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Bar Code Badge Guidelines

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Scope

With the increased popularity of bar code on badges for usage in applications such as security access systems and time and attendance purposes and numerous problems encountered in reading bar coded ID badges, it becomes necessary to outline those characteristics which are recommended for reliable reading. These characteristics are listed below. These guidelines will optimize performance with insertion readers and swipe-type slot readers but are also applicable to most other reading devices.

Recommendations

The following badge characteristics are recommended for best results.

Symbol Placement

The bar code should occupy the area from 0.20 inch to 0.60 inch (0.5 to 1.5cm) measured from the edge of the card. Refer to Figure 1 for clarification on symbol placement.

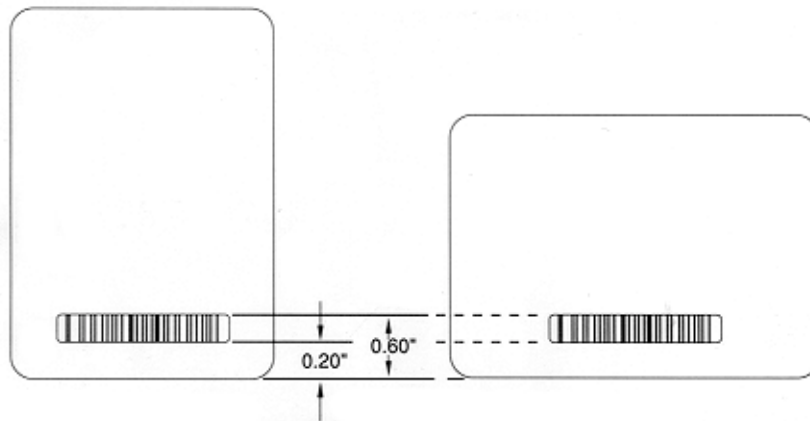


Figure 1: Bar Code Symbol Placement

Note: The bar code symbol may be positioned off of either the short or long side of the card.

Skew

The bar code symbol should not be skewed by more than three (3) degrees as referenced to the edge of the card.

Edge and Surface Defects

A flat smooth badge with crisp, straight edges, and rounded corners reduces performance changes due to distance variations and undesirable reflectance variations. Any overlamine or coating should also be flat and free from surface defects.

Symbol Orientation

If the badge is to be used with an insertion reader the symbol must be placed on the side compatible with the insertion reader chosen. Specific requirements of the insertion reader chosen must be coordinated with the symbol placement on the badge.

Reflectance

The reflectance and signal level of the materials across the scan sweep should be as closely matched as possible. It is recommended that the white or space/quiet zone reflectance exceed 50%* at the illuminating scanning wavelength. If the surrounding background reflectance does not match the symbol's white reflectance, a background reflectance that is lower than the white reflectance is preferred.

*Note: All reflectances are referenced to Kodak 6080 paint, BaSO4

Symbol Dimensions

The bar code symbol should be dimensionally correct with adequate quiet zones. Bar and space tolerance specifications differ from one symbology to the next and requirements for wide to narrow element ratios are dependent upon the narrow element width. The quiet zones are areas clear of stray marks which immediately precede the first bar and immediately follow the last bar. For hand and slot type scanning applications, it is recommended that each of these quiet zones be at least 0.25 inch (0.6 cm) or 10 times the narrow element width, whichever is greater. All applicable AIM specifications for bar code symbols must be met.

Contrast

A high contrast black to white transition allows for better performance. Contrast is defined by two different methods.

MRD

where:

MRD = R (min) - R (max) and

Rm (min) refers to the minimum reflectance of the spaces

Rb (max) refers to the maximum reflectance of the bars

The Rm should be > 50% and

Rm - Rb should be > 40%

Print Contrast Ratio

The print contrast ratio is defined as:

P.C. R. =

$$\frac{\text{Light Reflectance} - \text{Dark Reflectance}}{\text{Light Reflectance}}$$

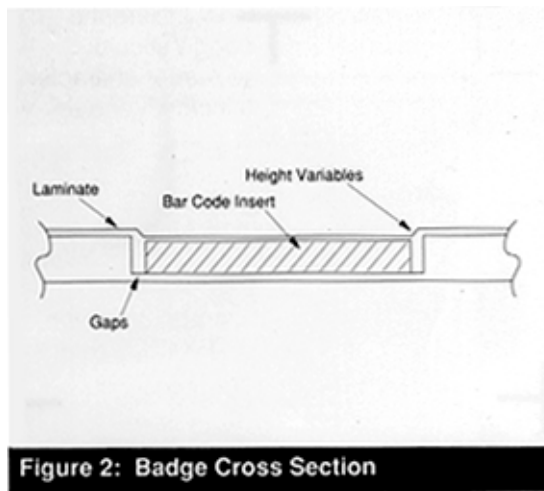
where:

The light and dark refers to the spaces and bars.

