NEMA Z535.3 91 ■ 6470247 0500593 1 ■

American National Standard

ANSI Z535.3-1991

Criteria for Safety Symbols

National Electrical Manufacturers Association
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American National Standard

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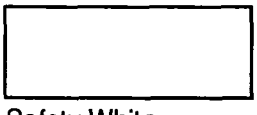
Safety color sheet for use with ANSI Z535.1, Z535.2, Z535.3, Z535.4 and Z535.5-1991

Color Name	Munsell Notation Hue	Value/Chroma	Equivalent CIE Data (Y%)	x	y	Approximate PMS Color
 Safety Red	7.5R	4.0/14	12.00	0.5959	0.3269	15 parts Warm Red 1 part Rubine Red 1/4 part Black
 Safety Orange	5.0YR	6.0/15	30.05	0.5510	0.4214	13 parts Yellow 3 parts Warm Red 1/4 part Black
 Safety Brown	5.0YR	2.75/5.0	5.52	0.4766	0.3816	9 parts Yellow 7 parts Warm Red 4-1/2 parts Black
Safety Yellow	5.0Y	8.0/12	59.10	0.4562	0.4788	Pantone 108 C
 Safety Green	7.5G	4.0/9.0	12.00	0.2110	0.4121	Pantone 3415 C
 Safety Blue	2.5PB	3.5 /10	9.00	0.1691	0.1744	13-1/2 parts Process Blue 2-1/2 parts Reflex Blue
 Safety Purple	10.0P	4.5 /10	15.57	0.3307	0.2245	Pantone 253 C
 Safety White	N	1.0 (5R-5Y)	78.70	0.3101	0.3163	White
 Safety Gray	N	5.0/	19.80	0.3101	0.3163	1-1/2 parts Black 1/2 part Reflex Blue 13 parts Trans. White
 Safety Black	N	5.0/	19.80	0.3101	0.3163	Black

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ANSI®
Z535.3-1991

American National Standard

for Criteria for Safety Symbols

Secretariat

National Electrical Manufacturers Association
National Institute of Standards and Technology

Approved June 1991

American National Standards Institute

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Foreword (This foreword is not a part of American National Standard for Safety Symbols, ANSI Z535.3-1991.) This standard, approved by ANSI on June 6, 1991, is the first edition of an American National Standard for Safety Symbols, Z535.3-1991.

In 1979, the Z53 Committee on Safety Colors was combined with the Z35 Committee on Safety Signs to form the Z535 Committee on Safety Signs and Colors. This committee has the following scope:

> "To develop standards for the design, application, and use of signs, colors, and symbols intended to identify and warn against specific hazards and for other accident prevention purposes."

Five subcommittees were created and assigned the tasks of updating the Z53 and Z35 standards, and writing two new standards. The five standards include:

Z535.1 - Safety Color Code, which updates Z53.1 (1979).

Z535.2 - Environmental and Facility Safety Signs, which updates Z35.1 (1972).

Z535.3 - Criteria for Safety Symbols, a new standard.

Z535.4 - Product Safety Signs and Labels, a new standard.

Z535.5 - Accident Prevention Tags (for Temporary Hazards), which updates Z35.2 (1974).

Together, these five standards contain information needed to specify formats, colors, and symbols for safety signs used in environmental and facility applications (Z535.2), product applications (Z535.4), and accident prevention tags (Z535.5).

It is desirable that new signs, labels, symbols and colors specified after the approval of this standard, comply with the standard.

Neither the Foreword, nor the normative Annexes, are to be considered part of this standard.

Suggestions for improvement of this standard are welcome. They should be sent to the American National Standards Institute, 11 W. 42nd Street, New York, New York 10036.

This standard was processed and approved for submission to ANSI by the Accredited Standards Committee on Safety Signs and Colors, Z535. Committee approval of the standard does not necessarily imply that all members voted for its approval. At the time of approval the Z535 Committee had the following members:

Belinda L. Collins, Ph.D., Chairperson
Carrol E. Burtner, P.E., Secretary
Nora Olgyay, Z535.3 Subcommittee Chairperson

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National Safety Council	James P. Kalatta Joseph Slifka (Alt.)
Rural Electrification Administration	Harvey Bowles
Safety Equipment Distributors	Larry Nandrea Lee Stone(Alt.)
Society of Environmental Graphic Designers	Nora Olgyay Sonia Slobojan Swigart (Alt.)
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American National Standard

for Criteria for Safety Symbols

1 Introduction

The U.S. population is multi-ethnic, highly mobile, and derived from a multiplicity of social and educational backgrounds, with different reading skills and word comprehension. These factors complicate the effectiveness of word-only signs. Effective safety symbols have demonstrated their ability to provide critical information for accident prevention and for personal protection. Illustrated or pictorial signs can promote greater and more rapid communication of the safety message, and therefore, greater safety for the general population. An initial set of such selected symbols is presented here. Methodologies for designing and evaluating safety symbols for additional applications are also presented.

