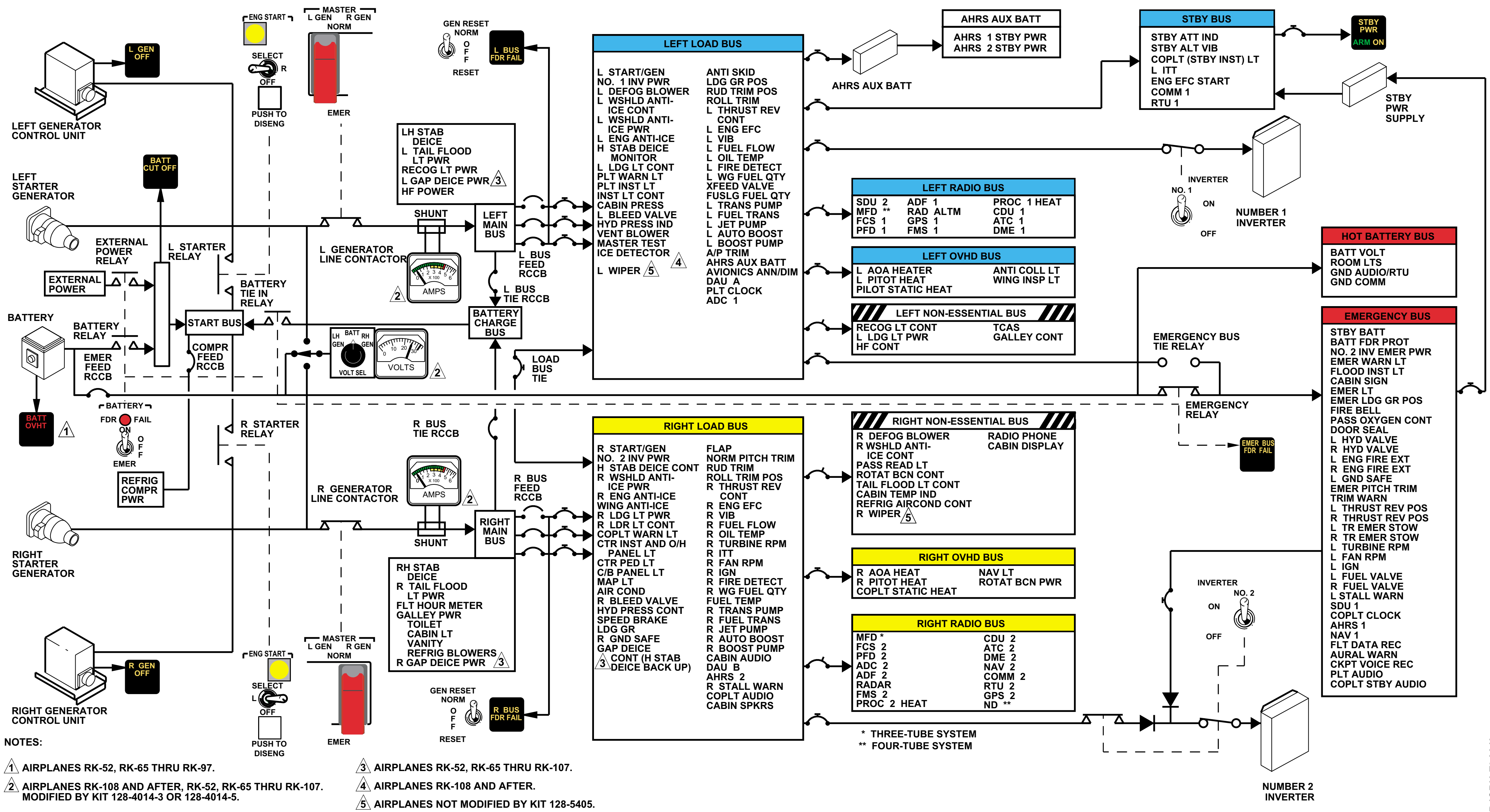
