SVENSK STANDARD
SS-ISO 16001:2008

Fastställd/Approved: 2008-03-31
Publicerad/Published: 2008-04-17
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 53.100

Anläggningsmaskiner – System för riskdetektion och visuella hjälpmedel – Utförandekrav och provning (ISO 16001:2008, IDT)

Earth-moving machinery – Hazard detection systems and visual aids – Performance requirements and tests (ISO 16001:2008, IDT)

SIS

SWEDISH
STANDARDS
INSTITUTE

Hitta rätt produkt och ett leveranssätt som passar dig

Standarder

Genom att följa gällande standard både effektiviserar och säkrar du ditt arbete. Många standarder ingår dessutom ofta i paket.

Tjänster

Abonnemang är tjänsten där vi uppdaterar dig med aktuella standarder när förändringar sker på dem du valt att abonnera på. På så sätt är du säker på att du alltid arbetar efter rätt utgåva.

e-nav är vår online-tjänst som ger dig och dina kollegor tillgång till standarder ni valt att abonnera på dygnet runt. Med e-nav kan samma standard användas av flera personer samtidigt.

Leveranssätt

Du väljer hur du vill ha dina standarder levererade. Vi kan erbjuda dig dem på papper och som pdf.

Andra produkter

Vi har böcker som underlättar arbetet att följa en standard. Med våra böcker får du ökad förståelse för hur standarder ska följas och vilka fördelar den ger dig i ditt arbete. Vi tar fram många egna publikationer och fungerar även som återförsäljare. Det gör att du hos oss kan hitta över 500 unika titlar. **Vi har även tekniska rapporter, specifikationer och "workshop agreement".** Matriser är en översikt på standarder och handböcker som bör läsas tillsammans. De finns på sis.se och ger dig en bra bild över hur olika produkter hör ihop.

Standardiseringsprojekt

Du kan påverka innehållet i framtida standarder genom att delta i någon av SIS ca 400 Tekniska Kommittéer.

Find the right product and the type of delivery that suits you

Standards

By complying with current standards, you can make your work more efficient and ensure reliability. Also, several of the standards are often supplied in packages.

Services

Subscription is the service that keeps you up to date with current standards when changes occur in the ones you have chosen to subscribe to. This ensures that you are always working with the right edition.

e-nav is our online service that gives you and your colleagues access to the standards you subscribe to 24 hours a day. With e-nav, the same standards can be used by several people at once.

Type of delivery

You choose how you want your standards delivered. We can supply them both on paper and as PDF files.

Other products

We have books that facilitate standards compliance. They make it easier to understand how compliance works and how this benefits you in your operation. We produce many publications of our own, and also act as retailers. This means that we have more than 500 unique titles for you to choose from. We also have technical reports, specifications and workshop agreements. Matrices, listed at sis.se, provide an overview of which publications belong together.

Standardisation project

You can influence the content of future standards by taking part in one or other of SIS's 400 or so Technical Committees.

Den internationella standarden ISO 16001:2008 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 16001:2008.

The International Standard ISO 16001:2008 has the status of a Swedish Standard. This document contains the official English version of ISO 16001:2008.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00.
Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), tel +46 8 555 520 00.
Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

SIS Förlag AB, SE 118 80 Stockholm, Sweden. Tel: +46 8 555 523 10. Fax: +46 8 555 523 11.
E-mail: sis.sales@sis.se Internet: www.sis.se

SS-ISO 16001:2008 (E)

Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16001 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 2, *Safety requirements and human factors*.

SS-ISO 16001:2008 (E)

Introduction

This International Standard outlines test procedures and sets criteria for the development of hazard detection systems (HDS) and visual aids (VA) for detecting people.

Proper job-site organization, operator training and the application of relevant vision standards (ISO 5006 and ISO 14401) address the safety of people on job sites. In some cases, vision of the working area cannot be achieved either by the operator's direct view or indirect view using mirrors. In such cases, operator awareness can be improved by the use of HDS and VA.

HDS and VA provide information to the operator as to whether a person or object is in the path of the machine, primarily during rearward movement.

