WIRE SEPARATION

This Subject gives:

- The general conditions for wire separation
- The special conditions for wire separation in the specified models.

1. General Conditions for the Separation of Circuits

A. General Data

The airplane wiring is designed and installed:

- To prevent the propagation of the effects of electrical faults to other independent power sources
- To prevent possibility that the failure of a component in a redundant system can disable another related, redundant system
- To avoid electromagnetic interference (EMI) between electromagnetic compatibility (EMC) circuits that are not compatible.

B. Necessary Conditions of Separation for Wire Harness Design

These are the applicable types of separation:

- Separation between independent power sources (Functional Separation)
- Separation between redundant system circuits (Functional Separation)
- Separation between EMC circuits that are not compatible (Electromagnetic Separation).

To obey these conditions:

- Electrical circuits, for which separation is necessary, are put in different wire harness assemblies
- If the circuits cannot be put in different wire harnesses, separation is done within the same wire harness with sleeves and shielded wire except in the case where the EMC circuits are not compatible.

C. Functional Separation Group

The primary conditions for the functional separation of circuits are:

- Separation between the independent power sources for a single system
- Separation between the redundant system circuits.

NOTE: In relation to functional. separation, the airplane engine systems are redundant for each engine.

D. EMC Separation Group

These are the 3 basic separation codes:

- Code 1 for circuits contain the noisy, interference wiring; usually power Lines
- Code 2 for all the wiring that satisfies the conditions of EMC
- Code 3 for the sensitive, susceptible circuits; such as audio or analog.

E. EMC Separation Group Code 1 - Source of Interference Circuits

These are system wires that carry power current or other EM1 offensive circuits. Examples of these are:

- Both AC and DC generator and power feeders
- Other 400 Hz power wires that go beyond 12000V-ft or 400A-ft of potential coupling
- Automatically switching DC circuits that switch 5 amps or more
- Both AC and DC inductive Load turnoff transients that are not suppressed.

F. EMC Separation Group Code 2 - Passive Circuits

These are systems wires which are expected to tolerate and not degrade the electromagnetic environment in the airplane. Examples of these are:

- AC signal or control circuits that are not susceptible to common mode coupling of 100 mV RMS or Less
- 400 Hz power wires do not go beyond 12000V-ft or 400A-ft when they are Located with their own Category 2 system harness.

G. EMC Separation Group Code 3 - Sensitive or Susceptible Circuits

These are system wires that cannot satisfy the Limits of Category 2 susceptibility.

H. Sub-Functional Separation Category

Some more separation may be necessary within a functional separation code because of special system functional conditions. Decisions for sub-functional conditions are made in relation to:

- The airplane model
- The system.

NOTE: When a sub-functional separation is given, that separation must be kept.

2. Wire Harness Identification For Functional Separation

A. Functional/EMC/Sub-Functional Separation Code

The separation code has these properties:

- A separation code is assigned to each wire harness
- When the sub-functional separation is not necessary for 737, 747, 757, and 767 airplane models, the third digit is removed; only 2 digits are necessary
- When the sub-functional separation is not necessary for 777 airplane model, the fourth digit is removed; only 3 digits are necessary
- An N code identifies a wire that does not have any separation conditions and can have the same routing as a wire harness from any other functional separation group.

B. Color Codes of the Separation Groups

NOTE: Refer to the specified model for the color codes that are used for each functional separation code.

A color code system is used so that:

- The separation group of a wire harness can be identified
- The installation and inspection of a wire harness on the airplane is easier.

For the 737, 747, 757, and 767 airplane models, all wire harnesses have color codes except these types:

- A coax cable that is installed as a single cable and does not have any wire harness ties
- Wire harnesses in which all wires are covered with sleeves (white tie material)
- Wire harnesses which that contain only shielded wires (white tie material)
- Shelf harnesses (white tie material)
- Wire harnesses that are identified as neutral (N).

For the 777 airplane model, all wires harnesses have have color codes except these types:

- A coax cable that is installed as a single cable and does not have any wire harness ties
- Shelf harnesses (white tie material)
- Wire harnesses that are identified as neutral (N).

3. Wire Harness Functional Separation

A. Separation by a Distance

Refer to Table I to find the minimum distance for the specified separation code of each model.

NOTE: In the areas where a turbine burst occurs, a Larger physical separation is necessary between the specified engine functions.

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NOTE: More protection or a Larger physical separation, or both are given in the areas where damage, that is caused by a mechanical failure, can occur to the primary and the redundant wiring. Some types of mechanical failures are:

- The rupture of a pneumatic duct
- A tire tread that is thrown.

These standby system power wires must be isolated from all other wiring through separation by distance:

- Battery to hot battery bus
- Hot battery bus to battery bus and static inverter
- Static inverter to standby AC bus.

CAUTION: THE STANDBY SYSTEM POWER WIRES MUST NOT HAVE THE SAME ROUTING AS ANY OTHER WIRING. DAMAGE, THAT IS CAUSED BY THE FAILURE OF THE OTHER WIRING, CAN OCCUR TO THE STANDBY SYSTEM POWER WIRES.

TABLE I