U.S. Department
of Transportation

Federal Aviation
Administration

# Advisory Circular

**Subject:** SPECIFICATION FOR L-841 AUXILIARY RELAY CABINET ASSEMBLY FOR PILOT CONTROL OF AIRPORT LIGHTING CIRCUITS

**Date:** September 20, 2007 **AC No:** AC 150/5345-13B

**Initiated by:** AAS-100 **Change:**

**1. PURPOSE.** This advisory circular (AC) contains the specification requirements for a relay cabinet used to control airfield lighting circuits. The L-841 consists of an enclosure containing a direct current (DC) power supply, control circuit protection and 20 pilot relays.

**2. CANCELLATION.** AC 150/5345-13A, *Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits*, dated August 8, 1986, is cancelled.

**3. APPLICATION.** The Federal Aviation Administration (FAA) recommends the guidelines and standards in this AC for L-841 Auxiliary Relay Cabinets. This AC does not constitute a regulation and in general is not mandatory. However, use of these guidelines is mandatory for L-841 Auxiliary Relay Cabinets funded under Federal grant assistance programs. Mandatory terms such as "must" apply only to those who purchase L-841 Auxiliary Relay Cabinets using Airport Improvement Program (AIP) or Passenger Facility Charge Program (PFC) funds. These standards must be met where lighting systems are required for FAA-developed procedures.

**4. PRINCIPAL CHANGES.**

a. Paragraph 3.1a: low temperature is changed to -40 degrees F (-40 degrees C) for standard commercial parts availability.

b. Paragraph 3.3a: cabinet enclosure is changed to National Electrical Manufacturers Association (NEMA) 1.

c. Paragraph 3.3c: cabinet finish updated to industrial grade epoxy and thermoset powder coatings. Aviation orange added.

d. Paragraph 3.3.1a: a tapped transformer for the power supply is added.

e. Paragraph 3.3.1c: oil filled capacitor requirement is removed.

f. Paragraph 3.3.2b: relay requirements are changed to be in line with commercially available products.

g. Paragraph 3.3.2c: inductive current inrush requirements are removed.

h. Paragraph 3.3.2e: relay coil transient suppressor resistor capacitor (RC) network requirement removed - replaced with performance-oriented requirement.

i. Paragraph 4.1.3a: requirement for oscillscope photographs is deleted.

j. Paragraph 4.1.3d: requirement for an inductive load is changed to a resistive load. Contact arcing requirement is restated.

k. Paragraph 4.1.3e: requirement for "capacitive effect" across relay contacts is deleted.

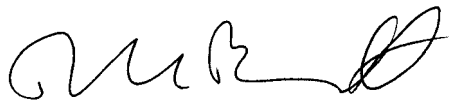
l. Figure 1 is updated.

**5. METRIC UNITS.** To promote an orderly transition to metric units, this AC contains both English and metric dimensions. The metric conversions may not be exact metric equivalents and until there is an official changeover to the metric system, the English dimensions will govern.

**6. COMMENTS OR SUGGESTIONS** for improvements to this AC should be sent to:

Manager, Airport Engineering Division
Federal Aviation Adminstration
ATTN: AAS-100
800 Independence Ave., S.W.
Washington, DC 20024

**7. COPIES OF THIS AC.** The Office of Airport Safety and Standards is in the process of making ACs available through the Internet. These ACs may be found through the FAA home page (www.faa.gov).



David L. Bennett
Director of Airport Safety and Standards

## 1. SCOPE AND CLASSIFICATION.

### 1.1 Scope.

This specification covers the requirements for auxiliary relay cabinet assemblies for pilot control of airport lighting circuits.

### 1.2 Classification.

One type of cabinet is covered by this specification.

### 1.3 Type.

Type L-841, Auxiliary Relay Cabinet.

## 2. REFERENCED DOCUMENTS.

### 2.1 General.

The following is a listing of documents referenced in this AC:

#### 2.1.1 Federal Aviation Administration (FAA) Publications.

##### 2.1.1.1 FAA Advisory Circulars.

AC 150/5345-53 *Airport Lighting Equipment Certification Program*

### 2.2 Document Sources.

FAA ACs may be obtained from:

U.S. Department of Transportation
Subsequent Distribution Office
Ardmore East Business Center
3341 Q 75th Avenue
Landover, MD 20785

Telephone: (301) 322-4961
FAX: (301) 386-5394
Website: www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

## 3. REQUIREMENTS.

### 3.1 Environmental Requirements.

Auxiliary relay cabinets must withstand the following environmental conditions:

a. Temperature: Exposure to any temperature from -40 degrees Fahrenheit (F) to 120 degrees F (-40 degrees Celsius (C) to 49 degrees C).

b. Humidity: Exposure to any relative humidity between 10 and 95 percent.

c. Salt Fog: Exposure to a salt laden atmosphere typically encountered near coastal areas.

