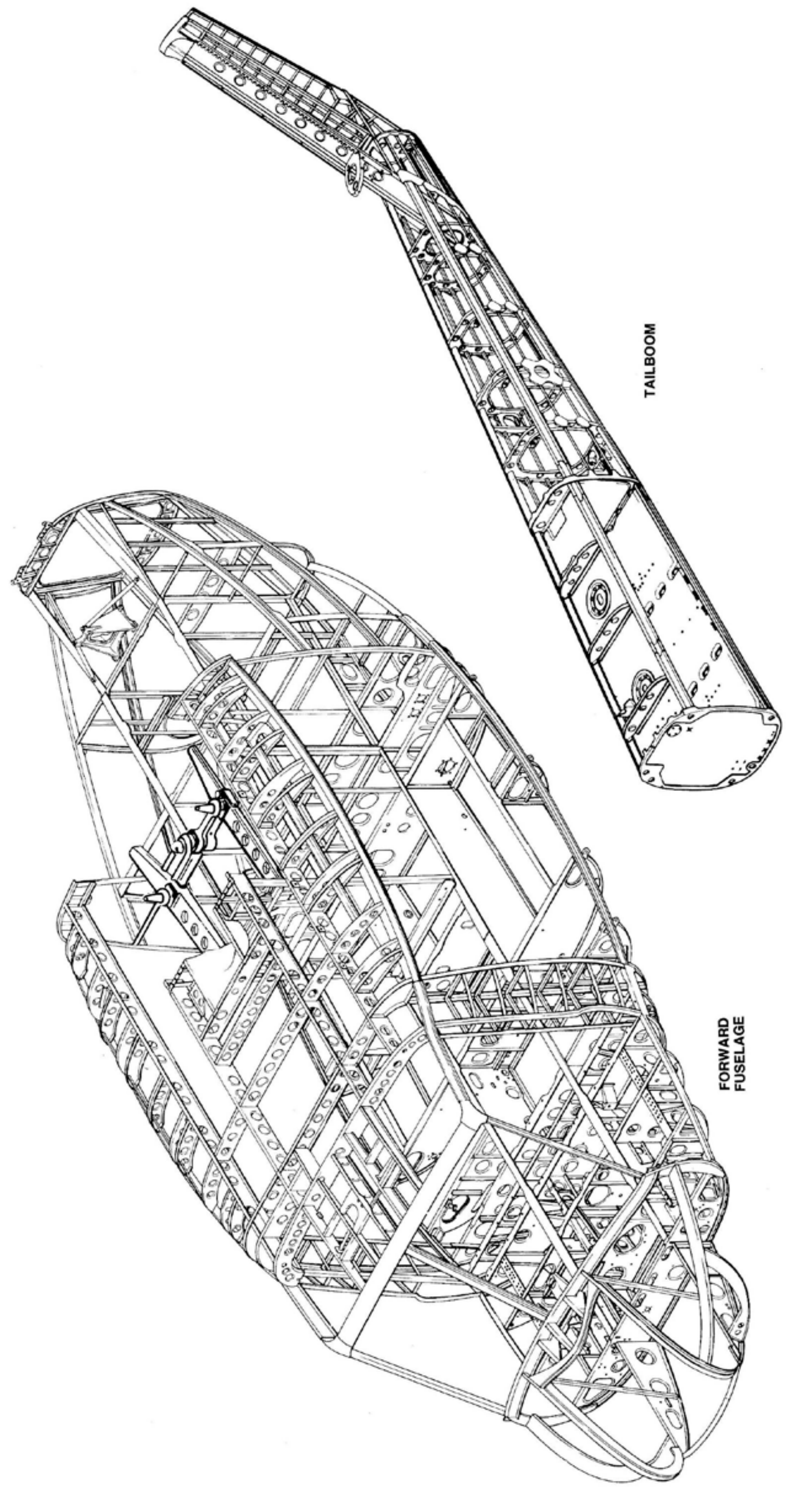
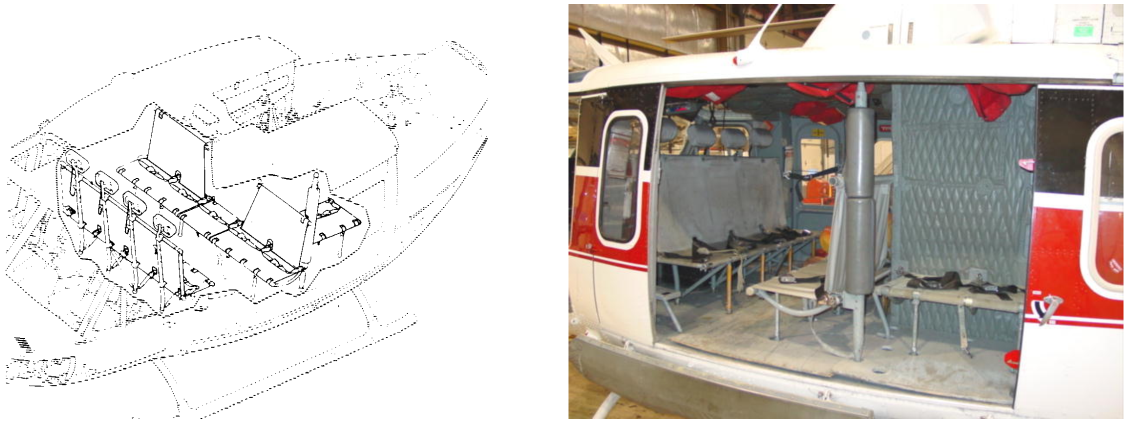


Figure 2-3 Bell 212 Fuselage Primary Structure

Figure 2-4 Cockpit Layout (Typical)



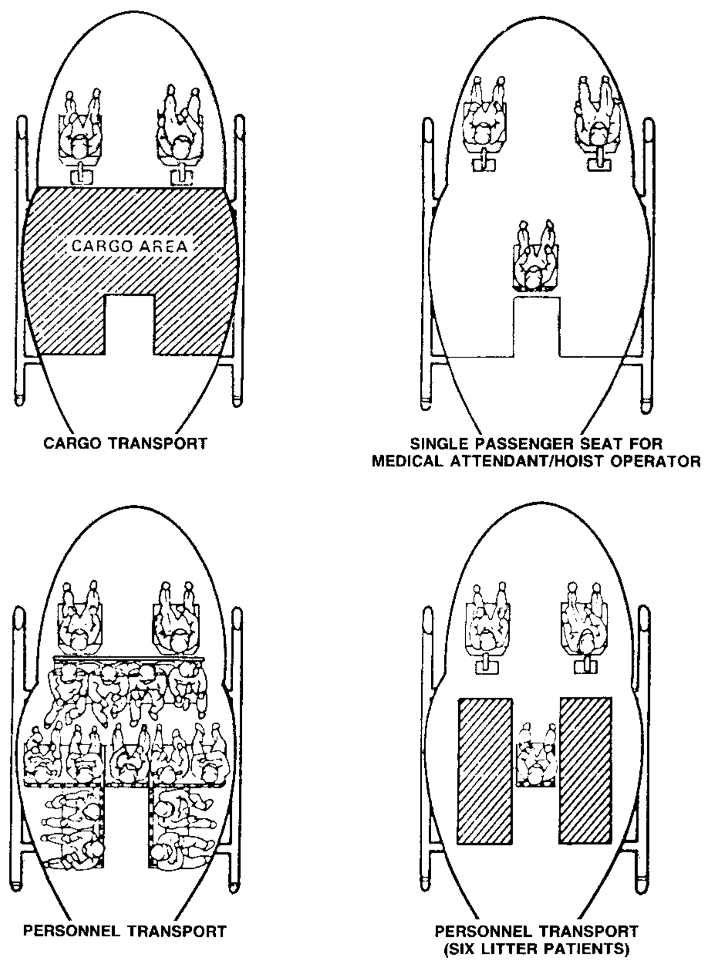


Figure 2-5 Seating Arrangements

(At Campbell normally only Cargo and Personnel arrangements)

SEATING

The pilot seats are a tubular construction covered with a nylon mesh for ventilation. Attached to each seat, there is a standard seat belt and shoulder harness restraint system. The shoulder harness utilizes an inertia reel to provide inertial locking of the harness with a manual lock located to the left side of the seat itself. The seats are located on tracks for fore and aft adjustment and are also adjustable in the vertical plane. The fore and aft lock for the seat is on the forward left side. The vertical adjustment lock is located on the forward right side.

The basic passenger seat structure is normally the “jump seat” rip resistant nylon type, outfitted with a safety belt. Baggage or cargo stored under the passenger’s seats must be restrained by an approved cargo or baggage tiedown.

The passenger seat legs are not stressed for cargo restraint. Figure 2-5 shows several typical seating options.

Figure 2-6 Sling Seat

DOORS AND WINDOWS

Access to the cockpit is provided on each side through large doors that are hinged on the forward edge (Figure 2-7). A crew step is built into the skid landing gear. Each crew door has three acrylic plastic windows, termed "forward," "upper," and "adjustable." The adjustable window slides up and down and has a screw device to lock it in any position. Most Campbell 212’s have a bubble window on the left cockpit door to facilitate long-lining (Figure 2-7). A latch assembly with L shaped handles and an integral key lock secures the door in the closed position. In an emergency, the crew doors may be jettisoned by pulling the EMERGENCY EXIT handle located inside and forward of each door (Figure 2-8).

The sliding cargo/passenger door on each side (Figures 2-9a and 9b) has a latching assembly with L shaped handles and an integral key lock. The sliding doors can be secured in the open position when so equipped with the latching mechanism. The two acrylic windows in each sliding door can be jettisoned from either inside or outside by applying approximately 50# of pressure to any of the four corners. On some older model doors the windows are jettisoned by a rotatable latch protected by a pull off plastic cover located just below each window.

