
**Graphical symbols — Test methods —
Part 3:
Method for testing symbol referent
association**

Symboles graphiques — Méthodes d'essai —

Partie 3: Méthode pour les essais de reconnaissabilité des symboles

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 145, *Graphical symbols*

ISO 9186 consists of the following parts, under the general title *Graphical symbols — Test methods*:

- *Part 1: Method for testing comprehensibility*
- *Part 2: Method for testing perceptual quality*
- *Part 3: Method for testing symbol referent association*

Introduction

The reason for the publication of this International Standard is the increasing use of non-verbal presentation of information.

Continued growth of international trade requires graphical symbols to be understood. This part of ISO 9186 specifies a method for assessing the referent association of graphical symbols by familiarizing people with a set of specialized referents and then testing what proportion of those people can associate a particular graphical symbol with its referent.

ISO 9186-1 specifies a method of testing what proportion of people can comprehend a graphical symbol correctly.

ISO 9186-2 specifies a method of testing how well people can identify the elements which make up a graphical symbol.

This part of ISO 9186 specifies a method of familiarizing people with a set of specialized referents and then testing what proportion of those people can associate a graphical symbol with its referent

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Graphical symbols — Test methods —

Part 3: Method for testing symbol referent association

1 Scope

This part of ISO 9186 specifies a method for testing the referent association of graphical symbols intended to communicate information to users who are familiar with what the symbol is intended to denote or represent (the referent). The referents can be specialized, so that the general public cannot be expected to be familiar with them without familiarity training. The intention is to develop graphical symbols which are correctly recognized by users familiar with the referents when no supplementary (i.e. explanatory) text is presented. When such a graphical symbol cannot be obtained, it might be necessary to present a graphical symbol together with supplementary text explaining its meaning in the language of the intended users.

NOTE 1 Alternatively, it could be necessary to inform people about the meaning of the graphical symbol by including its meaning in manuals, instructions, or training.

NOTE 2 ISO 9186-1 specifies a method for testing the comprehensibility of graphical symbols. ISO 9186-2 specifies a method for testing the perceptual quality of graphical symbols, the extent to which the elements of the graphical symbol can be correctly identified.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9241-302, *Ergonomics of human-system interaction — Part 302: Terminology for electronic visual displays*

ISO 9241-400, *Ergonomics of human-system interaction — Part 400: Principles and requirements for physical input devices*

ISO 9241-5, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 5: Workstation layout and postural requirements*

ISO 9241-12, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 12: Presentation of information*

ISO 17724, *Graphical symbols — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17724 and the following apply.

3.1

comprehension test

procedure for quantifying the degree of understanding of a proposed graphical symbol

3.2

familiarity training

procedure for ensuring that a group of people are familiar with what the symbol is intended to denote or represent

3.3

function

full description of the symbol's intended meaning

3.4

symbol referent association test

procedure for assessing the degree to which the meaning of a symbol can be recognized when the symbol alone is presented

3.5

referent

facility, control, display, concept, or object that a graphical symbol is intended to represent

3.6

variant

alternative graphical symbol design for a given referent

4 Principle

Symbols for specialized referents are used to denote or represent facilities, controls, displays, concepts, or objects. Many different referents/graphical symbols can be within the working environment and on equipment operated by specialist users.

The method for testing comprehensibility described in ISO 9186-1, which involves presenting participants with a symbol and asking them to say what they think it means, is not appropriate for testing a symbol for a specialized referent which is not familiar to the participants. This is because they might respond "don't know" because they are ignorant of the referent, not because the symbol does not provide a clear representation of its referent. It is, therefore, necessary to use a different method for testing symbols for specialized referents, a method which includes an initial stage in which respondents are familiarized with the referents and demonstrate familiarity before the symbols are tested. This is referred to as familiarity training.

When the respondent is familiar with specialized referents, symbols can be tested by presenting them to the respondents together with a list of the familiarized referents and asking them which, if any, of the referents is indicated by the symbol. This is called the symbol referent association test. In order to avoid later responses being unduly influenced by earlier ones, and to reduce the ability to make a correct response by a process of elimination, the test should include some items in which none of the familiarized referents presented is the one intended to be represented by the symbol. Every test question should include the possible answer "none of these".

The size of the set of symbols to be tested depends on the context in which the symbols are used. For example, the set might be all the symbols found on a particular item of equipment or on a number of items of equipment in a particular location. In a set, there are typically many symbols to be tested.

5 Pre-test information

Before embarking on testing, the submitter shall obtain a copy of whatever forms are required by the standards organization for submitting the graphical symbol for standardization and shall ensure that they are in a position to provide whatever information is required on those forms.