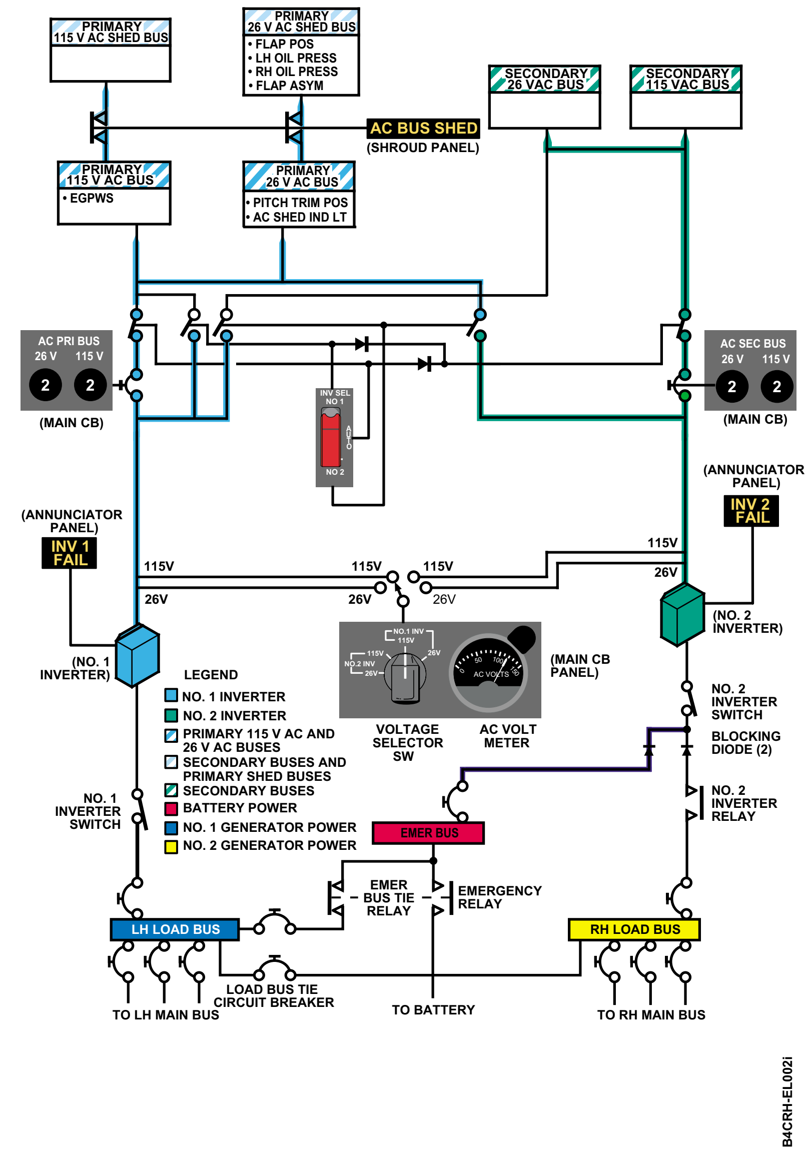
DC Electrical System Diagram