An 18-inch wide removable hinged door panel just forward of each sliding door opens outward and forward to increase the total width of the opening for passengers or cargo. Figures 2-9 and 2-10 show the panel in the closed and open positions.

The latch assembly on each door panel has an L shaped handle located on the inside of the door. Most have a plastic fairing to prevent inadvertent of the latch (Figure 2-10b). Each hinged panel has an acrylic window that cannot be jettisoned.

Figure 2-7a Cockpit Door

Figure 2-7b Bubble Window

Figure 2-8 Emergency Exit Handle

Figure 2-9a Cargo/Passenger Doors

Figure 2-9b Cargo/Passenger Doors

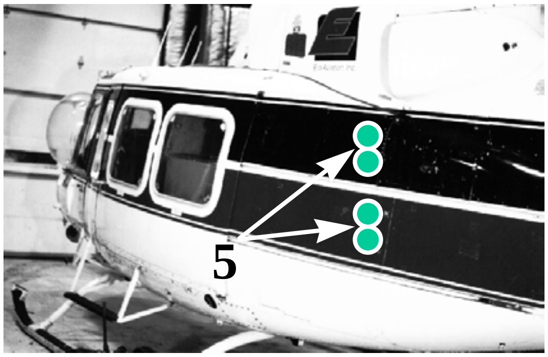


Figure 2-9c Cargo/Passenger Doors

Note: ◖ (Inset 5) Make sure the latches are closed before opening the sliding door. The latches maybe sheared off or jam the sliding door open. If the hinged doors are left open their hinges may be sheared off.

Note also the passenger step which is typical of that utilitzed on Campbell 212's.

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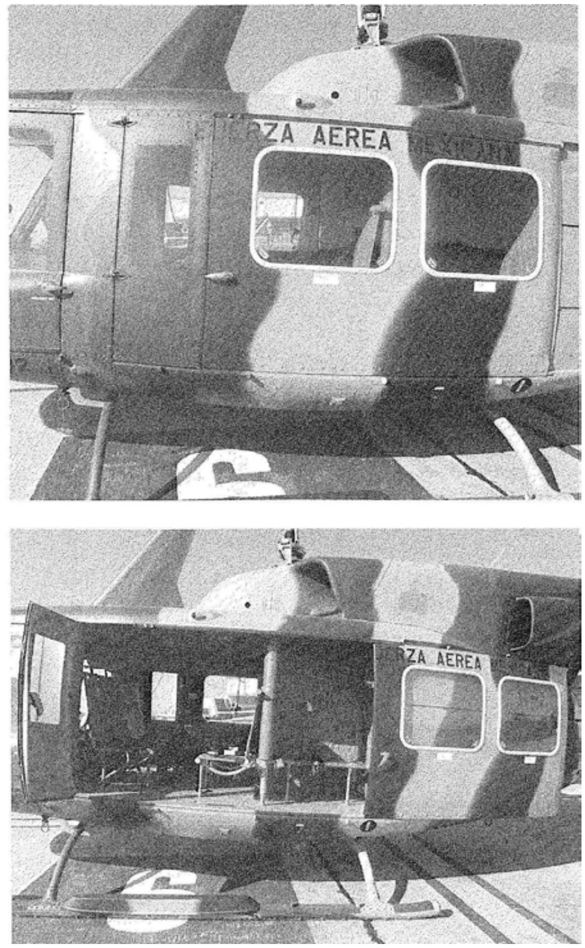


Figure 2-9d Cargo/Passenger Doors

Figure 2-10a Hinged Door Panel

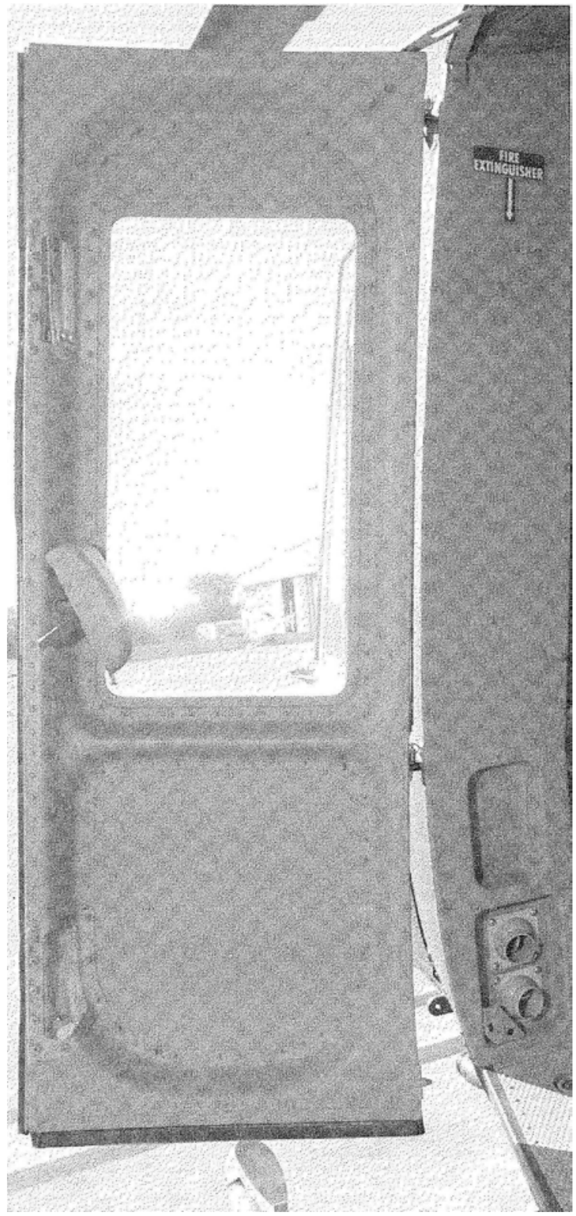
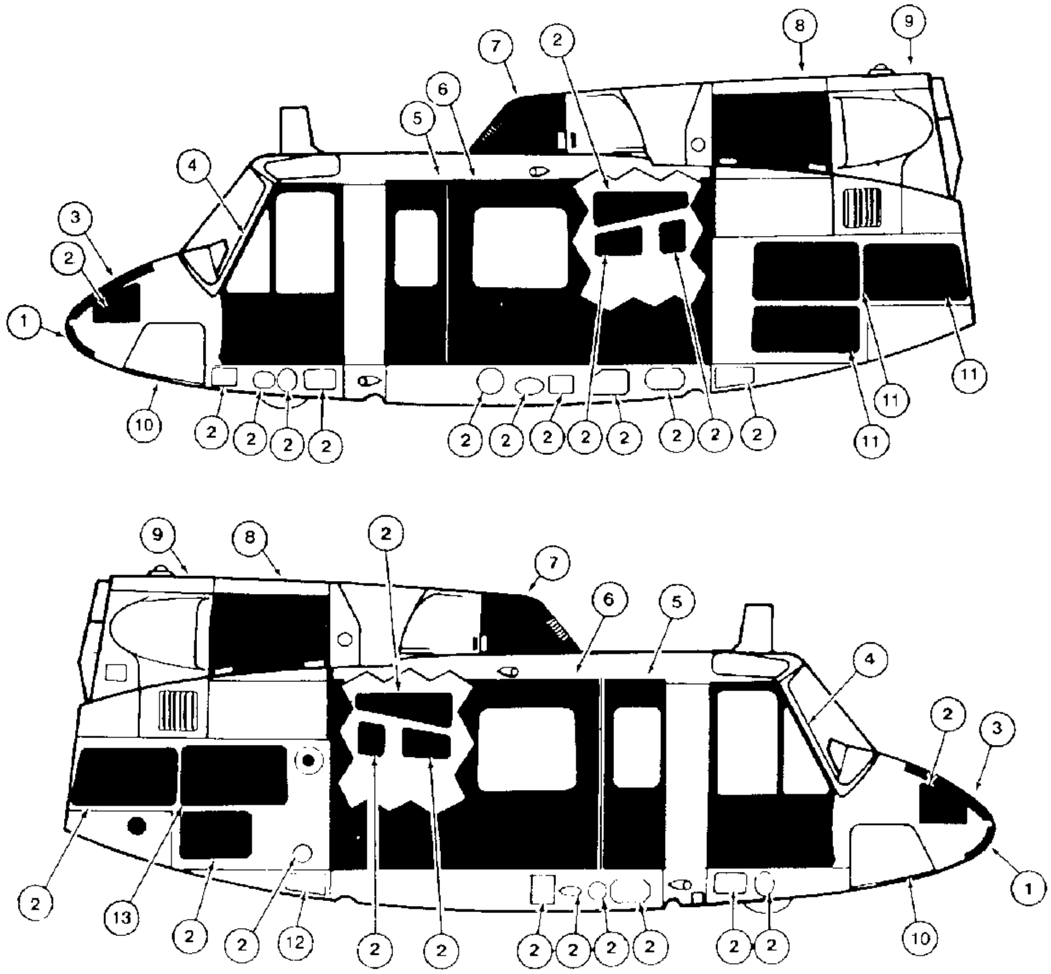


