ELECTRICAL

GENERAL

Electrical power is made available through the use of batteries, DC power generators, an Auxiliary Power Unit (APU) located in the tail section, and two engine driven alternators (which provide AC power). The battery system uses two, twenty cell, 44 ampere-hour nickel cadmium or the optional lead-acid batteries. There are two brushless engine-driven generators that provide DC power (rated at 400 amperes up to 41,000 feet and 300 amperes above 41,000 feet). DC power is controlled by the use of two generator control units (GCUs). AC power, which is used only for the windshield anti-ice system, is generated by two engine-driven, three phase, 115/200 volt, three kilovolt-ampere (KVA) alternators (having a variable frequency of 200-400 cycles, depending on engine speed) controlled by an two altenrator control units.. The 400 ampere on-board Auxiliary Power Unit (APU) provides DC electrical power and is equipped with its own DC ammeter, providing current drain information to the flight crew. The APU can be started and used up to an altitude of 31,000 feet.

Two battery ON-OFF switches and an emergency (EMER) switch provide power to the electrical system when battery power is desirable or in the event of a generator failure.

A Ground Power Unit (GPU) receptacle facilitates use of a GPU. Power from a GPU is made available by the external power switch located in the cockpit.

DIRECT CURRENT (DC) POWER

DC power required to operate the airplane and all DC operated equipment is provided by the engine-driven generators, the dual battery installation, and the on board auxiliary power unit (APU). Generator power is selected by the LH and RH GEN switches and the APU GENERATOR switch. In the LH GEN, RH GEN or APU ON position, the GCUs will place the respective generator on line when the engines or APU are running. The left and right engine generators operate independently. There is no load paralleling. The APU generator will not come on line or will drop off line if the right engine generator is on line. The reset switch position is momentary and resets the GCU after a system trip has occurred. The left and right generators supply 28.5 VDC power to the RH feed bus through the RH isolation relay, to the RH battery bus through the crosstie relay and the LH isolation relay, to the LH battery bus.

DIRECT CURRENT (DC) POWER INDICATORS

The voltage and amperage of the engine-driven DC generators can be read on the crew alerting system (CAS) section of the EICAS display unit. In order to read the information, the ELEC bezel button must be depressed. The voltage and amperage of both generators and the temperature of both batteries may be then read simultaneously. Eight different digital EICAS messages may be annunciated to apprise the crew of abnormal electrical system operation. The ELEC bezel button can then be pressed to read the specific system condition. The APU has its own ammeter which is located on the copilot's meter panel.

Unless the ELEC bezel button is depressed, routine monitoring of the electrical system is not available, however, any abnormal condition will be presented on the EICAS display as a red, amber, or cyan digital message. When a red message appears, the message will also appear on the cross-side multifunction display (MFD) and the master warning. The message will flash until it is acknowledged. An amber message will cause the master caution light to illuminate steadily, and the message will flash until it is acknowledged. Cyan advisory messages will appear and flash for five seconds then annunciate steadily. The messages which can be presented are: BATT 1-2 O'TEMP (red), GEN OFF L-R (red or amber, depending on whether 1 or 2 generators have failed), BUS CTRL 1-2 FAIL (amber), BUS ISO OPEN L-R (amber), REMOTE CB TRIPPED (cyan), and DC BEARING L-R-APU (cyan).