NOTE 1 Application forms for submission of public information symbols for standardization by ISO/TC 145 are available on www.iso.org/tc145/SC1 or from the ISO/TC145/SC1 secretary. Application forms for submission of safety symbols for standardization by ISO/TC 145 are available on www.iso.org/tc145/SC2 or from the ISO/TC145/SC2 secretary. Application forms for submission of symbols on equipment for standardization by ISO/TC 145 are available on www.iso.org/tc145/SC3 or from the ISO/TC145/SC3 secretary.

NOTE 2 If necessary, the secretary of the relevant standards committee can provide supporting information such as whether testing can be required in a number of countries, whether there are any requirements regarding the format in which symbols are to be submitted.

The submitter shall ensure that the symbol variant or variants to be tested have been designed in accordance with the relevant design principles and design criteria.

NOTE 3 Design principles and design criteria for graphical symbols are specified in ISO 3864, ISO 22727, and IEC/ISO 80416.

NOTE 4 A standards organization can require a minimum number of symbols or variants to be tested.

Where the test is to be conducted in a number of countries, the submitter shall ensure that all materials, including computer presentations when they are used, are of the same standard. With both paper and computer presentation, it is essential that all presentations are of an equivalent legibility and that all images are of an equivalent quality.

6 Familiarity training

A person familiar with the referents relevant to the set of symbols under consideration should construct a list of all referents, each entry in the list being paired with a simple description of what the referent means (its function) if the referent meaning is not commonly known.

NOTE An example of a list of referents and their functions is provided in [Table A.1](#).

Potential respondents on the referent association test of the symbols should be presented with the list of referents and their functions and asked to read through the list or study it until they feel they are familiar with all the entries. When they consider themselves familiar with the list contents, they should be tested on their familiarity by presenting to them a list of the referents in a random order and asking them to state what the referent means. The person marking the test should decide for each response whether it shows correct understanding of the referent's function. The respondent should be accepted as a member of the symbol referent association test respondent group if they show understanding of all the referents in the list. A respondent can go through the familiarity procedure and take the familiarity test again until understanding of all the referents is achieved. At least 25 respondents who have demonstrated understanding of the referents are required for the symbol referent association test.

7 Symbol referent association test

7.1 General

Carry out the test using either a printed presentation or computer screen presentation, depending on which is the most practicable. Computer screen presentations include internet presentations.

NOTE For the description of the test using a computer screen presentation, the word "page" is used for a predefined presentation of text and/or graphic elements and their layout on a computer screen.

For screen presentations, use a screen size such that the test pages are clearly legible to the respondents. Each test page content shall fit legibly on the screen in its entirety or with only vertical scrolling required.

Verify that the graphical symbol images presented are not distorted. If the presented graphical symbol images show jagged lines or curves to the extent that the symbol image or image elements cannot be correctly interpreted, apply anti-aliasing methods or increase minimum screen resolution to improve the quality of the image.

7.2 Preparation of test material

Variants should be black on white. Colour should only be used if colour is used for coding information. If a coloured variant is used, it is necessary to ensure the contrast between figure and ground is sufficient for the variant to be readily visible, and that the colours and contrast levels are reproduced accurately in the materials presented to respondents.

Create a series of test pages, each including at the top one of the symbols intended to denote a referent. It is important to inform the respondents in words or pictorial form of the context in which the symbol would be seen when in normal use. Below the symbol show with a line drawing or photograph or state in words the context in which the symbol is likely to be seen. When using a picture to show the context, where appropriate, include a picture of the full set of symbols that would appear in proximity to the tested symbol. For example, include a close-up of the full control panel of a machine as well as an image of the entire machine. Below the context, provide a number (usually no fewer than seven) of functions of referents which were included in the familiarity test. One of the functions should be the one intended to refer to the symbol given at the top of the page. Ask the respondents to indicate which if any of the functions shown is represented by the symbol shown at the top of the page. Include an option to respond "none of the above". Within each series, include at least one additional test page on which none of the functions refers to the symbol given at the top of the page.

NOTE 1 The purpose behind the additional test page is to ensure respondents carefully study each test page.

NOTE 2 Examples of test pages are shown in [B.3](#) and [B.4](#).

For each respondent provide an instruction page, a respondent self-report page and an example page written in the language of the respondent. On the instruction page, include a statement that a symbol might not denote any of the referents described by the functions shown on the page, and that if the respondent thinks this is the case he/she should tick the option "none of the above". Also include a statement that there will be at least one page where this is the correct response.

NOTE 3 An example of an instruction page is shown in [B.1](#).