P.C.R. values greater than 75 are recommended for optimum read rates.

Applying Bar Code Symbols

Whenever possible, a bar code should be printed directly onto the substrate material. A thickness of 0.008 or 0.010 inches is recommended for the substrate material. By printing directly onto the substrate the chance of readability problems with the bar code will lessen by eliminating bumps that might be apparent if a cutout is used. If an insert is used, a bar code symbol should fit snugly into the badge cutout area with no gaps about its perimeter and a consistent height from bar code insert to surrounding badge areas. This is also true for other inserts, like pictures, which lie in the scan path. Refer to Figure 2 for illustration of a badge cross section with a bar code symbol insert.



Scratches

Whenever possible, all extraneous material, photos scratches or anything that might obscure or distort the bar code symbol should not extend into the scan path.

Badge Thickness

Total badge thickness of 0.033 inch (0.84 mm) is recommended. The maximum thickness acceptable is 0.062 inch (1.57 mm).

Laminations

With the laminated badges special care should be taken to insure that the plastic overlay does not have thickness and lensing effects which cause the bar code, as viewed through the laminate, to violate dimensional, contrast and reflectance requirements or recommendations. In addition, the plastic overlays distort the image as seen by the scanner. This phenomenon is commonly referred to as the laminate effect. The laminate should also not vary in thickness or contain bubbles, either of which could distort the bar code symbol.

Symbol Location

The symbol should be located towards the center of the badge so that acceleration and deceleration effects would tend to be reduced. This does not apply when insertion readers are used .

Black Overlays

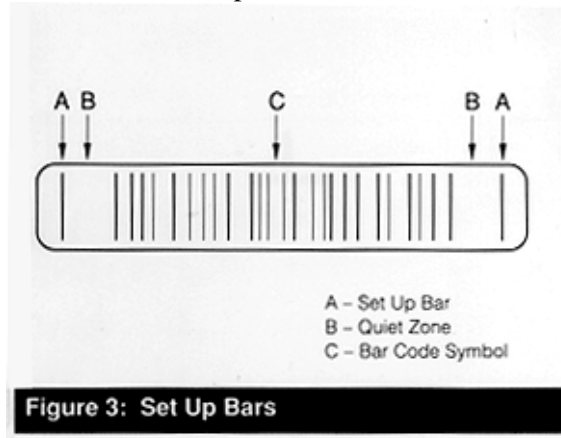
Any black overlay which prevents the bar code to be seen or photocopied should be transparent to the illumination wavelength to minimize contrast variations and signal level losses. The required reflectance levels must be taken through any laminates and overlays used (820nm - 940nm wavelength range for infrared scanners).

Red Overlays

Red overlays, which are used to inhibit photocopying of the bar code symbol, must be transparent at the wavelength used by the reader. As with other overlays, any reflectance or print quality measurements should be made through the laminate using an illumination source of the same wavelength as the reader which will be used .

Set Up Bars

Use of "Set Up Bars" is recommended for cases where color of the badges or method of construction present reading problems. A setup bar is a bar one "X" wide (where "X" is the narrow bar width) located at the end of both quiet zones. The setup bar resets the digital circuitry which may have been disoriented by stray reflectances caused by badge construction variables or the effects of background reflectance being greater than that of the symbol. The setup bars must not reduce the quiet zone below acceptable levels. Refer to Figure 3 for illustration of set up bars.



Laminate Thickness

Laminate thickness is a total of the laminate and adhesive thickness. Quantitative recommendations for laminate and adhesive thickness are dependent upon the optical system used for reading. In general, the laminate thickness should avoid 1.5X where X is the width of the narrow bars in the bar code symbol.

Laminate Glare

The laminate should have a low glare surface and have a minimum 95% light transmission at the wavelength to be used for reading. The material of construction should be suitable for the intended use. Badges may be made of many different materials with new materials periodically becoming available. Properties such as resistance to cracking and discoloration should be considered.

Badge Property Measurements

The method used to measure the properties of the badge should simulate the badge reader characteristics in regards to incident and reflected light paths.