ELECTRICAL SYSTEM BLOCK DIAGRAM

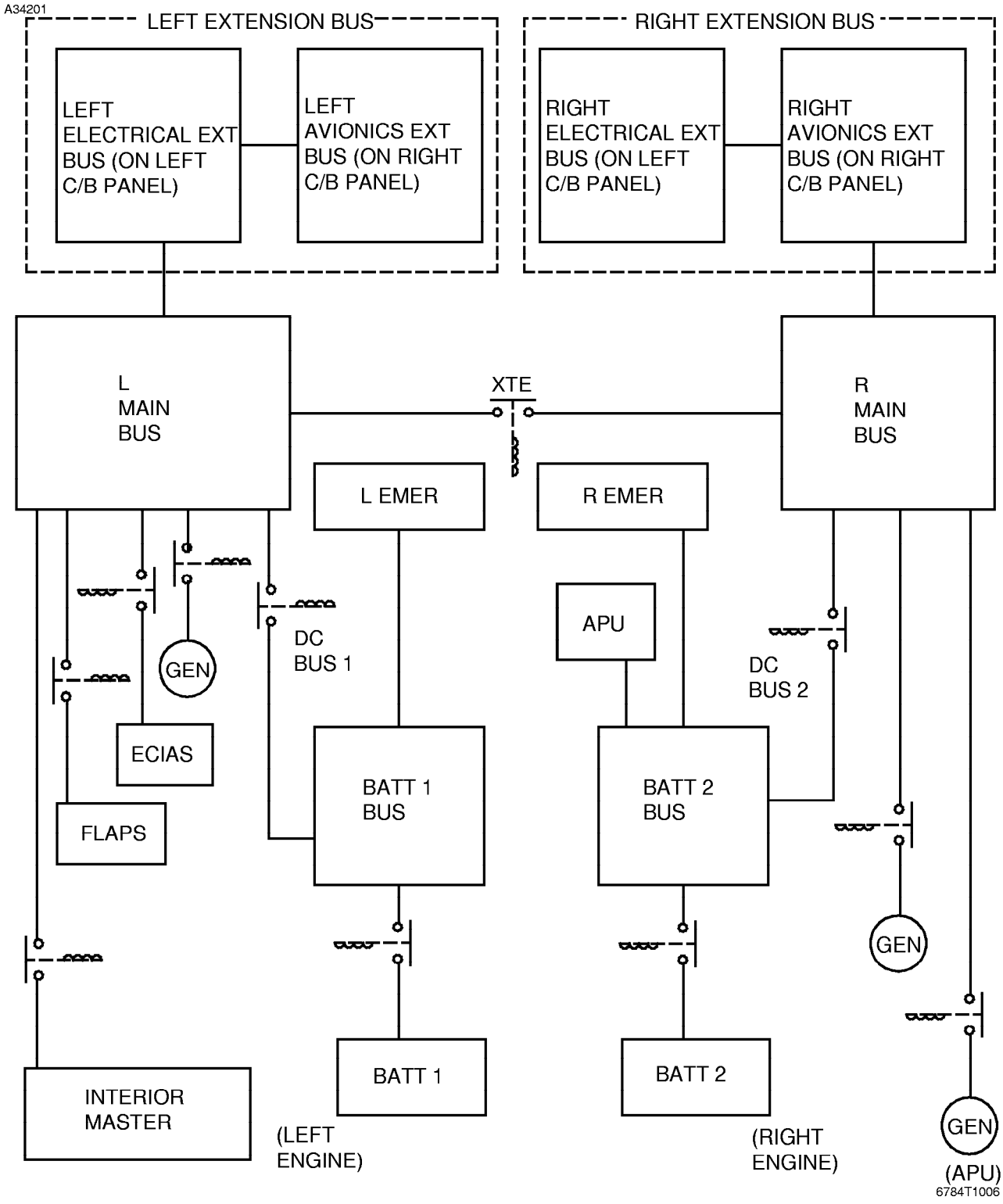


Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 1 of 3)

ELECTRICAL SYSTEM (Continued)

POWER SOURCE/DISTRIBUTION STATUS						BUS STATUS/POWER SOURCE										
L GEN	R GEN	APU	BUS 2	BUS 1	XTIE	L MAIN	EICAS	L EXT	L BAT	L EMER	R MAIN	R EXT	R BAT	R EMER	APU	NOTES
INOP	GEN	- -	NORM	NORM	~CLSD	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	
GEN	INOP	- -	NORM	NORM	CLSD	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	
INOP	INOP	GEN	NORM	NORM	CLSD	APU	APU	APU	APU	APU	APU	APU	APU	APU	APU	
INOP	INOP	INOP	EMER	EMER	- -	INOP	INOP	INOP	L BAT	L BAT	INOP	INOP	R BAT	R BAT	RBAT	1
GEN	GEN	- -	NORM	EMER	OPEN	L GEN	L GEN	L GEN	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	1
GEN	GEN	- -	EMER	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	R GEN	R GEN	R BAT	R BAT	R BAT	1
INOP	GEN	- -	NORM	EMER	OPEN	INOP	INOP	INOP	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	1, 2
GEN	INOP	INOP	EMER	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	INOP	INOP	R BAT	R BAT	R BAT	1, 2
GEN	INOP	INOP	NORM	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	R BAT	R BAT	R BAT	R BAT	R BAT	3
INOP	GEN	- -	NORM	NORM	OPEN	L BAT	L BAT	L BAT	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	3

NOTES

1.) Battery endurance approximately 60 minutes.
2.) Failure probably due to affected side overcurrent fault. Isolation crosstie, relays and generator not resetable.
3.) Battery endurance approximately 14 minutes.

EXAMPLE: From the Power Source/Distribution Status side of the table, find the status of power distribution systems. For this example, we have selected L GEN, R GEN and APU as INOP, with DC Power BUS 1 and BUS 2 switches in EMER. Reading from left to right into the Bus Status/Power portion of the table, we can determine which buses are operating on what power source. The status of specific components can then be further cross-checked against sheet 3 of this Figure to determine if they are powered or inoperative give the power source/distribution status configuration.

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 2)

ELECTRICAL SYSTEM (Continued)

LEFT HAND DISTRIBUTION

LEFT MAIN

L LANDING LIGHT
COCKPIT ECU
GRD RECOG LIGHTS
IRS 1 (primary)
L FAIRING HT
FLAPS
IRS 2 AUX

EICAS

IAC 1
MFD 1
EICAS DISP
DAU 1 / 2 A
DISP CONT 1

LEFT BATT

ENTRY LIGHTS
BATT SENSE 1

LEFT EMER

L START LOGIC
AUX PANEL LTS
L W/S A/I CONT
L BLD PRECOOLER
SEC STAB TRIM
AILERON TRIM
PITCH FEEL
UPPER RUD/YAW DAMP A
RUD LIMIT A
BAT 1 AMMETER
WARN AUDIO 1
COM / NAV / RMU 1
TRANSPONDER 1 (opt)

STANDBY HSI
IRS 1 AUX
L FIRE DET / EXT
L F/W SHUTOFF
L & R FADEC A
L EMER LTS
AUDIO AMP 1
MADC 1
L. FUEL PUMP

LEFT EXTENSION

GPWS
ANTI-COL STROBE LTS
L WING INSP LT
L PANEL LT
CKPT FLOOD LT
L RAT, P/S, AOA HT
L A/I (fail valves open)
L FUEL TRANSFER
(fails current position)
L START VALVE
L/CTR FUEL QTY
L TLA DISCRETES
L STALL WARN/AOA
PAX OXY AUTO DROP
ANTI SKID
LH TR
(deploy & stow)
HYD CONT A (fails on)
FLAPS
SLAT CONT A
RADAR / LTG DET
L ENG BLEED
(valves fail open)
CKPT TEMP CONT
CABIN DOOR MONITOR
ADF 1
DME 1
RADALT 1
FLT PH / CAB INTCOM
GPS 1 / FMS 1
AP / FGC 1
DAU 1 B
FDR
TCAS
NORMAL
PRESSURIZATION

RIGHT HAND DISTRIBUTION

RIGHT MAIN

R. LANDING LT
TAXI LTS
CAB ECU (PAC)
BAG FAN
R. FAIRING HT
STBY INST (primary)
STBY BAT (charge)
IRS 2 (primary)

RIGHT BATT

BATT SENSE 2

APU

APU PWR / SENSE
APU ECU
APU FIRE

RIGHT EMER

R START LOGIC
UPPER RUD/YAW
DAMP B
R BLD PRECOOLER
HF 1
AUDIO AMP 2
AUDIO WARN 2
MADC 2
R EMER LTS
STBY P/S HT
RUD TRIM
LDG GEAR
RUD LIM B
A AUX HYD PUMP
R FIRE DET / EXT
R FIREWALL SHUTOFF
L & R FADEC B
BAT 2 AMMETER

