Section 1

SYSTEMS DESCRIPTION

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)

TABLE OF CONTENTS (CONT)

FIGURES

Section 1

SYSTEMS DESCRIPTION

1-1. INTRODUCTION

Model 212 helicopter, primary and auxiliary systems, and emergency equipment are described in this section. Optional equipment systems which do not require flight manual supplements (FMS) will be described herein as data becomes available.

1-2. HELICOPTER DESCRIPTION

Model 212 is a single pilot, fifteen place twin engine helicopter with a two-blade semi-rigid main rotor and a two bladed tail rotor that provides directional control.

Airframe is a semimonocoque structure with metal and fiberglass covering. Two longitudinal main beams and pylon support structure provide primary support.

Skid type landing is affixed below fuselage. Optional airframe mounted emergency pop out flotation gear is available.

1-3. PRINCIPAL DIMENSIONS

Principal exterior dimensions are shown in figure 1-1. All height dimensions must be considered approximate due to variations in loading and landing gear deflection.

Principal interior dimensions, to include baggage compartment, are shown in figure 1-2.

1-4. LOCATION REFERENCES

Locations on and within helicopter can be determined in relation to fuselage stations, waterlines, and buttock lines measured in inches from known reference points.

1-4-A. FUSELAGE STATIONS

Fuselage stations (FS or sta) are vertical planes perpendicular to, and measured along, longitudinal axis of helicopter. Station zero is reference datum plane and is 20.0 inches (508 millimeters) aft of most forward point on cabin nose.

1-4-B. WATERLINES

Waterlines (WL) are horizontal planes perpendicular to, and measured along, vertical axis of helicopter. Waterline zero is a reference plane located 7.44 inches (189 millimeters) below lowest point on fuselage.

1-4-C. BUTTOCK LINES

Buttock lines (BL) are vertical planes perpendicular to, and measured to left and right along, lateral axis of helicopter. Buttock line zero is a plane at longitudinal centerline of helicopter.

1-5. GENERAL ARRANGEMENT

Fuselage forward section contains nose

compartment for electrical and avionics equipment, crew compartment, and

passenger/cargo compartment. Center section incorporates transmission compartment and pylon support structure. Aft section houses engines, combining gearbox and oil coolers, and has compartments for avionics, bleed air heater, and optional equipment components.

Tailboom is attached to aft end of fuselage and supports tail rotor and drive train, vertical fin, horizontal stabilizer/elevator, and tail skid. A baggage compartment is located in forward end of tailboom.

1-5-A. CREW COMPARTMENT

Crew compartment or cockpit occupies forward part of cabin. Pilot station is on right side and copilot/forward passenger station is on left.

A door on either side permits direct access to crew compartment. Glass windshields and clear acrylic windows in crew doors, roof, and lower nose area allow good visibility from crew compartment.

1-5-A-1. CREW SEATS

Pilot and copilot seats are equipped with shoulder harnesses with inertia reels. Adjustment handles, located beneath right side of each seat, can be pulled to adjust seats 4.0 inches (10.2 centimeters) vertically and 4.5 inches (11.4 centimeters) longitudinally.

1-5-A-2. CREW SEAT RESTRAINT SYSTEM

Each crew seat is equipped with lap seatbelt and a dual shoulder harness with inertia reel which locks in event of rapid deceleration.

1-5-B. PASSENGER/CARGO COMPARTMENT

Aft area of cabin contains a space of 220 cubic feet (6.2 cubic meters) for carrying passengers or internal cargo.

Thirteen passengers can be accommodated when optional passenger seat kit is installed.

A sliding door and hinged panel on each side of cabin provides full, direct access to passenger/cargo compartment. Acrylic windows in doors allow outside viewing from any seat.

1-5-B-1. PASSENGER SEATS

Passenger seats are arranged in a row of four seats facing aft, another row of five seats facing forward, and a pair of seats facing outboard from each side of pylon support structure. All seats are equipped with lap seatbelts.

1-5-B-2. TIEDOWNS AND EQUIPMENT FITTINGS

Tiedown rings and studs are recessed into cabin deck for securing internal cargo, passenger seats, and other optional equipment kits such as internal hoist, litters, etc. Additional studs are incorporated into cabin roof for attachment of optional equipment kits.

Deck mounted tiedown fittings have airframe structural capacity of 1250 pounds (567 kilograms) vertical and 500 pounds (227 kilograms) horizontal per fitting.

Provisions for installation of cargo tiedown fittings are incorporated in aft cabin bulkhead and transmission support structure. Each tiedown point has an airframe structural capacity of 1250 pounds (567 kilograms) at 90 degrees to

bulkhead and 500 pounds (227 kilograms) in any direction parallel to bulkhead.

1-4

1-5-C. BAGGAGE COMPARTMENT

The baggage compartment is located in the forward end of the tailboom and has a capacity of 28 cubic feet (0.8 m^3). The compartment can carry up to 400 pounds (181 kg) of baggage or other cargo, which can be secured using tie-down fittings provided.

The floor of the baggage compartment has four separate rows of footman loops at Boom Stations (BS) 18, 45, 73, and 101. Each of these rows contains three footman loops that have the following safe load limits: a vertical limit of 110 pounds (49.8 kg) or a horizontal limit of 80 pounds (36.2 kg) or a 45° limit of 70 pounds (31.7 kg).

The floor of the baggage compartment also has two additional rows of footman loops running fore and aft directly inside the baggage compartment door between BS 45 and 73. Each of these rows contains four footman loops that have the following safe load limits: a vertical limit of 45 pounds (20.4 kg) or a horizontal limit of 45 pounds (20.4 kg).

The access door is on the right side of the tailboom and is provided with a key lock for security of baggage compartment contents.

Two interior lights illuminate when the door is open. The DOOR LOCK caution light illuminates on the caution panel when the door is open or is not properly latched.

A smoke detector is installed in the compartment and is connected to the BAGGAGE FIRE warning light on the instrument panel.

1-6. INSTRUMENT PANEL

The instrument panel extends across the front of the cockpit and is tilted slightly to provide better viewing of the instruments by the flight crew. Pilot flight and navigational instruments are on the right; propulsion, fuel, hydraulic, and electrical systems instruments are in the center; optional copilot flight and navigational instruments are on the left. All instruments have integral white lighting. Warning and caution lights are sunlight readable.

1-7. OVERHEAD CONSOLE

The overhead console is centered on the cabin ceiling and incorporates electrical system switches and circuit breakers.

Three types of switches are used in the overhead console:

Rheostat.

Four-position rotary.

Positive latch.

The console has integral white lighting controlled by the CONSOLE LT switch.

1-8. PEDESTAL

The pedestal is located between the crew seats and supports the avionics control panels and engine and flight control system switches. A case for stowage of the helicopter logbook, maps, and other data is built into the pedestal.

1-9. ROTOR SYSTEMS

1-9-A. MAIN ROTOR

The main rotor is 48 feet in diameter and is a two-bladed, semi-rigid flapping type, employing preconing and underslinging. The rotor head assembly consists of two all metal bonded blades, yoke and spindle assembly, pillow blocks, trunnion assembly, tension-torsion straps, pitch change horns, blade grips, and drag braces. Each blade is connected to a common yoke by a blade grip and pitch change bearings with tension straps to carry centrifugal forces.

The main rotor assembly is attached to the mast with a bearing mounted trunnion, allowing the rotor to flap. The trunnion is secured to the mast by splines and a nut cap fitting that incorporates provisions for cable

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attachment used in hoisting the helicopter. Blade pitch change is accomplished by movement of the collective and a series of controls terminating at the blade grip horn. Upward movement of the collective increases the angle of attack of the rotor blades and causes the helicopter to ascend. Downward movement of the collective decreases the angle of attack of the rotor blades, allowing the helicopter to descend. Tilting of the rotor is accomplished by movement of the cyclic, resulting in a corresponding change in the plane of rotation of the rotor.