### 3.2 Materials and Workmanship.

Materials and workmanship must be per the highest commercial standards for this type of equipment.

### 3.3 Enclosure.

a. The cabinet assembly must be manufactured in a size adequate to accommodate the power supply, pilot relays, accessory devices, and provide a minimum gutter space of 4 inches (102 millimeters) on all sides.

b. The cabinet must be per the National Electrical Manufacturers Association (NEMA) Type 1, 14 gauge steel minimum.

c. The cabinet must be cleaned, prepared (including any corrosion inhibiting or other paint/chemical coatings if applicable), and finished with either thermoset powder coatings or industrial grade epoxy paint that are applied per current industry standards. The paint color may be gray or aviation orange.

d. The cover must be attached to the housing with flush or concealed hinges, and equipped with a handle capable of locking the door in a closed position. Two keys must be furnished for the lock.

e. The enclosure must be designed for surface mounting with at least 4 holes provided in the back for 1/4 inch (6 mm) mounting bolts. Bolts for interior equipment mounting must not protrude through the back of the enclosure.

f. The cabinet must be of a suitable size to provide sufficient punch space for the following conduit entrance holes: two l-inch (25 mm) holes located on each of the 4 sides, and three 2-inch (51 mm) holes located on the bottom.

g. A suitable ground lug, clearly marked, must be provided either inside or outside the enclosure for a No. 6 American Wire Gauge (AWG) ground wire.

#### 3.3.1 DC Power Supply.

The power supply must consist of a single phase input transformer, a full wave rectifier, and necessary protective devices.

a. The input transformer must be designed to supply the rectifier with adequate power to perform per paragraph 3.3.1b below. The transformer may use adjustable taps to compensate for control circuit length and other losses to maintain an optimal voltage for the relay coils. The transformer must be designed for a 115-volt, 50/60 Hertz (Hz ) input.

b. The full wave rectifier must be designed to supply at least 48 volts DC at an output of 1.25 amperes at an ambient temperature of 120°F when supplied with a 115-volt, 50/60 Hz input. The power supply must have a no-load output voltage of less than 70 volts DC, with an input voltage of 125 volts, 50/60 Hz. The ripple content of the output voltage must be less than 1% (500 millivolts).

c. The power supply must have a 2 ampere (A) fuse connected in both-the transformer and the rectifier secondary circuits as shown in Figure 1. A suitable filter must be connected across the DC output of the power supply to limit power supply ripple and high frequency transients and transient switching surges. All power supply components must be rated for continuous operation at an ambient temperature of 120°F.

**3.3.2 Pilot Relays.**

a. The pilot relays must be plug-in type and mounted in an accessible location. Each relay must be furnished in a transparent dustproof enclosure.

b. The relay pull-in voltage must be 80 percent of the nominal coil voltage; the relay drop-out voltage must be 15 percent or less of the nominal coil voltage; and the maximum coil voltage must be 110 percent of the nominal coil voltage.

c. The relay must have 2 sets of open contacts rated to perform 100,000 operations, making and breaking a 10 A, 50/60 Hz resistive load.

d. The equipment manufacturer must use methods of transient suppression connected across the relay coil to prevent damage to the power supply or other components when the coil is de-energized. The method of transient suppression must not cause welding of the relay contacts.

e. A low capacitance arc suppression device, suitable for installation across a 120-volt AC circuit must be connected across each pair of relay contacts. A suitable "back-to-back" diode or metallic oxide varistor (MOV) will be adequate for this application. A single diode is not acceptable.

f. Each of the 20 relays must have an identifying letter, from "A" through "T", painted on the cabinet adjacent to it for rapid identification.

