

## 1.0 Introduction

This section applies to the design, application, and use of signs or symbols intended to indicate and, insofar as possible, to define specific hazards such that failure to designate them may lead to accidental injury to workers, the public, or both, or to property damage. These specifications are intended to cover all safety signs except those designed for streets, highways, railroads, and marine regulations. (OSHA CFR 29 Part 1910.145)

The specific symbols presented in this section are intended as general guides for the formulation of graphical symbols used in drafting practice and are not meant to imply that they are standard.

For specific markings governing the transportation of materials there are standards set by the Department of Transportation that must be adhered to. When formulating graphical symbols to be used with the transportation of materials, on streets, highways, railroads, vehicles, in marine or airport applications, the appropriate federal regulations must be followed.

This section is consistent with ISO R557 and ISO R408.

## 2.0 Colors

Safety colors should attract attention, and afford a rapid indication of dangers and facilitate their identification. They may also be used to indicate the location of devices and equipment of special importance for safety. Safety colors do not by themselves eliminate any danger, and colored safety instructions cannot be substituted for proper accident prevention measures.

## 3.0 Safety and Auxiliary Colors

### 3.1 General Meaning Assigned to Safety Colors

#### RED

- Stop e.g. - Stop signals
- Harmful e.g. - Fire-fighting equipment and location
- Activity e.g. - Emergency stop devices

#### YELLOW

- Attention e.g. - Warning of danger
- Danger e.g. - Caution signs; Inside of machinery guards

#### GREEN

- Safety e.g. - Escape routes and refuges; Clear or go signals for persons and vehicles; First aid and rescue stations and equipment and their location

#### BLUE

An auxiliary color, blue may be used as a signaling color for organization, instruction or information.

**3.2 Physical Definition of the Colors** - The three safety colors and the auxiliary color are defined by the standard color-metric system of the International Commission on Illumination (CIE).

The specifications are expressed in CIE chromaticity coordinates  $x$  and  $y$  and luminance factor  $b$  determined under CIE conditions, i.e. source C, direction of illumination normal, direction of viewing 45 degrees.



Safety RED

$$y < 0.290 + 0.080 x$$
$$y > 0.920 - x$$
$$y > 0.559 - 0.394 x$$
$$y > 0.316$$
$$0.07 < \beta < 0.15$$

Safety YELLOW

$$x < 0.048 + 0.827 y$$
$$y > 0.887 - x$$
$$y > 0.120 + 0.632 x$$
$$\beta > 0.45$$

Safety GREEN

$$x > 0.526 - 0.683 y$$
$$x < 0.410 - 0.317 y$$
$$y > 0.282 + 0.396 x$$
$$y < 0.547 - 0.394 x$$
$$0.15 < \beta < 0.16$$

Auxiliary BLUE

$$x < 0.433 - 0.95 y$$
$$y < 0.64 x + 0.12$$
$$x > 0.342 - 0.95 y$$
$$y > 1.26 x - 0.074$$
$$0.08 < \beta < 0.16$$

**3.3 Contrasts** - The use of white or black is recommended to improve visibility of safety colors.

**3.4 Materials Used and Their Application** - The colors should be prepared with materials having appropriate color stability under the expected conditions of use.

Safety colors and the auxiliary color should be applied so as to be clearly visible in all conditions, and generally on a limited scale, so as not to interfere with color schemes in which colors are applied to relatively large surfaces.

Safety colors and the auxiliary color, with or without white or black as contrasts, can be directly applied on objects or on safety signs.

## 4.0 Safety Signs

**4.1 Geometrical Forms** - If safety colors are used on signs or in certain geometrical forms, the notions "prohibition," "warning," and "instruction and information" should be represented as follows:

CIRCLE = Prohibition

TRIANGLE (equilateral, base downward) = Warning

RECTANGLE = Information

Note: For non-safety signs, do not use safety colors.



**4.2 Symbols and Text for Safety Signs** - In order to complete safety signs, certain symbols may be used within the geometrical forms. If necessary, written text may be used either within or outside the geometrical forms.

## 5.0 Symbols, Dimensions and Layout for Safety Signs

**5.1 Scope** - This recommendation applies to the dimensions of safety signs in geometric forms; symbolic images to be placed on those safety signs, representing the objects or events to which the safety signs are intended to call particular attention; and layout of the signs.