1-9-B. TAIL ROTOR

The tail rotor is a two-bladed system mounted on the right side of the vertical fin. It is a rigid delta-hinged type, employing preconing and underslinging. Each blade is connected to a common yoke by means of a grip and pitch change bearing. The blade and yoke assembly is mounted on the tail rotor gearbox shaft by means of a delta-hinge trunnion to minimize rotor flapping. Blade pitch is changed by movement of the antitorque pedals to control or maintain heading. Blade pitch change provides torque control and change of directional heading.

1-9-C. ROTOR SYSTEM INDICATORS

Rotor system indicators consist of the triple tachometer, triple torquemeter, rotor RPM caution light, and rotor RPM audio warning signal.

1-9-C-1. TRIPLE TACHOMETER

The triple tachometer indicates, in percent, the main ROTOR RPM (N_R) on the inner scale and ENG RPM (N_2) (power turbine N_l) of each engine on the outer scale.

1-9-C-2. TRIPLE TORQUEMETER

The triple torquemeter indicates, in percent, the torque applied to the transmission on the outer scale and the torque from the engine(s) on the inner scale.

1-9-C-3. RPM CAUTION LIGHT

The main rotor RPM caution light is mounted in the instrument panel above the triple tachometer. The light will illuminate to alert the pilot that the main rotor RPM (N_R) is above or below limits.

1-9-C-4. RPM AUDIO WARNING

An audio warning signal will sound in the pilot and copilot headsets, simultaneous with the illumination of the RPM caution light, when the main rotor RPM (N_R) decreases below the minimum limit.

1-10. TRANSMISSION

The transmission is located directly forward of the power plant and is supported by isolation mounts attached to the fuselage pylon structure. The transmission is connected to and driven by the power plant through a main driveshaft. The transmission provides a drive angle change and speed reduction. Transmission driven accessories include a rotor tachometer generator, two hydraulic pumps, an oil pump, and the rotor brake.

The transmission has two debris collectors, one under the mast bearing and one under the planetary gears, to prevent secondary transmission damage. The transmission also has a triple zone chip detection system, one in each debris collector and one in the sump case.

A gauge in the instrument panel allows the flight crew to monitor transmission oil temperature and pressure. Caution lights are provided to warn of high transmission oil temperature, low transmission oil pressure, and metal particles in transmission oil. Three remote transmission chip indicators are located on the right side of the pedestal.

1-10-A. TRANSMISSION OIL SYSTEM

An integral lubrication system circulates oil under pressure throughout the transmission.

A gear driven pump forces oil out of the sump, through a filter, and through external lines to the cooler. When oil is cooled and returns to the transmission, oil passes through another filter before entering a pressure manifold for circulation throughout the transmission. During startups, the cooler is bypassed until oil is warm. A pressure relief valve is included in the system. The oil level sight gauges are located on the sump case.

1-10-B. TRANSMISSION INDICATORS

Transmission indicators include an oil temperature and pressure gauge, oil temperature and pressure warning lights, and a chip detector caution light.

1-10-B-1. TRANSMISSION OIL TEMPERATURE AND PRESSURE GAUGE

Transmission oil temperature and pressure gauge is a dual instrument that simultaneously displays oil temperature in degrees Celsius on the left scale and oil pressure in PSI on the right scale.

1-10-B-2. TRANSMISSION OIL WARNING LIGHTS

The XMSN OIL TEMP warning light will illuminate when transmission oil temperature exceeds 110°C and the XMSN OIL PRESS warning light will illuminate when transmission oil pressure falls below 30 PSI.

1-10-B-3. TRANSMISSION OIL CHIP DETECTOR CAUTION LIGHT

The XMSN CHIP caution light will illuminate if any of the three transmission chip detectors sense metal particles in the transmission oil.

1-11. POWER PLANT

The power plant, Pratt and Whitney PT6T-3 or PT6T-3B twin pac, consists of two identical free turbine power sections connected to a combining/reduction gearbox. Each power section has a lubrication system, starter-generator, and fuel control. The combining gearbox has a separate lubrication system.

1-11-A. ENGINE CONTROLS

Engine controls include the gas producer control system, droop compensator control system, governor switches, particle separator switches, and various subsystem control switches.

1-11-A-1. GAS PRODUCER CONTROL SYSTEM

The gas producer control system provides independent control of the gas producer RPM (N_1) of both engines. Twist grip throttles, located on pilot and copilot collective, are connected to the gas producer fuel control (which automatically regulates fuel flow) of each engine.

1-11-A-2. DROOP COMPENSATOR CONTROL SYSTEM

The droop compensator control system schedules the power turbine governors to maintain RPM within a specified range. A mechanical connection, into a collective system bellcrank, provides automatic scheduling (droop compensation) when changes in collective occur.

1-11-A-3. GOVERNOR SWITCHES

Governor switches, located on pedestal, are two position switches labeled ENGINE NO 1 GOV AUTO and MANUAL and ENGINE NO 2 GOV AUTO and MANUAL. When in AUTO, automatic fuel control unit (gas producer RPM) is automatically controlled and when in MANUAL, pilot controls gas producer RPM with throttles.

1-11-A-4. PARTICLE SEPARATOR SWITCHES

Particle separator switches, located on pedestal, are two position switches labeled ENGINE NO 1 PART SEP NORM and OVRD ON

and ENGINE NO 2 PART SEP NORM and OVRD ON that control an engine air bypass door. When in NORM, bypass door is open and particles (dust, sand, ice, snow, rain) are carried straight through system and out exhaust ejector allowing only clean air to enter engine. Bypass door opens when switch is moved to OVRD ON and automatically closes when ENG LOW RPM light illuminates (gas producer RPM (N_I) is below 53 ±2%) or when FIRE PULL handle is pulled, allowing all air to pass through engine.

1-11-A-5. IDLE STOP REL SWITCH

IDLE STOP REL switch, located on pilot collective, is a three-position, momentary switch used to activate idle stop solenoid for each engine. When pressed to ENG 1 or ENG 2, idle solenoid is retracted and respective throttle can be rolled above or below idle stop.

1-11-A-6. RPM INCR DECR SWITCH (N_2)

RPM INCR DECR switch, located on pilot and copilot collective, is a three-position, momentary on switch. INCR (increase) DECR (decrease) positions control an electric linear actuator in droop compensator control linkage and provides simultaneous adjustment of speed selector levers on both engine power turbine governors.

1-11-B. ENGINE INDICATORS

Engine indicators include triple torquemeter, triple tachometer, gas producer gauges, interturbine temperature gauges, oil temperature and pressure gauges, engine out warning lights, governor caution lights, particle separator caution lights, oil pressure caution lights, and chip detector caution lights.

1-11-B-1. TRIPLE TORQUEMETER

Triple torquemeter simultaneously displays, in percent, torque from engine(s) on inner scale and torque applied to transmission on outer scale.

1-11-B-2. TRIPLE TACHOMETER

Triple tachometer simultaneously displays, in percent, ROTOR RPM (N_R) (inner scale) and ENG RPM (N_2) (outer scale).

1-11-B-3. GAS PRODUCER GAUGES

Gas producer (GAS PROD) RPM (NI) gauges display engine gas producer in percent of rated RPM.

1-11-B-4. INTERTURBINE TEMPERATURE GAUGES

Interturbine temperature (ITT) gauges display engine gas temperature in degrees Celsius.

1-11-B-5. OIL TEMPERATURE AND PRESSURE GAUGES

Each engine oil temperature and pressure gauge simultaneously displays oil temperature in degrees Celsius on left scale and oil pressure in PSI on right scale.

1-11-B-6. ENGINE OUT WARNING LIGHTS

ENG 1 OUT and ENG 2 OUT warning lights, located on instrument panel, illuminate to alert crew that respective engine has failed (gas producer RPM (N_I) below 53 ±2%)

1-11-B-7. GOVERNOR CAUTION LIGHTS

ENG 1 GOV MANUAL and ENG 2 GOV MANUAL caution lights illuminate to alert pilot that respective governor switch is in MANUAL and pilot has to control gas producer RPM with throttles.

