

SEMI S1-90

SAFETY GUIDELINE FOR VISUAL HAZARD ALERTS

NOTICE: This guideline does not purport to address all of the safety issues associated with its use. It is the responsibility of the user of this guideline to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

NOTE: As listed or revised, all documents cited shall be the latest publications of adopted standards.

1 Preface

1.1 Visual hazard alerts should be used whenever hazardous features cannot be designed out of a product or protected against through the use of guards, shields, interlocks, and other safety devices per the Product Safety Hierarchy Rule. The Product Safety Hierarchy Rule addresses the elimination or reduction of hazards through application of the following elements:

- a. Duty to design
- b. Duty to provide necessary guards and interlocks
- c. Duty to alert
- d. Duty to provide procedures and instructions on proper use, servicing, etc.

1.2 Visual hazard alerts should be used whenever there are potential hazards associated with the sale, installation, use, service, and disposal of the product, and even hazards which may arise from foreseeable misuse.

1.3 Many years of thought and effort on the part of the members of American National Standards Institute, ANSI Committee Z535 and its four subcommittees: Z535.1-Color, Z535.2-Signs, Z535.3-Symbols, and Z535.4-Product Alerting has resulted in a number of important contributions to state-of-the-art visual hazard alerting. Some of the important contributions are contained in Related Documents and Referenced Documents. SEMI is grateful to ANSI for permission to adapt the unpublished ANSI draft standards work to the very specific needs of the semiconductor industry.

1.4 This SEMI document is intended to assist in developing simple, direct, and understandable visual hazard alerts for people who could contact hazards associated with a product.

2 Scope

2.1 This SEMI guideline describes visual hazard alerting approaches for installation, operator and service (maintenance and repair) manuals, hazard

alerting decals, labels, and tags to be mounted on hardware and included in technical data and instruction sheets, advertisements, warranties, contracts, catalogs, recall notices, and other similar written communication relating to a product. This guideline includes: (1) configuration and content of visual hazard alerts; (2) how they should be displayed; and (3) symbols to use. The symbols given as examples are not all inclusive. Safety analysis done by a competent safety professional should be used to identify hazards and to determine the nature and extent of hazard alerting requirements.

2.2 This guideline does not preclude the use of other visual hazard alerting guidelines and/or standards which achieve the same purposes.

3 Related Documents

3.1 ANSI Standards¹

C95.2 — Radio-Frequency Warning Symbol

N2.1 — Radiation Symbol

N12.1 — Fissile Material Symbol

Z136.1 — Safe Use of Lasers

Z535.4 — Specifications for Product Safety Signs and Labels

3.2 NEMA Standard²

77 — Standards for Warning Labels

3.3 NFPA Standards³

70 — National Electrical Code

178 — Standard Symbols for Fire Fighting Operations

3.4 NIST Documents⁴

NBSIR — The Development and Evaluation of Effective Symbol Signs

NBSIR 80-2003 — Workplace Safety Symbols

NBSIR 80-2088 — The Assessment of Safety Symbol Understandability by Different Testing Methods

1 American National Standards Institute, 1430 Broadway, New York, NY 10018

2 National Electrical Manufacturers Association, 2101 L Street, N.W., #300, Washington, D.C. 20037

3 National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

4 U.S. Department of Commerce, National Institute of Standards and Technology, Center for Building Technology, Washington, D.C.

NBSIR 82-2485 — Symbols for Industrial Safety

3.5 Federal Document⁵

21 CFR Part 1040 — Performance Standards for Light-Emitting Products

4 Terminology

4.1 *hazard* — A set of recognizable conditions with the potential for initiating an event which could result in death, injury, or illness to people or facility or equipment damage.

4.2 *key word (signal word)* — The word or words that designate a degree or level of hazard. Some key words which may be used are: very dangerous, high hazards, warning, danger, caution, attention, and notice.

4.3 *may* — Understood to be permissive.

4.4 *message section* — The section of a safety sign that contains those words which clarify the nature and severity of the hazard, so as to provide the rationale for evasive actions. It must also state the appropriate evasive actions. Whenever possible, these messages shall be chosen from common usage or community acceptance.