2 Scope and purpose

2.1 Scope

This standard provides general criteria for the design, evaluation, and use of safety symbols to identify and warn against specific hazards, and to provide information to avoid personal injury.

2.2 Purpose

It is the purpose of this standard to promote the adoption and use of uniform and effective safety symbols for safety communications. The standard also provides a procedure for evaluating image effectiveness in communicating the intended message, as well as considerations for graphic design of symbols.

3 Application

3.1 This standard is intended to provide guidance in selecting symbols to alert persons to hazards and to provide general safety messages. This may include applications and information associated with products, the immediate environment, and workplaces. For chemical products and chemical mixtures follow ANSI Z129.1-1988.

3.2 There are a number of existing American National Standards which are recognized for particular industries or specific uses. Compliance with such a standard may be considered for such particular industries or uses. It is not the intent of this ANSI Z535.3 standard to replace existing standards or regulations, which are uniquely applicable to a specific industry or use. It is the intent to encourage adoption of this standard in subsequent revisions of other standards and regulations.

4 Definitions

4.1 environmental safety signs: Sign (or placard) in a work or public area that provides safety information about the immediate environment.

4.2 hazard: A source of potential injury to a person.

4.3 image: That portion of the symbol which is a graphic rendering, either abstract or representational, of the safety message.

4.4 panel: An area of a safety sign which has a distinctive background color different from adjacent areas of the sign, or which is clearly delineated by a line, border, or margin. There may be up to three (3) panels per sign: signal word, message, and symbol.

4.5 product safety sign: Sign (or label) on product that provides safety information about that product.

4.6 referent: The message intended to be associated with the symbol.

4.7 safety sign: A method of visual communication to alert persons to hazards and their consequences, as well as to provide general safety information (see ANSI Z535.2-1991).

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4.8 signal word: The word or words that designate a degree or level of hazard. Acceptable words include: Danger, Warning, and Caution. Color is also used to convey signal word meanings (see ANSI Z535.2-1991).

4.9 surround shape: A geometric configuration around the image, which can convey additional safety information.

4.10 symbol: A configuration, consisting of an image with or without a surround shape, which conveys a message without the use of words. As used in this standard, the word symbol includes graphic art, such as pictograms, pictorials and glyphs.

5 Symbol surround shapes, colors, and application

5.1 Designated surround shape

The designated surround shape can provide additional emphasis about the nature of the safety message. Only one surround shape in conjunction with an image is recommended for any one panel. A surround shape is not to be used without an image. The perimeter of the panel may function as a surround shape but it is recommended that a contrasting border be used to delineate this surround shape. Five types of surround shapes (see 5.4) are used with symbols to convey different safety messages.

5.1.1 Hazard alerting

An equilateral triangle or a diamond is used to convey hazard alert messages, regardless of hazard level. Hazard level is conveyed by use of the appropriate signal word and color. See ANSI Z535.2-1991 and Z535.1-1991 (see Annex D).

5.1.2 Mandatory action

A solid color circle is used to convey mandatory action.

5.1.3 Information

A square or rectangle is used to convey general safety information messages including equipment location, fire equipment location, egress, and permitted actions.

5.1.4 Prohibition

A circular band with a diagonal slash at 45° from upper left to lower right is used to indicate prohibition.

5.2 Color

5.2.1 Single-panel symbol-only signs

The following recommendations for colors apply only to single-panel signs. For multi-panel signs consult ANSI Z535.2 and Z535.4. Discussion of one-panel signs can also be found in Annex A of ANSI Z535.2. Color specifications are contained in ANSI Z535.1.

Adequate contrast between symbol and background must be maintained. When legibility factors are a problem, the image and background colors may be reversed, as long as adequate contrast between symbol and background is maintained.

5.2.1.1 Hazard alert symbols:

DANGER - White image on red background

WARNING - Black image on an orange background

CAUTION - Black image on a yellow background

5.2.1.2 Mandatory action symbols:

General - White image on a blue background

5.2.1.3 General safety information symbols:

General - White image on a green background, or black image on white background with a green border.