Figure 2-10b Hinged Door Panel with Protective Fairing

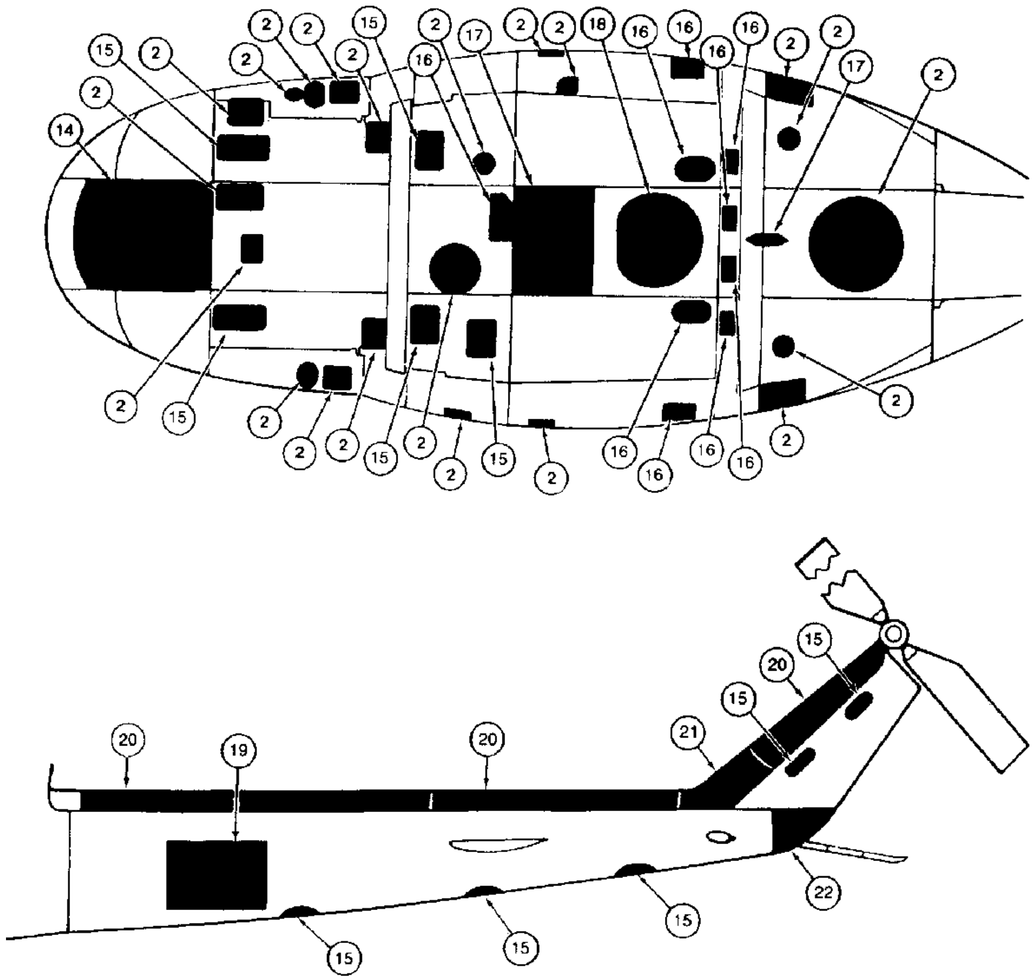
Figures 2-11 and 2-12 illustrate the names and locations of the doors and panels for maintenance and servicing and the systems and structures which they access.



LEFT AND RIGHT SIDE VIEWS

1 External Power Receptacle
2 General Access Door
3 Nose Compartment Access Door
4 Crew Door
5 Hinged Panel Door
6 Cargo Door
7 Transmission Fairing
8 Engine Cowling
9 Tailpipe Fairing
10 Lower Forward Cabin Window
11 Electrical Compartment Access Door
12 Heater Duct Access Door
13 Heater Compartment Access Door

Figure 2-11 Doors and panels (Sheet 1 of 2)



FUSELAGE SKIN AND LEFT SIDE TAIL BOOM

2	General Access Door	18	Cargo Hook Opening
14	Nose Compartment Access	19	Baggage Compartment Door (RH Only)
15	Flight Control Access Door	20	Drive Shaft Cover
16	Fuel Line Access Door	21	42 Degree Gearbox Cover
17	Antenna	22	Tail Skid Fairing

Figure 2-12 Doors and Panels (Sheet 2 of 2)

The two windshields (Figure 2-13) are made of Plexiglas for VFR equipped aircraft (IFR aircraft have laminated glass windshields and are virtually free from distortion). Plexiglass windshields are very susceptible to scratching and therefore use of windshield wipers should be avoided except in absolute necessity. Deet products are also very damaging to plexiglass and should not be sprayed on or around any of the windows.

Although the glass windshields are relatively hard and resistant to scratches, care must be taken when cleaning the windows because they will scratch and craze if improperly cleaned. Never operate the windshield wipers when the windows are dry as it will cause damage. Heated glass windshields are available as optional equipment.

Figure 2-13 Windshields

ENGINE DECK

The engine deck is located above and aft of the cabin area (Figure 2-14) and is designed and constructed to accommodate the engines, fire walls, engine air management systems, combining gearbox, and other equipment, lines, and fittings needed for the installation. The deck is divided into four major sections: left, right, aft and center. Internal firewalls isolate and protect each engine, the combining gearbox, and the main drive shaft.

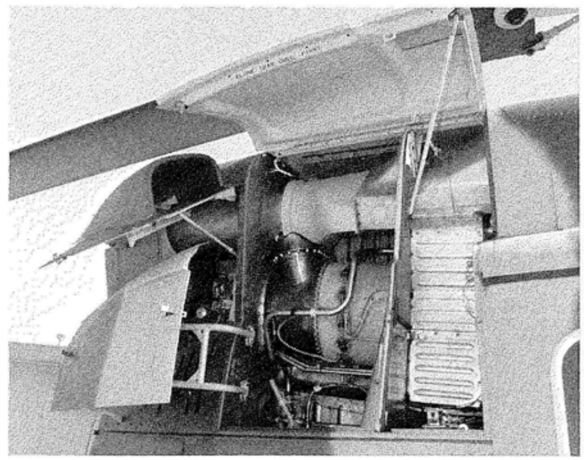


Figure 2-14 Engine Deck

TRANSMISSION AND ENGINE COWLING

The transmission and engine cowling (Figure 2-15) is attached to the cabin roof with quick release fasteners. Use of self-locking screws, hinges and latches, allow for quick maintenance access. An oil cooler air scoop is located on each side of the fuselage.

LANDING GEAR

The skid landing gear (Figure 2-16) is made of aluminum alloy. It consists of two main skid tubes connected by two arched cross tubes. An optional high skid gear kit, consisting of taller crossover tubes, provides greater ground clearance for operations in rough terrain, tall grass, and

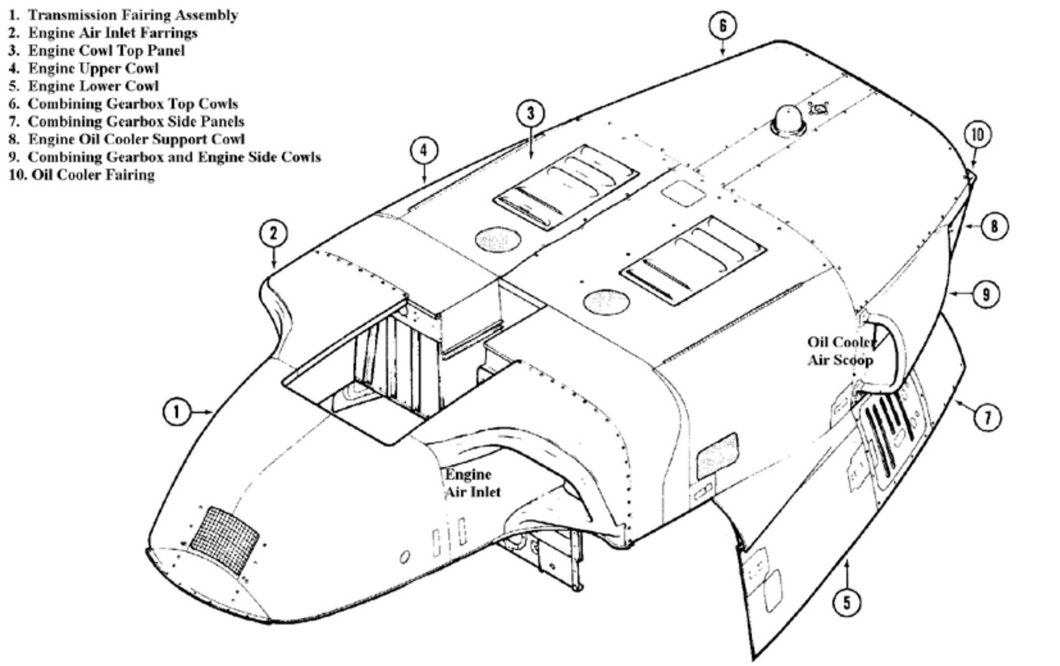


Figure 2-15 Transmissions and Engine Cowling

other adverse ground conditions. It also allows fitted, under-slung loads to be carried. The kit adds approximately six to ten inches to the standard ground clearance. Refer to Towing, this chapter, for additional information.

The gear is rugged and designed to absorb energy in the event of a hard landing with eleastic deflection of the crosstubes attenutating energies up to 500 fpm (620 fpm if crosstubes also yield beyond normal operating limits.)

Campbell has an approved fix step for use with high skid gear. An optional passenger step kit (Figure 2-17) is also available when the high skid gear. The steps are electrically operated from the step switch on the center pedestal. This type is not used with float kits.

An optional emergency floatation kit (Figure 2-17) is designed to provide flotation of the helicopter in the event of an emergency ditching in water. The kit consists of four floats, an inflation system, an automatic (electrical) actuation system, a mechanical (Emergency) actuation system, and hardware to complete the system.

BAGGAGE COMPARTMENT

A 28 cubic foot baggage compartment is located in the forward end of the tailboom (Figure 2-18). The door is on the right side and has a latch and lock on the aft portion of the door panel. Maximum weight capacity of the compartment is 400 pounds (max load bearing capacity 100 lbs/sq ft). Avoid heavy loads in the tail when single pilot without additional weight forward of the mast. Ensure your center of gravity is within limits. A smoke detector is mounted in the upper left forward part of the compartment, and a BAGGAGE FIRE indicator is located in the cockpit. The caution panel DOOR LOCK light illuminates any time the baggage compartment door is unlatched.