1-11-B-8. PARTICLE SEPARATOR CAUTION LIGHTS

ENG 1 PART SEP OFF and ENG 2 PART SEP OFF caution lights illuminate to alert pilot the particle separator door is not fully open.

1-11-B-9. OIL PRESSURE CAUTION LIGHTS

ENG 1 OIL PRESSURE and ENG 2 OIL PRESSURE caution lights illuminate to

alert crew that respective engine oil pressure is below operating limits.

1-11-B-10. CHIP DETECTOR CAUTION LIGHTS

ENG 1 CHIP and ENG 2 CHIP caution lights illuminate to alert crew that respective engine chip detector has detected metal particles in engine oil.

1-12. FUEL SYSTEM

Fuel is contained in five interconnected fuel cells (figure 1-3), three aft of passenger compartment and two under passenger compartment floor. Two cells under floor are continuously supplied by gravity feed from three aft cells. Under normal conditions, lower left cell supplies fuel to left power section and right cell supplies right power section. However, if boost pump in either cell fails, a crossfeed valve automatically opens to permit flow from operating pump to supply both power sections.

Each lower cell is separated into a forward and aft compartment by a baffle. Aft compartment contains a sump assembly equipped with an electrically operated boost pump, breakaway valve, flow activated switch, drain valve, defueling valve, and low level float switch. A fuel quantity probe is installed in each compartment. A flapper valve, in baffle, allows front to back flow and a hose assembly with an ejector type pump ensures this flow regardless of helicopter attitude. Electrically controlled interconnect valves, in line between forward compartments of both fuel cells and another between aft compartments, can be opened to permit crossflow between cells when fuel level becomes low.

Three aft cells are aligned across fuselage. Each outboard cell feeds lower cell on

Fuel system filler port is located on right side of helicopter with an electrical ground receptacle for fuel nozzle located nearby.

1-12-A. FUEL SYSTEM CONTROLS

Fuel system controls consists of fuel valve switches, boost pump switches, interconnect switch, crossfeed switch, and crossfeed test switch.

1-12-A-1. FUEL VALVE SWITCHES

ENGINE 1 FUEL and ENGINE 2 FUEL switches, located on pedestal, are two position switches labeled ON and OFF that control fuel flow from fuel tanks to engine. ON position provides power to fuel valve, fuel control heater, emergency fire pull handle, and arms ignition system. When switch is OFF, power is removed and sump drain switches are powered so fuel sample can be taken from sump drain. When FIRE PULL 1 or FIRE PULL 2 warning lights illuminate and fire pull handle is pulled, fuel valve is closed and fuel flow is stopped for respective engine.

1-12-A-2. BOOST PUMP SWITCHES

ENGINE 1 BOOST PUMP and ENGINE 2 BOOST PUMP switches, located on pedestal, are two position switches labeled ON and OFF. When in ON position, power is supplied to fuel cell mounted boost pumps and when in OFF position, power is removed from pumps.

1-12-A-3. INTERCONNECT SWITCH

INTCON switch, located on pedestal, is a two position switch labeled NORM and OPEN. When in NORM position, forward and aft interconnect valves are closed. When in the OPEN position, forward and

same side. Interconnect lines are installed between outboard cells and center cell.

aft interconnect valves are open, allowing fuel to flow between tanks.

1-9

1-12-A-4. CROSSFEED SWITCH

FUEL XFEED switch, located on pedestal, is a two position switch labeled NORM and OVRD CLOSE. During normal operations, no. 1 engine is fed by left boost pump and no. 2 engine is fed by right boost pump. If either boost pump fails, with FUEL XFEED switch in NORM, crossfeed valve will open and remaining boost pump will feed both engines. If FUEL XFEED switch is in OVRD CLOSE position and either boost pump fails, remaining boost pump will only feed respective engine.

1-12-A-5. CROSSFEED TEST SWITCH

FUEL XFEED test switch, located on pedestal, is a three position switch labeled TEST BUS 1, NORM, and TEST BUS 2. This switch provides a means to determine if redundant electrical power is available. When placed to TEST BUS 1, bus 2 is disconnected and FUEL XFEED caution light will illuminate to indicate power is not available. If caution light does not illuminate, power is available. Placing switch in TEST BUS 2 disconnects bus 1 and results will be same as mentioned before. NORM position deactivates the test function.

1-12-B. FUEL SYSTEM INDICATORS

Fuel system indicators include fuel quantity indicator, fuel boost caution lights, fuel filter caution lights, fuel low caution lights, fuel valve caution lights, and fuel crossfeed caution light.

1-12-B-1. FUEL QUANTITY INDICATOR

Fuel quantity indicator, located on instrument panel, displays total fuel quantity, left system quantity, and right system quantity depending on position of FUEL QTY SEL switch located to left of

1-12-B-2. FUEL BOOST CAUTION LIGHTS

ENG 1 FUEL BOOST and ENG 2 FUEL BOOST caution lights illuminate to alert crew that respective fuel boost pump pressure is low or pump has failed.

1-12-B-3. FUEL FILTER CAUTION LIGHTS

ENG 1 FUEL FILTER and ENG 2 FUEL FILTER caution lights illuminate to alert crew that respective fuel filter is partially clogged.

1-12-B-4. FUEL LOW CAUTION LIGHTS

ENG 1 FUEL LOW and ENG 2 FUEL LOW caution lights illuminate to alert crew that fuel available to respective engine is low (approximately 140 pounds remaining).

1-12-B-5. FUEL VALVE CAUTION LIGHTS

ENG 1 FUEL VALVE and ENG 2 FUEL VALVE caution lights are normally illuminated during transit, and extinguish when valve position is same as that of switch. A fault is indicated if it does not extinguish.

1-12-B-6. FUEL CROSSFEED CAUTION LIGHT

FUEL XFEED caution light illuminates to alert crew that fuel crossfeed valve is not fully closed or fully open (in transit), or crossfeed valve test is in progress and power is not available to crossfeed valves.

1-13. ELECTRICAL SYSTEMS

1-13-A. DC ELECTRICAL SYSTEM

Primary electrical power (helicopter serial numbers prior to 30554) is supplied by two

indicator. Fuel quantity is displayed in pounds × 100.

30 volt, 200 ampere (derated to 150 amps) starter generators, one

mounted on each power section. This power is distributed by two interconnected main buses to permit parallel operation of generators. Each main bus supplies power to an essential and a nonessential bus. If one generator fails or one engine fails, both nonessential buses are automatically disconnected and all essential DC loads are supplied by remaining generator. A bus reset feature allows nonessential buses to be manually reactivated by placing NON ESS BUS switch in MANUAL position. A backup source of emergency power, in event both starter generators become inoperative, is provided by 24 volt, 34 ampere hour battery. Power for engine starting is provided by battery or an external 28 VDC power source. Refer to figure 1-4 for electrical system schematic.

Primary electrical power (helicopter serial numbers 30554 and subsequent) is supplied by two 30 volt, 200 ampere (derated to 150 amps) starter generators, one mounted on each power section. Output voltage of each generator is monitored and regulated by a DC control unit. DC control units control paralleled generator operation and provide overvoltage and reverse current protection. Each generator provides power to an individual main DC bus and a common nonessential DC bus. Each main DC bus provides power to two common essential buses through appropriate circuit breakers and isolation circuitry. If one generator fails or one engine fails, nonessential bus is automatically disconnected and all essential DC loads are supplied by remaining starter generator. A bus reset feature allows nonessential buses to be manually reactivated by placing NON ESS BUS switch in MANUAL position. A backup source of emergency power, in event both starter generators become inoperative, is provided by 24 volt, 34 ampere hour battery. Refer to Figure 1-5 for electrical schematic.

1-13-B. AC ELECTRICAL SYSTEM

115/26 VAC, 400 Hz, single phase, 250 Va, solid state inverters, one connected to each essential DC bus. AC power is distributed by a dual bus arrangement such that each inverter normally supplies its own buses independent of other inverter buses. If an inverter fails, AC buses are automatically connected together and all AC loads are supplied by remaining inverter. Refer to figure 1-4 for electrical system schematic.