4.5 *panel* — This word refers to an area of a safety sign having a distinctive background color which is different from other areas, or which is clearly delineated by a line border or margin. There may be up to three panels per sign: key word, message, and symbol panels.

4.6 *product* — Hardware and/or literature provided for sale.

4.7 *referent* — The message intended to be associated with the symbol.

4.8 *shall* — Understood to be mandatory.

4.9 *should* — Understood to be advisory.

4.10 *sign (safety sign) (visual hazard alert) (alert)* — A sign is a visual communication system which advises the observer of potential hazard(s) which can cause accidental bodily injury, death, or property damage. It provides safety precautions, evasive actions, or other directions to eliminate or reduce the hazard to an acceptable level.

4.11 *surround shape* — A geometric configuration around the symbol, which can convey additional safety information.

4.12 *symbol (pictorial) (image)* — A graphic representation, either abstract or representational, of a

hazardous situation and/or evasive actions to be taken to avoid harm. It may include a description of protective equipment to be used to eliminate or reduce the hazard to an acceptable level.

4.13 *target audience* — That audience which needs to be advised of the hazard.

5 Message to Be Conveyed by Visual Hazard Alerts

5.1 Product visual hazard alerts should address inherent product hazards specifically. Such alerts should neither overplay the hazard nor minimize it. Carefully defined signal or key words may be used to command the reader's attention and make the hazard obvious.

5.2 *Product Hazard Alerting Trilogy Rule* — In addition to the signal or key word, hazard alerts should comply with the Hazard Alerting Trilogy Rule. The alert:

- Starts by advising of the hazard;
- Advises of the specific risk or injury result which might occur;
- Clearly explains how to avoid the hazard.

The Trilogy Rule is illustrated by Figure 1.

5.3 *Other Product Visual Alerting Requirements* — The product visual hazard alert should be simple, direct, and understandable by people who could come into contact with the product. Consistent with this requirement, the language requirements of potential installers, operators, service personnel, and others who might come in contact with the product should be considered.

6 Display of Visual Hazard Alerts

6.1 *Amplification for Use of Symbols, Pictorials, and Color* — Visual hazard alerts should command the viewer's attention through use of graphics and easily understood symbols and pictographs. While the use of color in alerts on products is advisable, its use on alerts in manuals may detract from the duty to instruct and is, therefore, discouraged except in color photography of products in these manuals and other product literature.

6.2 *Locations of Visual Hazard Alerts on Hardware* — Product visual hazard alerts should be permanently attached to the product near the hazard and in plain view (aesthetic considerations should not influence placement or display of such alerts). Some specific locational constraints follow:

⁵ U.S. Government Printing Office, Washington, D.C.

6.3 *Proximity for Timely Action* — Visual hazard alerts should be so placed to alert and inform the viewer of:

- a. the hazard,
- b. the seriousness of its consequences if it is encountered, and
- c. the appropriate evasive action

to allow sufficient time to avoid, or take appropriate evasive action to reduce the potential harm from, the hazard. In addition, to be appropriate, the distance permits sufficient time and/or space to implement the evasive action. Finally, the alert should also be as close to the hazard as practical while conforming to the preceding requirements.

6.4 *Avoidance of Distortion and Creation of Hazard* — Safety signs should be so placed that they are legible, non-distracting, and not hazardous in themselves.

6.5 *Preclusion of Inadvertent Removal and/or Blockage* — Visual hazard alerts should not be located in areas where they may be removed by the motion of the hazardous device, or rendered ineffective by situational conditions of the hazard (i.e., it is not advisable to place visual hazard alerts on a removable panel unless the alert is repeated inside and/or the panel is interlocked). These alerting devices should not be blocked by moveable panels such as doors, windows, racks, etc.

6.6 *Location of Visual Hazard Alerts in Product Manuals* — Visual hazard alerts should be incorporated in product manuals with appropriate language just prior to the narrative describing a process or function where the hazard could be encountered. In addition, a summary of detailed hazard alerts should be provided in a safety section (such as in the front) of all manuals. Such alerts should also be replicated at the appropriate points on drawings or schematics used for service, when the person performing the service needs to be advised of a hazard. Where the text of an alert is long, and is required repeatedly in the text of a manual, the following alternate method may be used: Print a brief alert using the trilogy rule in Section 5.2 in the text, and refer to the safety section of the manual.

