A. **Purpose**

These recommended design criteria are for a repeating bell, operated by direct current, as an adjunct to highway-rail-grade crossing warning systems.

B. **Design**

1. Bell should be designed to be attached to the top of 4” or 5” pipe post.

2. The outside dimensions of the bell complete with pipe post attachment should not exceed the following:
   - Height 20”
   - Width 15”
   - Depth 10”

3. Bell should be provided with a sound horn or speaker.

4. The unit should emulate the sound of an electro-mechanical bell Manual Part 3.2.60 Recommended Design Criteria for an Electro-mechanical Highway-Rail Grade Crossing Bell.

5. Bell operating circuit board should be coated, encapsulated, or potted to prevent deterioration.


7. The unit should be designed with reverse polarity protection to prevent damage if the control wires are reversed.

8. The unit should be protected against lightning and other voltage surges in the input, output and power supply leads when installed in conjunction with external surge protection as described in Manual Part 11.2.1 Recommended General Practices for Electrical Surge Protection for Signal Systems and manufacturer’s recommendations.

10. Mechanism wiring from circuit board to the wire termination point should be stranded insulated wire the diameter of which is not less than No. 18 AWG (1.0 mm²) and secured so as not to interfere with the operation of the bell.

C. Housings

1. Housing design should be of aluminum, cast iron, or other materials not adversely affected by the environment.

2. The design should provide a separate compartment environmental protection for the operating circuit.

3. Housing and any mounting adapters should have an opening in the bottom to permit the entrance of wires from the pipe post. Opening should be free from burrs and sharp edges to prevent damage to wire insulation.

4. Housing should provide accessibility to the binding posts wire termination points.

D. Operating Characteristics

1. Nominal operating voltage should be 10 vdc. The bell should operate properly between 8 vdc and 14 vdc.

2. Bell should operate between 100 and 325 impulses per minute.

3. Impulse sound shall be so timed that no one sound wave is broken up by subsequent waves.

4. Omni-Directional Bells (360 degree) Decibel Values

   a. For a Loud Tone Bell:

   In the 360° horizontal plane, the maximum sound reading measured in decibels in an Anechoic test chamber at a point 10 ft from the face of the sound horn and in increments of 20°, should not be more than 105 dB(A) and not less than 85 dB(A).

   b. For a Soft Tone bell:
In the 360° horizontal plane, the maximum sound reading measured in decibels in an Anechoic test chamber at a point 10 ft from the face of the sound horn and in increments of 20°, should not be more than 85 dB(A) and not less than 75 dB(A).

5. Uni-Directional Bells (180 degree) **Decibel Values**
   a. For a Loud Tone Bell:
      In the 180° horizontal plane, the maximum sound reading measured in decibels, in an Anechoic test chamber at a point 10 ft from the face of the sound horn and in increments of 20°, should not be more than 105 dB(A) and not less than 85 dB(A).
   b. For a Soft Tone bell:
      In the 180° horizontal plane, the maximum sound reading measured in decibels in an Anechoic test chamber at a point 10 ft from the face of the sound horn and in increments of 20°, should not be more than 85 dB(A) and not less than 75 dB(A).

5. Program memory shall be of permanent non-volatile type, and completely independent of any power source to guarantee memory integrity.

6. To achieve the effective operating characteristics and facilitate maintenance, the bell may be located at a location other than the top of the warning device mast.

E. **Identification**

An identification tag should be attached inside the housing in a conspicuous location with the following data:

- Manufacturer's name.
- Manufacturer's part number/model number
- Serial number of bell
- Date of manufacture
- Tone Type (Soft or Loud)
- Normal operating volts.
- Rated dB(A) output \(^1\)
- Sound dispersion pattern

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\(^1\) 'A' weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear. Measurements made with this frequency weighting will be displayed as dB(A) or dBA.
F. Binding Posts/Wire Terminations


3. Bindings posts or terminals shall be mounted so they cannot be turned in the base or frame to which applied. They shall be properly insulated from each other and other metallic parts.

4. Terminal Blocks and Connectors shall conform to Manual Part 14.1.2 Recommended Design Criteria and Functional/Operating Guidelines for Solderless Screw-Type or Screwless Spring-Type Terminal Blocks for Use in Wiring Signal Apparatus with Copper Wire Only Solderless Screw-clamp or Screwless Cage-Clamp Terminal Blocks Used in Wiring Signal Apparatus with Copper Wire Only.

5. Binding posts or all wire terminations should be clearly marked with proper polarity.