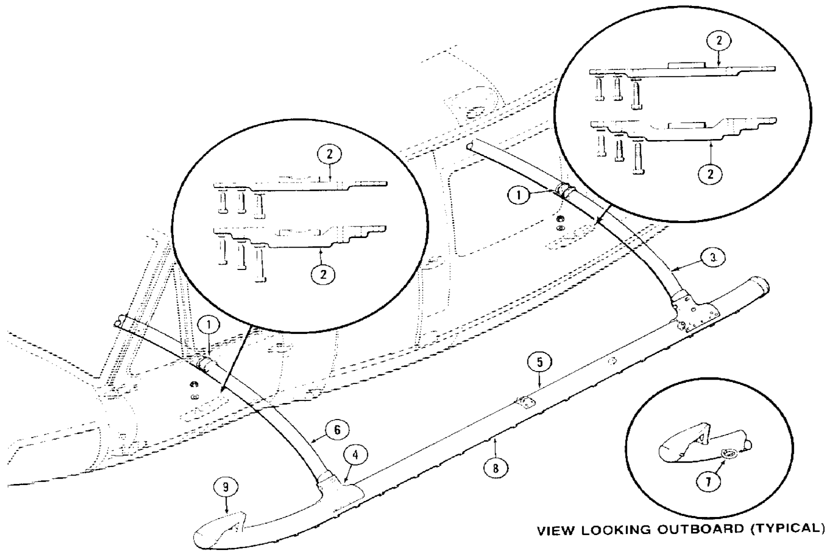


Figure 2-16 Skid Landing Gear

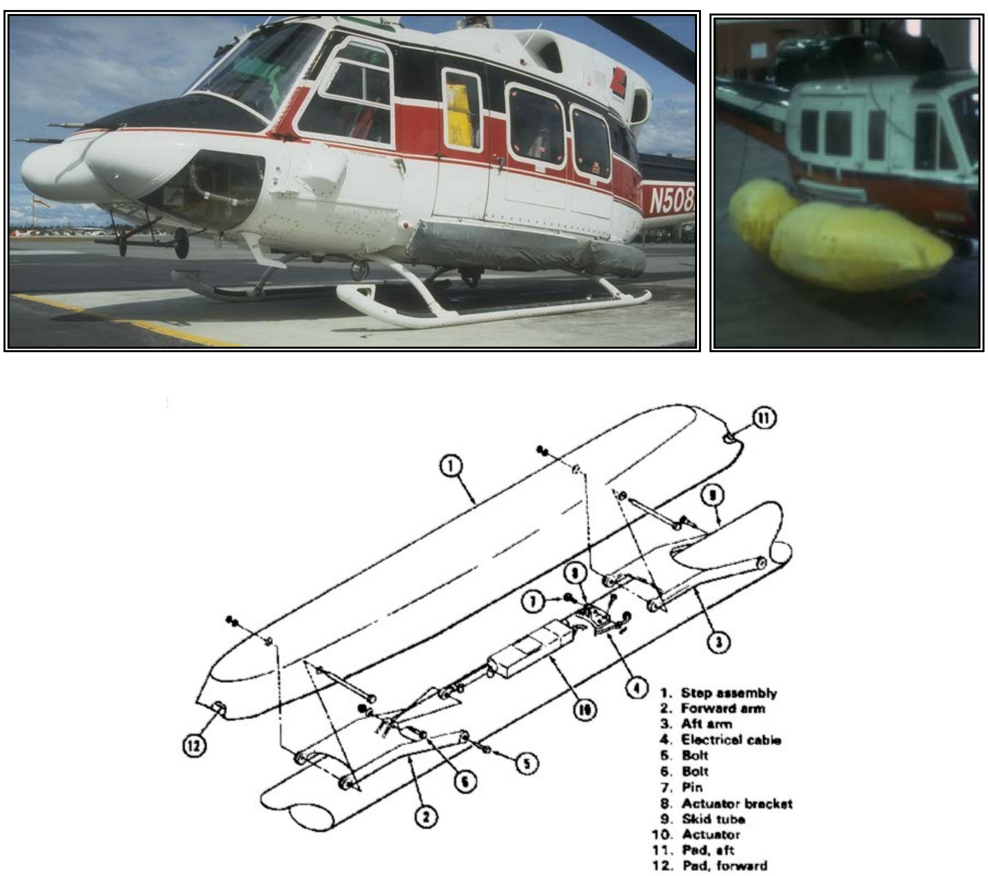


Figure 2-17a Emergency Floats (top) and Passenger Step Kit

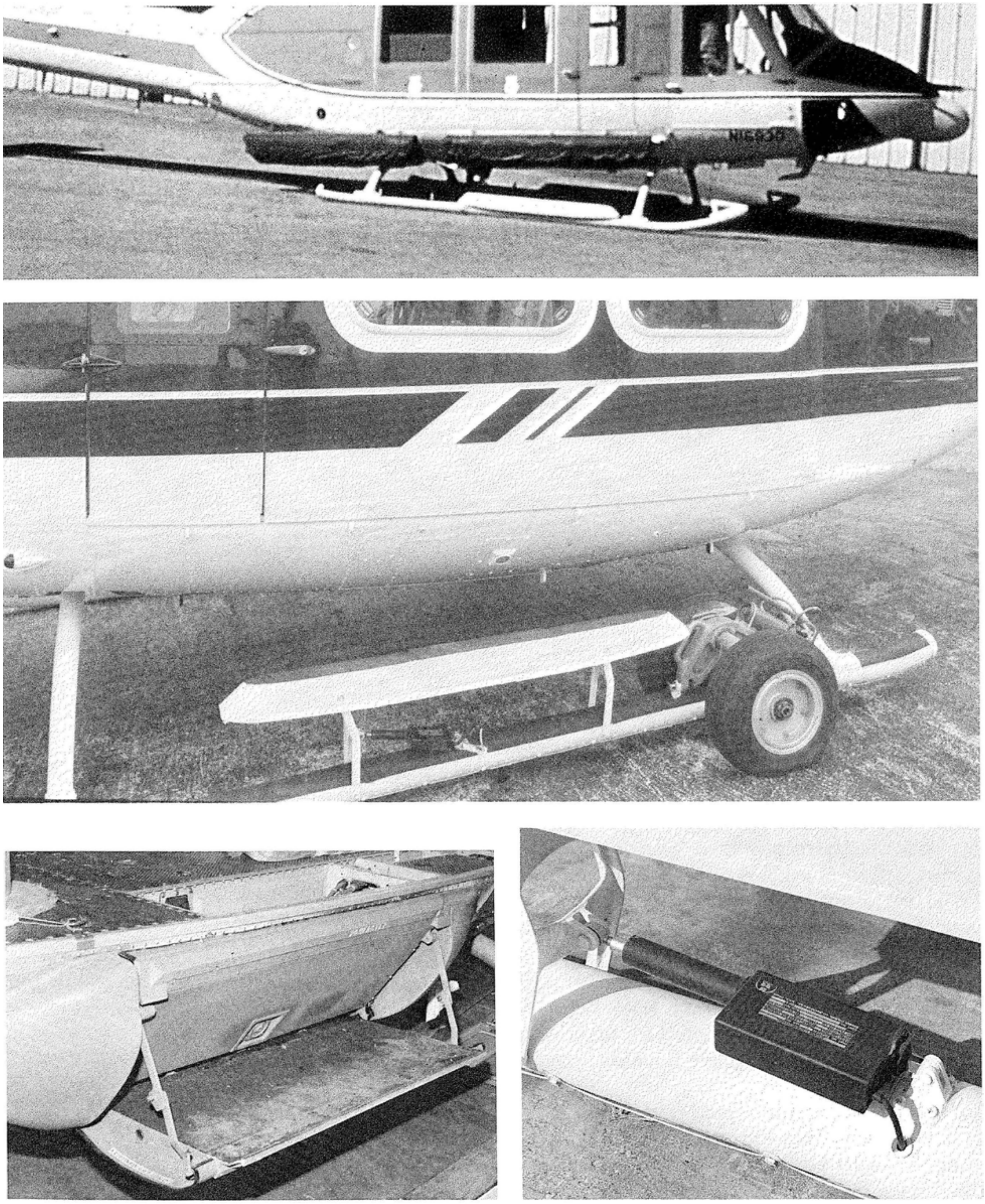


Figure 2-17b Passenger Step Kit Variants in Use with Floats

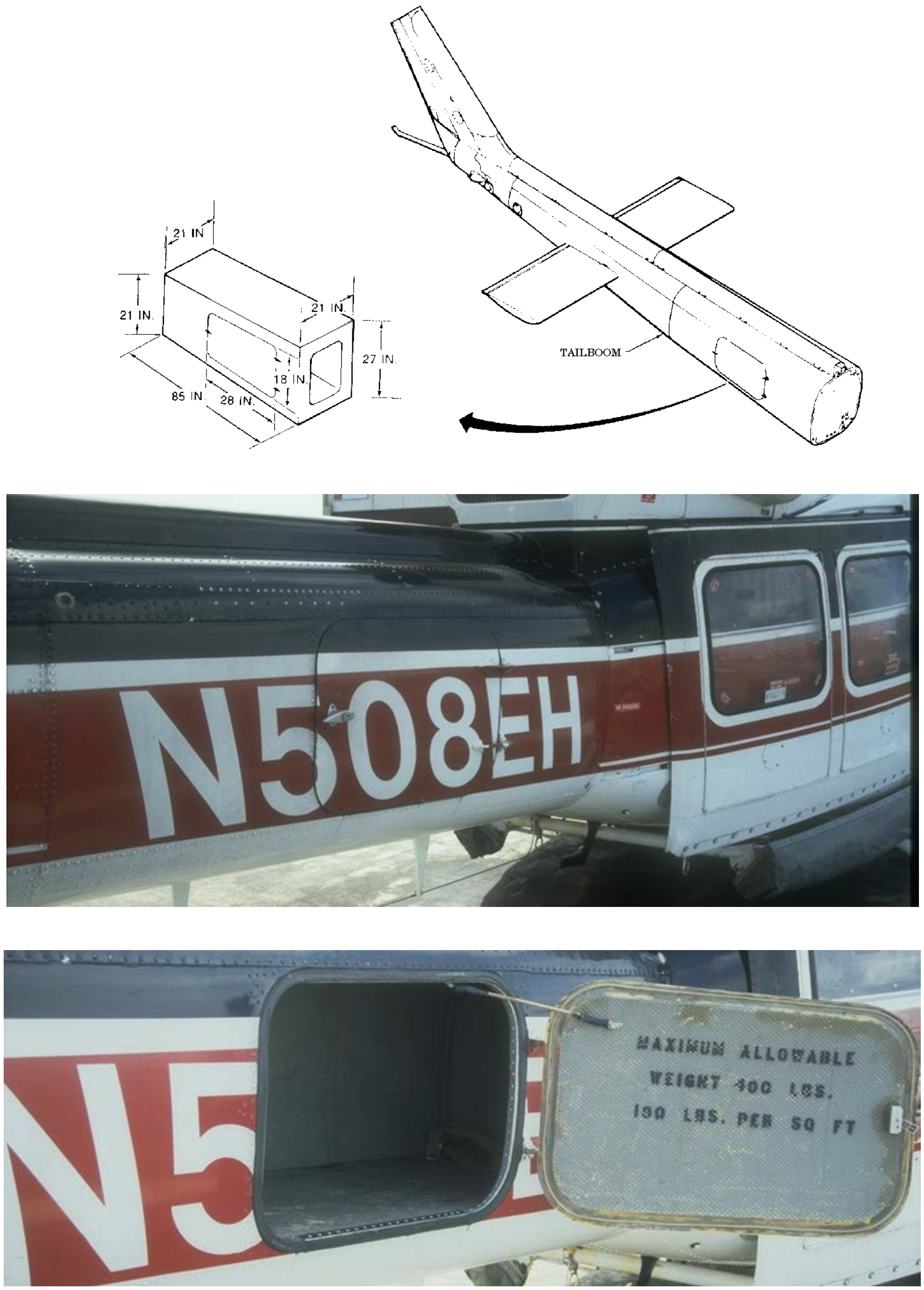


Figure 2-18 Baggage Compartment

NOTE: Be sure to consult the applicable weight and balance instructions when planning any flight that will involve baggage compartment loads.

ELEVATORS

A synchronized elevator (stabilizer) is located near the aft end of the tail boom, to increase the controllability of the helicopter and effectively lengthen the CG range. The elevator (Figure 2-19) consists of two aerodynamic surfaces attached to a horn assembly extending through the tailboom. The elevator incidence/pitch is a function of the cyclic control position and is connected by push pull control linkage from the swashplate to the elevator horn.

Refer to Chapter 11 "Flight Controls for additional information on the aerodynamic elevator.

Figure 2-19 Synchronized Elevators

AIRCRAFT SYSTEMS

ELECTRICAL POWER SYSTEMS

The 212 is equipped with both DC and AC electrical power system. The primary electrical power system is a 28V DC single-conductor system with the airframe structure being ground or negative. Two generators supply 28-volt DC power. The starter-generator can be either a generator or starter, depending on which field winding is used. A 24-volt, 38-ampere hour nickel-cadmium battery will supply DC power in the event that both generators fail. An external power unit can also supply 28V DC power on the ground.

The two 200 ampere starter generators each mounted on the engine accessory gearbox of provide 28 VDC to dual essential buses and dual non-essential buses connected in parallel with both generators. With both generators operating, all buses are powered equally from both generators except the battery bus, which can be powered by either generator, but is normally paralleled, with the No. 2 generator. Under normal flight conditions, both generators operating, the non-essential bus is powered automatically; loss of either generator causes loss of the non-essential bus, unless the bus control switch is placed in the manual position.

Three (or in a rare case, two) 250 volt-ampere, solid state inverters supply 115 volt and 26 volt AC, single phase, 400 hertz power to three 115V AC busses and two 26V AC busses.

LIGHTING

Bell 212 lighting systems provide cockpit and cabin illumination as well as exterior navigation, landing, and search lighting. (Not applicable to all variant - The lighting systems can provide full night and IMC flight capability. Standard passenger warning lights and step lights for loading and unloading are installed). All lighting systems are DC powered, protected with circuit breakers, and operable cockpit located switches; not applicable to all variants.

The majority of lighting controls are located on the overhead console along with the lighting system circuit breakers. Controls for the landing light and searchlight are located on the pilot's collective head.

CAUTION/WARNING SYSTEM

The Bell 212 caution/warning system provides the pilot with immediate notification of all major system malfunctions. The majority of the caution/warning lights are located on the caution panel. Additional caution/warning lights are located on the instrument panels and readily visible to both pilots. Two MASTER CAUTION lights alert the pilots if a malfunction occurs.

The caution/warning system includes the caution panel, the caution/warning lights, two Master Caution lights, caution panel system switches, and associated electrical supply systems. Warning lights, which identify system malfunctions requiring the pilot's immediate attention, have black letters on a red background. Caution lights associated with systems that require other than immediate attention has amber letters on a black background.

FUEL SYSTEM

There are five fuel cells in the standard Model 212 fuel system. Two are located under the cabin floor, and three are located behind the aft cabin bulkhead above the cabin floor level and below the engine work deck. The fuel system includes the five interconnected fuel storage cells, boost pumps, ejector pumps, associated plumbing, control and check valves, cockpit gauges, switches, caution panel lights, and necessary electrical power to provide two totally separate and independent fuel supply systems required for proper twin engine operation. Crossfeed and interconnect capabilities afford added safety in the event that one fuel system malfunctions.

POWERPLANT