Egress - White image on a green background, or black image on a white background with a green border.

Fire - White image on a red background, or black image on a white background with a red border.

5.2.1.4 Prohibition symbols

Black image, red circular band with slash, and white background is preferred for hazard alerting symbols, unless another appropriate level of hazard can be determined (see Annex D).

5.2.2 Multi-panel signs

For multi-panel signs, the color and format requirements given in ANSI Z535.2, Z535.4, or Z535.5 for environmental signs, product safety signs or accident prevention tags should be followed.

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5.3 Surround shape application

5.3.1 Environmental signs

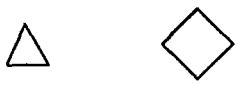
For single-panel (symbol-only) signs, the designated surround shape of 5.1 is required. For multi-panel signs, the designated surround shape may be used (see ANSI Z535.2).

5.3.2 Product signs

For multi-panel signs, the designated surround shape may be used (see ANSI Z535.4).

5.4 Surround shape examples

Suggested Surround Shape

Message	Shape
Hazard Alerting	
Mandatory Action	
Information	
Prohibition	

6 Symbols

The following symbols are examples. They are used in communicating hazard information and safety messages. These symbols are based on data from a procedure similar to that outlined in Annex A. (See Collins [1983]; and Collins, Lerner, and Pierman [1982].) Typical surround shapes have been shown for illustrative purposes only. Note: Surround shapes are not required for multi-panel signs.

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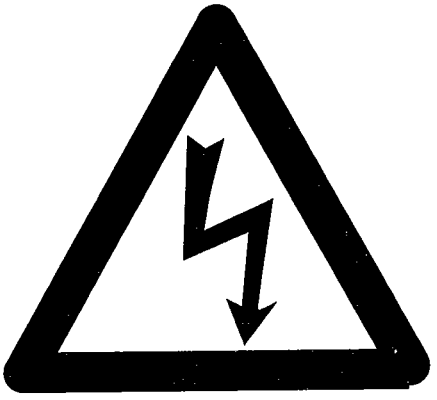
6.1 Hazard alerting symbols

REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Flammable		Flames
Explosion		Object exploding
Electrical		Lightning bolt

For multi-panel signs the designated surround shape may be used.

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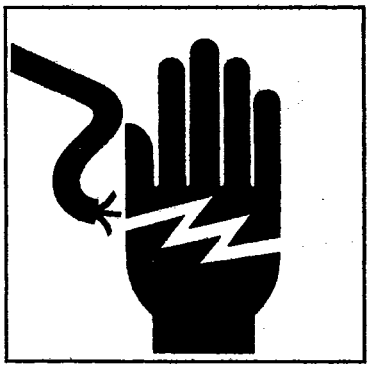
REFERENT	SYMBOL	IMAGE CONTEXT
Electrical	 	Hand* with wire *Other portions of the body may be substituted as needed.
Corrosion		Test tube, hand, drops
Poison		Skull and cross-bones

For multi-panel signs the designated surround shape may be used.

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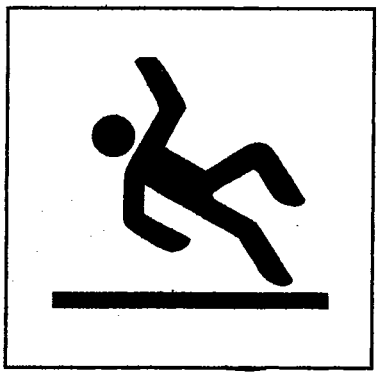
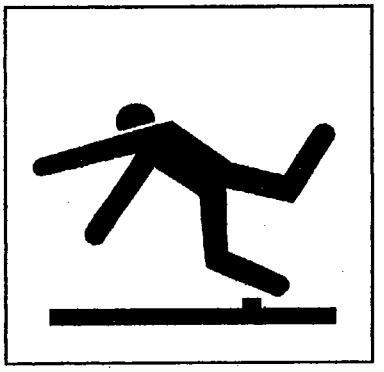
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Slip	 	Person* falling on surface
Trip	 	Person* tripping over object
Fall	 	Person* falling from surface backward or forward

*Other portions of the body may be substituted as needed.
For multiple panel signs the designated surroundshape may be used.