Dual or Multimedia Cards

When dual or multimedia cards are used, the following recommendations apply.

- A. Bar code and magnetic stripe should not be placed on the same edge and side. In addition, the method of placement or printing of the bar code symbol should not cause surface distortion in the magnetic stripe.
- B. Any embossing used should not occupy the same area or scan path as the bar code or magnetic stripe portion of the card.
- C. ISO standards ISO 7811/ 2-1985(E) for magnetic stripe placement and ISO 7811/3-1985(E) for embossing location should be adhered to. Sketches which show the general placement area allowed by these standards are provided in figure 4. If either embossed or magnetic stripe is used, the ISO standards should be obtained from ANSI (see reference).

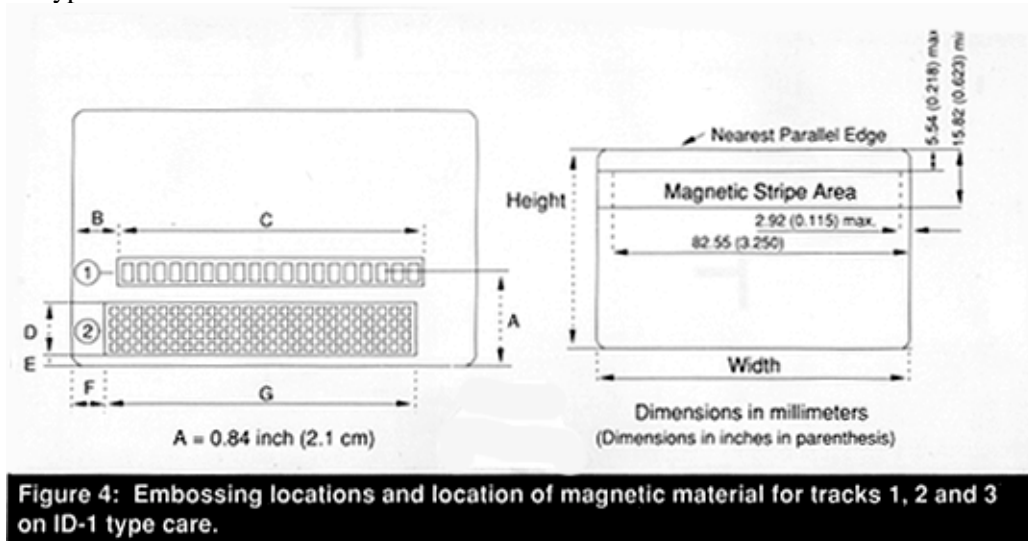
Reading Device Resolution

The resolution of the reading device should be compatible with the apparent "X" dimension of the bar code symbol and the void and speck characteristics of the bar code symbol

ANSI / AIM Recommendations

ANSI and AIM recommendations for bar code symbol production should be adhered to.

Refer to Figure 4 for recommended embossing locations and location of magnetic material for tracks 1,2, and 3 on ID type card.



Badge Considerations

There is a wide range of methods of generating a bar code identification badge for a wide range of applications. The prime factor in selecting materials and method of construction is matching the badge to the application. Typical questions which must be answered in the badge selection process are:

1. How long will the badge be used?
2. What environmental conditions will the badge be exposed to
3. What mechanical stress will the badge encounter?
4. What level of security against counterfeiting is required?
5. What information in addition to bar code must be included on the badge (i.e. photo, magnetic strip, etc.)?
6. How much information must be encoded in bar code?
7. What type of reader will be used

Once these factors are identified the badge can be produced.

If the badge is a single use such as an airline boarding pass, un laminated paper stock can fill the need. The extension of the application is a one day ski pass where the badge will likely get wet and therefore either a treated paper or laminate coating will assure a successful useful life.

The use of laminates requires an understanding of the use. Some laminating materials (laminates include both laminate and adhesive) will discolor or become brittle upon aging or exposure to sunlight and chemicals encountered in the workplace .

If the badge will be used extensively and subjected to flexing both the substrate and laminate must be flexible over the life of the badge.

If security is a high priority, use of overlays and material which will destruct when disassembled should be considered.

Selection of symbology and density is an important consideration but is beyond the scope of these guidelines.

Note: It is important to remember that the recommendation for symbol tolerances, including reflectivity, are as seen by the scanner which includes the effects of overlays and laminates.

Drawings for Figure 4 reprinted with permission of :
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