RIGHT EXTENSION

MAP LTS
R W/S A/I CONT
R RAT, P/S, AOA HT
R A/I (valves fail open)
PRI STAB TRIM
R FUEL BOOST
F FUEL TRANSFER
(fails current position)
R START VALVE
R FUEL QTY
R TLA DISCRETES
R STALL WARN / AOA
NOSE STEERING
R TR (deploy & stow)
HYD CONT B (Fails on)
PCU MONISOT
RUD STBY HYD
COM / NAV / RMI 2
TRANSPONDER 2
ADF 2
DME 2
HF 2
GPS / FMS 2
AP / FGC B
PFD / MFD 2
DISP CONT 2
DAU 2 B
NAV LTS
R & CTR PANEL LTS

STANDBY BUS

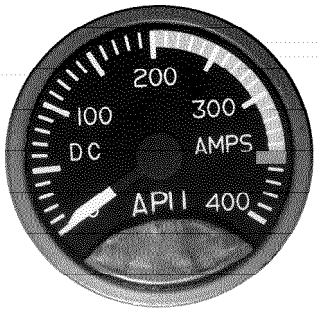
STBY ALT/AS VIB
STBY ATT INDICATOR
STBY ENG INST
STBY INST/LIGHTING

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 3)

Specific causes for the appearance of the above messages are covered under Engine Indicating and Crew Alerting System (EICAS) in this section. The ammeters function as loadmeters indicating the load being carried by each generator or by the onboard auxiliary power unit. When the auxiliary power unit is in operation output current can be monitored at all times on the APU ammeter (DC AMPS APU) which is mounted on the copilot's meter panel.

AUXILIARY POWER UNIT AMMETER

A34202



6785P1005

Figure 2-35

GENERATORS

Each engine is equipped with a generator rated at 400 amperes (300 amperes above 41,000 feet) that is self cooled on the ground and is cooled by ram air when in flight. The generator serves two functions: (1) to generate direct current (DC) power to the airplane systems and, (2) to charge the airplane batteries and the standby battery.

The generators normally provide 28.5 volts direct current (DC) to their own busses; generator number one to bus number one (left main bus) and generator number two to bus number two (right main bus). An overvoltage of approximately 32 volts will result in a generator being tripped off the line. The generators have an overcapacity of 150% for 5 minutes and 200% for 20 seconds, which will normally give the crew time to consider the required load shedding in case of loss of one generator.

The engines are normally started with the generator switches (DC POWER LH GEN/OFF/RESET and RH GEN/OFF/RESET) in the GEN position, however, if external power is used during the start, the GEN switch may be positioned to OFF, if desired. If the engines are started with the generator switches in the GEN position, the generator control units (GCU) will bring their respective generators on line automatically when they reach a minimum RPM. When an airplane engine driven generator or the APU generator comes on line, the ground power unit (GPU) is automatically disconnected.

The RESET position of the generator control switches is a momentary position, and is used to reset the generators before placing them into operation when there has been a system trip.

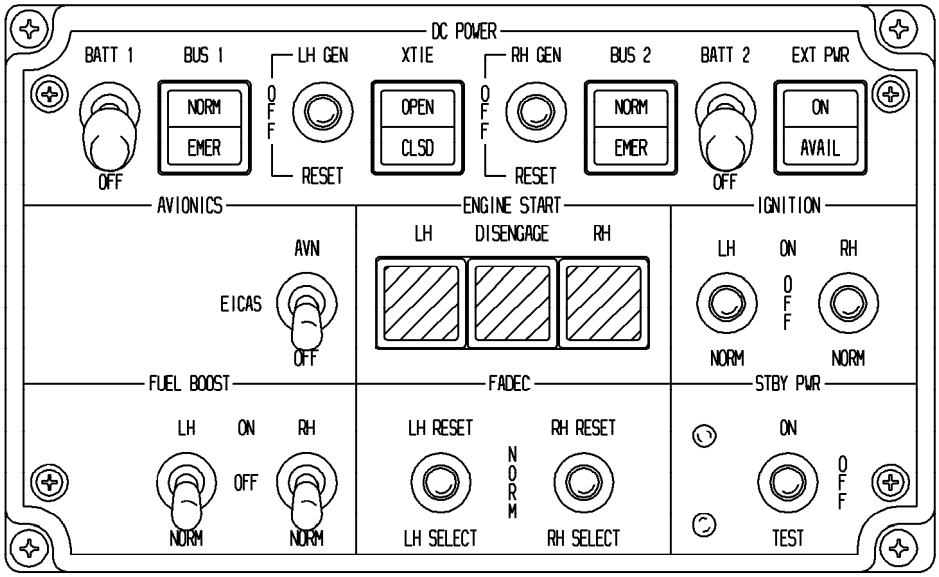
Each generator is wired directly to a separate power junction box, and each has electrical terminal filtering to suppress radio noise output. A single generator is capable of supporting the entire electrical system requirements. Generator limitations are the same whether one or both generators are in operation.

Operation of the generators is controlled by two generator control units (GCU) that are installed on the tailcone electrical equipment rack in the lower forward tailcone compartment. The on-board auxiliary power unit (APU) also has a GCU which is mounted in the same area. The GCU units provide the following features: (1) voltage regulation at 28.5 volts throughout the rated load and temperature range, (2) load sharing to a tolerance of within ten percent (amperage) of the indicated load in parallel operation, (3) overvoltage protection, (4) reverse current control, (5) ground fault protection and (6) overspeed sensing and consequent protection from damage that might result from a sheared generator shaft. The generators are also protected from overload/overspeed by a shear shaft in the generator drive.

An overvoltage protection system is provided during use of an external power unit. The control unit monitors the external power unit voltage and will de-energize the external power relay, removing power, if the voltage exceeds 32 volts. External power cannot be re-applied to the airplane until the voltage is reduced below 32 volts.