NOTES:

1. AIRPLANES RK-52, RK-65 THRU RK-97.
2. AIRPLANES RK-108 AND AFTER, RK-52, RK-65 THRU RK-107. MODIFIED BY KIT 128-4014-3 OR 128-4014-5.
3. AIRPLANES RK-52, RK-65 THRU RK-107.
4. AIRPLANES RK-108 AND AFTER.
5. AIRPLANES NOT MODIFIED BY KIT 128-5405.

AC Electrical System Diagram



DC Electrical System

Electrical power to the airplane is normally supplied by two 28.5 V DC, 400-ampere engine-driven starter-generators. A 24-volt, 40-ampere-hour lead-acid battery or a 24-volt, 36-ampere-hour nickel-cadmium battery (**on airplanes RK-1 thru RK-97**) supplies electrical power for engine starting and emergency requirements. A 28 V DC external power receptacle located on the right side of the aft fuselage is provided for connection of an external power unit.

Nicad Batteries (RK-1 thru RK-97 only)

The battery system includes a battery, a switch, a battery feeder protection unit, a temperature warning system, and indicating lights. The system provides a secondary source of DC electrical power for the airplane. It also supplies power for engine start or the emergency buses.

The system is equipped with one nickel-cadmium battery, which is a 20-cell unit rated at 24 V DC at 36 ampere-hours. The battery is housed in a steel case that is installed in the aft fuselage compartment. It is the power source for the battery system.

The BATTERY switch, located on the overhead panel, is a toggle-type with three positions: ON, OFF, and EMER. During normal operation, the BATTERY switch is in the ON position and the battery relay and battery tie-in relay remain energized. Placing the BATTERY switch to the EMER position will drop off the battery relay and battery tie-in relay, isolating the battery from the start bus. The battery will supply DC power only to the emergency bus and the BATT CUT OFF annunciator, located on the annunciator panel, will illuminate. The amber BATT CUT OFF annunciator also indicates that the bus connecting the battery relay and the external power relay has lost electrical power.

A battery feeder protection unit is provided to detect a ground fault in the secondary power feeder line. A FDR FAIL light normally comes on when the battery feeder has failed. This light also illuminates when either the battery feeder protection circuit breaker or the EMER FEED RCCB trips.

The battery temperature warning system consists of a red BATT OVHT annunciator light on master warning panel. The warning system is calibrated from 100º to 190ºF. The airplane master test switch may be used at any time to test this system.

Lead-Acid Batteries

One 24-volt, 40-ampere-hour lead-acid battery is used as a secondary source of DC electrical power in the airplane. It also supplies power for engine start or the emergency buses.

The battery power components are the battery relay, battery switch, battery feeder protection unit, current transformers, control relays, and indicating lights. A battery feeder protection subsystem is provided to detect a ground fault that may occur in the secondary power (battery and external power) feeder line between the main junction box and secondary power sources. If a ground fault occurs, the battery feeder protection unit illuminates the BATTERY FDR FAIL light, located on the overhead switch panel, and drops off the battery and battery tie-in relays. The BATT CUT OFF annunciator, located on the annunciator panel, will illuminate when the bus connecting the battery relay and external power relay loses DC electrical power.

The BATTERY switch, located on the overhead panel, is a toggle-type with three positions: ON, OFF, and EMER. During normal operation, the BATTERY switch is in the ON position and the battery relay and battery tie-in relay remain energized. Placing the BATTERY switch to the EMER position will drop off the battery relay and battery tie-in relay, isolating the battery from the start bus. The battery will supply DC power only to the emergency bus and the BATT CUT OFF annunciator, located on the annunciator panel, will illuminate.

DC Generation

Primary electrical power is generated by two 28.5 V DC 400-ampere engine-driven starter-generators. These generators are also used as starter motors for engine starting. The generator power is distributed by two main buses that are paralleled through two remote control circuit breakers (RCCBs) and the battery charge bus. A generator control unit for each generator utilizes solid state, integrated circuits and amplifiers to provide control in both starting and generating modes.

A function of the generator control unit is to monitor for a generator feeder wire ground fault. Should this occur, generator field excitation is disconnected by the generator control unit, resulting in generator output voltage decay to zero. The generator is also disconnected from the main bus. The system may be tested during engine ground run by selecting the L or R GEN GND FAIL position of the master test switch on the overhead switch panel. This simulated ground fault will cause the illumination of the L or R GEN OFF annunciator and GO light, while the DC voltmeter will indicate zero. Upon completion of the system test, reset the appropriate generator by placing the GEN RESET switch to the RESET position for approximately one second.

