A. Purpose

This Manual Part recommends design criteria for an electric light unit for grade crossing signals.

B. General

1. Unit shall be designed so that the center of the roundels and side lights are 8-3/8 in. +/- 1/4 in. (21.59 cm +/- 3.18 cm) below the center for 8-3/8 in. (21.27 cm) diameter suspended light units, and 11-1/2 in. +/- 1/2 in. (29.21 cm +/- 1.27 cm) below the center of the crossarm for 12 in. (30.48 cm) diameter suspended light units, conforming to Manual Part 3.2.50 Recommended Design Criteria for Crossarm for Suspended Lights for Flashing-Light Grade Crossing Signal Without Gate, Assemblies; and Manual Part 3.2.51 Recommended Design Criteria for Crossarm for Suspended Lights for Flashing-Light Grade Crossing Signal with Mast Mounted Gate, Assemblies.

2. Any gaskets or similar sealing provisions, shall be made of a material conforming to Manual Part 15.2.10 Recommended Functional Guidelines for Gasket Material Suitable for Circuit Controllers, Signal Cases and Other Signal Apparatus Housings, and should be fastened securely in place.

3. Unit shall be so designed that optical system parts may be cleaned without disturbing their adjustments.

4. The unit shall be designed such that either the main indication, or an indicator representing the main indication’s operation, can be visually detected from 90° left and right of the unit.

5. Unit should be designed with a wire entrance at the point of attachment to its support.

6. Replaceable component parts of a unit shall be interchangeable with like parts of same manufacturer or supplier.

C. **Housing**

1. All unit housings, including inner sub-housings, shall be of a rigid material, which is not injuriously affected by atmospheric conditions or by changes in temperature as defined by Class B in Manual Part 11.5.1 Recommended Environmental Requirements for Electrical and Electronic Railroad Signal Systems.

2. All parts should be uniform in composition, clean, smooth and free from flaws, cracks, blowholes, shrinks and other defects.

3. Outer housings shall not project more than 3-4/2½ in. (8.9 cm) to the rear of the centerline of the supporting fixture for 8⅜ - 3/8 in. (21.27 cm) diameter light units and 4½ - ½ in. (11.43 cm) to the rear of the centerline of the supporting fixture for 12-in (30.48 cm) diameter light units.

4. Doors should open in front and be hinged at the side or bottom with a door-fasting device, which shall provide weatherproofing without change in optical alignment. Unit shall provide means of being locked sealed or secured against unauthorized entry.

5. Specific provisions shall be made for protecting against internal damage to wiring or internal components from moisture, heat buildup, contaminants, or insects, such as filtered breather openings, sealing, or other means.

6. A protective finish shall be applied to housings made of materials susceptible to corrosion, weathering, degradation from ultraviolet rays, or other elements identified in Class B in Manual Part 11.5.1.

D. **Lamp Receptacles**

1. Units using a single contact candelabra bayonet brass lamp receptacle shall be designed for electric lamps having a light center length of 1⅛-1/4 in. (3.18 cm) and filament on centerline of the lamp base. The receptacle shall be adjusted on a rigid support and sealed in position at the factory so that the 1/64 in. precision lamp will have its filament at the focal point of the reflector. Receptacle shall be insulated from the housing.

E. **Reflector (For Incandescent Lamp Signals)**

1. Reflector shall project parallel light rays through the effective diameter of the roundel used.
2. Reflectors shall be capable of meeting the following:

   a. Immerse for 24 hr. at room temperature in a solution composed of clean water and 20% by weight of sodium chloride (NaCl). Remove from the salt solution and immerse in clean water at room temperature and gradually heat to the temperature of +171°F (+77°C) and maintained at that temperature for 4 hr. Remove from the water and place in dry air at +171°F (+77°C) for 4 hr.

   b. Following completion of the above test, the surface shall show no signs of chipping, cracking or softening of the coatings. There shall be no separation of the backing into layers or from the mirrored surface. There shall be no appreciable change in the color of the backing or the reflecting surface. The reflector shall withstand ordinary handling without scratching or chipping.