**5.2 Definitions** - The following terms are used for notions applied in this recommendation:

- Contrast color - neutral color, or white or black, used as a contrast in combination with the safety color or with the auxiliary color;
- Safety symbol - simple image, graphically specifying more closely the meaning of the safety indication;
- Safety sign - geometric form (e.g. circle, triangle or rectangle) containing a safety symbol, wording, or both.

**5.3 Purpose of Safety Signs** - The purpose of the safety signs and the symbols which may appear on them, along with the application of the safety colors which may reinforce their effect, is to attract attention rapidly to a danger and to facilitate its identification.

They may also be used for indicating the location of devices and equipment that are important from the safety point of view.

**5.4 Overall Dimensions of Safety Signs** - The overall dimensions of safety signs should be such that the area S of a safety sign and the distance of observation L comply with the following formula. S and L are expressed in the same unit of measurement.

$$S \geq \frac{L^2}{2000}$$

**5.5 Symbols** - The dimensions of essential details of safety symbols should be in the ratio of a least 1/1000 of the distance of observation; corresponding approximately to a visual angle of 3 feet, 30 inches. (In compliance with the rule that the dimensions of essential details of the symbols should be at least 3% of the maximum dimension of the safety sign.)

This rule is sufficient for the observation of the essential details under the following conditions:

luminance level not less than 50 lux on the surface of the sign.

luminance contrast  $\Delta$  within the sign, not less than 25% where  $\Delta$  is the difference between the luminance level of the safety color and that of the contrast color divided by the higher of the two.

When ordinary lighting does not attain the minimum luminance level of 50 lux, special lighting on the signs is recommended. In a number of cases, it may be advantageous to make use of luminescent or retro-reflective signs.

The design of symbols should be as simple as possible and details not essential for the identification of the symbols should be omitted. A representation of a flame, for example, should contain only those details that are strictly necessary so that there can be no doubt as to its identification as a flame. It is also recommended that the use of macabre or horrifying designs for the symbols should be avoided as far as possible.

Following is a list of symbols recommended for use in representing various notions, objects, events or notices.

Greek cross –	First aid equipment
Safety goggles –	Protection for eyes
Helmet –	Protection of head
Gas mask –	Protection of respiratory organs
Glove –	Protection of hands
Flame –	Flammable material
Exploding bomb –	Explosive material
Skull and crossbones -	Toxic material
Corroded hand or, drops falling from a test tube on a corroded hand or plate –	Corrosive material
Trefoil, as specified in ISO R 361, Basic ionizing radiation symbol, or skull and crossbones –	Radioactive material
Flash of lightning or the figure of a man struck by a flash of lightning -	Electricity
Load suspended on a hook –	Suspended loads
Falling stone, brick, or hammer –	Falling objects
Thermometer indicating high or low temperatures –	Dangerous temperatures
Person falling backwards –	Risk of loss of balance, slipping or falling
Burning pipe or cigar with or without burning match –	Smoking
Burning candle or flame –	Open fire

## 6.0 Layout of Safety Signs

The safety color should cover at least 50% of the total surface of the safety sign.

**6.1 Color Pattern** - The following two principles may be followed for the color pattern:

Principle 1 - On the area of a safety sign showing the relevant safety color, the symbols should be given in a contrast color. In this case the sign may be provided with a narrow border in the same contrast color.

Principle 2 - On the area of a safety sign showing a wide border in the relevant safety color, enclosing a background in a contrast color, the symbols should be given:

- in the safety color itself on the contrasting background;
- in black, if the background is white.

**6.2 Framing of Symbols and/or Text** - Symbols and text, if any, should be placed within the area indicated by a dotted line in the figures below.

The ratio of the dimensions of the area assigned to the symbols and of the dimensions of the border to the maximum overall dimensions should be as indicated in the figures. This will ensure that the requirement expressed in Section 5, that at least 50% of the total surface is covered by the safety color, is complied with, regardless of the area of the symbol.

**6.3 Recommended Layout for Safety Signs and Symbols** - Figures 1 and 2 specify how to calculate dimensions for symbols.