The L and R MASTER GEN switches on the overhead panel, have a NORM position and an EMER position. When the guard is closed, the toggle lever is in the NORM position. Placing both switches to the EMER position removes all electrical power. The GEN RESET switches have a NORM, OFF or RESET position. With the switches in the NORM position, generator control is automatic. Placing the switches to the OFF position will isolate the generators from the main buses. The RESET position is momentary and resets a generator that has tripped as a result of an over voltage, feeder fault, or activation of either ENG FIRE PUSH switch.

Two DC ammeters (LH and RH), installed below the overhead switch panel, display the load current supplied by the respective generator. A DC voltmeter indicates the voltage supplied by the left generator, right generator or battery. The voltage source is selected by the three-position VOLT SEL switch which is placarded LH GEN-BAT-RH GEN.

Two amber generator off annunciators, L GEN OFF and R GEN OFF are located on the annunciator panel. These annunciators illuminate when the respective generator relay opens, isolating the generator from the main bus.

AC Power System

Two static inverters mounted in the nose electronic compartment supply AC power. These inverters are designated No. 1 and No. 2 and are controlled by INVERTER switches located on the overhead switch panel. The inverters are designed to produce 115 volts and 26 volts 400 Hz AC, with apparent power rating of 50 volt-amperes each. The inverter operates when its respective INVERTER switch is placed to the ON position. DC power from the left load bus is applied directly to the No. 1 inverter. Normally, the No. 2 inverter is powered from the right load bus through the No. 2 inverter relay. If DC power on the right load bus fails, the No. 2 inverter relay is automatically de-energized and the No. 2 inverter is powered from the emergency bus.

External Power System

The DC external power system consists of an external power receptacle and an external power relay. The external power system components provide a means of connecting 28 V DC external power to the airplane's electrical system. Connecting the 28 V DC external power source with the BATTERY switch ON energizes the external power relay to supply the external power source to the start bus. The battery tie-in relay is also energized and the external power source is connected to the battery charge bus and the left and right main buses. Any time a generator comes on line, the external power relay is de-energized and the ground power unit is dropped off line.

Standby Power System

The standby power system, which is mounted in the nose electronics compartment, supplies emergency power to its loads for a minimum of 30 minutes. The system provides power to the following:

- standby attitude indicator and lighting,
- standby altimeter and lighting,
- standby magnetic compass lighting,
- left ITT indicator and lighting,
- standby airspeed indicator lighting,
- No. 1 COMM, and
- No. 1 RTU

This power is provided when normal and emergency power has failed. An additional 9 minutes of gyro data is available after the gyro flags during spin-down.

Electrical Load Distribution

AC Power Distribution

Six AC buses are provided for AC power distribution: three 115 V AC (primary, primary shed, and secondary) and three 26 V AC (secondary). All electrical subsystems utilizing AC power are connected to one of these buses. The 115 V AC and 26 V AC of each inverter are coupled as a pair and supply either the primary AC buses or secondary AC buses through typical circuits. These circuits determine the relation between the inverter and the buses. Interchange of inverters is performed by these circuits either automatically or manually.

An INV SEL switch on the main circuit breaker panel is installed to change the power source of the primary AC buses. Selecting No. 1 or No. 2 on the switch will cause the primary buses to be powered by the selected inverter. If either inverter fails, the operational inverter will automatically supply power to the four primary buses. The secondary buses will lose power.

AC power requirements are automatically limited during emergency operations by the load shedding circuits. If the No. 1 inverter loses power and the No. 2 inverter is powered by the emergency bus (battery switch in emergency), the 115 V AC shed and 26 V AC shed circuits are opened, the two primary shed buses lose power, and the AC BUS SHED annunciator on the shroud panel illuminates.

The voltage select switch, mounted on the aft circuit breaker panel, transfers the inverter outputs to the voltmeter. The AC voltmeter continuously indicates any one of four voltages corresponding to the position of the voltage select switch.

The INV 1 FAIL and INV 2 FAIL annunciators on the annunciator panel will illuminate when the output power of the respective inverter fails or the output voltage or frequency is out of the allowable range.