ELECTRICAL POWER/ENGINE CONTROL PANEL

A34204



6718T1001B

Figure 2-36

GENERATOR CONTROLS AND SWITCHES

A three position generator switch, located on the tilted panel (DC Power Panel), immediately to the left of the pedestal, is provided for each generator. The switch is labeled LH (RH) GEN, OFF and RESET. Selecting the GEN (ON) position with the engine running will extinguish the amber GEN OFF L-R EICAS annunciation and will supply a signal to the generator control unit which monitors the battery bus voltage. It will connect the generator to the bus, unless voltage or amperage is such that the generator control unit (GCU) will not parallel the generator with other(s) which may be on the line, or voltage is otherwise out of tolerance. Placing the switch to the OFF position will disable the signal to the generator control unit, the generator will be dropped offline, and the amber GEN OFF L-R annunciation will appear. The RESET position is a momentary position that will momentarily connect the armature directly to the field creating a rapid buildup to 28.5 volts. The switch is spring loaded from the RESET back to the OFF position; therefore, it must be manually positioned to GEN when the RESET feature is utilized, and the generator will then come back on line. The RESET position will reset a generator that has been tripped as a result of an overvoltage, feeder fault, or if the fuel and hydraulic firewall shutoff valves have been activated. Generator operation will again be disabled during reset attempts if the fault still exists or until firewall shutoff valves have been de-activated. The MASTER WARNING indicator will flash at any time both generators have faulted or have been tripped off the line for any reason, and a red EICAS message GEN OFF L-R will appear in the flashing mode. An attention tone will also be heard, and if the voice warning system is installed a voice synthesis will be heard until the annunciation is acknowledged.

DIRECT CURRENT (DC) POWER GENERATION AND DISTRIBUTION

DC power originating from the batteries, airplane generators, on board auxiliary power unit or ground external power sources, is initially controlled with different main DC power busses being activated by current switching relays located in the aft power junction box. The junction box is constructed in three sections and is located at the forward end of the baggage compartment on the aft side of a pressure bulkhead. A small isolated section of the main electrical power junction box contains components of the electrical emergency system. Three separate cables from each section of the junction box route DC power to the right and left circuit breaker panels in the cockpit. “Crossover” busses are used to permit convenient grouping of related equipment. The entire system is protected by current limiters and circuit breakers. Current limiters of 275 amperes capacity protect each connection between the crossfeed bus, and the left and right main generator busses. An isolation relay separates the DC emergency bus from the crossfeed bus so that, if required, the emergency bus may be separated from the other busses and their loads.

The left and right feed busses are connected through a crosstie (XTIE) relay. The crosstie relay is closed on the ground during initial power up and then opens automatically, when the second generator comes on line after engine start on the ground, to allow the left and right electrical systems to operate independently. The crosstie relay can be pilot controlled using a XTIE/OPEN, CLSD switch annunciator in the electrical switch panel. In the event that a generator overcurrent causes a generator to be automatically shut off, the crosstie relay will be latched open and cannot be selected closed.

Safety and Protective Features of the System Are:

- When any generator is connected to the distribution bus, application of external power will be prevented.
- Ground external power overvoltage protection is provided.
- Two separate and distinct distribution systems, and related subsystems, supply power.
- No malfunctioning power source can prevent the remaining power sources from furnishing power to essential loads.
- Individual, or collective disconnection of the electrical power sources, including batteries, is available in flight to the flight crew.
- When fuel and hydraulic firewall shutoffs are activated, the respective generators are de-activated, and cannot be re-activated until the fuel and firewall shutoffs are reopened.
- Generator overvoltage protection at 32.5, +0.5, -0.5 volts is provided.
- All circuit breakers are “trip free” and cannot be reset if a fault is present in the circuit.
- Each battery is provided with a separate switch to provide for individual battery disconnection.
- Electric engine starting, which can result in high battery temperature, is used only on the small APU engine. The airplane engines are started pneumatically.
- Generators are monitored for impending primary bearing failures by the EICAS system. If the system senses that a bearing will fail within ten operating hours a cyan EICAS message DC BEARING L-R-APU will be annunciated.
- The generators are equipped with secondary bearings which will maintain operation for up to twenty hours.
- Failure of bus tie fuse limiters will trigger an EICAS message.