On the self-report page, ask the respondent to indicate their age group, their sex, their educational level and, when appropriate, whether they have any disability. The wording of the question regarding educational level should be modified to match local usage and educational terminology. Include a statement that respondents are free to refuse to answer any question.

NOTE 4 The aim of asking about educational level is to determine how many respondents have a post-school qualification such as a degree.

NOTE 5 The aim of asking whether the respondent has a disability is to reveal whether the respondents reflect the eventual user group. If this group is not expected to contain people with disabilities, the question can be omitted.

NOTE 6 An example of a self-report page is shown in [B.2](#).

Except where the graphical symbol in actual use is likely to be presented less than 28 mm on its longest dimension, for printed presentations print the symbols within a square not less than 28 mm × 28 mm such that the graphical symbol fills the square. For screen presentations, the dimensions of a square enclosing each graphical symbol should be not less than 28 mm × 28 mm. When the graphical symbol is likely to be presented less than 28 mm on its longest dimension when in use, the symbols presented in the test should be the same size as the symbol in actual use.

When using printed materials, collate each test set into a booklet. Arrange the test pages in the test booklet randomly. With screen presentations, present the test pages in a different, random order for

each respondent. For each 25 booklets, use at least five different random orders of symbols, i.e. no more than five booklets in 25 shall have the same order of presentation.

When a screen presentation is used in an environment controlled by the test administrator, the workstation layout, the visual display and the keyboard shall be in the positions recommended in ISO 9241-302, ISO 9241-400, ISO 9241-5, and ISO 9241-12. Ensure the graphical symbols are clearly legible to the respondents.

7.3 Respondents

Conduct the symbol referent association test in the number of countries required. (See [Clause 5](#), Note 2.)

When the test is carried out in more than one country, whenever possible, the countries should be chosen to represent different cultural backgrounds, for example one European country and one Asian country.

To test a set of symbols, at least 25 respondents in each country are required. The respondents shall have passed the familiarity test. Normally, different respondents are used for testing different sets of symbols.

The respondents should be approximately representative of the eventual user population in terms of age, sex, educational level, cultural, or ethnic background and (when relevant) physical ability.

7.4 Respondents' task in the symbol referent association test

Present a single test booklet or set of screen pages to each test respondent.

Tell the respondent to follow the instructions given on the instruction page. Tell the respondents to carry out the test in silence and not to confer with anyone while they are doing it. Confirm that all respondents indicate that they understand their task.

7.5 Analysis of the results of the symbol referent association test

For every symbol, count the number of times each of the functions listed on the test page was selected as the one represented by the symbol. The "correct identification" score for each symbol is the number of times the correct function is selected by a respondent.

7.6 Presentation of results

Present the results for each symbol in a form such as that shown in [B.5](#). On the form for each symbol, include the information listed below:

- a) the referent of the symbol;
- b) year and month of the symbol referent association test;
- c) the function of the symbol;
- d) the field(s) of application;
- e) the intended user group;
- f) the country in which the test was conducted;
- g) the number of respondents;
- h) the number of respondents of each sex, age group, educational level, (when appropriate) with a disability;
- i) copies of the graphical symbol tested in the colours in which it was presented;
- j) the context information presented when the symbol was tested;

- k) a statement of the colour in which the symbol was presented;
- l) the dimensions (height and width) of the image as tested, expressed in mm;
- m) the source of each symbol;
- n) the frequency with which the correct function was selected or “none of the above” was correctly selected and this frequency expressed as a percentage of the number of responses;
- o) the frequency with which incorrect functions were selected and this frequency expressed as a percentage of the number of responses;
- p) the frequency with which the “none of the above” response was incorrectly selected and this frequency expressed as a percentage of the number of responses;
- q) the frequency with which each of the incorrect functions was selected and this frequency expressed as a percentage of the number of responses.

7.7 Combination of the results from different countries

For each symbol, complete a table, showing for each country that carried out the test the percentage with which the correct function was selected, the percentage with which each of the incorrect functions were selected, and the percentage with which the “none of these” response was incorrectly selected. Calculate the mean of “the correct function was selected” percentages.

7.8 Determination of the most frequently correctly associated variant

The variant with the largest mean percentage of “the correct function was selected” is to be taken as the most recognizable variant.

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Annex A (informative)

Familiarity training

NOTE For this example, the functions (meanings) of the referents have been given. When the referents are commonly understood, the functions can be omitted.

