G550 Electrical System

Diagram showing the electrical system with labels for L IDG, APU GEN, EXT AC, R IDG, L MAIN AC, ESS AC, R MAIN AC, L STANDBY AC, and R STANDBY AC.
- **The Electrical Power System produces:**
  
  - 115 Volts AC is **generated** in order to produce 28 Volts DC via Transformer Rectifier Units (TRU).

  ![Diagram](image)

- **AC** is used for Motors, Heaters, and Chargers. **DC** is used for everything else.

- **Two (2) separate systems/networks**:

  ![Diagram](image)

- **A split bus system prevents a short on one side from affecting the other side.**
- Operative side can power inoperative side

- Power Distribution Buses (PDBs):

- The Electrical System is controlled by two (2) Bus Power Control Units (BPCUs)

- Six (6) Computers (2 BPCUs and 4 GCUs)
AC System

115 VAC is generated by:

L IDG  APU GEN  EXT AC  R IDG  HMG GEN

NORMAL

L MAIN AC  APU GEN  EXT AC  R MAIN AC

L STANDBY AC  ESS AC  R STANDBY AC

EMERGENCY

Open Bus Tie Relay
- DC System

28 VDC is produced by:

L ESS TRU  L MAIN TRU  AUX TRU  R MAIN TRU  R ESS TRU

NORMAL

L ESS TRU  L MAIN TRU  AUX TRU  R MAIN TRU  R ESS TRU

L MAIN DC

L ESS DC

EXT DC

R MAIN DC

GSB

R ESS DC

L MAIN BATT  R MAIN BATT

EMERGENCY
- The electrical power system is controlled by two identical and interchangeable microprocessors called BPCUs

\[
\begin{array}{c|c}
\text{L BPCU} & \text{R BPCU} \\
\end{array}
\]

= The brains

- In charge of power distribution and protection
- Traffic cops and protectors of the buses
- Control and make all logical decisions associated with the electrical power system
- BPCU logic: ESS before MAIN / L before R
- Located in LEER and REER
Fault detected by L BPCU
Bus contactor opened and locked out to protect the bus

L BPCU

---

Notifies the crew via CAS

L AC Power Fail

L AC Reset

Can be reset by the crew via the AC/DC switch if the fault is no longer present

AC/DC = CTRL + ALT + DEL
Resets BPCU
Control the Bus Tie relays which allow operative side to power the inoperative side in the event of a short/fault on one side.
- No Break Power Transfer (NBPT)
  - Controlled by \( L \) BPCU
  - Power Transfer without a momentary interruption
  - Matches the phases of the IDGs and/or APU GEN

- No Break
  - IDG
  - No failure

- Break
  - No IDG and/or Failure

- Failure
  - Ext AC
  - APU GEN
  - GEN
  - Eng
  - Fire Handle pulled
INTEGRATED DRIVE GENERATORS (IDG)

- Two (2) Engine-driven IDGs

- Located on the engine’s accessory gearbox

- IDG < CONSTANT SPEED DRIVE (CSD)
  - Oil-cooled generator (oil is cooled by fan air)
  - Rated at 40 kVA
  - Produces: 115 VAC, 400 Hertz, 3-phase

- CSD converts variable engine speed to constant speed at the generator (12,000 RPM)
- Dispatch with an IDG u/s not permitted due to AFM 015 G550-2016-03 APU SEALANT

- Generator switches:

- Galley buses require:
  - One (1) GEN source on the GROUND
  - Two (2) GEN sources in the AIR
Auxiliary Power Unit (APU) Generator

- The APU provides an auxiliary source of:
  1. Electrical AC power - Ground
  2. Backup Electrical AC power - Air

- The APU can be started with power

- When the APU reaches 99% RPM + two (2) seconds, the APU generator comes online and can power all AC and DC buses

- APU GEN Rated at 40 kVA

  Produces:
  - 115 VAC
  - 400 Hertz
  - 3-phase

- 100% Ground

- Refer to AFM OIS G550-2016-03 APU Sealant for APU inflight operation limitations
Hydraulic Motor Generator

- The Hydraulic Motor Generator (HMG) is a backup AC generator

- The HMG is part of the Standby Electrical Power System

- The HMG is driven by:

- The HMG powers:

  Rated at 10 kVA

  Produces:
  - 115 VAC
  - 400 Hertz
  - 3-phase
- The HMG produces AC power in the event of a dual [L JIG, R JIG] and [APU, GEN] failure.