ELECTRICAL COMPONENTS LOCATION

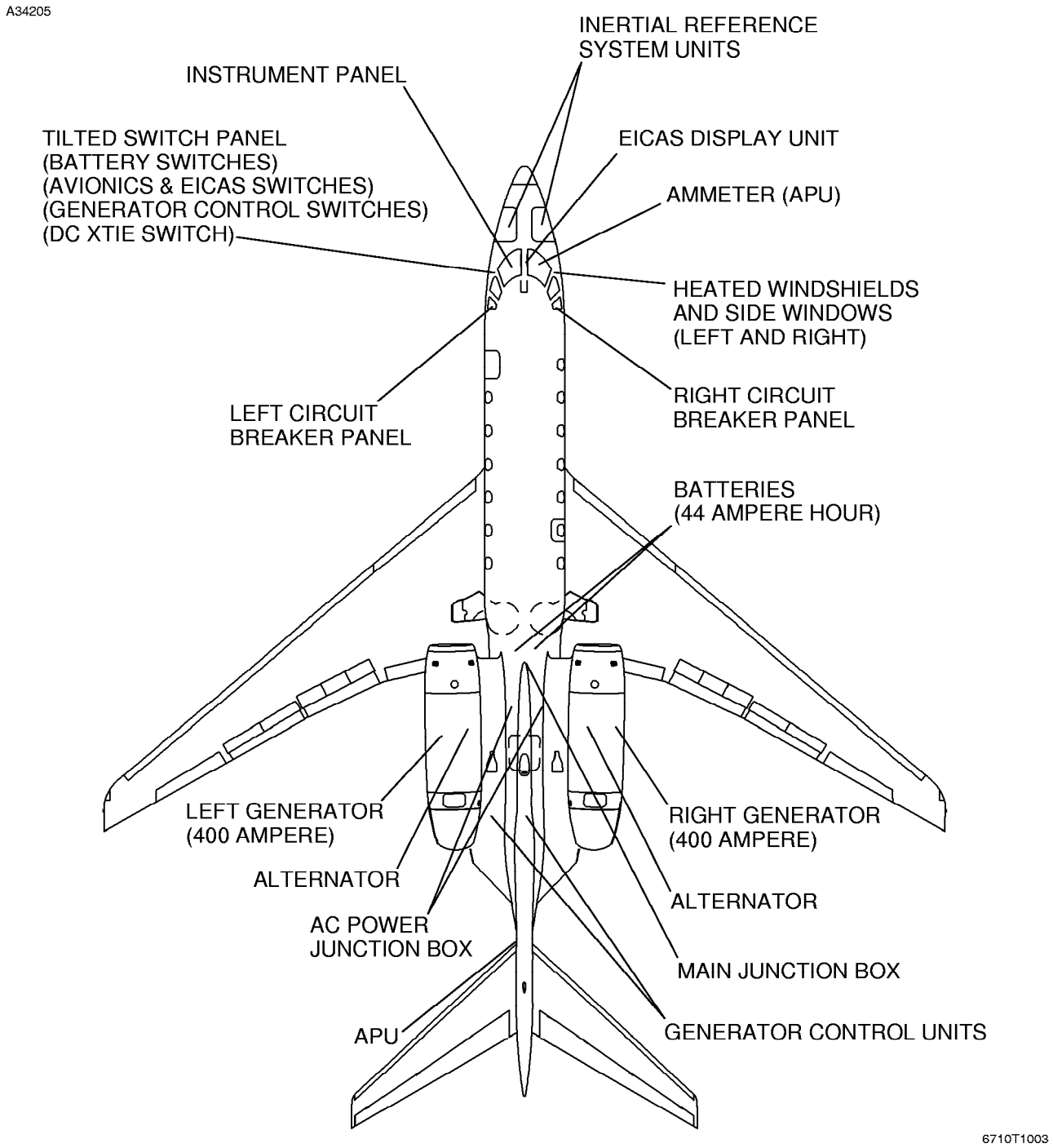


Figure 2-37

BATTERIES

Two 44 ampere-hour nickel-cadmium batteries are connected directly to their respective left and right battery busses, which are connected, through isolation relays, to the emergency battery bus.

Battery power is selected by the BATT 1 and BATT 2 switches. Battery 1 is located in the left aft fuselage fairing and Battery 2 is located in the right aft fuselage fairing. They are vented overboard through tubes located on the belly beneath the batteries. Selecting BATT 1 or BATT 2 supplies battery power to the respective LH and RH battery busses and also allows battery charging. The batteries are a secondary source of direct current (DC) power that is used to provide power during the engine starting sequence and to provide power to the emergency battery bus in the event of a dual generator failure. With no generator on line and the BUS 1 and BUS 2 switches set to NORM, the batteries will provide power to all aircraft systems, except interior master, for approximately 14 minutes. Selecting both bus switches to EMER within 5 minutes after loss of generator power will allow the battery busses to supply power for approximately 60 minutes to the emergency bus equipment.

The main batteries are supplemented by a 2.5 ampere-hour, 28 VDC lead-acid power pack, located in the airplane nose compartment, which provides emergency electrical power to the standby instruments.

External power is applied to the external power bus when the ground power unit (GPU) is connected to the airplane and the GPU is started. When the external power relay is closed by placing the EXT PWR switch to EXT PWR (ON) the external power is applied to the crossfeed bus, and is available to the complete airplane electrical system. Ground external power will automatically be disconnected by the external power relay when a generator switch is placed to the GEN position after an engine has been started.

Both airplane batteries will charge from the ground power unit. With either battery switch in BATT and the ground power unit connected and in operation, external power will be applied to the airplane busses and the respective battery will be charged. The ground power unit should have the voltage adjusted to maintain 28.5 volts, +0.5 or -0.5 volts.

Nickel cadmium battery temperature should remain below 60°C (140°F). A thermal monitoring system is installed as an integral part of each battery. The system provides continual monitoring of the internal thermal condition of the batteries and will warn the pilot if battery overheat condition exists. If a temperature of 62.8°C or greater is sensed, it will illuminate a flashing red BATT 1-2 O'TEMP annunciation in the crew alerting system (CAS) area of the EICAS display unit. The master warning will also flash, and a double chime will sound. If the battery temperature continues to climb to 71°C, or if the second battery were to also exceed 62.8°C, the system will re-activate and will annunciate again. Refer to the Emergency Procedures section of the FAA Approved Airplane Flight Manual, or to Section Three of this manual for specific action to be taken when a battery overheat condition exists. Lead-acid batteries do not have temperature monitoring; therefore, these procedures do not apply.

If the ELEC bezel button on the EICAS display unit (DU) is pressed, the electrical system can be continuously monitored on the one section (page) of the DU that is selectable by the pilots. The battery temperature can be monitored digitally as well as the generator voltage, battery voltage, and DC amperage. A battery temperature of greater than 20°C to 62.7°C will be digitally annunciated in green. A temperature of less than 20°C will be annunciated in amber. A temperature of 62.8°C will be annunciated in red; if the temperature rises above 71°C the same message will be triggered again.

The batteries must be serviced per the maintenance manual when the battery temperature exceeds 60°C (140°F).

The OFF position of the BATT switches disconnects battery power from all the electrical busses except the hot battery bus. Selection of BATT 1 or BATT 2 supplies power to the emergency bus, and through the emergency isolation relay, to the rest of the airplane busses.

When the battery switch is in the OFF position, certain electrical equipment will still operate, such as BATT 1 and BATT 2 sensing, certain forward and aft compartment lights, EICAS emergency power, and emergency exit lights, since power is taken directly from the hot battery bus.

INTERIOR MASTER SWITCH

A covered interior master switch, located just aft of the right circuit breaker panel, can be used to electrically isolate the cabin area, shutting off all power to it except emergency and exit lighting. Its primary purpose is to shut off power to the cabin in case of a cabin electrical fire, or of a generator failure. This amount of reduction will lower the electrical load to the point that a single generator will carry it, although a single generator will normally carry the regular electrical load of the airplane.

STANDBY POWER SWITCH

The STBY PWR switch controls power distribution from the standby battery, located in the nose compartment, to the standby equipment bus. This switch must be selected to ON for the standby equipment to operate. Electrical power will normally be supplied to the standby equipment bus from the emergency bus if either airplane battery, generator or external power is on-line. After loss of battery, generator and/or external power, with the switch ON, power will be drawn from the standby battery pack. This will be indicated by an amber light adjacent to the switch. In the OFF position, the standby equipment bus is not powered, regardless of other airplane electrical configuration. The TEST position permits the crew to test the lead-acid standby battery pack.