Table A.1 — Example of list of referents and functions for use in familiarity training

Referent	Function
Warning; oxidizing substance	To inform people of the presence of an oxidizing substance so that they take care when in the vicinity of such substances
Warning; low temperature/freezing conditions	To inform people of low temperatures so that they put on protective clothing or avoid exposure to such conditions
Warning; optical radiation	To inform people of optical radiation so that they take care to avoid injury to eyes and skin
Warning; explosive material	To inform people of the proximity of explosive materials so that they take care if handling them or when they are in the vicinity
Warning; radioactive material	To inform people of radioactive material or ionizing radiation so that they can avoid exposure to it or take appropriate protective measures
Warning; non-ionizing radiation	To inform people of non-ionizing radiation so that they avoid exposure to it
Warning; biological hazard	To inform people of a biological hazard so that they avoid exposure to it or wear appropriate clothing
Warning; toxic material	To inform people of toxic material so that they can avoid coming into contact with it or put on protective clothing
Warning; laser beam	To inform people of a laser beam so that they avoid exposure to it
Warning; flammable material	To inform people of flammable material so that they take care not to ignite it

Annex B (informative)

Symbol referent association test

B.1 Example of an instruction page for the symbol referent association test

Instructions

We would like you to help us evaluate some proposed symbols (pictograms). We want to see how well these symbols are understood. You will be helping us do this by indicating what you think each symbol means from a list of possible meanings.

On each page, we will show you a symbol and show or tell you where you might find it. Look at this context information before making your response.

Below the symbol, there is a list of possible meanings for that symbol. There is also the opportunity to show that you think none of the meanings in the list is the meaning of the symbol. If you think that one of the meanings given is the meaning for that symbol, please put a cross against it. If you think none of the meaning in the list is the one for that symbol, put a cross against the phrase "none of the above" at the bottom of the list.

It is important you work alone. Do not talk to anyone or make comments out loud.

There is no time limit, but try not to spend too much time on each symbol. Once you finish a page do not go back over it, but do feel free to look at these instructions again at any time.

Remember it is the symbols that are being tested, not you.

The next page asks you for some information about yourself. Please do not give your name. The page after that is an example sheet showing a completed test page. The test pages come after the example sheet.

Thank you for taking part in this study. If you have any queries, you can contact ***** by phone on ***** or by e-mail at *****

B.2 Example of a respondent self-report page

This is a study of the meaning of symbols. We would like to know how far the people responding to the symbols reflect the population of the country, and so would be grateful if you would provide a little information about yourself. You are of course free to refuse to answer any of these questions if you do not wish to give the information. Please do NOT give your name: the responses are entirely anonymous.

Date: _____ Test administrator: _____

Age (please put a tick against whichever age group you are in):

15 - 30 _____

31 - 50 _____

over 50 _____

Sex (please put a tick to show which sex you are): Male _____ Female _____

Educational level (please put a tick against whichever one alternative best describes the level of education you completed):

Did you leave school at the normal school-leaving age? _____

Do you have a post-school qualification which is not degree level? _____

Do you have a degree or degree equivalent? _____

Are you disabled? Yes ____ No ____

If you are disabled, which of the following describes your disablement? (Please put a tick against whichever is appropriate):

Problems with physical mobility _____

Problems with hearing _____

Problems with your sight _____

B.3 Example of a test page for the symbol referent association test



The symbol shown is intended to have a meaning. Is that meaning included in the list below? If it is, place a tick or a cross beside the meaning of the symbol. If none of the meanings given below are the intended meaning of this symbol, put a tick or cross against the last entry in the list, "none of the above".

You might see this symbol on the side of an aerosol container.

Which of these does the symbol mean? (Please indicate only one of the alternatives by putting a tick or cross in the right-hand column.)

Warning; toxic material	
Warning; oxidizing substance	
Warning; optical radiation	
Warning; non-ionizing radiation	
Warning; laser beam	
Warning; flammable material	
Warning; biological hazard	
Warning; radioactive material	
None of the above	

B.4 Example of a test page for the symbol referent association test where the correct response is “none of the above”



The symbol shown is intended to have a meaning. Is that meaning included in the list below? If it is, place a tick or a cross beside the meaning of the symbol. If none of the meanings given below are the intended meaning of this symbol, put a tick or cross against the last entry in the list, “none of the above”.

You might see this symbol on the side of an aerosol container.

Which of these does the symbol mean? (Please indicate only one of the alternatives by putting a tick or cross in the right-hand column.)

Warning; toxic material	
Warning; oxidizing substance	
Warning; optical radiation	
Warning; non-ionizing radiation	
Warning; low temperature/freezing conditions	
Warning; explosive materials	
Warning; biological hazard	
Warning; radioactive material	
None of the above	