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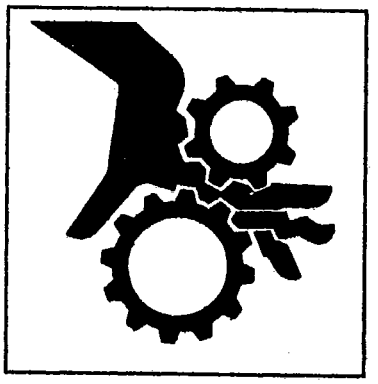
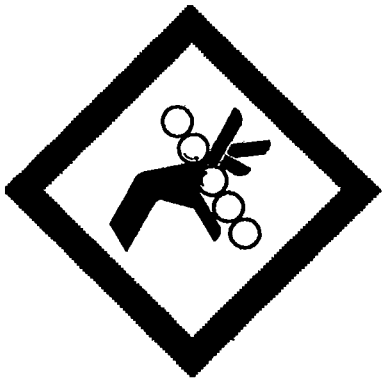
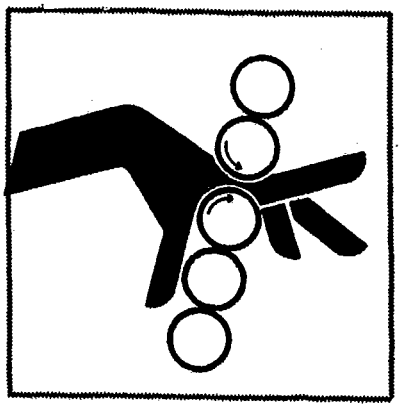
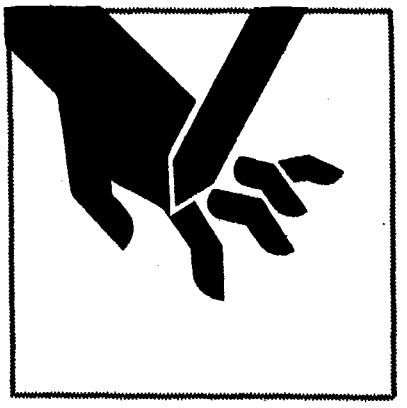
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Entanglement			Hand* and rollers
Pinch			Hand* and rollers
Cut/sever			Hand & sharp object

*Other portions of the body may be substituted as needed. For multi-panel signs the designated surround shape may be used.

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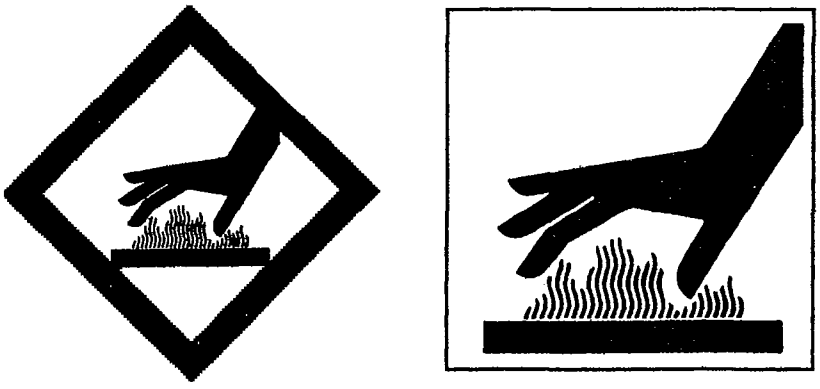
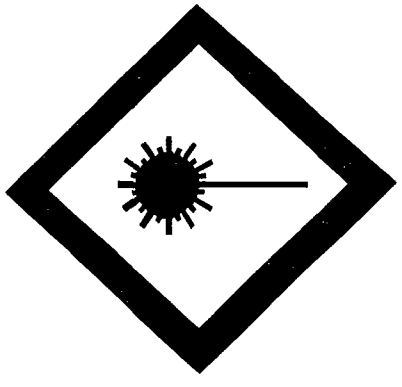
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Hot surface		Hand* and radiating surfaces

THE FOLLOWING SYMBOLS SHOULD BE USED ONLY WITH SUPPLEMENTARY WORD MESSAGES (see Annex D for Rationale).

REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Radiation		Abstract three-bladed object
Laser		Radiating sunburst and line

*Other portions of the body may be substituted as needed. For multiple-panel signs the designated surroundshape may be used.