Secondary power (helicopter serial numbers 30554 and subsequent) is supplied by three 115/26 VAC, 400 Hz, single phase, 250 Va, solid state inverters. Inverter No. 1 is connected to essential DC bus No. 1 and inverter No. 2 is connected to essential DC bus No. 2. These two inverters provide power to their respective 115 VAC and 26 VAC essential AC buses and are independent of each other. Inverter No. 3 can be energized from either main DC bus, depending on INV 3 switch position. If inverter No. 1 or inverter No. 2 fails, nonessential AC bus is disconnected and inverter No. 3 supplies power to essential AC bus in lieu of failed inverter. Refer to figure 1-5.

1-13-C. ELECTRICAL SYSTEM CONTROLS

Electrical system controls consist of two battery switches, two generator switches, non essential bus switch, and inverter switches.

1-13-C-1. BATTERY SWITCHES

Each BATTERY switch, located on overhead console, is a two position switch labeled OFF and ON DC BUS 1 or ON DC BUS 2. When switch is in ON DC BUS 1 or ON DC BUS 2, respective battery relay is closed and power is supplied to respective main DC bus.

1-13-C-2. GENERATOR SWITCHES

Each generator switch (GEN 1 / GEN 2),

Secondary power (helicopter serial numbers prior to 30554) is supplied by two located on overhead console, is a three position switch labeled RESET, OFF, and

Rev. 1 1-11

ON. Switches control flow of current to respective main DC bus. When switch is ON, generator output circuit is completed to reverse current relay and main DC bus. Switch is spring loaded to return to OFF when placed in RESET and released. RESET position is used to attempt to restore generator power to system if ENG 1 DC GENERATOR/ENG 2DC GENERATOR caution light(s) illuminate, indicating system malfunction. Switch should be placed in RESET momentarily, then moved to ON. If caution light extinguishes, system has returned to normal. OFF position removes generator output.

1-13-C-3. NONESSENTIAL BUS SWITCH

NON ESS BUS switch, located on overhead console, is a two position switch labeled NORMAL and MANUAL which controls nonessential bus relay. When in NORMAL position and either generator fails, nonessential bus relay will open and power to nonessential bus will be dropped. When in MANUAL position, nonessential bus will be remain powered by main DC bus regardless of generator operation.

1-13-C-4. INVERTER SWITCHES

INV 1 and INV 2 switches, located on overhead console, are two position switches labeled ON and OFF. When in ON position, power is supplied to respective inverter. When in OFF position, power is removed from respective inverter. INV 3 switch, located on overhead console, is a three position switch labeled ON DC BUS 1, OFF, and ON DC BUS 2. INV 3 also supplies power to the avionics cooling fan (SN 30554 and sub.). When in ON DC BUS 1 position, inverter is powered by main DC bus 1 and when in ON DC BUS 2, inverter is powered by main DC bus 2. When in OFF position, power is removed from inverter.

1-13-D. ELECTRICAL SYSTEM INDICATORS

Electrical system indicators include dual DC ammeter, dual AC/DC voltmeters, warning light, and caution lights.

1-13-D-1. DUAL DC AMMETER

Dual DC ammeter, located on instrument panel, displays electrical current load, in amperes, for each generator.

1-13-D-2. DUAL AC/DC VOLTMETERS

Dual AC/DC voltmeters, located on instrument panel, display electrical output of respective inverter and generator in volts.

1-13-D-3. BATTERY TEMPERATURE WARNING LIGHT

BATTERY TEMP warning light illuminates to alert pilot battery case temperature has exceeded limits and battery thermal runaway is possible.

1-13-D-4. BATTERY CAUTION LIGHT

BATTERY caution light illuminates to alert pilot that battery relay is open or both BATTERY switches are in ON position.

1-13-D-5. DC GENERATOR CAUTION LIGHTS

ENG 1 DC GENERATOR and ENG 2 DC GENERATOR caution lights illuminate to alert crew that respective generator is not operating.

1-13-D-6. GENERATOR OVERHEAT CAUTION LIGHTS

ENG 1 GEN OVHT and ENG 2 GEN OVHT

caution lights illuminate to alert crew that respective generator is overheating.

1-12

1-13-D-7. INVERTER CAUTION LIGHTS

INVERTER 1, INVERTER 2, and INVERTER 3 caution lights illuminate to alert crew that respective inverter is not operating.

1-13-D-8. EXTERNAL POWER CAUTION LIGHT

EXTERNAL POWER caution light illuminates when external power receptacle door is open.

1-14. HYDRAULIC SYSTEMS

Two separate hydraulic systems are used to assist cyclic, collective, and antitorque flight controls. Each system contains a reservoir, pump, integrated valve and filter assembly, accumulator, and check valves.

Each integrated valve and filter assembly contains a system pressure filter and a system return filter. In event any of these filters becomes partially clogged, a button on filter housing will pop out to give an indication of filter bypass. This button will also activate a switch which will cause a remote hydraulic filter bypass indicator, in lower right area of nose section, to switch from green to red. Remote bypass indicator can be seen on preflight check through lower right nose window.

Hydraulic pumps are driven by transmission and have different rated capacities. System 1 pump delivers a greater volume of fluid to operate antitorque flight control servoactuator.

Cyclic and collective flight control servoactuators are each powered by both hydraulic systems, such that if either system falls, remaining system will operate servoactuators. Antitorque servoactuator is powered by system 1 only.

1-14-A. HYDRAULIC SYSTEM CONTROLS

HYDR SYS NO. 1 and HYDR SYS NO. 2 switches, located on pedestal, are two in ON position, hydraulic power is provided to flight control servoactuators and when in OFF position, hydraulic power is removed.

1-14-B. HYDRAULIC SYSTEM INDICATORS

Hydraulic system indicators include dual temperature and pressure gage for each system and a caution light.

Helicopters serial number 30504 through 30596 incorporate a gage for temperature as well as for pressure for each system.

1-14-B-1. HYDRAULIC TEMPERATURE AND PRESSURE GAGES

Hydraulic temperature and pressure gages, mounted on instrument panel, display hydraulic oil temperature in degrees Celsius on left scale and hydraulic oil pressure in psi on right scale. On helicopters serial number 30504 through 30596 a gage is included for temperature as well as pressure for each hydraulic system.

1-14-B-2. HYDRAULIC SYSTEM CAUTION LIGHT

HYDRAULIC caution light will illuminate to alert crew that hydraulic oil pressure has dropped below 650 psi or hydraulic oil temperature has exceeded 88 °C.

1-15. FLIGHT CONTROL SYSTEM

Flight control system, consisting of cyclic, collective, and antitorque controls is used to control helicopter attitude, altitude, and direction of flight. Flight controls are hydraulically boosted to reduce pilot effort and to counteract control feedback forces.

Control inputs from cyclic, collective, and antitorque pedals are transmitted by pushpull tubes and bellcranks to hydraulic flight control servoactuators. Two cyclic flight control servoactuators are

switches, located on pedestal, are two position switches labeled OFF and ON. When

Rev. 1 1-13

connected to swashplate, located above transmission. Swashplate converts fixed controls to rotating controls and actuates alternating cyclic pitch inputs to main rotor. Synchronized elevator is connected by control tubes and mechanical linkage to fore and aft cyclic control at swashplate. Fore and aft movement of cyclic produces a change in synchronized elevator attitude, thus increasing controllability and lengthening CG range.

Collective flight control servoactuator is connected to collective lever at swashplate support. Collective lever actuates collective sleeve, which moves mixing lever up and down to induce collective pitch into blades.

Antitorque flight control servoactuator is located in aft fuselage compartment near tailboom attachment area. Tail rotor fixed controls are connected to rotating controls through a bearing in crosshead assembly which slides along tail rotor output shaft to provide pitch change control.

Antitorque control pedals can be adjusted fore and aft by pressing and rotating a knob located on floor just forward of each crew seat.