Note for Figure 2: The exact critical ratio of  $h1\ max/h$  should be calculated from the following quadratic equation:



$$\left(\frac{h_1}{h}\right)^2 + \left(\frac{l}{h} - 1\right)\frac{h_1}{h} - \frac{l}{2h} = 0$$

For simplicity it is recommended that  $h_1 \text{ max}/h$  remain a constant value for each of the following ranges:

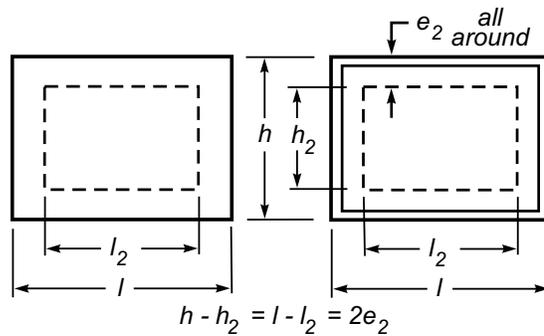
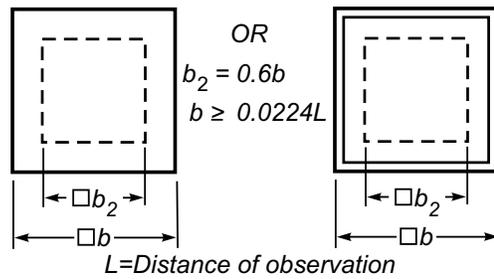
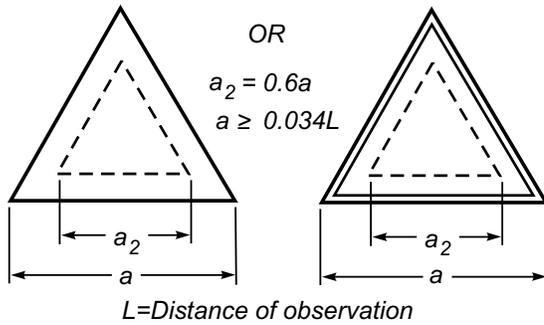
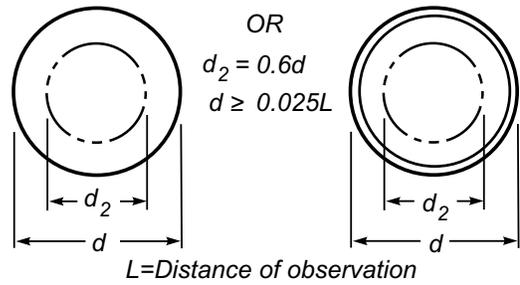
*$l/h > 1$  to  $1.4$*

*$l/h > 1.4$  to  $2$*

*$l/h > 2$  to  $4$*

*$l/h > 4$  to  $8$*

Figure 3 consists of possible applications of symbols.