The powerplant is a PT6T-3, PT6T-3B or PT6T-3DF twin-pac installation, consisting of two identical power sections and a common reduction gearbox. The twin-pac series is rated at a total of 1800 shp. The power section drives the output shaft through separate reduction gear trains in the combining gearbox or "C-box." Each engine is totally separate and independent in operation except for the attachment to the C-box, thus providing true twin engine reliability.

The engines are mounted side by side on the engine deck with the left engine designated as No. 1 and the right engine as No. 2. Each engine has an accessory gearbox (N1 accessory section), a gas producer or N1 section, a power turbine or N2 section, and an exhaust section.

Each engine is attached to and powers the C-box at the rear of its N2 section. The C-box has three internal sections: an input gear reduction section for each engine, and a combining section driving a single output, the main drive shaft to the transmission. The C-box contains two clutch assemblies, or freewheeling units, which provide positive drive from each engine yet allow for freewheeling if one or both engines become inoperative. N2 accessories for each engine are mounted on the rear of the associated engine gear reduction section of the C-box.

Each engine is equipped with its own air management, fuel, starting, ignition, lubrication, and fire protection systems. The combining section of the C-box has its own lubrication system.

Operationally, the engines can be started using either airframe battery power or external power. Battery starts may be made at temperatures as low as 25° C (-13° F). After one engine is started on battery power, the associated generator may be used to assist the battery in starting the second engine.

AIR MANAGEMENT SYSTEM

Each engine on the Bell 212 is equipped with an independent particle separator system (PSS). The PSS is designed to protect the engine from damage that would be caused by ingestion of foreign matter. The PSS prolongs the life of critical engine components and allows helicopter operation from unimproved areas. The PSS functions any time the engine is operating above 53±2% N1 rpm. Operation of the system terminates automatically when engine N1 rpm decreases below 53±2% or when the FIRE PULL handle for that engine is actuated. Automatic termination of PSS operation (closing of the particle separator doors) associated with low engine N1 rpm may be overridden by using the cockpit PART SEP switches.

ICE AND RAIN PROTECTION

The Bell 212 is certificated for operation in non-icing conditions but is equipped with several systems designed to protect against the hazards induced by ice, rain, and other forms of visible moisture. The helicopter is electrically protected from ice formation in the pitot tubes and static ports. Windshield wipers clear accumulations of snow, light ice, and rain from the windshields. Windshield defogging and defrosting use heated air tapped from the heating and ventilation systems. Heated windshields are available as optional equipment. Engine anti-icing is a function of the engine air particle separator system (PSS).

FIRE PROTECTION

Fire protection systems on the Bell 212 consist of detection and extinguishing systems. Detection systems, using warning lights, alert the pilot that a fire or potential fire exists and that immediate action is required. Extinguishing systems include electrically controlled and hand held extinguishers.

The engines are protected by fire detection and extinguishing systems. The tailboom baggage compartment incorporates a smoke detection system. In addition, design features such as firewalls, rupture resistant fuel cells in individual structural compartments, flexible fuel lines, and fire retardant materials reduce the possibility of fire. Crew compartment and passenger cabin fire protection is provided by hand held portable fire extinguishers.

POWERTRAIN

The powertrain distributes engine power to drive the helicopter main and tail rotor systems and other required sub-systems. The powertrain includes the main drive shaft, main transmission, main rotor mast, and tail rotor drive system. Engine power is transmitted from the combining gearbox to the main transmission by the main drive shaft. Splined couplings at each end of the main drive shaft provide positive, self-aligning connection.

The main transmission reduces the power-plant/ main drive shaft rpm through ring and planetary gear systems to drive the main rotor mast and main rotor. The transmission, through additional gearing, drives the tail rotor drive system, No. 1 and No. 2 hydraulic pumps, NR tachometer generator, and main transmission oil pump. The transmission also provides connection for an optional rotor brake system.