- The HMG is located in the main landing gear wheel well.

- With the HMG on, the thirty (30) minute limit on the main batteries is no longer a factor.

- The [AUX, TRU] produces DC voltage and will power the [L ESS, DC, R ESS, DC] buses when selected by the crew with a ten (10) second interval between selections.

- Speed brake deployment is OK as long as the handle is moved from stowed to fully extended in three (3) seconds or more.
- HMG operation is permitted only when normal AC power generation is not available.
**Generator Control Units (GCU)**

- GCUs control GEN output (quality assurance) and provide fault protection.

There are 4 GCUs:

- **L IDG GCU**
- **R IDG GCU**
- **APU GEN GCU**
- **HMG GEN GCU**

- **L IDG GCU**
  - **R IDG GCU**
  - **APU GEN GCU**
  - **HMG GEN GCU**

- **If GEN**
  - **Voltage**
  - **Frequency**
  - **Amperage**

- **GCU takes GEN offline**
- **GCU notifies L BPCU**
- **L BPCU**
  - Notifies the crew via CAS
  - **L AC Power Fail**
  - **L Generator Fail**

- **GCU can be reset by cycling associated GEN switch**
Transformer Rectifier Units (TRU)

- TRUs are powered by the buses
- A TRU converts 115 VAC to 28 VDC
- TRUs are located underneath the floor
- **L\text{ ess TRU}** and **L\text{ main TRU}** power their own buses.

- **AUX TRU** will **take over** the duties of a failed **ESS** or **MAIN TRU** using the following priority process:

  1. L\text{ ess DC}
  2. R\text{ ess DC}
  3. L\text{ main DC}
  4. R\text{ main DC}

- TRU load limits (OM 03-02-00):
  - **FWD Cabin**
    - > \text{106°F} \quad \leq \quad 95°F
    - 50% < 100%
  - **AFT Cabin**
    - \text{Single pack}:
      - \leq \text{106°F}
      - 50%
- TRU switches allow opposite bus to power a 
  [MAIN] 
  [TRU] 
  THAT LOST POWER DUE TO THE FAILURE OF ITS 
  [MAIN] 
  [AC] 
  OWN 
  [MAIN] 
  [AC] 

+ TRU [L MAIN] [R AC] 
  [L MAIN] [AC] 
  [R MAIN] [L AC] 

- TRUS ARE RATED AT 250 AMPS
Ground Service Bus

- When you don't want to wake up the beast

- Ground Operations (APU shutdown)
  - Refueling
  - Engine oil
  - Potable Water Servicing
  - Hydraulic Fluid Servicing
  - Wheelwell lights

- Three **(3)** GSB Switches
  - Forward Exterior Switch Panel
  - System Monitor/Test Panel
  - Tail Compartment

- Power Sources (Priority)
- Rotating beacon light is powered by the **GSB**
  when the **MAIN BATT** is the source of power

- At least one of the following must be open when using one of the **GSB** switches:

  **Forward Exterior Switch Panel**
  **Main Entrance Door**

**ELECTRICAL POWER CONTROL**

- **L Bus Tie**
  - **Reset**
  - **L Gen**
  - **APU Gen**
  - **Ext Pur**

- **R Bus Tie**
  - **R Gen**
  - **E-INV**

- **Main Batteries**
  - **Left**
  - **Right**

**GND SVC BUS**

**ON**

21 / 31

11/24/18
E-INVERTER

- The ESS AC bus is normally powered by the MAIN AC bus.

- If bus power is not available, the ESS AC bus can also be powered by the MAIN AC bus.

- The E-INV is a backup source of AC power to the ESS AC bus (Phase A only) by converting 18 VDC to 115 VAC.

- The E-INV is located underneath the floor.