DC Power Distribution System

The DC electrical power distribution system is divided into four subsystems: power source distribution, primary power distribution, secondary power (load) distribution, and emergency power distribution.

Power source distribution includes four buses in the main junction box (left and right main, battery charge, and start bus). All DC power sources are connected to respective buses. The DC power is distributed from the main junction box to the electrical loads directly or through the circuit breaker panels located in the cockpit. During normal operation, the four buses are connected to each other and can be energized by any power supply.

Primary power distribution provides connection between the main buses and the respective load buses. The system consists of two identical (left and right) circuits containing three power feeders. The feeders are protected by circuit breakers at each end. During normal operation, two parallel feeders of each circuit are used to supply electrical power from the main bus to the load bus. The No. 3 feeder is provided to backup the No. 1 or No. 2 feeder in case of failure. In the event one or two feeders fail, the L or R BUS FDR FAIL annunciator will illuminate. The annunciator will extinguish if the third feeder fails.

Secondary power distribution consists of eight buses: left and right load buses, left and right nonessential buses, left and right overhead buses, and left and right radio buses.

- The LOAD BUS TIE circuit breaker, located on the main circuit breaker panel (DC PWR group), provides the connection between the left and right load buses.
- Two toggle-switch-type circuit breakers located on the main circuit breaker panel are marked NON ESSN BUS and have two positions: LH (RH), and OFF. With the circuit breakers in the LH and RH positions, the left and right non-essential buses will connect to the left and right load buses. The OFF position isolates the non-essential buses from the load buses.

- Two push-pull-type circuit breakers marked OVHD LH and OVHD RH are located on the main circuit breaker panel. The left and right overhead buses are connected to and/or isolated from the left and right load buses respectively by these circuit breakers.
- Two toggle-switch-type circuit breakers located on the radio master circuit breaker panel are placarded RADIO MASTER-L-R-OFF. With the circuit breakers in the L and R positions, the left and right radio buses will connect to the left and right load buses. The OFF position isolates the radio master bus from the load bus. The radio master buses supply electrical power to the avionics equipment.

Emergency power distribution consists of the emergency bus, emergency feeder remote controlled circuit breaker (RCCB), and associated relays and circuit breakers. The emergency bus normally receives power through the emergency feeder RCCB. If the emergency feeder RCCB faults, the EMER BUS FDR FAIL annunciator, located on the annunciator panel, illuminates, the emergency relay opens and the emergency bus receives power from the left load bus. During a starter assisted air start, the emergency bus will also be powered by the left load bus. With the BATTERY switch in emergency, the battery will power only the emergency bus through the emergency feeder.

Remote Control Circuit Breakers

RCCBs are used for circuit protection against high current flow and are controlled by a circuit breaker on the main circuit-breaker panel, located in the cockpit. The RCCB control circuit breakers are labeled as follows:

- LH BUS FDR NO. 1
- LH BUS FDR NO. 2
- LH BUS FDR NO. 3
- RH BUS FDR NO. 1
- RH BUS FDR NO. 2
- RH BUS FDR NO. 3

During normal operation, two parallel feeders supply power from the main bus to the load bus. The third remains in standby. If one of the bus fed RCCBs trips, the respective amber L or R BUS FDR FAIL annunciator comes on.

The load bus feeder circuit breakers are also located on the main panel and are labeled as follows:

- LH BUS NO. 1
- LH BUS NO. 2
- LH BUS NO. 3
- RH BUS NO. 1
- RH BUS NO. 2
- RH BUS NO. 3

Circuit Breaker Panels

All associated circuit breakers are located on the main circuit-breaker panel located on the pilot's left console.

Each primary power distribution system (left and right) has two active power leads and one standby power lead between the main bus and the load bus. Each lead has an RCCB at the main bus end and a push-pull type circuit breaker at the load bus end. The secondary power distribution system (left and right) is protected by either a toggle-switch type or a push-pull type circuit breaker.