The tail rotor drive system uses five drive shaft sections, mounted between hanger bearings, to drive the intermediate gearbox. The intermediate gearbox, with a self-contained lubrication (42°) system, changes the direction of drive 42° and drives a sixth section of drive shafting to power the tail rotor gearbox. The tail rotor (90°) gearbox, with a self-contained lubrication system, reduces tail rotor drive rpm, changes the direction of drive to 90°, and drives the tail rotor mast and tail rotor. The tail rotor gearbox also mounts and houses the tail rotor pitch change mechanism.

MAIN ROTOR

The Bell 212 main rotor is a two bladed, semi rigid, seesaw high kinetic energy type, with preconing and under-slinging capabilities to increase stability and provide smooth control response in all modes of flight. The rigidity of the blade hub unit eliminates ground resonance and the high energy associated with the system allows accomplishment of auto rotational landings in case of dual engine/main drive shaft failure.

TAIL ROTOR

The anti-torque tail rotor system uses a two bladed, semirigid, tractor type counteracts the torque of the main rotor. The tail rotor provides heading control in hovering flight and flight control coordination in forward flight. The rate of rotation is approximately 1,600 rpm.

The tail rotor system consists of three basic sub- assemblies: the tail rotor hub assembly, the tail rotor blades, and the tail rotor pitch change mechanism. Newer tail rotor pitch change mechanisms utilize fixed length pitch links.

Tail rotor blades are attached to a yoke that is part of the tail rotor hub. The pitch change mechanism connects between the tail rotor flight controls and the tail rotor blades to provide a collective change in thrust.

HYDRAULIC POWER SYSTEMS

Two separate and independent flight control hydraulic systems are used to relieve control forces and absorb feedback forces. The main rotor cyclic and collective systems have dual servo actuators that are powered from SYS #1 and SYS #2. The tail rotor control system has a single actuator that is powered from SYS #1 only. The rotor break, if installed would be considered a third hydraulic system.

[The hydraulic system, in the Bell <u>IFR</u> 212 only, also powers the SCAS actuators. SYS #1 powers the YAW SCAS actuators while SYS #2 powers the LATERAL and LONGITUDINAL SCAS actuators.]

Each hydraulic system is completely separate and independent from the other system, and each includes a reservoir, a pump, hydraulic actuators, plumbing, control capability, and associated caution/warning lights.

FLIGHT CONTROLS

The aircraft flight controls are mechanical linkage systems, actuated by conventional helicopter controls, and are used to control flight attitude and direction. A “sync” elevator (horizontal stabilizer), is linked into the fore-aft cyclic control system. An electronically operated force trim, connected to cyclic and tail rotor controls, induce artificial control feel and stabilize the control stick and pedals to prevent them from moving of their own accord.

Optional full-time, three axis automatic flight control systems (Bell AFCS or Sperry IFCS) provide increased stability and reduced pilot workload in the pitch, roll, and yaw axes [IFR variants].

Cockpit flight controls are connected to push- pull rods, bellcranks, AFCS acutators, and hydraulic servoactuators which transmit pilot control movements directly to the rotor systems. Force trim systems on the cyclic and antitorque cockpit controls provide control positioning and artificial feel. Friction systems on the cyclic and collective controls allow pilot adjustment for desired stiffness. A collective downlock is also provided.

AVIONICS

Campbell 212 avionics configurations provide air to air and air to ground communication on VHF AM and VHF FM (Hi and Lo bands) to facilitate communications with ATC and Provincial forestry agencies. Inflight navigational capability relies on Garmin portable GPS. Satellite tracking and alternative comms systems are also integral to the fleet.

Typical Bell 212 IFR avionics systems configurations systems include the interphone, the compass control panel, VHF communication radios, VHF navigation radios, a navigation audio control panel, DME equipment, an ATC transponder, a marker beacon receiver, ADF receivers and radio altimeter.

Some additional avionics options may include: UHF, HF, and FM communication radios, radar, LORAN C, and GPS. Most communication and navigation radios are mounted in the upper deck in the nose compartment.

ENVIRONMENTAL SYSTEMS

Environmental systems in the Bell 212 include heating and ventilation for the crew and passengers and the nose, floor, and aft compartment areas. The systems are divided into cabin heating and ventilating, cockpit ventilation, fresh air ventilation, and the optional winterization heater.

KITS AND ACCESSORIES

There are many options offered for the 212 aircraft. These options come in the form of kits that may be installed by manufacturer, or by another service center.

When a kit is installed, the installation is accomplished in compliance with a service instruction. Operational procedures for kits, as well as additional limitations are contained in supplements to the *RFM.* Each kit is identified with a BHT *Flight Manual Supplement (FMS)* number.

SERVICING

Servicing and inspection points are located for easy accessibility through access doors and fairings. Figure 2-20 illustrates the access points and lists the specifications of lubricants and fluids.

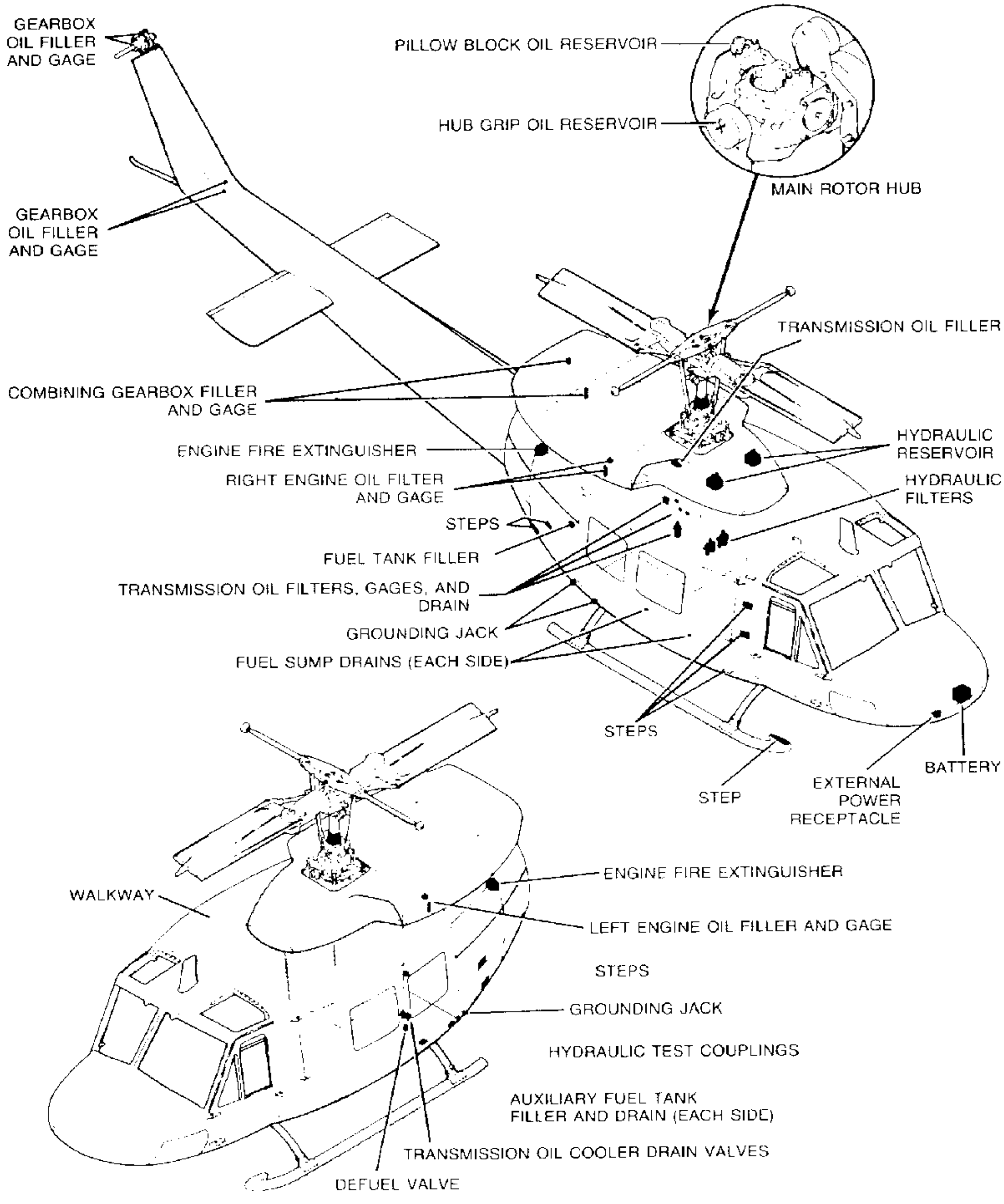


Figure 2-20 Inspection and Servicing (Sheet 1 of 2)

SYSTEM	MATERIAL
FUEL	TURBINE FUEL JP-4 AND JP-5
ENGINE OIL, LEFT AND RIGHT POWER SECTIONS, AND COMBINING GEARBOX	LUBRICATING OIL: MIL-L-7808 MIL-L-23699 ASTO 555
TRANSMISSION OIL	LUBRICATING OIL: MIL-L-7808 MIL-L-23699 ASTO 555
INTERMEDIATE GEARBOX	LUBRICATING OIL: MIL-L-7808 MIL-L-23699 ASTO 555
TAIL ROTOR GEARBOX	LUBRICATING OIL: MIL-L-7808 MIL-L-23699 ASTO 555
HYDRAULIC SYSTEMS	HYDRAULIC FLUID: MIL-H-5606
ROTOR BRAKE	HYDRAULIC FLUID: MIL-H-5606
MAIN ROTOR BLADE GRIPS	LUBRICATING OIL: MIL-L-7808 MIL-L-23699
TRUNNION PILLOW BLOCKS	LUBRICATING OIL: MIL-L-7808 MIL-L-23699
STABILIZER BAR DAMPERS	HYDRAULIC FLUID: MIL-H-5606
BATTERY	
FIRE EXTINGUISHERS (ENGINE AND PORTABLE)	