7 Sign Layout

7.1 *Three Panel Signs* — Three panel signs should be as illustrated in Figure 2.

7.2 *Two Panel Signs* — Two panel signs should be as illustrated in Figure 3.

7.3 *One Panel Signs* — One panel signs should be as illustrated in Figure 4. Symbol-only signs use hazard classification surround shapes.

8 Sign Color

8.1 *Color Specifications* — The color of sign finishes should conform to the approved color specifications as outlined in Sections 8.2 through 8.4 inclusive. All color measurements are made in accordance with the methods defined in the following guidelines or references. Signs used in areas with other than white lighting may require special considerations.

8.2 *Opaque Colors* — Opaque colors should conform to those colors specified in American National Standards Z53.1 or Z535.1.

8.3 *Retroreflective Colors* — Retroreflective colors should conform to those colors specified in American National Standards Z535.1.

8.4 *Fluorescent Colors* — Colors should conform to those colors specified in American National Standards Z53.1 or Z535.1.

8.5 *Acceptable Alternative Color Specifications* — Colors specified within the FMC, Westinghouse, or other equivalent standards may be considered acceptable alternatives to those colors specified in Section 8.1.

9 Symbols and Pictorials

9.1 Symbols and pictorials may be used to clarify, supplement, or substitute for the worded message found in the message panel of safety signs.

9.2 *Selection* — Symbols and pictorials are graphic representations chosen to clearly convey a specific alerting message.

9.3 *Use* — Symbols and pictorials are encouraged if they are readily understood by the observer, and if they serve to clarify the message (as determined by Section 5).

9.4 *Function* — A symbol or pictorial may be used to describe the nature of the hazard, potential consequences of the hazard, or evasive/avoidance actions to be taken. These symbols or pictorials should also be compatible with worded messages when used in combination.

9.5 *Permitted Location* — Symbols and pictorials are located on the alerts in areas designated in Figures 2, 3, and 4.

9.6 *Colors for Symbols and Pictorials* — All colors of symbols and pictorials should be as specified in Section 8.1.

9.7 *Surround Shapes* — Surround shapes are geometrical figures that surround a symbol or pictorial to convey added information about the message. Commonly used are the circle with a slash (denotes a prohibition), a triangle (alert), and diamond (warning or caution). Surround shapes are particularly recommended on single panel symbol-only hazard alert devices. See Appendix 1 for examples of surround shapes.

Australian Standard⁹ — 234Z

10 Letter Style and Size

10.1 Key words or single words should be sans serif letters in upper case only.

10.2 Message panel lettering should be in sans serif letters in upper case only, or in combinations of upper case and lower case letters, as deemed appropriate.

10.3 Acceptable lettering styles should include Guideline Medium, Folio Medium, News Gothic Bold, Poster Gothic, and Helvetica.

10.4 Balance and legibility should be determined by the combination of the signal word message panel length and the size of a symbol to pictorial, if used.

10.5 The overall size of the lettering should be determined by the total length of the message and the distance from which the sign will be easily read. The message should be as concise as possible. Letters should be appropriately spaced and not crowded.

10.6 Minimum letter height should be one unit in height for every 400 units of safe viewing distance from the hazard alerting device. For example, the minimum letter height should be one centimeter for each four meters, or one quarter of an inch for each eight feet, of safe viewing distance.

Safe viewing distance is the distance a person can be from a hazard and still avoid the hazard. Safe viewing distances for the signal word panel may be different than that required for the message section panel.

11 Referenced Documents

11.1 *ANSI Documents*⁶

Z53.1 — Color Coding

Z 535.1 — Safety Color Code

11.2 *Other Documents*

FMC⁷ — Product Safety Signs and Labels

Westinghouse⁸ — Product Safety Label Handbook

6 American National Standards Institute, 1430 Broadway, New York, NY 10018

7 FMC Corporation, Santa Clara, CA

8 Westinghouse Electric Corporation, Pittsburgh, PA

9 Standards Association of Australia, Standards House, 80 Arthur Street, North Sydney, New South Wales, Australia