The nonessential buses are protected by the toggle-switch type circuit breaker located on the main circuit-breaker panel. This type of circuit breaker has two positions: LH or RH and OFF. When the circuit breaker is placed in the LH or RH position, the respective nonessential bus connects to its load bus. The OFF position isolates the respective nonessential bus from the load bus.

The radio buses are protected by toggle-switch type circuit breakers also. They are located just forward of the nonessential circuit breakers. These breakers have two positions: L or R and OFF. The radio buses are depowered with the breakers in the OFF position.

The left and right overhead buses are protected by push-pull type circuit breakers, also located on the main circuit-breaker panel. These devices, labelled OVHD LH and OVHD RH, allow their respective buses to be powered when closed and isolated when opened.

Four bus-tie circuit breakers are also located on the main circuit breaker panel. Two of the circuit breakers, labelled LH BUS TIE and RH BUS TIE, are the push-pull type. They control their respective bus-tie RCCBs that connect their respective bus to the battery charge bus, thus tying the two main buses together. The other two circuit breakers are also the push-pull type. One is labelled LOAD BUS TIE, and it ties the left and right load buses together. The last one is labelled EMER BUS TIE and is left in the closed position during normal operation. In the closed position, the EMER BUS TIE circuit breaker supplies power from the left load bus to the emergency bus via the emergency bus-tie relay when the emergency relay opens.

Electrical and Electronic Junction Boxes

The electrical and electronic junction boxes include the main, the LH and RH control, radio junction boxes, junction, relay and the resistor and relay panels. The main junction box is mounted in the upper aft tailcone area; the LH control junction box is mounted on the cabin sidewall next to the generator control units; and the RH control junction box is on the RH cabin side-wall forward of the aft pressure bulkhead. The resistor and relay panels include both electrical and electronic components and are located on the LH side of the cockpit. The relay panels are in the center pedestal and the LH side panel and the battery relay panel is incorporated into the main junction box. Signals from individual components and systems that are used to control or supply information to other components or systems are switched in the radio junction box in the nose compartment of the airplane.

Lighting System

The aircraft incorporates three lighting systems: exterior lighting, interior lighting and emergency lighting. The exterior lighting system includes landing, navigation and recognition lights. The interior lights include lights used in the cockpit and cabin areas as well as the cargo and service areas. The emergency lighting system includes all emergency lighting inside the airplanes as well as emergency cabin lights.

Interior Lighting

The interior lighting system consists of various combinations of lighting throughout the cockpit, cabin, and aft fuselage baggage compartment. Ceiling mounted fluorescent lights installed in the cabin provide general area lighting controlled by the cabin light switch in the cockpit and the entrance light switch near the door. A switch inside the compartment door controls an aft fuselage baggage compartment light. Individually controlled reading lights are installed above each passenger seat and above the card tables in the cabin.

Cabin passenger sign lights are installed in the cabin where they can be easily seen from all seating locations. A three-position CABIN SIGN switch on the overhead panel controls them. The switch's SAFETY position illuminates the NO SMOKING and FASTEN SEAT BELT legends while the FSB position illuminates only the FASTEN SEAT BELT legend.

Instrument/circuit breaker panel lighting is divided into five groups: pilot's instrument panel, copilot's instrument panel, center instrument and overhead panels, center pedestal, and circuit breaker panels. Each group is powered by an individual power supply that provides 5 V DC for instrument lights and 115 V AC for the electroluminescent panels. The INTEG switch located in the INST LIGHT group on the overhead panel controls lighting. Light intensity may be varied for individual preference using the PLT INST LT, COPLT INST LT, CTR INST and O/H PNL, and CENTER PED LT rheostats located on the overhead panel, and the C/B PNL rheostat located on the aft circuit breaker panel.

Four instrument panel floodlights mounted in the shroud provide additional lighting. The FLOOD switch in the INST LIGHT group on the overhead panel controls them. Map lights are located in the forward and outboard sections of the overhead panel. They are individually illuminated using the MAP LT switch located immediately above the lights. Intensity is controlled by dimming rheostats located adjacent to the lights.