**3.3.3 Terminal Boards.**

There must be 2 sets of terminal boards installed inside the enclosure.

a. A total of 60 consecutive terminals must be provided on terminal boards arranged in a set as shown in Figure 1. The terminal boards must be suitable for connecting No. 19 AWG wire. The terminals must be the screw type and rated to carry at least 2 amperes at 75 volts DC. Forty of the terminals must be marked, in pairs, with their corresponding relay's identifying letter followed by a plus or minus sign. For example, the coil of relay "A" shall be connected to terminals A+; A-, and the coil of relay B shall be connected to terminals B+; B-. This system of marking must be continued for all relays so that the coil of relay "T" will be connected to terminals T+; T-. The remaining 20 terminals must be marked with numerals from "1" through "20". No connections must be made to these terminals.

b. A second set of terminal boards consisting of 82 terminals must be arranged as shown in Figure 1. The terminal boards must be suitable for connecting No. 12 AWG wire. The terminals must be the pressure type and rated to carry at least 10 amperes at 250 volts AC. One side of the terminal boards, the first 80 terminals, must serve as connection points for the relay contacts. The terminals must be marked, in groups of 4, with their corresponding relay's identifying letter followed by the numeral "1", "2", "3", or "4". For example, the contacts of relay "A" must connect to terminals Al, A2, A3, and A4, respectively. This system of marking must be continued for all relays so that the contacts of relay "T" will be connected to terminals T1, T2, T3, and T4, respectively. The final 2 terminals in the set of 82 must be marked "Xl" and "X2". These terminals must serve a connection point between the incoming 120-volt AC power and the input transformer.

**3.3.4 Wire and Wiring.**

The auxiliary relay cabinet assembly must be completely wired at the factory with connections made to all appropriate terminals so that the only connections necessary in the field will be to connect the external control circuits and the input power. All DC wiring must be at least No. 19 AWG insulated wire. All AC wiring must be at least No. 12 AWG stranded, 600-volt rated insulated wire. Wire insulation must be rated appropriately for the application. All wires must be neatly trained and bundled with DC wiring bundled separately from alternate current (AC) wiring.

**3.3.5 Wiring Diagram.**

A wiring diagram must be permanently mounted on the interior of the cabinet door.

**3.4 Relay Schedule**

A relay schedule that identifies individual relays, must be mounted on the interior of the cabinet door. The schedule must consist of 20 lines, marked "A" through "T", corresponding to the relays of the panel; with space for identifying information to be filled in, in the field. The relay schedule form may be printed on a material similar or equal to "mylar".

**3.5 Code Requirements.**

The auxiliary relay cabinet assembly must comply with all applicable requirements of the National Electrical Code.

**3.6 Parts List.**

A component parts list must be furnished with each cabinet.

**3.7 Nameplate.**

A nameplate must be permanently mounted on the outside of the auxiliary relay assembly door, and it must contain the following information:

a. Airport Lighting Auxiliary Relay Assembly

b. Identification: FAA L-841

c. Manufacturer’s Part No.

d. Manufacturer's Name or Trademark

**3.8 Optional Interlock Switch.**

An interlock switch must be installed as optional equipment if specified by the user. The switch must be designed to carry 5 amperes at 120 volts AC, continuously. The switch must also be designed and installed so that the 120-volt AC input power to the auxiliary relay cabinet will be automatically disconnected when the cabinet door is opened.

**4. EQUIPMENT QUALIFICATION REQUIREMENTS.**

**4.1 Qualification Testing.**

**4.1.1 Qualification Procedures.**

Procedures for obtaining qualification approval are contained in AC 150/5345-53, *Airport Lighting Equipment Certification Program.*

**4.1.2 Dielectric Test.**

All terminals on the terminal block must have a potential of at least 500 volts, root mean square (RMS), 60 Hz applied for a period of one minute between the terminal and the grounded case. There must be no breakdown of insulation.

**4.1.3 Power Supply Tests.**

a. A 115-volt, 60 Hz signal must be connected to the input terminals Xl and X2 of the assembly, and all relays must be energized. The voltage across the relay coils must be at least 48 volts DC. The ripple content of the DC power supply output must be less than 1% (500 millivolts).

b. A 125-volt, 60 Hz voltage must be applied to the input terminals Xl and X2 of the assembly. The no-load output voltage of the DC power supply must not exceed 70 volts DC.

c. A dummy load, consisting of capacitance and resistance, must be connected in the circuit with each of 2 relay coils to simulate a cable installation 3 miles (4.8 kilometers) in length. While the dummy load is connected, the relays must be checked for proper operation when they are switched on and off. The capacitor and resistor must correspond to the values of capacitance and resistance encountered in 1 pair of 26 pairs No. 19 AWG telephone cable that has an average mutual capacitance of 83 ± 4 nanofarads (nF) per mile and a nominal DC conductor with a resistance of 42.5 ohms per mile (26.4 ohms per kilometer).

d. A resistive load current of not less that 10 amperes must be switched on and off while connected across a pair of relay contacts. There must be no evidence of damage arising from arcing to the relay contacts.