1-15-A. FORCE TRIM SYSTEM

Cyclic and antitorque controls incorporate a force trim system to provide artificial control reaction forces when controls are manually moved from their reference positions. Force trim system is also interrelated with operation of automatic flight control system (AFCS). Refer to Automatic Flight Control System.

Force trim components include spring-loaded force gradient cartridges connected in series with rotary trim actuators to fore/aft and lateral cyclic control and to antitorque control. When engaged, trim actuators become locked in position by internal magnetic brakes. Manual movement of controls then actuates force gradients which provide desired control resistance.

1-15-B. FORCE TRIM CONTROLS

Force trim system is activated by FORCE TRIM switch located on pedestal. A FORCE TRIM release switch, located on cyclic, can be pressed to deenergize system momentarily, allowing pilot to position cyclic and pedals for long term pitch, roll, and yaw corrections. Upon releasing switch, magnetic brakes are reenergized and will lock trim actuators in new reference positions existing at moment switch is released.

1-16. PITOT-STATIC SYSTEM

Pitot system consists of an electrically heated pitot tube connected to airspeed indicator. A second, independent pitot system is installed when optional copilot instrument kit is installed.

Static system consists of static ports and tubing necessary to connect ports to airspeed indicator(s), altimeter(s), and vertical speed indicator(s). Two static ports are located just forward of crew doors. IFR configured helicopters are equipped with heated static ports.

1-17. HEATING SYSTEM

Cabin heating system, which includes windshield defrost system, uses bleed air from engine compressor section as source of heat. A mixing valve, which is controlled by a thermostat, mixes heated air with outside air to obtain desired temperature.

When windshield defrost is selected, heated air is diverted from doorpost and pedestal heater outlets to windshield nozzles.

1-18. VENTILATING SYSTEM

Ventilating system delivers outside air to outlets by instrument panel and also to windshield nozzles to defog windshield

and provide fresh air ventilation. Overhead ventilation system delivers

1-14

outside air through overhead nozzles to crew and passenger compartments.

1-19. LIGHTING SYSTEMS

1-19-A. INTERIOR LIGHTING

Two multipurpose cockpit/map lights are mounted overhead in crew compartment. Either white or red light can be selected and light may be adjusted from spot beam to flood type illumination. These lights may be removed from their mounts for increased utility.

Three dome lights, with intensity adjustments, are mounted in passenger compartment. Dome lights illuminate red or white and are controlled by a switch, labeled AFT DOME LT OFF and BRT and rheostat, labeled WHITE, OFF, and RED, located on overhead console.

Two lights in baggage compartment are automatically illuminated when door is opened and nonessential DC bus 2 is energized.

Other interior lighting circuits include instrument panel lights (COPLT INSTR LT, ENG INSTR LT, PILOT INSTR LT), instrument secondary lights (SEC INSTR LT), overhead console lights (CONSOLE LT), and pedestal lights (PED LT) controlled by rheostats in overhead console.

Four self illuminating, beta lights are mounted over windows in passenger/cargo doors to identify emergency exits.

1-19-B. EXTERIOR LIGHTING

Exterior lighting circuits include landing light, searchlight, position lights, anticollision lights, and utility (step) lights. Landing light and searchlight are controlled by switches located on pilot

1-20. WINDSHIELD WIPERS

Electrically powered windshield wipers are mounted above windshields. Switches (WIPER SEL and WIPERS), located on overhead console, allow independent control of windshield wipers.

1-21. ROTOR BRAKE SYSTEM

Rotor brake incorporates dual hydraulic systems which are independent of flight control hydraulic systems. Primary components include a dual master cylinder located on forward cabin roof, a brake disc with dual brake cylinders mounted on transmission, and associated hydraulic tubing. Two ROTOR BRAKE warning lights, on caution panel, are activated by micro switches in brake housing to warn pilot that brake is not fully released or the linings are not fully retracted.

Rotor brake application is limited to ground operation after both engines have been shut down and rotor rpm has decreased to 40%. Brake handle should be returned to full up detent position after blades stop. After securing main rotor blades, rotor brake may be locked to stabilize rotor during windy conditions.

1-22. EMERGENCY EQUIPMENT

1-22-A. FIRE DETECTION

A set of heat sensing elements is mounted to cowling and forward firewall of each power section. A fire or overheat condition will cause FIRE PULL handle, of affected power section, to illuminate.

A smoke detector is mounted at forward end of baggage compartment ceiling. Smoke in baggage compartment will cause

collective. Remaining lights are controlled by switches located on overhead console.

BAGGAGE FIRE warning light, located on instrument panel, to flash intermittently.

1-15

1-22-B. ENGINE FIRE EXTINGUISHING SYSTEM

A fire extinguishing bottle for each power section is mounted in aft fuselage. These bottles are connected in such a way as to allow either bottle to be discharged into either engine. Fire extinguisher selector switch may then be used to discharge main and reserve bottles individually. Pulling FIRE PULL handle of affected power section closes particle seperator door in air management system, closes fuel shutoff valve, closes both heater bleed air valves, and arms both fire bottles.

1-22-C. PORTABLE FIRE EXTINGUISHERS

Two portable fire extinguishers are mounted in cabin, one on cabin floor to right of pilot seat and other on doorpost aft of copilot seat.

1-22-D. FIRST AID KIT

A portable first aid kit is attached to left side of pedestal by hook and pile fasteners.

1-22-E. EMERGENCY EXIT - DOOR JETTISON

If crew doors can not be opened, door jettison can be accomplished by pulling jettison handles located on each crew door doorpost.

1-22-F. EMERGENCY EXIT - WINDOW JETTISON

If cabin sliding doors or hinged panels can not be opened, emergency escape is possible by pushing on lower corners of windows in sliding doors to jettison windows.

1-22-G. JETTISON PANELS

Escape panels on helicopters so equipped, may be jettisoned by removing plastic cover, turning 'D' handle (inside or outside). and pushing panel out.

1-23. VOICE/FLIGHT DATA RECORDER

Voice/flight data recorder system (if installed) consists of a flight data recorder, cockpit voice recorder, air data computer, flight data acquisition unit, and impact switch.

Flight data acquisition unit gathers data from air data computer, various instruments, and other sensors and passes data on to flight data recorder. Flight data acquisition unit is DC powered and flight data recorder is AC powered. FDR SYS FAIL caution light, located on instrument panel, indicates either flight data acquisition unit or flight data recorder is inoperative. Each of these units is protected by an FDR circuit breaker located in nose of helicopter.

Cockpit voice recorder records voice signals from pilot intercom, copilot intercom, and area microphone. It also records a time signal from flight data acquisition unit. Cockpit voice recorder tape is 30 minutes long, and will write over previously recorded information after 30 minutes has expired. Recording will cease if impact switch is tripped. Cockpit voice recorder is DC powered and is protected by CVR circuit breaker located in nose of helicopter. A functional test can be performed by pressing TEST switch on COCKPIT VOICE RECORDER control head, located on pedestal, and verifying meter reads GOOD. ERASE switch is deactivated and performs no function.

Both recorders are powered automatically and require no pilot action for operation.