NOTE

Following loss of electrical power, the standby equipment battery pack will continue to supply electrical power to the following equipment for 60 minutes: standby altimeter/airspeed vibrator, standby attitude indicator, standby engine indicators and standby instrument lighting. If the airplane is on the ground, turning the standby power switch to OFF will turn off IRS power.

EMERGENCY LIGHTING BATTERIES

Two 1.5 ampere-hour, 18-cell, nickel-cadmium battery packs are installed in the airplane; one in the pilot's console and one in the left side of the raised aisle at the aft end of the cabin. The battery packs are connected to the airplane charging system and are being charged any time the main airplane power is on. An emergency lighting switch (EMERG LT ARM/ON/OFF), located at the left end of the pilot's tilt panel, is used to control the emergency lighting system and the emergency battery packs. The ON position directs power to the emergency lighting system from the main batteries/generators. The ARM position will provide power to the emergency lighting system from the emergency battery packs in the event the airplane should experience a 5G longitudinal deceleration, or if there is a loss of normal airplane power. The OFF position disables the emergency lighting system and the emergency battery packs. An amber warning light, located adjacent to the EMER LT switch, will illuminate when power is on the airplane, signifying the emergency lighting is off and that the EMER LT switch should be placed to the ARM position.

The battery packs provide the power for the cabin emergency lights, selected reading lights, cabin exit signs, and escape path lighting. One pack is dedicated to the cockpit and forward cabin while the second pack powers the mid and aft cabin emergency lighting. The batteries also provide power for the SEAT BELT and NO SMOKING illuminated signs.

AUXILIARY POWER UNIT

An auxiliary power unit (APU) is mounted in the stinger of the airplane. The APU turbine powers a DC generator which has a rated capacity of 200 amperes in flight and 300 amperes on the ground. It may be started and used up to an altitude of 31,000 feet. It may also be used to provide engine starting air, auxiliary bleed air for the air conditioning system and door seal inflation, and therefore makes the airplane largely self sustaining on the ground.

Engine power for the APU is provided by a simple turbine using a single-stage centrifugal compressor and a single-stage radial inflow turbine. Turbine maximum rated speed is 58,737 RPM with a maximum continuous exhaust gas temperature of 665°C; a temperature of 718°C constitutes an overtemperature condition. Maximum start temperature is 973°C.

APU electrical power is controlled by a generator control unit (GCU) which is mounted in the tailcone aft of the cabin pressure bulkhead, with the engine generator GCUs. Fuel for the APU operation is provided from the left wing fuel hopper by the left fuel boost pump. The fuel boost pump is started, if not already running, any time the APU is put into operation. The APU is so designed that shaft loads (electricity generation) will have priority over an air bleed load. If the APU load is excessive, with air bleed and generator output being used, the amount of air output will be reduced by the load control valve (LCV) in order to maintain the APU load within its capacity.

The APU control panel is mounted in the cockpit, forward of the right circuit breaker panel. APU RELAY ENGAGED and APU FAIL annunciator lights are mounted on the right meter panel. A logic control module, which provides an interface for the aircraft mounted controls and the APU digital engine sequencing unit (ESU), is located in the right main power junction box. The ESU is essentially a microprocessor that has been programmed to control and initiate a series of events necessary for satisfactory operation of the auxiliary power unit. Functions which are controlled by this logic are: auxiliary power unit start and sequence to operation, malfunction indication and automatic shutdown during start, and malfunction indication and shutdown during auxiliary power unit operation. The logic also sequences itself to restart condition on re-application of power to the system after a shutdown.

The APU MASTER ON/OFF switch controls electrical power to the APU. The TEST/PUSH switch causes the APU to repeat its internal tests. The APU/START/NORM/STOP switch is spring loaded to NORM and is used to start or shut down the APU. The APU STARTER DISENGAGE/NORMAL switch is spring loaded to NORMAL and is used to disengage the APU starter if it does not disengage normally. A READY TO LOAD annunciator will illuminate when the APU has started and is ready for the generator to be put on-line. The BLEED AIR MAX COOL/ON/OFF switch controls the APU bleed air. The ON position is used for normal environmental bleed air extraction and for cooling. The maximum flow valve bypasses the bi-level flow control valves and, therefore, will not shut off environmental air during engine start. The APU MAX COOL bleed air is not approved for engine start; the start pressure could be low, which would result in a hung start.

On starting, when the engine speed reaches approximately ten percent, the APU electronic control box (ECB) completes a circuit to the fuel shutoff valve, ignition unit, and surge control valve. The fuel shutoff valve is then energized open to permit fuel flow to the fuel nozzle assemblies, and the ignition fires the fuel-air charge in the combustion chamber. The surge control valve is energized open to permit reaction to compressor discharge pressure. When engine speed reaches 50 percent, the controller provides a signal for starter disengagement. At approximately 60 percent RPM compressor discharge pressure opens the surge control valve and dumps a small percentage of compressor discharge air overboard, preventing engine surge. At 99 percent the controller opens the circuits to the ignition unit, and acceleration continues to the no-load govern speed point. At governed engine speed the turbine discharge temperature is automatically regulated to within established limits by the load control valve.

NOTE

Refer to the FAA Approved Airplane Flight Manual for Auxiliary Power Unit Operating Limitations and Procedures.

Fire protection is provided by a fire detector system and a fire extinguisher system. An associated warning light/switch (APU FIRE) located on the copilot's instrument panel will illuminate in case of an APU fire. An aural tone will also sound. The fire detector sensor is of the continuous loop gas filled type, which is routed around the APU at strategic points, and is connected to an alarm responder and to an integrity responder. A dedicated fire bottle is installed below the APU. The fire bottle is fired by lifting the cover on the illuminated APU FIRE switch/light and pressing the switch. The fire extinguishing system does not discharge automatically.

The APU is designed to handle full cabin loads prior to main engine starts. The APU is started electrically and can be started and operated up to a maximum altitude of 31,000 feet. It can be paralleled with the engine driven generators. Parallel operation is considered to be a variance of ten percent of the amount of the maximum rated amperage; therefore, a load variation of 40 amperes is acceptable. The APU ESU stores APU system fault data in a nonvolatile memory and retains it from the last five APU cycles. If the APU is on-line or operating in parallel with the engine generators, the automatic load shedding function of the electrical system is inhibited. The APU directly feeds the crossfeed/emergency bus. At least one battery switch must be on to operate the APU.