Figure 2-20 Inspection and Servicing (Sheet 2 of 2)

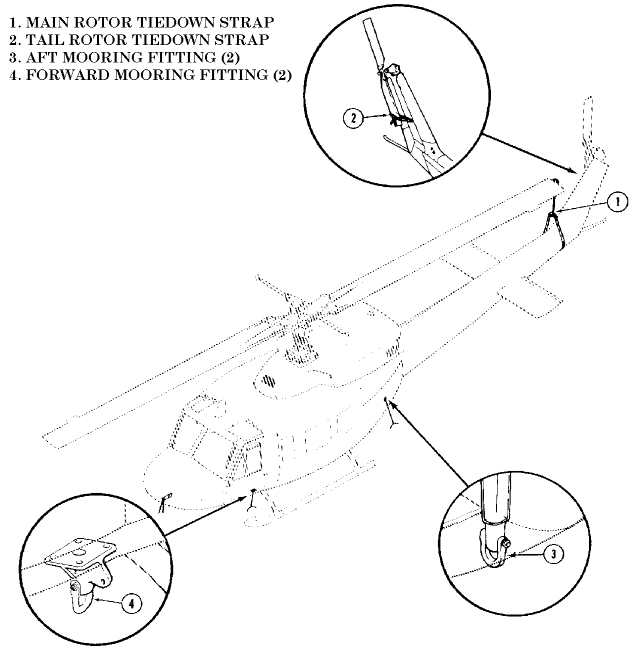
PARKING AND MOORING

Whenever possible, the helicopter should be parked on a level surface and the ground handling wheels removed or retracted to allow the aircraft to rest on the skids. Main rotor blades should be aligned to the helicopter centerline, and the tail rotor blades should be aligned with the vertical fin.

The main rotor tiedown is installed between the blade tip and a fitting on the left side of the tailboom. The tail rotor tiedown is attached to one blade and to the loop on the right side of the fin (Figure 2-21). Flight control friction locks should be tightened and the collective down lock may be installed. All switches should be off, all doors, windows, and access panels closed, and external power disconnected.

Figure 2-21 Parking and Mooring

When winds up to 45 knots are expected, the helicopter should be headed into the wind. Installation of inlet, Pitot tube, exhaust covers and a forward Main Rotor Blade Tiedown should also be included in the securing procedures. If winds over 45 knots are expected, the helicopter should be moored. Winds of 75 knots or more call for evacuation of the helicopter to a safe area.



TOWING

The Bell 212 may be towed by attaching a standard tow bar to the two rings provided at the forward end of each landing gear skid (Figure 2-22). Ground handling wheels, required for the towing operation, are attached to fittings on the skids and are extended and retracted by means of hand operated hydraulic pumps located on the supporting cradle of each wheel assembly. Towing should be limited to walking speeds and short distances.

CAUTION

Do not tow the helicopter on unprepared surfaces or across hangar door tracks at gross weights in excess of 9500 lbs.as this could cause a permanent set in the aft cross tubes.

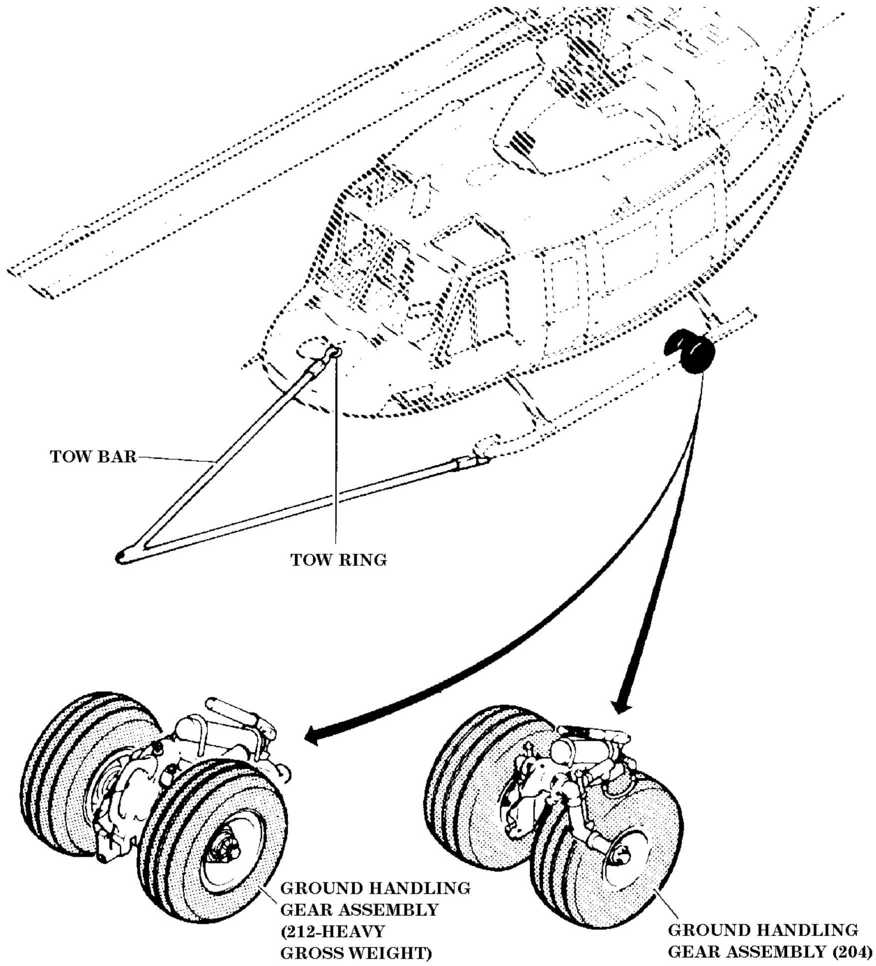


Figure 2-22 Towing

HYDRAULIC GROUND HANDLING WHEELS

MODEL BDW-245-1800/500

Figure 2-22 Towing-2

MODEL: BDW-245-1800

FOR BELL MODELS: 204, 205, 206L, 212, 222UT, 412, UH1, AH1, AH1W

The BDW-245-1800 has been designed to be rugged, durable, and easy to maintain. These wheels are hi-gross to 20,000 lbs. The wheels are jacked straight down. This is done with a simple reliable 8 don hydraulic bottle jack. The fluid iused is aircraft 5606. The jack handle is also used as a tote handle to move the wheels to and from the aircraft to save physically lifting the wheels. The top of the frame is flat and can be used as a step. The jack valve control is large for easy use with gloves.

SPECIFICATIONS:

Skid tube dia. 4.00”

Attach points, 2 ea. Eye bolts fits both 16.25” & 18.00: centers

Operation – Hydraulic 8 tonne jack

Tire size – 18x5.5 105 psi.

5.00x5-10 ply inner

Approximate skid lift 3”

Weight each 95 lbs.

Color orange power coat

MODEL BDW-245-1800/500

This set of wheels is identical to P.N. BDW-245-1800 with the excepting of inner wheel which is 500x5-10 ply.

AREAS, DIMENSIONS, WEIGHTS AND CAPACITIES

AIRFRAME

Overall length (rotor turning) --57 ft. 3 in.

Fuselage length

(tail rotor horizontal) ----------- 45 ft. 11 in.

Width ---------------------------------9 ft. 4 in.

Height (tail rotor horizontal)----12 ft. 7 in.

Landing gear tread (no load)----8 ft. 8 in.

MAIN ROTOR

Number of blades ---------------------------2

Diameter --------------------------------- 48 ft.

Chord (equivalent) ---------------1 ft. 11 in.

Disc area------------------------ 1,809 sq. ft.

Airfoil section:

At tip-------------------------- NACA 0006
At root----------------------- NACA 0012

(National Advisory Committee of Aeronautics)

Engine to rotor gear ratio---------- 20.37:1

Tip speed ------------------------ 814 ft./sec.

RPM 100% (6,600 engine rpm) 324 rpm

TAIL ROTOR

Number of blades ---------------------------2

Diameter -----------------------------8 ft. 7 in.

Chord ---------------------------------- 11.5 in.

Disc area--------------------------56.7 sq. ft.

Tip speed ------------------------ 745 ft./sec.

RPM 100% NR------------------1,661 RPM

ENGINE (PT-6T-3 or 3B)

Manufacturer------------Pratt and Whitney of Canada, Ltd.

Model number ---------------PT6T-3 or 3B

Single engine 2.5 min power - 1,025 shp

Single engine 30 min power ----- 800 shp

Output (100%) ------------------ 6,600 rpm

TRANSMISSION RATING

Maximum continuous power-- 1,135 shp

Take-off 5 minute power------- 1,290 shp

WEIGHTS

Standard configuration

(approximate empty weight) ---- 6,180 lb.

Maximum gross weight 11,200 lb.

FUEL

Capacity 219.6 U.S. gal.

ENGINE OIL

Capacity:

Each engine 1.6 U.S. gal.

Combining gearbox---- 1.25 U.S. gal.

Total ---------------------- 4.45 U.S. gal.

TRANSMISSION OIL

Capacity---------------------- 2.75 U.S. gal.

CARGO AREA

Length (overall)-------------------- 7 ft. 8 in.

Width (floor level) -------------------------8 ft.

Height (maximum)---------------- 4 ft. 4 in.

USABLE CUBAGE

Main cargo space ----------------220 cu. ft.

Left side co-pilot/
passenger seat space-------------20 cu. ft.

Baggage compartment space---28 cu. ft.