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REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Biohazard, (see OSHA, 1910)		**Abstraction No surround shape is provided for in the referenced standard**
Safety/alert (from SAE J284a)		**Exclamation point and triangle* *Surround shape is mandatory. This symbol should NOT be used in place of a more specific available symbol. It also should be used only in multi-panel signs, as part of the signal word panel.**
Radio frequency hazard		**Abstraction**

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6.2 Mandatory action

REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Eye protection		Head with eye glasses or goggles
Ear protection		Head with ear protection
Head protection		Head with hard hat

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REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Respiratory protection		**Head with respirator**
		**Head with mask**
		**Airline respirator**

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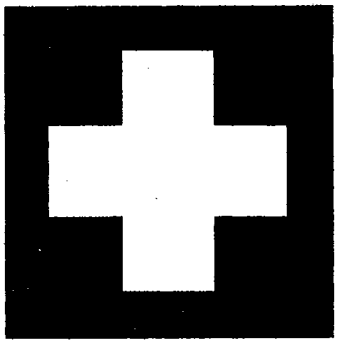
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Foot protection		Safety shoe
Hand protection		Two gloves

6.3 General safety messages

REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
First aid		Cross

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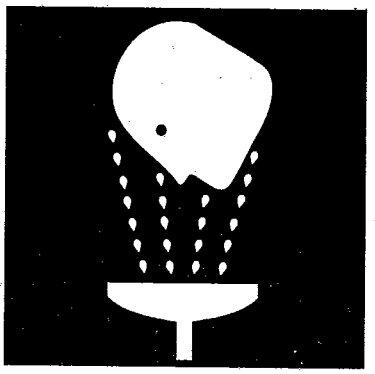
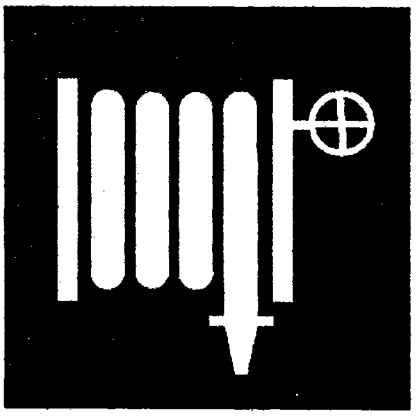
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Safety shower		Person, shower head, drops
Eyewash		Head, drops, basin
Fire hose and reel		Hose and reel

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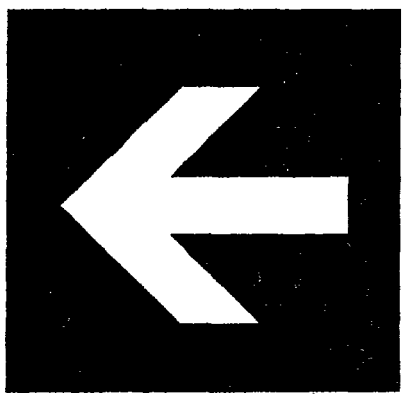
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Extinguisher		Extinguisher
Exit		Person, open door*
Direction		Arrow* to be used only in conjunction with another safety symbol. Direction of travel must be consistent with that of exit figure, when used with exit symbol.

*Direction of travel of exit figure must be consistent with direction of arrow - and with true direction of exit.

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6.4 Prohibited actions

REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
No smoking		Lighted cigarette
No open flame		Lighted match
No open flame		Flame

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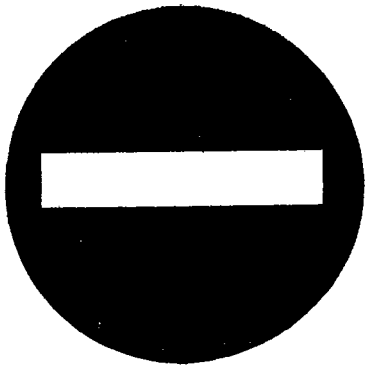
REFERENT	SYMBOL EXAMPLE	IMAGE CONTEXT
Do not touch		Hand, surface
No exit, no way out		Person, open door
No entrance, no admittance for people		Standing person
No entry for vehicle		Circle, horizontal bar

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6.5 General recommendations

The symbols in section 6.1 through 6.4, as recommended for each referent, are based upon the results obtained from tests using the testing procedures outlined in Annex A. As situations vary, different parts of the body can be portrayed to give a better representation of the hazard. The criteria given in section 8 are suggested as guidelines.

6.6 Special applications

The reader is directed to the reference section for a listing of relevant standards for symbols for more specialized applications (see Annex C for examples).

7 Symbol selection

7.1 A symbol should have demonstrated understandability as verified by acceptable selection procedures involving an appropriate test group. A methodology for testing is contained in Annex A.

7.2 A symbol used without demonstrated understandability shall be reinforced by a word message explaining the intent of the symbol. Its format shall follow that given for multi-panel signs.