1-16

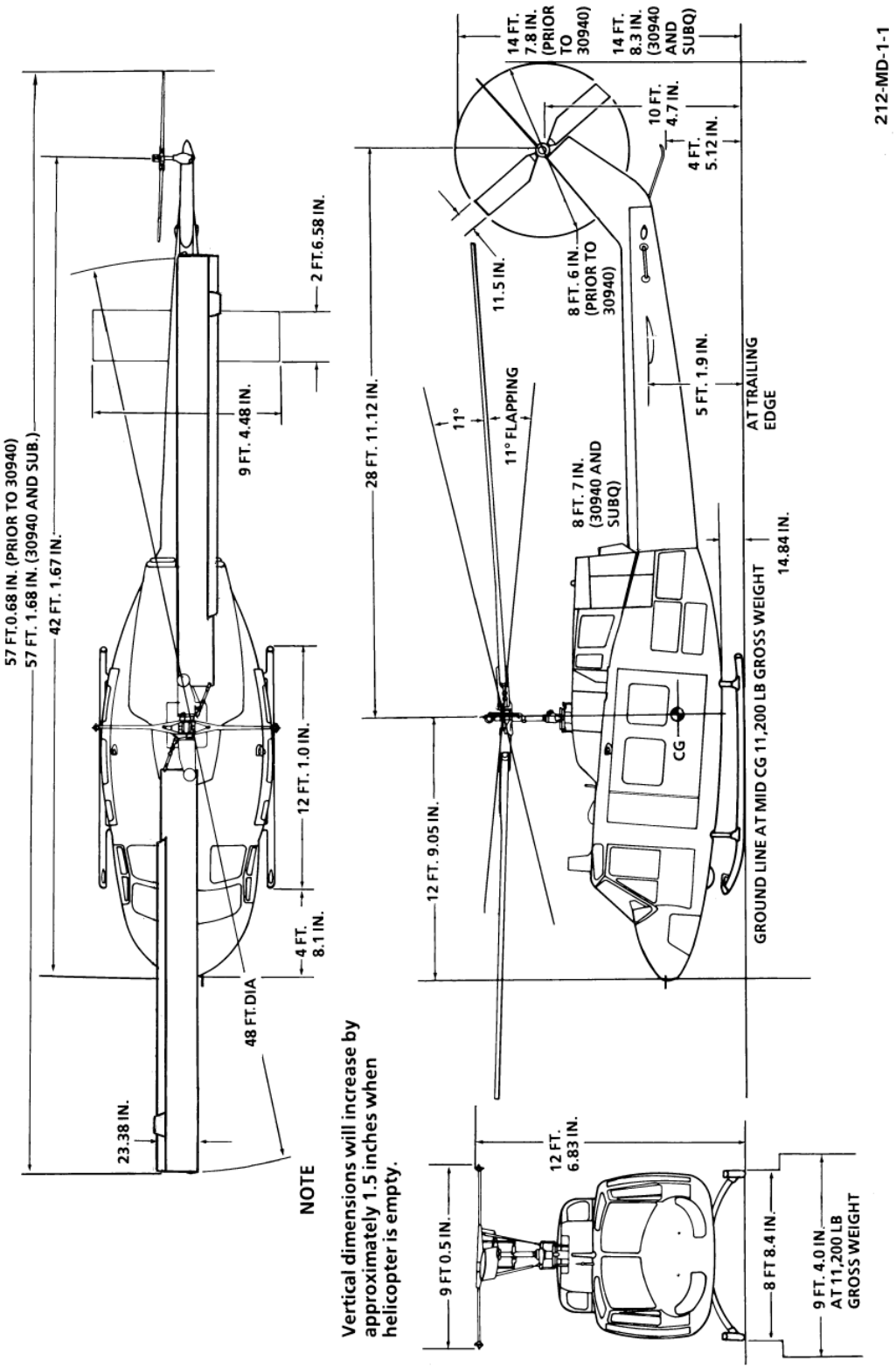
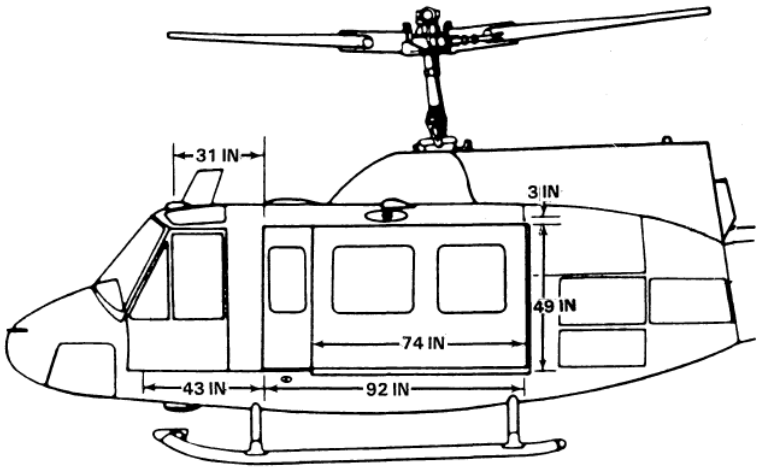
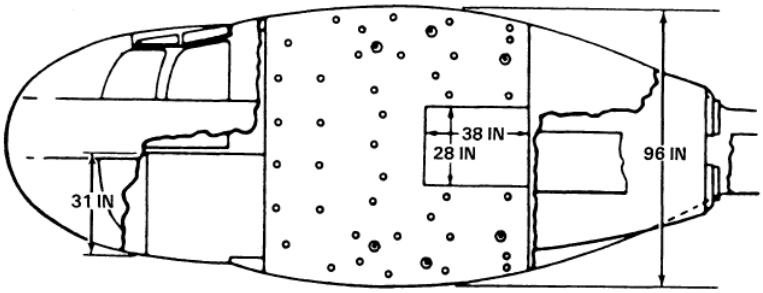


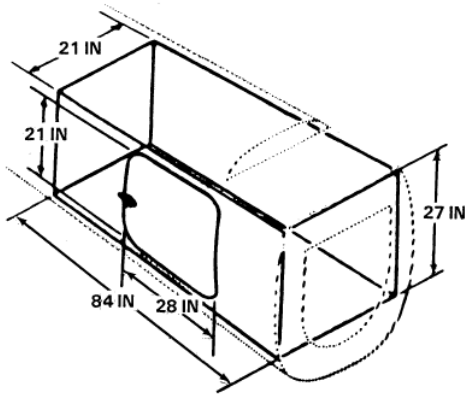
Figure 1-1. Principal exterior dimensions