**4.1.4 Operational Tests.**

The unit must be energized by applying a 115-volt, 60 Hz signal to the input terminals Xl and X2. All relay coils and terminals must be jumped, simulating a closed external control switch. The relay's contacts must be checked (using an ohmmeter or a pilot light test board) to determine that they are

properly closed. The jumpers must then be removed, and the relays must again be checked to determine that their contacts have properly opened.

## 5. PRODUCTION TESTS.

### 5.1 Production Testing.

**1.** Each production auxiliary relay cabinet assembly must be subjected to the tests specified in paragraphs 4.1.3a and 4.1.3b.

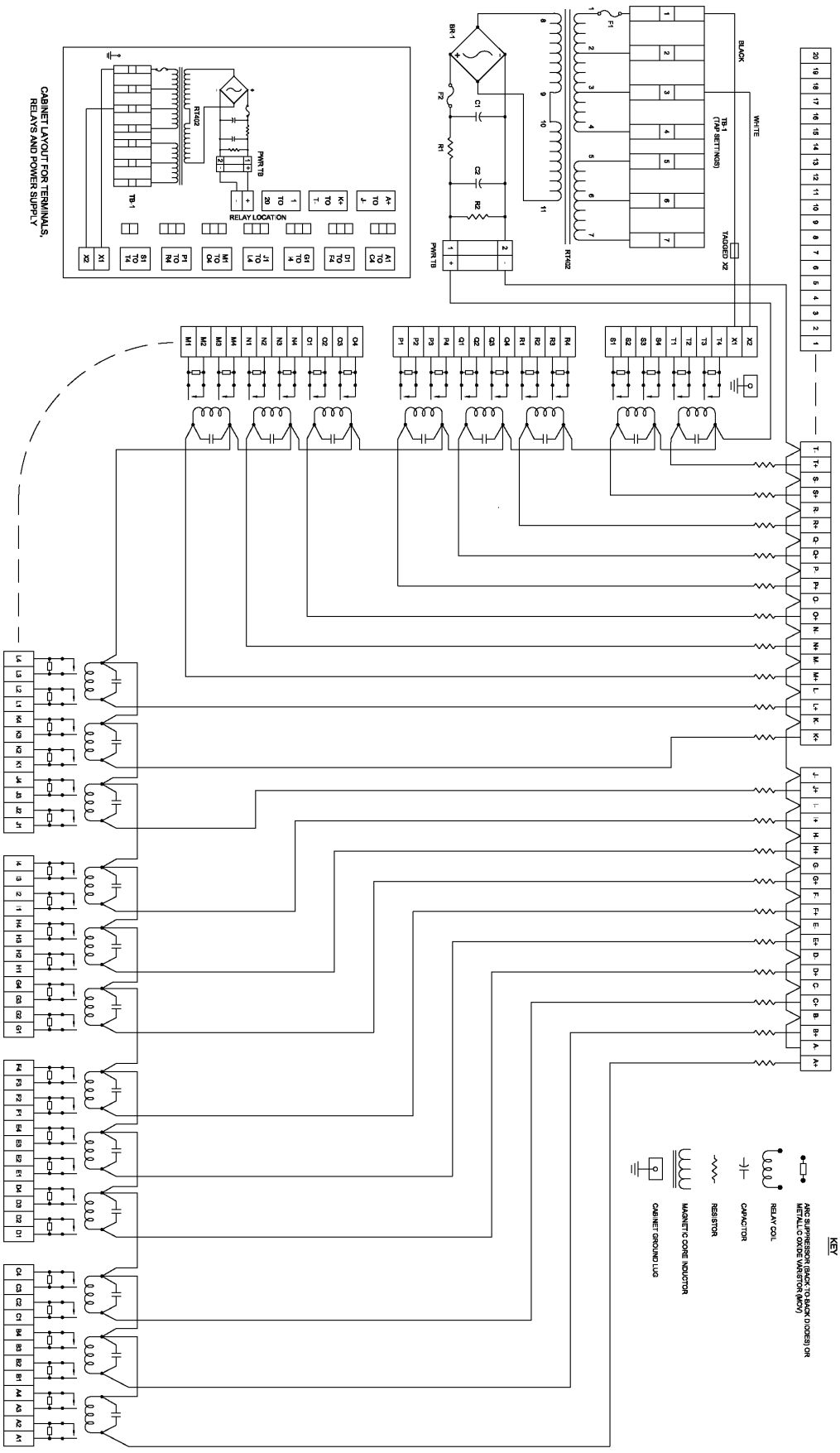



FIGURE 1. TYPICAL WIRING DIAGRAM OF L-841 RELAY ASSEMBLY