7.3 A symbol training/recognition procedure is recommended to familiarize intended users with symbols and their meanings. This procedure should be conducted by the employer or product manufacturer who plans to use the symbol.

7.4 If a new symbol has been tested and found to be acceptable, it and the results of the testing procedure may be forwarded to the ANSI Z535 Committee for consideration for inclusion in a revision of the present standard.

8 Graphic design considerations

8.1 Procedure for the design of new symbols

Where a symbol is desired for a referent not covered in section 6, the following considerations are suggested as guidelines for designing a new symbol or for modifying an existing symbol.

8.1.1 Visual design considerations

Individual symbols should be designed, wherever possible, as elements of a consistent visual system. Visual consistency within a system can be strengthened by attention to the following graphic guidelines.

8.1.1.1 The use of representational, rather than abstract, symbols is recommended whenever possible.

8.1.1.2 When a full human figure is used, the graphic rendition should be in the form of the human figure used by the U.S. Department of Transportation (DOT) (see Annex B).

8.1.1.3 When objects, faces, or the full human body are shown, the view (front or side) that is most easily recognized should be used. Recognition can be verified by using a testing procedure such as that given in Annex A.

8.1.1.4 When parts of the human body or objects are used as elements of a new symbol, these elements should conform as much as possible to the illustrations shown in section 6.

8.1.1.5 Symbols depicting action are recommended.

8.1.1.6 Hazard alerting symbols should depict, where possible, both the human element and the hazard.

8.2 Specific design considerations

The following factors are specified as elements that contribute to good symbol design.

8.2.1 Proportion: avoid long, narrow forms.

8.2.2 Symmetry

Generally, symbols should be designed to be symmetrical about a vertical or horizontal axis.

8.2.3 Direction

Conflicts or ambiguities in direction between elements of a graphic symbol must be avoided. When a symbol with directional characteristics is combined with another directional element, the combination shall give the same directional information. An example is the exit symbol and the arrow.

8.2.4 Form

Solid forms are preferred to outline forms. An outline form if used, should be bold and discriminated from its background.

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8.2.5 Detail

Simple geometric forms are preferred. The use of superfluous detail or decoration shall be avoided. The critical details of the symbol should be discriminable at the intended viewing distance.

8.3 General considerations

Because symbols are used in a variety of conditions which vary widely, some of the following considerations should be considered when designing or implementing symbols.

8.3.1 Symbol size

Since symbols may be used on large and small products or areas, they should be legible at the intended viewing distance.

8.3.2 Symbol placement

Symbols used on safety signs should be placed within the normal field of view, and near the hazard or area for which action is required.

8.3.3 General concerns

Attention should be paid to environmental factors such as dirt, degradation, light level and light quality which may impair the effectiveness of a symbol.

References

9.1 Standards and regulations

American National Standards Institute (ANSI). *Safety Color Code,* ANSI Z535.1-1991.

American National Standards Institute (ANSI). *Specifications for Environmental and Facility Signs,* Z535.2-1991.

American National Standrds Institute (ANSI). *Product Safety Signs and Labels,* ANSI Z535.4-1991.

American National Standards Institute (ANSI). *Radio Frequency Radiation Hazard Warning Symbol.* New York: ANSI C 95.2-1982 (R1988).

American National Standard for Hazardous Industrial Chemicals - Precautionary Labeling. New York: ANSI Z129.1-1988.

Department of Transportation, Federal Highway Administration. *Manual on Uniform Traffic Control Devices* (MUTCD) Title 23, CFR Washington, D.C. 1979.

International Organization for Standardization (ISO). *Safety Colours and Safety Signs,* Geneva, Switzerland, ISO3864, 1984-03-01.

International Organization for Standardization (ISO). TC 145 *Graphic Symbols* Part 1 - Rules for the presentation of graphic symbols: General Principles. Geneva: ISO, Revision of ISO 3461, N115E. 1980(a).

International Organization for Standardization (ISO). TC 125/SC1, ISO/DIS 7001.

Procedure for the Development of Public Information Symbols. Geneva, 1980(b).

International Organization for Standardization (ISO). Draft Technical Report 7239. Development and Application Principles for Public Information Symbols. Geneva: ISO, TC 145, 1982.

Society of Automotive Engineers (SAE). Safety Alert Symbol for Agricultural, Construction, and Industrial Equipment - SAE J284a. Warrendale, PA: SAE, June 1975.

Standards Association of Australia. *The Design and Use of Graphic Symbols and Public Information Standards,* Part 3. Test Procedures for Evaluating Graphic Symbols and Symbol Signs. Australian Standard, AS 2342, Part 3, 1980.