20 CUBIC FEET AVAILABLE IN COCKPIT



220 CUBIC FEET AVAILABLE IN CARGO AREA



28 CUBIC FEET IN BAGGAGE COMPARTMENT

212-MD-1-2

Figure 1-2. Principal interior dimensions

1-18

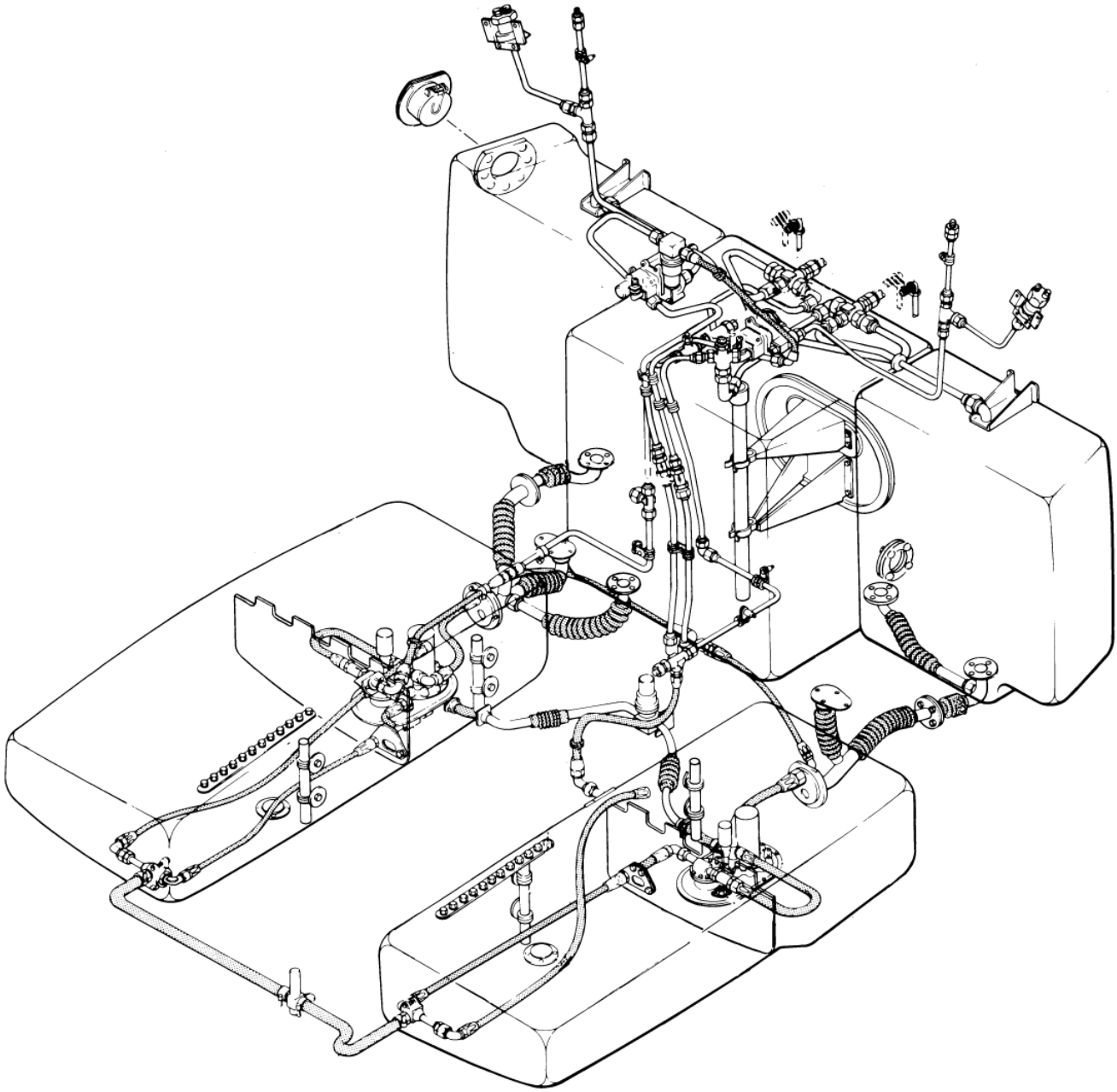


Figure 1-3. Fuel system (Sheet 1 of 2)

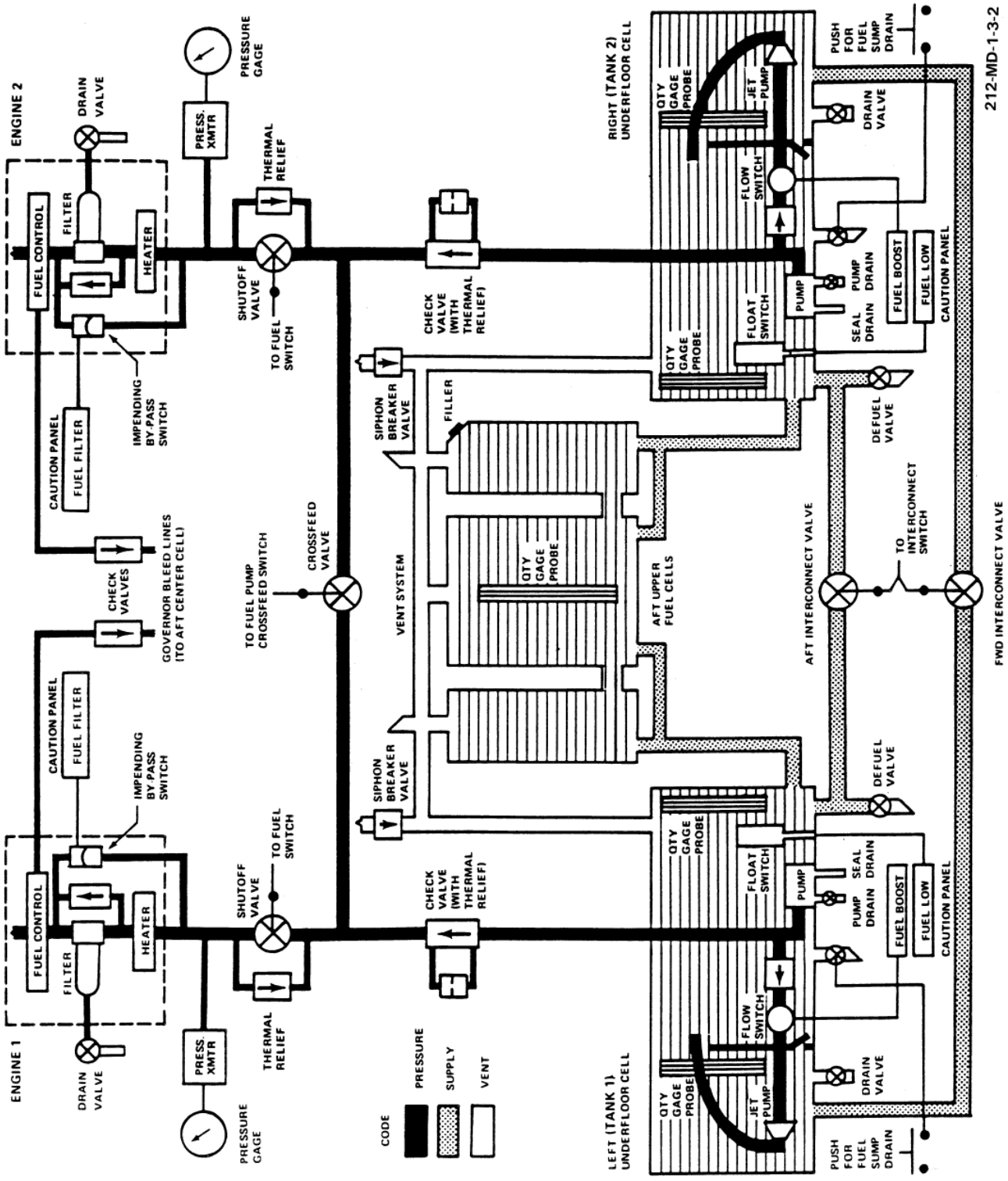


Figure 1-3. Fuel system (Sheet 2 of 2)