- E-INV: 115 VAC, 400 Hz, 1 KVA.
- The **E-INV** has been renamed **Standby Inverter**

- In the event of failure the **E-INV** can be deferred in accordance with the Minimum Equipment List (MEL)

- During the pre-flight inspection with main battery switches pressed IN and no **AC** power available operation of the **E-INV** can be confirmed as follows:

**Cabin Pressure Control**

<table>
<thead>
<tr>
<th>Flight</th>
<th>Fault</th>
<th>Auto</th>
<th>E-INV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landing</td>
<td>Manual</td>
<td>Semi</td>
<td></td>
</tr>
</tbody>
</table>

- **Phase A (OA):** Cabin Pressure Channel 1, R Pitot heater and Standby Pitot heater
- In the unlikely event that normal (IDG) or back up AC power (APU GEN) is not available, the E-INV can continue to power the E-INV.

- In the unlikely event that the HMG is not available, the main batteries can power the E-INV.
MAIN BATTERIES

- Two (2) MAIN BATTERIES:

- Located in the Tail compartment
- Nicad, 21 cells, 95 pounds
- 24 VDC, 53 amp/hour

- Purpose:

  1. START THE APU - USES ONLY BUT BOTH switches must be selected ON

     NOTE: Minimum 22 volts on both batteries to start the APU

  2. OPERATE AUX HYD PUMP -

  3. POWER ESS DC buses - (if no other source of power)

Main Batteries

ON ON

LEFT RIGHT

Switchlights illuminate (Discharging)
• Thirty (30) minutes with two (2) APU start attempts
• Must be removed from aircraft in cold soaked conditions (≤ -20°C)
• If ≤ 22 volts but not less than 7 volts the batteries can be recharged as follows:
  - Ext AC power connected
  - Batt switches ON ON

- The L MAIN BATT R MAIN BATT are normally recharged by the MAIN AC buses through battery chargers located in the tail compartment
EMERGENCY BATTERIES

- EMERGENCY POWER SYSTEM

EMERGENCY POWER

<table>
<thead>
<tr>
<th>ON</th>
<th>ARM</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIGHTS</td>
<td>DC POWER</td>
<td></td>
</tr>
</tbody>
</table>

- Power of last resort
- Sealed lead acid. Thirty (30) minutes approximately
- 24 VDC, 9 amp/hour
- ON when LESS DC and/or R LESS DC buses < 20 Volts, even momentarily

- Four (4) E-BATTS:

Avionics  Avionics  Lighting  Lighting

- Power the following buses:

L EMERGENCY  R EMERGENCY  Flight Instrument
- After a break power transfer the E-BATTS will come on and must be re-armed to avoid depletion.

- When all power lights the following equipment is powered:

  **Emergency Lighting**

  - Cabin Emergency lights
  - Exterior Emergency lights

  **Pilot’s Audio Control Panel (ACP)**
  **MCDU 1 - STBY Engine Instruments**
  **MCDU 3 - Backup Radios (VHF1/NAV1)**

  **Two (2) Clocks**

  **Three (3) IRUs**

  **Standby Flight Display (SFD)**

  **Electronic Bearing & Distance Indicator (EBDI)**

  **Landing gear down indication**

- An integrated charger/transformer rectifier recharges the E-BATTS.
ELECTRICAL POWER CONTROL

L Bus Tie

- AUTO
- ON
- L GEN
- APU GEN
- EXT PWR
- ON
- R GEN
- GND SYC BUS
- E-INV
- AUTO

Two (2) Green
Three (3) Blue
Six (6) Black

Main Batteries

Two (2) switchlights Pressed IN
Two (2) switchlights Pushed OUT
Emergency (ESS DC buses < 20 volts)

- Main Batt
- APU Batt (2 APU start attempts)

- Normal - Emergency

- All AC/DC buses
- All AC/DC buses

- Normal IDG
- IDG OP
- IDG

- ESS DC
- ESS AC
- 28VDC
- 115VAC

- Standby Flight Instruments
- Standby AC
- Standby AC
- Standby AC

- 00:30 Minutes (approximately)

- IRU's
- Comm Radio
- Emerg. lights

- 12/13/17 30/31
Questions, comments or errors?

ivan.luciani@gmail.com

Thank you!