It is essential to note that HDS and VA have both advantages and disadvantages. There is no device that works perfectly in all situations. It is especially important that the shortcomings of HDS and VA be recognised and known to system users. The advantages and disadvantages of selected devices are summarized in Annex A.

Earth-moving machinery — Hazard detection systems and visual aids — Performance requirements and tests

1 Scope

This International Standard specifies general requirements and describes methods for evaluating and testing the performance of hazard detection systems (HDS) and visual aids (VA) used on earth-moving machines. It covers the following aspects:

⎯ detection of people in the detection zone;

⎯ visual and/or audible warning(s) to the operator and/or to the persons in the detection zone;

⎯ operational reliability of the system;

⎯ compatibility and environmental specifications of the system.

It is applicable to machines as defined in ISO 6165. HDS and/or VA can be used to augment the operator's direct vision (see ISO 5006) or indirect vision using mirrors (see ISO 14401) or to provide additional means of hazard detection, for example, where ergonomic considerations limit the effectiveness of direct vision, e.g. to avoid repeated turning of the head and upper body.

2 Normative references

The following referenced documents are indispensable for the application 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 6165, *Earth-moving machinery — Basic types — Identification and terms and definitions*

ISO 6394, *Earth-moving machinery — Determination of emission sound pressure level at operator's position — Stationary test conditions* [1]

ISO 9533, *Earth-moving machinery — Machine-mounted forward and reverse audible warning alarm — Sound test method*

ISO 13766, *Earth-moving machinery — Electromagnetic compatibility*

ISO 15998 [2], *Earth-moving machinery — Machine-control systems (MCS) using electronic components — Performance criteria and tests for functional safety*

---

1) To be published. (Revision of ISO 6394:1998)

2) To be published.

3 Terms and definitions

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

3.1
hazard detection system
HDS
system that both detects hazards and warns the operator and/or the person on the ground

NOTE   The system generally includes a sensing device, warning device and evaluation device.

3.1.1
sensing device
HDS component that detects a test body in the detection zone

3.1.2
warning device
HDS component that transmits information to the operator and/or to persons in the detection zone by visual and/or audible signals

3.1.3
evaluation device
HDS component or components that analyse the signals and information transmitted from the sensing device and transform the corresponding signal to the warning device

3.2
visual aid
VA
system that provides visual information without warning

NOTE   The system generally includes a monitor and camera.

3.2.1
monitor
VA component that provides a visual image of the detection zone on a screen

3.2.2
camera
VA component that transmits to the monitor an image of the detection zone

3.3
detection zone
zone within which a test body is detected by an HDS or is shown by a VA

3.4
test body
person or a standard measuring unit representative of a person, used to test the geometry and size of the detection zone

NOTE   Depending on the system used, test bodies can be varied (see Annexes B to F).

3.5
self-testing
capability of the system to self-check continuously and immediately to inform the operator, audibly and/or visually, of a failure

3.6
detection time
time required for a hazard detection system to detect the test body in the detection zone and activate the signal output

3.7
stand-by
operation mode whereby the hazard detection and visual aid systems are active, but no information is transmitted by the warning device or monitor

3.8
job-site organization
rules and procedures for managing the working together of machines and people at a job site

EXAMPLE   Safety instructions, traffic patterns, restricted areas, operator training, machine and vehicle markings, communications systems.

4   Performance requirements and tests

4.1   General requirements

4.1.1   Test of detection zone

The test method shall be performed on a system that is either fitted to the machine or to a representative configuration in accordance with Annexes B to F.

4.1.2   Test body requirements

The test body requirements are specified in Annexes B to F.

4.1.3   Environmental conditions

The test shall be undertaken under the following environmental conditions:

— temperature (23 °C ± 5 °C);

— relative humidity (60 % ± 25 %).

The test shall not be affected by reflections from surrounding walls, auxiliary test equipment or other objects. For further details, see Annexes B to F.

4.1.4   Evaluation of test results

4.1.4.1   Detection

Detection shall take place unambiguously with an uninterrupted sequence of the signal or information appropriate to the warning range. For further details, see Annexes B to F.

4.1.4.2   Evaluation of false signals

False signals, such as the following, should be minimized:

— when a machine approaches a ramp;

— from objects outside the detection zone;

— from weather conditions of fog, snow, rain, wind, dust, etc.