F. Background and Hood

   1. A background having not less than 20 in. (50.8 cm) diameter shall be provided for the unit. The background may be integral to the unit or designed to be mounted on the unit without requiring special tools.

   2. Background color shall be matte or flat black (Color 17038, FED STD 595B) to provide maximum contrast with the red indication. Surface coloration shall be of a material for which reflectivity shall not change by more than 10% within 5 years under the environmental conditions specified in Manual Part 11.5.1, Class B.

   3. Background material shall meet the same durability requirements set forth in section C.1. and C.2.

   4. A hood, not less than 8 in. (20.32 cm) long, projecting substantially at right angles to the body of the housing at least one-half way around the lens opening shall be provided. The hood may be integral to the unit or designed to be mounted on the unit without requiring special tools.

   5. Hood color shall be matte or flat black (Color 17038, FED STD 595B) to provide maximum contrast with the red signal indication.

   6. Hood material shall meet the same durability requirements set forth in Section C.1. and C.2.
G. **Light Unit Performance**

1. Units shall produce a uniform, red, light output which shall be highway crossing signal red and conform to Appendix Part FF, Manual Part 7.1.10 Recommended Design Criteria and Functional/Operating Guidelines for Signal Roundels, Lenses, Discs and Cones.

H. **Visible Distance**

1. Visible distance is defined as the distance that the signal shall be clear and distinct under bright sunlight conditions, with the sun at or near the zenith.

2. Visible distance shall be determined when the signal is operated at the manufacturer's recommended voltage.

Table 3235-3: Horizontal Axis and Downward Axis

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I. **Light Unit Electrical Requirements**

1. LED normal operating range is 8.0 Vdc to 16.5 Vrms dc or 8.0 Vac to 16.5 Vac rms rms; LED’s shall stay illuminated to at least 50% of its rated luminous intensity down to 7 voltsV.

2. In-rush current of LED units shall not exceed 10 amperes; 100 microsecond micro-second-rise time.

3. LED unit hysteresis (turn on vs. turn off voltage) shall be a minimum of 10% of the nominal rated voltage of the unit.
1.4. **Incandescent Light Units** shall be designed to operate when they are powered by either an ac source of 10 volts Vdc source rms or a 10 Vac rms dc source of 10 volts. Units shall be designed so as to not be damaged by any voltage up to 115% of the design voltage.

2.5. **Maximum operating current draw** for the light unit shall not exceed 3.0 amperes at any voltage up to the maximum rated operating voltage of the unit over the temperature range of -40˚F (-40˚C) to +158˚F (+70˚C).

3.6. **Light Emitting Units** other than incandescent lamp units should achieve 90% nominal light output (rise-time) within 75 milliseconds when voltage is applied to the unit and be at or below 1% nominal light output (fall-time) within 75 milliseconds when voltage is removed from the unit.

7.47. **Polarity** in dc-powered applications shall be internal to the unit and not require observance of polarity for connection to the existing housing terminals.

8.5. **Electrical connections** shall be insulated stranded copper wires of sufficient size for the maximum operating current of the light source. In no case shall the wiring be less than No. 20 AWG (0.5 mm²), and shall be terminated with insulated, positive retention connectors compatible with the housing terminals. There shall be no requirement for intermediate connectors or other types of adapters.

**K. Identification**

1. Beam deflection classification shall be plainly marked on the light unit. If a unit is suitable for use as a replacement for any of the beam deflection patterns, then the light unit should be marked with each deflection pattern, to which it conforms.

2. Light units shall be plainly marked "Highway Crossing Red".

3. Light unit body shall be plainly marked with the manufacturer’s name or trademark, model number and date of manufacture.

4. Any components requiring vertical orientation shall be prominently and permanently marked with an indexing indication marked as "TOP".

L. Binding Posts


M. Dielectric

1. Dielectric requirements shall conform to Manual Part 11.5.1, Class B except for lamp receptacles that shall conform to Class E.