CARGO DOOR OPENING

Height ---------------------------------4 ft. 1 in.

Width (with hinged panel open) 7 ft. 8 in.

Height above ground
(approximate)------------------------2 ft. 6 in.

LIMITATIONS

GENERAL

The limitations presented in this chapter focus primarily on the operational capabilities of the helicopter. Specific system limitations are provided in each system chapter with the exception of instrument markings, which are presented in this chapter. These limitations are not complete; refer to the approved RFM for a complete limitations listing for all operating conditions.

WEIGHT/CENTER OF GRAVITY

Weight

Take-off (maximum gross)-----11,200 lb.
(5,080 kg.)

Landing (maximum gross)-----11,200 lb.
(5,080 kg.)

Minimum combined crew
weight at FS 47----------170 lb. (77.1 kg.)

Center of Gravity

Longitudinal

IFR Model----------------------132.0 - 142.5

VFR Model---------------------130.0 - 144.0

Sperry IFCS Model----------130.0 - 143.0

Lateral (left and right of fuselage centerline, all weights):

IFR version ------------3.5 in. left and right

VFR version -------4.7 in. left, 6.5 in. right

Sperry version -------3.5 in. left and right

LOADING

Passenger Loading

NOTE

> Refer to the "Weight and Balance" section of the *Rotorcraft Manufacturer's Data* for loading tables to be used in weight/CG computations.

The outboard facing seats should not be occupied unless at least four of the forward or aft facing passenger seats are occupied.

Internal Cargo Loading

Maximum deck loading----- 100 lb./sq. ft.
(4.9 kg./100 sq. cm)

Deck mounted cargo tiedowns

(structural capacity) -- 1,250 lb. (567 kg.)

vertical; 500 lb. (227 kg.) horizontal

Refer to the applicable *RFM* for optional tiedown fitting information.

OPERATING

Type of Operation

The Bell 212 is a 15 place helicopter approved for day, night, VFR, and non-icing operation. It can be used for external or internal cargo. The 212 also comes in an IFR version.

Refer to the Category A supplement of the *RFM* for additional limitation procedures and performance data for Category A operations.

Required Equipment

AFCS Limitations

The AFCS shall be disengaged or operated in SCAS mode during ground operation, except as required for the AFCS check.

Required Equipment - IFR

For IFR flight, the following equipment shall be operational:

- Heated pitot-static system
- Pilot windshield wiper
- 3 inch stand-by attitude indicator, or Dual Turn and Slip indicators
- Two VHF communication radios
- Two navigation receivers with auxiliary equipment appropriate to intended IFR route of flight
- DME
- Marker beacon receiver
- Pilot VSI
- Force trim

Flight Crew

The minimum flight crew is one pilot. The right seat is designated as the first pilot station. The minimum flight crew for IFR (FAR 135) operation shall consist of two pilots, both of whom must hold instrument ratings in helicopters.

Doors Open and Removed

The helicopter may be flown with the doors open or removed only with the Bell Standard Interior installed. Flight operation is approved for the following alternative configurations during VFR conditions only:

- Both crew doors removed
- Both sliding doors locked open or removed with both hinged panels installed or removed

In all cases, door configuration shall be symmetrical for both sides of the fuselage.

NOTE: Opening or removing the doors shifts the helicopter center of gravity and reduces V_{NE}. Refer to the “Weight and Balance” section in the Rotorcraft Manufacturer’s Data and to Airspeed Limitations in the RFM.

Altitude

Maximum operating pressure altitude is 20,000 feet (6,096 meters).

Maximum density altitude for take-off, landing and in-ground effect maneuvers is 14,000 feet (4,267 meters). Refer to the Weight Altitude Temperature Limitations chart (RFM, Page 1-5).

NOTE: Refer to the applicable operating rules for high altitude oxygen requirements.

Ambient Air Temperature

Maximum (sea level)-------- 51°C (125°F)

(Decreases at 2♣C/1,000 feet)

Minimum
(All altitudes)------------------ -54°C (-65°F)

Height-Velocity

Refer to the applicable RFM.

Maneuvering

Acrobatic maneuvers are prohibited.

AIRSPEED

The V_{NE} decreases linearly from 130 knots (VFR version) or 120 knots (IFR version) to 100 knots with gross weight. The V_{NE} also decreases 3 knots per 1,000 feet above 3,000 feet density altitude.

Minimum IFR airspeed is 40 KIAS in the Bell IFR version and 50 KIAS in the Sperry version.

Airspeed shall not exceed 80 KIAS when operating above maximum continuous transmission torque (87.5%).

V_{NE} with doors open or removed is 100 KIAS.

RFM Performance Section shows the critical relative wind azimuths. Operations in crosswind and downwind conditions have been demonstrated up to 20 knots, though this is not considered a limiting factor.

INSTRUMENT MARKINGS

AIRSPEED INDICATOR MARKINGS

Yellow 0 to 25 KIAS
(Indicator unreliable)

Green 25 to 100 KIAS
(Continuous operation)

Yellow------------**VFR** **100 to 130 KIAS**
-----------------IFR 100 to 120 KIAS

Red (V_{ne})--------**VFR** **130 KIAS**
-----------------IFR 120 KIAS

Dual Torque Indicator (Twin-Engine Operation)

Green 0 to 87.5%
(Continuous operation)

Yellow 87.5 to 100%
(5 minute take-off range)

Red 100%
(Maximum)

Dual Torque Indicator (Single-Engine Operation)

Green 0 to 63.9%

(Continuous operation)
Yellow 63.9 to 71.8%

(30 minute range)
Red -------------------------------------- 71.8%
(Maximum Single Engine)

For helicopters with the 212-070-160-101 or 103 torquemeter: (series 3B enigines)

Green ----------------------------- 0 to 63.9%
(Continuous OEI operation)

Yellow------------------------- 63.9 to 79.4%
(30 minute OEI range)

Red -------------------------------------- 79.4%
(Maximum OEI)

NOTE: OEI means One Engine Inoperative. Operation in an "OEI" Range is not allowed for Training purposes.

Triple Tachometer

Rotor RPM (N_R)

Red --- 91%
(Minimum for autorotation)

Green ----------------------------- 97 to 100%
(Power on continuous operation)

Green -------------------------- 91 to 104.5%
(Power off continuous operation)

Red ------------------------------------- 104.5%
(Maximum)

Engine RPM (N2)

Red --- 97%
(Minimum)

Green ----------------------------- 97 to 100%
(Continuous operation)

Red --------------------------------------- 100%
(Maximum)

Gas Producer RPM (N_1)

	PT6T-3B	PT6T-3DF
------------------------ (Minimum for opening throttle during start)	12%	12%
----------------------- (Flight idle rpm)	61%	61%
Green ----------------- (Continuous operation)	to 100.8%	to 103.2%
Red ------------------ (Maximum for take-off)	100.8%	103.2%
Red ------------------ (2.5 minute OEI range)	102.4%	109.2
Red ------------------ (Maximum OEI)	102.4%	109.2%

Transmission Oil Temperature

Green--------------------------- 15 to 110°C
(Continuous operation)

Red-------------------------------------- 110°C
(Maximum)

Transmission Oil Pressure

Red--------------------------------------- 30 psi
(Minimum for flight idle)

Yellow---------------------------- 30 to 40 psi
(Flight idle range)

Green---------------------------- 40 to 70 psi
(Continuous operation)

Red--------------------------------------- 70 psi
(Maximum)

Fuel Pressure

Red---4 psi
(Minimum)

Green------------------------------ 4 to 35 psi
(Continuous operation)

Red--------------------------------------- 35 psi
(Maximum)

Engine Oil Temperature

	PT6T-3B	PT6T-3
Red ---------------------- (Minimum)	0°C	5°C
Green -------------------- (Continuous operation)	0 to 115°C	5 to 107°C
Red -------------------- (Maximum)	115°C	107°C

Engine Oil Pressure

Red 40 psi
(Minimum for flight idle)

Yellow 40 to 80 psi
(Operation below 79% N_1) rpm)

Green 80 to 115 psi
(Continuous operation)

Red 115 psi
(Maximum)

Combining Gearbox Oil Temperature

	PT6T-3B	PT6T-3DF
Red------------ (Minimum)	0°C	0°C
Green--------- (Continuous operations)	0 to 115°C	0 to 107°C
Red------------ (Maximum)	115°C	107°C

Combining Gearbox Oil Pressure

Red--------------------------------------- 40 psi
(Minimum for flight idle)

Yellow --------------------------- 40 to 60 psi
(Operation below 94% N_2 rpm)

Green---------------------------- 60 to 80 psi
(Continuous operation)

Red--------------------------------------- 80 psi
(Maximum)

Ammeter

Green----------------------------0 to 75 amps
(Continuous operation)

Yellow ---------------------- 75 to 150 amps
(Caution)

Red --------------------------------- 150 amps
(Maximum)

Interturbine Temperature (ITT)

PT6T-3,3B / PT6T-3DF

Green-------300 to 765°C / 200 to 765°C
(Continuous operation)

Yellow-------765 to 810°C / 765 to 810°C
(5 minute take-off range)

Red ------------ 810°C / 810°C
(Maximum for take-off)

Yellow **(3B)** -- 822°C N/A
(Maximum 30 minute OEI)

Red **(3B)** ----- 850°C N/A
(Maximum 2.5 minute OEI)

------------- 1,090°C 1,090°C
(Maximum for starting, two seconds maximum above 960°C, or 810°C for the PT6T-3)

Hydraulic Oil Temperature

Red --88°C
(Maximum)

Hydraulic Oil Pressure

Red --600 psi
(Minimum)

Yellow----------------------------- 600 to 900 psi
(Caution)

Green ---------------------------900 to 1,200 psi
(Continuous operation)

Red -------------------------------------- 1,200 psi
(Maximum)