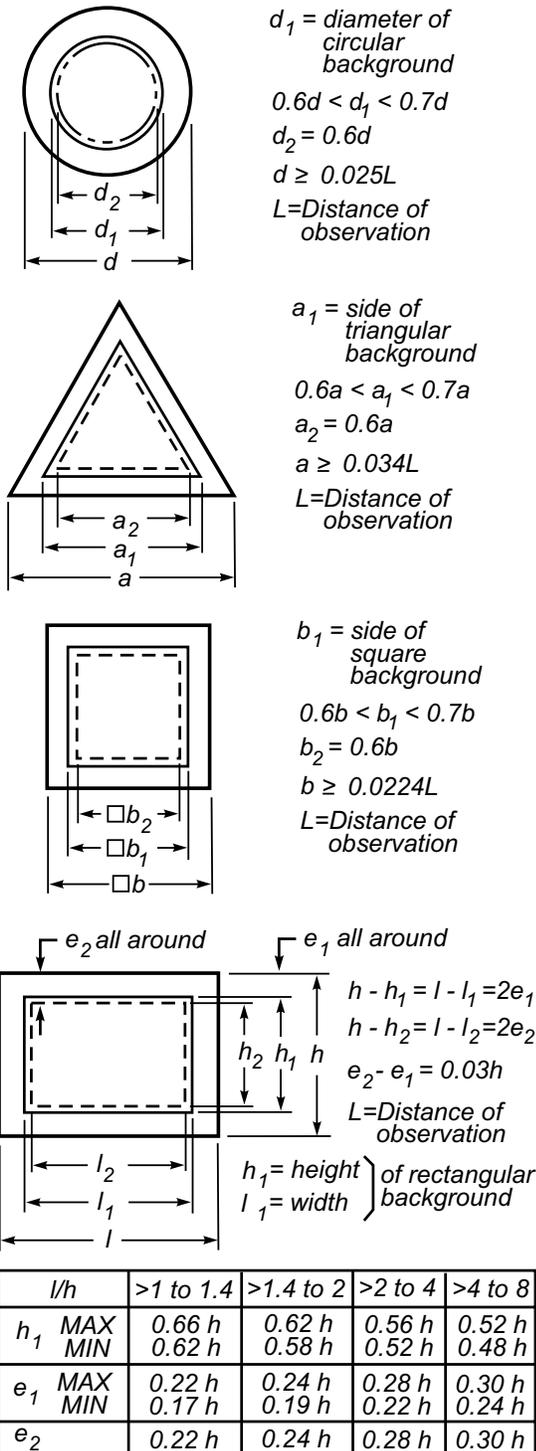


$l/h$	>1 to 1.4	>1.4 to 2	>2 to 4	>4 to 8
$e_2$	$0.22 h$	$0.24 h$	$0.28 h$	$0.30 h$

$l \times h \geq 0.0005 L^2$

Figure 1 – Principle 1: Signs in the Safety Color, Without Border or With Narrow Border in the Contrast Color





$l \times h \geq 0.0005 L^2$

Figure 2 – Principle 2: Signs for Symbols on Contrasting Background With Border in the Safety Color (See Note)



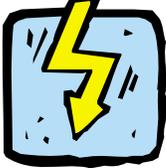
<p>Look Out! (Safety Alert)</p> 	<p>Handicapped</p> 	<p>Slippery</p> 
<p>First Aid</p> 	<p>Watch for Work Vehicles</p> 	<p>Electrical Danger</p> 
<p>No Entry</p> 	<p>Slow Moving Vehicle</p> 	<p>Machine Hazard</p> 
<p>No Entry to Pedestrians</p> 	<p>Do Not Start</p> 	<p>Falling Objects</p> 
<p>Emergency Exit</p> 	<p>Do Not Touch</p> 	<p>Poison</p> 
<p>Fire Alarm</p>  <p>FIRE ALARM</p>	<p>No Riding</p> 	<p>Caution: Laser</p> 

Figure 3 – Possible Applications of Symbols (Continued on next page)

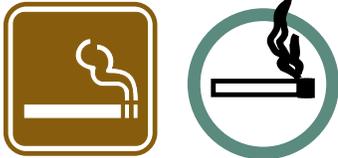
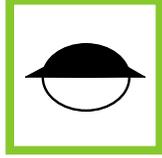
<p>Ionizing Rays (Radiation Warning)</p> 	<p>Fire Hose</p> 	<p>Wear Boots</p> 
<p>Fallout Shelter (Civil Defense)</p> 	<p>Don't Extinguish with Water</p> 	<p>Wear Gloves</p> 
<p>Biohazard Warning</p> 	<p>Fire Extinguisher</p> 	<p>Wear Ear Protection</p> 
<p>Smoking Permitted</p> 	<p>Protection and Safety Equipment</p> 	<p>Wear Goggles</p> 
<p>No Smoking</p> 	<p>Where Protective Clothes</p> 	<p>Wear Gas Mask</p> 
<p>No Open Flame</p> 	<p>Wear Protective Belt</p> 	<p>Wear Helmet</p> 

Figure 3 – Possible Applications of Symbols (Continued on next page)

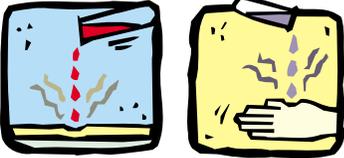
Oxidizing Agent 	Explosive 	Inflammable Liquid 
Compressed Gas 	Radioactivity, Low Level 	Inflammable Solid 
Corrosive 	Magnetized Materials 	Spontaneously Combustible 
Noxious 	Photographic Materials 	Poison 

Figure 3 – Possible Applications of Symbols (Continued)