Additional cockpit lighting is provided by lap/map lights mounted on the pilot’s and copilot's side panels. Dimming controls are located adjacent to the lights to adjust the light intensity.

The cabin ENTRY LIGHTS switch is mounted just aft of the cabin entrance door. The switch, which incorporates a timer, supplies power to the cabin incandescent lights and the INTERIOR LT COCKPIT switch on the overhead switch panel.

Either the cockpit INTERIOR LT CABIN switch or the VIP panel INDIRECT LIGHTS ON/OFF switch, controls the cabin indirect lighting. The illumination level can only be controlled by the VIP panel INDIRECT (increase/decrease) switch.

Exterior Lighting

The exterior lighting system consists of navigation lights, anticollision lights, a wing inspection light (right light optional), landing lights, rotating beacon, forward recognition light, and optional tail floodlights. Switches located on the overhead switch panel individually control all the exterior lights.

Navigation lights are installed on the wing tips and the top rearmost section of the vertical stabilizer. Anti-collision lights are installed on the left and right wing tips and on the rearmost section of the fuselage. These lights generate white flashes at 50 to 60 cycles per minute.

The wing inspection light is installed on the left side of the fuselage, just aft of the entrance door. An optional second light is mounted directly opposite on the right side of the fuselage. These lights are used to inspect for ice formation on the leading edge of the wings during night flight.

Landing lights are installed on both sides of the airplane's nose. They are individually controlled for extension, retraction, and illumination by switches located on the upper right portion of the overhead panel in the LAND LT group. The landing lights will automatically retract when the landing gear handle is moved to the UP position even though the LAND LT switches are in the EXT/ON position. Lights (L and R) aft of the switches and a LDG LT NOT RETRACT annunciator on the shroud panel will illuminate when the landing lights are extended and extinguish upon completion of the retraction cycle. Once extended, the landing lights may be illuminated or extinguished as desired using the two push button switches located immediately forward of the extend/retract switches. These push button switches will illuminate when the landing lights are on and extinguish when they are off. The landing lights become very hot during ground operations, so they should be turned off or retracted as soon as possible after landing.

A rotating beacon is installed on top of the vertical stabilizer and generates red flashes at 80 to 90 cycles per minute. Optional tail floodlights may be installed on both sides of the horizontal stabilizer's lower surface to illuminate the identification markings painted on the vertical stabilizer. These lights should not be turned on while flying in clouds. A recognition light is installed on the top leading edge of the vertical stabilizer. This light provides increased airplane visibility from the front while in flight.

Emergency Lighting

The emergency lighting system consists of an emergency exit sign light, emergency exit outside lights, and emergency cabin lights. An emergency exit sign light is installed above the entrance and escape hatch doors in the cabin. In addition to the lighted exit sign, an emergency outside light is mounted in the escape hatch doorframe to illuminate the outside area around the escape hatch. There is also an emergency outside light mounted near the cabin doorframe to illuminate the outside area around the cabin door.

Two power supplies, one installed under the floor in the forward right hand cabin and one installed in the right hand aft cabin sidewall, contain batteries and supply power to the emergency lights. A guarded EMER LT switch located on the overhead panel controls all emergency lights. This switch, placarded TEST/ON, ARM, and OFF, is positioned to ARM when the guard is closed. When all power is lost, 6 V DC power is supplied to the emergency lights. The power supplies are charged by generator power when the emergency light switch is set in the OFF or ARM position. Charging is stopped and the emergency lights are illuminated by their power supply when the EMER LT switch is set to the TEST/ON position. When the EMER LT switch is placed in the OFF or TEST/ON position, the EMER LT NOT ARM annunciator on the shroud panel illuminates.

With the EMER LT switch positioned to TEST/ON and the BATTERY switch in the ON position, a green light adjacent to the switch will illuminate when the power supply batteries are fully charged.