An APU shutdown switch is located inside the tailcone access door on the right aft side of the door frame, to permit APU shutdown without requiring cockpit access.

AVIONICS POWER

Power to the avionics is controlled by an AVIONICS POWER ON/OFF switch located on the AVIONICS POWER control panel, which is immediately to the right of the DC POWER control panel. When in the ON position all avionics equipment receives power. An EICAS/OFF switch, just to the right of the ON/OFF switch, supplies power only to the engine instrument and crew alerting system (EICAS) bus (partial power). Only the left multifunction display (MFD) and EICAS system will then be powered. This switch allows the essential EICAS equipment to be powered for maintenance, and for other functions which require only engine information or EICAS readings, thereby saving power-up cycles and operating time on the complete EICAS system and the electronic flight instrument system (EFIS). The EICAS, EFIS, and other avionics systems of the Model 750 are direct current (DC), and therefore system inverters are not required.

EXTERNAL POWER SWITCH

An external power switch (EXT PWR/OFF) is mounted on the DC power control panel. Its function is to control the power from a ground power unit (GPU). In the EXT PWR position, external power is applied to the airplane busses, and overvoltage and undervoltage protection is provided, but the batteries will not charge unless the battery switch(es) is/are turned on.

WINDSHIELD ALTERNATING CURRENT (AC) ELECTRICAL ANTI-ICE SYSTEM

Windshield and forward cockpit side window anti-icing is provided by two 3.0 kilovolt-ampere alternators, one of which is mounted on the accessory drive case of each engine. They deliver three-phase alternating current (AC) power. The speed of the alternators is not governed, so their speed varies with engine speed, which causes the current cycle rate to vary. The cycle variations have no effect on the windshield heaters.

The windshields are divided into three heating sections: power from the left alternator is applied to the left outboard and center sections of the left windshield, to the right windshield inboard section, and to the right side window.

Power from the right alternator is applied to the right outboard and center sections of the right windshield, to the inboard section of the left windshield, and to the left side window.

Control switches for the system are located on the ANTI-ICE control panel which is located to the right of the center pedestal on the tilt panel (WINDSHIELD ANTI-ICE LH/RH). The three position toggle switches are labeled OFF/HT ON/O'RIDE. Placing the switches to HT ON (center position) will initiate a ramp heating function which will gradually warm the windshield to operating temperature. If anti-icing is needed immediately, such as when unexpected icing is encountered, the switches may be placed immediately to O'RIDE position and the ramp heating function will be bypassed. The switches are spring loaded out of the O'RIDE position and will automatically be positioned back to ON. The HT ON position should be used for normal operation.

Three integral temperature sensors are incorporated in each windshield assembly. One sensor is used as a primary sensor, one as a secondary or backup sensor, and the third is a spare. There is a control unit for each windshield side, mounted in the respective pilot or copilot side console. The control units monitor the windshield temperature through the primary sensor. If the primary sensor should develop a fault, the system will revert automatically to the secondary sensor, and temperature monitoring will not be interrupted. The left and right main windshields are regulated to a temperature of 110°F.

The engine and crew alerting system (EICAS) constantly monitors the windshield heat and will alert the crew of a fault or overtemperature condition. An amber EICAS message, WSHLD O'TEMP L-R will illuminate, and electric power to the windshield will automatically be cut off if windshield surface temperature exceeds 140°F. Power will be restored and an amber message will extinguish when the windshield surface temperature drops below 115°F. Another amber EICAS message, WSHLD HEAT INOP L-R, will illuminate if the electrical windshield controller is unable to supply current to the heater elements. When any of the above messages appear, a chime will sound.

The windshield anti-ice must be turned ON any time icing is detected. It may be operated full time from engine start to shutdown and will improve cockpit comfort at high altitude, particularly at night. Windshield anti-ice is also required for defogging the windshield.

CIRCUIT BREAKERS

Push-to-reset, pull-off type circuit breakers with the amperage rating marked on each breaker, are installed in panels located on both sides of the cockpit. The panels are readily accessible to the flight crew during flight. Panel configurations may vary from airplane to airplane due to differences in installed equipment; therefore, the panels shown are typical installations.

Additional circuit breakers, to which flight crew access is not essential, are located in the tailcone junction boxes.