4.2 Location and fixing of HDS and VA devices

Devices shall be located and arranged on the machine in accordance with the specification of the device manufacturer so that

⸺ the device does not restrict any function or operation of the machine,

⸺ the device is protected against external damage,

⸺ the device is affixed to the machine so as to deter unauthorized disablement and/or removal,

⸺ the device is mounted so as to limit exposure to, or amplification of, dynamic loads, temperature, shock or vibration that could prematurely damage the device,

⸺ the attachment and fixings of HDS and VA devices do not affect the integrity of the protective structures, e.g. rollover protective structures (ROPS), and

⸺ the device is designed and mounted to permit routine service access from the ground or from a service platform so that the intended performance is maintained.

4.3 Operator station devices

4.3.1 Location of monitor

The monitor shall be located within the operator's view. Restriction of the operator's view of the working area or of the machine working equipment shall be minimized.

When the monitor is used to cover the area behind the machine, the system shall be configured to provide a reverse image on the monitor.

In order to see a person at the maximum distance of the detection zone, the monitor shall display the height of a fifth percentile person (see ISO 3411) such that the image is 7 mm on the monitor. The monitor should be within 1,2 m of the operator's eye point. The monitor shall be positioned so as to minimize the glare caused by direct sunlight.

NOTE   Factors that influence an operator's ability to detect a person on the monitor are the position of the monitor within the cab, the distance of the operator from the monitor, the size of monitor, the ambient lighting, the lens on the camera and the distance of the object from the lens.

4.3.2 Warning devices

Both audible and visual warning devices are required for an HDS. These devices shall provide indications to the operator and may provide indications to workers and other persons present at the work site.

4.3.2.1 Audible devices

Operator station warning devices shall be set at, or shall automatically adjust to, a level at least 3 dB higher than the ambient noise level as measured at maximum governed speed under no load.

All in-cab warnings should be selected so that they are clearly audible at the operator station. The warning signal should be in the frequency range 500 Hz to 2 500 Hz.

In-cab alarms shall be distinguishable by the operator from other sounds (i.e. warnings or machinery noise) in the operator's station.

NOTE   This can be achieved by varying the spectral characteristics and the temporal distribution of the signals (see ISO 9533).

4

4.3.2.2 Visual devices

A green system-status light shall inform the operator that the system is powered and functional. The light may be continuous or turn off after the function check is completed.

The warning signals in the cab shall be mounted in direct view of the operator and be visible in direct sunlight. The warning signals shall be distinguishable from other instrument panel warnings; the most severe warning shall be a flashing red light.

4.3.2.3 External warning devices

If an external warning device is fitted as part of the HDS, then the external alarms shall comply with ISO 9533.

External visual warning devices, when fitted, shall be visible to people in the detection zone.

4.4 System activation and initial check

The system shall activate automatically on engine start, perform an initial system check and give a proper function indication. For visual aid systems, the indication of proper function shall be by a clear image of the detection zone on the monitor.

In the case of a HDS malfunction, a warning shall be given to the operator.

The system may enter stand-by mode until the relevant machine movement mode is selected.

If multiple cameras or sensors are fitted, the system shall automatically select the camera or sensor appropriate to the direction of travel.

4.5 HDS detection and response time

HDS detection and response time shall not exceed 300 ms after activation of the system or after waking from stand-by. The system detection and response time is the time from which the operator selects the relevant machine movement mode until the system is able to detect a person.

4.6 Operational integrity

4.6.1 General

The operational integrity of the HDS and VA shall comply with ISO 15998 and ISO 13766.

4.6.2 Continuous self-checking

The availability of an image of the detection zone on the monitor is sufficient as a monitoring function for a VA. An HDS shall have a permanent monitoring function including at least the following:

a) an operating indication light (green);

b) a stand-by indication light (flashing amber or green) (see 4.3.2.2);

c) a visual and/or audible failure signal if the operation of the system is impaired, including monitoring of each link on the HDS, which includes the monitoring of all machine signals used for system operation, i.e.

— wire break,

— short-circuit,

— time management (if applicable),