



# SURFACE VEHICLE RECOMMENDED PRACTICE

J2830™

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## Process for Comprehension Testing of In-Vehicle Symbols

### RATIONALE

Symbols – also referred to as icons - can be used to communicate information to the driver in a manner that is not dependent on language and can save valuable space on in-vehicle displays. Incomprehensible symbols, however, have the potential to negatively affect safety (e.g., if the driver does not understand the symbol and either does not respond in a timely manner, or responds in a manner that makes things worse). Despite the ubiquity of symbols within the in-vehicle environment, few guidelines exist for testing of symbols. Key shortcomings of existing symbol testing procedures include: (1) a lack of contextual information provided to experimental participants, (2) over-reliance on evaluator judgment regarding how well an experimental participant comprehended a symbol's meaning, and (3) a lack of prescriptive information - feedback to symbol designers regarding how individual symbols could be improved based on the results of the comprehension testing.

This update to the 2008 version of J2830 includes (1) references to ISO symbols testing guidelines, (2) more recent research in this area (e.g., Chi & Dewi, 2014; Huang, Shieh, & Chi, 2002), (3) research not considered in previous drafts (e.g., Zwaga, 1989 and Zwaga, 2000), (4) newer ways in which symbols are used in the in-vehicle environment (e.g., on mirror surfaces), and (5) references to other aspects of the symbol development procedure to aid the comprehension testing process and make it more likely to lead to easily-perceived and well-understood symbols.

Although the focus of this document is comprehension testing of in-vehicle symbols, there are a number of additional symbol design/evaluation procedures that provide great value to the overall process of developing effective symbols. Therefore, this recommended practice provides an overview of procedures for the production test (4.1.3.1) the appropriateness ranking test (4.1.3.2), and the matching test (4.5).

### INTRODUCTION

This recommended practice provides a valid and reliable process for testing the comprehension of candidate automotive symbols. The comprehension testing process was developed through a multi-year effort, supported by the SAE International (SAE) and other organizations, aimed at generating a test method that would: (1) yield high-quality comprehension data for new and proposed automotive symbols, (2) provide clear and specific guidance to symbol developers regarding how they can redesign these symbols to improve comprehension, and (3) be adopted and performed internationally to support international standards efforts.

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## 1. SCOPE

This recommended practice describes a process for testing the comprehension of static (i.e., fixed or non-dynamic) symbols for all ground vehicles, for both OEM and aftermarket products. With advancing display technology, it is now possible to display dynamic symbols (e.g., a spinning beach ball to show that a process is ongoing, or a diagram showing energy distribution in hybrid vehicles). Such graphics are outside of the scope of this recommended practice, though extensions of this process may be useful for testing them. However, several symbols which occupy the same space on a display may change state without movement (e.g. play/pause button); these are within the scope of this recommended practice.

The process described in this recommended practice includes criteria that are used to identify how well the perceived meaning matches the intended meaning for a representative sample of drivers. The data from this process are analyzed to determine the drivers' comprehension of the symbol. These data provide guidance as to the symbols that can be improved and used. Although the process described in this recommended practice emphasizes a paper-and-pencil approach to administer the test, a computer could be used instead.

NOTE: This process was initially developed specifically for testing active safety symbols (e.g., collision avoidance functions), or other symbols that reflect some in-vehicle message (e.g., navigation, vehicle status, or infotainment functions). For that reason, many of the examples provided concern those systems.

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001 USA, phone: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

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Sayer, J.R. & Green, P. (1988). *Current ISO automotive symbols vs. alternatives: A preference study* (SAE paper 880057 and SAE Special Publication SP-752). Warrendale, PA: SAE International, DOI: 10.4271/880057.

### 2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

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### 3. DEFINITIONS

#### 3.1 COMPREHENSION

The degree to which a user understands the intended meaning of a symbol.

#### 3.2 COUNTERBALANCING

Using all of the possible orders of conditions, or randomly determining the order for each participant to control for order effects (Cozby, 2009).

#### 3.3 CRITICAL CONFUSION

A response to the symbol undergoing comprehension testing indicating that the test participant perceived the meaning to convey a potentially unsafe action/meaning or one actually prohibited by the symbol.

#### 3.4 “MAJOR” MESSAGE ELEMENTS

Those words or phrases within the definition or message associated with a symbol that are critical to adequate comprehension. For example, for a “Tire pressure warning-low” symbol, the “tire” and “warning” parts of the message are “major” elements. See 4.1.2.1.

#### 3.5 MESSAGE

The idea, status, or action that the symbol is intended to represent.

NOTE: ISO 9186 and other documents use the term referent.

#### 3.6 “MINOR” MESSAGE ELEMENTS

Those words or phrases within the definition or message associated with a symbol that are less critical to adequate comprehension. For example, for a “Tire pressure warning-low” symbol, the “pressure” and the “low” parts of the message are “minor” elements. See 4.1.2.1.

#### 3.7 SAFETY CRITICAL SYMBOLS

Symbols that are intended to communicate a likely or immediate hazard, status, or required action.

#### 3.8 SYMBOL

A visually perceptible figure used to transmit information, usually independently of language, produced by drawing, printing or other means (see also ISO 2575)

NOTE: In this recommended practice, the term “symbols” does not refer to mathematical symbols (e.g., +, =, or > ) or words/letters (e.g., CRUISE or BRAKE).

### 4. PROCESS STEPS

#### 4.1 Step 1: Develop and Review Candidate Symbols for Subsequent Comprehension Testing

##### 4.1.1 Obtain candidate symbols for testing

Symbols should be provided by individuals and organizations interested in having the comprehensibility of candidate symbols assessed. All symbols should be submitted as electronic graphic files (e.g., .jpg or .gif). Alternative versions of the same symbol should be as similar as possible, in terms of size, appropriate color, resolution, etc., to the intended future