Treasury Board of Canada. Graphic Symbols for Public Areas and Occupational Environments. Ottawa, Canada, July 1980.

9.2 Supporting references and research

1. American Institute of Graphic Arts (AIGA). *The Development of Passenger/Pedestrian Oriented Symbols for Use on Transportation-Related Facilities.* US Department of Transportation (DOT). DOT-RSPA-DPB-40-79, 1979.

2. Collins, B.L. Use of Hazard Pictorials/Symbols in the Mineral Industry. Bureau of Mines Contract J011-3020. NBSIR 83-2732-R. September, 1983.

3. Collins, B.L., Lerner, N.D., Pierman, B.C. Symbols for Industrial Safety. National Bureau of Standards, NBSIR 82-2485, April 1982.

4. FMC Corporation. *Product Safety Signs and Labels.* Santa Clara California: FMC, 2nd Ed., 1978.

5. Westinghouse Electric Corporation. *Product Safety Label Handbook.* Trafford, PA: Westinghouse, 1981.

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Annex A
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Suggested procedure for evaluating candidate symbols

A.1 Rationale

The intent of the following recommended testing procedure is to provide an objective, empirical approach for selecting symbols for safety messages. The procedure is intended to choose a symbol which best conveys the message, so that reliance upon word messages and/or symbol training is minimized. The procedure also provides feedback for those situations where no symbol tests well, thus indicating the need for supplementary word messages or training to aid understandability. Use of this or an equivalently validated procedure can provide objective, reliable data for selecting the most effective symbol for a given referent.

In the following procedure the primary criterion for determining symbol effectiveness is that of understandability; in other words, that the symbol clearly conveys the intended message to the appropriate test group. The procedure consists of a test in which selected members of a target audience provide comprehension data for proposed symbols. The goal is to determine the meaningfulness of each symbol proposed, and where more than one symbol is proposed for a given referent, to compare the relative performance.

The following steps are recommended for determining the necessary understandability data. The procedures represent a minimal program for empirical evaluation. In some cases, more extensive testing procedures, or more stringent acceptance procedures, may be necessary.

A.2 Procedure

A.2.1 Purpose

Determine the meaning of the symbol by establishing clearly the intended referent or message. Use this message as the correct answer in scoring data.

A.2.2 Target audience

The population(s) of potential users of a symbol must be carefully determined. Testing should utilize a smaller, target audience representative of the population(s). Particular attention may be warranted for subgroups anticipated to have greater comprehension problems or information needs.

A.2.3 Approach

Determine the meaning of each proposed symbol from the responses given by the target audience. A minimum size of 50 persons is suggested as the best balance between statistical reliability and ease of testing (Australian Standard, 2342, Part 3, 1980). If this minimum cannot be met, testing for symbol meaning should still be conducted. After collecting the data, score and analyze the data for each symbol. Four scoring categories are suggested; correct, wrong, critical confusion (that is, the opposite of correct), and no answer. Calculate the percentage of answers in each category. If the responsesfor a given symbol are at least 85 percent correct, and if there are also not more than 5 percent critical confusions, the symbol may be accepted for use. If the percentage of responses does not meet both criteria, modify the symbol design based upon the responses given during the testing session, and retest. Retesting should be with a different group of people.

A.2.4 Testing procedure

The following procedure is suggested as a good way of determining symbol understandability. Collect short definitions of the meaning of each symbol from the appropriate target audience. After collecting definitions, use two or more people to score the data independently according to the suggested categories. Calculate

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the percentage of answers in each category.

A.2.5 Alternative testing procedure

For ease in testing, develop three reasonable wrong answers for use in a four-alternative multiple choice test. Where applicable, the critical confusion should be included as one of the choices. The intended referent must be the remaining choice alternative. Use of a forced-choice procedure is recommended. Once all the data have been collected, calculate the percentage of answers for each multiple choice item.

A.2.6 Other procedures

Other testing techniques, such as matching can be used. Care should be exercised to ensure the validity of these methods or procedures. It should be stressed that different techniques may not give comparable results.

A.2.7 Criteria for acceptance

The following criteria for acceptance of a symbol are recommended. A criterion of 85 percent correct responses with a maximum of 5 percent critical confusions is suggested for acceptance of a given symbol. Higher criteria for acceptance may be used depending on the importance of the message or severity of the hazard. Any symbol which fails to meet these criteria should be either rejected, modified and retested, used with a supplementary word message, or be supplemented by specialized training. Where several symbols are evaluated for a given referent, the symbol which both meets the above criteria, and performs best in terms of highest percentage of correct answers and lowest percentage of critical confusions should be selected. The symbol should also satisfy, whenever possible, the graphic considerations discussed in section 8.