CIRCUIT BREAKER PANEL

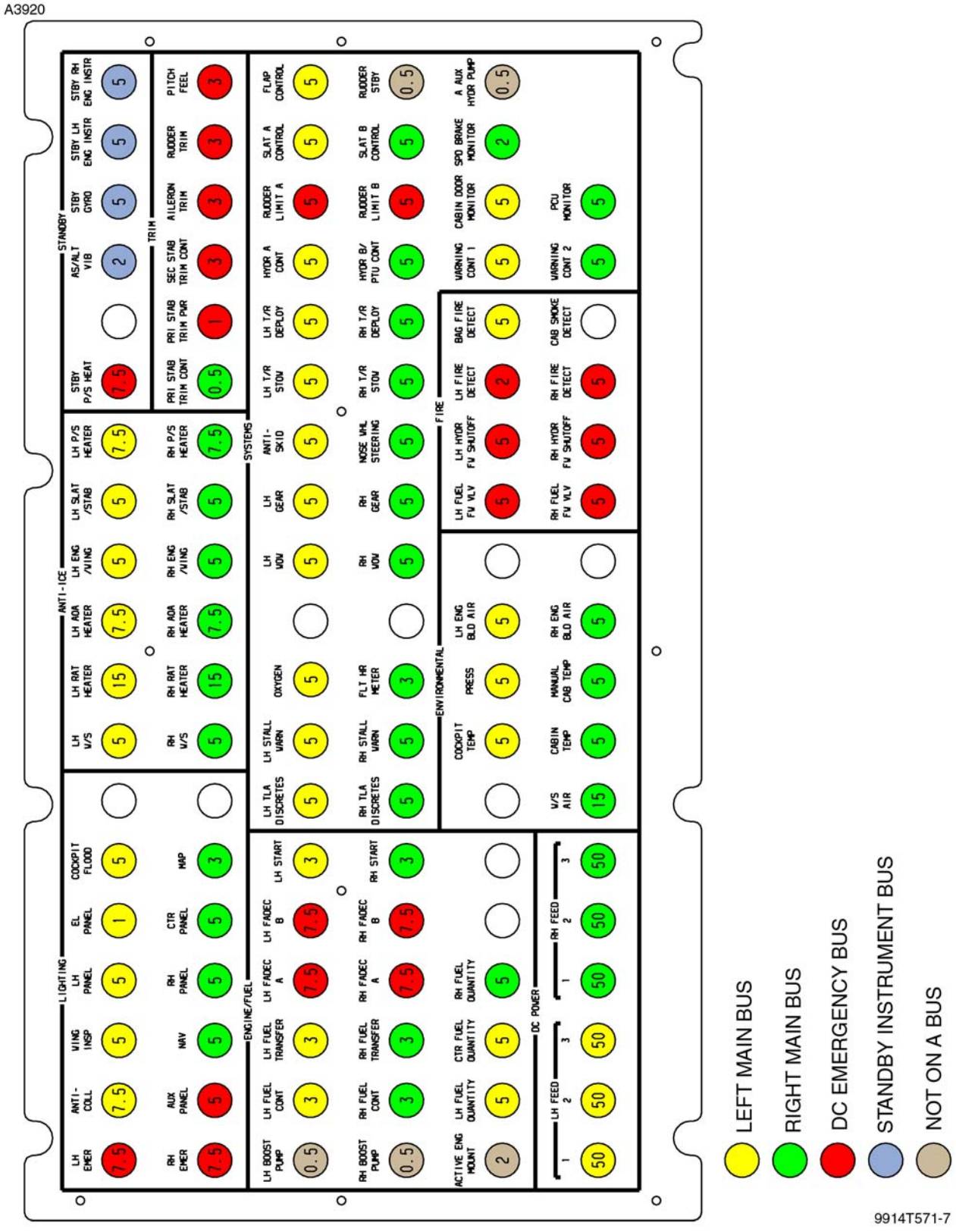


Figure 2-39 (Sheet 1 of 2)

CIRCUIT BREAKER PANEL

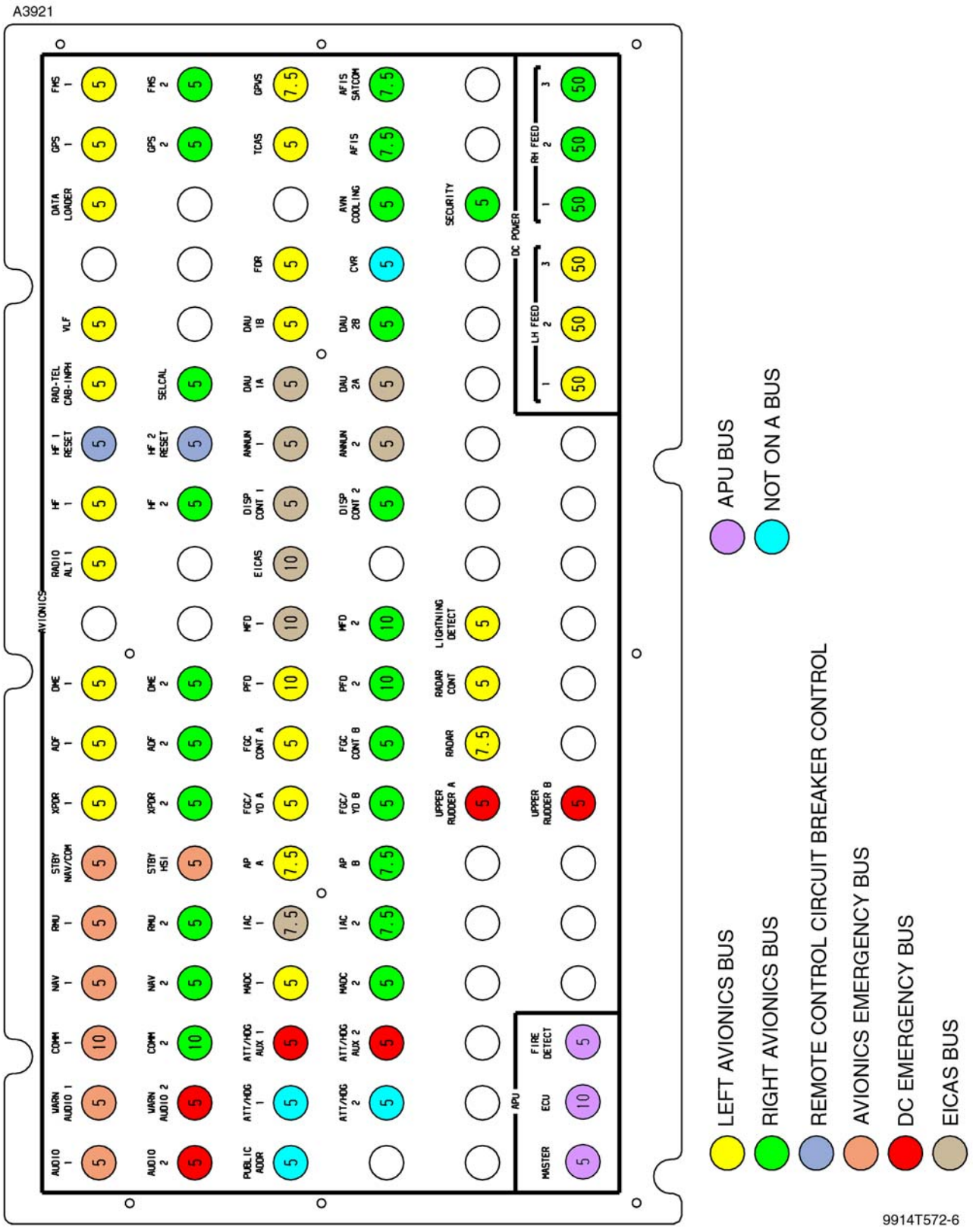


Figure 2-39 (Sheet 2)