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Earth-moving machinery — Visual display of machine operation

Engins de terrassement — Affichage visuel des fonctions de l'engin

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Foreword

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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 document 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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This document was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 3, *Machine characteristics, electrical and electronic systems, operation and maintenance*.

This fourth edition cancels and replaces the third edition (ISO 6011:2003), which has been technically revised.

The main changes are as follows:

— provided an information classification process;

— Scope has been updated to include non-seated (standing or pedestrian) operator machines;

— removed Table 1.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

As the technology being applied to earth-moving machinery (EMM) has changed, the amount of information presented to the operator has increased.

An aspect of EMM that has seen a significant growth is operator assist features. Some of these features are used specifically for work efficiency, (e.g. return-to-dig depth, bucket levelling), while others are used for safety, (e.g. collision warning and avoidance). If the operator assist feature has different operational states, (e.g. on/off, stand-by, inactive) this information is also presented to the operator.

Another change that is becoming more prevalent is the availability of electric-powered EMM. With these machines, the information that an operator utilizes for management of the energy source of the EMM is different than what was needed with an internal combustion engine.

The energy sources available to EMM are growing to include battery power, hybrid, and others. ISO 6011:2003 contained internal combustion engine parameters. Machines that do not utilise an internal combustion engine as an energy source no longer have many of the items expressed in the previous edition of this document. Machines with an electric energy source would not have engine coolant temperature and engine oil pressure. Some electric machine indications are analogous to internal combustion engine machines, for example, battery state of charge is analogous to fuel level.

This document provides a process for classification of information to be displayed and the specific requirements associated with those classifications along with general requirements for visual displays; the requirements of what information to be provided could be handled by other standards and reference this document for guidance on how to present the information.

This document does not prescribe what information is to be provided to address risk reduction for safety requirements (see ISO 12100), rather it provides a framework for how this information is presented to the machine operator.

This document does not address the complexity of human factors for the perception of displayed information; there are informative references in this document to assist the user with this topic.

Earth-moving machinery — Visual display of machine operation

1 Scope

This document provides requirements and principles for location and visibility, information classification, characteristics and colour of visual displays of direct control earth-moving machinery (EMM) as defined in ISO 6165 for the operator in the intended operating position, as recommended by the manufacturer.

The principles of this document can be applied to remote-control earth-moving machinery.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6405-1, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 6405-2, *Earth-moving machinery — Symbols for operator controls and other displays — Part 2: Symbols for specific machines, equipment and accessories*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
visual display
device that provides information to the operator, by means of an *indicator* (3.2) or a *tell-tale* (3.3), that is relevant to the status of specific machine operational functions and characteristics

EXAMPLE 1 Analogue gauge or hour meter (indicator).

EXAMPLE 2 Multifunction electronic display or digital gauge cluster (indicator or tell-tale or both).

EXAMPLE 3 Labelled light, lighted symbol, or icon (tell-tale).

Note 1 to entry: A multifunction electronic display screen may be part of a visibility aid (VA) system as described in ISO 16001.

Note 2 to entry: Machine operational functions can have an identifiable active state initiated by operator, for example, cruise control, creep mode, auxiliary hydraulic flow.

3.2
indicator
device that shows the magnitude of the physical characteristics that the instrument is designed to sense

EXAMPLE Speedometer, oil pressure, fuel level.

3.3
tell-tale
optical signal that indicates a machine operational function's activation or deactivation, correct or incorrect function, or failure to function

EXAMPLE Cruise control active, low oil pressure, low fuel.

4 Visual displays

4.1 Location and visibility

Taking into consideration the sectors of vision outlined in Annex A, the visual display shall be located such that it is visible and recognizable to an operator in the intended operating position, as recommended by the manufacturer.

NOTE 1 ISO 16001:2017, 4.3 provides requirements for location of VA monitor.

NOTE 2 See ISO 4040, or a similar technical document for guidance.

NOTE 3 See ISO 6682, or a similar technical document for guidance, for visual displays that operators touch.

Glare on, and from, the visual display shall be minimized.

Shielding, display brightness, or other means, may be used to reduce the effect of direct light. Common sources of direct light are sunlight during the day or site work lights during the night.

Dark background colour, display brightness, or other means may be used to reduce glare created by the visual displays in night time or low-light operating environments

4.2 Information classification

4.2.1 General

The information to be displayed relevant for the proper operation of the machine shall be determined at the design stage. Machine type, systems installed and intended use shall be considered when determining the information to be displayed.