A.2.8 General considerations

As in any other testing situations there will be any number of variables associated with the eventual use of symbols that will have to be considered in each evaluation situation. It is not the intent of this section to specify an exhaustive list of potential variables and/or to outline specifications/procedures on how to handle these factors. The number of these conditions vary considerably; procedures to handle them are situation sensitive and should be determined for each individual case. For example, some of the factors which evaluators will need to consider are: establishment of baseline criteria for test subjects such as age, education, experience, visual capabilities, etc; uniformity of test instructions; manner of presentation of symbols to subjects; size of test symbols; amount of time that subjects are allowed to view the symbols; selection of alternative responses in a multiple choice situation to assure that correct selection is not based on irrelevant/absurd alternatives; and the specific number of subjects, etc.

Therefore, a comprehensive and uniform protocol for evaluating a very wide range of potential symbols is not possible here. Evaluators are encouraged to review the references contained in this document as well as other texts on human factors, psychology, and ergonomics to familiarize themselves with the procedures and techniques used by other experimenters.

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Annex B
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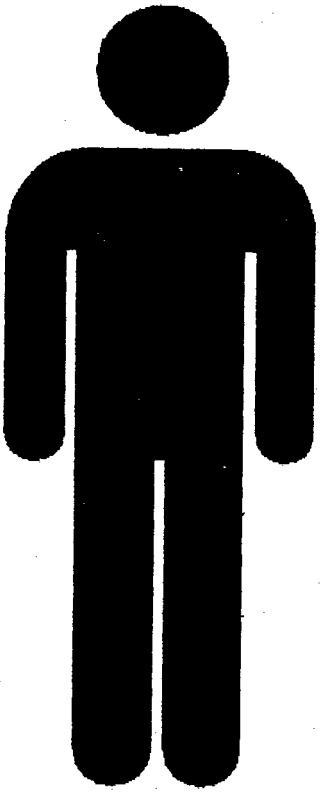
Graphic example of person

Where an entire person is depicted, the following figure used by the U.S. DOT is recommended.

Example



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Annex C
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Examples of symbols from referenced standards

Hand Tools Institute symbol



Surround shape as shown is not preferable but is included due to acceptance in the hand tools industry.

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Annex D
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Supplementary explanatory information

D.1 For Section 5.1.1, the rationale for recommending the diamond surround shape is based on the following three pieces of evidence:

1) The diamond shape can allow a greater interior area for locating the symbol centrally;

2) The diamond surround shape is used by the Department of Transportation for highway warning symbol signs (see Manual on Uniform Traffic Control Devices, 1979) and as the sign shape for hazardous materials transport signs (in this case, however, the symbol appears in the upper portion of the diamond). The extensive use on the highways has given the U.S. population some familiarity with this approach;

3) Research by Collins (1983) suggests that the diamond shape is perceived as more hazardous than the triangle, inverted triangle, circle, or square.

It is recognized that ISO 3864 (1984) recommends a triangle for indicating the presence of a hazard, and SAE recommends its use for the "Slow Moving Vehicle" symbol. As a result, either shape may be used.

D.2 For Section 5.2, the rationale for recommending this color scheme for single-panel only signs (only) is that, while the colors for this symbol should follow from the signal word for multi-panel signs, when there is no signal word, the color-coding should follow that given by Z535.1-1991 for "stop". The intention is to indicate that there are no degrees of prohibition. In other words, the desire is to stop the action completely. Since the scope of the present standard is safety application, the presumption is that total prohibition of an action is justified on safety grounds. This coding is thus consistent with the MUTCD (1979) and ISO 3864 (1984) standards which show a red circle and slash for single panel symbol-only signs. Deference to informational sign coding appears to be outside the scope of this standard. If another appropriate level of hazard can be determined, however, that level should be used.

D.3 For Section 6.1, the rationale for suggesting supplementary word messages for these symbols is that research by Collins (1983) and Collins, Lerner and Pierman (1982) showed poor understandability of them. Fewer than 50 percent of the groups of individuals studied (industrial personnel, miners, and students) identified these correctly. Major confusions with opposite to correct meanings were also identified. It is recognized, however, that understandability may improve with increasing use of these symbols with accompanying word legends.

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