1-20

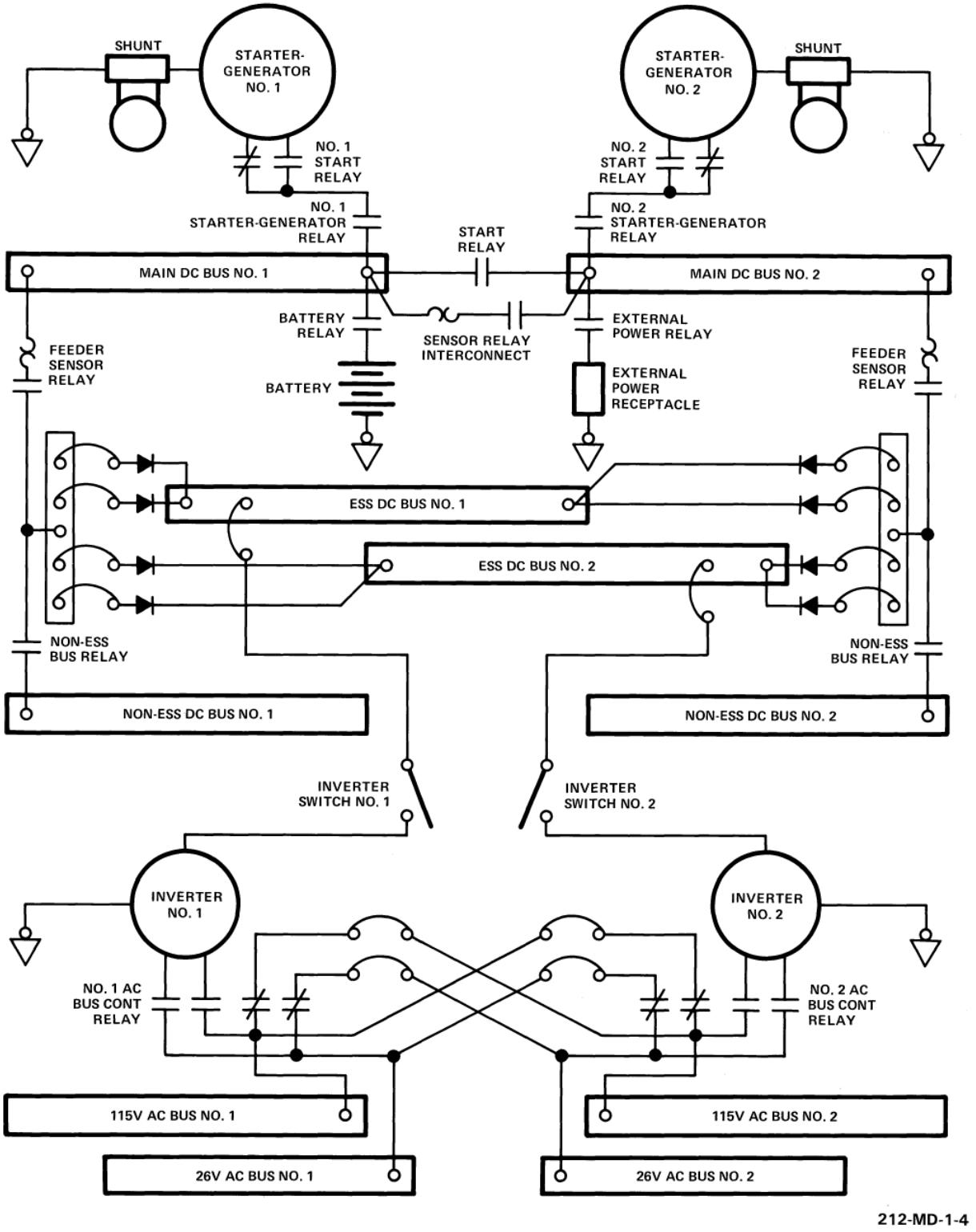
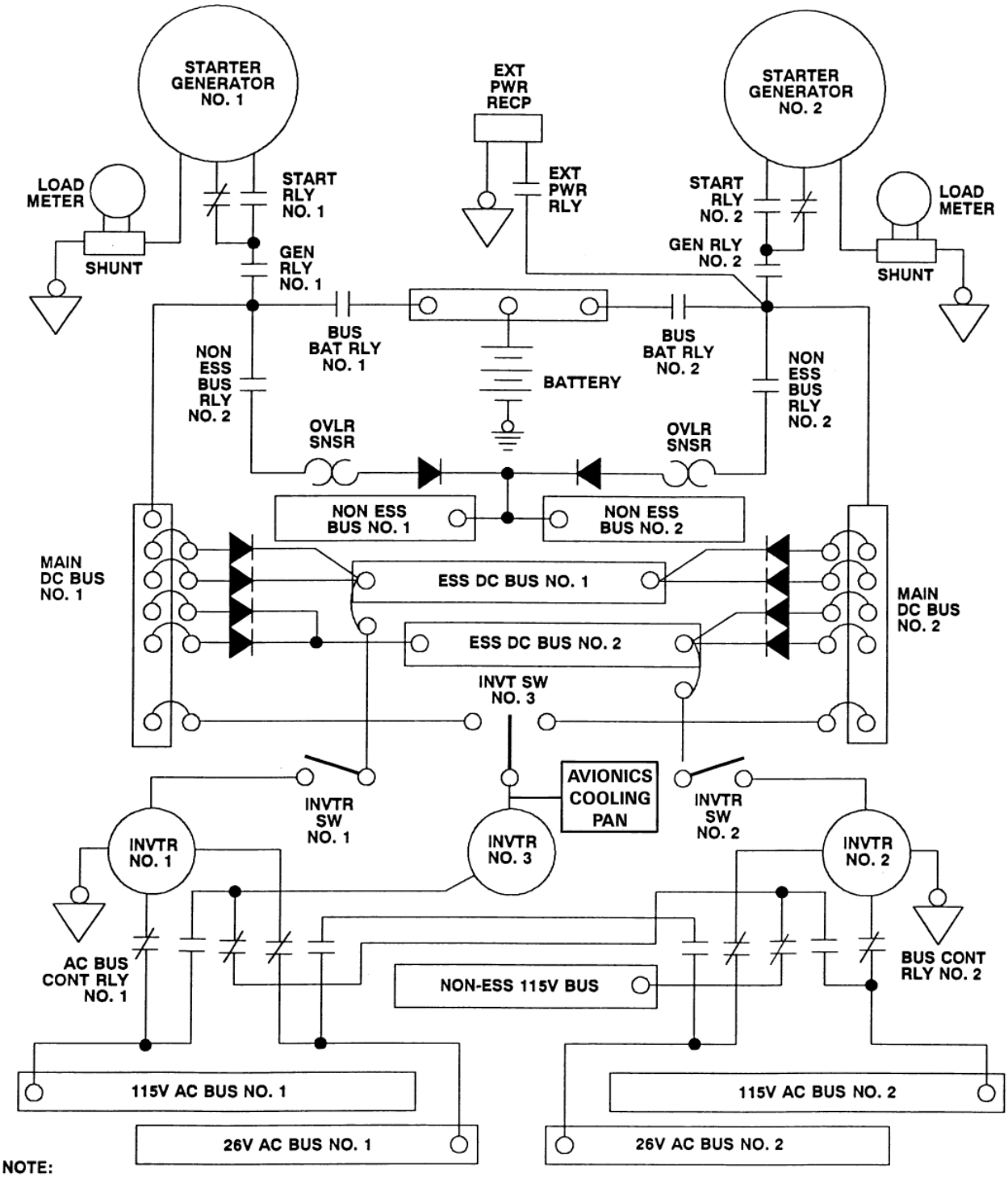


Figure 1-4. Electrical system schematic — SN 30504 through 30553



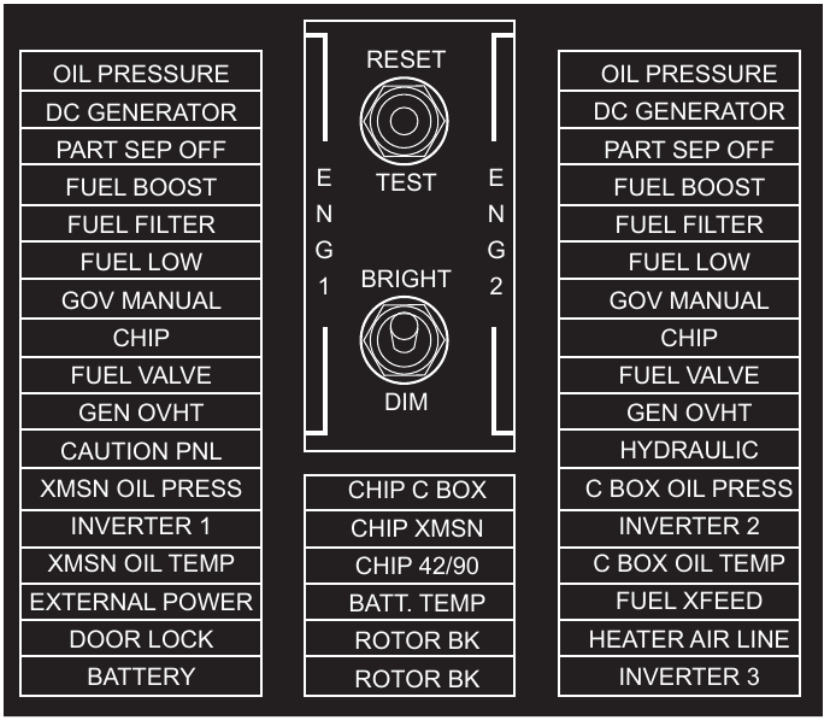
NOTE:

SIMPLIFIED SCHEMATICS ARE TO BE UTILIZED AS A GENERAL OVERVIEW ONLY. FOR TROUBLE SHOOTING AND SYSTEM TRACING REFER TO PERTINENT WIRING SCHEMATIC.

212-MD-1-5

Figure 1-5. Electrical system schematic — SN 30554 and subsequent.

1-22



TYPICAL

Figure 1-6. Master Caution/Warning Panel — Typical