Information to be displayed, other than information required by a regulation or standard, shall be assigned a classification as described in 4.2.2, 4.2.3, and 4.2.4. This classification may be determined following the steps below (see Figure 1), or identified as prescribed in other standards or regulations.

— Determine whether an existing regulation or standard has requirements for information to be displayed. If the regulation or standard does not provide specific information, the process in Figure 1 may be applied.

— Determine whether the information to be displayed is necessary for the operation of the machine.

— Determine whether the information to be displayed is utilized for performance or efficiency of the operation of the machine.

Application examples using the classification process, including examples for each classification category, are shown in Annex B.

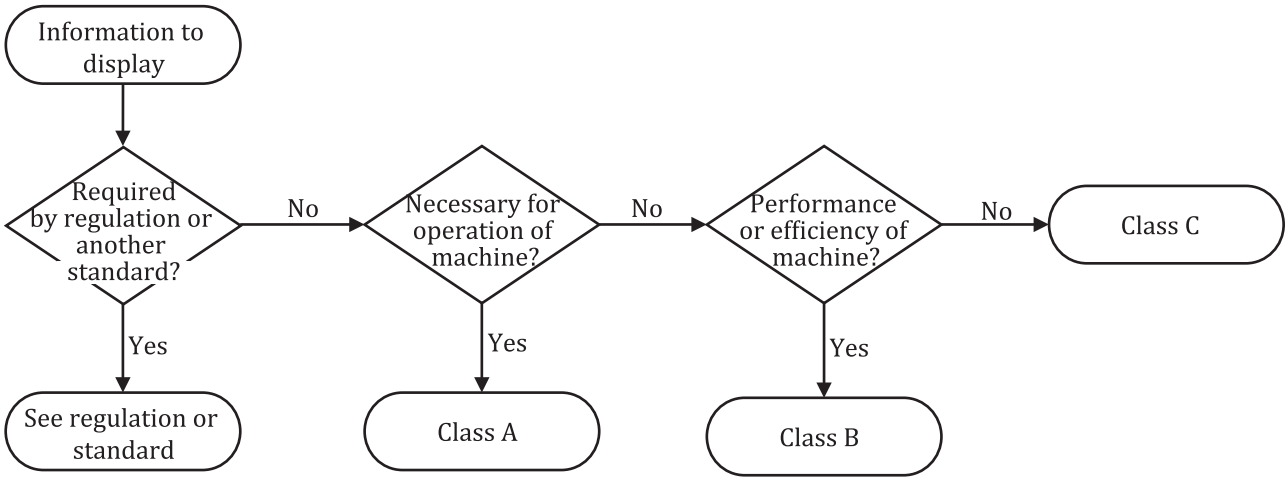

Figure 1 — Information classification process

4.2.2 Class A information

Class A is information necessary for operation of the machine and shall be continuously available to the operator. Displaying Class A information shall require no action by the operator.

4.2.3 Class B information

Class B is information not required for operation of the machine but necessary for monitoring performance or efficiency of the machine. Class B information shall be available to the operator. Displaying Class B information may require action by the operator (e.g. pressing button, tapping screen).

4.2.4 Class C information

Class C is other information that may be available to the operator. Displaying Class C information may require action by the operator (e.g. pressing button, tapping screen).

5 Characteristics

5.1 General

The visual display shall provide characters or symbols of a size large enough to be recognizable by the operator at the operating position. Guidance on character or symbol sizing can be found in IEC 80416-3 or other appropriate standards.

Tell-tales and indicators shall be visible when activated and may be hidden when they are not activated.

NOTE Class B and Class C information can include action by the operator to display the information, see 4.2.3 and 4.2.4.

Indicators may be divided into sections by graduations. The number of graduations used should be commensurate with the accuracy required.

5.2 Identification

The meaning of tell-tales and indicators shall be identified in the operator's manual. Symbols used on visual displays shall, if available, follow ISO 6405-1 or ISO 6405-2. ISO 7000 contains additional symbols that may be used based on the information to be displayed.

5.3 Illumination

Visual displays shall be illuminated to allow viewing at night.

NOTE See ISO 15008, or a similar technical document for guidance.

6 Colour distinction of visual displays

6.1 Colours for visual display elements

The choice of colours for visual display elements shall provide high contrast to facilitate ease of viewing. Visual display element may include the following:

— background;

— graduations;

— identification symbol;

— icon;

— label (numeric or text characters in the form of full words or abbreviations or acronyms);

— pointer (either physical or digitally represented).

6.2 Colours for indicators and tell-tales

Where applicable, colours used on indicators and tell-tales shall follow the colour requirements in ISO 6405-1 and ISO 6405-2.